Assessment of Low-Carbon Policies for the Chinese Urban Residential Sector at Provincial Level

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Abstract

In recent years, the economy of China has developed rapidly, which directly caused an aggressive growth of energy consumption in the residential building sector. To cope with such an issue, it is necessary to setup a reduction target and promote efficiency policies. Hence, cost effectiveness is rather important in terms of policy enforcement. Thus in this study, an efficiency policy evaluation model was developed to predict district level CO_2 emission and marginal abatement cost (MAC) in the future.

The applied model consists of 3 sub-models. First the CO_2 emission sub-model estimates residential CO_2 emissions through 2050. Next the efficiency scenario sub-model provides 2 low carbon scenarios, of which reference scenario (RS) refers to government-plotted policies, and abatement scenario (AS) refers to OECD countries low carbon plans. Last but not the least the MAC sub-model produces MAC curves to evaluate the cost effectiveness of each policy.

As results, CO_2 emissions in all districts saw a 10-fold increase (2000 level compared) in the frozen technology (FT) level scenario. While in RS the FT compared reduction rates were predicted as 20% (warm area) to 40% (cold area). And in AS the reduction rates could be brought up to 60%. In cold area such like Beijing promotion of eco-appliance appears to be the most expensive policy (MAC=1271 USD per ton). Thermal retrofit is highly effective in Beijing and Shanghai however lost its advantage in Guangdong. The 3 behavioral changes policies performed well as the have strength on both energy consumption saving and cost savings.

In this study the uncertainty analysis has also been applied using Monte Carlo simulation. During the analysis, certain input values have been defined with distributions. Take Beijing's results as an example, percentile range 10% to 90%, reduction rate varied from 41% to 48%. The most influential input value was penetration rate of building retrofit in cold areas and electricity CO_2 intensity in warm areas. The same analysis has been applied on MAC for 31 districts as well.

Basing on the above assay results, this study was able to propose the optimum mitigation plan for each different climatic area.