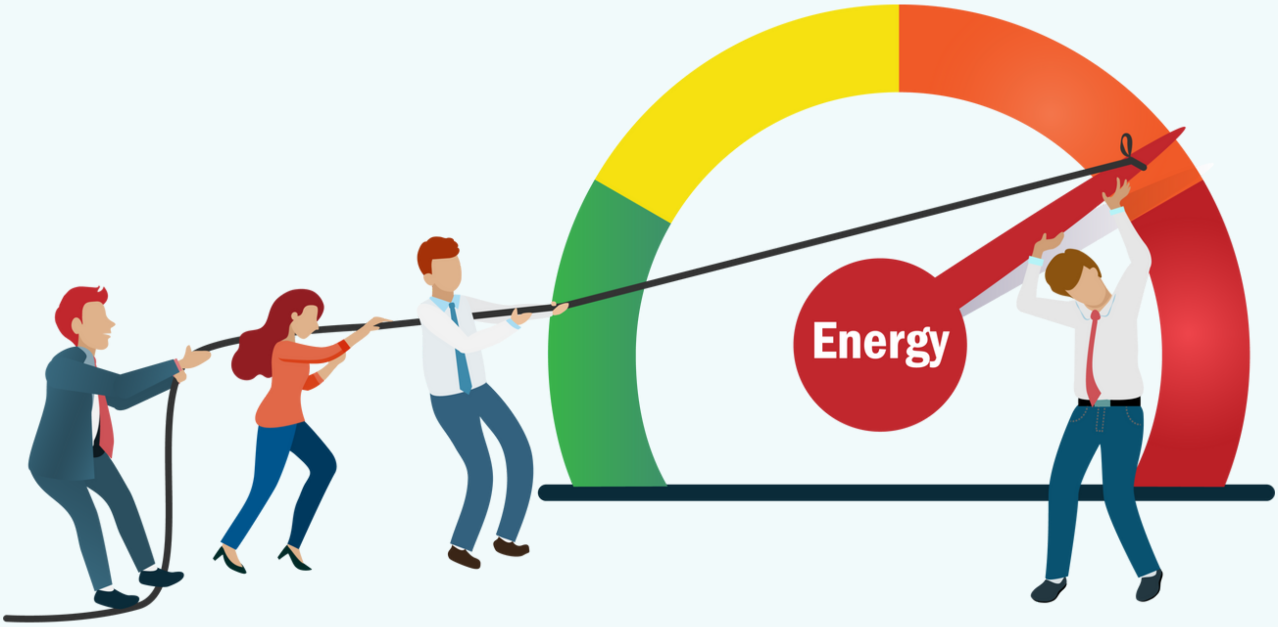
Multiple Impacts Calculation Tool

Empirical basis of Economic Impacts Avoided Additional Energy Generation Capacity



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Executive summary

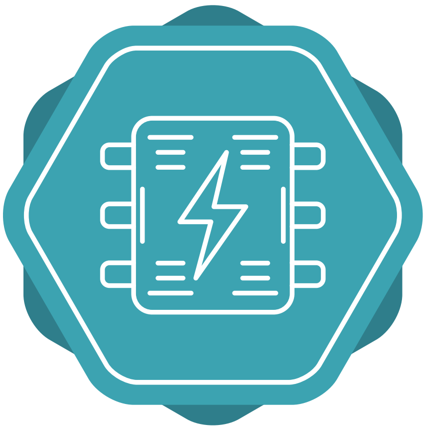
Against the backdrop of the electrification of large parts of our economies and the decommissioning of legacy fossil fuel-combusting power plants, the need for additional renewable energy capacities is expected to rise in the years to come. However, by saving energy with energy efficiency and sufficiency measures, the need for additional capacities can be reduced. This indicator assesses the impact of energy savings on the need for additional capacities, taking regional full load hours of different technologies into account.

This impact is predominantly important on the national level, since the vast majority of electricity grids mainly operate nationally.

In light of the necessary investments in renewables across the bloc, this indicator might still be interesting on a European level to showcase the effect energy efficiency can have in decreasing the pressure on renewables expansion.

To quantify the reduced need for additional capacities, the regional respective full load hours of PV, onshore and offshore wind are considered in the form of a utilisation factor $u_{c,t}$:

$$u_{c,t} = E_{act,c,t}/E_{opt,t}$$



In this equation, $E_{act,c,t}$ describes the actual energy generation of a given RES technology in a specific country, whereas $E_{opt,t}$ specifies the RES technology's optimal energy output. Then, the shares of the different RES technologies in new electricity capacities $\lambda_{c,t}$ are taken into account, using the average of the PRIMES projections for 2020, 2025, and 2030:

$$\lambda_{c,t} = \emptyset_y(\lambda_{c,t,y})$$

These intermediate results can be used to calculate the change in additional cap $\Delta C_{c,t}$ triggered by electricity savings $\Delta E_{el,c}$:

$$\Delta C_{c,t} = \frac{\Delta E_{el,c} \cdot \lambda_{c,t}}{u_{c,t} \cdot 8760\ \mathrm{h}}$$

To monetise this impact, the reduced capacity is multiplied with the technologies' marginal investment prices P_t :

$$M_{\Delta C,c} = \sum_t \Delta C_{c,t} \cdot P_t$$

The only issue is the overlap of this impact with "Energy savings", suggesting not to aggregate the monetised values by default and excluding it from the cost-benefit-analysis.

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Scope of MI Indicator

Definition

Against the backdrop of the electrification of large parts of our economies and the decommissioning of legacy fossil fuel-combusting power plants, the need for additional renewable energy capacities is expected to rise in the years to come. However, by saving energy with energy efficiency and sufficiency measures, the need for additional capacities can be reduced. This indicator assesses the impact of energy savings on the need for additional capacities, taking regional full load hours of different technologies into account.

Relevance on EU, national and/or local level

This impact is predominantly important on the national level, since the vast majority of electricity grids mainly operate nationally.

In light of the necessary investments in renewables across the bloc, this indicator might still be interesting on a European level to showcase the effect energy efficiency can have in decreasing the pressure on renewables expansion.

On the local level, this indicator is less relevant.

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

The monetisation of this indicator has slight overlaps with two other indicators:

- Energy (cost) savings: since the investment costs are internalised in energy costs, the costs of additional capacities are comprised in the energy cost savings, which would have originated from these additional capacities. However, since the investment costs of renewables are currently extremely low and the payback times have gone along with them, significantly underbidding the technologies' lifetimes, the energy costs include far more price components than just the investment costs.

- RES share: this indicator monetises the costs of missing the Renewable Energy Directive's targets. However, since the monetisation refers to statistical transactions of renewables, meaning surplus volumina can be sold whereas shortfall volumina can be purchased, the transfer is independent of actual physical values. This monetisation does not relate to the amount of generated electricity but merely to the way it was produced, renewably or not. Thus, the risk of double counting can be neglected for this impact.

Impact pathway figure

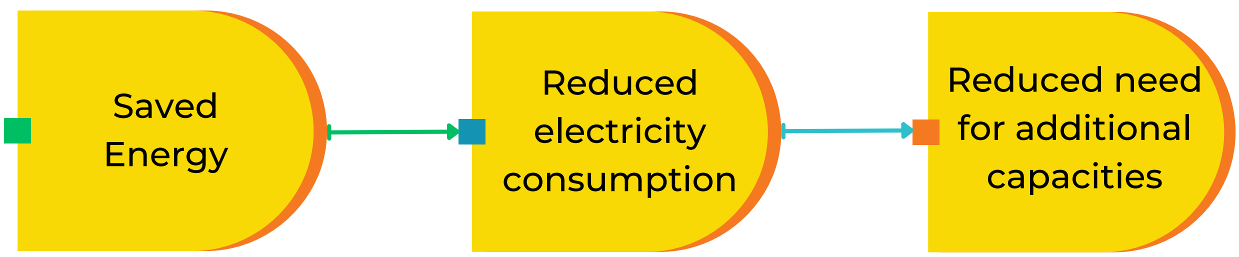

Figure 1: Impact pathway for the indicator avoided additional energy generation capacity

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Quantification method

Description

In order to assess this impact, the underlying assumption is that the energy savings merely cushion the need for additional renewable energy sources. This is mainly due to two reasons: new electric capacities should be renewable to comply with the Paris Agreement and the Fit-for-55 package and predominantly include photovoltaics (PV), onshore and offshore wind; the fact that the decommissioning of fossil fuel and nuclear power plants is mainly planned politically rather than as a response to market signals.

To quantify the reduced need for additional capacities, the regional respective full load hours of PV, onshore and offshore wind are considered in the form of a utilisation factor $u_{c,t}$:

$$u_{c,t} = E_{act,c,t} / E_{opt,t}$$

In this equation, $E_{act,c,t}$ describes the actual energy generation of a given RES technology in a specific country, whereas $E_{opt,t}$ specifies the RES technology's optimal energy output. Then, the shares of the different RES technologies in new electricity capacities $\lambda_{c,t}$ are taken into account, using the average of the PRIMES projections for 2020, 2025, and 2030:

$$\lambda_{c,t} = \emptyset_y(\lambda_{c,t,y})$$

These intermediate results can be used to calculate the change in additional capacity $\Delta C_{c,t}$ triggered by electricity savings $\Delta E_{el,c}$:

$$\Delta C_{c,t} = \frac{\Delta E_{el,c} \cdot \lambda_{c,t}}{u_{c,t} \cdot 8760\ \mathrm{h}}$$

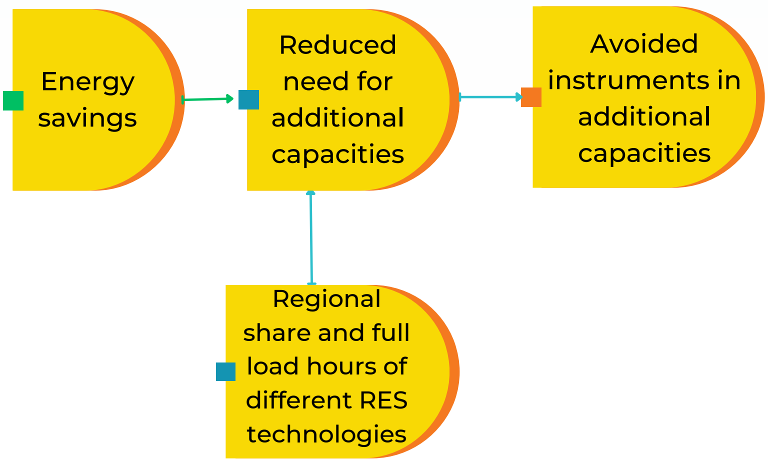

Figure 2: Quantification of the indicator avoided additional energy generation capacity

Methodological challenges

There are no methodological challenges.

Data requirements

This indicator mainly needs electricity savings as generated by the indicator "Energy savings". Furthermore, the changes in additional capacity triggered by electricity savings have been calculated for all EU countries.

Impact factor/functional relationship

The functional relationship is shown in the last equation of the quantification section.

Monetisation

To monetise this impact, the reduced capacity is multiplied with the technologies' marginal investment prices P_t :

$$M_{\Delta C,c} = \sum_t \Delta C_{c,t} \cdot P_t$$

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The latter are issued and averaged from two publications (Table 1).

Source	Onshore wind [€/kW]	Offshore wind [€/kW]	PV [€/kW]
IRENA (IRENA 2016)	1370	3950	790
European Commission (Tsiropoulos I, Tarvydas, D, Zucker 2017)	1290	2950	800
Assumption for the cost in this work by the author	1330	3450	795

Table 1 : Marginal costs of RES technologies

Aggregation

The indicator's monetisation should not be aggregated with other impacts, since the benefits of this indicator are already reflected in the monetisation of "Energy savings".

Conclusion:

The indicator can help pinpoint how energy efficiency can reduce the pressure on the expansion of renewables. Both the methodology of the quantification and of the monetisation are straightforward. The only issue is the overlap of the monetisation of this impact with and of "Energy savings", suggesting not to aggregate it by default and excluding it from the cost-benefit-analysis.