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Overview of the Energy Supply Model

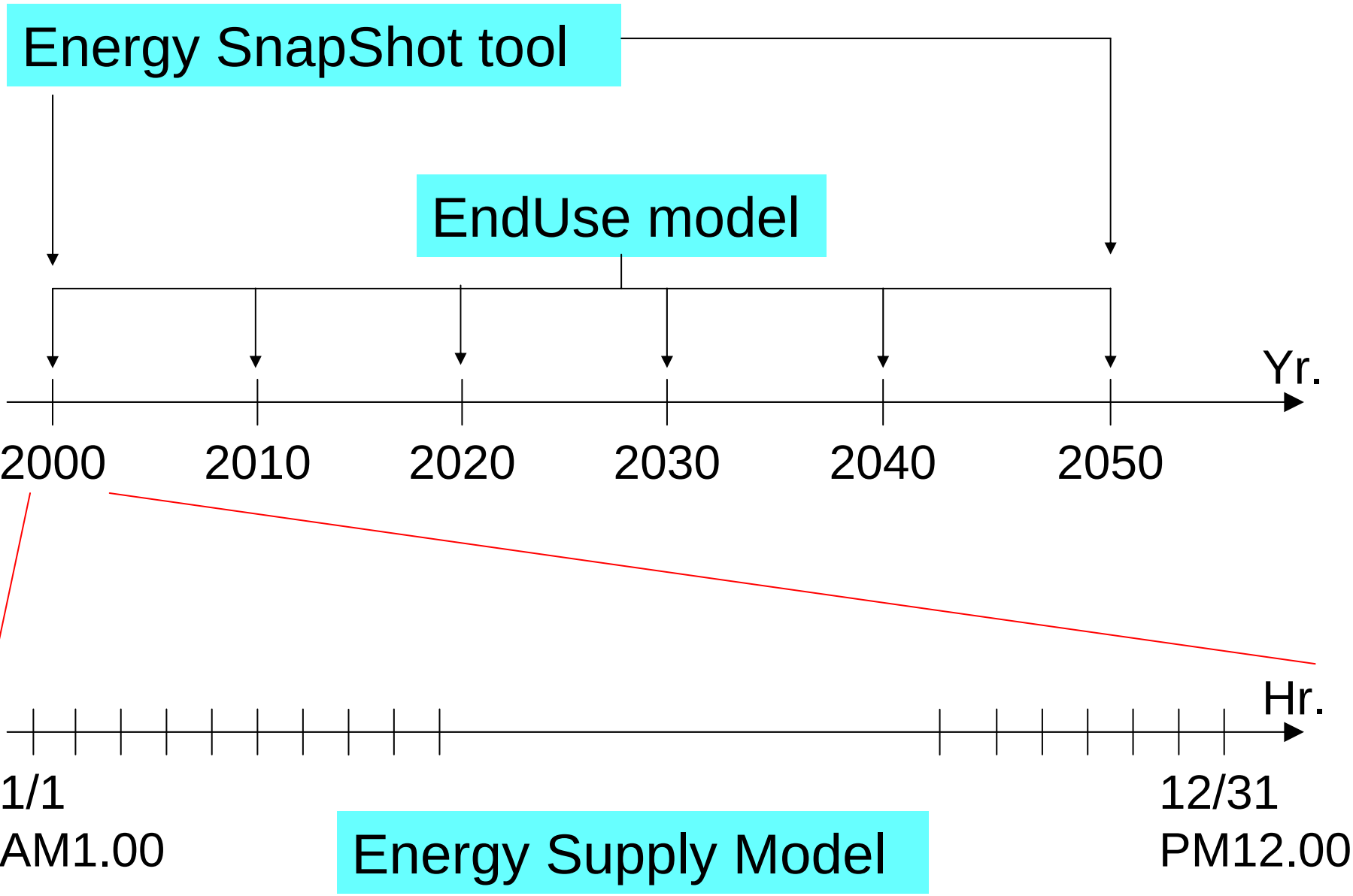
Shuichi Ashina
National Institute for Environmental Studies
ashina.shuichi@nies.go.jp

What is the Energy Supply Model?

- Bottom-up type technology selection model.
- Technology selection is based on a linear optimization framework in which total costs are minimized by several constraints such as service demands and energy supplies.

- Basic concepts of the model is close to that of the AIM/EndUse model and the Energy SnapShot tool.

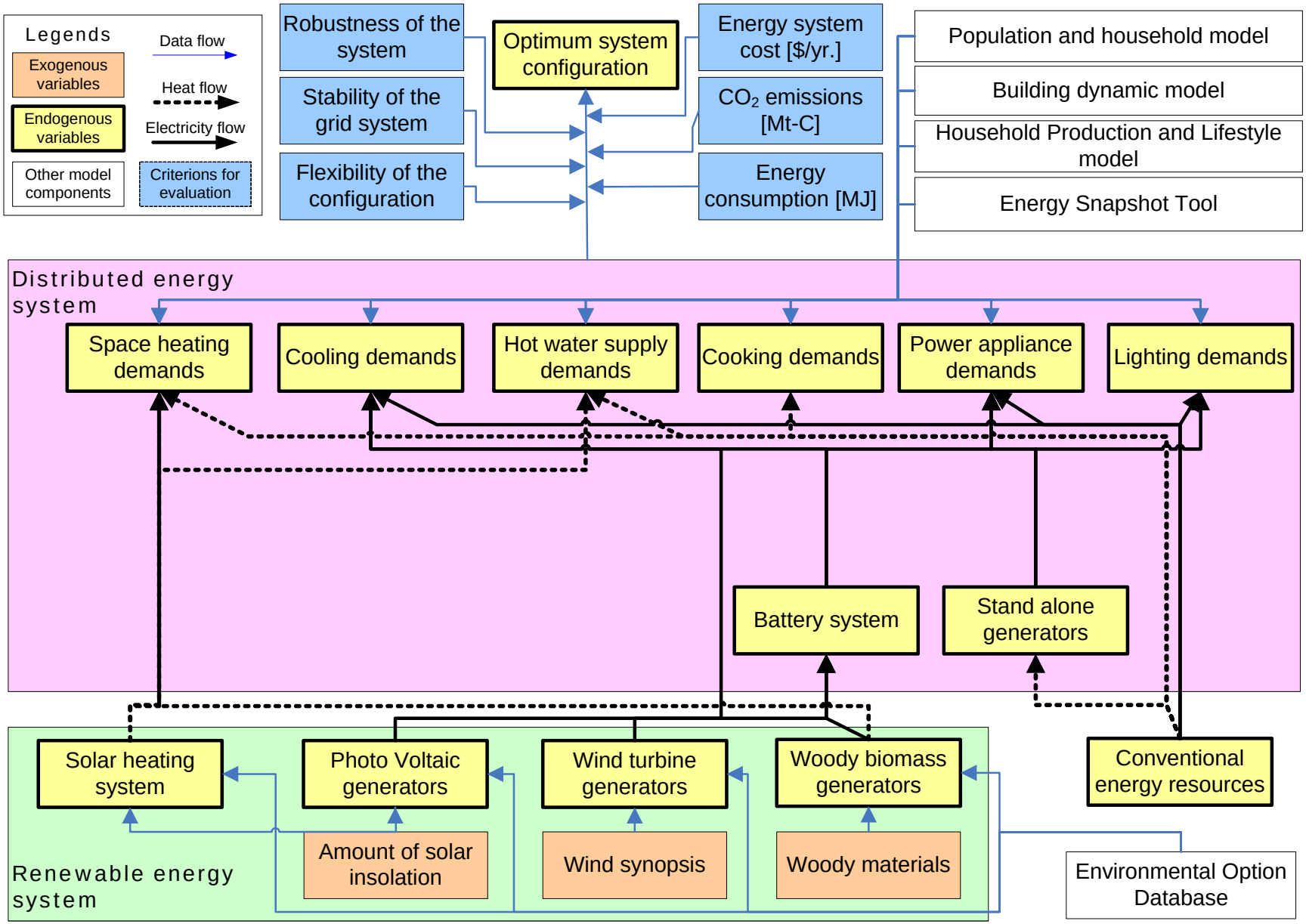
Comparison with AIM/"Energy" models



More detailed information about the ESM

- Energy supply model (ESM) seeks optimum configurations of the energy system based on the energy balance between supply and demand, in order to take full advantage of renewables in specific regions.
- In order to explore future energy system, the model can shed some light on the micro-grid and/or stand alone generators, such as diesel engine generators, gas engine generators and combined heat and power system (CHP).

Schemes for the ESM



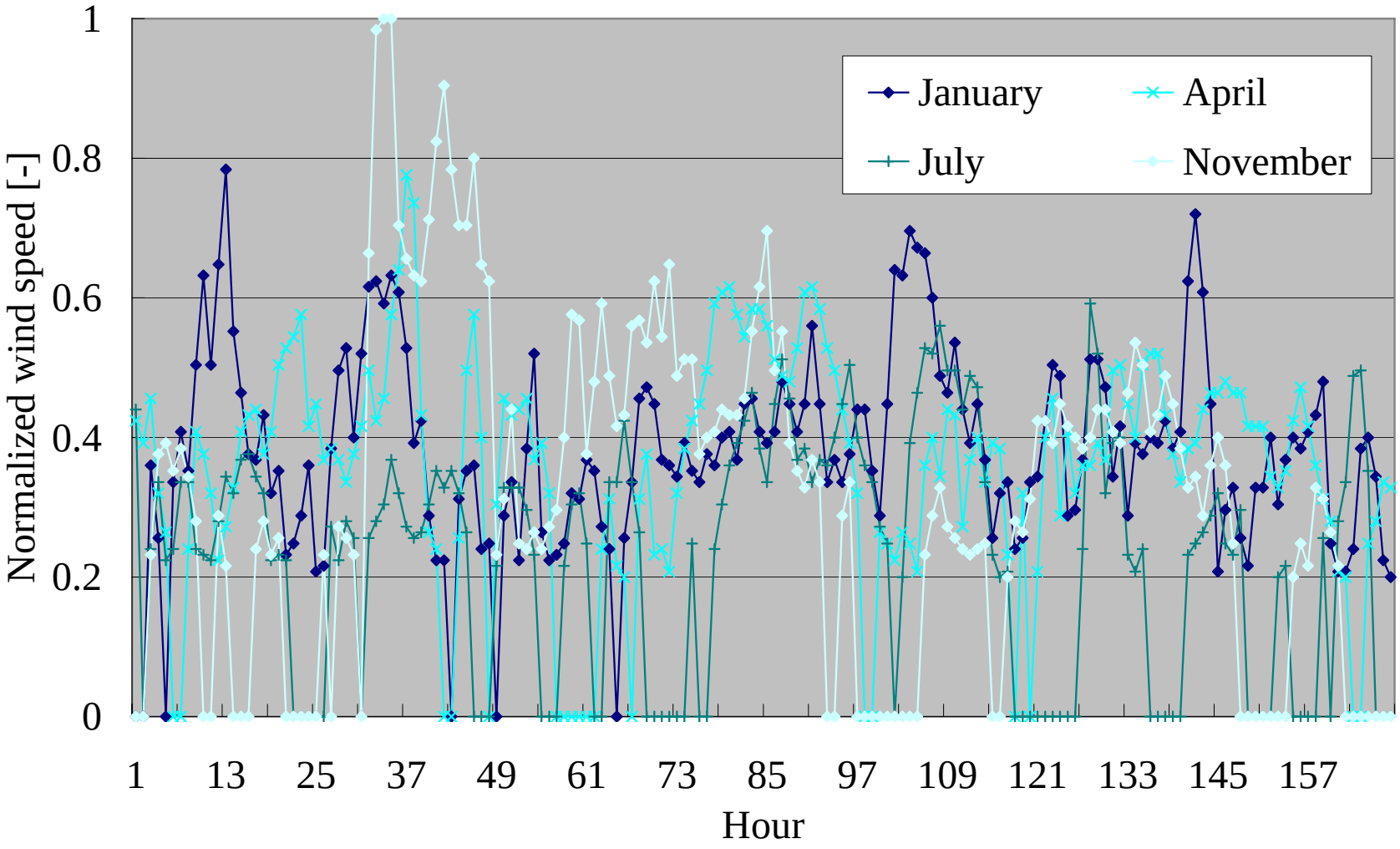
Types of renewables in the ESM

- Renewable energy component in the model includes:
  - Wind turbine generation
  - Photo voltaic generation (PV),
  - Woody biomass CHP system
  - Solar heating
- These are arbitrary sets.
- We selected these energy in the light of the installability, maintenance performance and mass productivity for the system.

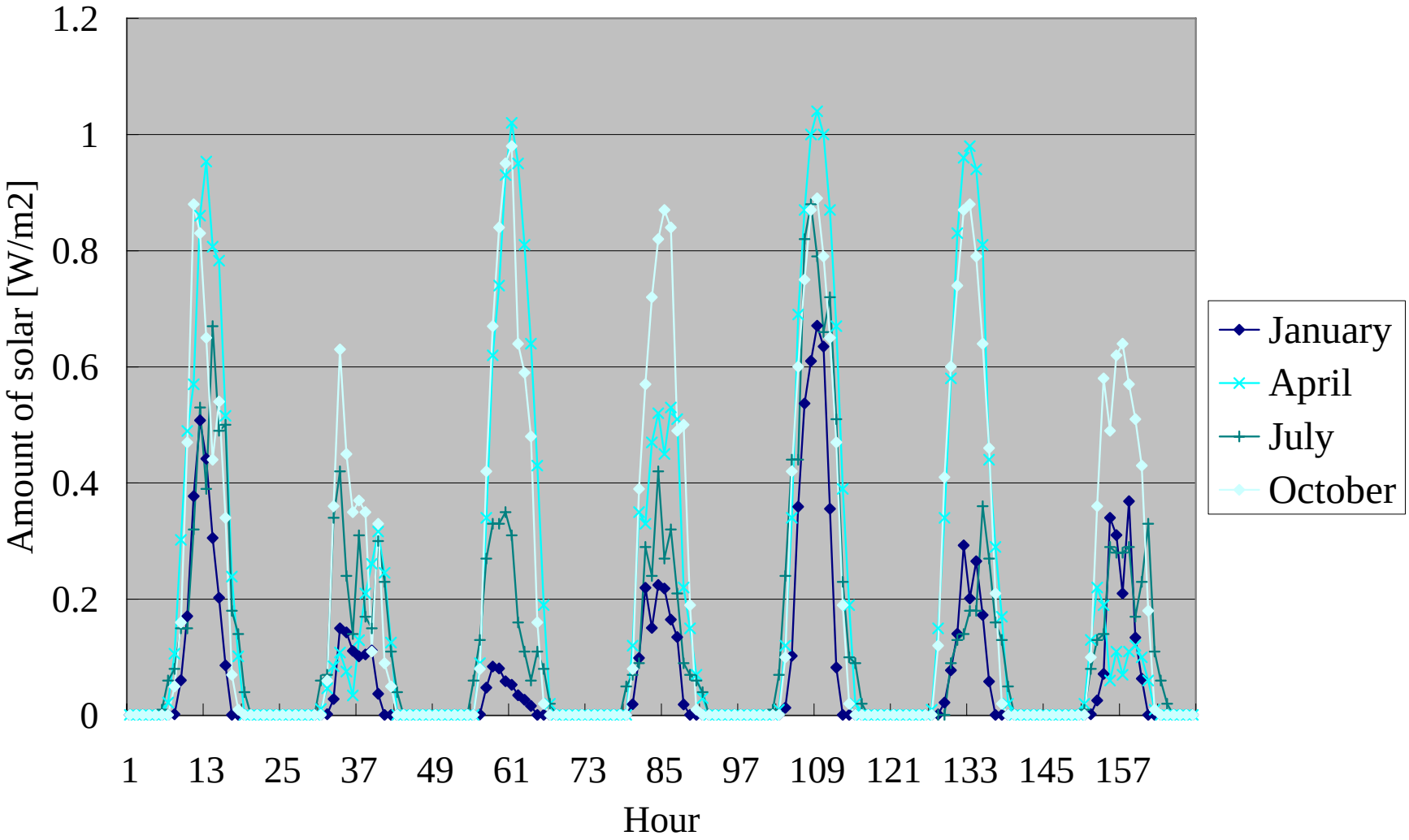
Model inputs

- Three types of data as exogenous variables:
  - Cost characteristics for the system component
    - Capital costs
    - Operation and maintenance costs
    - Fuel costs
  - Technological performance for the component
    - Thermal efficiencies
    - Service life
    - Energy quality
  - Resource data for renewables
    - Wind synopsis
    - Amount of solar insolation
    - Stocks of woody materials in the region

Examples for renewable characteristics data: Wind synopsis (Wind speed)



Examples for renewable characteristics data: Solar insulation



Model inputs (Cont'd)

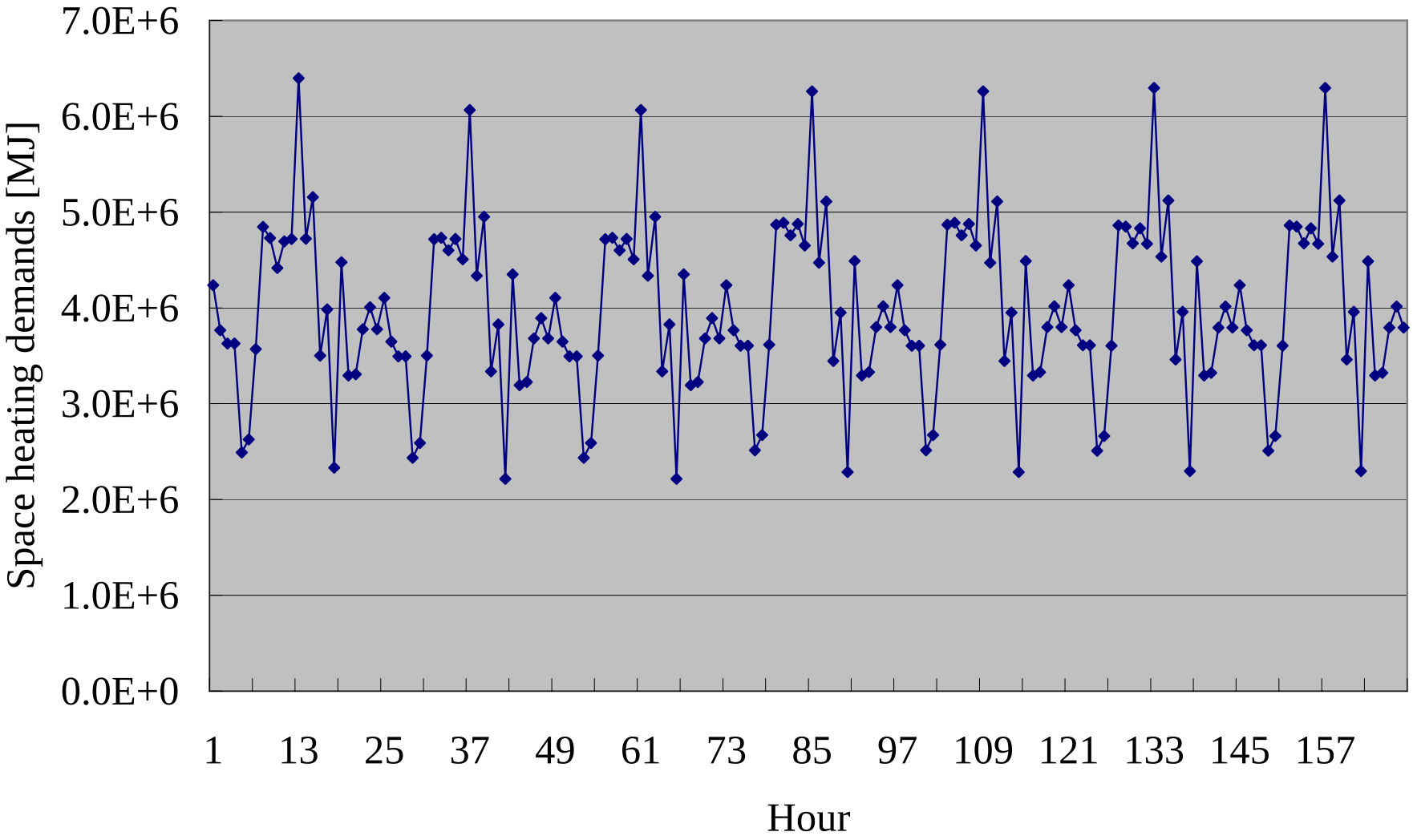
- The energy demands are determined by other model elements
  - Population and Household Model (PHM)
  - Building Dynamic Model (BDM)
  - Household Production and Lifestyle Model (HPLM)
  - Energy SnapShot tool (ESS)

- Input data for ESM =

  Input data for AIM/EndUse

  + Hourly variation data for both energy demands and renewable resources

Examples for hourly energy demands



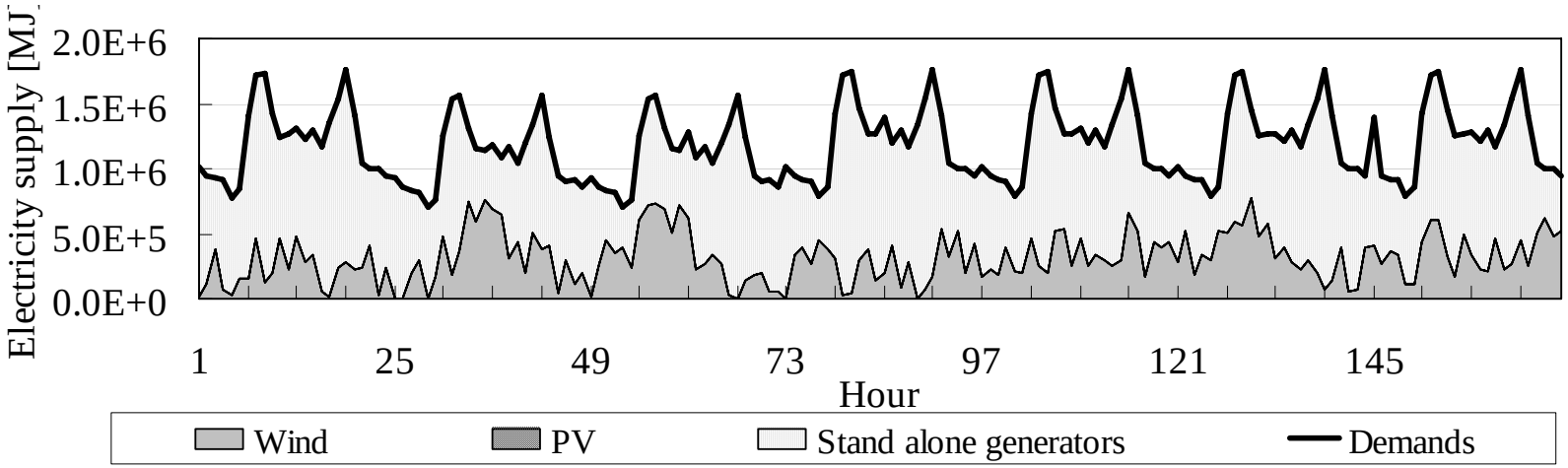
Model outputs

- Major findings of the model are:
  - Optimum capacity of each system
  - Energy consumption
  - Total energy system cost
  - CO2 emissions

- Model outputs are quite similar to that of AIM/EndUse or AIM/ESS.

Examples of model results

Stand alone generator + Wind + PV



Stand alone generator + Wind + PV + Zinc battery