MICAT

Multiple Impacts Calculation Tool

Empirical basis of Economic Impacts Employment Effects

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E3-Modelling

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Executive Summary

The indicator presented in this factsheet describes the impacts of energy saving measures on employment. Employment implications of planned policies or measures are of primary concern, thus an ex-ante assessment of changes in employment can serve as an indicator for the performance of specific energy efficiency policies and measures. We follow a static multiplier approach to estimate the creation (or reduction) of employment due to the additional demand generated in specific sectors that deliver the investments associated with the energy efficiency measures. A key step in order to estimate the employment impacts is **the calculation of the employment multipliers based on IO-Analysis**.

The Employment Multiplier provides a quantification of the employment in persons that will be generated in the economy by 1 m. € of new final demand. This considers the share of imported goods, the direct and indirect effects through the structure of the IO table. The methodology assumes only the employment impacts from the generated additional demand, thus not assuming any other structural changes, e.g. due to the drop of activity in certain sectors, nor the effects of changes in income and prices. Finally, the methodology relies on the allocation of investment expenditure to demand by economic activities, which is based on expert judgement and assumed uniform by country and sector that applies the measures.

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Scope of MI Indicator

Definition

Energy efficiency measures create demand for products with subsequent income and value-added implications. Employment implications of planned policies or measures are of primary concern, thus an ex-ante assessment of changes in employment can serve as an indicator for the performance of specific energy efficiency policies and measures. We follow a static multiplier approach to estimate the creation (or reduction) of employment due to the additional demand generated in specific sectors that deliver the investments associated with the energy efficiency measures. Here we limit the analysis to estimating in a static approach the employment impacts resulting from the demand for energy efficiency goods and consider that the energy saving measures generate additional demand for goods and do not substitute existing demand or investments. Similarly, we do not make any explicit assumptions on the financing of the measures.

Relevance on EU, national and/or local level

Employment is a key indicator for the socioeconomic assessment of policies at all levels of policy-making, from the EU to national and even local level. Together with the indicator of GDP or Value Added, these two can be considered as the primary economic indicators of ex-ante policy impact assessment. The employment indicator is common in most European Commission Impact Assessment documents for climate and energy policies, including the latest documents associated with the Fit-for-55 policy package.

Impact pathway figure

The methodology adopted to perform the assessment of the employment indicator of the different measures is composed from the following steps:

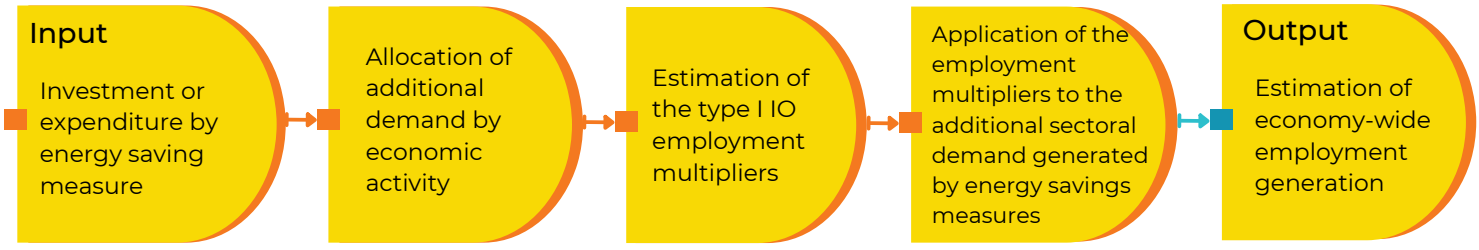

Figure 1: Quantification steps for the estimation of the employment MI indicator

Overlaps with other MI indicators and potential risk of double-counting

No risk of overlaps or double-counting with other MI indicators.

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Quantification method

Description

A **key step** in order to estimate the employment impacts is the calculation of the employment multipliers based on IO-Analysis. The Employment Multiplier provides a quantification of the employment in persons that will be generated in the economy by 1 m. € of new final demand. This considers the share of imported goods, the direct and indirect effects through the structure of the IO table. As described in Figure 2, we follow the steps shown below for the quantification of this indicator.

Steps:

- Receive as input the investment expenditure by type of energy saving measure
- Calculation of type I employment multipliers based on the IO table
- Associate the investment expenditure to specific demand of goods and services to allocate the additional generated demand by economic activity.
- Application of the respective multipliers by economic activity and estimation of aggregate employment multiplier by type of energy efficiency measure
- Estimation of economy-wide employment generation by applying the multiplier to the level of expenditure by type of measure.

In **the second step,** the Leontief type I multipliers are calculated by country given the technology coefficients and the consumption preferences of a given economy. This type of analysis does not consider capacity constraints and thus no consideration is taken for the change in prices and the markets of primary factors. The technical coefficient matrix A consists of all technical coefficients as its elements a_{ij} . For every country and for each branch the technical coefficient a_{ij} is calculated as the ratio of the intermediate consumption to total supply for each industry.

The Employment multiplier effect is calculated based on the following formula:

$$coeffEMPL_j = \sum_i EMPLRT_i \cdot L_{i,j} \quad (1)$$

where:

$EMPLRT_i$: the ratio of number of employees to total supply for the industry I, measured in jobs per million € coefficients derived by the IO table.

$L_{i,j}$: the -element of the Leontief inverse Matrix $L = (I - A)^{-1}$, where i is the sector providing intermediate inputs to the production of sector j

$coeffEMPL_j$: the total number of employees that will be generated in the economy for an additional demand of 1 m€ in sector j.

Leontief Inverse Matrix L:

$$L = (I - A)^{-1} \quad (2)$$

where:
I : Identity matrix
A : direct requirements matrix, the ratio of the intermediate consumption to total supply for each industry.

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The third step of our methodological approach assumes a table that associates the investment expenditure of each energy efficiency measure to the specific demand of one goods and services. This table aims to allocate the additional generated demand to each of the 65 identified economic activities so that the impacts of energy efficiency measures are dispersed over a number of NACE sectors. The table has been constructed according to expert judgement and thus changing the default assumptions of sectoral allocation by energy efficiency measure can be redefined by the users. Below, in Table 1 we provide a few examples of the allocation of demand by economic activity for the measures of "Building envelope", "Heating fuel switch", and "Energy efficient heating". The numbers in Table 1 express the shares by which the investment expenditure is allocated to each economic activity.

Economic activity	Nace-code	Building envelope	Heating fuel switch	Energy-efficient heating
Other non-metallic mineral products	C23	20%		
Basic metals	C24	20%		
Computer, electronic and optical products	C26			5%
Electrical equipment	C27		15%	5%
Machinery and equipment n.e.c.	C28		50%	50%
Repair and installation services of machinery and equipment	C33		10%	15%
Constructions and construction works	F	40%	10%	10%
Retail trade services, except of motor vehicles and motorcycles	G47	10%	10%	10%
Architectural and engineering services; technical testing and analysis services	M71	10%	5%	5%

Table 1: Examples of sectoral allocation of investment expenditure by energy saving measure

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As a next step, we estimate the annual additional employment generated in the economy by an investment of 1 m € for energy saving measures. The sectoral allocation of demand is derived by the respective share in Table 6 and determines how the additional demand from 1 m€ of investment in energy saving measures is allocated to sectors. Based on this allocation the total effect in the employment from 1 m€ investment in energy saving measures is calculated by multiplying each of the additional demand allocated to sectors with the respective employment coefficient as calculated in step one, see equation (3).

$$coeffTOTEMPL_{m,c} = \sum_{j} coeffEMPL_{j,m,c} \cdot es_{j,m} \quad (3)$$

where:

j : subsector/activities
m : measure / end-use
c : country
$es_{j,m}$: Allocation share of Energy Saving Investment (m) to sector (j)

At the final step, we estimate the economy-wide employment generation by applying the level of expenditure by type of measure with the employment effect generated in the total economy by 1 m€ expenditure, see equation (4).

Methodological challenges

The 2015 SIOT tables from Bulgaria are not available on Eurostat. Czechia, Ireland, Luxemburg and Malta data are deficient. Sweden data are unbalanced (i.e., SIOT is not symmetric) however this country is not excluded. The employment impact of certain energy saving measures cannot be quantified, thus by default cannot be calculated, as these cannot be associated with the purchase of specific economic activities or are too generic. The methodology assumes only the employment impacts from the generated additional demand, thus not assuming any other structural changes, e.g. due to the drop of activity in certain sectors, nor the effects of changes in income and prices. Finally, the methodology relies on the allocation of investment expenditure to demand by economic activities, which is based on expert judgement and assumed uniform by country and sector that applies the measures.

Data requirements

The starting point of the analysis is the latest available Symmetric Input Output tables (SIOT) by EU Member State, which are available in Eurostat for year 2015. The sectoral resolution adopted in our analysis is the 65 sectors in NACE rev2. 2-digit, in line with the CPA resolution. Additionally, in order to evaluate the exact effect on the Employment, the sectoral demand contributions should be assumed.

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Impact factor/functional relationship

The associated additional Employment is proportional to the Energy Saving Investments. Every investment in energy saving measure is attributed to sectors and the total effect on employment is calculated as shown below.

$$TOTEMPL_{m,c,y} = coeffTOTEMPL_{m,c} \cdot Inv_y \quad (4)$$

where,

m : measure / end-use
c : country
y : year
Inv_y : Energy Saving Investments

In conclusion, Employment effect depends on impact factor coefficient per country and measure, which are determined as aggregation of industries or product groups of the IO-table, and the sectoral investment demand assumptions, which are set by default or according to user's choice. Thus, Employment level is determined by the impact factor and the Investment according to energy saving allocation measures.

Monetisation

No monetisation is expected for this indicator, unless associated with a mean wage by country.

Aggregation

The indicator cannot be directly aggregated with other indicators.

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Conclusion

Below we provide examples for the calculation of the Employment indicator for three selected EU Member States, namely Germany, Italy and Poland.

Germany

Annual energy saving expenditure in million €									
Subsector	**Measure**	**Country**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Machinery	Space heating and cooling	Germany	150	150	150	150	150	150	150
Annual additional employment generated by investment for energy saving measures									
Coefficient for employment effect in jobs per 1m. € of investments			**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
10.14			1521.6	1521.6	1521.6	1521.6	1521.6	1521.6	1521.6

Table 2: Calculation of the employment indicator for Germany

Therefore, it can be derived that for each million € invested into machinery industry for the energy efficiency measure space heating and cooling, 10.14 annual additional employment is generated. Thus an 150 million € investment would annually generate 1521.6 additional employment.

Italy

Annual investments in million €									
Subsector	**Measure**	**Country**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Average tertiary	Building envelope	Italy	150	150	150	150	150	150	150
Annual additional employment generated by investment for energy saving measures									
Coefficient for employment effect in jobs per 1m. € of investments			**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
13.88			2081.7	2081.7	2081.7	2081.7	2081.7	2081.7	2081.7

Table 3: Calculation of the employment indicator for Italy

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Therefore, it can be derived that for each million € invested into average tertiary sector for the building envelope energy efficiency measure, 13.88 annual additional employment is generated. Thus an 150 million € investment would annually generate 2081.7 additional employment.

Poland

Annual investments in million €									
Subsector	**Measure**	**Country**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Construction	Fuel switch	Poland	150	150	150	150	150	150	150

Annual additional employment generated by investment for energy saving measures							
Coefficient for employment effect in jobs per 1m. € of investments	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
13.88	2713.1	2713.1	2713.1	2713.1	2713.1	2713.1	2713.1

Table 4: Calculation of the employment indicator for Poland

Therefore, it can be derived that for each million € invested into the construction sector for fuel switch energy efficiency measure, 18.09 annual additional employment is generated. Thus an 150 million € investment would annually generate 2713.1 additional employment.