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PROSPECTIVE ANALYSIS OF POST-COPENHAGEN CLIMATE POLICY: THE PLAUSIBILITY OF INVESTMENTS IN CARBON CAPTURE AND STORAGE

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OVERVIEW

A key issue for the Post-Copenhagen agreement is the participation of the United States and of non-Annex I countries, and especially China. Indeed, China and the USA are the major global CO_2 emitters, and a climate agreement without their participation will have difficulties to reach the stabilisations of both the CO_2 concentration and the global temperature. In this paper, we analyse different paths and targets for the mitigation of CO_2 emissions through different scenarios and we focus on their regional implications on the costs, the total energy consumption and the energy mix. This analysis provides some understanding keys of the international climate policies and raises the question of their technological plausibility which is a critical issue for policy design. In this exercise, we mainly study the plausibility of investments in Carbon Capture and Storage (CCS) technologies.

METHODS

The analyses carried out in this paper are based on the ETSAP-TIAM-FR model, which offers a technology-rich representation of the world energy system divided into 15 regions. This model performs a minimization under constraints of the total discounted cost of the energy system over the long-term and in a partial equilibrium framework. We cover the period 2000-2050 for different scenarios representing post-Copenhagen regional targets, depicted in the table 1.

Table 1: Regional pledges announced in 2010 for post-COP 15

Regions	Reference year	Target level	Emission reduction		Reduction type	
			2020	2050	2020	2050
Western Europe	1990	Low	20%	60%	Emission reduction	
		Up	30%	80%		
USA*	2005	Fix	17%	83%	Emission reduction	
Australia	2000	Low	5%	60%	Emission reduction	
		Up	25%	80%		
Canada*	2005	Fix	17%	83%	Emission reduction	
Japan	1990	Fix	25%		Emission reduction	
		Low		60%		
		Up		80%		
China	2005	Low	40%	90%	Carbon intensity	Carbon intensity
		Up	45%	10%		Emission reduction
India	2005	Low	20%	60%	Carbon intensity	Carbon intensity
		Up	25%	10%		Emission reduction

* Intermediate targets are introduced for USA and Canada regarding their pledges to UNFCCC: 30% for 2025 and 42% for 2030

Furthermore, for each scenario, we introduce an additional constraint which sets an upper limit for investments in the CCS technologies.

RESULTS

The analysis provides the evolution of the primary energy consumption, the energy mix, and finally the levels of the regional CO_2 emissions and the costs of the climate policies. Particularly, we compare regional targets of CO_2 mitigation and carbon cost, and we assess the impact of the cabone constraints on the energy mix in 2020 and 2050.

Our first result is a fair comparison of the different pledges, knowing that the reference years are different, and that for China and India the targets are expressed in terms of reduction of their carbon intensity. Concerning the energy mix, fossil fuels represent the highest share of energy production of the whole time horizon, despite a major increase in renewable energy sources. Interestingly, coals also represent an important share of energy production – to the detriment of gas – when the level of sequestrated CO_2 is not constrained. Consequently we analyse how a limitation of CCS will impact the total primary energy supply The prospective analysis finally focuses on the deployment of CCS technologies. We study the plausibility of these investments and their impacts on the energy system and on the cost of the post-Copenhagen climate policies.

CONCLUSIONS

These scenarios compare the effects of post-Copenhagen climate policies on the main environmental and economic indicators. Our model shows the CO_2 emissions levels by regions and enables to study the impacts of international strategies against climate change on the energy system. From our results, it appears that the impacts of the CO_2 mitigation mid-term targets of the USA and China on the global CO_2 emission are far for being ambitious and satisfying. This is even more true for the USA, considering the CO_2 marginal cost for China. These scenario analyses also bring to discuss the importance of technological improvement in these climate policies, regarding the development of CCS technologies and the evolution of the global energy mix. In 2050, 7 Gt of CO_2 emissions should be avoid by investing on CCS technologies which is strongly questionable and requires paying special cares to technological plausibility when designing future climate policies.

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