Transfer of "top-down energy saving calculation method" to emerging countries: concrete results and implementation process

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Keywords

evaluation methods, benchmarking, top-down evaluation methods, developing countries, capacity building, energy efficiency indicators

Abstract

Evaluation of energy efficiency policies through energy efficiency indicators is broadly applied in many multilateral projects or at national level in many countries. This methodology, usually called "top down method" or "indicators-based method" is one of the methods recommended by the European Commission (EC) to report on energy savings in their National Energy Efficiency Action Plan (NEAAP). It has been the object of standardisation at European level (CEN/CENELEC) and a standard is currently under negotiation at world level (ISO TC 257). However, the concrete application of this methodology raises many application issues in emerging countries with less organized data systems. Based on 20 years of experience in implementing such methodologies in the European context within the ODYSSEE MURE project (www.odyssee-mure.eu), we have been in a position to transfer this know-how to various emerging countries through several multilateral projects: in 18 Latin American countries within the IPEEC/ECLAC/BIEE project or in 4 South Mediterranean countries within the MEDENER indicators project) or on a bilateral basis (e.g. India, Brazil, Thailand. The concrete steps we have taken for a proper implementation in emerging countries will be presented. We will attempt to evaluate the success of our practices through a set of quantitative criteria of success (number of indicators, of times series etc.) and a set of 11 complementary qualitative criteria, such as project implementation, in-country assistance, human factors etc. Conclusions will be drawn on the solutions to overcome the barriers for implementation and to enhance capacity building.

Introduction: a growing demand in emerging countries to implement Top-Down evaluation methods

Could you implement ODYSSEE energy efficiency indicators (EEI) in Latin American Countries (LACs)? This simple question was raised 4 years ago by an UN officer to ADEME as coordinator of the ODYSSEE experience. Above the scientific and strategic interest for ADEME, the question becomes: is it workable to transfer TD methods in emerging countries and how to ensure structural embedding of the process through capacity building? Now, 18 LACs are implementing for their own national energy efficiency monitoring system, an adaptation of the ODYSSEE methodology through the BIEE project (UN-ECLAC-ADEME 2014, see box 1). This article intends to open discussion on that issue.

Implementing energy efficiency policies and measures (EE P&Ms) is increasing worldwide, including in emerging countries (WEC, 2013). However this green signal should be qualified because in the meantime we observe a slowdown in energy efficiency trends since 2008 (-0.6 %/year between 2008–2012 compared with -1.3 %/year over 1990–2008 for the primary energy intensity at world level) (WEC 2013). This situation implies for government a need to implement or reinforce the monitoring of EE P&Ms impact. In the European context, Members States (MS) are "enforced" by the Energy Efficiency Directives (2006/32/EC [Energy Services Directive, ESD], then 2012/27/EU [Energy Efficiency Directive, EED]). The European Commission (EC, 2010) has defined recom-

Table 1. Energy efficiency Indicators classification.

Indicators	Levels	Example(s)
1. Energy intensity	By sector & sub-sector	TPES/GDP; IFC/VA industry
2. Adjusted intensities	Final and industry	Purchasing Power Parity (ppp); constant GDP and industry structure
3. Specific energy consumption	By sub-sector & end-use	l/100 km, koe/M^2; Kwh per refrigerator, Toe/ton of cement,
4. Benchmarked specific energy consumption	Steel, cement, paper, heating, cooling	Adjusted to process mix, to heating or cooling Degree-Day
5. Energy efficiency indices	Final and by end-use sector	ODEX
6. Energy savings	Final, primary, by sector and by end-use	
7. Indicators of diffusion	By equipment	% of CFLs, of efficient cars, heat pumps, % of efficient electric motors
8. Financial indicators	Macro level	Contribution of energy efficiency in the reduction of the energy bill or households expenditures

Source: The authors.

mendations to evaluate the energy savings to be reported by the MS, using Top-Down (TD) and/or Bottom-up (BU) methods (Bosseboeuf et al 2012).

TD methods have been already applied in emerging countries during the nineties (Bosseboeuf 1995) but clearly a new interest emerges in BRICS or emerging countries, which are starting to implement larger P&Ms, to develop this type of evaluation. In the recent past, we have had the opportunity to develop capacity building on that matter in around 30 emerging countries. Based on this experience, we will discuss the conditions and the success of on-field implementation of TD methods in emerging countries.

After having recalled the concept of indicators-based methods, we will present our step by step methodology that we have developed to enhance capacity building in emerging countries. It will be illustrated by concrete case studies, and projects will be summarized. The second part will attempt to assess through quantitative analysis the reality of implementation. This analysis will then be completed with a qualitative analysis using a set of criteria which will allow us to discuss the conditions for capacity building that leads to structural embedding of TD evaluation methods.

The TD methods or indicators-based methodology for evaluating energy efficiency

WHAT ARE ENERGY EFFICIENCY INDICATORS (EEI)?

For over thirty years, researchers and policy implementers have developed methodologies on monitoring energy efficiency. One approach is the so called top-down (TD) methodology for the calculation of energy savings and, more generally, to assess energy efficiency (Bosseboeuf et al. 2013). The principles of calculations are presented in the CEN CENELEC standard (EN 16212: 2012) or in the recommendations proposed by the EC (2010) for assisting MS to fulfil their NEEAP mandatory reporting related to the ESD then EED energy saving calculation[1].

Table 1 provides a classification of the EEIs. Only the first category (energy intensity) is an "easy to obtain" indicator; using data from the energy balance and general socio-economic data (e.g., GDP). However, the others require data beyond that data sources. Therefore the development of EEIs is potentially a challenge for most of emerging countries which have a limited number of detailed end-use data, given that these EEIs should be statistically representative to the selected boundaries (region, countries).

Application cases for TD methods

The most comprehensive application at international level of the TD methods is certainly the ODYSSEE project[2] that develops and calculates over 200 comparable energy efficiency indicators across 29 European countries (ADEME and Enerdata 2012). Outside Europe, IEA has given a new dynamics to EEI as part of their "energy efficiency market report" (IEA 2014). At world level, ISO TC 257 is carrying out a set of standards on energy saving calculation at different levels of analysis (country, project and organisations) which constitutes an updated and broader discussion on TD and BU methods. The novelty is the growing interest of many emerging countries to implement TD methods, both at national level (e.g. Tunisia [ADEME 2012a] or Morocco [ADEREE 2015]) or regional level (UN-ECLAC; MEDENER, RCREEE etc.). ADEME is engaged in several of these international initiatives. The following boxes present two emblematic projects dedicated to EEIs methods in non-IEA countries.

We believe that the success of the TD methods implementation partly relies on the project implementation itself. Table 2 presents a summary of the project characteristics for different

1. Concrete application has been recently made by MS for their NEEAPs 3 (reported in 2014) and the Commission is currently assessing these results in particular to check in the EU in on track with their energy efficiency objectives.

2. http://www.odyssee-mure.eu/

Box 1. The BIEE project (UN-ECLAC-ADEME) on energy efficiency indicators in Latin America.

UN-ECLAC, the United Nations Commission for Latin America and the Caribbean, launched in 2010 a project on energy efficiency indicators (*Base de Indicadores de Eficiencia Energética* – BIEE project) to develop energy efficiency indicators for its member countries. The project started with capacity buildings in Mercosur countries and was later extended to Central American and other Latin American countries (Mexico, Costa Rica, Ecuador, El Salvador, Nicaragua, Panama, Peru, Santo Domingo) and is palled to cover in 2015 some English-speaking Caribbean countries (Trinidad & Tobago, Aruba, Barbados, St Lucia). This capacity building took the form of training sessions in Latin America, technical assistance in some countries, data collection by each partner country and assistance in the interpretation of results indicators energy efficiency.

Results and deliverables are available in the website : http://www.ECLAC.org/drni/biee/, including data mapper with a selection of key indicators: http://www.biee-cepal.enerdata.eu/

Box 2. The MEDENER indicators project (MED-Ind).

As part of its support and energy policies monitoring activities, MEDENER (Club of Mediterranean energy efficiency agencies) has established a regional observatory for monitoring energy efficiency trends in the Mediterranean region. For two years (2012-2014), the first MED-IEE project (Energy Efficiency indicators for Mediterranean countries) was carried out by the MEDENER network teams under the coordination of ADEME and ANME (Tunisian energy agency). Trends in energy efficiency in the Mediterranean region have been analysed in a regional report. This project has allowed the establishment of similar national and regional databases on energy efficiency indicators for Morocco and Lebanon were already existing for Tunisia and Algeria, as well as of a regional database with common indicators for all Mediterranean countries. The interpretation of the evolution of these indicators has also been done in national reports. A second phase is under negotiation which will include new countries and more detailed indicators. The main results and deliverables of the project can be found at http://medener-indicateurs.net/uk, including an interactive database with the main energy efficiency indicators for the nine countries covered.

initiatives where ADEME's was involved as well as some technical elements such as number of EEIs and related times series.

A STEP BY STEP APPROACH TO IMPLEMENT EEIS IN EMERGING COUNTRIES

Based on the experience gained through the ODYSSEE project, a methodology for knowledge transfer and capacity building has been developed, with slight differences according to the type of project (regional or bilateral), mainly related to the outputs level of sophistication.

In addition to the coordinator whose main role is to get the commitment, select the team and manage the project, two kinds of partners are involved: National Teams and a Technical Coordination.

The National Teams (NTs) are the core of the project and are the focal point for the country. Their composition differs according to country but they should preferably gather statisticians and energy demand and policy analysts. Their role is to participate in the training, to collect data, to report, to participate in the workshops for exchange of information and results, and to disseminate them.

The Technical Coordination (TC) proposes methodologies, trains and assists countries, manages the database. In detail, the TC proposes a template of data to be filled-up by the NTs, develops methods of EEIs calculation, performs the quality check of data and reports on data gaps.

The project is generally organized in a certain sequence which has an importance (Table 3) that can be summarized as follows for a regional program.

This table highlights the importance of the exchange of information between the TC and the NTs, but also between different NTs to get confidence in the practices and results. The quality check and sufficient in-country assistance are essential. The training can be made by international experts, in collaboration with local trainers. Our experience shows that NTs have difficulties to report due to lack of practice. Some NTs are reluctant to proceed to the step of national dissemination.

Provided that participating countries want this, and sufficient funding is available, the methodology could be enlarged in four ways:

- Development of national energy efficiency data base with an interactive internet tool. The basic software could be provided by the TC and being adapted through exchanges of information. Alternatively, it can be developed by the country itself (more difficult but more sustainable for similar cost). These databases can be protected by a password, which guarantees the confidentiality of the information contained in the interface.
- Development of a methodology to monitor the NEEAP implementation. It may require additional indicators.

Table 2. Characteristics of different projects on implementing energy efficiency indicator.

	ODYSSEE	BIEE	MEDENER
Number of countries	29 European countries	18 LAC	5 North Mediterranean countries, 4 South Mediterranean countries
Period	1992–2015		
Sponsor	EU (75 %); agencies (25 %)	UN; GIZ; ADEME	ADEME
Funded team	Yes	No (In kind)	No (In kind)
Governance	EE agencies	Government	National EE agencies
Data collectors	National team	National team	National Team
Number times series	1,500	700	700
Indicators number	200	100	100
Quality check	Yes (automatic and manual)	Yes (automatic and manual)	Yes (automatic and manual)
In country assistance	No	Important (local assistance)	Important
Reporting	National team	National team	National Team
Dissemination	Important (ADEME, National)	Light but high level	Yes national reports
Web site	Yes	Yes	Yes
Data Mapper	Yes	Yes	Yes
User facilities	Yes	No	No
Impact on national monitoring	Yes	Perhaps later	Yes
National data bases	No	No	Yes (4)

Source: The authors.

- Development of more advanced indicators requiring an additional effort on data collection.
- Development of friendly dissemination materials or statistical indicators books.

Criteria to assess the success of a methodological transfer

EVALUATION CRITERIA AND SCORE

It is partly possible to evaluate the success of TD methodology implementation through a quantitative analysis using the following criteria:

- the number and length of time series effectively collected to perform the indicators
- the number of indicators obtained
- the coverage for end-use sectors and parts thereof.

There is an obvious link between the number of time series and the number of indicators, because time series define the indicators that are possible to produce. However, it happens that the number of indicators can drastically improve with limited additional data (e.g. using energy consumption by branch in industry or a breakdown of motor fuels by vehicle type). The length of times series is important as well for a better interpretation of trends.

We have presented this type of analysis in a previous article (Bosseboeuf et al. 2013) in case of the European ODYSSEE practice. It is noticeable that beyond the common features among countries (i.e. good coverage in industry, worst coverage in services), there are discrepancies which depend on many factors such as the geographical situation, the economic development, the experience in energy efficiency policies implementation and monitoring. However it is difficult to find any obvious common rule explaining the data coverage (i.e. Austria

Table 3. A step by step approach to enhance the capacity building on EEIs methodology transfer.

Step	Explanation
Step 1: Kick off meeting for motivation and getting confidence between partners	General objectives of the project, justification as to the need of indicators (TC), presentation of the current experience on EEIs, presentation of EE P&Ms (NTs).
Step 2: TC develops a region-specific data template	Excel sheet gathering all the necessary data for EEIs calculation, automatic calculation of EEIs, integrated quality check.
Step 3: TC perform a first training workshop on data collection needs	EEIs definition and calculation, data needs, practical exercise, demonstration of the template. Support materials need to be adapted to national circumstances with examples from the region. Local consultants trained earlier can also be involved.
Step 4: NT perform data collection	Data mapping, possible adaptation of the template, first data collection to fill up the template.
Step 5: First data check by the TC, reports on data gaps	Hot line service with NT, comments from the NTs in the data gap report.
Step 6: Second training workshop on data collection improvement	Exchange on information on preliminary results and data gaps (NTs). TC proposes solutions to increase the data coverage. Discussions on new surveys, first discussion on interpretation (TC).
Step 7: In country assistance or job training	TC or local consultant. Mainly to increase the quality and coverage of data; need for TC to have a good know-how of the energy demand situation and data specific to the region (and countries involved).
Step 8: Third training on interpretation and reporting on energy efficiency trends.	Contents of the report, graphs, example of interpretation of indicators adapted to the region (TC). First presentation of indicators by NT. Comments from TC.
Step 9: Reporting by NT	NT carries out itself the report relating EEIs and EE P&Ms. Identification of data mistakes, final consolidation of the data collection, recommendations on data collection and EE P&Ms.
Step 10: Reporting quality check (TC)	Hot line service or in-country assistance or job training.
Step 11: Final reporting and preparation of the dissemination material (NT)	Presentations, key messages, preparation of recommendations.
Step 12: Benchmark analysis (TC)	Consolidation of the regional database, calculation of adjusted indicators, report on cross-country comparison (TC). Review of the report (NT).
Step 13: Final regional meeting on exchange of results	Exchange on information on results based on the national reports (NT); Comments from the TC. Presentation of the cross country comparison. Recommendation for future works.
Step 14: National dissemination seminar	Presentation of national report to national stakeholders (ministries and agencies, statisticians, researchers, NGOs, press etc.).

Source: The authors.

(a small country) has a better data coverage than Germany). The impact of the level of development is not fully clear, despite the fact that in general, Eastern European countries have lighter data coverage than the Western countries. But this situation reflects above all the later implementation of energy efficiency policies in these countries.

The end use data availability in emerging countries, mainly Northern African countries and LACs involved in the projects presented in this paper, is shown in Tables 4 & 5.

As it can be easily observed from the extraction of the common data template, the data coverage is very satisfactory with small discrepancies among sectors and countries. However it corresponds to a more limited data collection requirement compared to EU countries (Bosseboeuf 2012), implying a lower number of indicators to be produced. The indicator template for these countries was conceived on purpose and adapted to the expected level of data availability. The strong in-country assistance performed by experienced local and regional experts has contributed to this achievement, but also the acceptance by the partners to fill-up the database by "expert data" which are not necessarily considered as official data.

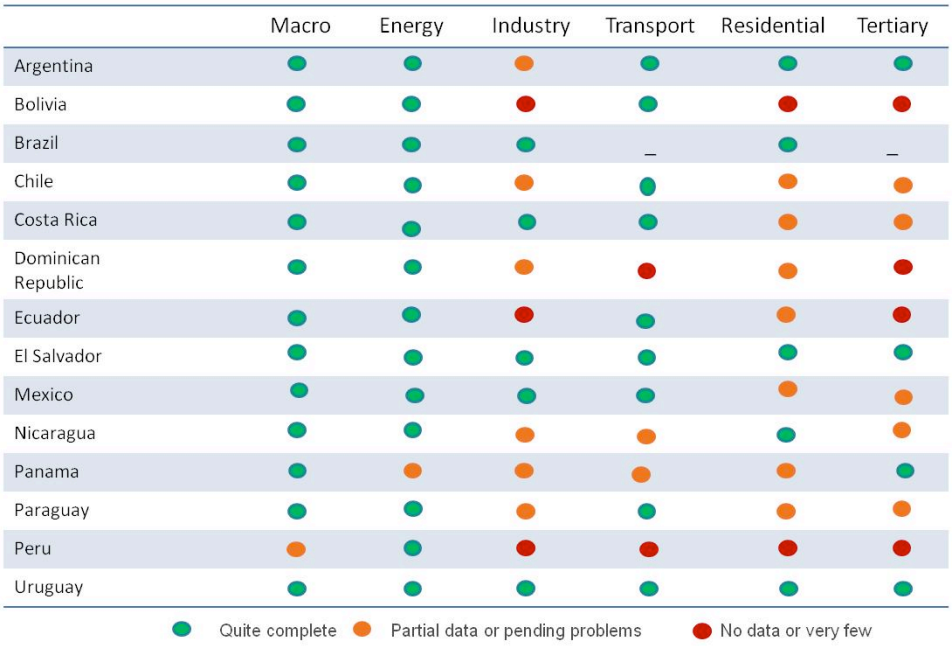
This is clearly an important strategic issue that governments are facing for a mandatory reporting on energy savings due to the following dilemma: either using official data from the en-

Table 4. End-use data collection coverage for selected Mediterranean countries, by sector (2013).

Country	Macro-economic data (GDP, VA, etc.)	Energy consumption data	Industry	Households	Services	Transport
Algeria	100 %	100 %	100 %	95 % (b)	98 %	100 %
Morocco	100 % (a)	90 %	100 %	95 %	100 %	95 %
Tunisia	100 %	100 %	100 %	95 %	98 %	90 % (c)
Lebanon	100 %	100 %	98 %	98 %	98 %	100 %

Source: The authors. Percentage are calculated as the ratio of total number of times series effectively collected under the total number of times series requested, (a) No data on biomass; (b) except CFLs and solar water heater; (c) no data on traffic and specific consumption of new cars.

Table 5. End-uses data coverage for LACs, by sector and countries (2014).



Source: The authors, from the BIEE database; Brazil did not collect data for transport and tertiary sectors quite complete: over 85 %, partial data 50 %–85 %, no data or very few (below 50 %).

ergy balance but often not disaggregated enough (e.g. by end-use), or using more disaggregated data from unofficial sources. The ability to analyse energy savings requires the highest disaggregation as possible, to eliminate as much as possible structural effects (e.g., basic chemical and para-pharmacy, Diesel and gasoline cars) that distort the calculation of savings that are as close as possible to real energy efficiency improvements. Another issue is that official data are not always considered the most reliable by practitioners. It can be said that, provided that the quality of the expert adaptations is guaranteed, the higher the level of disaggregation (e.g. by end-use and type of energy), the better the evaluation.

The experience in LACs is less convincing despite the data requirement being similar to the one experienced in MEDENER (Table 5). But it should be noted that the project implementation is still on-going. Clearly there are discrepancies according to the countries and sectors. In Costa Rica, Paraguay and Uruguay the data availability is very high. A more important result from a practitioner perspective is that the sector coverage differs from the situation observed in OECD countries (see ODYSSEE in Europe). In emerging countries where biomass accounts for a larger share of the energy consumption, the lack of data on biomass use strongly affects the interpretation in the household sector. However the most surprising observation emerges from the industry sector where the availability of consumption by branch is very rare due to absence of end-use surveys or mandatory reporting of consumption (common practice in OECD countries). In the same way in transport, the lack of fuel consumption by road vehicle limits the analysis.

Table 6. The limited number of available indicators in industry in LACs (2014).

	Energy intensity	Energy intensity of mining	Energy intensity by industry branch	Energy intensity at constant structure	S.c. ciment (toe/t)	S.c. paper (toe/t)	S.c. steel (toe/t)
Argentina	☺	☹	☹	☹	☹	☹	☹
Bolivia	☺	☹	☹	☹	☹	☹	☹
Brazil	☺	☺	☺ (few missing)	☹	☺	☺	☺
Chile	☺	☺	☹	☹	☺	☺	☹
Costa Rica	☺	☹	☺	☺	☹	☹	☹
Dominican Republic	☺	☹	☹	☹	☹	☹	☹
Ecuador	☺	☹	☹	☹	☹	☹	☹
El Salvador	☺	☺	☺	☺	☺	☹	☹
Mexico	☺	☺	☺	☺	☺	☺	☺
Nicaragua	☺	☹	☹	☹	☹	☹	☹
Panama	☺	☹	☹	☹	☹	☹	☹
Paraguay	☺	☹	☺	☺	☹	☹	☹
Peru	☹	☹	☹	☹	☹	☹	☹
Uruguay	☺	☹	☺	☺	☹	☹	☹

Indicators marked in red: included in the data mapper

☺ Indicator available ☹ Missing data to calculate indicator

Source: The authors, from the BIEE database.

Due to lower data coverage in industry, the number of related EEIs is significantly lower than targeted for example in Europe for the "Preferred indicators (PIs)" as defined by the European Commission (EC 2010) (Table 6).

Quality of data and collection process

However the most challenging issue from a quantitative point of view is to assess the data quality, because in practice it is always possible to fulfil a data collection requirement with "expert data". This assessment requires from the evaluators an additional knowledge about the methodologies used to obtain the data (posted questionnaire versus face to face survey, sampling size, accuracy of the results, etc.). In that respect, the recent IEA initiative to present in detail the current practices about end-use data collection should be highlighted (IEA 2013). A similar initiative has been made for francophone countries illustrated with more practices taken from emerging countries (IEDD 2014). Unfortunately, we are not in position to provide a table showing the quality assessment of the data collected in emerging countries as we did for ODYSSEE. A first attempt for practitioners will be to elaborate a comprehensive "data mapping" which presents the sources of data, their characteristics (cost, starting date, etc.) and the data flows including what we can call the "governance" of the data collection. A good example can be found in Mediterranean countries from the MEDENER project (Figure 1).

This type of data flow scheme, as part of a more complete mapping of data availability, is very useful for the government to visualize the data collection status in order to organize in the future a systematic and automated system of data collection between ministries or others stakeholders, including utilities. As it can be seen above, the flows of information is country specific even if the main categories of stakeholders are similar.

Progress for data and indicators over time

To finalize our review of workable quantitative criteria, we can consider the progress of data or indicators coverage along a given period of times. We can provide such type of figures for European countries only, based on the last 3 years of the ODYSSEE project. Interesting enough this criterion was imposed by the EC as a criterion of success of the project implementation (Figure 2). We can notice that the gap between countries in data collection (and indicators) coverage is narrowing in the course of the project, giving a positive example to other countries which are starting the process of implementing indicators-based method. We have observed a similar pattern in the other projects but with a slower timing and path. TD implementation is a step to step approach which never ends according to the penetration of new equipment or end-uses (i.e. air conditioning, small appliances, etc.). This criterion demonstrates that a strong-willed attitude can fulfil the gap. Such monitoring allows the government to identify the data gap to be covered by new end-uses surveys.

From this quantitative analysis, we can conclude that TD methodologies can be successfully transferred in very different types of countries and is partly sector specific. However the level of ambition depends on the countries' experience, both on data collection and energy efficiency policies implementation. We should mention that the end-use sectors where the BU evaluation is less applied (i.e. transport and services) can be generally better covered through TD methods in OECD countries. A different situation may exist in emerging countries.

QUALITATIVE ANALYSIS

We believe that for a better understanding or judgement on the effective implementation of TD methodologies, a qualitative assessment can usefully complement the quantitative analysis. However, the qualitative analysis presented below will allow us

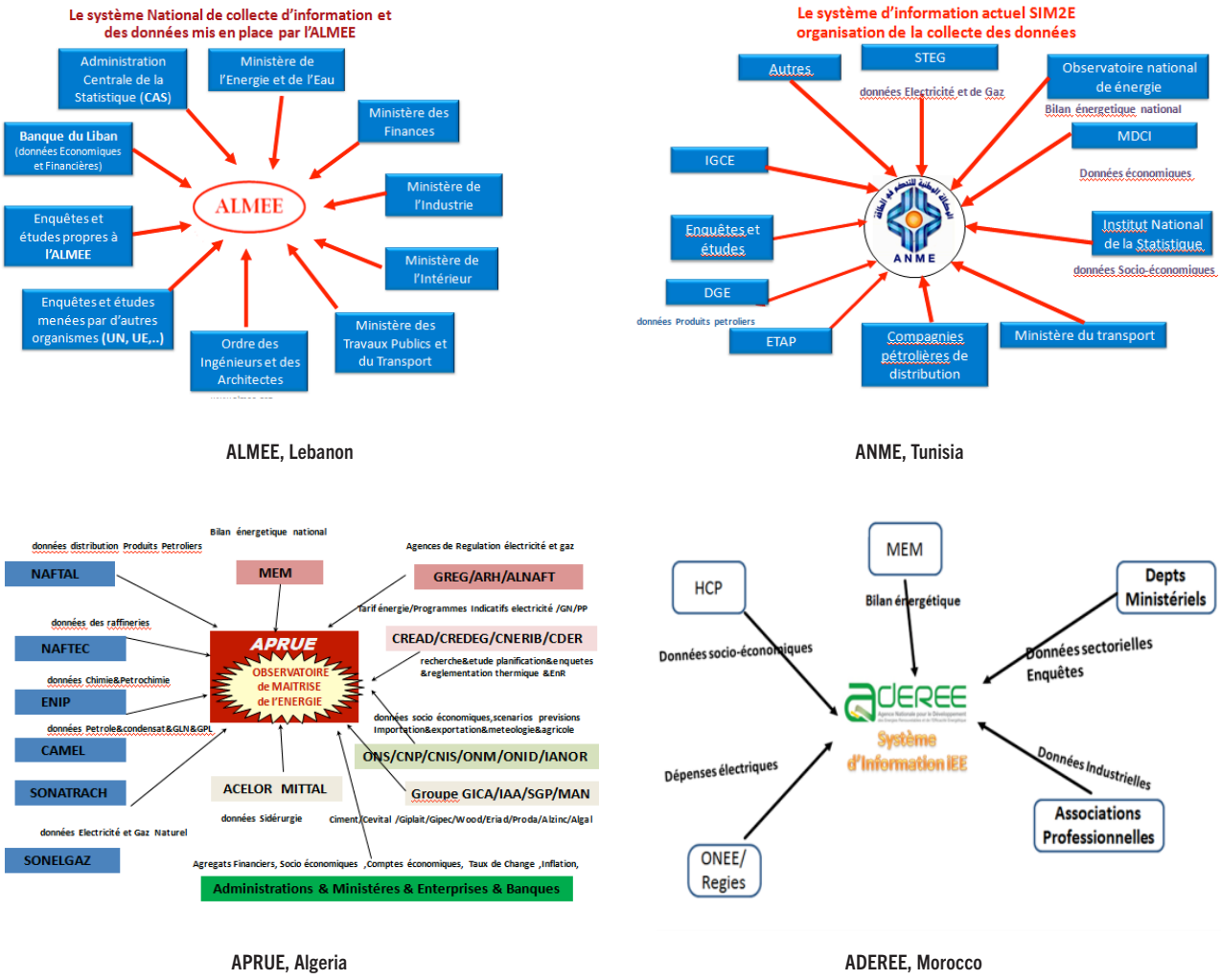


Figure 1. Data collection flows for EEIs in Mediterranean countries.

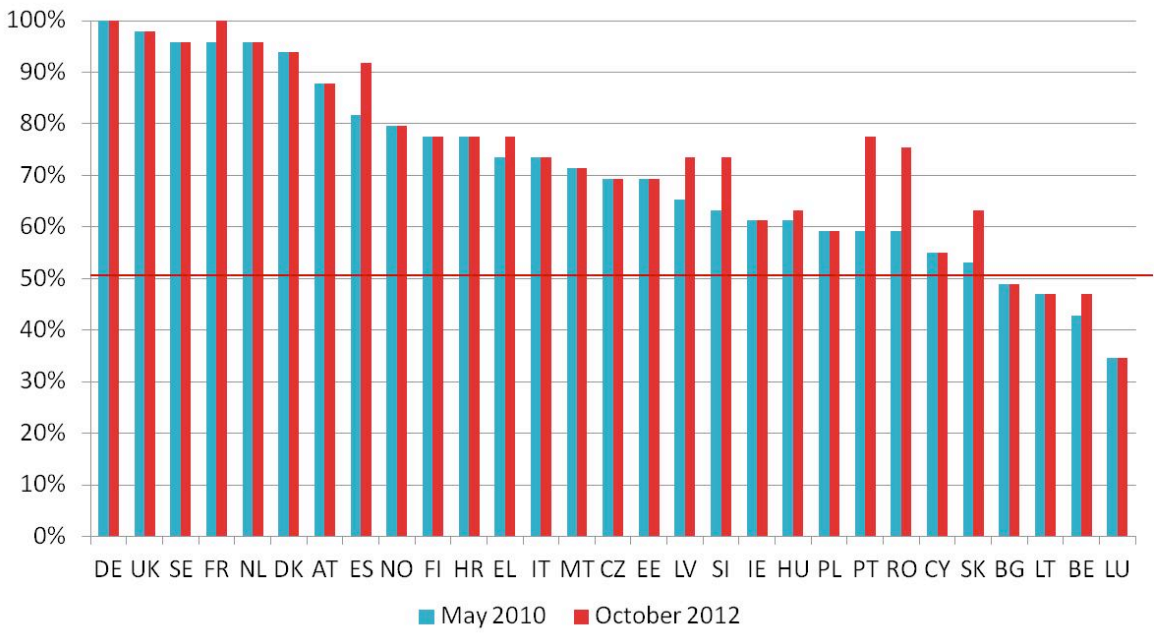


Figure 2. Data collection coverage in ODYSSEE (2010–2013). Source: The authors in ODYSSEE final report 2012, Percentage corresponds to the ratio: number of data collected under the number of data requested for calculating EEI indicators.

to discuss the condition of an effective implementation rather than provide a real assessment.

It is difficult to classify these criteria and no academic reference on that matter exists. Therefore our contribution should be considered as a first attempt for further discussion. We propose to review some criteria and to illustrate their impact on TD implementation through concrete issues we have encountered along the projects implementation in emerging countries. We have observed that the project design and implementation is a key for successful implementation of TD. Under this heading various criteria can be mentioned.

Structure of the consortium of participants

They are basically two approaches which can be combined in practice:

1. A **centralised** approach where a consultant performs indicators using pre-existing international sources such as IEA, World Bank or sectoral databases (Iron and Steel Institute: IISI). This is the approach followed for the worldwide WEC indicators database and the IPEEC/IPEEI G20 countries database. The advantage is the rapidity of the results, a certain consistency and homogeneity of the results, a lower cost of implementation and an easy management. The main drawback is the absence of legitimacy of the results, but a certain degree of acceptance can be reached by the countries covered through a real review process. This approach could be favoured when the number of countries is large and the funding limited.
2. **A decentralised project** where national teams (NT) are responsible for the data collection and reporting under the guidance of a technical coordination which proposes methodologies and manages the database. The better the relationship between the TC and the NTs is organised (through workshops, hot line service, quality check reporting etc.), the better the quality of the results. The main advantage is the legitimacy of the results and a more effective dissemination due to the appropriation of results by NTs. The drawbacks are the management of the consortium when the number of countries is large, and the associated costs, in particular if the NTs are funded, and the difficulty to get consensus on methodological choices.

The type of organiser/coordinator/sponsor

Usually the initiators are international organisations (IEA, UN-ECLAC, EU etc.) or bilateral cooperation, ADEME/French government at the occasion of a twinning programme (Turkey, Morocco, India) and more recently with AFD (Mexico) or GIZ in Thailand and South-Africa. The advantage of an international management is certainly the institutional power (for instance UN can negotiate more easily a governmental commitment) and the capacity to organise large project implementation. However these organisations do not sometimes have internal technical skills to perform the concrete work. Some countries are also reluctant to work with international organisations (e.g. IEA) for political reasons or because they are reluctant to be benchmarked. Through bilateral cooperation, a closer relationship allows a better fit with the national circumstances. But this is obviously more costly per country. Comparing the two approaches that were implemented in Mediterranean countries (MEDENER and RECREEE regional initiatives versus bilateral cooperation in Tunisia, Algeria and Morocco), we can assume that the capacity building obtained through bilateral contact is more effective but does not allow benchmarking, which is an important objective when monitoring energy efficiency. To be complete, some countries prefer to work with sister organisation, e.g. between energy efficiency agencies (Medener, EnR Club) or research networks. The issue of language or culture could be also an issue (RCREEE (Arabic countries) and BIEE (LACs).

The level of funding

It is merely true that the quality of the capacity building is linked with the level of funding. The first classical issue is whether or not the NTs should be funded for their work. In the ODYSSEE project, the NTs are lightly supported (15 days for data collection, 10 days for reporting, 10 days for workshop participation over 2 years). One reason is that the Commission would like to have a full EU coverage. Similarly in the RCREEE project the NTs are supported (mainly through local consultants). When transferring methodologies, we believe that NTs from emerging countries should demonstrate their motivation through in kind funding, at least for the data collection and reporting, the travel costs for regional workshop being covered by the donors (i.e. UN-ECLAC, MEDENER). A typical level of funding is around 2–3 months for the first run and 1 month for a yearly updating, slightly higher than in ODYSSEE to take into account the differences in experience and data availability, simply because it is easier to fulfil data requirement when the data are easily available.

The second issue is the funding level to support the **in-country assistance**. Our experience shows this is one of the key factors of success (see below).

The third item of funding is the TC. The level here depends of course on the skills of the consultants (usually costly OECD senior consultants), but also the eventual costs of the tools associated with the methodology (i.e. from a simple Excel sheet to an interactive online database), the times allocated for the training (around 10 days per year) and above all for the quality check and the hot line service to the NTs which can be estimated to 1 week per country per year. One solution to reduce the costs is to hire regional or local consultant but they are still quite rare in this field in emerging countries.

The last important item is the cost associated to the exchange of information through the workshops between NTs, privileging the south-south debate and with the TCs. On average each ODYSSEE or UN-ECLAC workshop costs around €80,000–€100,000 (travel costs included).

In total, the level of funding is proportional to the number of countries but also to the expected quality of the work and capacity building.

The nature of the NTs

Technically speaking, the composition of NTs should preferably gather energy statisticians and EE policy analysts able to perform the data collection, reporting, exchange of information and the dissemination of results. Politically speaking, the NTs should have the highest possible level of commitment (i.e. government) in order to facilitate the use and the dissemination

of the results. It is not obvious to combine both objectives because firstly the skilled staff (Master degree on energy economics) does not necessarily exist within the emerging countries' governments themselves. Secondly the high level of turnover in public administrations makes the sustainability of the capacity building questionable. A well paid staff will limit this risk. This is why the ADEME's cooperation favours energy efficiency agencies as the focal point due to their expected motivation, expertise and willingness to disseminate the results, as it has been proven over the last 20 years in the ODYSSEE project. This implementation has been replicated in the case of the MEDENER project with ADEREE (Morocco), ALME (Lebanon), ANME (Tunisia) and APRUE (Algeria). For the UN-ECLAC project, the commitment is given by the government and the work performed by the energy efficiency division of the Ministries. However in some cases, this is the energy agency which is in charge of carrying out the work (e.g. CONUEE for Mexico). In many cases, the NTs sub-contract the tasks to **local consultants**. This implementation has finally proven as a key of success. The main argument is that consultants have more time than government staff to spend and have a more stable position in the process. This type of organization has been deliberately taken in the RCREEE project (one consultant for each NT) and partially achieved in the UN-ECLAC project. This strategy also allows allocating more time to the task as can be illustrated with the figures taken from the UN-ECLAC project (Bolivia 7 man-months; El Salvador; Costa Rica, Panama 3 man-months; Uruguay, Paraguay, Guatemala, Nicaragua 2 man-months). It has also been the case for the GIZ-Thai government project where a local consultant associated to an experienced international consultant has really contributed to the success of the project. However these local consultants should be firstly trained by the TC to guarantee a certain homogeneity in the methodological transfer, which is not always properly done due to budget constraints. These consultants should be also properly managed by the government team. A third possibility could be to rely on a network of researchers or NGO's to perform the works with a certain independency but we do not have concrete experiences to mention.

The importance of training

In our methodology we propose 2 to 3 sessions of two consecutive days. The material displayed should be adapted to the national circumstances, for instance by taking case studies from similar context (i.e. air conditioning practices in warm or tropical countries, substitution from wood to commercial energy, irrigation). The training should be performed by experienced experts and the intervention of local experts is certainly a plus. Our strategy has always been to include in the projects several training sessions (4 in 5 years in ODYSSEE, 2 in MEDENER + 12 bilateral job training, 8 in the UN-ECLAC project, 3 on job training plus local training in the GIZ-Thai project).

The importance of routine workshops

Particularly for projects aiming at providing EEIs benchmarks across countries, it is important to organize a routine of workshops, for instance every 6 months, to consolidate the network of experts and to maintain an incentive for NTs to perform the work. But the main objectives should be to organize the exchange of information among participating countries in order to gain trust among countries on data quality and on the interpretation of results, and between NTs and TC to monitor the capacity building transfer. Participants should be in priority those persons which will really fill-up the template and prepare the report on energy efficiency trends. Each ODYSSEE workshop gathers around 50–70 experts and more than 50 workshops have been organized since the beginning of the project (1992) mainly to get consensus on methodological issue and exchange on results.

The institutional framework

We would like to stress the fact that the relationship between data providers (see Figure 1 for instance) and the government plays a crucial role in the data collection process. It is impossible to relate all the institutional organigrams relevant to the data collection we have encountered, and all the concrete stories we were facing to collect data since the data providers are so creative to refrain to provide their data. Obviously for small size countries such as Caribbean islands, Uruguay or Paraguay or even Malta and Ireland in Europe, it is difficult to gather data in industry due to statistical confidentiality rules (less than 3 companies in one sector). In other countries, some sectors are considered strategic (refinery in Morocco, gold mine in Bolivia, oil sector in Algeria). Besides these extreme cases, difficulties come from the reluctance of sectorial ministries (transport, housing) to provide activity data to the Ministry in charge of Energy. It could be also the case for energy data such as in India where each fuel has its own Ministry and they are reluctant to give the data to the EE agency (BEE: Bureau of Energy Efficiency) in charge of the energy consumption data. This low level of relationship is also due to the "shyness" of the governmental staff to go out from their own ministry for "data mining" in other ministries. Another typical case is the difficulty to get end-use data from utilities which is a crucial source of data (and vice versa). Our experience is that there always exists more data available than the first diagnosis may reveal. To overcome these barriers, several strategies can be taken. First personal relationships generally facilitate the process of data collection but it is not a sustainable way of proceeding. Secondly, in order to attract other ministries in the data collection game, they should be "invited" in the full process of the project mainly to understand why their data are needed and to share with them the results. The third one is the most sustainable strategy. It is to either organize a working group gathering all stakeholders referenced in the data mapping able to provide end-use data, or even better to set up specific regulations organizing the data collection for energy demand or energy efficiency. In that respect the case of Algeria should be mentioned since the energy efficiency agency APRUE has been appointed by law to organize the energy demand observatory. In case of Tunisia, the good practice was to conceive a single data base combining energy and CO_2 emissions data (SIEEN database at ANME). At international level, the recent IEA's initiative to test the feasibility of a mandatory questionnaire on EE data collection to its network of OECD energy statisticians should be highlighted, being in principle the most sustainable way to implement TD methods. This process is a similar procedure used successfully by IEA from decades for the so-called annu-

al questionnaires (e.g. on oil, gas). However, the response rate seems deceiving due to the large number of data (1,000 times series) and the type of data (energy and activity) which may discourage governmental officers.

The in-country assistance

This task makes the difference both for the data collection and the reporting. The main challenge here is to find experts able to adapt or create new TD methods to take into account national circumstances. In practice, the approach could consist in delivering the highest number of indicators from a limited number of primary data through estimate, extrapolation or modelling. This know-how implies a very good knowledge of the energy end-uses and their drivers in emerging countries (i.e. no space heating and air conditioning in Colombia, biomass consumption mainly affected to cooking in Ethiopia , smuggling of motor fuels in border regions, cold water used in washing machine in Brazil, diesel motor for back-up). We found also essential to display assistance for the interpretation and reporting of the EEI trends. Providing example of reports carried out by similar countries and pre-determined contents and graphs are good ways to accelerate the capacity building. One good indicator of success could be to check if the NTs are able to carry out a second report without assistance.

The acceptance of non official data

A prerequisite for any good transfer of TD methods is to have an accurate energy balance. This is not always the case in emerging countries (biomass, allocation of petroleum products among sectors, etc.). However, to properly monitor energy efficiency, we need to collect end-use data beyond the energy balance (i.e. energy consumption by branch in industry and services, break-down of electricity consumption by appliances or motor fuels by vehicle type and specific energy consumption of equipment). This is important to convince national experts to use reasonable estimates which enrich drastically the capacity of interpretation. We should notice that the visualisation of EE indicators sometimes reveals mistakes in the energy balance (i.e. bad allocation of diesel between transport and industry sectors; too high car performances due to smuggling or border effect, bad allocation of electricity between residential and service sector), as experienced in Tunisia or Turkey using new set of data from surveys.

The willingness to disseminate the results

Each year ADEME is publishing reports on energy efficiency trend (ADEME-Enerdata from DATAMED 2014) and the main results are reported in a yearly statistical yearbook (ADEME 2014). This strategy of diffusion is completed by a national ODYSSEE report (ADEME 2013) and national seminar opened to various stakeholders including press and NGO's. This is still challenging to find such type of national dissemination process in emerging countries. It can be understandable that the publication of the first report by a government may require a lot of caution. On average we experienced a 1 to 2 years delay in delivering the first country report. Tunisia is a good practice in dissemination even if the energy efficiency agency is still hesitating to publish an alternative energy balance based on better assumptions provided at the occasion of the EEI approach. Finally, one of the most tangible criteria of success for capacity building is when a NT is able to properly present itself the results without assistance and disseminate the results in an official publication.

The need to maintain an EE data base

Usually, the first attempt to monitor energy efficiency is to store the data collection in an Excel template. In order to facilitate the TD methodology transfer, it is preferable to conceive a template with transparent formula of EEI calculation, systematic sourcing of data, automatic procedure of data quality checking, automatic display of graphs, etc. However to make this transfer more user friendly and above all more sustainable, we have implemented an energy demand and energy efficiency database tool in a number of countries (in particular in MEDENER countries) but only through national cooperation due to the costs. This type of interactive database facilitates the dissemination of EEI to the selected stakeholders through a password procedure. The joint elaboration of the database design is an important process and is not too much time consuming (around 2 weeks). The storing and sourcing of the data certainly contributes to the sustainability of the TD methodology transfer at a relatively low cost. The software can be developed by the NTs themselves which avoid future issues of property rights.

The human factors

This criterion is often mentioned as a key of success in project implementation but is very difficult to apprehend. We have already partially touched upon this issue in describing issues concerning the skills of consultants or of the NTs. Undoubtedly, the good relationship between the UN and French cooperation staff and the confidence with NTs carefully selected have largely influenced the motivation to continue besides the results alone. The success of the MEDENER project relies certainly on the fact that the TC gathered two sister organisations ADEME and ANME-Tunisia which have developed through a long established relationship cooperation providing a North-South experience that NTs have appreciated. The issue of language (French-speaking countries) and a common culture among Maghreb countries has also played an important role. Similarly the community of language (Spanish-speaking) and culture among LACs should be mentioned despite the large size of the consortium. The motivation of the initiator of the project is also essential to overcome all the barriers when implementing international project.

Conclusions

The European methodology "ODYSSEE" on TD methods, using energy efficiency indicators to monitor energy efficiency policies impacts, is implemented in more than 70 countries over the world. In the recent past, the French partners in Odyssee had the opportunity to transfer this methodology to more than 30 emerging countries, including capacity building in governments or energy efficiency agencies in these countries. Based on this on-field practice we can conclude that TD methods can be successfully transferred in emerging countries. This conclusion is evidence-based using a set of quantitative indicators of success, such as number of indicators produced or the number of (energy) data sets that have been collected. How-

ever this quantitative analysis also demonstrates that the data coverage currently achieved in emerging countries is generally (slightly) lower than common practice in OECD countries. It also differs according to the sector, but can be above the current practice of some European countries. In general, the TD method can be transferred as such. But some adaptations are needed in order to take into account of economic and cultural national circumstances, but also country specific end-uses of energy. This situation is not fixed in time since we observed that through new surveys and extra capacity buildings emerging countries practices can meet, in some years, the average standard of TD implementation (Tunisia, Paraguay, Costa Rica for instance). We performed a complementary qualitative analysis aiming at revealing the essential keys of success for transfer of TD methods, using a set of interlinked criteria such as project implementation, skills, in-country assistance, human factors, etc. This can be used as a "guideline" for practitioners to enhance the capacity building in emerging countries. It is difficult to conclude about the main factors which are crucial because they form a package of good practices which should be adapted to each country. This transfer requires a particular know-how from the consultants which have to find ways to concretely adapt the methodology to national circumstances. This knowledge should be extended at national and international levels. But the success also depends on the acceptance and the voluntarism of emerging countries. There are still many barriers, such as the reluctance to provide data and to participate in benchmarking exercises, and the classic lack of funding. To overcome these barriers, more exchanges of practices between emerging countries should be organized in order to gain confidence on TD practices. ISO TC 257 on energy saving calculation or IPEEC conferences are good opportunities for emerging countries to participate in these methodological issues. The remaining issue is the persistence of capacity building initiated along the projects donors implementation, due to the high level of turnover of governmental staff and discontinuations in the aid. Obviously the increase in weight and the recognition of energy efficiency and monitoring in particular within the governmental officers are key. One technical solution to create persistence is that emerging countries develop tools, in particular energy demand and energy efficiency indicators, or even CO_2 emissions databases, with proper sourcing and proper dissemination access, for instance with an interactive data base such as in Tunisia or Algeria. However above all we believe that the interest for emerging countries to implement TD successfully will increase when the need of monitoring becomes essential as the P&Ms implementation will become mature.

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