Xiaojing Lin is a doctoral candidate at the Integrated Research on Energy, Environment and Society (IREES) at the University of Groningen, the Netherlands. She holds a bachelor's and a master's degree in Economics from the Harbin Institute of Technology (Shenzhen), China. Her research focuses on economic analysis of renewable technologies (such as PV, wind, and energy storage system), and projecting the demand patterns of critical materials (lithium, cobalt, copper, etc.) for renewable energy transition. As many countries set net-zero emissions targets and increasingly rely on renewable technologies to mitigate climate change, the demand for critical materials has grown significantly. This trend has raised concerns regarding the geographical concentration of material supply, along with associated environmental, social, and sustainability challenges. Her work aim s to develop sustainable pathways for the energy-materials-climate nexus.

Project at IAS-STS: Assessing techno-economics of solar power systems and energy storage deployment in West Africa:

West Africa stands at a critical juncture in its energy transition, facing persistent electricity access deficits alongside rapid population growth. Despite ambitious targets, large-scale solar photovoltaic (PV) deployment remains constrained by infrastructure deficits and limited transparency regarding economic performance.

This study addresses this gap through a bottom-up high-granular techno- economic assessment of utility-scale PV across 184 districts in the West African Power Pool under 13 climate scenarios, and a multi-objective optimization of hybrid energy systems integrating batteries and hydrogen technologies.

Our results reveal pronounced spatial heterogeneity in grid-connected PV costs, with the levelized cost of electricity ranging from $0.087/kWh to $0.319/kWh. This heterogeneity is driven by a distinct urban-rural divide, where remote inland regions face prohibitive transmission penalties, while dense urban centers are constrained by elevated land rental costs. Coastal tropical countries such as Sierra Leone and Liberia exhibit heightened vulnerability to future climate uncertainty, whereas nations like Senegal and The Gambia demonstrate consistent investment resilience. Electricity tariff subsidies and risk-inflated financing costs, remain the dominant barriers to solar PV implementation. Furthermore, the optimization of hybrid energy systems highlights a critical geographical divergence in storage technology. Regions with stable solar resources (e.g. Nigeria) favor battery storage for short-term variability, while tropical regions with prolonged rainy seasons (e.g. Liberia) require hydrogen-based systems for seasonal balancing. The storage-driven cost structures fundamentally reshape regional competitiveness, enhancing the viability of countries such as Liberia and Guinea-Bissau. By capturing these spatial, climatic, and technological trade-offs, this study establishes a data-driven framework for policymakers to design differentiated zonal electrification strategies and for investors to optimize investment allocation.

Selected Publications

J.L. Liu, T.T. Wang, Y.H. Wang, **X.J. Lin**, R. Zhou, K. Wang. China's 1+N policy system supports an earlier peak in carbon emissions. Renewable and Sustainable Energy Reviews, Volume 215, 2025, 115626.

Liya Xue, Junling Liu, **Xiaojing Lin**, Mengyue Li, Takuro Kobashi. Assessing urban rooftop PV economics for regional deployment by integrating local socioeconomic, technological, and policy conditions. Applied Energy, Volume 353, Part A, 2024, 122058.