Evaluating the macroeconomic impacts of energy efficiency

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Overview

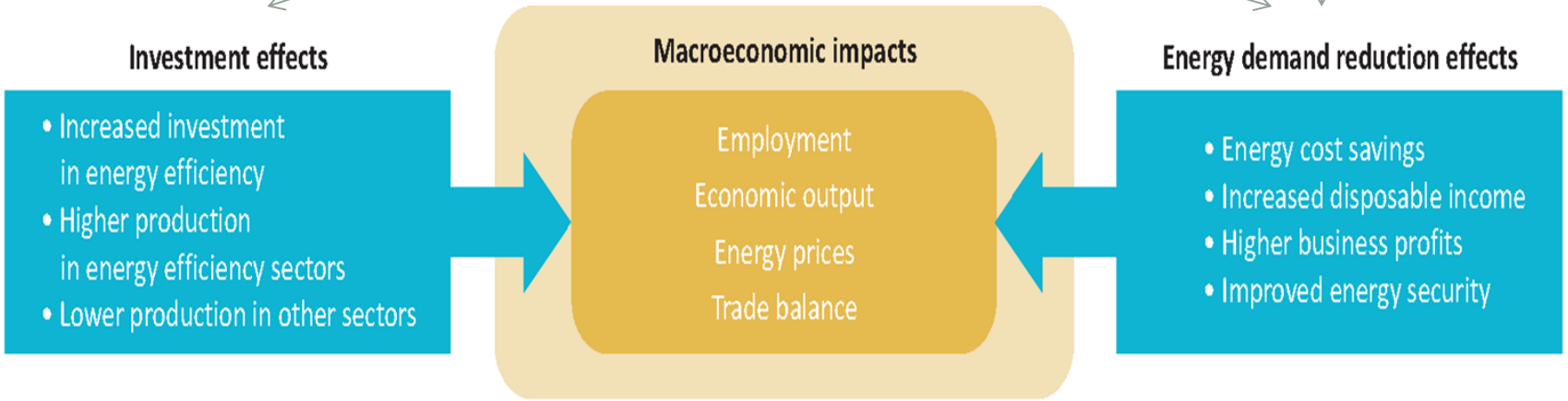
- Introduction to macroeconomic impacts – how do they occur?
- Key macroeconomic indicators and modelling techniques used in estimation
- Overview of values from the literature
- Welfare effects
- Policy implications

Macroeconomic Impacts of EE

Microeconomic

Substitution effects

Income effects



Source: IEA (2014) Capturing the Multiple Benefits of Energy Efficiency

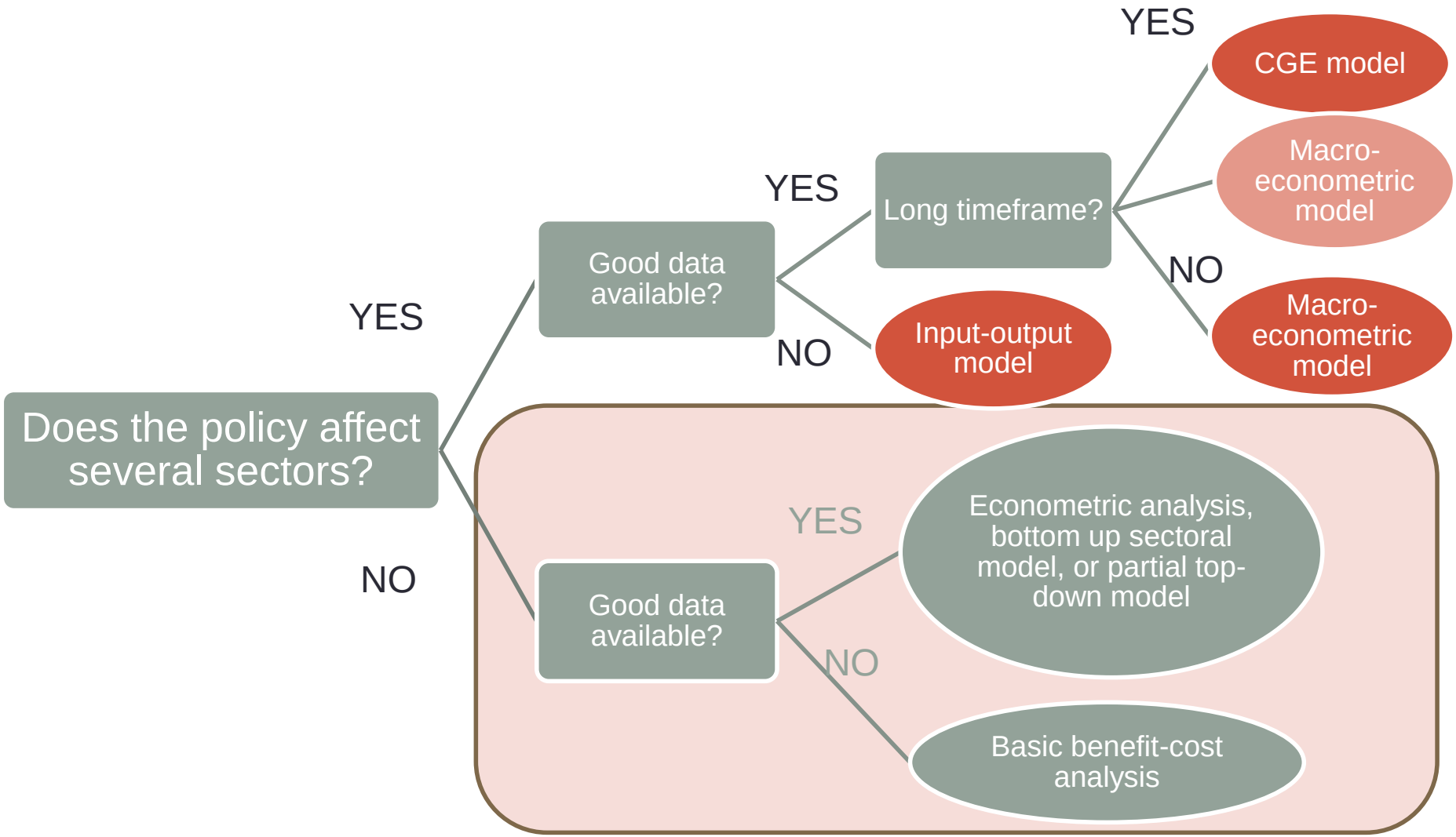
Macroeconomic

- Pricing effects
- Growth effects

Key macroeconomic indicators of interest

Impact	Indicator	Components	Description
Economic output	GDP	Consumer spending (C) Investment (I) Exports - imports (E) Government spending (G)	Total market value of all goods and services produced in a country Growth effect: sectoral reallocation, multiplier effect, induced innovation
Employment	No. of net new jobs	Net new jobs Sectoral shifts Wage rates Labour intensity	Number of net jobs created or lost, directly or indirectly through EE measures
Price effects	Energy unit price, CPI	Cost per unit energy Substitutability for energy, labour and other market conditions	Price effects through changed energy demand and economic activity
Trade balance	Exports, Imports	Investment choices Origin of goods and services	Change in trade flows through EE investments and reduced energy costs

Choosing an assessment approach to examine the macroeconomic impacts of EE policy



Some indicative values from modelling of macroeconomic EE impacts

	Range	Median	References
Change in GDP per unit investment (EUR/EUR)	0.91 - 3.73	1.81	Copenhagen Economics; EC, 2011 ; Lehr et al., 2012
Change in household income per unit investment (EUR/EUR)	-0.16 - 0.88	0.34	OECD, 2013; Lehr et al., 2012; EC, 2011
Jobs created per year per unit investment (jobs/million EUR)	0.0 - 17.07	11.64	Copenhagen Economics; EC, 2011 ; Lehr et al., 2012 ; Cambridge Econometrics, 2014
Jobs created per PED savings (Jobs per ktoe)	0.76 - 19.61	7.06	Copenhagen Economics; Lehr et al., 2012 ; Barker and Foxon, 2008
Industrial productivity (change in output)	0.1 - 0.4%		Cambridge Econometrics, 2014

Irish example - SEAI analysis of HES scheme

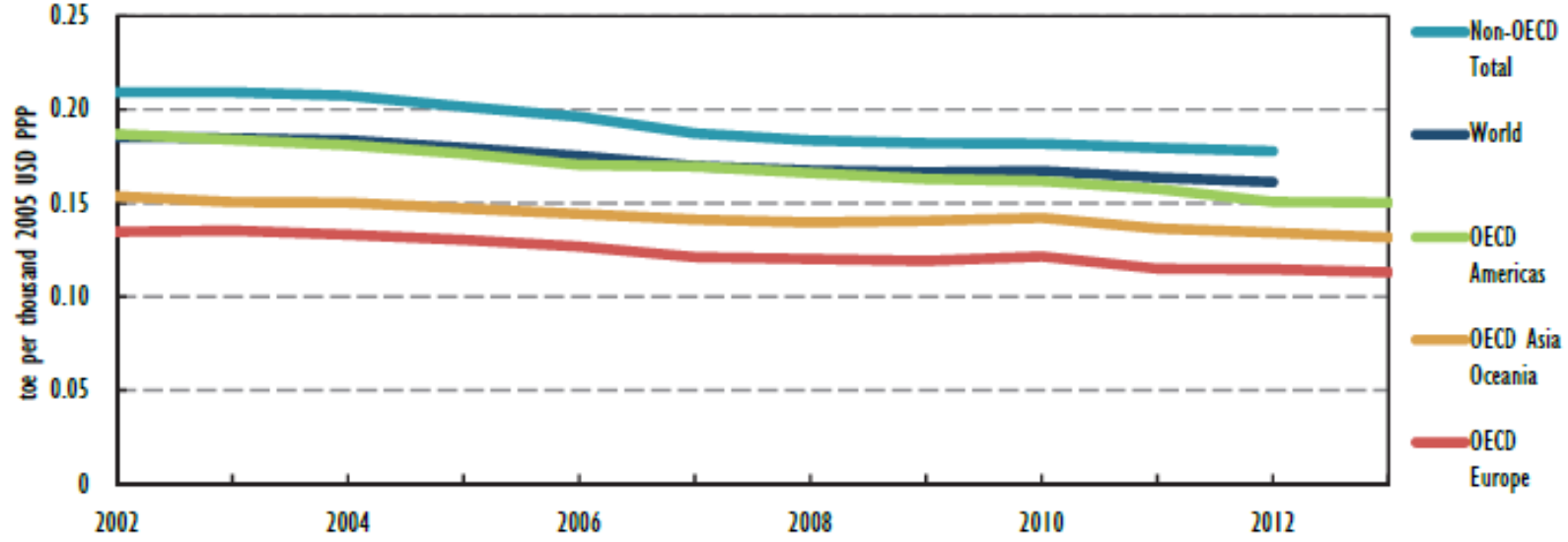
- 2009-2011 programme budget: €109 million.
- Other costs: lost VAT and carbon tax due to the reduction in energy use of scheme participants €163.5 million
- Inflows to the Exchequer: the value of CO2 savings on the basis of avoided need to purchase carbon credits (37% of benefits) and eventual inflow of VAT (50% of benefits)
- Estimated NPV: €481 million over lifetime of technologies (including Energy, CO_2 and other pollutant savings) or -€0.028 €/kWh saved
- Employment effects: 60% of overall expenditure estimated on labour (without I/O tables)
- 2010: estimated expenditure more than €72 million, directly support 2000 full-time jobs (ave industrial wage); with indirect jobs, over 3000 jobs in 2010.

http://www.seai.ie/Publications/Statistics_Publications/Energy_Forecasts_for_Ireland/Economic_Analysis_of_Residential_and_Small-Business_Energy_Efficiency_Improvements.pdf

Energy repercussions of increase in economic activity

- Macroeconomic impacts appear to be welfare-enhancing
- However, GDP growth historically linked to energy consumption

Energy intensity



Notes: PPP = purchasing power parity; toe = tonne of oil-equivalent. 2013 data are estimated.

Source: IEA (2014) Energy Efficiency Market Report 2014

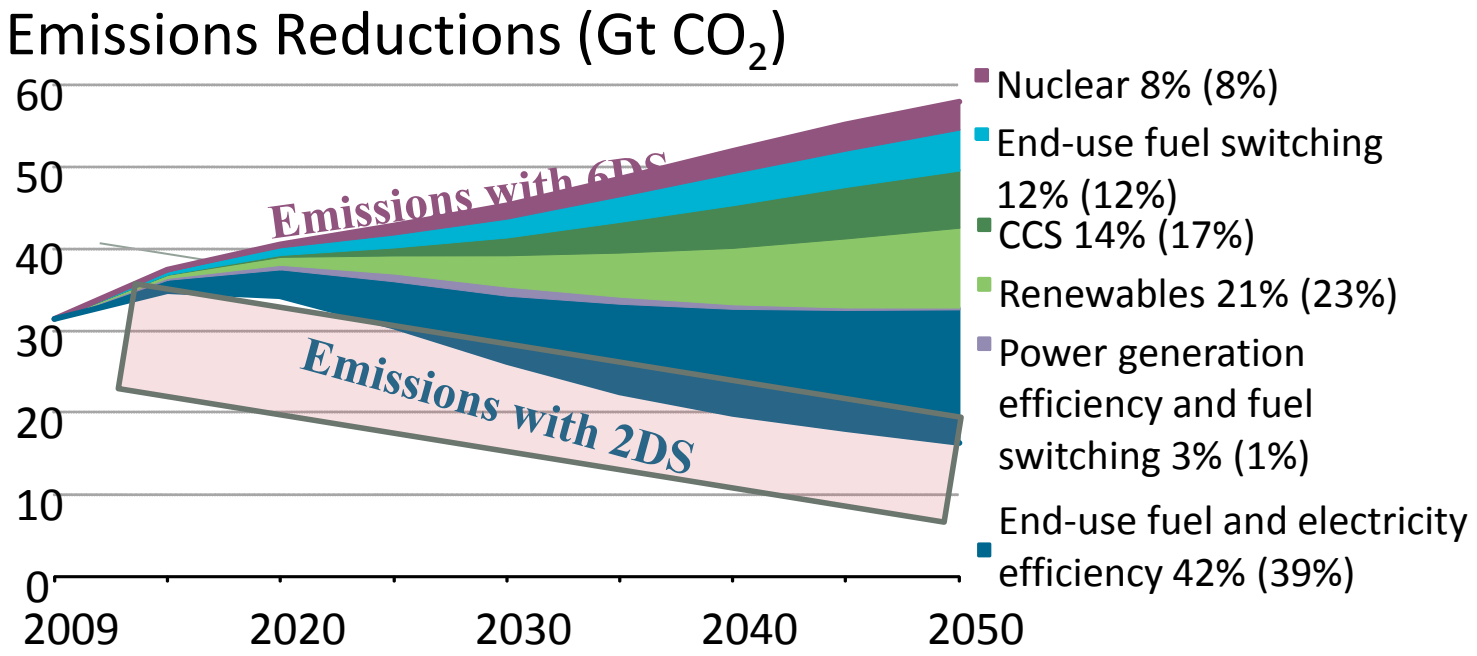
Rebound effects vs welfare

- Definition: A behavioural response to an improvement in energy efficiency that reduces or even eliminates the energy savings expected from the improvement. It is the difference between the real and predicted reductions in energy consumption.
- Rebound effect (%) = $\frac{\Delta E_{pred.} - \Delta E_{real}}{\Delta E_{pred.}} = 1 - \frac{\Delta E_{real}}{\Delta E_{pred.}}$

- Are rebound effects beneficial for social welfare?
  - Many investment and spending effects are welfare-enhancing and lead to economic growth.
  - Generally viewed negatively but analysis of welfare effects needed.

Macroeconomic effects and GHG emissions reductions

Study	Energy savings	GDP growth (EUR billion)	Additional energy (Mtoe)	Rebound effect
GWS	6.20%	18	2.14	11.6%
E3ME	15.4%	30	3.60	1.3%
Cop. Econ.	5.40%	153	183.60	28.2%



Source: IEA (2014) Energy Technology Perspectives.

Policy Implications

- Macroeconomic impacts of EE are generally positive – increased economic activity, employment; price effects and trade balance: country-dependent
- Need more integration of macroeconomic impacts in EE programme evaluation
- Trade-off between welfare gains and “lost” energy savings and GHG emissions likely
- EE measures should be evaluated on a wider basis than energy and GHG emissions savings alone; more analysis of welfare effects of EE and macro rebound effects needed – optimisation, indifference curves…?
- When net positive welfare effects => don’t mitigate rebound

BUT

- GHG mitigation strategy needs to account for “lost” emissions

Thank-you

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