Europe energy future
and the climate-security nexus:
insights from the SECURE scenarios

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Scenarios and their policy settings

Main results of the SECURE scenarios
Consequences for EU energy imports
Insights for EU energy policy
SECURE: purpose of the study

- The SECURE project – in FP7 – aims at analysing future energy Security of Supply for Europe
- Research and policy also needs to take into account the impacts of climate policies on the world energy system
- The POLES model is used to produce framing scenarios, in order to explore the « climate change and energy security nexus »

5 scenarios + 3 sensitivity studies with the POLES model

- Scenarios
  1. The BaseLine case is a counter-factual, no climate policy scenario, used mostly for benchmarking
  2. The Muddling Through scenario describes the consequences of non-coordinated, low profile climate policies
  3. The Muddling Through & Europe Plus case represents the same settings but with a stronger effort in Europe
  4. The Europe Alone case represents the outcome of a scenario in which only the European Union commits to strong targets (~80%)
  5. The Global Regime explores a new world energy system, under strong emission constraint, consistent with the 2°C target

- Sensitivity studies and shocks
  1. Oil and gas shocks
  2. Nuclear accident + phase out
  3. Problems in the diffusion of the CCS
The carbon constraint according to IPPC AR4

\[ \Delta T \, ^{\circ}C \quad \leftarrow \quad 2050/2000 \]

**Table SPM.5.** Characteristics of post-SAT stabilization scenarios [Note 32, 3.119]

<table>
<thead>
<tr>
<th>Category</th>
<th>Radiative forcing (W/m²)</th>
<th>( \text{CO}_2 ) concentration (ppm)</th>
<th>( \text{CO}_2)-eq concentration (ppm)</th>
<th>Global mean temperature increase above pre-industrial at equilibrium, using &quot;best estimate&quot; climate sensitivity (°C)</th>
<th>Peaking year for ( \text{CO}_2 ) emissions (2050/2000 emissions)</th>
<th>Change in global ( \text{CO}_2 ) emissions in 2050 (2000 emissions)</th>
<th>No. of assessed scenarios</th>
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Total 177

SECURE scenarios, hypotheses and outcomes

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<th>Carbon Price 2050 (€/t CO2)</th>
<th>Emissions 2050 / 1990</th>
<th>AR4 categories</th>
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<td><strong>Baseline</strong></td>
<td>0</td>
<td>134%</td>
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<tr>
<td><strong>Muddling Through</strong></td>
<td>40 in Eur 32 in RoW</td>
<td>72% (EU: -21%)</td>
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<tr>
<td><strong>MT E+</strong></td>
<td>89 in Eur 32 in RoW</td>
<td>67% (EU: -40%)</td>
</tr>
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<td><strong>Europe Alone</strong></td>
<td>185 in Eur 32 in RoW</td>
<td>59% (EU: -60%)</td>
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<tr>
<td><strong>Global Regime</strong></td>
<td>392 in A1 257 in NA1</td>
<td>(2050/2000) -50% (Annex 1: -80%)</td>
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</tbody>
</table>
Scenarios and their policy settings

Main results of the SECURE scenarios

Consequences for EU energy imports

Insights for EU energy policy

Unsustainability of the Baseline

- In the Baseline case, Oil and Gas first increase but then peak in 2030 and 2040 and thus Coal more than doubles, to 6.5 Gtoe in 2050
- World energy consumption and CO2 emissions double in 2050: this is not sustainable from the climate perspective
Global outcomes of the SECURE scenarios

◆ The **Baseline** is not sustainable as it implies:
  - a doubling of emissions in 2050 (5-6°C profile)
  - extremely high production levels for oil and gas with risks of crises

◆ The **Muddling Through** and **Europe Alone** cases somehow alleviate tensions, but they don’t solve the problems

◆ Only the **Global Regime** case can bring a sustainable energy system to 2050:
  - an emission profile that is (almost) compatible with the 2°C target
  - lower energy prices (60 €/bl, instead of more than 100)

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European primary mix by scenario

◆ In the **Global Regime** total demand is 20% lower in 2050 than in the Baseline

◆ And non fossil sources represent almost two thirds of supply, compared to only one fourth in the baseline
European electricity production by source

- A strong carbon constraint induces more nuclear and renewables and triggers a substitution of coal-based by biomass-based generation while CCS develops
- Natural gas power generation is hardly impacted

European Gas supply

- Domestic production drops over time and as imports stabilize after 2040 at a level triple of today in BL and MT
- They peak in 2020 and then decrease in the EA and GR cases
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Dependence rate, by energy and global

- The dependence rate for each fossil source does not change very much from one scenario to the other
- While global dependence rate (on total GIC) is significantly altered, due to domestic sources

<table>
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<th>2010</th>
<th>2020</th>
<th>2030</th>
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<td>51%</td>
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GIC and volume of fossil imports

- Dependence may be lower and also applied to smaller quantities
- In terms of global vulnerability, importing 40% of 200 Mtoe is not equivalent to 40% of 400 Mtoe

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Value of energy imports

- From 1.8% of EU GDP (EA) to 2.2% (BL) in 2020 and from 0.5%(GR) to 2.5% (BL) in 2050.

<table>
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<th>2010</th>
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</table>
The international agreement on climate is not granted this increases the uncertainty in the energy sector.

But the climate dimension also introduces elements of visibility, associated to the physical emission constraints.

For Europe climate policies bring a significant double dividend in terms of reduced vulnerability to energy shocks, even in a non-cooperative framework.

Risks and climate-energy policies

<table>
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<th>Probability</th>
<th>Magnitude</th>
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</table>

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Insights for EU energy policy
Conclusions: the technical side

- Beyond modeling exercises, many issues should be kept in mind, in particular the institutional dimension:
  - Framework and incentives for electricity investment
  - Degree of integration of the European electricity system
  - Institutional factors in new technology chains (scale-up of CCS)
  - Regulatory framework for nuclear development

- Across the different scenarios total electricity consumption remains strong as it is the main carrier of the decarbonisation

- The power generation technology mix changes a lot with more renewables, nuclear and CCS, but natural gas is almost not impacted

- From MT to GR, Europe’s natural gas consumption is down by 40%, but imports from Russia only lose 20%, a clear sign of competitive advantage

Conclusions: the political side

- Climate policies strongly impact the energy-security problem and illustrate the type of uncertainties that EU and Russia will have to face in the next decades

- The debate on “Energy Charter Treaty or Pdt Medvedev’s Energy Document … where to start?” is part of the problem

- But this problem cannot be examined without taking into account the fundamentals of supply and demand in a global policy framework

=> Efforts are needed to combine institutional solutions with a dialog on a Pluriannual Programming of Investments in the energy sector, in a balanced and mutual understanding perspective
Thank you for your attention