Session: POLICY EVALUATION #6
Views from the top: What can energy efficiency indicators and trends tell us about policies?
Tuesday, Mar 16, 2021

Energy balances in useful energy in Latin America Lessons learnt

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From final to useful energy balances

- Many countries, especially in Latin American countries (e.g. Argentina, Columbia, Peru, Uruguay and Paraguay) have developed Useful Energy Balance (UEB) by sector in addition to their classic energy balance.

- The objectives of such studies are to:
  - Assess the real the level of energy needs (or energy services);
  - Evaluate the average energy efficiency of the sector
  - Estimate the energy efficiency potential, as it enables to measure and identify the potential technologies that could be promoted to improve end-use efficiency in the future.

- This paper reviews their practices and aims at drawing findings, conclusions and recommendations on the methodologies implemented and their results.

Useful Energy Balance in Latin America

Country	Years	Author/ Consultant
Brasil	1984,1994, 2004, 2014	EPE/FDTE
Colombia	2018	UPME/IREES-Corpoema
Dominican Rep	2001, 2006	Bariloche, Corpoema
Uruguay	2006, 2020	MIEM/Bariloche
Paraguay	2011	Bariloche
Peru	2016	Mercados Energeticos Consultores

Source: Felipe Toros, Irees Useful Energy Balances as means to monitor energy efficiency policies. Innovative approach in Colombia , ECEEE, 2019
Argentina has developed a useful energy balance for households (to be published in 2021)

Content

- Typical disaggregation
- Energy efficiency by sector
- Energy saving potential
- Conclusions

How to build a Useful Energy Balance ?

- Setting-up an UEB is intensively data demanding and far more complex and costly than a classic energy balance, as end-use efficiencies vary according to end-use, energy type and equipment/technology: UEB have to be calculated at a very detailed level.

- The first step of an UEB is to break down the final energy consumption of a sector by end-use /energy and type of equipment, i.e. to produce a sectoral energy account.

- The second step is to calculate the useful energy consumption by multiplying the final energy consumption by an end-use efficiency, (i.e. average efficiency of LPG or wood stoves for cooking): this useful energy indicates what amount of energy is really available for the final consumers, i.e. the so called "energy service".

Data needed to build an UEB

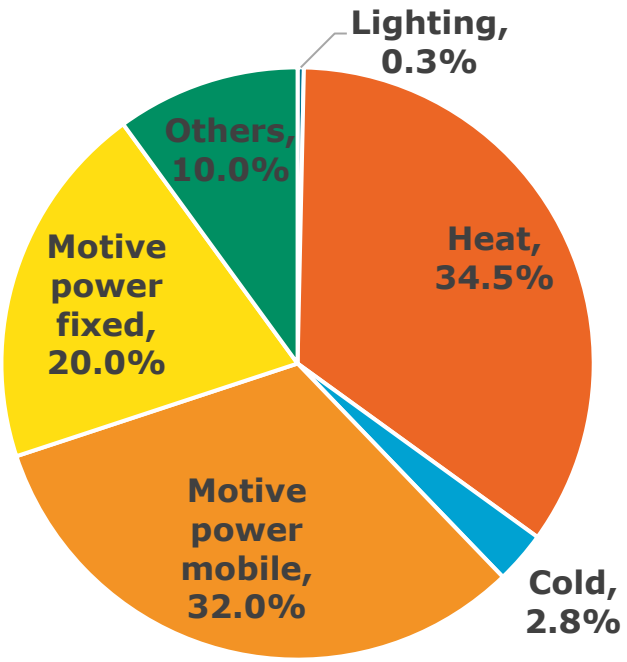
- The data needed are based on a combination of different sources:
  - end-use surveys (either dedicated to the study or done separately), especially for the penetration of the different technologies (e.g. share of households with different types of fuels and technology for cooking or water heating),
  - energy audits, values prepared for EE standards or labels or default value taken from the literature or technical documentation, especially for the efficiency values (e.g. efficiencies of LPG or wood cooking stove).
- Our experience in many countries demonstrates that around 1000 times series are needed for setting up an UEB.

Examples of breakdown by end-use in UEB

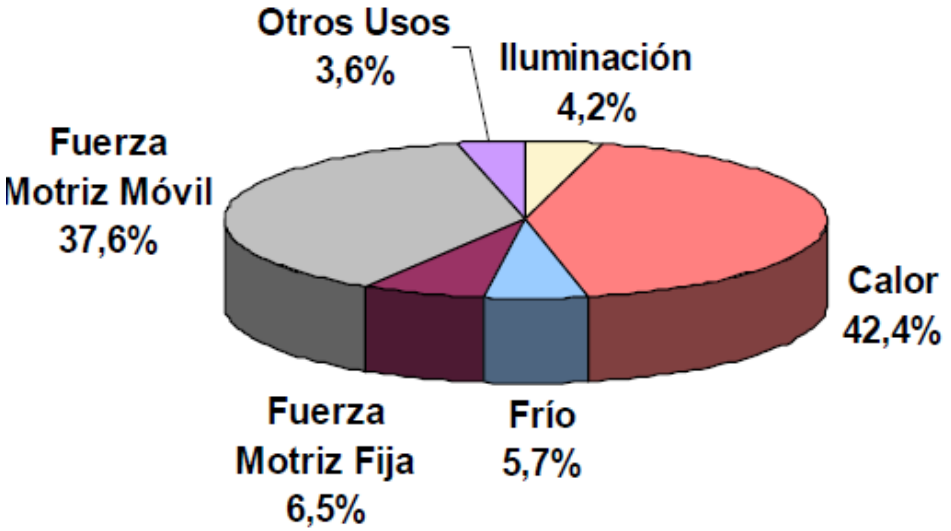
- The useful energy balances are disaggregated into a multiple of consumers categories, corresponding to end-uses, but also regions for households, types of vehicles in transport etc…. For instance in Uruguay there were around 100 categories.
- The end-uses are aggregated in broad categories (see below).

Breakdown of UEB by main end-use

Peru



Uruguay



Source: MIEM

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End-use efficiencies derived from UEB: case of Uruguay and Peru

- Studies on useful energy balance in LACS shows discrepancies in end-use efficiencies due to different levels of penetration of various technologies, because of national circumstances (energy mix, energy prices and age of equipment) or different level of implementation of energy efficiency policies.
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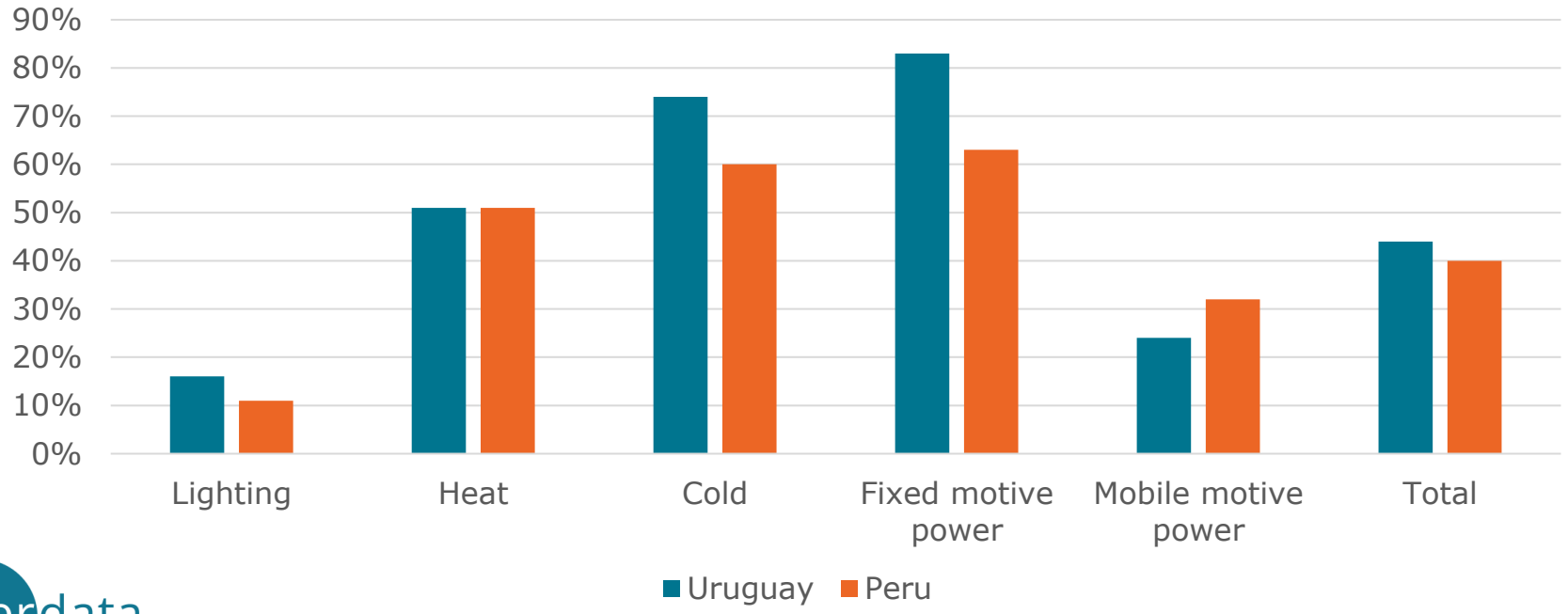

Source: MIEM and MINEM

Average efficiency from UEB in LACs

- Differences are the largest in the household sector, due a different penetration of biomass, the least efficient fuel for cooking, and of efficient lighting technologies (CFL, Led).
- The overall efficiency depends on the power mix, as it includes the efficiency of power generation.

Country	Years	Households *	End-use efficiency *	Overall efficiency**
Sectors		Households	All end-use sectors	End-use sectors and transformations
Uruguay	2006	42%	44%	37.6%
Peru	2016	27%	40%	32%
Colombia	2015	18%	47%	26%
Paraguay	2011	33%	39%	35%

**Share of useful energy in final energy consumption*
***Share of useful energy in total energy supply*

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Estimation of the potential of energy savings : case of Columbia

The evaluation of the potential is based on 3 levels of efficiency:

- Average ("actual") ➔ value used to get the UEB (eg 83% for LPG or gas water heating in Columbia) (representative of national average, can be based on average label);
- Reference ("Referente"): best on the market (based on best labels) (eg 87% for gas water heating) ; ➔ used to assess the potential
- BAT: best available technology (eg 95% for gas water heating)

Example of water heating in Columbia

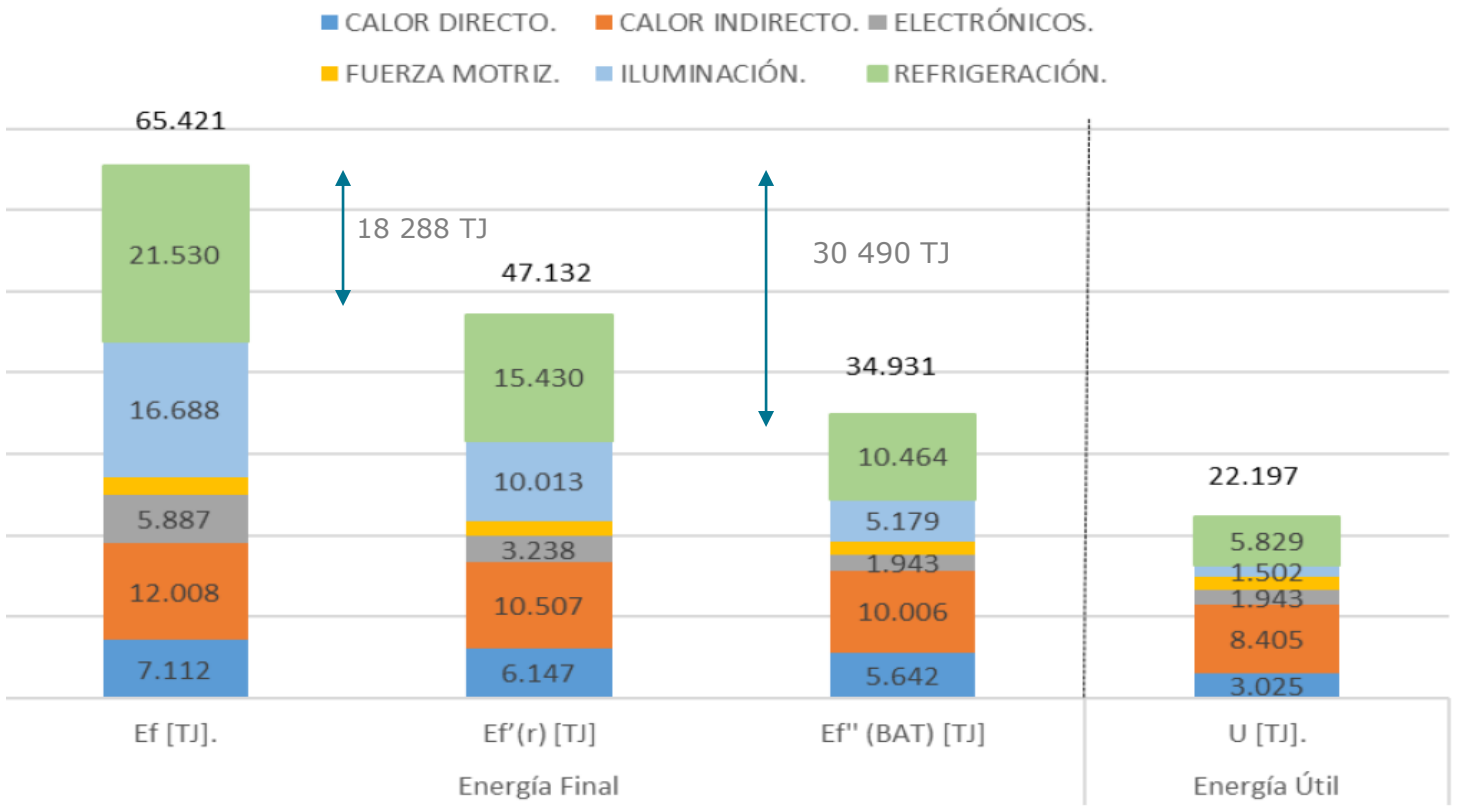
			factor de eficiencia actual	Referente Colombiano	BAT
Uso	Equipo	Energético	%	%	
1.1. Calentamiento de agua	1.1.1. Calentador de paso a Gas	Gas Natural	83,0	87,0	95%
		GLP	83,0	87,0	95%
	1.1.2. Calentador de paso eléctrico o calentador eléctrico con acumulación	Energía eléctrica	70 y 90	71 y 95	95%

Fuente: Cálculos propios Corpoema, 2019.

Estimation of the potential of energy savings in services: case of Columbia

The estimation of the potential of energy savings at the level of the final energy consumption is done in two steps:

1. Calculation of a fictive final consumption with reference and BAT efficiencies by applying these efficiencies to the UEB.
2. Estimation of the potential by difference between the final consumption and the fictive consumption: e.g 18 288 TJ (reference) and 30 490 TJ (BAT)



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Conclusions on useful energy balances (1/2)

- It is feasible to build a useful energy balance but it requires a significant effort of data collection as it has been demonstrated in LACs.

- Beyond the direct benefits of an UEB for a country (i.e. assessment of the real level of energy services, of the average energy efficiency and of the energy efficiency potential), there are also two indirect benefits as the information collected can also be used to:

    - Evaluate the impact of energy efficiency policies on energy demand, through detailed energy efficiency indicators by end-use, the so-called energy efficiency indicators (EEIs) (top-down evaluation);

    - Project the long-term demand with end-use models, such as MedPro,LEAP, or MAED.

Conclusions on useful energy balances (2/2)

- Although the useful energy balance does not need to be updated regularly, the information used to estimate it need to be collected or estimated on a yearly basis: a critical issue is to define a methodology to easily update the information on a yearly basis.

- Apart from the construction of UEB, there are initiatives to collect consumption data by end-use, such as the ODYSSEE-MURE project for 30 European countries, the BIEE project of UN-Eclac for LACs, the Meetmed data base for 7 Arabic countries, the EEUDM initiative of ADEME and IEA for G20 countries or the data tools developed by CONUEE in Mexico.

- It can ne noted that EU countries require each members states to produce on an annual basis such the energy consumption by end-use for households