

# IEA DSM Task XXI

## Standardisation of Energy Savings Calculations



### Technology case application Air conditioning in commercial building/offices; Summary on calculations (section 2 in the case applications)

#### 1. Formula used.

The formulas for calculating the annual energy savings as used in the three countries case applications<sup>1</sup> are developed from a different view:

- the Spanish for a replacement of an existing air conditioner (R22 machines) with a water condensed chillier system (electric); so in the Spanish case application the energy savings are based on calculations for that specific system to meet the cooling demand; and
- the Dutch for all types of air conditioners and different energy sources (electricity, gas or heat); so in the Dutch case application the energy savings are based on calculations for the efficiency of several systems that are in use for meeting the cooling demand.

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
The Netherlands	$\text{Annual energy savings: } ES = \sum^{Units} \left( \frac{Q_{cool,yr}}{\eta_{gen}} \right)_{ref} - \left( \frac{Q_{cool,yr}}{\eta_{gen}} \right)_{sel}$ <p> <i>Unit</i> = number of air conditioning systems installed  <i>Q<sub>cool,yr</sub></i> = yearly cooling demand  <i>η<sub>gen</sub></i> = efficiency of the air conditioner  <i>ref</i> = reference air conditioner  <i>se</i> = selected air conditioner                 </p>
Spain	<p>Annual electricity savings:</p> $ES = \sum^{Units} \text{discount factor} * \text{load} * t * P_{nominal} \left( \frac{1}{COP_{old}} - \frac{1}{COP_{new}} \right)$ <p> <i>Unit</i> = number of (new) air conditioning systems installed                      Discount factor = annual performance reduction                      Load = annual cooling load profile                      t = time of use (in hours)                      P<sub>nominal</sub> = Nominal power                      COP = Coefficient of Performance                      Old = existing air conditioner                      New = new installed air conditioner                 </p>
United States case area New Mexico	Energy savings calculated using simulation models for 29 project applications

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

#### 2. Parameters

The yearly cooling demand as well as the annual cooling load profile is both a sum of demands or loads in a shorting time period: monthly cooling demand or 10% load in combination with hours per year.

<sup>1</sup> The USA case application "2006-2008 comprehensive commercial building Energy Efficiency program in New Mexico" holds HVAC measures, but is not specific for air conditioners

In the Spanish case application the annual electricity savings are discounted with 2,5% over the theoretical performance. In the Dutch case application, the parameters on the dimensions of the building are in line with those specified in ISSO 75.1.

### *3. Baseline issues*

For the baseline in the Spanish case application is this the efficiency of the existing cooling system, while in the Dutch case application this is a reference situation with an other air conditioning system or an other air conditioner. In the USA case application the International Energy Conservation Code (IECC) 2006 was applied as baselines.

### *4. Normalisation*

Normalisation is not conducted in the Spanish case application; while in the Dutch case the yearly cooling demand are calculated using average monthly values for a standardised year (Test Reference Year in De Bilt). In the USA case application, when extrapolating annual savings Typical Meteorological Year (TMY) data for the appropriate region was applied.

### *5. Corrections*

No corrections are conducted apart from the USA case application, where corrections for free riders were applied.

### *6. Life time savings applied*

In the Spanish case application the annual electricity savings are discounted with 2,5% over the theoretical performance. So at the 10<sup>th</sup> year of the savings the expected lifetime of a chiller is assumed to be around ten years), the annual savings are discounted with a factor of 0,825. In the USA case application the effective useful life (EUL) values from the California DEER 2008 database was used (15 years for air conditioners; split and unitary).