

Course Form for PKU Summer School International 2024

Course Title	Title in English: Climate Change and Sustainable Development
	Title in Chinese: 气候变化与可持续发展
Teacher	DAI Hancheng
First day of classes	July 1, 2024
Last day of classes	July 12, 2024
Course Credit	3 credits
Course Description	
Objective:	
<p>It is increasingly recognized that climate change is intricately linked to sustainable development, not just in terms of joint underlying drivers, but also with respect to synergistic policy choices. Well-designed climate change mitigation policy can lead to significant co-benefits for sustainable development in air pollution control, energy security enhancement and resource efficiency improvement. To effectively inform decision making on these issues, whether at the national or international level, science must take an integrated and holistic perspective. The course aims to give an overview on the latest scientific consensus on climate change, climate impacts, climate change adaptation and mitigation, and the nexus between climate change mitigation and sustainable development goals such as high-quality economic growth, energy security, food security, air pollution control and human health improvement. Furthermore, it will briefly introduce how the complicated nexus could be understood and uncovered from system analysis perspectives.</p>	
Pre-requisites /Target audience	
<p>English proficiency, basic economics.</p> <p>Undergraduate students and graduate students who are interested in climate science, energy and climate economics and policy</p>	
Proceeding of the Course	
Assignments (essay or other forms)	
<p>➤ Homework (Short essays and multiple literature review reports)</p> <p>➤ Final presentation (critical review of a subject)</p>	
Evaluation Details	

1. Weekly homework (70%); 2. Final presentation (30%).	
Text Books and Reading Materials ➤ Assigned readings	
Academic Integrity (If necessary) Students will follow the academic principles of honesty, fairness, respect, and accountability and make a pledge as follows: “I will not lie, cheat, or steal in my academic endeavors; I will conduct myself responsibly in all my endeavors; and I will act if the academic principles are compromised.”	
CLASS SCHEDULE (Subject to adjustment)	
Session 1: <i>Climate change 1: observations</i>	Date: July 1 st
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To introduce course objectives, the structure, and the participation from students. To demonstrate the phenomenon of climate change based on observations from different earth systems. Afternoon session (2 hours): Group discussion	
【Questions】 1. What is the scientific evidence that could support the existence of climate change? 2. What influences the trend in global average temperature? 3. What are the greenhouse effects and its relationship to climate change?	
【Readings, Websites or Video Clips】 To be provided (TBP)	
【Assignments for this session (if any)】 Please search for evidence based on observations that support climate change.	
Session 2: <i>Climate change 2: impacts</i>	Date: July 2 nd
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To introduce the impacts of climate change on agriculture, precipitation, sea level etc. Afternoon session (2 hours): Breakout discussion with DPSIR framework	

【Questions】 What are/will be the impacts of climate change on nature and human systems?	
【Readings, Websites or Video Clips】 TBP	
【Assignments for this session (if any)】 TBP	
Session 3: <i>Climate adaptation</i>	Date: July 3 rd
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To introduce how human beings could adjust to actual or expected climate and its effects. Afternoon session (2 hours): Breakout discussion with DPSIR framework	
【Questions】 <ol style="list-style-type: none"> 1. Why do we need to adapt to climate change? 2. How could we adapt to climate change effectively? 	
【Readings, Websites or Video Clips】 TBP	
【Assignments for this session (if any)】 TBP	
Session 4: <i>Climate change mitigation</i>	Date: July 4 th
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To describe various efforts to reduce or prevent the emission of greenhouse gases. To understand the challenge of long-term low-carbon transition. Afternoon session (2 hours): To learn the Climate negotiation tool	
【Questions】 <ol style="list-style-type: none"> 1. What are the main countermeasures to bring down GHG emissions from technological, management and consumption behavioral perspectives? 2. What are the costs of climate mitigation? 	

【Readings, Websites or Video Clips】	
【Assignments for this session (if any)】	
Session 5: <i>Carbon neutrality</i>	Date: July 5 th
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To introduce the concept of carbon neutrality, carbon sink and carbon reduction Afternoon session (2 hours): To use the Climate negotiation tool	
【Questions】 1. What are the major sources of greenhouse gas (GHG) emissions in the various parts of the world? 2. What are the emission spaces for the globe to achieve 1.5 and 2 degree targets?	
【Readings, Websites or Video Clips】 TBP	
【Assignments for this session (if any)】 TBP	
Session 6: <i>Energy and climate change</i>	Date: July 8 th
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To understand how energy supply and consumption affect greenhouse gas emissions globally. Afternoon session (2 hours): Study tours (Site to be determined)	
【Questions】 1. What is primary energy and secondary energy? 2. How energy supply and consumption contribute to climate change and what is the regional disparity worldwide?	
【Readings, Websites or Video Clips】 TBP	
【Assignments for this session (if any)】 TBP	

Session 7: <i>Climate change driving forces</i>	Date: July 9 th
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</p> <p>Morning session (3 hours): To demonstrate the socio-economic driving forces of climate change in the historical periods after the Industrial Revolution. To introduce possible future climate change trends under different development pathways.</p> <p>Afternoon session (2 hours): To learn the online energy simulator</p>	
<p>【Questions】</p> <ol style="list-style-type: none"> 1. What are the key driving forces of climate change related to human beings? 2. How future socio-economic development could affect climate change? 	
<p>【Readings, Websites or Video Clips】</p> <p>TBP</p>	
<p>【Assignments for this session (if any)】</p> <p>TBP</p>	
Session 8: <i>Sustainable development goals</i>	Date: July 10 th
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</p> <p>Morning session (3 hours): To provide a knowledge framework for achieving sustainable development. To introduce a framework for and fundamental concepts of sustainable development goals.</p> <p>Afternoon session (2 hours): To use the online energy simulator</p>	
<p>【Questions】</p> <ol style="list-style-type: none"> 1. What are the key concerns and elements of sustainable development? 2. How are the goals interconnected? 	
<p>【Readings, Websites or Video Clips】</p> <p>TBP</p>	
<p>【Assignments for this session (if any)】</p> <p>TBP</p>	
Session 9: <i>Climate Actions and sustainable development</i>	Date: July 11 th


【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To describe how climate change mitigation could lead to various co-benefits that are the key elements of SDGs. Afternoon session (2 hours): Study Tour 2	
【Questions】 1. How climate change mitigation could bring co-benefits for air pollution control, water management, energy security enhancement and resource efficiency improvement? 2. How could synergistic policy choices be formulated to maximize the synergy?	
【Readings, Websites or Video Clips】 TBP	
【Assignments for this session (if any)】 TBP	
Session 10: <i>Final exam (Presentation)</i>	Date: July 12 th
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Morning session (3 hours): To make a final presentation about how to address climate change taking a typical region as an example. Afternoon session (2 hours):	
【Questions】 Depending on which target region you choose, what is the most appropriate strategy to address climate change, and what are the potential synergies and tradeoffs on other development goals.	
【Readings, Websites or Video Clips】	
【Assignments for this session (if any)】	

A CV of 250-300 words and a high-resolution personal photo should also be provided



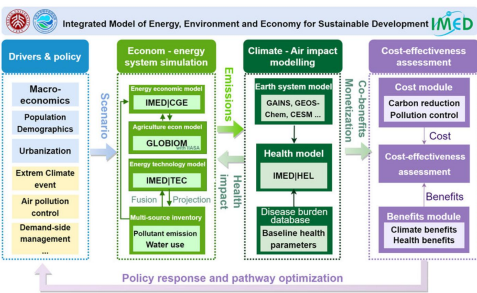
Dr. Dai is an Associate Professor with Tenure and Director of the Department of Environmental Management in the College of Environmental Sciences and Engineering at Peking University. He is also a joint appointment research fellow of the Institute of Carbon Neutrality at Peking University. Dr. Dai's research focuses on green & low-carbon transformation and human & planetary health at the local, national and global scales. By developing and applying the state-of-the-art integrated assessment model, key questions are explored on the mitigation costs of achieving ambitious climate targets and their co-benefits on improvements in air pollution, human health and resource efficiency. Dr. Dai was ranked as the World's Top 2% most-cited scientists released by Stanford University from 2020 to 2023. Due to his academic excellence, Dr. Dai was awarded the Outstanding Young Scholar by the National Natural Science Foundation of China in 2022. His main publications, including 16 ESI 1% highly cited papers, are on energy economics and policy-related journals such as *Nature Food* and *One Earth*. Dr. Dai is active in multiple international and domestic science programs by serving as the Lead Author of the *Global Environment Outlook Sixth Edition (GEO-6)* for Cities, Contributing Author of the *IPCC 6th Assessment Report*. He is also the Standing Committee Member of the Branch of Ecological and Environmental Systems Engineering, Systems Engineering

Society of China, as well as Committee Member of Branch of Climate Change of Chinese Society for Sustainable Development. He has also provided professional consulting services frequently to various well-known Non-Governmental Organizations such as the Energy Foundation China (EFC), Environmental Defense Foundation (EDF) and Natural Resources Defense Council (NRDC). More information could be found here: <http://scholar.pku.edu.cn/hanchengdai>.




LEEEP 北京大学能源环境经济与政策研究室 **IMED**
Laboratory of Energy & Environmental Economics and Policy, PKU

The LEEEP team at Peking University specializes in **environmental** and **climate policy** research through its self-developed **IMED integrated assessment model**, focusing on key scientific breakthroughs and policy demands essential for green and low-carbon transition to support national and global **sustainability** targets.



Integrated Model of Energy, Environment and Economy for Sustainable Development IMED

The flowchart illustrates the IMED model's structure, starting from Drivers & policy (Macro-economics, Population, Demographics, Urbanization, Extrem Climate event, Air pollution control, Demand-side management) leading to Scenario, then to Econom - energy system simulation (Energy emissions model IMEDICE, Agriculture sector model GLOBIOM, Energy technology model IMEDITEC, Fusion, Projection, Health, Pollutant emission, Water use), then to Climate - Air impact modelling (Earth system model GAINS, GEOS-Chem, CESM, Health model IMEDJHEL, Disease burden, Catastrophe, Baseline health parameters), and finally to Cost-effectiveness assessment (Cost module, Carbon reduction, Pollution control, Cost, Cost-effectiveness assessment, Benefits, Benefits module, Climate benefits, Health benefits). A feedback loop for Policy response and pathway optimization connects the assessment back to the scenario.



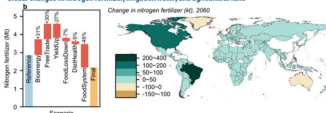
Prof. Hancheng Dai

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- Founder of the Laboratory of Energy & Environmental Economics and Policy (LEEEP)
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Food security

nature food
Enhanced food system efficiency is the key to China's 2060 carbon neutrality target
Ren M., Dai H., Nature Food, 2023

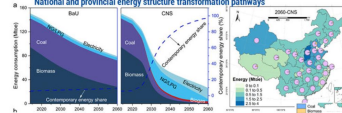
Global changes in nitrogen fertilizer, irrigation water, and agricultural land



Human health

nature communications
Costs and health benefits of the rural energy transition to carbon neutrality in China
Ma T., Xie Y., Nature Communications, 2023

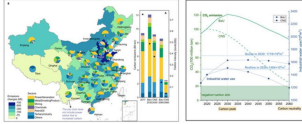
National and provincial energy structure transformation pathways



Water sustainability

One Earth
Achieving carbon neutrality enables China to attain its industrial water use target
Xiao Y., Guo Y., Liu Y., One Earth, 2023


A synergistic pathway of carbon reduction and water conservation



IAM training workshop

China's First Carbon Neutrality Integrated Assessment Model Training Workshop

- ✓ Held in 2023 by LEEEP, PKU
- ✓ Lasting a whole week
- ✓ Training top-down & Bottom-up IAM models
- ✓ Over 50 participants from 30+ institutes



More information:
Homepage: <http://scholar.pku.edu.cn/hanchengdai>
IMED online model: <https://www.imedmodel.com>

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