MICAT

Multiple Impacts Calculation Tool

The Multiple Impacts of Energy Efficiency:

Social Indicators

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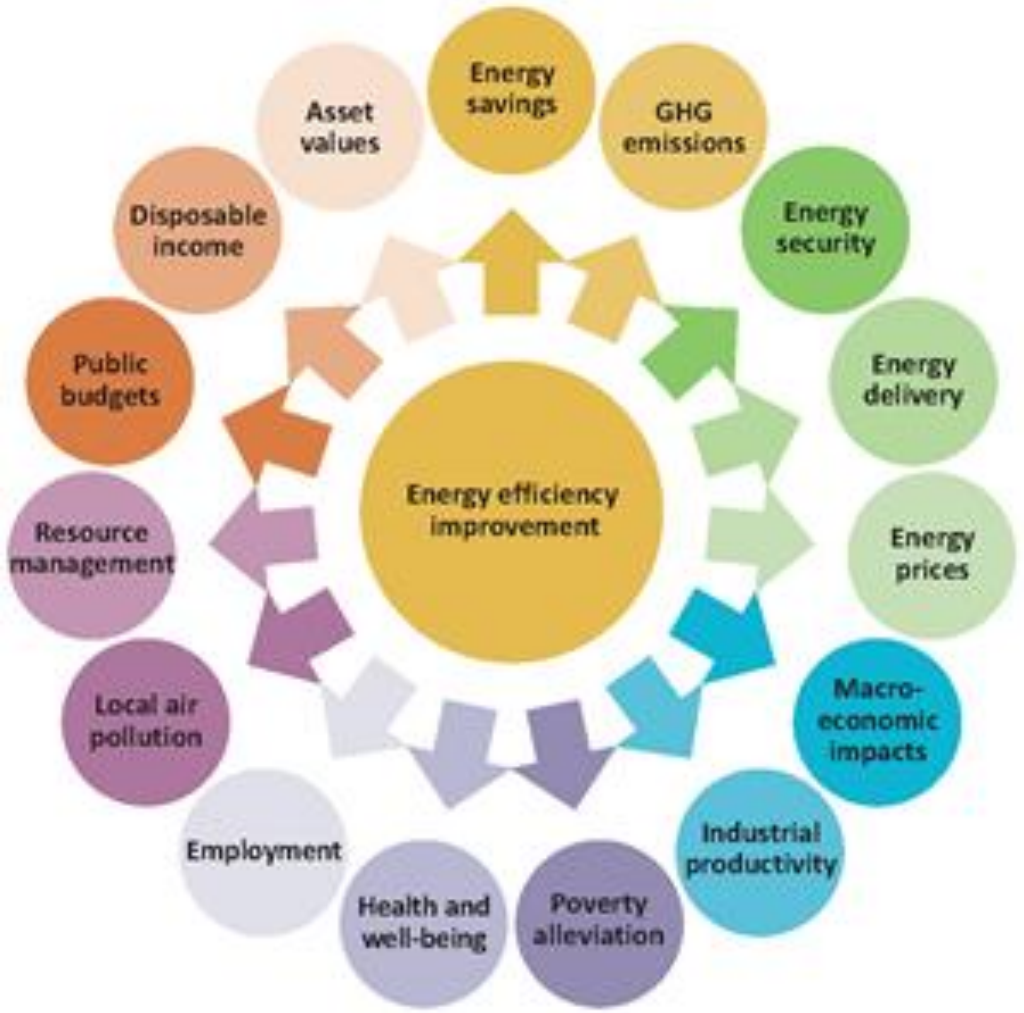
Why MICAT? - The project idea

„Multiple Impacts“: Co-benefits, non-energy benefits (NEBs), multiple benefits (MBs), or impacts (MIs)

- accompany energy efficiency projects and provide additional arguments to implement EE measures, but are rarely reported
- explicitly mentioned in EC’s policy-making (e.g. EPBD, EED) and reporting (NECPs)

Show the full set of advantages of energy efficiency policy measures through monetization and aggregation of impacts and cost-benefit analyses



Source: IEA 2015

The MICAT Approach

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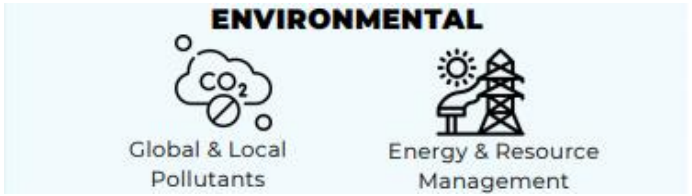
Development of a comprehensive approach to estimate Multiple Impacts of Energy Efficiency by providing a publicly available and easily usable online tool → MICAT: **M**ultiple **I**mpacts **Ca**lculation **T**ool

- **Improve scientific knowledge** and methods to quantify Multiple Impacts
- **Facilitate assessment of MI** of policies at EU, national and local levels:
  - Allow evaluation of **customised scenarios and policy measures**
  - **Quantification and monetisation** of different categories of multiple impacts



COMBI
Calculating and Operationalising the Multiple Benefits of Energy Efficiency in Europe

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ODYSSEE-MURE
MB:EE

General Approach of MICAT

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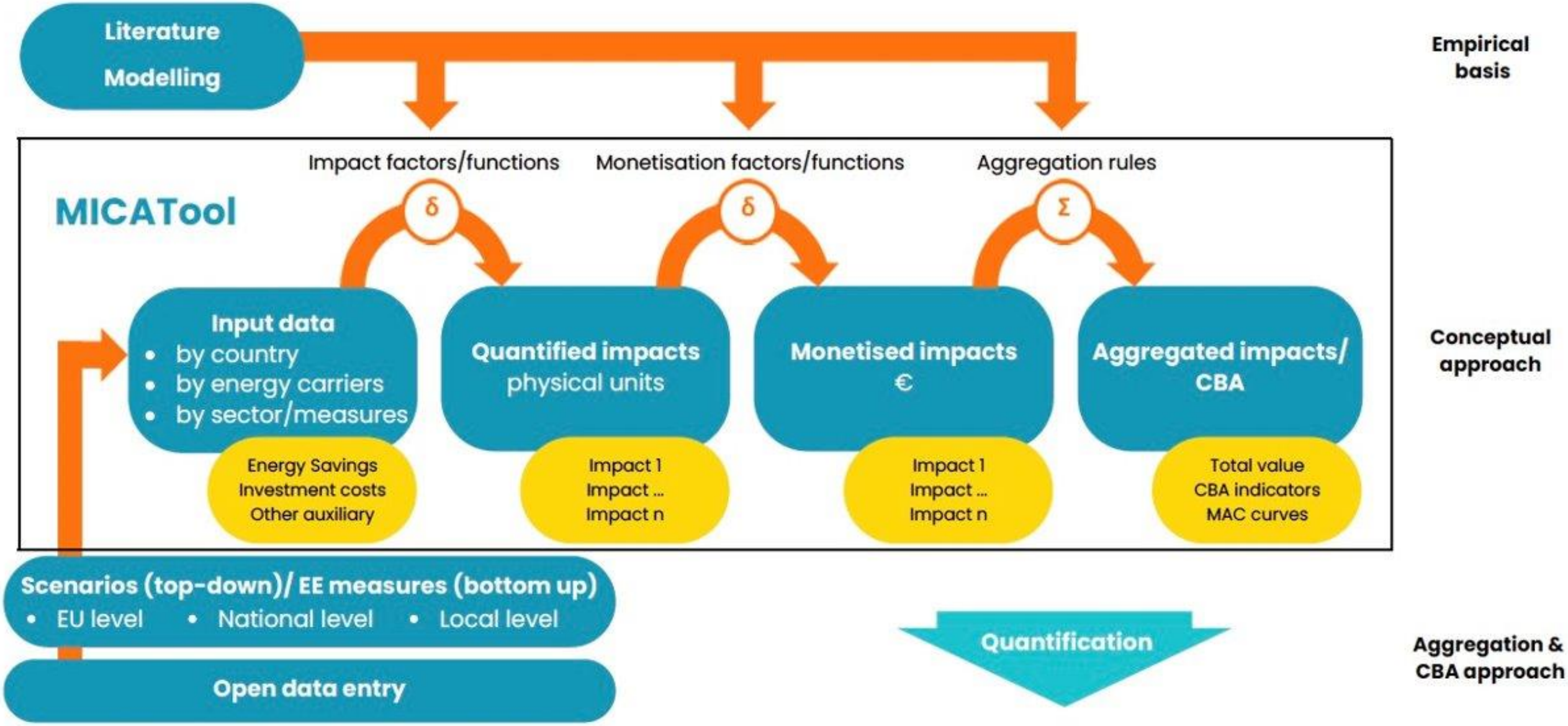

Social impacts of energy efficiency in MICAT

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Energy poverty alleviation

Number of persons lifted from energy poverty

Energy efficiency improvements (EEI)

Improvements in welfare

Change in the share of consumption of non-energy goods in income by income quintile

Health impacts due to

Improved indoor climate

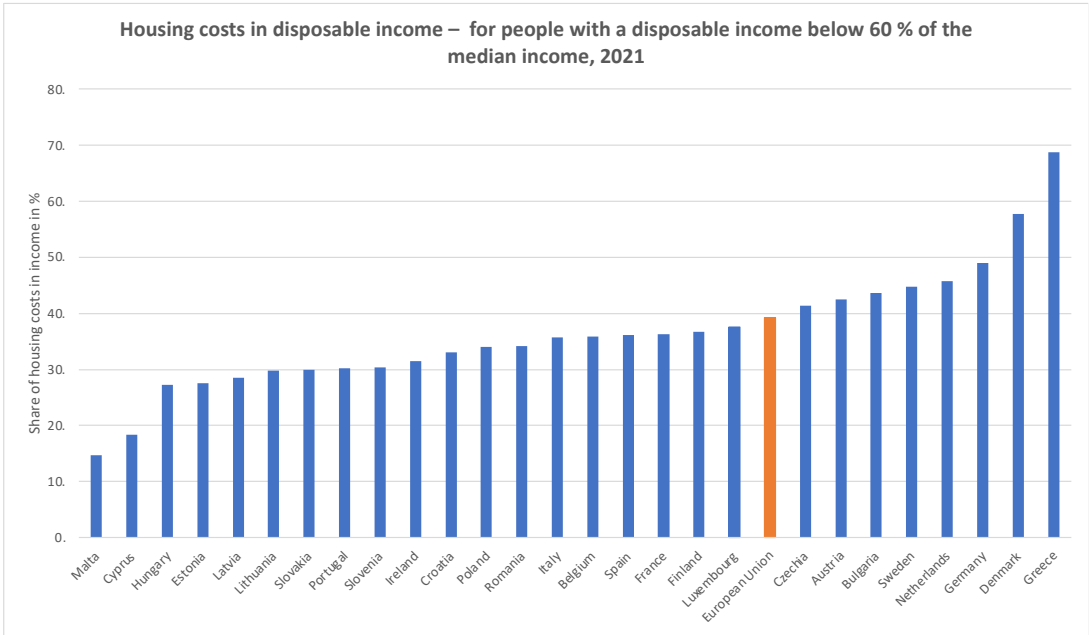
- Avoided asthma cases
- Avoided premature deaths due to indoor cold

Reduced air pollution

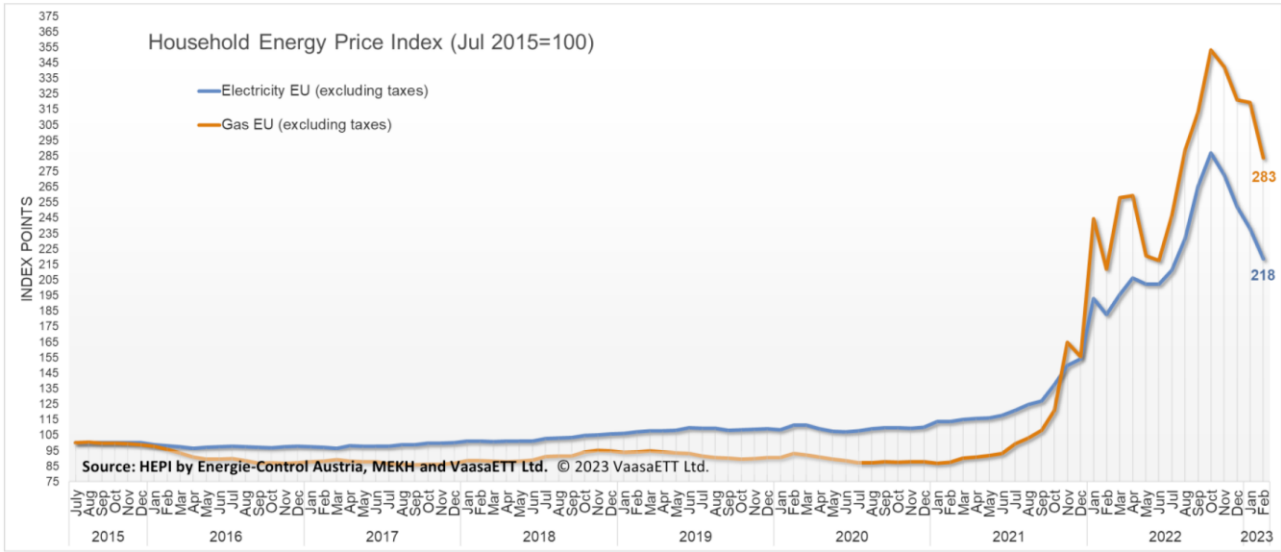
- Change in morbidity
- Avoided premature deaths

Energy poverty alleviation - Background

- In 2021 around 7% of the EU population or 31 mio. people unable to adequately heat their home, 29 mio. had arrears on utility bills
- Share of housing costs in income for households at risk of poverty at 40% in 2021
- Recent energy price and rent developments plus overall inflation further increase financial burden on household budgets



Source: Eurostat 2022



- Non-targeted policy responses, often in the form of income support or energy subsidies

→ Unsustainable and in contradiction to climate policy (e.g., CO_2-Taxes, introduction of EU ETS 2 for residential and transport sector)

Targeted action necessary to improve energy efficiency in vulnerable households and decrease costs for access to basic energy services

Energy poverty alleviation - EU Policy framework

Set up of EU Energy Poverty Observatory (2018) and the EU Energy Poverty Advisory Hub (2021)

EU ENERGY POVERTY Observatory | European Commission

EU Energy Poverty Advisory Hub

Increasing emphasis on monitoring and alleviating energy poverty in the pertinent EU legislation:

- **Electricity Directive (2019/944):**
  - Establishment and publication of criteria to assess energy poverty (Art. 29)
- **Governance regulation (2018/1999)**
  - Assessment of energy poverty → target setting, policy definition / reporting in NECP (Art. 3 (3d))
- **Energy Efficiency Directive (2023 recast)**
  - Definition of energy poverty (**new**)
  - Achievement of proportional share of savings under Art. 8 saving obligation → Reporting of results in NECPs
- **Buildings Directive (recast pending)**
  - Indicate energy poverty actions in long term renovation strategies (Art. 2a (1d))

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- ☑ Support Member States with limited resources / capacities in their reporting
- ☑ Provide indications on how policy design affects energy poverty impacts
- ✗ Replace detailed modelling of energy poverty impacts

Energy poverty alleviation - Definition / Indicator selection

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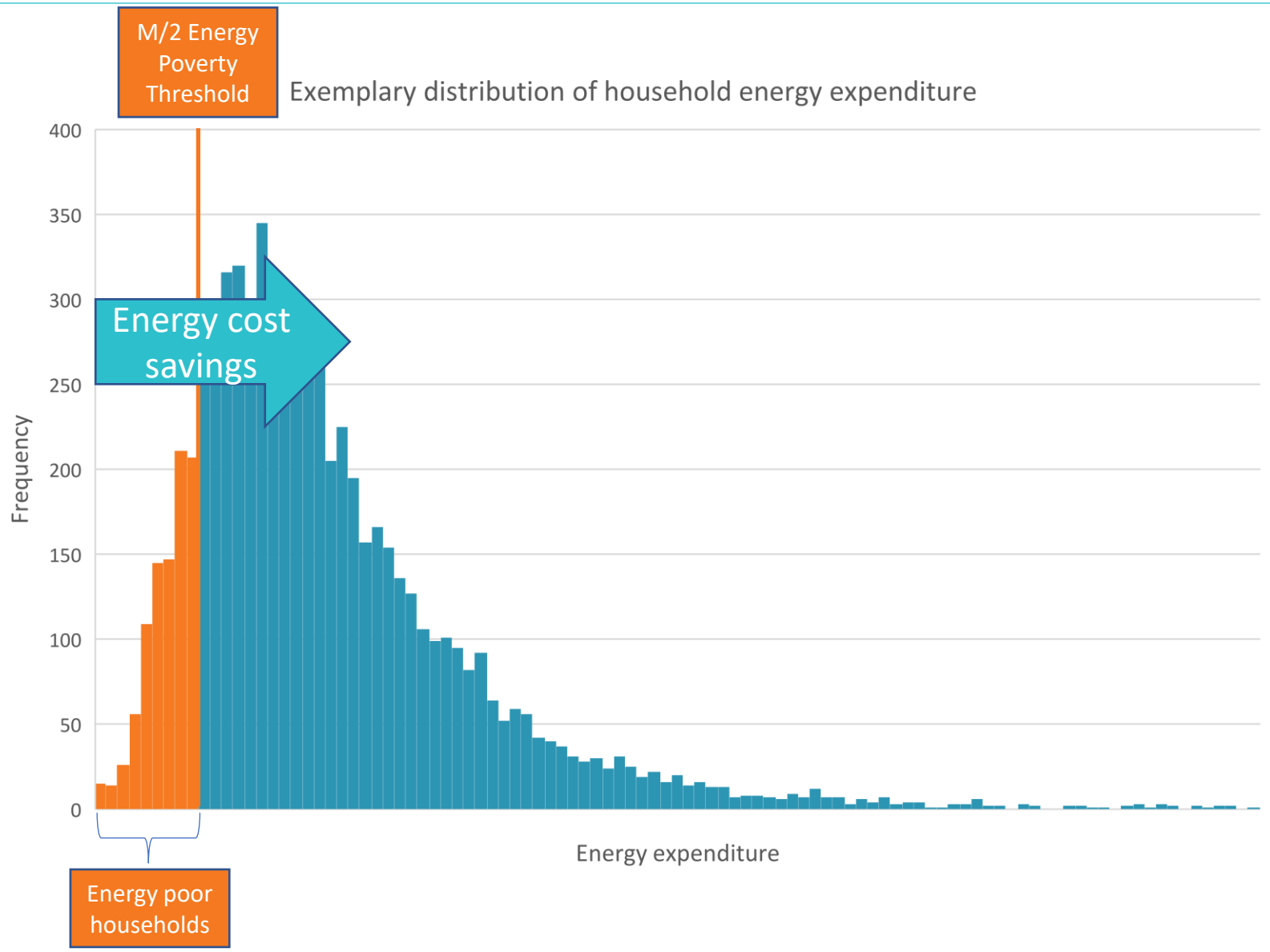
- Variety of definitions and supporting metrics in the EU (cf. Raedemakers et al. 2019)
- Article 2 EED Definitions (49) (new): 'energy poverty' means **a household's lack of access to essential energy services that provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing social policy and other relevant policies** […].
- Commission recommendation on energy poverty lists a set of different indicators to assess energy poverty

Type of indicator	Consensual (self assessment)	Expenditure-based (in relation to a national threshold)
Database	• EU-Survey on Income and Living Conditions (SILC)	• Household Budget Surveys (HBS)
Indicators	• Ability to keep home adequately warm • Arrears on utility bills • Presence of leak, damp or rot	• **M/2:** absolute energy expenditure (and income) below half the national median • **2M:** share of energy expenditure in income more than twice the national median
Advantages	• Regular collection • Capture subjective experience of energy poverty	• Allow assessment of severity → define monetary value
Shortcomings	• Possible underreporting • No nuances (binary)	• Irregular data collection • Threshold arbitrary

Energy poverty alleviation - Methodology



- Use of two expenditure-based metrics to capture underspending (M/2) and relative overspending (2M)
- Model the impact of both building and household targeted energy efficiency improvement (EEI) actions
- Differentiation between tenants and owners
- Adjustment of yearly household energy cost savings with view to (possibly subsidized) investments or rent increases
- Comparison of calculated net cost savings to the difference of energy poor households absolute or relative energy expenditure to the energy poverty threshold values (M/2 or 2M) → **Energy Poverty Gap**

Energy poverty alleviation - Data requirements / sources

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User input:

- **Final energy savings in residential buildings by EEI action type**
- **Investment costs by EEI action type**
- **Number of (induced) EEI actions by type**
- Share of EEI actions implemented in energy poor households (Policy Targeting)
- Subsidy rate for EEI action
- Renovation Rent Premium

Member State specific data in the MICATool:

	Type	Sources
Building stock data	• Occupied dwelling stock / Number of households • Average number of dwellings per residential building	Labour Force Survey; Hotmaps (BPIE)
Household data	• Average rents of energy poor households • Ownership rate among energy poor households • Average size of energy poor households • Energy Poverty Gap by indicator and tenure status	SILC 2020; HBS 2015 (adjusted)
Other	• Standard energy savings / investment costs by EEI action	PRIMES data

Energy poverty alleviation - Quantification approach

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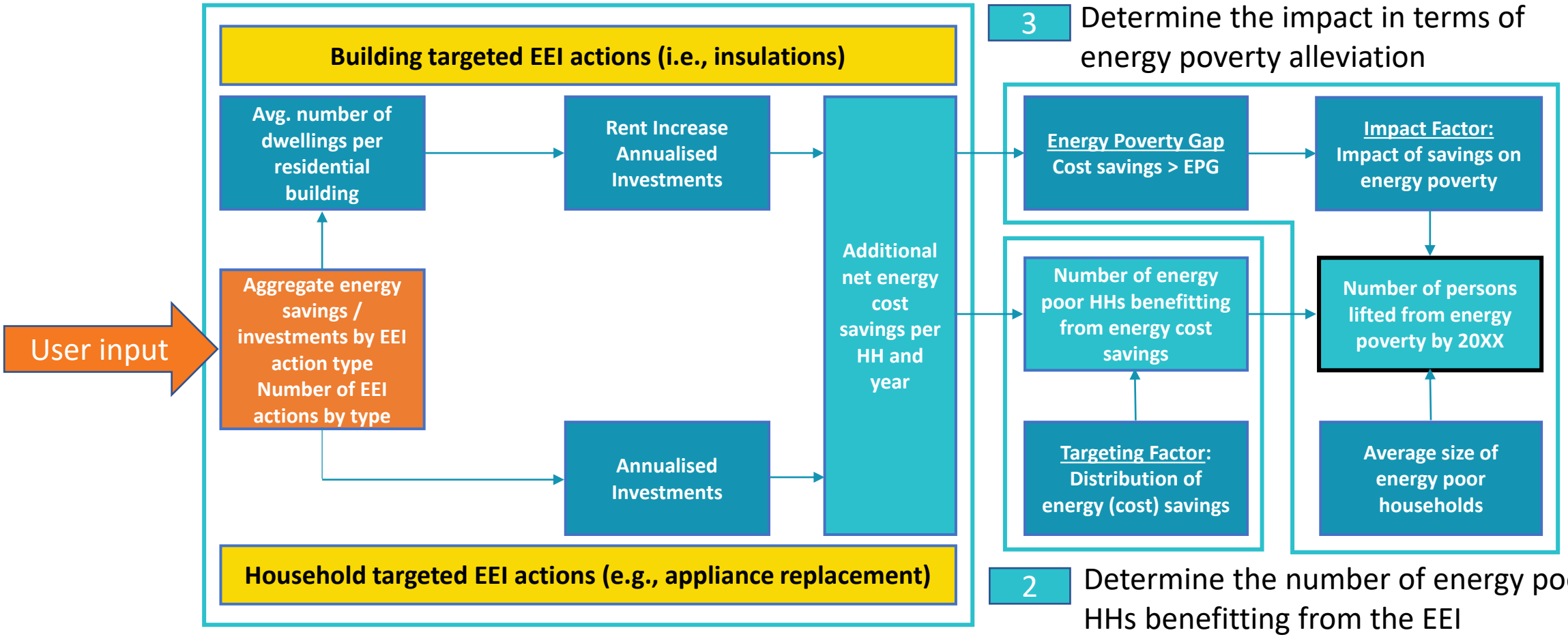
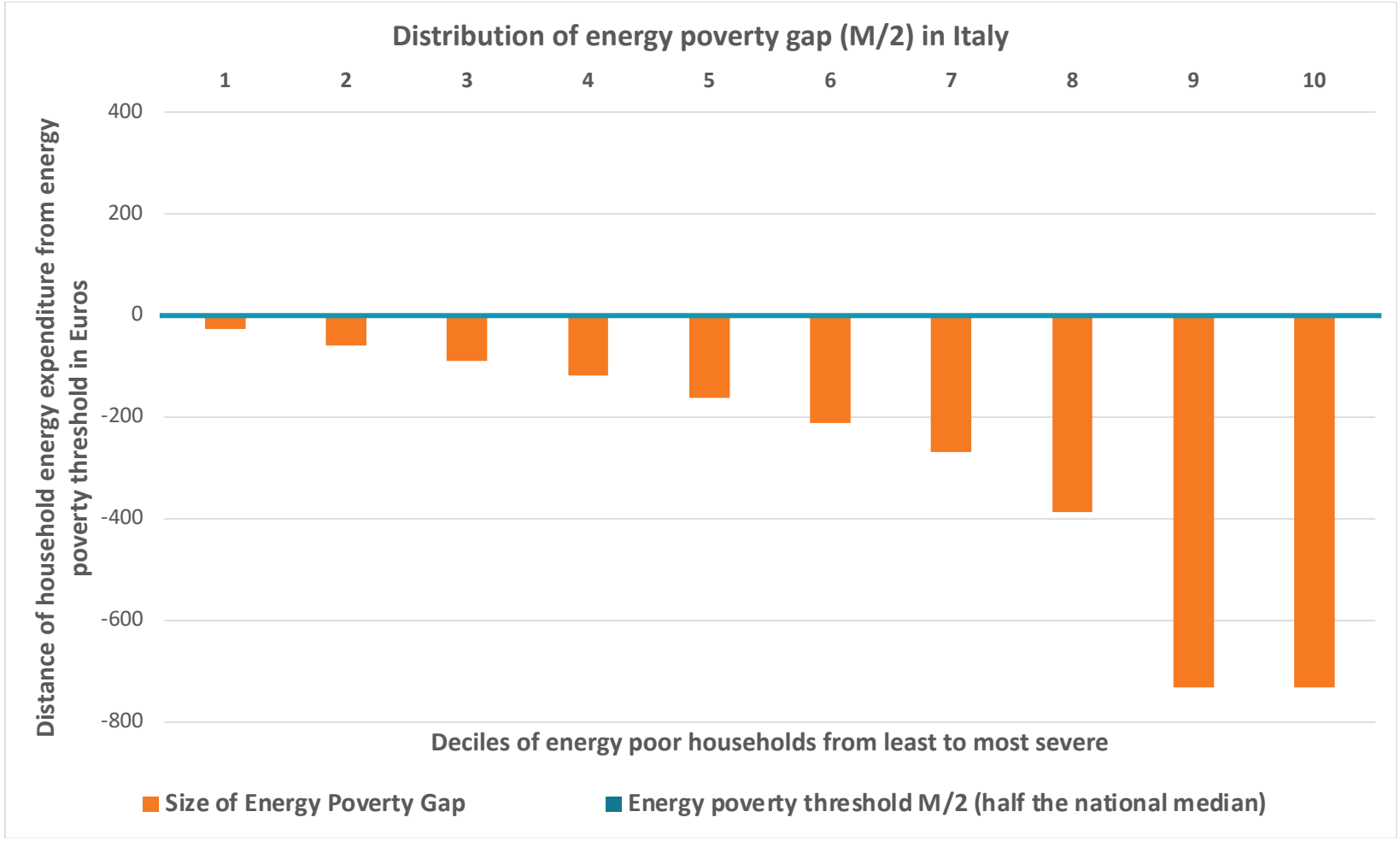
1 Define the type and number of EEI actions and the corresponding net energy cost savings per household



Energy poverty alleviation - Energy Poverty Gap / Impact Factor

Energy poverty gap:
Distance of households' absolute or relative energy expenditure to a defined energy poverty threshold value (M/2 or 2M)

Definition of Impact Factor
Share of HH for which the net energy cost savings suffice to bridge the energy poverty gap, i.e., increase / decrease their energy expenditure above / below the threshold value



Energy poverty alleviation - Example

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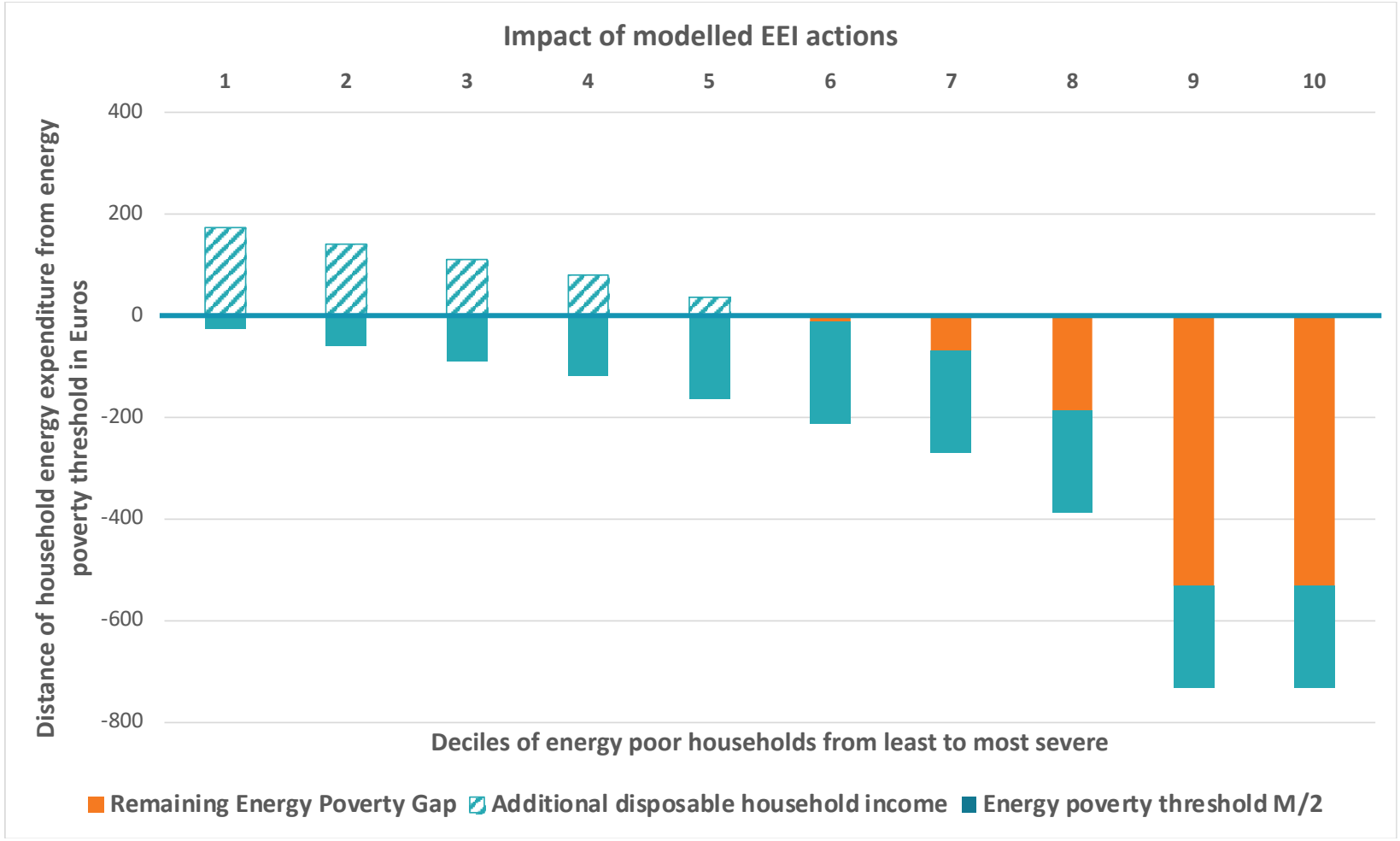
Example:

- Energy efficiency policy / programme generates yearly energy cost savings of 600 € per household and year
- Adjusted for investment costs or rent increase, 200 € net energy cost savings remain



Energy poverty alleviation - Example

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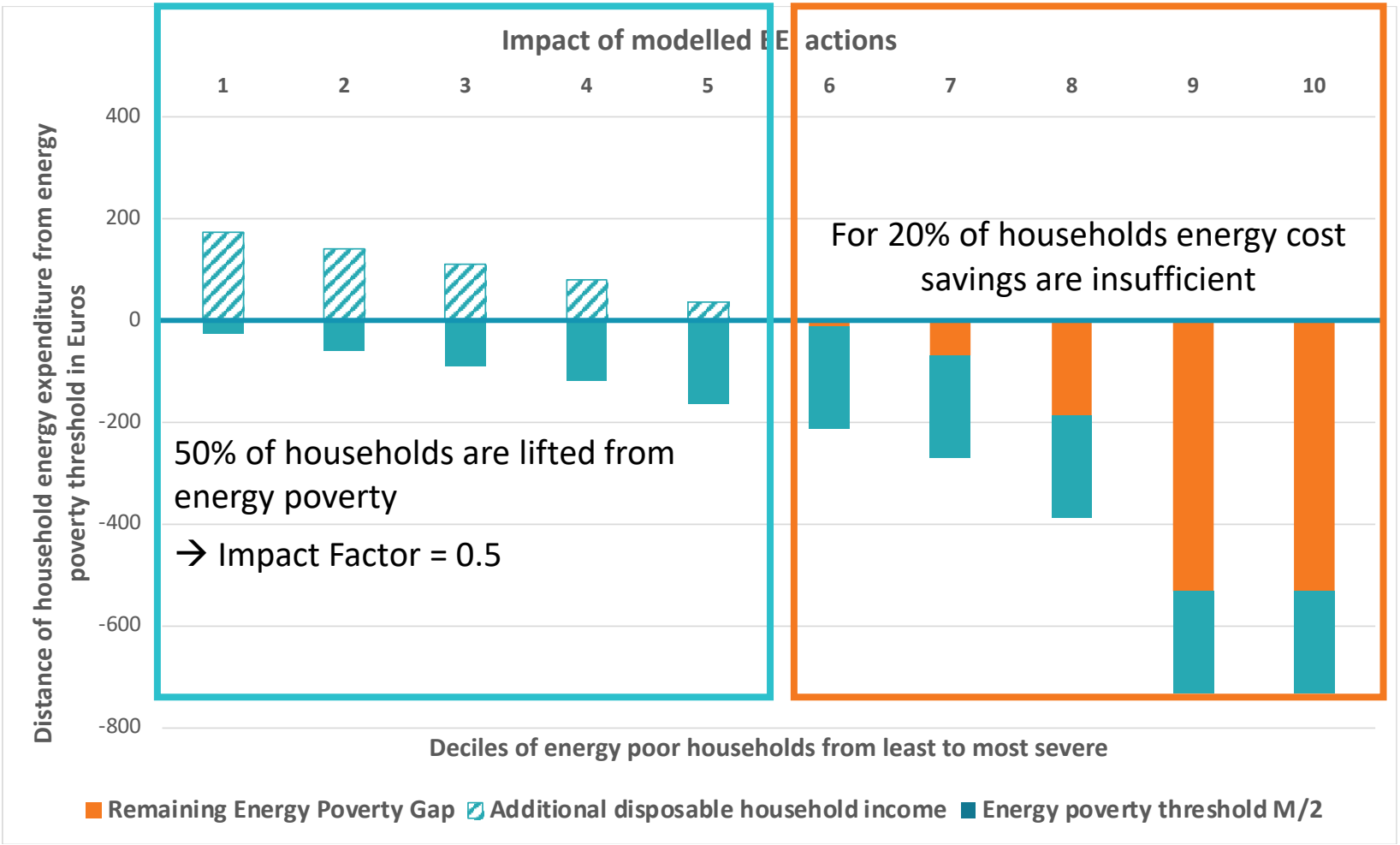
Example:

- With the energy cost savings of 200 €, 50% of energy poor households are enabled to increase their expenditure to a level above the threshold value
- 50% of benefitting households remain energy poor although less



Energy poverty alleviation - Main assumptions / limitations

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Main assumptions

- Additional disposable household income sufficient to ensure access to basic energy services (M/2) / sufficiently reduce financial burden (2M)
- Equal distribution of building renovations to different building types (single, double, multi family)
- Proportional distribution of building renovations among owner occupiers and tenants
- Equal distribution of investment costs and energy cost savings among building occupants

Methodological limitations / uncertainties

- Outdated HBS database for energy and rent expenditure → adjustment may introduce bias
- Subnational data only for some regions available → use national values as proxies
- Limited data on rent premiums for energy efficiency building improvements → user adjustment possible
- Modelling of different EEI actions with unequal numbers only possible in a separate manner

Human health (air pollution) - Motivation

Health impacts of air pollution in Europe, 2022

Air pollution is the largest environmental health risk in Europe. It is a major cause of adverse health effects: for instance, air pollution causes and aggravates respiratory and cardiovascular diseases. Heart disease and stroke are the most common causes of premature deaths attributable to air pollution, followed by lung diseases and lung cancer. This chapter presents the latest estimates of the health impacts of exposure to fine particulate matter, nitrogen dioxide and ozone in terms of morbidity and premature deaths. It also assesses progress towards the EU's zero pollution action plan target to reduce mortality attributable to air pollution.

Published 24 Nov 2022 — Last modified 13 Mar 2023 — 15 min read — Photo: © Elia Lazzari, Well with Nature /EEA.

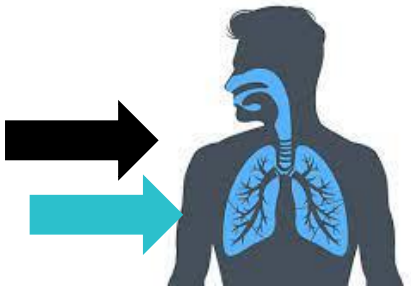
Publications > Air quality in Europe 2022 > Health impacts of air ...

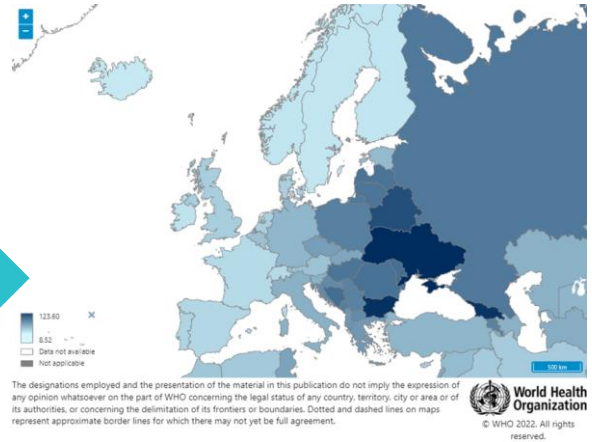
Key messages

- In 2020, air pollution led to a significant number of premature deaths in the 27 EU Member States (EU-27). Exposure to concentrations of fine particulate matter above the 2021 World Health Organization guideline level resulted in 238,000 premature deaths; exposure to nitrogen dioxide above the respective guideline level led to 49,000 premature deaths. Acute exposure to ozone caused 24,000 premature deaths.
- The zero pollution action plan aims to reduce the number of premature deaths due to exposure to fine particulate matter by 55% by 2030, compared to 2005. In 2020, the number of premature deaths attributable to exposure to fine particulate matter above the WHO guideline level fell by 45% in the EU-27, compared to 2005. If this rate of decline is maintained, the EU will reach the aforementioned zero pollution action plan target before 2030.

Source: EEA

Human health (air pollution) - Motivation





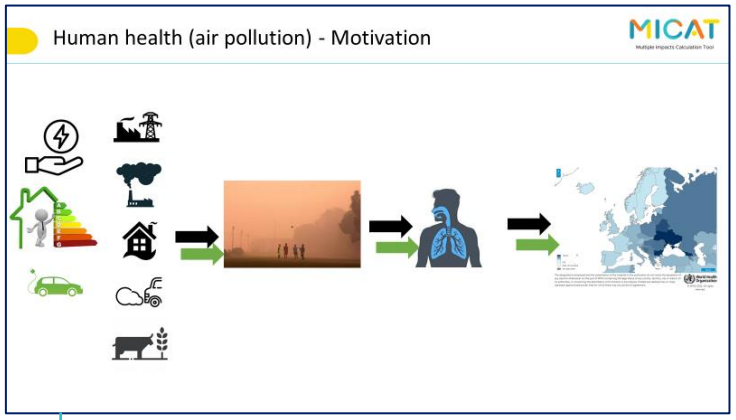
Emissions

Ambient air quality

Exposure and vulnerability

Impact

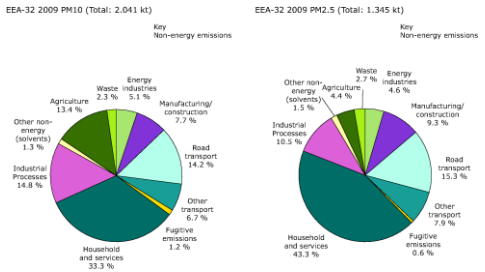
Human health (air pollution) - Methodology



GAINS model

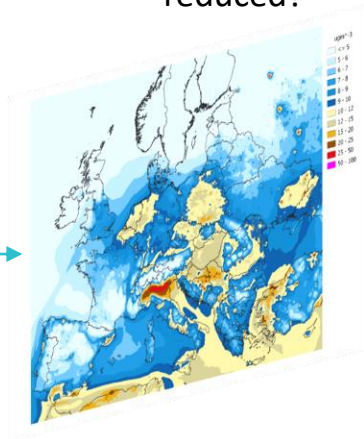
- Supports EC air quality policy development & reflects current policies
- Hundreds of sectors and technologies
- Interfaces with PRIMES
- Covers both air pollutants and GHGs
- Includes a reduced form chemical transport model derived by EMEP
- Here: focus on health impact of fine particles (PM2.5)

How many tons of emissions are reduced?



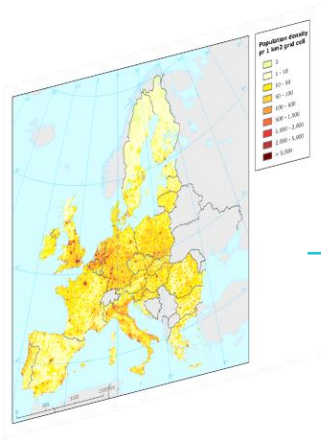
Reflect use of technologies, sector specific emission factors and regulations

Where is the ambient pollution being reduced?



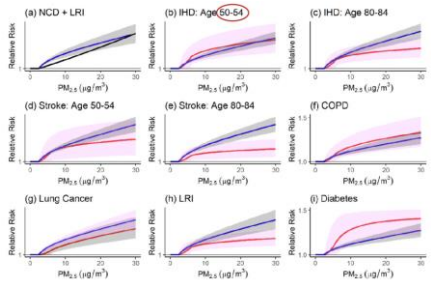
Reduced form chemical transport model

Where do people live?



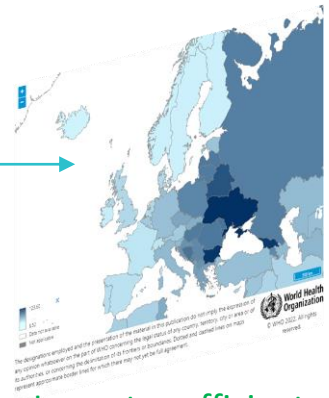
Population density map

How vulnerable are the populations?



Relative risks

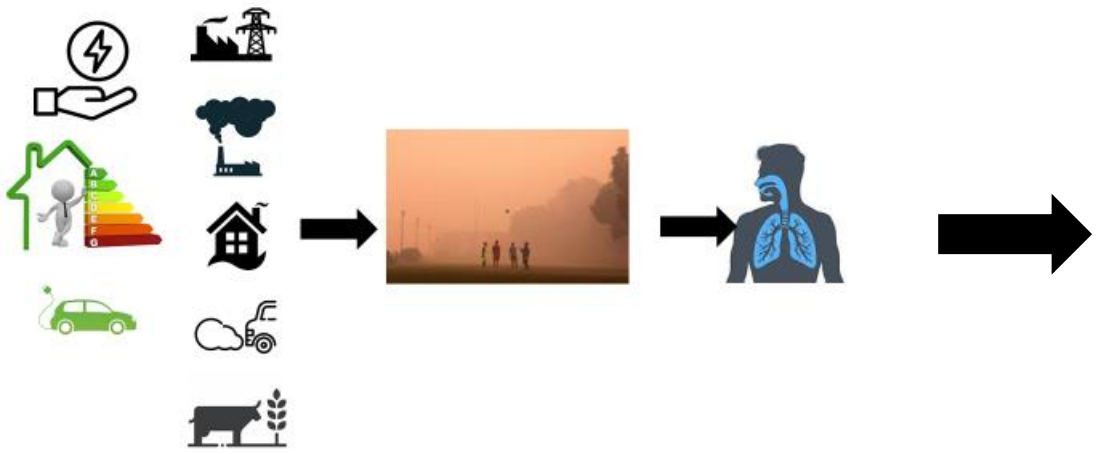
How many people are affected?



Impact coefficients per unit of energy saved

Human health (air pollution) - Monetization

Human health (air pollution) - Monetization



Related hospitalizations

(Costs per day) x days

Work days lost

(Costs per day) x days

Premature deaths

Value of statistical life

Human health (air pollution) - Main assumptions / limitations

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Main assumptions

- PM2.5 has the most significant air pollution related health impact → focus on PM2.5 and precursors
- The GAINS model methodology for calculating PM2.5 concentrations is well-established, peer-reviewed and consistent across member states
- The dataset used in MICATool is consistent with the assumptions made for recent EC work on the Ambient Air Quality Directive (AAQD) and the Clean Air Outlook (CAO3) → future scenarios reflect current policies

Methodological limitations / uncertainties

- Energy efficient measures in MICATool are often not fuel-specific
- Spatial distribution of sources are constant (within a sector) in GAINS
- Linear dose-response functions at the national level → not straightforward to scale down to city level

THANK YOU

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