State of residential energy consumption in Southeast Asia

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Waseda University

Overview of survey

plan in





- Bangkok(30hh), Hanoi (15hh), Phnom Penh (10hh)
- Detailed interview survey, Thailand (200hh), Vietnam(210hh), Cambodia(200hh)
- Survey on energy consumption of commercial buildings

BELDA Home Page

(Building Energy structure and Lifestyle Database of Asia)



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Survey Items



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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



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)

Misunderstanding of the developed countries on 🗸

household energy consumption in Southeast Asia



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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.

Household energy consumption in

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

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



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Misunderstanding of the developed countries on

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Energy Consumption per Capita

(GJ/capita/year)

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

CO₂ emission





Characteristics of households and housing

- > 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.
 High consume of
 - 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 90m in urban area. It is similar as Japan. However, housing size per capita is smaller than Japan. Japan: 40 m²/person, Southeast Asia: $15 \sim 28 \text{m}^2$ /person.



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High consume

of lighting and

home appliances

kitchen

High consume of electricity

Penetration ratio of home appliances and ways to keep cool



- 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 $^{\circ}$ (Japan is 26.4 $^{\circ}$)
- 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.



- 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 litter (grow in size).
- > Penetration ratio of rice cooker is as same in Japan.
- > 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 of fridge's capacity

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.



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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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

0.5

0.5

0.3

0.4

0.2



Hanoi(n=110)

Phnom Penh(n=210)

Samut Sakorn (n=150)

Hoa Binh (n=110)

Kandal (n=100)

apan(n=11,632)

0%

PC

<households penetration> <appliances penetration>

58%

79%

77%

84%

100% 0

44%

35%

31%

33%

50%

17%







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Kuala Lumpur, Malaysia



Satisfaction with indoor environment

Temperature



Night time



Humidity

Kuala Lumpur





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Bangkok, Thailand Ways to keep cool Satisfaction with indoor environment Open windows Temperature Day time Turn on fans Turn on fans with windows open Very satisfied ■ Somewhat satisfied ■ Can's say either way Turn on AC Dissatisfied Very dissatisfied Turn on air conditioner and fans without AC(n=105)12% without AC(n=105)88% 13% 64% 15% 5% Bangkok angkok with AC(n=95) 178% with AC(n=95)82% 2%7 8% 71% 11% 6% Verage(n=200) 1%10% Average(n=200) 85% 11% 67% 13% 6% 0% 20% 40% 60% 80% 100% 0% 20% 40% 60% 80% 100% Night time Humidity without AC(n=105) 2% without AC(n=105) 8%3% 10% 61% 19% 57% 41% **3angkok 3angkok** with AC(n=95) 0%1% 12% 55% 23% with AC(n=95)8% 4% 20% 64% Average(n=200) 1% 35% 27% 26% Average(n=200) 11% 8% 4% 63% 20% 0% 20% 60% 40% 80% 100% 0% 20% 40% 60% 80% 100%



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Ho Chi Minh, Vietnam



Satisfaction with indoor environment Temperature Very satisfied Somewhat satisfied Can's say either way Dissatisfied Very dissatisfied without AC(n=45)58% 22% 16% 4% Ho Chi Minh with AC(n=55)13% 64% 18% 5% Average(n=100) 9% 61% 20% 10% 0% 20% 40% 60% 80% 100% Humidity







10% 1%

6% 3%

9% 2%

100%

21% 1%

6%

3%

100%

80%

24%

80%

22%

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Hoa Binh, Vietnam Ways to keep cool Satisfaction with indoor environment Open windows Temperature Day time Turn on fans Turn on fans with windows open Very satisfied Somewhat satisfied Can's say either way Turn on AC Dissatisfied Very dissatisfied Turn on air conditioner and fans without AC(n=67)without AC(n=67)3% 85% 31% 49% 19% Hoa Binh Hoa Binh with AC(n=33)with AC(n=33)88% 18% 12%3% 3% 30% 36% Average(n=100) Verage(n=100) 86% 31% 45% 19% 4<mark>%</mark>1% 3% 20% 40% 60% 0% 0% 20% 40% 60% 100% 80% Night time Humidity without AC(n=67)without AC(n=67)61% 16% 16% 58% 25% Hoa Binh Hoa Binh with AC(n=33)with AC(n=33)15% 21% 18% 39% 6% 24% 45% Average(n=100) 16% 52% 24% **6% 2%** Average(n=) 19% 56% 0% 20% 40% 60% 80% 100% 60% 0% 20% 40%



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Phnom Penh, Cambodia





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Kandal, Cambodia Ways to keep cool Satisfaction with indoor environment Temperature Day time Open windows Turn on fans Turn on fans with windows open Very satisfied Can's say either way Somewhat satisfied Turn on AC Dissatisfied Very dissatisfied Turn on air conditioner and fans without AC(n=89)8% 26% 66% without AC(n=89)42% 31% 11%39 12% Kandal Kandal with AC(n=11) 9% with AC(n=11)36% 55% 64% 9%0% 27% Verage(n=100) 7% 27% 65% Average (n=100) 18% 38% 28% 13%39 1% 0% 20% 40% 60% 80% 100% 0% 20% 40% 60% 80% 100% Night time Humidity without AC(n=89)without AC(n=89)9% 40% 11%39 67% 33% 36% Kandal Kandal with AC(n=11)27% 55% with AC(n=11)18% 45% 27% 27% Average(n=100) 6% Average(n=100) 63% 31% 13% 39% 32% 13%39 60% 0% 20% 40% 80% 100% 0% 20% 40% 60% 80% 100% 19

Hours of Use of Home Appliances







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Thank you for your attention