China's prospect to peak its CO_2 emissions around 2030
- Indicator from IEEJ/IEA Energy Outlook -

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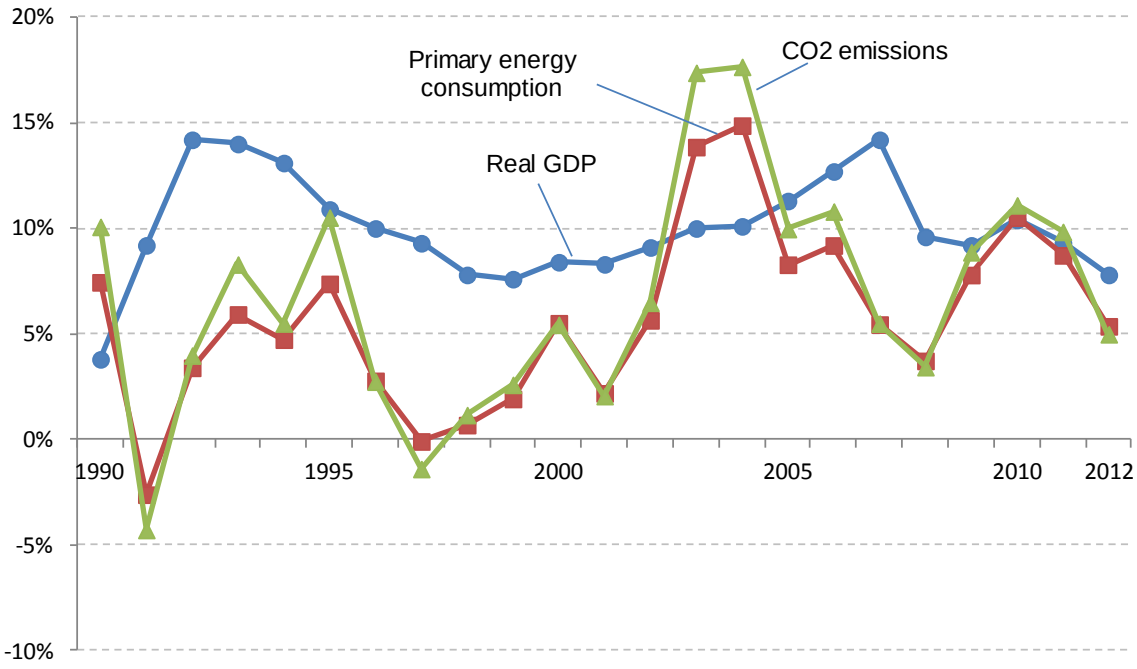
China is currently the world's largest CO_2 emitter, and accounted for 26% of the world's total emissions in 2012. With respect to the issue of global climate change, China's movements will produce a great impact on the effectiveness of CO_2 emission reduction efforts in terms of reducing future greenhouse-gas emissions globally. Prior to the final phase of negotiations over the international framework with respect to combating climate change for the year 2020 and thereafter, which is to be discussed at COP21 next year, on November 12, a U.S.-China joint statement was issued following a summit meeting in Beijing between President Obama and President Xi Jinping of China. In said statement, China announced its targets to peak its CO_2 emissions around 2030.
Is such an ambitious CO_2 emission target attainable? Moreover, if so, what approaches must be taken to reach the goal? In this article, we will explore answers to those questions based on the reports made in the Asia/World Energy Outlook 2014 published in October 2014 by our institution (hereafter, IEEJ Outlook) and the World Energy Outlook 2014 published in November 2014 by the International Energy Agency (hereafter, IEA Outlook).

■ Current status of China's economic growth, energy consumption, and CO_2 emissions

For 20 years following 1990, the Chinese economy experienced a rapid, average annual growth rate of 10%. This economic growth was accompanied by an annual increase of 5.6% (1990-2012) in the average of primary energy consumption. Its average annual increase rate of fossil fuel consumption in particular exceeded 6.3%, with fossil fuel accounting for 88% of the total primary energy consumption in 2012. During the same period, CO_2 emissions from fossil-derived fuels increased at an annual rate of 6.4%.

68% of primary energy consumption in China, and 85% of CO_2 emissions in 2012, were generated from coal, compared with oil and natural gas, which respectively represented 16% and 4% of primary energy consumption, and 13% and 3% of CO_2 emissions.



Source) estimated according to World Development Indicators, World Bank , and IEA Energy Statistics

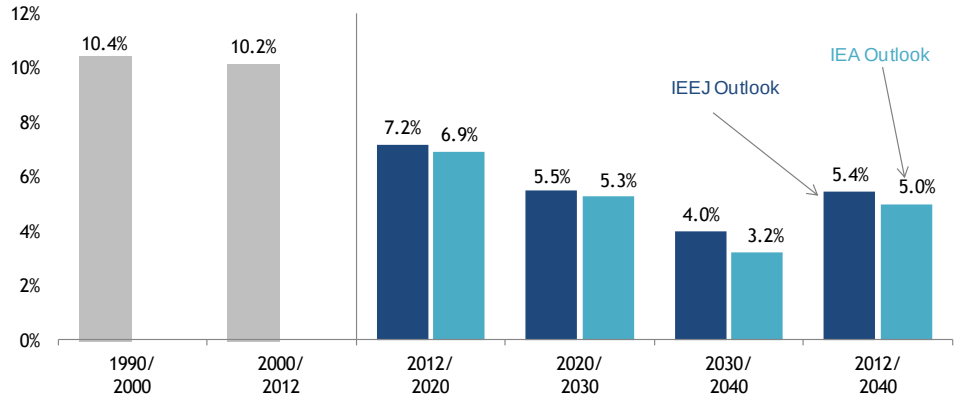
Figure 1 Rates of change in China's real GDP, primary energy consumption, CO_2 emission

■ Outlook of economic growth in China

China is now the world's second-largest economy after the United States. While it has attained a certain level of industrialization and urbanization, its 2013 nominal GDP per capita sits at around $7,000, which is less than one fifth of that of Japan, indicating that there is still significant room for growth.

The economy, which had been driven by exports and investment, now faces the need to shift its focus to domestic consumption in order to sustain its growth. The working population is predicted to start declining around 2015, making it difficult to target a strong growth rate of around 10% as in the past. In 2012, the real GDP growth rate for 2013 was already below 8%, with a further drop to 7.3% during the July-September period this year.

With regard to future economic growth in China, both the IEEJ and IEA project rates around 7% to be maintained to 2020, and a decline to the 5% level in the 2020s, and 3-4% in the 2030s.



Source) IEEJ Asia/World Energy Outlook 2014, IEA World Energy Outlook 2014

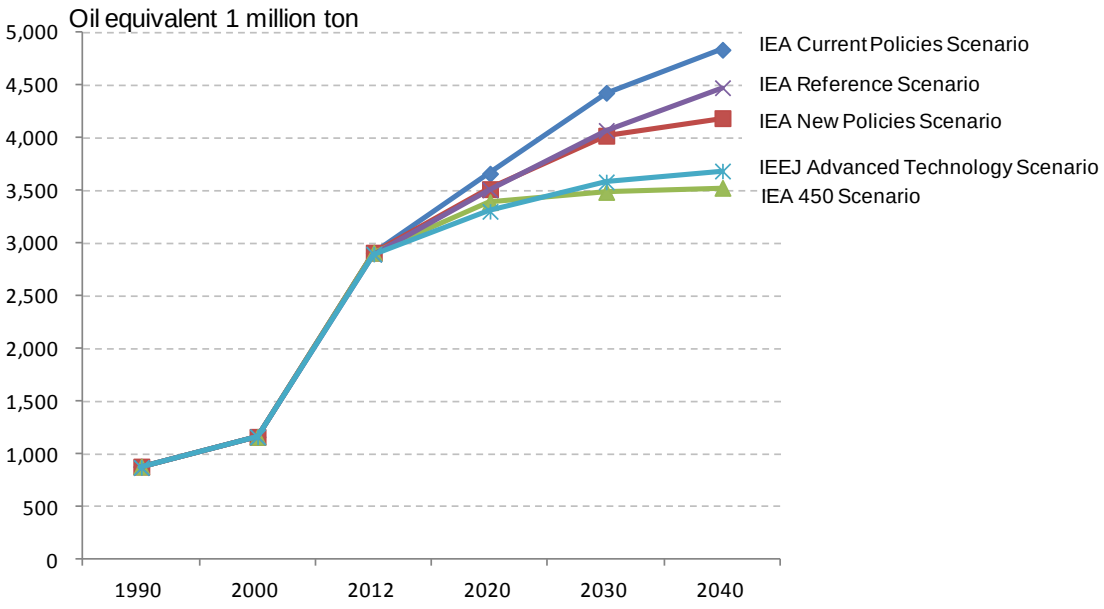
Figure 2 China's real GDP growth rate prediction

■ Outlook on energy supply-demand and CO_2 emissions

Slowing economic growth is expected to impact how energy consumption increases in China. All the predictions, from two scenarios[1] provided in the IEEJ Outlook to three scenarios[2] in the IEA outlook, still forecast primary energy consumption in China to continue to increase even after 2030, though there are some fluctuations in value. In most cases, the Outlook on CO_2 emissions also shows a steady rise to 2030, with some estimating a shift to decline in 2030 and thereafter.

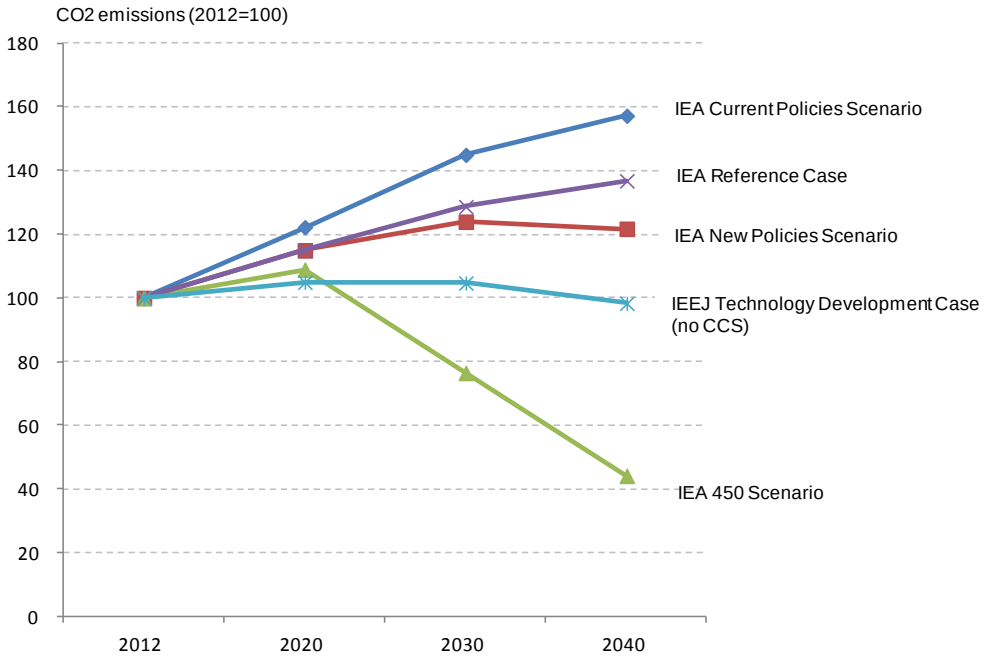
[1] The IEEJ predicts energy supply-demand trends through its Reference Scenario, based on current economic/social conditions, by considering policies that are more likely to be enacted and developing technologies that have high potential to be popularized. Advanced Technology Scenario assumes accelerated technological advancements and extensive expansion of innovative technologies, based on a foundation of securing stable energy supply, the enforcement of climate change countermeasures, and the promotion of international technological collaboration and transfers.

[2] IEA provides forecasts in the Current Policies Scenario assuming the maintenance of current policies, as well as the New Policies Scenario (it demonstrates a scenario where all the recent pledges and plans related to global warming, including those that have not officially been adopted, are being enforced) and the 450 Scenario (a projection to stabilize the concentration of greenhouse gases in the atmosphere at 450 ppm).



Source) IEEJ Asia/World Energy Outlook 2014, IEA World Energy Outlook 2014

Figure 3 Outlook on primary energy consumption in China



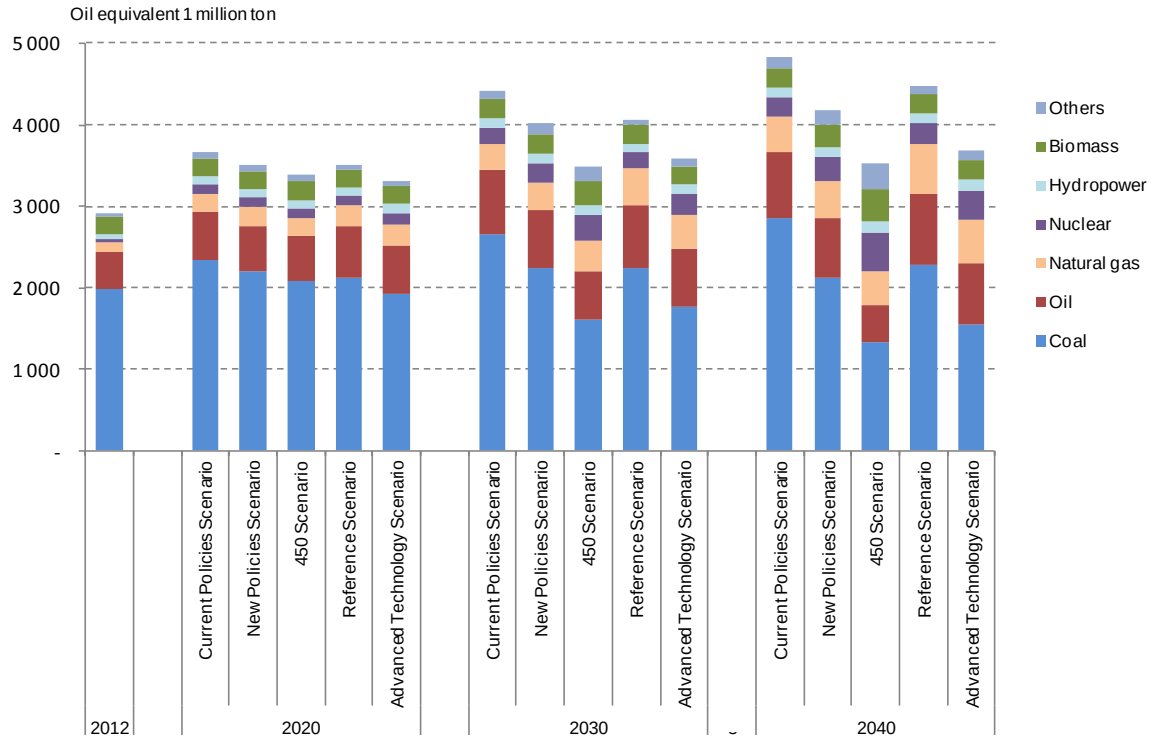
Source) IEEJ Asia/World Energy Outlook 2014, IEA World Energy Outlook 2014

Figure 4 Outlook on CO_2 emissions in China

The Current Policies Scenario by IEA Outlook, which incorporated policy objectives only up to 2015 in its 12th five-year plan, forecasts steady increase in both energy consumption and CO_2 emissions in China to 2040.

The IEEJ Outlook Reference Scenario envisions, beyond reaching a certain level of industrial restructuring, energy efficiency improvement at the current pace, and the implementation of the target for non-fossil driven energy sources, such as hydropower, atomic-power, windpower, and solar power by 2020. It predicts lower energy consumption and CO_2 emission as of 2020 than that

of the Current Policies Scenario by IEA Outlook, but they follow an ongoing trend after 2020, with CO_2 emissions continuing to increase in 2030 and thereafter.
On the other hand,the New Policies Scenario by IEA Outlook incorporates the assumption of fully meeting the targets for energy-saving and non-fossil driven energy implementation by 2020. This Scenario also speculates on the attainment of additional enhancements in energy efficiency standards for the industry, transport, and buildings, the promotion of alternative fuel automobiles, abolition of fossil fuel subsidies, reform of the energy pricing system, CO_2 emission pricing after 2020, and further expansions in non-fossil fuel use. The result indicates that the pace of energy consumption increase will slow in China, and CO_2 emissions will start to decline after peaking around 2030.
IEEJ's Advanced Technology Scenario (no CCS) also integrates advancements in industrial restructuring as in the Reference Scenario, and assumes the earliest application of energy-saving technologies over all sectors, and further expansion of non-fossil fuel usage in 2020 and thereafter. This scerario indicates a more moderate increase in China's energy consumption than that predicted by the IEA's New Policies Scenario. It shows that coal consumption will peak before 2020, followed by a constant decline driven by energy-saving measures and alternative energy use. The report concludes that CO_2 emissions will level off in the 2020s, turning to downward movement in the 2030s, and will then go below the 2012 level as of 2040.
The 450 Scenario by IEA Outlook predicts higher coal prices, advancing energy-saving measures, and the large-scale introduction of CCS in 2020, depicting China's primary energy consumption to show only a slight increase after 2030, with its CO_2 emissions drastically falling starting around 2020.



Source) IEEJ Asia/World Energy Outlook 2014, IEA World Energy Outlook 2014

Figure 5 Outlook on primary energy consumption by source in China

■ China's prospect to peak its CO_2 emissions around 2030

Among the three Scenarios that forecast CO_2 emissions will peak around 2030, the 450 Scenario by IEA Outlook was calculated backwards from the target goal of 450 ppm to stabilize the concentration of the relevant greenhouse gas; thus, the actual likelihood of realization is not necessarily high.

The IEEJ's Advanced Technology Scenario is based on the premise of implementing ideal degrees of advancement and the diffusion of related energy technologies in both the demand and supply sides. These technologies are assumed to progress at a maximum pace even beyond the governmental targets from the early stages, resulting in the stabilization of CO_2 emissions early, around 2020. The post 2030 period will see a relative decline in energy saving potential as advanced industry structures are achieved and energy use efficiency is improved, while maintaining the pace to decarbonize. CO_2 emissions reduced through energy-saving and decarbonizing the energy supply are expected to exceed the emission amount incurred from the low growth rate of 4%, and will turn the overall emission toward a decline (See Figure 6). In these four projections, except the IEA's 450 Scenario, The Advanced Technology Scenario by IEEJ Outlook estimates the most rapid progress in energy-saving and the decarbonization process, yet commands a relatively high cost.

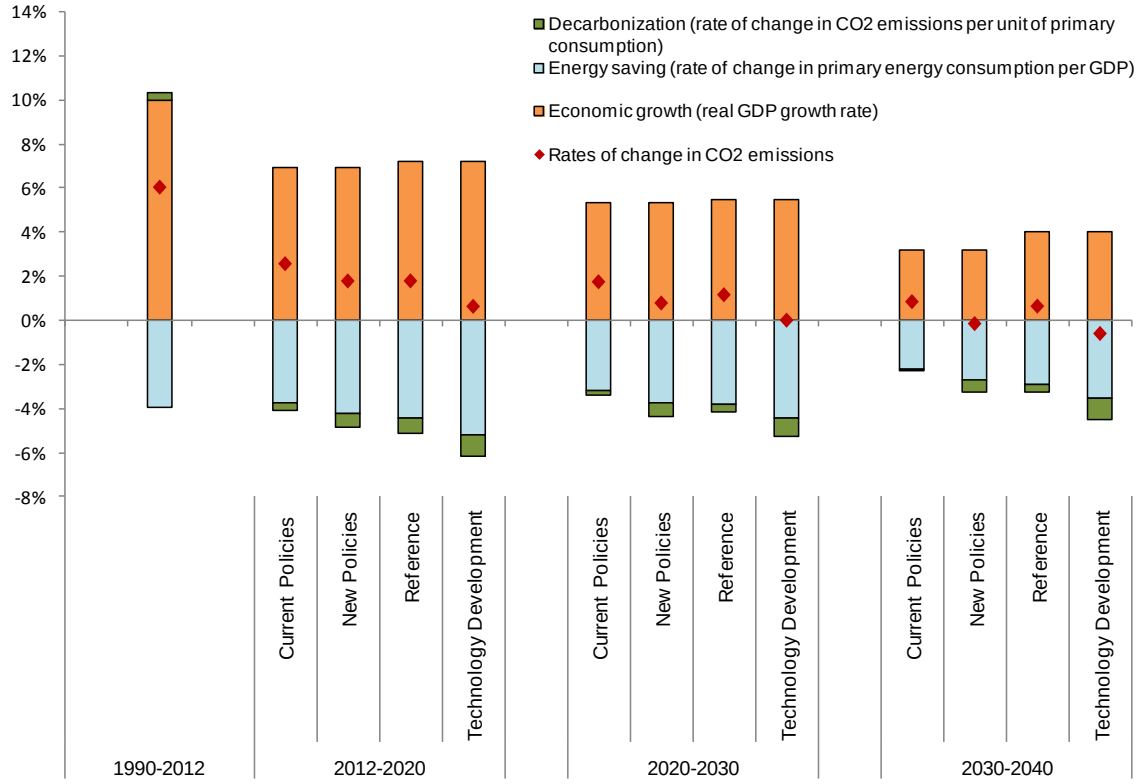
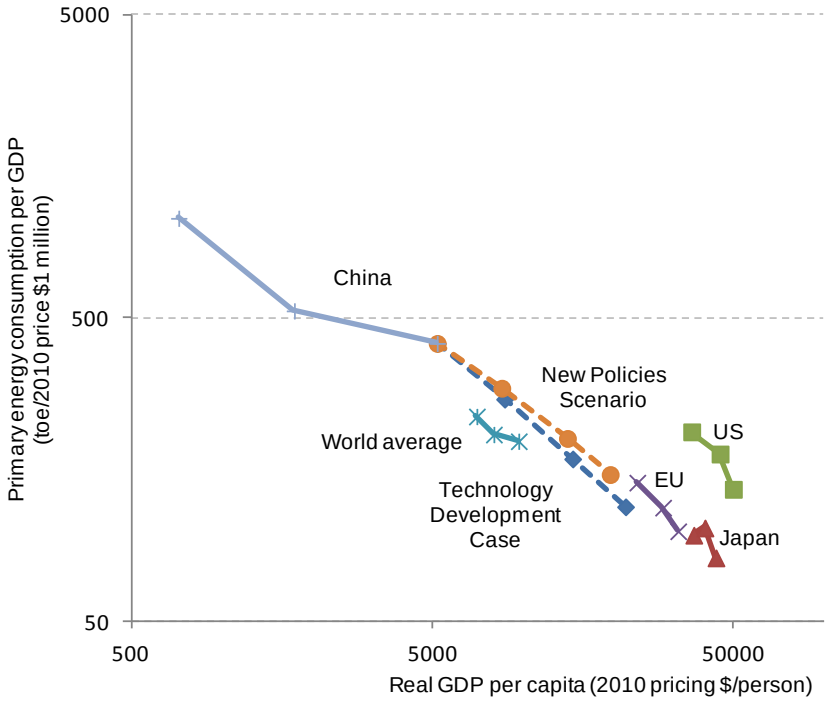


Figure 6 Factor analysis on the rate of change in CO_2 emission

The IEA's New Policies Scenario presents approaches that may most closely reflect the hopes of the Chinese government. It takes account of factors such as slower economic growth and industry restructuring, and predicts further popularized energy-saving technologies through regulations and support to ease the energy demand increase. Following 2020, the continued support of decarbonization efforts will expand the use of nuclear power and renewable energy, leading to a structural shift to natural gas from coal, even among fossil-fuel options. The consumption of coal will start to decline during the 2020s. The period after 2030 will see CO_2 emissions peak, thanks to combined effects, including a significantly decelerated economic growth rate.

The possibility of easing the energy consumption increase in China will be discussed in comparison with other major countries and regions. As shown in Figure 7, in many developed countries, energy

intensity (primary energy consumption per real GDP) declines as economic levels (real GDP per capita) rise after reaching a certain level of industrialization. As the development with respect to heavy industrialization in China appears to have settled in the past few years, it is anticipated to show a constant decline in the energy intensity as the economy advances. The IEA's New Policies Scenario predicts that the energy intensity will improve toward 2040 to the levels that EU countries were at in 1990, as real GDP per capita in China increases to the average level for EU countries in 1990. Considering what EU countries have accomplished, this progress model may be feasible.



Note) Actual values are in solid lines, predicted values are in dotted lines
Actual figures in each country are from 1990, 2000, and 2012. Predicted values for China are for 2020, 2030, and 2040.

Figure 6 International comparison of economic levels and energy intensities

With respect to low-carbonization energy in the IEA's New Policies Scenario, 21% of China's primary energy consumption in 2040 comes from non-fossil energy, such as nuclear power, hydropower, windpower, solar power, and biomass fuel. 40% of electricity will be generated from non-fossil energy source. The "variable renewables", which have unstable output, such as windpower and solar power, will account for 13% of the generated power, and 24% of facility capacity. Considering the fact that this variable power ratio level has been already been realized in countries such as Germany and Spain, it is technologically feasible, especially considering the anticipated future technological advancements.

Such examinations lead us to conclude that having CO_2 emissions peak in China around 2030 is not unachievable. In line with the recent comment made by Mr. Zhenhua Xie, a leading expert of climate change countermeasures in the Chinese government, this target "must be realized through comprehensive policy approaches covering energy-saving, improved energy use efficiency, the development of renewable energy and non-fossil energy, increased carbon sinks using forestry assets, and enhanced adaptability.[1]" The goal of having CO_2 emissions peak around 2030 will require solid attainment of both energy saving and the non-fossil energy implementation schedule by the government by 2020. In addition, strong policy establishment and enforcement will be required to be continued over both the system and technologies after 2020. One notable point is the lower coal prices

[1] Comments made at a press conference on November 25, 2014.

in recent years and the sharp decline in crude oil prices. An imminent challenge is to overcome the negative impact from such lower energy prices, and maintain incentives for energy-saving efforts by businesses and individuals.

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