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Mitigation targets and actions in China up to 2020:

Progress towards the 2020 carbon intensity target, allocation of provincial targets, design of carbon market pilots, and links with broader socio economic objectives

Emmanuel Guerin, Xin Wang (IDDRI)

CHALLENGES OF THE XIth, XIIth AND XIIIth FYP

The transition from the XIth to the XIIth Five-Year Plan (FYP) is a major breakthrough and requires a profound policy shift. Under the XIIth FYP, climate policies will have to combine the decarbonisation of the energy mix with the reduction of energy consumption per unit of output. And given the level of ambition of the XIIth FYP, to meet the high end of its UNFCCC pledge, China should increase its carbon intensity reduction target by 7% (from – 17 to – 24%) during the XIIIth FYP compared to the XIIth. Even reaching the low end of its UNFCCC pledge will require an equal level in its carbon intensity target during the XIIIth FYP compared to the XIIth (17%).

REGIONAL CARBON INTENSITY TARGET ALLOCATION

The allocation of carbon intensity targets by provinces in the XIIth FYP follows predominantly the principle of ability to pay. The structural factors play differently among provinces' carbon intensity decrease. The design of carbon market pilots, but also the implementation of policies complementary to the carbon market, will have to reflect these differences.

STRENGTHENING THE MRV SYSTEM

The Chinese carbon accounting system needs to be more up to date and transparent. A strengthening of the Chinese carbon MRV system is indeed of key importance: both domestically, for the relevance of the design, the efficiency of the implementation and the accuracy of the assessment of climate-related policies; and internationally, in the context of the International Consultation and Analysis (ICA) process.

REBALANCING THE MACROECONOMIC DRIVERS FOR GROWTH

In spite of some real efforts to rebalance the economy, the macroeconomic drivers of GDP growth remained largely unchanged (export-led and public-investment-driven GDP growth) or even worsened (inequalities) during the XIth FYP. Unless new incentives are designed to encourage these shifts, it is unlikely that these economic and climate objectives will be met within the XIIth FYP.

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INTRODUCTION

China made publicly available on January 16, 2011 its Plan for greenhouse gas (GHG) Emissions reductions[1] (hereafter, the Plan) under its XIIth Five Year Plan (FYP). This Plan is the first of its kind, the first to be entirely dedicated to emissions reductions strategies. It is an intermediary step between the release of the XIIth FYP, on March 14, 2011, and the further implementation of concrete policies to reduce GHG emissions, still forthcoming. It includes two noteworthy types of new information: new carbon intensity targets, both at the national and provincial levels; and new governance structures and better measurement, reporting and verification (MRV) systems, to facilitate the further implementation of mitigation policies. It confirms and refines the targets and policy orientations taken by China. And it gives some of the links previously missing to undertake an in-depth assessment of Chinese mitigation targets and actions.

This short working paper therefore takes the occasion of the public release of this Plan to:

- Analyse the shift in policy, compared to the XIth FYP, which will be necessary to meet the XIIth FYP targets; and quantify the emissions gap, which will have to be closed during the XIIIth FYP, to reach the UNFCCC 2020 carbon intensity pledge (section 1);
- Unveil the methodology that prevailed to allocate carbon intensity targets to provinces; and describe the main challenges facing the provinces that will implement carbon market pilots(section 2);
- Put the mitigation targets and actions in the broader context of the overall objectives of the XIIth FYP and show how the success climate policies is intimately linked to the achievement of these overall objectives (section 3).

The conclusion stresses the weaknesses of the current GHG statistical system, and presents the new efforts included in the Plan to reinforce the carbon MRV system.

1. NATIONAL CARBON INTENSITY TARGET

1.1. The shift in policy required between the XIth and XIIth FYP

Under the XIth FYP, carbon emissions were not directly targeted, and the decrease of the carbon intensity was less (- 13% in 2010 / 2005[2]) than the decrease of energy intensity (- 19.1% in 2010 / 2005, just below the 20% target[3]). Under the XIIth FYP, carbon emissions are directly targeted, and the carbon intensity target (- 17% in 2015 / 2010) is slightly higher than the energy intensity target (- 16% in 2015 / 2010)[4].

This represents a major breakthrough and requires a profound shift in policy. Up to now, structural and technological changes, as well as pro-active energy policies reduced effectively the energy consumption per unit of output, but the amount of carbon emitted per unit of energy continued to increase. And yet China undertook serious efforts

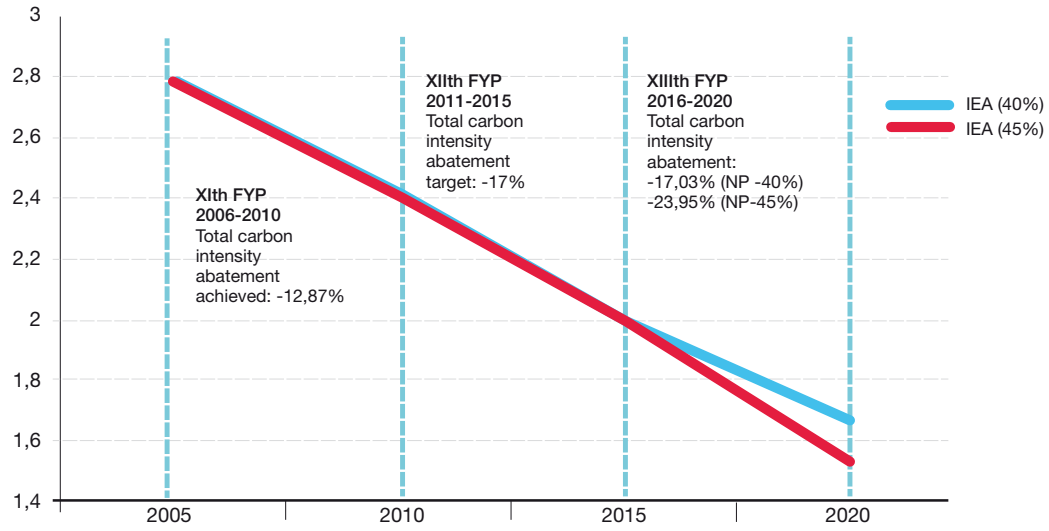
1. Authors' translation fromt he original Chinese name "十二五控制温室气体排放工作方案", available at http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=30914 (in Chinese)

2. Authors' calculation based on CO_2 emissions data (2005-2009) (IEA, 2011), (2005-2010) (Enerdata) and GDP data of 2010 Annual Statistical Yearbook of China (in 2005 price)

3. XIth FYP, available at http://www.moc.gov.cn/zhuzhan/jiaotongguihua/guojiaguihua/guojiaxiangguan_ZHGH/200709/t20070927_420873.html (in Chinese)

4. XIIth FYP, available at http://www.gov.cn/2011lh/content_1825838.htm (in Chinese)

Figure 1. Reduction in carbon intensities: Achieved during the XIth FYP, targeted during the XIIth FYP, required during the XIIth FYP to reach the low end (40%) and high end (45%) of the Chinese UNFCCC pledge



Unit: tCO2/10kyuan (2005 price)
Source: 2005 and 2009 values are calculated based on CO_2 emissions data of IEA (2011) and Gross domestic product data of National Bureau of Statistics of China. (The 2010 value is calculated based on 2009 carbon intensity and assuming that the carbon intensity decrease of 2010 / 2009 was equal to the carbon intensity decrease of 2009/2008, given that 2010 CO_2 emission data is not available.)

to deploy decarbonized sources of energy (renewable, nuclear, hydro)[5]. But the very rapid increase of highly carbonized sources of energy (coal, oil) more that offset the rapid increase in decarbonized sources. The share of coal in primary energy consumption increased by 3% (from 65 to 68%[6]) in 2010 / 2005.

Under the XIIth FYP, climate policies will therefore have to combine the decarbonisation of the energy mix with the reduction of energy consumption per unit of output. Non fossil fuels represent 8.3% of total energy consumption in 2010, and targets are set for 2015[7] (11.4%) and 2020 (15%). Depending on the assumptions made, this would require a 320 – 480 GW installation of non fossil fuels capacities over the next decade[8].

1.2. The emissions gap to be closed during the XIIIth FYP

Under the UNFCCC, China pledged a – 40 - 45% decrease of carbon intensity in 2020 / 2005. Taking into account the 12% decrease in carbon intensity during the 2005 – 2010 period, assuming that the 17% target in 2015 / 2010 will be met, China would have to reduce its carbon intensity by 17% during the XIIIth FYP to reach the low end of its UNFCCC pledge (- 40%), and by 24% to reach the high end (- 45%).

This represents a major challenge. Given the level of ambition of the XIIth FYP, it will therefore be extremely difficult, if not impossible, for China to meet the high end of its UNFCCC pledge at the end of its XIIIth FYP. This would require an7% increase (from – 17 to – 24%) in its carbon intensity target. Even reaching the low end of its UNFCCC pledge will be challenging. It would require maintaining constant the level of the carbon intensity target during the XIIIth FYP compared to the XIIth (17%). But constant intensity targets become more and more difficult to reach over time, as low hanging fruits disappear[9].

Besides, China released publicly on January 19, 2011 its Plan for Industrial Transition under the

5. Renewable Energy Law, available at http://www.china.com.cn/chinese/law/798072.htm (in Chinese)
6. ENERDATA, http://www.enerdata.net/.
7. XIIth FYP.
8. Houser Trevor, China's Low-Carbon Development" (The Brookings Institution, Washington, DC, May 31, 2011). http: //www.br ooki ngs.edu/~/medi a/Fi l es/events/2011/0531_chi na_car bon/20110531_chi na_carbon.pdf
9. Using 2010 GDP (2005 price) calculated based on 2010 Annual Statistical Yearbook of China and the 2010 Statistical Communiqué of National Bureau of Statistics of China, assuming that the 2015 carbon intensity target as well as China's UNFCCC pledges are achieved, an annual GDP growth rate of 8% for the period of 2011-2020 would lead to 10,829-11,814 MntCO2 by 2020 while an annual GDP growth rate of 6.5% (as the XIIth FYP target) for 2011-2015 and 6% for 2016-2020 would lead to 9639-10,516 MntCO2 by 2020.

Table 1. XII[th] FYP carbon and energy intensity targets and related variables at provincial level.

	Provinces and municipalities	XII[th] FYP Carbon intensity reduction target 2015/2010(%)	XII[th] FYP Energy intensity reduction target 2015/2010(%) (XI[th] FYP targets between parentheses 2010/2005)	Energy intensity in 2009 (tsc/ Mnyuan)	Share to total GDP (2009) (%)	Per capita GDP in 2009 (2009 price) (1000yuan)	Average GDP growth rate (2005-2009) (%)
CI target higher than national CI target	Guangdong	19.5	18 (16)	68.4	10.81	40.97	12.42
	Tianjin	19	18 (20)	83.6	2.06	61.24	15.80
	Shanghai	19	18 (20)	72.7	4.12	78.33	11.42
	Jiangsu	19	18 (20)	76.1	9.43	44.60	13.72
	Zhejiang	19	18 (20)	74.1	6.29	44.38	11.87
	Beijing	18	17 (20)	60.6	3.33	69.25	11.68
	Hebei	18	17 (20)	164	4.72	24.50	11.56
	Liaoning	18	17 (20)	143.9	4.16	35.22	13.92
	Shandong	18	17 (22)	107.2	9.28	35.79	13.27
	Fujian	17.5	16 (16)	81.1	3.35	33.74	13.82
	Sichuan	17.5	16 (20)	133.8	3.87	17.29	13.37
CI targetequal to national CI target	Shanxi	17	16 (25)	236.4	2.01	21.47	10.58
	Jilin	17	16 (30)	120.9	1.99	26.57	15.17
	Anhui	17	16 (20)	101.7	2.75	16.41	13.07
	Jiangxi	17	16 (20)	88	2.10	17.27	12.95
	Henan	17	16 (20)	115.6	5.33	20.53	12.99
	Hubei	17	16 (20)	123	3.55	22.66	13.67
	Hunan	17	16 (20)	120.2	3.58	20.39	13.85
	Chongqing	17	16 (20)	118.1	1.79	22.84	14.42
	Shaanxi	17	16 (20)	117.2	2.24	21.66	14.92
CI target lower than national target	Yunnan	16.5	15 (17)	149.5	1.69	13.50	11.62
	InnerMongolia	16	15 (25)	200.9	2.67	40.21	18.25
	Heilongjia	16	16 (20)	121.4	2.35	22.44	11.82
	Guangxi	16	15 (15)	105.7	2.12	15.98	13.85
	Guizhou	16	15 (20)	234.8	1.07	10.30	12.57
	Gansu	16	15 (20)	186.4	0.93	12.85	11.05
	Ningxia	16	15 (20)	345.4	0.37	21.64	12.47
	Hainan	11	10 (12)	85	0.45	19.14	12.73
	Xinjiang	11	10 (20)	193.4	1.17	19.81	10.56
	Tibet	10	10 (12)	n.a.	0.12	15.22	12.44
	Qinghai	10	10 (17)	268.9	0.30	19.40	12.59

Source: The Plan and National Bureau of Statistics (various years).

XII[th] FYP. This Plan sets a new target for the share of industry in Gross domestic product (GDP): a 2% increase (from 47% to 49%) in 2015 / 2010. This continued industrialization will certainly make it even more complicated for China to reach its UNFCCC pledge.

2. PROVINCIAL CARBON INTENSITY TARGETS

2.1. Methodology to allocate carbon intensity targets

Each province has been allocated an individual carbon intensity target. Targets range from 19.5% (Guangdong) to 10% (Tibet, Qinghai). During the XI[th] FYP, provinces were allocated an energy intensity target, but not a carbon intensity target. Most (20) of them were allocated an energy intensity target equal to the national average of the energy intensity target (20%). Only few of them received a higher (4 provinces) or lower (7 provinces) target[10]. For the XII[th] FYP, provinces received both and energy and carbon intensity target. They can be grouped in three categories of almost equal number: 9 of them were allocated a carbon intensity target equal to the national average, 11 a higher target and 11 a lower target.

In theory, the allocation of carbon intensity targets by provinces can follow different principles and be based on different criteria[11]: equity (measured by carbon emissions per capita), efficiency (measured by carbon intensity), and ability to pay (measured by GDP per capita).In practice, the allocation of carbon intensity targets by provinces in the XII[th] FYP follows predominantly the principle of ability to pay.

Almost all provinces receiving carbon intensity higher than the national average have GDP per capita superior to 30 000 yuan. Those allocated the national average GDP per capita between 20 000 and 30 0000 yuan. And those receiving a target lower than the national average a GDP per capita inferior to 20 000 yuan. Only a few exceptions stand out in each category:

Hebei and Sichuan received carbon intensity targets higher than the national average, in spite of GDP per capita lower than 30 000 yuan (24 500 and 17 290 respectively). The belonging of Hebei to this category of provinces receiving higher carbon intensity targets than the national average can be explained by a high energy intensity (164.0 tsc/Mnyuan in 2009) and a GDP per capita close to 30 000 yuan. The situation of Sichuan is more difficult to explain: its energy intensity is not (compared to the rest of China) so high (133.8 tsc/Mnyuan) and its GDP per capita is lower than any province receiving a carbon intensity target equal to the national average.

Anhui and Jiangxi received 17% carbon intensity target, in spite of GDP per capita lower than 20 000 yuan (16 410 and 17 270 yuan respectively). This is also difficult to explain given that they also have energy intensity lower than any (except Hunan) province receiving a carbon intensity target lower than the national average.

Inner Mongolia, Heilongiia and Ningxia received carbon intensity targets lower than the national average, in spite of GDP per capita higher than 20 000 yuan (40 210, 22 440 and 21 640 respectively). The situation of Inner Mongolia is especially impossible to justify based strictly on energy and economic criteria (its energy intensity is one of the highest in China: 200.9 tsc/Mnyuan), and reflects purely political considerations.

In the absence of the possibility to trade between provinces Assigned Amount Units (AAUs) of carbon, it makes sense that the allocation of carbon intensity targets during the XII[th] FYP followed predominantly the principle of ability to pay. And given the weaknesses of the existing GHG statistical system, China was right not to introduce the possibility to trade between provinces of AAUs of carbon during the XII[th] FYP. But in the future, the possibility to trade between provinces will be an interesting way to explore to bring together the principles of efficiency and ability to pay.

Indeed, the situation of provinces with high energy and carbon intensity, but low GDP per capita, will have to be addressed rapidly, to control the absolute level of emissions in China. In the XII[th] FYP the average energy intensity of provinces receiving a lower target than the national carbon intensity target is twice (189.14 tsc/Mnyuan) that of the provinces receiving a higher target than the national carbon intensity target (96.86 tsc/Mnyuan).

The possibility to trade between provinces AAUs of carbon would make it possible for provinces with high carbon intensity and low GDP per capita to receive higher targets, part of these emissions reductions being paid by provinces with lower carbon intensity and higher GDP per capita, and would enable China to take a higher carbon intensity target overall. But these financial transfers

10. Teng, Fei ; Yang, Xi : Decomposing energy intensity change in China : a comparative analysis at the provincial and regional levels, Institute of Energy, Environment and Economy, Tsinghua University, Beijing, China

11. Different criteria exist to measure these principles. The ones we chose are only here as an illustration.

Figure 2. 12th FYP carbon intensity target and per capita GDP 2009

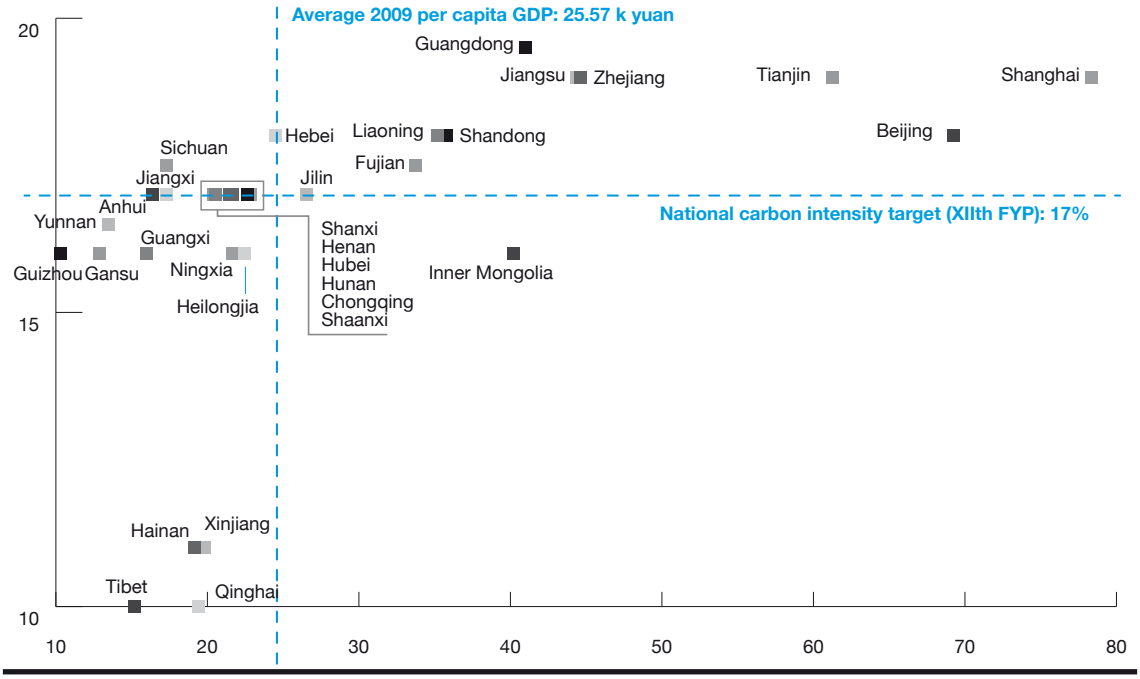
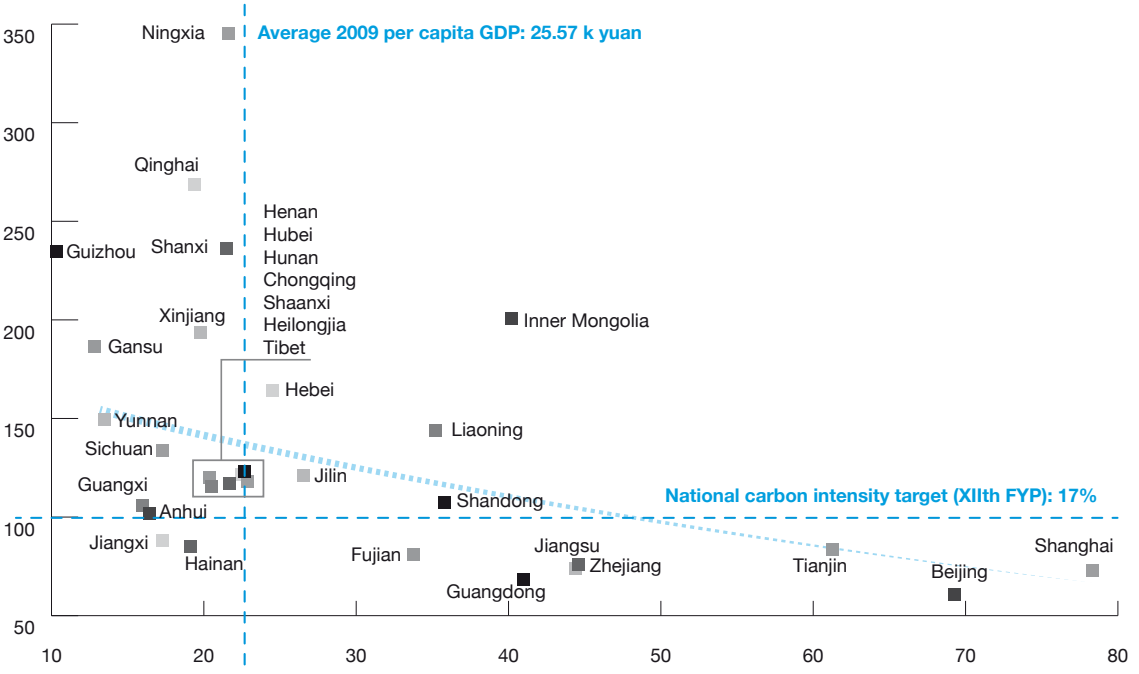


Figure 3. Per capita GDP and energy intensity in 2009 at provincial level in China



would have broader macroeconomic and political rebalancing effects for China that need to be further explored.

2.2. Challenges facing provinces with carbon market pilots:

7 pilots of carbon markets will be implemented in 2013 in 2 provinces (Hubei, Guangdong), 4 municipalities (Beijing, Shanghai, Tianjin, Chongqing), and 1 local city (Shenzhen)[12]. The analysis of provincial indicators reveals that carbon market pilots will have to play vey different roles within these different contexts.

The 2 provinces and 4 municipalities can be grouped in three different categories: those (Beijing and Shanghai)where the 2009 energy intensity was quite low (60.6 and 72.7 tsc/Mnyuan respectively) and where the average annual rate of GDP during the XIth FYP was lower (by 2.7 and 3.3% respectively) than the overall GDP growth; then those (Guangdong and Tianjin) where the 2009 energy intensity was quite low (68.4 and 83.10 tsc/Mnyuan respectively) but where the average annual rate of GDP during the XIth FYP was higher(by 1.2 and 1.8% respectively) than the overall GDP growth; and finally those (Hubei and Chongqing) where the 2009 energy intensity was high (123 and 118.1 tsc/Mnyuan respectively) and where the average annual rate of GDP during the XIth FYP was much higher (by 2.4 and 3.9% respectively) than the overall GDP growth

The structural factors therefore play positively in the carbon intensity decrease of Beijing and Shanghai, but negatively in the other 5, where the technological factors are the only drivers of carbon intensity decrease. The design (in particular the scope) of carbon market pilots, but also the implementation of policies complementary to the carbon market, will have to reflect these differences.

The Plan provides new elements to improve the climate change governance in China. Most importantly, it details the ways in which provincial and other local governors will be involved in mitigation strategies. They will all have to integrate the carbon intensity target into their own economic and social development plans under the XIIth FYP. And provincial governors will also have to define and allocate binding carbon intensity at sub-provincial levels. Finally, the evaluation of provincial and other local governors' performance, and consequently their promotion, will be based – among other things – on the reach of the intensity target.

3. MITIGATION IN THE CONTEXT OF THE BROADER SOCIO-ECONOMIC TRENDS AND OBJECTIVES OF THE XIITH FYP

The progressive shift in policy, from command and control to economic instruments, such as carbon markets, goes in the right direction. But carbon markets alone will not enable China to transition towards green economy and meet its climate objectives. The climate performance of China will be intimately linked to the achievement of the overall objectives of the XIIth FYP, and in particular to the macroeconomic rebalancing of the Chinese economy.

The objectives of the XIIth FYP can be summarized as follow[13]. Two of them are directly related to emissions reductions: 1) conserving energy and 2) protecting the local and global environment. The former reinforces the energy policy of the XIth FYP, the latter brings the climate policy to another stage. The other four objectives are to: 3) encourage domestic consumption; 4) reduce socio-economic inequalities;5) develop the service sector; 6) shift to higher value added in the industrial sector.

The question is: what are the chances for these four objectives to be met? These four shifts in economic policy were indeed already defined as objectives during the XIth FYP. But progress made to achieve these goals was uneven:

Service sector development: The XIth FYP set a target of 43.3% for the share of the service sector in GDP in 2010. This target was – almost – met (43%). There are therefore great chances that the new target will be met: 47% in 2015.

Shift to higher value added in the industrial sector: The XIth FYP mentioned four key industries for industrial upgrading: next generation of information technology; biotechnology; high end equipment manufacturing; new materials. No target was set for these industries. The XIIth FYP adds 3 Strategic Emerging Industries (SEI), all of them related to emissions reductions: clean energy technology (High-efficiency and energy savings; advanced environmental protection; recycling usage; reusing waste products), alternative energy (Nuclear power; solar power; wind power; biomass power; smart power grids) and clean energy vehicles

12. The circular published by National Development and Reform Commission of China is available at http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=30913 (in Chinese)

13. Joseph Casey, Katherine Koleski, Backrounder : China XIIth FYP. U.S.-China Economic & Security Review Commission June 24, 2011

Table 2. Provinces and municipalities selected for carbon market pilots experiments: Carbon intensity target, energy intensity, share to total and per capita GDP, average GDP and secondary sector growth rates

Provinces and municipalities	Carbon intensity target, (%, 2015/2010)	Energy intensity in 2009 (tsc/Mnyuan)	Share to total GDP (%, 2009)	Per capita GDP in (1000yuan, 2009)	Average GDP growth rate (%, 2005-2009)	Average secondary sector growth rate (%, 2005-2009)
Guangdong	19.5	68.4	10.81	40.97	12.42	13.57
Tianjin	19	83.6	2.06	61.24	15.80	17.60
Shanghai	19	72.7	4.12	78.33	11.42	8.12
Beijing	18	60.6	3.33	69.25	11.68	8.93
Chongqing	17	118.1	1.79	22.84	14.42	18.34
Hubei	17	123	3.55	22.66	13.67	16.10

Source: NBS, various years.

(Electric hybrid cars; pure electric cars; fuel cell cars). Taken together, these SEI represent 5% of GDP in 2010, and targets are set fro 2015 (8%) and 2020 (15%). The plan lists incentives to support the development of these SEI: standard subsidies like preferred financing, tax breaks, subsidized electricity and utility fees, free or subsidized land. There are therefore chances that this target can be met.

Domestic consumption and socio economic inequalities. In spite of political speeches, and of some real efforts to rebalance the economy, the macroeconomic drivers of GDP growth remained largely unchanged (export-led, public-investment-driven, GDP growth) or even worsened (inequalities) during the XIth FYP. Unless new incentives are designed to encourage this shift to domestic consumption, it is therefore unlikely that these objectives will be met.

Table 3. Annual growth rates of GDP, exports and investment in fixed capital: 2005-2010

Growth rates(2005 price)	GDP	Exports	Investement in fixed capital
2006/2005	12.7	27.2	23.9
2007/2006	14.2	26	24.8
2008/2007	9.6	17.2	25.9
2009/2008	9.2	-16	30
2010/2009	10.3	31.3	23.8
Average annual growth rate (2005 – 2010)	11.2	15.7	25.7

Source: National Bureau of Statistics of China, various years.

The next economic policy developments in China will therefore be key, both for the global economy and the global climate. Anyone interested in our chances to limit the temperature increase below 2°C should have an eye on the policy implementation of carbon market pilots; but also on the broader economic policy decisions, and whether or not they will enable the macroeconomic rebalancing of the Chinese economy.

CONCLUSION

To write this paper, we had many problems navigating the Chinese GHG statistics. There is no official Chinese figure for the decrease of carbon intensity during the XIth FYP. Indeed, there is no official Chinese data of 2005 and 2010 carbon emissions. Quasi-official or independent research institutions have made their own calculations, which differ from the IEA and Enerdata statistics that we have used. The Energy Research Institute (ERI) calculated a – 20.5% decrease in carbon intensity over the 2005 – 2010 period[14] and the Climate Policy Initiative (CPI) in Beijing a -21% decrease in 2010 / 2005[15].

These differences are significant. Using these figures would slightly change the two conclusions that we reached in section 1:

- A shift in the nature of Chinese climate policies between the XIth and the XIIth FYP would still be necessary, to reverse and accelerate the decarbonisation of the energy mix. But it would have to be less profound.
- China would be easily on track to reach the low end of its UNFCCC pledge: it would require only a – 9.1% decrease in carbon intensity during the XIIIth FYP. And it would be challenging,

14. Kang, J., Liu, Q., 2011, An introduction of *Work Plan of GHG Emissions Control for the 12th Five Year Plan* (2011-2015), Energy Research Institute of National Development and Reform Commission of China, December 27, 2011, Economic Journal, available at http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=30749 (in Chinese)

15. Climate Policy Initiative at Tsinghua University, 2011, Annual Review of Low-carbon Development in China (2011-2012).

but possible, to reach the high end of its UNFCCC pledge: it would necessitate a – 16.67% decrease in carbon intensity over the period 2015 – 2020.

These differences should not be over emphasized. But the difficulties to navigate Chinese GHG statistics underline the need to make the Chinese carbon accounting system more up to date and transparent.

The plan details the ways in which the GHG emissions MRV systems will be reinforced. A comprehensive GHG statistical system will be introduced, both at the central and local levels and will cover all areas of GHG emissions (energy use, process, agriculture, land-use, forest, wastes, etc.), aiming at striking the right balance between accuracy and feasibility. The Plan provides GHG emissions measurement guidelines for key sectors and firms, and creates a complex reporting system: national and provincial GHG emissions will have to be published regularly, and big firms will have to report directly to the government.

These new development are welcome. They will need to be up to the challenge. A strengthening of the Chinese carbon MRV system is indeed key: both domestically, for the relevance of the design, the efficiency of the implementation and accuracy of the assessment of climate-related policies; and internationally, in the context of the International Consultation and Analysis (ICA) process.

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