

TMR technical workshop: *Carbon Pricing and Sustainable Development Co-Benefits*

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How Carbon Pricing can Drive Innovation, Growth, and Jobs in New Sectors

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Wuppertal Institute for Climate, Environment and Energy

- State-owned global think tank for sustainable development
- Founded: 1991
- More than 200 employees in **4 Departments:**
 - Future Energy and Industry Systems
 - Energy, Transport and Climate Policy
 - Sustainable Production and Consumption
 - Circular Economy



Two potential ways of impact

■ Carbon pricing:

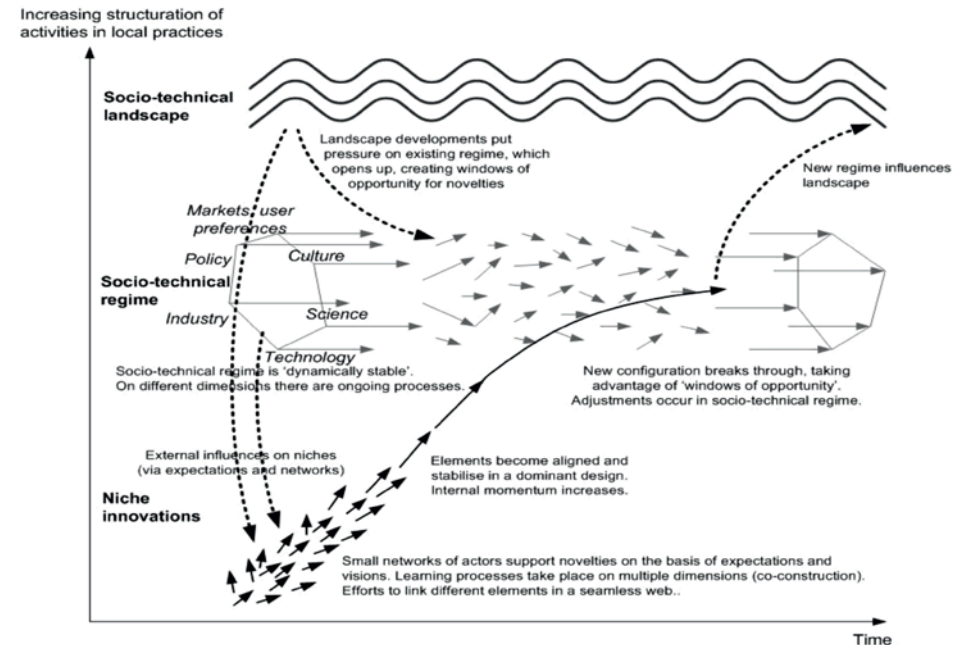
- Emissions trading,
- Carbon taxation,
- Energy subsidy reform

■ Low-carbon innovation, e.g.:

- Energy efficiency
- Renewable Energy Sources
- Flexibility and storage
- Low-carbon industry processes, e.g. direct reduction steel-making
- Electric vehicles and other low-carbon mobility
- 'green' and 'blue' hydrogen
- CCUS

■ Two potential ways of impact:

- (1) Carbon price improves cost-effectiveness of investments, incl. innovations
- (2) Using the revenues from carbon pricing to drive innovation



Impact through changes in cost-effectiveness (1)

Price elasticities as an empirical proof

	End use	Energy	Price elasticity
Private Households	Space heating	Fuel oil	-0,2
		Natural gas	-0,2
		Electricity	-0,2
	Water heating	Fuel oil	-0,05
		Natural gas	-0,05
		Electricity	-0,05
Appliances	Electricity	-0,025	
Commercial and public sector	Space heating	Fuel oil	-0,2
		Natural gas	-0,2
		Electricity	-0,2
Transport und Mobility	Transport und Mobility	Gasoline	-0,25
		Diesel	-0,05

Data for Germany
Source: Prognos
(2013), based on
BMW i (2011)

=> Doubling energy prices will only reduce energy consumption by max. 20 %

Impact through changes in cost-effectiveness (2)

Sometimes faster and stronger too

- **However:**
 - Carbon pricing shifted electricity generation in the UK from coal to gas
- **=> This route for impact may work with standardised, well-established technologies with little variation in cost**
- **What about innovation that is (by definition) not yet established?**
 - Initially higher cost; high variation in cost
(=> what is the *appropriate* carbon price?)
 - Uncertainty and (perceived or real) risk
 - Other barriers (knowledge, skilled suppliers, etc.)

Why do we need governance for innovation, particularly for energy efficiency?

To overcome the plethora of barriers

- Energy efficiency = many small to medium technical improvements
 - lack of oversight (where to start?),
 - lack of information (both consumers and technology providers!),
 - sometimes small financial gains from an improvement
- => lack of priority
- sometimes lack of funds
- Energy prices too low (subsidies?) => Energy cost savings too low
- split incentives between investors and users or between technology/building providers and buyers
- => make energy efficiency easy, attractive, and eventually the default
- => **policy packages** with more information, practical guidance, regulation, and financing support needed („the sticks, the carrots, and the tambourines“)

Policy package to increase energy efficiency

Governance framework

Targets and Concepts

Infrastructure and funding

Eliminating distortions

- Energy Efficiency Targets
- Roadmaps and Strategies
- Voluntary Agreements with commercial and public organisations
- International co-operation

- Energy Agencies
- Energy Efficiency Funds
- Energy Saving Obligations for energy companies
- Feed-in-tariff for certified energy savings
- Energy services

- Removal/reform of subsidies to end-use energy prices and on energy supply
- Energy / CO2 taxation
- Emission Trading
- Removal of legal barriers
- Regulation of energy companies

Specific policies for each sector

Regulation

Planning

Information and
Advice

Incentives and
Financing

Capacity Building
and Networking

Research and
Development and
BAT promotion

Policy package for energy efficiency: The industry sector as an example

Policy package to increase energy efficiency in industry (selection)

Governance framework

Targets and Concepts

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- Minimum energy performance standards
- Energy audits and energy management:

- Voluntary Agreements with commercial organisations
- Heat-/Cold-/Power supply plans for commercial areas

- Provision of information
- Energy advice
- Good practice examples

- Financial incentives

- Education and training
- Energy efficiency clusters and networks

- Funding for R&D projects
- BAT promotion

■ Potential ways of using revenues:

- Fund the policy packages needed to spur low-carbon innovation
- Fund other innovation, education, health system, infrastructures
- Provide lump-sum cash-backs to consumers and businesses and/or help poor people pay their energy bills (“just transition”?)

=> How do they match some criteria?

Option	economic efficiency and growth	Climate change mitigation impact	Distribution effects	Consequences for acceptance
Fund low-carbon innovation	+ to ++	++	- to +	- to +
Fund other societal goods	+	0	- to +	0 to +
Lump-sum cash-backs	+	0 to – (rebounds)	+	+ to ++

Impact through using revenues (2)

Doubling cost-effectiveness of low-carbon action:

- **Through the carbon price:**
 - Will need to **double energy prices**
 - Immediately affects **all** energy consumers, whether they can act or not (tenants; reinvestment cycles for equipment)

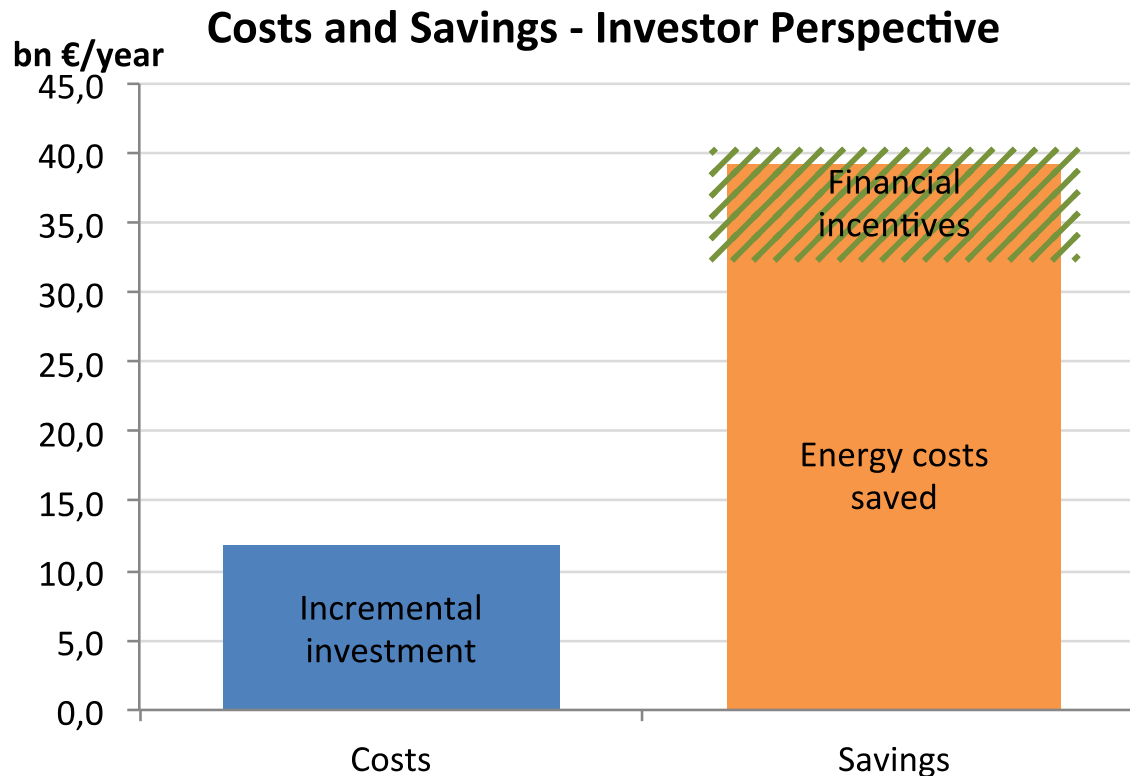
- **Through using revenues for funding low-carbon innovation:**
 - **Funding grants** worth 30 to 50% of investment costs, plus individual advice and coaching, and loans for the rest of costs where needed
 - Only need to fund **those who can invest** (reinvestment cycles for equipment => 5 to 10% of all equipment per year)

- **Our calculation for Germany:**
 - State needs around **10 bn Euros/year** in addition to existing programs to reach 55 % carbon reduction target for 2030
 - Carbon price of **30 to 50 Euros/tonne (ca. 5 to 23 % of current energy prices)** would be enough to fund this AND lump-sum cash-backs (50% of revenues each)

Impact through using revenues (3)

„Just transition“? – limiting consumers' (energy) costs

- **Energy costs = consumption x price**
 - Provide cash-backs?
 - Or fund energy efficiency and renewable energy programmes instead that may **save consumers 5 to 10 times as much money** over time?



An illustrative energy efficiency program portfolio for Germany
Source: Wuppertal Institut (2013)

Impact through using revenues (4)

And what about the government's budget?

- **Cash-backs or low-carbon innovation?**

- Provide cash-backs?
=> Consumers will spend or save the money. May create some new tax revenue.
- Or fund energy efficiency and renewable energy programmes instead?
=> Will lever three times or more of private money. May create more tax revenue and budget savings than original low-carbon innovation funds

- **Example from Germany: the KfW building energy efficiency programs** (data for 2011; similar year on year since then)

- **1.5 bn** Euros/yr from government for soft loans and grants
- **9 bn** Euros/yr in induced investment
- **4.3 bn** Euros/yr of return to government:
 - VAT: 1.7 bn Euros/yr
 - Income tax and social insurance payments: 1.9 bn Euros/yr
 - Avoided unemployment: 1.3 bn Euros/year
- **Ca. 120,000 jobs** created or secured

Some examples

EU – energy efficiency targets for 2030

- **Impact assessment by European Commission**

(33 % savings case – close to final decision)

- **Jobs:**

- Depends on model and assumption used
- Result: between - 500,000 and + 700,000 (net) vs. reference scenario
- Negative results: if investors are unable to borrow, in one model (realistic?)
⇔ three positive cases

- **GDP:**

- Depends on model and assumption used too (same as for jobs)
- Result: between -0.8% and +1.5 % vs. reference scenario

- **Combi-project.eu**

(savings scenario 2030 – close to final decision; 32 impacts for 21 energy efficiency improvement actions and 28 Member States)

- **Jobs:**

- 2.3 million job-years

- **GDP:**

- +1 % vs. reference scenario

Some examples

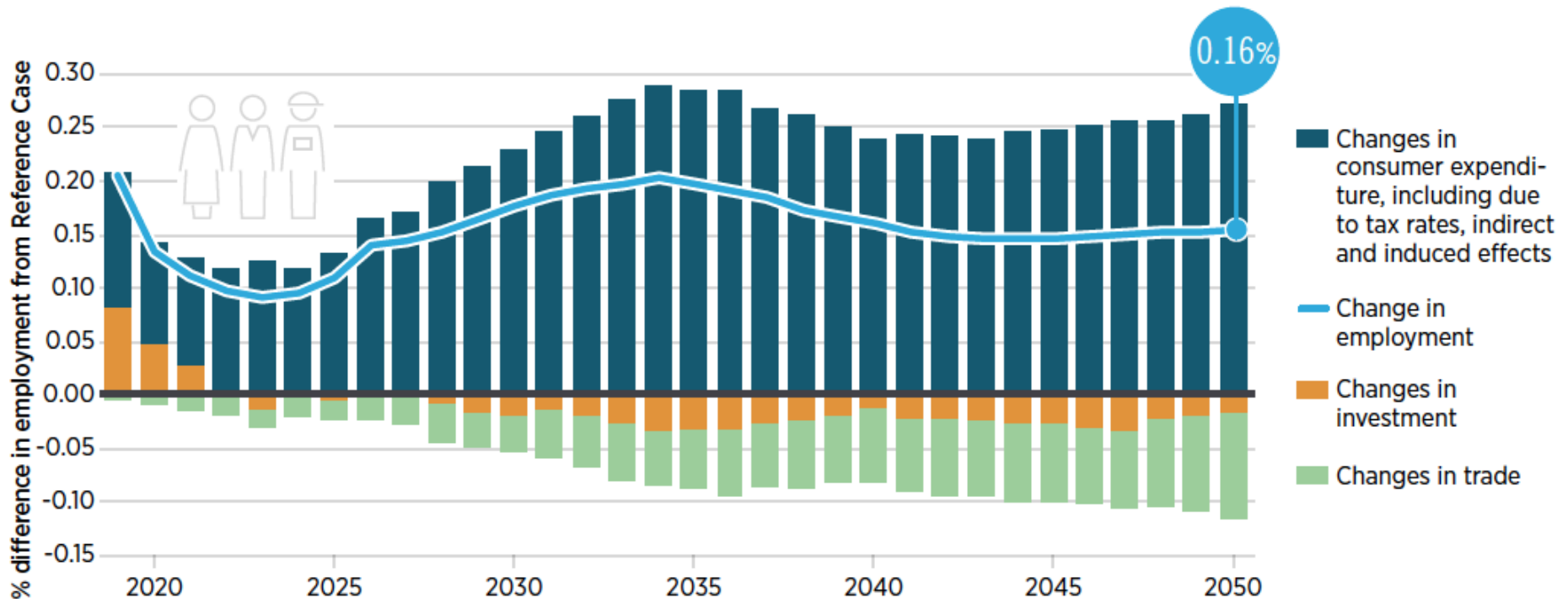
EU – climate change mitigation targets for 2050

- **Modelling for European Commission**
(GHG neutral case; EU)
- **Jobs:**
 - Depends on model and assumption used
 - Result: between 0% and + 1 %, i.e. + 2,000,000 (net) vs. reference scenario
- **GDP:**
 - Depends on model and assumption used too (same as for jobs)
 - Result: between -1.3 % and +2.2 % vs. reference scenario (+ 68 % vs. 2015)
- **Sectoral distribution:**
 - Winners: construction, electricity, and metals
 - Losers: fossil fuels
 - Roughly neutral to positive: other sectors

Some examples

World – climate change mitigation for 2050 (1)

- **IRENA's modelling** (2018; 2019)
(ReMAP scenario – 2° C target; World; carbon revenues to reduce income tax)
- **Jobs:**
 - +19 million in renewable energies, energy efficiency, grid enhancement;
 - -7.4 million in fossil fuels

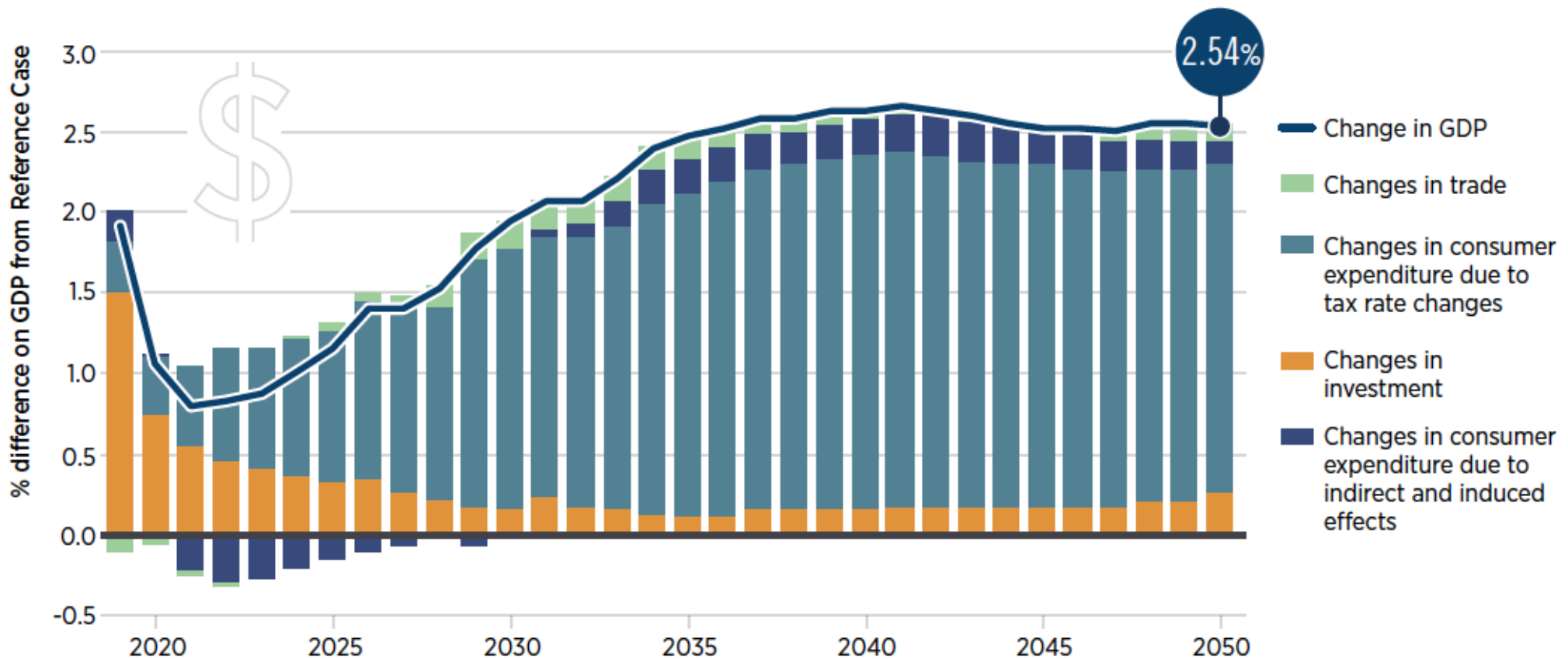


Some examples

World – climate change mitigation for 2050 (1)

- **IRENA's modelling** (2018; 2019)
(ReMAP scenario – 2° C target; World; carbon revenues to reduce income tax)

- **GDP:**



Conclusions

- Carbon pricing **may yield positive impacts** on innovation in low-carbon sectors, jobs, and growth
- The impact is due both to
 - 1) **direct effects**, from the change in relative prices of different forms of energy, and
 - 2) the **use of the carbon pricing revenues**
- The **use of revenues** to support low-carbon innovations, their deployment, and overall low-carbon development **will likely yield much higher impact** than the direct pricing effects in most sectors
- Overall, the **size and direction of the impact depends** on the way of use of carbon revenues – for low-carbon innovation and development, or for other societal goods, or for lump-sum cash-back, or for reductions in labour/income tax, or health or pension insurance fees.
- **Distributional** effects, including in use of revenues, are not to be neglected: can be decisive for **acceptance**.
- Also need to **support structural change** in sectors and regions that currently depend on extraction or use of fossil fuels.

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Thank you
for your attention
