Building Dynamics Model : BDM

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1. Background

- Number and types of dwelling stock have been changing along with transition of population composition, economic growth and life style change. ▲

- Energy consumption in households especially for space heating and space cooling depends on dwelling types, insulation level and inhabited area.

- It's necessity to introduce countermeasures based on a long-term perspective because of its long lifetime.

2. Input/Output of BDM

Population and household model

Input

(1) Number of household [region, year]

(2) Number of dwelling stock in the base year
[region, building type, years since construction, year]

(3) Proportion of number of dwelling stock to number of households

(4) Residual ratio [building type, years since construction, year]

(5) Region distribution of new dwellings [region, year]

(6) Building type distribution of new dwellings [region, building type, year]

(7) Average floor space of new dwellings [building type, year]

Building Dynamics Model

Output

Number and floor space of dwelling stock
[region, building type, Years since construction, year]

- Energy Snapshot Tool
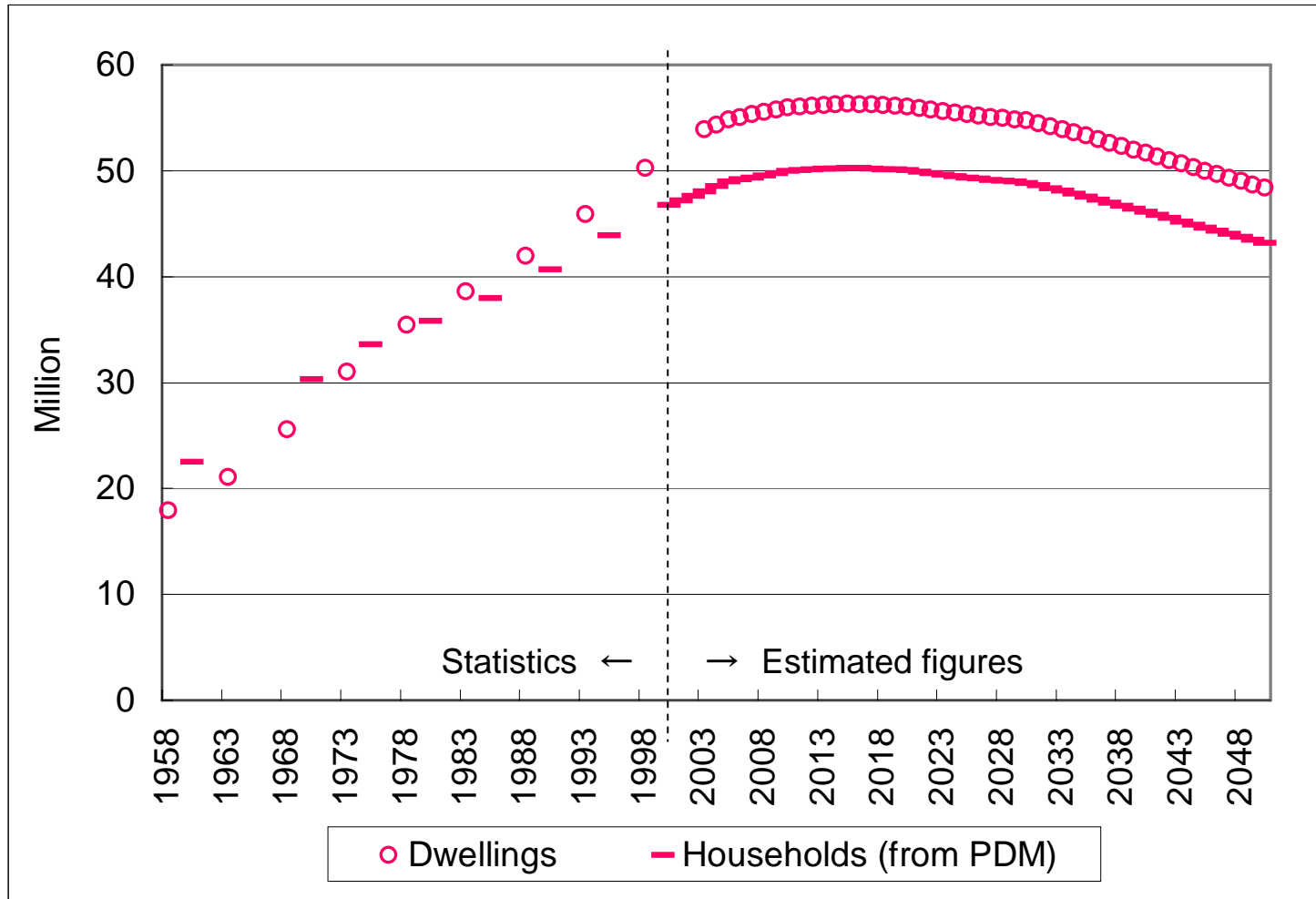- AIM/Enduse Model
- Material stock and flow model

2. Input/Output of BDM

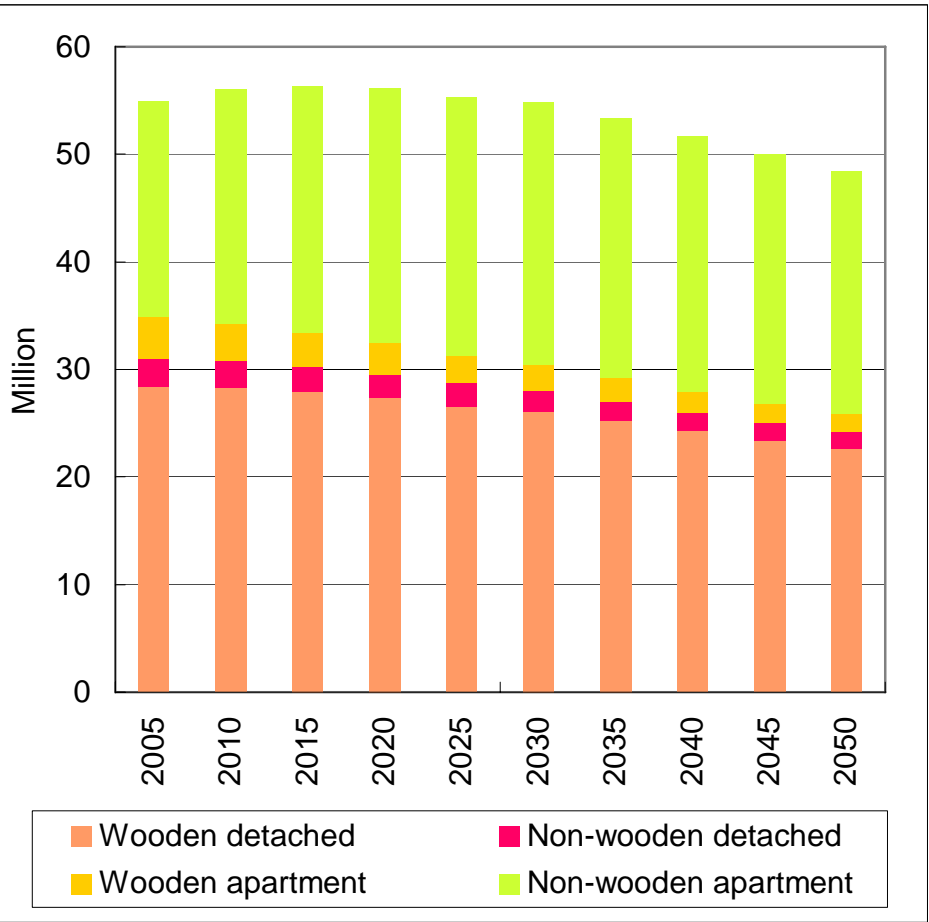|	Source
(2) Number of dwelling stock in the base year	Statistics of MLIT, Architectural Institute of Japan
(3) Proportion of number of dwelling stock to number of households	Base year: Calculation from Statistics of MLIT Future: Value of the base year (fixed)
(4) Residual ratio	Base year: Estimation from Statistics of MLIT Future: Value of the base year (fixed) ▲
(5) Region distribution of new dwellings	Population and household model
(6) Building type distribution of new dwellings	Base year: Statistics of MLIT Future: Assumption from past trend (detached houses increase, highly insulated housed increase)
(7) Average floor space of new dwellings	Base year: Statistics of MLIT Future: Assumption based on government's target

MLIT: Ministry of Land Infrastructure and Transport

3. Logic of BDM

Proportion of number of dwelling stock to number of households

Number of dwelling stock (year T-1) [region, building type, years since construction]

Population and Household Model

Number of households

Number of new dwellings (year T)

Residual ratio

Region distribution

Average floor space of dwellings

Building type distribution

Average floor space of new dwellings

Floor space of new dwellings (year T) [region, building type years since construction]

Residual number of dwellings (year T) [region, building type, years since construction]

Number of new dwellings (year T) [region, building type]

Floor space of new dwellings (year T) [region, building type]

Floor space of dwelling stock (year T) [region, building type, years since construction]

Number of dwelling stock (year T) [region, building type, years since construction]

Bottom-up engineering model

Household production and lifestyle model

: endogenous variable
: exogenous variable
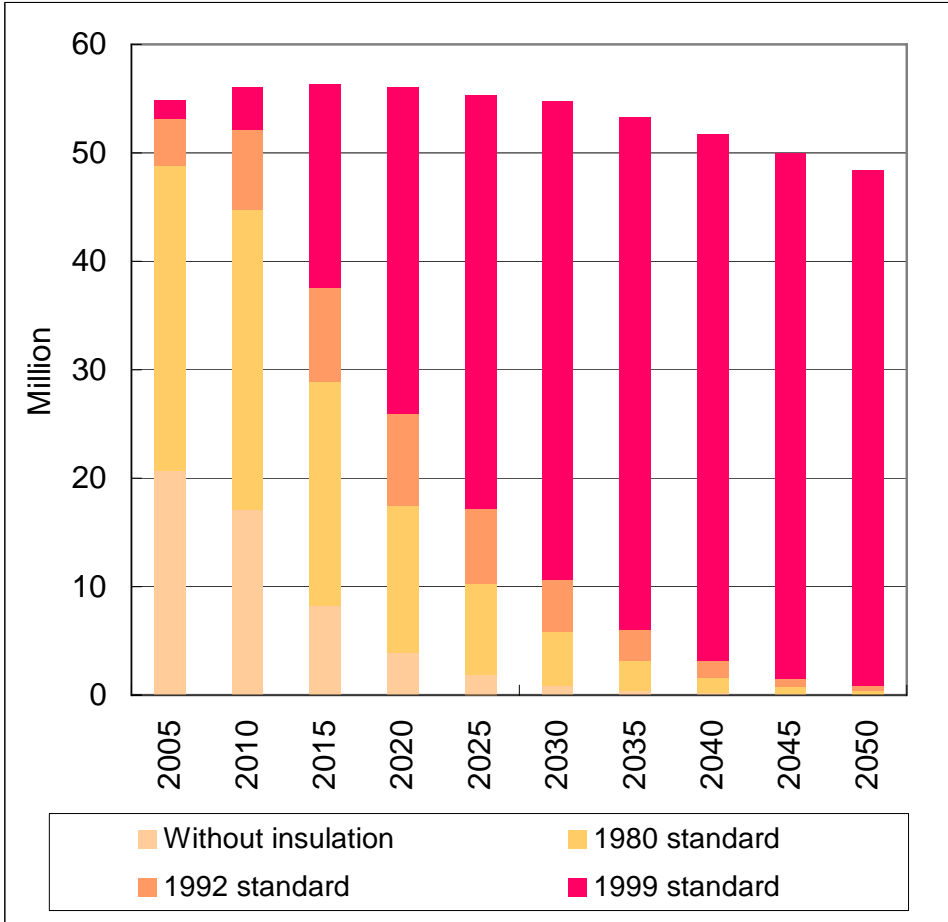
4. Output of BDM

Number of dwelling units

4. Output of BDM

Estimated number of dwelling units (by construction)

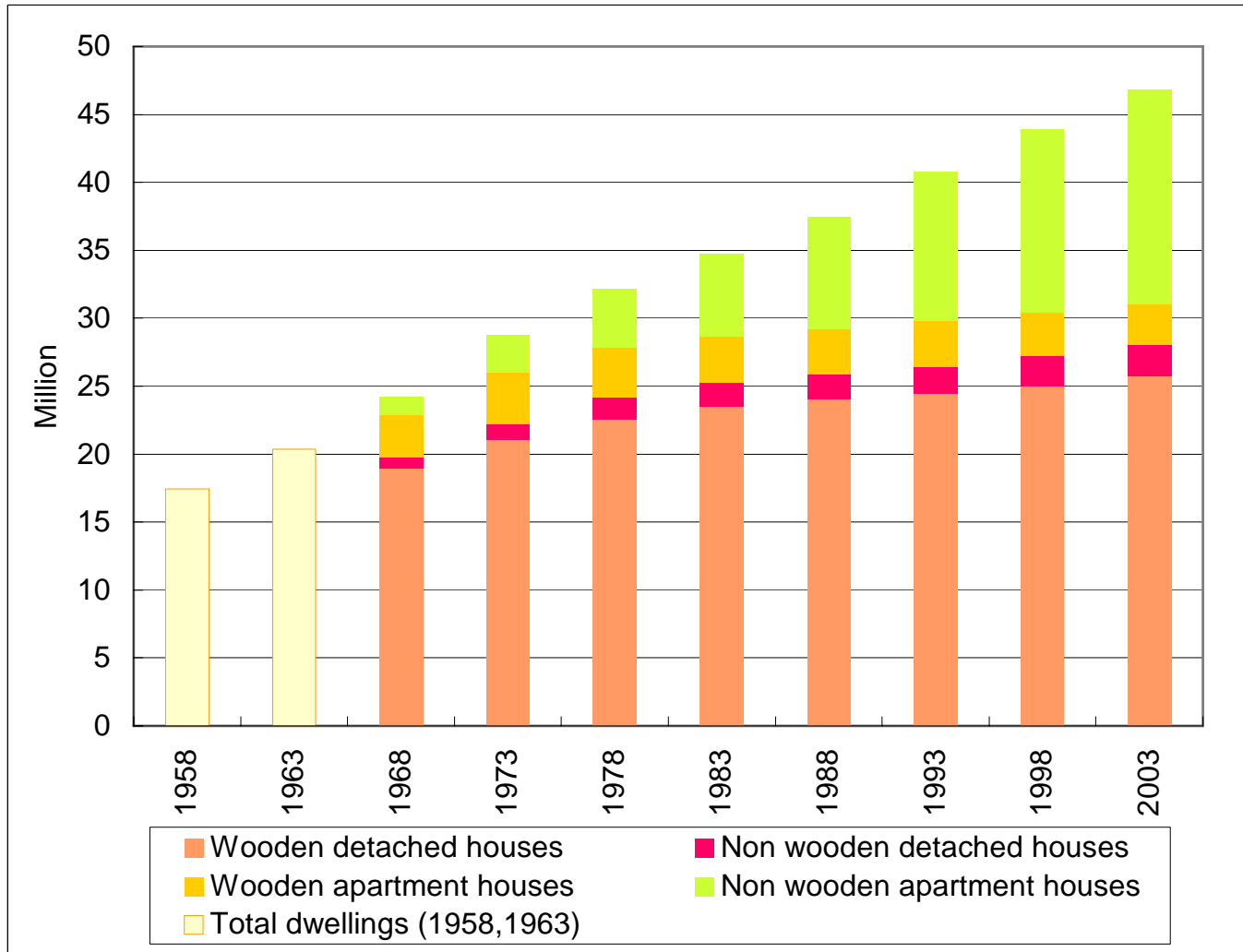Estimated number of dwelling units (by Insulation level)

5. Future work

- Consider relationship between number of new-built dwellings and macro-economic data

- Investigate relationship between household data and dwelling data
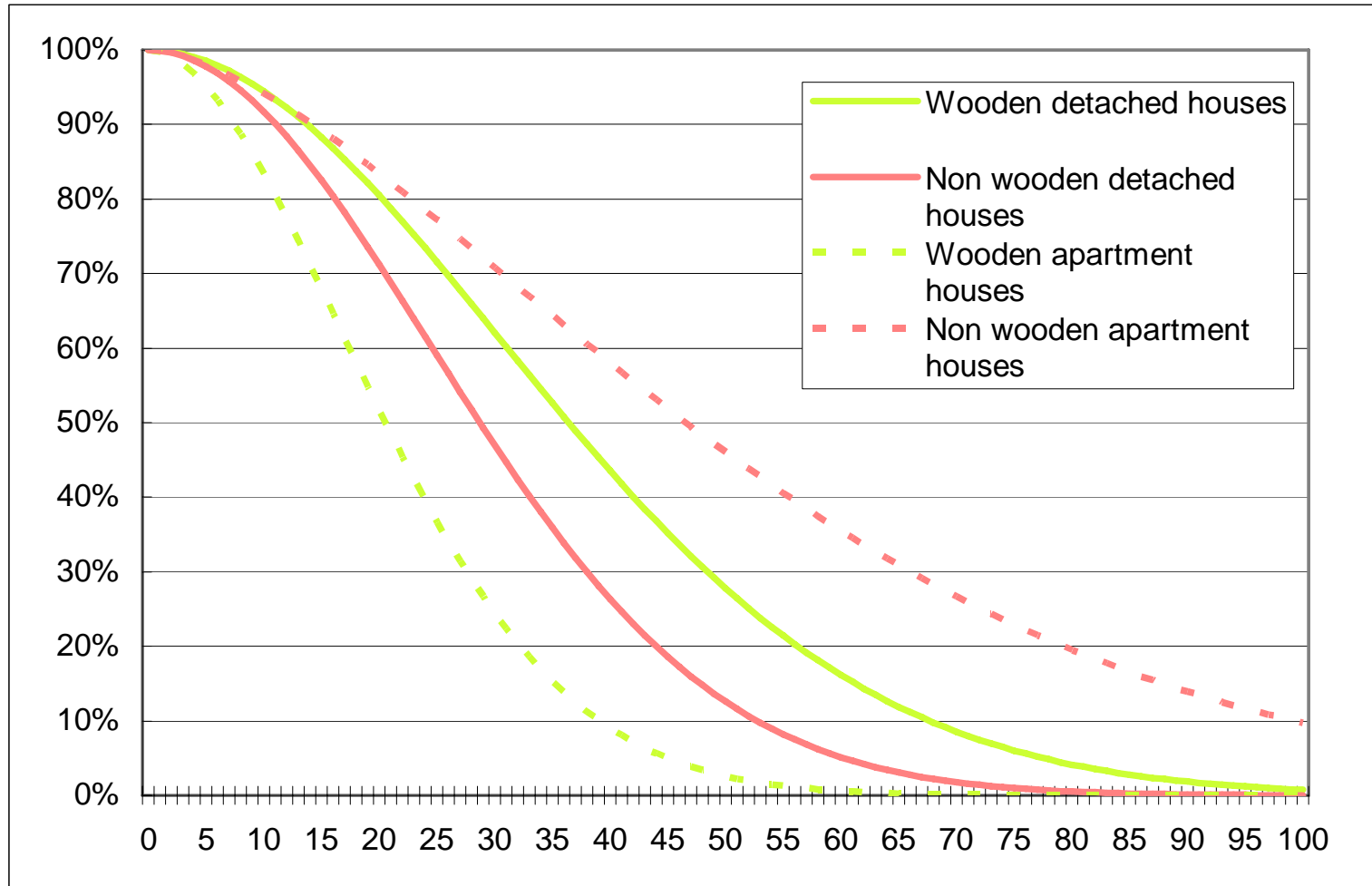
- Expand targeted countries

Thank you!

1. Background

Number of occupied dwelling stock

2. Input/Output of BDM

Estimated residual ratio