



# Importance of advanced energy efficiency indicators

*Taller “Cooperación técnica México-Francia: resultados en materia de eficiencia energética”*

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**FLACSO, Sede México**

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# Advanced energy efficiency indicators are required by policy-makers for a better interpretation of energy efficiency trends

*“Dear Didier,*

*In order to better understand progress towards energy efficiency, the Energy Efficiency Unit of the European Commission is organizing a dedicated expert workshop in Brussels on 25 May **to look into energy consumption trends in Europe in the latest years across sectors**. I would like to invite you to be a speaker in this workshop.*

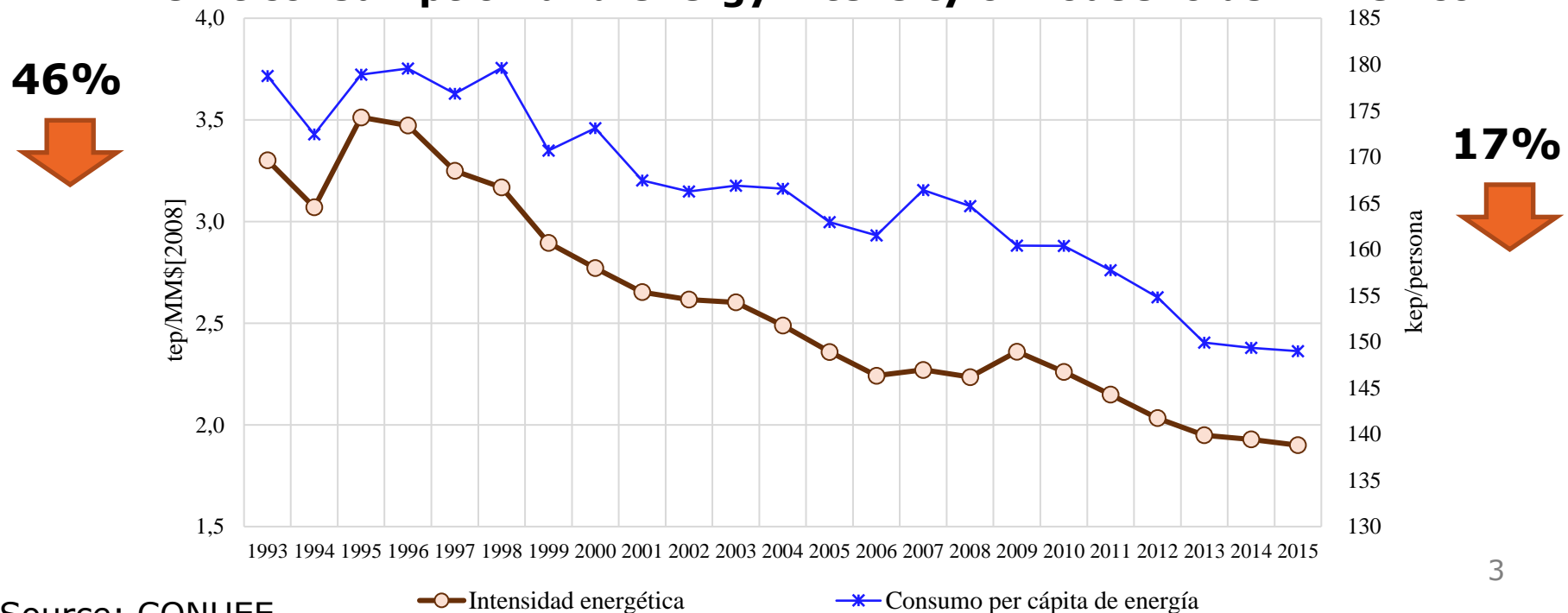
*We aim to gather experts with sectoral and national knowledge of **drivers for energy demand and energy efficiency**. We thought that you could contribute with a presentation focusing on the analysis of **recent trends in energy consumption specifically for France**. We have also contracted a rapporteur to prepare a report based on the input from the experts participating in the workshop and the relevant literature.”*

*Paul Hobson, Head of the energy efficiency division  
DGENER European Commission*

# What are energy efficiency indicators?

- Energy efficiency indicators have been developed to assess energy efficiency progress and monitor the effect of policies.
- The most common indicators relate the energy consumption to indicators of economic activity, either measured in physical values (e.g. kWh/m<sup>2</sup>, kWh/refrigerator for households, km/l for cars, or toe/t in industry) or in monetary values → indicators of **specific or unit consumption** or **energy intensities**.

### Unit consumption and energy intensity of households in Mexico



# From simple indicators to advanced indicators

- Usual energy efficiency indicators are useful to describe trends, but cannot answer all questions raised by energy efficiency monitoring.
- To answer to more questions and enrich the interpretation, these indicators need to be complemented with additional indicators, the so-called “advanced indicators”.
- These indicators have been first introduced in Europe and have been adapted to Mexico in the framework of a cooperation project between AFD, ADEME and CONUEE with the technical assistance of Enerdata.
- These indicators **do not need additional data**: they just start from the same data as the usual indicators but include additional calculations.

# Six types of advanced energy efficiency indicators

1. **Energy efficiency index** to measure EE improvements at sector and overall levels.
2. **Energy savings** to quantify the amount of energy saved over a period or for given year .
3. **Financial indicators** to show the financial benefit of energy savings for households or industrial consumers.
4. **Benchmarking indicators** to assess how each country performs compared to other countries?
5. **Decomposition of energy consumption variation** to show how energy efficiency improvements have impacted the energy consumption of the country?
6. **Avoided CO2 emissions** to show what is the effect of energy efficiency improvement on CO2 emissions.

# Energy efficiency indicators require an effort in terms of data collection but have multiple applications

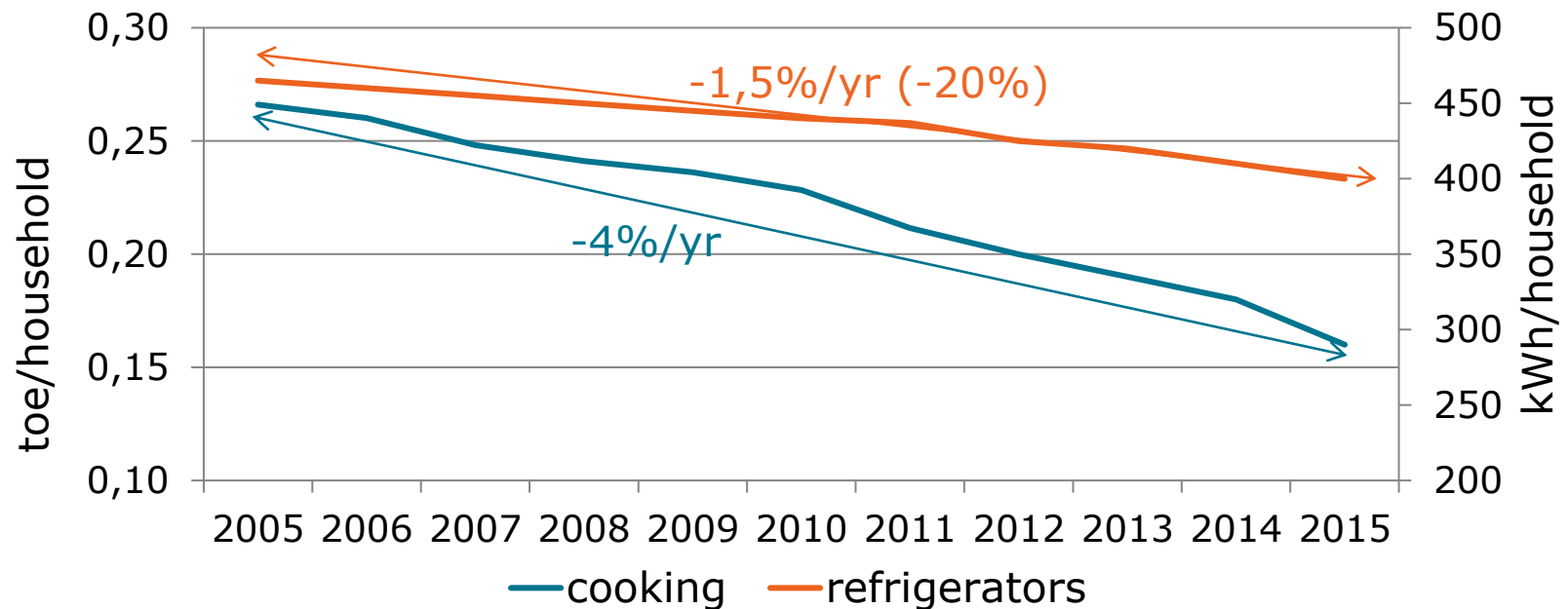


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- **Energy efficiency index**
- Energy savings
- Decomposition of energy consumption variation
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- Benchmarking indicators
- Avoided CO<sub>2</sub> emissions

# How to measure energy efficiency progress at sector level from all detailed indicators?

- For households, we may find different energy efficiency trends, for different end-uses: for instance 1.5%/yr for refrigerators and 4%/yr for cooking.



- The question now is: **what is the overall energy efficiency progress for households?** Or in other words, how to combine the different assessments of energy efficiency progress by end-use to get one trend for the whole sector.
- This is the objective of the **energy efficiency index**.

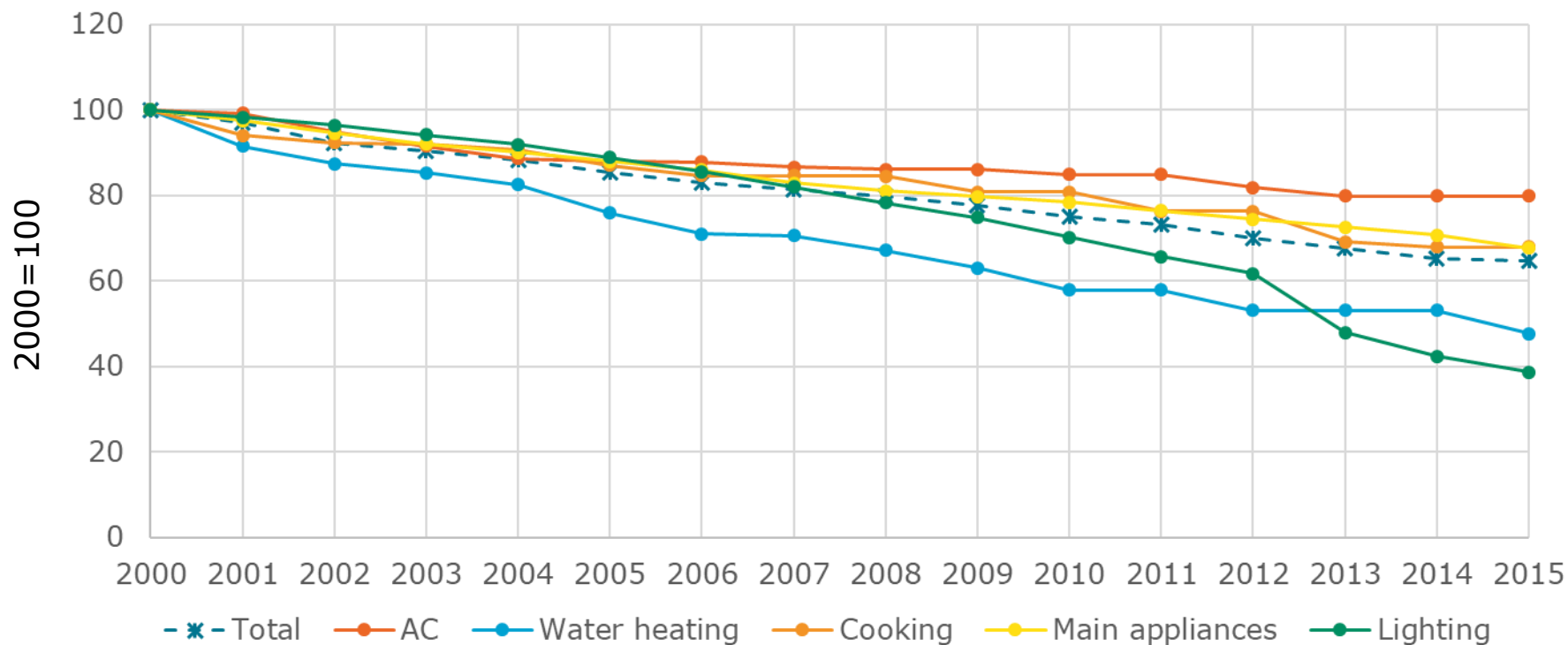


# ODEX households in Mexico: results

The energy efficiency of households in Mexico improved sharply between 2000 and 2015 (by 2.9%/year on average), as measured by technical energy efficiency index.

Greater energy efficiency progress was achieved for water heating and lighting (by 4.8%/year and 6.1%/year respectively).

Technical ODEX in households sector



Source: project CONUEE/AFD/ADEME; calculation carried out at the level of 8 end-uses: air conditioning, water heating, cooking, refrigerators, TV, washing machine and lighting.

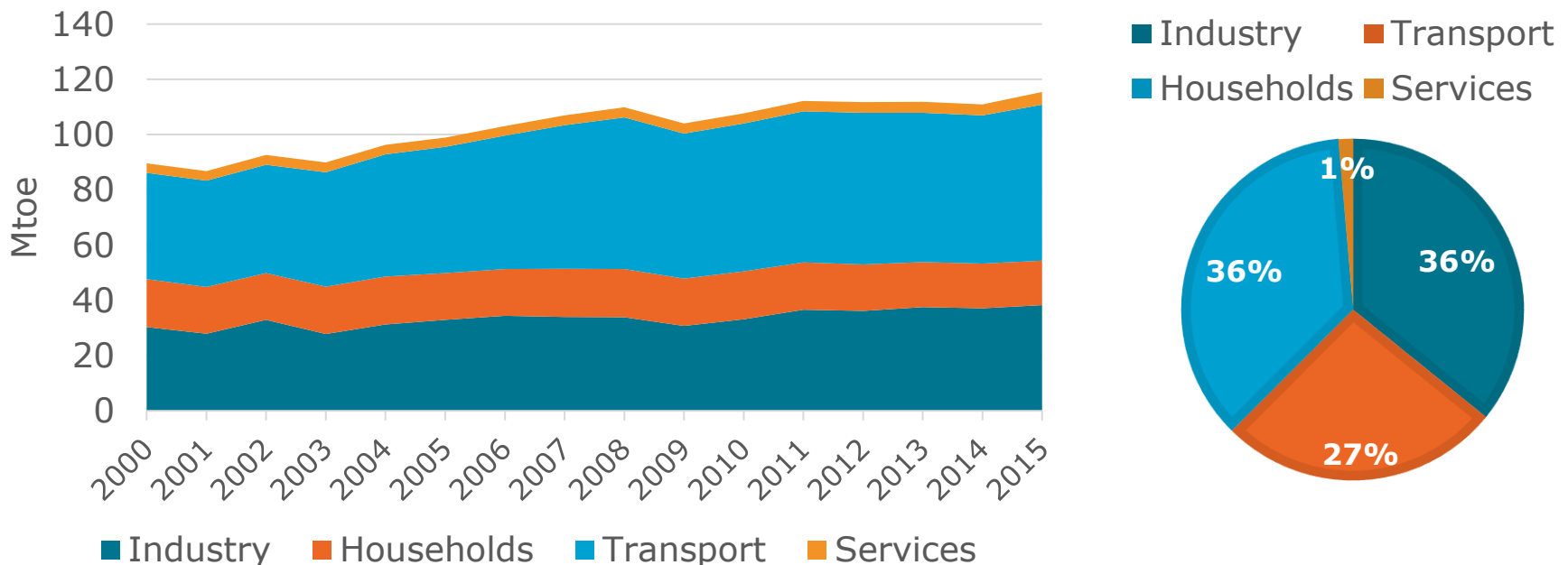
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# Total annual final energy savings for Mexico

- Around 20 Mtoe energy savings in 2015 compared to 2000 (i.e. 17% of final energy consumption).
- Most of these savings come from households and industry (36% each), 27% from transport and 1% from services.

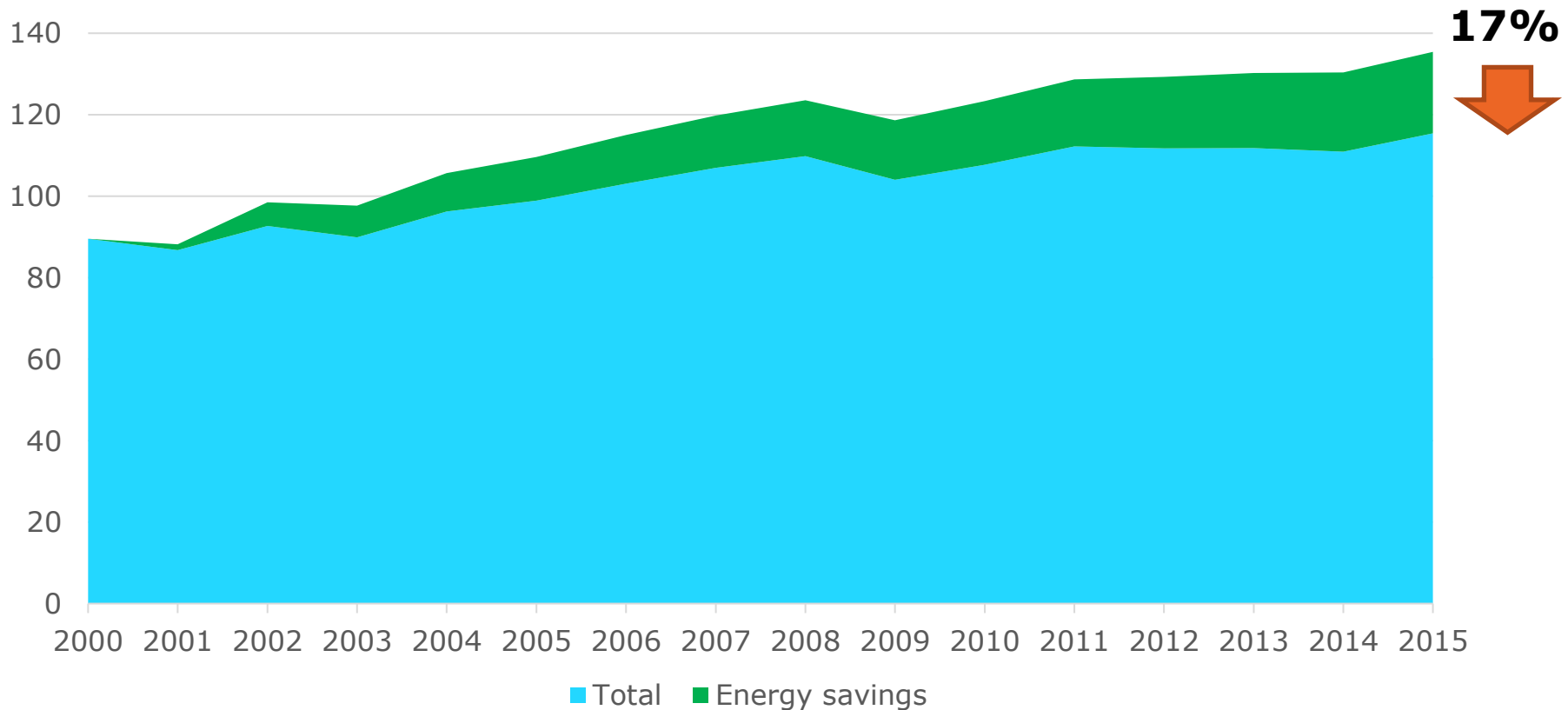
## Annual energy savings for all final consumers compared to 2000\*



# Energy savings vs final energy consumption for Mexico

Without the energy savings the final energy consumption would have been 17% higher in 2015.

Energy savings and final energy consumption



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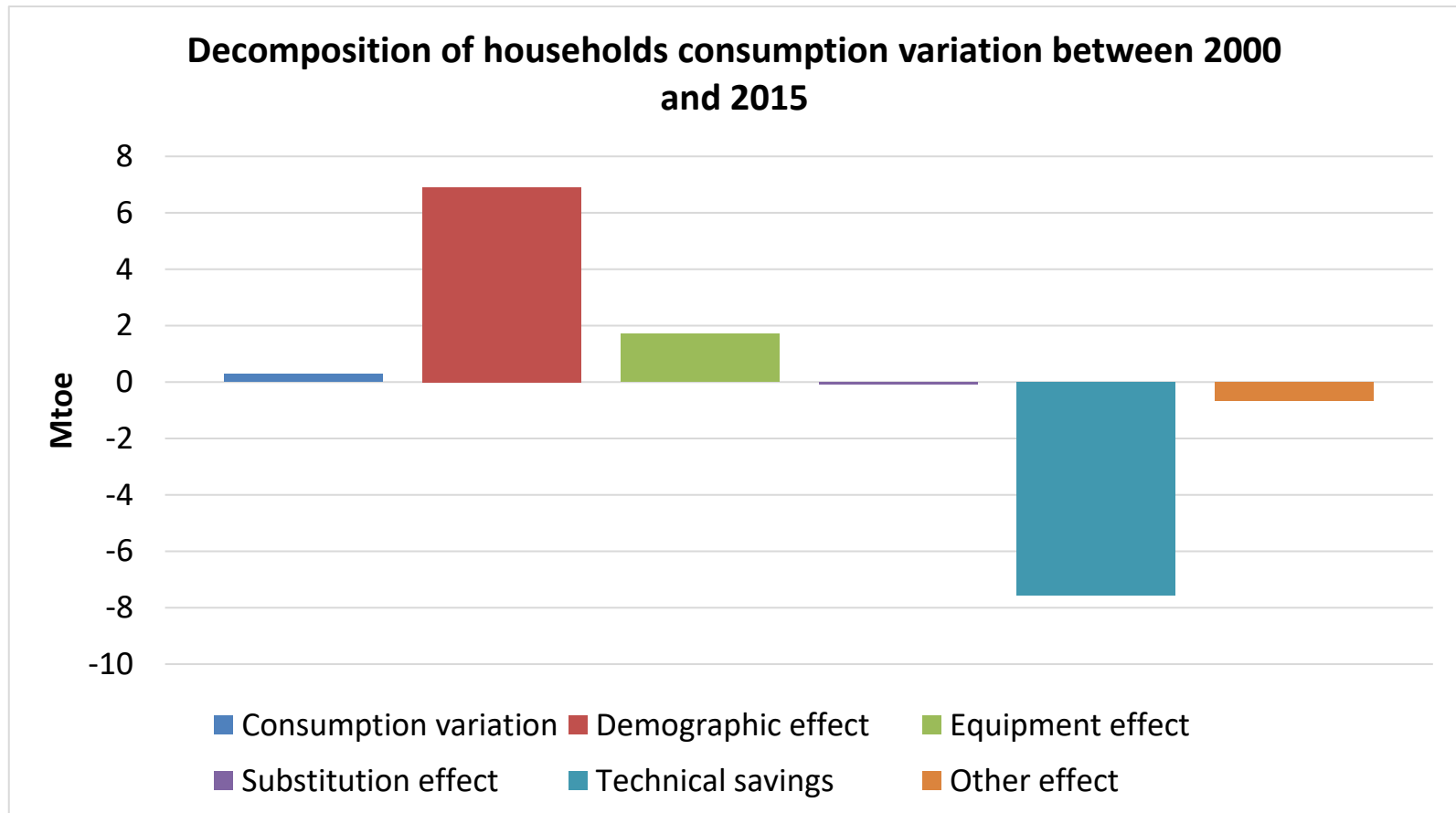
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# Decomposition of energy consumption : objectives

- The objective of the decomposition analysis of the energy consumption is to show how different factors contribute to explain the energy consumption variation over a given period.
- The method is first applied at the level of end-uses and sub-sectors, and then by aggregation at the level of the different sectors (industry, transport, households and tertiary), the total final consumption, the power sector and finally the primary energy consumption.
- In each case what will change are the types of explanatory factors, the so called "effects", although two main effects will be identified in each case:
  - an activity effect, showing the impact of economic growth
  - an energy savings effect coming from efficiency improvements for the different sub- sectors and end-uses.

# Decomposition of the energy consumption variation for households: case of Mexico (2000-2015)

Energy consumption of households sector was only slightly higher in 2015 than in 2000 (+0.3 Mtoe). This trend is due to the fact that the increase in the number of households (6.9 Mtoe) and equipment effect (+1.7 Mtoe) were almost balanced by technical savings (-7.6 Mtoe). Substitution effect is close to 0.



Source: project CONUEE/AFD/ADEME

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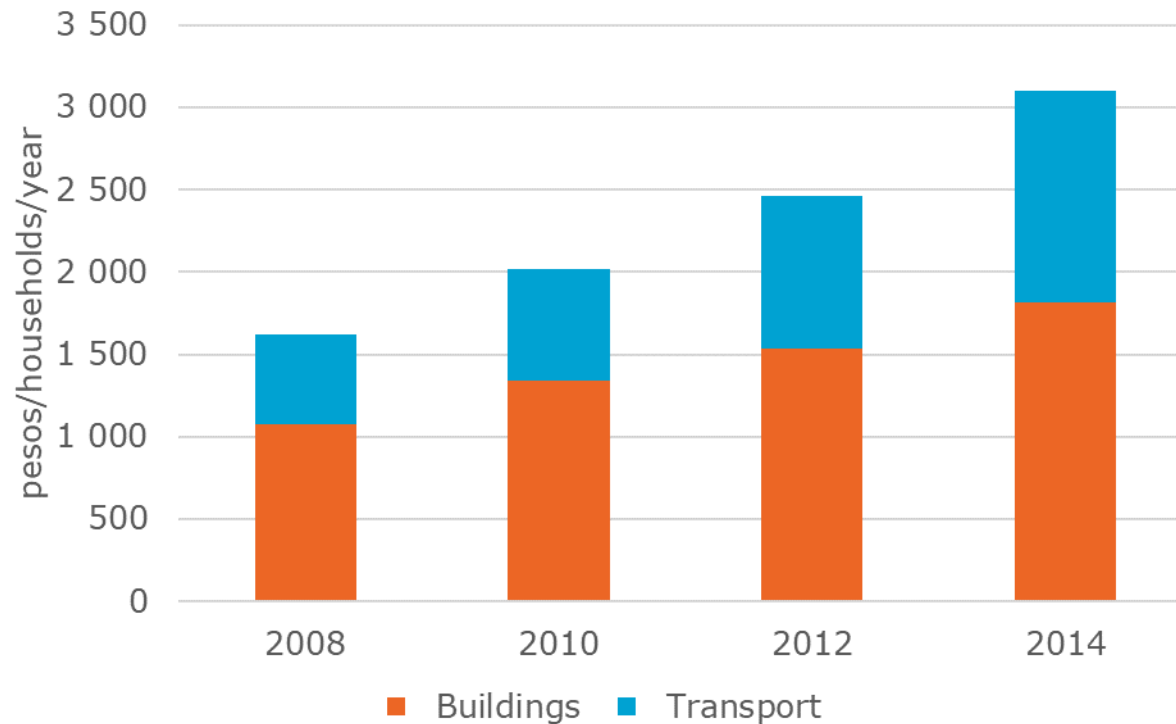
# Objective of the financial indicators

- The aim is to assess the financial impacts of energy efficiency improvements in Mexico.
- The principle is to convert energy savings in monetary terms, using average energy price data.
- Such indicators are calculated for households, taking into account the energy savings in their homes (i.e. savings in the household sector) and in the use of their cars, due to more efficient appliances and cars.
- They are also calculated in industry taking into account energy savings in the various industrial branches.

# Financial indicators for households

The energy savings in dwellings and cars since 2000 led to an increase in disposable income of around 3 000 pesos per year per households in 2014, i.e. a 2.4% increase in 2014 .

## Annual increase in disposable income per household in Mexico due to energy efficiency\*



Source: project CONUEE/AFD/ADEME

\* Equal the monetary savings per household (savings by fuel \* average energy prices).

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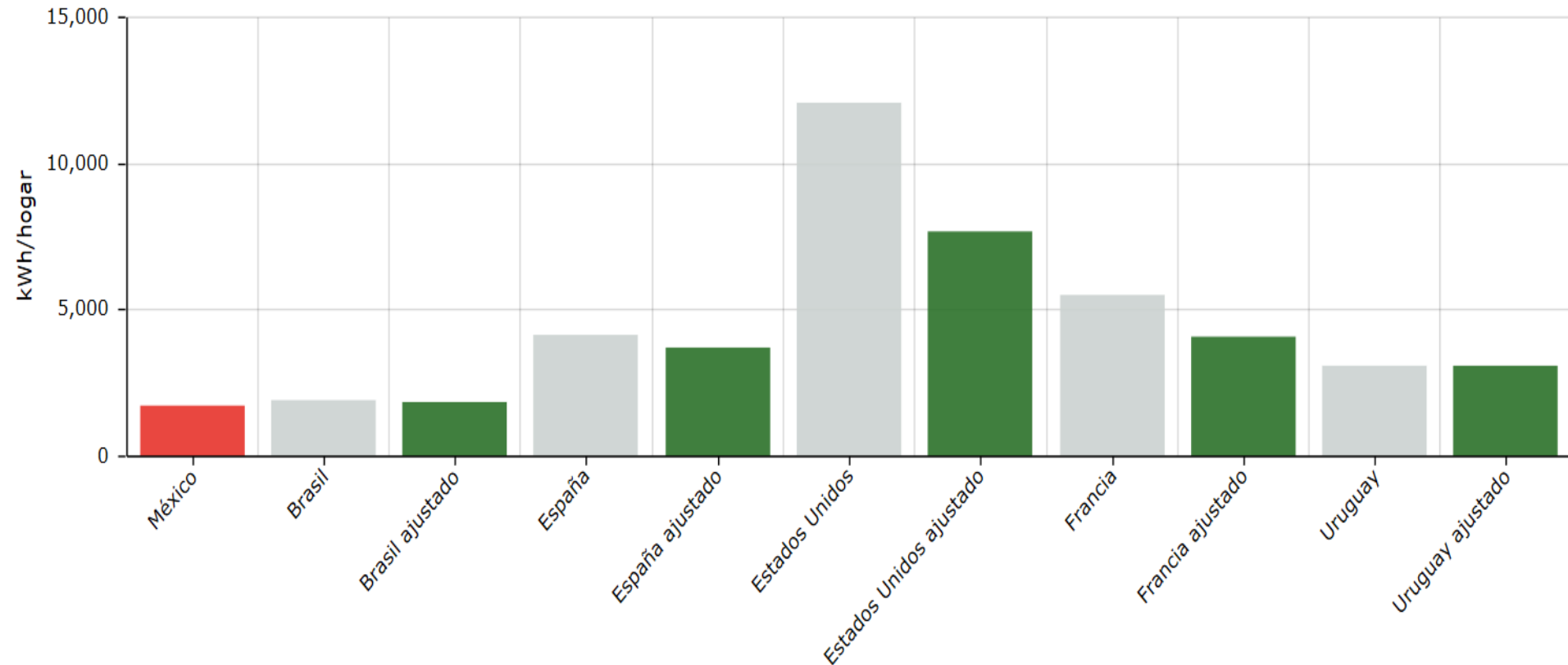
# Benchmarking indicators: objectives

- Benchmarking of indicators is important to see how each country compares to others in energy efficiency performances. Such comparisons somehow give an idea of energy efficiency potential when comparing with best practices.
- To be meaningful such comparison should take into account the national characteristics in terms of **prices** (ppp), **climate**, **economic and industry specialisation**, **process mix**, **fuel mix** (especially for households and power mix), **lifestyles** (equipment ownership for households appliances and cars).
- Comparisons have to be made with “**adjusted indicators**”

# For households, Mexico perform very well



## Electricity consumption per household: actual values and adjusted values to the climate and level of equipment of Mexico



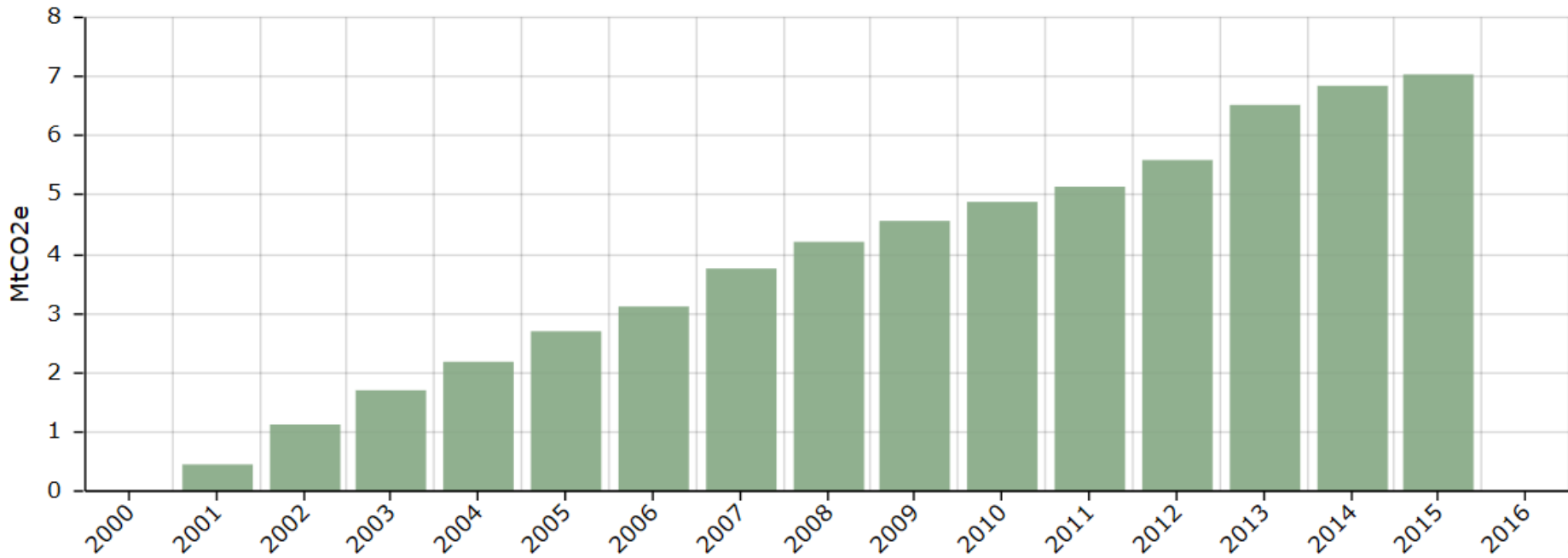
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- **Avoided CO<sub>2</sub> emissions**

# Avoided CO<sub>2</sub> emissions due to energy savings

Energy savings for households avoided 7 Mt of CO<sub>2</sub> emissions in 2015. These emissions include **direct** emissions at household level and **indirect** emissions for power generation, which represents the majority of the avoided emissions as energy savings are mainly coming from electricity

## Annual avoided CO<sub>2</sub> emissions from energy savings for households in Mexico



# Conclusions

- Because energy efficiency policies are designed at a detailed level (technologies, end-uses), a comprehensive monitoring system of energy efficiency should rely on a large set of complementary indicators (i.e. around 100 for Mexico).
- The classical indicators (energy intensities, unit consumption) are purely descriptive. They should be complemented by explanatory indicators aiming at a better understanding of energy efficiency trends. This is the role of **advanced indicators**.
- 
- These « advanced indicators » are broadly implemented at international or national levels.
- Because they rely on specific calculations, discussion on harmonization of methodologies are still continuing. An **ISO standard (500047)** is currently under negotiation to fix these methodologies in an harmonized way.
- Mexico is one of the best practice in Latin America in deploying advanced indicators