

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	<b>课程名称 Course Title</b>	碳中和和新能源概论 <b>Introduction to Carbon Neutrality and Renewable Energy</b>
2.	<b>授课院系 Originating Department</b>	机械与能源工程系 Department of Mechanical and Energy Engineering
3.	<b>课程编号 Course Code</b>	ME171
4.	<b>课程学分 Credit Value</b>	2
5.	<b>课程类别 Course Type</b>	通识选修课程 General Education (GE) Elective Courses
6.	<b>授课学期 Semester</b>	春季 Spring/秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中文 Chinese
8.	<b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	李文甲，助理教授，机械与能源工程系 Email: <a href="mailto:liwj@sustech.edu.cn">liwj@sustech.edu.cn</a> Wenjia Li, Associate Researcher, Department of Mechanical and Energy Engineering, Email: <a href="mailto:liwj@sustech.edu.cn">liwj@sustech.edu.cn</a>  曾林，副教授，机械与能源工程系 Email: <a href="mailto:zengl3@sustech.edu.cn">zengl3@sustech.edu.cn</a> Lin Zeng, Associate Professor, Department of Mechanical and Energy Engineering, Email: <a href="mailto:zengl3@sustech.edu.cn">zengl3@sustech.edu.cn</a>
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	待公布 To be announced
10.	<b>选课人数限额(可不填) Maximum Enrolment</b>	

(Optional)

<b>11. 授课方式</b> <b>Delivery Method</b>	<b>讲授</b> <b>Lectures</b>	<b>习题/辅导/讨论</b> <b>Tutorials</b>	<b>实验/实习</b> <b>Lab/Practical</b>	<b>其它(请具体注明)</b> <b>Other (Please specify)</b>	<b>总学时</b> <b>Total</b>
<b>学时数</b> <b>Credit Hours</b>	32				32
<b>12. 先修课程、其它学习要求</b> <b>Pre-requisites or Other Academic Requirements</b>					
<b>13. 后续课程、其它学习规划</b> <b>Courses for which this course is a pre-requisite</b>					
<b>14. 其它要求修读本课程的学系</b> <b>Cross-listing Dept.</b>					

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程旨在让学生了解并掌握关于碳中和和新能源的基本概念、技术、政策及发展新能源并实现碳中和的意义和主要挑战，为后续相关学习打好基础。

This course aims to enable students to understand and master the basic concepts, technologies, policies and the significance and main challenges of developing new energy and achieving carbon neutrality, and to lay a good foundation for subsequent relevant studies.

1. 掌握碳中和的基本概念，了解碳中和的意义和当前面临的主要挑战

1. Master the fundamental concepts of carbon neutrality, understand the significance of carbon neutrality, and be aware of the major challenges it currently faces.

2. 了解碳中和的基本原理和实现的方式路径

2. Understand the basic principles of carbon neutrality and the pathways to achieve it.

3. 掌握新能源的基本概念、原理、分类，对各种新能源的实际应用与发展前景有一定认识，建立碳中和的意识

3. Master the fundamental concepts, principles, and classifications of new energy sources, have a certain understanding of the practical applications and development prospects of various new energy sources, and establish an awareness of carbon neutrality

#### 16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生将了解实现碳中和并发展新能源的意义、技术原理、发展前景等方面的知识，为其为其未来从事相关领域的科学研究或工程实践提供必要的理论和实践基础。具体的，学生将掌握碳中和的基本概念、原理和技术，掌握新能源的基本概念、原理、分类，了解实现碳中和并发展新能源的意义和发展前景。

Through this course, students will gain knowledge in the significance, technical principles, and prospects of achieving carbon neutrality and developing new energy sources. This knowledge will provide them with the necessary theoretical and practical foundations for future scientific research or engineering practice in related fields. Specifically, students will

acquire a grasp of the fundamental concepts, principles, and technologies related to carbon neutrality and new energy. They will also understand the significance and potential of achieving carbon neutrality and developing new energy sources.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

**第一部分：绪论-碳中和基本概念和意义（2 学时）**

- 全球碳排放现状和气候变化
- 碳中和的概念和意义
- 国内外碳中和的政策与法规
- 碳中和的挑战与机遇

**Section 1 –Introduction - basic concepts and significance of carbon neutrality (2 credit hours)**

- Global carbon emission status and climate change
- The concept and significance of carbon neutrality
- Policies and regulations of carbon neutrality at home and abroad
- Challenges and opportunities of carbon neutrality

**第二部分：传统能源结构与发展现状（6 学时）**

- 传统能源的定义、分类与发展史
- 化石能源简介及技术原理（煤炭、石油、天然气）
- 水电简介及技术原理
- 国家能源结构与传统能源资源分布概况（世界&中国）
- 生态保护、碳排放与传统能源发展应用前景

**Section 2 –Traditional energy structure and development status (6 credit hours)**

- Definition, classification and development history of traditional energy
- Introduction and technical principle of fossil energy (coal, oil and natural gas)
- Brief introduction and technical principle of hydropower
- National energy structure and distribution of traditional energy resources (World&China)
- Ecological protection, carbon emissions and the development and application prospects of traditional energy

**第三部分：可再生能源的概念和分类及发展趋势（10 学时）**

- 可再生能源的定义、分类与发展史
- 太阳能简介及技术原理（光伏技术、光热技术、光伏-光热互补）
- 风能简介及技术原理（海上风电技术）
- 生物质能与地热能简介及技术原理（生物柴油、地源热泵）
- 可再生能源技术应用领域及技术研究前沿

### Section 3 – Concepts, classification, and development trends of new energy sources (10 credit hours)

- Definition, classification and development history of renewable energy
- Introduction and technical principle of solar energy (photovoltaic technology, photothermal technology, photovoltaic solar thermal complementary)
- Introduction and technical principle of wind energy (offshore wind power technology)
- Introduction and technical principle of biomass energy and geothermal energy (biodiesel, ground source heat pump)
- Renewable energy technology application field and technology research frontier

### 第四部分：储能技术的概念和分类（6学时）

- 储能技术的定义和对碳中和的意义
- 机械储能和电磁储能简介
- 燃料储能技术原理与应用
- 电化学储能技术原理与应用
- 热能储能简介
- 新型储能技术及研究前沿
- 智慧能源系统与能源互联网

### Section 4 – Concepts and Classification of Energy Storage Technologies (6 credit hours)

- Definition of energy storage technology and its significance for carbon neutralization
- Introduction of mechanical energy storage and electromagnetic energy storage
- Principle and application of fuel energy storage technology
- Principle and application of electrochemical energy storage technology
- Introduction to thermal energy storage
- New energy storage technology and research frontier
- Smart energy system and energy Internet

### 第五部分：碳中和技术案例分析及展望（6学时）

- 世界能源政策与碳足迹计算
- 国内外碳中和技术案例介绍及分析
- 碳中和技术未来发展方向及前景展望
- 碳中和案例及建筑参观

### Section 5 – Case analysis and Prospect of carbon neutralization technology (6 credit hours)

- World Energy Policy and Carbon Footprint Calculation
- Introduction and Analysis of Carbon Neutralization Technology Cases at Home and Abroad
- Future development direction and prospects of carbon neutrality technology
- Carbon Neutrality Cases and Building Visits

### 第六部分：课程项目汇报（2学时）

**Section 6- Course project report (2 credit hours)**

**教材及其它参考资料 Textbook and Supplementary Readings**

- [1]余红辉. 碳中和理论与实践[M]. 中国环境出版集团, 2021.
- [2]马丁·卡茨施密特, 沃尔夫冈·施特莱歇尔, 安德利亚斯·维泽. 可再生能源: 技术, 经济和环境[M]. 经济管理出版社, 2021.
- [3]刘强, 袁铨. 碳中和产业路线[M]. 社会科学文献出版社, 2022.
- [4]中国社会科学院数量经济与技术经济研究所“能源转型与能源安全研究”课题组. 中国能源转型: 走向碳中和[M]. 社会科学文献出版社, 2021.

**课程评估 ASSESSMENT**

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance	每次课程开始 Beginning of each class	20%		
课堂表现 Class Performance				
小测验 Quiz	随堂 In class quiz	40%		
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation	学期末 End of the course	40%		期末报告必须围绕课程讲授内容撰写 The final report must be written around the course content
其它(可根据需要 改写以上评估方式) Others (The above may be modified as necessary)				

20. **记分方式 GRADING SYSTEM**

- A. 十三级等级制 Letter Grading
- B. 二级记分制 (通过/不通过) Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
This Course has been approved by the following person or committee of authority