



Overcoming Energy Poverty in Cambodia and Emerging Issues

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Background

As the ASEAN emerges as a hub of the global economy, this region consumes energy more.

The international energy agency (IEA) predicted that the ASEAN's energy demand will grow by **80%** from 2015 to about **46EJ** (1100 Mtoe) in **2040**, accompanying with the regional economic development [*].

[*] IEA (2015) *Energy demand prospects*. In: Southeast Asia energy outlook 2015



Focus

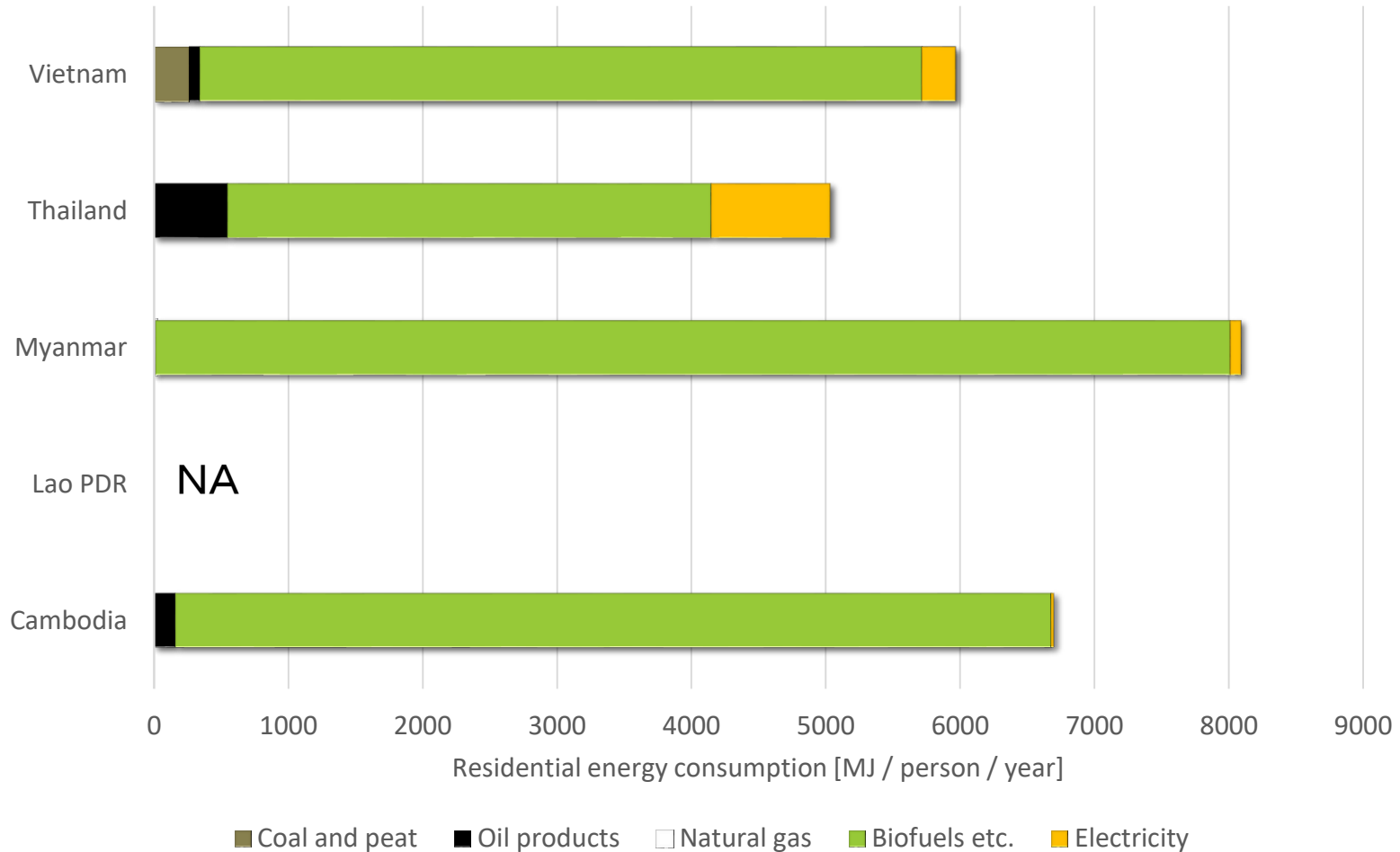
Recently the authors focus on the increase in the residential energy consumption in the Asian least developed countries such as Cambodia, Laos, Myanmar, and Nepal

Today, the authors focus on the Cambodian energy situation and analyze the data of the Cambodia Socio-Economic Survey (CSES) in order to know the energy poverty situation

And furthermore, we check the energy-related issues Cambodia confronts

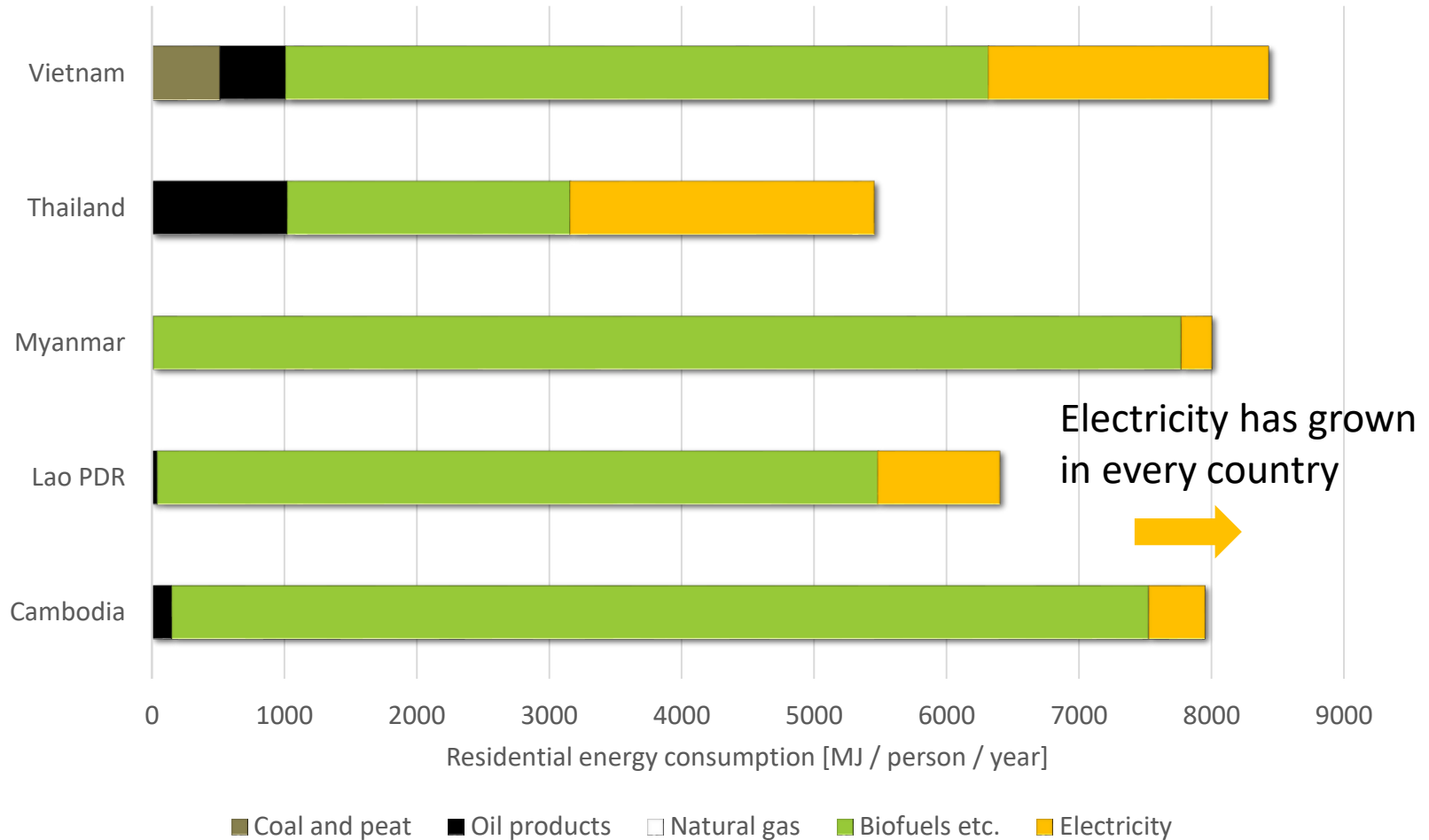


Residential energy consumption in the Mainland Southeast Asia in 1995



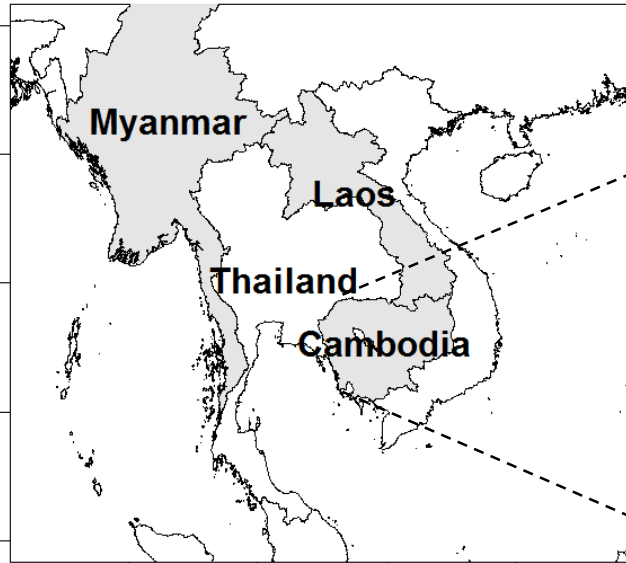
Calculated by the author; Data sources: IEA, UNSD, World Bank

Residential energy consumption in the Mainland Southeast Asia in 2016

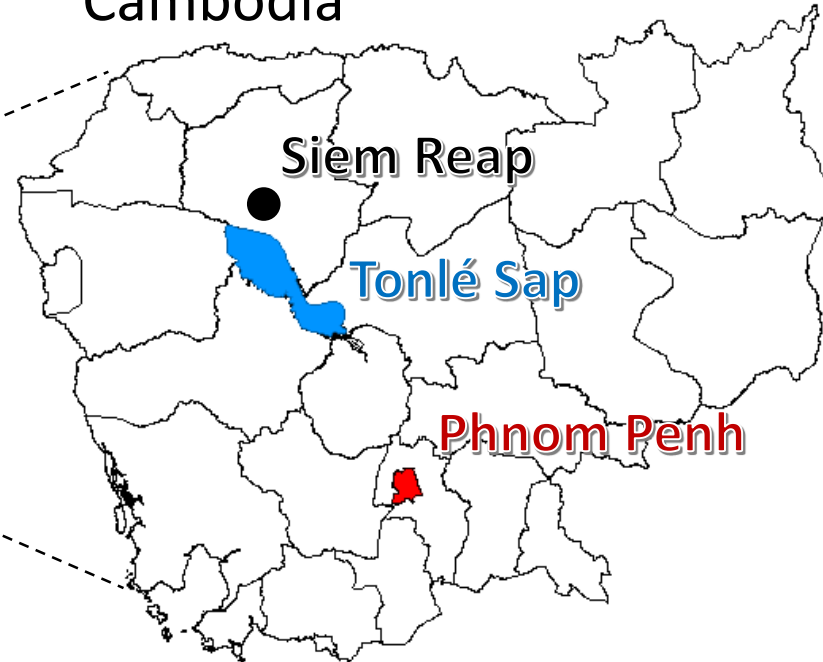


Calculated by the author; Data sources: IEA, UNSD, World Bank

Brief information of Cambodia



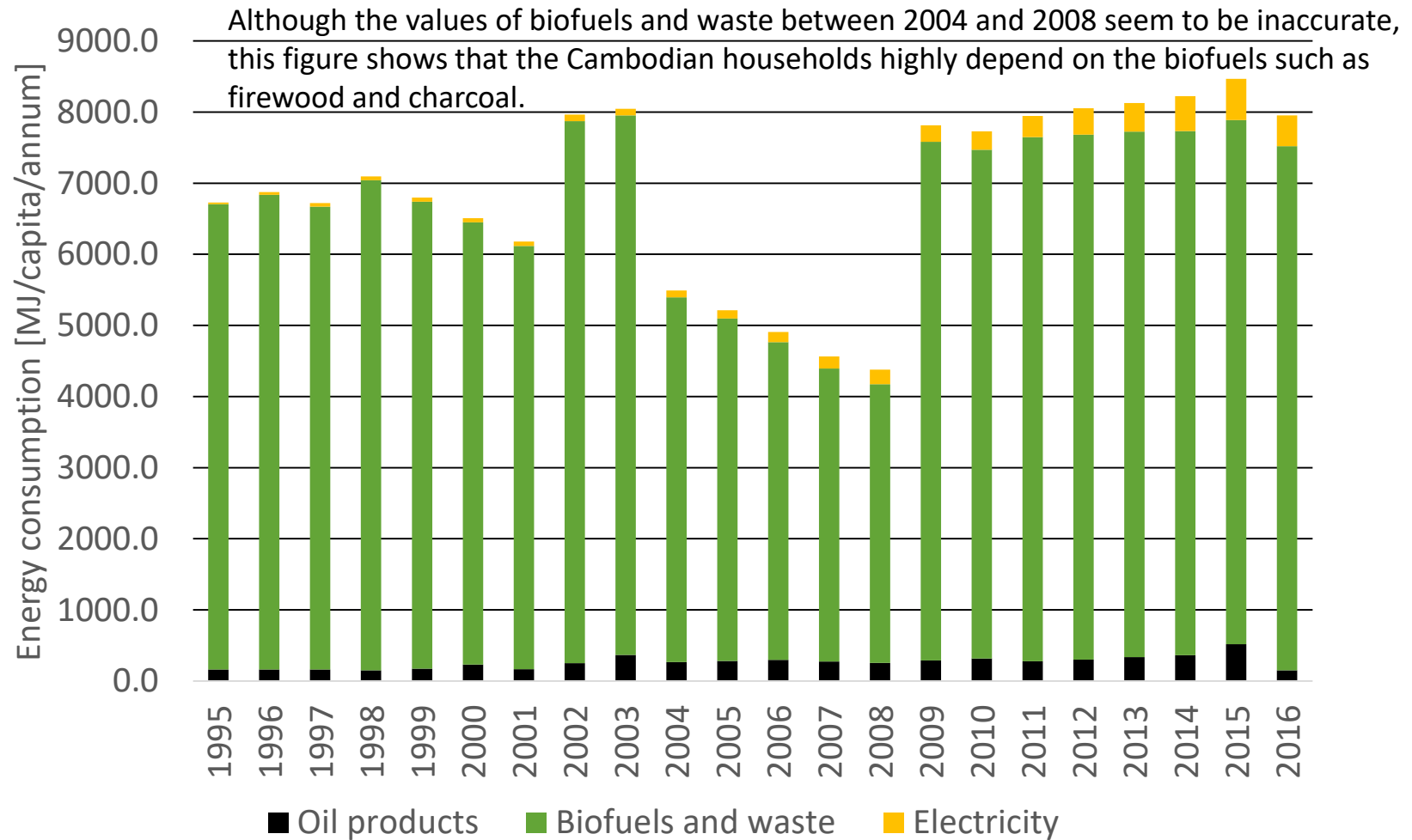
Cambodia



Population*: 16.01 million (2017)
GDP per capita*: 1,146 dollar
(2017, PPP, 2011 const.)
GDP growth rate*: 7.1% (2017)

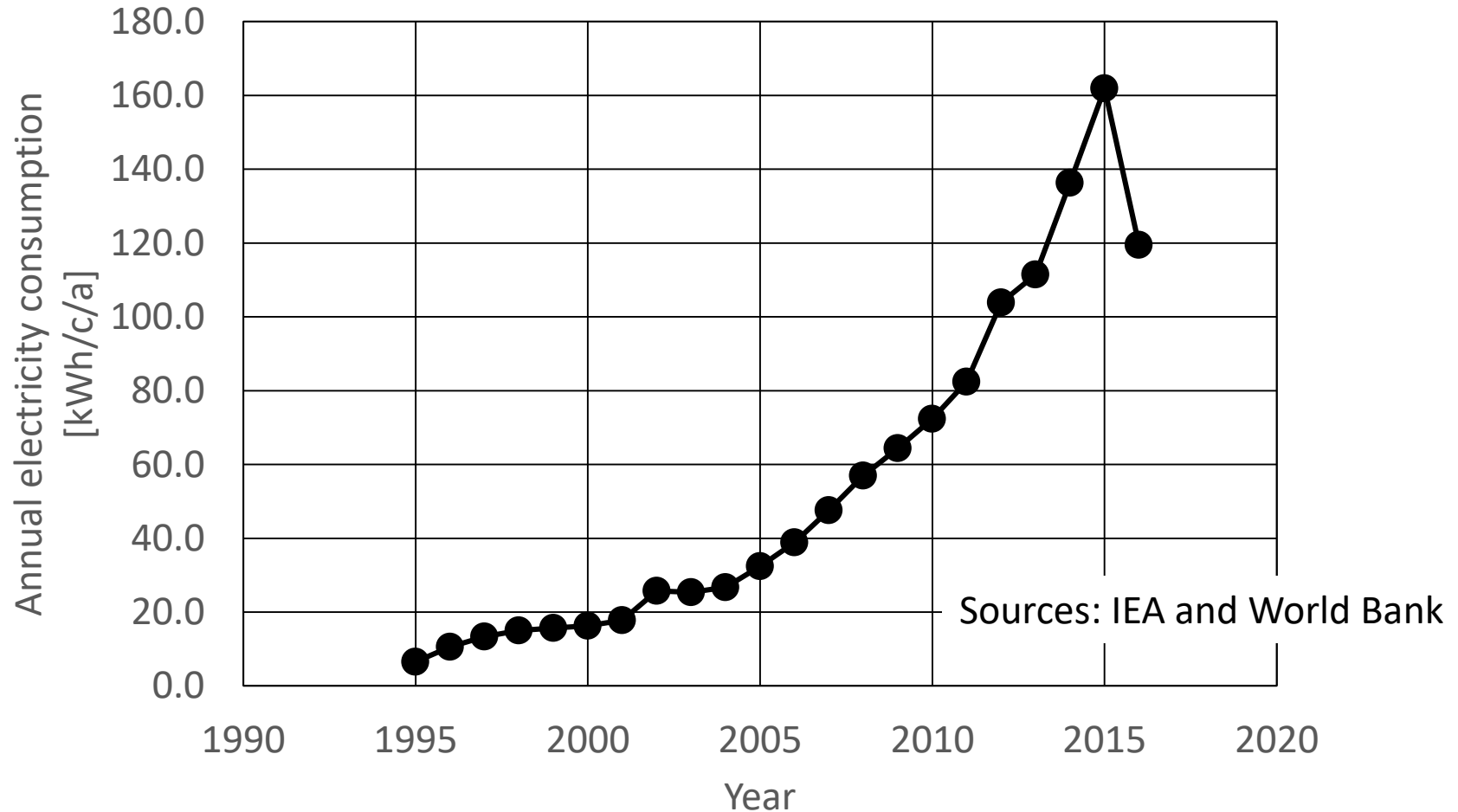
Phnom Penh (Capital city)
Population**: 1.688 million
Pop. dens.**: 2,468 person/km²

Annual residential energy consumption in Cambodia



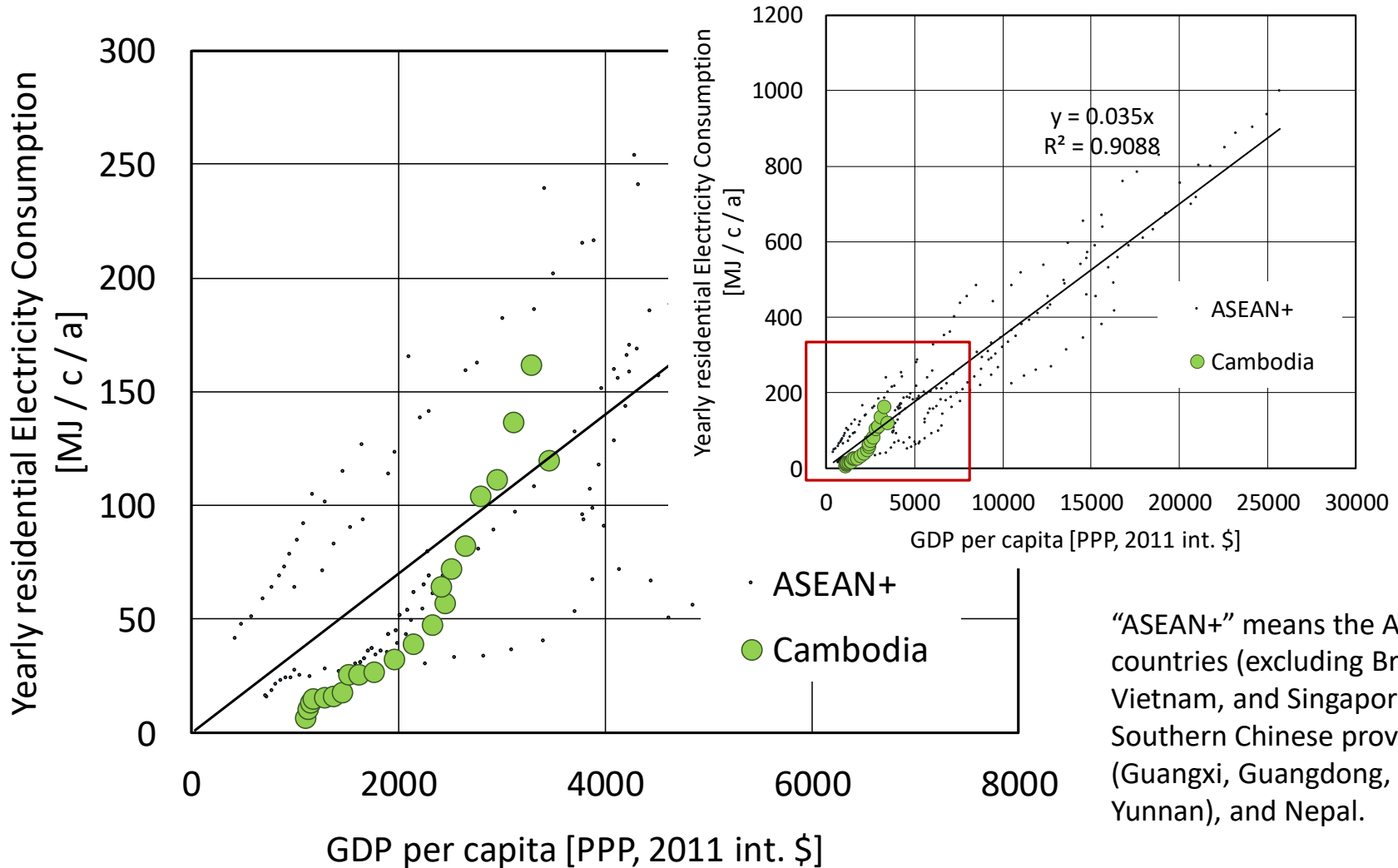
The energy data are provided by IEA and the population data are provided by World Bank

Annual residential electricity consumption in Cambodia



Although the share of the electricity is relatively small, the electricity consumption is increasing year by year as shown in this figure

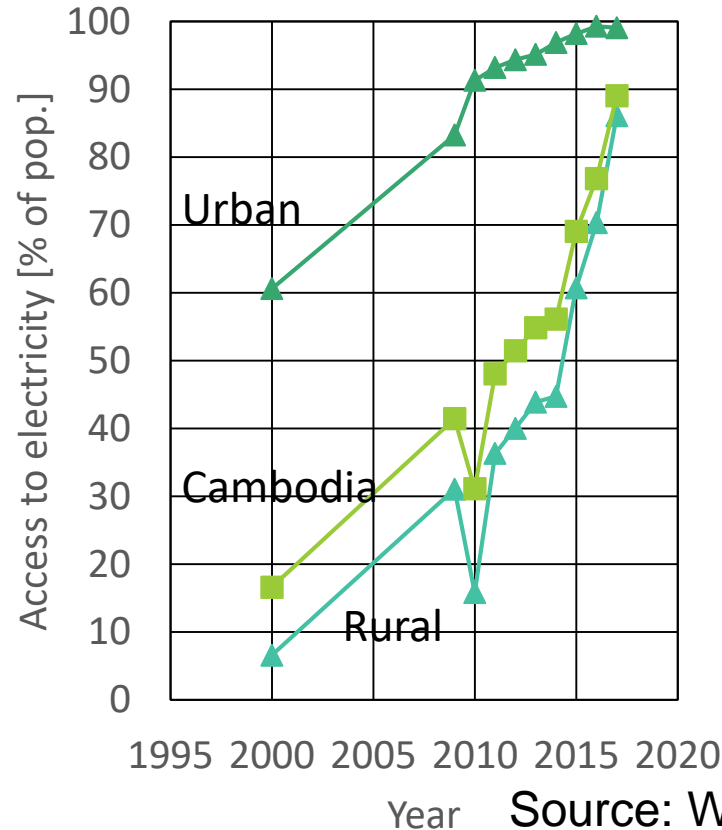
GDP per capita and Yearly Residential Electricity Consumption



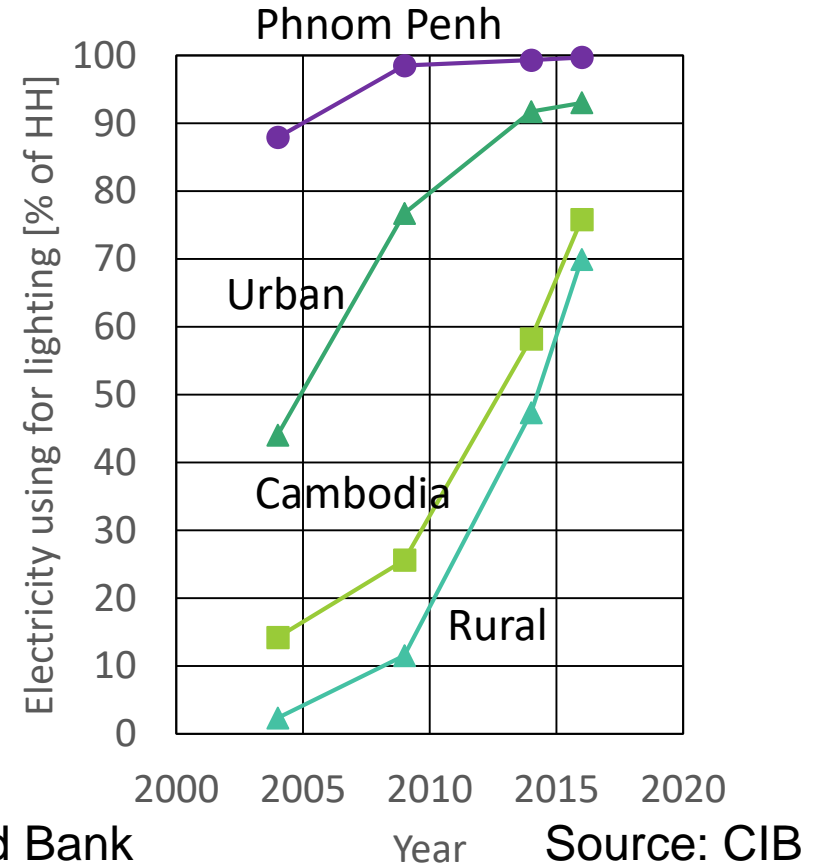
“ASEAN+” means the ASEAN countries (excluding Brunei, Vietnam, and Singapore), Southern Chinese provinces (Guangxi, Guangdong, and Yunnan), and Nepal.

Electricity use

ACCESS TO ELECTRICITY



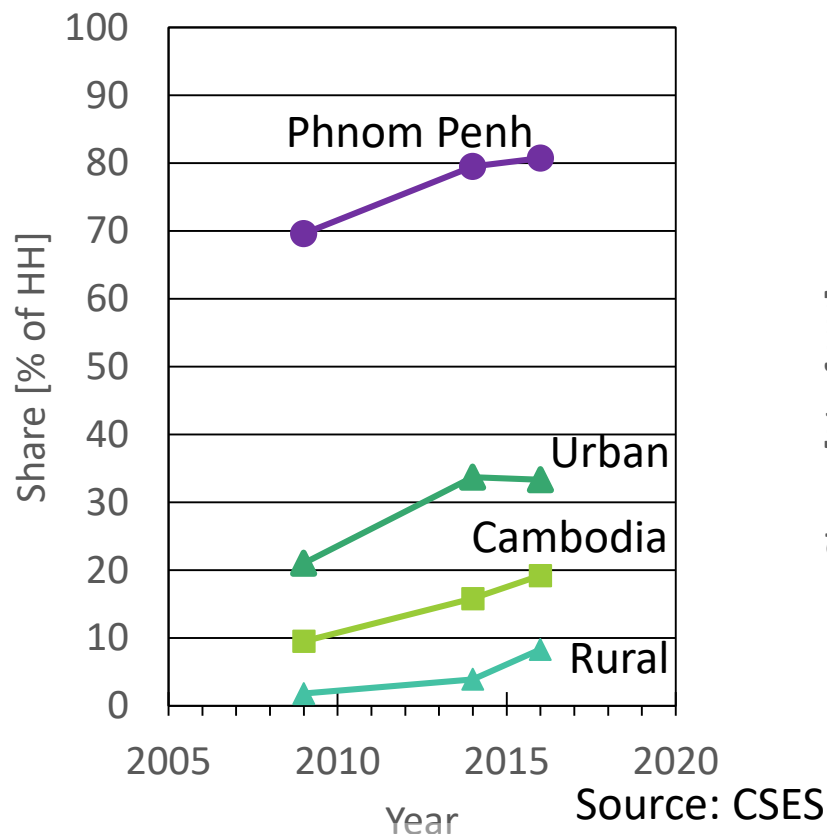
SHARE OF ELECTRICITY FOR LIGHTING



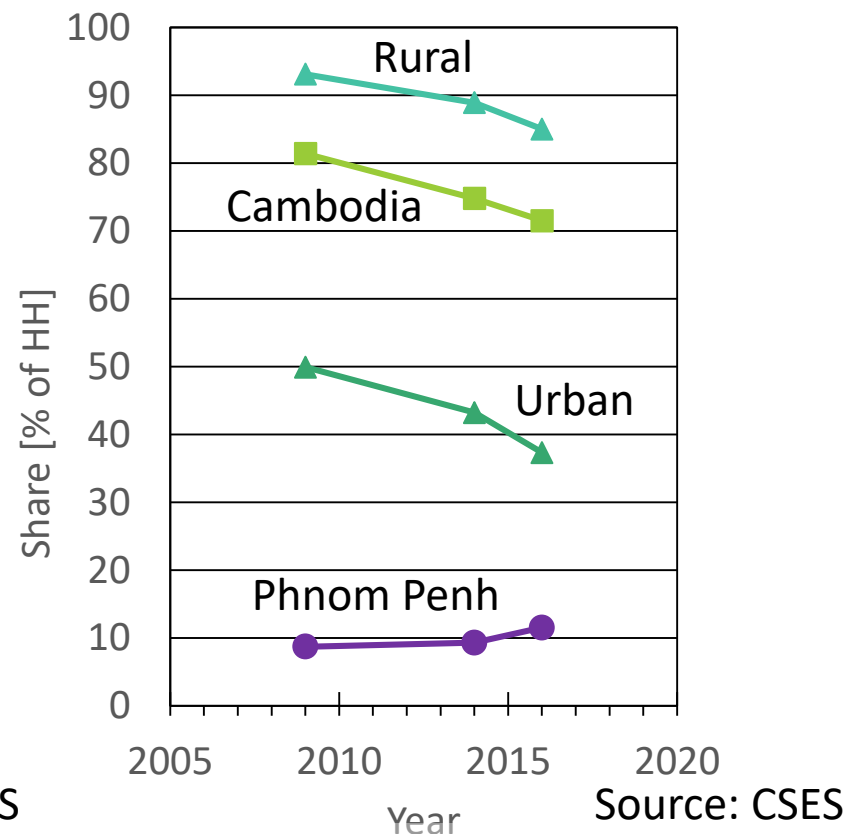
- Accompanying with the enhancement of the access to electricity, the share of the households using public electricity for lighting increases in throughout Cambodia

Energy sources for cooking

SHARE OF LPG



SHARE OF FIREWOOD



- These results show that the use of modernized energy resource (electricity and LPG) has expanded throughout Cambodia
- Cambodia has been overcoming the energy poverty, accompanying with the economic development.



Emerging issue 1

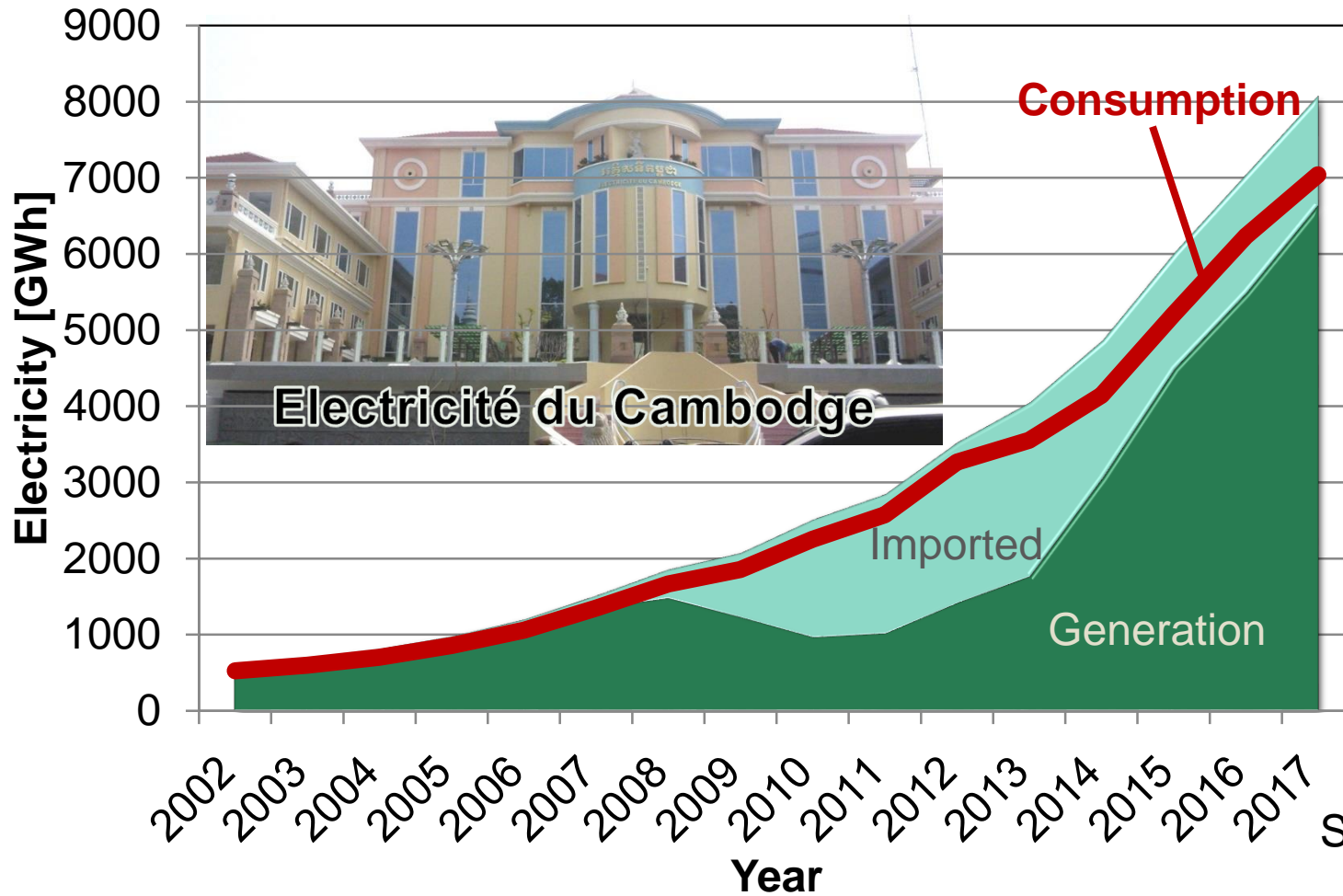
Supply and demand of electricity

Cambodia faces the emerging issues:

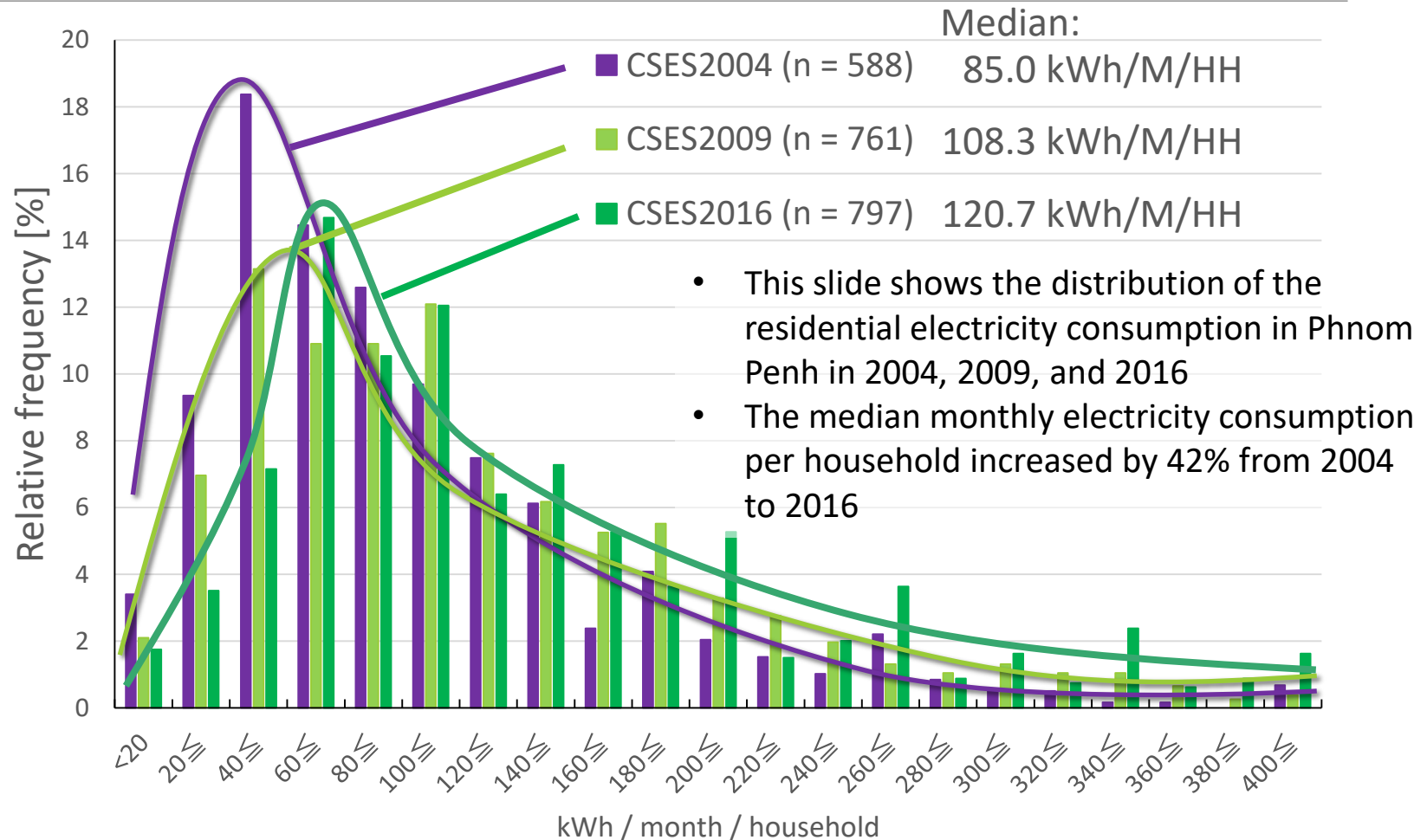
- a rapid increase in electricity consumption and the use of fossil fuels to generate electricity in order to meet the growing demand

The next slide shows the electricity generation, import, and consumption. The electricity consumption (i.e., demand) grows rapidly because of the increase in the residential electricity consumption

Electricity generation, import, & consumption



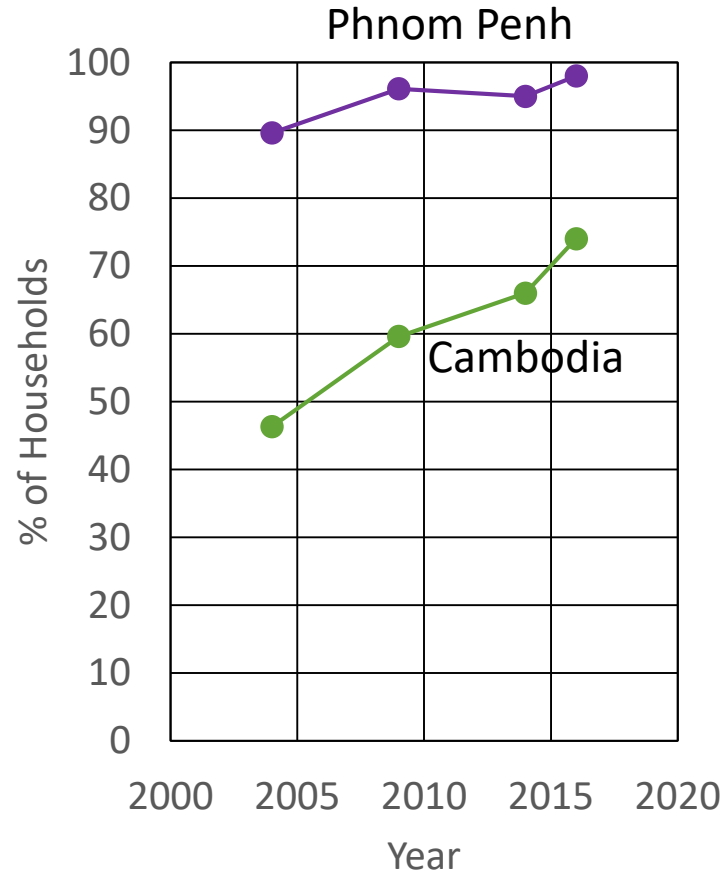
Household electricity consumption in Phnom Penh



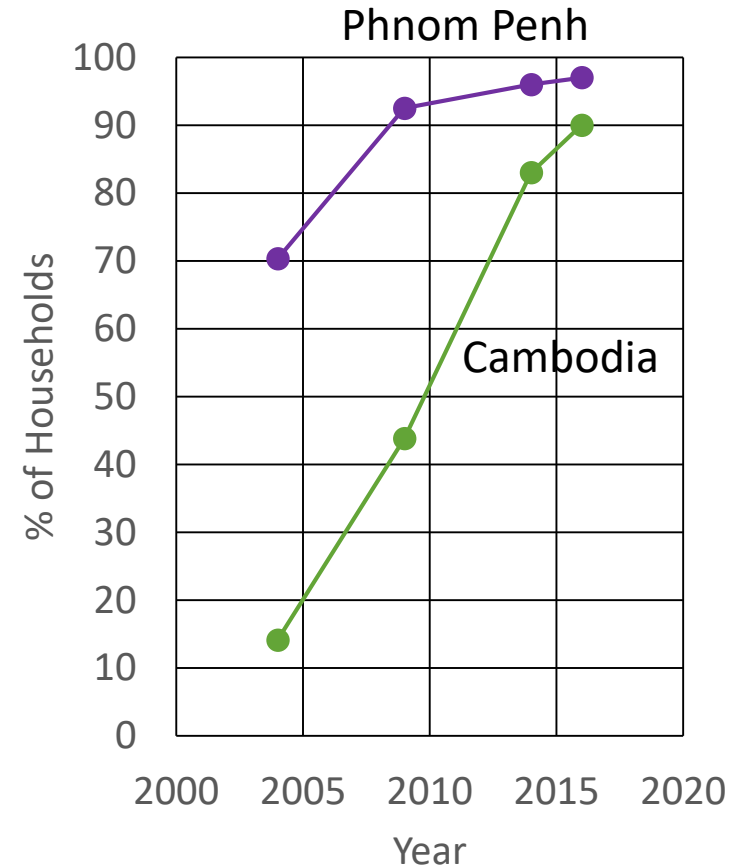
- This increase may be caused by the spread of home appliances and the change in the residential structure

Durable goods owned by households (TV and cell phone)

TV



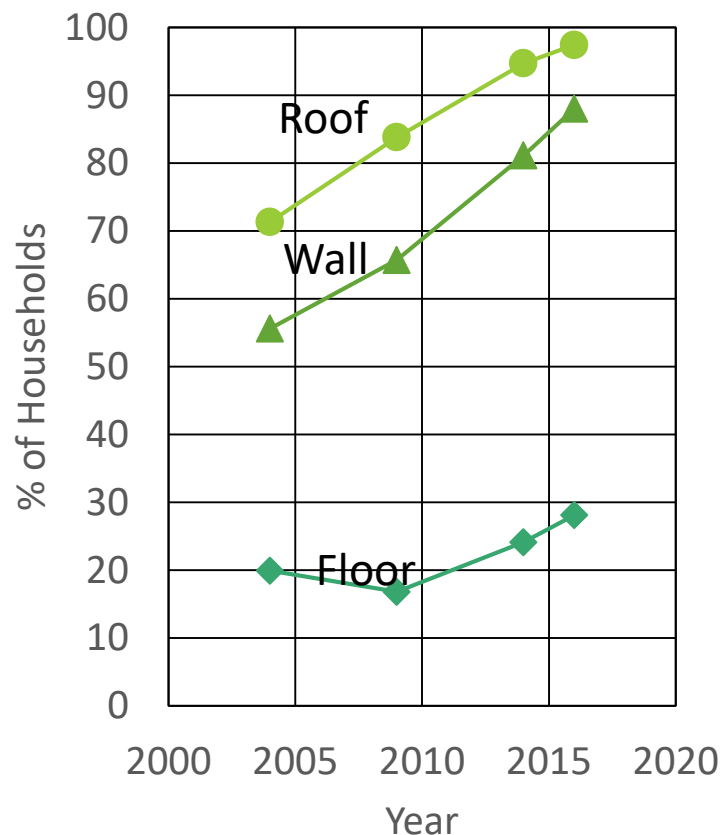
CELL PHONE



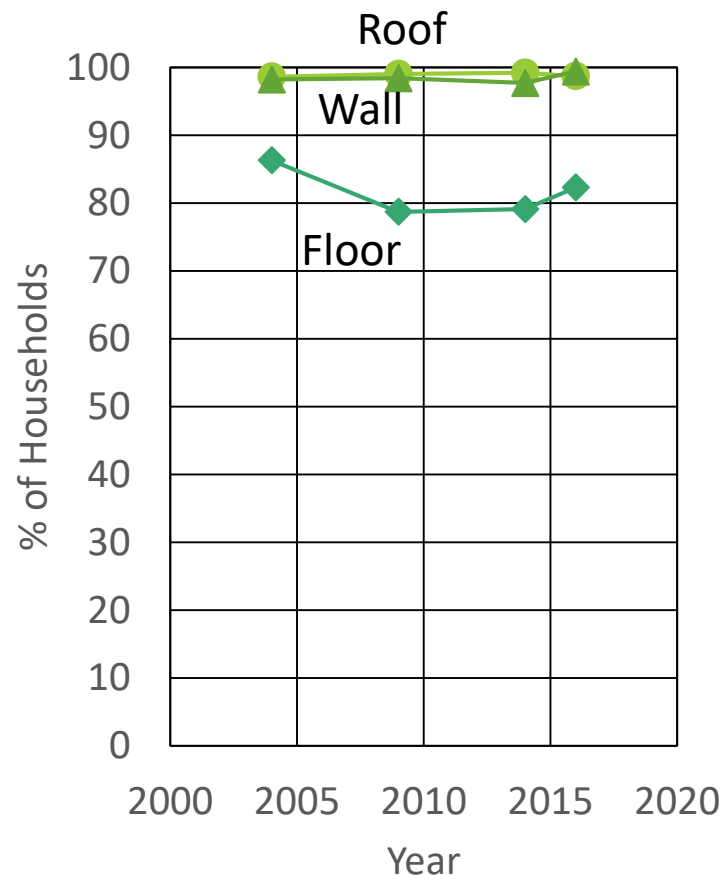
- The ownership of TV in Cambodian households increased from 46.3 % in 2004 to 74.0 % in 2016

Share of hard/permanent materials used in roof, wall, & floor

CAMBODIA

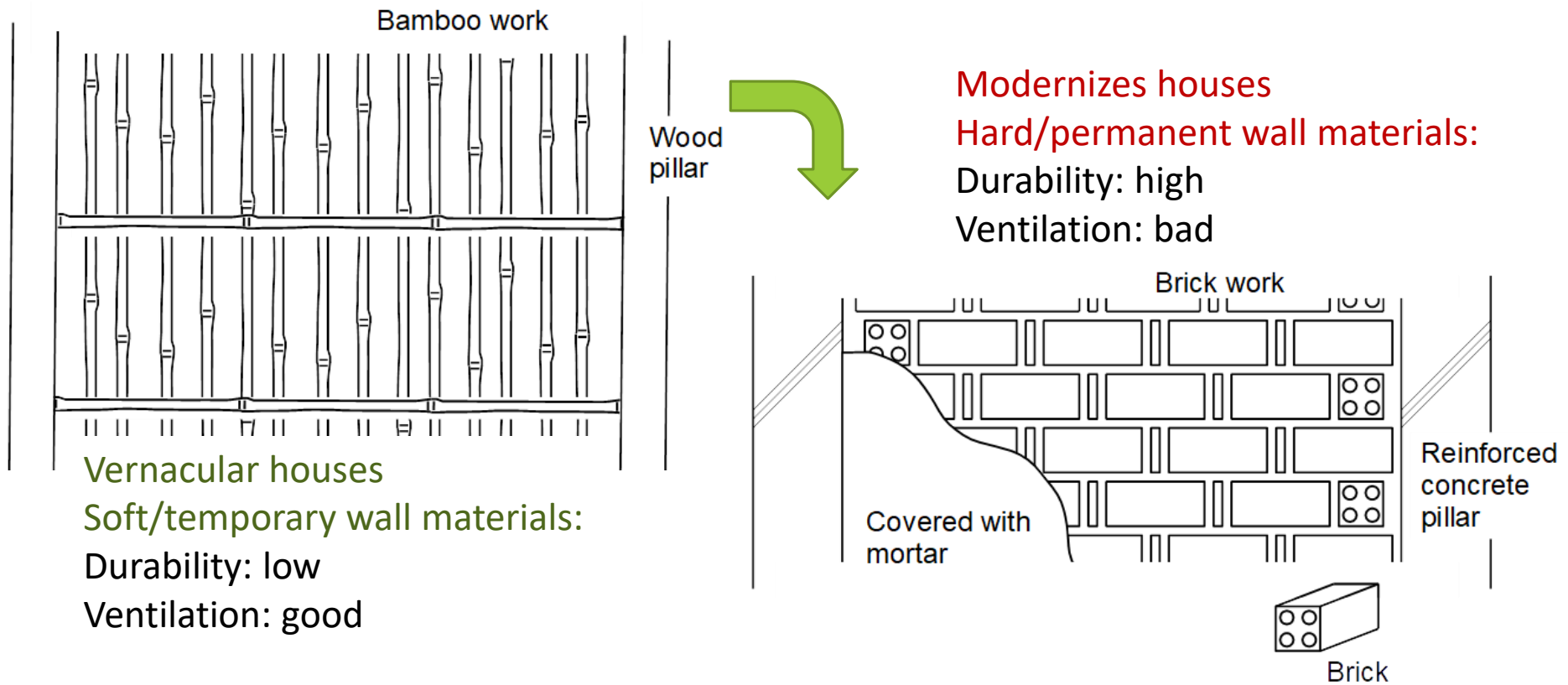


PHNOM PENH



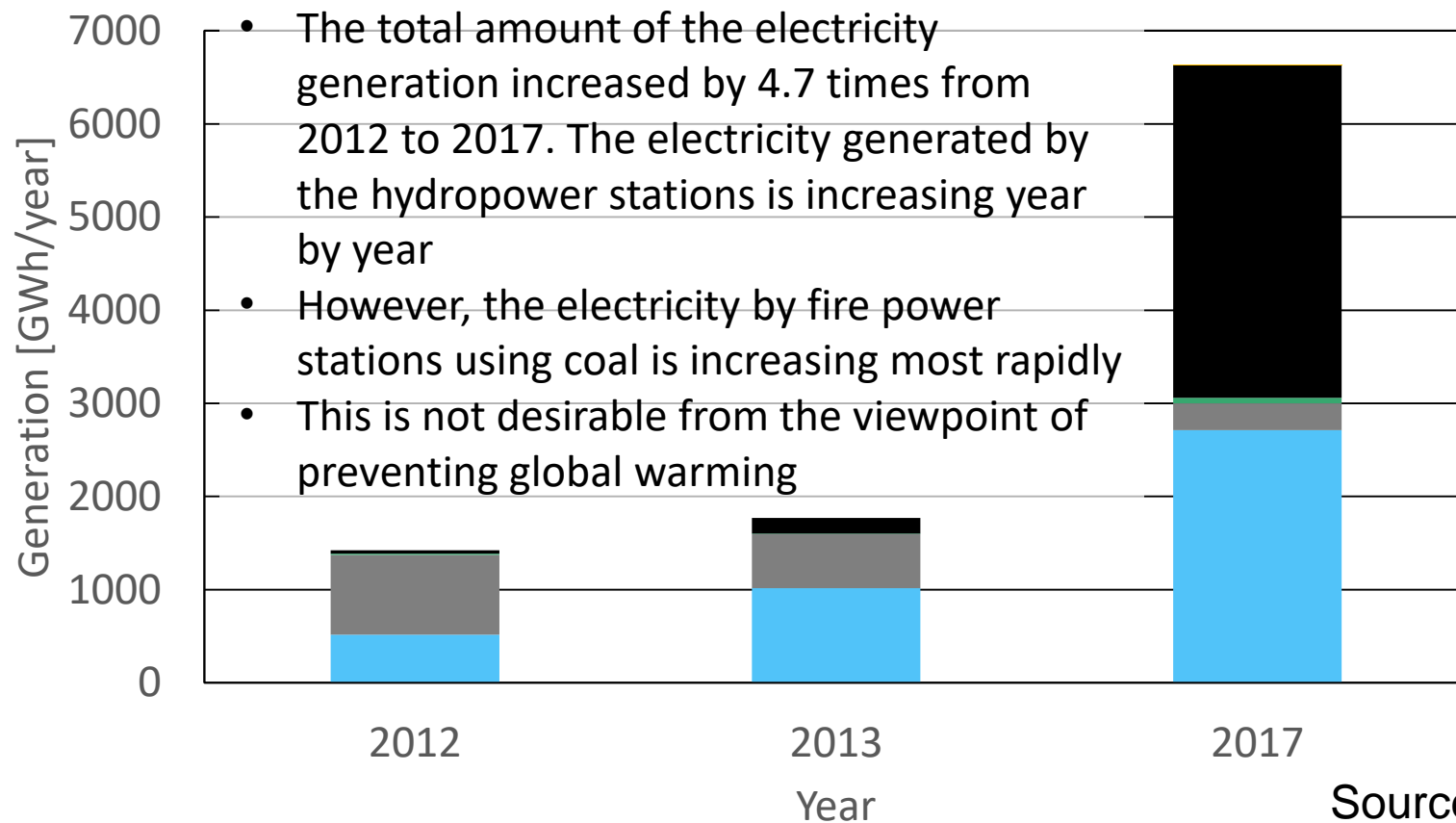
- Share of hard/permanent materials has increased throughout Cambodia
- Phnom Penh keeps higher share of hard/permanent materials

Shift from vernacular architecture to modern one



- The shift from **climate-responsive vernacular** houses to **climate-irresponsive modernized** houses leads to the potential for increase the energy for maintaining thermal comfort by artificial measures

Electricity generation by energy sources



■ Hydropower
 ■ Diesel/HFO
 ■ Biomass
 ■ Coal
 ■ Solar



Summary of emerging issue 1

The ownership of the home appliances increases the electricity consumption

The shift from climate-responsive vernacular houses to climate-irresponsive modernized houses leads to the potential to increase the energy for maintaining thermal comfort by artificial measures.

Cambodia has imported a large amount of the electricity from the neighboring countries and construct new power stations to fill the gap between the generation and consumption



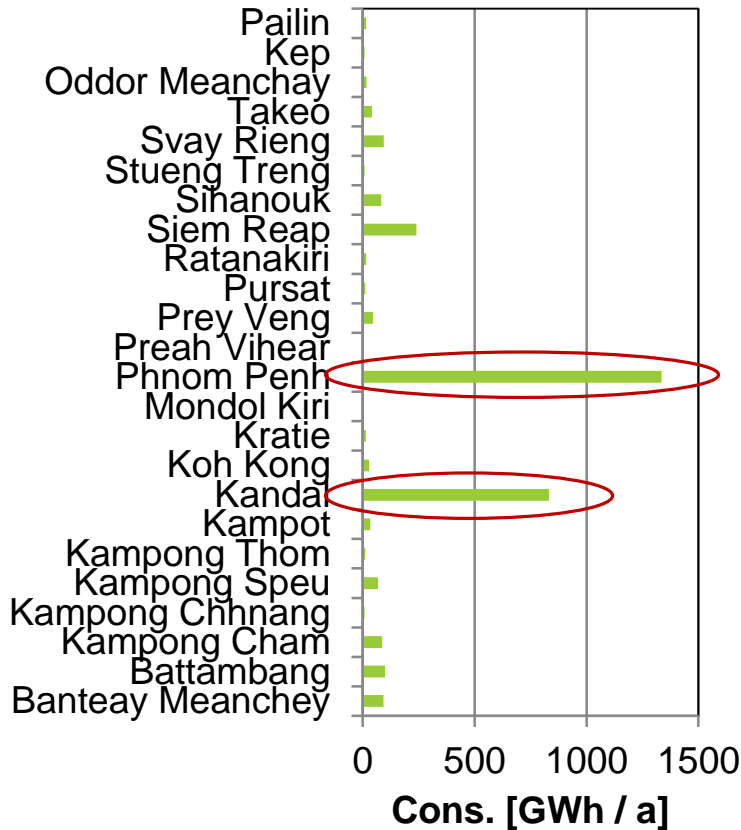
Emerging issue 2

Excess concentration of the electricity supply in the capital region

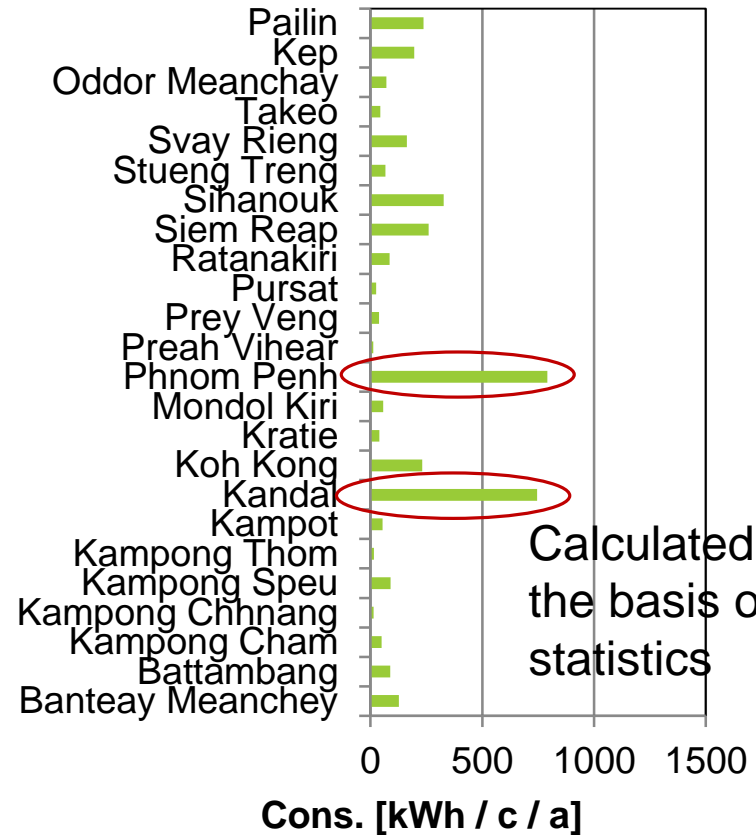
- The other issue confronting Cambodia is the excess concentration of the electricity supply in the capital region
- The next slide shows the electricity consumption by province/city in 2012
- We can see an excess concentration of the electricity supply in Phnom Penh and the adjacent province Kandal
- The people in the capital region enjoy the benefits of electricity while the people in the rural provinces such as Preah Vihear are able to access to electricity but only for limited purposes.

Electricity Consumption by Province in Cambodia (2012)

ANNUAL CONSUMPTION



ANNUAL PER CAPITA CONS.



Calculated on the basis of EAC statistics

- An excess concentration of the electricity supply in Phnom Penh and the adjacent province Kandal



Discussion

In order to meet the growing electricity demand, construction of the fire power station is rapid way

However, introducing low-carbon or renewable power generation technology is preferable from the viewpoint of preventing global warming

Reducing the electricity consumption is another solution to this issue

In addition to apply the energy saving technologies to the home appliances, introducing traditional climate-responsive measures in the modernized houses will reduce the electricity consumption.



Discussion (Continued)

As to the inequality of electricity supply, the construction of power stations and transmission lines and connection of the national electricity grids in the sparsely-populated rural areas, may not be economical

Establishment of cross-border electricity grids, construction of local micro-grids, and introduction of renewable energy technologies will be effective measures

Electrification by biomass and solar power are higher potential measures in Cambodia

The rural electrification promotion project by introducing PV cells in Laos, which was supported by the Japan International Cooperation Agency (JICA), will become helpful in solving the inequality in electricity use in Cambodia



Conclusions

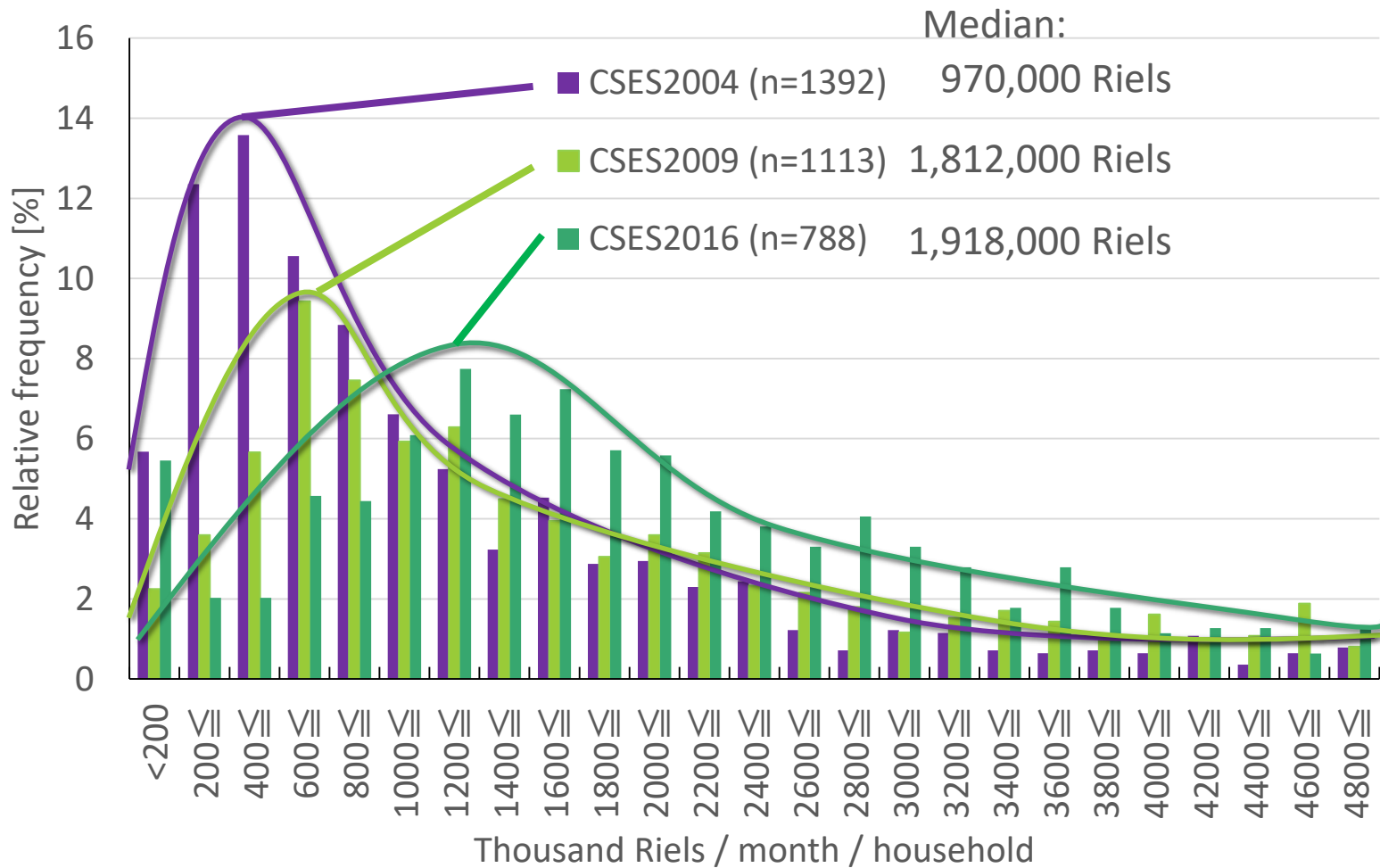
Cambodia has been overcoming the energy poverty, accompanying with the economic development

However, Cambodia confronts new issues: a rapid increase in electricity consumption and the use of fossil fuels to generate electricity in order to meet the growing demand

The excess concentration of the electricity supply in the capital region is also an emerging issue

The authors listed the sustainable solutions such as shifting to climate-responsive and modernized architecture, promoting smart use of electricity, and spreading renewable electricity generation.

Household income distribution in Phnom Penh



Challenges for the future

It is unavoidable that the people have come to live in the modernized houses and use electric appliances in association with the economic growth

Sustainable means are required:

- Climate-responsive modernized houses
 - Introduce passive climate-responsive measures in vernacular architecture into the modernized houses
 - Sun and wind
- Smart use of electricity
 - Use energy saving technologies to reduce power consumption of home appliances
 - LED, liquid crystal TV, etc.
- Renewable electricity generation
 - Photovoltaic cells, solar heater, micro hydropower, etc.



Buildings in Phnom Penh



Countermeasure for unstable power supply

