Professional Association for China's Environment (PACE)

PACE Annual Conference 2023

China's Environment & Development under Carbon Neutrality & De-globalization

CONFERENCE

MANUAL

Organizer

环球中国环境专家协会
Professional Association for China's Environment

Co-organizer

香港中文大學環境、能源及可持續發展研究所
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Contents

About the Conference

China is going through fundamental environmental improvement, with traditional pollution of air, water and soil largely past the inflection point of the Environmental Kuznets Curve. Climate change has become the dominant environmental issue. Carbon neutrality has gained crucial momentum in the past three years and all major economies have set national targets for it. China's plan is to achieve carbon peaking by 2030 and carbon neutrality by 2060. The COVID-19 pandemic has come to its end after three years of rampage, but the ongoing US-China trade war and de-globalization are creating new challenges for the deploy of environmental and carbon-neutral technologies and supply chains. In response to the new phase of China's environmental and climate issues, the PACE 2023 Annual Conference will explore (but not limit to) the era of environmental post-turning point and carbon neutral policies and implementation, development challenges and opportunities, domestic and global governance and other related topics, to serve country's need of environmental improvement and sustainable development in the new age.

Academic Committee (in alphabetical order)

Maoliang BU, Dan Guttman, Tao HU, Zonghuang HUANG, Zhuoqi LIU, Manhong SHEN, Hua WANG, Tao WANG, Linyu XU, Yuan XU, Xiaoling ZHANG, Da ZHANG, Da ZHU

Organizing Committee

Chairman: XU Yuan, XU Linyu

Administrative and Logistics Support:

Davis DU, ZHANG Xing, DU Yufan

Venue:

YIA LT4 & 5, The Chinese University of Hong Kong, Hong Kong, China

Programme

August 18th, 2023: Technical Tour

Technical Tour: Sha Tin Sewage Treatment Works (STSTW) (Person-in-charge: Prof. XU Yuan, PACE President)

Time: 2:30pm - 4:00pm

Gathering time and location: 2:00pm, MTR University Station Exit B

Number of visitors: 40

Medium of Instruction: Mainly English, with Putonghua support

August 19th, 2023

8:30—9:00   On-site registration (Venue: outside of YIA LT4 & 5) (Person-in-charge: DU Yufan, Zhang Xing)

9:00—9:15   Opening (Venue: YIA LT4)

      Moderator: Prof. XU Yuan, Associate Professor, The Chinese University of Hong Kong & President, Professional Association for China's Environment

      Opening speech by:

      Prof. LAM Hon-Ming, Director, Institute of Environment, Energy and Sustainability, The Chinese University of Hong Kong

      Prof. HU Tao, Chairman of the Board of Directors, Professional Association for China's Environment

9:15—9:20   Group Photo (Person-in-charge: DU Yufan)

9:20—10:30   Planetary session 1 (Venue: YIA LT4)

      Moderator: Prof. HU Tao, PACE Chairman

      Keynote speakers:

      Prof. Dan Guttman (Online), PACE Board Member

      Prof. LI Wei, Professor, Beijing Normal University

10:30—11:00   Coffee break & networking (Person-in-charge: DU Yufan)

11:00—12:30   Concurrent sessions 1A & 1B

Session 1A: Sustainability in China (Venue: YIA LT4; Chair: Prof. LIANG Sai)

Session 1B: Water and Ecosystem Management (Venue: YIA LT5; Chair: Prof. LI Wei)

12:30—14:00 Lunch & networking (Person-in-charge: DU Yufan)

14:15—15:25 Planetary session 2 (Venue: YIA LT4)

Moderator: Prof. XU Linyu, Professor, Beijing Normal University & Vice President, Professional Association for China's Environment

Prof. HU Tao, Chairman, Professional Association for China's Environment

Prof. LIANG Sai, Professor, Guangdong University of Technology

15:25—16:55 Concurrent sessions 2A & 2B

Session 2A: Energy Transition (Venue: YIA LT4; Chair: Prof. ZHANG Xiaoling)

Session 2B: Environmental Policy and Impacts (Venue: YIA LT5; Chair: Prof. CHEN Shaoqing)

16:55—17:25 Coffee break

17:30—18:00 Closing & PACE AGM (Chair: Prof. XU Yuan, PACE President)

Panel:

Prof. HU Tao, PACE Chairman

Prof. XU Yuan, PACE President

Prof. XU Linyu, PACE Vice President

Prof. ZHANG Xiaoling, PACE Board Member

August 20th, 2023: Departure

Technical Tour

Sha Tin Sewage Treatment Works

Sha Tin Sewage Treatment Works (STSTW) is the largest secondary sewage treatment works in Hong Kong. It occupies 28 hectares of land and serves a population of 650,000 in Sha Tin and Ma On Shan Districts, which produces 260,000 cubic metres of sewage per day.

STSTW was commissioned in 1982. The treatment capacity was 100,000 cubic metres per day and was later increased to 200,000 cubic metres per day in 1986. In order to improve the marine environment of the Tolo Harbour, the aeration tanks were upgraded to equipped with nutrient removal facilities in 1991. This, however, reduced the treatment capacity to 150,000 cubic metres per day.

To manage the population expansion of Sha Tin and Ma On Shan Districts, STSTW commenced its Stage III Extension in 2001. Upon completion of the extension in 2011, its treatment capacity subsequently increased to 340,000 cubic metres per day. To further improve the effluent quality, an ultraviolet disinfection system was also installed in the extension works.

Relocation of Sha Tin Sewage Treatment Works to Caverns

To support Hong Kong's sustainable development, the Government is actively exploring various approaches to develop new land resources. One possible approach is rock cavern development. The Drainage Services Department completed a feasibility study on the relocation of the Sha Tin Sewage Treatment Works (STSTW) to caverns in end 2013. The results confirmed that relocating the STSTW is technically feasible and financially viable. Two-staged public engagement exercises were conducted and collected the public opinions on the relocation project. After the feasibility study, the investigation and design works for the relocation project was commenced in September 2014.

The future cavern complex for the relocated STSTW (the relocated STSTW to be named "Sha Tin Cavern Sewage Treatment Works) will be the largest of its type ever built in Hong Kong. It will be constructed by stages, namely: site preparation and access tunnel construction; main caverns construction; upstream sewerage works; sewage treatment facilities installation; and decommissioning and demolition of existing STSTW. The project involves several professional engineering disciplines, and we will look into the possibility of introducing relevant advanced technologies and make reference to overseas experience with a view to optimising the benefits of the project.

Stage 1 Works including site preparation and access tunnel construction commenced in February 2019 and targeted for completion in the fourth quarter of 2022. We are continuing the detailed design for the remaining stages of construction works and seek funding approval to implement the remaining stages in a timely manner aiming to complete the whole project by 2031.

The texts & photo are taken from https://www.dsd.gov.hk/EN/HTML/20512.html. More information can also be found there.

Planetary session 1

Keynote speaker: Prof. Dan Guttman

Bio

Dan Guttman is a teacher and lawyer and has been a public servant. He served as Executive Director of a Presidential (Clinton) bioethics advisory Commission, was Presidentially appointed Commissioner of the U.S. Occupational Safety and Health Review Commission, directed, as special counsel, US Senate investigations of US government energy and environmental management, and was UNDP and EU "foreign expert advisor" on China environmental law development. He is Professor, Tianjin University Law school, adjunct professor, Fudan University/London School of Economics Institute for Global Public Policy, fellow New York University US-Asia Law Institute. Following 2004-6 years as China Fulbright scholar, he taught and worked with China, US and global colleagues developing comparative governance courses, texts, research projects at Peking, Tsinghua, Nanjing, and Shanghai Jiao Tong Universities. In the US he taught for many years at Johns Hopkins, and been Fellow at Hopkins, Emory and the University of California Santa Barbara. He was partner in a firm representing cities, states, citizens, workers in energy, environment, antimonopoly, human/civil rights litigation. He is of counsel to Guttman, Buschner and Brooks, whose lawyers have represented whistleblowers in litigation recovering billions for government from fraud by energy and health care companies, and military contractors. He co-authored The Shadow Government, a seminal study of the "contracting out" of the U.S. government, and author/coauthor of many further books and articles (most recently, Nonstate Actors in China and Global Environmental Governance). He shared in journalism awards, most recently for investigation of $900 billion in Pentagon contracting, testified many times before Congress and other public bodies, and was graduated from Yale Law School and the University of Rochester.

Title：

Climate change impacts: what can be learned from comparative study of how countries and localities are adapting to the governance challenge?

Abstract：

The impacts of climate change are increasingly unmistakable and intense. While global leader discussion focuses on mitigation (greenhouse gas reduction) continued reports of local and regional devastation from heat, floods, fire, and drought are bringing the challenge of adaptation to climate change to the forefront of policy agendas from local to global levels. The UN Intergovernmental Panel on Climate Change (IPCC) reports that across continents, "governance" is the sole "high-level constraint" in addressing "adaptation" to climate change. How will country governance systems, at various levels, respond to this challenge? Will differences among governance systems lead to the adoption of country specific adaptation strategies? How effective will the strategies, including reliance on traditional natural disaster preparation and response, be? So far, however, there appears to be only a limited focus on what may be learned by comparing emerging adaptation efforts across governance systems in different countries.

In 2021, Australia, China and US colleagues launched a project to develop a framework for use by scholars and practitioners seeking to learn from comparing adaptation governance approaches. This talk will discuss the work of the project, and next steps-in which participation is welcome.

Keynote speaker: Prof. LI Wei

School of Environment, State Joint Key Lab of Environmental Simulation and Pollution Control, Beijing Normal University

Bio

Li Wei is a professor and doctoral supervisor at the School of Environment, Beijing Normal University. He has long been engaged in research on strategic environmental assessment, biodiversity value accounting and impact assessment (BIA), environmental economic analysis and policy assessment, ecological value assessment theory and methodology, green finance and transformational development.

Title：

To Build-Up a Green One-Belt & One-Road by Mainstreaming Environmental Governance in Overseas Development

Abstract:

China launched the ambitious One-Belt & One-Road Initiative (BRI) to embrace the trend of economic deglobalization and regional cooperation. To seek new models for global governance and sustainable development, the domestic commitment and international consensus have been calling for rigorous environmental stewardship in the context of green BRI. A bibliometric review involving 170 studies indicated, the studies on environmental conservation under BRI have experienced exponential growth in recent times, and revealed the great potentials of environmental governance to mitigate climate risk and compensate negative impacts along OBOR. This study investigated thirteen BRI projects with a focus on such energy intensive industries as cement, iron and steel, power production and industrial parks. The results showed that though all the projects strictly abode by the provisions of local regulations and attempted to adopt higher standards than those of the host country, they were still confronted by inadequate institution and implementation. Overly simplified and laggard standards of evaluation in specific

industries ignored the risk of pollution characteristics. Incompetence practitioner and inadequate labor lay the main reason of non-rigorous reviewing with unvalidated data and inefficient protection during operation. Lack of transparency during decision-making led to invalid procedure. To further promote contributions of environmental governance under strategic cooperation of green BRI, based on a comparative analysis of EIA systems and management in 20 countries in Asia and Africa, it is suggested to improve environmental management in overseas cooperation by strengthening the EIA/SEA system especially in transboundary impact assessment, biodiversity conservation and compensation, climate change adoption and low-carbon development.

Concurrent session 1A: Sustainability in China

Title:

Carbon market resilience: evidence from China

Author: Wen SUN and Xiaoling ZHANG

Affiliation: City University of Hong Kong

Speaker: Xiaoling ZHANG is Convenor of Smart and sustainable city Cluster and affiliated professor at the School of Energy and Environment at City University of Hong Kong. She has dedicated to advancing the theoretical development of sustainability science by developing integrated and quantitative models that synthesize environmental science, economics, engineering, satellite remote sensing analysis as well as other multidisciplinary approaches. Along with being the Associate Editor of npj Urban Sustainability and Co-Editor in Chief of Land Use Policy, she has also received the Clarivate Highly Cited Researchers Award in 2022 (Cross-field). Under the theoretical umbrella of sustainability science, she has made substantial contribution in the following areas: (1) basic research underpinning sustainability science and engineering management; (2) low carbon and carbon neutral studies, climate change, resource management, energy transformation and governance at Asian and global scale; (3) industry sustainability, socioecological systems and circularity in production and consumption systems; (4) global and local urbanization and land use change: theoretical critiques, processes, drivers, and consequences; (5) paradoxical trade-off between "ecology" versus "economy" at enterprises and industry level.

Abstract:

The origins of carbon markets being virtual or artificial make them increasingly vulnerable to intra- and cross-system risks. However, the concept of "carbon market resilience" lacks a clear definition. Some studies acknowledge that stakeholders are concerned about carbon prices and related mechanisms, and emphasize the need for a precise definition and assessment of carbon market resilience. Unfortunately, there is currently no relevant methodology or specific definition available.

To address this issue, this paper proposes a definition of carbon market resilience as the ability to resist risks and adapt to a state of equilibrium under a composite system based on interactions between different agents, economic factors, social factors, and ecological factors. By

simulating different policy changes on various carbon markets in China, we show that a good policy combination can effectively improve the resilience of the carbon market.The findings indicate that the system resilience of China and its pilot carbon markets has been on a downward trend, primarily due to increased carbon intensity constraints. This trend suggests a pressing need for reforms. Furthermore, the system resilience of each region reflects a clear downward trend as carbon prices increase, particularly in terms of enforcing a uniform minimum carbon trading guideline price nationwide. Similarly, the study finds that different regions follow the same trend in terms of systemic resilience when given a proportion of free carbon allowances, albeit with varying values. To improve the overall resilience of the carbon market, it is recommended to leverage the synergistic efforts of the central and local governments as well as private enterprises to improve the resilience of the carbon market.

Title:

Dietary-Driven Phosphorus Consumption in the Greater Bay Area of China:
Implications for Sustainable Phosphorus Management

Author: Yue ZHANG, Linyu XU

Affiliation: Beijing normal University

Speaker: Yue ZHANG, PhD candidate, School of Environment, Beijing Normal University

Abstract:

The Greater Bay Area of China stands out as one of the most economically vibrant and densely populated regions. Rapid urbanization has not only significantly elevated the living standards of residents but has also brought about a profound shift in the urban- rural dietary consumption patterns. Anthropogenic phosphorus consumption, which interact with socio-economic factors, imposes simultaneous pressures on both the upstream production subsystem and the downstream waste management subsystem within the urban ecosystem. Understanding the dietary-driven characteristics of urban- rural phosphorus consumption and the pathways of phosphorus metabolism can provide opportunities for alleviating the pressure on phosphorus resource supply and reducing phosphorus losses. Currently, there is a lack of the interconnection between urban and rural consumption in phosphorus metabolism within urban agglomerations, as well as the neglect of the impact of consumption section on upstream and downstream subsystems. Thus, our study plans to construct a framework of urban-rural dietary consumption based on substance flow analysis to quantify the hotspots of phosphorus flows, and the trend of spatiotemporal variations will be identified. Furthermore, supply and demand indicator as well as emission indicator will be integrated into the framework to quantitatively analyze the impacts of dietary consumption on both upstream and downstream subsystems. Our study focuses on the phosphorus metabolism characteristics of urban-rural dietary consumption and emphasizes the coordinated development of phosphorus resources across various sections within the urban ecosystem, while providing scientific measures for the sustainable management of phosphorus resources in the bay area cities.

Keywords: phosphorus metabolism, substance flow analysis, urban-rural dietary consumption, Guangdong-Hong Kong-Macao Greater Bay Area

Title:

Review the drivers for the historical cost reduction of offshore wind

Author: LIN Sijia

Affiliation: The Chinese University of Hong Kong

Speaker: LIN Sijia

Abstract:

Wind power has developed from onshore to offshore these years. The evaluation of the driving mechanism for the cost-reduction of wind technologies can serve to recognize the potential role of emerging offshore wind in carbon neutrality realization. Moreover, comparing the technological development trajectory of offshore wind with onshore wind conduces to understand the whole picture of wind power deployment for its further promotion.

Therefore, this study attempts to, (1) compare the LCOE, CAPEX variation ranges of offshore wind with onshore wind from 2010 to 2021, (2) review the historical learning rate of offshore wind estimated in the existing literature and analyze the factor introduced in the learning curve that impacts learning rate estimation, (3) review the difference cost-reduction driving pattern between wind power generation and wind farm development, between different factors, and between different countries, (4) propose a component-based multi-factor learning curve model by integrating it with LCOE and CAPEX estimation framework for evaluating the cost-reduction effect of the factors and disclosing the explanatory power of the component technology for the cost variation of its composed wind technology. Through these analyses, this study would provide a research framework for better analyzing the cost variation trajectory of offshore wind.

Title:

Economic policy uncertainty and Co-Control of Air Pollutants and CO2: Evidence from Chinese 282 cities

Author: Xuan YANG, Zeyang ZHANG, Lei SHI

Affiliation: Renmin University of China

Speaker: Xuan YANG, born in 1998. Her undergraduate and master's degrees graduated from the School of Environment and Natural Resources, Renmin University of China. She is a doctoral candidate in the School of Environment and Natural Resources, Renmin University of China now. Her research area is environmental economics and management.

Abstract:

China's rapid economic growth is accompanied by large amount of air pollutants emissions and CO_2 emissions. Making coordinated efforts to reduce pollution and carbon emissions is essential for China to coordinate its efforts to pursue sustainable development. However, the impact of COVID-19, heightened geopolitical risks, and other factors have brought great challenges to the synergistic reduction of pollution and carbon emissions. In this process, China's economic policy adjustment frequency increased and economic policy uncertainty intensified. Economic policy uncertainty (EPU) is defined as a risk in which government policies and regulatory frameworks are undefined for the near future. A growing body of literature has shown the impact of EPU on stock markets, commodity price and international trade. However, few literature explores the effects of EPU on carbon emission, even fewer research focuses on the impact of EPU on synergistic reduction of of pollution and carbon emissions by EPU. Higher EPU gives local governments an incentive to sacrifice the environment for economic growth or even to deregulate it, which could result in considerable pollutant emissions. The objective of this paper is to give a comprehensive evaluation of the possible influence of cities' EPU on intensity of synergistic emissions of SO_2, dust and CO_2 (SCpg). Using a panel data of 282 cities from 2003–2017 and a newly constructed city-level EPU index in China based on government work report, this paper constructs a spatial Durbin two-way fixed effect model and estimates the impact of EPU on SCpg, explores its potential channels and conducts heterogeneity analysis to deeply explore the relationship between EPU and SCpg.

The findings show that EPU has obvious positive spatial aggregation characteristics and imposes a significantly positive impact on the intensity of synergistic emissions of air

pollutants and CO_2 in adjacent cities through spatial spillover effect. When the EPU increases by 1 unit, the intensity of synergistic emissions of air pollutants and CO_2 of local cities, adjacent cities and total cities will increase by 9.309 units ($p<0.01$), 691.627 units ($p<0.01$), and 700.936 units ($p<0.01$), respectively. The mechanism analysis indicates that, generally, EPU affects the SCpg through the following two channels: industrial structure and allocative efficiency. EPU exacerbates synergistic emission intensity through increasing industrial structure distortion, weakening industrial structure upgrading and escalating labor market distortion. Capital market distortion was not one of the possible channels. The results of the heterogeneity analysis are as follows: (1) Taking into account the impact of air pollution control pressure, we find that EPU in non-key environmental protection cities has a stronger inhibitory effect on the co-control of air pollutants and CO_2 than key environmental protection cities; (2) Considering the pressure on cities' economic development, this paper finds that the lower a city's GDP growth rate ranking in the province was the previous year, the more pressure on that city's economic development was placed on it that year, which ultimately magnifies the impact of EPU on increasing pollutant emissions; (3) From the perspective of region, EPU of cities in the east and west regions shows a significant inhibitory effect on pollution reduction, while there is no significant effect in the central region.

This study recommends that policymakers strive to ensure the continuity and stability of domestic economic policies. It is essential to further promote the upgrading of industrial structure, eliminate distortions in industrial structure and improve labor market construction to improve the efficiency of labor resource allocation. Moreover, the central government should emphasize the importance of controlling urban air pollution, guide cities to coordinate between economic development and environmental protection, and pay attention to EPU's inhibitory effects in the eastern and western regions. This study is conducive to comprehending how EPU triggers the increase of SCpg and undertaking adequate policy decisions in the face of uncertainties. The conclusions obtained from the China situation are applicable to other nations, particularly developing countries with unstable economic policies.

Keywords: economic policy uncertainty; co-control of air pollutants and CO_2; spatial spillover

Concurrent session 1B: Water and Ecosystem Management

Title:

Water uses in India affected by hotspots of global supply chains

Author: Mengting YI, Qiumeng ZHONG, Xuechun YANG, Sai LIANG

Affiliation: Guangdong University of Technology

Speaker: Mengting YI is a Ph.D. candidate in the School of Ecology, Environment and Resources at the Guangdong University of Technology. Her current research focuses on environmental systems analysis.

Abstract:

India plays a pivotal role in global water resources governance. Existing studies have not well characterized the structural characteristics of the virtual water flow network in India, which would reduce the efficiency of the policy decisions on mitigating India's water scarcity. This study identified critical transmission sectors, transactions, supply chain paths, and community structure in India's virtual water flow network, based on the global environmentally extended multi-regional input-output analysis, structural path analysis, betweenness concept, and community detection. Results show that the role of transmission centers, transactions and paths associated with the service sector (e.g., "Hotel and restaurant services" and "Other land transportation services") in India and related sectors (e.g., "Chemical nec") in strong manufacturing entities for the transmission of water in India also should receive the attention of policymakers. The ranking profiles of the transmission centers, transactions, and paths related to the foreign regional sector changed significantly during the study period, which provides hotspots for trade structure adjustment measures. Moreover, the results of community detection show the major communities involve sectors from different regions, which provides new perspectives for international cooperation strategies.

Title:

中国水污染的边界效应与治理——基于工业企业环境行为的经验证据

Author: 昌敦虎，张泽阳，徐湘博，董战峰

Affiliation: 中国人民大学

Speaker: 张泽阳，1998 年生，本科、硕士均毕业于中国人民大学环境学院，现为中国人民大学环境学院人口、资源与环境经济学专业博士生。研究方向：环境经济与管理。

Abstract:

水环境边界污染问题严重阻碍我国污染防治攻坚和生态文明建设的深入推进。本文通过整理全国县级行政区的省际和市际边界情况并匹配 2011—2014 年中国环境统计数据库，从工业企业环境行为视角检验了不同尺度下的水污染边界效应。研究发现：在省界上，边界地区的工业企业污染物处理率显著低于非边界地区，这种"以邻为壑"的边界效应主要存在于小微型企业和环保重点城市的企业；而市界上表现出边界地区的工业企业污染物处理率更高的现象，这种"以邻为伴"的逆边界效应主要存在于大中型企业和环保重点城市的企业。机制上，省界边界效应并非由边界地区工业企业增产或忽视清洁生产引起，而是由末端治理投入不足所致，虽然市界上也存在末端治理投入不足的问题，但工业企业采取减产的方式提高了环境绩效。同时，市界地区通过提高财政竞争强度吸引了污染物处理率更高的工业企业进入，这也是市界上表现出逆边界效应的作用渠道之一。作为流域污染治理重要措施的河长制在推动市际污染协同共治方面发挥了积极作用，但未能有效治理省界边界效应。本文为在我国分权情境下系统理解边界效应和完善流域跨界污染治理政策体系提供了重要经验证据。

关键词：水污染；边界效应；分权；企业环境行为；河长制

Coupling and coordination of carbon metabolic processes and ecological resilience in the Pearl River Delta cities

Author: Xing ZHANG, Linyu XU

Affiliation: Beijing Normal University

Speaker: Xing ZHANG, PhD candidate, School of Environment, Beijing Normal University

Abstract:

Rapid urbanization had a huge impact on the global climate change. Land-use changes caused by urban expansion are an important source of urban carbon emissions. Therefore, controlling urban carbon emissions is the key to mitigating the global warming, and the key to controlling urban carbon emissions is regulating urban carbon metabolism to ensure a healthy, stable, adaptive and sustainable state from the perspective of the human-land relationship. Faced with the increasing disturbances and pressures caused by human activities, the urban carbon metabolism also suffers from unavoidable disturbances and impacts during the process of rapid urbanization. Therefore, the urban carbon metabolism needs to improve its resilience, which includes the ability to resist shocks, adapt itself and recover after shocks, in order to achieve the dissipation and absorption of these disturbances. In this context, it is crucial to study the interaction between urban carbon metabolism and ecological resilience. In this study, we construct a spatially explicit "carbon flow" model and quantitatively assess the ecological resilience level of cities through long time series dynamics. We also use a physical coupling model to measure the spatial coupling coordination of carbon metabolism and ecological resilience in Pearl River Delta (PRD) cities. The objectives of this study include: (1) quantitatively simulating and analyzing the ecological relationships between compartments and the spatial distribution characteristics provoked by urban carbon flow; (2) systematically constructing an urban ecological resilience evaluation index system, dynamically quantitatively evaluating and analyzing the ecological resilience level; (3) measuring the interaction between urban carbon metabolism and ecological resilience, and proposing suggestions and strategies for resilient space optimization. This study aims to identify the specific reasons that advance or inhibit the harmonization of carbon metabolism levels and ecological resilience within cities and provide scientific support for the implementation of the "dual carbon" policy and the construction of low-carbon cities.

Title:

Beyond rangelands: mitigating forage-livestock conflicts in China through domestic economic structure transitions

Author: 杨明岳，梁赛，吴晓慧，钟秋萌

Affiliation: 北京师范大学

Speaker: 杨明岳，博士研究生，现就读于北京师范大学环境学院。研究方向为社会经济活动对草地生态系统影响分析。已在国际主流期刊 Environmental Science& Technology、Fundamental Research、Agriculture Ecosystems & Environment、Journal of Environmental Management 等发表论文 10 余篇。

Abstract:

China has committed to eradicating the forage-livestock conflict (FLC) by 2035 to restore degraded rangelands. This commitment is accompanied by China's rapid socioeconomic development, including technological advancement, consumption pattern change, and affluence. The socioeconomic transition would affect production and consequently the FLCs. This study explored the impacts of regional socioeconomic transitions on China's FLC changes. Results show that, during 2005–2015, the FLC intensity change cumulatively drove 51.3 Mt of FLC reductions. Domestic economic structure transition cumulatively drove 26.7 Mt of FLC reductions. In particular, the FLC reduction driven by the final demand structure transition of pastoral provinces (15.4 Mt) was over three times that of non-pastoral provinces (4.3 Mt). The effects of final demand structure transition of external regions generally decrease with increasing distance from a certain pastoral province. Meanwhile, the FLC reduction caused by the production structure transition of non-pastoral provinces (4.4 Mt) was almost twice that of pastoral provinces (2.5 Mt). However, the production structure transition of the Middle of Yellow River and pastoral provinces in the Northwest drove the increase of China's FLCs (particularly in Inner Mongolia and Xinjiang). This study highlights the significance of economic structure optimization and interregional cooperation to achieve China's "Forage-Livestock Balance 2035 Goal."

Title:

基于生态产品价值实现的红树林修复及碳储量调查评估研究

Author: 汤德福

Affiliation: 广州市海洋双碳研究会

Speaker: 汤德福，男，广州市海洋双碳研究会执行会长，高级工程师，国家注册环境影响评价工程师，毕业于中山大学，目前主要从事海洋、水环境治理与生态修复、环境规划与评价和蓝碳（红树林）评估等相关咨询、研究工作，国家环境影响评价技术评估专家库、广州市增城区生态环境产业协会专家库成员，受聘担任华南河湖长学院特聘研究员、佛山科学技术学院兼职授课教师。

Abstract:

　　红树林在三大滨海蓝碳生态系统中固碳效率最高，被誉为"海上森林""海岸卫士"，我国红树林主要分布在东南沿海一带，上世纪五十年代以后面积一度锐减，导致海岸带生态系统失去平衡，难以抵御各种灾害，近年来虽有回升趋势，但仍面积一系列的生态系统问题，需进一步保护修复。广东省在国家《红树林保护修复专项行动计划（2020-2025 年）》的指引下，印发了实施方案及专项规划，并出台了红树林生态修复技术指南，在红树林保护修复方面走在全国前列。本研究基于广州南沙和湛江的红树林保护修复实例，介绍了广东省红树林面临的主要生态问题，总结了有效的修复技术和方法，并利用自然资源部关于红树林生态系统碳储量调查与评估技术规程，对修复案例的碳汇进行了估算，明确了红树林的蓝碳增汇对实现双碳目标的重大作用。本研究还基于国家碳交易市场平台的模式和目前已有的蓝碳交易案例，提出了红树林碳汇交易及生态产品价值实现的有关建议，可为地方建立蓝碳交易平台提供参考。

Planetary session 2

Keynote speaker: Dr. HU Tao
特邀报告人：胡涛 博士

深圳市湖石海洋科技研究院 院长

个人简介

胡涛博士，深圳市湖石海洋科技研究院院长，湖石可持续发展研究所所长，全球中国环境专家协会（PACE）理事长，美国华人专业联合会（UCAPO）副会长，中国碳中和 50 人论坛成员，联合国负责任教育（PRME）中国学术委员会成员，生态环境部政策研究中心高级顾问。原世界自然基金会（WWF）美国分会中国项目总监、世界资源研究所（WRI）高级研究员，环保部政策研究中心研究员。兼任北京大学国家发展学院能源安全与国家发展中心研究员，天津大学绿色发展研究院研究员，美国俄勒冈大学亚太研究中心、北京师范大学环境学院客座教授。曾担任环保部 WTO 贸易与环境专家组组长，中国环境与发展国际合作委员会核心专家组成员，联合国-中国气候变化框架合作项目高级协调员。他的研究领域涉及环境经济学、政策与体制，投资贸易与环境，全球化与"一带一路"，减污降碳、协同控制，负碳排放技术 NETs，能源环境与经济政策等。

报告题目：

碳中和及反全球化背景下我国应对欧盟碳边境调节机制 CBAM 的策略

报告摘要：

报告将剖析在碳中和背景下，欧盟出台碳边境调节机制 CBAM 政策背后的原因；我国企业适应与减缓 CBAM 可能影响的应对之策；在反全球化背景下，中国政府应对 CBAM 的可能策略。

Keynote speaker: Prof. LIANG Sai
特邀报告人：梁赛 教授

广东工业大学生态环境与资源学院 副院长

个人简介

梁赛教授，广东工业大学生态环境与资源学院副院长，大湾区城市环境安全与绿色发展教育部重点实验室执行主任。从事环境系统分析方向研究。主持国家重点研发计划重点专项项目、国家自然科学基金重大项目课题/面上项目/专项项目等。在 Nature 子刊、Cell 子刊、环境专业顶刊 Environmental Science & Technology 等权威刊物发表论文 150 余篇，论文总被引 6500 余次（Google Scholar）。入选全球学者库全球顶尖前 10 万科学家。曾获中国工程院院刊系列期刊 Front. Env. Sci. Eng.的 Young Talent Award、南京大学紫金全兴环境基金青年学者奖、北京市第十四届哲学社会科学优秀成果奖二等奖、《环境科学研究》2021 年度最佳论文奖、华人产业生态学会最佳论文奖、ES&T 2020 年度优秀评审奖等。任中国生态学学会产业生态专业委员会副主任、J. Clean Prod.编委、Science 伙伴期刊 Ecosyst. Health Sustain.青年编委。

报告题目：

全球贸易对温室气体净排放的影响

报告摘要：

《巴黎协定》提出在本世纪中叶实现温室气体人为源排放与汇清除之间的平衡。目前，多个国家提出国家自主贡献目标和净零排放承诺，并根据自身情况制定行动方案。然而，在经济全球化背景下，国家温室气体净排放同时受到本地和外地生产消费活动影响。为有效实现净零排放目标，亟需探究全球贸易对温室气体净排放的影响。本研究基于环境投入产出分析方法，综合考虑排放源和林业碳汇影响，量化 2017 年全球温室气体净排放和贸易隐含的温室气体净排放。研究发现：若仅考虑能源活动等排放源影响、忽略土地利用变化和林业碳汇影响，巴西、印度尼西亚和中非南部温室气体排放足迹将被明显低估；中国、俄罗斯和美国排放足迹被明显高估。此外，巴西和印度尼西亚贸易隐含的温室气体排放净转移亦被明显低估。相关结果可为制定净零排放相关政策提供新视角。

Concurrent session 2A: Energy Transition

Title:

粤港澳大湾区碳减排责任的跨区域多准则分担机制

Author: 吴俊良，池韵雯，陈绍晴

Affiliation: 中山大学

Speaker: 陈绍晴，中山大学环境科学与工程学院教授、博士生导师。从事城市代谢与低碳可持续管理研究。入选国家高层次青年人才计划、国家科技智库青年人才计划，为广东省杰出青年基金获得者。在 Nature 子刊、ES&T、Resources, Conservation and Recycling、《中国科学：地球科学》等期刊上发表论文，出版专著 2 本，联合开发中国产品全生命周期温室气体排放系数库，研究成果多次被国家部委和省市级政府批示和应用。入选全球前 2%顶尖科学家榜单，获国际华人产业生态学会最佳论文奖。

Abstract:

　　全球气候变化已成为当前人类生存发展面临的重大挑战之一，未来想要将全球温升控制在 1.5 摄氏度就必须立即采取有效的减缓行动。城市是实现《巴黎协定》和我国的碳达峰碳中和目标的主战场。本研究以粤港澳大湾区为研究对象，对比在生产和消费视角下碳排放之间的差距，同时从国际、国内及城市群的角度追踪大湾区及其内部城市间的碳流动与碳泄漏现状，剖析了大湾区及各城市间的碳减排责任转嫁问题。此外，研究还构建城市尺度的固碳潜力与可交易碳汇的核算体系，并由此挖掘大湾区各城市（包括港澳）的总绿地碳吸收与碳汇交易潜力。在综合考虑经济、排放、贸易流动及生态潜力的基础上，建立一套面向湾区城市群的碳减排责任分担机制，量化并

比较在不同原则下各城市应承担的减排责任。同时，基于规划设定多种发展-减排的情景，通过预测大湾区碳达峰路径与碳汇潜力，评估未来各城市的减排责任分配。

研究结果表明，大湾区各城市间碳减排责任的差异显著，但这种差异会随着时间的推移有所下降。其中消费端视角下，香港所需承担的减排责任尤为突出，而生产端视角下，广州、佛山所需承担的减排较高；在考虑林业碳抵消后，部分相对欠发达地区（如肇庆）所需承担的减排责任有所降低；在考虑碳转移后，大湾区各城市间的减排责任分配则变得更加均衡。基于未来预测的视角，绝大部分情景下大湾区城市均可在 2030 年前如期实现碳达峰，而减排责任分配与历史相似，但在人均排放的视角下，广州、深圳等城市的减排责任相比基准年有所缓解。基于上述分析结果，研究最后提出针对解决大湾区责任划分公平性、城市间减排责任相互转嫁以及区域协同减排等问题的政策建议。本研究所构建的城市碳减排责任跨区域多准则分担机制，一方面可为未来粤港澳大湾区本身合理分配减排责任、地区碳排放配额、协同供应链上各区域间的减排、防止碳责任转嫁等问题提供科学的对策和方案，另一方面可为全国乃至全球其他城市群合理划分减排责任提供方法参考。

Title:

Critical materials demand for China's solar photovoltaics towards 2060 under uncertainty: based on a dynamic integrated assessment framework

Author: ZHANG Yuning, WANG Yanhua, WANG Ke

Affiliation: School of Environment and Natural Resources, Renmin University of China

Speaker: ZHANG Yuning, a PhD candidate at the School of Environment and Natural Resources, Renmin University of China. His research interests include energy and climate change economics and energy-materials nexus analysis. He has published several articles in International Economic and Trade Research and China Environmental Science (in Chinese).

Abstract:

China announced to accelerate the capacity of solar photovoltaics (PV), which would support China's carbon neutrality target towards 2060. The additional demand for solar PV modules will bring along intense critical materials (i.e. Silicon, Germanium, Copper, Indium, Gallium, Selenium, Cadmium, and Tellurium) consumption. It is expected to induce resource shortage and supply risk. This study systematically assesses the critical materials demand of China's solar PV development towards 2060 by developing an integrated quantitative framework, involving an optimized Markov model, hybrid input- output model, and material flow analysis. Ten scenarios are designed to address the uncertainty from the solar PV installment pathway by coupling Shared Socioeconomic Pathways (SSPs) and solar PV sub- technology market share, while Monte Carlo Stochastic Sampling is used to identify the possible range of materials intensity. It is found that approximately 5.25-11.82 million tons of silicon are required for the installment growth of c-Si PV technology. Meanwhile, the cumulative Gallium and Cadmium demand toward 2060 are equal to 2.73-19.48% and 22.91-39.78% of China's current reserve. However, Indium and Tellurium used for China's thin-film PV technology are of most concern, because their cumulative demand by 2060 corresponds to 7.76-15.47 thousand tons (kt) and 6.01-118.79 kt respectively, which will exceed the national reserve by 3.3-7.6-fold and 0.9-2.9-fold in 2020. Therefore, policymakers in China should consider the potential resource constraints in different PV sub-technology strategies. To support China's solar PV installment toward 2060, it is necessary to enhance ore imports of critical materials and develop a circular economy for recovery rate promotion from the perspective of economic strategies. Materials intensity reduction is also effective via reducing layer thickness and increasing conversion efficiency.

Title:

Techno-economic assessment of industrial decarbonization with clean hydrogen towards carbon neutrality in China

Author: LIU Fangming, LIU Junling, WANG Ke

Affiliation: School of Environment and Natural Resources, Renmin University of China

Speaker: LIU Fangming, who is affiliated to School of Environment & Natural Resources of Renmin University of China, as a PH.D. student. With her research in economics of population, natural resources and environment, her dissertation of master's degree is The Impact of Population Structure of China on Consumption and Carbon Emissions of Residents. Her another publication in economics of climate change is 'Research on China's Carbon Emissions Pathway under the 1.5°C Target'.

Abstract:

1．Introduction

Hydrogen is a promising zero-emission energy carrier in the transition toward a long-term net-zero carbon emission target. It is also versatile and plays a unique role in the industrial sector's decarbonization. It produces high-temperature heat for industrial processes, which are difficult to electrify, and can substitute fossil fuels feedstock and reduce emissions from industrial processes such as iron making, ammonia synthesis, and oil refining. However, due to the highly integrated production processes in the industrial sector, hydrogen application has raised economic concerns, since it requires the large-scale replacement of current infrastructure and equipment, which translates into substantial investment. These challenges are even greater for China. The industrial sector contributes 43% of the total domestic CO_2 emissions and, thus, has a significant impact on the long-term carbon neutrality targets of both the world and China. In this regard, it is important to have a thorough understanding of the role of hydrogen in China's industry sector in terms of its mitigation potential and economic implications in the context of carbon neutrality.

2．Main findings

Hydrogen could play a key role in decarbonizing the industry sector. With fuel substitution and feedstock replacement in the iron and steel, ammonia and methanol syntheses, and oil refining industries, hydrogen could contribute 799.4-823.8 Mt CO_2 reduction, 4.9%-5.0% to the total mitigation requirement under the carbon neutrality target. Under the close mitigation potential,

HG scenario has 11.4 billion dollars higher total extra cost than LG scenario, but requires 10.8 billion dollars lower extra investment from 2022-2060. However, this investment reduction need 0.1 billion dollars higher investment for green hydrogen development by 2030. Mitigation costs of iron and steel and methanol synthesis in HG scenario with higher green hydrogen proportion are lower than in LG scenario in 2060. Cost of CO_2 avoidance in ammonia synthesis and oil refining under HG scenario would not be 5% higher than under LG scenario. Price of renewable electricity would be the dominant factors of total extra cost and cost of CO_2 avoidance. With possible decrease of renewable electricity price in the long term, the cost of CO_2 avoidance is likely to decline to be negative. Therefore, hydrogen application will not pose a large economic burden on the industry sector and green hydrogen requires more attention at early stage.

Title:

A multi-level characteristic analysis of urban agglomeration energy-related carbon emission: A case study of the Pearl River Delta

Author: Ying YU, Yuqi DAI, Linyu XU, Hanzhong ZHENG, Wenhao WU, Lei CHEN

Affiliation: Beijing Normal University

Speaker: Yuqi DAI

Abstract:

Urban agglomeration is identified as the important geographic units of country development while contributing immensely to carbon emission. This paper explored energy- related carbon emission characteristics of the Pearl River Delta (PRD) - the typical urban agglomeration in China, from cities and sectors perspectives.   By conducting LMDI model, this paper decomposed carbon emission by sector and by cities to illustrate the key impact factors in the PRD, explored the reasons for the change of driving effects in urban agglomeration in view of regional difference. It concludes that, most cities carbon emission rebound around 2017, while carbon emission sharply decreased. There are differences in key reduction industries in different cities, while production and supply of electric power and transport sector had negative impact on reduction processes in most cities. The significant inhibition effect of energy intensity is mainly attributed to the great decrease of energy intensity in main industries reduction cities, such as Shenzhen, Guangzhou, Dongguan and Foshan. Based on the characteristics of carbon emission and social and economic development of the PRD, this paper puts forward specific suggestions and measures for differentiated emission reduction in urban agglomeration, and provides a new idea for the governance of carbon emission in urban agglomeration.

Keywords: Carbon emission; LMDI; Urban agglomeration; Sector; City

Concurrent session 2B: Environmental Policy and Impacts

Title:

Machine Learning for Data Verification in Emissions Trading System

Author: Runxin YU, Da ZHANG, Xiliang ZHANG

Affiliation: Tsinghua University

Speaker: Runxin YU is a Master's student at the Institute of Energy, Environment and Economy, Tsinghua University, with research interests in carbon market mechanism design, policy evaluation and corporate behavior.

Abstract:

Data integrity is the cornerstone of any emissions trading system (ETS), although developing an effective mechanism to ensure data quality is a considerable challenge. To evaluate potential data quality issues of regulated firms and develop a cost-efficient data verification scheme for the authorities, this study uses domain knowledge and data-driven approaches to identify firms with high data quality risks. Using a unique dataset from China's national ETS, each sample obtains an ensemble outlier score generated by several supervised and unsupervised machine learning techniques, and limited inspection resources are allocated to the facilities with higher scores. Our results show that the models make good predictions where potential misreports are found among the predicted high-risk samples, and 70% of tampered datapoints are detected in the robust test. The method presented here helps in efficiently verifying firms' self-report emissions and proposes a feasible solution for intelligent data quality management under ETS context.

Title:

Environmental Ethical in the Use of Contingent Valuation Method

Author: Fengyuan ZHANG

Affiliation: Renmin University of China

Speaker: Fengyuan ZHANG: School of Environment & Natural Resources, Renmin University of China, doctoral candidate, majoring in population, resources and environmental, under the guidance of Professor Hua Wang, research focuses on the irrational decision-making behavior of respondents in contingent valuation method.

Abstract:

The contingent valuation method (CVM) is an important and widely used approach for assessing the value of public goods in the field of ecological and environmental economics, and in some scenarios, it is the only economic valuation method available. In the use of CVM, there are some features that may cause environmental ethics issues and inequality issues apart from irrational decision-making impacts. For example, (a) different respondents perceive different welfare from the same environmental improvement. (b) different respondents value the same welfare differently. (c) it is difficult for respondents to perceive ecological environmental value which exists but cannot be felt, such as indirect use values of ecological environments, including water conservation, air regulation, and soil conservation and etc..

This paper summarizes the mainstream environmental ethical viewpoints related to ecological environmental values and discusses the potential environmental ethics issues that may arise during the process of evaluating environmental values using CVM. Specifically, the following issues are considered:

(1) Is the health of residents in economically developed areas more important than the health of residents in economically underdeveloped areas?
(2) Does the value that respondents do not understand exist?

If respondents do not understand some of the invisible welfare brought by the environment, will their answers result in an undervaluation of environmental values?

(3) Is the value of the environment itself important even if it is unrelated to the respondents?

Humans are a part of the environment and have no right to destroy the habitat of other organisms and cause their extinction. The existence of the environment itself has enormous value.

CVM still has irreplaceable advantages in the overall valuation of ecological environments. Considering the potential environmental ethics issues mentioned above, future use of CVM should take these issues into account when designing questionnaires. It is recommended to conduct surveys in different cities and regions and establish databases and models to analyze and adjust the results obtained through CVM. This will enable more rigorous and targeted use of CVM to evaluate the value of ecological environmental resources.

Keywords：contingent valuation method; environmental values; environmental ethical; inequality issues

Title:

Heterogeneous roles of income groups in the synergistic control of atmospheric mercury and CO2 emissions in China

Author: Xiaohui WU, Sai LIANG, Zhifeng YANG

Affiliation: Beijing Normal University

Speaker: 吴晓慧，博士一年级，就读于北京师范大学环境学院。从事环境系统分析方向研究。发表论文十余篇。曾获《环境科学研究》2021 年度最佳论文奖、"生态环境系统工程交流研讨会"优秀海报奖、国家奖学金等荣誉奖项。

Abstract:

China has an urgent need to reduce atmospheric mercury (Hg) and CO_2 emissions to fulfill the Minamata Convention on Mercury and achieve the "double carbon" targets. Income groups drive substantial Hg and CO_2 emissions. Moreover, their disparities in consumption behavior changes may lead to differences in the synergy of trends in Hg and CO_2 emission. This study reveals the synergy and driving factors of changes in Hg and CO_2 emissions caused by various income groups in China during 2007-2017. Results show that only 19% of income groups synergistically promoted Hg and CO_2 emission reduction. Urban middle- and above middle-income groups in coastal regions contributed more significantly to synergistically reducing emissions. More than half of the income groups drove a decrease in Hg emissions but an increase in CO_2 emissions. The broadscale non-synergism was mainly due to the relatively small contribution of the decrease in CO_2 emission intensity compared with Hg. In addition, the contribution of consumption structure change was not synergistic. In particular, consumption structure changes of income groups in rural areas contributed to a decrease in Hg emissions but an increase in CO_2 emissions during 2012-2017. Moreover, some income groups (e.g., the urban rich in Middle of Yellow River) synergistically drove the emission increments. Findings in this study can provide scientific foundations for socioeconomic regulations at the regional and group levels to improve the synergistic emission reduction effectiveness.

Title:

Changes of production and consumption structures in coastal regions lead to mercury emission control in China

Author: Qiumeng ZHONG, Sai LIANG

Affiliation: Guangdong University of Technology

Speaker: Qiumeng ZHONG, a PHD student from Guangdong University of Technology, devoting to the environmental systemic analysis. The research mainly focuses on the socioeconomic transitions and the environmental impacts of food systems. During the recent five years, I have published 17 papers, where I am the first author in 4 papers.

Abstract:

China is important in the global mercury (Hg) cycle and is experiencing substantial economic structure transitions. There are pronounced differences in economic development, industrial structure, and consumption patterns across regions in China. However, the impacts of regional economic structure transitions (i.e., production and final demand structures) on Hg emissions in China remain unknown. Here, we reveal the transboundary impacts of changes in regional economic structures on provincial Hg emissions in China. We found that the transitions of production and final demand structures in coastal regions led to Hg emission reductions in China during 2007–2017. In particular, production structure changes in East Coast contributed to 36 metric tons of national Hg emission reduction, where 28 metric tons occurred in other regions (especially Hebei). Its final demand structure transition contributed to 19 metric tons of national emission reduction, where 15 metric tons occurred in other regions (especially Henan). Unfortunately, production structure changes in Northwest and final demand structure changes in Southwest contributed to Hg emission increments in China during 2007–2017. For instance, changes in the final demand structure of Southwest caused 34 metric tons of emission increments, mainly from provinces within the region. Thus, spatially explicit measures for China's Hg emission control can focus on the optimizations of production structure in Northwest and final demand structure in Southwest, as well as the promotion of interregional joint actions between East Coast and North China (especially Hebei and Henan). The findings of this study can inform region-specific policy decisions and interregional joint efforts to control Hg emissions around the world.