NL Agency
Ministry of Economic Affairs, Agriculture and Innovation

Comparable energy savings: how to ensure that singers form a harmonious chorus?

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Harry Vreuls, NL Agency, The Netherlands

Overview

- The IEA DSM Agreement & the project on harmonisation of energy savings calculation
- Key elements of energy savings calculation
- Experiences from case applications
- Importance of choices within the calculations
- Conclusions

Harmonisation of energy savings calculation, a project within the IEA DSM programme

- The IEA Demand Side Management Agreement: a co-operation between 16 countries in the field of energy savings on the end-user (demand) side.
- Since the early 1990s over 20 projects.
- Database on DSM projects (INDEEP); no longer operational
- An evaluation guidebook for governmental and non-governmental Energy Efficiency Programmes targeted towards energy end-users; finalised 2006

Harmonisation of energy savings calculation

- Project to research options to harmonise energy savings calculations
  - to contribute to more simplified internationally comparable energy savings
  - to define subsequent actions for future standardisation of energy savings calculations
  - additional to energy savings also dealing with greenhouse gas emissions and Demand Response

- A combination of country experts from Norway, France, Spain, Switzerland, The Netherlands, USA and the Republic of Korea and the project manager

A template with the key elements for energy savings calculations

Key elements for energy savings calculation:

1) summary information of the programme; including the "status of the calculation"

2) formula for calculation of annual energy savings; including choice of baseline and types of corrections

3) input data and calculations; including "type of data"

4) GHG savings

1 Summary of the program
   1.1 Short description of the program
      1.1.1 Purpose or goal of the program
      1.1.2 Type of instrument(s) used
   1.2 General and specific user category
   1.3 Technology(/ies) involved
   1.4 Status of the evaluation and energy savings calculations
   1.5 Relevant as a Demand Response measure

2 Formula for calculation of Annual Energy Savings
   2.1 Formula used for the calculation of annual energy savings. specify if the formula
   2.2 Specification of the parameters in the calculation
   2.3 Specification of the unit for the calculation
   2.4 Baseline issues
   2.5 Normalisation
   2.6 Energy savings corrections
      2.6.1 Gross-net corrections
      2.6.2 Corrections due to data collection problem

3 Input data and calculations
   3.1 Parameter operationalisation
   3.2 Calculation of the annual savings as applied

   3.3 Total savings over lifetime
      3.3.1 Savings lifetime of the measure or technique selected
      3.3.2 Lifetime savings calculation of the measure or technique

4 GHG savings
   4.1 Annual GHG-savings
      4.1.1 Emission factor for energy source
      4.1.2 Annual GHG-savings calculation as applied
   4.2 GHG lifetime savings
      4.2.1 Emission factor
      4.2.2 GHG lifetime savings as applied

Key elements for energy savings calculations for case applications lighting in households (1)

All use the same components in the formula:

1. the situation before: the old lamp;
2. the situation after: the new lamp;
3. the average burning hours of the lamp;
4. possible normalisations;
5. correction factor(s)

Annual energy savings: $ES = 1/1000\ (P_{old} - P_{new}) \times t$

ES: annual energy savings in kWh

1/1000: conversion from W to kW

P_{old}*: power old lamp in Watt*

P_{new}*: power new lamp in Watt*

t: time period for energy consumption hours/year ("burning hours")

Key elements for energy savings calculations for case applications lighting in households (2)

- The key parameter Delta Watt ($P_{old} – P_{new}$) is derived in two ways:
  - An (average) value of the old as well as the new lamp; In this case the averages are depending on CFLs, lamp wattage and the relevant baseline.
  - An average value for Delta Watt. This is applied in situations of replacement by multiple CFLs having different wattages

- The key parameter annual burning hours is derived in two ways:
  - an average annual value;
  - An average daily value multiplied by 365 (days)

Key elements for energy savings calculations for case applications insulation of houses

- The formulas for calculating the annual energy savings are based rather different views:
  - based on energy savings per m^2 of insulation materials/ windows; based on the estimated heat demand calculated using a model approach for meeting the heat demand
  - based on a model for the building performance.
  - billing analysis with two models is used to calculate energy savings

- The formulas, even after harmonisation of parameters, are very different

Key elements for energy savings calculations for case applications air conditioning in commercial building/offices (1)

- In the Spanish case the programme was targeted to a replacement of an existing air conditioner with water condensed chillier system (electric)
- In the Dutch case all types of air conditioners and different energy sources (electricity, gas or heat) are included for the savings calculation
- Different formulas, harmonisation is difficult

Key elements for ESC: case applications air conditioning in commercial building/offices (2)

Spain:

- The yearly cooling demand based on monthly cooling demand
- the annual cooling load profile based 10% load in combination with hours per year.
- Baseline: efficiency existing R22 machines
- Normalisation is not conducted
- Annual savings discounted with 2.5% over the theoretical performance
- No corrections are conducted

Netherlands

- The yearly cooling demand is calculated using average monthly values for a standardised year.
- Baseline: a reference situation with another air conditioning system or another air conditioner.
- Parameters on the dimensions of the building are in line with ISSO 75.1
- No corrections are conducted

Choices within the calculations (1)

France

Method is focused on CFL units

Average 80 W for incandescent bulbs and 18 W for new CFLs. Delta Watt is therefore 62W

Burning hour t is assumed to be 800. Based on the living room and an assumed utilisation of 2 hours and 10 minutes per day on average. Burning hours t do not change after the replacement

Korea

Method is focused on fluorescent lamps

Old fluorescent lamps of 40W and new fluorescent lamps of 32W. Delta is 8W

Burning hour t is assumed to be: 2771. Based on all rooms in a building

The Netherlands

Method is focused on CLF-units

Average power old lamp is 55,8W and average power new lamp is 12,4W. Delta is 33,4W

Burning hour t is assumed to be 482. Based on all households and on all rooms in a house. Burning hours do not change after the replacement

Choices within the calculations (2)

Spain

Method is focused on LED-units

Assumed power old lamp is 40W and assumed average power new lamp is 4W. Delta is 36W

Burning hour t is assumed to be around 700. This amount is based on energy auditing experiences. Burning hours do not change after the replacement

United States case area California

Method is focused on CLF

Overall delta watts 44.5 W. This value depends on CFLs, lamp wattage and the relevant baseline

Burning hours t are approximately 657 hour annually (1.8 daily time 365 and are determined via monitoring e.g. retrieving information on operating hours of installed measures.). This is done as a function of dwelling unit characteristics, room type, fixture type, lamp type, and region

Choices within the calculations; same burning hours

	Values France			Values Netherlands			Values Spain			Values California		
	delta P	t	kWh	delta P	t	kWh	delta P	t	kWh	delta P	t	kWh
	to CFL			to CFL			to LED			to CFL		
	62	800		62	482		62	700		62	657	
E savings per lamp			49.60			29.88			43.40			40.73
	33.4	800		33.4	482		33.4	700		33.4	657	
E savings per lamp			26.72			16.10			23.38			21.94
	36	800		36	482		36	700		36	657	
E savings per lamp			28.80			17.35			25.20			23.65
	44.5	800		44.5	482		44.5	700		44.5	657	
E savings per lamp			35.60			21.45			31.15			29.24

Choices within the calculations; same delta W

	Values France			Values Netherlands			Values Spain			Values California		
	delta P	t	kWh	delta P	t	kWh	delta P	t	kWh	delta P	t	kWh
	to CFL			to CFL			to LED			to CFL		
	62	800		33,4	800		36	800		44,5	800	
E savings per lamp			49.60			26,72			28,80			35,60
	62	482		33,4	482		36	482		44,5	482	
E savings per lamp			29,88			16,10			17,35			21,45
	62	700		33,4	700		36	700		44,5	700	
E savings per lamp			43,40			23,38			25,20			31,15
	62	657		33,4	657		36	657		44,5	657	
E savings per lamp			40,73			21,94			23,65			29.24

Choices within the calculations have more impact on the calculated energy savings than the data collection method (1)

- The high value of the old light bulb and high number of burning hours in the France case is related to the assumption that the CFLs will be installed in the living room. (Dutch documentation burning hours in kitchen and living room were about 890 hours in 1995/2000)
- In the France case is assumed that 30% of the installed CFLs replace CFL and does not result in energy savings, while in the Dutch case the assumption is still that CFLs do not replace existing one
- In all case applications, it is assumed that a bought CFL is installed immediately. But an increasing number of bought CFLS are spare lamps. This does not influence the savings per lamp, but the overall impact of summed annual savings.
- The assumptions as used in the case application are over years assumptions seldom changed. Once they are agreed, they are repeated over and over in programmes

Conclusions; IEA DSM template

- The IEA DSM template for key elements for energy savings calculations is a good starting point for harmonisation of savings calculations

- Using this template for five technologies from different countries shows that, although calculated energy savings are different, they can be made comparable to each other

- With this template the evaluator has a tool to provide information more transparently.

- The template increases the understanding on how the calculation is conducted and what choices were made

Conclusions: A common framework

- An important first step is taken by creating a common framework within the IEA DSM Agreement and the European standard

- Recently started work by ISO calculations is targeted to get a broader agreement on a common framework
- This should make the documentation and presentation of calculations more easy and transparent

- The number of case applications is very small and more are needed
  - to improve the framework and the understanding
  - To prove the strong elements in the framework as well as the weak ones which need to be improved

Thanks for your attention

Harry Vreuls
NL Agency

Harry.vreuls@agentschapnl.nl