

Dynamic Transition Analysis with TIMES: I²CNER Initiative on Challenges in Energy Assessment and Energy Transitions

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Objectives

- Evaluate potential impact of novel energy technologies within Japan's energy system. Specifically:
- Guide practical near term (2010-2050) transition strategies.
 - Minimize carbon emissions within realistic constraints.
 - Identify high impact technologies.
 - Assess role of technology readiness.
 - Predict impediments to strategically optimal technology deployment.
 - Identify ideal timelines for energy system deployment, infrastructure development, high impact R&D investment.

Methodology

Multiple studies have been conducted to compare the impact of innovative energy technologies in different regions of the world using *static* scenario analyses [1] [2] [4] [5] [7] [8]. We will simulate *dynamic transition scenarios* [3] [9], with realistic constraints and technology readiness of energy generation technologies (in terms of generation, transmission & storage), aimed at minimizing carbon emissions. We will further extend previous work by combining multiple technologies in a single heterogeneous system. The TIMES (The Integrated MARKAL-EFOM System) model generator [6] [10] optimizes energy systems of a model using linear and mixed-linear algorithms while implementing user-defined objective functions (such as minimizing carbon emissions or costs) within user defined constraints such as energy generation demand. It will be used to simulate near-term energy transitions while focusing on reduction of carbon emissions.

Anticipated Results

- Analysis results can be filtered by sector (commercial, industrial, residential, building etc) or by region.
- Many metrics are automatically postprocessed- such as energy intensity, thermal energy efficiency, transmission capacity.
- Technology deployment transitions driven by constrained optimization will have valuable strategic value.

Impact

- Results will:
- Optimize realistic decarbonization roadmaps.
 - Identify potential transition bottlenecks.
 - Help Japan's policymakers create timelines for R&D investment and infrastructure development.
 - Quantify system sensitivity to technology readiness.

Challenges

Reliable data for each technology's deployment and operation is required, such as:

Summary

- Dynamic simulation of Japan's energy system in TIMES model generator using a heterogeneous model and realistic constraints will help develop near-term decarbonization strategies.
- Policymakers will benefit from identification of high impact technologies, and creation of R&D investment and infrastructure development timelines.
- Simulations will quantify system sensitivity to technology readiness, and also account for secondary scenarios where decarbonization is not the main priority.

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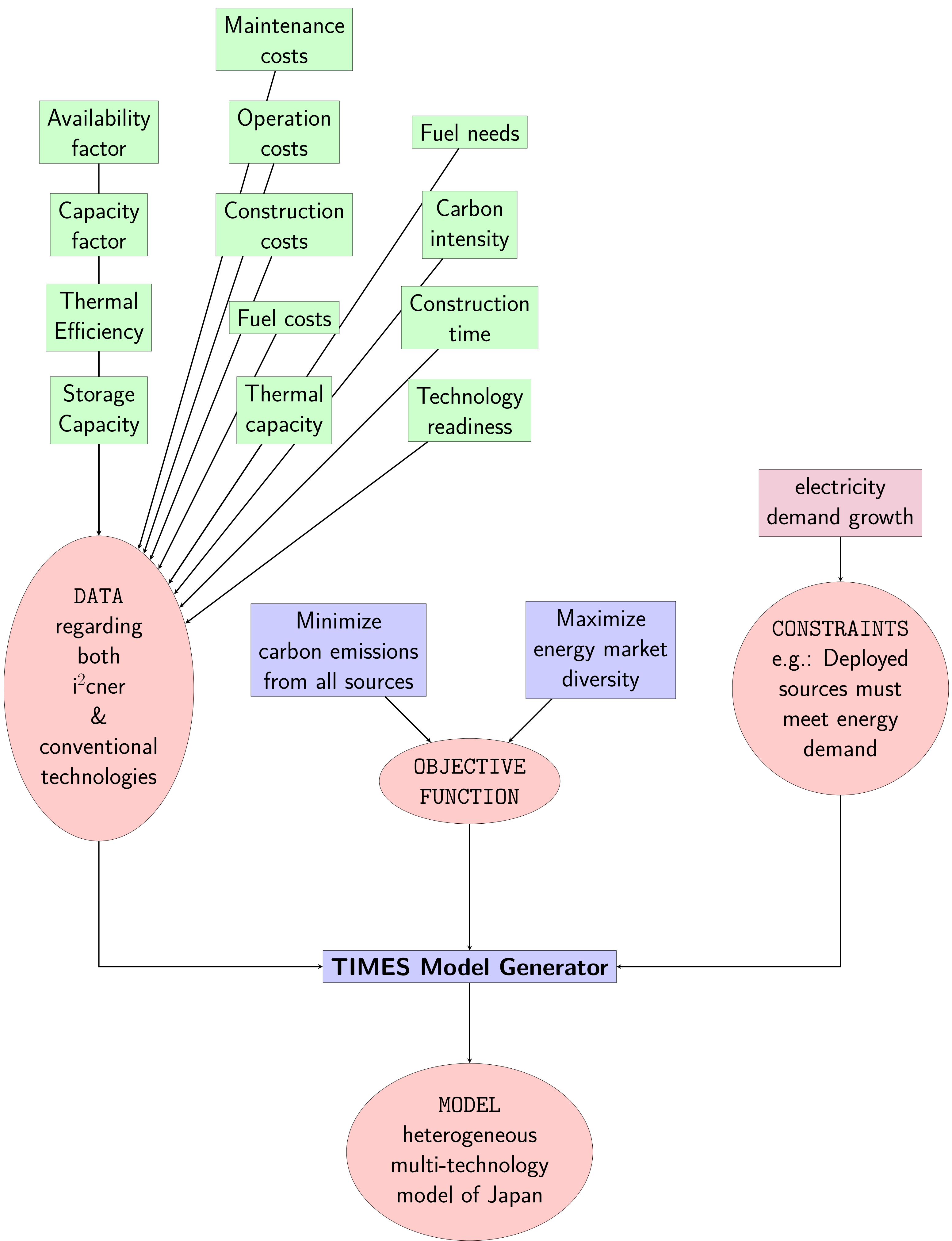


Figure: Basic methodology for dynamic simulation of Japan's energy system.