Panel Discussion

Accelerated climate change and the Food-Energy-Water-Nexus

Time: Dec. 3rd 12:00–13:40 (GMT+1)

The dramatic events of 2021 reveal that in the Anthropocene, climate change can affect everyone, rich and poor around the globe. This year illustrates the importance of the transformation of the fossil fuel-based societies into net-zero-emission societies to avoid severe damages through climate change. The food-energy-water nexus (FEW-Nexus) is at the centre of this transformation process to enable a net-zero emission resilient future. We will discuss the socio-economic transformation options presenting examples from Africa, China and Europe.

We will discuss industrialization of countries to enhance economic growth and inclusiveness by preserving their effectiveness in fighting climate change. The job creation potential of developing countries for a decarbonized economic development is another topic of debate. Furthermore, the technology transfer option to support developing countries in their transformation process will be presented. Thereby a focus will be set on the biogas potential especially for Africa and Europe.

JÜLICH Forschungszentrum

UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

AppliedEnergy Editor in Chief: J. Yan

Moderator

Dr. Holger Schlör
Forschungszentrum Jülich, Jülich, Germany

Short Bio

Holger Schlör studied economics at the University of Heidelberg and went on to complete his PhD in economics in Berlin. He received a scholarship from the German Marshall Fund and the Alfried Krupp von Bohlen und Halbach Foundation. He has conducted research at several scientific institutions and the German Parliament. He is currently working at Forschungszentrum Jülich in the Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE). His research here focuses on the fields of Sustainable Development, Food-Energy-Water-Nexus, Energy and Resource Economics and Energy Systems Analysis. The "Applied Energy 2017 Outstanding ICAE Paper" price was awarded to his paper: "The energy mineral society nexus – A social LCA model." He is subject assistant editor of the Journal Applied Energy.

Co-Moderator

Dr. Nicola Cantore
United Nations Industrial Development Organization (UNIDO)

Short Bio

Nicola Cantore holds a Ph.D in environmental economics and management at the University of York and a Ph.D in economics at the Universita` Cattolica del Sacro Cuore in Milan. He worked as a junior researcher at the FEEM (Fondazione ENI Enrico Mattei) in Milan, as a senior researcher at the Department of Agricultural Economics and Engineering of the University of Bologna and as a research fellow at the Overseas Development Institute in London. He is currently a research and industrial policy officer at the Department of Policy Research and Statistics of UNIDO. His work covers research, capacity building activities and policy advice. His research interests include environment, development and structural change.

Dr. Wilhelm Kuckshinrichs
Forschungszentrum Jülich, Jülich, Germany

Short Bio

Dr. Wilhelm Kuckshinrichs studied economics at the Universities of Dortmund and Oldenburg. From 1986-1991 he worked also for AGEP, a study group on energy and systems planning, Oldenburg. In 1991, he joined the team of IEK-STE at Forschungszentrum Juelich as an energy economist, and in 2019, he was appointed to the acting head of IEK-STE. He is working in the area of assessment of strategies for systems transformation, primarily for energy systems, but recently also for bio-economic systems. He became speaker of topic3 'Energy Systems – Issues of Energy Efficiency and Energy Security' in the Helmholtz program 'Technology, Innovation, Society'. He is also appointed as Head of Core Group for 'Economy and Society' of the Bioeconomy Centre.

Speakers

Dr. Lea Eggemann
Forschungszentrum Jülich, Jülich, Germany
GMT+1 12:10-12:20

The Contribution of Manure Utilisation in Biogas Plants in Terms of Climate Change

Abstract

The main source of global CO2 is heat and electricity production, which requires an increase in renewables that cover fluctuating sources. Biogas plants are one possibility, which are already commonly used in the European energy system. This study focuses on the utilisation of unused manure to reduce direct emissions of methane within an advanced and expensive, and a simplified and less expensive plant. Therefore, the environmental impact in terms of CO2 eq emissions of a biogas plant with either subsequent combustion in a combined heat and power plant or the direct use of the biogas in a simplified burner are investigated. The analysis shows that the more advanced system yields 493 t CO2 eq, while the simplified one causes 42 t CO2 eq per year. Nevertheless, increasing average annual temperatures generate higher manure credits and thus reduce emissions of both plant options to 726 and -178 t CO2 eq per year, respectively, making the direct biogas usage become more interesting. Thus, both systems hold the potential for savings in terms of improved manure management against the background of climate change.

Short Bio

I graduated in agricultural economics and started working in sustainability management at the research centre Jülich in 2016. In the beginning of 2018, I started my PhD about a novel Power-to-Fuel system, producing methanol from CO2 in biogas. I am currently a postdoc at the Institute of Energy and Climate Research in Jülich, where I deal with biomass-related topics in energy systems analysis.

Dr. Daphne Keilmann-Gondhalekar
Technical University of Munich TUM, School of Engineering and Design
GMT+1 12:20-12:30

Feasibility of energy generation with biogas at the household level: assessing the impact of anaerobic co-digestion of waste activated sludge and food waste taking a Water-Energy-Food (WEF) Nexus approach, and implications for Europe and Africa

Abstract

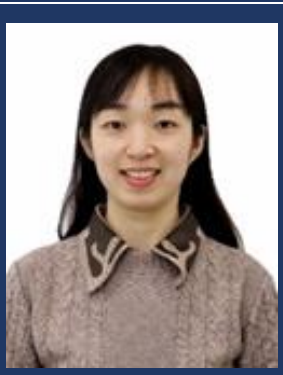
The effects of anaerobic co-digestion at a household level with waste activated sludge and food waste as co-substrates were studied in a GD-BMP test with mix ratio volatile solids basis of 20:80, 30:70, 50:50, 70:30 and 80:20 (WAS/OW) respectively. The results obtained were used to assess the feasibility of energy generation and the volume of each waste that can be treated. The highest specific methane yield calculated was of 431.31mL$_{CH4}$/g$_{VSadded}$ from the 30:70 mix ratio sample with an RSD of 4.68%. It was hypothesized that the benefits of adding food waste will shift the C/N ratio leading to a potential coverage to reduce the energy demand from households by 50%. In addition, the benefits from a house scale SBR with microbubble aeration followed by SCSTR anaerobic co-digestor. Using the 30:70 mix ratio analyzed, a calculation to obtain the electrical energy that can be recovered from a single household resulted in a 30% reduction of energy coming from the grid. This paper reflects that biogas can be used as a replacement of fossil fuels, reducing the carbon dioxide footprint and the strong link to the WEF Nexus cycle, and discusses the implications for Europe and Africa.

Short Bio

Dr. Daphne Gondhalekar is an urban planner and research scientist at the Chair of Urban Water Systems Engineering, Technical University of Munich, Germany.

Her research focus is integrated urban planning, Water-Energy-Food Nexus, and multi-stakeholder processes in India, Niger, Ghana and Germany. She heads the urban Water-Energy-Food Nexus research group and co-coordinates the TUM Water-Energy-Food Nexus field of study in the Environmental Engineering Masters Programme. She holds a Ph.D. in Urban Planning from The University of Tokyo and a Masters and Bachelor in Architecture and Urban Design, has worked as Postdoctoral Associate at Department of Urban Studies and Planning at Massachusetts Institute of Technology (MIT), USA and Center for Development Research (ZEF), University of Bonn, Germany.

Food-energy-water nexus in context of planting and breeding coupling mode-a case study in China



Prof Xing Fan
Institute of Environment and Ecology, Shandong Normal University, Ji'nan, Shandong, 250358

Prof. Bin Chen,
State Key Joint Laboratory of Environmental Simulation and Pollution Control, School of Environment, Beijing Normal University, Beijing 100875, China

GMT+1 12:30-12:40

Abstract

Towards the goal of sustainable agricultural development, China has issued a series of practical policies promoting the coupling of crop planting and livestock breeding, where crop straws are collected and used as animal green feeds and animal manure are treated and recycled in croplands to provide nutrients. In this study, the trade-offs and synergies among food, energy and water resources were quantified for the planting and breeding coupling mode of Chinese agriculture. Taking a typical project as the case, the energy and water resource consumption along the cycling process of planting and breeding coupling system was calculated considering the specified food yields. The saving potential of such food-energy-water nexus incorporating technical and managerial innovation was also simulated in context of SDG goals of UN and carbon neutrality of China. Finally, a range of policy suggestions were proposed for the promotion of circular agriculture in China.

Short Bio

Xing Fan is an associate professor in Institute of Environment and Ecology of Shandong Normal University. She obtained Ph.D. degree in environmental science from Zhejiang University. Her research focuses on ecological engineering. She has published more than 10 papers in journals including Nature Communications, Environmental Science and Technology, Applied Energy, Ecological Engineering, etc.

Bin Chen is a full professor at Beijing Normal University in the School of Environment as well as the State Key Joint Laboratory of Environmental Simulation and Pollution Control. He obtained B.E. degree in electrical engineering from Zhejiang University, and Ph.D. degree in environmental science from Peking University. His background is environmental system modelling studies. He has authored more than 200 academic publications in peer-reviewed journals including Science Advances, Nature Communications, Nature Climate Change and Proceedings of the National Academy of Sciences (PNAS). He is serving as Editor-in-Chief of Energy, Ecology and Environment, Executive Editor of Journal of Cleaner Production, Associate Editor of Frontiers of Earth Science, Subject Editor of Applied Energy, Ecosystem Health and Sustainability, and an editorial board member of Energy, Ecological Modelling, Journal of Environmental Management, Journal of Hydrodynamics, Ecological Informatics, Fundamental Research, Environmental and Sustainability Indicators, Current Research in Environmental Sustainability, etc.

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GMT+1 12:40-12:50

Energy-water nexus stress driven by food trading in China

Abstract

Food production has consumed considerable energy and water resources in China. In this study, an energy-water nexus stress evaluation framework was proposed considering local food scarcity. The energy and water transfer embedded in the food trading activities was also assessed using multiple regional input-output method according to the food supply and demand in China. The spillover effects and saving potential were then simulated considering the current food trading pattern. The results showed that the spatial heterogeneity of energy-water nexus stress in China was notable, of which Beijing and three coastal provinces, Zhejiang, Fujian and Guangdong, were of higher resource stress. It was concluded that the hidden transfer of energy and water in food trade should be highlighted to promote the collaborative resource utilization on the national scale.

Short Bio

Wen Zhang is an associate professor in Institute of Environment and Ecology of Shandong Normal University. She obtained Ph.D. degree in environmental science from Northwest Agriculture & Forestry University. Her research focuses on sustainable agriculture. She has published more than 10 papers in journals including Journal of Environmental Management, Plant Cell and Environment, Journal of Agro-Environment Science and Transactions of the Chinese Society for Agricultural Machinery, etc.

Prof Bin Chen is a distinguished professor of environmental system modelling at Beijing Normal University. Dr. Chen has published over 200 peer-reviewed papers in international journals such as Science Advances, Nature Communications, Nature Climate Change, PNAS, etc. He is serving as Editor-in-Chief of Energy, Ecology and Environment, Executive Editor of Journal of Cleaner Production, Associate Editor of Frontiers of Earth Science, Subject Editor of Applied Energy, etc.

Mr. Abu Saieed
United Nations Industrial Development Organization (UNIDO)
GMT+1 12:50-13:00

Are Energy Efficiency Improvements Always the Most Cost-Effective Investments?

Abstract

The United Nations Industrial Development Organization (UNIDO) implemented the Mediterranean Transfer of Environmentally Sound Technology (MED/TEST) Phase II in the Southern Mediterranean Region between 2016 and 2018. This paper reports the findings of resource efficiency demonstrations with 58 companies in three North African countries (Algeria, Morocco, and Tunisia). The paper draws on the findings of Material Flow Cost Accounting that estimates the full costs of energy, water, and raw materials used in production processes, and of Resource Efficiency and Cleaner Production Assessments that identify feasible and cost-effective interventions. The combination of these two tools allows for a comparison of the payback periods of a full range of potential resource efficiency measures. Not surprisingly, there are several water and raw materials measures that have returns on investment similar to those for energy measures.

Short Bio

Abu Saieed is working as an International Expert on Green Industry at the Department of Environment of the United Nations Industrial Development Organization (UNIDO) based in Vienna, Austria. As a technical expert, he is responsible for the UNIDO's portfolio under Partnership for Action on Green Economy (PAGE) in Asian and African countries. Before joining UNIDO, Mr. Saieed worked for the International Atomic Energy Agency in Austria, United Nations Development Programme in Bangladesh, and several research institutes. He is an economics and public policy graduate of Central European University, Hungary, and the National Graduate Institute for Policy Studies, Japan

Dr. Stelios Grafakos
European Office of the Global Green Growth Institute (GGGI)
GMT+1 13:00-13:10

Assessment of jobs creation potential of NDC Renewable Energy targets in selected African countries

Abstract

This study assessed the employment co-benefits of implementing targets related to renewable energy (RE) set in the Nationally Determined Contributions (NDCs) under the Paris Agreement in five GGGI Member developing countries in Africa. Quantitative NDC targets related to RE were found for five African countries related to five RE technologies, namely 1) solar photovoltaic, 2) onshore wind, 3) biomass, 4) geo-thermal, and 5) hydropower. The study used employment factors (EFs) to estimate the number of direct job-years generated as a result of investments in RE to achieve the NDCs. EFs, particularly in the RE sectors, were obtained from an extensive literature review and subsequently adjusted for each country under study to account for national labor market conditions and changes over time. RE job-years are estimated separately for four stages in the value chain: 1) construction and installation, 2) manufacturing, 3) operation and maintenance, and 4) fuel production.

Short Bio

Dr Stelios Grafakos is the Head of the European Office of the Global Green Growth Institute (GGGI) and Global Lead of GGGI's work on Long Term – Low Emission Development Strategies (LT-LEDS). In his current role, he is leading GGGI's technical work on supporting member and partner countries to develop their Long-Term Low Emission and Climate Resilient Development Strategies. Under this workstream, Stelios is providing strategic direction and leadership on conducting low emission pathway analysis and modelling, assessing socio-

economic impacts of low carbon development policies, and incorporating climate resilience in LT-LEDS. In addition, Stelios is also responsible for GGGI's work on the (macro)-economic analysis of green and low carbon growth plans and strategies, with main focus on the assessment of green jobs. Stelios has led several green jobs related studies in Fiji, Mexico, Indonesia and Rwanda and currently in Mongolia. Prior to GGGI, Stelios was the Head of Environment and Climate Change unit at the Institute for Housing and Urban Development Studies (IHS) at Erasmus University Rotterdam (EUR) in the Netherlands. In his career Stelios has led a number of research, advisory and capacity building projects on climate policy, supporting national and sub-national governments in low- and middle-income countries to develop their low carbon and climate-resilient strategies.

Stelios holds a PhD in integrated assessment of climate actions and decision support from the Erasmus University Rotterdam, a Master's Degree in Environmental Management and Policy from the University of Amsterdam and a Bachelor's degree in Economics from the Athens University of Economics and Business. In addition, Stelios has published many peer-reviewed articles in academic journals, books, and international conferences, while he has led and contributed to several GGGI flagship publications.

Discussion

GMT+1 13:10-13:40