

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

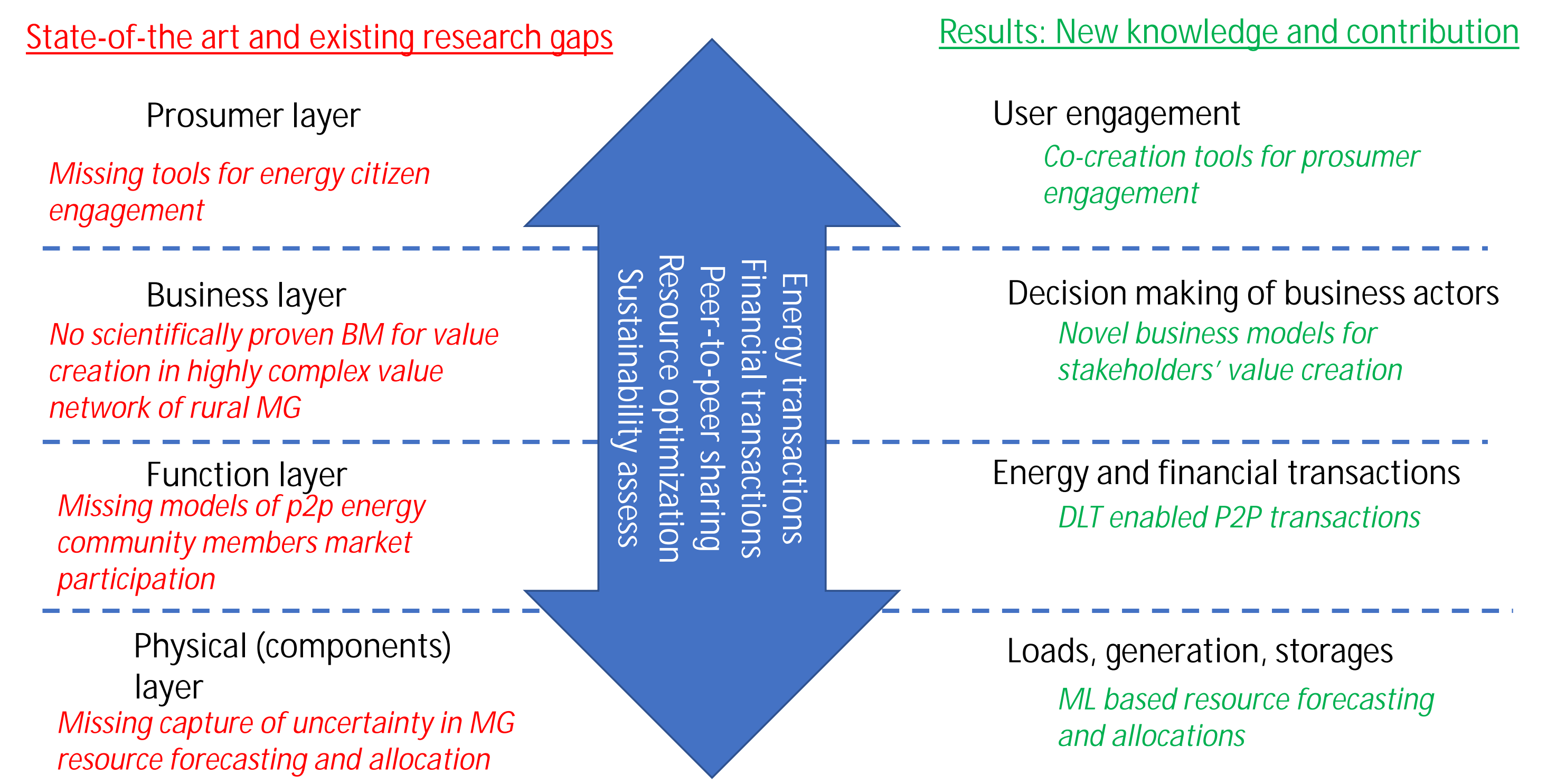
Main objectives

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

Advancing beyond state-of-the-art



Related previous work

- [1] Demidov, I., Dibaba, H., Pinomaa, A., Honkapuro, S., Nieminen, M., "Energy Management System for Community-Centered Off-Grid System with a Blockchain-Based P2P Energy Market," in Proc. 19th International Conference on the European Energy Market (EEM) 2023, 6-8 June, Lappeenranta, Finland.
- [2] Dibaba, H., Demidov, I., Vanadzina, E., Honkapuro, S., Pinomaa, A., "Feasibility of rural electrification and connectivity—A methodology and case study," Applied Energy Vol. 315, 2022.
- [3] Nieminen, M., Demidov, I., Pinomaa, A., "The Emerging Energy Citizenship – User-Centred Approach for Seasonal Demand Response in Multi-Source Energy Houses, in Proc. EEM 2023 6-8 June, Lappeenranta, Finland.
- [4] Carbon handprint guide – VTT. Available at: 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. Available at https://fusiongrid.cs.aalto.fi/Fusion_Grid_Final_Report.pdf
- [7] Nuutinen, P., et al., Research site for low-voltage direct current distribution in a Utility network-structure, functions, and operation," IEEE Transactions on Smart Grid, vol. 5 no. 5, pp. 2574-2582, March 2014.