1. 概述

背景

在不到一代人的时间内，中国成为了世界机动车生产和销售市场的第一大国。在许多城市，从前满街自行车的景象已被拥堵的机动车流所取代，而这其中，大部分是国产的轿车、摩托车、卡车和巴士。中国的汽车年销售量（不含摩托车和农用车）从1980年的25万辆增长至2009年的1400万辆。摩托车的销售量（包含电动自行车）也从80年代的60万辆飞速增长至2009年的5000万辆以上。

环境保护部于2008年正式成为国务院组成部委，该部及其前身[1]长期致力于减少机动车及其它空气污染。在过去的10年中，根据中国《大气污染防治法》的规定，中国已经实施了一系列逐步加严的机动车和燃料管理标准，配合相关监督及维修保养措施，划定限行区，以求改善空气质量。然而，快速增长的机动车数量带来了严峻的挑战。一辆辆汽车走下流水线，加入到城市交通，对本已不堪重负的空气造成更多污染。随着工业企业逐渐搬离各大城市，交通领域成为细微颗粒物(PM2.5)、灰霾、烟雾和其它严重空气质量问题的主要源头之一[2]。而由此引发的健康危害则包括过早死亡和提高呼吸道及心血管疾病的发病率。

出于减少石油依赖性的考虑，中国于2005年引入了轻型乘用车和摩托车燃料消耗标准，成为世界上为数不多的首批实施这类法规的国家之一。的确，在过去的15年当中，中国已经从一个石油自给自足的国家逐渐成为世界上最大的原油进口国之一。20世纪末，中国已经成为仅次于美国和日本的世界第三大原油消耗国。而促使中国原油消耗量增长的一个主要因素就是快速增长的交通流量，特别是机动车数量的增长[3]。2009年，交通领域所消耗的原油约占中国原油总消耗量的60%。

目标和方法

受中国环境保护部的委托，国际清洁交通委员会（以下简称ICCT）对中国机动车排放控制政策实施的成果与不足进行评估。此外，环保部要求ICCT对不同政策选择和实施情景进行短期和较长期（2010-2030年）的分析评估，政策涉及城市和区域空气污染以及气候影响。实施情景分析包括对实施更加严格的车辆和燃料标准、改善实施措施、加严燃料消耗量标准以及新能源车辆技术和替代燃料的影响进行分析评估。

ICCT在此报告中的评估结果既包括了各种情景下对常规排放物、温室气体排放、燃料消耗和公众健康影响的定量分析，也包括中国在这些方面的政策措施与国际先进措施的定性对比。此次，ICCT与环保部下属的政策研究机构机动车排污监控中心（以下简称VECC）紧密合作，此外还有由贺克斌教授领导的来自清华大学的研究人员，负责采集中国机动车保有量和环保部相关项目的详细信息和数据。

1 环境保护部的前身为1974年成立的国务院环境保护领导小组，之后于1978年成为城乡建设环保部的环保局，1988年成为国务院直属的国家环境保护局，1998年成为国务院直属的国家环境保护总局。在2008年，环境保护部正式成为国务院组成部委。

2 柴发合，2009，《“十二五”中的大气污染控制法规》，发表于第五届区域空气质量管理会议，中国北京，09年10月26日。郝吉明，2008，《通过排放控制保障北京奥运期间空气质量》，08年11月6日。

3 贺克斌、霍红、张强、何东全、Michael Walsh、王全录，2005年，《中国道路交通燃料消耗和CO_2排放现状、未来趋势及政策实施》能源政策33卷。

1. Executive summary

Introduction

In less than a generation, China has become the world's leading motor vehicle market in terms of both production and sales. The iconic image of bicycle-filled boulevards has been replaced in many cities by one of congested roadways where primarily domestically produced cars, motorcycles, trucks, and buses vie for space. Annual sales of on-road vehicles (excluding two-wheelers and rural vehicles) have grown from roughly 250,000 in 1980 to nearly 14 million in 2009. Annual sales of two-wheelers (including electric bikes) have grown from about 600,000 to a staggering 50 million plus.

The Ministry of Environmental Protection (MEP), which achieved cabinet-level ministry status in 2008, is on the front line of efforts to mitigate the air pollution resulting from these vehicles and other sources[1]. In the last decade, under the auspices of the China Air Pollution Prevention and Control Law, China has implemented a series of increasingly stringent vehicle and fuel standards, inspection and maintenance programs, and traffic restriction zones to improve air quality. However, the rapidly growing vehicle fleet poses a great challenge. Every vehicle rolling down the assembly line and joining traffic on those roadways adds to an already heavy burden of air pollution. With industry increasingly located away from the big cities, motorized transportation has become one of the leading contributors to fine particulate matter pollution (PM2.5), haze, smog, and other serious air quality problems[2]. The resulting public health impacts range from increased risk of premature death to rising incidence of respiratory and cardiovascular diseases.

Driven by oil independence concerns, China was among the first countries in the world to adopt its first phase of fuel consumption standard for light-duty passenger vehicles in 2005 and has also regulated motorcycle fuel consumption. Indeed over the past decade and a half, China has gone from being self sufficient in oil to becoming one of the largest importers in the world. By the end of the 20th century, China became the world's third largest oil consumer after the US and Japan. One of the major drivers of this increase in Chinese oil consumption is the rapid growth of the transportation sector in general and motor vehicles in particular[3]. About 60% of China's oil consumption in 2009 was for transportation.

Objectives and methodology

At the request of MEP, the International Council on Clean Transportation (ICCT) has undertaken an assessment of the accomplishments to date and deficiencies of China's current vehicle emission control program. Further, MEP asked the ICCT to assess the impact of various policy options and implementation scenarios in the short- and longer term (between 2010 and 2030) covering urban and regional air pollutants as well as emissions of climate forcers. The scenarios are to include the potential tightening of vehicle and fuel standards along with improvements to the compliance program, improvements in fuel consumption standards, and the impact of advanced vehicle technologies and alternative fuels.

1 The MEP, formerly known as the State Council Leadership Group of Environmental Protection, was established in 1974. The agency was elevated to become the Bureau of Environmental Protection under the Ministry of Urban and Rural Construction and Environmental Protection in 1978, then became the National Environmental Protection Agency (NEPA) in 1988, directly reporting to the State Council. In 1998, NEPA became the State Environmental Protection Administration (SEPA) directly under the State Council. And in 2008, it was formally elevated to the cabinet-level as the Ministry of Environmental Protection, as one of the ministries of the State Council.

2 Chai Fahe, 2009. Air Pollution Control Law in the 12th Five Year Plan. Presentation at the 5th Regional Air Quality Management Conference, Beijing, China. 10/26/09; Hao Jiming, 2008. Emission Control to Guarantee the Air Quality during the Olympic Games in Beijing. 11/6/08.

3 He, Huo, Zhang, He, Walsh and Wang, 2005. Oil consumption and CO_2 emissions in China's road transport, current status, future trends and policy implication. Energy Policy Vol. 33.

此次的定量分析主要以中国机动车模型（China Fleet Model, CFM）及健康影响评估方法（Health Impact Assessment, HIA）[4]为基础。CFM模型能够根据以往和今后的不同政策方案，测算中国机动车的排放和燃料消耗。该模型能够测算所有与空气质量和气候变化相关的排放污染物，如一氧化碳、氮氧化物、碳氢化合物、颗粒物、二氧化碳、一氧化二氮、甲烷和黑炭。使用者可以在该模型中设定不同的新车排放标准、燃料硫含量和车辆燃料消耗标准情景。使用者还可以在模型中调整政策的执行实施效果以及电动车的推广程度。

为了评估现有政策，ICCT进行了一项对比，即以上世纪90年代末为起点，将执行车辆和燃料标准以及相关排放控制手段与不实施任何管理办法的效果进行对比（“现行管理”对比 “无管理”）。

在对未来进行预测时，排放量与燃料消耗量的预测，都是假定实施了管理措施，即所有目前采用的管理方案措施都有效的实施，并考虑了车辆保有量的持续增长。对未来的政策方案改善进行潜在评估时，多设计了两个额外的情景（“改善方案”与“强化方案”）。我们同时评估了这两种情景稍有差异的情况下延迟实施机动车标准（推迟到2020年实施国VI标准，而不是2015年）所带来的影响。我们还特别设计了一个情景，来反映城市地区的不同政策选择（“城市改善方案”）。在开发设计这些情景时，我们咨询了来自VECC和清华大学的项目人员以及环保部的官员。排放和燃料标准、燃料消耗量标准和实施方案的情景设计反映了项目人员对今后10-20年中可能取得的进展的最佳判断。情景设计详见表1.1。

在进行定性分析之初，我们深入的研究了制定新车和燃料标准及其执行方法的最佳经验。为了达到这一目的，我们综合了美国、欧盟、日本的成熟机动车排放控制措施，并将这些与中国国情相结合。与此同时，ICCT在VECC与清华大学的协助下，了解掌握了中国现行的管理措施。我们重点研究了排放标志，这是一种为消费者提供信息和实施在用车管理的手段。ICCT还开展了燃料经济性/消耗量和温室气体方案以及替代燃料和新能源汽车方案的评估。虽然这些项目目前尚不是环保部的工作重点，但随着对交通领域气候影响的增加，环保部将越来越多的参与到这些领域当中。对于所有评估的项目，ICCT都会将中国现有措施与国际先进案例进行对比，并指明中国在未来发展中的障碍。

4 中国机动车模型及健康影响评估方法资料详见附录B。

The ICCT assessment presented in this report includes a quantitative analysis of each scenario's impact on conventional and climate forcer emissions, fuel consumption and public health as well as a qualitative comparison of China's programs to international best practices. The ICCT team worked closely with the Vehicle Emission Control Center (VECC), which is a policy research center affiliated with MEP, and a team of researchers from Tsinghua University led by Prof. He Kebin to assemble detailed information and data about China's vehicle population and MEP's programs.

The quantitative analysis is based on the China Fleet Model (CFM) and the Health Impact Assessment (HIA) tool[4]. The CFM can estimate emissions and fuel consumption from the entire Chinese vehicle fleet under a variety of past and future policy scenarios. The model estimates all the major emissions of concern for air quality and climate change such as carbon monoxide, oxides of nitrogen, total hydrocarbons, particulate matter, carbon dioxide, nitrous oxide, methane and black carbon. The model user can customize policy scenarios that cover new vehicle emission standard levels, fuel sulfur concentration and vehicle fuel consumption limits. The model user can also adjust the effectiveness of enforcement and compliance programs and the penetration of all-electric vehicles.

To assess the current program, the ICCT compared the vehicle and fuel standards implemented to date and the existing compliance efforts with the emissions which would have occurred if no program improvements had been adopted beyond those already in effect by the late 1990's ("Business as Usual" vs "No Regulation").

Looking ahead, emissions and fuel consumption estimates were made assuming that business as usual, i.e., all currently adopted program elements are fully implemented while forecasted vehicle population growth continues. To assess potential program improvements in the future, two additional scenarios were constructed ("Improved Program" and "Strong Program"). A variation on these two scenarios was analyzed to evaluate the impact of delayed implementation of vehicle standards (China VI in 2020 instead of 2015). A special scenario was also created to reflect policy options for urban areas ("Improved Urban Program"). These scenarios were developed after consulting with the project team at the VECC and Tsinghua University and stakeholders within the MEP. The emissions and fuels standards, fuel consumption requirements and compliance program elements set forth in these scenarios reflect the project team's best judgment for what can be achieved over the next one to two decades. The scenarios are further defined in Table 1.1.

The qualitative analysis begins with an in-depth review of best practices for setting new vehicle and fuel standards and enforcing compliance. To this end, mature vehicle emission control programs in the United States, the European Union, and Japan are synthesized and related to the Chinese context. In parallel, the ICCT team documented, with the help of the VECC and Tsinghua University, the implementation of the current Chinese programs. A closer look was given to emission labels, an important consumer information and in-use program enforcement tool. The ICCT also included a review of fuel economy/consumption and GHG programs as well as alternative fuel and new energy vehicle programs. Although these programs are currently not MEP's primary focus, the Ministry's involvement is expected to grow as concerns about transportation's climate impact redefine MEP's scope. For each program reviewed, the ICCT team compared China's current program to the global best practices and identified barriers to further progress in China.

4 The China Fleet Model and Health Impact Assessment tool documentations are available in Appendix B.

表 1.1: 情景设定说明

情景设定	排放标准	燃料标准	燃料消耗量标准	实施方案	电动车比例
无管理	止步于1999年标准	止步于1999年标准	无	只进行型式核准	无
现行管理	国I, II, III, (IV)	国 I, II, III	轻型车: 第I、II 、III阶段标准 (每年加严2%); 对重型车无管理要求	10% 的车辆为高排放车	无
改善方案	2015年实施国VI	2015年，低硫汽柴油 (50 PPM)	轻型车: 每年加严3%; 重型车:从2015年起，到2030年加严 20%	到2015年，仅5%的车辆为高排放车	轻型车: 2030年, 新车销售的5%为电动车
强化方案	国 V (2012) 国VI (2015)，2020年实现“超低排放”(轻型车) 及“国 VII”(重型车)	2015年，超低硫汽柴油(10 PPM)	轻型车: 每年加严4%; 重型车:从2015年起，到2030年加严 50%	到2020年, 仅3%的车辆为高排放车	轻型车: 2030年, 新车销售的10%为电动车
城市改善方案	2012年国 IV + 柴油车颗粒物捕集器，2015年国VI	2012年，低硫汽柴油(50 PPM)	同改善方案	同改善方案	同改善方案

结论

尽管车辆保有量和使用率都有巨大增长，中国的车辆排放控制措施还是能有效的削减常规污染物排放。根据中国机动车模型（CFM），从2000年到2010年，较之无管理情景，现有管理措施累计减排4450万公吨总碳氢化合物（THC）、2.387亿公吨一氧化碳（CO）、3800万公吨氮氧化物（NOx）和700万公吨颗粒物（PM）。图1.1展示了两种情景的对比5。中国机动车模型（CFM）数据源、假设和方法论详见附录B。

5 该模型不能评估过去的燃料消耗和CO_2，因为该模型只能计算2010年之后的燃料消耗量。

Table 1.1: Scenario description

SCENARIOS	EMISSION STANDARDS	FUEL STANDARDS	FUEL CONSUMPTION STANDARDS	ENFORCEMENT AND COMPLIANCE	DEGREE OF ELECTRIFICATION
No regulation	Stop at standards adopted by 1999	Stop at standards adopted by 1999	None	Existing type approval only	None
BAU/Baseline	China I, II, III, (IV)	China I, II, III	LD: Phase I, II, and III (2% annual improvement); no HD regulation	10% of vehicle fleet are gross emitters	None
Improved program	China VI by 2015	Low-sulfur gasoline and diesel (50 PPM) by 2015	LD: 3% annual improvement; HD: 20% improvement by 2030, starting in 2015	By 2015, only 5% of vehicle fleet are gross emitters	LD: by 2030, 5% of new vehicle sales are electric vehicles
Strong program	China V (2012) and VI (2015) and “SULEV” (LD) and “China VII” (HD) by 2020	Ultra low-sulfur gasoline and diesel (10 PPM) by 2015	LD: 4% annual improvement; HD: 50% improvement by 2030, starting in 2015	By 2020, only 3% of vehicle fleet are gross emitters	LD: by 2030, 10% of new vehicle sales are electric vehicles
Improved urban program	China IV + diesel particle filter in 2012 and China VI by 2015	Low-sulfur gasoline and diesel (50 PPM) by 2012	Same as Improved program	Same as Improved program	Same as Improved program

Conclusions

Despite the massive growth in vehicle stock and activity, China's vehicle emission control program has been effective in curbing conventional pollutant emissions. According to the China Fleet Model (CFM), between 2000 and 2010, the cumulative emissions benefit of the current program over a "no program" scenario has been 44.5 million metric tons for total hydrocarbons (THC), 238.7 million metric tons for carbon monoxide (CO), 38 million metric tons for oxides of nitrogen (NO_x), and 7 million metric tons for particulate matter (PM). See Figure 1.1 for a comparison of the two scenarios[5]. For a detailed account of the China Fleet Model data sources, assumptions, and methodology, please see Appendix B.

5 The model does not provide retrospective estimates of fuel consumption and CO_2 estimates because it only include fuel consumption calculations from 2010 on.

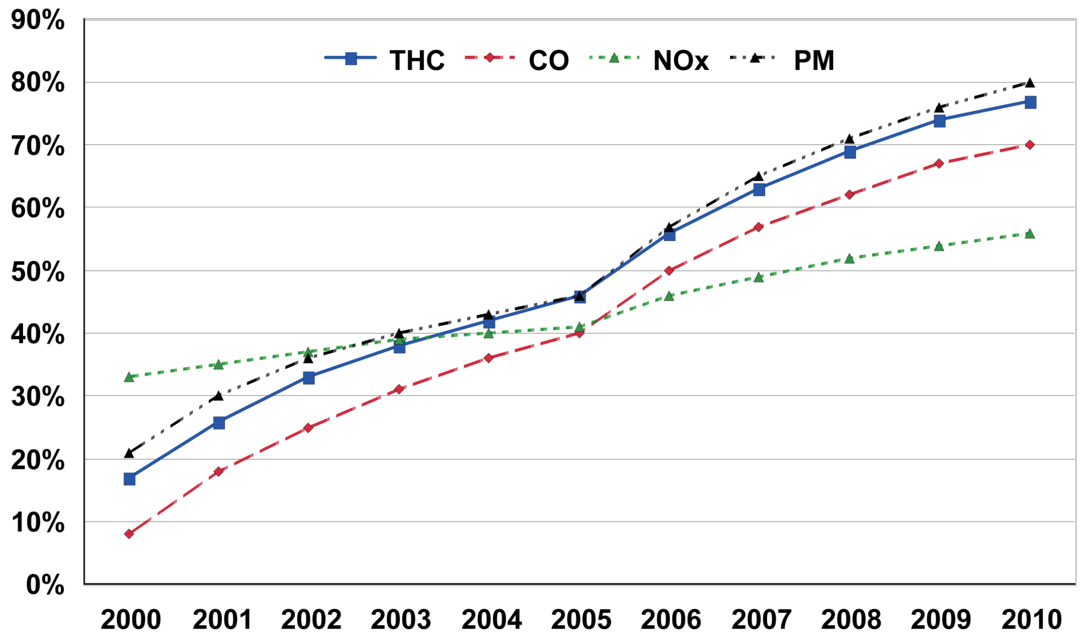

图 1.1: 现行管理与无管理相比的减排百分比

长期以来，环保部采取的各项政策为公众健康带来了很多收益。根据CFM模型的计算结果，ICCT利用健康影响评估方法，估算出了已避免的过早死亡人数和其它健康影响获益。而这一估算仅仅是包括了车辆直接排放的颗粒物和由NOx排放所形成的二次颗粒物的健康影响，尚没有将臭氧以及直接的NOx、CO、有毒物质、挥发性有机化合物（VOC_s）和其它排放物的影响考虑在内。表1.2展示了评估结果，即当前中国所实施的各项政策在过早死亡、急慢性支气管炎、哮喘、入院和工作影响天数等方面所取得的效益。关于健康影响评估的方法论，详见附录B。我们将此分析结论与其它相关研究结论进行对比，认为此分析对影响的评估结果是相对比较保守的。

表 1.2: 当前政策对避免不利健康影响的收效评估

健康影响(千人或天)	2000年	2005年	2010年
提前死亡	6.3	30	110
入院就医	0.95	4.2	15
慢性支气管炎	14	63	220
急性支气管炎	75	320	1,100
哮喘	96	420	1,400
工作影响天数	7,400	33,000	110,000

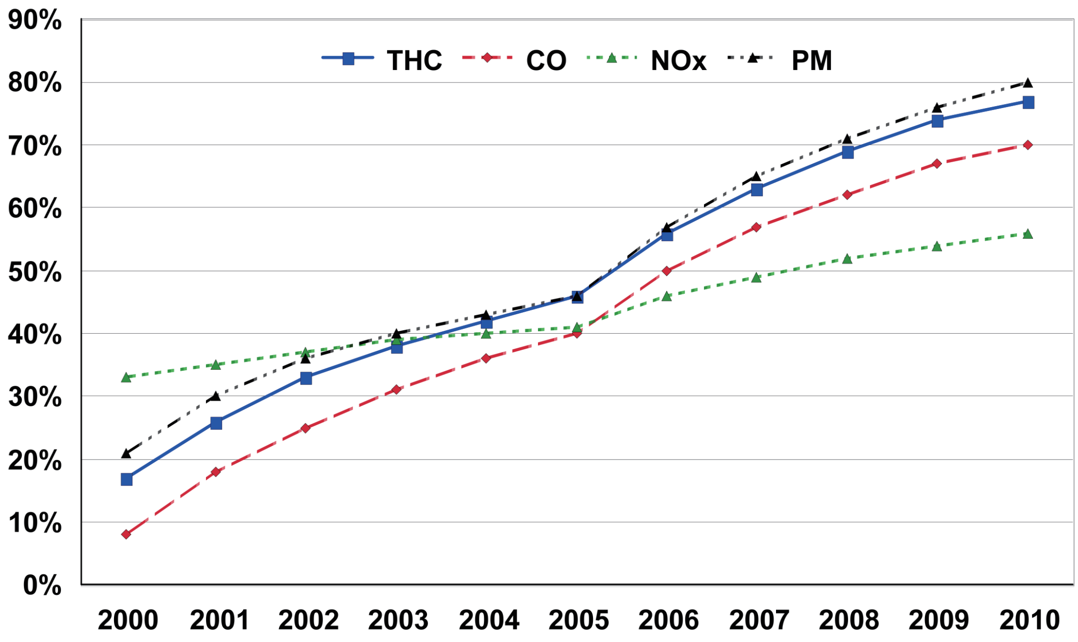

Figure 1.1: Percent emission reductions of current program versus no program

The policies carried out by MEP to date have resulted in substantial public health benefits. Using outputs from the CFM, ICCT estimated the avoided premature deaths and other health impacts in the HIA tool. These estimates only account for direct PM and secondary PM formation due to NOx emissions and do not include health impacts due to ozone formation and direct emissions of NOx, CO, toxics, volatile organic compounds (VOCs) and other species. Table 1.2 provides the estimated incidences of premature mortality, chronic and acute bronchitis, asthma attacks, hospital admissions, and restricted activity days that have been avoided in China due to the current policies that are in place. More details on the methodology for quantification of health impacts can be found in Appendix B. Comparison of ICCT's analysis with other recent studies suggests that ICCT's findings should be viewed as conservative, low-end estimates of impacts.

Table 1.2: Avoided incidences of health impacts due to the current policy package

HEALTH IMPACTS (THOUSANDS)	2000	2005	2010
Premature mortality	6.3	30	110
Hospital admissions	0.95	4.2	15
Chronic bronchitis	14	63	220
Acute bronchitis	75	320	1,100
Asthma attacks	96	420	1,400
Restricted activity days	7,400	33,000	110,000

根据保守估计，仅在中国大陆地区，健康收益的价值就十分可观。2010年，约收益1700亿人民币（250亿美元），相当于国内生产总值（GDP）的0.5%。在本研究中，对于健康影响价值的评估，主要是基于在中国进行的另外一些研究，即中国居民愿意花费多少钱来降低空气污染带来的死亡风险。关于健康影响评估的具体方法论，详见附录B。

尽管目前的政策措施已经在减排和维护健康方面取得了显著成就，但是随着汽车市场的不断扩大，仍需要不断改进和加严政策措施来减轻健康和气候影响。例如，图1.2展示了在当前政策措施下，排放的增长趋势。

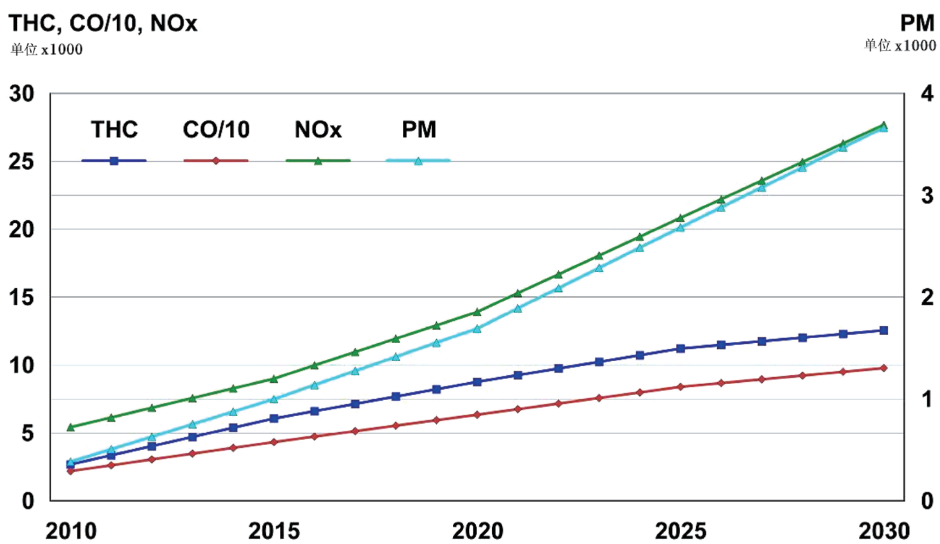

图 1.2: 现行管理情景下的排放趋势2010 – 2030年 (1000 公吨)

中国若承诺不断加严车辆和燃料标准，且配合引入国际先进的管理政策，将能够降低排放，并逐步实现国际级的排放控制措施。图1.3明确的展示了这一趋势，说明了两种不同情景（改善方案、强化方案）所带来的结果。实施时间也将对未来的减排效果有着重大影响。以2020年为结点，通过情景分析，如果到2020年才实施国VI标准，相对于2015年开始实施国VI标准，将会多排放30%-70%的颗粒物和64%-70%的氮氧化物。即使到了2030年，提前实施国VI（2015年）和延迟实施国VI（2020年）之间的减排差异依然存在。

Using conservative estimates, based on studies conducted within mainland China, the value of these avoided health impacts is significant. In 2010 it amounts to 170 billion RMB ($25 billion), the equivalent of 0.5% of the GDP. This study valued health impacts based on studies conducted in China of the willingness to pay to reduce the risk of dying from air pollution. The methodology for the valuation of health impacts is included in Appendix B.

Despite the emission reductions and concomitant health benefits achieved by the current program, continued improvements and more stringent policy measures will be required to mitigate the negative health and climate impacts of the significant projected growth trends in the vehicle market. For example, Figure 1.2 illustrates the emissions increases expected under the current program.

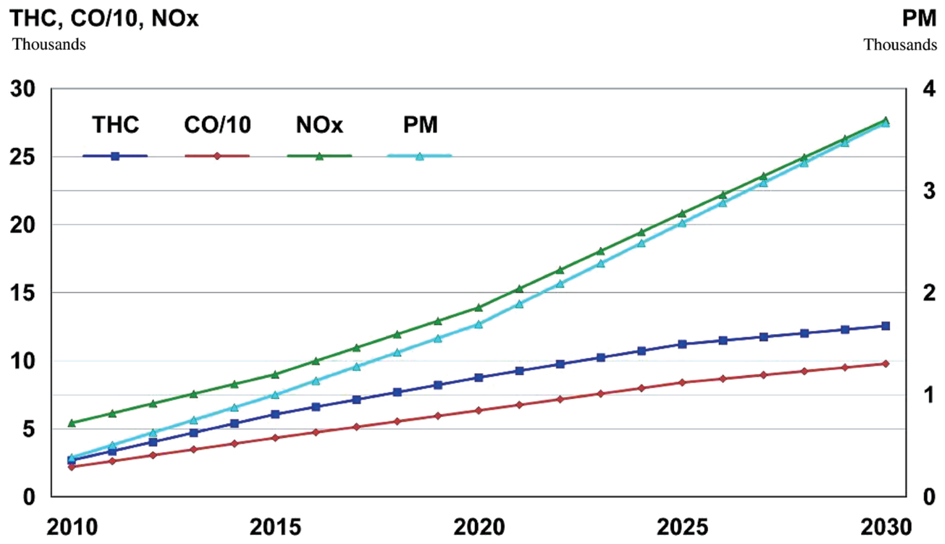

Figure 1.2: 'Business as Usual (BAU)' trends, 2010 – 2030 (thousand metric tons)

With continued commitment to further tightening vehicle and fuel standards and by introducing new policy elements that parallel international best practice, China can drive down emissions trends and move towards a world-class emission control program. This is clearly illustrated in Figure 1.3, which shows the results of the two national scenarios (Improved Program, Strong Program). Implementation timeline does have a significant impact on the potential to capture these emission reductions. In 2020, scenarios that achieve China VI by 2020 lead to 30% to 70% more PM and 64% to 70% more NOx emitted than the scenarios where China VI is reached by 2015. Even by 2030, there is still an emission reduction gap between 2020 and 2015 China VI implementation scenarios.

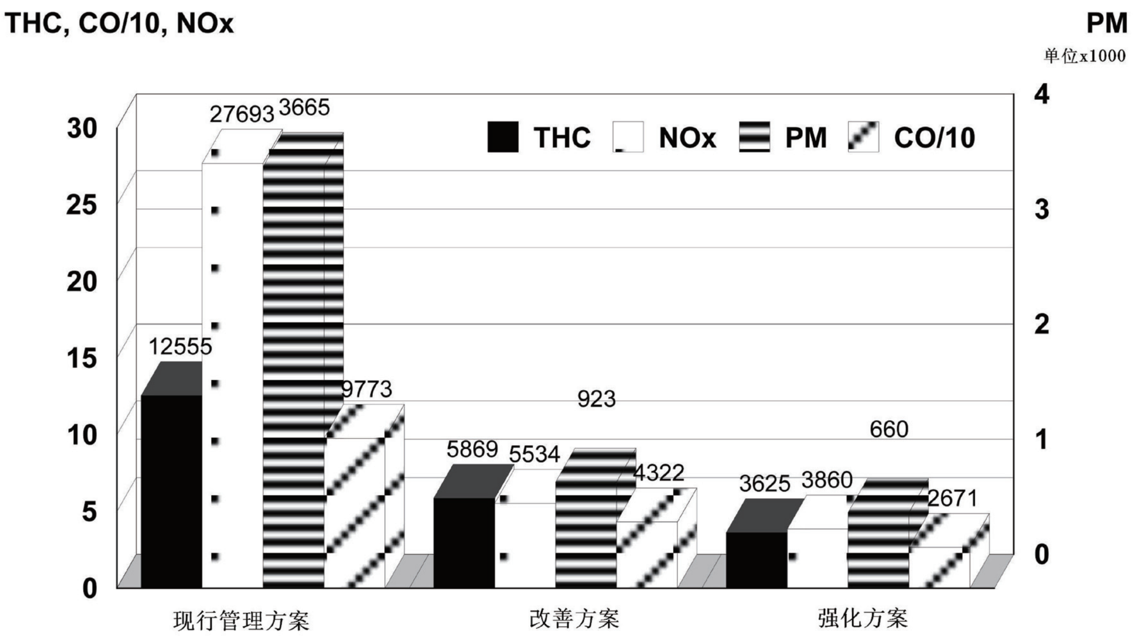

图1.3: 现行管理、改善方案和强化方案情景下2030年的排放趋势 (1000公吨)

在改善方案和强化方案情景下的显著减排还将在今后的几年中带来重大的健康收益。图1.4总结了各种情景下的健康影响评估结果，可以看出，现行管理措施在过去的10年中拯救了许多生命，而实施强化方案，在未来的20年中，还将避免3倍的人数由于污染造成过早死亡。

到2030年，实施强化方案所带来的健康收益的经济价值预计可达2.4-2.6万亿人民币（3500-3900亿美元），相当于国内生产总值的2.3%-2.6%。中国其它一些研究结果和英国以及其它地区的研究结果肯定了这样的价值评估，甚至认为减排所带来的健康收益（减少空气污染造成的过早死亡）和经济收益应比我们当前预计的更高。

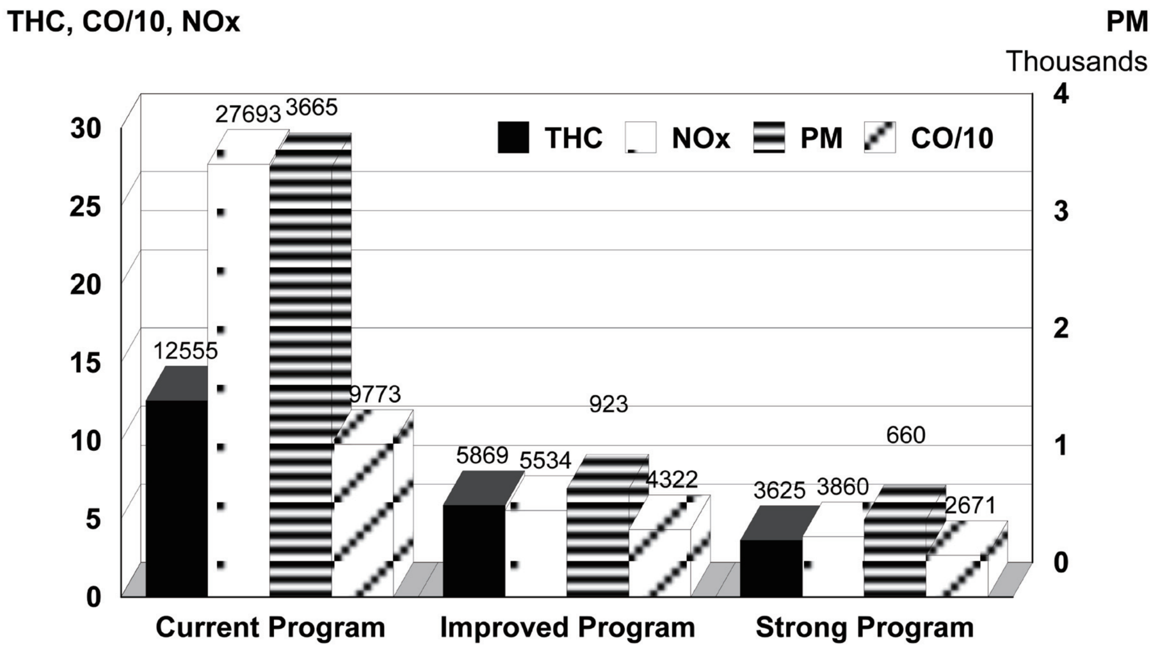

Figure 1.3: Emissions of the BAU, Improved, and Strong Programs in 2030
(thousand metric tons)

The dramatic reductions in emissions with the Improved and Strong Program scenarios would translate into important reductions in adverse health impacts in future years. Figure 1.4, which summarizes the health impact assessment results for all scenarios, shows that the current program has saved numerous lives in the past decade and that a strong emissions control program could prevent three times as many premature deaths in the coming two decades.

In 2030, the monetary benefits associated with the reduced health impacts of the Improved and Strong Programs would be expected to amount to approximately 2.4–2.6 trillion RMB ($350–390 billion), equivalent to an estimated 2.3%-2.6% percent of the GDP. Analyses conducted by other researchers in China, the United Kingdom and elsewhere confirm these findings with similar or higher expected impacts in terms of levels of premature mortality due to air pollution and total monetary benefits of reducing emissions.

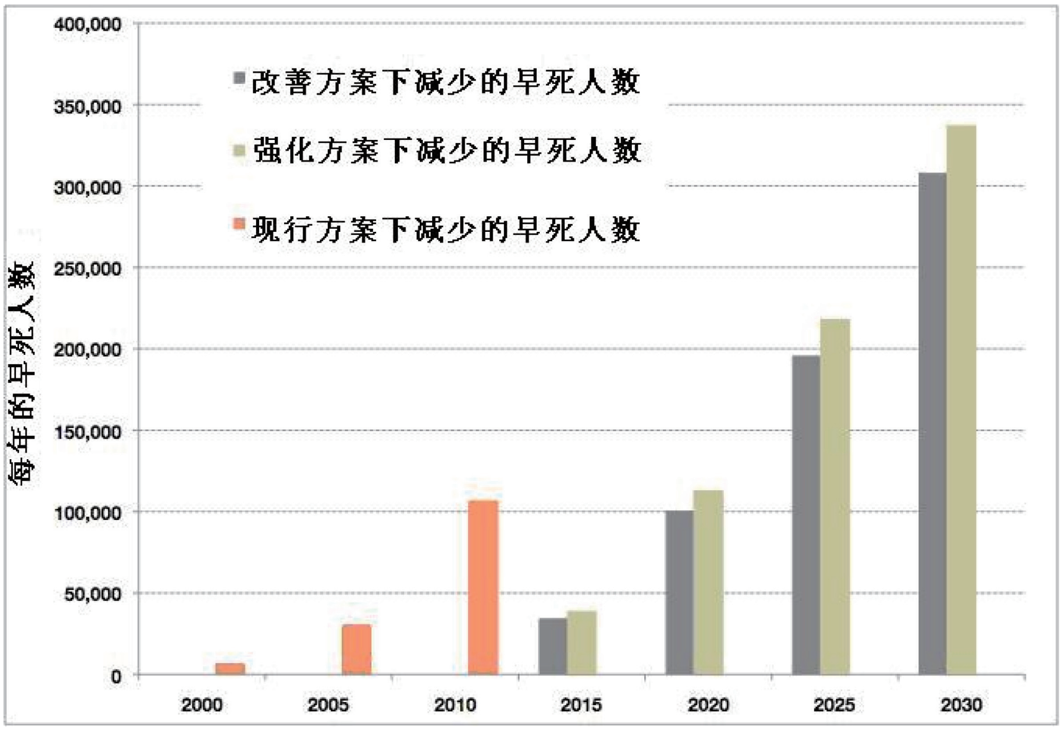

图1.4: 各种情境下提前死亡减少数量

改善燃料经济性政策将有效节省燃料并减少二氧化碳排放，同时将中国在这一政策领域推向世界领先位置（图1.5和图1.6）。到2030年，根据ICCT的估算，较之现行管理措施，实施强化方案将节省780亿加仑燃料（约18亿桶原油）。另外，还会带来相应的气候变化收益，因为颗粒物排放的减少直接减少了黑炭排放，而颗粒物中的黑炭是具有重大气候影响危害的颗粒。

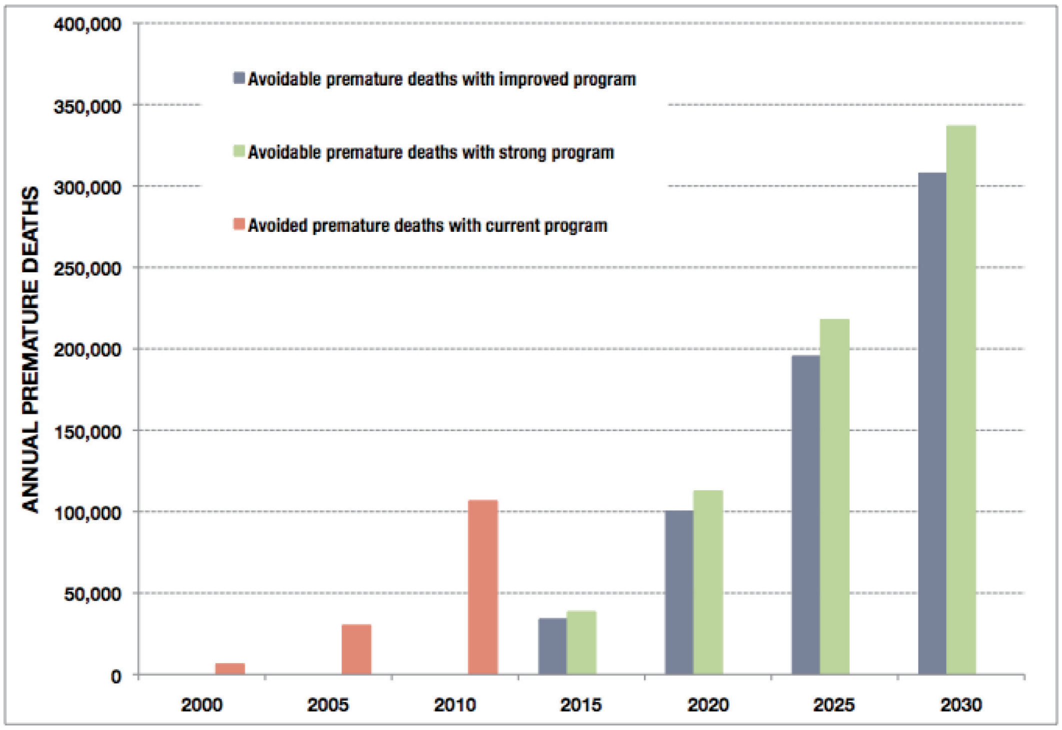

Figure 1.4: Annual premature deaths under different scenarios

Additional improvements to the fuel economy program will yield substantial fuel savings and avoided carbon dioxide (CO_2) emissions as well as cement China's position as a global leader in this policy arena (Figures 1.5 and 1.6). In 2030, ICCT estimates that the Strong Program will save roughly 78 billion gallons of fuel as compared to the baseline scenario (over 1,800 million barrels of oil). In addition, there are considerable climate co-benefits associated with decreasing particulate matter emissions due to the fact that black carbon-the highly potent climate forcing aerosol that is a subset of PM-is reduced as well.

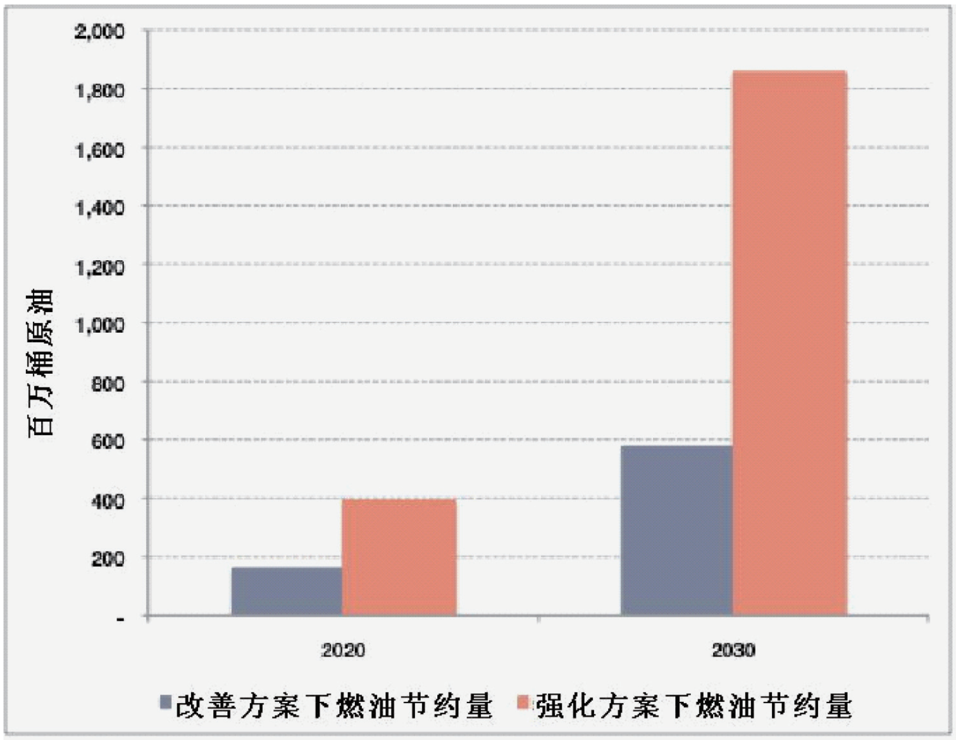

图1.5: 实施改善方案和强化方法的燃料节省预测 2020年及2030年

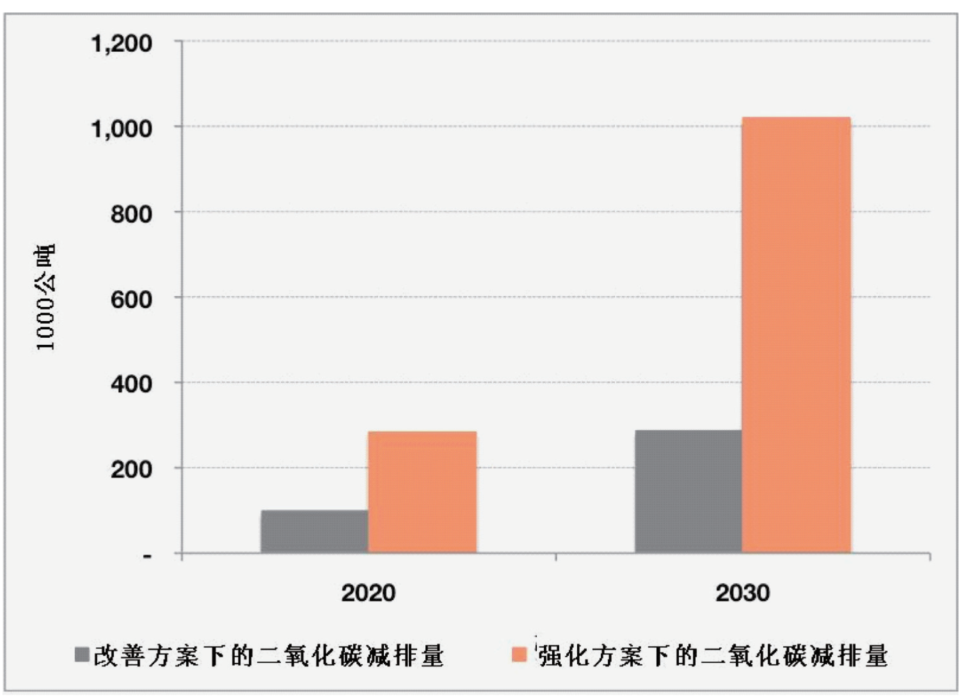

图 1.6: 实施改善方案和强化方法的二氧化碳减排预测 2020年及2030年

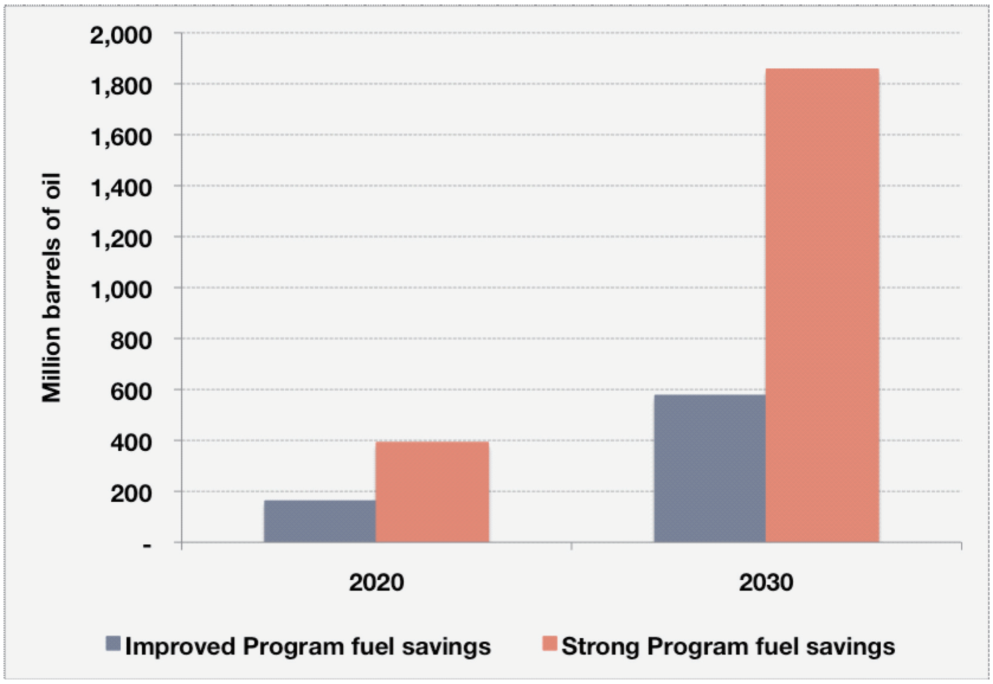

Figure 1.5: Projected fuel savings of Improved and Strong Program compared to BAU, 2020 and 2030

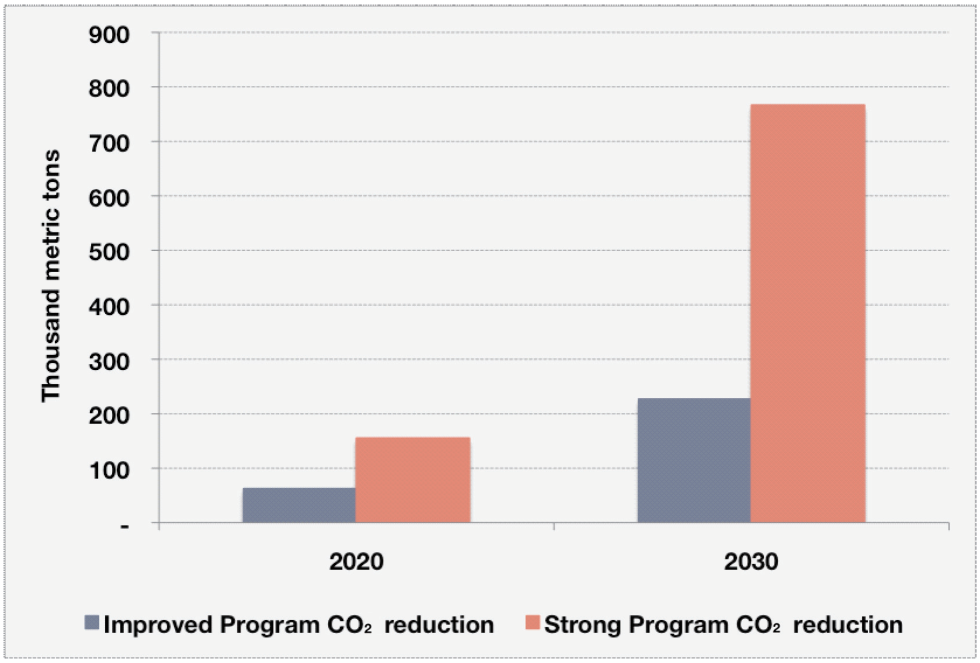

Figure 1.6: Projected CO_2 emissions reductions of Improved and Strong Program compared to BAU, 2020 and 2030

总而言之，在有限的资源下，环保部已经成功的采取了日益严格的排放标准和实施措施，已经有效削减了数百万公吨的污染物。在2010年，这些成效可避免大约17万人的死亡。如果不进行进一步管理，那么随着车辆保有量的增长，排放将会显著增加。通过两个前瞻情景预测，我们可以看到，采取适当的政策措施，在机动车不断增长的前提下，完全能够实现减排和节能双丰收。

目前，中国所面临的最大瓶颈，就是环保部在制订与排放切实相关的车用油品标准和实施车辆及油品标准方面的权限限制。这样一来，低硫燃料的推行速度必然受到影响，也就直接影响了当前标准的执行情况。此外，汽车制造企业和炼油企业对继续加严汽车排放和油品标准的反对以及财政和人员技术水平等问题，也是当前存在的障碍。

建议

我们通过定量和定性分析，为中国的清洁高效交通提出了一套近期和长期的建议。

中国为配合其在国际汽车市场的领先地位，已经在制定国际先进车辆排放控制措施方面走出了决定性的第一步。要想继续发展，需要在现有政策方案的基础上学习参考欧盟、美国和日本的成熟措施。同时，还要根据中国国情，解放思想，敢于创新政策，寻求最适合的可实践方案。在今后几年中，重点领域主要包括：

• *沿用当前的欧盟排放标准模式，继续实施更加严格的机动车排放标准，缩短与欧盟现行标准的距离。这并不是说中国一定要单纯的照搬欧盟的线路。*相反，环保部应当选择适当的、具有可行性的先进标准。目前部分有低硫燃料（使用排放控制技术的必须条件）的地区可以先“跳跃”性地实施国VI甚至更严的标准，然后再推广至全国。如果可以这样做，公众健康和环境收益都将十分显著。

• *修订《大气污染防治法》，加强环保部制订燃料标准和实施车辆及燃料标准的权威性，赋予环保部召回和处罚不达标对象的权力。*要想推进清洁燃料、有力的实施执行各项标准，就需要相应的权力。

• *提高环保部的财政预算和技术能力。已经有很多例子表明，经费和技术能力不足，会使机动车排放控制措施在其它政府机构和工业企业面前处于劣势地位。*环保部应当通过政策机制提高自身的财政收入，如征收排放费、车辆税费和其它财税手段。很多措施的出台和实施都需要联合其它部委。要想提高技术能力，可以从分批培训入手，陆续安排人员到一些经验成熟的机构进行培训，例如美国环保局，还可以从高校及研究机构补充一部分资源。

• *制订针对交通领域的温室气体排放的政策。温室气体政策可以被视为是环保部当前政策的自然延伸。*要实现常规污染物和温室气体控制的双赢，两种政策应齐头并进。在未来几年中，环保部应获得管理移动源温室气体排放的权力，并负责执行实施管理方案（包括违规罚款的权力）。

• *与相关单位合作，重新修订中国目前的轻型车燃料消耗量标准，代之以轻重型车辆的温室气体排放标准。*具体包括加严标准和优化标准设计体系两方面。将当前的根据质量或排量的分类方法改为根据尺寸（大小）分类，从而避免刺激车辆重量化或大排量化。

• *对常规污染物和温室气体减排项目进行经济激励能对相关标准起到有力配合作用。*在过去的几年中，中国已经不断的做出努力，通过车辆减税政策，鼓励购买小排量节能型汽车。若将目前按排量分级的财税政策改为按二氧化碳/温室气体排放量分级，能取得更好的效果。

以上各项评估方案的详细建议内容请参见第10章。

In summary, with limited resources, the MEP has successfully adopted increasingly stringent emission standards and implemented compliance programs that have helped eliminate millions of tons of pollution. In 2010, those efforts translated into approximately 170,000 avoided deaths. Without further regulation, however, emissions will increase dramatically, propelled by the expected vehicle population growth. The two forward-looking scenarios evaluated show that a suite of well-defined policies together can reduce emissions and fuel use as the Chinese fleet continues to grow.

Amongst the most important barriers to progress in China are the limits on MEP's authority with regards to emission-related fuel standards and vehicle and fuel standard enforcement. This has undoubtedly delayed the adoption of lower sulfur fuels and reduced the effectiveness of current standard compliance programs. Other barriers include opposition from the politically influential vehicle and fuel industries on further tighening the vehicle and fuel quality standards as well as limited financial resources and staff technical capacity.

Recommendations

The insights yielded by the quantitative and qualitative analyses lead to a set of near- and long-term recommendations for China's path towards cleaner and more efficient transportation.

China has taken the critical first steps in the development of a world-class vehicle emission control program that can match its position as a leading world vehicle market. Continuing that development will require building on the foundation established by the current program and incorporating lessons learned from mature programs in the European Union, United States, and Japan. It will also require unleashing creative and innovative policy thinking to adapt best practices to the Chinese context. Key areas of emphasis in the coming years should include:

• *Continued progress toward more stringent motor vehicles standards to close the gap with the Euro program, on which MEP currently patterns its standards. This does not mean that China should simply retrace the path followed by the EU.* On the contrary, MEP should seek to adopt the most advanced standards necessary and feasible whenever possible. There are clear opportunities to "leapfrog" to China VI and even beyond first in local jurisdictions where lower sulfur fuels (necessary for using the best available control technologies) are available and then nationally. The public health and environmental payoff of seizing those opportunities will be significant.

• *Amending the "China Air Pollution Prevention and Control Law" to enhance MEP's authority to set fuel standards for emission related parameters, enforce vehicle and fuel standards, conduct recall campaigns, and penalize noncompliance.* Any significant progress in the availability of clean fuels and the compliance and enforcement of adopted standards depends on the effectiveness of that authority.

• *Improving MEP's budget level and technical capacity.* Limits on funding and technical capacity have in several instances put the vehicle emission control program at a disadvantage with respect to other government and industry stakeholders. MEP should pursue opportunities to raise funds through creative policy mechanisms such as emission fees, vehicle taxes and fiscal policies. Many such programs would require partnerships with other ministries. Enhancing technical capacity could begin by prioritizing training needs, continuing staff training programs with mature agencies, such as the U.S. Environmental Protection Agency, and leveraging resources in China's universities and research institutes.

• *Establishing policies to address greenhouse gas (GHG) emissions from the transportation sector.* GHG policies are a natural extension of the MEP's current program. To realize the potential co-benefits, conventional pollutants and climate forcers should be addressed together. In near- to mid- term, MEP should obtain the authority to regulate GHG emissions from mobile sources and enforce these regulations (including by imposing fines for non-compliance).

• *Working with relevant agencies to realign China's current fuel consumption standards for light- and heavy-duty vehicles to GHG emissions standards.* This process should include enhancing the stringency and improving the structure of current passenger vehicle standards. Shifting from a weight-based or displacement-based to size-based (footprint) standard would remove incentives for up-weighting and gaming.

• *Fiscal incentives for both conventional pollutant and GHG/efficiency programs are an important complement to relevant regulation.* China in the past few years has made continuous efforts to reform its vehicle tax policies to encourage a market shift to smaller and thus more efficient vehicles. Replacing the current displacement-based fiscal policies with a CO_2/GHG-based scheme would better achieve this goal.

Detailed recommendations for each of the reviewed programs can be found in the relevant chapters and are summarized in Chapter 10.