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

Multiple impacts of energy efficiency:
The outcomes of an interdisciplinary partnership

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November 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649724.
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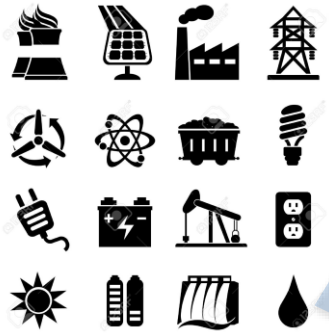
Energy savings

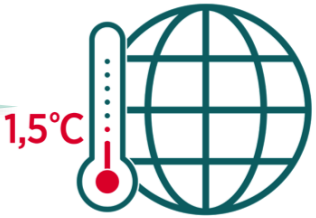


Air pollution

health
poverty

resources

Climate Change



Sustainability

economy
labour market

energy system
security

Project background & objectives

Quantification of multiple impacts of EE

Coordinated by Wuppertal Institut

- Quantification & monetization of multiple impacts
- By EU member state & 21 EEI actions
- Common framework scenarios: based on 21 energy efficiency improvement (EEI) actions
- Extended Cost-Benefit analysis

Air pollution	Resources	Social welfare	Macro economy	Terms of Trade
air pollutants	material footprint	disposable income	employment/ GDP	Energy system
health	abiotic/biotic	health, productivity	public budget	energy system costs
eco-system	energy/non-energy	health-related energy poverty impacts	Fossil fuel/ETS prices	energy security
	unused extraction			

The University of Manchester · Wuppertal Institut · The University of Manchester · ABUD Advanced Building & Urban Design · Copenhagen Economics · CE · Universiteit Antwerpen

Funded by EU Horizon 2020 EE12 (GA 649724, approx 1M€)

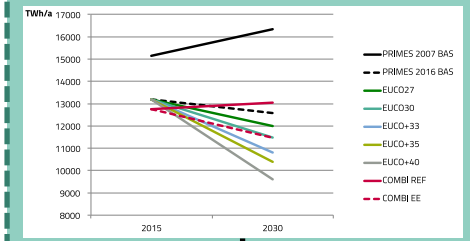
- March 2015 – May 2018

COMBI research design

user settings

Input data

COMBI stock models
→ BAS & EE scenario



- 2030 additional energy savings (1647 TWh)
- additional energy cost savings (225 bn €)
- total investment costs

additional data: stocks, scenario levels etc.

Impacts modelling

Dedicated models

Impact category	models
air pollution (health, eco-systems)	GAINS
resources	MIPS/Lifecycle assessment
health (indoor air quality) productivity	Socio-economic COMBI-model
economy (short/long-term)	Input-Output CGE (CECEM)
energy system energy security	COMBI energy balance model

COMBI online tool

- Physical impacts
- Monetary impacts
- Cost-Benefit calculations

D2.2 EEI action description
(+ Annex on scenarios)

D#.1 Literature reviews

D#.4 Quantification reports

D2.1 Synthesis lit. review

D2.4 Synthesis methodology

D2.7 Quantification report

D8.1 Tool manual & document.

D8.2 Policy report

D8.3 Summary brochure

COMBI Input data

21 EEI actions

Difference to PRIMES/EED-IA:

- disaggregated stock analysis model → bottom-up development of scenarios
- not complete energy system (excl. agric., only selected EEI actions, excl. supply sector)
- Multiple data sources: mostly EU stats & projects (ENTRANZE, PRIMES, FHG ISI, ECOFYS)

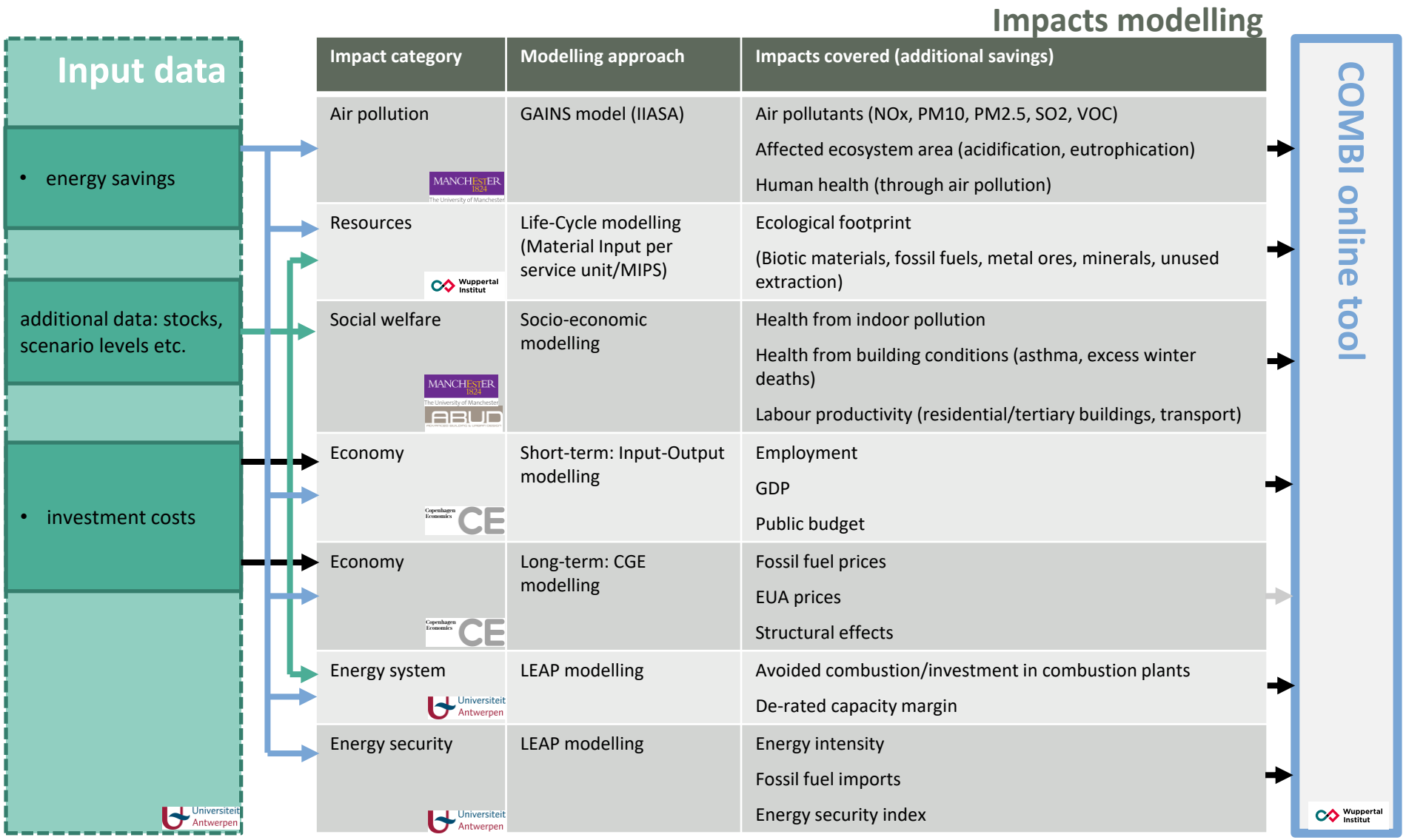
Buildings (residential & tertiary)	Transport	Industry
Actions 1 (residential) **and 5** (non-residential): **refurbishment** of building shell + replacement of building systems (space heating, cooling and ventilation) **Actions 2** (residential) **and 6** (non-residential): energy efficiency improvements of **new dwellings** or buildings, focusing on Passive House standards; **Actions 3** (residential) **and 7** (non-residential): energy efficiency improvements for **lighting** systems; **Actions 4** (residential) **and 8** (non-residential): energy efficiency improvements of **cold appliances** (residential) or product cooling (non-residential).	**Actions 9 and 12**: **modal shifts** for both passenger and freight transport; **Action 10**: energy efficiency improvements of motorized **two-wheelers**; **Action 11**: energy efficiency improvements of passenger **cars**; **Action 13**: energy efficiency improvements of **public road** transport, i.e. bus or coach; **Action 14**: efficiency improvements of **light duty trucks** (LDTs); **Action 15**: efficiency improvements of **heavy duty trucks** (HDTs).	**Action 16**: energy efficiency improvements of **high temperature process heating** (furnaces, ovens, kilns, dryers, …) **Action 17**: energy efficiency improvements of **low and medium temperature process heating** (boilers and steam systems in general); **Action 18**: energy efficiency improvements of industrial **process cooling and refrigeration**; **Action 19**: energy efficiency improvements of **process specific use of electricity**, mainly electrochemical processes in non ferrous metals and chemicals; **Action 20**: energy efficiency improvements of **motor drive systems**, including pumps, compressed air for utilities, compressed gas/air systems for processes; fans and blowers, and other motor applications; **Action 21**: energy efficiency improvements of heating, ventilation and air-conditioning (**HVAC**) systems in industrial buildings.

→ Outputs by EEI action and country:

- 2030 energy savings (EU total: 1647 TWh)
- energy cost savings (EU total: 131 bn €)
- total investment costs (EU total: 95 bn€ annualised)
- additional data: stocks, scenario levels etc.

Multiple impact modelling

Overview



COMBI key results: all EEI actions

EU-wide figures per year as of 2030

additional

Annualized investment in 2015-2030: 94.6 bn EUR/year
Energy savings: 1647 TWh/year
Avoided climate change emissions: 360–500 Mt CO_2eq

Air pollution

>10 000 avoided premature deaths due to $PM_{2.5}$ (460 mn €)

442 avoided premature deaths due to O_3 (46 mn €)

230 000 YOLLs of avoided life expectancy loss (26 bn €)
300Mt avoided direct CO2eq emissions (17 bn €)

WP3 report

Resources

850 Mt savings of material resources

WP4 report

Social welfare

3,000-24,000 avoided premature deaths due to indoor cold (323 mn EUR-2.5 bn €)

2,700-22,300 avoided DALYs due to indoor dampness related asthma (338 mn EUR-2.9 bn €)

39mn additional work days (4.7 bn €)

WP5 report

Economy

1% rise in GDP (+161 bn € in GDP)

2.3 mn job-years

+86 bn € for public budgets

Decrease in fossil fuel prices (oil -1.3%; coal–2%; gas-2.9%)

WP6 report

Energy system

Avoided generation of power from combustibles 257 TWh (10 bn € of avoided investment)

Improved energy security: up to 5% lower fossil fuel import costs (59 bn €)

WP7 report

Conclusions and thoughts

- Estimates of multiple impacts for different actions in the sectors buildings, transport, industry, for EU 28 MS: https://combi-project.eu/tool/
- Impacts on economy, public budgets, health, environment/air pollution, resources

- Benefits and challenges around interdisciplinary partnerships
  - Benefits: The project involved economists, modellers, environmental scientists, human geographers, sociologists
  - Success: Generated a novel conceptual framing spanning multiple disciplines
  - Value: tangible outputs, diverse stakeholders, applicable results
  - Challenges: different languages/frameworks/approaches across disciplines, comparative weighting of contributions

- Recommendations
  - Common discussion fora / Demonstrable examples / Incentivisation