Estimating the Potential for PV Installation in Non-Residential Buildings in Japan

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1. Introduction

Background

The potential installation of PV in non-residential buildings in Japan calculated **varies among several existing studies.**

METI (2011),
MOE (2020)…

Purpose

- **Examine and confirm existing estimation methods**
  ←calculating annual power generation applied to the actual non-residential buildings

66 ZEB Ready* are chosen

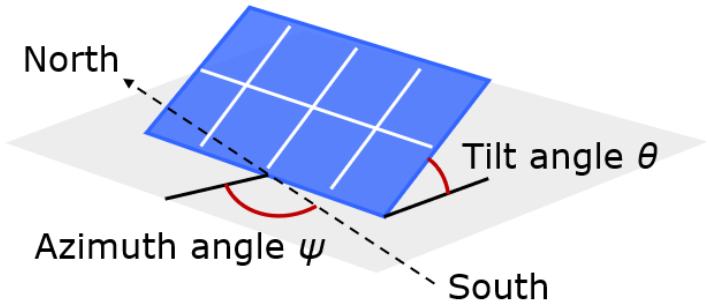
*the non-residential buildings ready
for zero-emission such as by saving energy

- **Compare the potential of PV and identify the degree of impacts** on calculated results on annual power generation **by changing the parameters**

2. Methodology

Outline

I calculated the annual system power generation in ZEB Ready
- registered in the ZEB Leading Owners
- installation performances are disclosed
- unequipped with both PV and solar heat collectors



Name	Study <z>	Azimuth direction <Solar radiation: H_{Am}>	Tilt angle of roof <W, ΔT, H_{Am}>
Case M_{A0}	METI	All south-facing	0°
Case M_{A30}	METI	All south-facing	30°
Case M_{B0}	METI	1/3 of the units face south, 2/3 face southeast/southwest	0°
Case M_{B30}	METI	1/3 of the units face south, 2/3 face southeast/southwest	30°
Case E_{A15}	MOE	All south-facing	15°<Output per area: W> 10°<Solar radiation: H_{Am}>

2. Methodology

Research Procedure

P: Standard solar array output [kW]
E_{py}: Annual system power generation [kWh/year]
G_s: Solar radiation intensity [kW/㎡]

※Σ means "annual total" values

① **Examining calculation methodologies**

② **Modeling calculation procedures**

1. Examine the total floor area (ST)
2. Formulate the installable area (SI) using installation factor (Z) as

$$SI = ST \cdot Z = \text{(total floor area)} \cdot \text{(Installation factor)}$$

3. Formulate the annual power generation (Epy) as

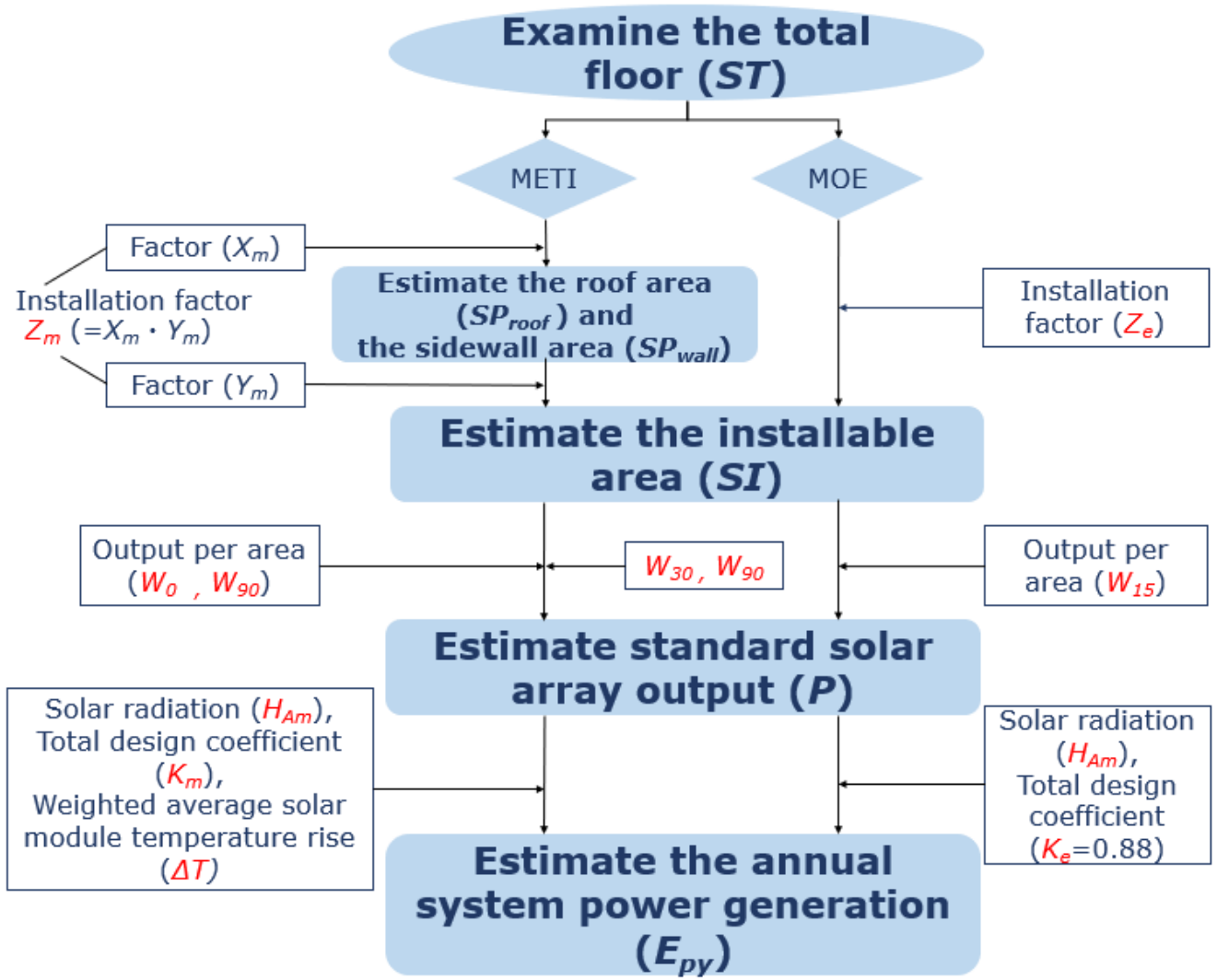
$$Epy = \sum\{P \cdot HAm \cdot K(\Delta T) \div Gs\}$$

③ **Executing calculations**

④ **Clarifying the degree of impact on the results by changing the parameters in the model**

2. Methodology

Estimation flow



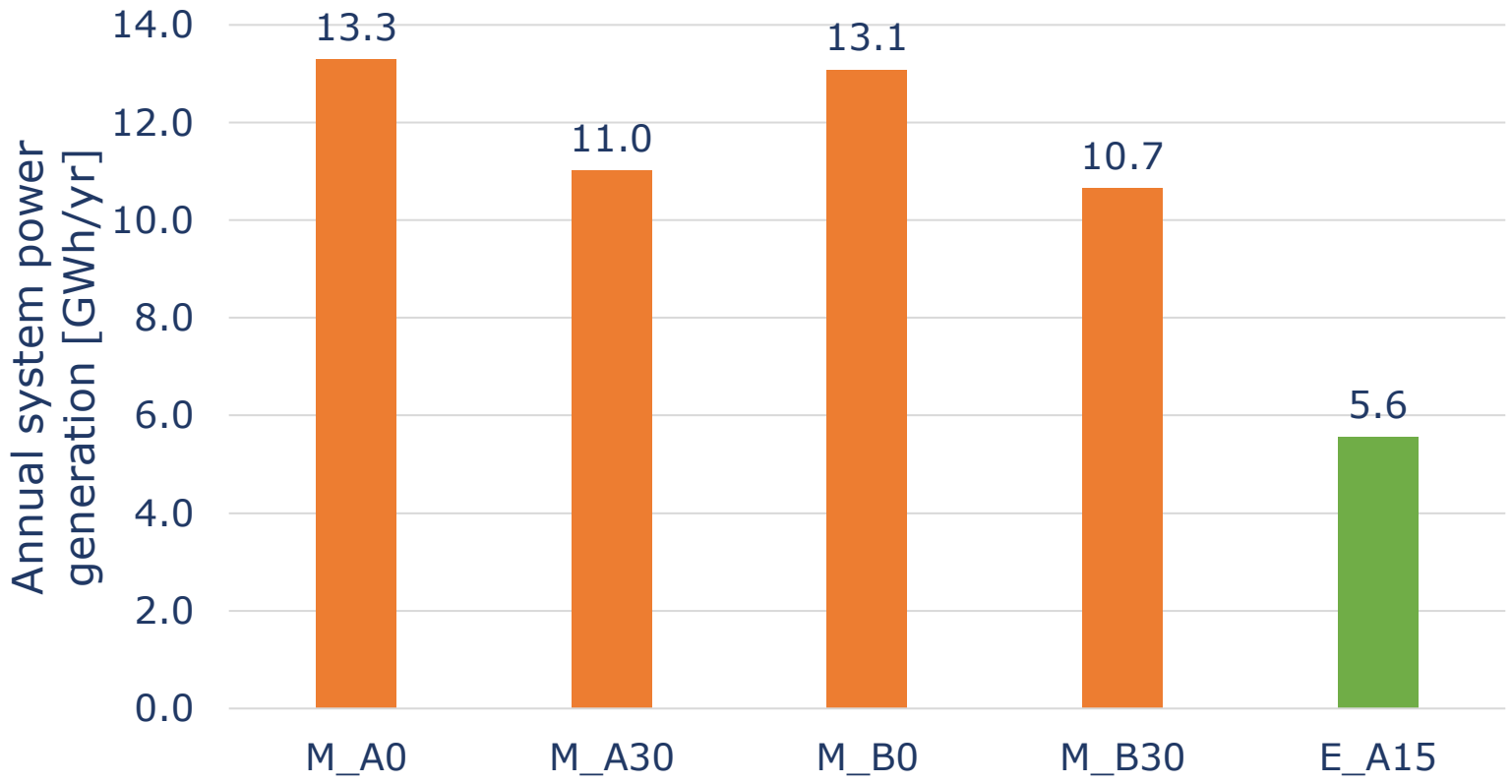
	M_{A0} reference	M_{A30}	M_{B0}	M_{B30}	E_{A15}
Φ (Azimuth Angle)			✓	✓	
Θ (Tilt Angle)		✓ (30°)		✓ (30°)	✓ (W:15° H_{Am}:10°)
Z					✓
W		✓		✓	✓
H_{Am} derived from φ			✓	✓	
H_{Am} derived from θ		✓		✓	✓
ΔT		✓		✓	※
K		✓		✓	**Const.** 0.88

※ E_{py} is independent on ΔT (∵K is constant)

3. Results

Annual system power generation (E_{py})

The generated amount of MOE (E_{A15}) showed **nearly half or less than half** compared to that of METI (M_{A0}, M_{A30}, M_{B0}, M_{B30}).



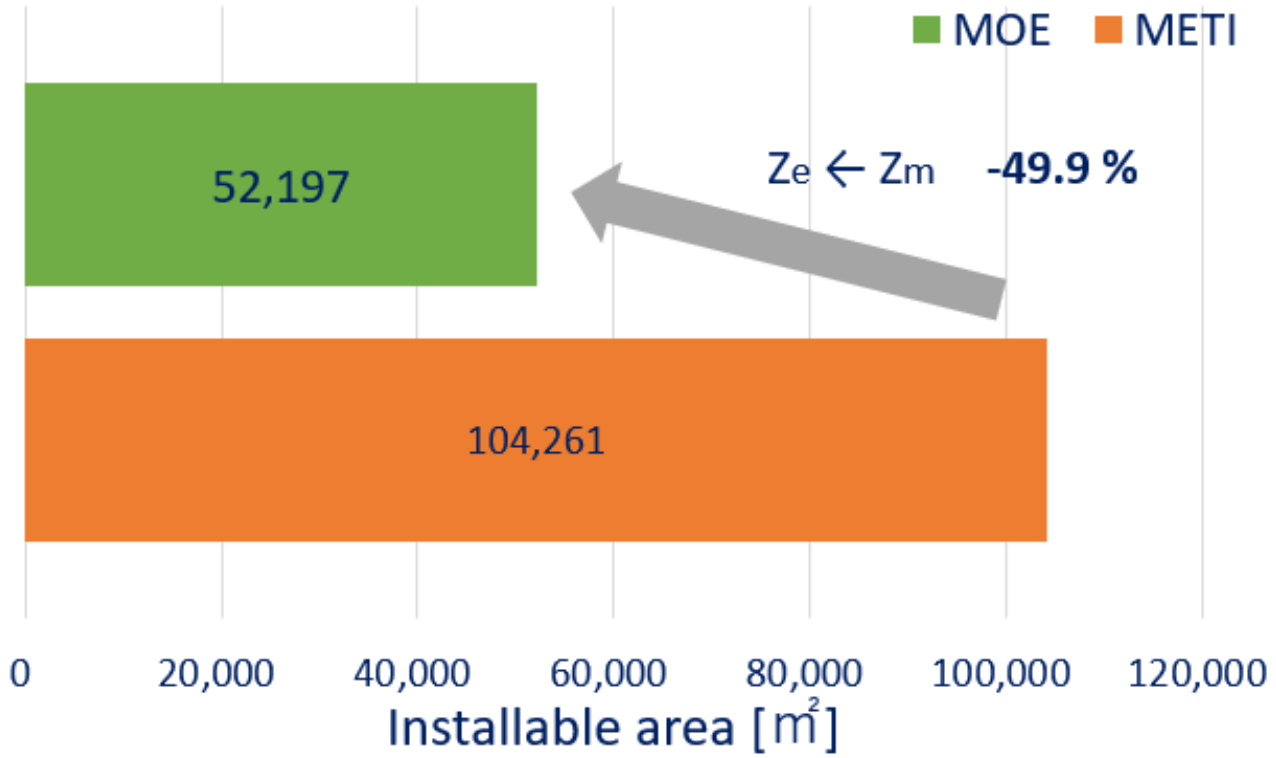
4. Discussion

The difference of each value compared to Case M_{A0} (reference) was changed for each parameter.

Installation factor (*Z*)

The ratio of the installation factor was equal to the ratio of the installable area.

The installation coefficient was **49.9% smaller** for MOE than for METI's four cases.

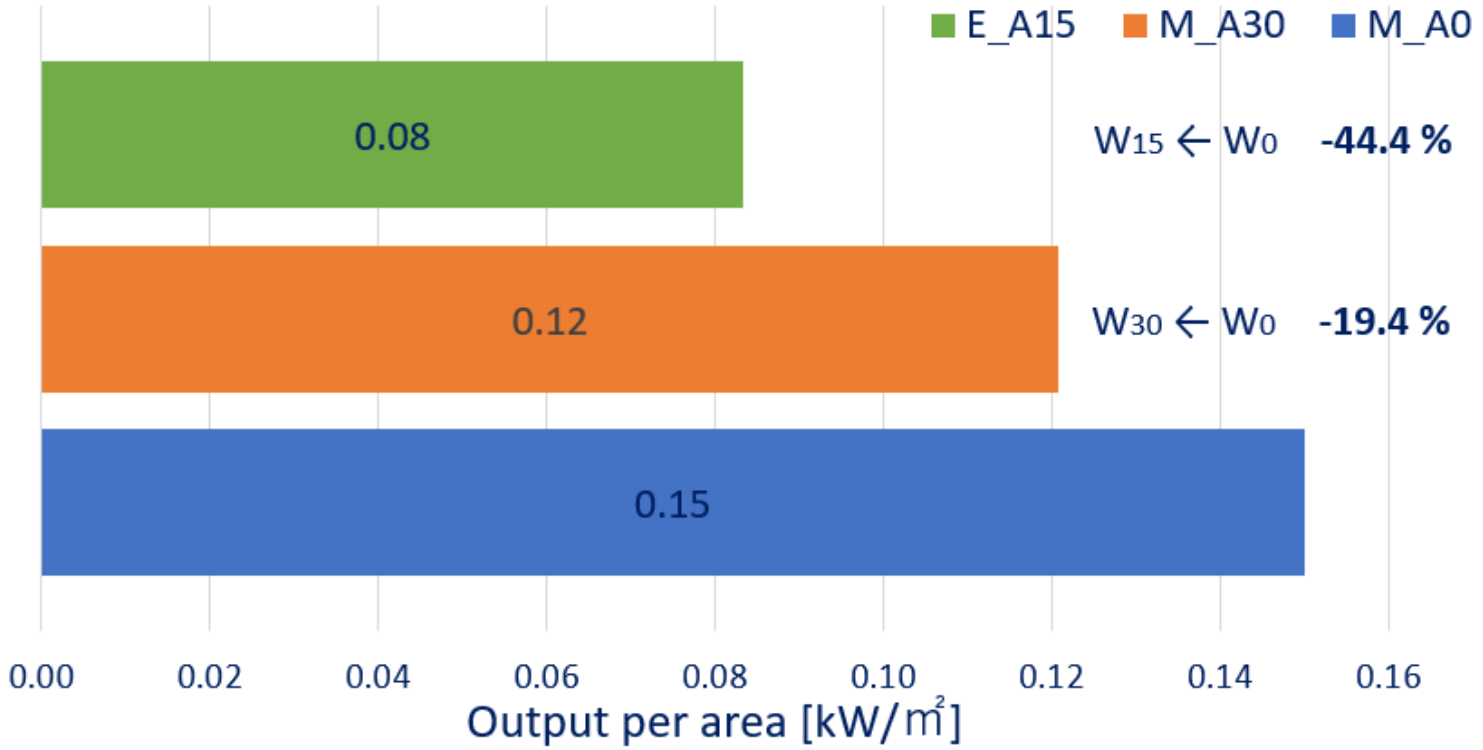


4. Discussion

Output per area (*W*)

Output per area was **19.4% smaller** at a tilt angle of 30° and **44.4% smaller** at a tilt angle of 15°.

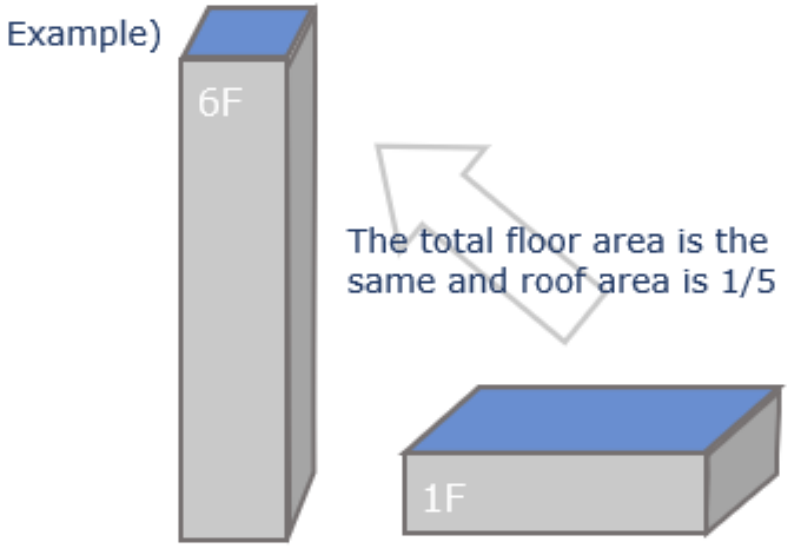
The change rate of the annual power generation is larger when *W* of the MOE's case is changed



5. Conclusion

Parameters

- **Z was the most sensitive** with the largest rate of change
- **H_{Am} depending on φ** was found **insensitive**



Limitations of this research

- Some values were untraceable from the literature

  -*Z, W*

- The estimated roof areas were not linked with the number of floors

References

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Thank you for your kind attention!