Energy Security in post-Paris Deep Decarbonisation Scenarios for European Countries

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Overview

There is a consensus that climate policies have a positive impact on gas, coal and oil dependency thanks to decreasing consumption of fossil fuel. However, the energy security is broader concept (APERC, 2007; Hughes, 2009; Sovacool, Mukherjee, 2011; Cherp, Jewell, 2014) that should take into account the availability of supply (dependency, diversity, energy reserves) and the ability of economy to deal with energy risks, as well as the energy sould be affordable and suistainable. Even if the global impact of worldwide climate policy is fairly positive, there are also some negative impacts. Sovacool and Saunders (2014) investigate 14 measures to address climate change, but half of them are in contradiction with energy security objectives. Bollen et al. (2010) study how the combination of energy security, climate and pollution policies affect GHG emissions, polition level and oil consumption in OECD countries. The authors show that in some cases a climate policy can be inconsistent with the reduction of pollution and would simply delay peak oil consumption. Other authors point out additional potential weaknesses: reduction in supply diversity (Victor et al., 2014; Jewell et al. 2014), increasing energy dependency (Bazilian et al. 2011) etc.

Our objective in this study is to analyze the European energy security in post-Paris deep decarbonisation scenarios using POLES model. We also propose a further analysis of energy security issues with respect to two elements of crucial importance in the European context: role of gas in European energy mix and the fesability of the high share of intermittent renewable in electricity mixe. This study is a part of European project RIPPLES, coordinated by French Institute for Sustainable Development and International Relation (IDDRI).

Methods

POLES is a bottom-up recursive dynamic partial equilibrium model with highly detailed spacial (57 regions) and tegnological resolution, endogenous international energy prices and technological change, as well as a good sectoral resolution. We use POLES to simulate 3 types of deep decarbonisation scenarios plus BAU scenario:

- Buissnes as usual scenario
- Implimantation of Intended Nationally Determined Contributions
- 2°C scenario
- 1.5°C scenario

We split each scenarios in several versions wich separate effects from carbon prices, possible technological breakthroughs and change of consumer behaviour.

Once the mitigation scenarios are built, we use POLES scenarios to analyse the energy security both at the EU and national level for major EU and non-EU emitters. To do so, we use 9 energy security indicators that cover supply diversity, energy dependency, affordability and suistainability. We do not use some classic energy security indicators, beacaus there are by definition enhanced in mitigation scenarios (carbon intensity and reserve to production ratio for fossil fuels). At the final step we propose a composite energy security indicators by dimension to compare countries and scenarios.

Intermediary results

The European Union is characterised from other regions by a no increase of CO_2 emissions in BAU scenario due to the proactive climate policies that have already implemented. Moreover in the mitigation scenarios, the gap between INDC, 2°C and 1.5°C scenarios is twice smaller than in the rest of the world. We should also note that worldwide biomass consumption and solar/wind generation increase in all scenario. Thus, several indicators improve in the same way in all scenarios and have litte diffirences: diversity of electricity generaion, diversity of natural gas imports and affordability of energy in developed countries (except in the case of high share of solar and wind generation).The mitigation scenarios show also that developing countries are more vulnerable in yearly (scince 2020) deep decarbonisation scenarios than in INDC scenario with regards to import dependency and energy affordability. Overall, the diversity of primary consumption and import independency are higher in the mitigation scenarios, while other indicators are same or quite same as in baseline. Only energy affordability indicator may be negatively influenced by climate policies.

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