Scenarios for the control of ozone precursors in China

XU Jiayu, ZHAO Bin

School of Environment, Tsinghua University

Rapid economic development has led to large amounts of energy consumption in China. Current projections suggest at least doubling of Chinese energy consumption up to 2030. Large amounts of primary pollutants are emitted during energy consumption, including NOx and VOC. They are transported, dispersed and transformed in the atmosphere, thus O_3 is formed. In this sense, NOx and VOC are called ozone precursors. O_3 not only does great harm to human health and ecosystems, but plays an important role in global warming. The essential way to control tropospheric O_3 concentration is to stabilize or even reduce the emissions of its precursors, mainly NOx and VOC. In this research, energy scenarios as well as emission control scenarios are developed to explore the potential and pathway to reduce NOx and VOC emissions in China.

Driving Forces

The government aims to turn China into a medium developed country by 2050, which implies the GDP per capita should be over 20,000 USD (at 2005 price). We assumed the annual average GDP growth rate would be 8.0% from 2011 to 2015, 7.5% from 2016 to 2020, 6.5% from 2021 to 2025, and 5.5% from 2026 to 2030, respectively. Total population will be 1.34 billion in 2010, 1.44 billion in 2020, and 1.47 billion in 2030, respectively. Urbanization rate is assumed to increase to 63% in 2030, representing a medium range in urbanization forecast.

Energy scenarios

Two energy scenarios, namely BAU and PC, are designed in this research. The definitions are shown in エラー! 参照元が見つかりません。. Only current legislation and compliance is considered in BAU scenario, while PC scenario assumes that new policies related to energy saving (CO_2 mitigation) are released and enforced more strictly, including life style changes, structural adjustment and energy efficiency improvement.

The total energy consumption will increase from 25.9 Mtce in 2005 to 58.9 Mtce in BAU scenario and 44.6 Mtce in PC scenario, respectively. Coal will remain dominant in both scenarios. However, in 2030, the share of coal will drop from 64% in 2005 to 55% in BAU scenario and 47% in PC scenario, respectively. Share of natural gas and other renewable is significantly higher in PC scenario compared with that in BAU, as a result of promotion of clean and renewable energy.

Pollution control scenarios

Two pollution control scenarios, namely Reference ([0]) and New Policy ([1]), are designed in this research. [0] scenario assumes current policies and compliance only, while [1] scenario assumes new policies and more strict compliance.

Results

Total NOx emission was 18.3Mt in 2005, and will nearly double in 2030 in BAU[0] scenario (33.1Mt). The emission will be reduced by 31% in 2030 in PC[0] scenario compared with BAU[0], because of a series of low carbon policies. By installing end-of-pipe anti-pollution devices, total NOx emission will experience further decrease in PC[1] scenario, and will account for only half the emission of PC[0] scenario in 2030.

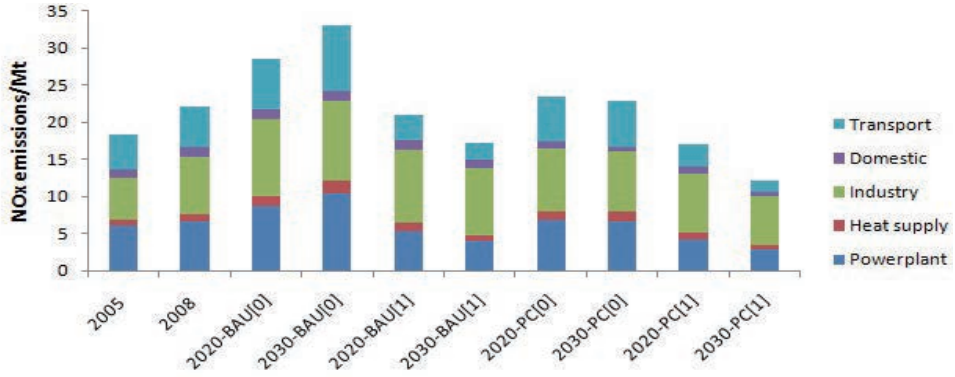

Figure 1. NOx emissions by sector

Total VOC emission was 18.7Mt in 2005, and will increase slowly to 20.5Mt in 2030 if no control measures are taken. By carrying out a series of energy saving policies, total emission will decrease to 15.9Mt in 2030 in PC[0] scenario, 22% less than that in BAU[0] scenario. Another 3.7Mt will be reduced in 2030 in PC[1] scenario compared with that of PC[0], which reflects the effect of new emission control policies implemented in transport, industry and fuel distribution sectors.

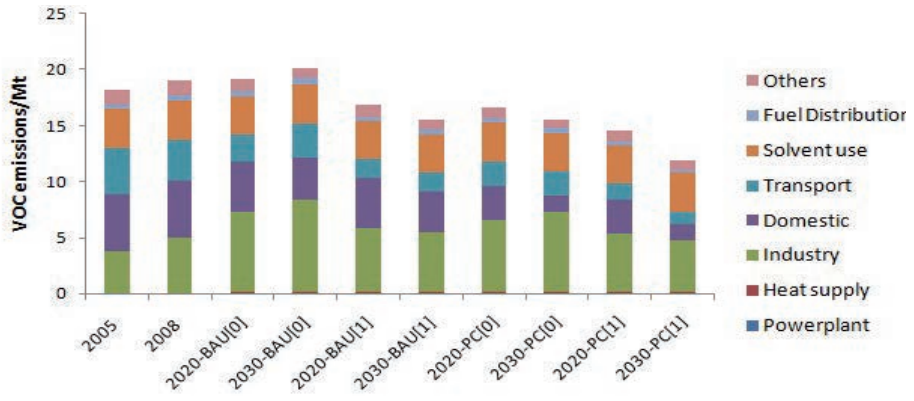

Figure 2. VOC emissions by sector