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TGP-EEDP
Thai - German Programme on Energy Efficiency Development Plan

Energy Policy and Planning Office
MINISTRY OF ENERGY

Final Results of Energy Data Analysis Phase 2:

Energy Efficiency Indicators Development

Organised by EPPO and GIZ on behalf of Thai-German Programme

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Energy efficiency trends for households

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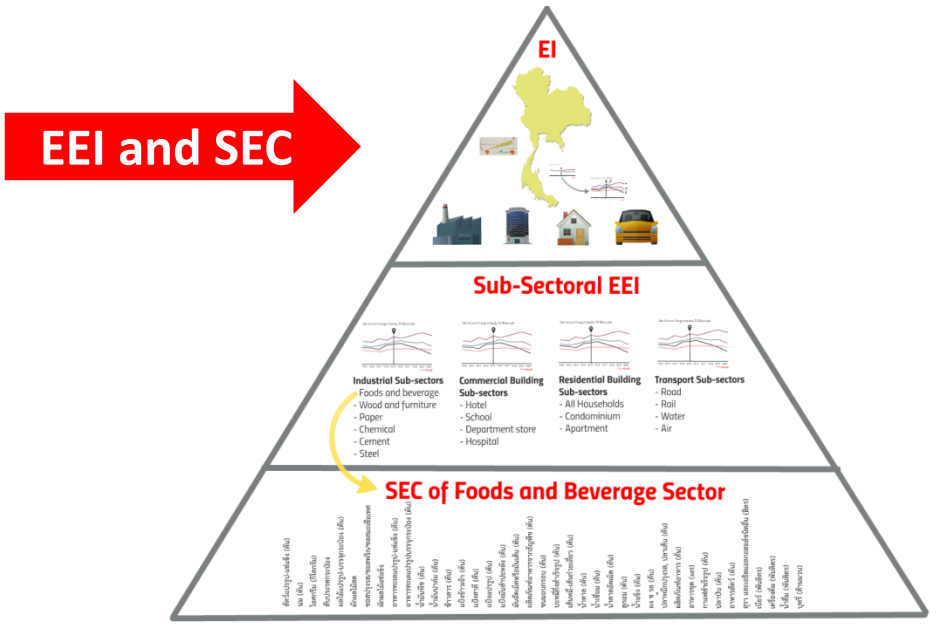
Prepared with the support of GIZ

Outline

1. **Overall trends**
2. Indicators by sub-sector
3. Annex



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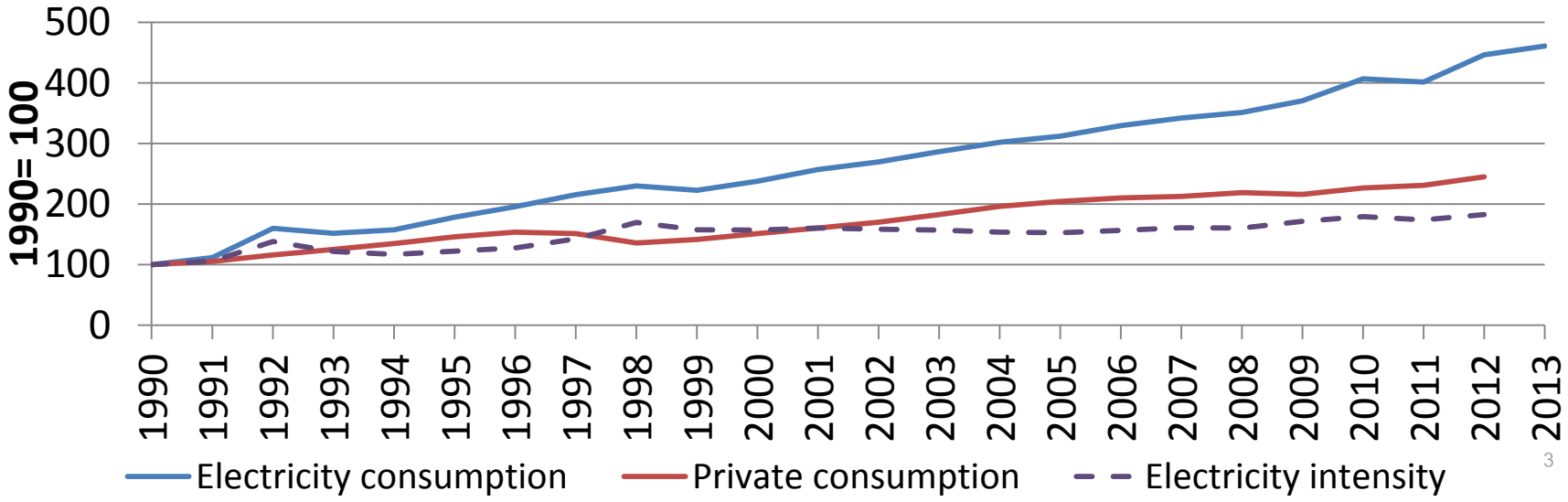
Electricity Consumption and Private Consumption in Household

- Electricity consumption has increased more rapidly than private consumption and quite independently of economic growth (i.e. in period of economic slow down, such as during the 1998 economic crisis and since 2005), electricity consumption continued to grow rapidly .
- As a result , the electricity intensity (electricity consumption over private consumption) increased since 2005
- Since 2005, electricity intensity grew by around 2.7% / yr and slow down to 2.3% /yr since 2011, that may be linked to energy efficiency improvements.

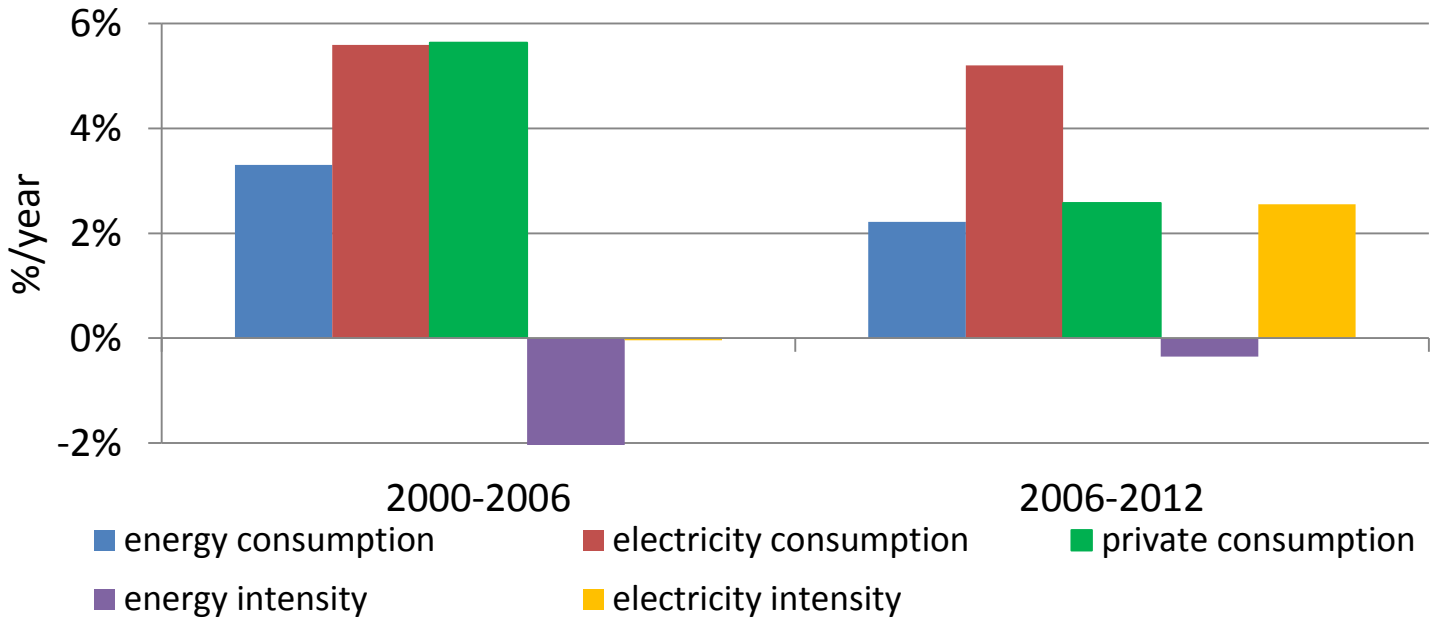
Electricity consumption and private consumption in household



Trends in main drivers of household energy consumption in Thailand

- High growth of the electricity consumption (over 5%/year)
- Progression in line with increase in household expenditure (i.e. household income) until 2006, but twice higher since 2006;
- Household energy consumption is growing moderately, especially since 2006 and much slower than household income.

Trends in energy consumption, private consumption, and energy intensity



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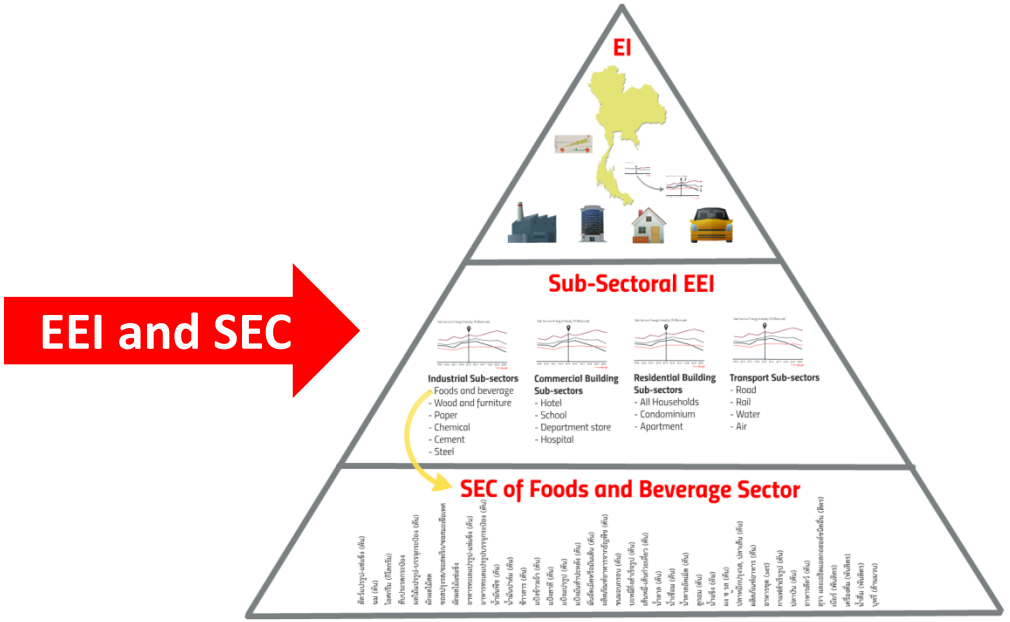

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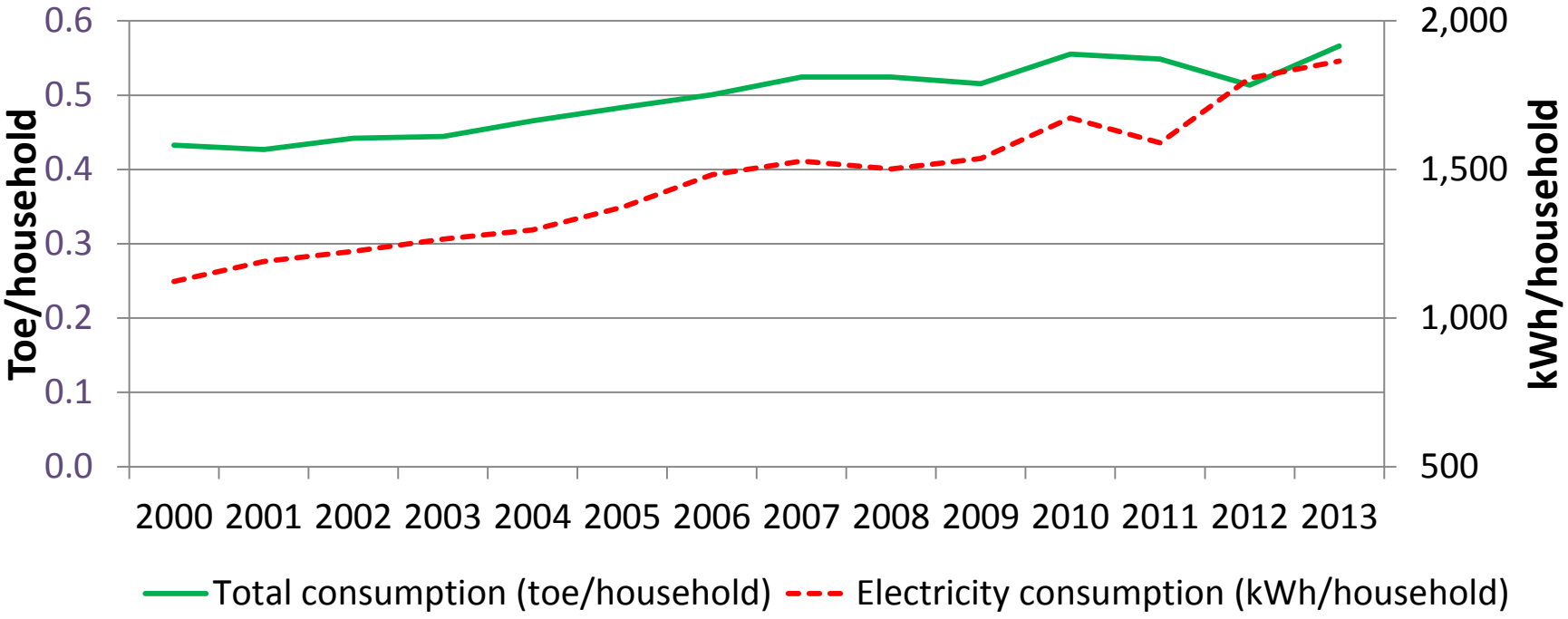
Specific energy consumption per household in Thailand

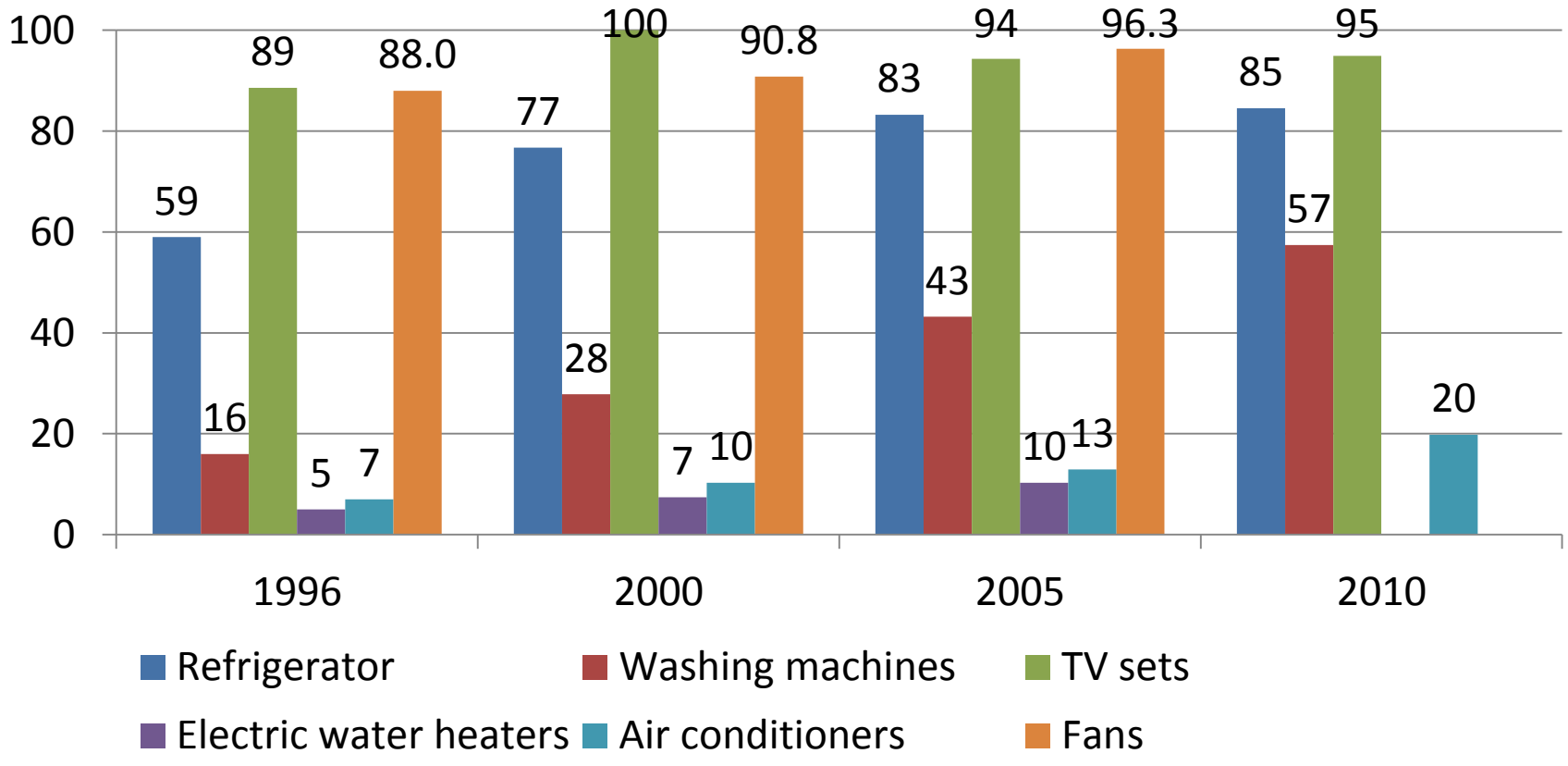
- Energy consumption decrease due to the fall in the firewood demand.
- Electricity consumption per household increases due to the growth in the number of electrical appliances



Source: based of data from DEDE and NSO

Equipment rates of households

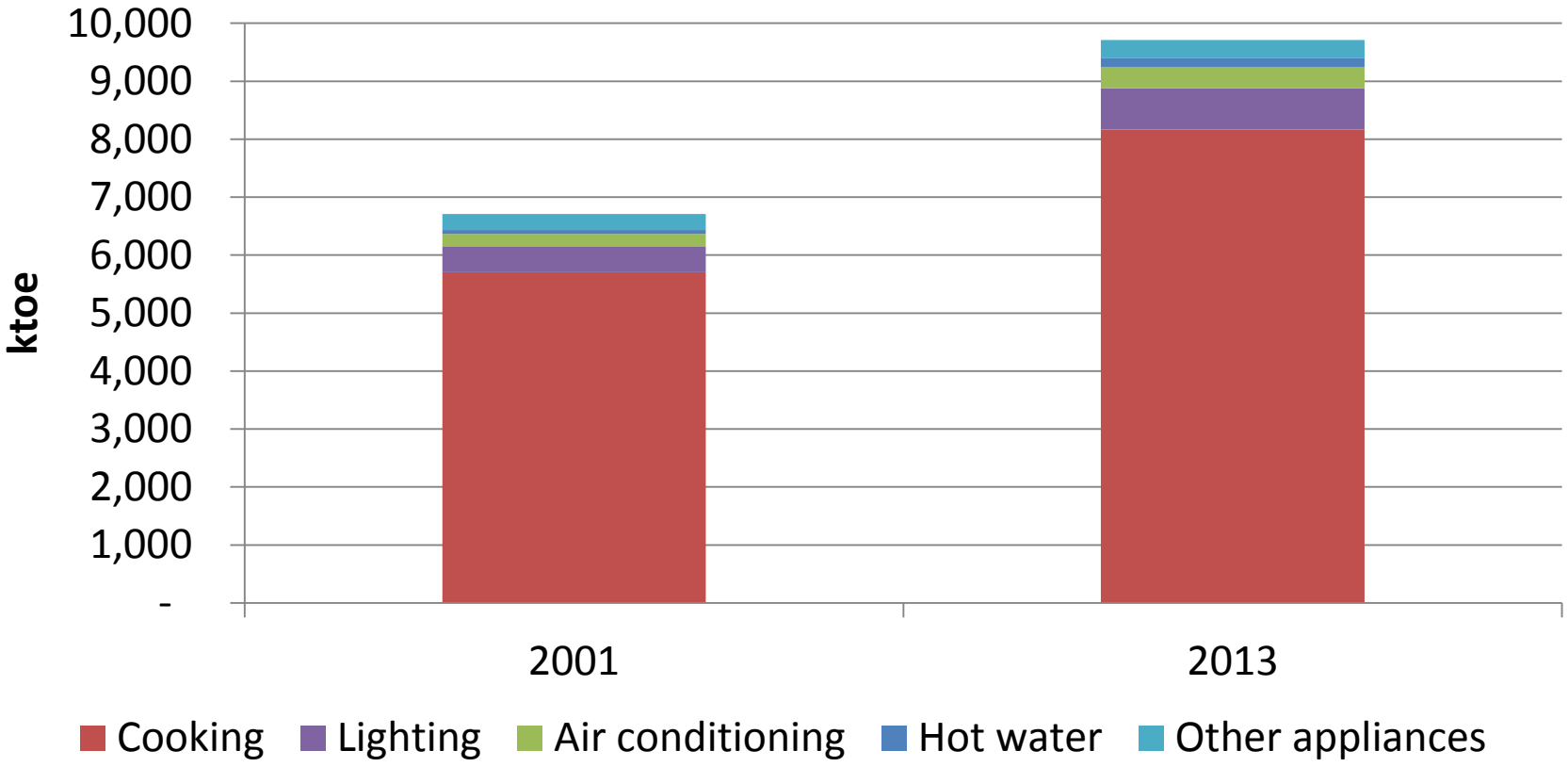
The ownership of household electrical appliances is increasing driving the electricity demand, especially refrigerators, AC and washing machines.



Source: NSO, The Population and Housing Census 2000, 2010, The 2005 – 2006 Survey of Population Change, Report on Housing Survey 1996

Share of Energy Consumption in Households by main end-use

- Cooking still represents a dominant share of household consumption (72% in 2013), but its role is declining with the growing share of other uses.
- High share of cooking due to the importance of biomass with low efficiency

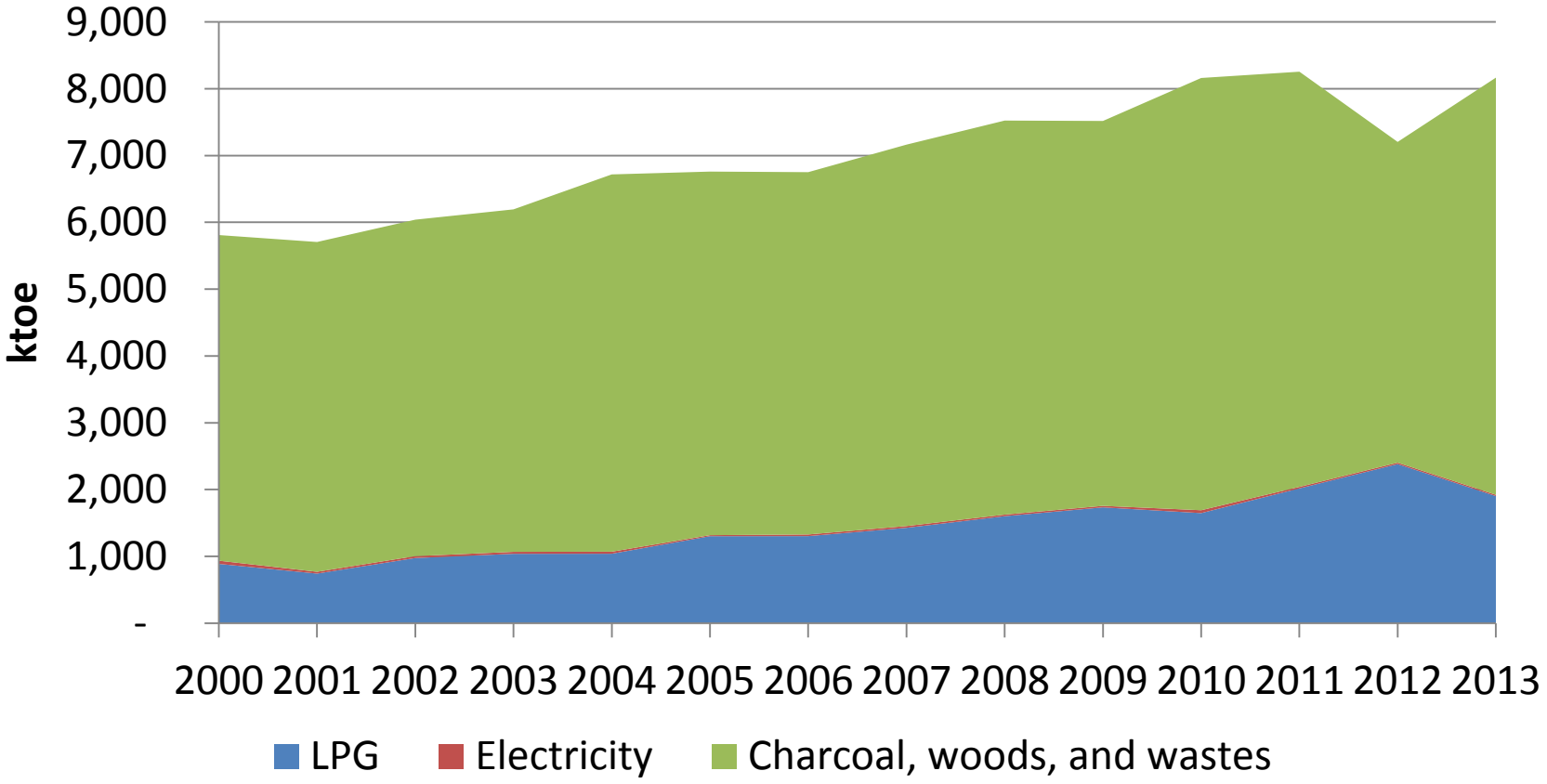


Source: estimated for the project based on equipment ownership for electricity and specific consumption per appliance assuming all fossil fuel used for cooking .

Consumption by fuel of households for cooking

•The main fuel of cooking is charcoal and woods and wastes. It is being replaced progressively by LPG, but at a slow rate.

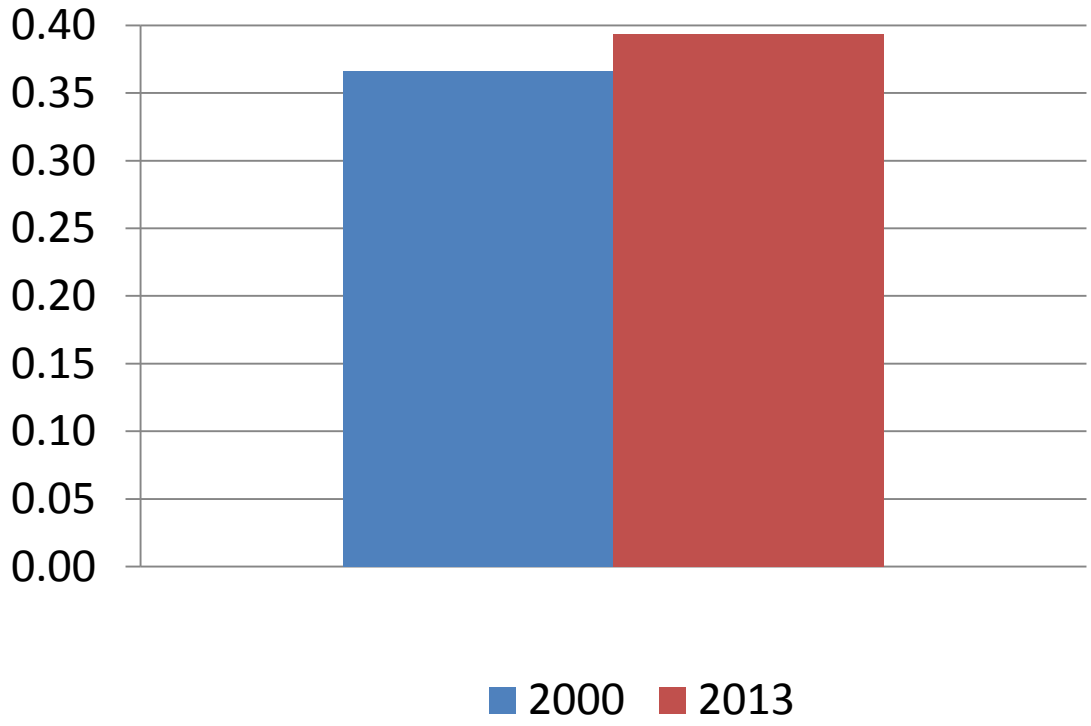
• The share of LPG increased from 15% in 2000 to 23% of cooking use in 2013 .



Specific energy consumption of households for cooking

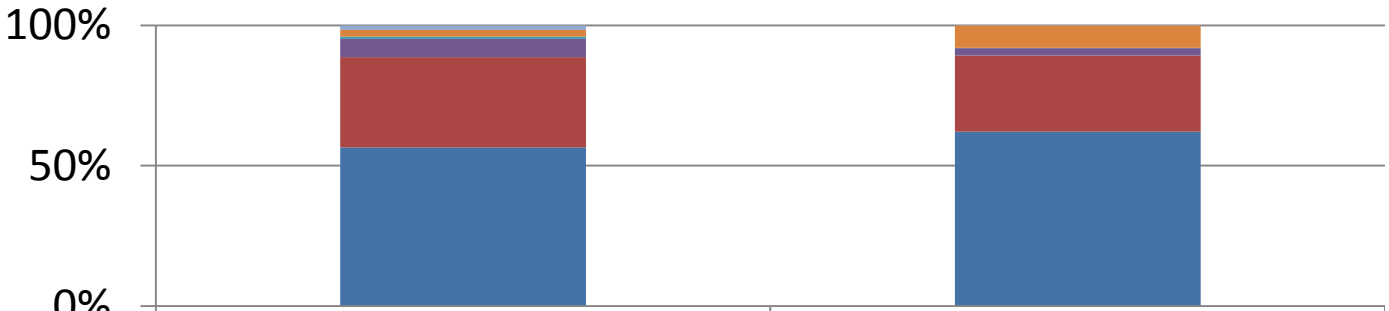
Specific energy consumption for cooking is slightly increasing despite the substitution of biomass by LPG that is more efficient .

Household specific energy consumption for cooking (toe/household) (Thailand)



Share of households by cooking fuel

Changes in the share of households by main cooking fuel, based on household surveys, show that people switch from using charcoal, woods and wastes to LPG.

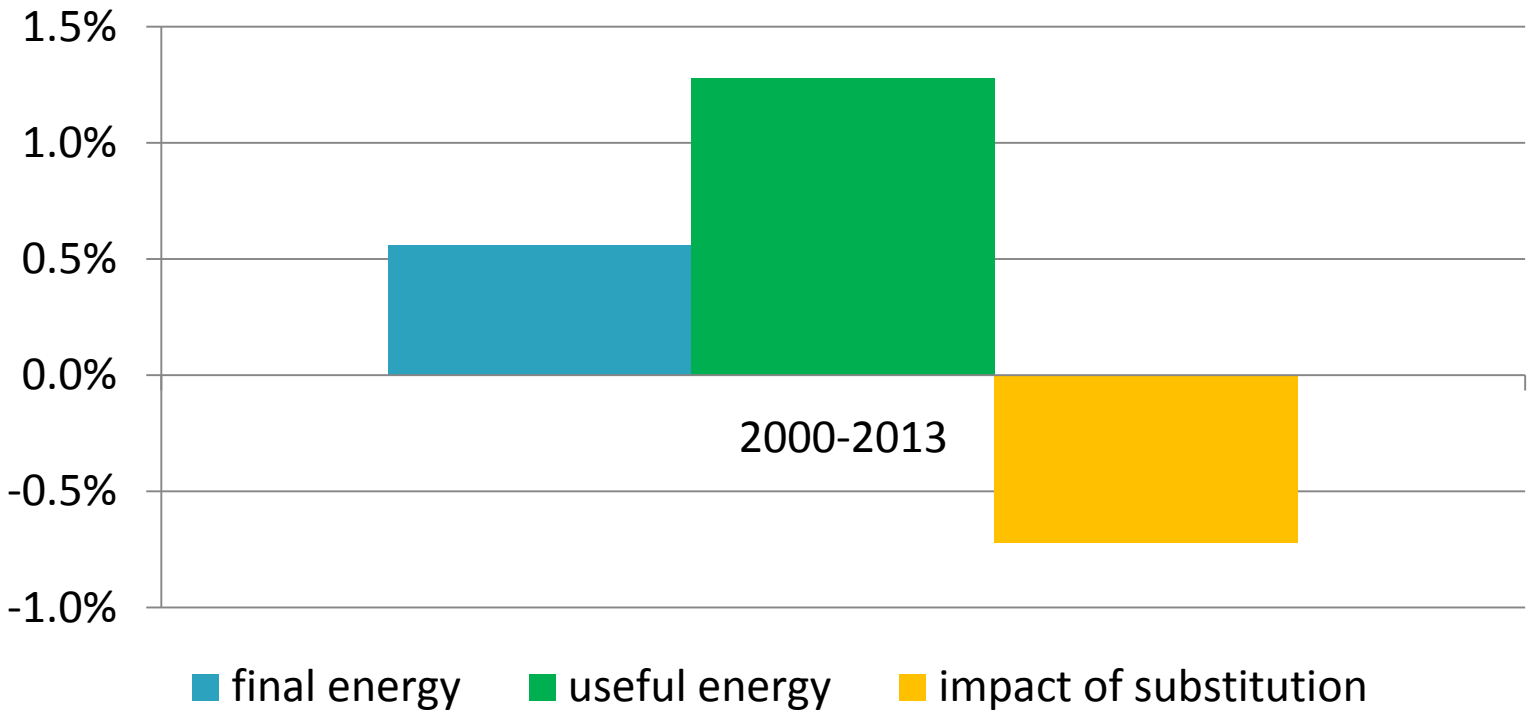


	2000	2011
Unknow	1.7	0.1
Not cooking	2.3	7.9
Other fuels	0.8	0.1
Electricity	6.5	2.7
Charcoal, woods and wastes	32.2	27.1
LPG	56.5	62.1

Source: NSO

Specific energy consumption of households for cooking: effect of substitution in Thailand

Over the period 2000-2013, substitution of LPG for biomass contributed to decrease the consumption per household by 0.7%/year ; this limited the increase in the consumption per household for cooking by the same amount. .



Substitution effect = difference in variation of final and useful energy; useful energy calculated by multiplying final energy by end-use efficiency (10% efficiency for wood,; 45% for LPG)

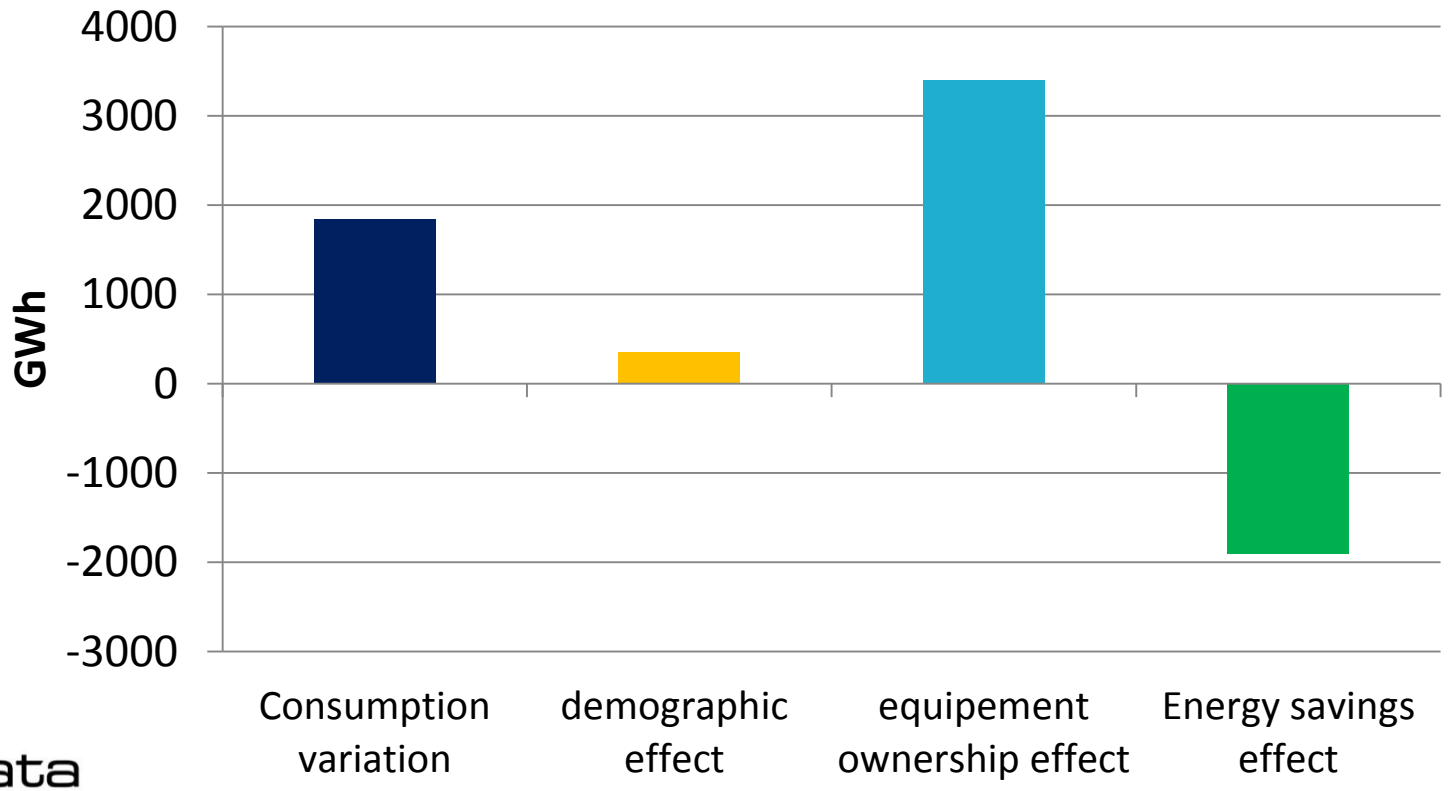
Drivers of the electricity consumption variation for AC

Between 2001 and 2013, the consumption of households for AC increased by around 1800 GWh.

Most of this variation is due to the increasing ownership of AC, from 11% to 24% of households; this would have increased consumption by 3400 GWh, all things being equal ("equipment ownership effect")

More efficient AC contributed to reduce consumption increase by 1900 GWh

Decomposition of the electricity consumption variation for AC between 2001 and 2013



Conclusions

- Some indicators are very powerful to explain the variations in the consumption and point out at the role of fuel substitution (as shown for cooking) or increased equipment ownership, as shown for AC.

- To better assess energy savings for households, data on specific consumption for the main electrical appliance or end-use should be monitored to consolidate this first assessment.

- Some adaptations of data are still necessary to well separate households and services (case of apartments)

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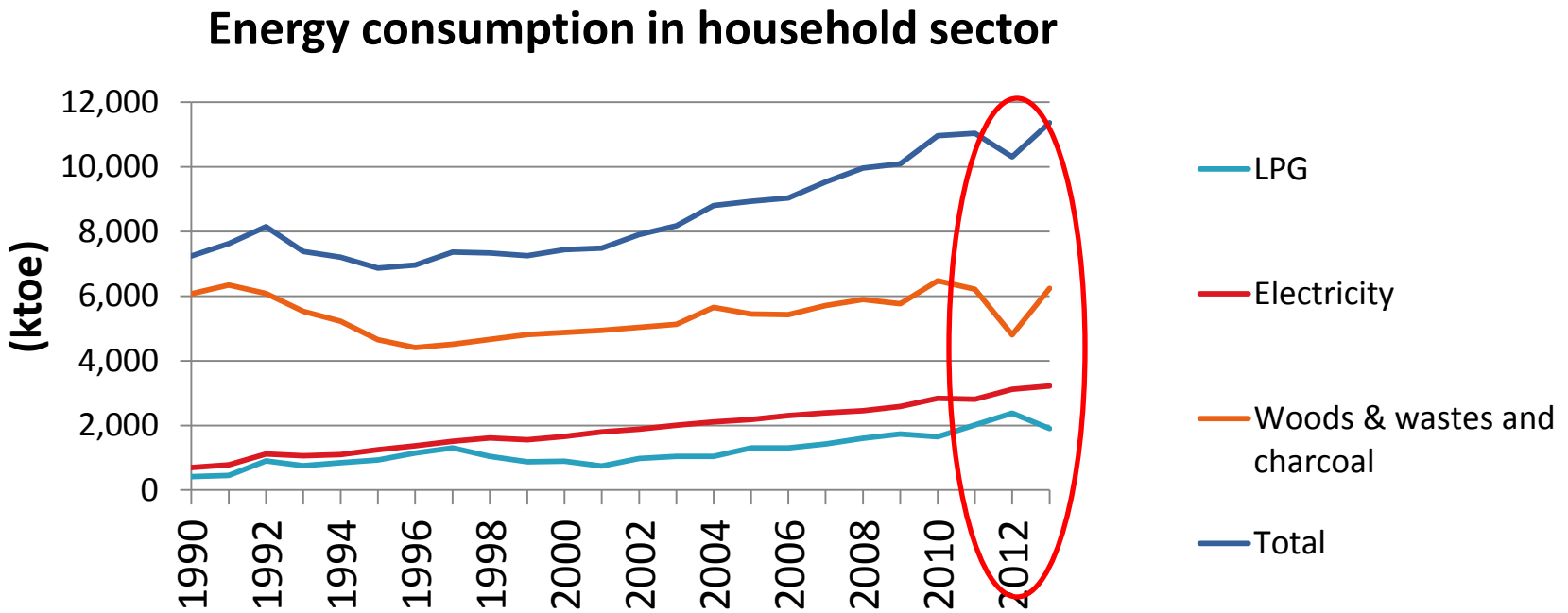
Energy Consumption in Households

- The share of wood, wastes and charcoal consumption in households sector is still dominant in total household energy consumption, although decreasing from 84% in 1990 to 55% of total consumption in 2013
- The shares of electricity and LPG are increasing continuously from 6% and 10% respectively in 1990 to 17% and 28% in 2013
- People shifted to convenient fuel such as LPG and electricity



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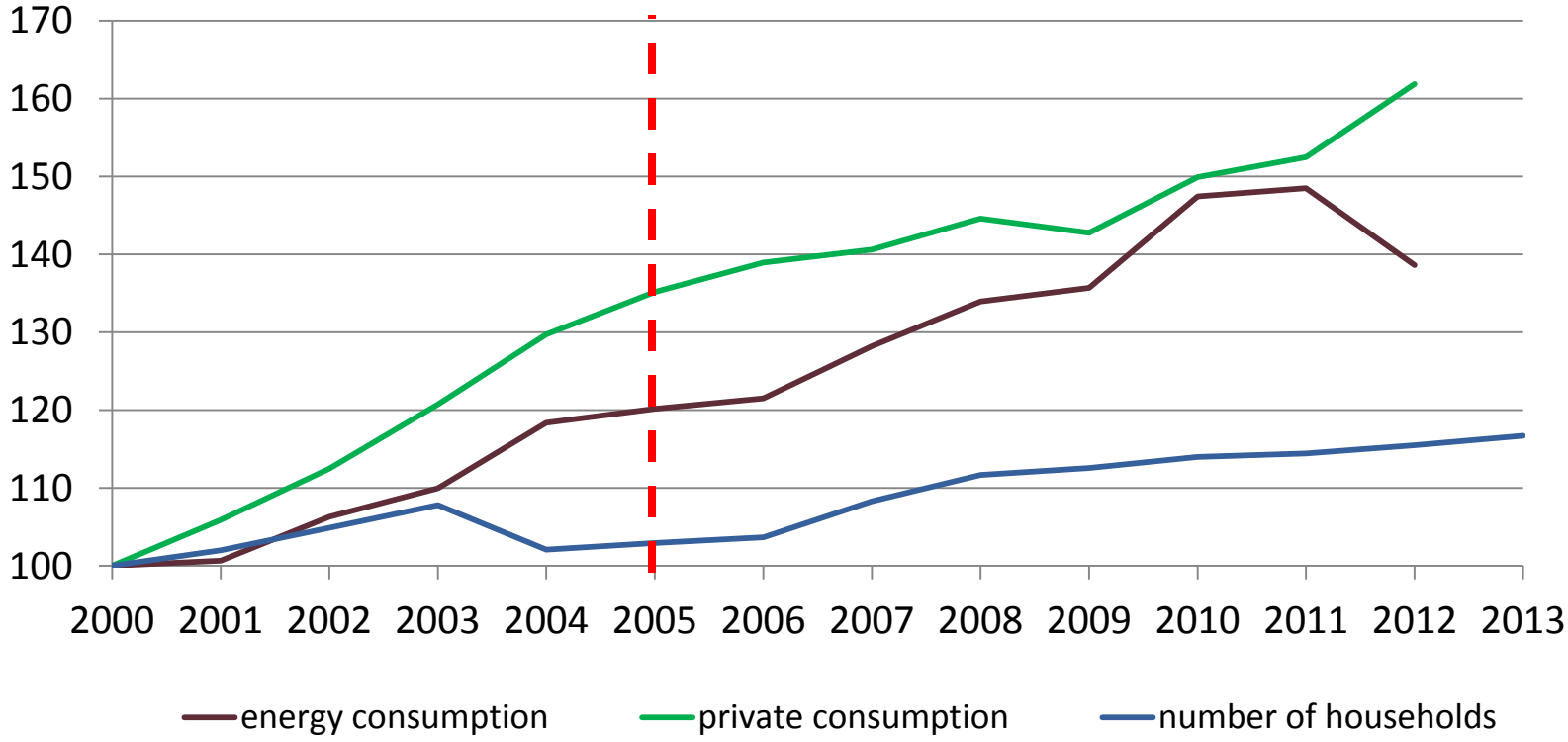
Trends in household energy consumption in Thailand and private consumption

Energy consumption trends, private consumption and number of households (2000=100, Thailand)



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Decomposition of the variation of the electricity consumption of appliances

- The objective of the decomposition of the electricity consumption variation of a given appliance (e.g. AC) between 2 years (e.g. 2001 and 2013) is to measure the effect of 3 factors:
  - Demographic effect : more households
  - Equipment ownership effect : impact of the increase in the number of appliances
  - Energy savings effect: influence of a decrease in the average specific consumption per appliance (kWh/year)

Decomposition of the variation of the electricity consumption of appliances : methodology

- Appliance consumption E= HH*TEQ*SEC

  With:

  E consumption of the appliance

  HH: number of households

  TEQ: equipment ownership ratio (% of households with the appliance)

  SEC: average specific consumption of the appliance (kWh/year)

- Calculation of electricity consumption variation between year 0 and t

  Demographic effect $=\Delta HH*TEQ_0*SEC_0$

  Equipment ownership effect: $HH_0*\Delta TEQ*SEC_0$

  Energy savings effect: $HH_t*TEQ_t*\Delta SEC$

  $E_t - E_0$= sum of 3 effects

Decomposition of the electricity consumption variation : example of AC

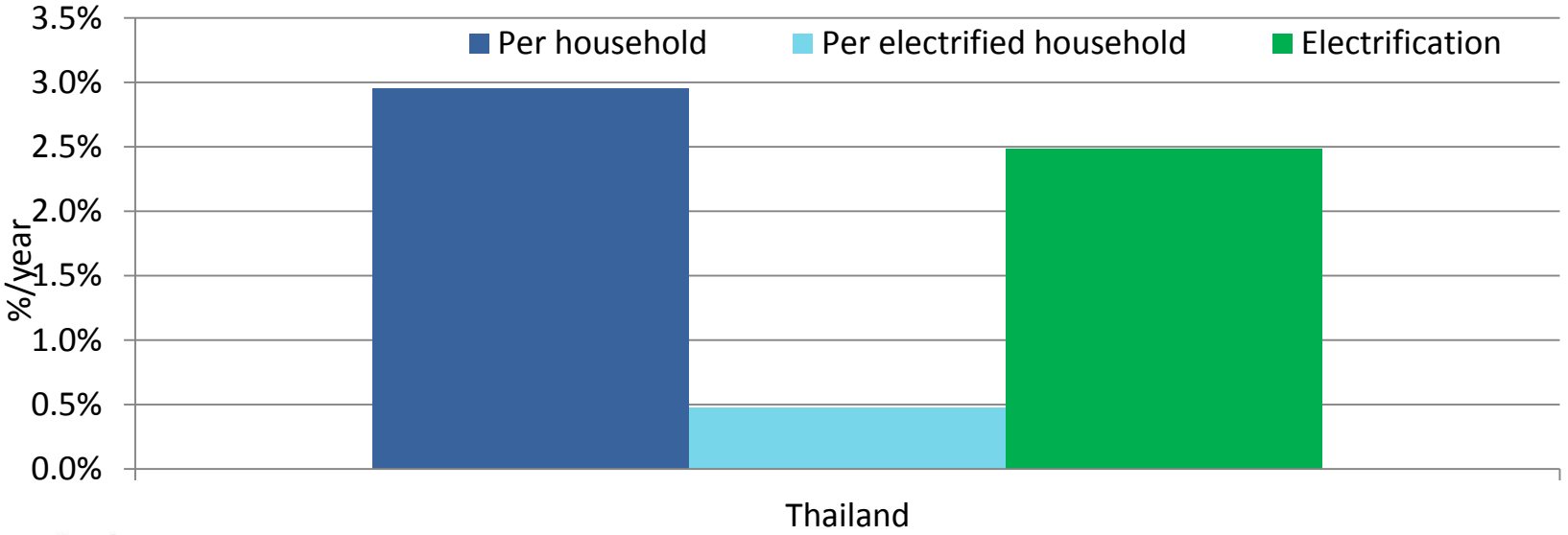
	Unite	2001	2013
Number of households	1000	17534	20076
% of households with AC	%	10.8	23.9
Specific consumption of AC	kWh	1290	893
Total consumption of AC	GWh	2448	4292

		2001-2013
Consumption of AC variation	GWh	1844
Effect of stock increase	GWh	3754
of which demographic effect	GWh	355
of which equipement ownership effect	GWh	3399

Specific electricity per household: effect of electrification

- Household electrification increased from 82 to 98% from 2004 to 2011
- Electricity consumption per electrified household increased less rapidly than per household, due to households electrification
- Households electrification explains 2/3 of the electricity consumption growth per household

Specific electricity consumption per household: effect of electrification in Thailand (2004-2011)



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