METHODOLOGY EUROPEAN ENERGY EFFICIENCY SCOREBOARD

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CONTENTS

I. Overall Scoreboard (levels, trends and policies)

The objective of the European Energy Efficiency Scoreboard is to assess and score the energy efficiency performances and policies of the European Union countries[1] and Switzerland by country and by sector (households, transport, industry and services). The scores are calculated on the following energy efficiency components:

- the energy efficiency level,
- the energy efficiency progress (i.e. energy efficiency trends),
- the energy efficiency policies,
- the overall energy efficiency score, i.e. a combination of these three components.

For each of the three criteria each country is scored with a score between 0 and 1 based on a variety of indicators (extracted from the ODYSSEE Database) and of energy policies (extracted from the MURE Database). Details are explained below in the corresponding sections.

The scoreboard can be viewed, either by component or by country; in the latter case, the scoring is detailed for each country by component.

The overall energy efficiency score is obtained as an average of the three scores obtained for "energy efficiency level", "energy efficiency progress" and "energy efficiency policies" (i.e. one third weighting).

II. Scoring of Levels and Trends (based on Odyssee-Indicators)

1. Scoring methodology for individual indicator

The scoring methodology is based on the OECD Composite Indicator methodology[2]. This method allows the countries to be compared in a relevant range where minimum and maximum values indicators define the best and worst scores and countries are ranked between these two extrema. The indicators are calculated and **normalized so that they range between 0 and 1** following this formula:

$$Normalized\ score = \frac{Indicator - Min\ indicator}{(Max\ indicator - Min\ indicator) * direction} + 0.5 * (1 - direction)$$

Indicator: The indicator value of the country.
Min indicator: The minimum indicator value across all countries.
Max indicator: The maximum indicator value across all countries.
Direction: The favored direction in the level of indicator; -1 if the decline is favored, 1 if the incline is favored.

[1] By European Union we understand the EU27 (excluding the UK)
[2] https://www.oecd.org/sdd/42495745.pdf

Example of calculation of score for cars: case of Austria

Unit consumption of cars (goe/pkm)	
aut	0.050
bel	0.040
cyp	0.064
esp	0.044
fin	0.030
fra	0.033
gbr	0.036
grc	0.025
hun	0.038
irl	0.039
ita	0.024
lat	0.043
lth	0.040
lux	0.040
mlt	0.042
nld	0.042
rom	0.022

Max indicator : 0.064
Min indicator : 0.022
Direction = -1 (decline in the indicator is favored)
Austria = 0.05

Normalized score calculation for Austria :

$$\frac{0.05 - 0.022}{(0.064 - 0.022)*(-1)} + 0.5 * (1-(-1)) = 0.33$$

2. Calculation of scores by sector

The scoring of sectors is done separately for four sectors (households, transport, industry and services) and for all sectors together.

The score by sector is based on scores calculated for selected indicators representative of end-uses in buildings or modes in transport (see Table 1). For industry, the score is directly based on aggregate indicators that already account for the energy efficiency characteristics of the various industrial branches.

Table: List of indicators used to calculate the scores by sector

Households

End-use	Indicator	Weighting factor
Heating	Consumption for heating per m^2 scaled to EU climate and equivalent to central heating[3]	Share of heating in total households' consumption
Other thermal uses	Consumption per dwelling for cooking and water heating[4]	Share of cooking + ½ of water heating in total households' consumption
Appliances	Specific consumption of electricity per dwelling for appliances (including AC) and lighting	Share of appliances (incl. AC) & lighting in household consumption
Solar penetration	% of dwellings with solar water heater	½ share of water heating in household consumption

Services

End-use	Indicator	Weighting factor
Thermal end-uses	Thermal end-uses consumption per employee scaled to EU climate	Share of thermal end-uses in total services
Electricity	Specific consumption of electricity per employee (including AC and excluding thermal uses[5])	Share of specific electricity consumption in total services

Transport

Modes	Indicator	Weighting factor

[3] The consumption for heating scaled to EU climate is obtained by multiplying the heating consumption of households per m2 at normal climate (excluding solar and ambient heat) by the ratio mean number of heating degree days of a country over mean number of heating degree days of the EU average (degree days from Eurostat). The indicator equivalent to central heating is obtained by dividing the unit consumption by (% of central heating + (1-% of central heating)*25%). This correction assumes that a dwelling with central heating (i.e. with all rooms heated) consumes 25% more than a dwelling with room heating (stove in the main rooms).

[4] Excluding solar heat and ambient heat

[5] For countries for which data by end-use are not available, the total electricity consumption is taken.

Cars	Specific consumption (goe/pkm)	Share of cars in total transport consumption
Trucks and light vehicles	Specific consumption (goe/tkm)	Share of trucks and light vehicles in total transport consumption
Air	Specific consumption (koe/pass)	Share of air in total transport consumption
Modal split: -Passengers -Goods	 % of traffic by public mode % of traffic by rail and water	 Share of buses and rail passengers in total transport consumption Share of water and rail freight consumption in total transport

Industry

Category	Indicator
Trend	ODEX (energy efficiency index)[6]
Level	Adjusted energy intensity at EU industry structure[7]

The **score by sector** is calculated as a weighted score of each indicator. The weights correspond to the average shares over the last 3 years of each end-use or transport mode in the sector consumption (see example below in the case of transport in Austria).

Example of calculation of score for a sector: case of transport Austria

The score of the sector (transport) is calculated by weighing the indicator scores.

Transport **level score** for Austria: $0.33 * 58\% + 0.96 * 25\% + 0.95 * 12\% + 0.70 * 3\% + 0.57 * 2\% = \mathbf{0.58}$

The score is normalized from 0 to 1 to give 1 to the highest value, 0 to the lowest: if the highest value for the sector is 0.91 and the lowest 0.30, the **normalized level score of** transport for Austria is:

$$\frac{(0.58-0.30)}{(0.91-0.30)} = \mathbf{0.46}$$

The same is done for the calculation of the trend score.

Austria (fictive example)	Cars	Trucks and light vehicles	Air	Public transport passengers	Rail and fluvial goods
Level scores normalized	0.33	0.96	0.95	0.70	0.57
Weigths (share of each mode in transport consumption)	58%	25%	12%	3%	2%

The sectoral score is normalized to a range of 0 (corresponding to the lowest country value for a sector) to 1 (corresponding to the highest EU country value for a sector).

[6] The index (ODEX) is calculated as a weighted average of sub-sectoral indices of unit consumption by branch; the weight being the share of each branch in the energy consumption of industry. The calculation is done at the level of 14 branches: the unit consumption is expressed in terms of energy used per ton produced for energy intensive products (steel, cement and paper) and of energy used related to the production index for the other branches.

[7] The energy intensity of industry at EU structure represents a fictitious value of the industrial intensity calculated by taking for each industrial branch the actual sectoral intensity of the country and the EU industrial structure (i.e. the share of each branch in the value added of industry). For Finland and Sweden, as pulp & paper represents around half of the total industrial consumption, the adjusted indicator is based on physical quantities instead of value added for pulp & paper (production of paper and pulp) and on VA for the other branches.

For the sectoral score (as well as for the global score described in section 3), two scores are proposed: one for "level" based on the level indicators, and one for "trend" based on the indicators' trends:

- The score based on the **level** of the indicator is calculated as a moving **average of the last three years** to smoothen yearly variations. For 2024 scores, the year 2020 is not included because of the Covid crisis. It is the average of 2019, 2021 and 2022.
- The second score is based on the **trend** indicator since 2010 (variation 2019-2022 for the 2024 scoreboard).

3. Calculation of global scores

The sectoral scores calculated as indicated in section 2 are then aggregated to a global score for levels and trends separately, by weighting the sector scores with the share in the final energy consumption.

- The global score results from the sectoral scores weighted by the average share over the last 3 years of each sector in the total final energy consumption. For 2024, 2020 was not included neither, it is the average of 2019, 2021 and 2022.
- Then again, the resulting values are normalized from 0 to 1, with 1 given to the country with the highest score, and 0 to the country with the lowest sectoral or overall score in the same way as described in section 2 for each sector.

III. Scoring of Policies (based on MURE Energy Efficiency Policies)

1. Scoring methodology for policies

The objective of the **policy part** of the European Energy Efficiency Scoreboard is to assess and score the energy efficiency policies of the European Union countries and Switzerland by country and by sector (households, transport, industry and services). The main advantage of this scoreboard is to present progress in policy development according to a standardised method over time and across countries. Though there are other scorecards of energy efficiency policies, in particular the International Scorecard of the American Council for an Energy Efficient Economy ACEEE, the policy part of the European Energy Efficiency scoreboard has a unique feature worldwide: **It is the only scoreboard which relies on the quantitative impacts (i.e. energy savings) collected from energy efficiency evaluations.**

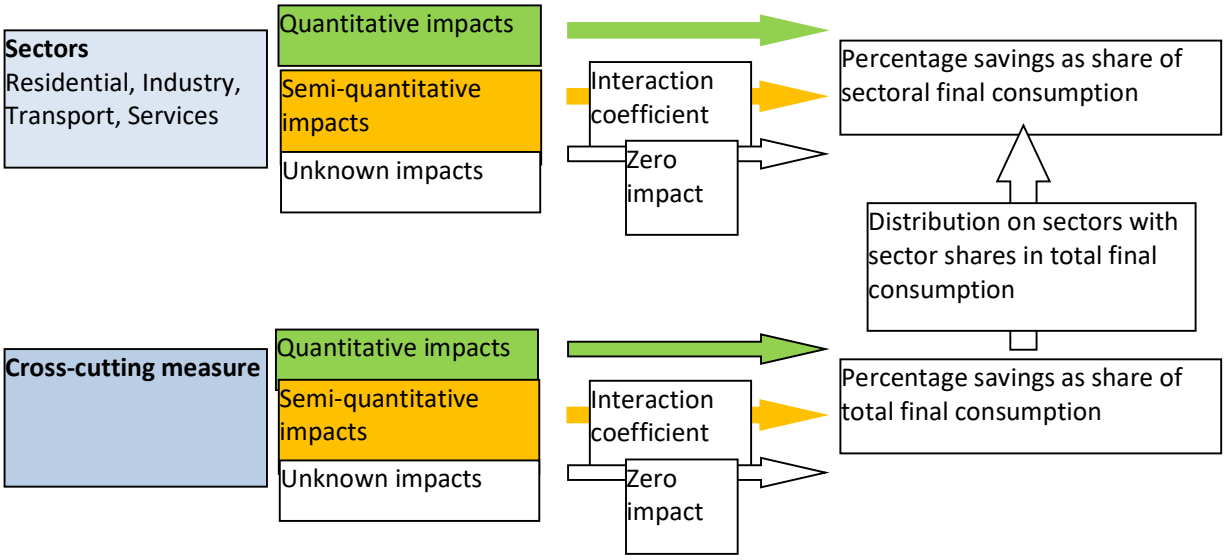
This scoreboard makes use of the information in the MURE database on energy savings and compares the savings with the final energy consumption of the sector or total final energy consumption for a given year. By default, the scoring period comprises ongoing measures from 2010 to present. Impacts are calculated for 2030.

The information on impacts in terms of energy savings for each measure in the MURE database may take two forms: quantitative and semi-quantitative estimates (see Figure 1).

- *Quantitative* information from dedicated evaluations of measure impacts, mostly from evaluations at national level. This information is gathered in formal tables and can be retrieved for the policy scoreboard. At present around 40% of all policy measures in the MURE database have such a quantitative policy impact evaluation.
- *Semi-quantitative expert estimates* on measure impacts which group the measures in three categories: measures saving less than 0.1% of the sector energy consumption (low impact measures), measures saving from 0.1 to less than 0.5% of the sector energy consumption (medium impact measures), and measures saving more than 0.5% (high impact measures). For

measures in the cross-cutting database the percentages refer to the overall final energy consumption of the country. These estimates have been made by the National Teams in the MURE project, who have an excellent knowledge of the energy efficiency policies and measures in their countries. Nearly all measures in the database have been classified in such a manner.

Figure 1: Basic methodology for the output-based Scoreboard (related to energy consumption)



The methodology for determining the savings from energy efficiency policies is described in Figure 1:

- Quantitative impacts are extracted from the MURE database for the time frame 2030 for those measure where such impacts are provided. Only ongoing measures are considered. It is assumed that measures with quantitative estimates already include the interaction with other measures. Frequently this is the case. In some cases, energy savings have to be derived from CO_2-savings. Those were converted to energy savings, using average CO_2-emission factors by sector and country.
- Semi-quantitative estimates are converted to energy savings by using 0.1% of the sectoral final energy consumption for low impact measures, 0.3% for medium impact and 0.5% for high impact measures. To consider interaction between those measures, a default interaction coefficient of 0.01% per measure is integrated into the calculation.
- Measures without a quantitative or semi-quantitative estimate are considered as "zero impact" in order to give a malus to measures, which are not characterized[8].
- Savings from the cross-cutting sector, which contains measures that concern all sectors, are established in a similar manner. The savings from the cross-cutting measures are then distributed over the four sectors (residential services, transport and industry) according to the sector share in final energy consumption.

An example for the calculation procedure is provided below.

Calculation steps of Policy Scores:

Step 1: Calculation of energy savings (ES) for one sector s from measures j with <u>quantitative</u> impacts

[8] In such a manner, the monitoring practice in the country is also considered.

For each country: $ES_{s,\ quantitative} = SUM\ (ES)_{s,j}$ s: sector, j: individual measure

In the example below, the quantitative savings add up to 55 PJ.

Country: Germany, Sector s: Housholds		
Measure Number j	Measure Title	Quantitative Impact in 2020 (PJ)
1	Building regulation	27.0
2	Subsidy scheme	18.0
3	Information programme	3.0
4	Energy label	7.0
	ES(s, quantitative) =	**55.0**

Step 2: Calculation of energy savings (ES) for one sector s from measures j with <u>semi-quantitative</u> impacts

a. Calculation of ES based on semi-qualitative evaluation (low, medium, high)

Scale: low = 0.1%, medium = 0.3%, high = 0.5% of sector final energy consumption. Depending on the sector $ES_{s,semi\text{-}quantitative} = SUM\ (Scale_{s,j}) * FEC2016_s$

Where $FEC2016_s$ is the Final Energy Consumption of the sector s in a country

b. Calculation of interaction coefficients

Interaction Factor (IF_s) $=0.99^{(n-1)_s}$ (for n measures in the sector s) assuming 1% loss of impact at each interaction

Recalculation of ES with interaction

$ESI_{s,\ semi\text{-}quantitative} = ES_{s,semi\text{-}quantitative} * IF_s$

Country: Germany, Sector s: Housholds		Final energy consumption households 2016 (PJ):		2327
Measure Number j	Measure Title	Impact category	Semi-quantitative impact (% of final demand of sector	Quantitative Impact in 2020 (PJ)
1	Subsidy scheme	High	0.5%	11.6
2	Saving obligation	Medium	0.3%	7.0
3	Information programme	Low	0.1%	2.3
4	Audit scheme	Low	0.1%	2.3
			ES(s, semi-quantitative) =	**23.3**
			ES(s, semi-quantitative, including interaction factor) =	**22.4**

Step 3: Calculation of total energy savings (ES)

$ES_s = ES_{s,\ quantitative} + ES_{s,\ semi\text{-}quantitative}$

For Germany total savings in the household sector are calculated as 55.0 + 22.4 = 77.4 PJ

Step 4: Distribution of savings from cross-sectoral measures on each sector

	Savings ESI	Sector final consumption 2016	Sector savings including cross-cutting savings
	PJ	PJ	PJ
Households	77.4	2327	83.4
Transport	38.3	2695	45.2
Industry	42.4	2631	49.2
Services	18.5	1474	22.3
Cross-cutting	23.5	9127	
		(=overall final energy)	

2. Calculation of scores by sector

The sector results are then first normalised by dividing the (absolute) savings by the sectoral final energy consumption of the country. Finally for each sector, the results for each country are then normalised to scale from 0 to 1 which is spanned up by the country with the highest savings (=1) and the lowest savings (=0), according to a similar formula as for the indicator-based parts of the European Energy Efficiency Scoreboard (see above):

$$Normalized\ score = \frac{Policy\ Score - Min\ Policy\ Score}{(Max\ Maximum\ Policy\ Score - Min\ Policy\ Score)}$$

Policy Score: The policy Score achieved by a country.
Min Policy Score: The minimum Policy Score across all EU countries.
Max Policy Score: The maximum Policy Score across all EU countries.

Normalisation of Policy Scores for one sector:

The savings obtained above for the household sector of 83.4 PJ (including the share of cross-cutting measures related to households) is normalised to the sector final energy consumption 2327 PJ:

83.4 PJ/2327 PJ =	3.58%

The score of the sector is normalized from 0 to 1 to give 1 to the highest value, 0 to the lowest: if the highest value for the sector is 4.38% and the lowest 1.55%, the normalized level score of households for Germany is:

$$\frac{(3.58-1.55)}{(4.38-1.55)} = \mathbf{0.71}$$

3. Calculation of global scores

The sectoral scores calculated as indicated in section 2 are then aggregated to a global score for policies, by weighting the sector scores with the share in the final energy consumption. Then again, the resulting values are normalised from 0 to 1 (scale set by EU countries), with 1 given to the country with the highest score, and 0 to the country with the lowest sectoral or overall score in the same way as described in section 2 for each sector.