SECURE: Policy recommendations from WP4, and POLES model scenarios

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SECURE: Policy recommendations from WP4

- A family of five long term energy scenarios
- The international energy markets perspective
- EU domestic energy perspective
- Shocks and uncertainties
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POLES scenarios in the SECURE project

- The POLES long-term world energy model is used to produce framing scenarios, in order to explore the « climate change and energy security nexus »

- The scenario exercises developed in the SECURE project illustrate the complex interactions of climate policies and energy security issues

- A family of five scenarios and 3 exercises have been tested:
  
  **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 scenario describes the consequences of non-coordinated, low profile climate policies but with some leadership from Europe
  4. The Europe Alone case represents the outcome of a scenario in which every country is free-riding (almost) … except the Union
  5. The Global Regime explores a new world energy system, under strong emission constraint (EU-type)

  **Exercises**
  1. Oil and gas shocks
  2. Nuclear accident + phase out
  3. Problems in the diffusion of the CCS
1. Baseline or No policy case: not a sustainable energy and environment future

1. Exhaustion of cheap hydrocarbon resources with consequences in terms of competition for the access to these limited resources and potential energy shocks,

2. Accumulation of GHGs in the atmosphere, with consequences in terms of accelerated climate change, disturbances in local ecosystems and increased vulnerability of economic systems.
2. Limited global mitigation action: Muddling Through

- Weak signals in terms of carbon price,
- but cheap options on the Marginal Abatement Cost curves already change the level of emissions through reduced demand, accelerated development of non fossil energy and CCS
- However, this scenario doesn’t succeed in meeting the emission targets that are considered as desirable to limit average temperature increase at level of 2°C compared to pre-industrial situation
- It doesn’t significantly alters the balance of demand and supply trends on the international energy markets
- Risks of energy shocks remain, although potential tensions are somehow alleviated
3. Unilateral actions in Europe: Muddling Through & Europe+, Europe Alone

- Unilateral action from Europe (MT E+ or Europe Alone) involves structural changes in the European energy system
- They are not sufficient to induce massive emission reductions at world level, nor do they limit the risk of energy shocks
- However these scenarios display highly beneficial dimensions for Europe:
  - imposing strong emission reduction domestically results in a restructuring of the European energy system
  - in case of energy shocks, this restructuring will allow Europe to be largely protected by lower energy demand, higher contribution of domestic non-fossil fuels (renewable and nuclear) and a much lower level of fossil fuel imports
4. Strong climate policies: Global Regime

1. Improves the situation from the former two cases, while reducing both emissions and the level of tension on international hydrocarbon markets, through lower oil and gas production.

2. This is a clear double dividend situation, probably the most important one to be derived from ambitious climate policies.
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Scenarios with no drastic change in Europe’s energy system oblige to develop the energy security strategy in a conventional setting, i.e. ensure that sufficient supply (particularly for oil and gas) is available through massive investment in production and transport capacities.

The Energy Charter that currently provides the basis for this policy is aimed at providing an almost free access to oil or gas resources in producing countries, but it is poorly attractive to energy exporting countries whether CIS or OPEC countries.

Energy Charter should at least be completed by other policies and ensure: demand security; possibility of downstream investment; some upstream-downstream reintegration with cross investments in common projects.

But such developments may indeed enter into contradiction with the liberalization policy and Energy Charter perspectives.
Scenarios that imply a deep restructuring of the European energy sector display very different dynamics in energy demand after 2030.

If Europe is alone in its efforts to develop a new energy paradigm, then it is highly probable that:

- energy exporters will follow investment profiles that will respond more to the demand dynamics of the other regions.
- In that case Europe may be less vulnerable to energy imports if its policy is successful.

If a global climate regime is implemented, then:

- energy will be more sustainable in the long term, but
- in the short term there is a risk of producing countries underinvesting because of the uncertainties created.
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EU domestic energy in the new paradigm

- “New energy paradigm” cases display a lower demand and higher share of non fossil domestic sources, whether renewable or nuclear
- Total electricity production is almost unchanged because electricity is the main carrier of decarbonisation, including in transport
- Renewable, nuclear and CCS increase with the strengthening of the carbon constraint. Wind and biomass play the major role for renewable power
- In order to better qualify the feasibility conditions of these new paradigm scenarios, many critical policy insights have to be taken from other packages, in particular the institutional dimension for:
  - 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
A family of five long term energy scenarios

The international energy markets perspective

EU domestic energy perspective

Shocks and uncertainties
Possible shocks for oil and gas price

- Simulation of possible shocks in POLES is performed through multiplying by 3 oil and gas prices for a given date (2015)

- The model results show:
  - a contraction of around 10 to 20% of the European oil and gas consumption in short terms, and a diminishing impact in longer term.
  - this situation is translated by a decline of primary consumption in the short term of the order of 6 to 8%
  - a noticeable modification in the energy mix, significantly promoting nuclear energy
  - with consequently lower CO2 emissions
Case of a nuclear accident

The impact of the occurrence of a nuclear accident is simulated through: no new capacities after 2015, and a progressive phase-out of existing plants

The results show:

♦ No significant differences of nuclear production in Europe in 2020

♦ But a cut by more than three in 2050

♦ Moreover the impact is important on EU27 electricity mix:
  - increase of fossil share (coal & gas) but
  - also of carbon capture and sequestration.
  - Consequently CO2 emissions from electricity generation increase gradually during the period.
No deployment of CCS

Because of barriers to safe and cost effective deployment of CCS, no deployment of CCS may occur

- In this case EU27 electricity production does not change significantly,
- Conversely the mix does indeed:
  - fossil fuels decrease considerably
  - weak impact on renewable
  - nuclear replaces the lack of CCS
  - but with the same carbon price CO2 emission however increase
## Energy risks and vulnerability

<table>
<thead>
<tr>
<th>Risk_{c/e} =</th>
<th>Probability_{e}</th>
<th>x Magnitude_{e}</th>
<th>x Vulnerability_{c/e}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muddling Through</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Europe Alone</td>
<td>High</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Global Regime</td>
<td>Low</td>
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</table>
UNCERTAINTIES (1)

Uncertainty into the POLES model is introduced by one or more parameters as random variables:

1. Variation of the Supply of oil and gas from the Middle East and North Africa increase (decrease) prices, thus increasing (decreasing) the net consumption of EU households net of expenditure on energy.

2. Variation of the price elasticity of demand for energy in the EU27 show that a higher price elasticity result in less expenditure on energy, thus increasing expenditure on other goods and services and increasing our measure of energy security.

So, the price elasticity of demand is an important factor: the higher is this elasticity the more energy secure are the outcomes from the model.
UNCERTAINTIES (2)

3. Variability in BRICs GDP growth rates, measured by the coefficient of variation of GDP growth.

Growth in the BRICs does impact energy security: the higher the growth the lower is energy security measured as the mean value of the indicator.

Furthermore the more uncertain is this growth in the BRICs, the lower is the value of the energy security.

However, the standard deviation of the energy security measure (which itself is an indicator of energy security) is smaller under the climate scenarios than it is under the Baseline scenario.
UNCERTAINTIES (3)

4. **Rate of development of clean technologies**, measured by the coefficient of variation of investment costs of chosen technologies. Variations in the rate of development of clean technologies have little impact on energy security.

   The mean value of the indicator of energy security is, however, slightly higher with carbon policies in place than without

5. **Nuclear discount rate**, measured by the coefficient of variation of the discount rate.

   Likewise the results are not sensitive to the discount rate applied to nuclear power.

   There is however a difference between the baseline and the climate scenarios: a greater variation in the discount rate results in a slight decline in welfare in the global trade scenario but not in the baseline.

Developments in the POLES model for taking into account the risk help to better appreciate the magnitude of the risk avoided through virtuous climate policy in different frameworks.
Conclusions

◆ The international agreement on climate is not yet granted and the introduction of the climate dimension thus increases the uncertainty in the energy sector.

◆ But it also introduces elements of previsibility, associated to the physical emission constraints.

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