

Recent energy efficiency trends in LACs

Synthesis of results from The BIEE project

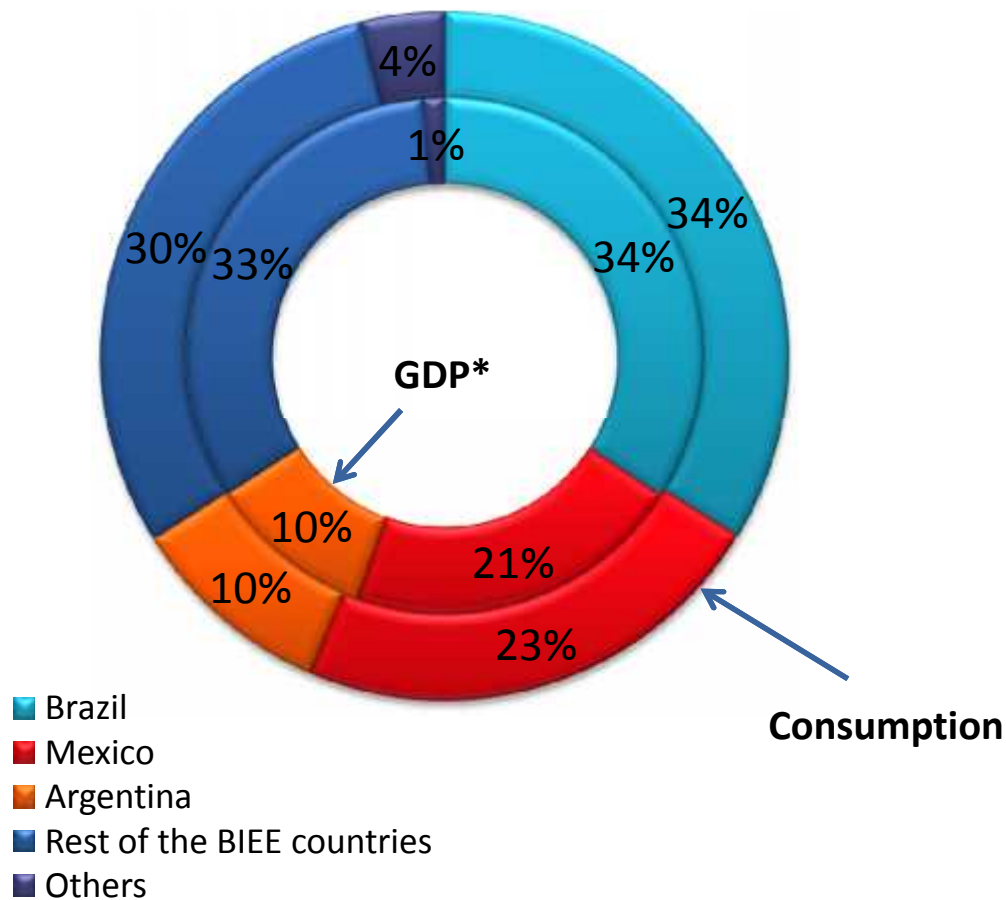
Dr Didier Bosseboeuf (ADEME, France)

Bruno Lapillonne, Scientific Director, Enerdata

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- ▶ 1. **Macro**
- 2. Power sector
- 3. Households
- 4. Transport
- 5. Industry
- 6. Services
- 7. Agriculture

GDP and energy consumption

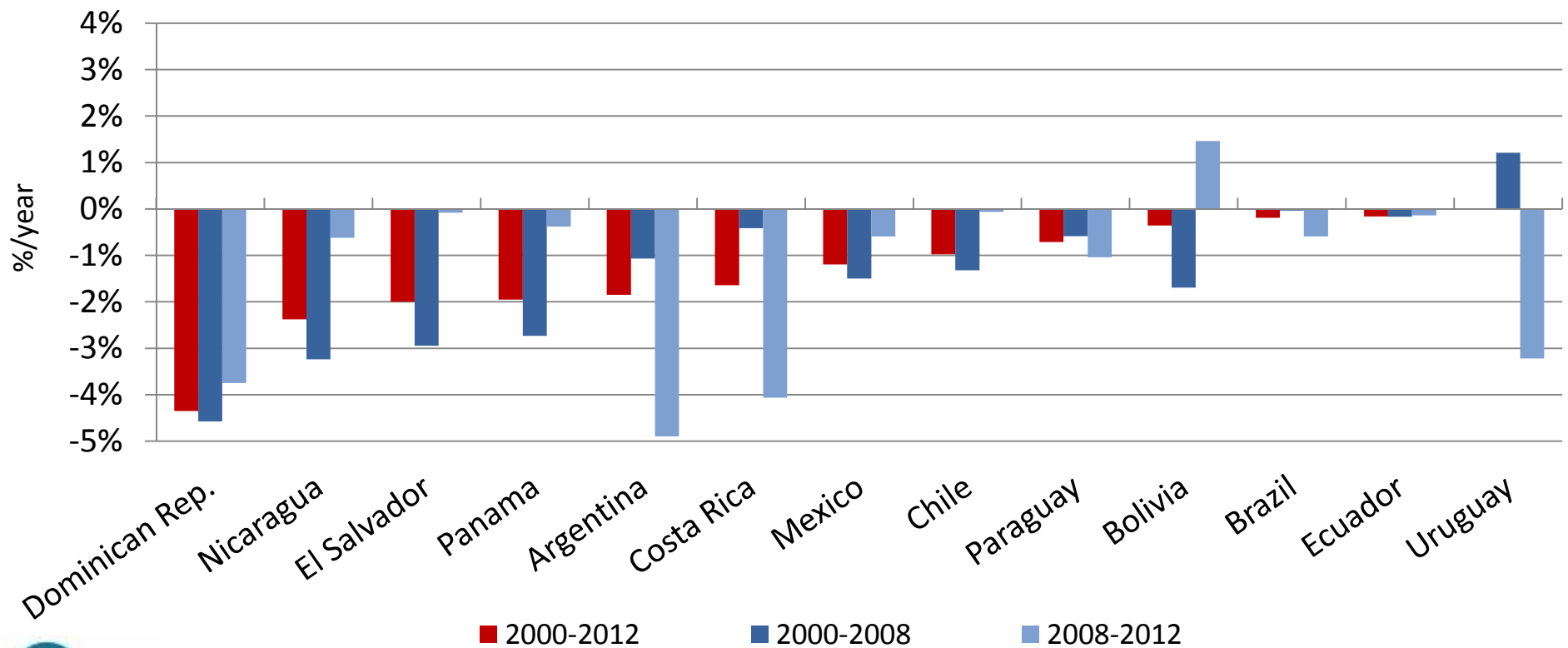


*GDP in purchasing power parities

- BIEE countries accounts for 96% of the consumption of Latin American countries (around 800 Mtoe in 2012) and around 99% of the GDP of the region.
- Brazil, Mexico and Argentina represents around 2/3 of the energy consumption of the region (respectively 34%, 23% and 10% in 2012).

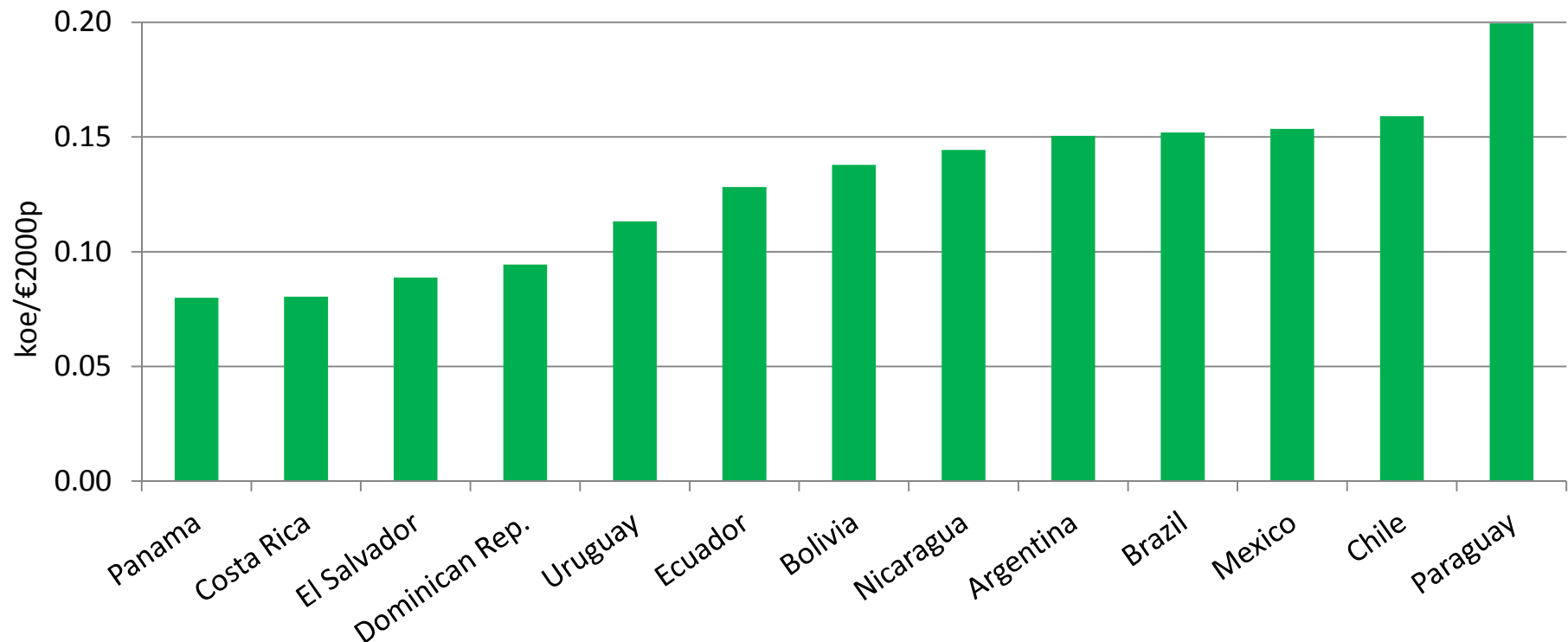
- The primary energy intensity has been decreasing in all countries
- The reduction has been particularly rapid in the Dominican Republic, Nicaragua, El Salvador and Panama.
- The reduction was on the other hand quite moderate in Brazil, Ecuador and Uruguay.
- The reduction has been faster since 2008 in Argentina, Costa Rica, Brazil and Uruguay.

Primary energy intensity trends (%/year)



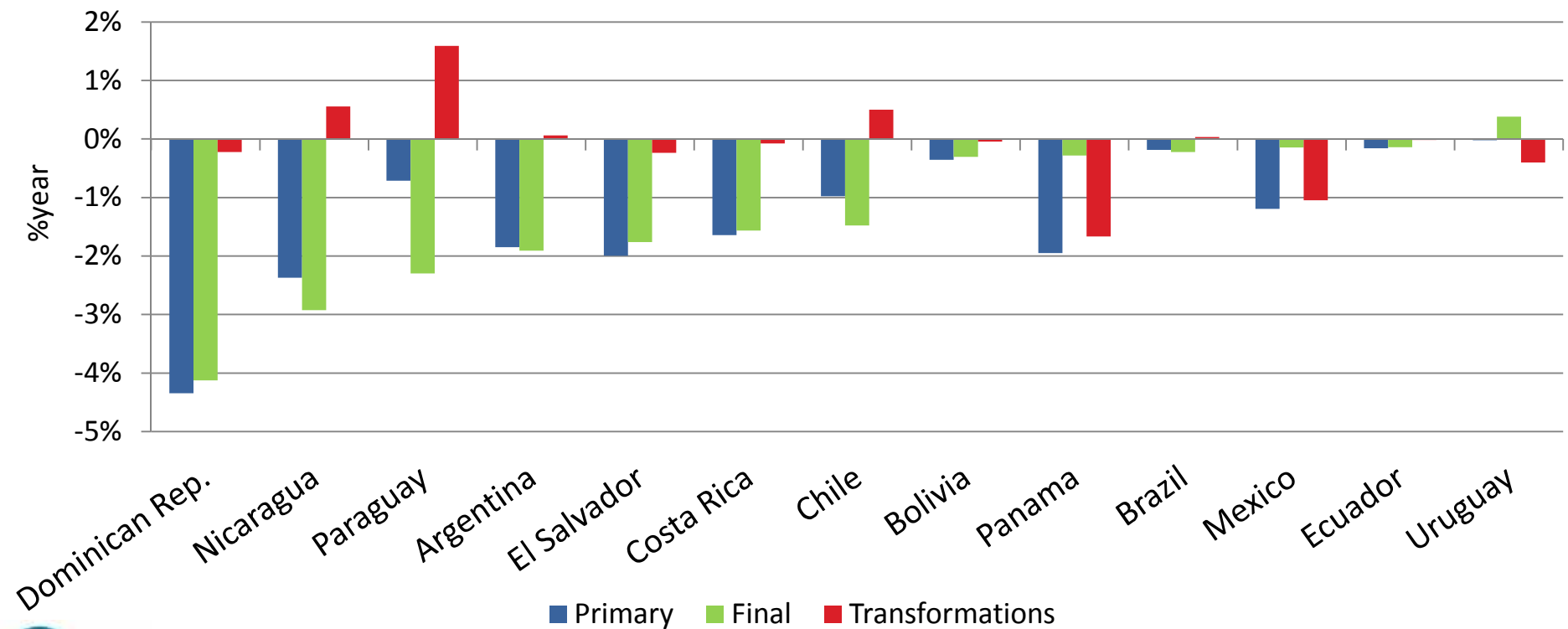
- Paraguay, that is a large user of biomass with a low efficiency, has the highest energy intensities at ppp.
- It is followed by Chile, Mexico and Brazil, that have a large energy intensive industrial sector.
- Panama and Costa Rica are the countries with the lowest primary energy intensity

Primary intensity at purchasing power parities (ppp) (2012)

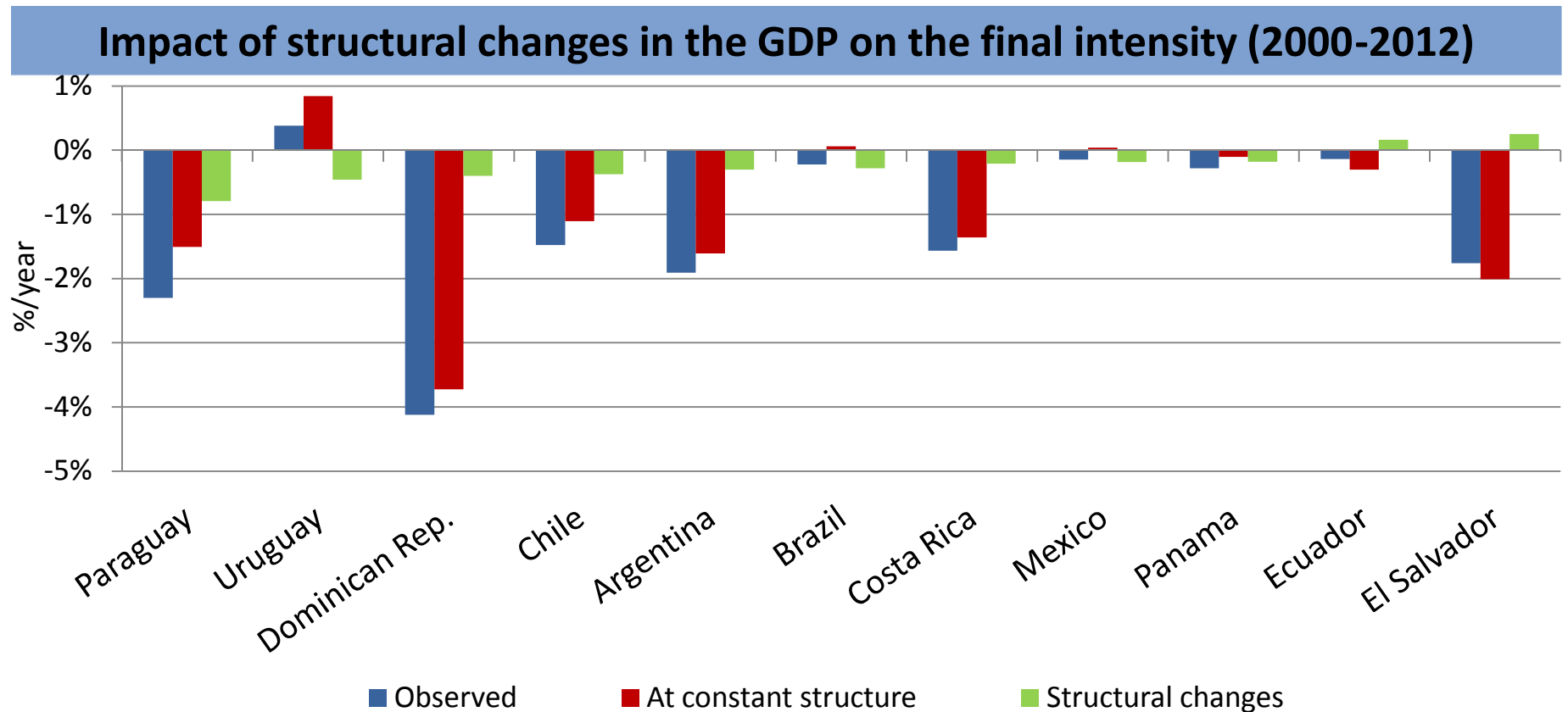


- Final intensity is decreasing in most countries, with a rather rapid reduction in Dominican Republic (by 4%/year), Nicaragua and Paraguay (over 2%/year)
- On the opposite, it has been increasing slightly in Uruguay
- In Nicaragua, Paraguay, and Chile, the final intensity decreased more rapidly than the primary intensity: energy productivity improved faster for final consumers, due to increased losses in power generation (linked to changes in power mix and to the rapid growth of electricity demand at end-use level).
- For Panama, Mexico and, to a lesser extent Uruguay, this was the reverse.

Trends in primary and final energy intensity (2000-2012)

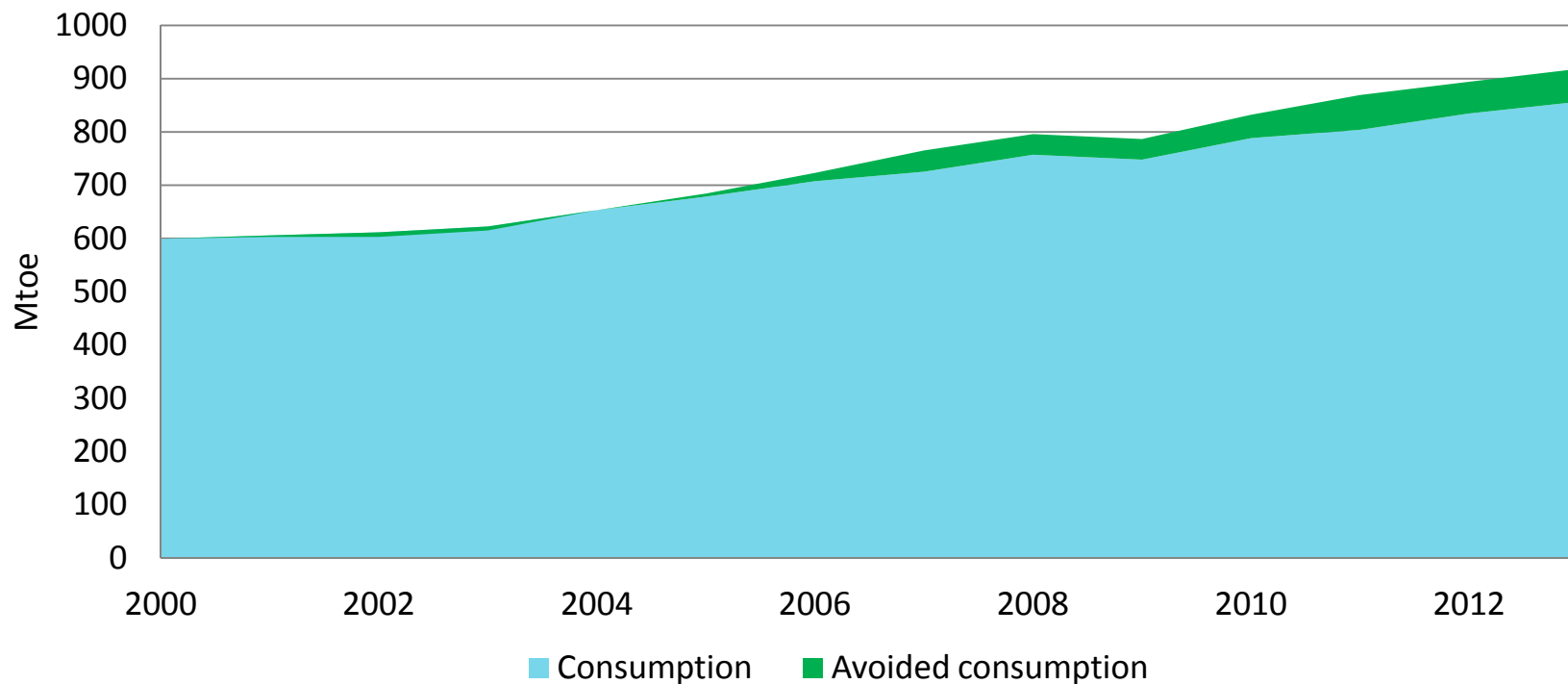


- In Argentina, Costa Rica, Mexico, Uruguay and Chile structural changes in the GDP to less energy intensive sectors (mainly services) contributed to decrease the final energy intensity. The share of services in the GDP increased by 5 points in Costa Rica and Chile and by 4 points in Mexico between 2000 and 2012.
- In Paragua, 2/3 of the decrease in the final intensity is explained by structural changes; Brazil almost all the gains are due to structural changes.
- In Ecuador and El Salvador there was a reverse trend, with structural changes contributing to raise the final intensity.



- The avoided primary energy consumption, due the decrease in the primary energy intensity, reached 62 Mtoe in 2013, which represents 7% of the primary energy consumption.
- **This is somehow less important than in other world region.**
- This avoided consumption is mainly visible since 2004.

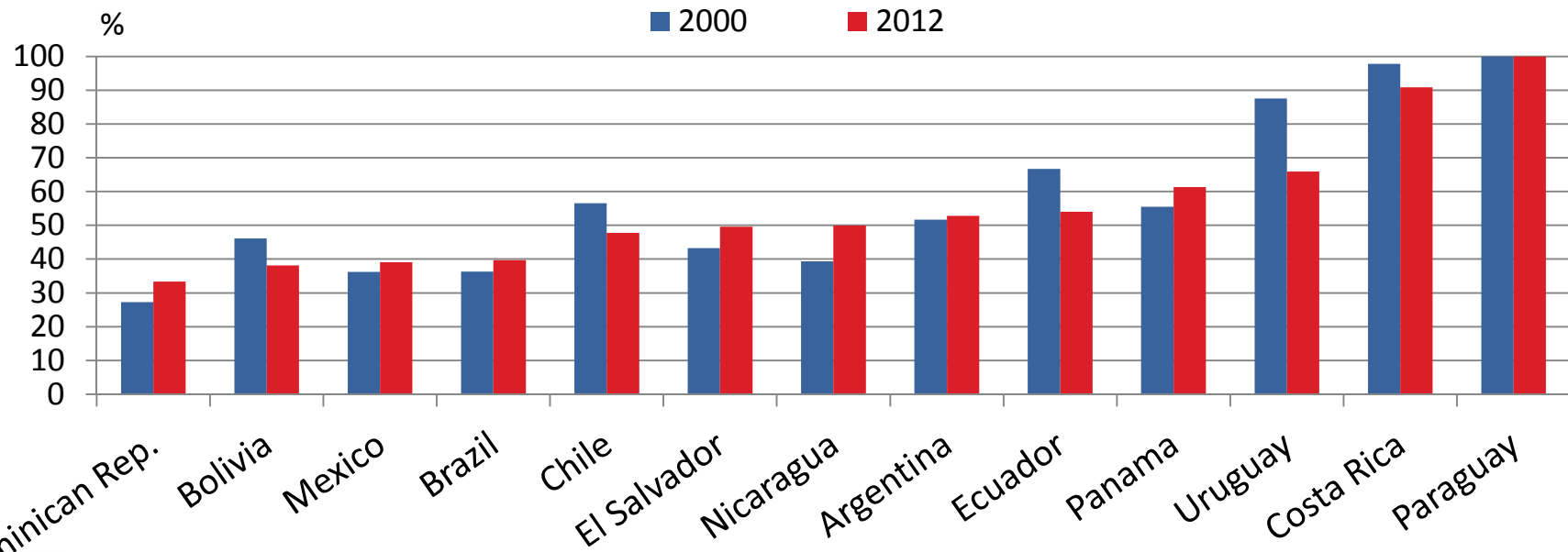
Primary consumption and avoided primary consumption (Latin America)



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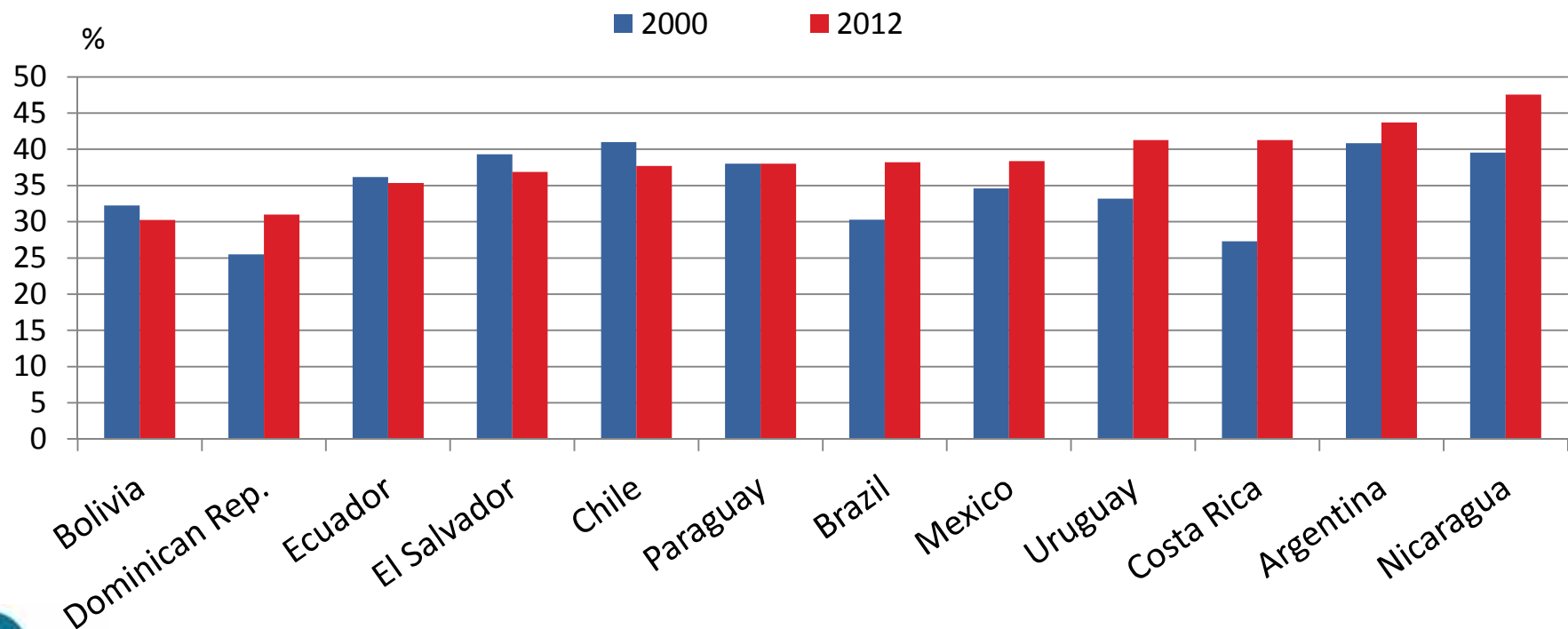
- Paraguay , Costa Rica and Brazil are the countries with the highest efficiency for power generation (above 90%), because of the high share of renewables (with 100% efficiency) in the power mix .
- The countries with the highest progression are Nicaragua, Dominican Republic, Panama and El Salvador (+11 points for Nicaragua and +6 points for the others).
- The significant increases are explained by the sharp increase in the share of renewables (+ 18 points in Nicaragua) and the rapid diffusion of gas combined cycles.
- It decreased in several countries especially in Uruguay (by -20 points) , Ecuador (-13), Chile (-9), because of a reduction in the share of renewables (-29 points in Uruguay , -18 points in Ecuador and -16 points in Chile).

Efficiency of power generation



- Argentina and Nicaragua are the countries with the most efficient thermal generation (48% and 44% respectively).
- Bolivia, The Dominican Rep has the lowest thermal power plant efficiency at about 30%.
- The efficiency of thermal power plants improved the most in Costa Rica, Uruguay, and Brazil.

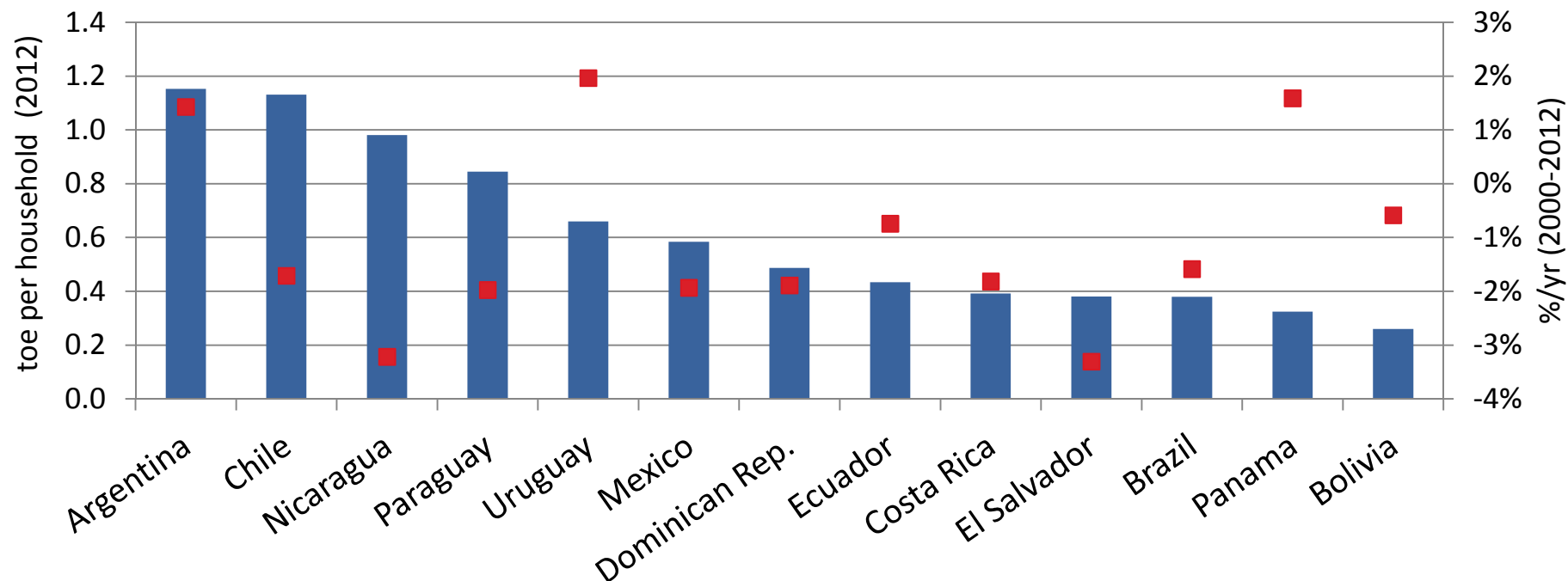
Efficiency of thermal power generation



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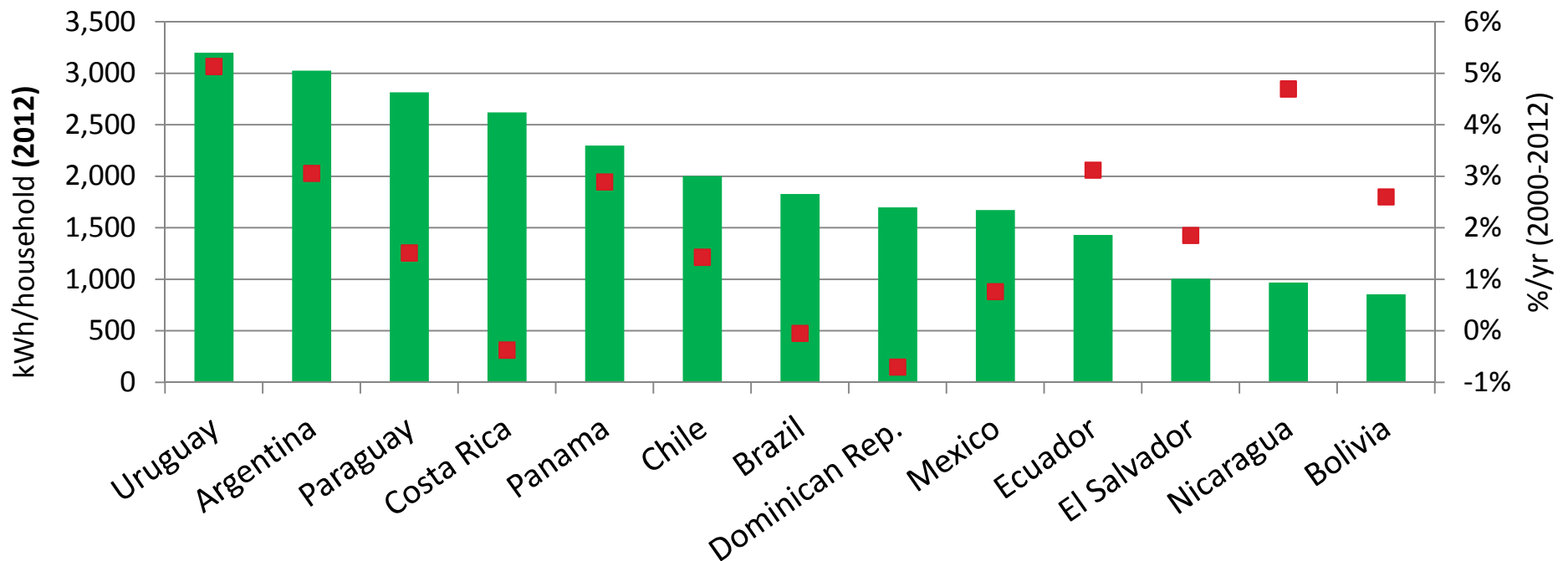
- The average unit consumption per household varies quite a lot among BIEE countries, from 0.26 toe in Bolivia, to around 1 toe in Nicaragua and 1.15 toe in Argentina and Chile .
- In Argentina and Chile the high value is due the heating needs which does not exist in all the other countries, except in Mexico; the high value in Nicaragua is linked to the large use of biomass for cooking .
- Between 2000 and 2012, this specific consumption has increased in Uruguay, Panama and Argentina (by about 1.5%/year), while it has been decreasing in all the other countries mainly due to the substitution of biomass by electricity.

Total unit consumption per household



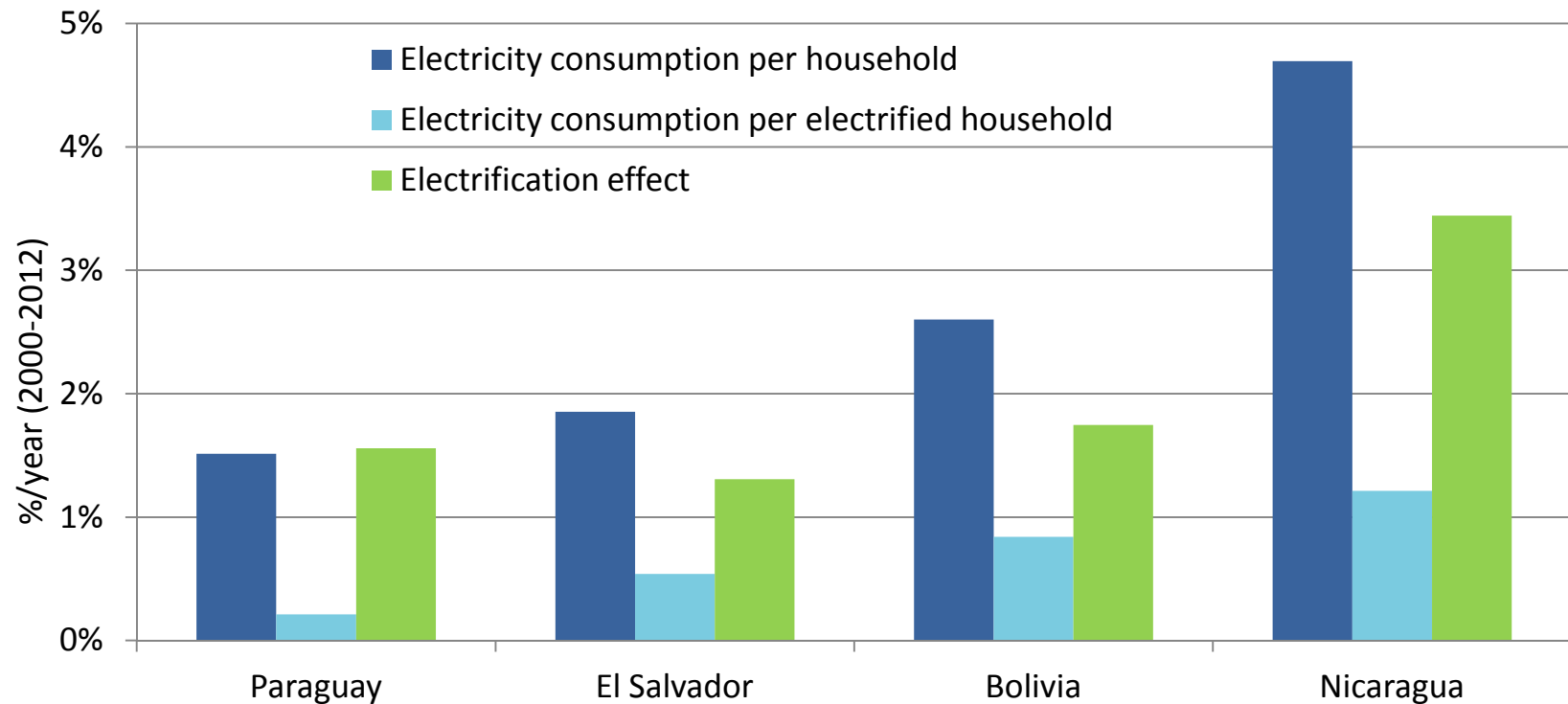
- The average electricity consumption per household (ratio between the electricity consumption of households and the number of households), varies significantly among BIEE countries, from 850 kWh per household in Bolivia, to 1670 kWh in Mexico, 3000 kWh in Argentina.
- The electricity consumption per household is increasing significantly in Nicaragua and Uruguay (over 4%/ year and 5%/ year) and in other countries (1-3%/year) due to a growth in equipment rate (refrigerators, TV, ICT, air conditioning, water heater) and electrification except Dominican Republic, Costa Rica and Brazil.

Unit consumption of electricity per household



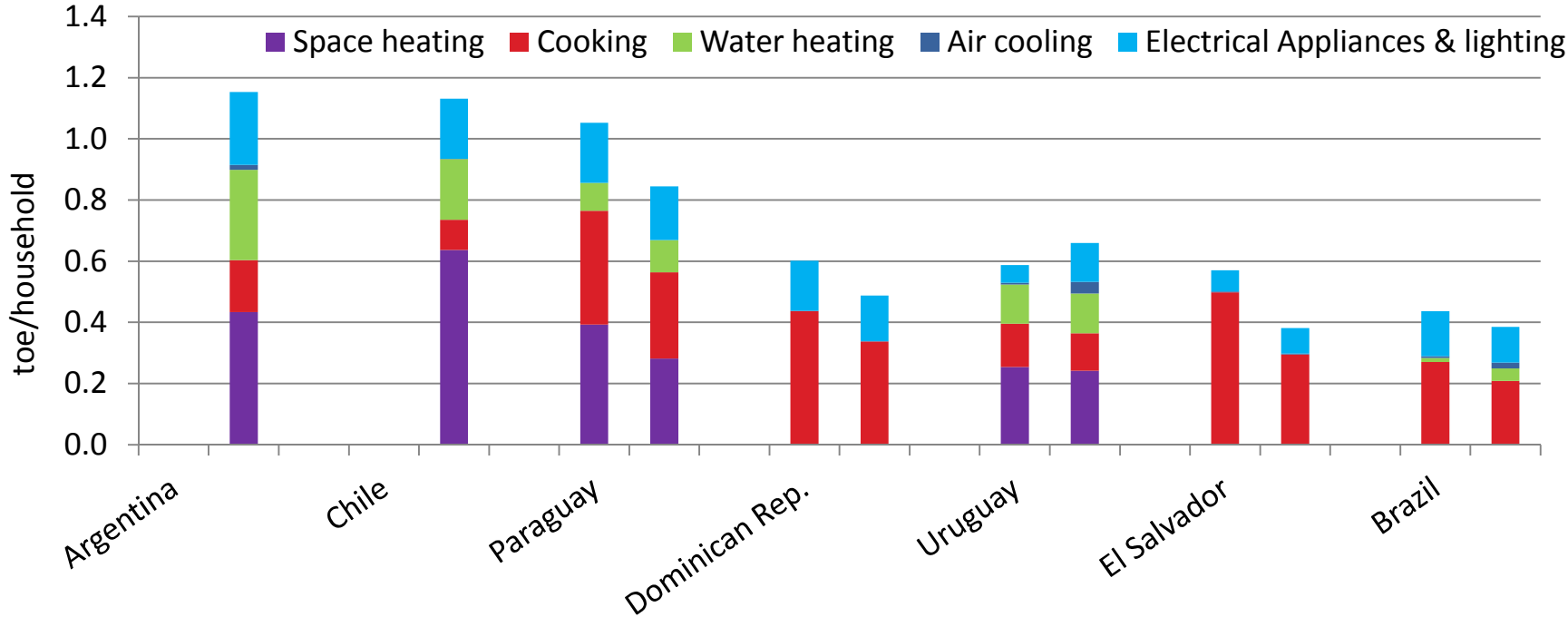
- Per electrified household, the electricity consumption increased less rapidly than per household, due to the electrification of rural households.
- The electrification rate has a strong increase in Nicaragua by more than 3%/year between 2000 and 2012; this is the main reason of the growth in electricity consumption per household from 2000 to 2012
- The same pattern of trends is obvious in all four countries with increasing electrification rates; only the level of growth is different.

Unit electricity consumption : effect of household electrification



Apart from countries with space heating needs (Chile, Argentina, and to a lower extent Uruguay and Paraguay), cooking is the dominant end use.

Energy consumption per dwelling (2000,2012)



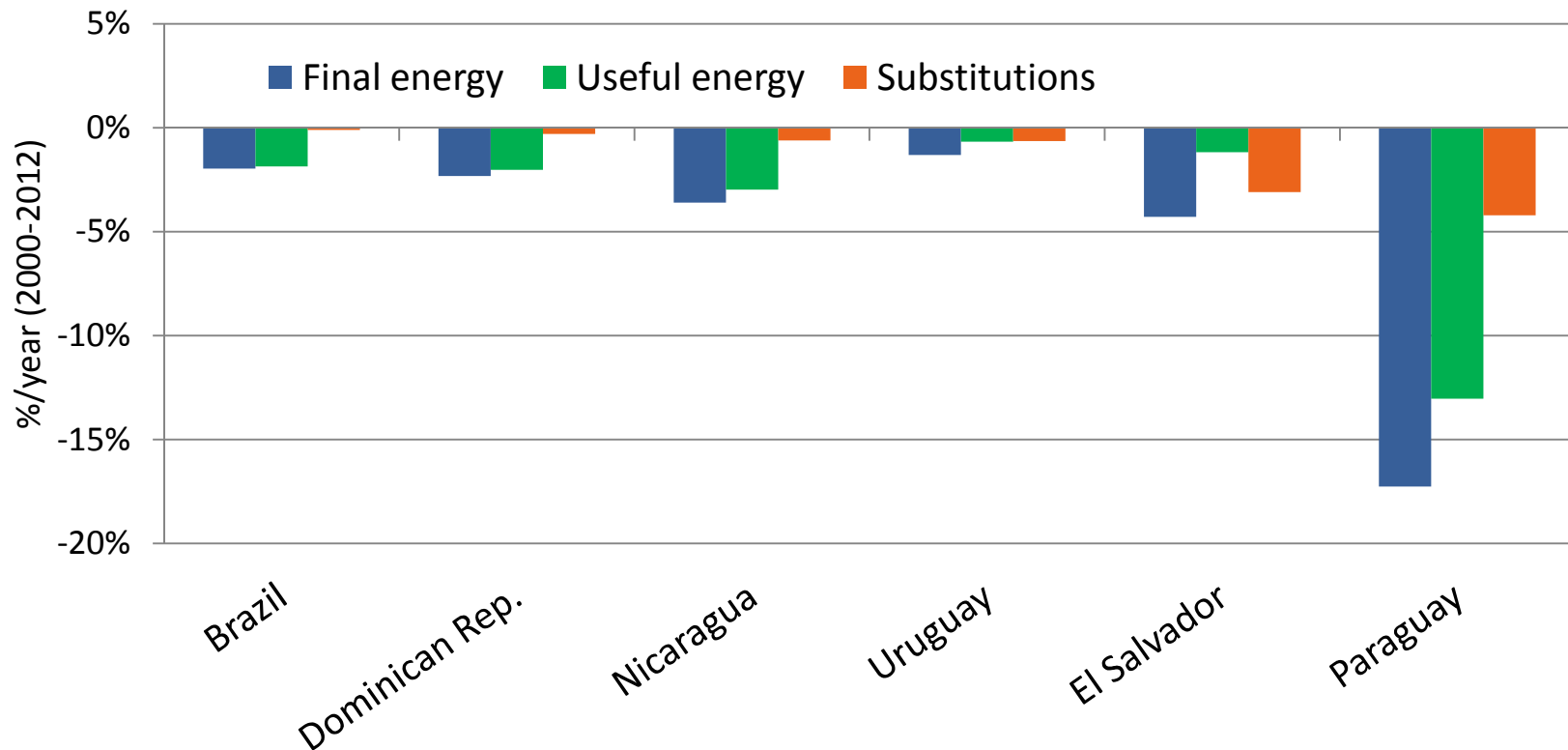
Water heating included with electrical appliances for Dominican Rep and El Salvado
 Cooling included with electrical appliances for Paraguay, Dominican Rep and El Salvador.



Source : BIEE Cepal

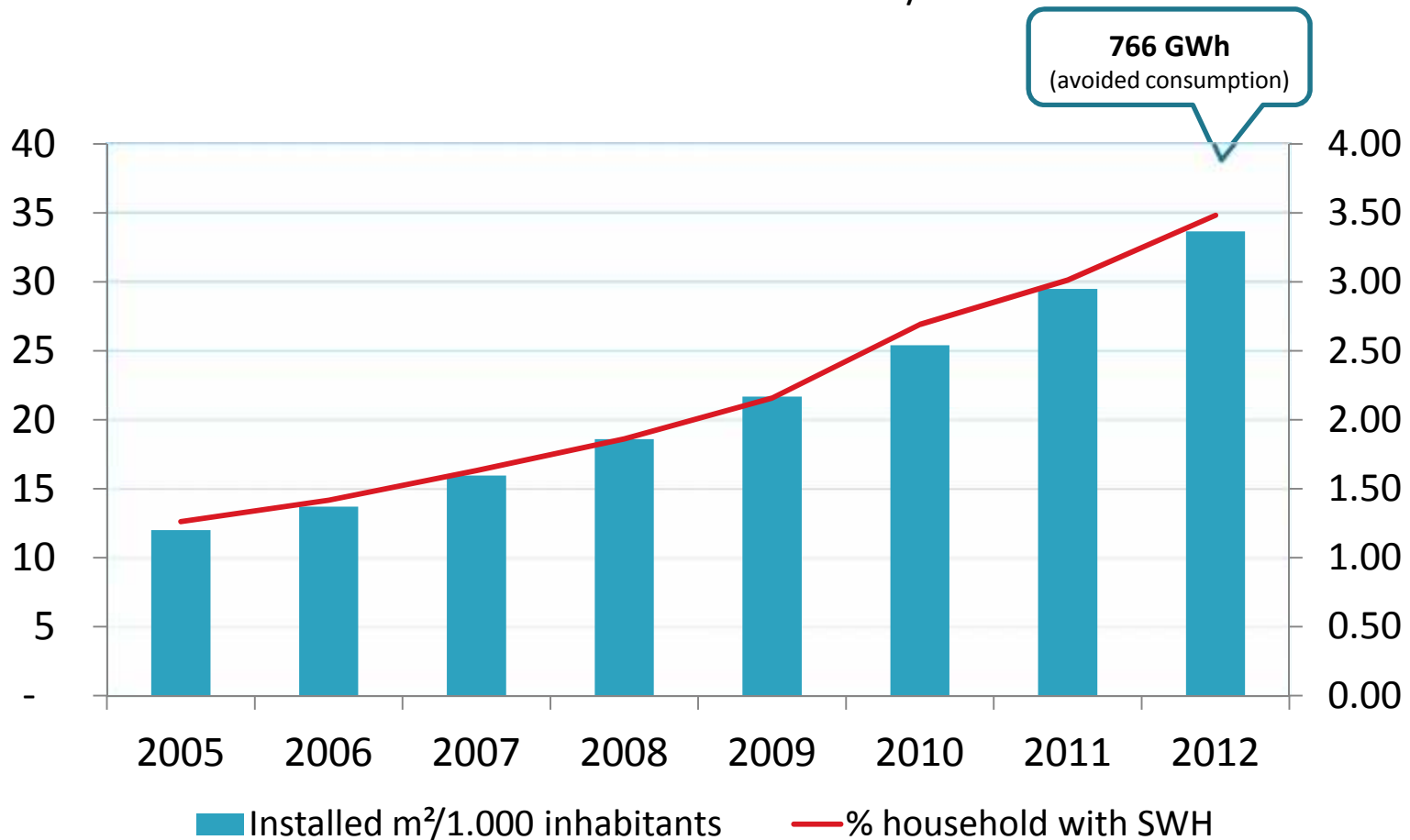
- In all countries, the energy consumption per dwelling for cooking decreased.
- Different trends between the specific consumption in final and useful energy are explained by fuel substitution.
- The substitution effect was the greatest in Salvador and Paraguay: substitutions from biomass to LPG in Salvador and to electricity in Paraguay contributed to decrease the specific consumption by more than 3%/year.

Specific energy consumption of households for cooking: effect of substitution



Solar water heater (SWH) equipment rates: Brazil

- Diffusion of SWH during period 2005-2012 from 1.3% to 3.5% of households;
- Increase of installed area from around 10 to 35 m²/ 1.000 inhab.

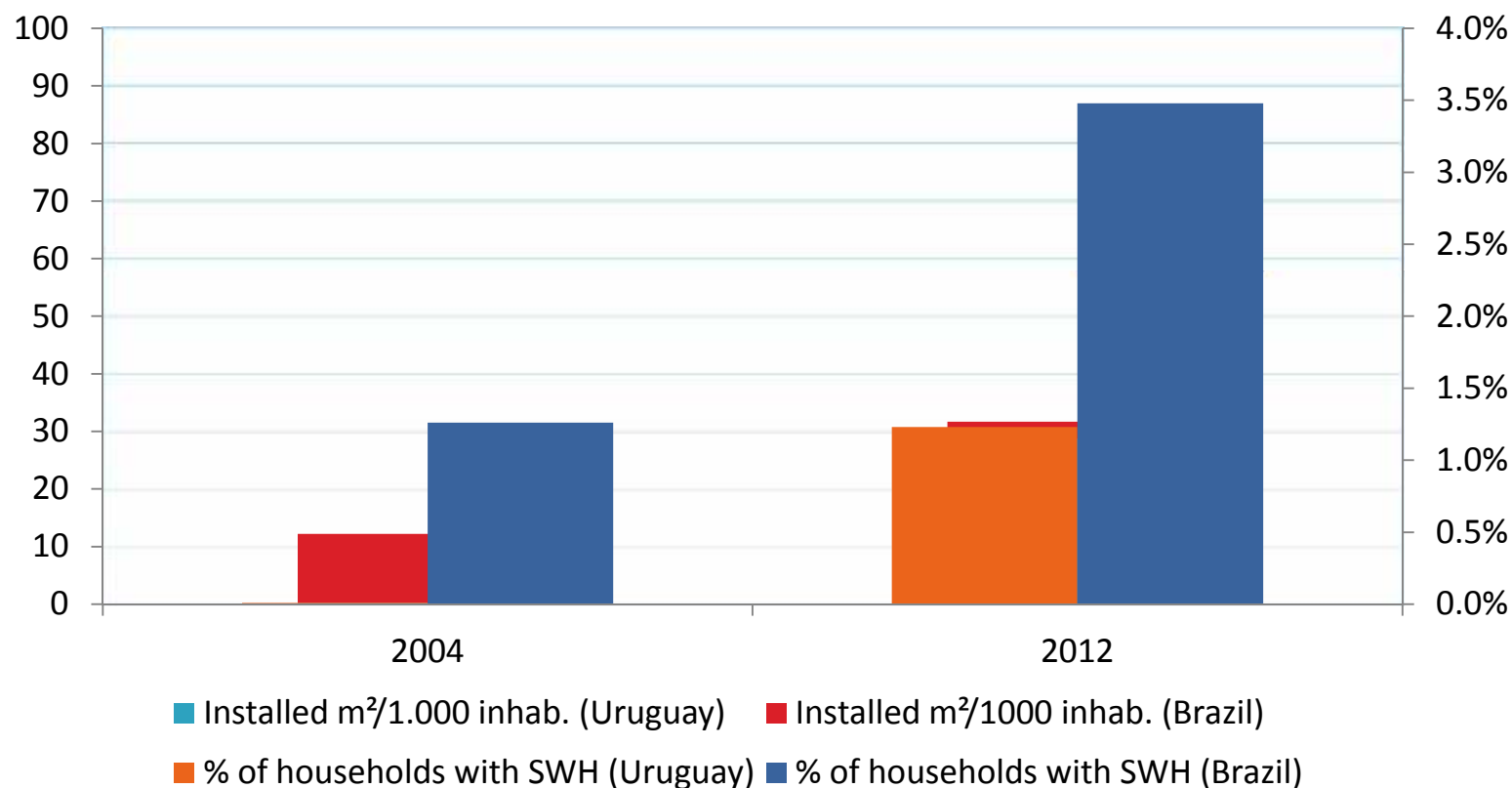


Source: Brazilian Association on Refrigeration, Air Conditioning, Ventilation and Heating (ABRAVA)

**% of households with SHW= total installed area in m² divided by the average size of a solar panel per dwelling (e.g. 3 m² /); avoided consumption= production of solar heat (calculated from the installed area of solar water heaters multiplied by the average solar output per m²).*

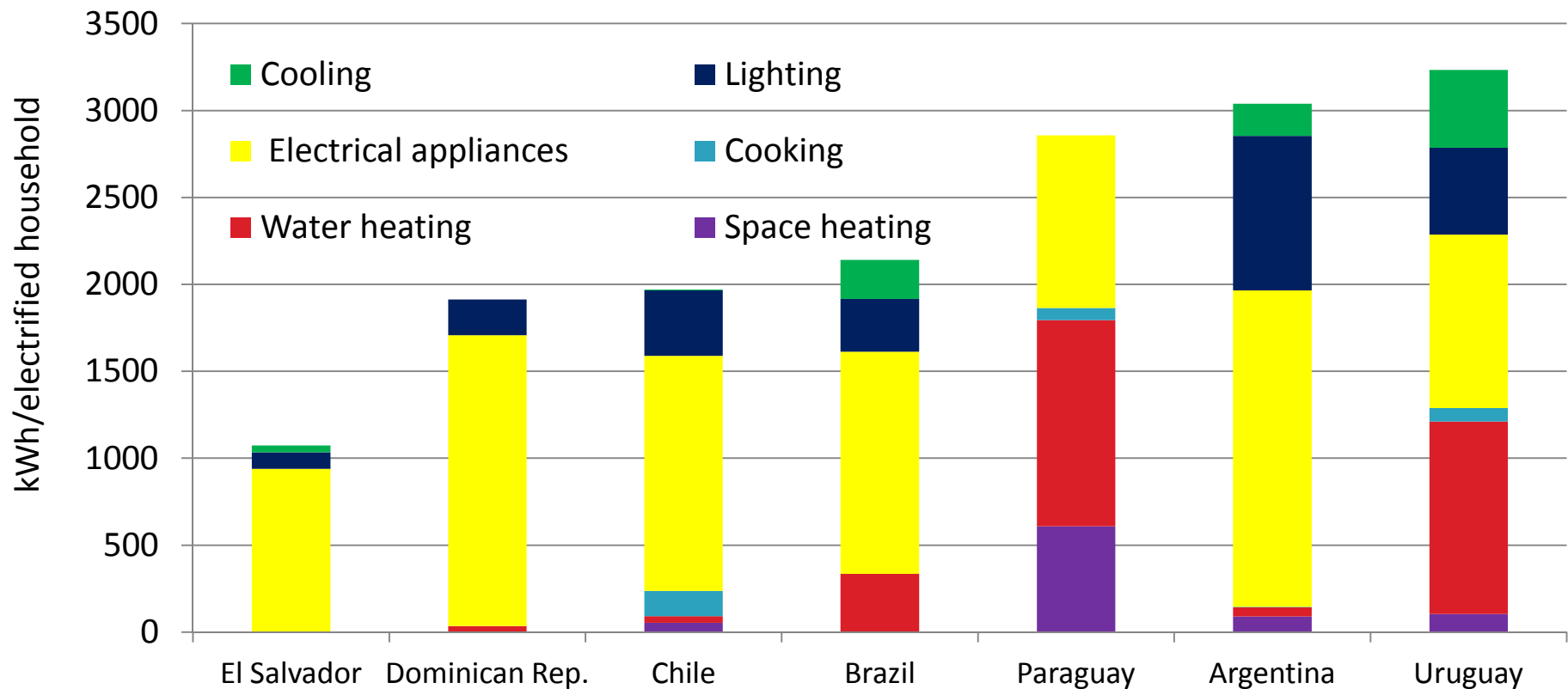
Solar water heaters

- Diffusion of solar water heaters from almost 0% to 1.2% of households in Uruguay and from 1.3% to 3.5% in Brazil between 2005 and 2012.
- Installed area of 30 and 35 m²/ 1.000 inhabitant respectively , compared to 400 in Greece and 800 in Cyprus



Most of the electricity used by households is for appliances, such as refrigerators. Water heating has also a significant share in Uruguay and Paraguay. The share of cooling is low but developing rapidly.

Electricity consumption per end -use

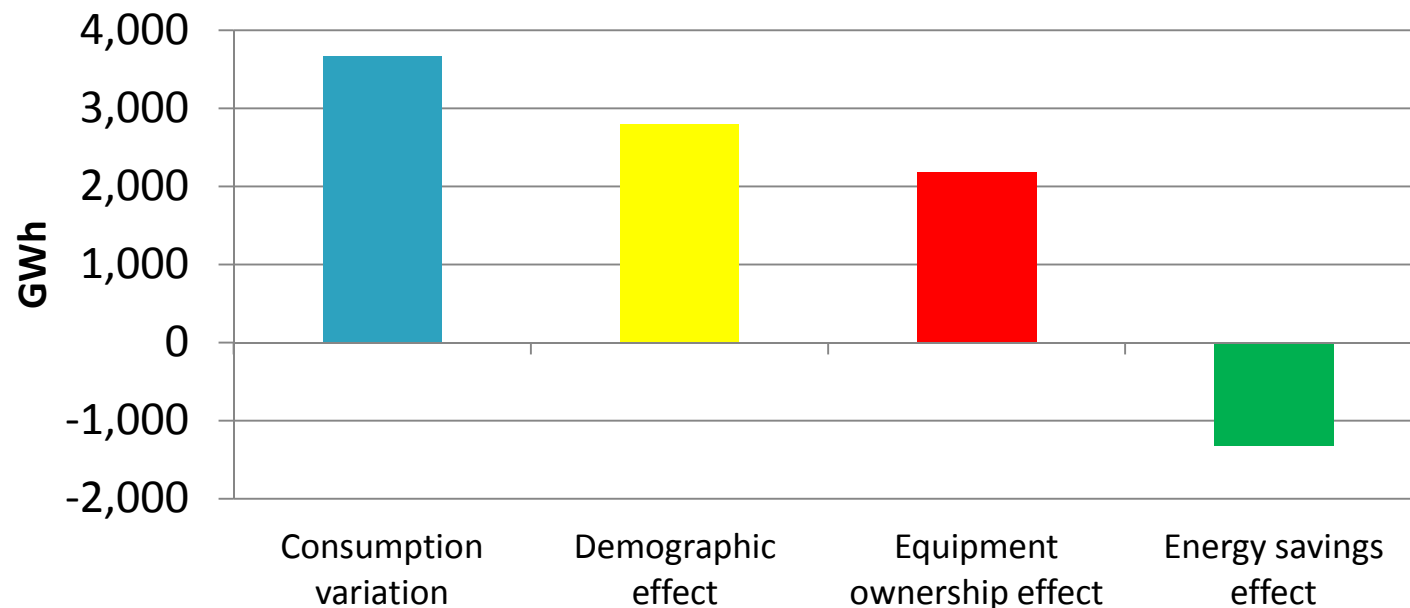


Note: Electrical appliances includes cooling for Dominican Rep. ; cooling and lighting for Paraguay

Decomposition of the electricity consumption variation : case of refrigerators in Brazil

- The increased number of households contributed to raise the consumption by 2805 GWh (“demographic effect”).
- Progression in the diffusion of the equipment contributed to a further 2180 GWh increase.
- However, the consumption of refrigerators only increased by 3665 GWh and not by 5985 GWh as energy savings contributed lower the consumption by 1320 GWh.

Drivers of the electricity consumption variation for refrigerators in Brazil (2005-2012)

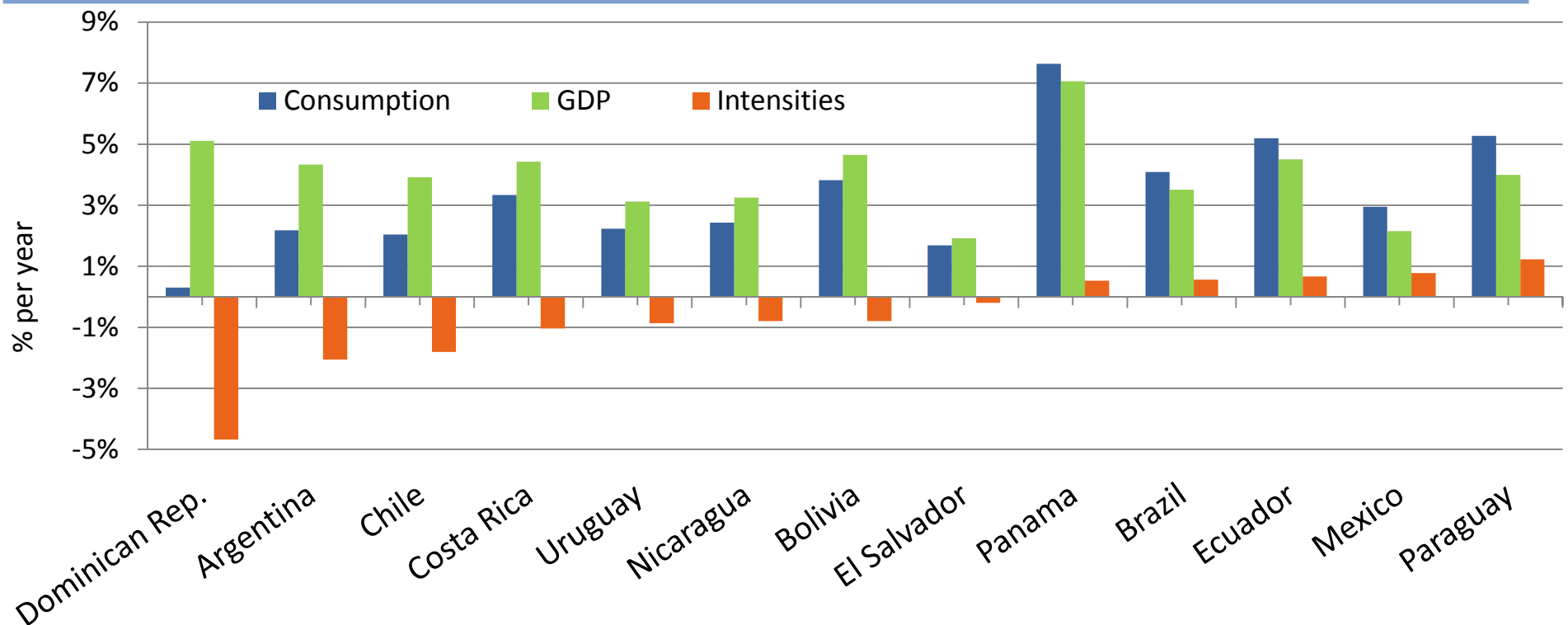


Source: EPE

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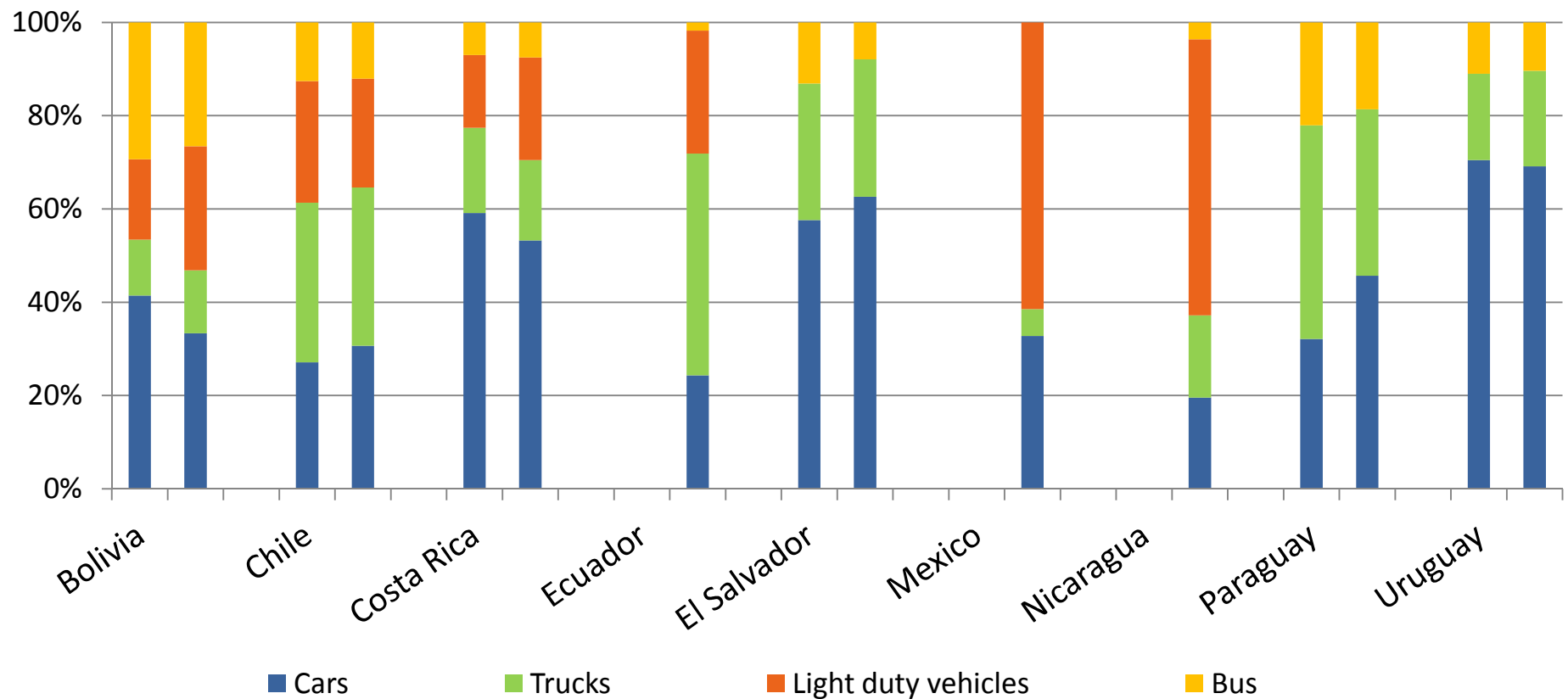
- In most countries transport consumption grew less rapidly than GDP from 2000 to 2012, especially in Dominican Republic, Chile and Argentina, and to a lesser extent in Costa Rica, Nicaragua, Bolivia and Uruguay.
- In Paraguay, Panama, Brazil and Ecuador there was a reverse trend.
- The intensity of transport (i.e. the energy consumption per unit of GDP) has decreased dramatically in Dominican Republic (-5%/year)

Trends in transport consumption, GDP and transport intensity (2000 -2012)



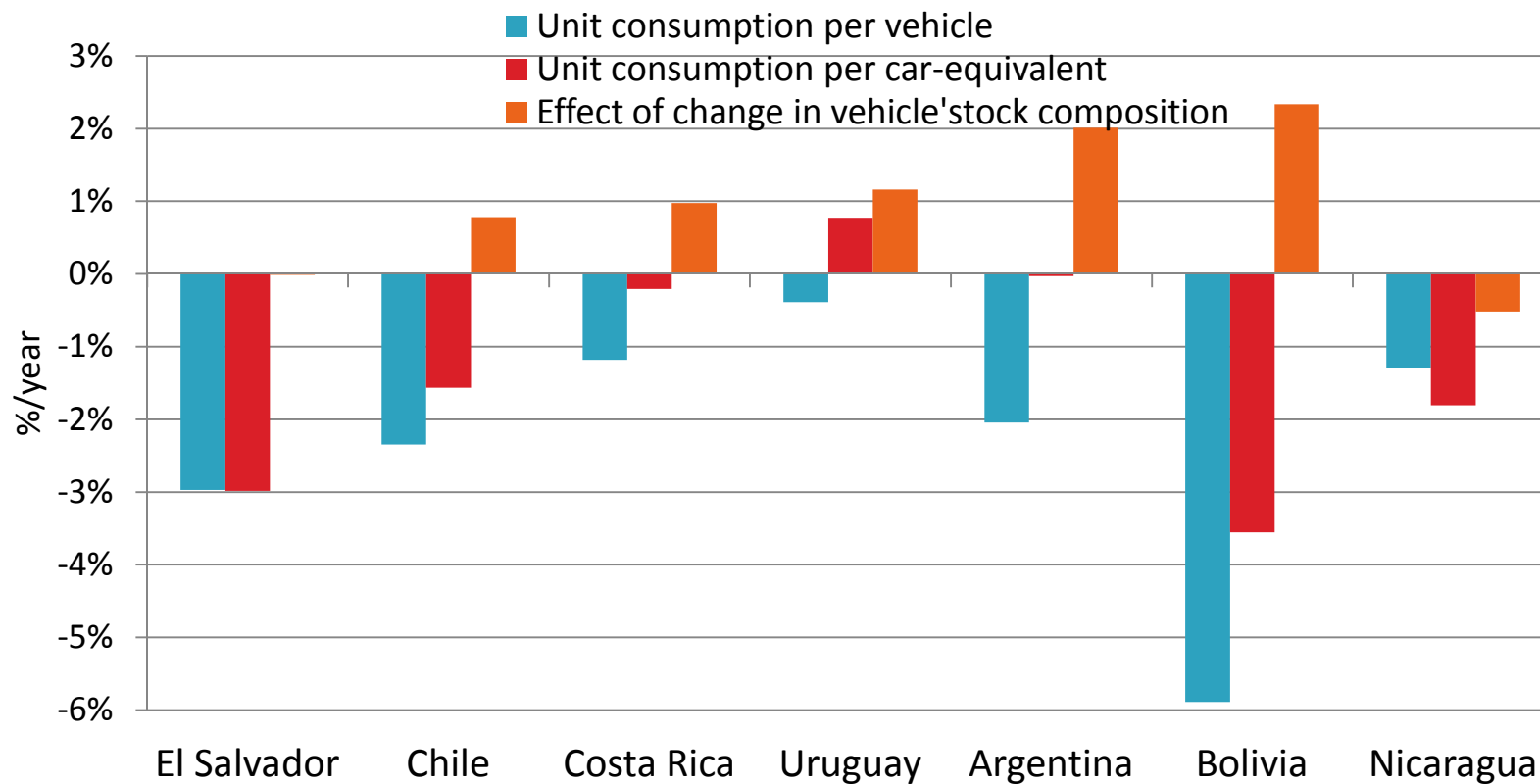
- Road transport shares according to type of vehicles shows strong variance in BIEE countries; in each country the share of transport by car is at least 20% with highest in Uruguay (69% in 2012).
- In Nicaragua and Mexico, transport by light duty vehicles has an important share (more than 55%).

Road energy consumption by type of vehicles (2000, 2012)



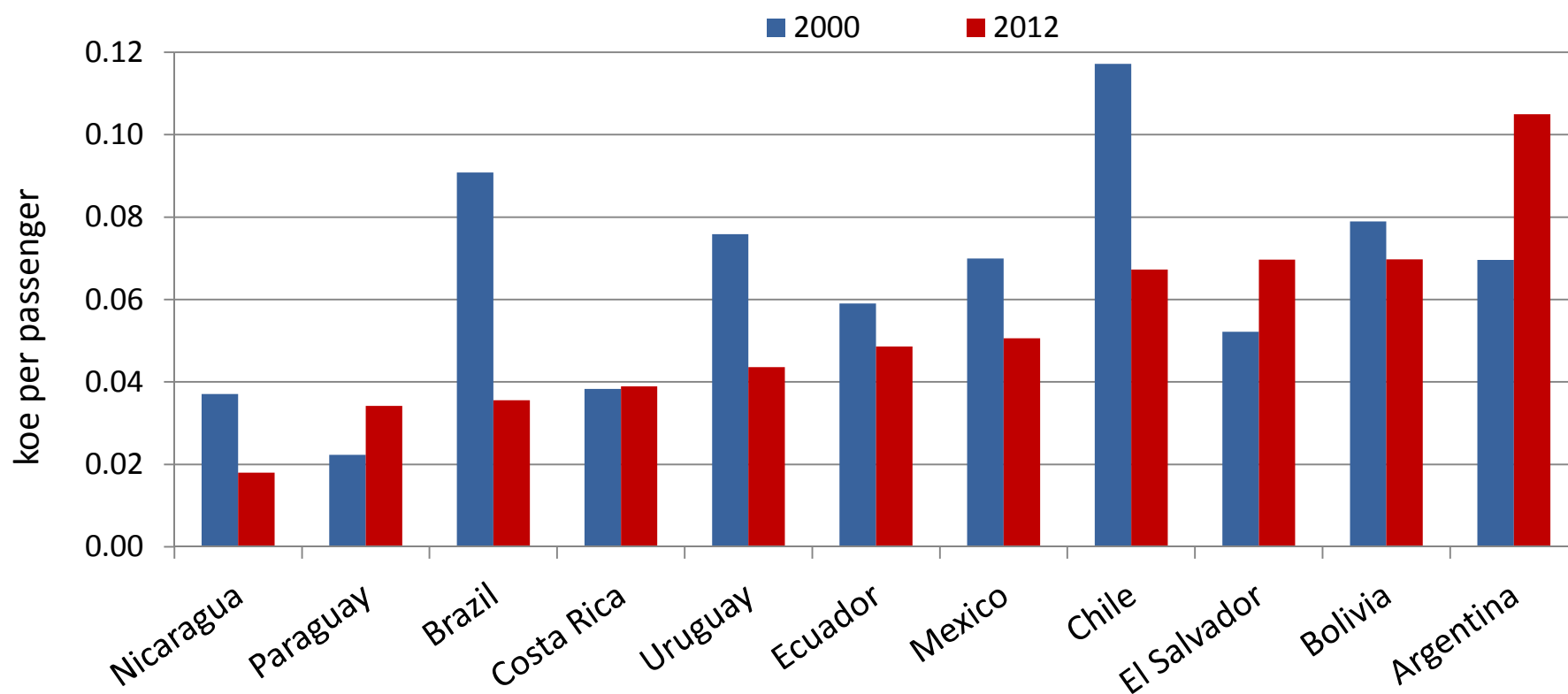
- The unit consumption of road transport per vehicle decreased in all countries.
- The difference between the energy consumption of road transport per vehicle car and per car equivalent corresponds to the effect of changes in the composition of vehicle stock.
- Energy efficiency improvements can be better evaluated with the variation of the unit consumption per car-equivalent, as it is cleaned from changes in the vehicle fleet.
- El Salvador, Chile and Bolivia had the highest energy efficiency improvements.

Trends in road transport consumption (2000-2012, %/year)



- The unit consumption of air transport (defined as a ratio between the energy consumption and the number of passengers carried) tends to decrease in most countries, mainly due technical progress with new aircrafts except in Argentina, El Salvador and Paraguay

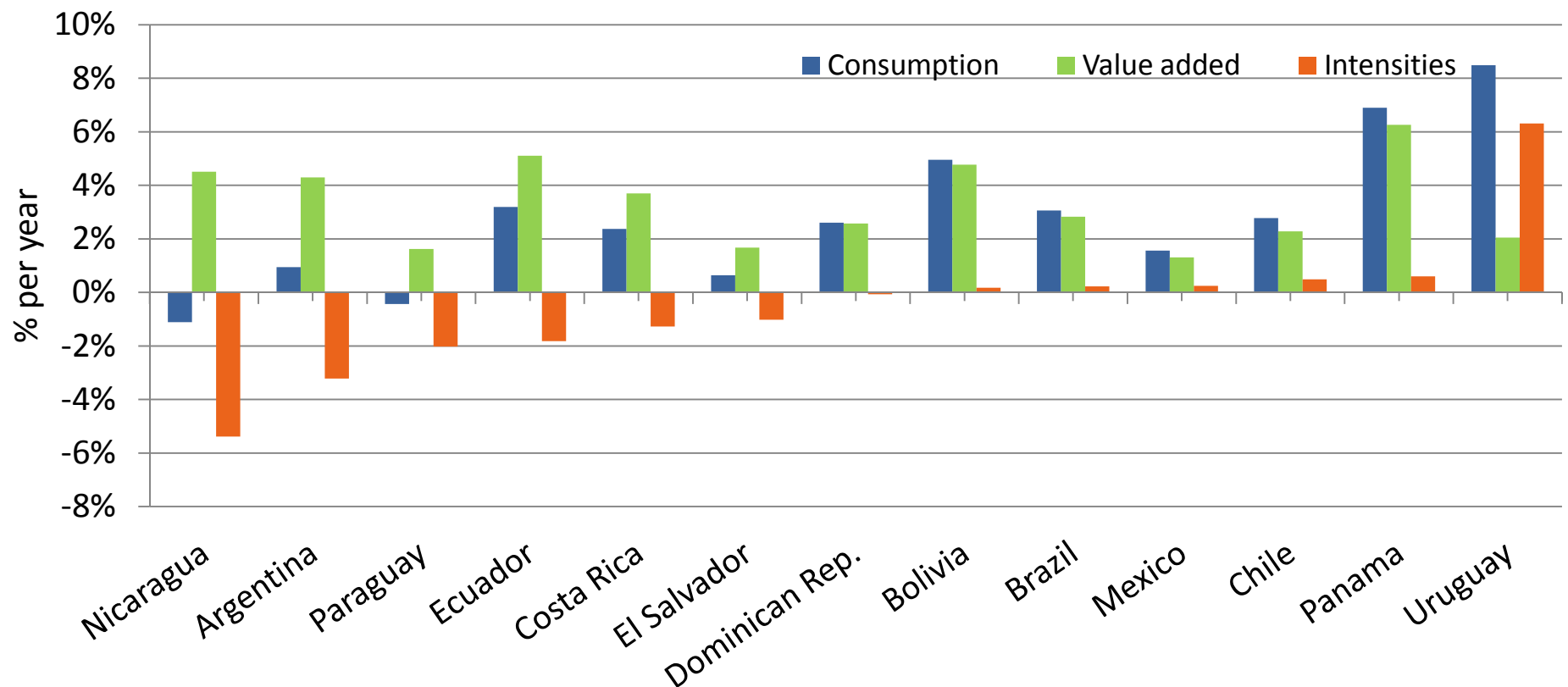
Energy consumption of air transport per passenger (toe/passenger)



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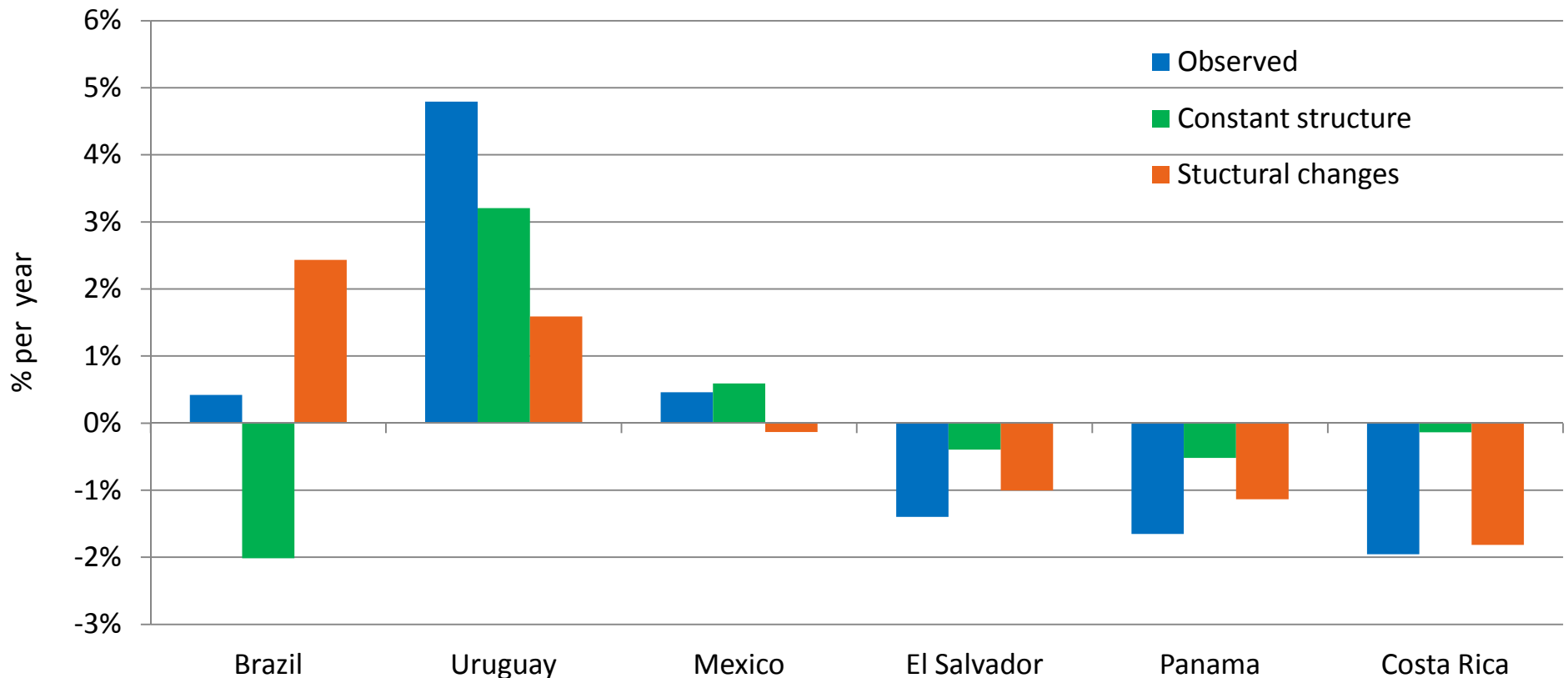
- The energy intensity of industry, calculated as the ratio between the energy consumption and the value added, decreased in six countries (by more than 5%/year in Nicaragua and about 3%/year in Argentina, between 0.2 and 2%/year in all the rest)
- In Uruguay, the intensity has been increasing (very rapidly by 8%/year), due to a new large pulp and paper factory coupled with a chemical complex.

Energy intensity trends in industry (%/year, 2000-2012)



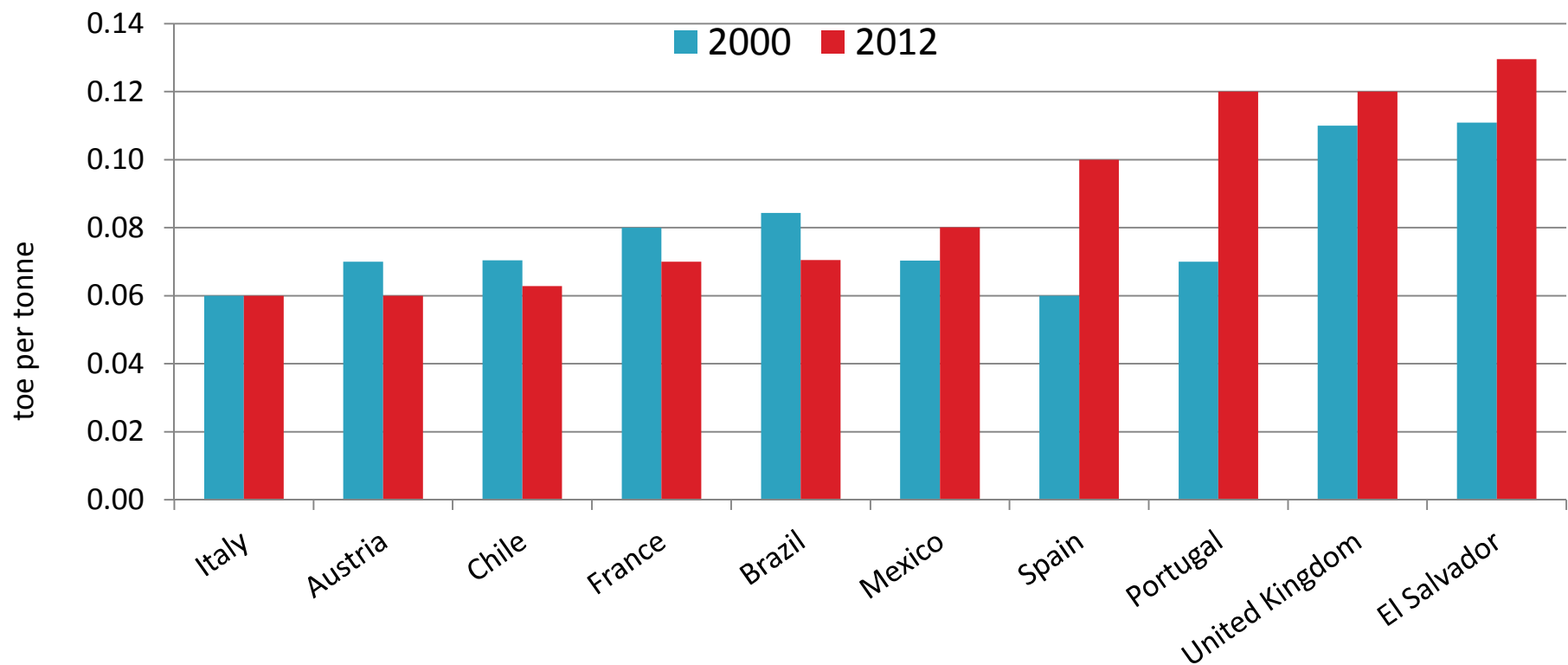
- In Brazil and Uruguay structural changes towards more energy intensive branches contributed to increase the energy intensity of industry.
- In the other countries there were structural changes to less intensive branches which contributed to decrease the intensity.

Structural effect in manufacturing intensity (%/year; 2000-2012)



- Brazil, Chile, Mexico and El Salvador have similar trend as European countries.
- The increasing trend in some countries, such as Spain and Portugal is due to the strong industrial recession.
- Latin American countries are well positioned in terms of performance

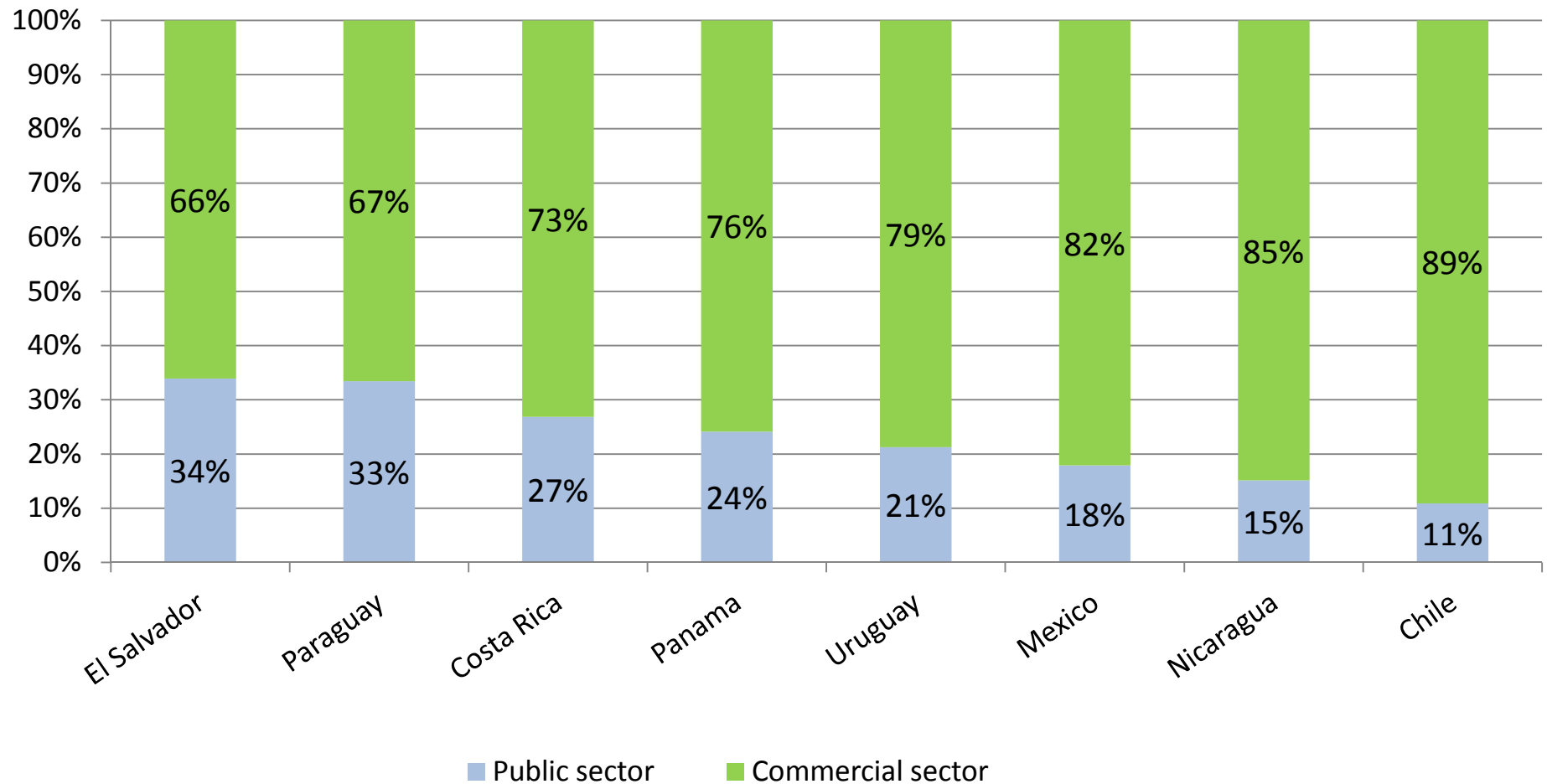
Trends in specific consumption of cement industry (2000,2012)



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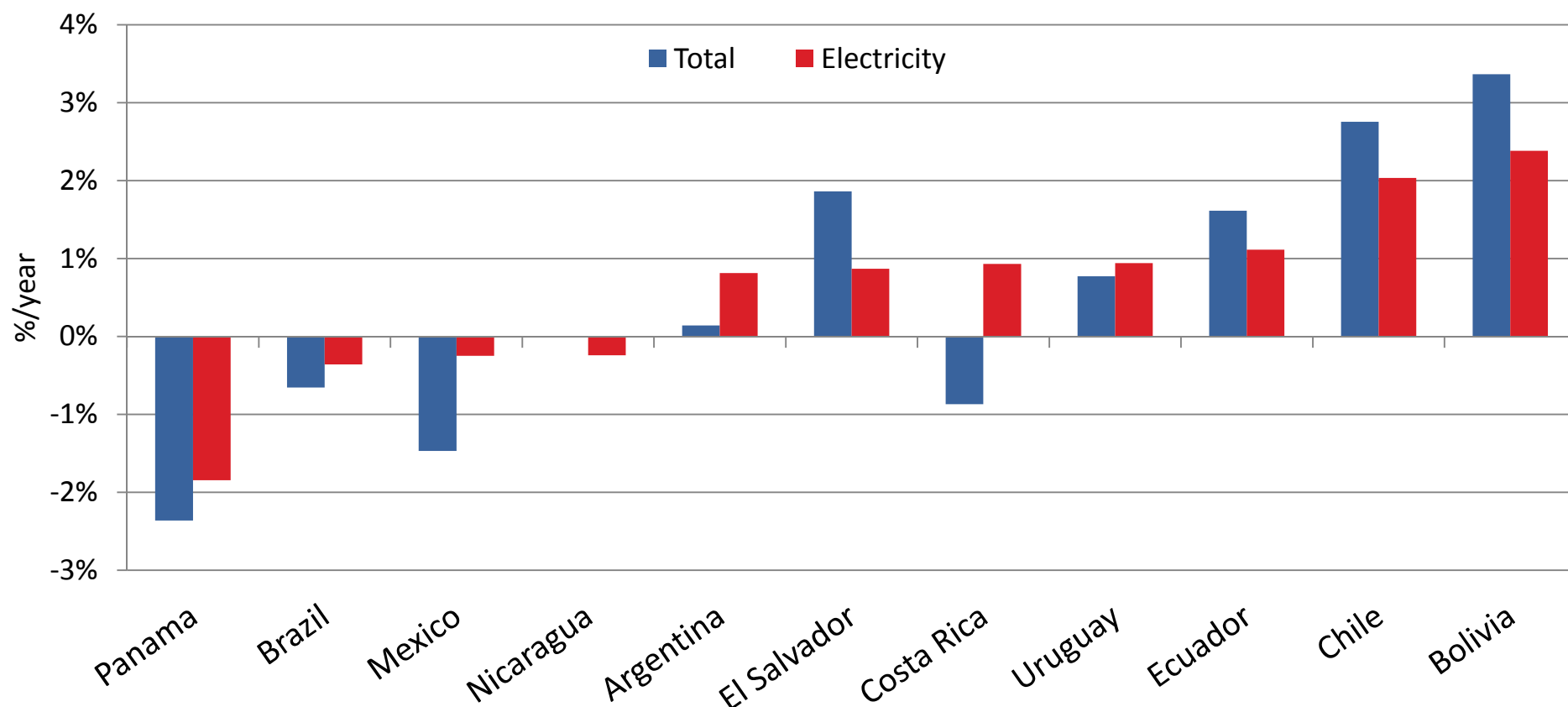
- The share of the commercial sector in total consumption of services vary between 66% and 90%.

Energy consumption of services by branch (2012)



- The trends in energy intensity of services vary significantly across BIEE countries from around -2.5%/yr in Panama to 3.4%/yr in Bolivia for total consumption.
- Electricity intensity increased in most of the countries except in Panama, Brazil, Mexico and Nicaragua.

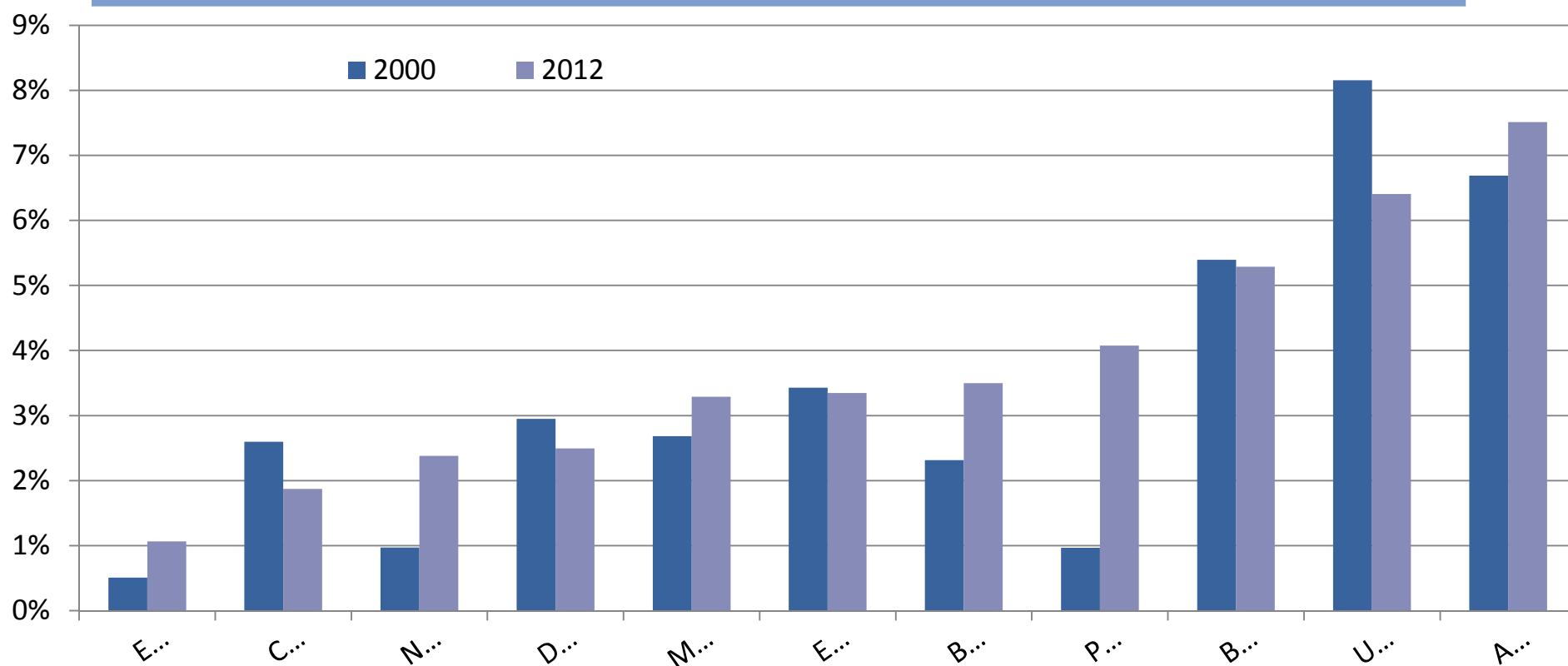
Trends in energy intensity of services (2000-2012)



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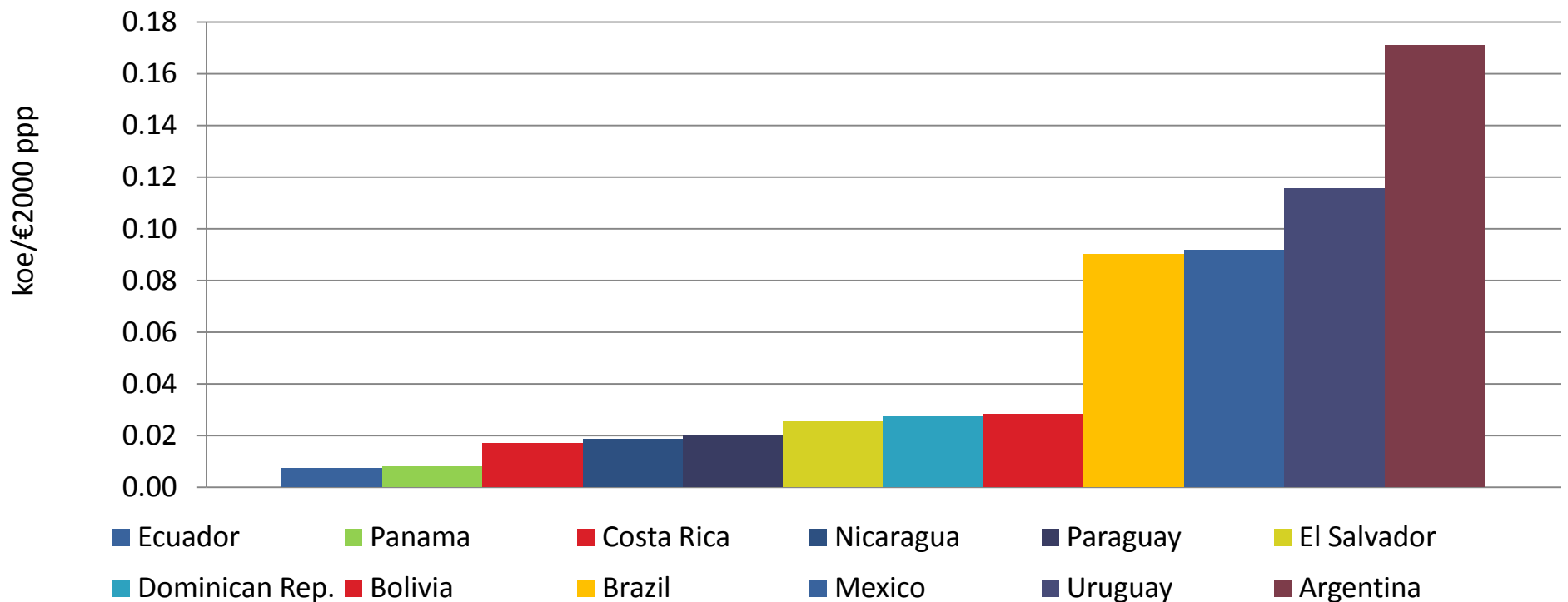
- The share of agriculture in the final energy consumption is less than 4% in most countries; it has the highest value in Argentina and Uruguay (around 8%)
- No relevant patter of increase or decrease for the all BIEE region; the rate of change between the value in 2000 and 2012 is between 1-4%.

Share of agriculture in final energy consumption

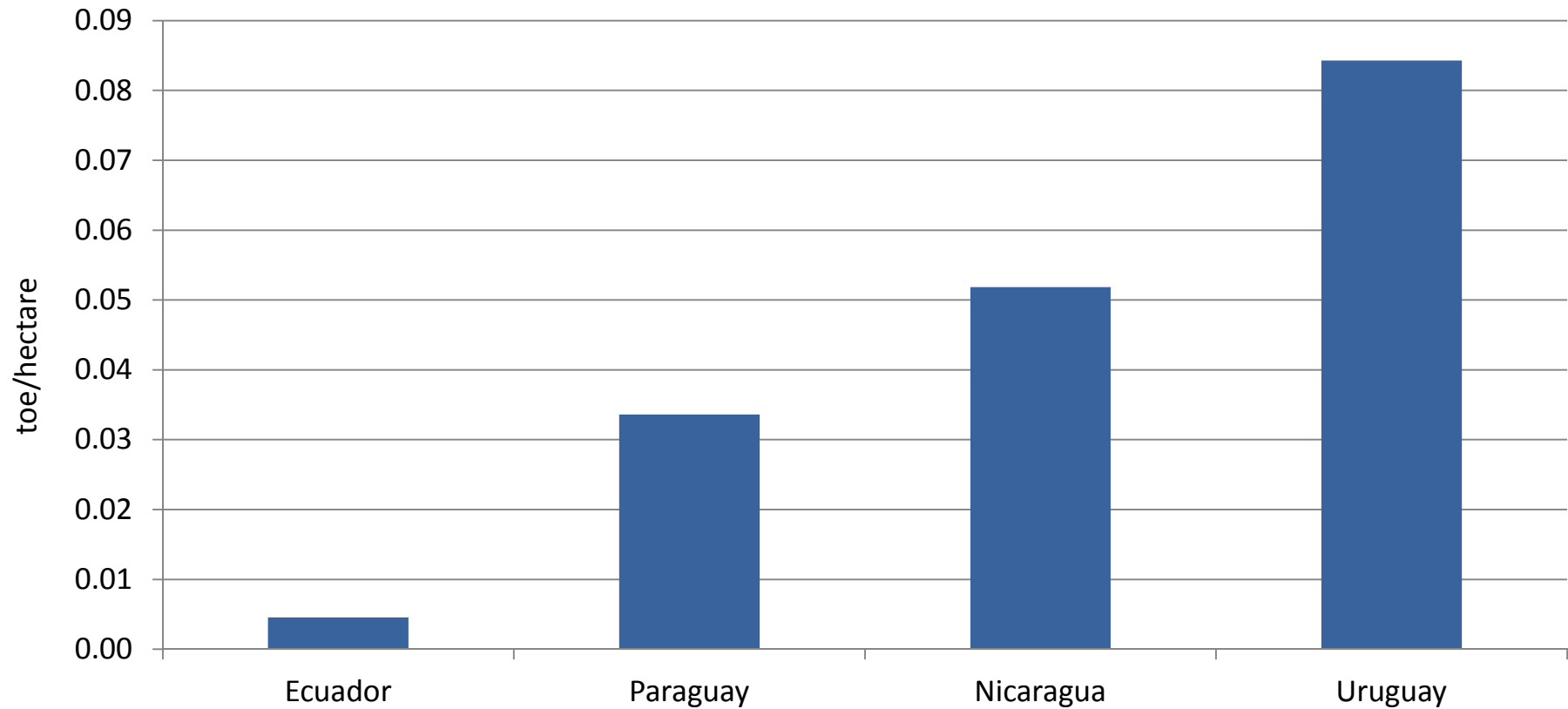


- The intensity is high in the countries with high share of agriculture in the GDP – Argentina, Uruguay, Paraguay and El Salvador with around or more than 0,10 koe/€2000 ppp
- The intensity level is similar in all the other countries with around and less than 0,03 koe/€2000 ppp

Energy intensity of agriculture (2012)

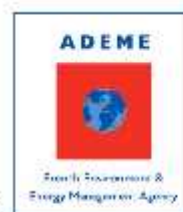


Energy consumption of agriculture per hectare





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Contribution of energy efficiency evaluation to climate change strategy

VI energy efficiency dialogue in LACs & Carribeans countries

Energy efficiency as state policy

Aruba 29& 30 October

Dr Didier Bosseboeuf (ADEME, France)



4th Seminar of the African Energy Information System and Database: Energy Efficiency Indicators (Nairobi, 3-6th Nov. 2015)

Many international african organisations are developping EIs
(RCREEE; ECREEE; CAPP; EEEO/WAPP; SAPP; EAPP; MEDENER, IFDD etc.)

- Building a network among energy databases providers
- Identification of networking modalities (people, communication, etc.)
- Synergy between AFREC's System and existing African energy databases
- Strategy for training AFREC's National Focal Points
- Establishment of national energy databases
- Modalities for technical assistance and capacity building



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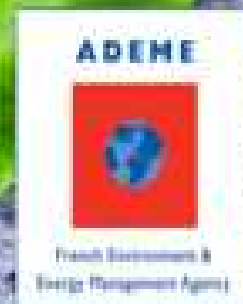
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Contribution of energy efficiency policies evaluation to climate change strategies



29-30th Sept. 2015
Paris, France



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Contribution of energy efficiency evaluation to climate change strategy:

Rationale

- Energy efficiency is now a reality and have reached the top of the agenda : **the first fuel**
- Who wants to address policies implementation, public budget, target setting issues needs **to rely on monitoring**
- Needs to evaluate energy efficiency policies **(BU)** but also to have a more global perspective of energy efficiency policy impact **(TD energy efficiency indicators)**
- Need to have a **detailed** monitoring system be able to disseminate **aggregated** information
- National monitoring should be complemented by **international benchmarks**



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Contribution of energy efficiency evaluation to climate change strategy: Objectives

1. **Benchmarking** on energy efficiency is very relevant to get and **exchange information on policies**.
2. To demonstrate that **EIs are workable** and that it provides valuable feedback for each of the participating countries.
3. To demonstrate that there exist **strong existing practices** and experiences on monitoring energy efficiency policies at detailed level and sometimes even in an harmonized way across countries.
4. **To demonstrate that this experience in EE monitoring could be useful for monitoring climate change strategies.**



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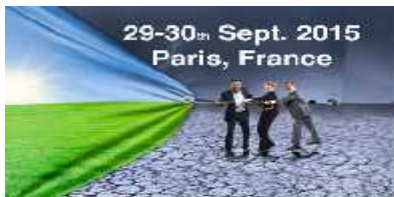


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Contribution of energy efficiency evaluation to climate change strategy: The LACs speakers

1. *The need for exchange of information on energy efficiency Lacs experience* – **Ricardo Sanchez** (Acting Director UN ECLAC, Chile)
2. *EE Monitoring in the new transition law in Mexico and link with existing NAMAs* - **Juan Navarrete** (Director, CONUEE, Mexico)
3. *The BIEE project in Latin America* - **Dr Andres Schuschny** (Senior Project Manager UN-CEPAL, Chile)
4. *Monitoring energy efficiency in building sector in Brazil* - **Ricardo Gorini** (Director energy economics and environmental studies EPE, Brazil)
5. *Monitoring energy efficiency trends and policies in Ecuador* – **Eduardo Noboa**, Director INER, Equator)
6. *Monitoring energy efficiency policies Uruguay* - **Mrs Carolina Mena** (MIEMDNE, Uruguay)



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Contribution of energy efficiency evaluation to climate change strategy:

Some conclusions

- Strong an opportunity with the **change of paradigm of the UNFCCC reporting** under negotiation to introduce some of our EE knowledge on monitoring.
- Energy efficiency indicators based methods are **now really spread over the world** both through regional institutions or initiatives and at national level.
- The community of reporting and evaluators on EE and climate changes are not talking enough together.
- To organise extra works on the correlation or **inter-relationship or coordination between the EE, RES and CO2 targets reporting** and achievements.
- To discuss the issue of policy energy saving **attribution** to policies.
- TD evaluators from emerging countries are also claiming **to complement this approach with BU evaluations** but they don't know how to do it.



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