

# ***Developed and Developing Countries Perspectives of the Climate Policy Based on the Copenhagen Accord. A long-Term Analysis with TIAM-FR.***

Sandrine Selosse\*, MINES ParisTech, +33 493 678 917, Sandrine.selosse@mines-paristech.fr  
Edi Assoumou, MINES ParisTech, +33 497 157 072, edi.assoumou@mines-paristech.fr  
Nadia Maïzi, MINES ParisTech, +33 497 157 079, nadia.maizi@mines-paristech.fr

## **Overview**

Challenges for climate change consideration involve evolution of the world energy system, especially, of the energy and technological mix permitting to satisfy the energy service demands. Different pathways to achieve a low-carbon economy are analyzed in the line of the climate goals expressed in the context of Copenhagen Accord, and according to several assumptions about technologies availability, energy sources potential, etc. The analysis of these possible futures brings information concerning the impact of climate policies in a world and regional view and, their effectiveness to reduce emissions in the line of the global warming objective. It also allows us to discuss the more plausible strategies to reduce GHG according to economic and technological considerations.

Stabilize the atmospheric concentrations of GHG at the level that prevents dangerous anthropogenic interference with the climate system is the ultimate objective of the UNFCCC. Significant GHG emissions mitigation is necessary to reach this long-term collective goal for climate change mitigation requiring limiting global average temperature increases to 2°C above pre-industrial levels. All major developed and developing countries have pledged targets under the Copenhagen Accord but the question is to determine if these promising emissions reductions will be sufficient and if a wider participation will be necessary for the ultimate objective of the UNFCCC. Also, what is interesting and important to analyze is the different impact of these climate policies according to developed and developing regions, in term of level of their contribution in the global effort of GHG emissions reductions, technological potentials and investments to reach their target. Such is the aim of this study.

## **Methods**

This research is developed with TIAM-FR, a bottom-up model describing the world energy system in great detail of current and future technologies expressed by region and sector. TIAM-FR, of the ETSAP-TIMES family model, is a geographically integrated model in 15 world regions on the time horizon from 2005 to 2100. Nevertheless, this study is investigated until 2050. It integrates GHG emissions, carbon capture and sequestration technologies and mitigation technological options for CH<sub>4</sub> and N<sub>2</sub>O and allows analyzing and making assumptions on atmospheric GHG concentrations and temperature changes.

So, for this study, we specified regional and global scenarios:

- A regional scenario considering post COP 15 pledges in 2020 and assumptions in 2050 representing the international convergence in term of GHG emissions reductions;
- A global 2050 target scenario expressing the global objective of keeping warming to 2°C;
- A regional scenario considering post COP 15 pledges in 2020 and the 2050 global target.

Table 1: Regional post COP 15 pledges in 2020

Regions	Reference Year	Emission reduction	Reduction type
Europe	1990	20% / 30%	Emission reduction
Japan	1990	25%	Emission reduction
Australia	2000	5% / 25%	Emission reduction
USA	2005	17%	Emission reduction
Canada	2005	17%	Emission reduction
China	2005	40% / 45%	Carbon intensity
India	2005	20% / 25%	Carbon intensity

Also, different strategies to achieve the environmental objective are assumed such the introduction of additional constraints regarding technologies of carbon capture and sequestration, the long term nuclear deployment or again the coal expansion in China.

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\* *Corresponding Author:*

MINES ParisTech / CMA, Rue Claude Daunesse, BP 207, 06904 Sophia Antipolis, France

## Results

The analysis of the scenario results focuses on the effects of the climate objectives on GHG emissions, on the energy mix and on the future technological investments. More precisely, we focus on GHG emissions levels by region and by sector and the impact of these different international climate change strategies on energy system as the place of fossil fuels, investments in renewable and CCS technologies, and costs of such investments.

This analysis allows us to discuss the weight of the allowed or required effort for developing regions by comparison with developed regions according to the climate policy strategies.

To take into account different regional characteristics, particularly between developed and developing regions, we express these results according to other indicators like emissions intensity reductions, emissions by capita (etc.); the aim being to determine the potential contribution and the cost of the mitigation effort according to developed and developing regions.

## Conclusions

In a global perspective, the evolution of the technological mix involved by the search of low carbon economies appeal a discussion as regard the feasibility of this development. For example, the deployment of CCS and renewable technologies appears as a response of carbon constraints but we still face technological and economic limits in term of infrastructures, of stability and security of power systems, of costs and scale of investments, of social acceptability... Geological storage of CO<sub>2</sub> is now opening new options for energy development. But it should not discourage the development of alternatives, including energy savings and renewable energy. For each region, costs and the most promising technologies to reach this target are different. Indeed, regional differences exists in terms of existing energy system and infrastructure, technological potential (renewable energies, CCS, etc.) or future economic development and priorities. We show the different weights of the mitigation effort for developing countries according to climate policies by comparison with developed regions.

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