

IEA DSM Task XXI

Standardisation of Energy Savings Calculations



Technology case application Heating systems in commercial buildings; Summary on calculations (section 2 in the case applications)

1. Formula used.

The formulas for calculating the annual energy savings as used in the two countries case applications have a complete different status:

- The French formulas are used by the obliged utilities in the white certificates scheme¹ and one is for bigger building and another, a standardised approach, is applicable to buildings with a total surface area of less than 5,000 m²;
- the Spanish formulas represent regular methods in use in Spain (due to the non-existence of accepted M&V standards) and is based upon engineering calculations and rooted in simple relationships.

Table 1 lists the formulas in a summarised fashion. The country reports hold more details.

Table 1. Issued formulas in the case application per country

Country	Formulas
France	<p>Annual savings: $ES = n_s * ES_{m2}$ in kWh</p> $ES_t = \sum_i n_s \cdot E_{m2}$ <p>i = individual building, $i = 1 \dots n$ n_s = floor area concerned by energy saving investments (in that year) ES_{m2} = unitary energy savings per m² of building floor area (in kWh/m²)</p> <p>Fore for a building type j (<5,000 m²) heated with a fuel type k in climatic zone i, the annual energy savings per m² for an individual building are equal to:</p> $ES_{jk} = ES_{ref} \cdot CC_i \cdot IC_j \cdot EN_k$ <p>ES_{ref} = reference unitary energy savings per m² of building floor area (default value) CC_i = coefficient for climatic zone i, IC_j = coefficient for building type j EN_k = coefficient for heating energy k (electricity versus fuels based systems)</p>
Spain	$TotalSavings \left(\frac{kWh}{year} \right) = N \cdot F_p \sum_{atoi} \left[\sum Load \cdot Hours \cdot NominalPower \cdot \left(\frac{1}{\eta_{old}} \cdot \frac{1}{\eta_{new}} \right) \right]$ <p>N = the total number of office buildings F_p = the capacity factor of yearly heater change $Load$ = Power/Nominal Power η = Efficiency of the boiler</p>

source: the individual case applications as included in the country report

2. Parameters

In the French case application the coefficient for the climatic zone (CC) ranges from 0.6 to 1.1, while the coefficient of intermitted and internal gain (IC) also ranges for the five different types of buildings from 0.6 to 1.1. The coefficient for heating energy (EN) is 95% for electricity and 60% for fuels.

¹ The savings are t expressed in **kWh cumac** (cumulated and discounted). Only the discounted and cumulated values are officially published; the values for annual energy savings are considered as intermediate parameters

In the Spanish case application the first step is to create a table holding the (estimated) number of working hours per heating load in a year. Per boiler the saving per load fraction are calculated using the formula:

$$YearlySavings\left(\frac{kWh}{year}\right) = DiscountFactor \cdot \sum Load \cdot Hours \cdot No\ min\ alPower \cdot \left(\frac{1}{\eta_{old}} \cdot \frac{1}{\eta_{new}}\right)$$

3. Baseline issues

For the baseline in both the French and Spanish case application is the initial situation, prior to the energy saving investments. But in the French case application a reference unitary consumption per m² is used as the baseline consumption while in the Spanish one the efficiency for each load of the existing boiler is used.

4. Normalisation

Normalisation is not conducted in the Spanish case application; while in the France case this is not needed as the calculation is using a coefficient for climate zones.

5. Corrections

No corrections are conducted.

6. Life time savings applied

In the French case application the life time savings are not used for how long savings are accounted for, but for accounting the savings of the investments promoted in year t. The life time savings are discounted (saving in kWh cumac) with a discount rate of 4%. In the Spanish case application the total electricity savings are calculated using a lifetime of twenty years.