



# Case application: Lighting in France

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Workshop: Harmonization in Energy Savings Calculation:  
How To Fit International Experiences With Korean Practice,  
Now And In The Near Future  
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- 2. General principles for the energy savings calculation
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## Energy savings obligation and certificates in France (1/2)

- The main effort of measurement of energy savings at a large scale in France is linked to the energy saving obligation introduced for energy companies in 2006
- In the obligation, energy savings are defined in **final energy** and are **cumulated** over the lifespan of the equipment or action; in addition, they are discounted at 4% ; they are expressed in kWh **cumac** (cumulated and discounted)
- The overall national target was 54 **TWh cumac** for the first 3 years period (2006-2009) and **345 TWh cumac** for the second period (2011-2013).
- Each utility has its own target based on its market share and has to prove with certificates (“white certificates”) that it has met its target at the end of the period (if not they pay a penalty).
- The question is how to measure the energy savings linked to the energy efficient equipment and operations that the companies have promoted

# White certificates in France: standardisation of energy savings

- There is no measurement but only a monitoring of the number of standard operations/equipment they have promoted.
- For each of these operations/equipment, there exist an official evaluation of the energy savings → ex-ante evaluation of energy saving
- These evaluations are presented as “summary sheets” and are available on the Ministry web site and in a printed a Memento once a year (in french only)
- The number of sheet is expanding and there are regular updates

Type of document	Documents	Date
On line summary sheets by operation on Ministry web site	○ <a href="http://www.developpement-durable.gouv.fr/Secteur-du-batiment-residentiel.html">http://www.developpement-durable.gouv.fr/Secteur-du-batiment-residentiel.html</a>	February 2011 (last update)
ATEE guide of standardised energy saving operations	○ “Mémento du Club C2E”	September 2010 (6 th edition)

# Standardisation of 214 operations and equipment

Sector	Number
<b>Residential buildings</b> <ul style="list-style-type: none"> <li>•Building Envelope</li> <li>•Thermal equipment (eg boilers, water heaters, regulators)</li> <li>•Equipment (e.g. refrigerator, lamps)</li> <li>•Services</li> </ul>	<b>65</b> 7 48 6 4
<b>Tertiary buildings</b> <ul style="list-style-type: none"> <li>•Envelope</li> <li>•Thermal equipment</li> <li>•Equipment (e.g. Lighting)</li> <li>•Services</li> </ul>	<b>89</b> 14 55 19 1
<b>Industry</b> <ul style="list-style-type: none"> <li>•Lighting</li> <li>•Equipment (e.g. high efficiency motors, variable speed drive, heat recovery)</li> <li>•Buildings envelopes</li> </ul>	<b>26</b> 6 18 2
<b>Networks</b> <ul style="list-style-type: none"> <li>•District heating &amp; cooling</li> <li>•Public lighting &amp; electricity distribution</li> </ul>	<b>11</b> 5 6
<b>Transport</b> <ul style="list-style-type: none"> <li>•Equipment (e.g. high efficiency tyres, public transport infrastructure)</li> <li>•Services (training)</li> </ul>	<b>16</b> 13 3
<ul style="list-style-type: none"> <li>•Agriculture</li> </ul>	<b>7</b>

# White certificates in France: example of summary sheets for standardised energy savings operations

- Each summary sheet specifies:
  - the conditions of eligibility,
  - the conventional life time
  - the amount of energy savings certificates in final energy expressed in kWh cumac (cumulated and discounted at 4%):
    - example: savings with a freezer of A+ class, saving 50 kWh/year during 10 years are 420 kWh cumac (and not  $50 \times 10 = 500$  kWh).
  
- Example of summary sheet : solar water heater:
  - Eligibility : need of a certification (CSTBat, Solarkeymark) and installation by certified companies ( Qualisol).
  - Conventional life time : 15 years.
  - Amount of certificates according to climatic zone
    - H1(North): 2 900 kWh cumac / m<sup>2</sup>
    - H2 (Centre): 3 500 kWh cumac / m<sup>2</sup>
    - H3 (South): 4 600 kWh cumac / m<sup>2</sup>

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# Calculation rules for energy savings certificates

- The methodology followed to define the energy savings associated to energy savings operations is to only account additional savings, i.e. the savings beyond the market trends; it relies on the following three components :
  1. selection of eligible operations/appliances
  2. definition of baselines;
  3. correction for free riders effects (market trends);



# Calculation rules for energy savings certificates: eligible operations

## Eligible actions:

- Actions that are required by regulations are not eligible
- The list of eligible actions and equipment is restricted and defined by government decree
- If an equipment is eligible but does not correspond to the best available on the market the energy savings are reduced by 50% (for instance, low temperature boiler get 50% of the energy savings of a condensing boiler; or CFL class B gets 50% of the savings of CFL class A)

# Calculation rules for energy savings certificates: baselines

- The baseline to calculate the energy savings corresponding to an energy saving operation depend on the operation:

Operation type	Baseline
1: improvement of building envelopes or heating appliances	Average of the stock
2: All other actions	Market average (i.e. average of new appliances sold on the market)
3: Renewables (thermal uses, e.g. solar heaters, wood boilers)	Energy savings = net contribution of renewables

- The calculation are made by type of energy (electricity or fuel) to avoid the effect of energy substitution; for instance, savings for a gas condensation boiler are calculated in comparison to a gas boiler and not to all heating appliances

# Calculation rules for energy savings certificates : corrections for free riders effect

- To account for the existence of actions that would be carried out without the measure, the energy savings are corrected with a coefficient that accounts for the market share of the efficient appliance.
- For instance, if a gas condensing boiler represent 20% of the market the savings are multiplied by  $(1-20\%)$ , i.e. by 0.8

## Calculation rules for energy savings certificates: refrigerators A+

Efficient appliance (kWh)	Baseline (market average) (kWh)	Gross annual saving (kWh)	Market share of efficient appliance	Net annual saving (kWh)	Life time saving (kWh cumac)
151 (A+)	221 (A)	60	0%	60	506 kWh

**Refrigerator A+:** 27% more efficient than label class A ; class A is approximately twice more efficient than the market average in 1990

**Net annual savings**= gross savings multiplied by a coefficient reflecting the market share of the efficient appliance (MSEFF) = gross savings  $\times$  (1-MSEFF)

**Lifetime saving in kWh cumac:** life time discounted savings with a discount rate of 4%= annual savings multiplied by discount factor, function of life time (10 years for a refrigerator and discount rate  $\rightarrow$  discount factor of 8.435 (506= 60\*8.435)

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## Formula used for the calculation of annual gross energy savings : Compact Fluorescent Lamps (CFL)

Gross savings in year t =  $\{n_s \times [1/1000 \times (P_{old} \times h_{old} - P_{new} \times h_{new})]\}$  in kWh

$P_{old}$  = the capacity in W of the (old) bulbs

$P_{new}$  = the capacity in W of the (new) CFL

$h$  = burning hours

$n_s$  = number of CFL units promoted/installed in year t

1/1000 = conversion factor from W to kW

*In red: calculation parameters*

## Baseline issues/ gross to net corrections : CFL

- The baseline used for the gross energy savings calculations is a market average.
- The baseline is static; the discounting (for the lifetime savings calculation) is considered to somehow take into account a dynamic baseline.
- To define the market average, it is considered that on average a CFL replaces in 70% of the case an incandescent lamp and in 30% of the cases a CFL
- There is no correction for spill over effects or rebound effect. The baseline accounts for the free rider effect
- The net savings are equal to the gross savings multiplied by a coefficient reflecting the market share of the efficient appliance (MSEFF):  
Annual net savings in year t = (1- MSEFF) \* gross savings in year t in kWh

## Calculation of net savings and input parameters: CFL

- Annual net savings in year t:

$$(1 - \text{MSEFF}) * \{n_s \times [1/1000 \times (P_{\text{old}} \times h_{\text{old}} - P_{\text{new}} \times h_{\text{new}})] \}$$
 in kWh

with:

- MSEFF = market share of the efficient appliance
  - $P_{\text{old}}$  = the capacity in W of the (old) bulbs
  - $P_{\text{new}}$  = the capacity in W of the (new) CFL
  - h = burning hours
- Parameters Assumptions:
    - MSEFF= 70%
    - $P_{\text{old}}$  : 80 W.
    - $P_{\text{new}}$  : 18 W.
    - h : 800 h (stable, ie does not change after the replacement)



## Life time savings: CFL

- The life time savings are not used for how long savings are accounted for, but for accounting the savings of the CFL promoted in year t.
- Life time of CFL Class A: 7.5 years ( 6,000 h over lifetime and 800 h/year →  $6,000/800=7.5$ )
- The life time savings are discounted (saving in kWh cumac) with a discount rate of 4% → annual net savings are multiplied by a discount factor, function of the life time and discount rate. This results in the value of 6.626 for the discount factor ( $LT_{disc}$ ) for CFL.
- Lifetime savings =  $LT_{disc} \times n_s \times 34.72 = 6.626 \times n_s \times 34.72 = n_s \times 230$  kWh
- This 230 kWh is presented as kWh cumac to clarify that this value is cumulated and discounted.

## Conclusions

- The ex-ante approach to the calculation of energy savings is quite the same as in other EU countries for sake of simplicity and to reduce the cost of measurements
- It took into consideration the experience and the reference parameters used in more advanced countries in terms of white certificate, namely UK and Italy
- The number of standard operations is maybe too large and a shorter list could have been preferable;
- The discounting is not easy to understand and could be left out



Thank you for your attention !



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