SOCIO-ECONOMIC IMPACTS OF AMBITIOUS GHG REDUCTION TARGETS WITH EXPLICIT GREEN TECHNOLOGY INFORMATION

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Background

► The new emerging energy economy: IEA sees an annual 1200 billion USD market in the NZE scenario in 2050

► 3-year BMWi funded project “Low carbon Leakage”, 2020-2023

⇒ How can the relocation of clean energy technologies (CET) be prevented?
  ▪ Pros and cons of first mover strategy

⇒ Where will the new goods be produced?
  ▪ Improved understanding and modelling of global low carbon value chains
  ▪ Socio-economic impacts (GDP, value added, jobs)

⇒ How can these technologies be quantified (often not in statistical classifications)?

![Figure 1.3](source: IEA (2021))

<table>
<thead>
<tr>
<th>Technology</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1 Wind Energy</td>
<td>8 Hydropower</td>
</tr>
<tr>
<td>2 Solar energy / PV</td>
<td>9 Heat storage</td>
</tr>
<tr>
<td>3 Batteries</td>
<td>10 Fuel cell vehicles</td>
</tr>
<tr>
<td>4 CCUS and CO₂</td>
<td>11 Heat pumps</td>
</tr>
<tr>
<td>infrastructure</td>
<td></td>
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<tr>
<td>5 Biomass</td>
<td>12 Efficiency in industry</td>
</tr>
<tr>
<td>6 E-mobility</td>
<td>13 Transmission and grid</td>
</tr>
<tr>
<td>7 Hydrogen</td>
<td>14 Building technologies</td>
</tr>
</tbody>
</table>

Source: IEA (2021)
The model: GINFORS-E

- Economic structures: Harmonized OECD input-output tables for 64 countries, 36 industries and one region Rest of the World from 2005 to 2015
- Macro models and bilateral trade from TINFORCE (Mönning/Wolter 2020)
- Bilateral trade shares for 33 goods and 154 countries econometrically estimated:
  - Explaining variables: Relative prices, trends
- Changes in the cost situation at the level of 36 industries are transmitted to world trade, change sectoral production, value added, and prices as well as GDP
- Input-output relations by 36 (homogeneous) industries
- Explicit modeling of carbon prices (ETS and non-ETS)
- Myopic agents, non-equilibrium
Concept

- CET and their value chain need to be identified in the existing IO classification of 36 production categories in order to implement them.
- Information about the value chain enters over input coefficients in the IO table.
- CET are not only produced domestically but also traded on a global scale.
- Trade in CET goods is reported in a classification other than IO.

⇒ How to match the classifications and separate different parts of the value chains?

- Input vectors for 11 renewable energy technologies exist for (O’Sullivan/Edler 2020).
- Previous studies estimated the employment linked to RE in Germany using an input-output model.

Schematic representation of the calculation steps for deriving effective domestic demand and gross production.

Source: O’Sullivan/Edler (2020)
Modelling approach

- **Carbon prices ↑**
- **Fossil energy prices ↑**
- **Demand for fossil energy ↓**
- **Energy imports ↓**

**Installations of CET ↑**

- **Investment requirement ↑**
- **Demand ↑**

**Imports ↑**

**Exports ↑/↓**

**Domestic production ↑**

**GDP impact ↑/↓**

**Legend**

- Established modelling
- New approach

**International trade structure**

(for different goods of the value chains such as:
- PV modules
- windmills
- battery modules
- electrolyseurs)

- **Production costs**
- **Competitiveness of comparable techn.**
- **Policy (Support, R&D, infrastructure)**
- **Distance to final demand, transport costs**
- **Size of home market**
- **Path dependencies**
- **Country specific technology acceptance**

€: depending on relative prices
First results

- **Reference scenario** without further mitigation
- **2° scenario** (EU targets for 2030/2050 reached, also similar carbon prices in Rest of World)
- Higher positive GDP effect of mitigation (2° scenario) in EU in new approach
Outlook

► Integration of value chains of 14 CET in a global model with IO bilateral trade, energy and emissions

► Explaining shifts in production and trade flows of CET goods (trade patterns)
  ⇒ What can be quantified?
  ⇒ Where will lead markets be created?

► What is the role of policies and other country specific factors?
  ⇒ Project partners from IZES will provide a socio-technical assessment based on regime (deficits and barriers) and landscape analyses for leading producer countries
  ⇒ Incorporation of information into scenarios or use in modeling (endogenization)?

► Quantify impacts of ambitious mitigation targets under the new approach, evaluate the impact of different transition speed for individual countries
Thank you for your attention!

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References: