

EMPERICAL INVESTIGATION OF ENERGY POVERTY IN JAPAN – A CATEGORICAL COMPARISON OF HOUSEHOLDS

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Table of Contents

- Introduction
- Literature Review + Research Question & Focus
- Methodology (Original Survey)
- Results
- Conclusion



Introduction – World Energy Status

- Energy is a daily necessity all across the globe
- Between 1990 2014, world economy nearly doubled while energy consumption increased 58.9% [1]
- Energy Consumption expected to increase by 50% between 2018 2050. [2]
- Studies have shown causal relationship between energy consumption and economic growth [3]

[1] Le et al., 2020

[2] EIA, 2019

[3] Rathnayaka et al., 2018





Introduction – World Energy Status

- Still nearly 940 million people (13% of global population) have no access to electricity. [4]
- Imbalance of energy consumption and economic prosperity across world
- Global intermittency in energy costs
- Climate change and GHG emissions
- Introducing renewables \rightarrow costs rise in long term [5][6]

[4] Ritchie et al., 2019
[5] Chapman et al., 2019
[6] Röckel, 2017
Introduction Literature Review Methods Results Conclusion



Introduction – Energy Poverty Definition

- Energy poverty (EP): Inability to possess/afford modern energy services
- Developing countries and developed countries
- Scope of this study is Japan **Energy Poverty** Aka (Fuel Poverty) **Developing countries: Developed Countries:** Accessibility oriented Affordability oriented

Literature Review – Case of Japan National Survey of Family Income &							
Japan: 2016~ vs. Europe: 1970s~ Ministry of Internal Affairs and Communications							and
#	Author	Year	Туре	Lang	Title	Data	Indicator
1	Okushima et al. [7]	2013	Conf.	EN	EP in Japan: How does energy price escalation affect low income & vulnerable households?	NSFIE	10%
2	Okushima [8]	2016	Journal	EN	Measuring EP in Japan, 2004–2013	NSFIE	10%
3	Mori et al. [9]	2016	Journal	JP	Research on FP in Japanese Cold Climate Region	Survey + NSFIE	10%
4	Okushima [10]	2017	Journal	EN	Gauging EP: A multidimensional approach	NSFIE	10% + MEPI
5	Konno et al. [11]	2018	Journal	JP	Research on Actual condition of FP in Hokkaido	Survey + NSFIE	10%
6	Okushima [12]	2019	Journal	EN	Understanding regional EP in Japan: A direct measurement approach	MOE Data	MEPI + cal. Value
7	Tabata et al. <u>[13]</u>	2019	Conf.	JP	Survey on FP Among Residents in the Kansai Region	Survey	10%
8	Chapman et al. [6]	2019	Journal	EN	Engendering an inclusive low-carbon energy transition in Japan	Survey+ NSFIE	MEPI
9	Tabata et al. [14]	2020	Journal	EN	FP in Summer: An empirical analysis using microdata for Japan	NSFIE	10%
10	Castano-Rosa et al. [15]	2021	Journal	EN	Prevalence of EP in Japan: A Comprehensive analysis of EP vulnerabilities	NSFIE etc.	10%
	Introduction Literature Review Methods Results Conclusion						

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	Introduction Literature Review Methods Results Conclusion 7						

Literature Review



- Majority of studies are based on NSFIE survey, without focusing on standards and qualitative data
- Studies focused on parents, aged etc.
- No study of college students, while studies elsewhere prove them to be vulnerable to EP [16] [17]
- It is required to assess college students vs. ordinary households in Japan

 [16] Morris et al. 2018

 [17] Ntouros et al., 2019

 Introduction

 Literature Review

 Methods

 Results

 Conclusion

Research Questions

Introduction

- (1) Is EP an existing issue in Japan? If so, to what extent?
- (2) Which households are most vulnerable?

Literature Review

- (3) Reconsidering vulnerables' category needed?
- (4) Why energy poverty could be a hidden risk in Japan?

Methods

Results







Methodology

- Original Surveys Conducted for this study (December 2018 ~ January 2020)
 - EP Rate Estimation Coefficient selected as "10% Indicator"
 - Comparison of existing data vs. original data
 - Statistical Analysis (Regression, Std. deviation, Students T-test, Pearson chi-square test)
 - Why is an original survey necessary amid relative preexisting data?

Difference of original surveys in comparison to existing data

National Survey of Family Income and Expenditure (NSFIE)





Methodology – Survey Details



Category Detail (N)	Tokyo City (165)	Beppu City (164)	Tokyo Students (166)	Beppu Student (229)	Total Sample Number			
Date of Survey	Dec.2019~ Jan.2020	Dec.2019~ Jan.2020	Dec. 2019 ~ Jan. 2020	Jan. 2019 Jan. 2020	724 households			
Distribution Amount	1300	1800	700	Online	Response by age < 30 30 - 39 40 - 49 50 - 59 60 - 69 70 - 79 80+			
Response M	64 (39.0%)	61 (31.9%)	137 (83.0%)	108 (47.4%)	9%			
By Gender F	100 (61.0%)	100 (62.1%)	28 (17.0%)	120 (52.6%)	9%			
Response Rate	13%	9%	24%	-	7%			
Distribution Method	Post Box	Post Box	Tokyo Tech Campus Internal Mailing Service	Ritsumeikan APU On-campus distribution	8% Student: 89.5% Non-Student: 10.5%			
Introduction Literature Review Methods Results Conclusion 12								



Results (1) - EP condition in Japan

r∕tr Tokyo Tech



Results (2) – Vulnerable categories by age



Conclusion

15

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Tokyo Tech

Results (3) – Reconsideration in categories?

Tokyo Tech

6

Students T-test: Determine statistical significance between two data sets of normal residents and students

H₀ No difference between categories H₁ Difference between student and city is statistically significant





Results (4) – Why is it a hidden threat?

Tokyo Tech

	Category					
		Not Student			Student	
Original Findings	Count	Column N %	Count	Column N %		
	Can't Afford	107	34.6%	122	31.5%	
Reasons to reduce	Climate change & Emissions	141	45.6%	93	24.0%	
domestic energy comsumption ^a	Outdoor time spending	21	6.8%	120	31.0%	
	Other	39	12.6%	6	1.6%	Y
	Nothing	74	23.9%	64	16.5%	-

a. Multiple response allowed

				Cate	gory		
			Not S	Student	Stu	ident	
Original Findings			Count	Column N %	Count	Column N %	
		Use energy at cafe, library etc.	72	22.2%	195	49.9%	
	Actions taken to	Upgrade appliances	132	40.7%	126	32.2%	
	curb domestic	Dwelling insulation	81	25.0%	25	6.4%	
	consumption ^a	Scheduling applications	14	4.3%	63	16.1%	. ,
	· ·	Other	62	19.1%	29	7.4%	ľ
		None	67	20.7%	43	11.0%	

a. Multiple response allowed

- Waste minimization (もったいない) •
- Saving resources
- Access to hot spring (温泉)

. . .

- Endure (我慢)
- Adjust clothes •
- Using cheaper sources (Kerosene)
 - . . .

Pearson Chi-Square Tests

		otatistical value
	Chi-square	172.340
gy	df	6

Statistical Value

Actions taken to curb domestic energy consumption	Cni-square	172.340
Actions taken to curb domestic energy consumption	df	6
	Sig.	.000*
	Chi-square	139.774
Reasons to reduce domestic consumption	df	5
	Sig.	.000*

Results are based on nonempty rows and columns in each innermost subtable.

Conclusion

*. The Chi-square statistic is significant at the .05 level.

Conclusion - Back to the Research Questions



(1) What is the condition of EP in Japan?

Increase from 4.7% in 2004 to 8.4% in 2013. Slight decrease from 2014, Increase expected from 2016. Estimated at 13.2% in 2019 (2) Type of households most vulnerable?

Single/couple elderly, Single parents with child(ren), ages 65+ followed by 20-30, 3 lowest income deciles, **lower income** \rightarrow higher EP rate

(3) Reconsideration of EP categories needed?

Perhaps! Results show high EP rates for students in comparison to normal residents



Characteristics of damaging consumers' actions are not investigated and reflected on national data → underestimation, ineffective countermeasures and worsened situation

Conclusion

Introduction

Methods

Results

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