THE SOCIOECONOMIC COSTS RELATED TO AIRPOLLUTION IN CHINA

China could increase the share of renewable energy to 60 % by 2050. This would lead to drastically improved air quality resulting in a number of socioeconomic benefits. An analysis by the Danish Energy Agency, Harvard University and CNREC shows that 1.75 million deaths could be avoided and that the value of the socioeconomic gain could cover one fifth of the costs involved in a transition to a more sustainable energy production. This analysis is a part of the Danish-Chinese energy cooperation and it illustrates how socioeconomic factors can be included in scenario analysis.

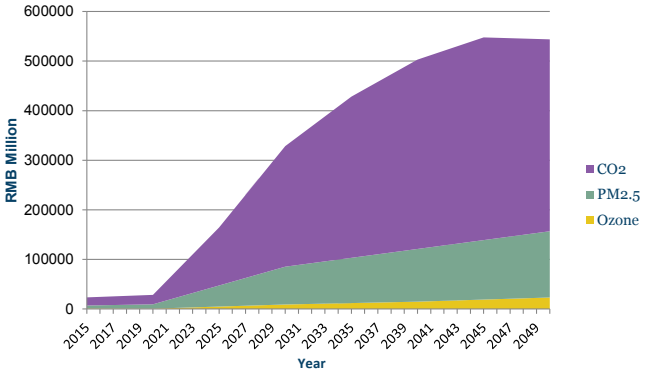
Cooperating with China National Renewable Energy Centre (CNREC) in Beijing, The Danish Energy Agency (DEA) is providing assistance in the promotion of renewable energy in China. The focal point of the cooperation has been to develop scenario analysis for the deployment of renewable energy in the Chinese energy supply from 2015 to 2050. The models analyze the direct cost of operation, investment and fuel costs for various strategies. However, they have previously not included the socioeconomic costs related to, for example, air pollution.

CNREC and DEA have therefore, in cooperation with Research Fellow Yanxu Zhang from Harvard University, prepared a socioeconomic analysis of harmful particles (PM2.5) and ozone (O3), in order to demonstrate the negative impact of air pollution on the Chinese public health. The study aims at producing data, which will allow CNREC to include socio-economic costs from air pollution into future scenario analysis. This will give CNREC a more complete picture of advantages and disadvantages of various energy supply approaches, as well as a more qualified assessment of the costs of transitioning to a renewable energy supply from coal. In developing the analyses DEA has contributed with the methodological framework, CNREC has performed emission calculations and Harvard University has made atmospheric modeling.

COAL AND AIR POLLUTION IN CHINA

Air pollution is an enormous problem in many major Chinese cities. The average concentration of harmful particles (Particulate Matters (PM) in different sizes) in Beijing is 10 times greater than the upper limit determined by the WHO. Emissions of other harmful substances such as SO2 and NOx to the atmosphere further contribute to serious health risks for the population.

ECONOMIC VALUE OF IMPROVED AIR QUALITY



SOCIOECONOMIC SCENARIO ANALYSIS

Emissions of harmful substances are closely related to the extensive use of coal in Chinese electricity production. China is the largest coal consumer in the world and a reduction in the use of fossil fuels would be an important element in reducing air pollution. Through the scenario analysis it has become evident that it is possible to limit the use of coal and increase the share of renewable energy to at least 60% by 2050, which would contribute to a significant improvement of air quality and reduce the derived health problems.

THE CONSEQUENSES OF AIR POLLUTION

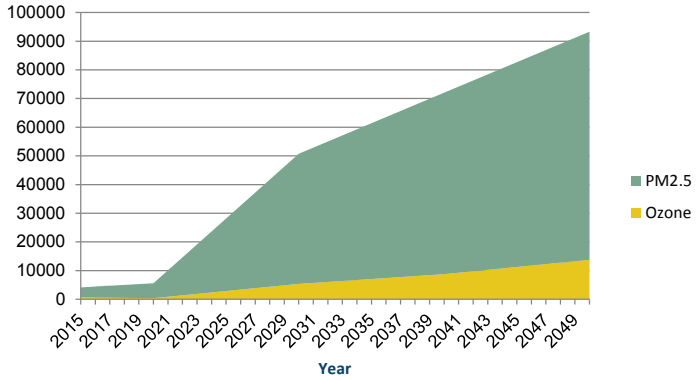
Air pollution seriously affects people's health. High concentrations of PM2.5 and ozone increases risks of premature death, as well as cardiovascular and lung diseases, both short-term and long-term. The correlation between the concentration of harmful substances in the air and mortality/ morbidity are mapped in epidemiological studies and described by statistical functions. With basis in PM2.5 concentrations it is possible to calculate share of mortality/morbidity caused by PM2.5.

Air pollution also affects – via SO2 pollution – buildings, agriculture plants and wildlife negatively. The effects on health are, however, considered the most important in economic terms and other harmful effects are therefore not included in the investigation.

Increased mortality and morbidity causes societal costs in terms of loss of production, increased costs for the health services etc. Power plants and other emitters of harmful substances inflict increased cost for third parties, which are not reflected in the prices.

When comparing future costs (fuel, operation, investment, interest etc.) of different strategies of energy supply, the value of externalities can therefore be included advantageously, when evaluating how society is affected by different strategies.

AVOIDED DEATHS FROM AIR POLLUTION



QUANTIFICATION

The study compares two scenarios for development of energy supply up to 2050. The first is based on a continuation of the current Chinese five-year plan (2011-2015), which means a renewable energy share of 20 % in 2050. The second scenario is based on a more sustainable energy production with a share of renewable energy of 60 %.

The project focuses on PM 2.5 and ozone concentration in the air and how this affects mortality in China. CO2-emisions are included in the analysis, despite the fact that these do not have a direct impact health. They are included in recognition of the fact that it is a greenhouse gas, which causes global warming and consequently has significant harmful effects.

Calculations indicate that 1,750,000 deaths, in the period 2015 to 2050, may possibly be avoided by implementing the scenario with a high share of renewable energy. PM2.5 is estimated to cause 80 % of these deaths and ozone 20 %.

ECONOMIC ASSESSMENT

Assessed using the VSL (Value of Statistical Life) 1.75 million deaths represent a socio-economic loss of 2.9 billion (10^12) RMB from 2015-2050. VSL may, according to recent Chinese research, make up 1.68 million RMB. Hence, a strategy with a large share of renewable energy entails a socioeconomic gain of 2.9 billion RMB; a value that can contribute to finance potential additional costs for the more sustainable strategy.

If the value of reduced CO2-emissions, by increased use of renewable energy, is added to the value of 130 RMB/tonne CO2 corresponding to the damage costs assessed by the American Environmental Protection Agency the value of external costs are reduced by additional 8.7 billion RMB for the period 2015-2050, totalling 11.6 billion RMB or 0.3 billion annually.

The scenario analysis shows that additional costs in the electricity sector, through the implementation of the high share of renewable energy strategy, amounts to 1.5 billion RMB annually. The socioeconomic benefit from air pollution constitutes app. 20 % of the differences in costs.

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