



A developing Asia emission trading scheme (Asia ETS)

Emanuele Massetti*, Massimo Tavoni

Fondazione Eni Enrico Mattei (FEEM), Italy

Euro-Mediterranean Center for Climate Change (CMCC), Italy

ARTICLE INFO

Article history:

Received 3 June 2011

Received in revised form 27 December 2011

Accepted 8 February 2012

Available online 16 February 2012

JEL classification:

C68

Q52

Q54

Q58

Keywords:

Climate change

Developing Asia

Mitigation scenarios

Emission trading

EU-ETS

Equity

ABSTRACT

This paper provides a model assessment of the role of developing Asia in the context of climate change policies. We diagnose the potential response of Asian economies to the imposition of various climate policies, showing that if we were to equally price carbon across the world roughly half of the abatement would occur in developing Asia. We show that such autarkic measures would be consistent with the policy targets put forward by the Major Economies Forum but would not necessarily be equitable. We thus propose a fragmented cap-and-trade scheme with a specific regional market for developing Asia, the Asian Emission Trading Scheme (Asia ETS). We assess the role of the Asia ETS on the macro-economy and international transfers vis-à-vis the standard case of global trading. Our results indicate that creating two large trading markets would result in small global efficiency losses, while at the same time generating more reasonable regional incentives and transfers.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

It is now an established fact that the role of developing Asia will be crucial in the context of climate change control. The rapid economic expansion of many Asian economies has been accompanied by a similar, and in some cases even higher, growth of energy consumption, leading to a significant increase of carbon intensive capital and of greenhouse gas emissions in recent years. The most notable case is of course China, which a few years ago became the world top emitting country, and whose emissions in 2008 are already 25% above the second largest emitter, the United States. It is not only China, though. The whole region is expected to see its share of global emissions increasing.

The stage of economic development of the region, which on average is approaching but still below the 5000 USD/capita threshold, believed to mark the real take-off of energy consumption, also suggests that important carbon abatement opportunities can be implemented before a too large fraction of carbon intensive investments are undertaken, locking in the medium term possibilities to shift away from a carbon intensive energy system. The region also

hosts considerable potential for deployment of low carbon options such as renewables, avoided deforestation, energy efficiency, and so forth. Indeed, modelling results have highlighted the importance of involving developing countries, and foremost Asia, in the task of mitigation. For example, the EMF22 comparison exercise (Clarke et al., 2009) has shown that the feasibility and costs of climate stabilization would become prohibitive without an effective and prompt collaboration between developed and developing countries.

Motivated by the increasingly alarming output of the climate science research, policy and modelling of climate change has in recent years increasingly focused on the assessment of stringent climate stabilization targets, such as those consistent with the objective of limiting temperature increase to 2 degree Celsius (2 °C) with adequate probability. From a modelling viewpoint, the role of technologies that allow to comply with a low future carbon budget has received particular attention. For example, the role of negative emissions via biomass burning and Carbon Capture and Storage (CCS) has been shown to be very important for this class of scenarios (see for example Azar et al., 2010), with significant repercussions on the economic estimates of climate policies (Tavoni and Tol, 2010).

However, translating global climate goals into regional commitments becomes progressively more problematic with an increasing stringency of the climate target, since a smaller carbon budget is left to be shared. For example, in order to achieve 2 °C policies an indicative target of –50% in 2050 (with respect to 2005 levels) has been identified. In

* Corresponding author at: Fondazione Eni Enrico Mattei, C.so Magenta, 63, 20123 Milano, Italy. Tel.: +39 02 520 36814.

E-mail address: emanuele.massetti@feem.it (E. Massetti).

2009 the G8 combined this level of ambition with a target for developed countries (–80 to –95%), thus effectively determining the obligations of the developing world as well. Similarly, the OECD International Energy Agency (IEA) recently stated that China's emissions need to peak by 2020 if the world is to meet the above mentioned 2050 target.¹ Not surprisingly, the reaction from developing countries has not been favourable, as such obligations are feared to come at a cost in terms of economic growth.

Thus, from a research standpoint, there is a need to discuss under what conditions stringent climate targets and a reasonably just allocation of effort can be jointly met (Tavoni et al., 2011). Asia is the key on both fronts, since it is a fast growing and emitting region, which also hosts a large share of the global population, including many people still in poverty. On the front of mitigation, it is imperative to understand the drivers of emissions in a baseline case, and to compare this counterfactual to the abatement opportunities that the region offers. As for the repartition of the global climate mitigation effort, it is important to evaluate acceptable levels of regional commitments and to design policy instruments that facilitate this process.

This paper aims at contributing to both issues. Within the context of the Asia Modeling Exercise (AME) we run a set of coordinated scenarios that include a baseline and a series of domestic climate policies. We complement this analysis with the issue of burden sharing, focusing on the role of international carbon quota policies. Specifically, we confront the standard, idealized case of a global carbon market with one in which this coexists with a specific carbon market for developing Asia, the Asia Emission Trading Scheme (Asia ETS).

A series of research questions are at the core of this analysis. What is the role of developing Asia in shaping global emissions and what are their abatement opportunities? How far is the baseline scenario from the 2050 targets discussed in policy, and what is the regional effort required to achieve them? How can we combine efficiency and equity, while maximizing political acceptability?

Unsurprisingly, the paper falls short of providing definitive answers to all of these important questions. Nonetheless, it strives to provide an assessment of the role of Asia in the context of climate stabilization that considers both the technological, economic and equity aspects at the same time.

The paper is structured into five sections. In the next one, we quickly describe the methodology and the set-up of the experiment. Then, we provide a diagnosis of Asia emissions under a Business-as-Usual as well as under domestic climate policies. In Sections 4 and 5, we present and discuss the role of an the Asia ETS. Conclusions are summarized in Section 6.

2. Model and scenario set-up

The analysis throughout the paper is carried out with the WITCH integrated assessment model (Bosetti et al., 2006 and www.witchmodel.org). WITCH is an inter-temporal, optimal growth model, with a game-theoretical set-up that allows to model multiple externalities. In particular, it features the climate as well as the technology externalities, the latter via international spillovers of knowledge and experience. For the sake of this paper, the climate policy scenarios in WITCH are run in two fashions. The cases of carbon taxation are implemented by imposing a pre-determined carbon tax whose revenues are fully recycled back into the economy. The cases of emission quotas, allocated to the model 13 regions, are implemented through a carbon trading market modelled in an iterative fashion, through a tâtonnement process in which demand and supply are matched by adjusting the carbon prices till the market clears. The

Table 1
The scenarios.

Scenario acronym	Scenario name	Scenario description
1a	Reference	Business-as-usual (BaU)
2a	CO ₂ price \$10 (5% p.a.)	Low carbon tax (starting at 7\$/tCO ₂ in 2013)
2b	CO ₂ price \$30 (5% p.a.)	Medium carbon tax (starting at 21\$/tCO ₂ in 2013)
2c	CO ₂ price \$50 (5% p.a.)	High carbon tax (starting at 36\$/tCO ₂ in 2013)
3a	3.7 W/m ² NTE	Stabilization at 3.7 W/m ² implemented as a carbon tax
3b	2.6 W/m ² OS	Stabilization at 2.6 W/m ² implemented as a carbon tax
4a		Stabilization at 2.6 W/m ² implemented as a quota system with one global carbon market
4b		Stabilization at 2.6 W/m ² implemented as a quota system with two carbon markets (ATS and Rest of the World ETS)

model generates financial flows in or out of the regions depending on their carbon trading position and the price of CO₂. Obviously, both systems are efficient because they equalize the regional marginal abatement cost to the carbon tax in the first case and the price of permits in the second (which for the same target are identical). However, they differ in that the quota system allows for compensation of the costs of abatement by allowing financial transfers, in proportion to the allocation of permits.

Eight scenarios are envisaged in this analysis, as described in Table 1. The first five scenarios are in adherence to the ones common to the AME exercise (Calvin et al., 2012–this issue): a Business-as-Usual, followed by 3 carbon tax cases, with values growing at the same interest rate but starting from different values in the first implementation period; and two stabilization scenarios, at 3.7 and 2.6 W/m², also implemented as a domestic carbon tax equal for all regions. In addition, we present two scenarios, focusing only on the most ambitious climate stabilization objective (the only one compatible with a 2 °C policy), both of which implemented through an international quota system with trading of permits. The first scenario features a single global carbon market. In the second, we consider two carbon markets, one that operates only for the developing Asia regions² and another for the rest of the world.

With this scenario set-up we can explore the questions raised in the introduction, by comparing policies with different levels of ambition (2a, 2b, 2c, 3a and 3b, 4a, 4b), or different implementation designs (3b, 4a, 4b). All cases but the last are idealised ones because they guarantee an efficient distribution of the abatement effort (though the only climate externality is taken care of, and thus even these scenarios are not necessarily Pareto optimal).

In order to run the 2.6 W/m² (450 ppm-*eq*) scenario, the WITCH model had to be amended to include options that allow CO₂ to be absorbed from the atmosphere. Technically, this was done by including the technology of biomass burning and storage of CO₂ in the ground (BECCS). Among the various carbon dioxide removal technologies, BECCS is considered to be a promising one, though only provided sufficient land is available to avoid clashed with other, arguably more fundamental, competing claims on land. Negative emissions technologies are key to achieving low carbon stabilization scenarios (Clarke et al.,

¹ <http://www.reuters.com/article/2010/07/16/us-china-carbon-iea-idUSTRE66F2XC20100716>

² In the model these are: China, India, South East Asia (EASIA) and South Asia (SASIA). South East Asia largely corresponds to the East Asia & Pacific region of the World Bank. We exclude China; we include New Caledonia, Brunei, French Polynesia, Guam, Northern Mariana Islands, Singapore, all in the World Bank non-OECD high income region. South Asia includes: Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات