SenterNovem

ESD reporting Bottom-Up savings; a nightmare or a next step in a better understanding of energy savings?

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Outline

- EMEEES BU case applications
  - 3 levels and 4 steps approach
  - Structure of the case descriptions
  - Selected case applications

- Examples of case applications
  - Voluntary agreements
  - Energy audits

- Lessons learned
- Key elements for harmonised reporting

- Conclusions

Bottom up Case applications, general approach

- 3 levels of evaluation efforts
  - Low: use of **EU** default methods and values
  - Moderate: use of **National** default methods and values
  - Enhanced: use of **ex post** (evaluation based) methods and values

- 4 calculations steps
  - Gross annual **unitary** savings
  - Total gross **annual** savings
  - Total **(net) ESD annual** savings
  - Total (net) ESD **period** savings

Four calculation steps for each level of effort

		Level 1	Level 2	Level 3
step 1	describe and report the calculation of *energy savings* per measure, project, or participant	*mean gross ex ante EUROPEAN DEFAULT VALUE*	*mean gross ex ante NATIONAL DEFAULT VALUE*	*mean gross EX POST (EVALUATION-BASED)*
step 2	describe and report how mean ex ante savings was extrapolated to the entire program population	*total gross EUROPEAN DEFAULT VALUE ex ante saving*	*total gross NATIONAL DEFAULT VALUE ex ante savings*	*total gross EX POST (EVALUATION-BASED) savings*
step 3	describe and report on how a net-to-gross factor was calculated for estimating *saving*	*total net ex ante EUROPEAN DEFAULT VALUE*	*total net ex ante NATIONAL DEFAULT VALUE savings*	*total net EX POST (EVALUATION-BASED) savings*
step 4	describe and report on how measure lifetimes were calculated and used to arrive at	*lifetime total net ex ante EUROPEAN DEFAULT VALUE savings*	*lifetime total net ex ante NATIONAL DEFAULT VALUE savings*	*lifetime total net EX POST (EVALUATION-BASED) savings*

Information for each EMEEES BU case application

- Summary
  - Title of the method
  - Type and details of EEI activities and definitions covered
  - General specifications
  - Formula for unitary gross annual energy savings
  - Indicative default value for unitary gross annual energy savings
  - Formula for total ESD annual energy savings
  - Indicative default value for energy savings lifetime
  - Main data to collect (for level 2 and 3 evaluation efforts)
- Introduction
  - Twenty bottom-up evaluation methods
  - Three levels of harmonisation
  - Four steps in the calculation process
  - Pilot projects
- Step 1-4
- Special items
- Appendix 1: Justification and sources
- Other appendices

4 Calculation steps

- Step 1: unitary gross annual energy savings
  - Step 1.1: general formula / calculation model
  - Step 1.2: baseline
  - Step 1.3: requirements for normalisation factors
  - Step 1.4 Specifying the calculation method and its three related levels
  - Conversion factors
  - Considering the rebound effect
  - Defining values and requirements
- Step 2: total gross annual energy savings
  - Step 2.1: formula for summing up the number of actions
  - Step 2.2: requirements and methods for accounting for the number of actions
- Step 3: total ESD annual energy savings
  - Step 3.1: formula for ESD savings
  - Step 3.2: requirements for double counting
  - Step 3.3: requirements for technical interactions
  - Step 3.4: requirements for multiplier energy savings
  - Step 3.5: Requirements for the free-rider effect
- Step 4: total ESD energy savings for year “i”
  - Requirements for the energy saving lifetime

Voluntary Agreements; 2 Case applications

	Voluntary Agreements billing analysis	**Voluntary Agreements engineering method**
Step 1: unitary gross annual energy savings; Unit = a participant		
Step 1. general formula	[annual energy consumption- delivered energy in year]$_{t-1}$ – [annual energy consumption - delivered energy in year]$_{t}$	Unitary gross annual energy savings = $RS_{h,f} + RS_e + (DV2_{h,f} * AC_{h,f}) + (DV2_e * AC_e)$ $RS_{h,f}$ = reported heat and fuel savings from actions identified in an energy audit and actually realised RS_e = reported electricity savings from actions identified in an energy audit and actually realised $DV2_{h,f}$ = national default value for savings from changes in routines and O&M $DV2_e$ = national default value for savings from changes in routines and O&M
Step 1.2: baseline	A. Situation before (aim is all energy savings); B. modelling development of annual energy consumption over time without the Voluntary Agreement (aim is additional energy savings)	Situation before (used for practical reasons also if the aim is to calculate additional energy savings, since it would demand too much from engineers to define a counterfactual new baseline equipment for each end-use action)
Step 1.3: normalisation factors	3 normalisation factors: - production level - structural change in production - weather	The relevance of normalization factors depends on the type of companies targeted;Companies should, within the framework of the energy management system, consider the impact of external condition and verify normalization factors for compensation
Step 1.4 the calculation method and its three related levels	Billing analysis	**Mixed deemed and ex-post** approach: Participants report the expected energy savings from the actions implemented after an energy audit (**enhanced engineering estimate**) National default value is used for savings from changes in routines and O&M (**deemed savings**) Average annual consumption is monitored and reported by the participant Participants monitor and report their achieved savings (**ex-post**) as far as possible Administrator controls quality and correctness of reports
Requirements energy saving lifetime	Defaults for energy savings lifetimes 10% of annual savings: 2 years; 75% of the annual saving: 8 years; 15% of the annual savings: 25 years	default for technical actions: 12 years default for organisational (EMS) actions: 2-4 years

Case application Energy Audits

Step 1: unitary gross annual energy savings; Unit = a participant	
Step 1. 1 general formula	Two alternative approaches are suggested A. Annual energy savings of one participant [GWh/y] = = DVh, f (heat+fuels)*TSP(heat+fuels) + DVe (electricity)*TSP(electricity) DV_e = EU default value for the share of the electricity savings potential implemented, % $DV_{h,f}$ = EU default value for the share of the heat and fuel savings potential implemented, % TSP = total annual energy savings potential of the participant identified in the energy audit (GWh/y) B. Annual energy savings of one participant [GWh/y] = AS(heat+fuels) + AS(electricity) AS = annual energy savings of the participant realised as a consequence of the energy audit and collected through a survey of at least 50 % of the participants (GWh/y) (this option is recommended only if no database of the total annual energy savings potential of the participants identified in the energy audit can be created, e.g., for past but recent energy audit schemes)
Step 1.2: baseline	In practice, auditors usually calculate the “before the improvement action” and ”after the action” energy consumptions for each audited technical system.
Step 1.3: normalisation factors	Normalisation factors are not used when total savings by energy audit programmes are calculated, as the individual audits are producing enhanced engineering estimates. However, some of them can be taken into account in calculations made within an individual energy audit.
Step 1.4 the calculation method and its three related levels	For level 2 and 3 different options of mixed deemed value and ex-post calculations for monitoring energy audits

Case application Energy Audits (2)

Step 2: total gross annual energy savings	
Step 2.1: formula summing up actions	The total gross annual energy savings are the sum of the annual energy savings of all participants (energy audits) in a given year.
Step 2.2: accounting number of actions	Depends on the level of calculation. The unit is one participant. From each participant, the total annual energy savings potential of the participant must be collected and stored in a database (Option A presented above), or the savings achieved as a consequence of the energy audit must be collected (Option B presented above).
Requirements for the energy saving lifetime	Default value proposed: 6-year sliding average for the services sector or proven national average values per type of participant8-year sliding average for industry or proven national average values per type of participant Alternatively, national default values can be used based on a sample survey of end-use actions implemented

Lessons learned

- Baselines: important issue, many times discussed
  - The differences between all and additional savings
  - Three main options for before situation
    1. Replacement situations
    2. Retrofit situations
    3. New situations

- Three level approach
  - Clear guidance for priority setting in energy savings calculations
  - EU default is not without discussion; Ongoing research for better defaults; Conservativeness (under discussion)
  - Dynamic approach

Lessons learned (2)

- Experts want to increase the level of details while policy makers want more general rules
- Not all elements in the four step calculation process are always relevant
- Knowledge is still missing for free-riders, multiplier and rebound effects and technical interaction
- The case applications could not be transposed to a few numbers that have more general applications

Key elements for harmonised reporting

- General structure for documentation
  - Four step of calculation
  - Following a check list
  - Quality assurance
- Selection of baseline
  - Country specific baselines
- Selection of baseline parameters
  - Documentation and link all – additional savings
- Dynamic approach over time

Conclusions

- EMEEES case applications are good examples
- Not possible to develop case applicaitons for the majority of situations
- Key elements should be harmonised
- Additional guidelines should be developed for reporting
- Default values should be updated on regular basis
  - Unitary gross annual energy savings
  - Lifetimes
- ESD reporting: a tool for learning and improving