



# Challenges of rapid economic growth in China: Reconciling sustainable energy use, environmental stewardship and social development

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## ABSTRACT

China aims at quadrupling per-capita GDP by 2020 compared to the year 2000. Without any energy and environmental policy measures, this tremendous economic growth would be associated with a quadrupling of primary energy consumption up to 6.3 billion tons of standard coal equivalents (sce) and energy-related CO<sub>2</sub>-emissions of 13.9 billion tons. Against this background, this paper is to set China's need to implement its sustainable development strategy into the quantitative context of the countries economic development and subsequent economic growth-related environmental problems. China is urgently searching for a way to ease the negative implications of economic growth and has committed itself to achieve a level of 3.0 billion ton sce primary energy consumption in 2020. As a consequence, the macro-economic energy intensity has to be reduced by 53% by 2020. A reduction of 53% by 2020 would lead to an energy intensity level 30% points below the year-2000 level of developed countries. As for natural resources, the expected economic growth will lead to an increase of crude oil net-imports up to 455 million ton sce in 2020 and 650 million ton sce in 2030. As for regional income distribution, economic growth helped to decrease existing inequities.

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## 1. Introduction

The term *sustainable development* has no single, comprehensive definition; more than 100 definitions can be found for this abstract concept (GDRC, 2005). The most frequently quoted definition is taken from the Brundtland report "Our Common Future": "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (GDRC, 2005). Along the lines of this definition, sustainable development implies improving the quality of life for all of the Earth's citizens without increasing the use of natural resources beyond the regeneration capacity of the environment.

Sustainable development is not a new idea. In human history, many cultures have recognized the need for harmony between the environment, society, and economy. In economics, this concept has been developed in the forestry sector, stating that not more

wood shall be cut than the forest is able to grow. Generally, sustainable development is seen as having three pillars: economy, ecology and a social dimension (Klemmer, 1994, pp. 14–18). For example, economic development should not only entail mere profit maximisation goals but should incorporate income redistribution mechanisms in cases where the market mechanisms fail to provide a socially fair outcome. Economic decisions also should internalise the external costs of their environmentally detrimental side effects. It has been attempted to measure the level of sustainable development by certain indicators of efficiency in these fields such as energy efficiency, emission intensities, etc.

China's sustainable development strategy is embedded in the country's efforts to transform China into a modern society with tremendous expectations of economic growth. Since 1980, the Chinese economy grew by about 8% per year until 2001. Real GDP quadrupled during this period. Although average per-capita income is still expected to more than triple by 2020 (Suding, 2005, p. 2), there are further increasing regional gaps in income growth between the prospering East and South coastal provinces and the hinterland. To achieve these economic development goals without severe energy security problems, e.g. relating to crude oil, China has to save energy specifically. In this article, energy security generally is defined as the sufficient and price-worthy

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allocation of energy resources to the energy users. Specifically, energy security issues in China, inter alia, touch aspects such as sufficient transport capacities, e.g. for coal and natural gas, security of supply for crude oil and sufficient generation capacities for electricity. Negative side effects of this substantial economic growth are increasing environmental degradation (e.g., forest degradation through acid rain) and growing social problems (e.g., educational shortfalls and increasing crime rates caused by migration). One instrument to ease the negative socio-economic and environmental implications of this growth pattern is to integrate economic, environmental and social policy into a national sustainable development strategy.

This paper is to set China's need to develop a sustainable development strategy and the current approaches to implement this strategy into the quantitative context of the countries economic development and subsequent economic growth-related environmental problems.

After giving an introduction into the problem (Section 1), China's rapid economic growth and future development goals are analysed (Section 2). Section 3 provides for an overview of the evolution of China's approach towards a sustainable development and the current state of China's sustainable development strategy. Against this background, Section 4 analyses the consequences of China's economic growth for its approach towards a sustainable energy, environmental and social development. Special focus are the resulting challenges for specific energy saving and emissions levels, net-imports of crude oil and the implications for regional income distribution inequities. A summary concludes this paper.

## 2. China's rapid economic growth and future development goals

One of the most important objectives of economic policy in China is economic growth to ensure the growing wealth of its 1.3 billion inhabitants, the most populated country on earth.

This welfare goal has top priority for the Chinese government. The record of the past 20 years shows almost a septuplication of real GDP from 1.8 trillion RMB in 1980 to 13.2 trillion RMB in 2004 (see Table 1). In purchasing power parities (PPP) which equalizes the purchasing power of different currencies in their home countries for a given basket of goods, China's GDP in 2004 reached 7334 billion US\$ (IMF, 2007).

In the same period of time, an annual 1.2% growth of population and an annual 7.4% increase of per-capita income led to a rising demand of private households in every category of consumption, including energy, e.g. for transportation purposes. This remarkable growth of economy and welfare in China was accompanied by a 3.7% p.a. improvement of energy efficiency,

leading to a moderate annual growth of primary energy consumption of 4.4% p.a. and a 4.4% p.a. growth of energy-related greenhouse gas emissions of carbon dioxide (CO<sub>2</sub>) in China. Due to end-of-pipe technologies (filters for desulphurisation) a substitution of high-sulphur coal with low-sulphur coal and a slight increase of coal washing, the emissions of regional sulphur dioxide (SO<sub>2</sub>) decreased by 2.7% p.a. (see Table 1).

China's government again aims at quadrupling real GDP per capita in exchange rates up to about 15,700 US\$ by 2020 against 2000 (Suding, 2005, p. 2). This task represents an extrapolation of the macro-economic trend of about 8% p.a. between 1980 and 2001. Against this background, the realisation of a sustainable development approach has to cope with a considerable growth of energy and natural resource consumption, along with related social implications. Before these implications can be analysed, in the following section, the evolution of China's approach towards a sustainable development have to be described.

## 3. Evolution of China's approach towards a sustainable development

China's approach towards sustainable development can be divided into comprises four steps: the formulation of a national strategy, the preliminary establishment of a legal system of the national strategy, the establishment of an institutional framework and the implementation of the national strategy through a national development plan. In the following, these four steps are briefly described.

### 3.1. Formulation of a national strategy

Formulating China's national strategy for sustainable development, three milestones can be identified:

#### 3.1.1. China's agenda 21: white paper on China's population, environment, and development in the 21st century in 1994

Following the outcome of the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, in the same year China started to draft its national Agenda 21. In July 1994, the State Council promulgated "China's Agenda 21: White Paper on China's Population, Environment, and Development in the 21st Century". The white paper describes policies and measures that have been taken and shall be taken in the future to achieve a sustainable development in China (China's Agenda 21, 1994). The Agenda contains general information about strategies and policies for sustainable development as well as specific sectoral development measures, e.g. in the fields of population, health, economic and environmental policies.

**Table 1**  
Development of selected macro-economic variables in China (1980–2004).

	1980	1985	1990	1995	2000	2001	2002	2003	2004	1980–2004 <sup>b</sup>
Real GDP <sup>a</sup> (billion RMB)	1809	2999	3756	6458	9038	9791	10,667	11,765	13,203	8.6
Population (million)	987	1045	1143	1211	1267	1276	1285	1292	1300	1.2
Per capita income (RMB)	1833	2869	3286	5332	7128	7564	8274	9104	10,157	7.4
Primary energy supply (Mt. sce)	621	783	970	1270	1156	1274	1452	1685	n.a.	4.4 <sup>c</sup>
PES/GDP (t SCE/1000 RMB)	0.343	0.261	0.258	0.197	0.128	0.132	0.137	0.143	n.a.	−3.7 <sup>b</sup>
CO <sub>2</sub> -emissions (million ton)	1538	1939	2391	3100	2771	3036	3503	4150	n.a.	4.4 <sup>c</sup>
SO <sub>2</sub> -emissions (million ton)	12	16	19	25	20	20	19	22	23	2.7

Source: ZRGGT (different years); LBL (2004).

<sup>a</sup> In prices of 1998.

<sup>b</sup> Annual average growth rate, own calculations.

<sup>c</sup> Growth rate 1980–2003.

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