Estimating macroeconomic impacts

Experiences from a EU-H2020 project

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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

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

- March 2015 – May 2018
## Multiple impact modelling

### Overview

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<th>Impact category</th>
<th>Modelling approach</th>
<th>Impacts covered (additional savings)</th>
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| **Air pollution** | GAINS model (IIASA) | Air pollutants (NOx, PM10, PM2.5, SO2, VOC)  
Affected ecosystem area (acidification, eutrophication)  
Human health (through air pollution) |
| **Resources** | Life-Cycle modelling (Material Input per service unit/MIPS) | Ecological footprint  
(Biotic materials, fossil fuels, metal ores, minerals, unused extraction) |
| **Social welfare** | Socio-economic modelling | Health from indoor pollution  
Health from building conditions (asthma, excess winter deaths)  
Labour productivity (residential/tertiary buildings, transport) |
| **Economy** | Short-term: Input-Output modelling | Employment  
GDP  
Public budget |
| **Economy** | Long-term: CGE modelling | Fossil fuel prices  
EUA prices  
Structural effects |
| **Energy system** | LEAP modelling | Avoided combustion/investment in combustion plants  
De-rated capacity margin |
| **Energy security** | LEAP modelling | Energy intensity  
Fossil fuel imports  
Energy security index |

### Input data

- energy savings
- additional data: stocks, scenario levels etc.
- investment costs
Our objective
Assess macroeconomic effects of a more ambitious EE policy

Our starting point:
a more ambitious EE policy which
• Is running until 2030+
• Assumes more than 1600 TWh of energy savings annually
• Assumes a total investment of 1330 billion EUR

Macroeconomic effects in 2030

A) Business cycle effects
• ‘short run’
  • GPD
  • Employment
  • Public budget
  • Input-Output-model (GTAP 9 database)

B) Structural effects
• ‘long run’
  • Fuel prices and marginal abatement costs
  • Structural change (economy, competitiveness)
  • Total value created
  • General equilibrium model (CE model)
A) Business cycle effects in 2018
The policy is estimated to increase the EU GDP by 35 billion EUR in 2018 in countries with positive output gap.

The aggregate demand effect on GDP is positive for all 28 EU Member States.
A) Business cycle effects in 2018

The policy is estimated to increase the EU GDP by 35 billion EUR in 2018 in countries with positive output gap.

The aggregate demand effect on GDP is positive for all 28 EU Member States.

For about half of the countries, this will be a beneficial fiscal stimulus given the current economic environment.

Our results for 2018, EU totals:

- **GDP**: 35 bn EUR
- **Employment**: 552,000 job-years
- **Public budget**: 20 bn EUR
A) Business cycle effect 2030
The policy is estimated to have the potential of creating more than 2 million job-years in 2030.

- Energy efficiency (EE) measures = Investment spending
- Immediate GDP effect
- Aggregate demand (AD) effect
- Output gap

Multiple impacts (MI):
(a) GDP
(b) Employment
(c) Public budget

Budgetary semi-elasticities

The stimulating effect of the programme in 2030, will be sizeable.

This effect can be interpreted as a benefit in the countries that happen to be in an economic downturn in 2030.

- GDP: 161 bn EUR
- Employment: 2.3 mio job-years
- Public budget: 86 bn EUR
B) Structural effects 2030
Reductions in fossil fuel prices, and gains in terms-of-trade

**EU fossil fuel prices**

- **Crude oil**: -1.3%
- **Coal**: -2.0%
- **Gas**: -2.9%

**Energy savings reduce prices**
- COMBI initiatives reduce gas consumptions directly and coal consumption indirectly through lower electricity demand
- Demand for crude oil is primarily reduced through switch in transport modes and less overall transport use

**Export/import ratio of fossil fuels**

- **EU countries are net importers of fossil fuels**
  - And will therefore on average benefit from reduced fossil fuel prices
Macro-economic impacts
Modelling issues

Inputs
- energy (cost) savings
- investment costs

Modelling
- Input-Output models
- General/partial equilibrium models
- Econometric models

Outputs
- Employment
- GDP
- Public budget
- Fuel prices
- EUA prices
- Structural effects

selected monetary
Macro-economic impacts
Modelling issues

**Inputs**
- energy (cost) savings
- investment costs
- other impacts

**Modelling**
- Input-Output models
- General/partial equilibrium models
- Econometric models

**Outputs**
- Employment
- GDP
- Public budget
- Fuel prices
- EUA prices
- Structural effects

Feedbacks:
- selected monetary
- monetary/non-mon.
Macro-economic impacts
Inclusion of other MIs & feedback loops

**Examples for other MI-inputs**
- energy costs → net incomes → expenditures
- better health →
  - labour productivity → commercial productivity
  - lower health costs → public budgets/taxes
- lower energy system costs → energy prices
- air pollution → ecosystems → agricultural output

**Examples for feedbacks**
- higher net incomes, employment, GDP →
  - poverty → investment in EE
  - health
  - additional energy demand (rebound)
- Lower energy prices →
  - disposable income/poverty
  - incentives for investment/fuel switch
Macro-economic impacts

Modelling issues

Model flaws
- IOM: predictability of output gaps
- GEM: problematic equilibrium assumptions
- Disaggregation levels (countries, sectors)
- Exclusion of MIs
- Feedback loops
  - model-internal: energy prices → incomes →...
  - to MIs: see previous slide

Level of modelling detail/disaggregation
- Example: Public budget
- COMBI IOM vs. complex interconnections
Macro-economic impacts
Example complexity

COMBI: public budget

- Energy efficiency (EE) measures = Investment spending
- Immediate GDP effect
- Keynesian multiplier
- Aggregate demand (AD) effect
- Output gap
- Multiple impacts (M1):
  - (a) GDP
  - (b) employment

Example: Thailand

Source: COMBI D6.4 report

Figure 2 Schematic overview of the evaluation approach

Macro-economic impacts

Modelling issues

**Inputs**

- energy (cost) savings
- investment costs
- other impacts

**Modelling**

- Input-Output models
- General/partial equilibrium models
- Econometric models

**Outputs**

- Employment
- GDP
- Public budget
- Fuel prices
- EUA prices
- Structural effects

Selected monetary feedbacks

Monetary/non-monetary feedbacks
Macro-economic impacts

Modelling issues

**Inputs**
- energy (cost) savings
- investment costs
- other impacts

**Modelling**
- Input-Output models
- General/partial equilibrium models
- Econometric models

**Outputs**
- Employment
- GDP
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- Structural effects

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**Aggregation of indicators (e.g. in CBA)**

Overlap danger: GDP = Gross Domestic Product

- Monetized employment
- Public budget
- Other impacts: health, productivity, resources, energy system

→ but these usually not included in economic modelling!

**COMBI:**

- ✘
- ✗
- ✓
- ✓
Macro-economic impacts
Modelling issues

Inputs
• energy (cost) savings
• investment costs
• other impacts

Modelling
Input-Output models
General/partial equilibrium models
Econometric models

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Need for Integrated Assessment Model for multiple impacts quantification?
Thank you
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