Lower Saxony – Scotland Joint Forum 2022

"A Strategic Energy Partnership for Lower Saxony & Scotland: Renewable Energies and Sustainability"

White Paper: Energizing Democratic Partnerships – Securing Electricity from Democratic Friends

1. Abstract

The Glasgow Climate Pact agreed at the 26th United Nations (UN) Climate Change Conference of the Parties (COP26) in November 2021 reaffirmed the international commitment to close the gap between existing emission reduction plans and what is required to scale down on emissions so that the rise in the global average temperature may be limited to 1.5 degrees.

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets legally binding targets to reach net zero emissions of all greenhouse gases by 2045. The cities of Glasgow and then Edinburgh set the target to become carbon neutral by 2030. In 2020, the Lower Saxonian state government included climate and its protection as state objective in its constitution.

After setting targets for climate neutrality by 2050, the German Bundestag passed a new edition of the Climate Protection Act in 2021, which sets out the national goal of reaching climate neutrality by 2045, with greenhouse gas emissions to be reduced by at least 65 percent by 2030 compared with 1990 levels. This is also reflected in the Lower Saxonian Climate Protection Strategy from 2021.

Reaching the net-zero goal requires transformational, whole-system change and clear pathways to accelerate the transition to clean, affordable and resilient energy systems.

The main objective of the third edition of the **Lower Saxony – Scotland Joint Forum 2022** was to discuss the ongoing energy transformation: the Scottish and Lower Saxonian perspectives post-COP26, in the wake of rising energy prices and geopolitical unrest. In the context of the panel discussion and following round table on **Renewable Energies and Sustainability,** ideas to enhance energy security, boost economic development and allow for a carbon-neutral future in the energy sector in both regions were considered and developed. These shall lay the foundation for establishing a strategic energy partnership between Lower Saxony and Scotland, extending far beyond the academic sphere.

In partnership with

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2. Keynotes & Panel Discussion: "Renewable Energies & Sustainability"

Moderation:

Gioia Falcone, *Rankine Chair of Energy Engineering, University of Glasgow*

Regional Perspectives:

Knut Kappenberg, *Research Service, Energy Research Centre of Lower Saxony (EFZN)*

Stephen-Mark Williams, *Executive Director, Energy Technology Partnership Scotland*

Energy Policy:

Karen Turner, *Director of The Centre For Energy Policy, University of Strathclyde*

Climate Change & Sustainability:

Thomas Schomerus, *Professorship for Public Law, in particular Energy and Environmental Law, Leuphana University of Lüneburg*

Jaime Toney, *Director of the Centre for Sustainable Solutions and Professor of Environmental and Climate Science, University of Glasgow*

Hydrogen Energy:

Knut Kappenberg, *Research Service, Energy Research Centre of Lower Saxony (EFZN)*

Markus Exenberger, *Executive Director, H2 Global Foundation*

David Flynn, *Professor in Cyber-Physical Systems, University of Glasgow*

David Scrimgeour MBE, *Hydrogen Advisory & Initiator of Scot2Ger Study*

3. Considerations

Energy policy – and broader Net Zero policy – really is a societal and public policy challenge as much as it is a technical one. For example, it is crucial to understand 'who pays, how and when', and what 'gains' can be used to balance outcomes of chosen pathways and required policy actions in a politically, economically and socially feasible manner. The challenge of balancing affordability, energy security and decarbonisation has been turbocharged by the 'energy crisis' and broader 'cost of living crisis'. Solutions that contribute to all three (e.g.,

energy efficiency, renewables and storage) are available, but take time to deploy, will have upfront and operational cost implications, and require significant market reforms.

Collaboration can be a crucial tool – opportunities for system benefits with interconnection across different vectors (electricity, hydrogen etc.) and for sharing learnings around delivering energy policy in a complex political and societal context. The Energy Research Centre of Lower Saxony (EFZN) and the Energy Technology Partnership (ETP) share common goals as multi-universities research alliances that act as catalysts for collaborative innovation in the clean energy transition. They offer significant potential for facilitating Lower Saxony-Scotland academic cooperation, extended to local non-academic stakeholders.

To date, the energy transition has predominately treated gas, electricity and transport networks separately. Silo investments have failed to deliver the required rate of decarbonisation whilst also incurring significant costs. The energy transformation requires a joint approach to energy supply, demand, efficiency, infrastructure decommissioning and waste management while considering sustainability key performance indicators. A just transition's social, environmental, and economic aspects must be embedded into policies. Potential risks to customers and the environment must be considered. In July 2022, the High Court ruled against the UK Government's inadequate net-zero strategy, concluding that it lacked any explanation or quantification of how the government's plans would achieve the emissions target, thereby failing to meet its obligations under the Climate Change Act. The UK Government was given eight months to update its strategy to include a quantified account of how its policies will achieve climate targets. This highlights the need for clear pathways to implement the energy transformation. The EU has been a frontrunner in implementing life-cycle assessment (LCA) policies. However, the development of new stringent and mandatory requirements related to LCA is still limited, with outstanding issues in the interface between science and policymaking (e.g., verification and market surveillance). Also, environmental LCA must be complemented by Life-Cycle Costing (LCC) and Social LCA for a complete sustainability assessment of the value chain of goods and services.

Currently, Scotland produces over 1,000 TWh of energy per year from oil and gas production, primary electricity, and bioenergy and waste; of this energy, 32 terawatt hours (TWh) is electricity generated from renewable sources. If all of Scotland's current energy demand of 145 TWh were met by clean electricity, an additional 113 TWh of renewable electricity generation capacity would need to be installed. With additional co-investment with Lower Saxony, renewable energy capacity in Scotland could be expanded to accommodate generation of sufficient green hydrogen for export to Lower Saxony. Green hydrogen is regarded as a gap technology, notwithstanding that more efficient options may exist. Blue hydrogen generation, on the other hand, is associated with a significant carbon footprint.

4. **Estimated Effects**

A strategic partnership between Lower Saxony and Scotland has the potential to create local solutions with global impact. This alliance is well aligned with the findings of the 2022 International Energy Agency (IEA) Breakthrough Agenda Report, which highlighted that due to a lack of international collaboration we threaten to undermine climate mitigation and delay net zero by decades. Within this report 5 key sectors were prioritised, which included energy networks and transport. Recommendations to accelerate net zero included interventions, such as (i) demonstrate and test new low carbon energy systems that increase their share of renewable energy, (ii) improve energy flexibility, security, and trading, (iii) mobilise investment into new charging infrastructure for Electric Vehicles (EVs), and (iv) utilisation of government policies and private-sector purchase commitments to drive demand and deployment of low-carbon and renewable energy.

A Lower Saxonian-Scottish alliance has the potential to establish a body of evidence in low carbon technologies and international collaboration, that will establish pathways for engineering supply chains and green finance investment. Creating a first mover advantage of this consortium, that can accelerate net zero transitions through an integration of the resources, attributes and networks of these two communities.

5. Open Questions

- Is there a ceiling in renewable electricity generation capacity in Scotland?
- What were the energy intensity and embodied carbon footprint of constructing and setting up energy production sites generated in a sustainable (and lower energy consuming) way?
- How can the risk of hydrogen pipeline leakages be prevented/minimized, as any hydrogen leakage will affect atmospheric composition and have an indirect global warming potential?
- Will it be necessary to provide permanent CO2 storage to achieve carbon neutrality throughout all processes?
- Is there a whole systems view of the energy infrastructure and services of Lower Saxony?
- Is the regulatory framework ready to enable scalable hydrogen integration and intelligent energy services?

When we understand the questions above, we start to understand what kind of low carbon technologies and/or intelligent energy demand solutions, are best placed.

6. Research and Development Map

1. Foundation of a Lower Saxony – Scotland Energy Transition Research Work Group
2. Provision of energy supply
3. Assessment of the potential for reduction of energy consumption in both regions
4. Analysis of Intelligent energy demand pathways.
5. Identification of areas and processes that may be relocated in proximity to energy production
6. Societal effects of the energy transition
7. Detailed KPIs for circular economy business models of sustainable energy services.
8. Operational and planning decision support framework for whole system
9. Establishment of a standardized sustainability assessment framework