

Regional Differences in Electricity Accessibility among the Asian Least Developed Countries

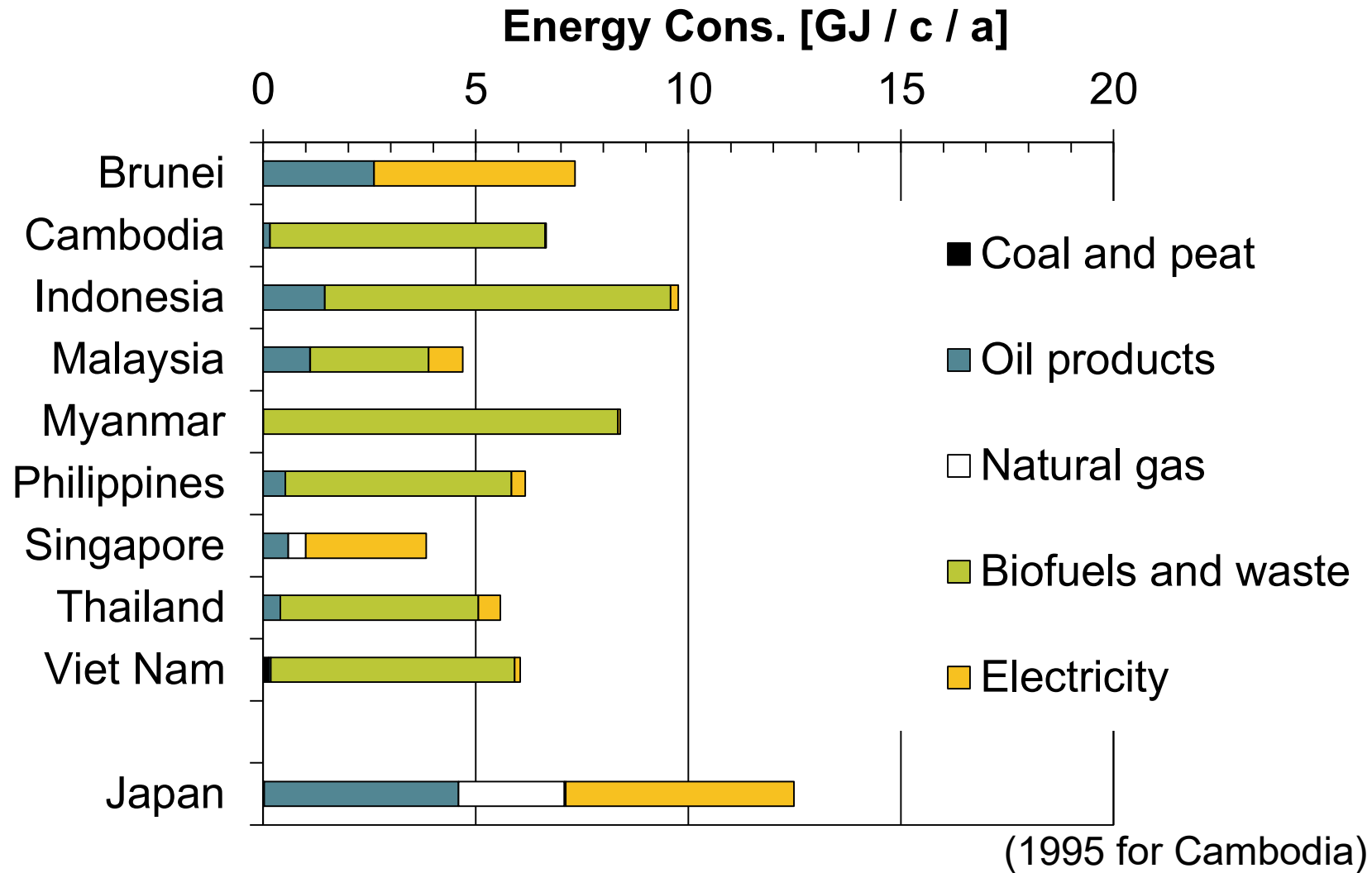
FUKUYO, Dean, Prof. Yamaguchi University

Background

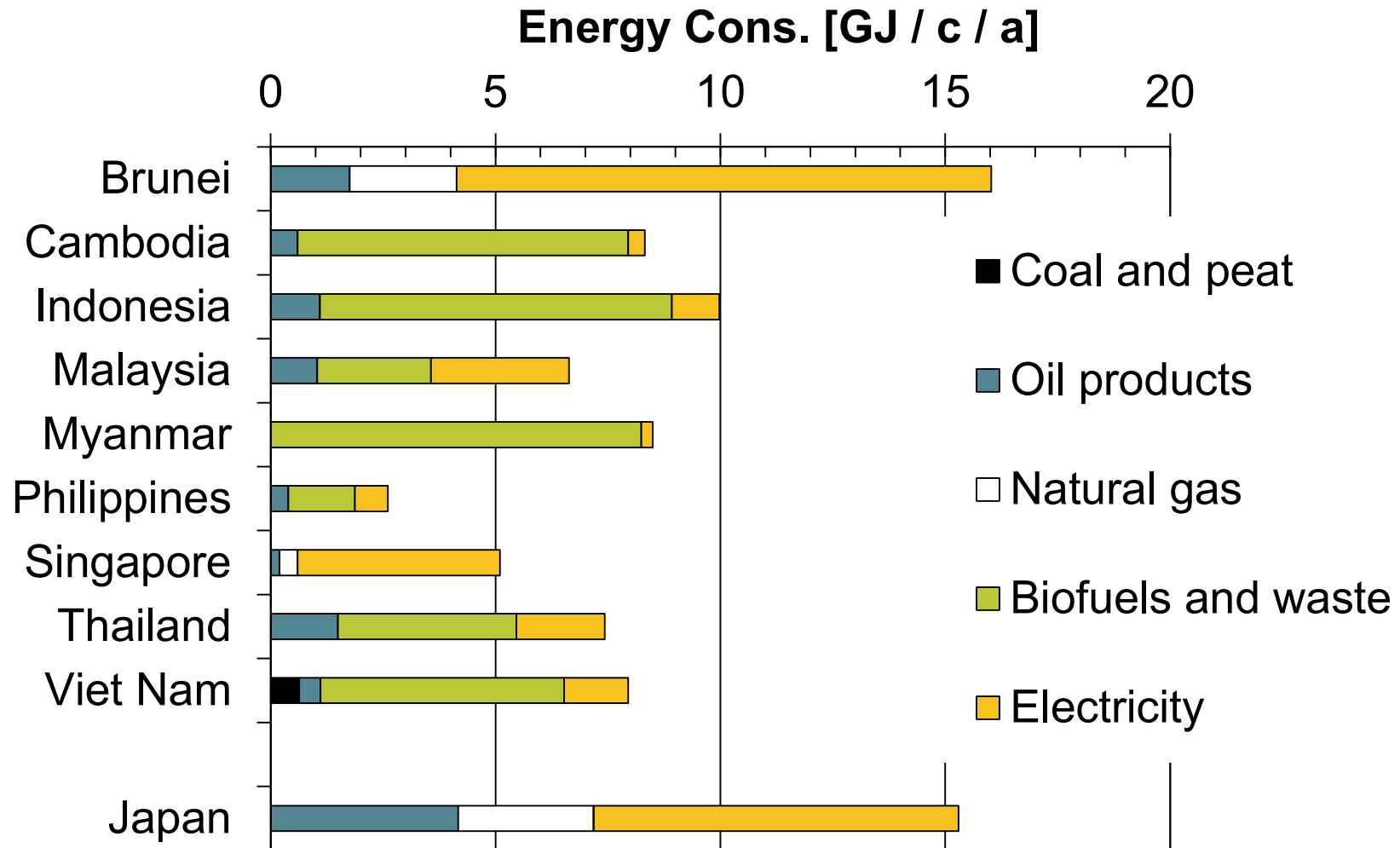
- ▶ Electricity is a key to socioeconomic development
- ▶ In the ASEAN countries, the energy consumption, especially the electricity consumption, has been rapidly increasing with the economic development and improvement in living standards
- ▶ The following figures show the residential energy consumption per capita per annum in the ASEAN countries and Japan (IEA, 2015)



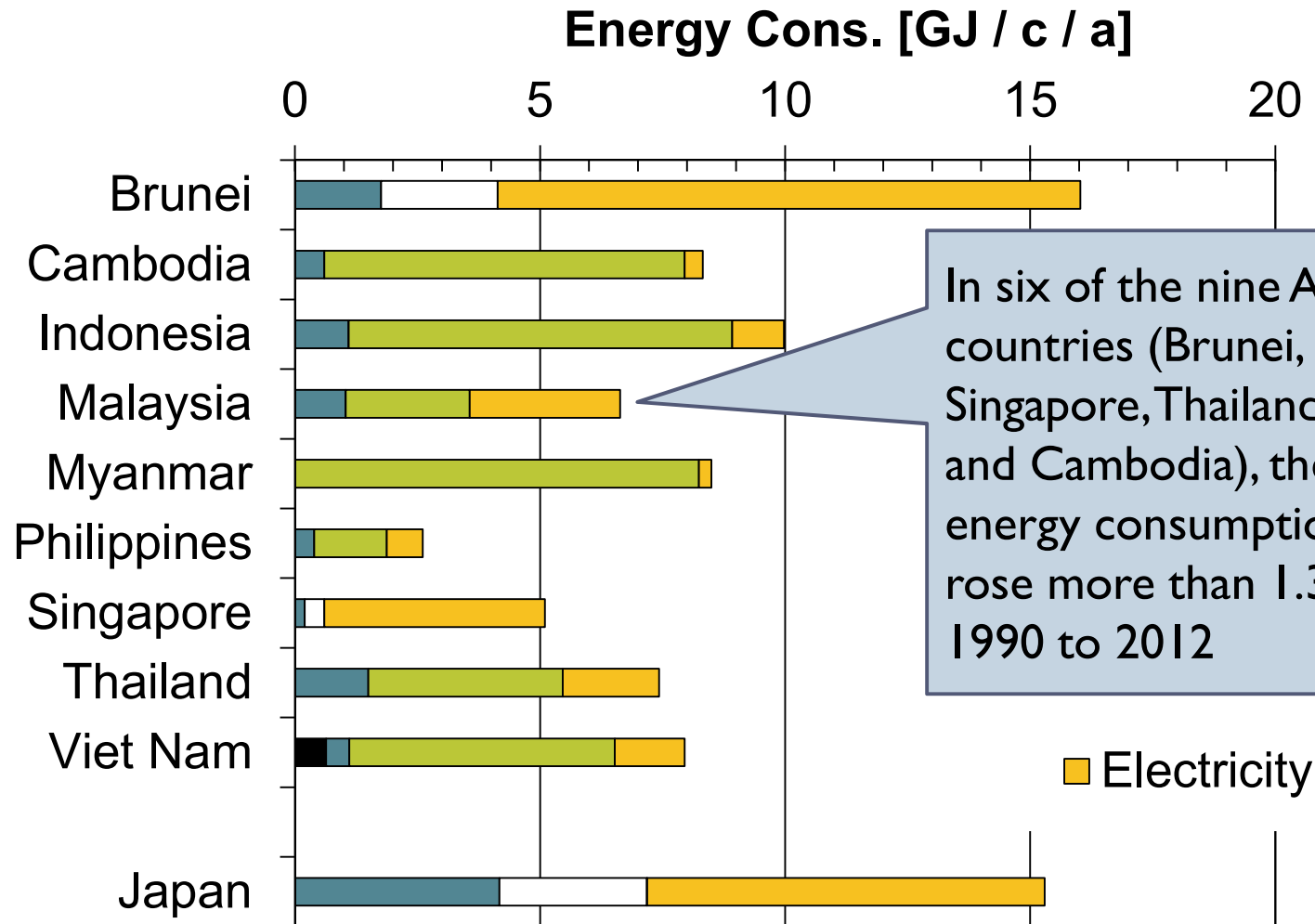
Residential energy consumption per capita per annum in the ASEAN countries and Japan in 1990



Residential energy consumption per capita per annum in the ASEAN countries and Japan in 2012

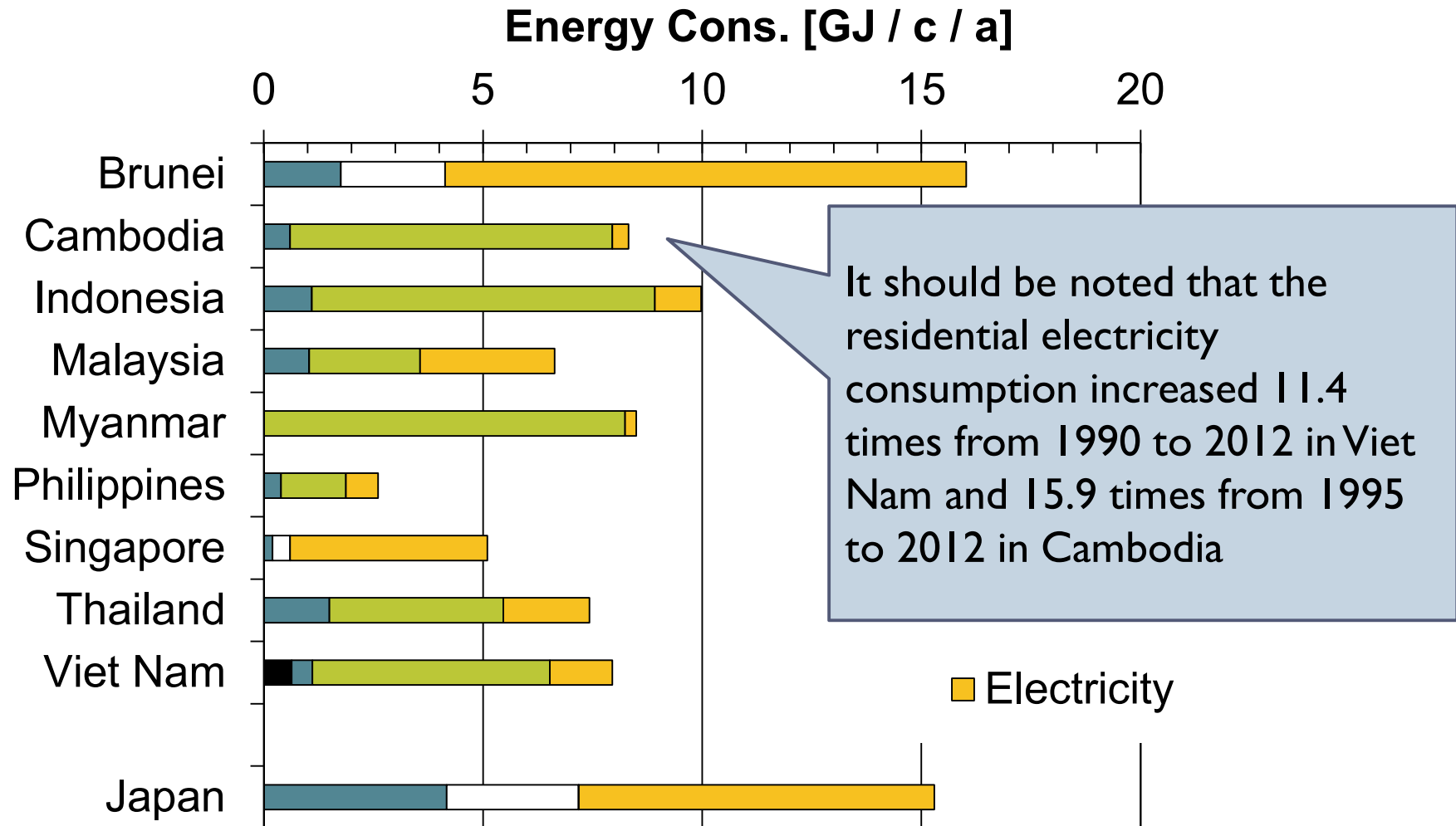


Residential energy consumption per capita per annum in the ASEAN countries and Japan in 2012



In six of the nine ASEAN countries (Brunei, Malaysia, Singapore, Thailand, Viet Nam, and Cambodia), the residential energy consumption per capita rose more than 1.3 times from 1990 to 2012

Residential energy consumption per capita per annum in the ASEAN countries and Japan in 2012

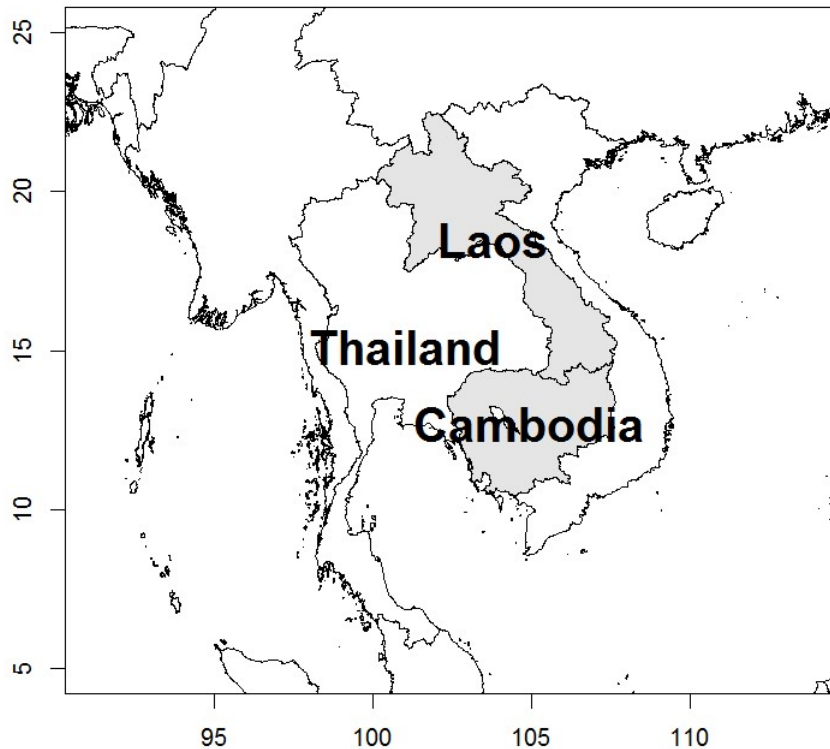


Focus

- ▶ I focus on the increase in the electricity consumption in the least developed countries such as Cambodia and Laos, describes the longitudinal changes in the electricity consumption
- ▶ And present problems such as regional inequality in electricity distribution



Brief information of Cambodia and Laos



▶ Lao PDR



Population: 7.03 million*
GDP per capita: 1,816USD*
GDP growth rate: 7.3%*

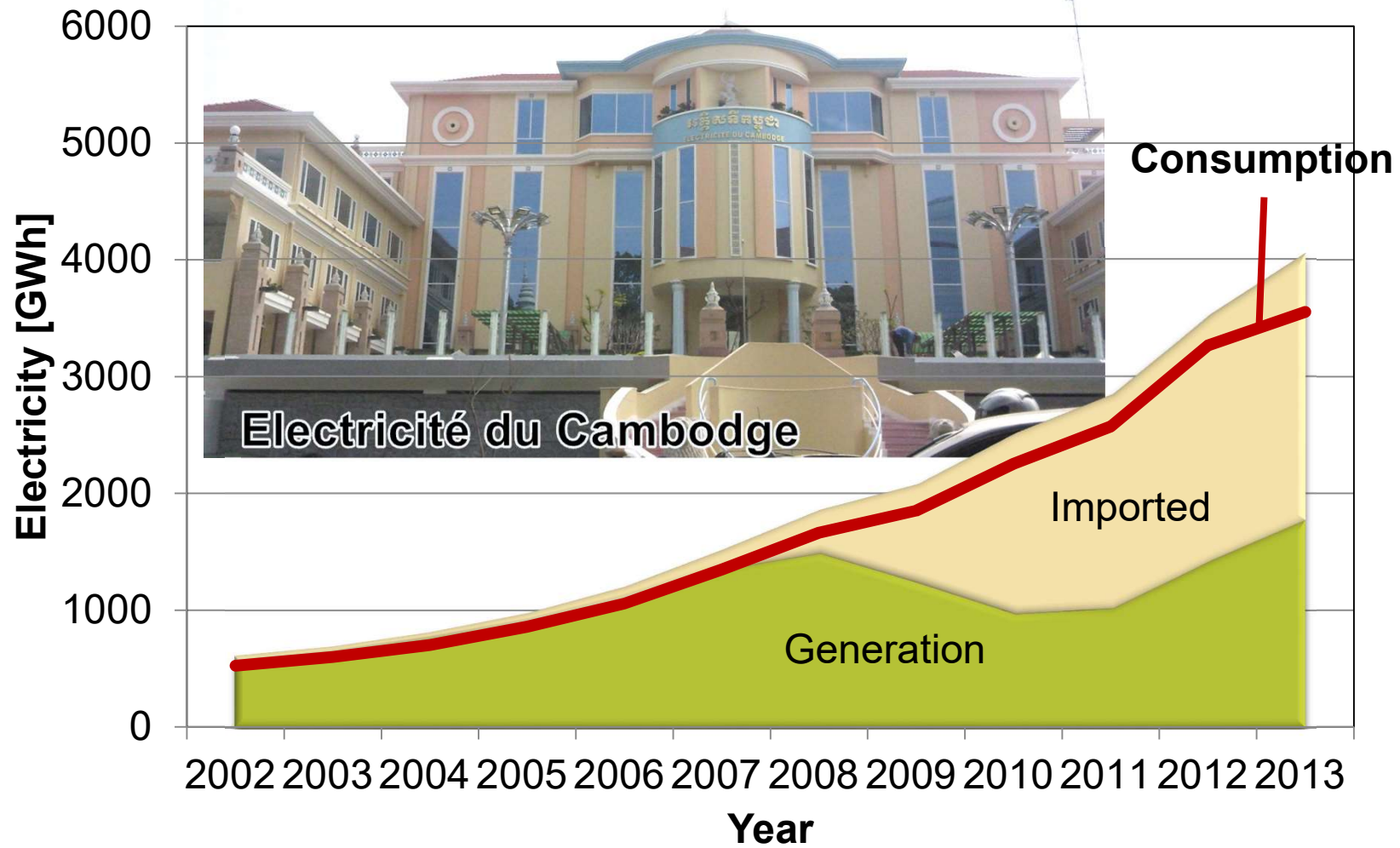
▶ Cambodia



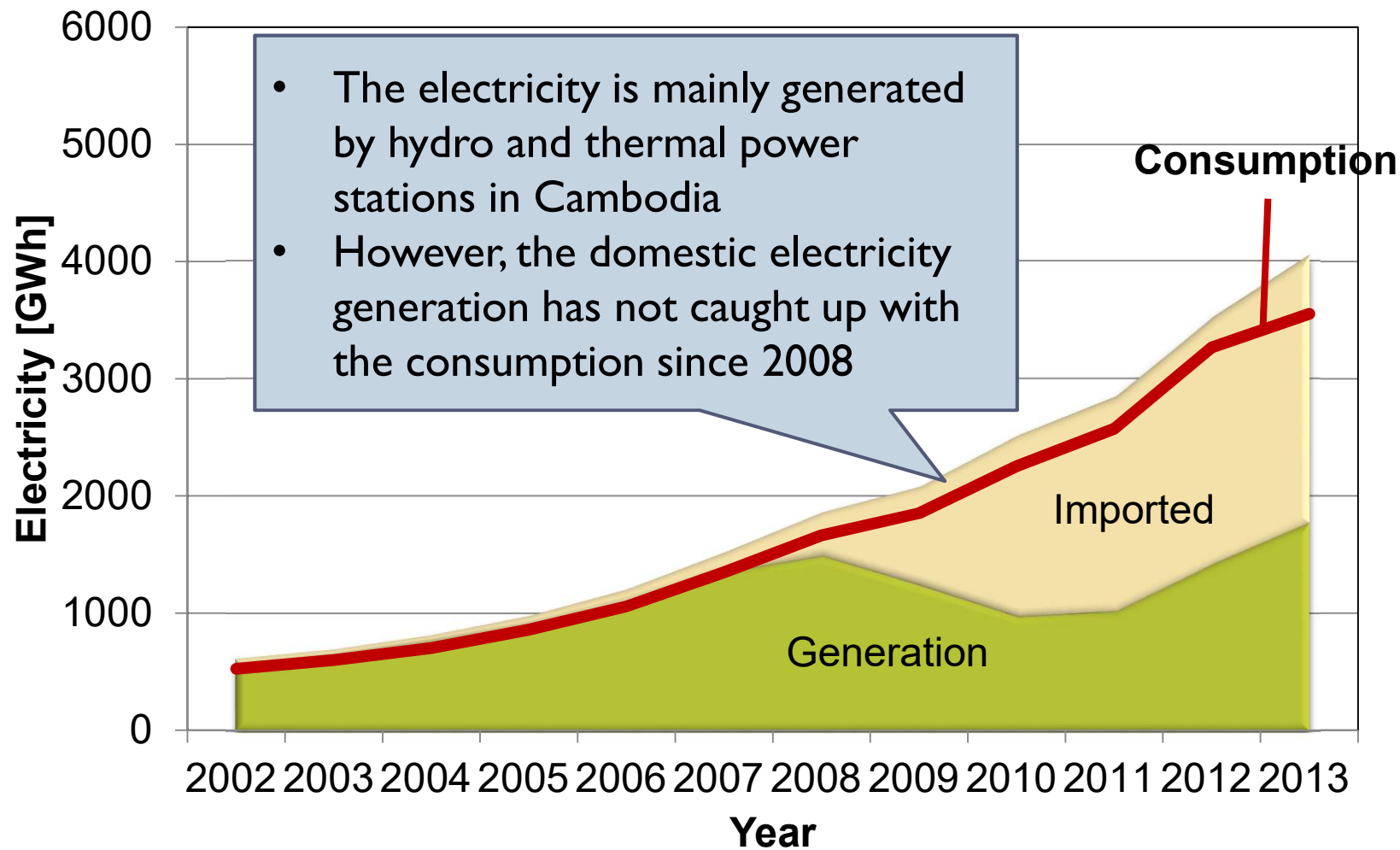
Population: 15.54 million*
GDP per capita: 1,146USD*
GDP growth rate: 7.2%*

▶ Source: *Estimated 2015 values by IMF (IMF, 2015)

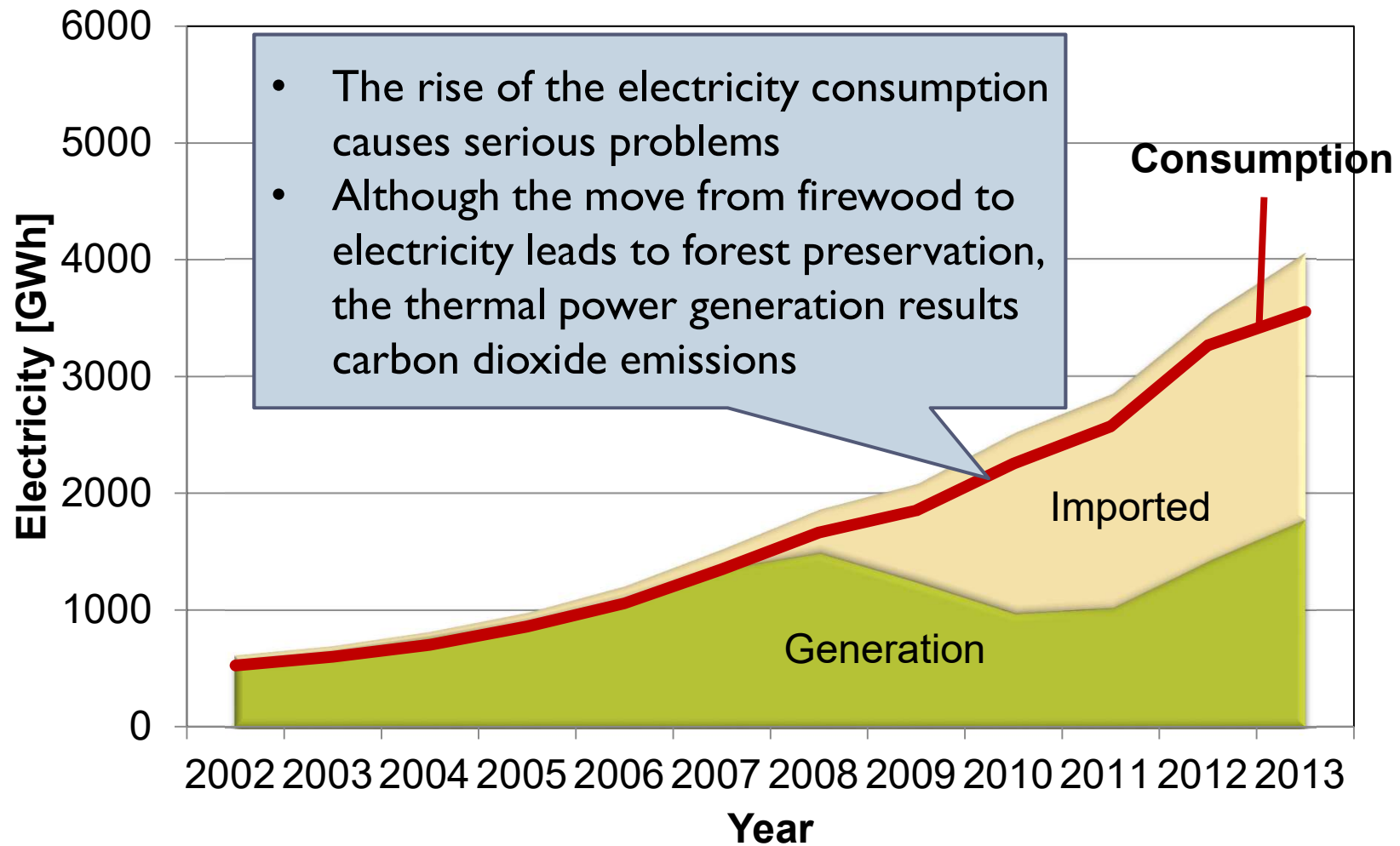
Electricity Generation, Import, and Consumption in Cambodia



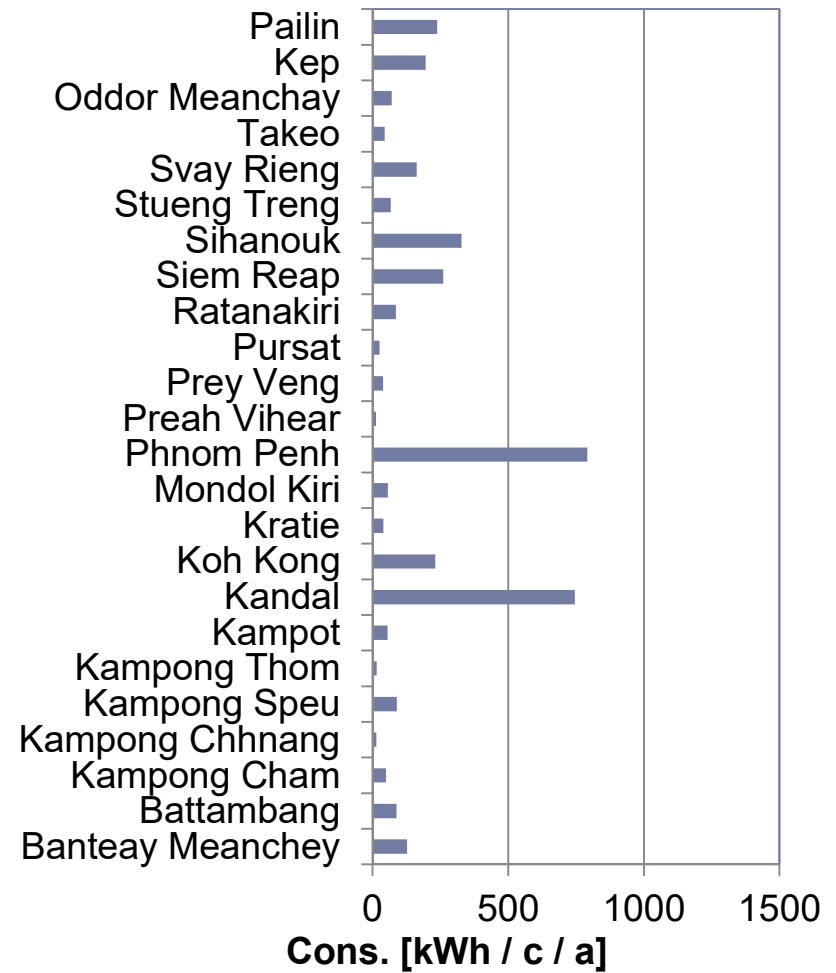
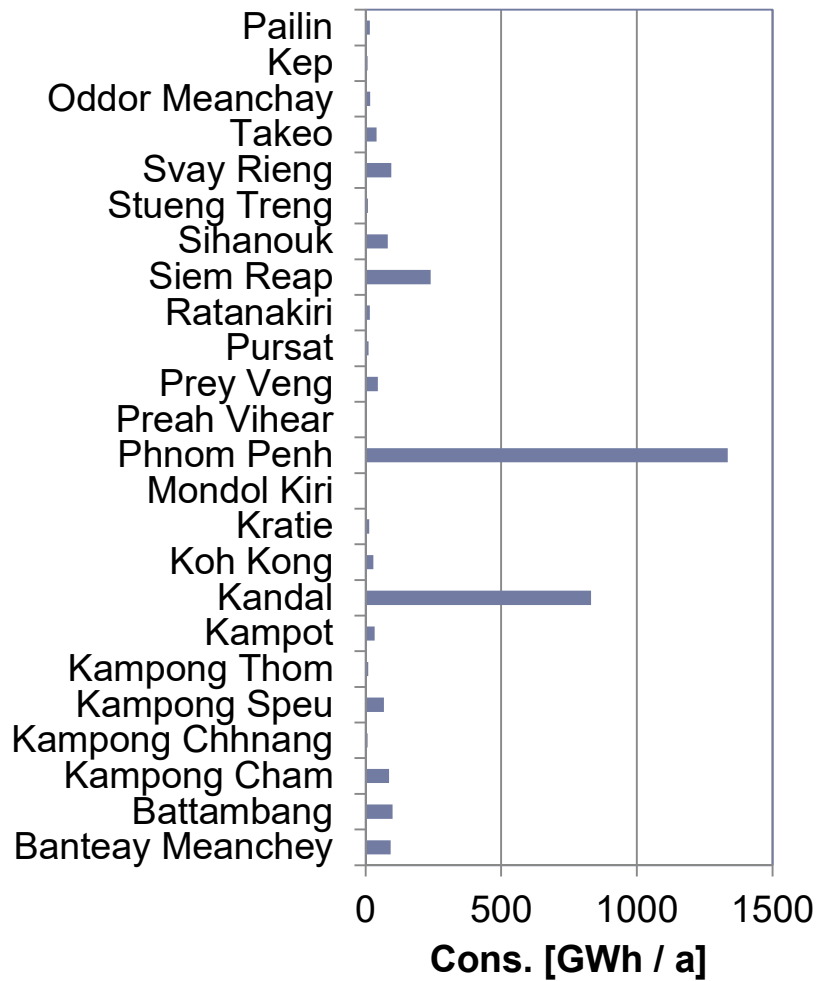
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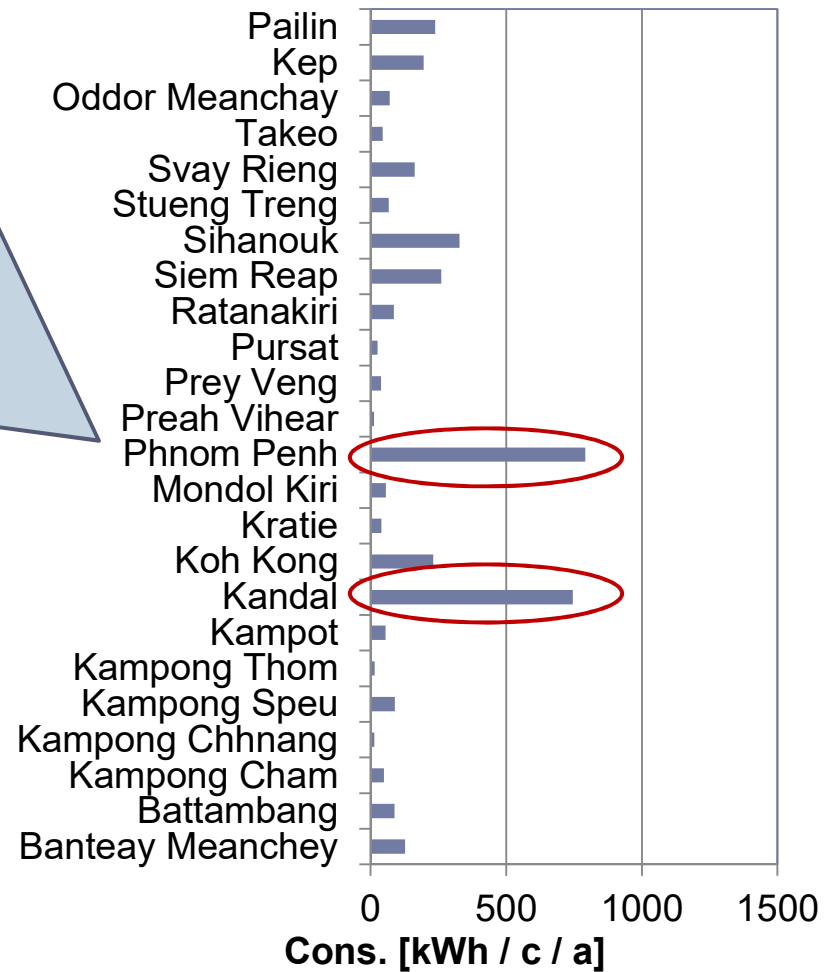
Electricity Consumption by Province in Cambodia (2012)



Calculated on the basis of EAC statistics

Electricity Consumption by Province in Cambodia (2012)

- This figure exhibits electricity inequality within the country
- The people in Phnom Penh city (the capital city) and Kandal Province (the neighbouring province to the capital) enjoy the benefits of electricity
- But the people in the rural provinces such as Preah Vihear are hard to access the electricity
- Concentration of the electricity grid in urban area leads to the widening the inequality in electricity accessibility and living standards.



Calculated on the basis of EAC statistics

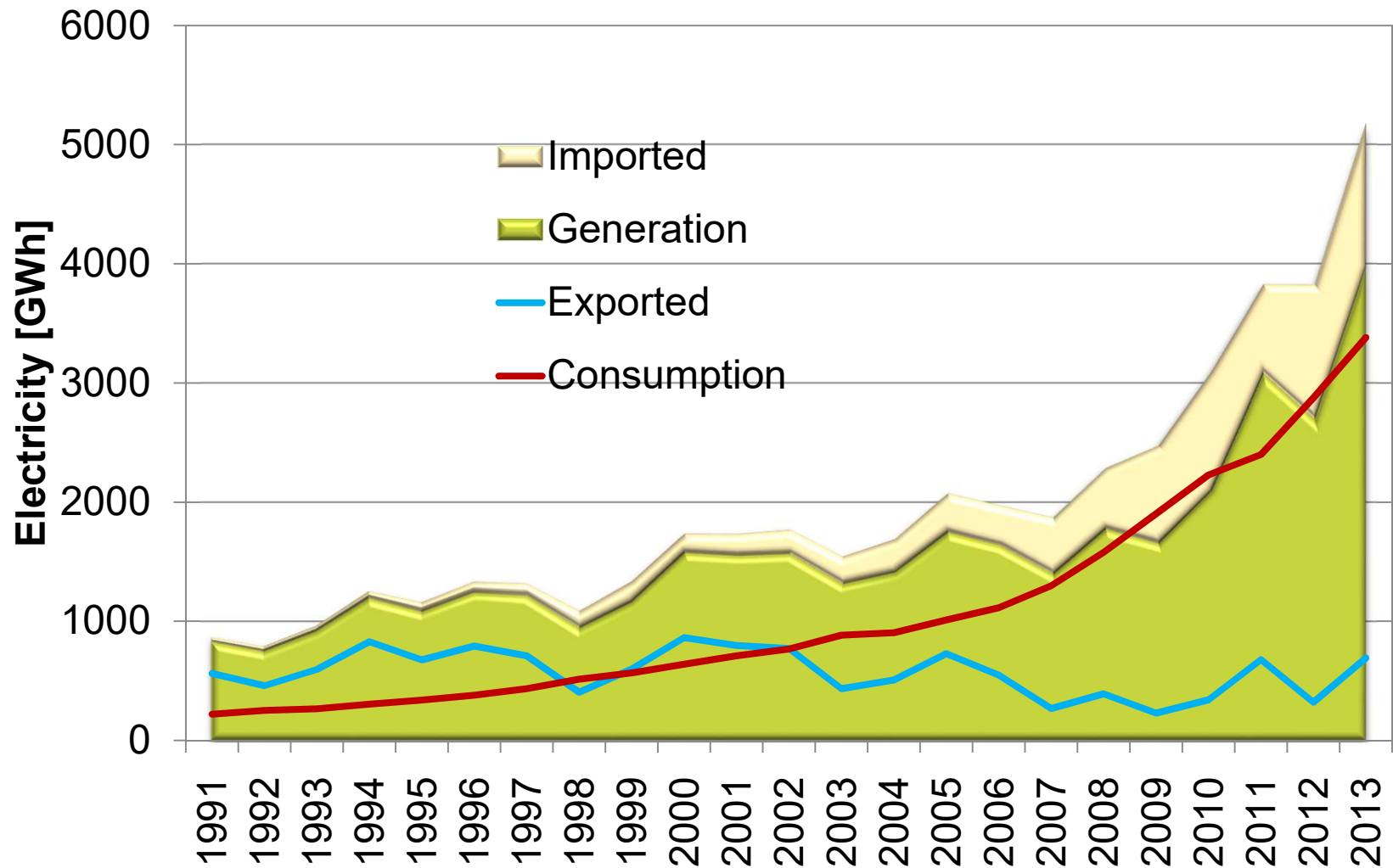
Buildings in Phnom Penh



Countermeasure for unstable power supply

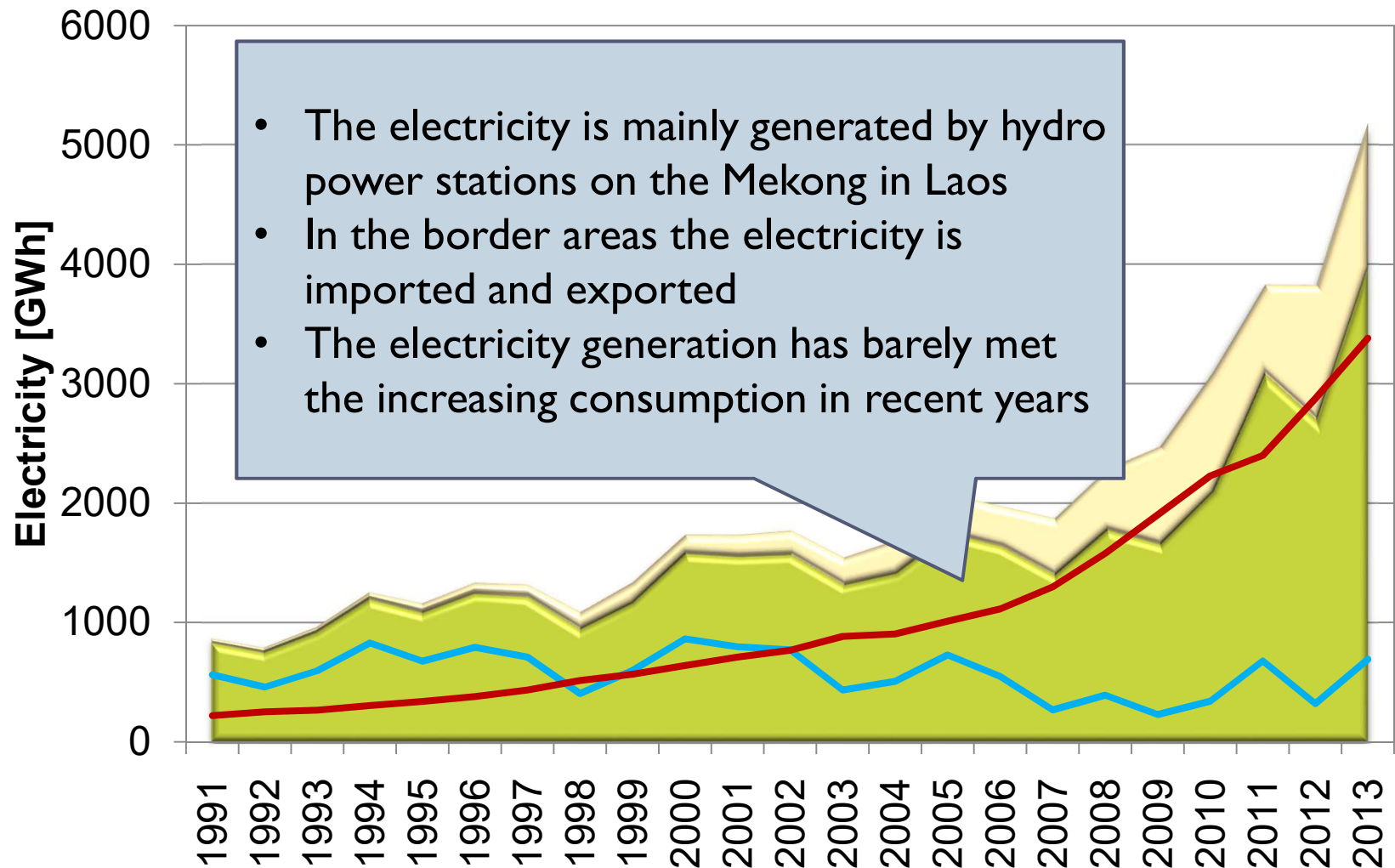


Electricity Generation, Import, Export and Consumption in Laos



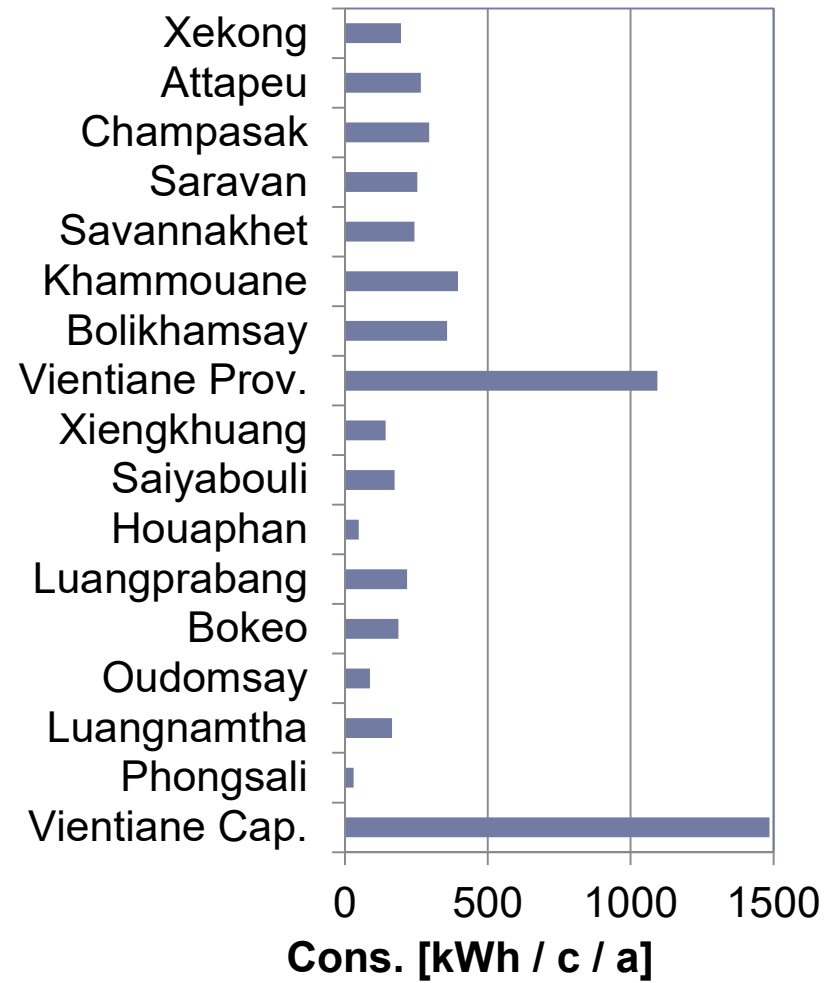
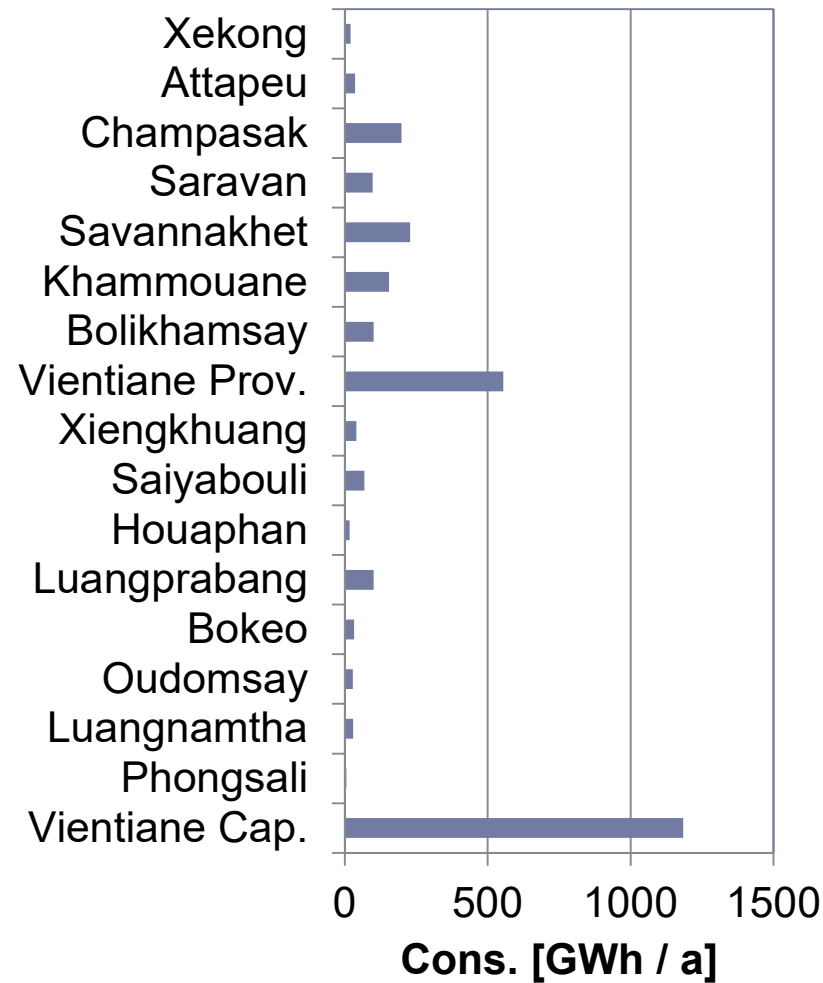
Source: EDL

Electricity Generation, Import, Export and Consumption in Laos



Source: EDL

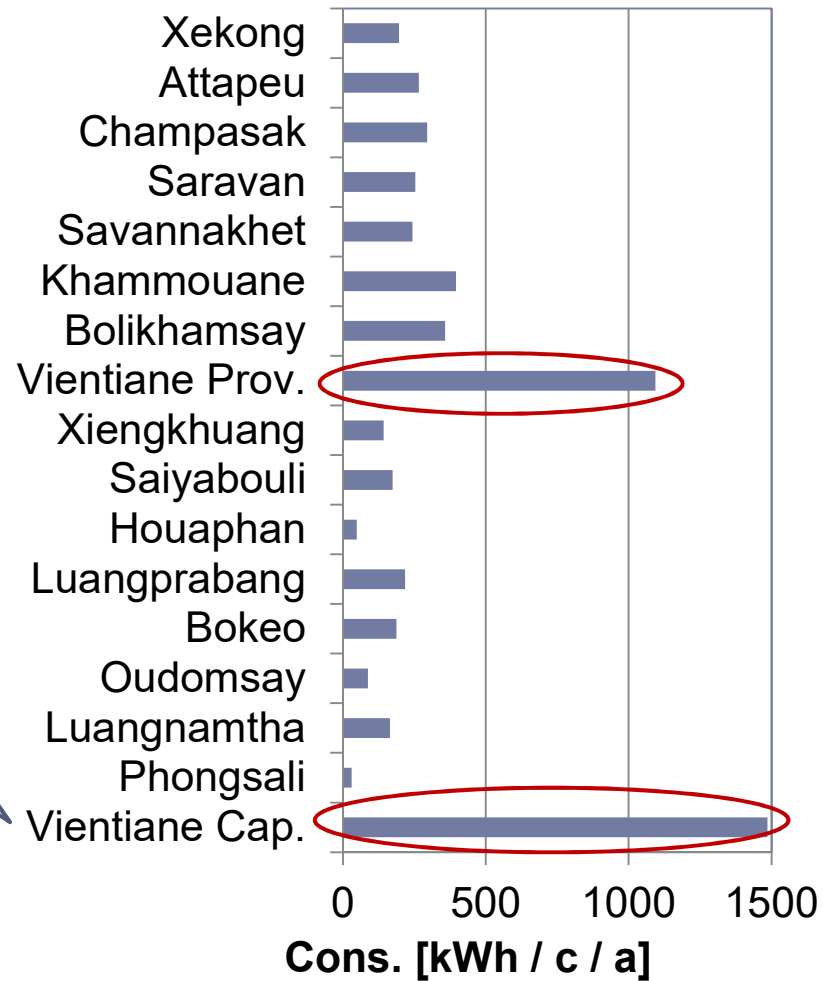
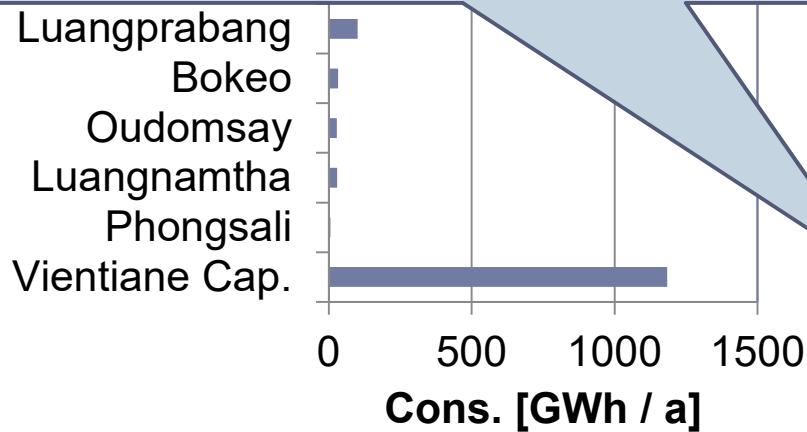
Electricity Consumption by Province in Laos (2012)



Calculated on the basis of EDL statistics

Electricity Consumption by Province in Laos (2012)

- In the capital city and the neighbouring province (Vientiane capital and province) consume electricity the most
- Although this figure exhibits electricity inequality within the country, the inequality is not severe as compared with Cambodia.

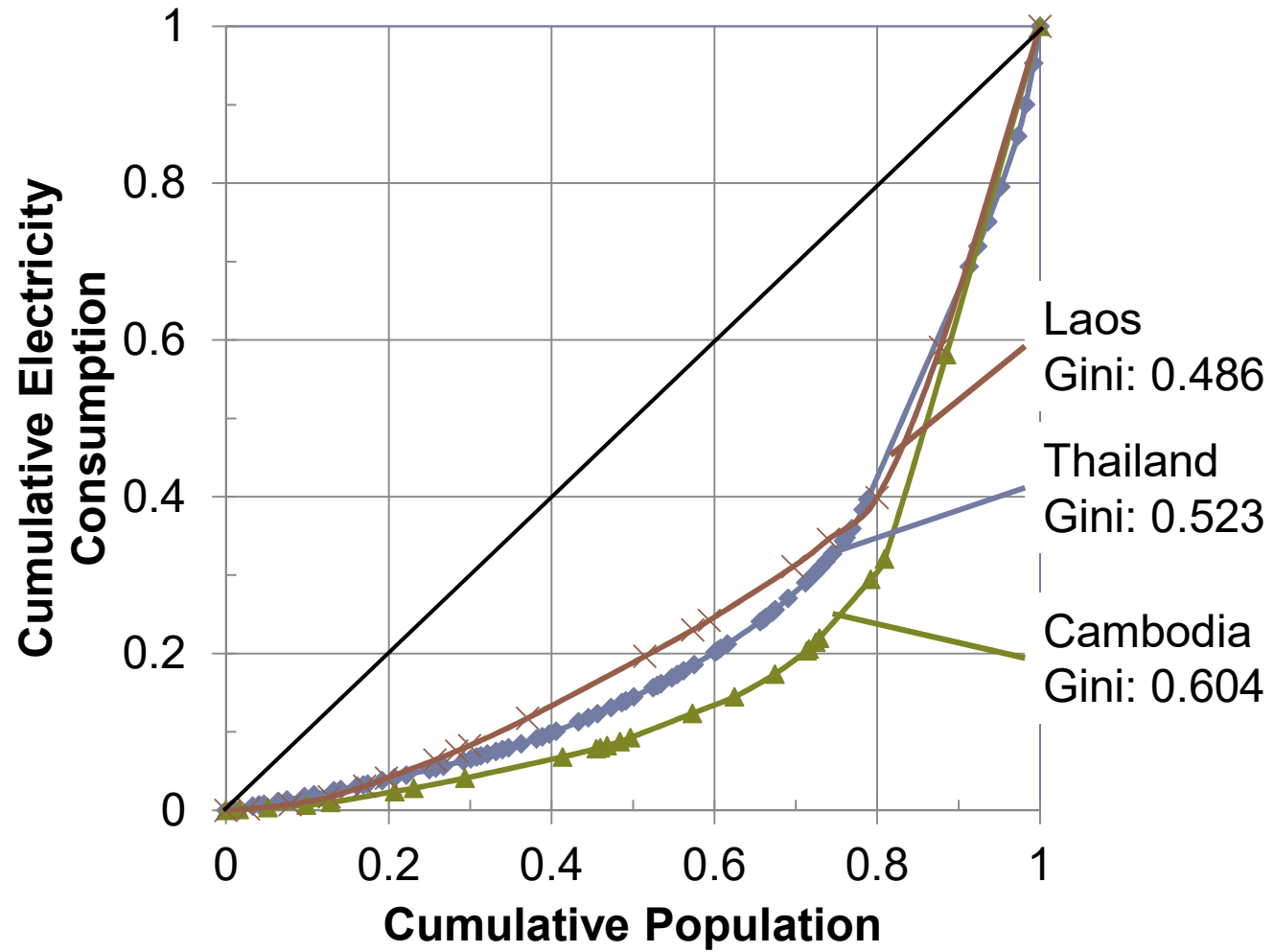


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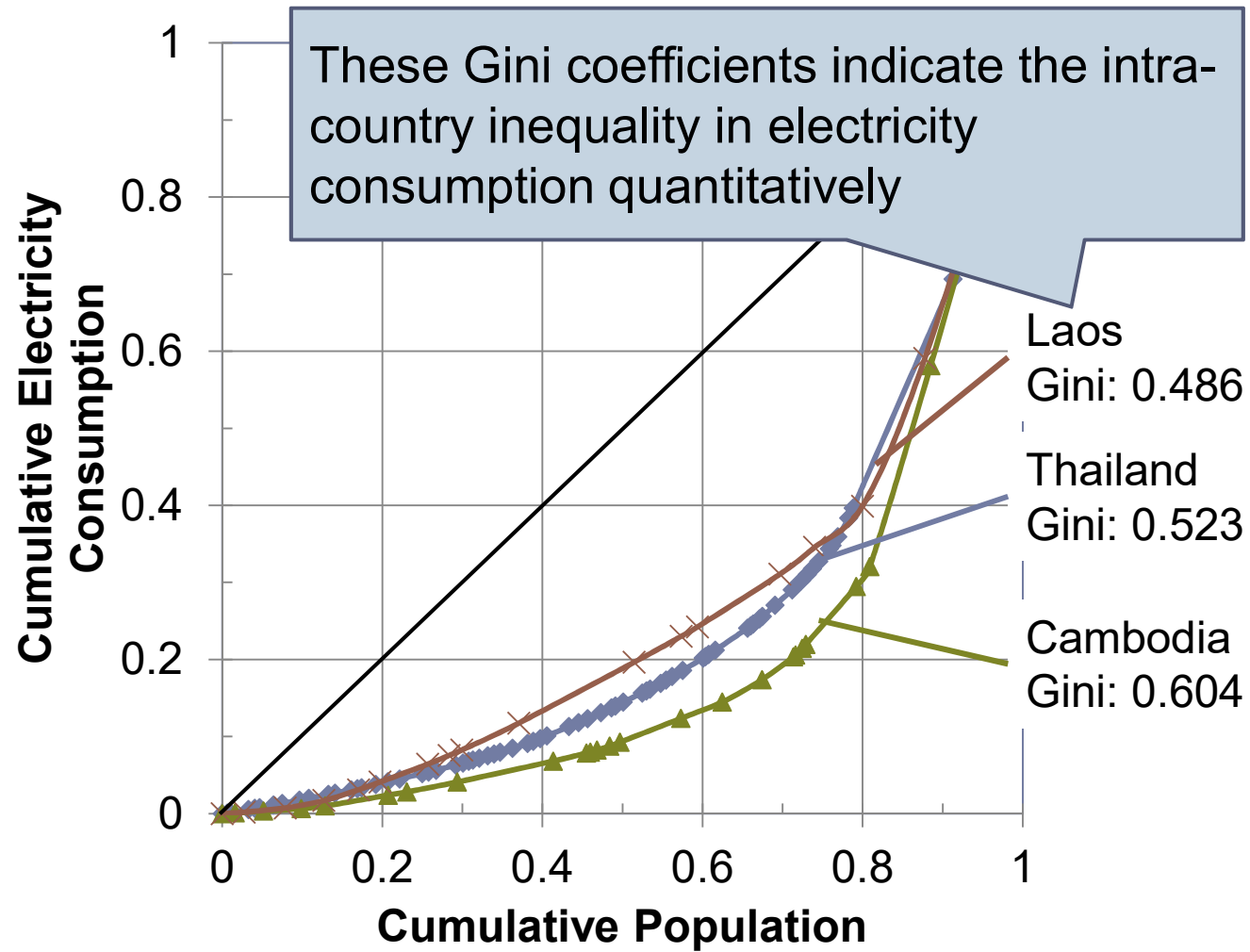
Buildings in Vientiane Capital



Lorentz curves for electricity consumption in Cambodia, Laos, and Thailand

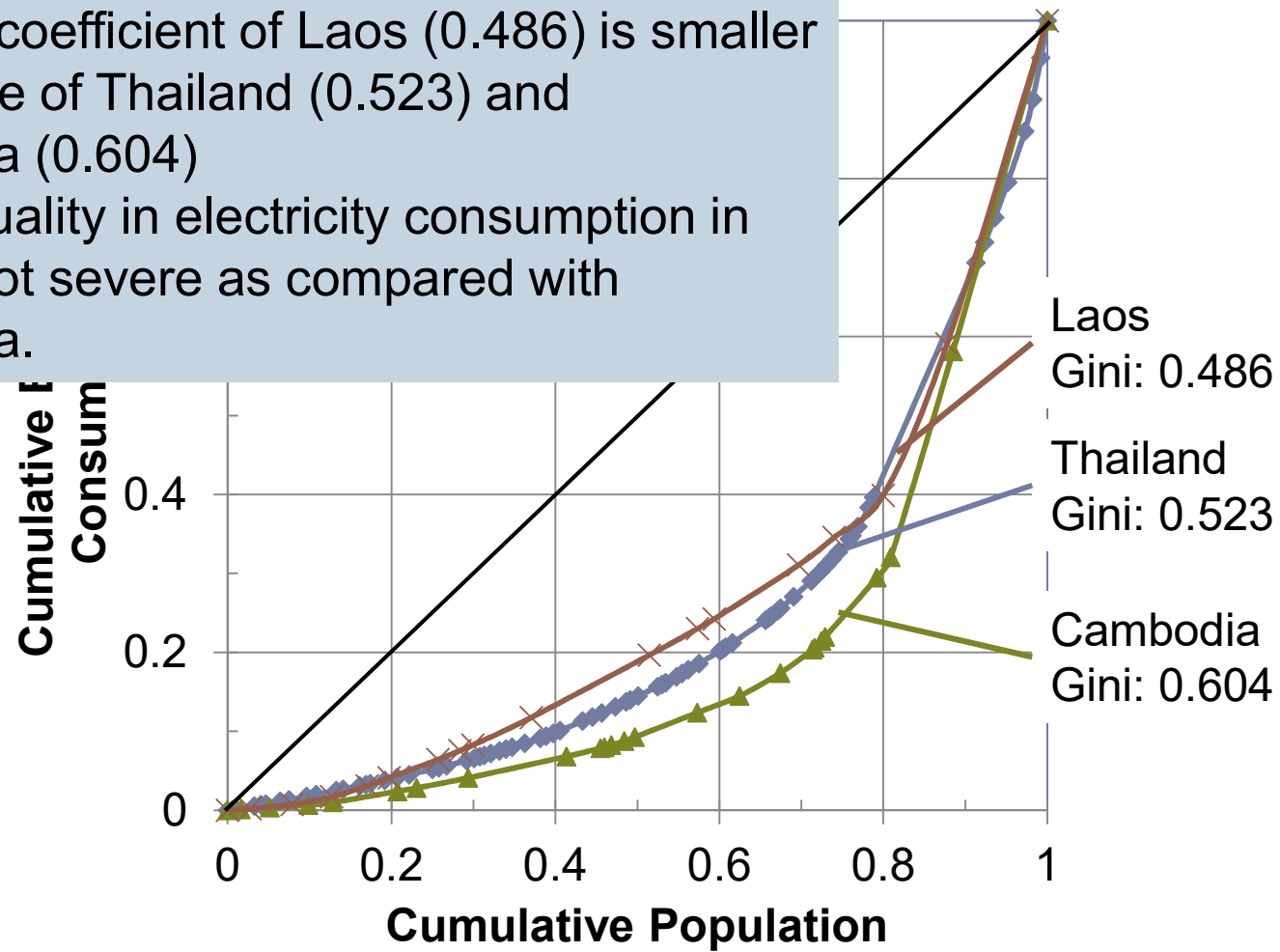


Lorentz curves for electricity consumption in Cambodia, Laos, and Thailand



Lorentz curves for electricity consumption in Cambodia, Laos, and Thailand

- The Gini coefficient of Laos (0.486) is smaller than those of Thailand (0.523) and Cambodia (0.604)
- The inequality in electricity consumption in Laos is not severe as compared with Cambodia.



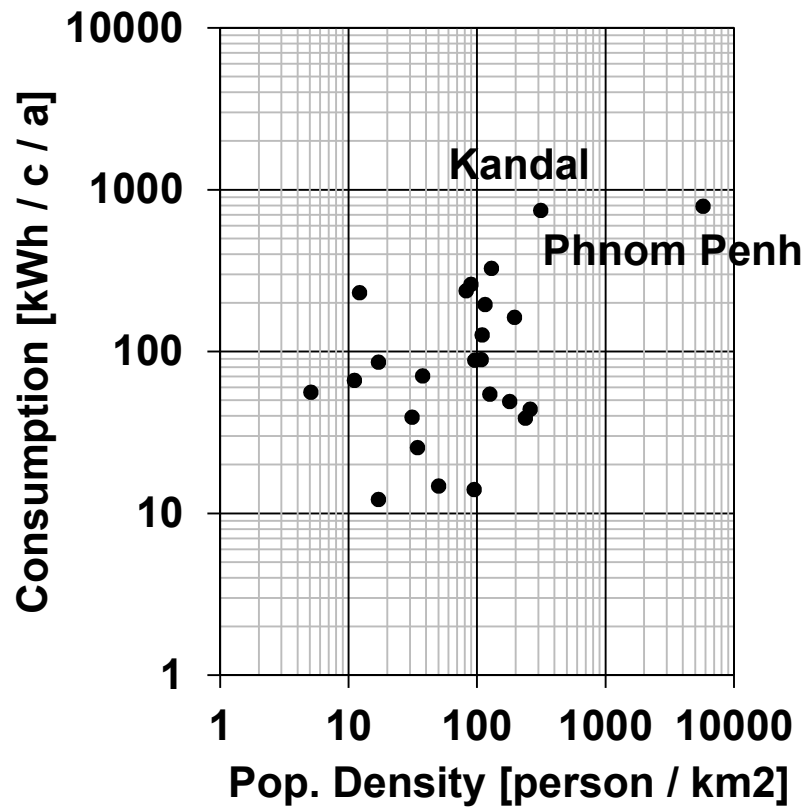
Factors, which affect the electricity consumption

- ▶ There seem to be many factors that may influence the inequality in electricity consumption, such as geographical condition, socioeconomic situation, etc.
 - ▶ Larivière and Lafrance showed a negative correlation between the population density and electricity consumption in urban areas in Canada (Larivière and Lafrance, 1999)
- ▶ Is there any relationship between the population density and electricity consumption in the least developed countries?

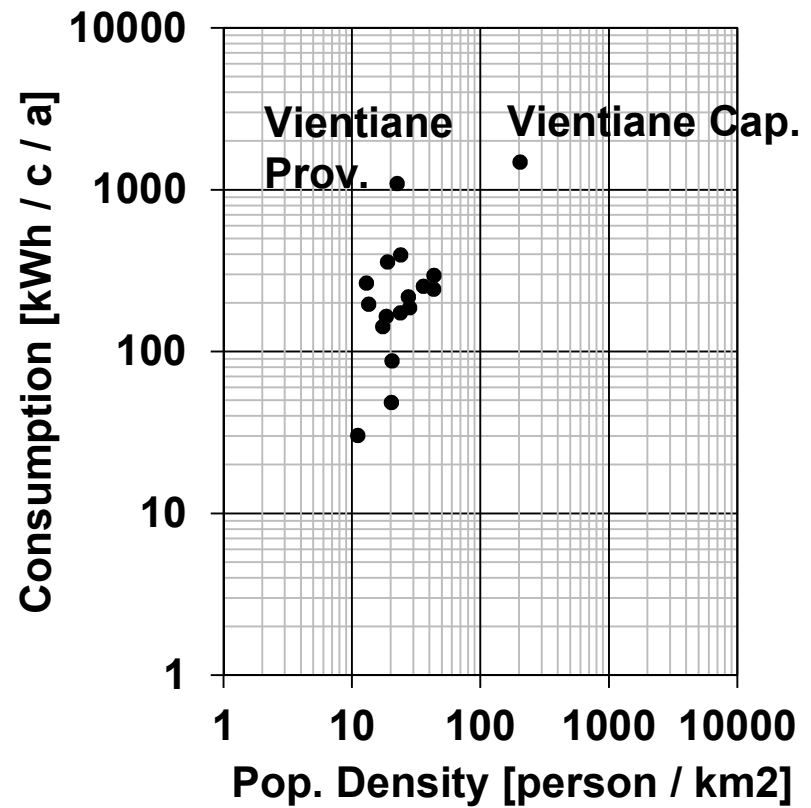


Population Density vs Electricity Consumption per capita per annum in Cambodia and Laos in 2012

Cambodia, 2012

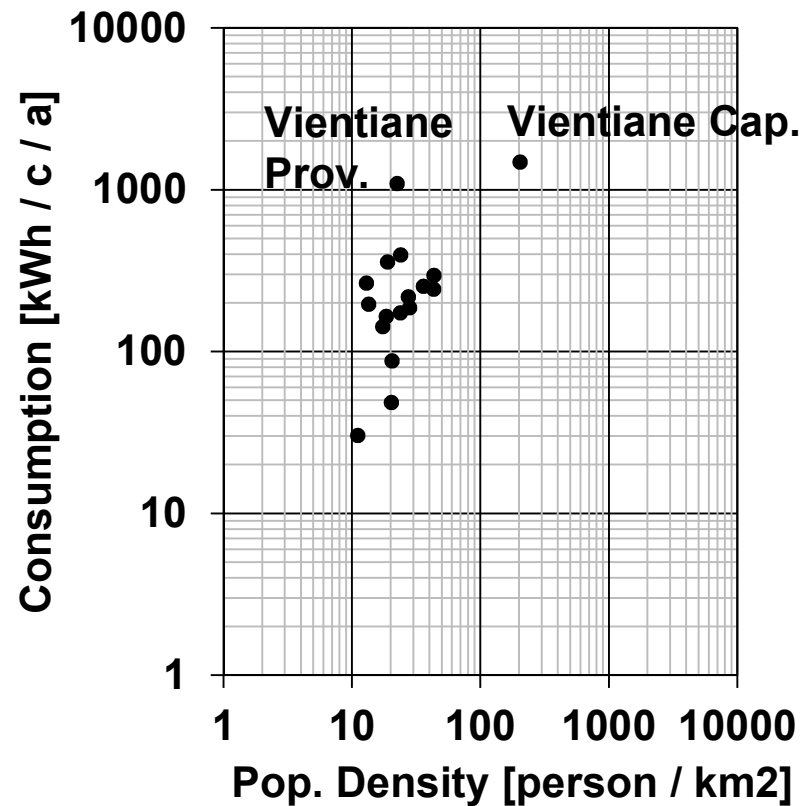
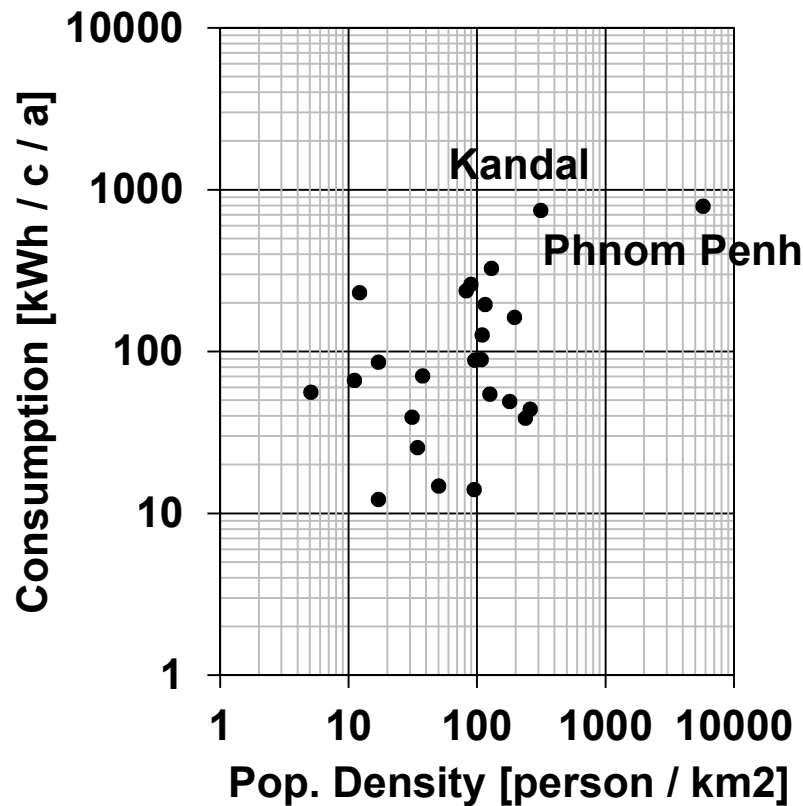


Laos, 2012



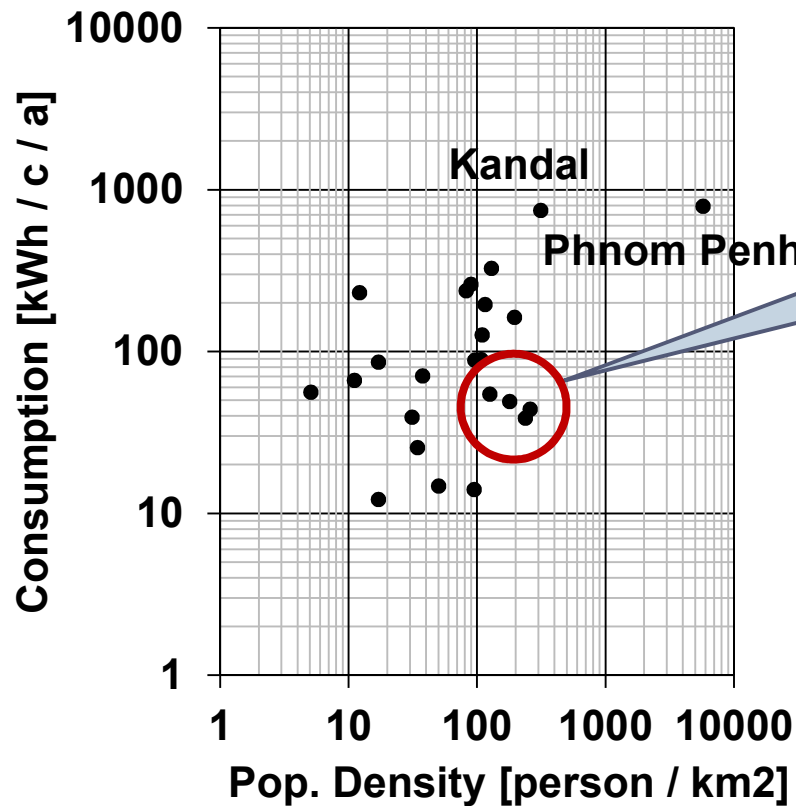
Population Density vs Electricity Consumption per capita per annum in Cambodia and Laos in 2012

- There seems to be a positive correlation between the population density and electricity consumption in whole but not in detail

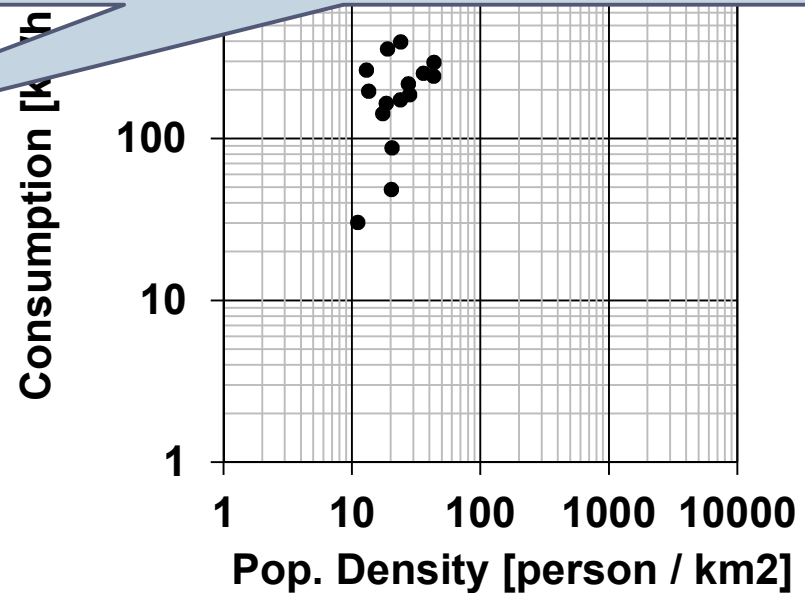


Population Density vs Electricity Consumption per capita per annum in Cambodia and Laos in 2012

Cambodia, 2012

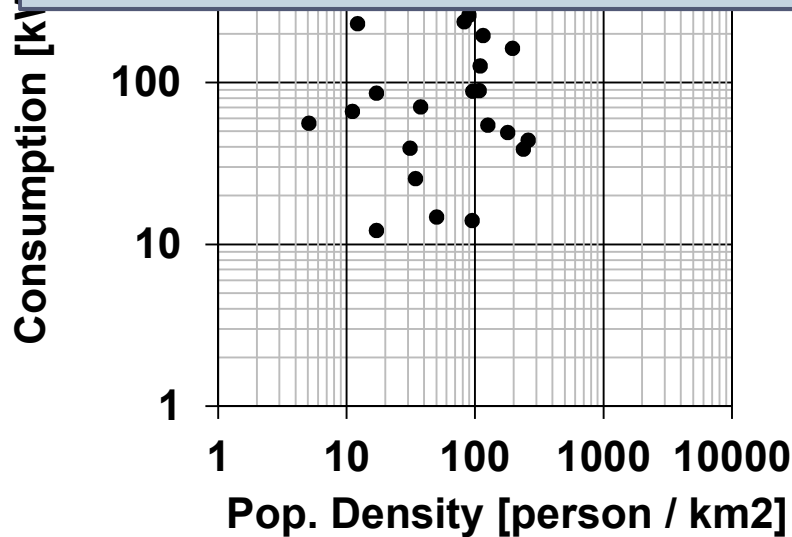


- In some provinces in Cambodia, the electricity consumption is less than 100 kWh per capita per annum even though the population density exceeds 100 person / km²

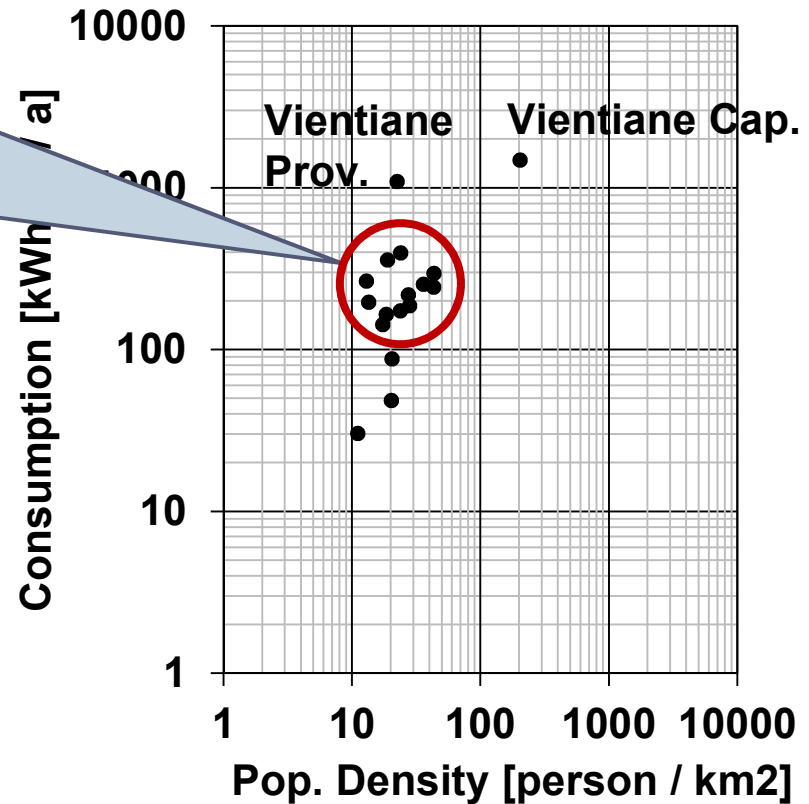


Population Density vs Electricity Consumption per capita per annum in Cambodia and Laos in 2012

- In many provinces in Laos, the electricity consumption exceeds 100 kWh per capita per annum independently of the population density.



Laos, 2012



Inequality in electricity

- ▶ There is a possibility that the inequality in electricity consumption will be gradually resolved in the populated provinces in Cambodia
 - ▶ A higher concentration of people encourages economic activity and investment to infrastructures including electricity grids
 - ▶ On the contrary, the inequality in electricity consumption may not be resolved in sparsely-populated areas unless some measures are taken



Effective measures

- ▶ In the sparsely-populated areas, the construction and connection of the national electricity grids 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 (Abe et al., 2007) and solar power (Janjai et al., 2011) are higher potential measures in Cambodia



Introducing PV cells in the rural areas

- ▶ Freeman Dyson wrote that
 - ▶ “A working solar energy system can make an enormous difference to the quality of life in a tropical village. Thirty or fifty watts of direct current is enough to run a couple of fluorescent light, a radio, or a small black-and-white television for several hours every night” (Dyson, 1999)
- ▶ 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



Conclusion

- ▶ The rise of electricity consumption and the intra-country inequality in electricity use in the least developed ASEAN countries, *i.e.* Cambodia and Laos, were described
- ▶ The Lorentz curves and Gini coefficients indicated the severe inequality in Cambodia as compared with Laos
- ▶ Some countermeasures for solving the inequality, such as establishment of the cross-border electricity grid, construction of local micro-grids, and introduction of renewable energy were required

