Development of an Optimization Model for the Community-Scale Biomass Power Plant (CSBPP) based on GAMS-BeWhere model framework in the Eastern Economic Corridor (EEC) region, THAILAND

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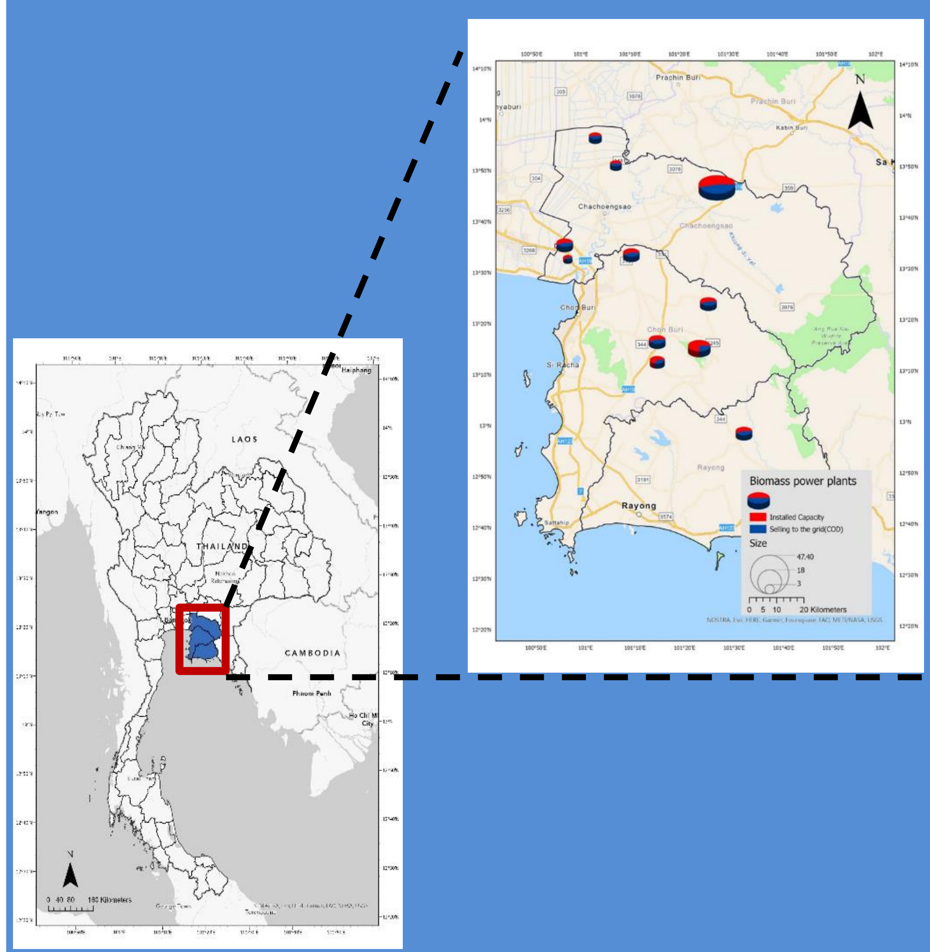
Introduction

- Distributed energy generation enables grassroots people to access to clean energy and increase income to region community by participating and having ownership. In Thailand, the new community-power plant promotion scheme was launched in 2020 with the aim to raise the income equality and quality of life of local community.
- Biomass supply is one of the most important issues for continuous plant operation. Systematic supply chain management must be done considering availability and logistics, seasonality, quality, and cost.
- BeWhere is a techno-economic engineering model for renewable energy systems optimization framework which is used for a case study of CSBPP in EEC region, Thailand as illustrated in Fig.1. It identifies the localization, size and technology of the renewable energy system that should be applied in a specific renewable energy community-based power from the region for the region.
- The objective is to develop decision-support tool and a linear mixed integer programming model to determine the optimal geographic locations and sizes of CSBPP using the EEC region as a case study.

Methods

- Priority Setting at regional level used a set of criteria in conjunction with a system transformation approach.
- The conceptual automated GIS-based Multicriteria Decision Analysis Method (MCDM) is used as input data for total cost parameters in the optimization model for supply chain configuration and Spatial techno-economic optimization model "BeWhere" (www.iiasa.ac.at/models-and-data/bewhere) as illustrated in Fig.2.

Fig.1 EEC region, Thailand



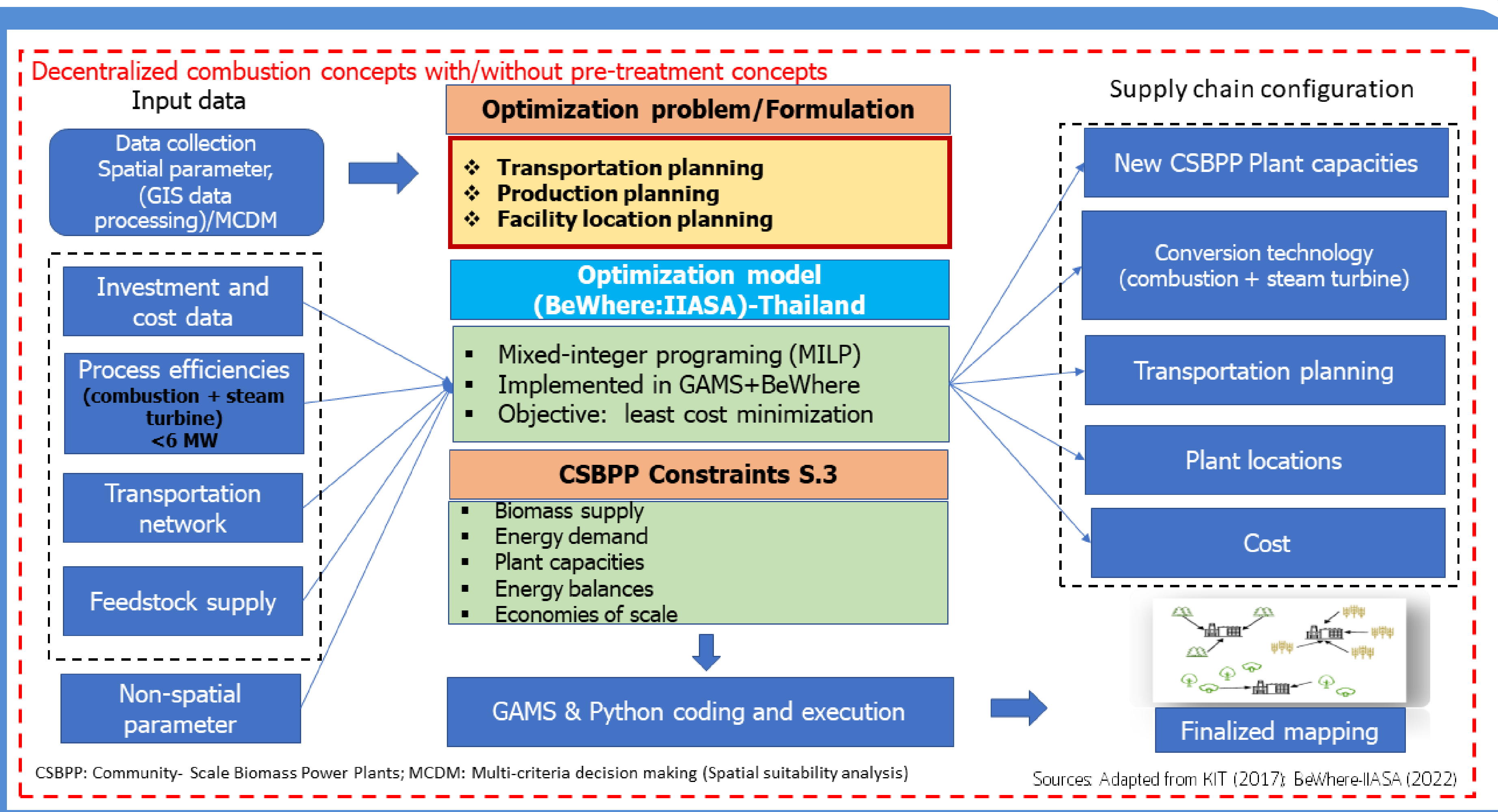


Fig.2 Modeling framework

Results

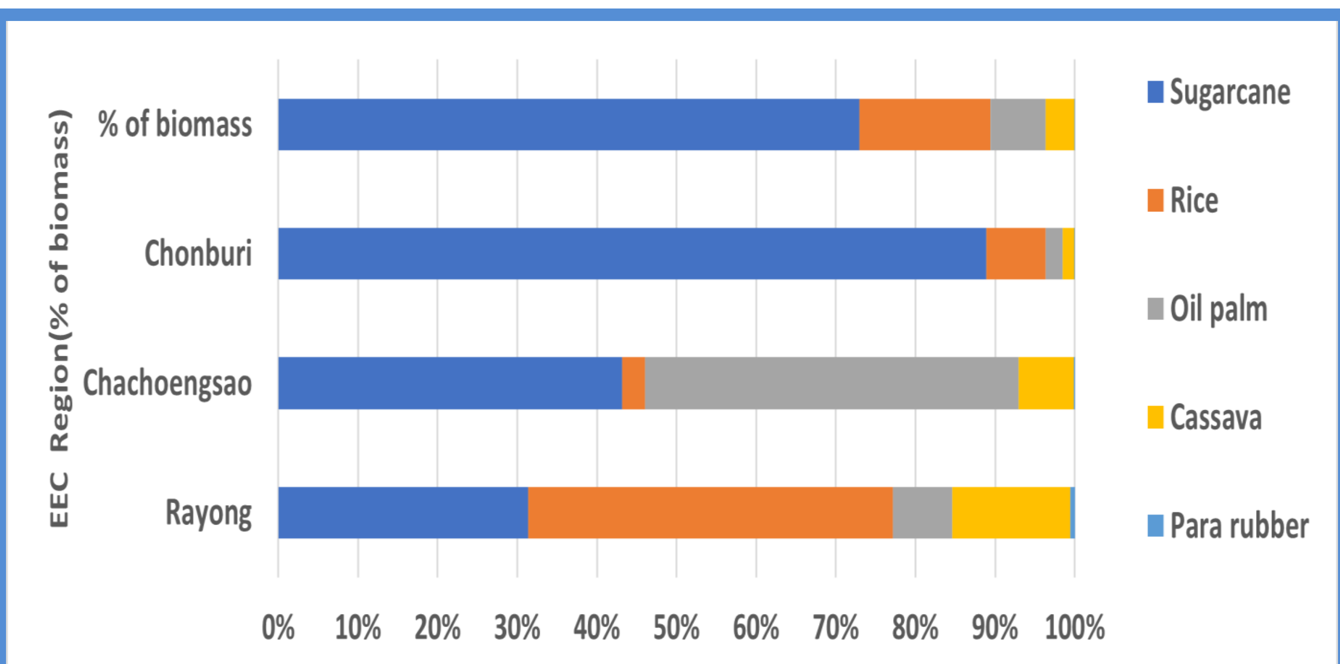


Fig.3 Total crop residues (dry matter) generated from top five crops in the EEC region

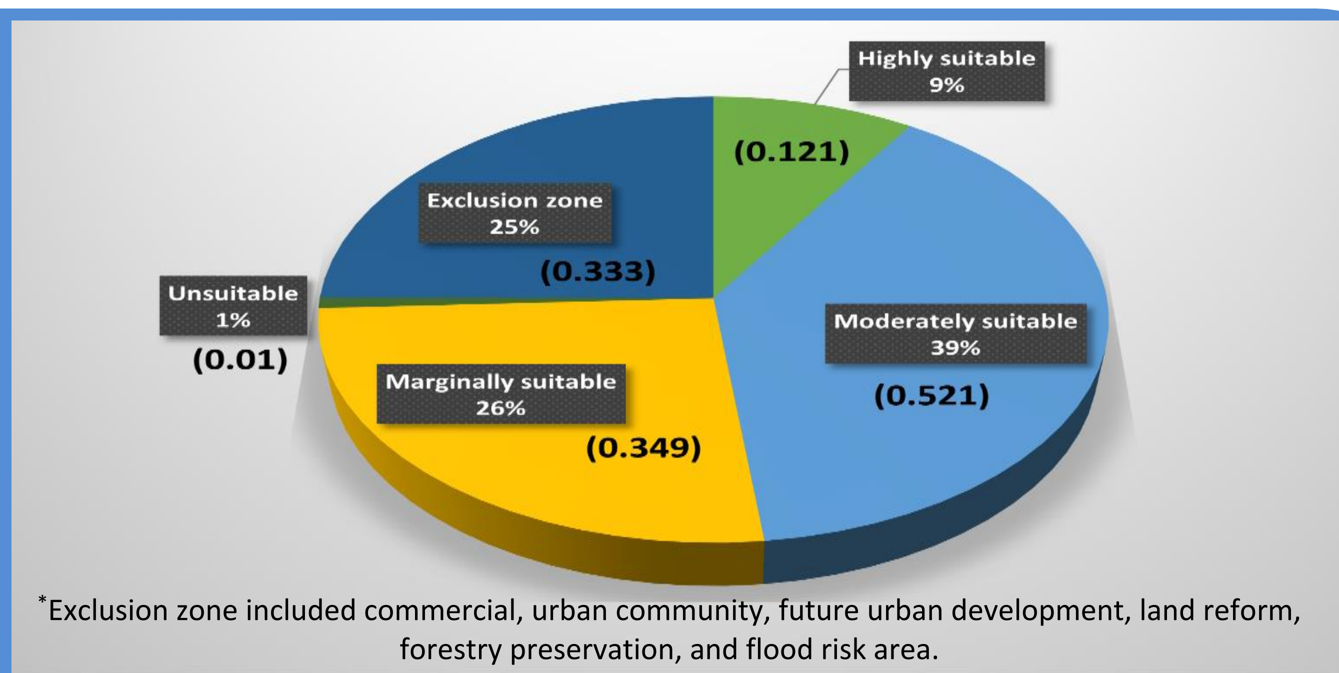


Fig.4 The area and percentile distributions of land suitability for CSBPP (Mha)

Conclusion

- The spatial decision support and optimization model (www.iiasa.ac.at/bewhere) will be instrumental to calculate the techno-economic and environmental benefits of substituting conventional with renewable energy. Furthermore, it can be easily applied systematically to other regions confronted with similar challenges.
- Policy recommendations should focus not only on aligning energy regulation and governance incentive schemes to promote distributed generation, but also on data science-based energy platforms, capacity building, cost optimization and services innovation model to support the participation of local governments, community cooperatives, and private businesses in regional power production.

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