



# THE USE OF ECONOMIC INSTRUMENTS FOR ENVIRONMENTAL POLICY IN OECD COUNTRIES

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# Why use environmental taxes?

- They provide economic incentives to **change** environmentally harmful **behaviour**.
- They equalise marginal costs of compliance => **Least-cost** instruments (*Static efficiency*).
- They provide incentives for **continued technological development** (*Dynamic efficiency*).
- They **raise revenues** that can be recycled, be used to reduce distorting taxes (e.g. on labour) or be used to strengthen public finances.





# Environmentally related taxes

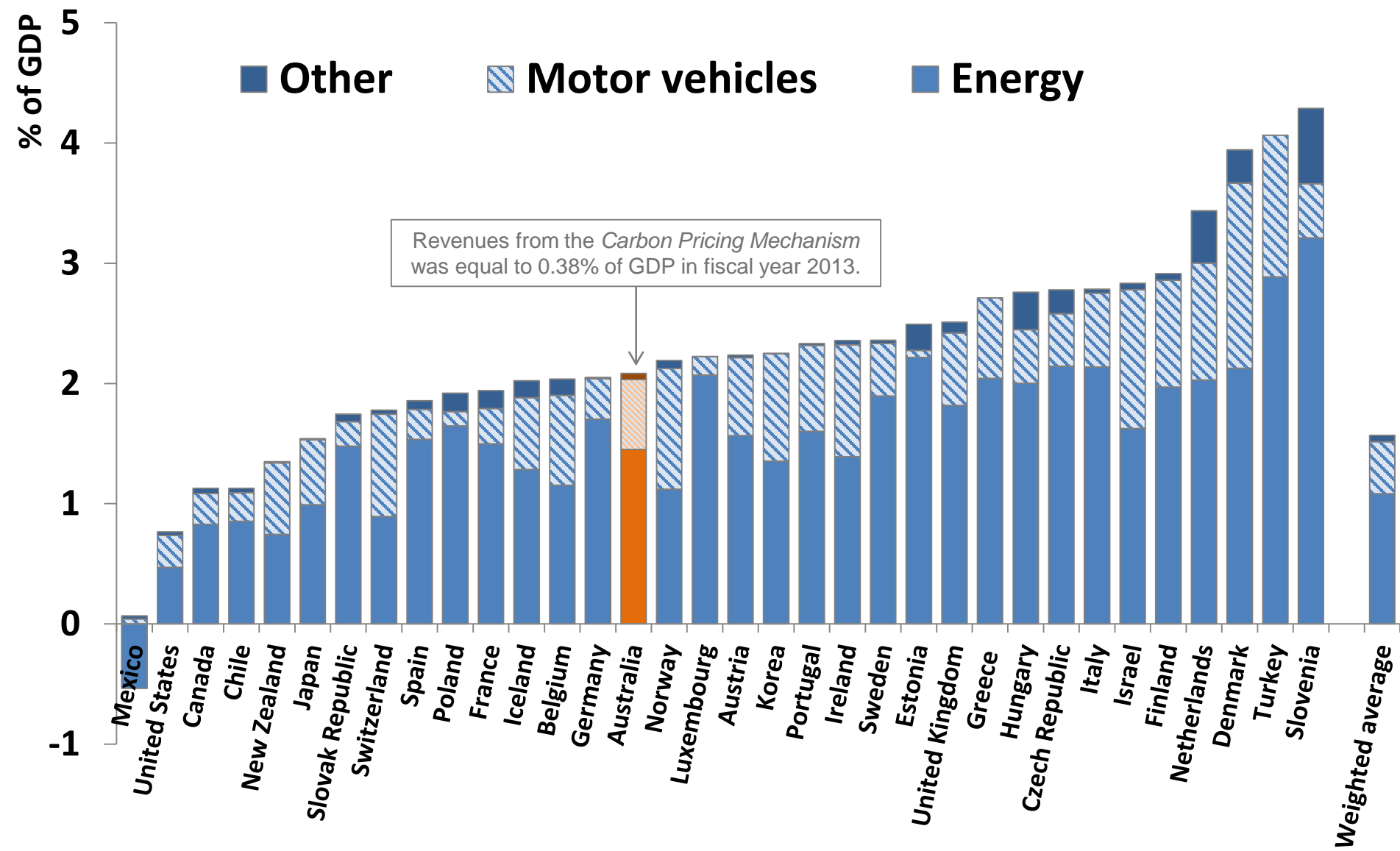
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- OECD defines environmentally related *taxes* as any compulsory, *unrequited* payment to general government levied on tax-bases deemed to be of particular environmental relevance (*e.g.*, energy use, motor vehicles, measured emissions, hazardous chemicals).
- “Unrequited”: benefits provided by government to taxpayers are not normally in proportion to payments.





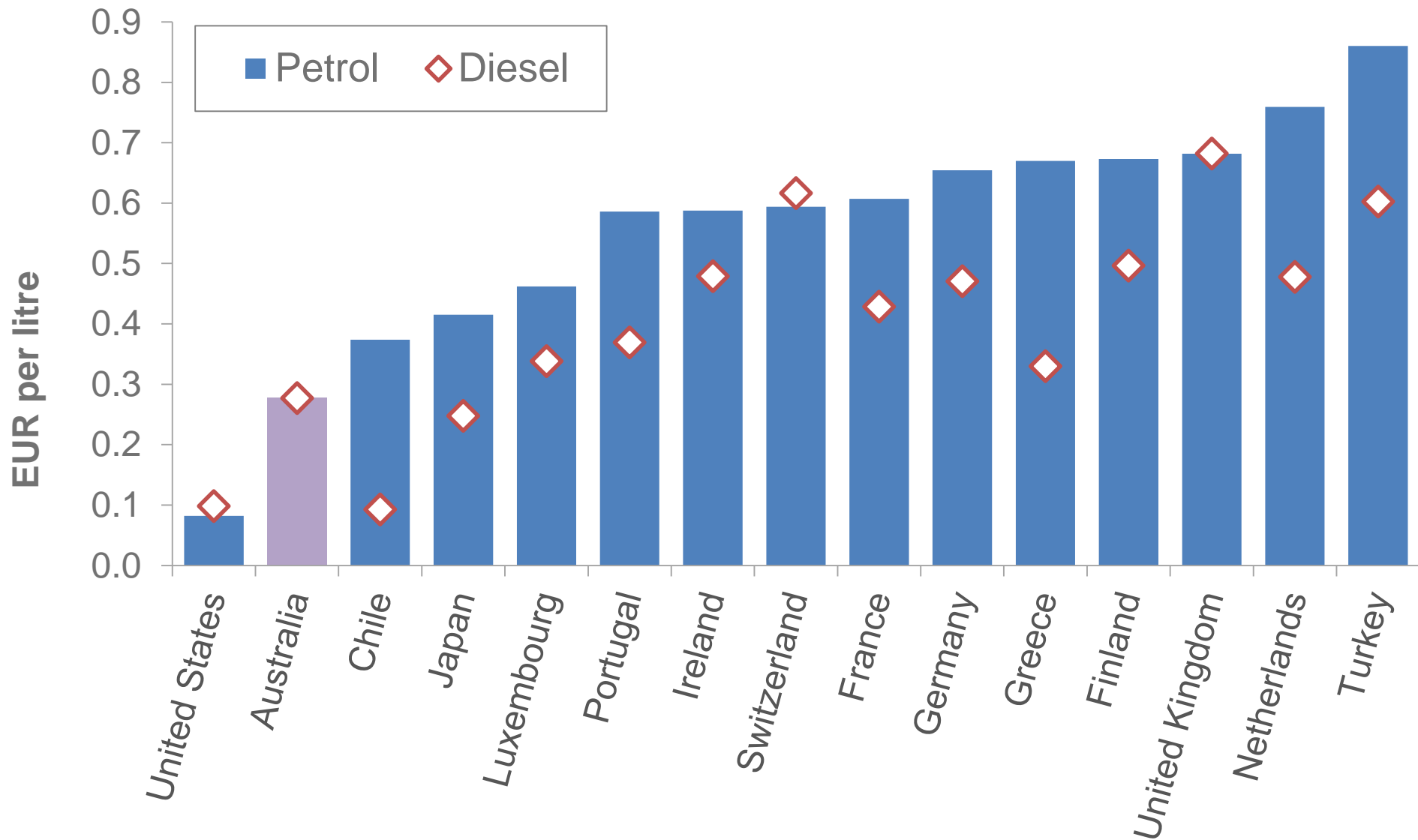
# Revenues from environmentally related taxes in OECD countries, Per cent of GDP, 2013





# Taxes on petrol and diesel in selected countries

01.01.2014





# Taxing Energy Use

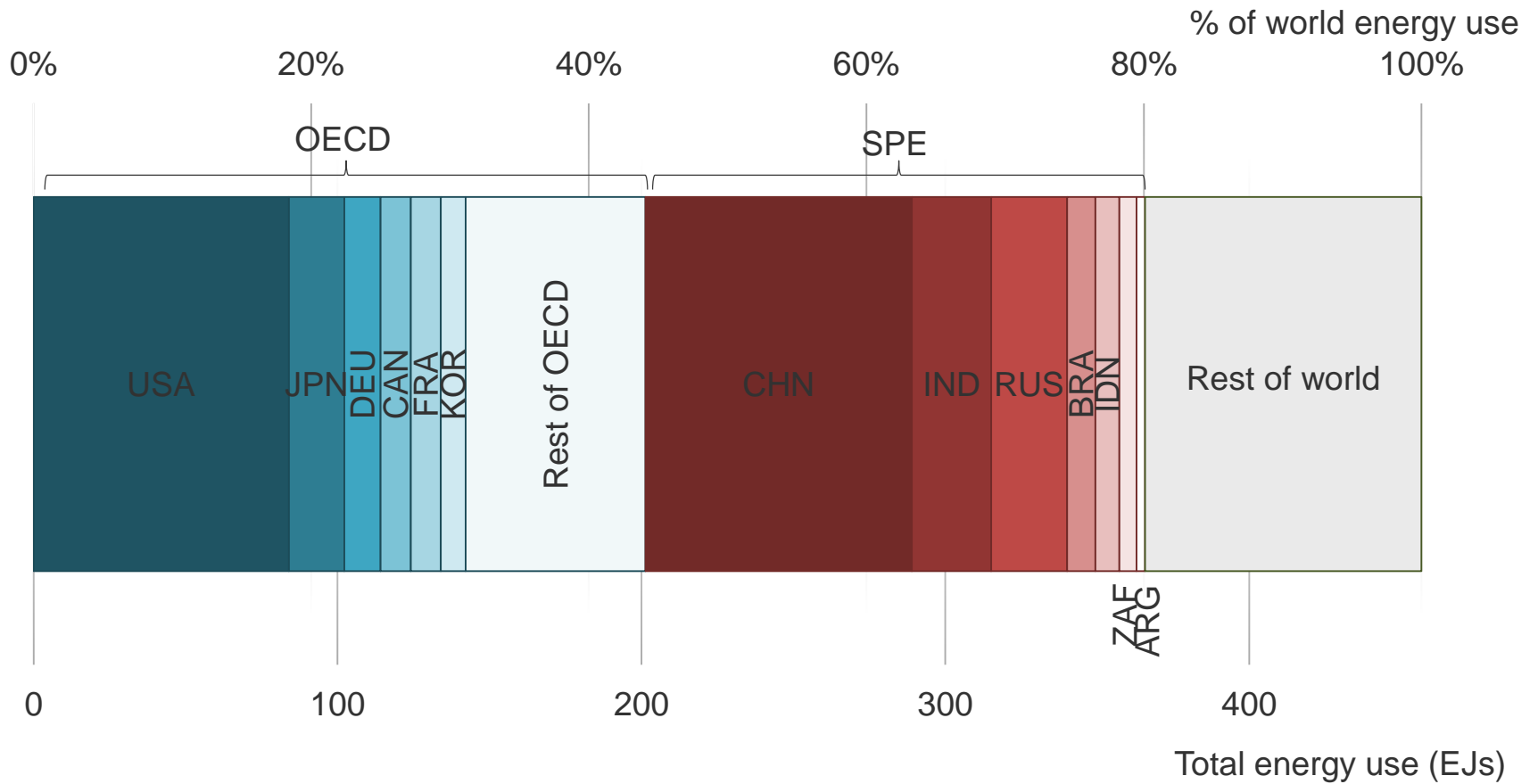
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- Energy use is important to modern economies, but it also has important environmental consequences
- *Taxing Energy Use: A Graphical Analysis* (2013)
  - Systematically described taxes on all energy use in OECD countries
  - Analysed tax patterns for different fuels & users
- *Taxing Energy Use 2015: OECD and Selected Partner Economies*
  - Cross-country analysis for all 41 countries
  - Detailed country chapters for Argentina, Brazil, China, India, Indonesia, Russia & South Africa
  - Country chapters & graphical profiles of energy use & taxation





# World energy use

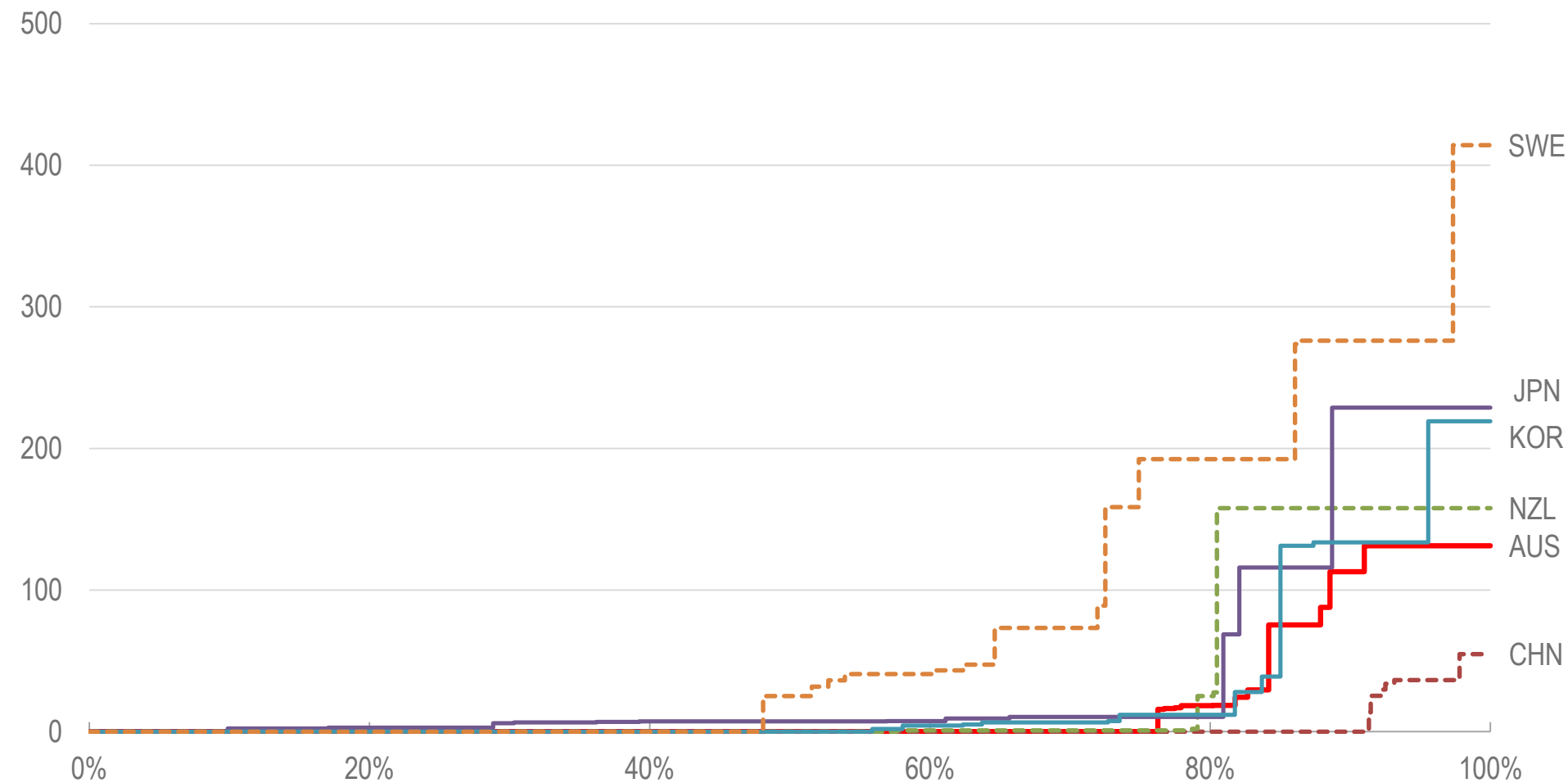




# Taxes on energy use in selected countries

EUR per tonne of CO<sub>2</sub>, energy use of 2009, tax rates as of 01.05. or 01.07.2012 (Australia).

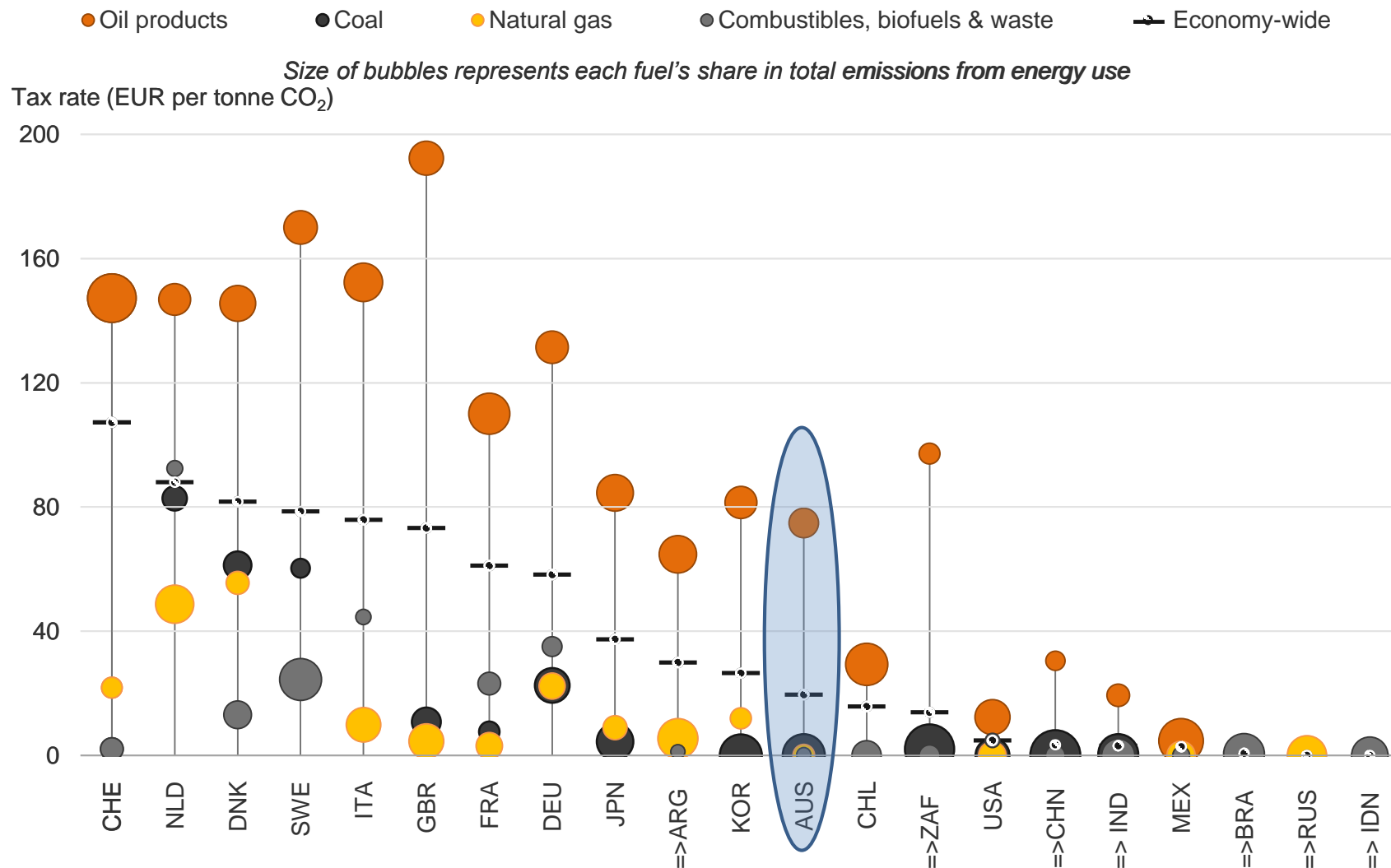
Effective tax rate (EUR per tonne CO<sub>2</sub>)



Cumulative carbon emissions from energy use



# Effective tax rates on CO<sub>2</sub> from different energy sources





# COMPETITIVENESS IMPACTS OF ENERGY TAXES



# Survey of all **ex post** studies suggests

*OECD Environment Working Paper, No. 87.*

- Carbon prices increase abatement.
- No effects of carbon and energy taxes on various competitiveness indicators, one small negative effect of energy taxes on employment.
- Generally no effects of the EU ETS on various indicators of competitiveness
  - slight decreases in employment found in one sector
  - increased profitability for power generators.
- Evaluations of energy price fluctuations identify slight increases in imports as a response to increased energy prices.
- Most estimations are based on schemes which include exemptions.
- Industry sometimes claims that it is the exemptions that “save them”.





# German tax on electricity

*OECD Environment Working Paper, No. 88.*

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Tax introduced in steps from 1999 to 2003.

- Full rate: EUR 20.5 per MWh from 2003.
  - wholesale electricity price ~ EUR 30 – 65 per MWh.
  - effective tax on carbon content EUR 44.4 per MWh.
- Reduced rates for firms in manufacturing sector.
  - Apply above certain thresholds of electricity use.
  - Resulting variation used to identify effect of reduced electricity tax rates.





## Effect of reduced marginal tax rate on

Year	Turnover	Investment	Turnover abroad	Value added	Employment
1999					
2000					
2001	+				
2002				-	
2003					
2004					+
2005			+		+

Source: Based on Flues and Lutz (2014)



# THE DISTRIBUTIONAL EFFECTS OF ENERGY TAXES



# Introduction

*OECD Taxation Working Papers, No. 23.*

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## Methodology:

- Calculate energy taxes with a micro-simulation model based on Household Budget Survey (HBS) expenditure micro-data
- Assess income (or expenditure share) spent on energy taxes as percentage of net income (or pre-tax expenditure) across income (or expenditure) deciles.

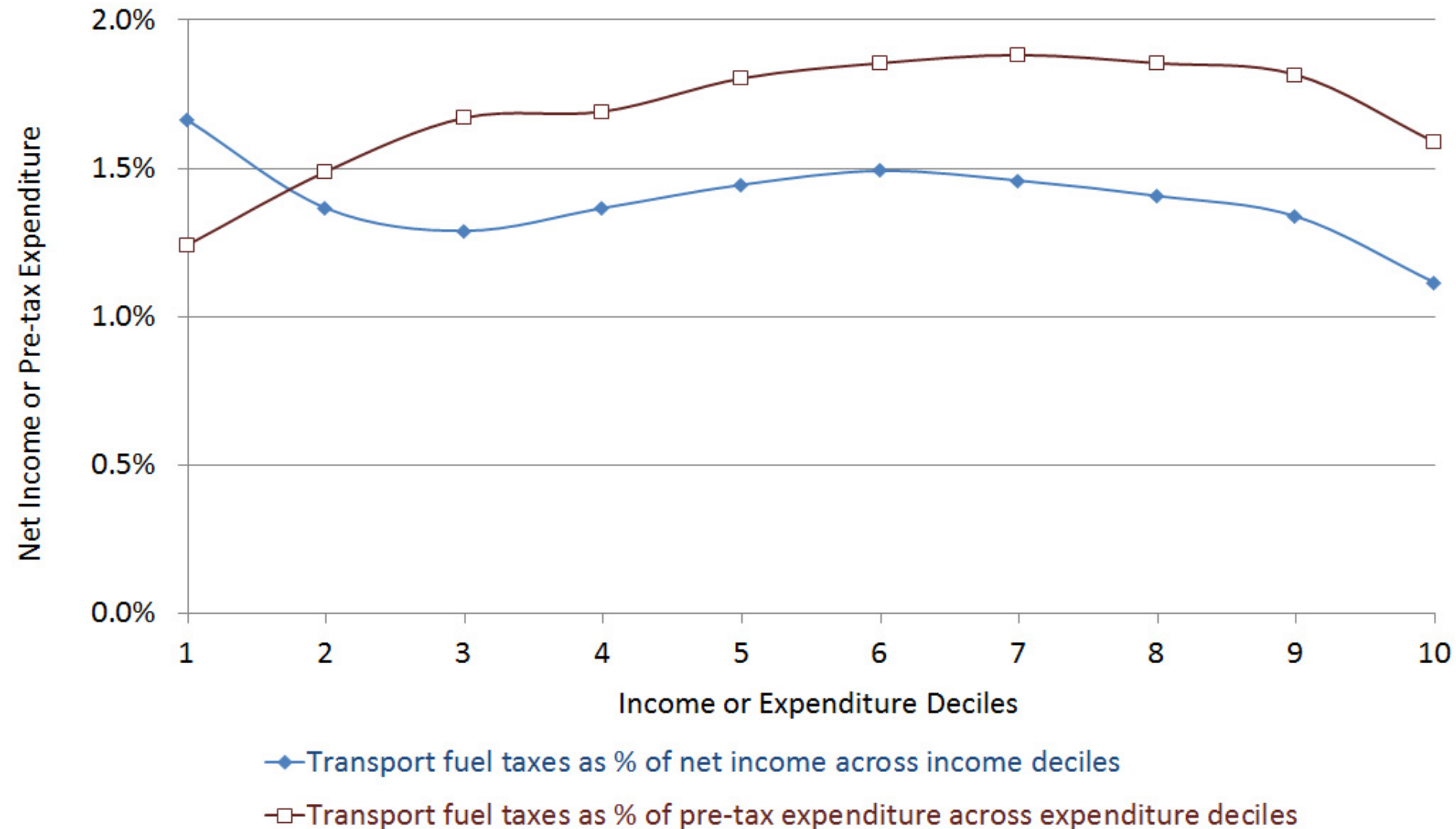
## Possible measures of distributional effects:

- Share of net income by income deciles
- Share of pre-tax expenditure by expenditure deciles
- Money spent on energy taxes by income or expenditure deciles





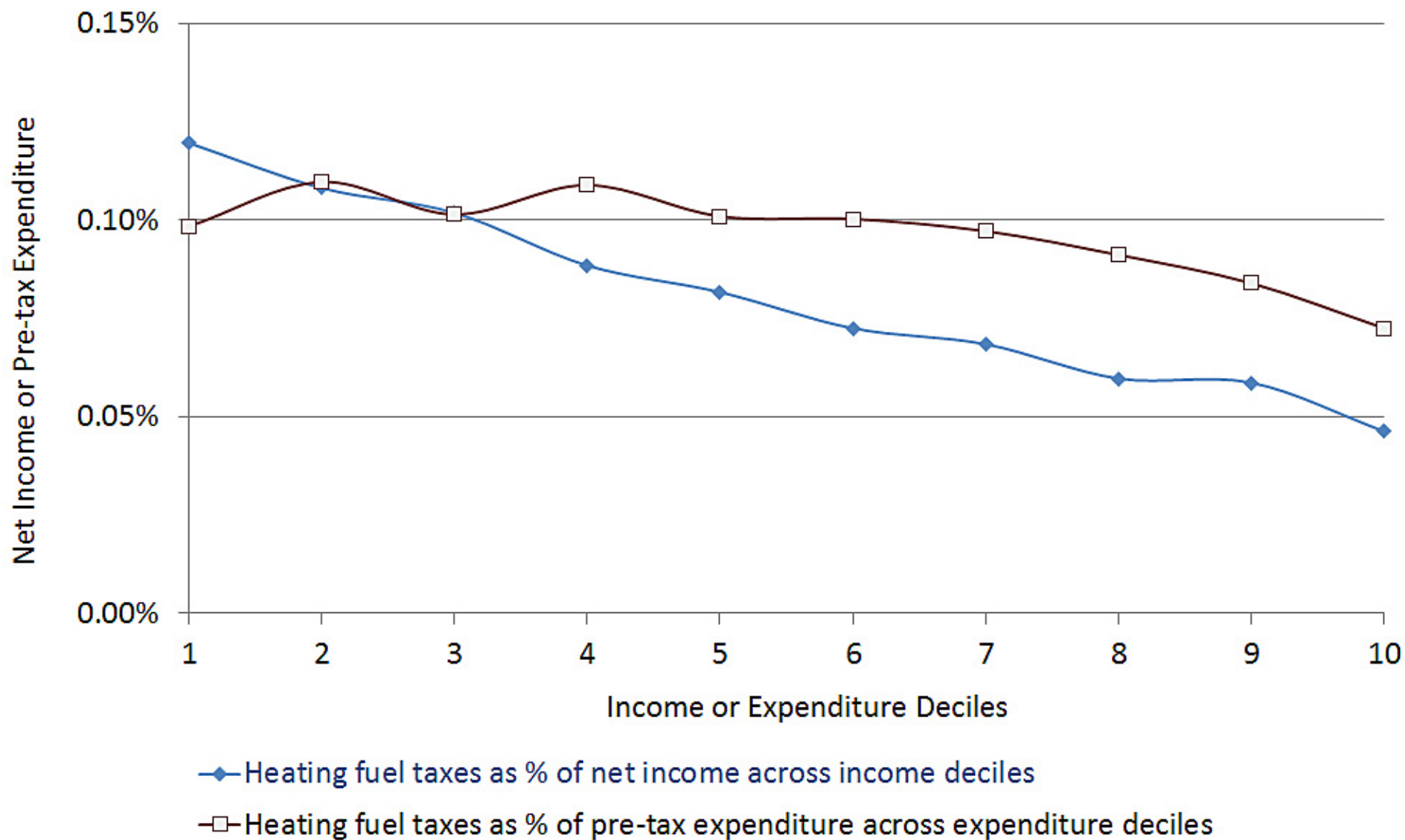
# Transport fuels







# Heating fuels





# Heating fuels

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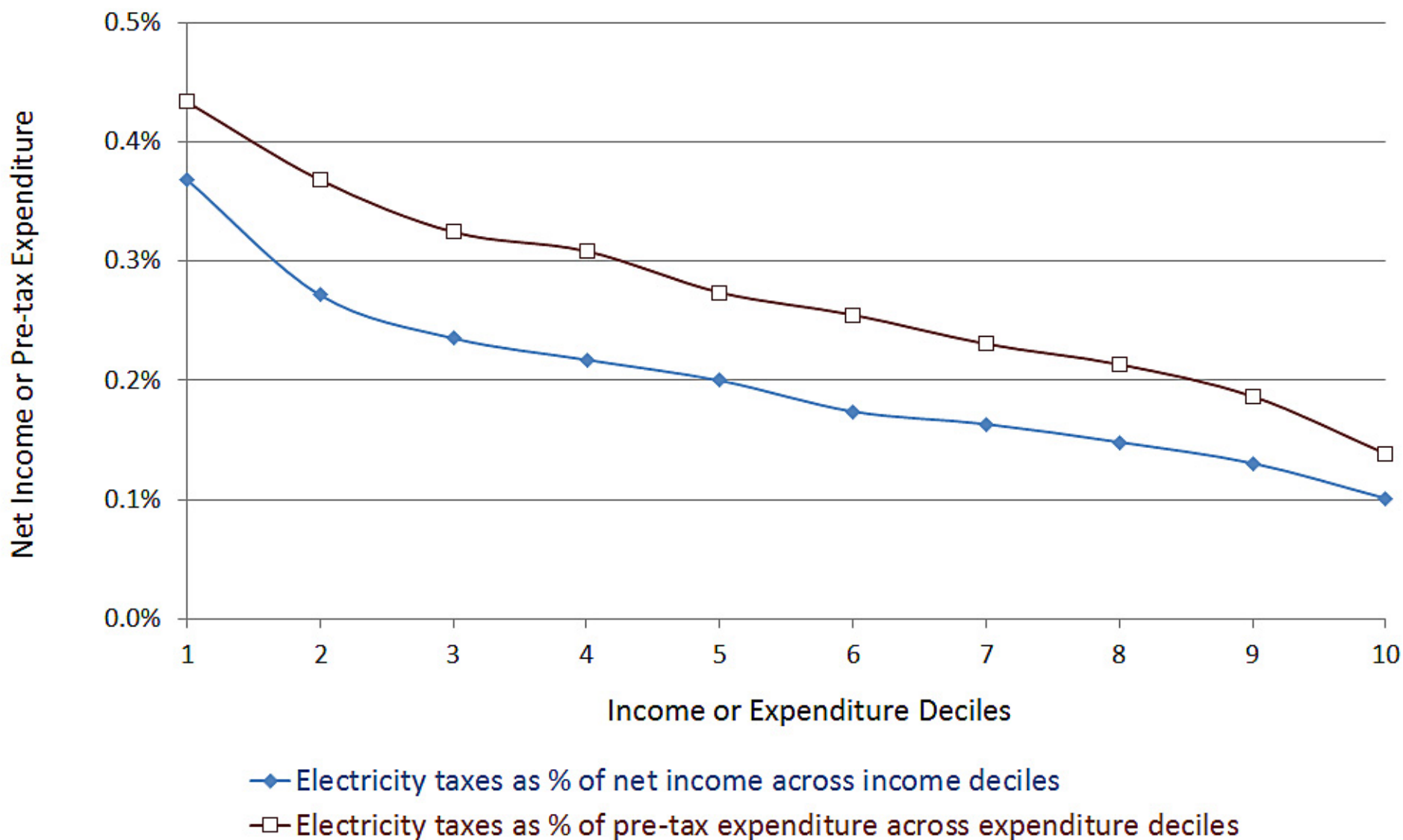
## Heating fuel taxes are slightly regressive

- Counteracting effects
  - More heating by poorer households required
    - Older houses with poorer insulation
  - Less heating by poorer households required
    - Fewer square metres
    - Apartment blocks instead of detached houses
    - Potentially more vigilant.





# Electricity





# Electricity

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## Electricity taxes are more regressive than heating fuel taxes

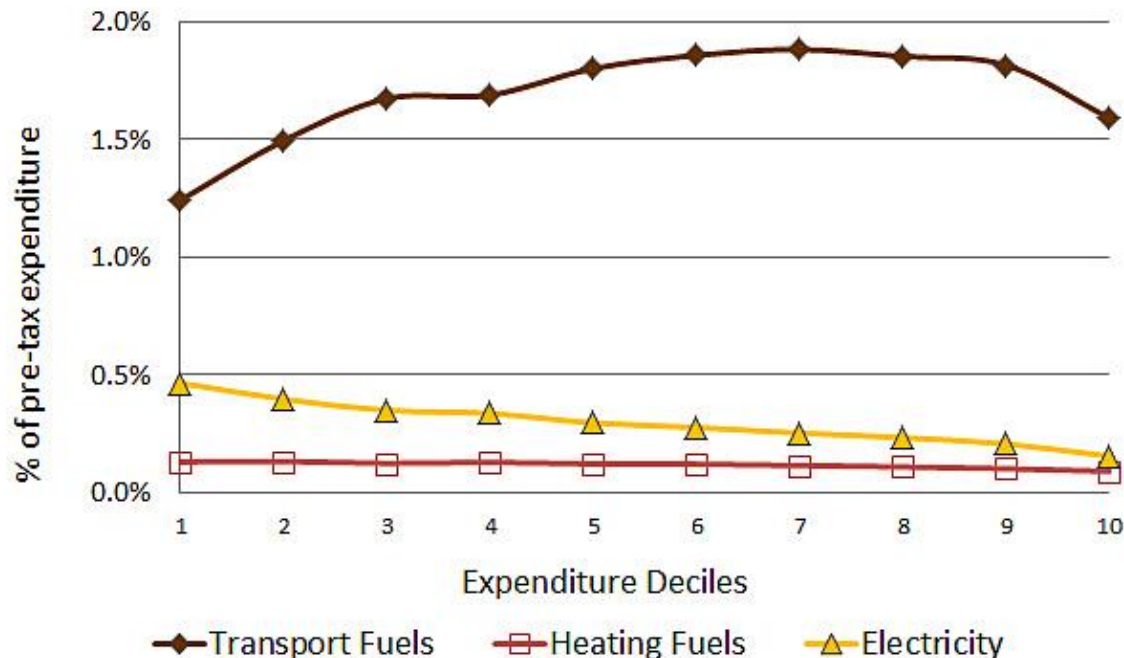
- Likely difficult for poorer households to conserve on electricity use
  - Fixed amount needed for, e.g., fridge and freezer
  - Substitutes for fuel use
    - Transport fuels: public transport, ride sharing, bicycle
    - Heating fuels: fewer m<sup>2</sup>, apartment blocks, increased vigilance
    - Electricity ???





# Energy affordability & distributional effects

- Distributional effects ~ *relative* expenditures on energy (as % of income or total expenditure).
- Energy affordability ~ *absolute* expenditures on energy.
  - Any additional spending on energy may be a challenge poor households.





# Simulation of an energy tax reform |

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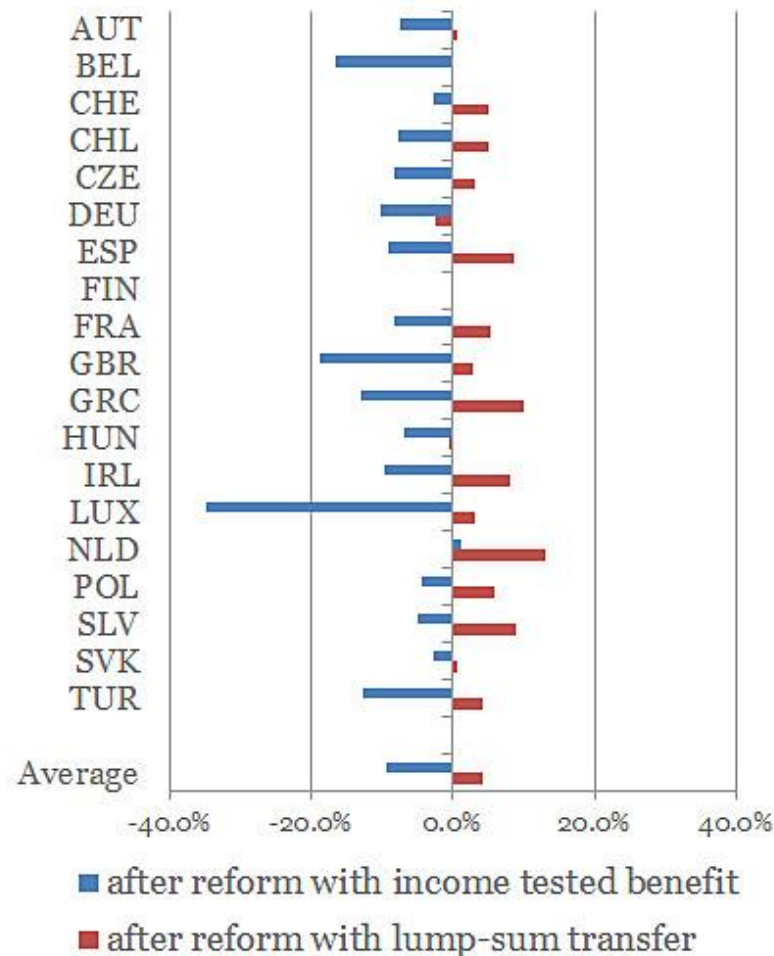
- A third of the revenues is distributed back to households via
  - A targeted cash-transfer, or
  - A lump-sum transfer
- Two reform scenarios are analysed
  - No behavioural adjustments assumed
  - Households adjust energy use in response to reform
- The reform increases prices on heating fuels and electricity in most, but not all countries – as the simulated reform replaces any pre-existing taxes.





# Effects of reform on high domestic energy expenditure share

Percentage change in share of households with high domestic energy expenditure, **accounting for behavioural adjustments**





# ENVIRONMENTAL EFFECTIVENESS





## Impacts of the Danish tax on SO<sub>2</sub>

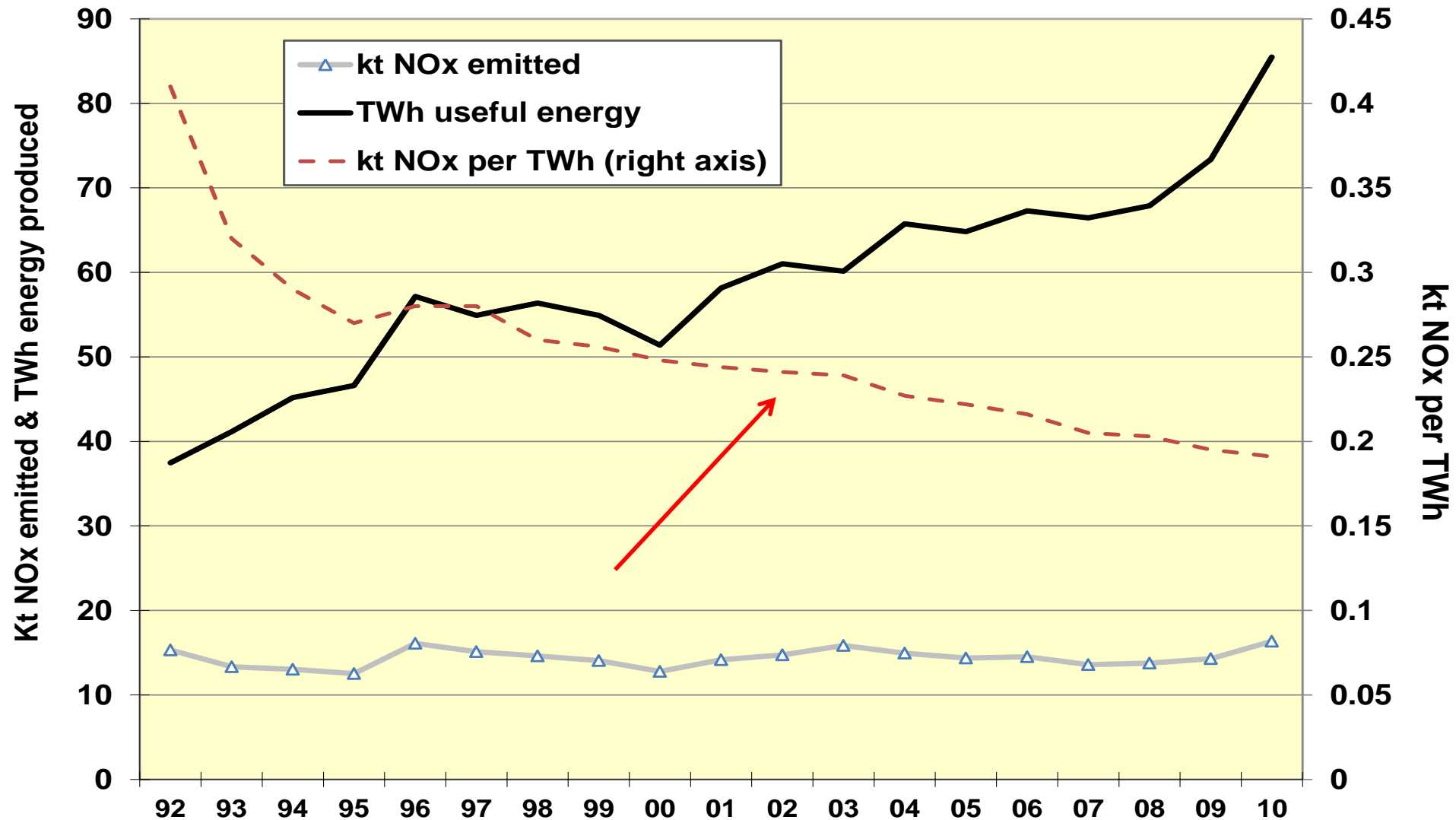
- Tax rate = 1.5 Euro per kg.
- Introduced in 1996
- Power plants were included from 2000.

Million kg	1995	2000	2005	2010	2013
Energy Industries	110.7	12.7	8.0	3.9	3.6
Industries and construction	12.9	7.9	6.6	3.7	2.8
Transport	7.4	2.2	2.4	1.6	1.4
Non-industrial combustion	8.0	4.5	4.2	3.0	2.6
Fugitive emissions from fuels	3.2	1.0	0.6	1.3	0.7
Industrial processes	3.5	3.4	3.4	1.3	2.0
Waste	0.7	0.6	0.6	0.6	0.6
Total	146.5	32.4	25.8	15.3	13.6

The tax give incentives to (1) shift to fuels with less sulphur, (2) remove sulphur from fuels (3) invest in equipment, which clean smoke (4) use less fuels.

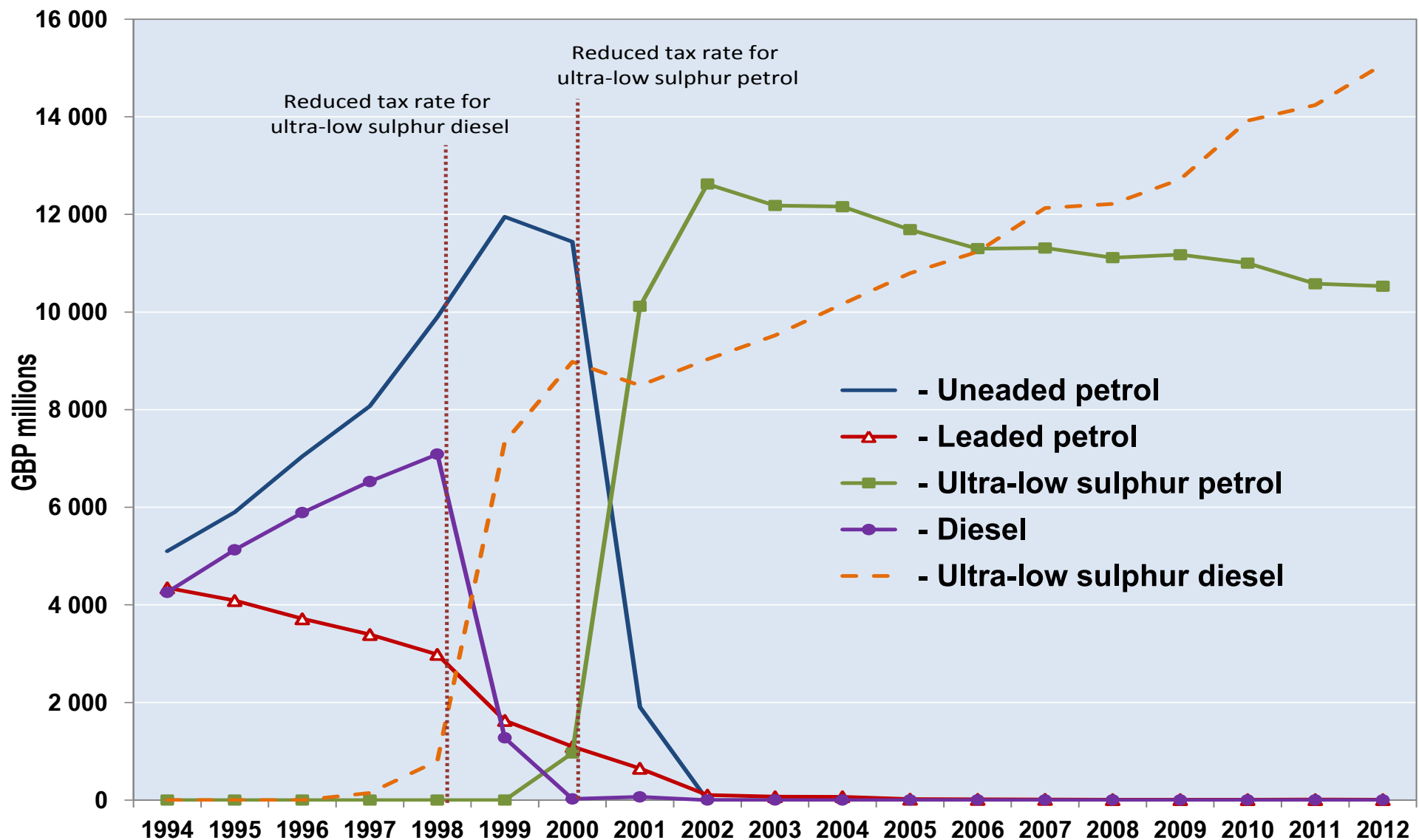


# The Swedish NO<sub>x</sub> tax: Emissions





# Changes in revenues due to sulphur-differentiation of fuel tax rates in the United Kingdom





# EFFECTIVE CARBON PRICES



# Effective carbon prices

- OECD published the book *Effective Carbon Prices* in November 2013
- The book looked at the amount of GHG abatement different policy instruments contribute to; the costs to society of achieving this abatement; and, hence, the costs to society per tonne of CO<sub>2</sub>eq abated.
- Covers electricity generation, road transport, pulp & paper, cement, as well as households' domestic energy use in 15 Countries, including Australia.
- **Keep in mind:** A high effective carbon price can stem from an ambitious policy – or from an inefficient policy.



[www.oecd.org/env/tools-evaluation/carbon-prices.htm](http://www.oecd.org/env/tools-evaluation/carbon-prices.htm)



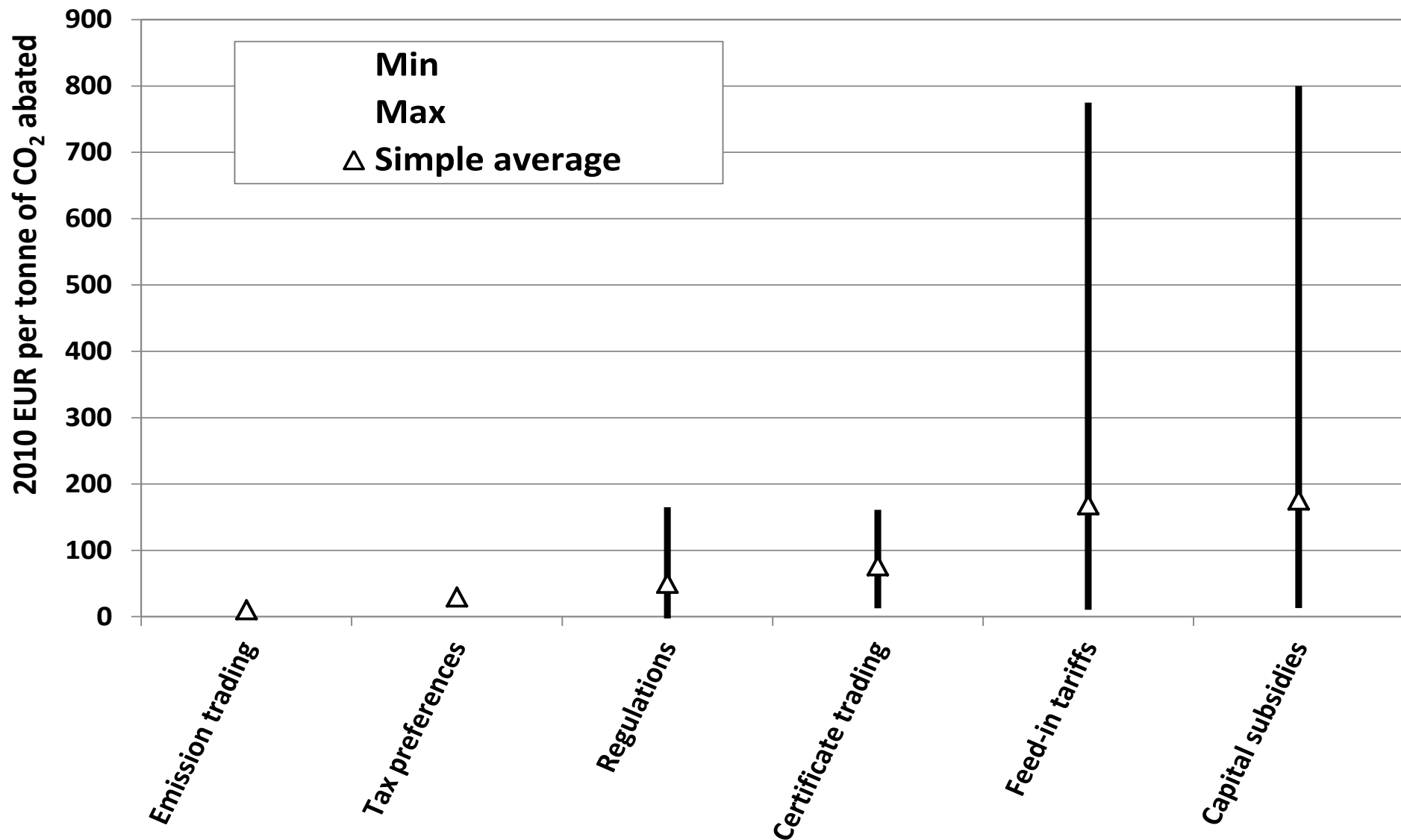
# Electricity generation

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- The **highest costs** per tonne of CO<sub>2</sub> abated are associated with **subsidies** for renewables, energy-efficient appliances, etc., and **feed-in tariff** systems.
- The **lowest costs** per tonne were found for **trading systems**.
- The costs were particularly low when the trading systems addressed the environmental externality as **directly** as possible – like with a trading system for GHG emission allowances (rather than **indirectly**, such as e.g. “tradable renewables certificates”).
- This confirms “textbook suggestions” that trading systems (and broad-based fuel taxes) are the most economically efficient policy tools to mitigate climate change.



# Average effective carbon prices in the electricity sector, by instrument category, EUR<sub>2010</sub> per tonne CO<sub>2</sub>





## To sum up ...

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- There are clear differences in effective carbon prices:
  - *within* a given sector, **across the countries** covered;
  - **across the different sectors**, *within* each country;
  - **across the different instrument types**, *across* all the countries covered.
- The study demonstrates clearly that **taxes** and **emission trading** systems are **much more cost-effective** than other policy instruments that countries apply.
- Many of the other instruments countries apply to limit GHG emissions (**feed-in tariffs** and other **subsidies to renewables**, various **subsidies for low-emission** product alternatives, etc.) are **very costly** per tonne of CO<sub>2</sub>eq abated.
- It will be very difficult to reach more ambitious, and urgently needed, abatement objectives if countries continue to focus their efforts on such inefficient instruments.





# STEPS TOWARDS SETTING TAX RATES THAT REFLECT MARGINAL DAMAGES



# Introduction

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- Textbooks in environmental economics suggest internalising environmental externalities through “Pigouvian” tax rates – using tax rates that reflect the marginal external costs to society.
- In practical policy making, this is easier said than done – e.g. due to a lack of knowledge about the magnitude of these marginal social costs.
- There will always be “gaps” to fill in this regard, but recent and on-going OECD work should allow some further steps to be taken.





# The Cost of Air Pollution

- This 2014 book combined estimates of mortalities caused by outdoor air pollution from the 2010 *GBD study* with VSL figures based on an OECD meta-analysis of VSL estimates.
- Outdoor air pollution cost OECD countries alone almost **USD 1.6 trillion** in 2010; China USD 1.3 trillion and India USD 0.5 trillion.
- Somewhat lower 2013 GDB mortality estimates have just been published, but the cost in OECD countries nevertheless were **USD 1.5 trillion**.
- VSL in China has been increased 15%.
- A very recent study by KCL indicates that **NO<sub>2</sub> cause more mortalities** (in London, UK) **than what PM<sub>2.5</sub> does**.





## *The Cost of Air Pollution*

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- For setting “Pigouvian” tax rates it is necessary to know how much each of the taxable goods or services contributes at the margin to the total air pollution costs.
- This requires information about how much of the pollution is caused per litre of transport fuels; per tonne of different fuels used per kWh of electricity generated; etc.
- The book estimated that *on average* in OECD countries, road transport caused approximately 50% of the air pollution.
- Estimates for individual countries are lacking, as earlier indications on the shares of different pollution sources in total emissions have not been updated.



# Social costs of morbidity impacts of outdoor air pollution |

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- *The Cost of Air Pollution* added 10% to reflect social costs of **morbidity** impacts of outdoor air pollution.
- Recent empirical evidence indicate such an order of magnitude, but more work is needed.
- An upcoming ENV Working Paper will provide a more in-depth discussion of morbidity costs of outdoor air pollution.
- Agrees that the greatest impacts are from increased **mortality in adults** attributable to long-term exposure to outdoor PM, ...
- ...but both PM and ozone also cause a wide range of less serious health outcomes.





# Monetary carbon values in policy appraisal

*OECD Environment Working Papers, No. 92*

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- Many projects and public policies in various sectors can have large impacts on GHG emissions.
- It is thus important how countries take these impacts into account in their assessments, ex ante and ex post.
- This is of relevance for any attempt to set “Pigouvian” tax rates in relation to energy use and transport.
- An upcoming ENV Working Paper discusses the range of approaches which can be employed to value changes in GHG emissions in policy and project appraisals, and presents a survey of current practice in OECD countries.



# Summary of questionnaire responses

		Transport investments	Energy investments	New policy assessments	Ex post assessments
Are there clear criteria for how to include GHG emission changes in CBAs?	Yes	63%	40%	24%	13%
	No	37%	60%	76%	87%
	Total	100%	100%	100%	100%
What is the share of cases in the last 3-5 years where impacts on GHG emissions have been part of the CBAs?	All	6%	7%	7%	0%
	Most	41%	21%	14%	20%
	Some	12%	29%	7%	0%
	A few	18%	7%	21%	10%
	Not known	12%	14%	36%	30%
	None	12%	21%	14%	40%
	Total	100%	100%	100%	100%
What is the <b>unweighted</b> average of the values of a tonne of CO <sub>2</sub> eq that have been reported – in USD in 2014 money value?	2014	57	38	56	53
	2020	66	47	82	68
	2030	99	67	115	104
	2050	164	153	237	248
	2100	349	467	467	467
	Average	147	154	191	188



## Further information

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- [www.oecd.org/env/policies/database](http://www.oecd.org/env/policies/database)
- [www.oecd.org/env/tools-evaluation/](http://www.oecd.org/env/tools-evaluation/)
- [www.oecd.org/greengrowth/greening-transport/transport-and-environment.htm](http://www.oecd.org/greengrowth/greening-transport/transport-and-environment.htm)
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