

End of life management and circular economy in the Renewable Energy Transition

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This is a PhD research proposal focusing on End of life management and circular economy in renewable energy development. This project started from 1st Mar,2021to 29th Feb,2024, supervised by Prof. Gang Liu in SDU Life Cycle Engineering, Department of Green Technology (IGT). Glad to communicate with you guys and collaborate with each other.

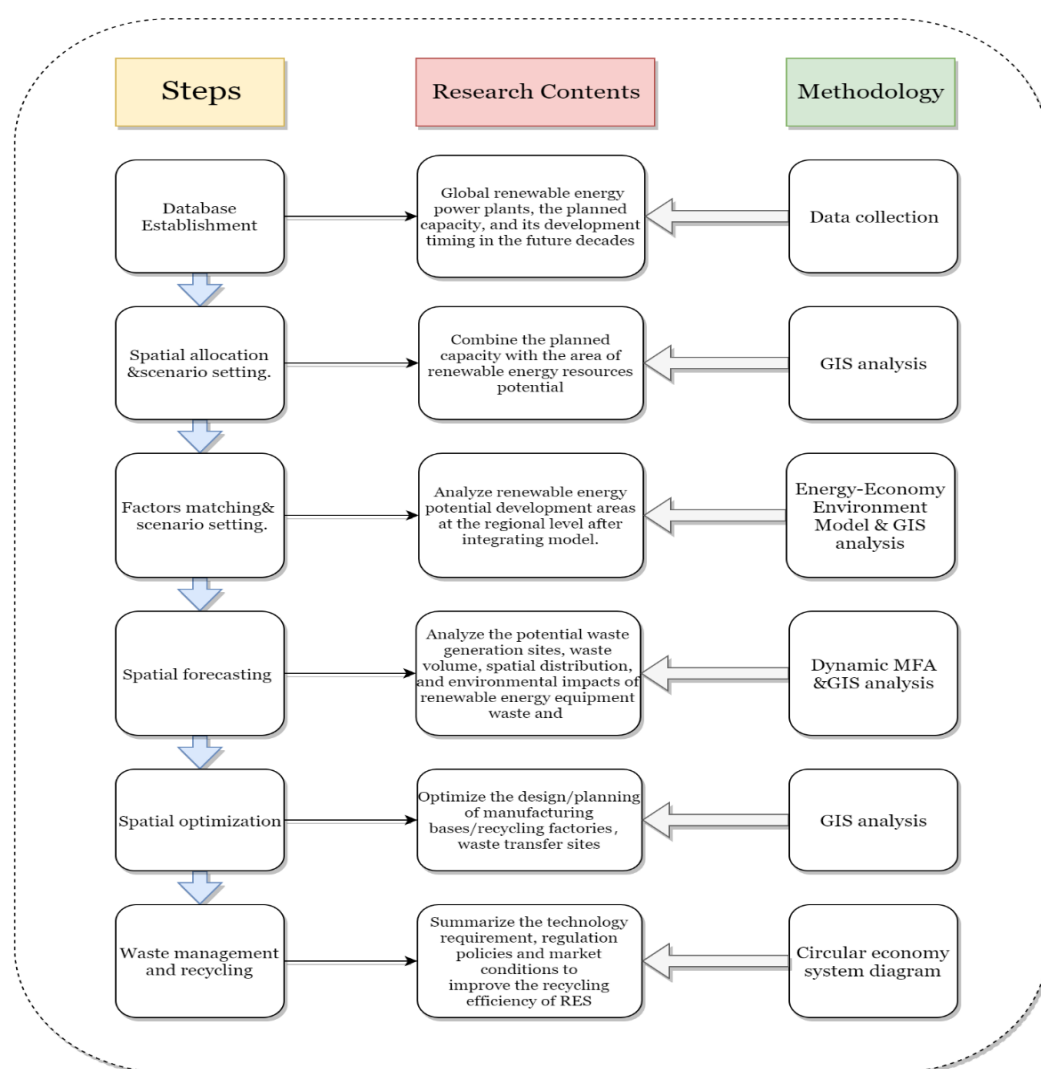


Fig 1. Workflow of this PhD plan

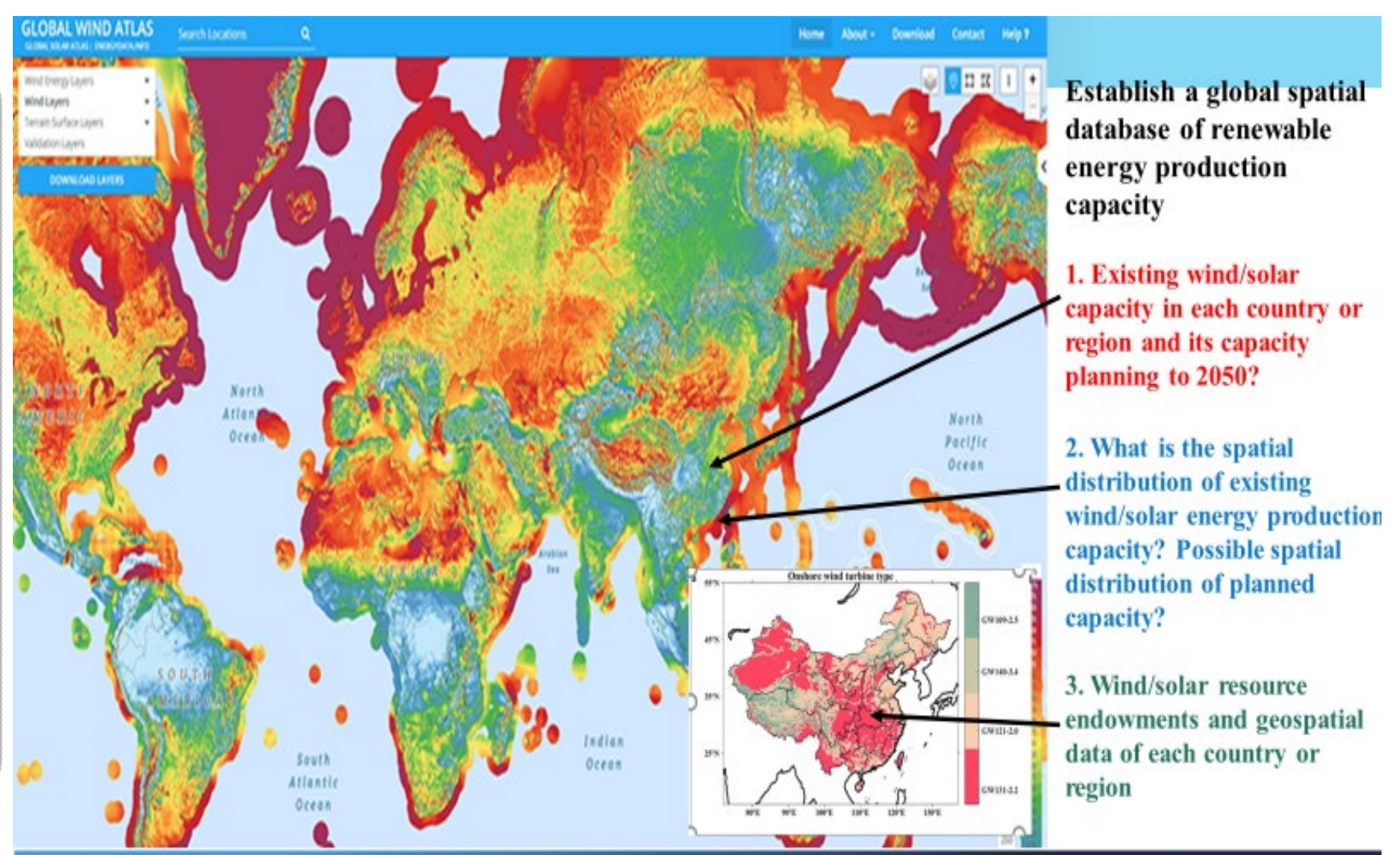


Fig 2. Global wind resource potential

Background

Emerging low carbon energy technologies, e.g., wind turbine(WT), photovoltaic(PV), which are often claimed to provide renewable energy without any emissions during operation, however, would produce a large amount of material waste, these new type of waste would bring tremendous pressure on our earth's environment and also cause huge energy waste.

There are fragmented forecasting studies on the quantity, quality, and spatial distribution of waste generated by renewable energy systems. And also, the research on the recycling of decommissioned renewable energy system(RES) components (WT blades, waste PV panels, composite materials, etc.) and the formation of the circular economy need to be further explored, for example, the global mapping on composite materials for decommissioned blades, industrial-grade recycling solution for WT blades, etc.,

This thesis aims to address those challenges on the end of life management and circular economy problems in the renewable energy development. This work will: a) analyze the potential waste generation sites, waste volume, spatial distribution, and environmental impacts of renewable energy equipment waste, b) Optimize the design/planning of manufacturing bases/recycling factories, transfer sites, and c) Summarize the technology requirement, regulation policies and market conditions to improve the recycling efficiency of RES.

Objectives

- Focus on waste management and recycling of renewable energy equipment in potential renewable energy development areas under setting scenarios, spatially analyze the potential waste generation sites, volume, spatial distribution, and environmental impacts of RES waste and further optimize waste transfer sites such as ports, warehouses, and the design/planning of manufacturing bases/recycling factories.
- From the perspective of circular economy, summarize the technology requirement, regulation policies and market conditions to improve the recycling efficiency of composite materials for RES components.

Methods

- Dynamic Material Flow Analysis (dMFA)
- Scenario Analysis
- Geographic Information System (GIS)
- Energy-Economy-Environment Model