



State of residential energy consumption in Southeast Asia

Apr, 2017

**Jyukankyo Research Institute
Waseda University**

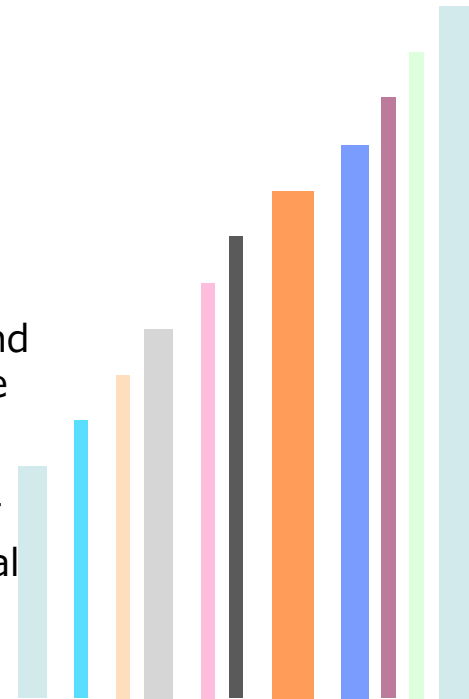
This research was supported by the Environment Research and Technology Development Fund (1-1502) of the Ministry of the Environment, Japan and also United nation the 10 year framework of programmes on sustainable consumption and production – sustainable lifestyle and education - , Ministry of the Environment, Japan and Institute for Global Environmental Strategies.



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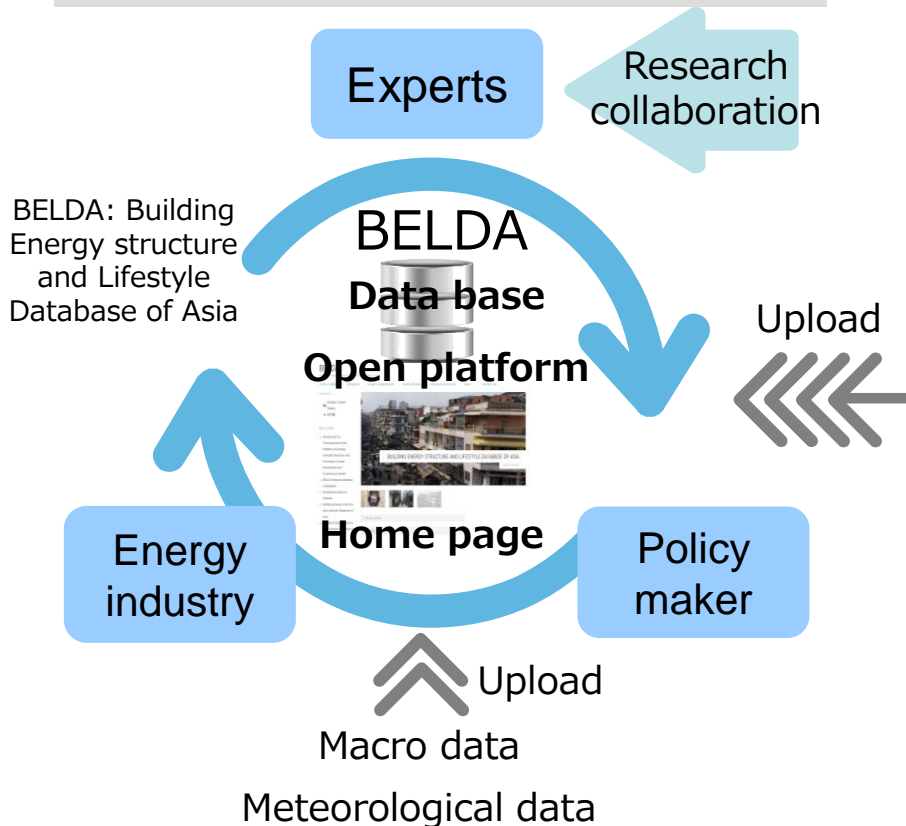
Waseda University



Overview of survey



Data base



Filed survey (2015)

Survey on energy consumption of residential sector

Malaysia

Kuala Lumpur : 100

Thailand

Bangkok : 300

Samut Sakorn : 150

Vietnam

Hanoi : 110

Ho Chi Minh : 110

Hoa Binh : 110

Cambodia

Phnom Penh : 210

Kandal : 100

Total : 1,190
households

Survey plan in 2016

- **Measurement survey: measure electricity usage during 1 year**
 - Bangkok(30hh), Hanoi (15hh), Phnom Penh (10hh)
- **Detailed interview survey, Thailand (200hh), Vietnam(210hh), Cambodia(200hh)**
- **Survey on energy consumption of commercial buildings**



BELDA

<http://www.belda.asia/wp/en/>

LANGUAGE

English (United States)

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– Part 1: Identification of Household

- demography
- age
- gender
- occupation
- the days that people usually at home during the daytime on weekdays
- annual income of all family members

– Part 2: Housing Characteristics

- building type
- structure type
- number of floors
- gross floor area
- established year
- ownership relationship
- number of rooms

– Part 3: Energy Consumption and Energy Bills

- monthly energy use by fuel type
- monthly energy bills by fuel type

– Part 4: Home Appliances and Electronics

- space cooling (room air-conditioning, fan, etc.)
- space heating (room air-conditioning, heaters, etc.)
- home appliances
- lighting

– Part 5: Hot Water

- type and number of water heating equipment
- hours of use
- bathing habits

– Part 6: Vehicle

- Type, number and frequency in use of automobiles and motorbikes/ scooters

– Part 7: Lifestyle and behaviors

- ways of keeping home cool
- satisfaction with the indoor environment
- willingness to buy energy-efficient home appliances in the future and problems when buying energy-efficient home appliances
- energy saving behaviors
- other

Misunderstanding of the developed countries on household energy consumption in Southeast Asia



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Household energy consumption in Southeast Asia is low.

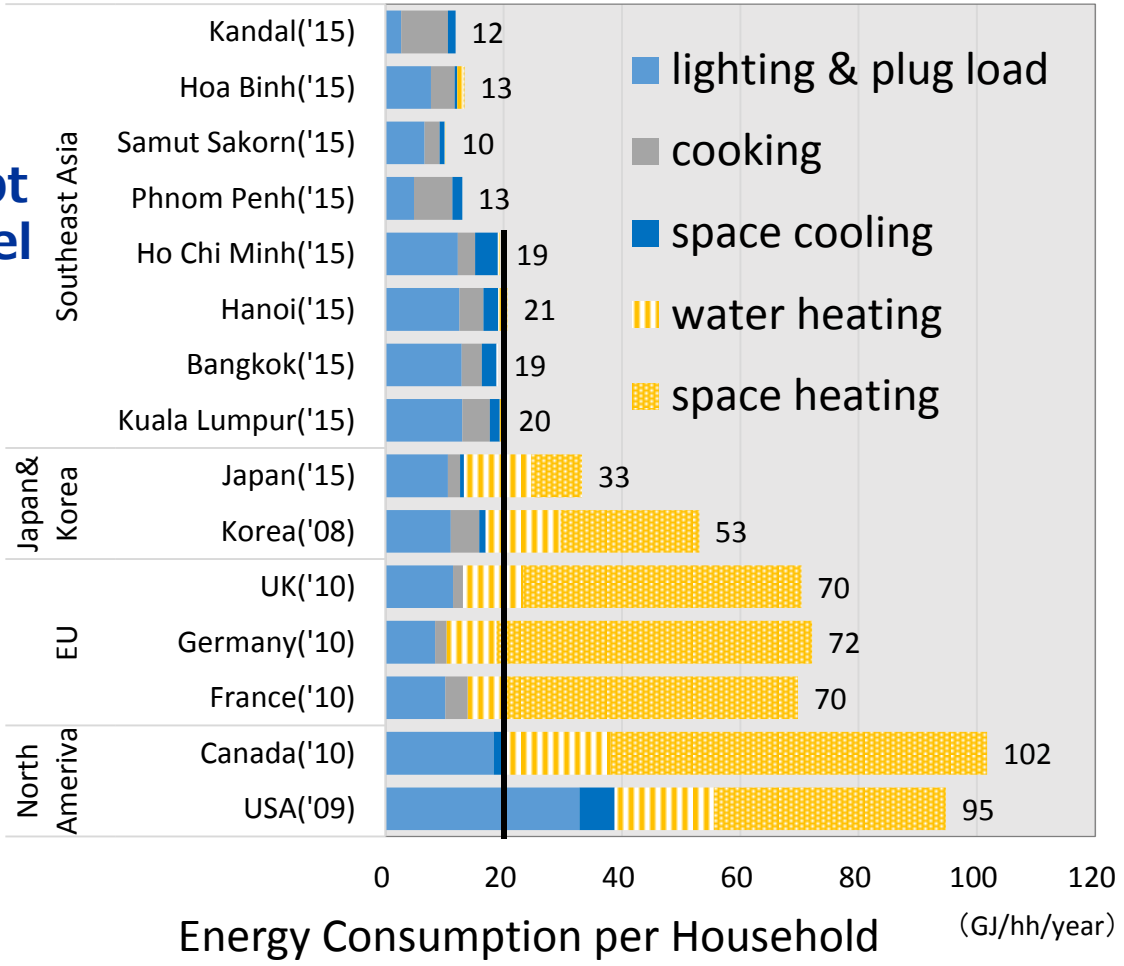


Consumption in urban areas except for the heat demand is the top level of the world.

Two incomes are many, consumption for the kitchen is low.



Consumption of kitchen is high because of remains large family system, high home proportion of noon.



Note) Source of data in Japan : "Pilot Survey, Survey on the Actual Conditions of Households for the Estimation of Carbon Dioxide Emissions" Ministry of Environment (Oct 2014 - Sep 2015)

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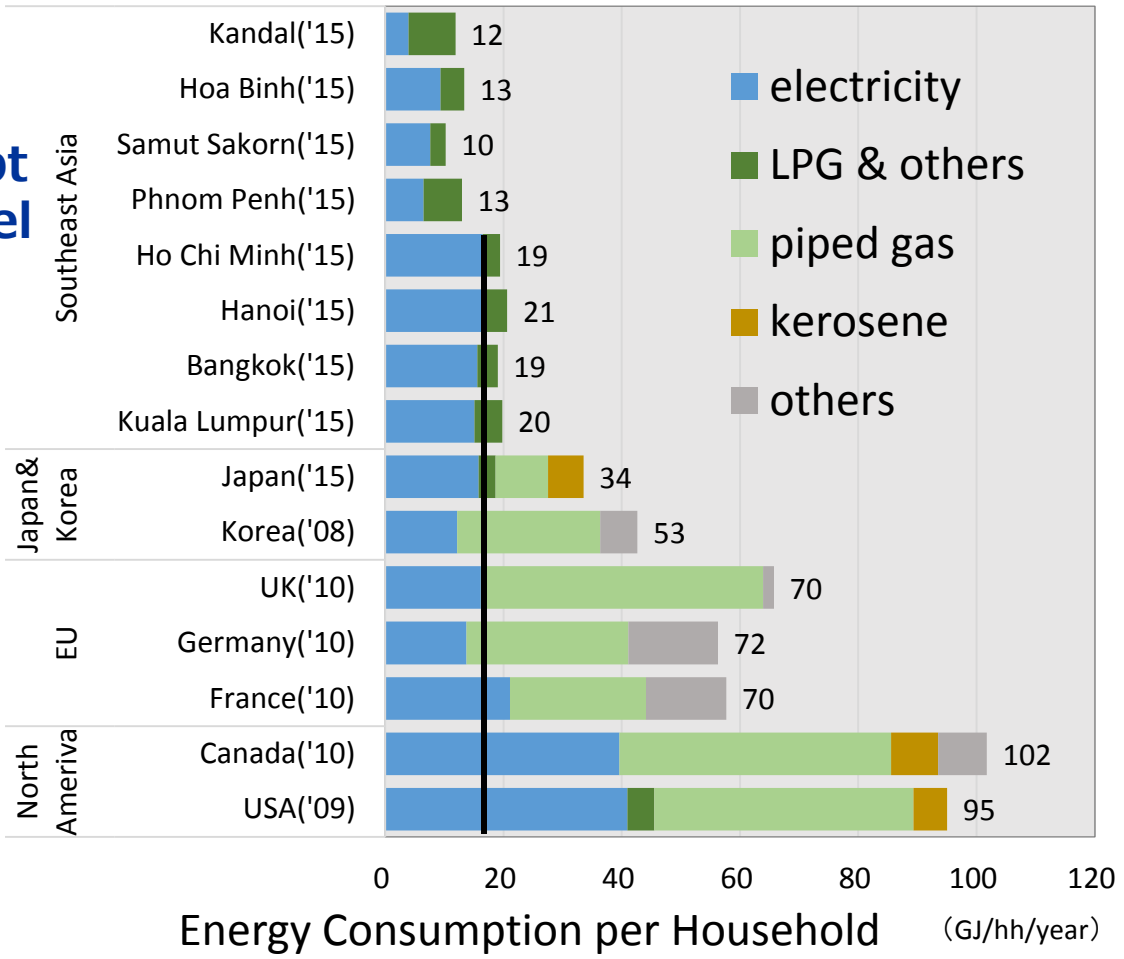
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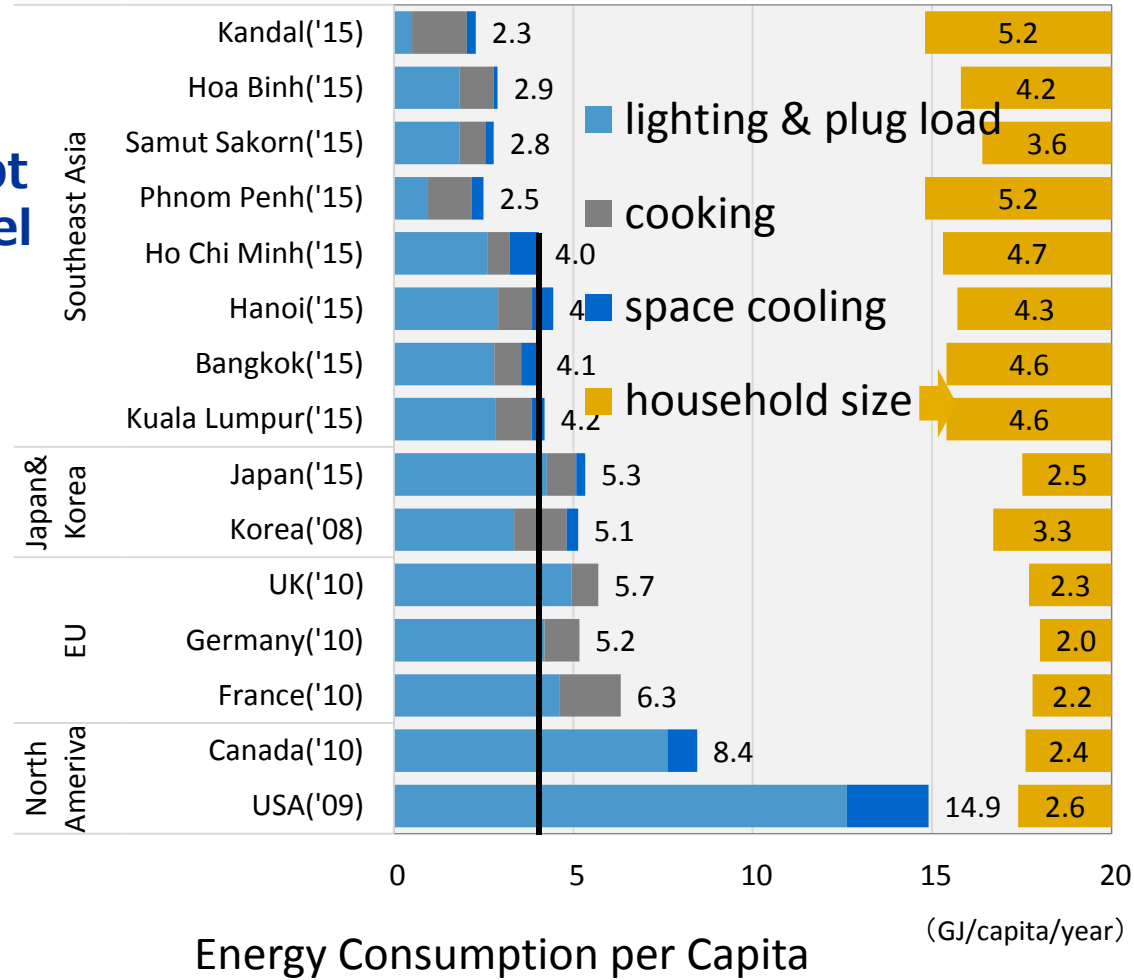


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Similarly, electricity consumption in urban areas is the top level of the world.



Consumption per capita is little lower than developed countries. Energy efficiency improvement is urgent need to more than developed countries.



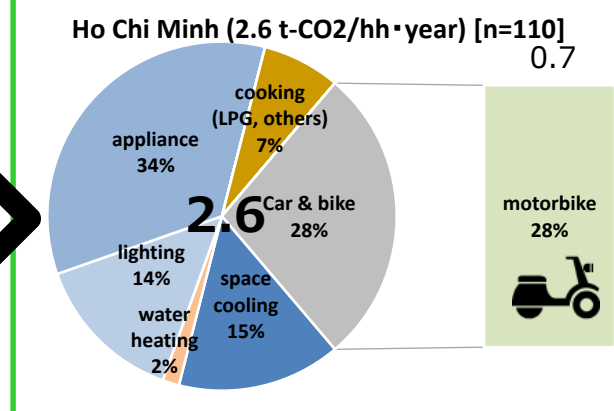
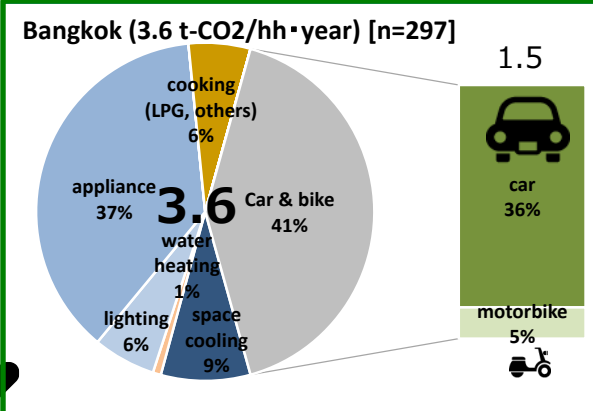
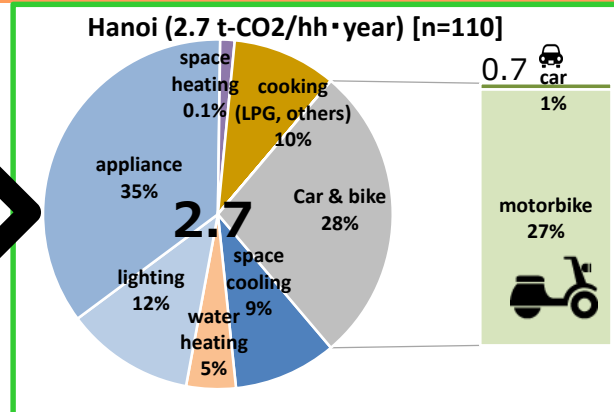
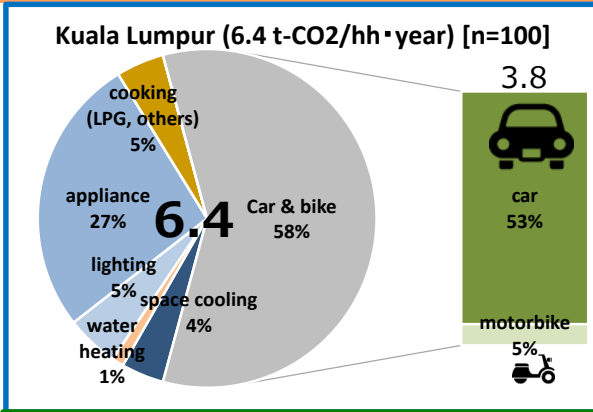
CO₂ emission



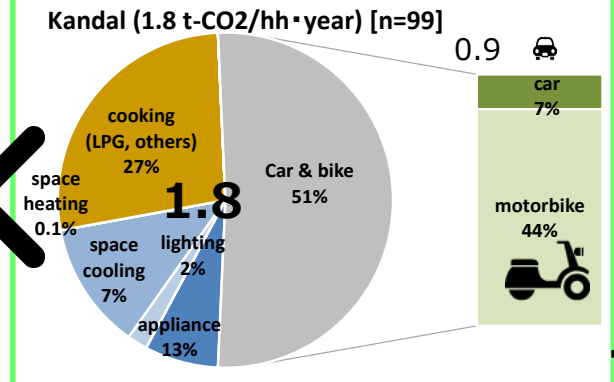
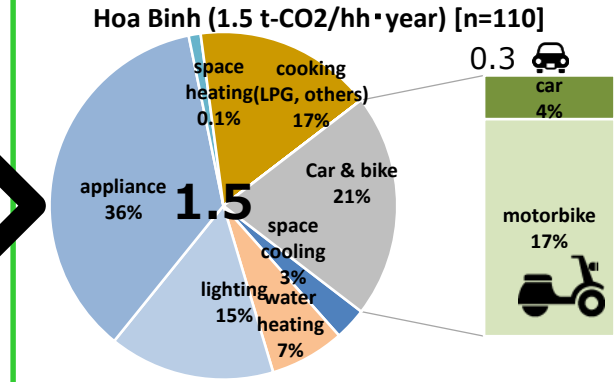
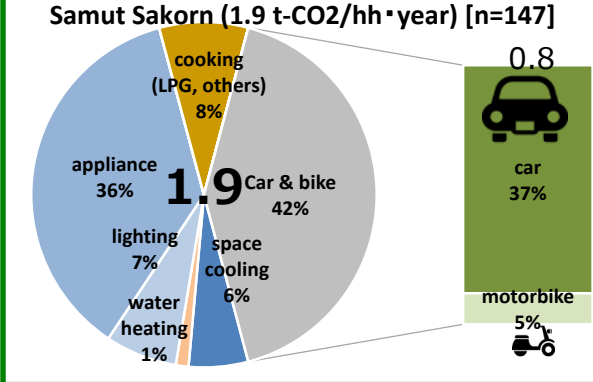
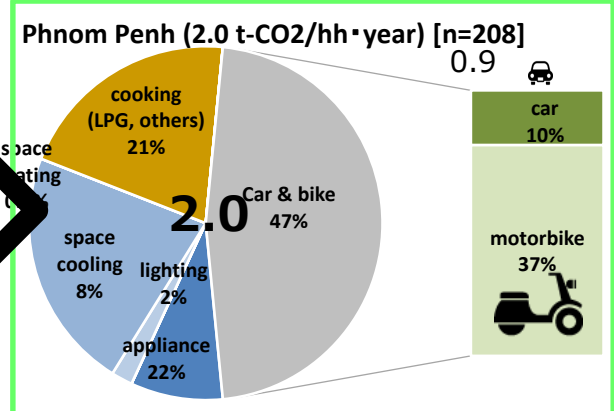
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Urban area

Rural area




t-CO ₂ /hh/year	In home	Car & bike	Total
Kuala Lumpur	2.7	3.8	6.4
Bangkok	2.2	1.5	3.6
Hanoi	1.9	0.7	2.7
Ho Chi Minh	1.8	0.7	2.6
Phnom Penh	1.1	0.9	2.0
Sumut Sajorn	1.1	0.8	1.9
Hoa Binh	1.2	0.3	1.5
Kandal	0.9	0.9	1.8
Japan	3.5	1.3	4.8



Characteristics of households and housing



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- Number of household members is 5/hh in urban area. Rural area is little smaller.
 - **There remains a large family system, three generations living together is more than 50% in urban areas except Kuala Lumpur.**
 - As a result, during the day on weekdays, someone is at home in most of them.
- Number of person with job: 2 or more in Cambodia, 1.7 in Bangkok, 1.6 in Kuala Lumpur and less than 1.5 in Vietnam and Thailand except Bangkok.
 - **We misunderstood that almost all are two incomes.** 
- Monthly income: Thailand > Malaysia > Vietnam > Cambodia. Urban > Rural. Big difference with developed country.
- **Energy price is low.** Electricity price: Malaysia, Vietnam: 8 cent/kWh, Bangkok: 13 cent/kWh, Cambodia : 21 cent /kWh and Japan: 27 cent/kWh.
- Size of housing: around 90m² in urban area. It is similar as Japan. However, housing size per capita is smaller than Japan. Japan: 40 m²/person, Southeast Asia: 15~28m²/person.

High consume of lighting and home appliances

High consume of kitchen

High consume of electricity

	household size (people)	frequency of stay-at-home (weekdays)	No. of workers (people)	monthly income (USD)	floor space (m ²)	
Urban Area	Kuala Lumpur (n=100)	4.6	74%	1.6	1,074	87
	Bangkok (n=300)	4.6	90%	1.7	1,248	107
	Ho Chi Minh (n=110)	4.7	96%	1.4	537	85
	Hanoi (n=110)	4.3	77%	1.4	595	96
	Phnom Penh (n=210)	5.2	78%	2.8	455	80
Rural Area	Samut Sakorn (n=150)	3.6	83%	1.2	727	98
	Hoa Binh (n=110)	4.2	70%	1.3	405	118
	Kandal (n=100)	5.2	94%	2.5	397	78
JPN	2.5	53%	1.2	3,950	100	

Penetration ratio of home appliances and ways to keep cool



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- AC, Hanoi is similar as Japan. Kuala Lumpur, Bangkok and Ho Chi Minh are about 50%. Cambodia and Rural area is low. 3 fans in each family.
- Hardly use AC during day time. Almost people take cool by ventilation and fan. Over half households use AC on night time.
- Setting temperature of AC is over 25 °C (Japan is 26.4°C)
- **Cooling has been used sparingly, but do not feel the discomfort.** From 50 to 70% people feel comfortable.
- Usage time of AC is 7-13 hour in urban area.



Cooling will increase significantly



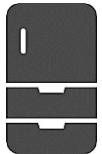
“Cooling is culture” would be misunderstanding.



Factor of high energy consumption



- Flat panel TV is rapidly spread. Japan, Malaysia and Vietnam > Thailand and Cambodia. CRT-type TV still remain in Thailand and Cambodia.



- Penetration ratio of fridge is almost 100% except Cambodia. Capacity of fridge is over 200 liter (grow in size).



- Penetration ratio of rice cooker is as same in Japan.



Pay attention of future growth of fridge's capacity



- PC, urban area of Vietnam is similar as Japan.



- One cellular phone in every household. Every one have it in Japan.



Pay attention of future growth

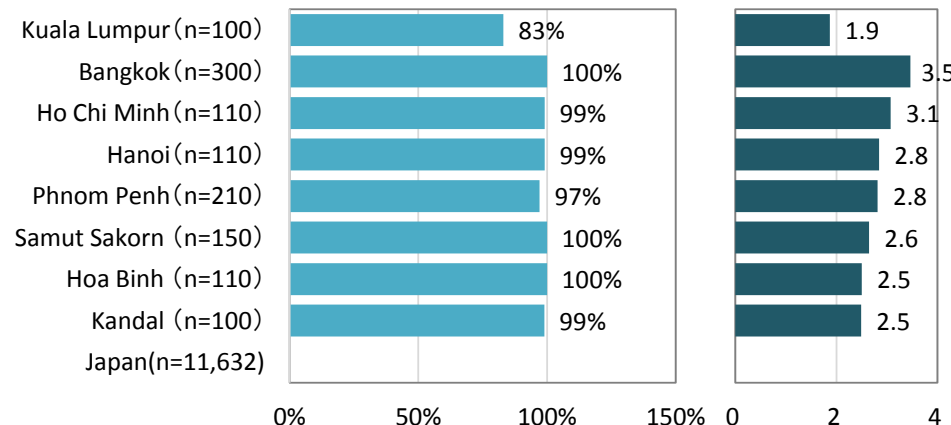
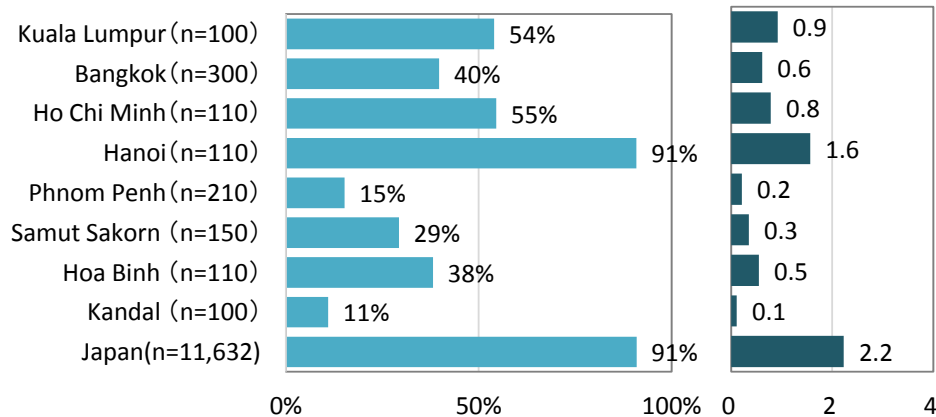
Penetration ratio of home appliances



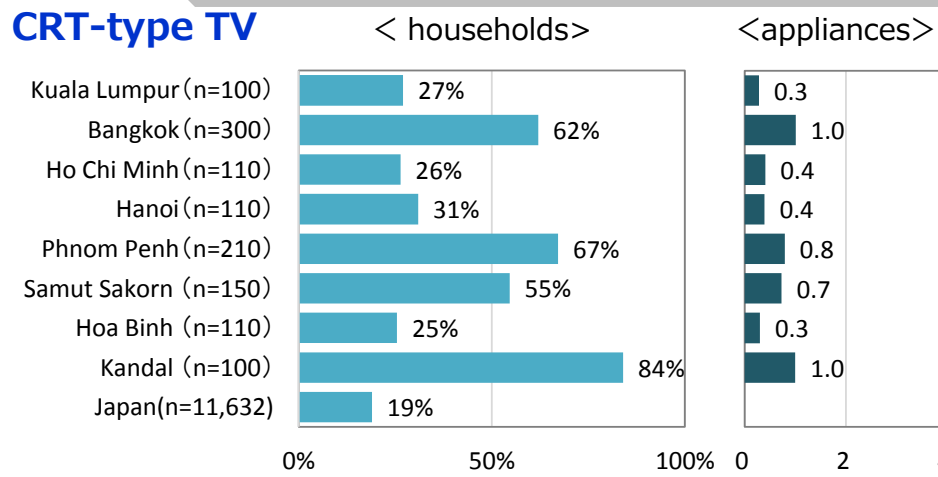
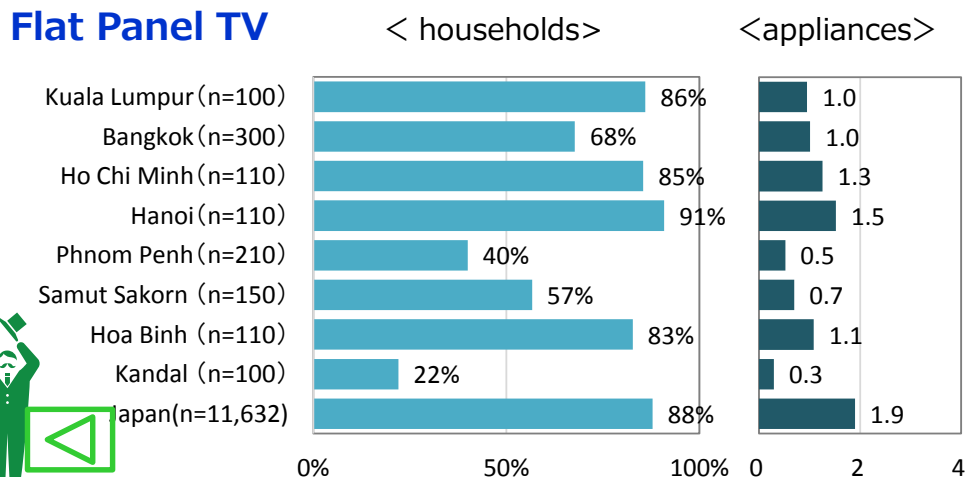
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- AC, Hanoi is similar as Japan. Kuala Lumpur, Bangkok and Ho Chi Minh are about 50%. Cambodia and Rural area is low. 3 fans in each family. **Cooling will increase significantly.**

Air Conditioner <households penetration> <appliances penetration> Fan <households penetration> <appliances penetration>



- Flat panel TV is rapidly spread. Japan, Malaysia and Vietnam > Thailand and Cambodia. CRT-type TV still remain in Thailand and Cambodia. **Factor of high energy consumption**



Penetration ratio of home appliances

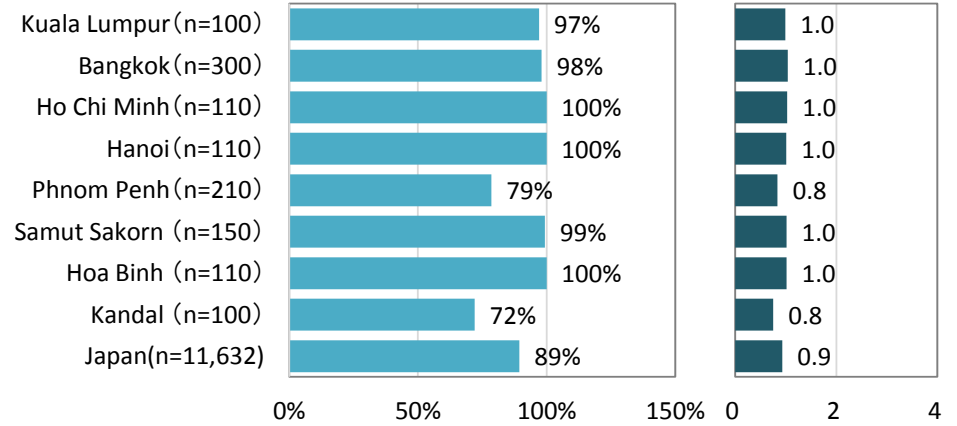
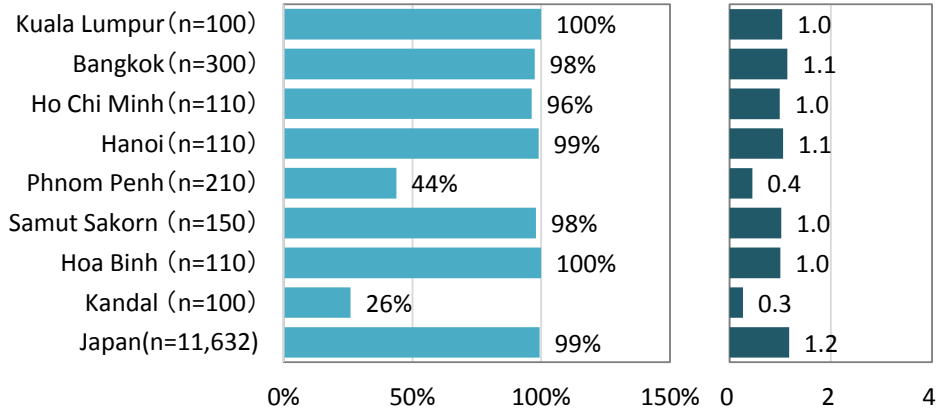


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- Penetration ratio is almost 100% except Cambodia. Capacity of fridge is over 200 litter (grow in size).

Promote high efficient fridge would be required due to grow in size.

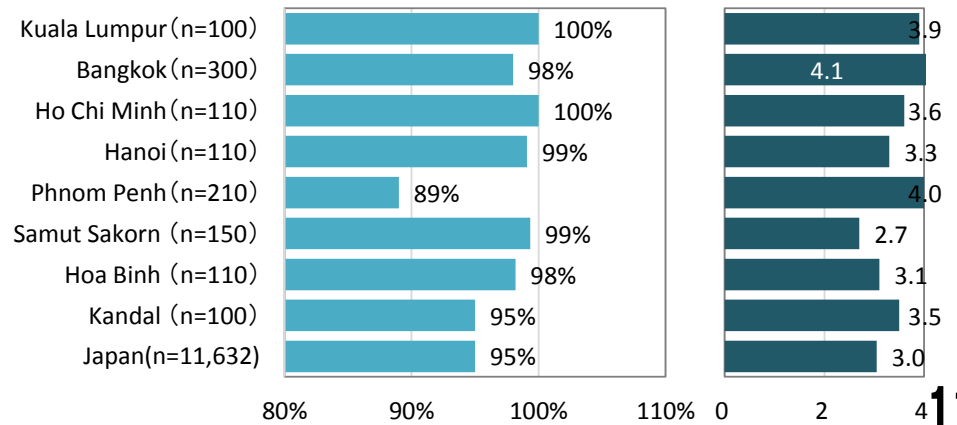
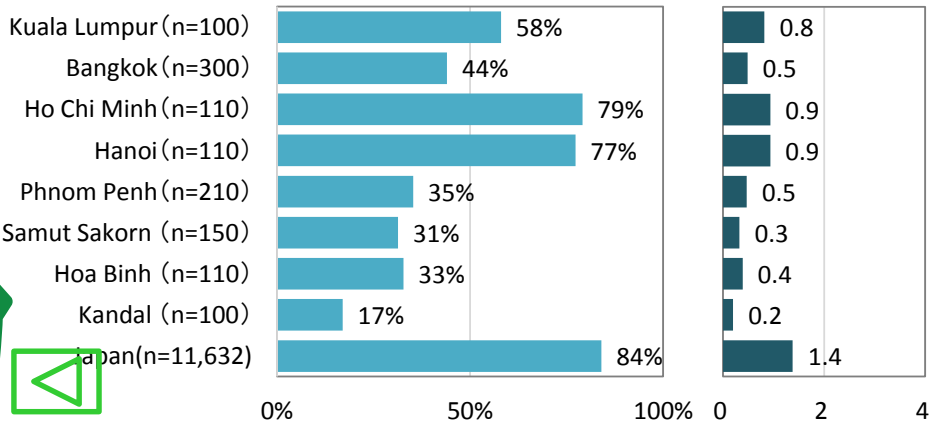
Refrigerator <households penetration> <appliances penetration> Rice cooker <households penetration> <appliances penetration>



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Pay attention of future growth

PC <households penetration> <appliances penetration> Cellular phone <households penetration> <appliances penetration>



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



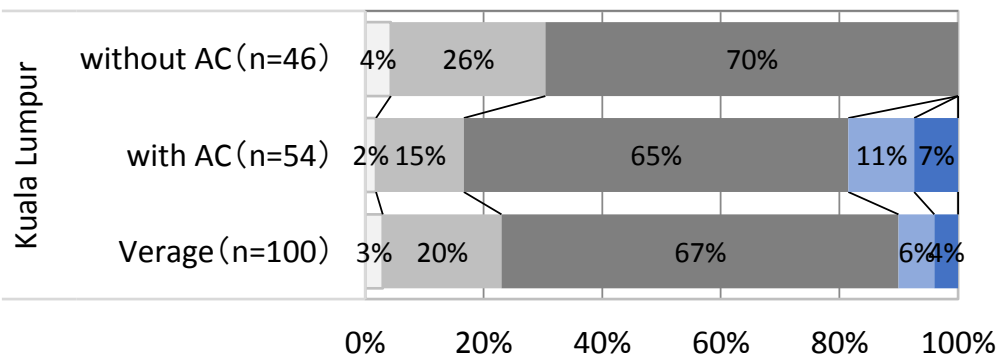
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Kuala Lumpur, Malaysia

Ways to keep cool

Day time

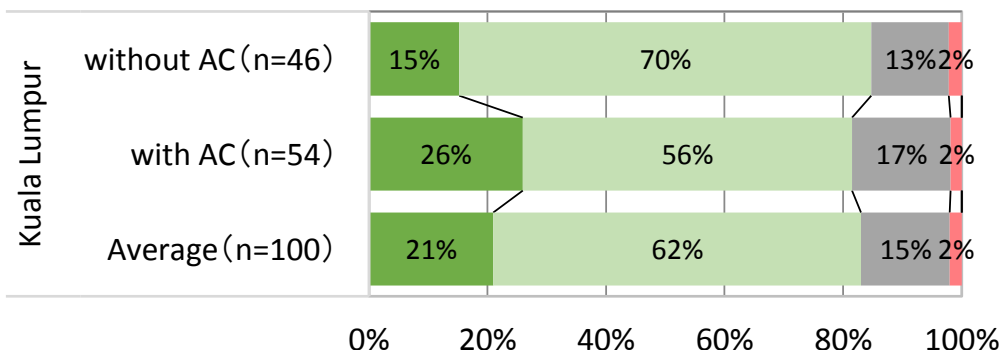
- Open windows
- Turn on fans
- Turn on fans with windows open
- Turn on AC
- Turn on air conditioner and fans



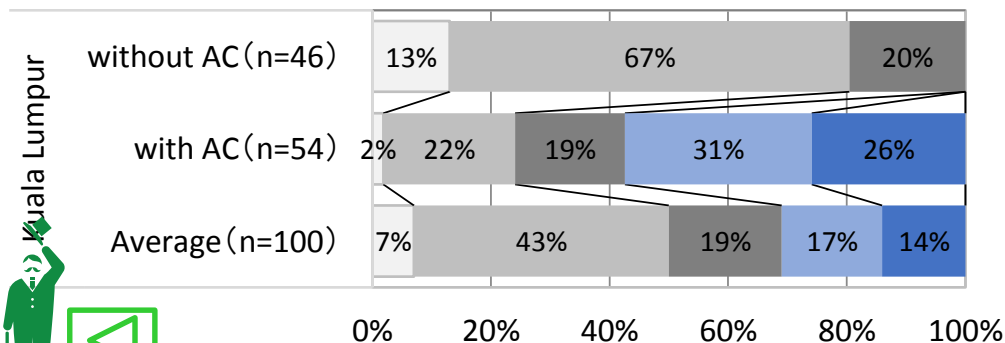
Satisfaction with indoor environment

Temperature

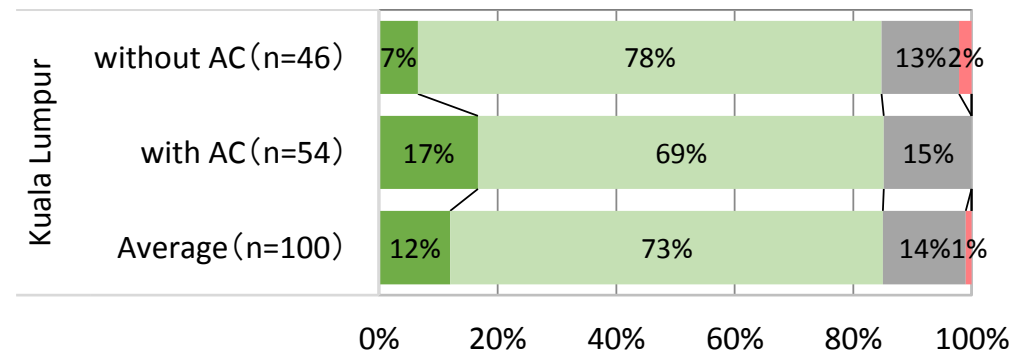
- Very satisfied
- Somewhat satisfied
- Can's say either way
- Dissatisfied
- Very dissatisfied



Night time



Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



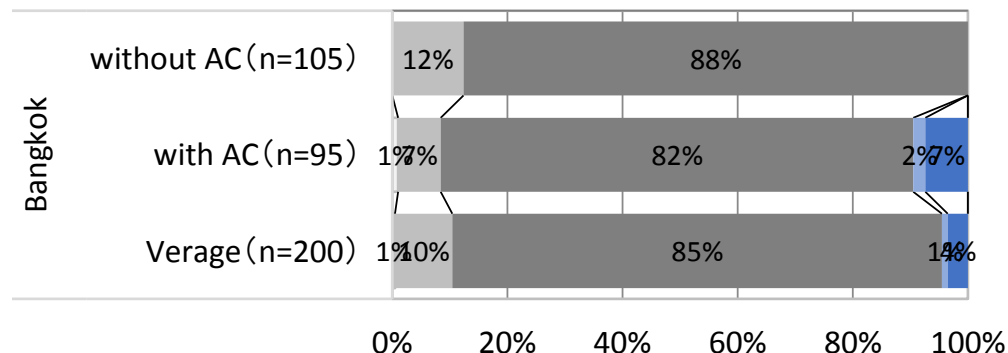
JYUKANKYO RESEARCH INSTITUTE INC.

Bangkok, Thailand

Ways to keep cool

Day time

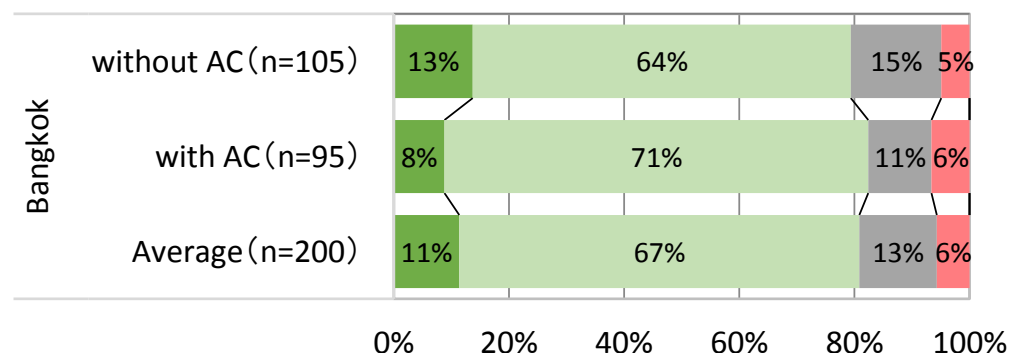
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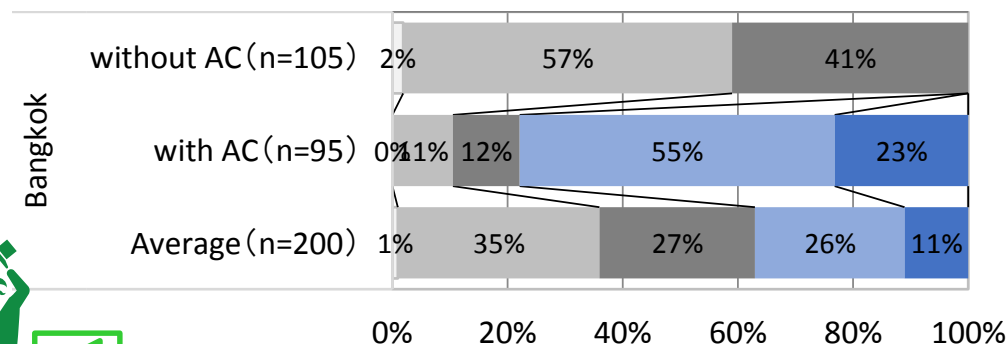
Satisfaction with indoor environment

Temperature

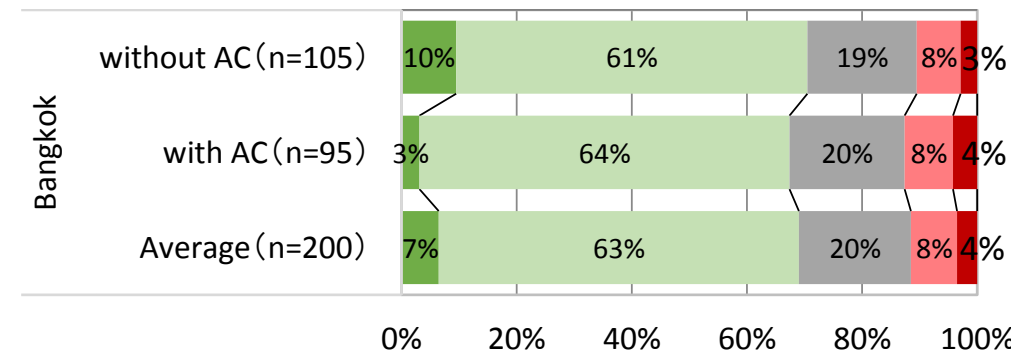
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Night time



Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



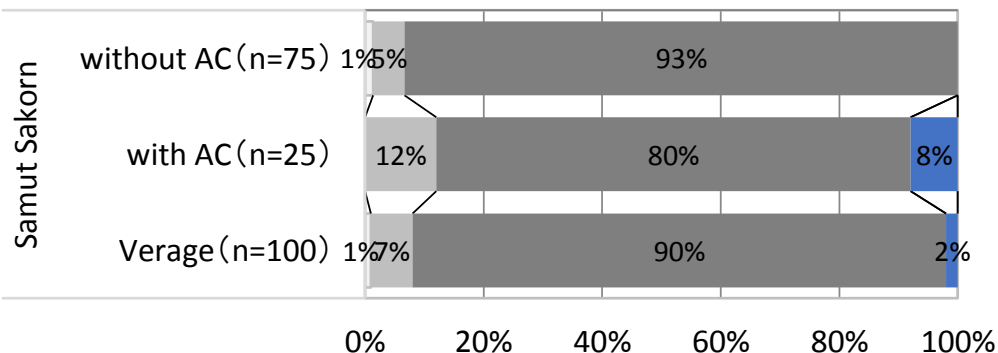
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Samut Sakorn, Thailand

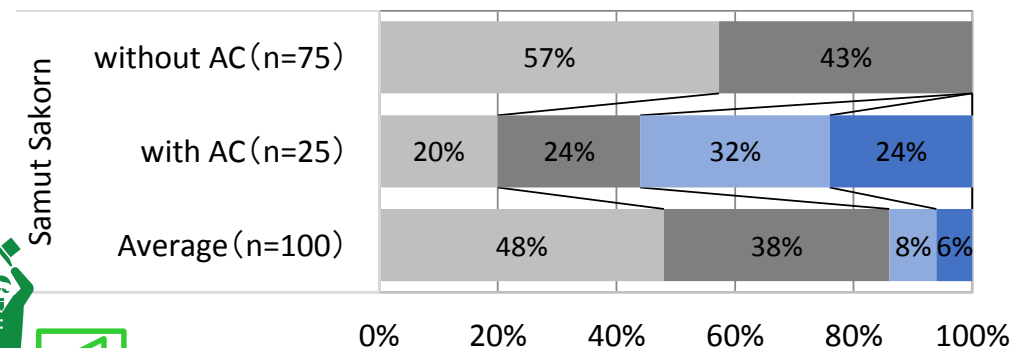
Ways to keep cool

Day time

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- Turn on air conditioner and fans



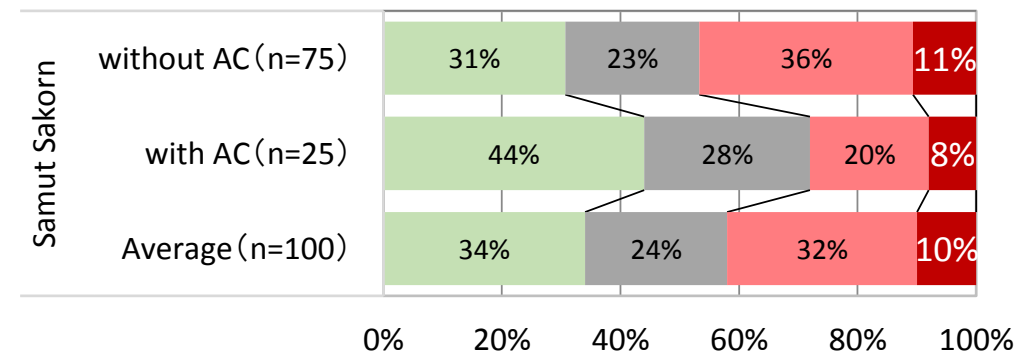
Night time



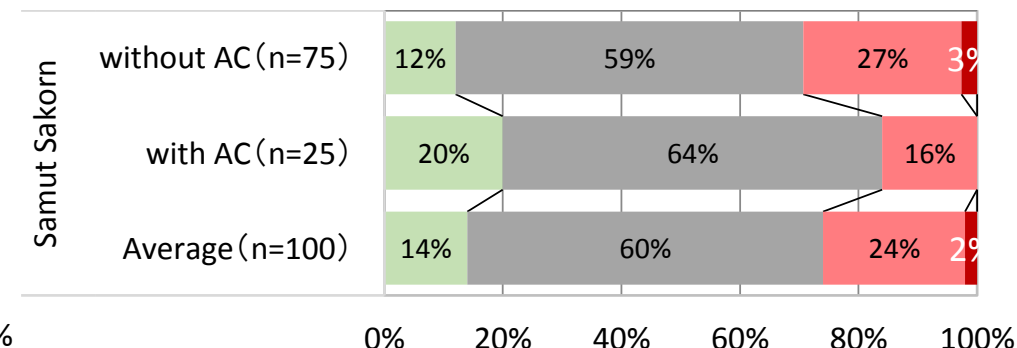
Satisfaction with indoor environment

Temperature

- Very satisfied
- Somewhat satisfied
- Can's say either way
- Dissatisfied
- Very dissatisfied



Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



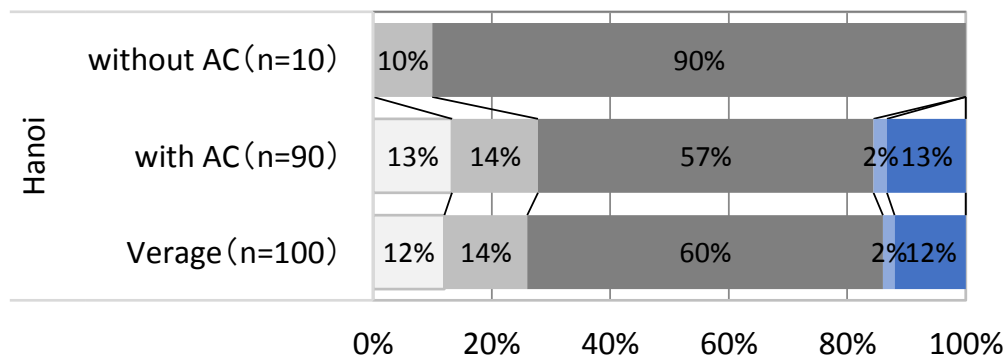
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Hanoi, Vietnam

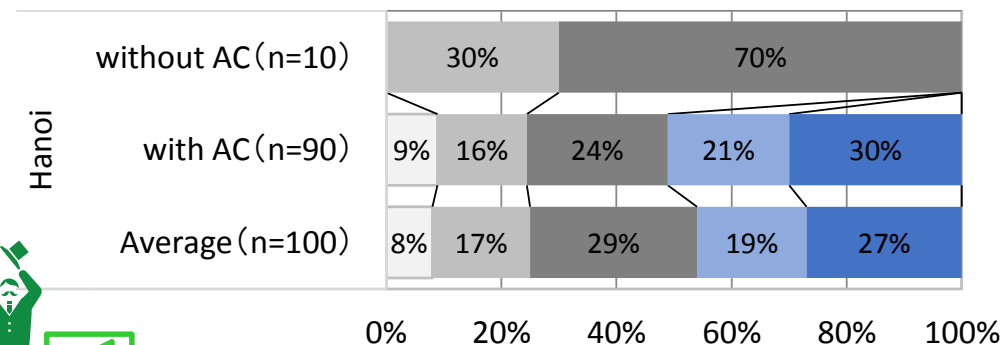
Ways to keep cool

Day time

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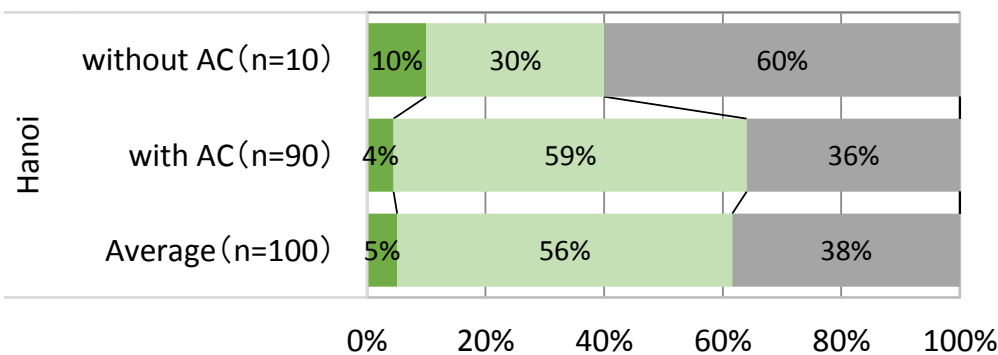
Night time



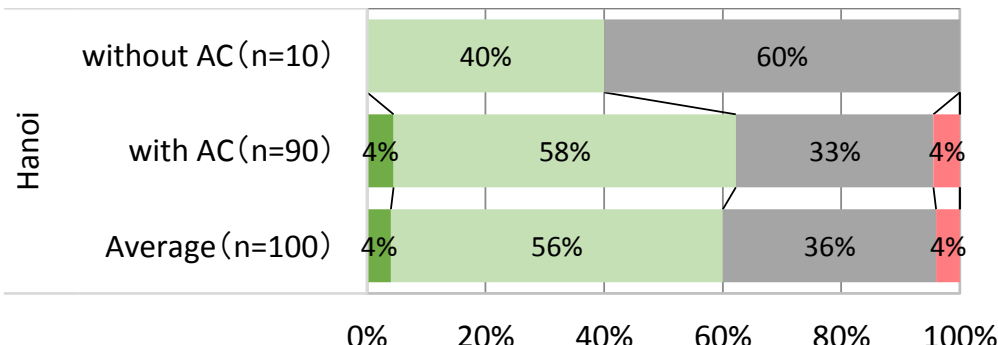
Satisfaction with indoor environment

Temperature

- Very dissatisfied
- Very satisfied
- Somewhat satisfied
- Can's say either way
- Dissatisfied



Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



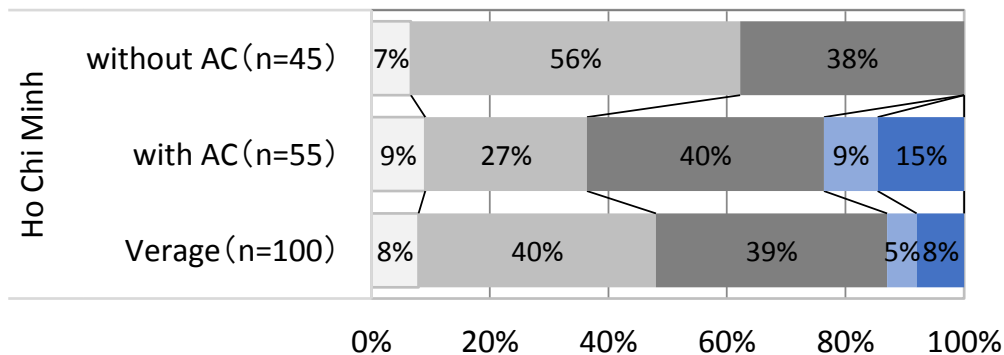
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Ho Chi Minh, Vietnam

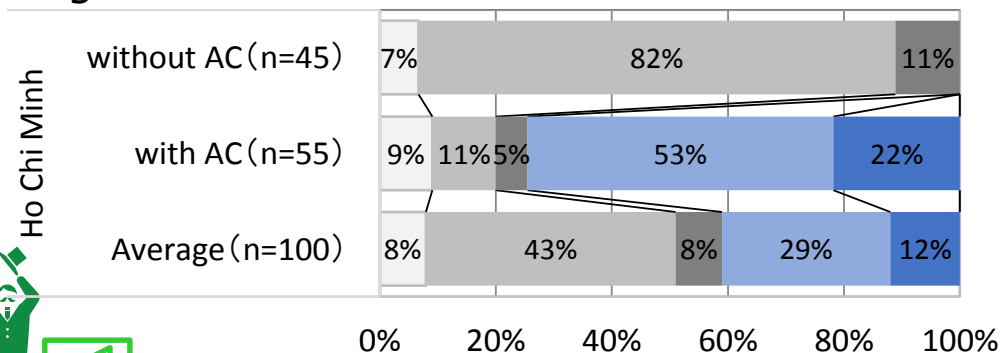
Ways to keep cool

Day time

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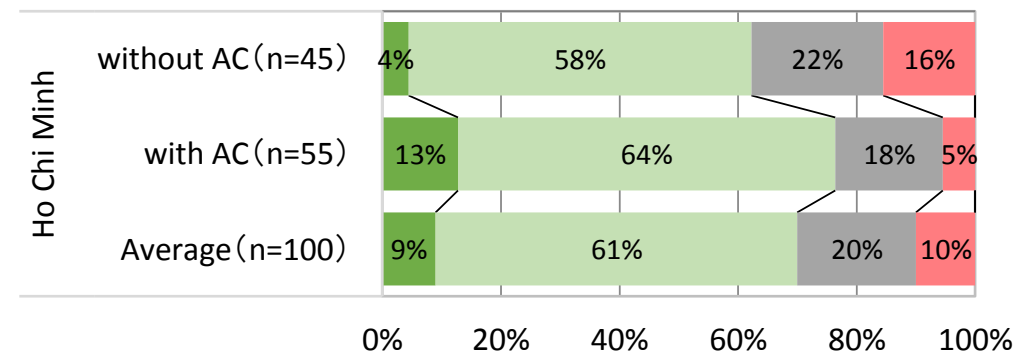
Night time



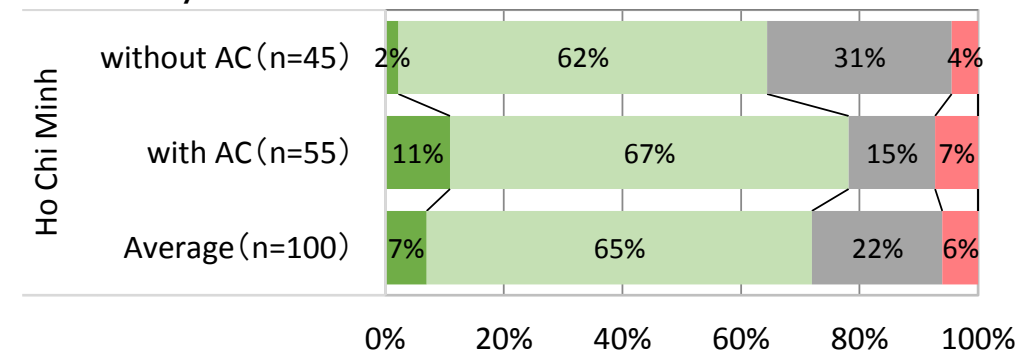
Satisfaction with indoor environment

Temperature

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- Somewhat satisfied
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Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



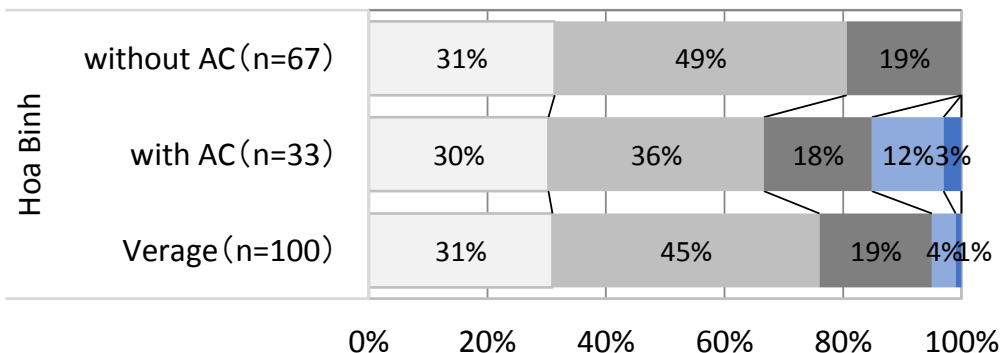
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Hoa Binh, Vietnam

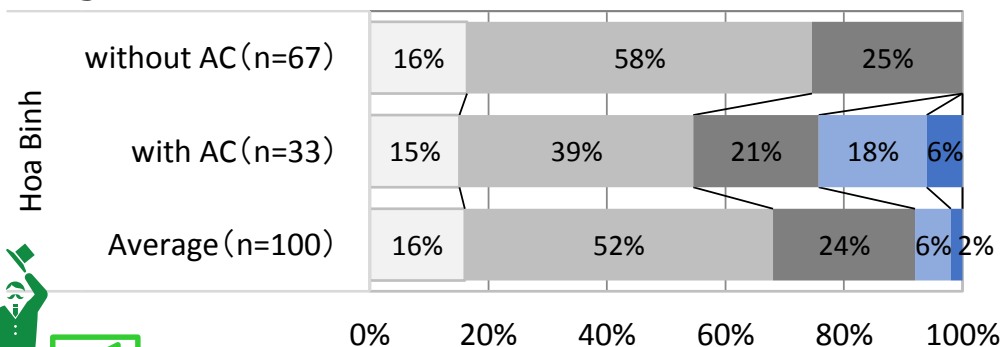
Ways to keep cool

Day time

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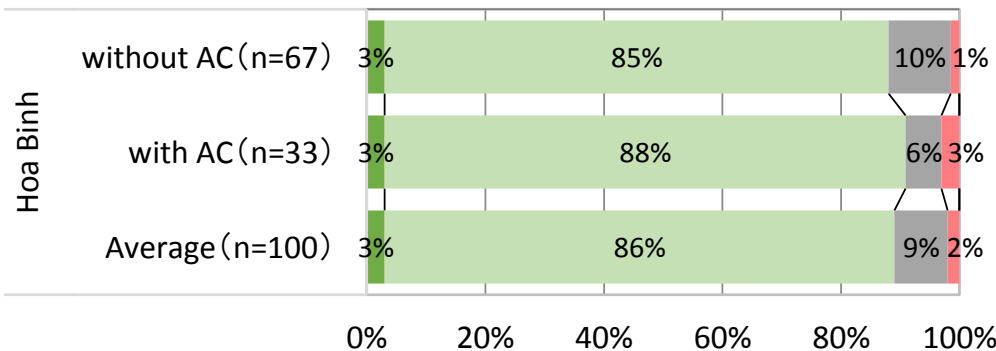
Night time



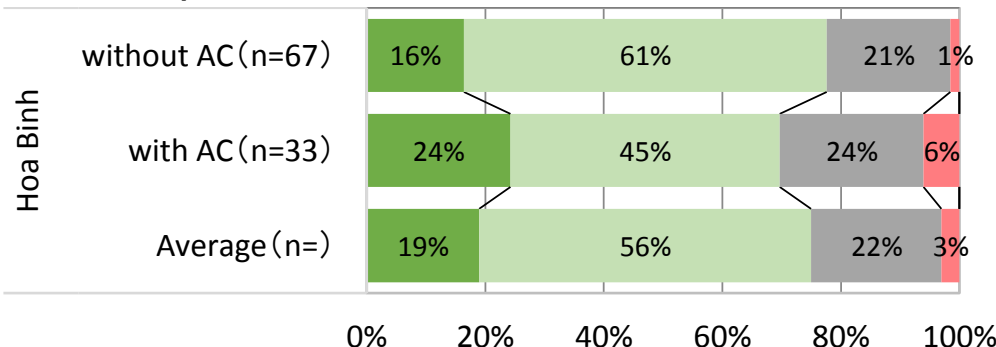
Satisfaction with indoor environment

Temperature

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Humidity



Ways to keep cool & Satisfaction with indoor environment (with & without AC)



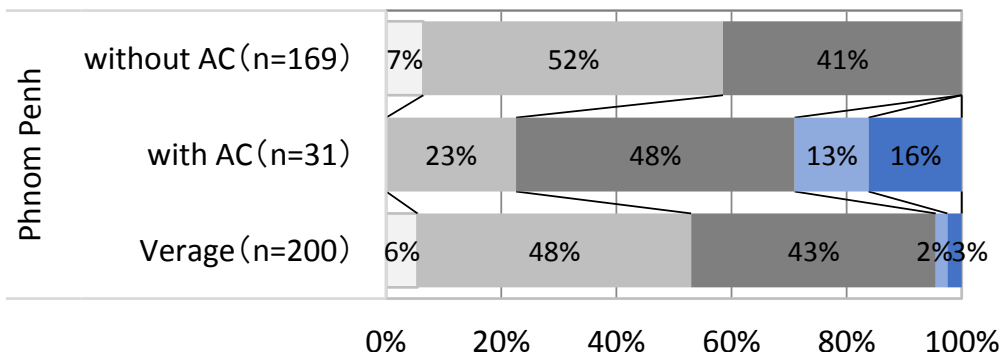
JYUKANKYO RESEARCH INSTITUTE INC.

Phnom Penh, Cambodia

Ways to keep cool

Day time

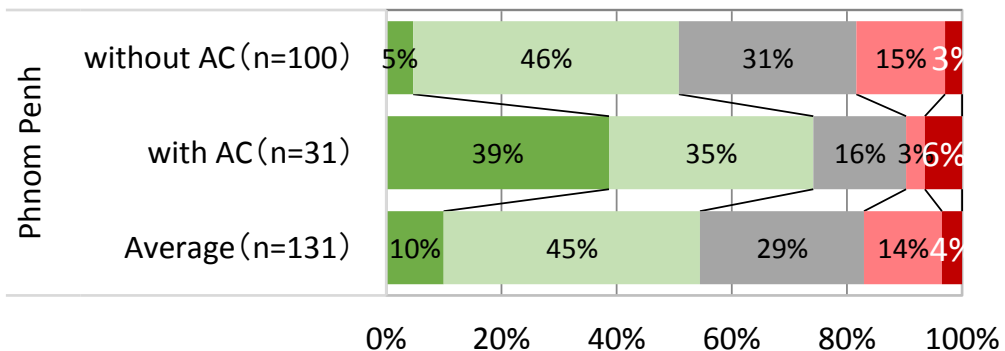
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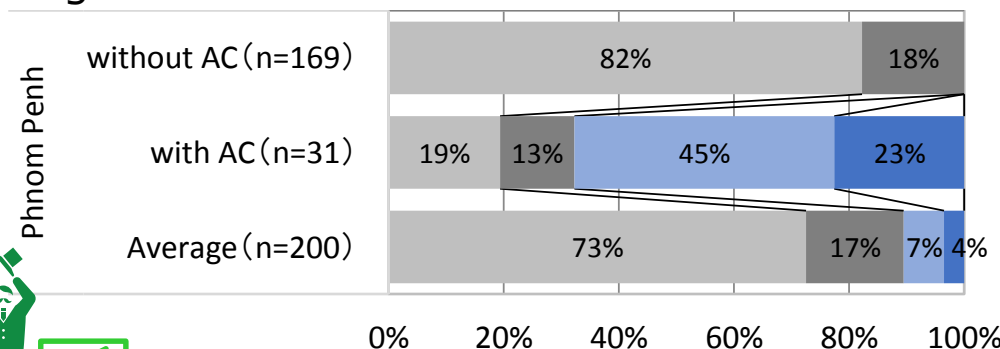
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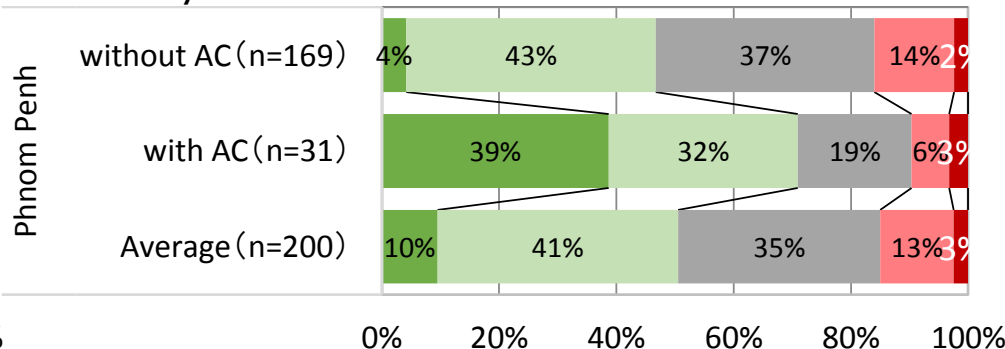
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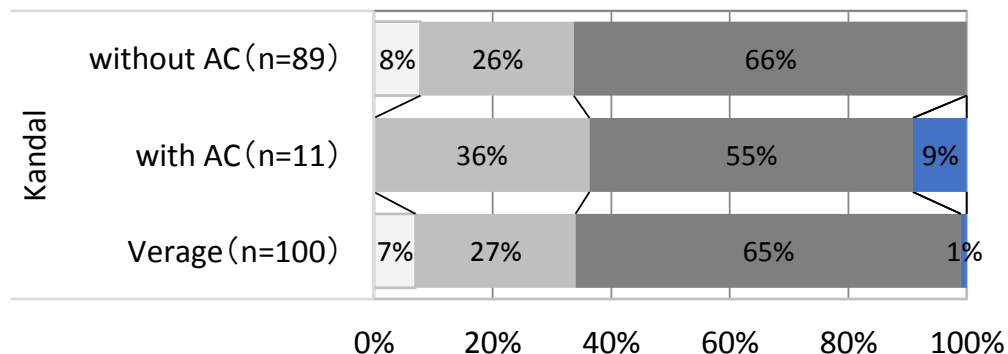
JYUKANKYO RESEARCH INSTITUTE INC.

Kandal, Cambodia

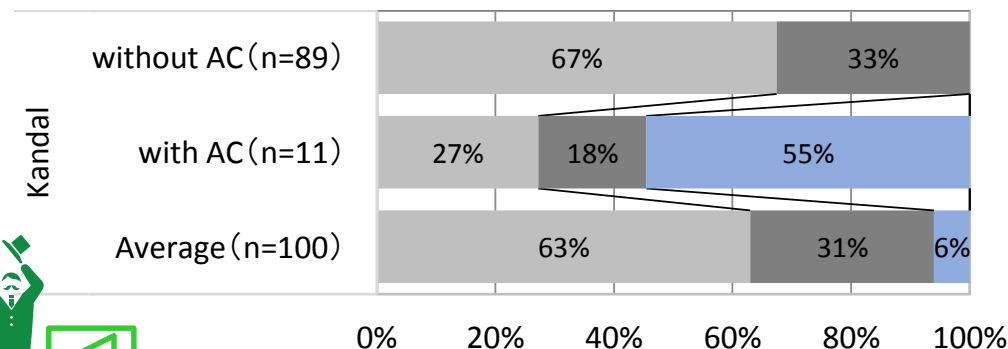
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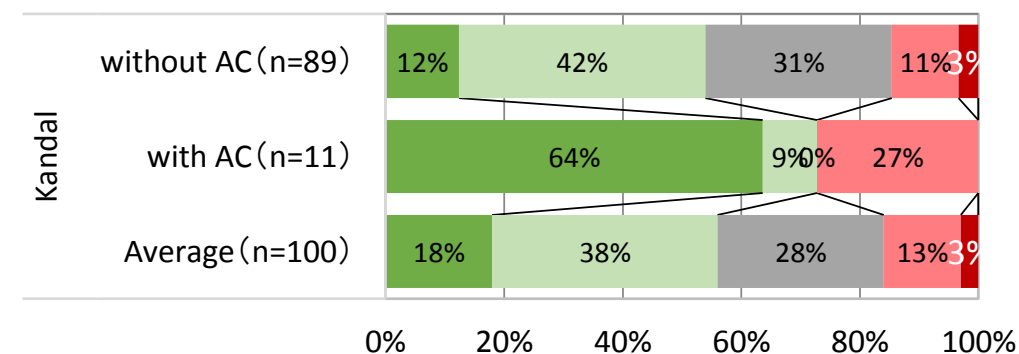
Night time



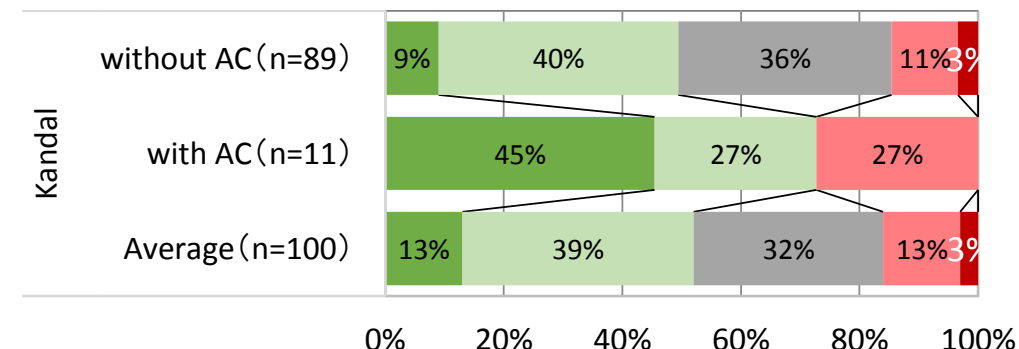
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- Very satisfied
- Somewhat satisfied
- Can's say either way
- Dissatisfied
- Very dissatisfied



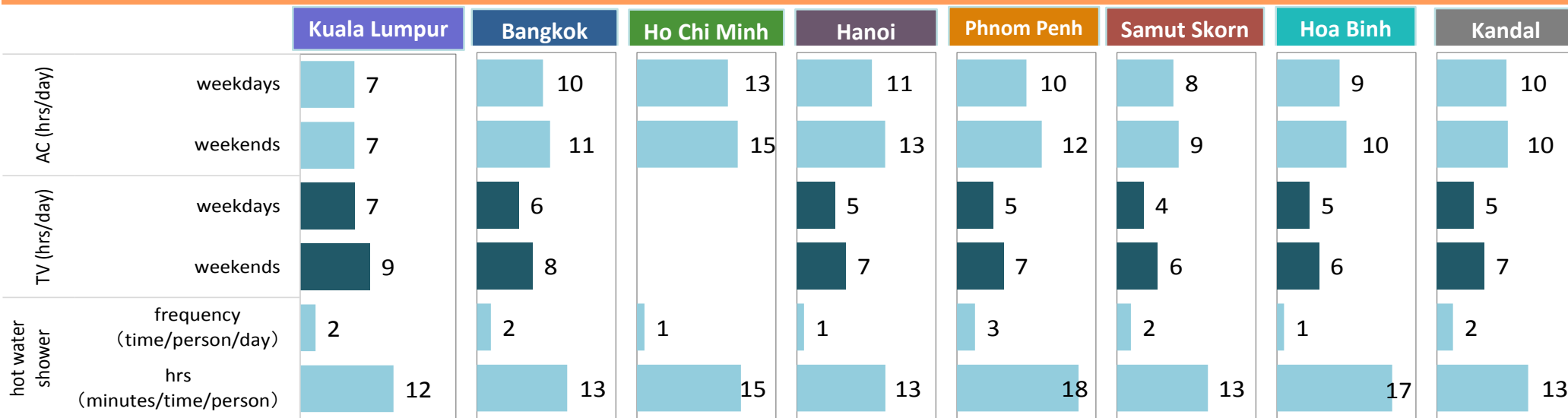
Humidity



Hours of Use of Home Appliances



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AC
Hours of AC usage
Japan : 8 hrs

TV
Average time spent watching TV
Japan: 6 hrs, USA: 5 hrs

TV & AC
Usage hours of AC & TV during weekends are 1-2 longer than during weekdays.

Hot water shower
People are taking hot water showers 1-2 times every day (under 20 minutes).

Lighting		Urban Area					Rural Area		
		Kuala Lumpur	Bangkok	Ho Chi Minh	Hanoi	Phnom Penh	Samut Sakorn	Hoa Binh	Kandal
Diffusion ratio	incandescent	3%	5%	40%	38%	5%	1%	28%	3%
	fluorescent	99%	100%	97%	97%	100%	100%	100%	100%
	LED	9%	4%	19%	27%	3%	0%	30%	0%
Usage hours	incandescent	4	3	15	4	6	1	3	4
	fluorescent	5	4	7	7	4	4	9	3
	LED	5	4	5	5	2	0	10	0





Thank you for your attention