XVI Interdisciplinary Seminar on Climate, Energy and Sustainability

Technology Special Edition

1 April 2025

9.30 – 11.30 CEST

PROGRAMME

Time	Programme
9.15 – 9.30	**ZOOM room opens**
9.30 – 9:50	**Welcome and Introduction** **Associate Professor Beatriz Martinez Romera**, Centre for Climate Change Law and Governance (CLIMA), Faculty of Law; Co-Director of Copenhagen Center for Disaster Research (COPE), University of Copenhagen **Christiana Aristidou,** Director of Legal Research, The Blockchain & Climate Institute and **Laura Iskau,** The Blockchain & Climate Institute *Explaining The Relevance of Blockchain Technology for Climate Change*
9.50 – 10.35	**Session 1** **Chair: Stella Ebbersmeyer**, Postdoc, Centre for Climate Change Law and Governance (CLIMA), Faculty of Law, University of Copenhagen 1. **Isabella De Judicibus**, PhD Candidate, Scuola Normale Superiore *It depends on the wind': understanding positions and navigating tailwinds for innovation in international shipping*

	2. **Naresh Prajapati,** Senior Doctoral Fellow in Law, School of Legal Studies, Central University of Punjab *Climate Technology and Policy Gaps: Challenges and Opportunities for Sustainability* 3. **Raquel Martínez Martínez,** Department of Marine Science and Technology, University of Oviedo *Machine Learning Integrated with a Thermodynamic Model for Fault Detection and Energy Performance Prediction in a Marine Diesel Engine*
10.35 – 10.40	**Break**
10.40 – 11.25	**Session 2** **Chair: Alberto Barrio**, Postdoc, Centre for Climate Change Law and Governance (CLIMA), Faculty of Law, University of Copenhagen 1. **Aitor Nicolás Fernández Álvarez,** Department of Marine Science and Technology, University of Oviedo *From Waste Cold to Efficiency: LNG-Based Refrigeration as a Decarbonization Strategy for Shipping* 2. **Byron Sequeira,** LL.M candidate in International and Comparative Law, George Washington University Law School *Can Artificial Intelligence Strengthen Environmental Accountability and Combat Greenwashing in the Private Sector within the European Union's Green Claims Directive?* 3. **Darryl Isabel,** LL.B student, Kabarak University *Leveraging Arbitration and Technology for Climate Dispute Resolution in Kenya: A Path to Sustainable Development*
11.25 – 11.30	**Concluding Remarks** **Associate Professor Beatriz Martinez Romera**, Centre for Climate Change Law and Governance (CLIMA), Faculty of Law; Co-Director of Copenhagen Center for Disaster Research (COPE), University of Copenhagen

ABSTRACTS

Isabella De Judicibus, Scuola Normale Superiore

It depends on the wind': understanding positions and navigating tailwinds for innovation in international shipping

A just and equitable energy transition is essential for the shipping sector, which not only transports vast quantities of fossil fuels but also accounts for nearly 3% of global greenhouse gas emissions. This study explores the role of wind propulsion technologies in decarbonising shipping while promoting a just sustainability transition. Little attention is given to the variegated picture of wind propulsion development worldwide and the types of innovations being advanced. Why do companies propose certain technologies over others? How is the adoption of a particular technology influenced by values? What does this reveal about the whole-system transition of international shipping? To address these questions, this work presents a preliminary exploration of the positions and narratives in the socio-technical ecosystem of wind propulsion initiatives across different geographies.

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Naresh Prajapati, School of Legal Studies, Central University of Punjab

Climate Technology and Policy Gaps: Challenges and Opportunities for Sustainability

The rapid advancement of climate technologies presents a critical opportunity to mitigate climate change, yet policy gaps and regulatory challenges continue to hinder large-scale implementation. This study explores the intersection of climate technology and policy, analysing key barriers that prevent sustainable innovations from reaching their full potential. This study highlights the disconnect between technological advancements and climate governance by examining current policy frameworks, regulatory bottlenecks, and legal ambiguities. Using a policy analysis approach, this study reviews international climate agreements, national policies, and emerging legal trends that influence the deployment of renewable energy, carbon capture, and digital climate solutions. Case studies from leading and developing economies provide insight into how different regulatory landscapes shape technological adoption, investment, and climate resilience. Key findings suggest that unclear regulations, fragmented policies, and inadequate financial incentives slow down the integration of climate technologies into mainstream climate action. However, progressive policy shifts—such as carbon pricing mechanisms, green subsidies, and digital governance frameworks—demonstrate potential pathways for overcoming these barriers. This study argues that achieving sustainable innovation requires a harmonised global policy approach, where governments, industries, and international institutions work together to create an enabling regulatory environment. By addressing policy gaps and leveraging technological advancements, nations can accelerate progress toward net-zero emissions and long-term climate resilience. This study contributes to climate law, energy policy, and sustainability governance, offering policy recommendations that foster the synergy between climate technology and effective regulation.

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Raquel Martínez Martínez, Department of Marine Science and Technology, University of Oviedo

Machine Learning Integrated with a Thermodynamic Model for Fault Detection and Energy Performance Prediction in a Marine Diesel Engine

Marine diesel engines play a crucial role in global maritime transport. They provide reliable and efficient propulsion systems capable of handling heavy loads. Additionally, auxiliary diesel engines are installed aboard ships to generate electric power. Engine projects aimed at increasing efficiency and reliability align with the global sustainability objectives established by the International Maritime Organization and the United Nations Sustainable Development Goals (SDGs): "Affordable and Clean Energy" (SDG 7), "Industry, Innovation, and Infrastructure" (SDG 9), and "Climate Action" (SDG 13), positioning this type of project as a globally relevant study. Developing a thermodynamic model of a real engine, which allows for comprehensive analysis without incurring the high costs and environmental impact associated with physical testing, is a fundamental component of the proposed study. The statistical analysis of historical data from the engine's thermodynamic model will provide the necessary tools to develop functions capable of identifying various types of failures and optimizing engine operations. Simultaneously, another statistical study will generate the required data to develop a function that determines the engine's performance efficiency under different operating conditions, ensuring maximum adaptability to real-world scenarios. Continuous analysis of operational data will not only facilitate more efficient maintenance scheduling but also reduce unplanned downtime. Failure prevention enhances engine availability and ensures that the lifespan of critical components is maximized, reducing the consumption of spare parts and minimizing associated costs. These improvements lead to significant advancements in energy utilization processes, resulting in cost savings and a lower environmental footprint. Additionally, the developed thermodynamic model, validated with real data from a marine diesel engine, provides a solid foundation for future research in energy optimization, maintenance resource management, and operational excellence

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Aitor Nicolás Fernández Álvarez, Department of Marine Science and Technology, University of Oviedo

From Waste Cold to Efficiency: LNG-Based Refrigeration as a Decarbonization Strategy for Shipping

Maritime transport is at the core of international trade, yet the sector is actively seeking ways to transition towards greater sustainability and efficiency. The implementation of energy efficiency indices for ships, key maritime policies such as the International Maritime Organization's Carbon Intensity Indicator, and new European regulations aligned with the Fit for 55 package are driving the industry towards decarbonization objectives, which can greatly benefit from improved energy utilization.

One area where currently untapped energy could be harnessed to enhance ship efficiency, reduce fuel consumption, and contribute to the ongoing decarbonization of maritime transport is the use of the low-temperature properties of liquefied natural gas (LNG). An increasing number of vessels are adopting LNG as fuel due to its lower carbon content and negligible sulfur emissions. To this end, LNG is stored in liquid form at extremely low temperatures but must be fed into the engine in a gaseous state at approximately 30°C. This transition presents an opportunity to improve the efficiency of mechanical compression refrigeration cycles. By vaporizing LNG through a heat exchanger, the refrigerant fluid of a mechanical compression cycle can benefit from the recovery of otherwise wasted cold energy, providing additional cooling and reducing the external work required by the system. This approach significantly lowers electricity consumption, leading to reduced fuel usage onboard and, consequently, lower emissions. Furthermore, it could decrease the number of onboard systems, resulting in lower maintenance requirements and optimized space utilization.

The recovery of cold energy from LNG vaporization, combined with the selection of ultra-low Global Warming Potential organic fluids, represents a strategy that not only enhances energy efficiency but also ensures compliance with international regulatory frameworks. This approach contributes to the broader goal of a more sustainable and environmentally responsible maritime industry.

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Byron Sequeira, George Washington University Law School

Can Artificial Intelligence Strengthen Environmental Accountability and Combat Greenwashing in the Private Sector within the European Union's Green Claims Directive?

In an era where environmental stewardship is crucial, addressing greenwashing is vital to achieving genuine sustainability. This paper examines how the European Union (EU) can effectively combat greenwashing by leveraging recent legislative advancements, notably the European Union Artificial Intelligence Act (EUAI Act). Part I defines greenwashing and examines its detrimental effects on consumer trust and sustainability initiatives. It also evaluates how AI technologies can enhance transparency and veracity in environmental claims. It reviews relevant UN resolutions and outlines the key provisions of the EU AI Act, setting the stage for a comprehensive understanding of the regulatory landscape. Part II delves into the role of AI technologies in combating greenwashing, including data analysis and real-time impact scoring. This part focuses on how these technologies improve transparency and regulatory oversight while addressing technical and ethical challenges like data privacy and security. It also addresses how the EU AI Act and other relevant legal frameworks including the Green Claims Directive, the Eco-Design for Sustainable Products Regulation, the EU Taxonomy Regulation, the Sustainable Finance Disclosure Regulation, the Corporate Sustainability Reporting Directive, and the EU Circular Economy Action Plan enhance transparency and accountability in environmental claims and can be integrated with AI for improved verification and enforcement. Part III reviews the EU's regulatory framework on sustainability, highlighting key directives such as the Green Claims Directive, and how AI can integrate with and enhance these regulations. It examines the regulatory practices in the United States and India, emphasizing the EU's innovative approach and international best practices. Part IV explores AI-driven mechanisms in relation to Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and

Production) and SDG 16 (Peace, Justice, and Strong Institutions), discussing implementation strategies, impacts, and privacy considerations. As the Act's effective date of August 2, 2026 draws near, it is crucial to address AI's limitations and prepare for its challenges. Part IV proposes how AI can enhance regulatory systems to verify environmental claims, improve transparency, and support global sustainability goals, thereby fostering a more responsible and transparent market environment in the EU and setting a global standard for accountability and integrity in environmental reporting.

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Darryl Isabel, Kabarak University

Leveraging Arbitration and Technology for Climate Dispute Resolution in Kenya: A Path to Sustainable Development

Climate change has intensified disputes over resource management, environmental obligations, and sustainable development, making efficient and credible dispute resolution mechanisms essential. Arbitration has emerged as a preferred alternative to litigation, offering flexibility, speed, expert adjudication, and enforceability. However, despite these advantages, arbitration processes often face criticism regarding transparency, accountability, and the integrity of records. This study examines how arbitration can be leveraged for climate dispute resolution in Kenya and how blockchain technology can address these procedural gaps.

Using the Cortec Mining Kenya arbitration case as a key illustration, the paper highlights how arbitration tribunals can balance investor interests with environmental protection. In this case, a mining license was revoked by the Kenyan government due to environmental non-compliance, leading to investor-state arbitration. The tribunal upheld Kenya's environmental regulations, but the process was criticized for lacking transparency and public accountability. This example underscores the urgent need for mechanisms that enhance trust and verifiability in arbitration.

The paper explores blockchain technology as a solution to these challenges. Blockchain's immutable, tamper-proof ledger can securely store arbitration proceedings, evidence, and awards, preventing manipulation and ensuring long-term credibility. Additionally, smart contracts can automate the enforcement of arbitral awards, reducing judicial interference and delays. While blockchain's transparency may clash with arbitration's traditional confidentiality, this tension can be mitigated through hybrid blockchain systems that selectively restrict access to sensitive data.

Finally, the study identifies key challenges—confidentiality concerns, technical barriers, and regulatory uncertainty—and proposes targeted solutions including capacity-building initiatives and the development of clear legal frameworks. By combining the strengths of arbitration with the reliability of blockchain technology, Kenya can strengthen its climate dispute resolution framework, supporting both environmental justice and the achievement of Sustainable Development Goal 13.

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