# Linkages among China's 2030 climate targets

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## Preamble

Objective:

- Presentation of some key results of the paper "Exploring linkages among China's 2030 climate targets" published at CPJ 2016

  Co-authored with **Shuwei ZHANG**

**Policy and target coherency** is one of my major research areas

- Another paper on instrument coherency (ETS and FIT):
  - Lin, W., Gu, A., WANG, X., Liu, B., 2015. Aligning emissions trading and feed-in tariffs in China, Climate Policy, DOI: 10.1080/14693062.2015.1011599

# Plan

1. Context

2. Method

3. Key results

# Increasing green quantitative targets in China

- Facing increasing domestic/international challenges on climate, energy and environment, China introduced for the first time quantitative and obligatory environmental targets in its 11th Five Year Plan (FYP) (2006-2010)
  - Energy per GDP intensity; Local pollutants emissions control (SO2, COD, etc.)
  - Cf. quantitative targets in previous FYPs only on economic and development issues
  - "Obligatory" indicates linking target achievement to career promotion of regional head officials

- In 12th FYP (2011-2015), new environmental targets are added:
  - $CO_2$ per GDP intensity (carbon intensity); new local pollutants, etc.
  - Prolonging and reinforcing existing targets

- With the general target of transition
  - Green and low-carbon
  - Restructuration of economy
  - Innovation and domestic consumption driven growth

efficiency firms by redirecting economic resources to high productivity and low carbon intensive sectors.

Besides drastic improvements in energy efficiency, the structural effect also plays a determining role in reducing carbon emissions through sectoral adjustment by shifting the economy from high carbon intensive to lower carbon intensive and high VA sectors (illustrated in Annex). Chapter 6 of the Plan outlines policy guidelines and actions to be taken. It advocates comprehensive measures for adjusting the industry and energy structure, energy conservation and energy efficiency improvement, increasing forest carbon sinks and other means to substantially reduce the intensity of energy consumption and carbon dioxide emissions, which would allow for the effective control of greenhouse gas emissions with minimised impact on economic growth.

### 2.2.2. *Diversify economic and policy instruments*

It is possible to decouple energy related GHG emissions from economic growth provided that appropriate economic policy and institutional adjustments are put in place timely; as empirical studies show that economic reforms have contributed to productivity growth, which in turn resulted in significant improvements

behaviour (e.g. use mo
private cars, buy energy

In fact, several ecoı
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tax, export VAT refund r
been implemented massi
being initially claimed f
resource conservation cı
generating neither uniqu
able political signals (W
domestic carbon pricing
Some policy think-tanks
alike cap- and trade- me
some industry and energ
Daily, 2010); Jiang (2011
may have positive econ
recycling regime is desig
clearly stated to implem
ments such as environm
pollutants mitigation. Tl
12th FYP highlights the c

Source: Li and Wang, 2012.

# 2030 climate targets studied in our work

- China submitted its Intended Nationally Determined Contribution (INDC) on 30 June 2015 to the UNFCCC, with quantitative targets up to 2030.
  - Previous to this, there exist a target: non-fossil fuels 15% to TPED by 2020

- China's INDC include three major targets (excluding forestry targets)
  - $CO_2$ emissions peak no later than 2030
  - Share of non-fossil fuels in TPED 20%
  - Carbon intensity 60-65% reduction comparing to 2005 level

=> We assess the link and interaction among these targets with different economic parameters.

# Choice of model to demonstrate linkages

- Complementary between simple and complex models
  - Complex models as “black box” for non-modelers
  - Extreme case: Pindyck (2013) of the MIT on integrated assessment models: illusory and misleading perception of knowledge
  - Simple models can also play a role to demonstrate causalities

- We aim at providing a first and rapid demonstration of linkages among CN’s 2030 climate targets for both modelers and non-modelers.

- We constructed a simple assessment framework that can be reused easily by others, with other data eventually.
  - This is based on a previous work of Zhang, S., & Bauer, N. (2013). Utilization of the non-fossil fuel target and its implications in China. Climate Policy, 13, 328–344.

## Our method

1. Assuming 2020 and 2030 non-fossil fuel targets (15% and 20% to TPED) are achieved

2. We have the estimated real quantity (GW) of each non-fossil fuels by 2030 from official or quasi-official sources in China

3. We can obtain the TPED level by 2030

4. Based on official sources, we adjusted China's energy mixt in 2030

5. We assume 8% and 6% as annual GDP growth rate for 2005-2020 and 2020-2030, respectively

6. We can than calculated related data: CO2 emissions, carbon/energy intensity, energy GDP elasticity, etc.

## On our assumptions

- Achievement of 2030 non-fossil fuel target
  - China in general can achieve its announced obligatory targets, especially those marked in FYPs and promised to the international community.
    - E.g., energy intensity abatement by 2010: 20% announced cf. 19.1% achieved
    - E.g., Target of increasing 10GW solar power each year since 2013, cf. 10.4GW and 15.1GW in 2014 and 2015 as achieved
  - The development of wind and solar power is also promoted by both central and local governments as a major element for low-carbon transition.

- GDP growth: these rate can be modified in a reasonable range but will not impact our major findings.

# Non-fossil fuel capacity by 2030

- Envisioned 2030 capacities are from experts judgments as the latter still dominate policy design in China today.

| | | | |
|---|---|---|---|
| Coal | 62% | Indicative | NDRC (2014) |
| Oil | 13% | | Calculated. |
| Total | 100% | | |

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# Energy mixt by 2030

- Adjustment in table 3 is made provided targets incoherency (table 2)

| | | | |
|---|---|---|---|
| Oil | 13% | | Calculated. |
| Total | 100% | | |

CLIMATE POLICY

18-19% current level

| | 2005 | 2010 | 2020 |
|---|---|---|---|
| Annual TPED growth from 2005 (%) | | 7 | 4 |
| Total $CO_2$ emission (Gt) | 6.3 | 8.4 | 9.7 |
| $CO_2$ emissions growth rate (%) | | 5.7 | 2.9 |

*Source*: $CO_2$ emissions in 2005 and 2010 are obtained from BP. Growth rate is relative to the 2005 base year.

CLIMA

# Finding No.1 CO2 emissions peak prior to 2030

- **As long as 2030 non-fossil fuel target is achieved, CO2 emission peak can be achieved prior to 2030**
  - Total CO2 emissions 9.7Gt in 2020 and 8.6Gt in 2030

- Note1: this excludes CO2 emissions from industrial process
  - Process emissions accounts 10% in total CO2 emissions 2005 (from 2nd National Communication on CC of China)
  - Reduction of the share/amount of cement, steel sectors as national plan in the future
  - Improvement in technology

=> Exclusion of process emissions will not likely impact our result.

- Note2: this result does not change even under the scenario with fixed coal share (from 65% as 2014 level up to 2030)

=> The increase of the share of NFF ensures an early peak from energy-related CO2 emissions.

# Finding No.2 Higher carbon intensity abatement by 2030 as long as NFF target achieved

- Based on the scenario assessed, we have – 56.8% and – 71.7% as CI decline relative to 2005 level by 2020 and 2030, respectively.
- Cf. announced target: -45-45% and -60-65% by 2020 and 2030, respectively.
- This means an annual energy use carbon intensity decline of 1.4% for 2010-2030, comparing to 0.9% for 2005-2010 period.

# Finding No.3 Very likely achievement using energy elasticity as proxy

- To achieve such a result, we need to have average annual energy GDP elasticity as 0.52 and 0.43 for 2010-2020 and 2020-2030, respectively.

- This is feasible following recent trends of diminishing energy elasticity

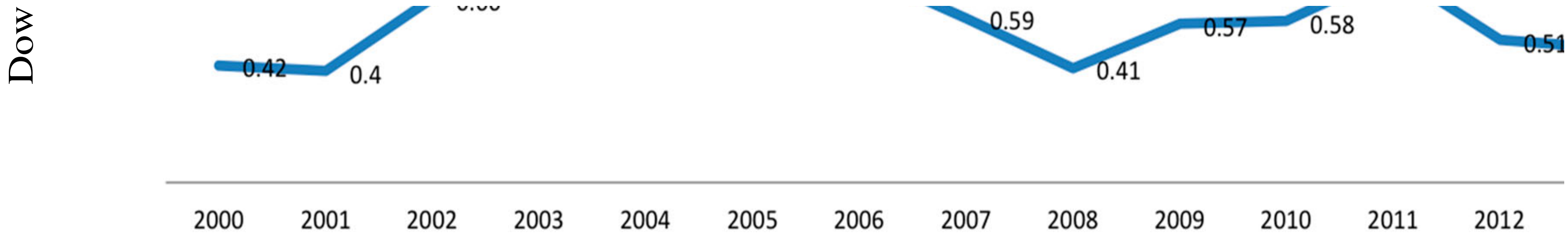



**Figure 2** Annual energy consumption elasticity 2000–2013

# Sets of energy elasticities and GDP growth rates for simultaneous targets achievement (2030)

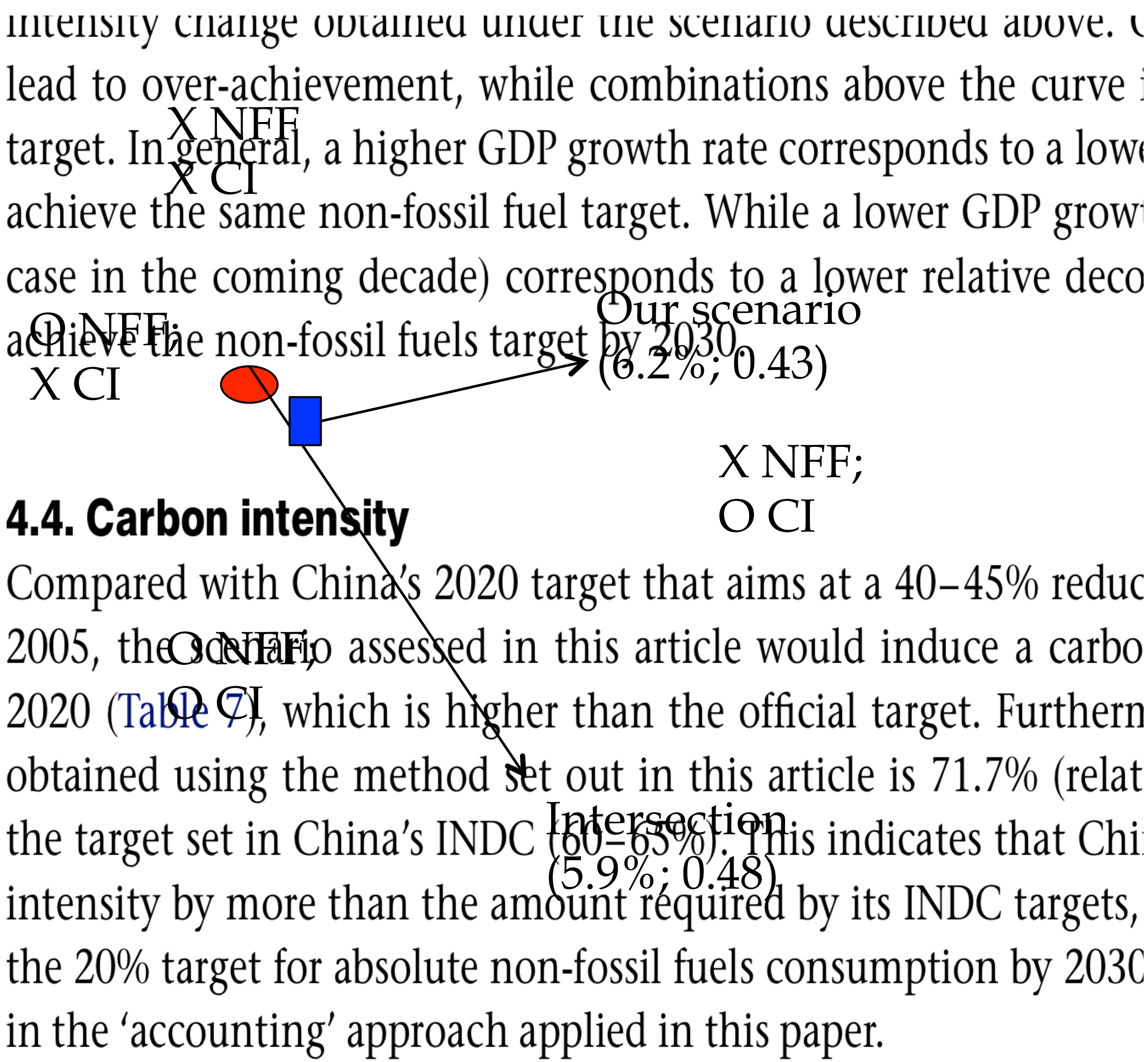
**Downward curve**: achievement of NFF target with a fixed amount of NFF level

-overachievement below the curve

**Upward curve**: simultaneous achievement of NFF (variable GW) and 65% carbon intensity target

-lower level on the curve indicates lower TPED

-overachievement of CI below the curve


intensity change obtained under the scenario described above.
lead to over-achievement, while combinations above the curve
target. In general, a higher GDP growth rate corresponds to a low
achieve the same non-fossil fuel target. While a lower GDP grow
case in the coming decade) corresponds to a lower relative deco
achieve the non-fossil fuels target by 2030.

**4.4. Carbon intensity**

Compared with China's 2020 target that aims at a 40–45% reduc
2005, the scenario assessed in this article would induce a carbo
2020 (Table 7), which is higher than the official target. Furthern
obtained using the method set out in this article is 71.7% (relat
the target set in China's INDC (60–65%). This indicates that Chi
intensity by more than the amount required by its INDC targets,
the 20% target for absolute non-fossil fuels consumption by 2030
in the 'accounting' approach applied in this paper.

# Finding No.4 Carbon intensity target 2030 could be inconsistent with the achievement of Non-fossil fuel target

Results obtained based on precedent figure.

- Carbon intensity does help to obtain total CO2 emissions

- Yet an energy per GDP intensity target is needed to ensure the TPED level if we argue in the logic of achieving non-fossil fuel target.

# THANK YOU !

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# Publications on carbon pricing; border carbon tax and statistics (2011-2012)

Li, J.F., Wang, X., Zhang, Y.X., 2012. Is it in China's interest to implement an export carbon tax?, Energy Economics, 34(6), pp.2072-2080.
[Summary republished at Nature Climate Change, 2, 230 (2012) doi:10.1038/nclimate1477]

Wang, X., Li, J.F., Zhang, Y.X., 2012. A case for introducing an explicit carbon price into China's export, Climate Policy, 12(4), pp.410-423.

Li, J., Wang, X., 2012. Energy paradigm shift and climate policy in China's twelfth five-year plan, Energy Policy, 41, pp.519-528.

Wang, X., Li, J.F., Zhang, Y.X., 2011. An analysis on the short-term sectoral competitiveness impact of carbon tax in China, Energy Policy, 39, pp.4144-4152.

Voituriez, T., Wang, X., 2011. Getting the carbon price right through climate border measures: a Chinese perspective, Climate Policy, 11(5), pp. 1257-1261.

Wang, X., 2011. On China's energy intensity statistics: toward a comprehensive and transparent indicator, Energy Policy, 39, pp.7284-7289.

# Some publications on CN ETS (2014)

- Fei Teng, Xin Wang, LV Zhiqiang, 2014. Introducing the emissions trading system to China's electricity sector: Challenges and opportunities, Energy Policy, 75, pp. 39-45.

- Ji Feng Li, Xin Wang, Ya Xiong Zhang, Qin Kou, 2014. The economic impact of carbon pricing with regulated electricity prices in China - an application of a computable general equilibrium approach, Energy Policy, 75, pp. 46-56.

# A publication on EU-CN solar panel trade dispute

- Voituriez, T., WANG, X., 2015. Real Challenges behind the EU-China PV trade dispute settlement, Climate Policy, 15(5), pp.670-677