Energy Poverty and Energy Inequality in Japan: A Direct Measurement Approach

Shinichiro Okushima

University of Tsukuba

E-mail: okushima@sk.tsukuba.ac.jp

Today's presentation

- Show the current situation of energy poverty (EP) in Japan using the traditional EP measure
- Consider the importance of climatic factors behind EP regional differences
- Present a new approach to measuring EP in calorific values and compare the results
- Suggest interesting results using the new measure - the two obstacles to an inclusive low-carbon energy transition in Japan

Review: concept and definition of EP

- Energy poverty can be defined conceptually as *e.g.*
  - the inability to attain a socially and materially necessitated level of domestic energy services (Bouzarovski and Petrova, 2015)

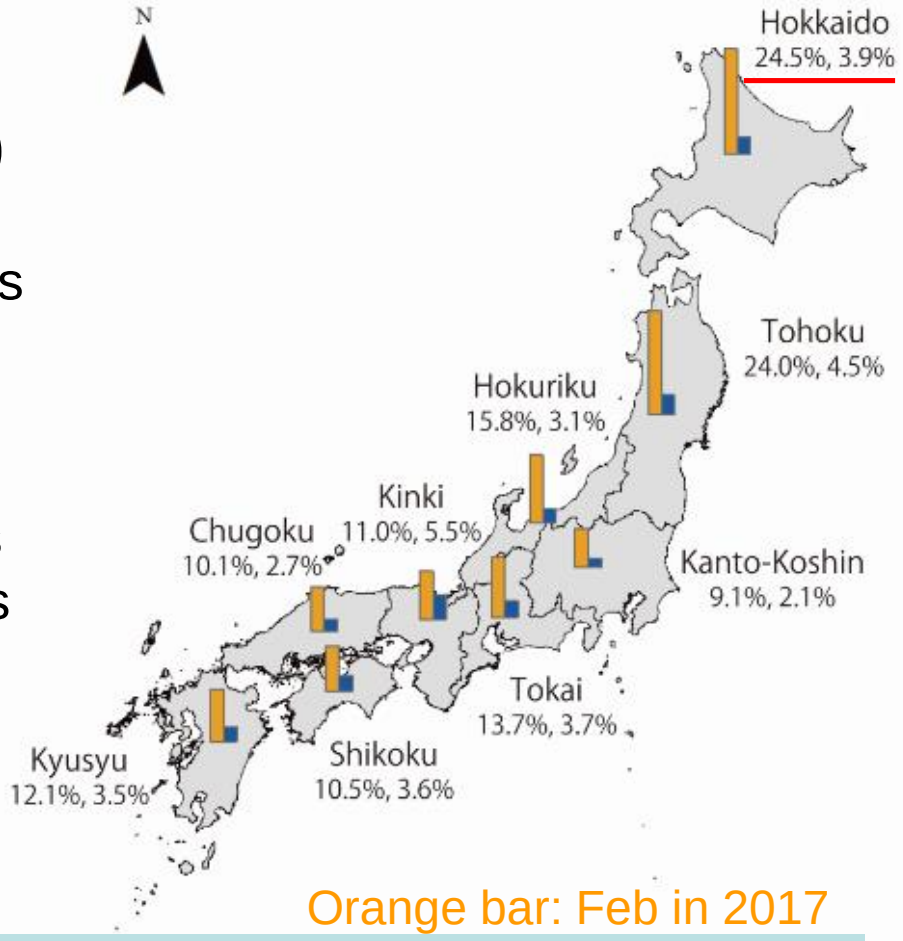
- Practically, e.g., the traditional 10% measure defines energy poverty households as those that spend more than 10% of their income on energy expenses (electricity, gas, and heating oil(=kerosene))

Energy poverty: $\frac{Energy\ expenses\ (electricity, gas, and\ heating\ oil)}{Income} > 0.1$

(Gauging 'energy affordability')

Energy poverty from the regional perspective

- EP prevalence much differ between regions (and seasons)
  - ♦Higher in the northern regions such as Hokkaido (in the subarctic zone), 25% in winter
  - ♦Higher in winter due to heating needs especially in the northernmost regions (very cold winter & much snow)
  - ♦In Okinawa (in the subtropical zone), EP is more serious in summer, 12%

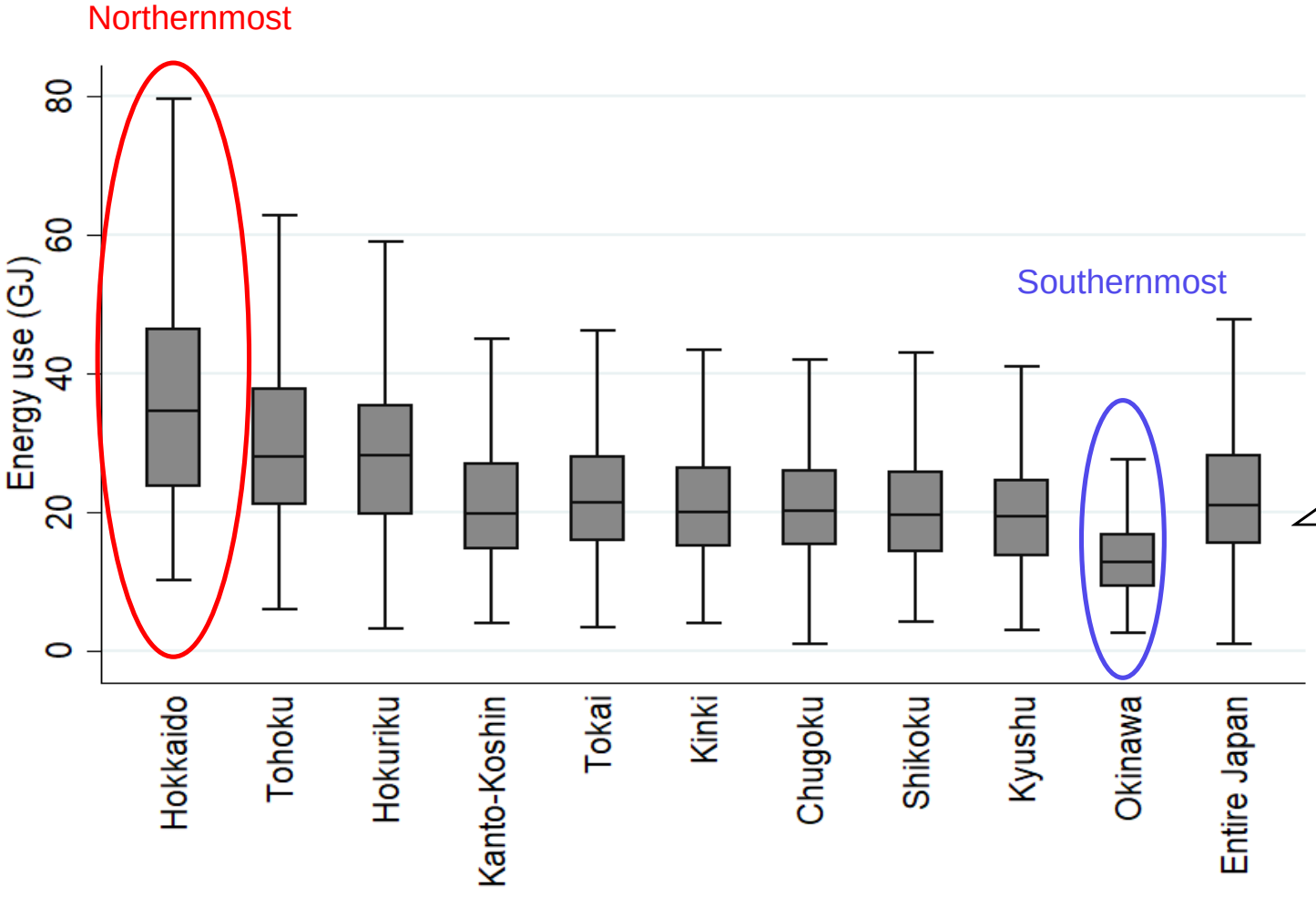


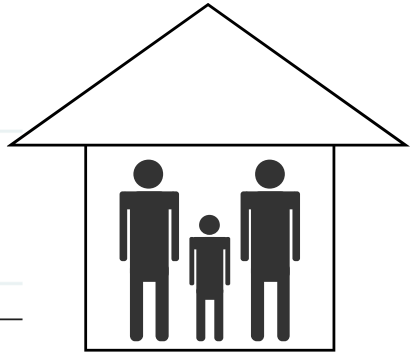
Orange bar: Feb in 2017

Climate differences have a (crucial) impact on EP evaluation
→But, in my view, never taking climatic differences seriously in the context of EP measurement

Inequality of domestic energy service use

- Figure shows distribution of domestic energy service use (in GJ)
  →Higher in the northern regions due to winter heating needs





Source: Okushima (2019)

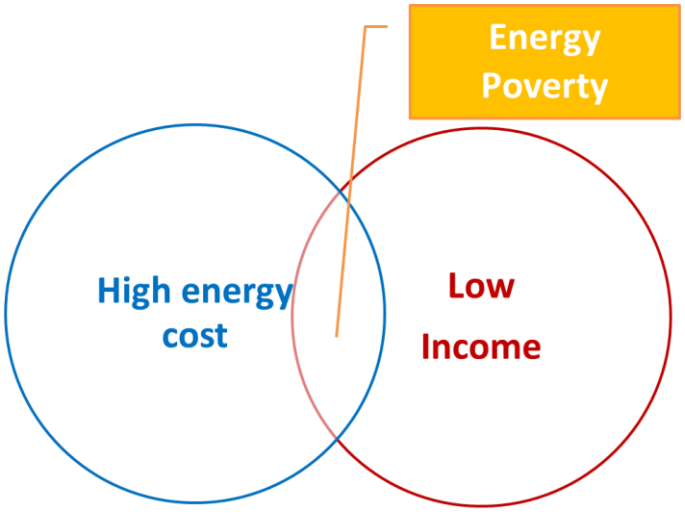
A new approach: measuring EP in calorific values

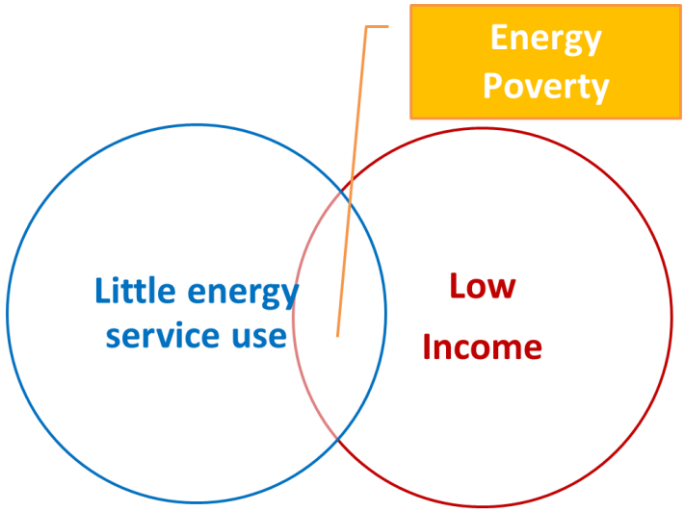
Traditional measures
(affordability measures)

①High energy costs
(in a monetary term)
&
②(Low) income

Our new measure
(measuring 'real' attainment)

①Little energy service use
(in Joule or kcal)
&
②Low income (included for avoiding 'false positive')





Poverty identification & aggregation

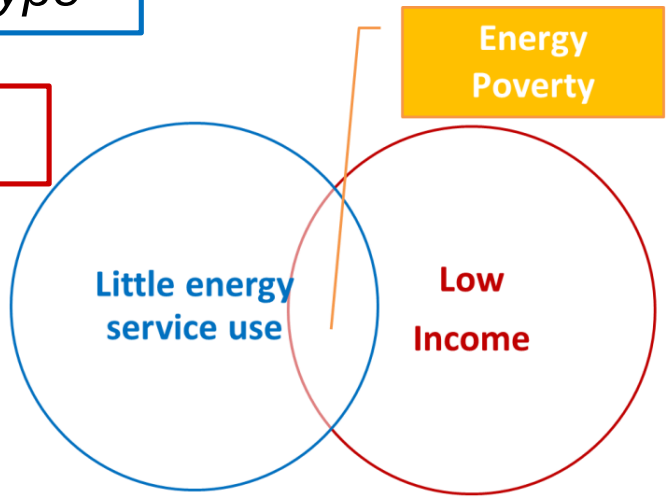
- Energy poverty can be measured by the two steps (Sen, 1997)
  - "Identification" (who are the poor?) - defining the poverty thresholds

① 60% of the median energy use *for each type*

&

② lowest 30% income

The 'energy poor' are identified!



  - "Aggregation" – how are the poverty characteristics of different people to be combined into an aggregate measure for the whole society?

    – using a headcount ratio *H* (the poor *q* to the total population *n*)

H = q / n (The energy poverty rate in the society)

Subclassified 16 types

For the poverty identification (= defining poverty thresholds),

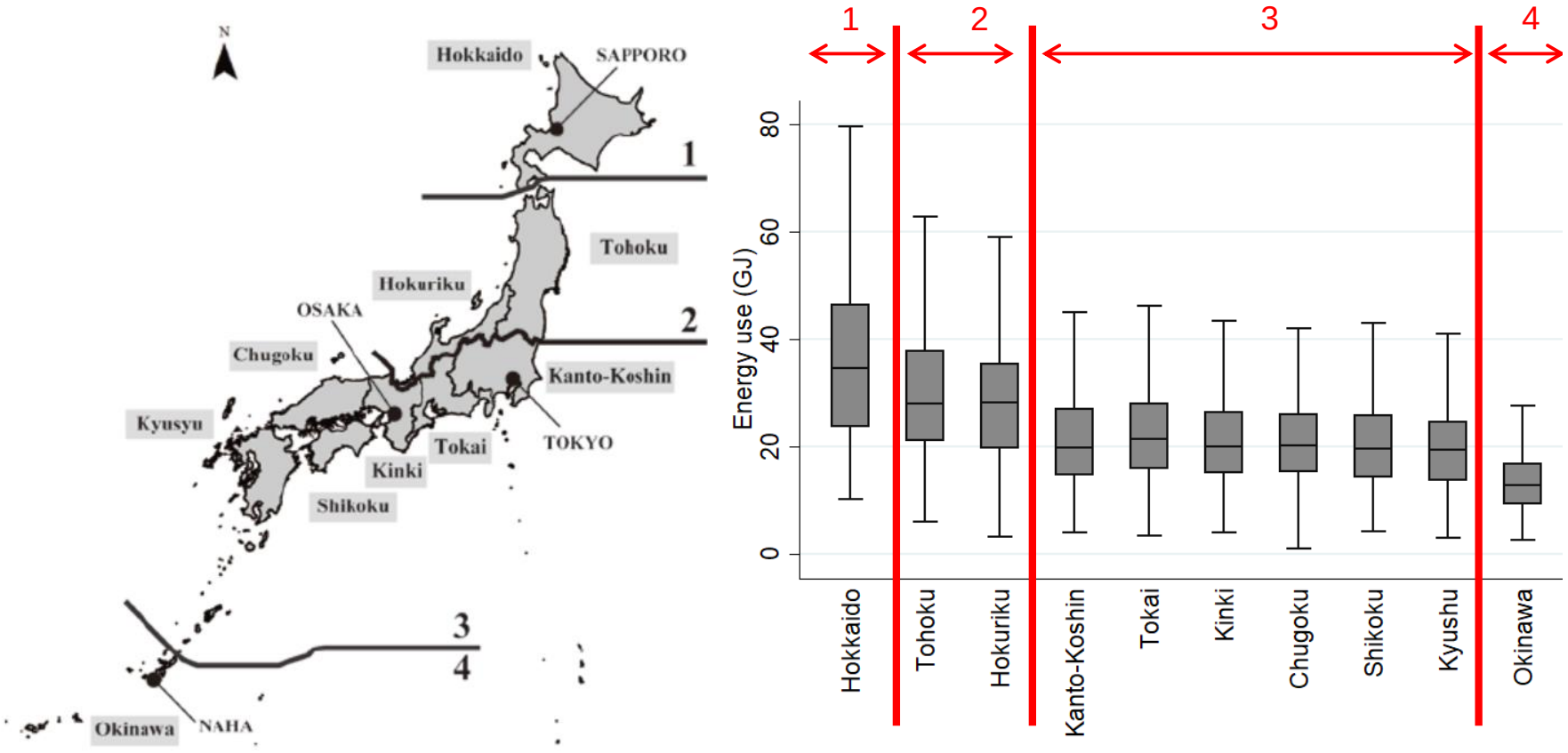
subclassified all households (*n*=9,505) into **16 types** here
(4 Climate × 2 Socio-demographic × 2 dwelling types)

(Having elderly members or not) (Detached or apartment)

3 most important determinants to household energy service use !

	Detached house		Apartments	
	Vulnerable type	Others	Vulnerable type	Others
1. Hokkaido	*Type 1*	*Type 2*	*Type 3*	*Type 4*
2. Tohoku Hokuriku	*Type 5*	*Type 6*	*Type 7*	*Type 8*
3. Kanto-Koshin Tokai Kinki Chugoku Shikoku Kyushu	*Type 9*	*Type 10*	*Type 11*	*Type 12*
4. Okinawa	*Type 13*	*Type 14*	*Type 15*	*Type 16*

E.g., 4 climate types are classified considering climate similarity



Source: Okushima (2019)

Poverty identification & aggregation

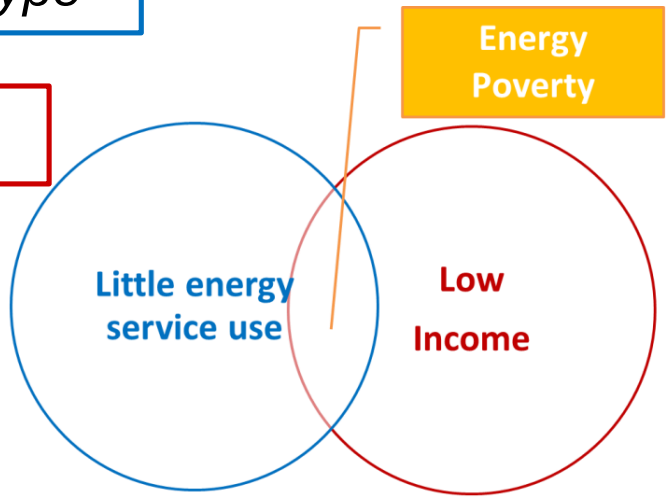
- Energy poverty can be measured by the two steps (Sen, 1997)
  - "Identification" (who are the poor?) - defining the poverty thresholds

① 60% of the median energy use *for each type*

&

② lowest 30% income

The 'energy poor' are identified!



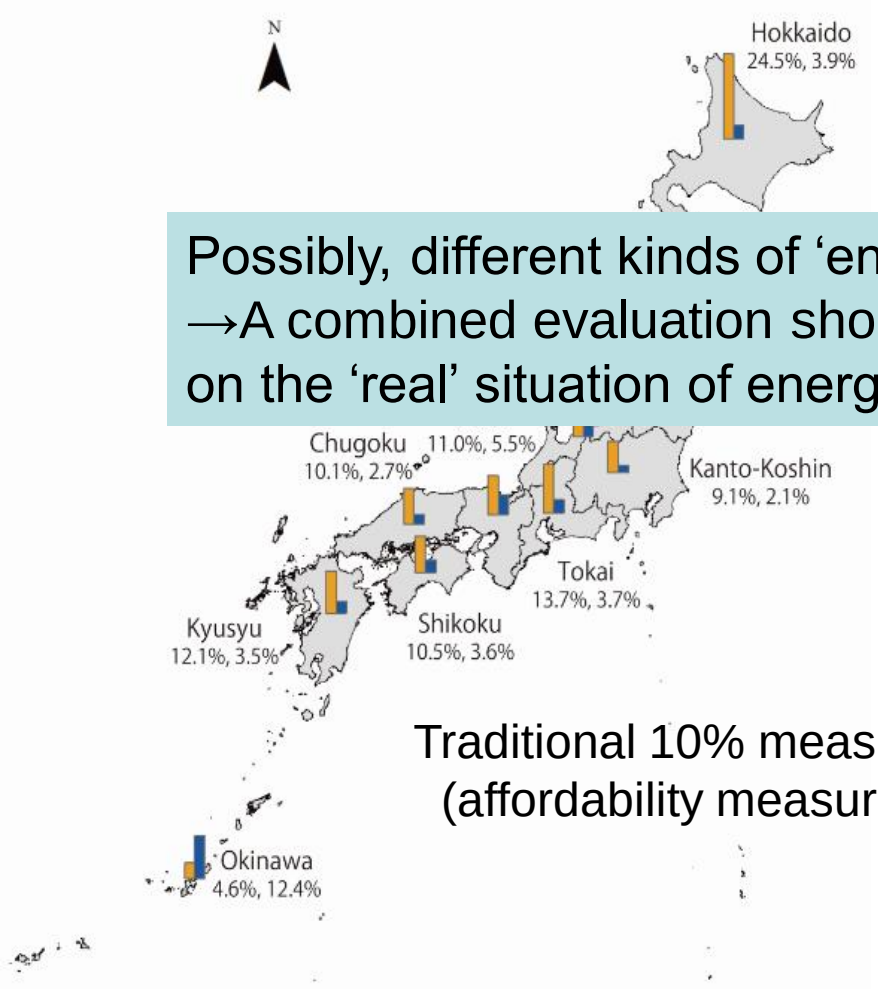
  - "Aggregation" – how are the poverty characteristics of different people to be combined into an aggregate measure for the whole society?

    – using a headcount ratio *H* (the poor *q* to the total population *n*)

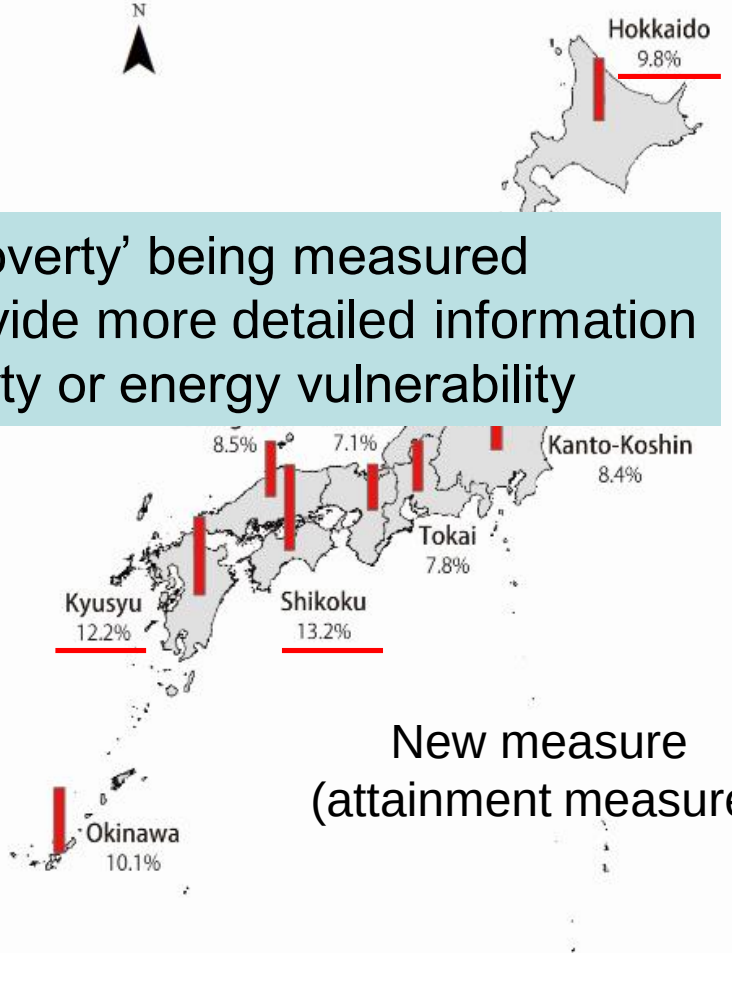
H = q / n (The energy poverty rate in the society)

Energy poverty prevalence by the new measure

- Evaluating EP from the viewpoint of ‘insufficient energy service use’,
  - Milder EP in the northern regions
  - More serious EP in the western regions (possibility of ‘hidden’ EP)



Traditional 10% measure
(affordability measure)



New measure
(attainment measure)

Possibly, different kinds of ‘energy poverty’ being measured
→A combined evaluation should provide more detailed information on the ‘real’ situation of energy poverty or energy vulnerability

Additional (interesting) results using the new measure

Government now considers higher ‘carbon pricing’
as a low-carbon ET policy

BUT,

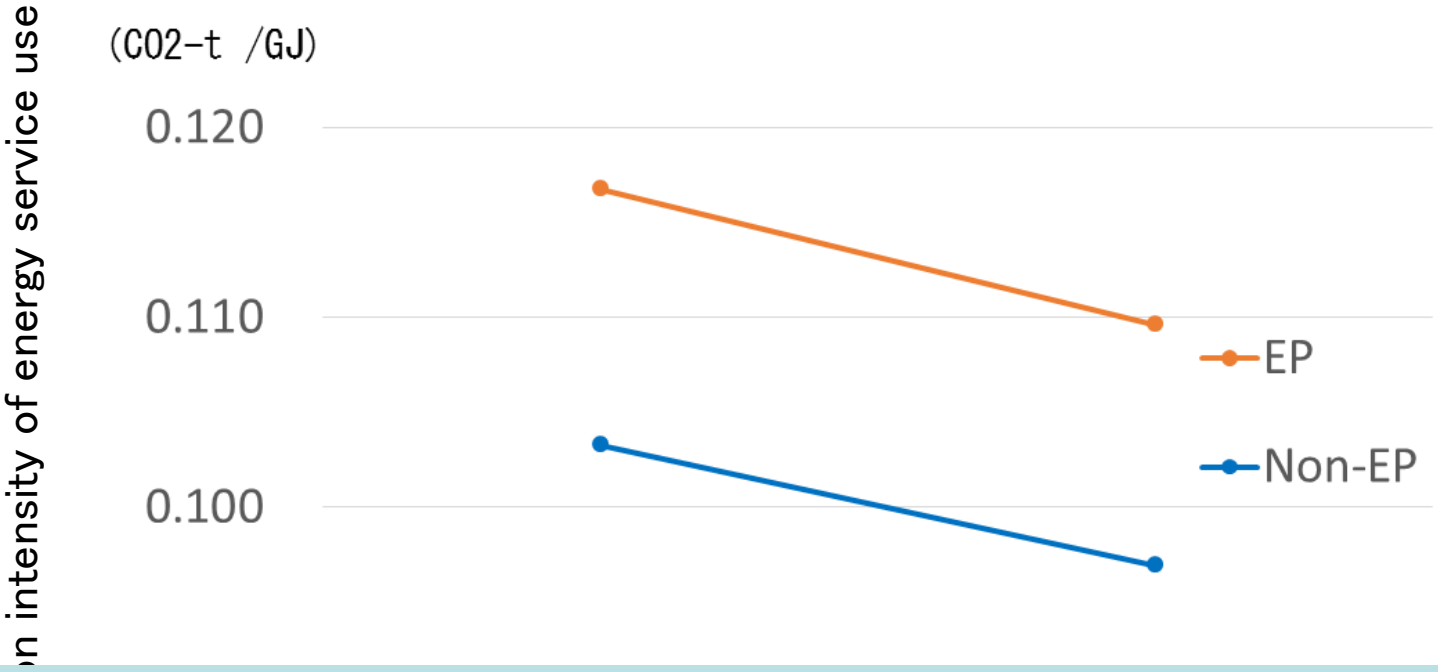
EP are significantly vulnerable to higher ‘carbon pricing’
Two issues which stand in the way

① Higher carbon intensity of EP
② Energy poverty premium (EPP)

Higher carbon intensity of EP households

- EP households: Higher carbon intensity than non-EP

Higher carbon pricing should places more burdens on EP!



Energy poor have ‘less’ access to lower-carbon energy (Okushima, 2019; Chapman and Okushima, 2018)

Energy poverty premium (EPP)

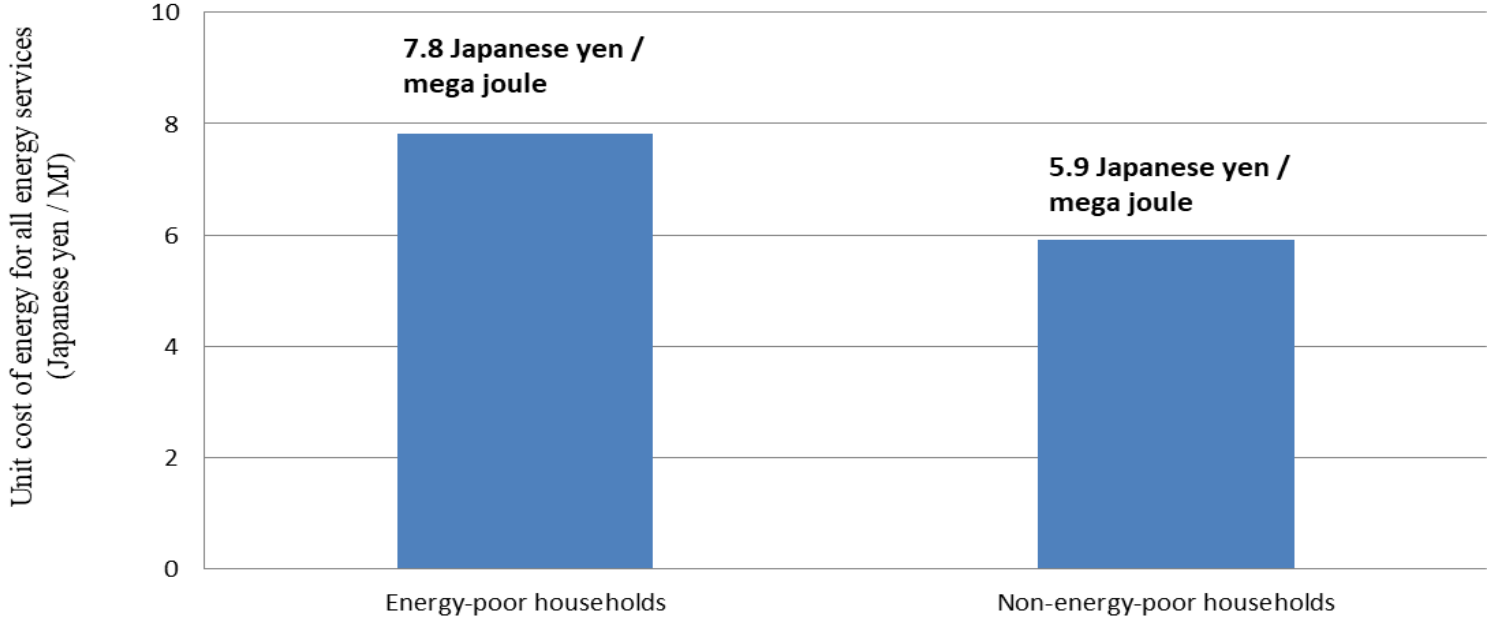
- An ‘energy poverty premium’ exists in Japan

  ⇔EP pay more for energy services (per MJ) than non-poor

  ⇔the poor pay more for essential goods and services (by unit cost)

  Possible reasons: differences in energy infrastructure, transport costs, etc.

EP are facing higher prices of ES than the more affluent people!
→Implication for the ‘energy justice’ issue in Japan



Source: Okushima (2019)

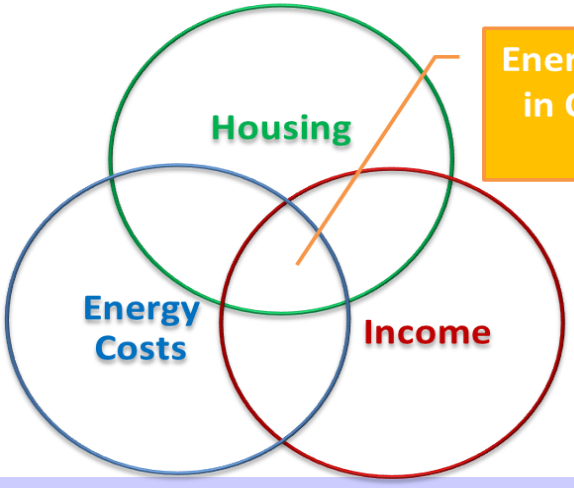
Policy for an inclusive, just energy transition

3 attributes of EP
(Traditionally focused)

Social tariffs (Price regulation for EP)
&
Income support for EP
&
Improving energy-efficiency of housing
Support 'retrofit' for EP housing

Vulnerability factors lying behind
(Today's focused)

Climate
&
Access to low(er) carbon energy



Energy Poverty in O (

Redistribute the benefit of renewables 'more progressively' to EP

= make RE more accessible to EP

one's control or responsibility)

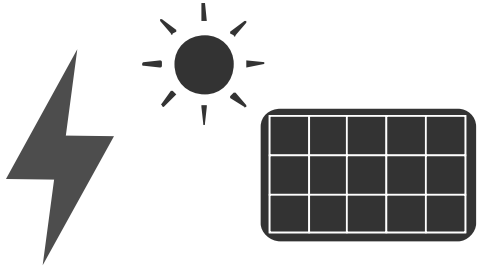
Policy suggestion: solar energy to EP

- Ensuring the access to solar energy for EP households
  - One option: providing low- or no-cost solar panels for EP

BUT,

EP's houses are unfitted for solar PV deployment in many cases…

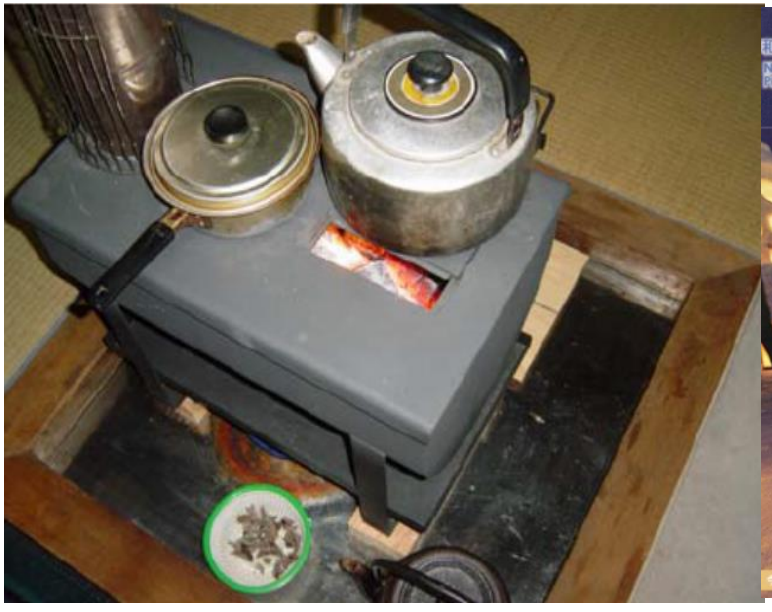
  - Another option: providing low- or no-cost electricity generated from community solar or publicly-owned solar facilities

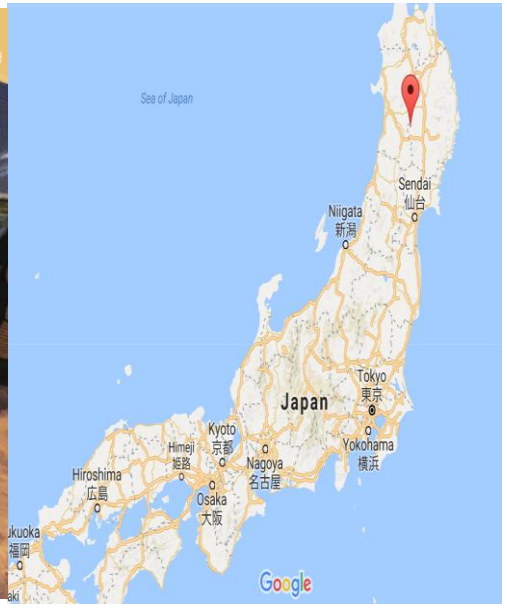


Policy suggestion: biomass energy to EP

- Promoting other renewables in line with the ‘local context’ is also a fruitful option for a just low-carbon energy transition

- One possible approach: promoting the use of wood stoves, replacing kerosene stoves, especially in the northern regions
  - ♦Replacing kerosene (imported fuels) by firewood (regional unutilized renewables)
  - ♦Ensuring the access to low-carbon energy for EP, in terms of winter heating





Source: Nishiwaga-town HP

Thank you very much for your kind attention !

Note: All the figures in this presentation were calculated by myself or ourselves, not official ones. Hence, the presenter assumes full responsibility for them.

References:

Boardman, B. *Fixing fuel poverty: challenges and solutions*. London: Earthscan; 2010.

Bouzarovski, S. and Petrova, S.A. “Global perspective on domestic energy deprivation: overcoming the energy poverty-fuel poverty binary,” *Energy Research and Social Science*, 10, 2015, pp. 31-40.

Chapman, A. and Okushima, S. “Engendering an inclusive low-carbon energy transition in Japan: considering the perspectives and awareness of the energy poor,” *USAEE/IAEE Working Paper*, No. 18-372, December 2018 (http://doi.org/10.2139/ssrn.3301084).

Okushima, S. “Measuring energy poverty in Japan, 2004-2013,” *Energy Policy*, 98, 2016, pp. 557-564 (https://doi.org/10.1016/j.enpol.2016.09.005).

Okushima, S. “Gauging energy poverty: A multidimensional approach,” *Energy*, 137, 2017, pp. 1159-1166 (https://doi.org/10.1016/j.energy.2017.05.137).

Okushima, S. “Understanding Regional Energy Poverty in Japan: A Direct Measurement Approach,” *Energy and Buildings* (SI: Energy Poverty Varieties), 193, 2019, pp. 174-184 (https://doi.org/10.1016/j.enbuild.2019.03.043).

Sen, A.,1997.*On Economic Inequality: Enlarged Edition*. Clarendon Press, Oxford.