ANNEX I

Methodology for calculating the national indicative energy savings target

The methodology used for calculating the national indicative energy savings target set out in Article 4 shall be the following:

1. Member States shall use the annual final inland energy consumption of all energy users within the scope of this Directive for the most recent five-year period previous to the implementation of this Directive for which official data are available, to calculate an annual average amount of consumption. This final energy consumption shall be the amount of energy distributed or sold to final customers during the five-year period, not adjusted for degree days, structural changes or production changes.

   On the basis of this annual average amount of consumption, the national indicative energy savings target shall be calculated once and the resulting absolute amount of energy to be saved applied for the total duration of this Directive.

   The national indicative energy savings target shall:

   (a) consist of 9 % of the annual average amount of consumption referred to above;

   (b) be measured after the ninth year of application of this Directive;

   (c) be the result of cumulative annual energy savings achieved throughout the nine-year application period of this Directive;

   (d) be reached by way of energy services and other energy efficiency improvement measures.

   This methodology for measuring energy savings ensures that the total energy savings prescribed by this Directive are a fixed amount, and thus independent of future GDP growth and of any future increase in energy consumption.

2. The national indicative energy savings target shall be expressed in absolute terms in GWh, or equivalent, calculated in accordance with Annex II.

3. Energy savings in a particular year following the entry into force of this Directive that result from energy efficiency improvement measures initiated in a previous year not earlier than 1995 and that have a lasting effect may be taken into account in the calculation of the annual energy savings. In certain cases, where circumstances can justify it, measures initiated before 1995 but not earlier than 1991 may be taken into account. Measures of a technological nature should either have been updated to take account of technological progress, or be assessed in relation to the benchmark for such measures. The Commission shall provide guidelines on how the effect of all such energy efficiency improving measures should be measured or estimated, based, wherever possible, on existing Community legislation, such as Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market[(1)] and Directive 2002/91/EC.

   In all cases, the resulting energy savings must still be verifiable and measurable or estimable, in accordance with the general framework in Annex IV.

[F1]ANNEX II

[[F1]Energy content of selected fuels for end use — conversion table**]**

Textual Amendments

F1 Deleted by Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (Text with EEA relevance).

[[F1]**]**

ANNEX III

Indicative list of examples of eligible energy efficiency improvement measures

This Annex provides examples of areas in which energy efficiency improvement programmes and other energy efficiency improvement measures may be developed and implemented in the context of Article 4.

To be taken into account, these energy efficiency improvement measures must result in energy savings that can be clearly measured and verified or estimated in accordance with the guidelines in Annex IV, and their impacts on energy savings must not already be counted in other specific measures. The following lists are not exhaustive but are intended to provide guidance.

Examples of eligible energy efficiency improvement measures:

Residential and tertiary sectors

(a) heating and cooling (e.g. heat pumps, new efficient boilers, installation/efficient update of district heating/cooling systems);

(b) insulation and ventilation (e.g. wall cavity and roof insulation, double/triple glazing of windows, passive heating and cooling);

(c) hot water (e.g. installation of new devices, direct and efficient use in space heating, washing machines);

(d) lighting (e.g. new efficient bulbs and ballasts, digital control systems, use of motion detectors for lighting systems in commercial buildings);

(e) cooking and refrigeration (e.g. new efficient devices, heat recovery systems);

(f) other equipment and appliances (e.g. combined heat and power appliances, new efficient devices, time control for optimised energy use, stand-by loss reduction, installation of capacitors to reduce reactive power, transformers with low losses);

(g) domestic generation of renewable energy sources, whereby the amount of purchased energy is reduced (e.g. solar thermal applications, domestic hot water, solar-assisted space heating and cooling);

Industry sector

(h) product manufacturing processes (e.g. more efficient use of compressed air, condensate and switches and valves, use of automatic and integrated systems, efficient stand-by modes);

(i) motors and drives (e.g. increase in the use of electronic controls, variable speed drives, integrated application programming, frequency conversion, electrical motor with high efficiency);

(j) fans, variable speed drives and ventilation (e.g. new devices/systems, use of natural ventilation);

(k) demand response management (e.g. load management, peak shaving control systems);

(l) high-efficiency cogeneration (e.g. combined heat and power appliances);

Transport sector

(m) mode of travel used (e.g. promotion of energy-efficient vehicles, energy-efficient use of vehicles including tyre pressure adjustment schemes, energy efficiency devices and add-on devices for vehicles, fuel additives which improve energy efficiency, high-lubricity oils and low-resistance tyres);

(n) modal shifts of travel (e.g. car free home/office transportation arrangements, car sharing, modal shifts from more energy-consuming modes of transport to less energy-consuming ones, per passenger-km or tonne-km);

(o) car-free days;

Cross-sectoral measures

(p) standards and norms that aim primarily at improving the energy efficiency of products and services, including buildings;

(q) energy labelling schemes;

(r) metering, intelligent metering systems such as individual metering instruments managed by remote, and informative billing;

(s) training and education that lead to application of energy-efficient technology and/or techniques;

Horizontal measures

(t) regulations, taxes etc. that have the effect of reducing energy end-use consumption;

(u) focused information campaigns that promote energy efficiency improvement and energy efficiency improvement measures.

ANNEX IV

General framework for measurement and verification of energy savings

1. Energy savings measurements and calculations and their normalisation

1.1. Measuring energy savings

General

In measuring the realised energy savings as set out in Article 4 with a view to capturing the overall improvement in energy efficiency and to ascertaining the impact of individual measures, a harmonised calculation model which uses a combination of top-down and bottom-up calculation methods shall be used to measure the annual improvements in energy efficiency for the EEAPs referred to in Article 14.

In developing the harmonised calculation model in accordance with Article 15(2), the Committee shall aim to use, to the extent possible, data which are already routinely provided by Eurostat and/or the national statistical agencies.

Top-down calculations

A top-down calculation method means that the amount of energy savings is calculated using the national or larger-scale aggregated sectoral levels of energy savings as the starting point. Adjustments of the annual data are then made for extraneous factors such as degree days, structural changes, product mix, etc. to derive a measure that gives a fair indication of total energy efficiency improvement, as described in point 1.2. This method does not provide exact measurements at a detailed level nor does it show cause and effect relationships between measures and their resulting energy savings. However, it is usually simpler and less costly and is often referred to as 'energy efficiency indicators' because it gives an indication of developments.

In developing the top-down calculation method used in this harmonised calculation model, the Committee shall base its work, to the extent possible, on existing methodologies such as the ODEX model[(2)].

Bottom-up calculations

A bottom-up calculation method means that energy savings obtained through the implementation of a specific energy efficiency improvement measure are measured in kilowatt-hours (kWh), in Joules (J) or in kilogram oil equivalent (kgoe) and added to energy savings results from other specific energy efficiency improvement measures. The authorities or agencies referred to in Article 4(4) will ensure that double counting of energy savings, which results from a combination of energy efficiency improvement measures (including mechanisms), is avoided. For the bottom-up calculation method, data and methods referred to in points 2.1 and 2.2 may be used.

Before 1 January 2008, the Commission shall develop a harmonised bottom-up model. This model shall cover a level between 20 and 30 % of the annual final inland energy consumption for sectors falling within the scope of this Directive, subject to due consideration of the factors referred to in points (a), (b) and (c) below.

Until 1 January 2012, the Commission shall continue to develop this harmonised bottom-up model, which shall cover a significantly higher level of the annual final inland energy consumption for sectors falling within the scope of this Directive, subject to due consideration of the factors referred to in points (a), (b) and (c) below.

In the development of the harmonised bottom-up model, the Commission shall take the following factors into account and justify its decision accordingly:

(a) experience with the harmonised calculation model during its first years of application;

(b) expected potential increase in accuracy as a result of a larger share of bottom-up calculations;

(c) estimated potential added cost and/or administrative burden.

In developing this harmonised bottom-up model in accordance with Article 15(2), the Committee shall aim to use standardised methods which entail a minimum of administrative

burden and cost, notably by using the measurement methods referred to in points 2.1 and 2.2 and by focusing on those sectors where the harmonised bottom-up model can be most cost efficiently applied.

Member States that so wish may use further bottom-up measurements in addition to the part prescribed by the harmonised bottom-up model subject to the agreement of the Commission, in accordance with the procedure referred to in Article 16(2), on the basis of a description of the methodology presented by the Member State concerned.

If bottom-up calculations are not available for certain sectors, top-down indicators or mixtures of top-down and bottom-up calculations shall be used in the reports to the Commission, subject to the agreement of the Commission, in accordance with the procedure referred to in Article 16(2). In particular, when assessing requests to this effect within the context of the first EEAP described in Article 14(2), the Commission shall demonstrate the appropriate flexibility. Some top-down calculations will be necessary to measure the impact of measures implemented after 1995 (and in certain cases as early as 1991) that continue to have impact.

1.2. How energy savings measurements should be normalised

Energy savings shall be determined by measuring and/or estimating consumption, before and after the implementation of the measure, while ensuring adjustment and normalisation for external conditions commonly affecting energy use. Conditions commonly affecting energy use may also differ over time. Such conditions may be the likely impact of one or several plausible factors, such as:

(a) weather conditions, such as degree days;

(b) occupancy levels;

(c) opening hours for non-domestic buildings;

(d) installed equipment intensity (plant throughput); product mix;

(e) plant throughput, level of production, volume or added value, including changes in GDP level;

(f) schedules for installation and vehicles;

(g) relationship with other units.

2. Data and methods that may be used (measurability)

Several methods for collecting data to measure and/or estimate energy savings exist. At the time of the evaluation of an energy service or energy efficiency improvement measure, it will often be impossible to rely only on measurements. A distinction is therefore made between methods measuring energy savings and methods estimating energy savings, where the latter is the more common practice.

2.1. Data and methods based on measurements

Bills from distribution companies or retailers

Metered energy bills may form the basis for measurement for a representative period before the introduction of the energy efficiency improvement measure. These may then be compared to metered bills for the period after the introduction and use of the measure, also for a representative period of time. The findings should be compared to a control group (non-participation group) if possible or, alternatively, normalised as described in point 1.2.

Energy sales data

The consumption of different types of energy (e.g. electricity, gas, heating oil) may be measured by comparing the sales data from the retailer or distributor obtained before the introduction of the energy efficiency improvement measures with the sales data from the time after the measure. A control group may be used or the data normalised.

Equipment and appliance sales data

Performance of equipment and appliances may be calculated on the basis of information obtained directly from the manufacturer. Data on equipment and appliance sales can generally be obtained from the retailers. Special surveys and measurements may also be carried out. The accessible data can be checked against sales figures to determine the size of energy savings. When using this method, adjustment should be made for changes in the use of the equipment or appliance.

End-use load data

Energy use of a building or facility can be fully monitored to record energy demand before and after the introduction of an energy efficiency improvement measure. Important relevant factors (e.g. production process, special equipment, heating installations) may be metered more closely.

2.2. Data and methods based on estimates

Simple engineering estimated data: Non-inspection

Simple engineering estimated data calculation without on-site inspection is the most common method for obtaining data for measuring deemed energy savings. Data may be estimated using engineering principles, without using on-site data, but with assumptions based on equipment specifications, performance characteristics, operation profiles of measures installed and statistics, etc.

Enhanced engineering estimated data: Inspection

Energy data may be calculated on the basis of information obtained by an external expert during an audit of, or other type of visit to, one or several targeted sites. On this basis, more sophisticated algorithms/simulation models could be developed and be applied to a larger population of sites (e.g. buildings, facilities, vehicles). This type of measurement can often be used to complement and calibrate simple engineering estimated data.

3. How to deal with uncertainty

All the methods listed in point 2 may entail some degree of uncertainty. Uncertainty may derive from[(3)]:

(a) instrumentation errors: these typically occur because of errors in specifications given by the product manufacturer;

(b) modelling errors: these typically refer to errors in the model used to estimate parameters for the data collected;

(c) sampling errors: these typically refer to errors resulting from the fact that a sample of units was observed rather than the entire set of units under study.

Uncertainty may also derive from planned and unplanned assumptions; these are typically associated with estimates, stipulations and/or the use of engineering data. The occurrence of errors is also related to the chosen system of data collection that is outlined in points 2.1 and 2.2. A further specification of uncertainty is advised.

Member States may choose to use the method of quantified uncertainty when reporting on the targets set out in this Directive. Quantified uncertainty shall then be expressed in a statistically meaningful way, declaring both accuracy and confidence level. For example, ‘the quantifiable error is found with 90 % confidence to be ± 20 %’.

If the method of quantified uncertainty is used, Member States are also to take into account that the acceptable level of uncertainty required in energy savings calculations is a function of the level of savings and the cost-effectiveness of decreasing uncertainty.

4. Harmonised lifetimes of energy efficiency improvement measures in bottom-up calculations

Some energy efficiency improvement measures last for decades while other measures last for a shorter period of time. The list below gives some examples of the average lifetime of energy efficiency improvement measures:

Loft insulation of private dwellings	30 years
Cavity wall insulation of private dwellings	40 years
Glazing E to C rated (in m^2)	20 years
Boilers B to A rated	15 years
Heating controls — upgrade with boiler replacement	15 years
CFLs — retail	16 years

Source: Energy Efficiency Commitment 2005 — 2008, UK

To ensure that all Member States apply the same lifetimes for similar measures, these lifetimes will be harmonised on a European level. The Commission, assisted by the Committee established under Article 16, shall therefore replace the above list with an agreed preliminary list of the average lifetime of different energy efficiency improvement measures not later than 17 November 2006.

5. How to deal with multiplier effects of energy savings and how to avoid double counting in mixed top-down and bottom-up calculation methods

The implementation of one energy efficiency improvement measure, e.g. hot water tank and pipe insulation in a building, or another measure with equivalent effect, may have future multiplier effects in the market, meaning that the market will implement a measure automatically without any further involvement from the authorities or agencies referred to in Article 4(4) or any private-sector energy services provider. A measure with multiplier potential would in most cases be more cost-effective than measures that need to be repeated on a regular basis. Member States shall estimate the energy savings potential of such measures including their multiplier effects and verify the total effects in an ex-post evaluation using indicators when appropriate.

With regard to the evaluation of horizontal measures, energy efficiency indicators may be used, provided that the way in which they would have developed without the horizontal measures can be determined. However, it must be possible to rule out, as far as possible, double counting with savings achieved through targeted energy efficiency programmes, energy services and other policy instruments. This applies particularly to energy or CO_2 taxes and information campaigns.

Corrections shall be made for double counting of energy savings. The use of matrices that enable the summation of impacts of measures is encouraged.

Potential energy savings resulting after the target period shall not be taken into account when Member States report on the overall target set out in Article 4. Measures that promote long-term market effects should in any case be encouraged and measures that have already resulted in multiplier energy savings effects should be taken into account when reporting on the targets set out in Article 4, provided they can be measured and verified using the guidance given in this Annex.

6. How to verify energy savings

If deemed cost-effective and necessary, the energy savings obtained through a specific energy service or other energy efficiency improvement measure shall be verified by a third party. This may be done by independent consultants, ESCOs or other market actors. The appropriate Member State authorities or agencies referred to in Article 4(4) may provide further instructions on this matter.

Sources: A European Ex-post Evaluation Guidebook for DSM and EE Service Programmes; IEA, INDEEP database; IPMVP, Volume 1 (Version March 2002).

F1ANNEX V

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F1ANNEX VI

[F1List of eligible energy efficient public procurement measures**]**

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(**1**) OJ L 52, 21.2.2004, p. 50.

(**2**) ODYSSEE-MURE Project, SAVE Programme. Commission 2005.

(**3**) A model for establishing a level of quantifiable uncertainty based on these three errors is given in Appendix B in the International Performance Measurement & Verification Protocol (IPMVP).