International Energy Agency

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How to collect the data needed?
Introduction to main data collection methods for developing efficiency indicators

Mafalda Silva and Charles Michaelis

Pretoria, 15 October 2019

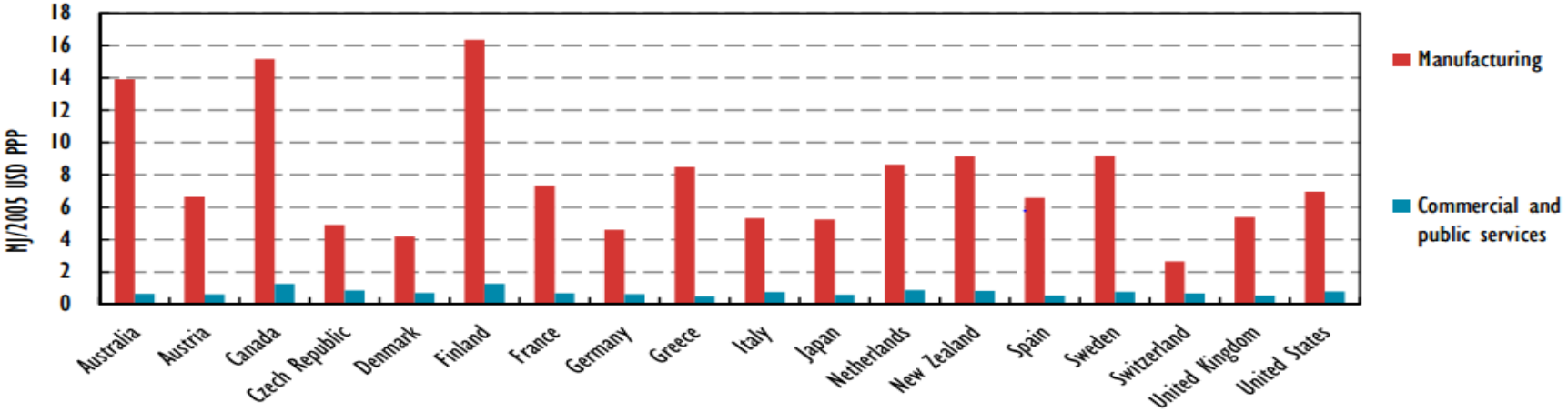
IEA #energyefficientworld

Session 5 overview

- Overview of main methodologies for collecting energy efficiency data
- The role of new technologies in data collection
- Experience across the region: group discussion

Energy intensities (MJ/value added)

Example of efficiency indicators: industry and services



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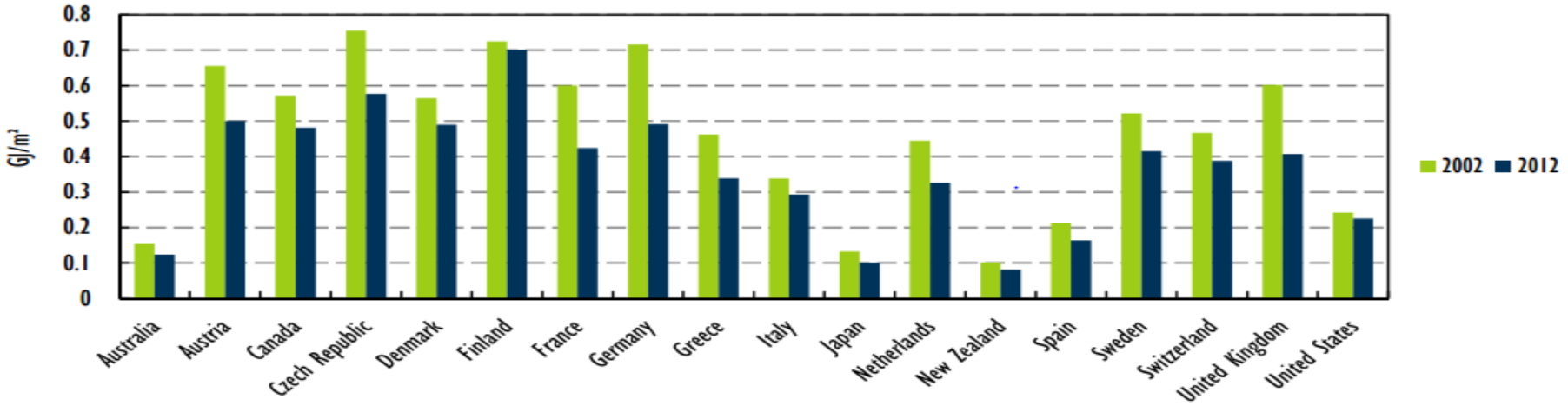
Residential space heating (GJ/m²)

Example of efficiency indicators: buildings



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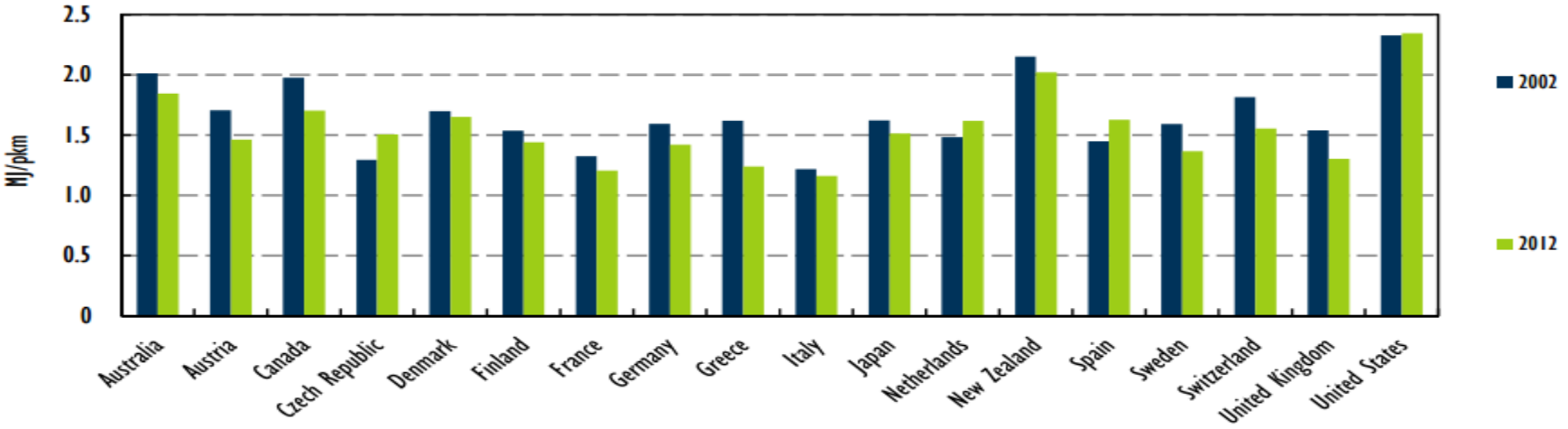
Passenger transport (MJ/pkm)

Example of efficiency indicators: transport



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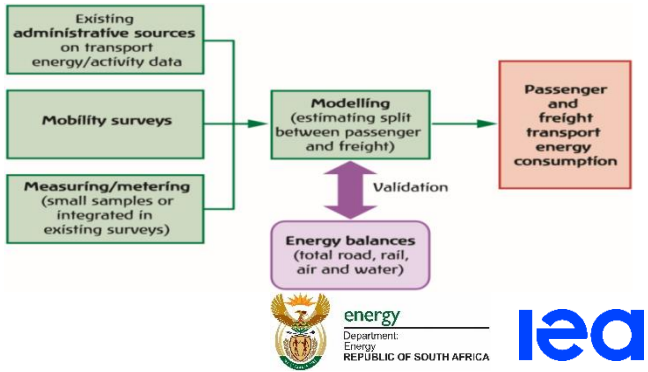
Methods used by countries to collect data for indicators

- **Administrative sources**
  - before starting new data collection
  - **data-sharing across organizations**, identifying data gaps
- **Surveys**
  - representative sample (cost, time, accuracy, detail)
  - possibly expanding existing surveys
- **Metering and measuring**
  - costly but very effective for monitoring specific equipment efficiency
  - identifying **specific energy-uses** (e.g. energy audits, smart meters)
- **Modelling**
  - complementary to surveys or stand alone to build complete set of indicators which can be provided in a timely and stable manner.

Schematics of a transport model: source, output and validation

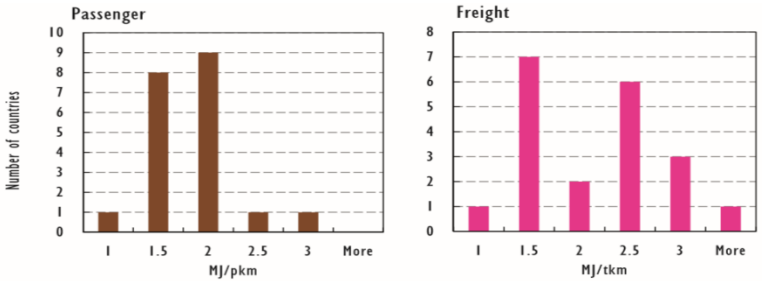


Collecting and checking energy efficiency data

- **Two general principles:**
  - Collect what is needed – focus on **priorities**
  - Research already **existing** sources (e.g. transport ministry)

- **How to check the data?**
  - **Coverage:** sub-sector boundary (ISIC), annual time-span, net calorific values
  - **Internal consistency:** data coherence and summation, revision of historical data (changes in definition, sources, classifications, methodologies, etc.)
  - **External sources consistency**: figures in national statistics or energy balances, publications from related authorities
  - **Plausibility:** zero vs not-available, reasonability within expected range of values

Reported range of transport EEI (OECD 20)



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- Data and sources: Example for the residential sector

Table 4.2 • Summary of the main data needed for residential indicators and examples of possible sources and methodologies

Data	Source	Methodology
Energy data		
Total residential consumption	National energy balance	Administrative sources Modelling
Energy consumption by source	National energy balance Utilities	Administrative sources Modelling
Activity data		
Floor area	National statistics offices Real estate Regional governments Taxation registers	Administrative sources Surveys
Number of dwellings	Land registry National statistics offices	Administrative sources Surveys
Heating equipment	Building registers Manufacturers/Vendors Subsidy registers	Administrative sources
Number of appliances	Manufacturers National statistics offices	Administrative sources Surveys

IEA Energy Efficiency Indicators: Fundamentals on Statistics, 2014

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Things to think about when conducting a quantitative survey

- **What do you want to learn?** Is a quantitative approach the best?
- **Who do you need data from?** If organisations, consider who will have the data within the organisation.
- **Constructing a representative sample** Can you define the population of interest? How will you select the sample to ensure randomness?
- **What data do you need?** Will respondents know, can they provide it without excessive effort?
- **How accurate do you need the results to be?** This will determine the sample size.
- **How will you collect the data?** The choice of data collection method will affect the response rate and may introduce bias.
- **Maximising the response rate** a low response rate means you can't be sure that the responses are representative. Types of non-response bias include…
    - **Knowledge bias** people who don't have the information you want won't respond
    - **Idleness bias** people who are very busy don't have time to respond
    - **Survivor bias** firms that are no longer in business can't respond
    - **Method bias** some people don't have a telephone or an internet connection or are out when an interviewer calls
    - **Power bias** surveys tend to be conducted by people with power – do they reflect everyone's views?
    - **Language bias** surveys may exclude minorities
- **How will you test the approach?** Conduct a pilot study
- **What will you do with the data?** Pilot the analysis as well as data collection.

Things to think about when conducting qualitative research

- **What do you want to learn?** Is a qualitative approach the best?
- **Who will have the answers to your questions?** How will you recruit them (no need for random samples)? Do you need an incentive?
- **Capture a diversity of views** including non-users, opponents, failed initiatives as well as success stories.
- **How many people do you need to speak to? I**t's not a precise science – looking for saturation.
- **How will you collect the data?** e.g. interviews or focus groups? Telephone or face to face interviews? It will depend on the respondent and the questions.
- **Allow enough time** engaging the right people can take longer than hoped
- **How will you analyse the data?** Software or pen and paper
- **Pilot data collection and analysis** test all aspects of the research process before launch

Administrative sources: *using existing data that fits your purposes*

Pros	Cons
Typically less expensive than a new data collection process	Boundary issues: potential mismatch between existing and needed data
Relatively quick availability	Challenges in establishing and keeping institutional communication
Increased synergy between institutions	Possible costs (e.g. purchase data, change data formats…)
Raise profile of energy efficiency among different services	Time investment in research to find the right sources

The importance of establishing a framework

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Surveying: *collecting ad-hoc data from a representative sample*

Pros	Cons
Relatively cost-effective, given extensive information collected	Potentially high absolute cost
Ad-hoc design of items collected based on purpose	Time consuming and requires trained staff
Representativeness / statistical significance	Need for further estimation (e.g. extrapolation between years)
Usually comprehensive and good quality data	Risk of incomplete responses, biases, sampling errors

Leveraging on national statistical capacity (NSO) and existing surveys

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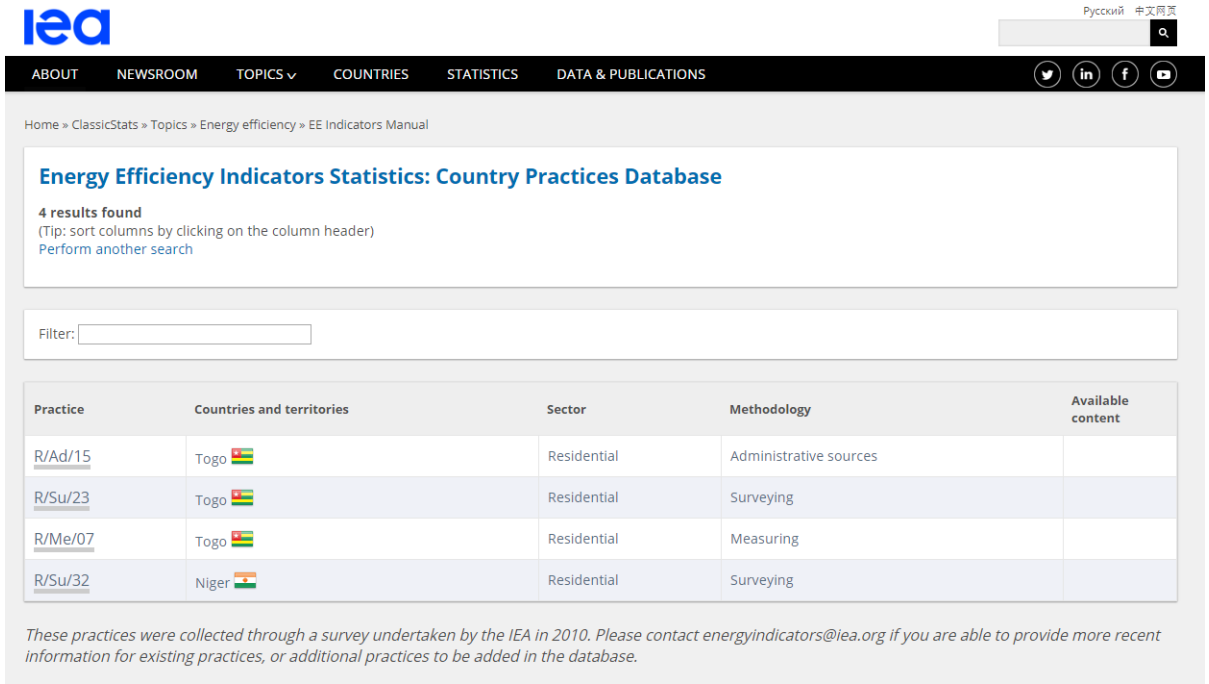
IEA database on country practices for data collection

- Practices in surveying, administrative sources, modelling and metering across sectors
- Questionnaires and other material available
- Links to various national administrations work



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Energy Efficiency Indicators Statistics: Country Practices Database

4 results found
(Tip: sort columns by clicking on the column header)
Perform another search

Filter:

Practice	Countries and territories	Sector	Methodology	Available content
R/Ad/15	Togo	Residential	Administrative sources	
R/Su/23	Togo	Residential	Surveying	
R/Me/07	Togo	Residential	Measuring	
R/Su/32	Niger	Residential	Surveying	

These practices were collected through a survey undertaken by the IEA in 2010. Please contact energyindicators@iea.org if you are able to provide more recent information for existing practices, or additional practices to be added in the database.

An example of how to benefit from each other's work
http://www.iea.org/eeindicatorsmanual/

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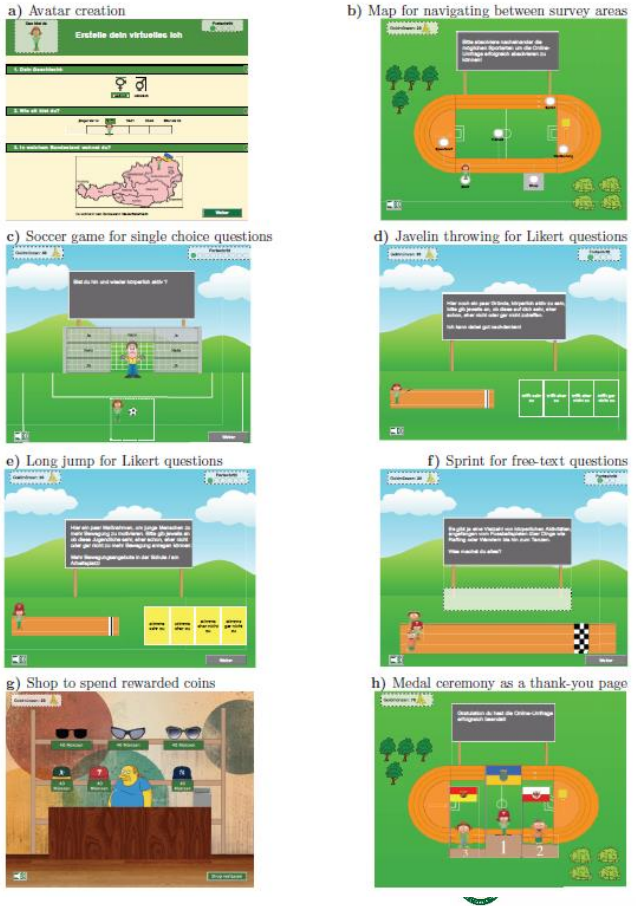
The role of new technologies in data collection

Gamification of surveys

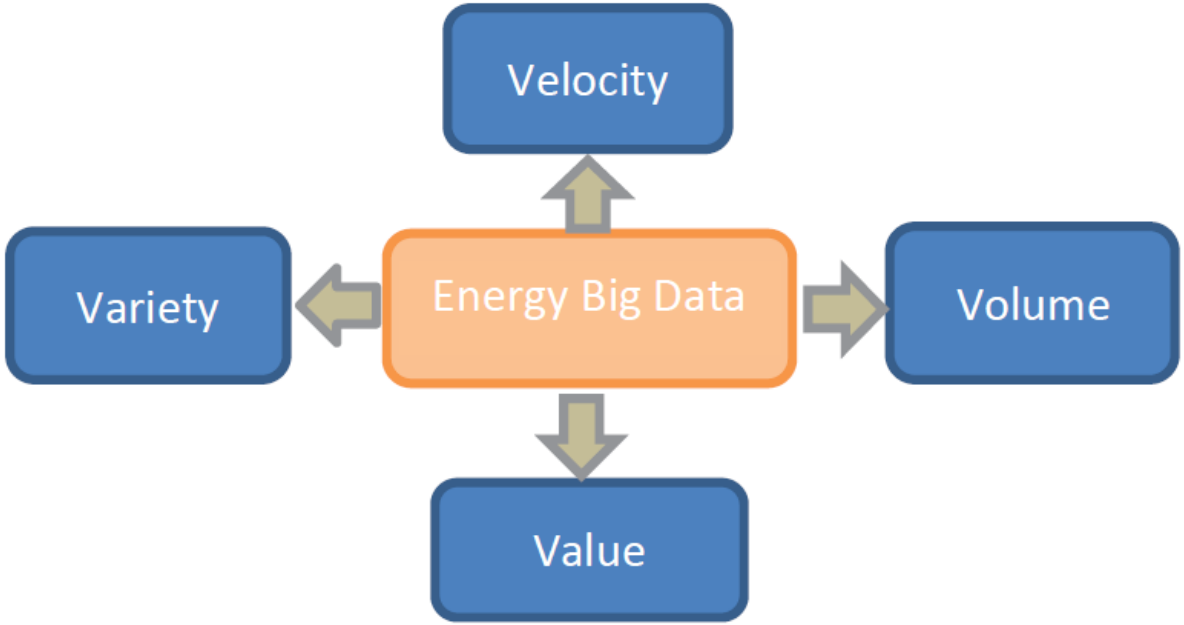
- *Gamification provides motivational affordances that produce **psychological** (e.g., user experience, emotion, fun) and **behavioral** (e.g., participation, performance) outcomes*

Source: Harms et al (2015) Gamification of Online Surveys: Design Process, Case Study, and Evaluation



New technologies and digitalization open a world of *big data*

- The advantages



Source: Koseleva and Ropaite (2017) Big data in building energy efficiency

Examples of applications for the residential sector

Photo: PSMA Australia Photo: Geoscape - PSMA Australia

All of Australia's 15.2 million buildings have been mapped

https://www.domain.com.au/news/ai-machine-learning-helped-a-canberra-company-map-every-building-in-australia-779281/

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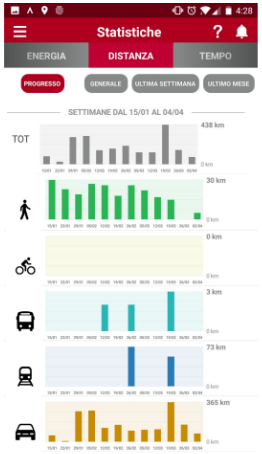
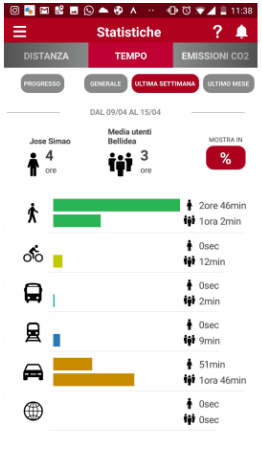
- Examples of applications for the transport sector

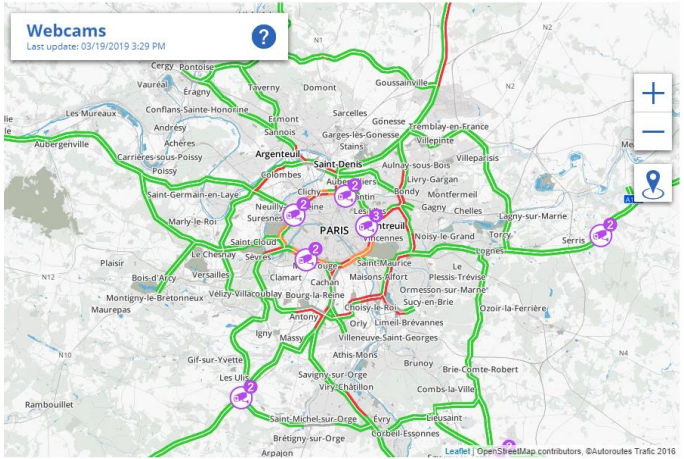




From left to right: weekly evolution of kilometers travelled; weekly share of transport modes and comparison with average Bellidea users; weekly evolution of points.

Source: Cellina et al (2018) Outcomes of a smart city living lab prompting low-carbon mobility patterns by a mobile app

Source: SmartComm Electronics Pte Ltd



Source: https://www.autoroutes.fr/en/webcams.htm

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- Few questions still open

- Data ownership
- Confidentiality issues
- Security issues
- Data standardization and treatment : easier to get in than out
- Best methodologies to process the data?

- What is your experience?

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Group discussion
Priority sectors, and data needs and challenges to monitor and evaluate energy efficiency policies

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For discussion

1. What are the priority sectors in your country?

2. What indicators and what data do we need for energy efficiency policy tracking?

3. What are the challenges that you face about energy efficiency data?

4. What is your experience?

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