China's provincial energy consumption, emissions and mitigation costs towards 2030

Hancheng DAI, Toshihiko MASUI
National Institute for Environmental Studies (NIES), Japan
19th* AIM International Workshop – *Tsukuba, Japan, December 13-15, 2013

Most existing integrated assessment models consider China as a homogenous region; however, in reality, China has huge regional diversity in terms of per capita GDP, per capita emissions, industry structure energy intensity, and carbon intensity and so on. Study at more detailed provincial level is needed to formulate low-carbon policies that suit regional circumstances. In this context this study establishes a new multi-region computable general equilibrium (CGE) model which explicitly represents China's 30 provinces (excluding Tibet) and 15 regions of the world economy. The model is used to project China's provincial energy consumption and emissions and assess the mitigation costs across provinces towards 2030.

Two scenarios, Business-as-Usual (BaU) scenario and Countermeasure scenario (CM), are developed. In the BaU scenario, GDP of provinces are assumed to grow at 6-8% per year from 2002-2030, no carbon emission cap or carbon intensity targets are imposed. In the CM scenario, China will reduce its carbon intensity in terms of GDP by 40% in 2020 and 60% in 2030 against 2005 level. By comparing both scenarios, we are going to find out the mitigation costs of carbon reduction across provinces.

The results show that **in the BaU scenario**, carbon intensity reduces by different extent among provinces, implying that the difficulty to reduce carbon intensity is different among provinces depending on their industry structure and energy mix. **In the CM scenario**, the carbon prices are different among provinces. Generally speaking, the more the carbon intensity decreases in the BaU scenario, the lower mitigation cost would be, vice versa. The carbon prices of Beijing, Jilin, Anhui, Chongqing, Gansu and Ningxia Provinces are relatively low, whereas those of Xinjiang, Sichuan, Hainan, Guangdong, Fujian, Heilongjiang Provinces are relatively high. In addition, most provinces would suffer GDP loss caused by carbon reduction; provinces with the highest GDP loss include Hainan (8.9%), Guangdong (6.5%), Shanghai (6.2%), Qinghai (5.3%) etc. Overall, China's GDP will fall by 3%. However, the GDP of some provinces even increases compared with BaU case, and such provinces include Guizhou, Henan, Jilin, Shanxi, and Inner Mongolia.

In conclusion, diverse trends of carbon intensity and carbon mitigation costs are observed among China's provinces. This study offers insights for regional climate policy making. Such regional diversity needs to be taken into account, e.g. when the central government sets carbon intensity targets for each province, in order to reduce negative economic costs, market based policy instrument such as inter-provincial emission trade should be introduced.