

## Net Zero-Carbon Fuels

Course Information			
*课程名称 (Course Name)	(中文) 碳中和燃料		
	(英文) Net Zero-Carbon Fuels		
课程类型 (Course Type)	Public course/Spring semester/APRU shared course		
授课对象 (Target Audience)	Undergraduate or postgraduate students of any discipline with interests in low carbon technology, fuel technology, environment and sustainability.		
授课语言 (Language of Instruction)	English		
*开课院系 (School)	中英国际低碳学院 China-UK Low Carbon College		
先修课程 (Prerequisite)	N/A	后续课程 (post)	N/A
*课程负责人 (Instructor)	Dr. Cheng Tung Chong	课程网址 (Course Webpage)	N/A
*课程简介 (英文) (Description)	<p>As nations bind together to tackle global climate change, one of the urgent needs is the energy sector's transition from being fossil-fuel reliant to embracing sustainable carbon-free solutions. This course aims to introduce a redefined perspective of fuel utilisation for the power and transportation sectors, placing emphasis on alternative fuels derived from renewable resources that are essential contributors to the goals of carbon neutrality. Some of the low or zero-carbon fuels such as hydrogen, ammonia, biofuels and emerging low carbon fuels adaptable to current or new energy systems will be explored in the context of production, utilisation, economics and sustainability. The impacts of future fuels on the environment, resource availability and social well-being need to be holistically considered and supported by diverse solutions, in alignment with the Sustainable Development Goals of Affordable and Clean Energy (SDG 7) and other related SDGs as put forth by the United Nations. From this course, the students will grasp the broad concept of alternative fuel production, application and challenges faced in moving towards a net zero-carbon society.</p>		
Course objectives and contents			

<p>*课程目标 (Course Object)</p>	<ol style="list-style-type: none"> <li>Describe the roles of alternative fuels for power and transportation sectors in the context of carbon neutrality in China and relate to the sustainable development goals.</li> <li>Describe the production process, potential application and limitations of alternative fuels in the context of power and transportation sectors.</li> <li>Assess the impact of alternative fuel usage on the local resources, society and nation in alignment of the sustainable development goals.</li> </ol>						
<p>*教学内容进度 安排及对应课 程目标 (Class Schedule &amp; Requirements &amp; Course Objectives)</p>	Chapter	Content	Credit hour	Teaching mode	Requirement	Teaching focus	Alignment with course learning outcome
	1	<b>Introduction to SDG with emphasis on SDG 7</b>	2	Online lecture + discussion	Attendance	Understand the importance of SDG and sustainable development	1,2
	2	<b>Advancements of biofuels</b> Biodiesel, bioethanol and biogas production, application	4	Online lecture + discussion	Attendance	Comprehend the limitations that restricts or promote the production of biofuels.	1,2
	3	<b>Biofuels sustainability: EWF + SDG perspectives</b>	2	Online lecture + discussion	Attendance	Understand the sustainability issues related to biofuel production	3
		Topical review 1 (Biofuels) + Guest lecture	2	Group discussion + lecture	Assignment	Enhance teamwork and networking	1,2
	4	<b>Sustainable aviation propulsion</b> Production, application and sustainability	4	Online lecture + discussion	Attendance	Able to relate to the potential of China and other countries in producing sustainable aviation fuel.	3

	5	<b>Green hydrogen as energy carrier</b> Production, use (fuel cells and combustion) and vectors (inc. ammonia)	4	Online lecture + discussion	Attendance	Analyse the policy in China and other countries in promoting hydrogen	1,2
	6	<b>Green ammonia as energy carrier</b> Production, distribution, fuel cells, combustion	4	Online lecture + discussion	Attendance	Explore the current effort in promoting ammonia usage	3
		Topical review 2 (H <sub>2</sub> vectors) + guest lecture	2	Group discussion + lecture	Assignment	Enhance teamwork and networking	1, 2
	7	<b>Electrification</b> Power-to-X, transport electrification	4	Online lecture + discussion	Attendance	Explore the progress of electrification, economics, and impacts related to electrification policies	3
	8	<b>Emerging zero-carbon fuels</b> Production of methanol, waste-derived fuel, solar fuel	2	Online lecture + discussion	Attendance	Understand the emerging technologies related to zero-carbon fuel production	3
		<b>Group project presentations</b>	2	Group presentation	Presentation	Enhance teamwork and networking	3
<b>*考核方式</b> (Grading)	(1) Attendance: 20% (2) Assignments: 40% (3) Presentation: 40%						

*教材或参考资料 (Textbooks & Other Materials)	<ol style="list-style-type: none"> <li>1. Cheng Tung Chong, Jo-Han Ng, Biojet Fuel in Aviation Applications, 1st edition, Elsevier, 2021</li> <li>2. Aldo Vieira da Rosa, Fundamentals of Renewable Energy Processes, 2nd ed. Academic Press, 2009</li> <li>3. Agustin Valera-Medina, Rene Banares-Alcantara, Techno-Economic Challenges of Green Ammonia as an Energy Vector, 2020</li> </ol> <p>Other supplemental materials will be provided during the course.</p>
其它 (More)	<p>Time table for the course: week 2-17 of Spring semester 2023  Every Tuesday, 14:00-15:40</p>
备注 (Notes)	-

**Net Zero-Carbon Fuels (SDG Summer Course 2022)**

<b>Week</b>	<b>Date</b>	<b>Day</b>	<b>Time</b>	<b>Topic</b>	<b>Credit hours</b>	<b>Teaching mode</b>	<b>Lecturer-in-charge</b>
1	20/6	Mon	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L1: Introduction to SDG with emphasis on SDG 7</b>	3	Online lecture + discussion	CCT
	21/6	Tue	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L2: Green hydrogen as energy carrier</b> Production, use (fuel cells and combustion) and vectors (inc. ammonia)	3	Online lecture + discussion	AVM
	22/6	Wed	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L3: Green ammonia as energy carrier</b> Production, distribution, fuel cells, combustion	3	Online lecture + discussion	AVM
	23/6	Thu	9:00-11:00 (UTC+1) 16:00-18:00 (UTC+8)	<i>T1: Topical review 1 (H<sub>2</sub> vectors)</i>	2	Group discussion	AVM
2	27/6	Mon	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L4: Sustainable aviation propulsion</b> Production, application and sustainability	3	Online lecture + discussion	CCT
	28/6	Tue	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L5: Advancements of biofuels</b> Biodiesel, bioethanol and biogas production, application	3	Online lecture + discussion	NJH
	29/6	Wed	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L6: Biofuels sustainability: EWF + SDG perspectives</b>	3	Online lecture + discussion	NJH
	30/6	Thu	9:00-11:00 (UTC+1) 16:00-18:00 (UTC+8)	<i>T2: Topical review 2 (Biofuels)</i>	2	Group discussion	NJH
3	4/7	Mon	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>L7: Electrification</b> Power-to-X, transport electrification	3	Online lecture + discussion	CCT
	5/7	Tue	9:00-11:00 (UTC+1) 16:00-18:00 (UTC+8)	<b>L8: Emerging zero-carbon fuels</b> Production of methanol, waste-derived fuel, solar fuel	2	Online lecture + discussion	NJH
	6/7	Wed	9:00-11:00 (UTC+1) 16:00-18:00 (UTC+8)	<i>T3: Topical review 3 (Elec + EF)</i>	2	Group discussion	CCT
	7/7	Thu	9:00-12:00 (UTC+1) 16:00-19:00 (UTC+8)	<b>Group project presentations</b>	3	Group presentation	CCT/NJH/AVM
Total					32		