Sectoral employment mutations in the socio-ecological transition
A modelling assessment

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Caution

- This work is ongoing and the results presented in this document are preliminary.
- This document is insufficient by itself and the comments of the authors are essential to properly understand the results.
- Do not quote.
1. Context
   - A modelling exercise
   - Two global contexts = Two reference scenarios
   - Two policy responses

2. Results
   - How to reach the decarbonisation targets?
   - Carbon price
   - Some insights from energy consumption
   - Impacts on GDP
   - Impacts on Employment
   - Sectoral mutations induced by the decarbonisation

3. Conclusion
Outline

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3. **Conclusion**
The NEMESIS model
To assess the potential impacts of the socio-ecological transition.

- One part of the NEUJOBS\(^1\) project is the quantification of different scenarios on the future of employment in Europe and especially in the case of the socio-ecological transition (Fisher-Kowalski and Haberl, 2007[6])
- Use of the NEMESIS model developed by SEURECO\(^2\) to quantify these scenarios.
- Translate the global storylines as well as the EU policy response scenarios developed within the NEUJOBS project (Fisher-Kowalski et al., 2012[5]) into quantitative scenarios.

\(^1\)www.neujobs.eu
\(^2\)www.erasme-team.eu
The NEMESIS model
An overview of the Black Box (1/2)

- The NEMESIS model covers
  - each EU-27 countries
  - 30 production sectors
  - 27 consumption functions
  - 5 different inputs of which two kind of labour: low-skilled and high-skilled

- The NEMESIS model is a hybrid model combining short-term keynesian features with long-term equilibrium and new growth theory mechanisms\(^3\)
  - Keynes said that in “the long-run we are all dead”
  - but in the NEMESIS model, “in the long-run Schumpeter has killed Keynes”

\(^3\)See a detailed description of the model: http://bit.ly/SA8Q8z
The NEMESIS model
An overview of the Black Box (2/2)

- The NEMESIS model also includes an energy/environment module that provides:
  - energy consumption by 10 different products
  - energy consumption by 5 different sectors
  - power generation mix with 8 different technologies
  - CO₂ emissions by sector and country
  - carbon prices
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### Table: Summary of main assumptions

<table>
<thead>
<tr>
<th></th>
<th>Friendly</th>
<th>Tough</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Societal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demography (million)</td>
<td>+37M</td>
<td>-11M</td>
</tr>
<tr>
<td>Old age dependency ratio (%)</td>
<td>26% to 38%</td>
<td>26% to 39%</td>
</tr>
<tr>
<td>Working age population (million)</td>
<td>-4.5M</td>
<td>-29M</td>
</tr>
<tr>
<td>- High-skilled</td>
<td>+36M</td>
<td>+11M</td>
</tr>
<tr>
<td>- Low-skilled</td>
<td>-40.5M</td>
<td>-40M</td>
</tr>
<tr>
<td><strong>Energy prices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil price ($US/10/bbl)</td>
<td>$78 to $117</td>
<td>$78 to $195</td>
</tr>
<tr>
<td>European gas price ($US/10/Mbtu)</td>
<td>$7.5 to $11.7</td>
<td>$7.5 to $12.6</td>
</tr>
<tr>
<td>European coal price ($US/10/t)</td>
<td>$99.2 to $109.3</td>
<td>$99.2 to $115.9</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World GDP growth (AAGR)</td>
<td>3.80%</td>
<td>2.5</td>
</tr>
<tr>
<td>European rate of interest (%)*</td>
<td>3.6 to 4.4</td>
<td>3.6 to 5.9</td>
</tr>
<tr>
<td>€/$ exchange rate</td>
<td>1.3 to 1.3</td>
<td>1.3 to 1.4</td>
</tr>
<tr>
<td>Public finance rule</td>
<td>Stabilisation of public debt</td>
<td>Stabilisation of public debt</td>
</tr>
</tbody>
</table>
Two global contexts
“Friendly” vs “Tough”: Some insights

- In the “Friendly” scenario:
  - release of the long-run economic growth of the European Union (+2.2% of GDP growth at the end)
  - re-balancing of the European economies and of their public finances
  - progressive return to long-run equilibrium, especially on the labour market (unemployment rate at 7.6% in 2030)
  - relatively strong improvement of the energy efficiency (+2.2%/year)

- In the “Tough” scenario:
  - EU GDP growth is penalised by unfavourable external conditions
  - thus, re-balancing public finances is more penalising
  - and labour market remains depressed (unemployment rate at 12.1% in 2030)
  - relatively weak improvement of the energy efficiency (+1%/year)

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4 See Boitier et al. (2013[1]) for details.
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Employment in SET
Alternative scenarios

- Two alternative scenarios:
  - **Eco-modernisation**, a scenario achieving an eco-efficient production through market-based instruments and price signals to "internalise externalities"
  - **Sustainable Transformation**, a scenario recognises that there are several transitions ahead and that a significant reduction in fossil fuel use is necessary.

- Implementation into the NEMESIS model:
  - A unique carbon tax in European Union with
    - recycling through lump sum to households
    - recycling through lower social contribution to firms
  - **Doubling the labour demand elasticity** in all sectors (higher substituability) in order to favour the employment benefits
EU policy responses
Decarbonisation: -40% or -50% in 2030

Source: EEA (2012[2]) and NEMESIS model.
EU policy responses
How much should we reduce in each case?

Source: NEMESIS model

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3. Conclusion
Kaya identity

The Kaya Identity (Kaya, 1990[9])

\[ CO_2 = CO_2 \]

\[ CO_2 = \frac{CO_2}{E} \times \frac{E}{GDP} \times \frac{GDP}{POP} \times POP \]

\[ d\ln(CO_2) = d\ln\left(\frac{CO_2}{E}\right) + d\ln\left(\frac{E}{GDP}\right) + d\ln\left(\frac{GDP}{POP}\right) + d\ln(POP) \]
Kaya identity

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**Kaya identity**

The Kaya Identity (Kaya, 1990[9])

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\]

\[
dln(CO_2) = dln\left( \frac{CO_2}{E} \right) + dln\left( \frac{E}{GDP} \right) + dln\left( \frac{GDP}{POP} \right) + dln(POP)
\]
How to decarbonise?
Energy efficiency and energy mix work together

<table>
<thead>
<tr>
<th></th>
<th>Energy Mix</th>
<th>Energy intensity</th>
<th>GDP</th>
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<tbody>
<tr>
<td>Friendly - Eco-modernisation</td>
<td>50.8%</td>
<td>44.2%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Tough - Eco-modernisation</td>
<td>49.8%</td>
<td>48.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Friendly - Sustainable Transformation</td>
<td>53.4%</td>
<td>41.2%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Tough - Sustainable Transformation</td>
<td>55.2%</td>
<td>43.0%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

Source: NEMESIS Model

- The decarbonisation of the European economy will pass through:
  - change in energy mix
  - and improvement of energy efficiency
The decarbonisation of the European economy will pass through:

- change in energy mix
- and improvement of energy efficiency

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Carbon price
Carbon price matters!

Source: NEMESIS model
Context
Results
Policy issues

What matters?
Price
RES
GDP
Global Employment
Sectoral mutations

Carbon price
Marginal abatement curves

Source: NEMESIS model
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Employment in SET
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Share of RES in power generation
RES are drivers of the change in the energy mix

Source: NEMESIS model
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Share of RES
The 20% target is not easily reached!

Source: Eurostat (2012[4]) and NEMESIS model
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GDP
A moderated impact on GDP

Table: GDP change w.r.t. reference scenarios (%)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>With recycling</th>
<th>Without recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friendly - Eco-modernisation</td>
<td>-0.55%</td>
<td>-1.23%</td>
</tr>
<tr>
<td>Tough - Eco-modernisation</td>
<td>-0.35%</td>
<td>-2.13%</td>
</tr>
<tr>
<td>Friendly - Sustainable transformation</td>
<td>-1.57%</td>
<td>-3.08%</td>
</tr>
<tr>
<td>Tough - Sustainable transformation</td>
<td>-0.75%</td>
<td>-4.34%</td>
</tr>
</tbody>
</table>

Source: NEMESIS model
Contribution to GDP change
Friendly - Sustainable transformation

Source: NEMESIS model
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Macroeconomic employment
Take advantage of a depressed labour market

Source: NEMESIS model

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Macroeconomic employment
Sensibility analysis - Initial Employment Elasticity of Substitution (divided by 50%)

Employment change (in thousand w.r.t. reference scenarios)

-1000 -500 0 500 1000 1500 2000 2500

Friendly - EM Tough - EM Friendly - ST Tough - ST

High-skilled Low-skilled

Source: NEMESIS model

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   - **Sectoral mutations induced by the decarbonisation**

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Production
Friendly - Sustainable Transformation

Source: NEMESIS model
Production
A sectorial shift

Source: NEMESIS model

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Employment in SET
Employment
Friendly - Sustainable Transformation

Source: NEMESIS model

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Employment in SET
Employment
Jobs creations and destructions

Source: NEMESIS model
The decarbonisation of the European economy should combine change in energy mix and improvement of energy efficiency.

But, is it necessary to impose a target on each?

The carbon price is an efficient economic instrument to support the decarbonisation.

But, as currently shown by the EU-ETS market, cap-and-trade can nearly miss the role of carbon price, as signal.

Decarbonisation of the European Union could be done at a weak economic cost.

Insomuch as revenues from economic instruments are suitably used to facilitate this transition.
Summary
Key points for 2030 European mitigation policy (2/2)

- Transition to lower carbon intensive society could be a good opportunity to **create new jobs**
  - Especially in a context of a depressed labour market

- The decarbonisation of the European implies a **sectoral shift** opening a space for policy action:
  - to support penalised activities, sectors and employees
  - to promote and organise the development of related skills
Thanks

Thanks for your attention


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