

PROGE — **Prosumer-driven green and digital transition** towards de-centralized peer-to-peer energy communities

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Rationale and Hypothesis

Energy communities equipped with peer-topeer (P2P) trading scheme together with a viable business models emphasizing societal values, sustainability, and inclusiveness, built on <u>scalable microgrid</u> and <u>ICT</u> systems, can economically feasible solution for provide delivering electricity, connectivity, and digital services, and thus better livelihoods for underserved communities in developing countries.

Advancing beyond state-of-the-art

State-of-the art and existing research gaps

resource forecasting and allocation

Prosumer layer User engagement Co-creation tools for prosumer Missing tools for energy citizen engagement engagement Finand Peer-to-peer Decision making of business actors Business layer Novel business models for No scientifically proven BM for value a a creation in highly complex value stakeholders' value creation al transactions peer sharing e optimization network of rural MG Energy and financial transactions **Function** layer Missing models of p2p energy DLT enabled P2P transactions community members market participation Physical (components) Loads, generation, storages layer ML based resource forecasting Missing capture of uncertainty in MG and allocations

Results: New knowledge and contribution

Main objectives

- Design and demonstrate conceptual solutions, which engage end-user to sustainable and green electrification actions
- Develop an energy community market design, which incorporates various societal values, including value of carbon reduction, and delivery of renewable energy and related green ICT solutions
- Promote feasibility and sustainability of green electrification and digital service provision for un-served communities in Global South
- Evaluate and test the approach against the previous studies [5], and in practice in the existing field sites; smart off-grid energy community in Namibia [6] and in grid-connected microgrid in Finland [7]
- Use the sites as virtual power plants (VPP) to design, implement, test and develop the P2P energy market models lacksquareand machine learning (ML) algorithms
- Measure societal effects and impacts and develop tools to improve the local community engagement, and
- Design business models for energy communities, which enhance the replicability and scalability of the off-grid electrification projects

PROGE research project

- Duration 9/2023 8/2027, funded by Academy of Finland (currently Research Council Finland)
- Project consortium: Lappeenranta-Lahti University of Technology LUT and Aalto University

Related previous work

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• Project collaborators from Europe and Africa; TALTECH (EE), Polimi (IT), NUST (NA), UWC (ZA)

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https://www.vttresearch.com/sites/default/files/pdf/publications/2021/Carbon_handprint_guide_2021.pdf [5] SETaDISMA research project. https://www.leap-re.eu/setadisma/

[6] Nieminen, M., Pinomaa, A., Fusion Grid - Electricity, Connectivity, and Digital Services for Underserved and Remote Communities in Developing Markets. Closing report.

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