

# China's Actions to Reduce Carbon Pollution

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Tianjin UN Climate Change Conference  
October 2010



# I. China's Climate Target: A Serious Commitment

NRDC WHITE PAPER

## **Putting it into Perspective: China's Carbon Intensity Target**

David Cohen-Tanugi

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# What is Carbon Intensity?

## Dissecting Carbon Intensity

The carbon intensity of a country can be divided into three major components:

- **Energy intensity:** The total primary energy consumed per unit of GDP, which is determined by the *energy efficiency* of its industry, buildings, vehicles, equipment, and the share of energy intensive industry, light industry, and services in its *economic structure*.
- **Non-fossil share of energy:** The share of China's primary energy consumption provided by non-fossil energy sources, such as hydro, wind, solar, and nuclear energy, which emit practically no CO<sub>2</sub>.
- **Fossil-fuel mix:** China's carbon emissions are also strongly determined by the relative share of its fossil energy sources. For example, natural gas emits about half the amount of CO<sub>2</sub> per unit of energy of coal. Together with the share of renewables and nuclear energy, the fossil fuel mix determines the 'carbon factor' of China's energy mix, or the amount of CO<sub>2</sub> emitted from consuming every Btu of energy.

The exact relationship between these three factors is explained in further detail in the Appendix.

# Scenarios

- **Scenario #1:**

**Previous Domestic Commitments** presents what might happen if China fulfills only the commitments that were in place prior to its carbon intensity announcement, without extending its energy intensity policies beyond 2010.

- **Scenario #2:**

**Extended Efforts** considers the situation if China strengthens its previous targets by carrying out sustained efforts to mitigate climate change through 2020 and beyond.

- **Scenario #3:**

**Economic Restructuring** examines the possibilities if China were to embark on a full-scale restructuring of its economy.

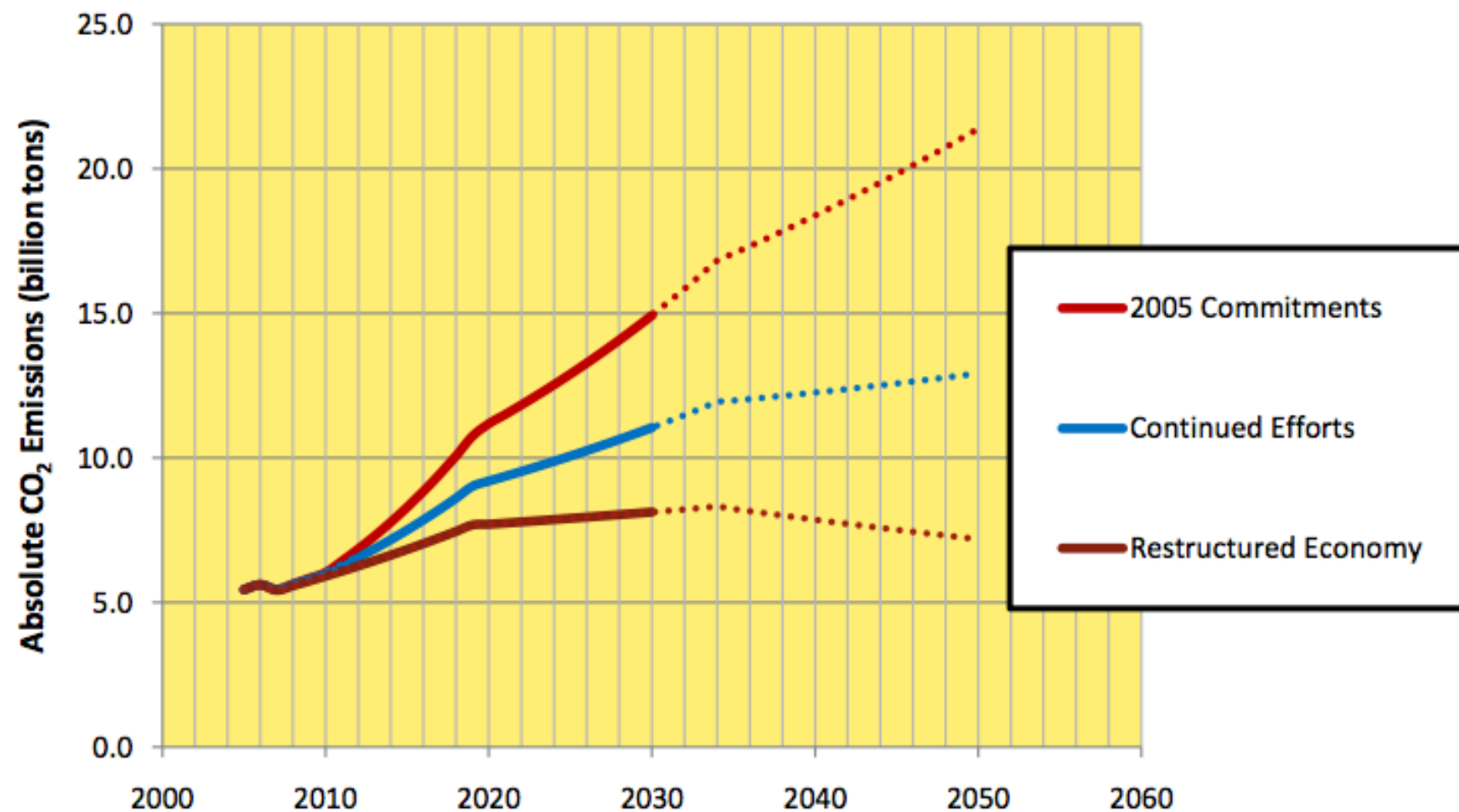
# Scenarios Assumptions and Results

**Table 1: Carbon intensity reduction from 2005-2020 under Previous Commitments, Extended Efforts, and Economic Restructuring scenarios**

|                                  | Scenario Assumptions                                                           |                                                                                 |                                                |                                       |
|----------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------|
|                                  | <i>Energy Intensity Reduction</i>                                              | <i>Fossil Mix Improvements</i>                                                  | <i>Non-Fossil Fuel Share of Primary Energy</i> | Reduction in Carbon Intensity 2005-20 |
| <b>1. Previous Commitments</b>   | 2006-2010: 20%, followed by the world historical energy/GDP elasticity of 0.8. | Coal: 66% of energy mix<br>Natural gas: 2%<br>Oil: 18%<br>No CCS deployment.    | 10% renewables by 2010 and 15% by 2020         | 37%                                   |
| <b>2. Extended Efforts</b>       | 2006-2010: 20%<br>2011-2015: 16%<br>2016-2020: 14%                             | Coal: 62% of energy mix<br>Natural gas: 5%<br>Oil: 18%<br>6 MT of CCS by 2030.  | 10% non-fossil by 2010 and 15% by 2020         | 48%                                   |
| <b>3. Economic Restructuring</b> | 2006-2010: 20%<br>2011-2015: 20%<br>2016-2020: 20%                             | Coal: 57% of energy mix<br>Natural gas: 10%<br>Oil: 13%<br>6 MT of CCS by 2020. | 10% non-fossil by 2010 and 18% by 2020         | 57%                                   |

# Absolute CO<sub>2</sub> Emissions Scenarios for China

Figure 4: Absolute CO<sub>2</sub> Emission Scenarios for China. The future emissions past 2020 are extrapolated from long-term energy trends projected by Renmin University.



# Key Takeaways

- China's 40 to 45 percent carbon intensity target represents a concrete new commitment.
- Low-hanging fruit will become increasingly scarce within each economic sector.
- If growth is low because of an economic slowdown, reducing carbon intensity will be more difficult.
- Absolute emissions will continue to increase past 2020, but reducing carbon intensity substantially can reduce growth of emissions and hasten the peaking of China's emissions.

## II. China's Energy Target: Taking the Lead

A graphic with the words "China Facts" in white, oriented vertically on a red rectangular background.

A photograph of a large wind farm in a flat, arid landscape. In the background, there are snow-capped mountains under a clear blue sky. Several wind turbines are visible, with one in the foreground being particularly prominent.

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This windmill in Xinjiang in western China is part of China's commitment to renewable energy. China invested \$34.6 billion in clean energy in 2009.

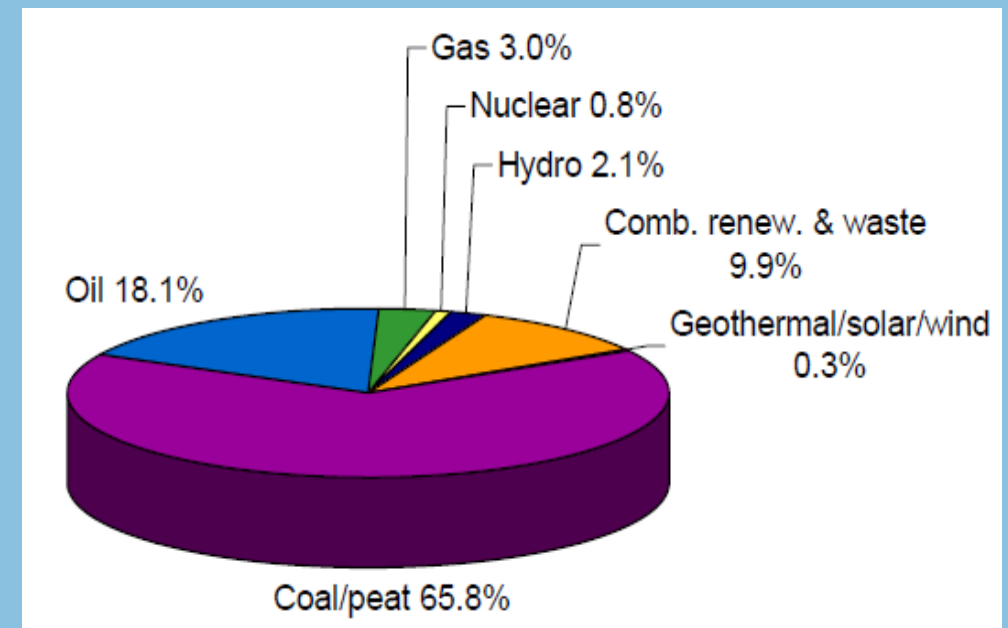
**From Crisis to Opportunity:**  
How China is Addressing Climate Change and Positioning Itself to be a Leader in Clean Energy

To Download go to:

[www.nrdc.org/international/chinaopportunity/chinaopportunity.asp](http://www.nrdc.org/international/chinaopportunity/chinaopportunity.asp)

# China: Coal

- Current energy mix **~70% coal**
- Deploying new technologies:
  - Combined heat and power
  - Ultra-supercritical
  - IGCC
  - CCS
- Still building new coal plants—although pace slowed from 2 plants a wk
  - Shutting down about  $\frac{1}{2}$  a plant a wk
  - Avg efficiency of new plants now higher than the US



2007

Source: IEA, 2007.

# China's Current Status

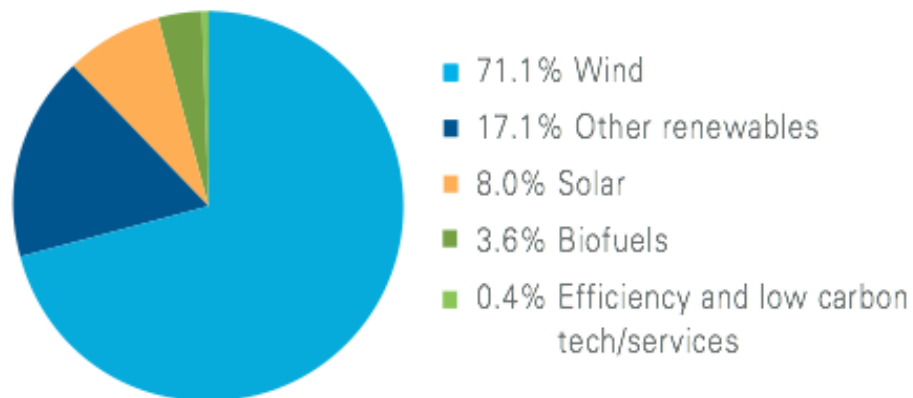
## FINANCE AND INVESTMENT (2009)

|                          |                |
|--------------------------|----------------|
| Total Investment         | \$34.6 billion |
| G-20 Investment Rank     | 1              |
| Percentage of G-20 Total | 30.5%          |
| 5-Year Growth Rate       | 147.5%         |

## INSTALLED CLEAN ENERGY (2009)

|                                 |         |
|---------------------------------|---------|
| Total Renewable Energy Capacity | 52.5 GW |
| Total Power Capacity            | 4%      |
| Percentage of G-20 Total        | 16.5%   |
| 5-Year Growth Rate              | 78.9%   |

## DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



## Key Renewable Energy Sectors

|          |           |
|----------|-----------|
| Wind     | 12,200 MW |
| Biomass  | 2,880 MW  |
| Solar PV | 140 MW    |

Source: The Pew Charitable Trusts

# Key Targets and Incentives

| KEY CLEAN ENERGY TARGETS (2020) |           |
|---------------------------------|-----------|
| Wind                            | 30,000 MW |
| Biomass                         | 30,000 MW |
| Solar                           | 1,800 MW  |

| KEY INVESTMENT INCENTIVES |                                                            |
|---------------------------|------------------------------------------------------------|
| Wind                      | Fixed feed-in tariff                                       |
| Renewable Energy          | Renewable energy surcharge and subsidy scheme              |
| Solar                     | Rooftop and building integrated photovoltaic tax subsidies |

| NATIONAL CLEAN ENERGY POLICIES |   |
|--------------------------------|---|
| Carbon Cap                     |   |
| Carbon Market                  |   |
| Renewable Energy Standard      | ✓ |
| Clean Energy Tax Incentives    | ✓ |
| Auto Efficiency Standards      | ✓ |
| Feed-in Tariffs                | ✓ |
| Government Procurement         |   |
| Green Bonds                    | ✓ |

Source: The Pew Charitable Trusts

# China Action: Renewable Energy

## Renewable Target:

- Increase non-fossil energy usage to around 15% of primary energy consumption by 2020

## Wind

- 2009 new installations: **13 GW** (#1 in world)
- Building off-shore: 102 MW Donghai Bridge project
  - ⇒ At end of 2009, 3<sup>rd</sup> largest amount of installed wind
  - ⇒ China's top 3 manufacturers have doubled share of global production b/t 2008-2009

Source: Zpryme, "Smart Grid Snapshot: China Tops Stimulus Funding" (2010)



# China Action: Renewable Energy (2)

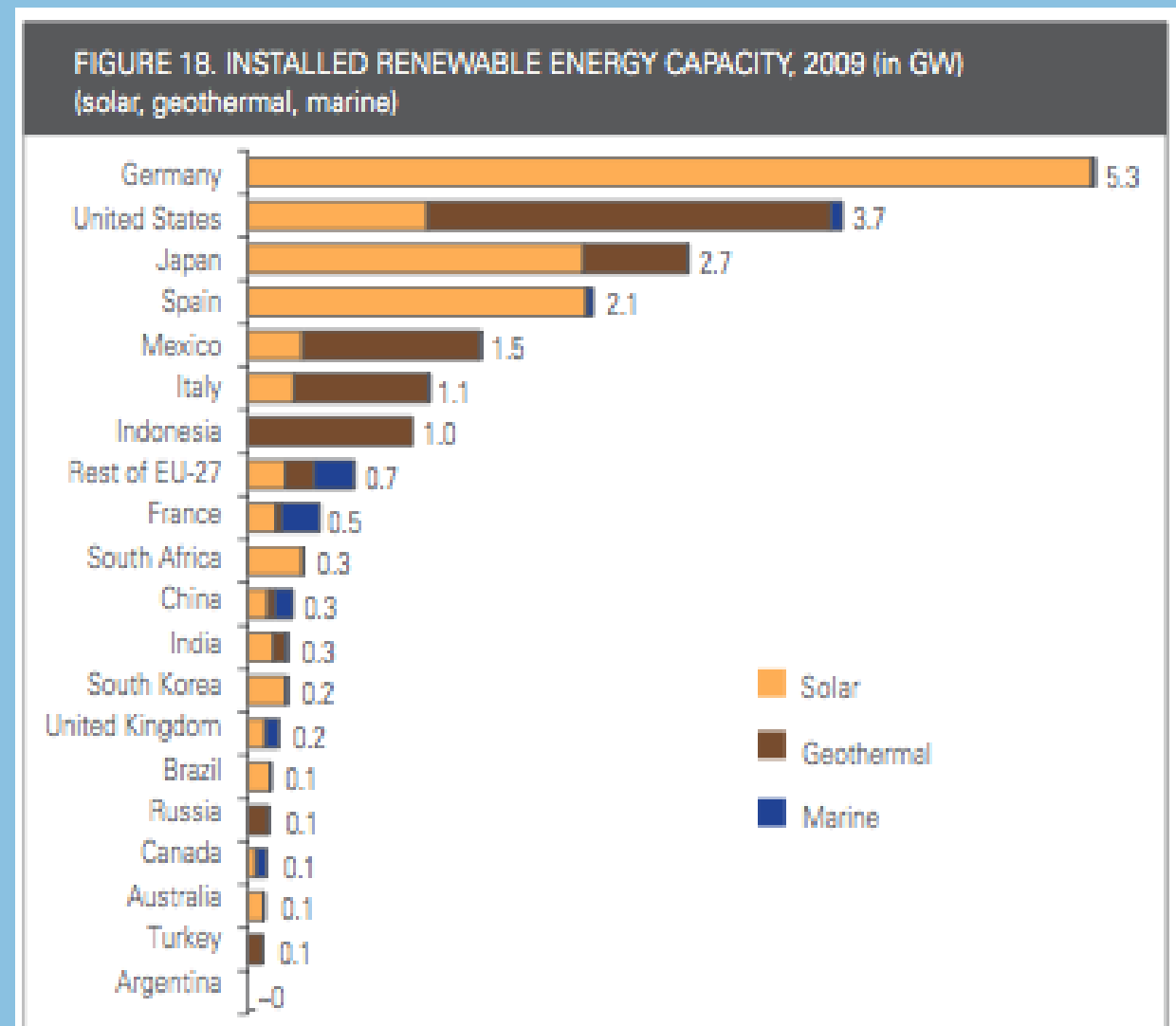
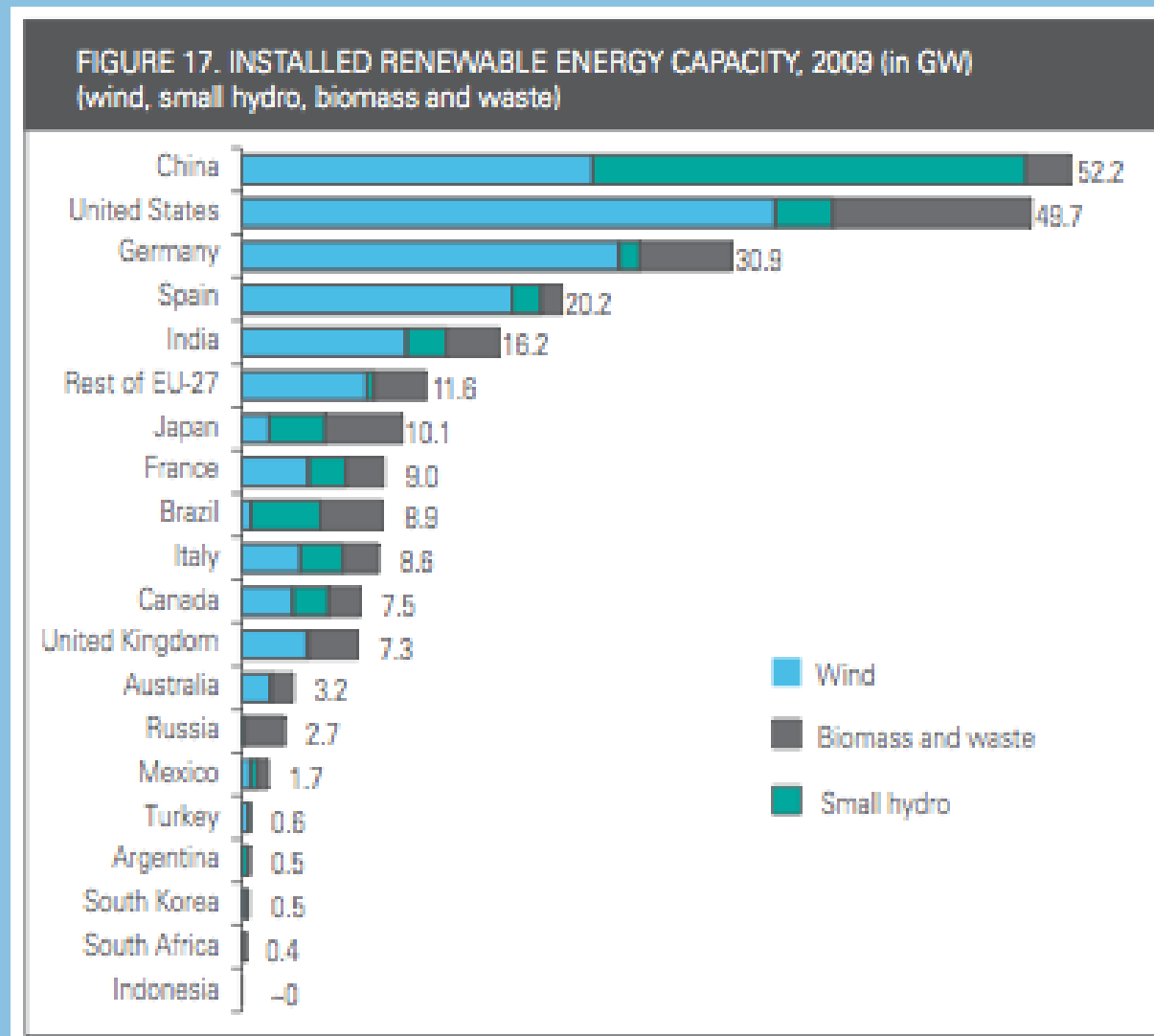
## Solar

- Created the “Solar Roofs” and “Golden Sun” Programs to boost domestic installation
- Planning for GW scale
- ⇒ Manufacturing nearly 40% of PV cells in the world
- ⇒ Largest solar hot water heater market: 60 million homes

## Smart Grid

- 2010: **\$7.3 bil** investment (#1 in world)
- Through 2012: **\$44 bil** on Ultra High Voltage

# Global Installed Clean Energy Capacity



Source: The Pew Charitable Trusts

# China Investing in Clean Energy

- \$13 trillion market for global clean energy over the next two decades<sup>1</sup>

## China

- In 2009: **\$34.6 billion** (#1 in world)<sup>2</sup>
- From 2010-2020: **\$738 billion** on alternative energy (includes nuclear and unconventional gas)<sup>3</sup>

(1) *International Energy Agency.*

(2) *Sources: The Pew Charitable Trusts, Who's Winning the Clean Energy Race? (2010).*

(3) Shanghai Daily, 21 July 2010, available at: [www.china.org.cn/business/2010-07/21/content\\_20544793.htm](http://www.china.org.cn/business/2010-07/21/content_20544793.htm)

# Global Clean Energy Investment

FIGURE 9. INVESTMENT BY FINANCING TYPE, 2009 (billions of \$)

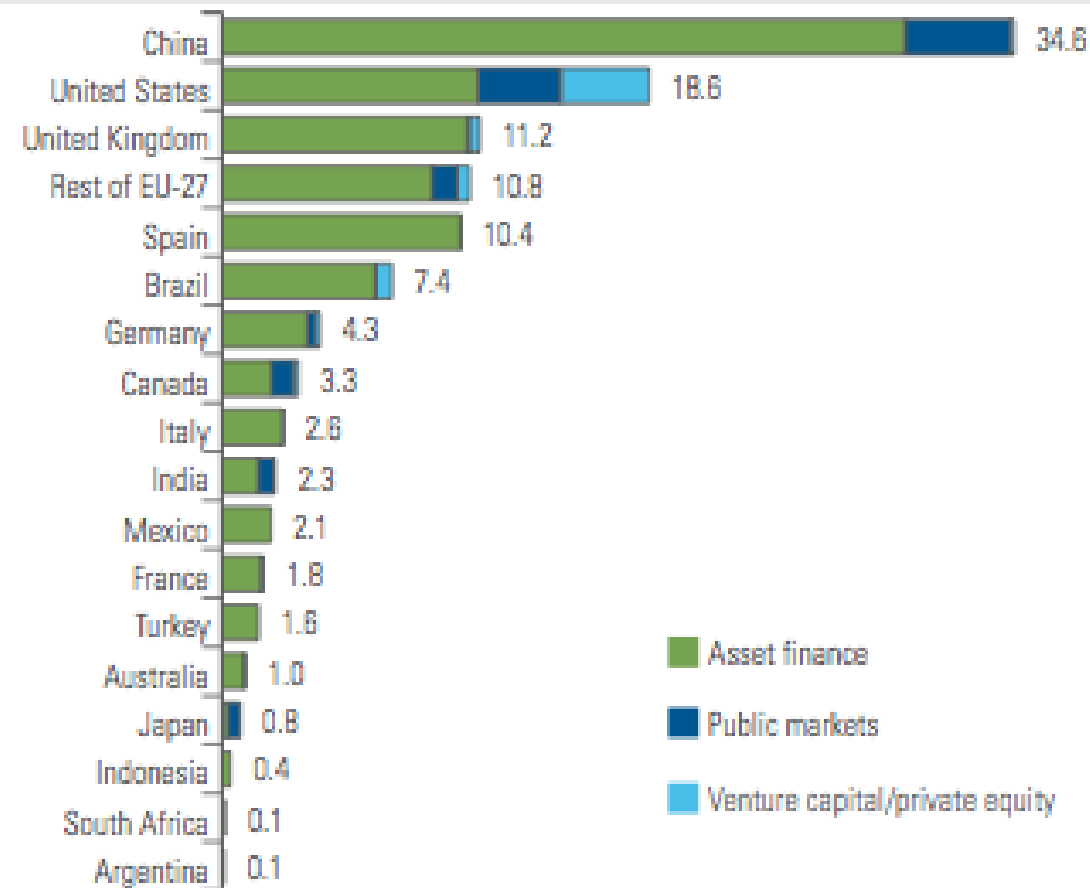
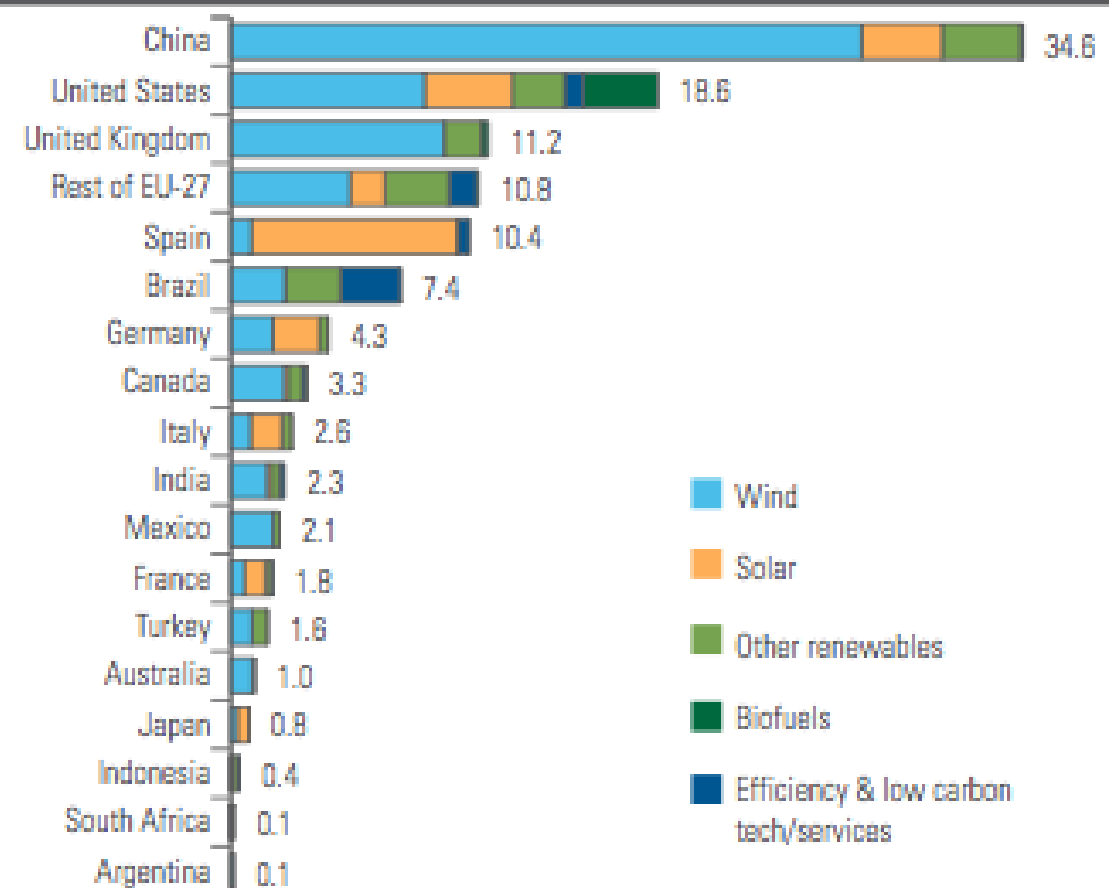


FIGURE 10. INVESTMENT BY SECTOR, 2009 (billions of \$)



Source: The Pew Charitable Trusts

# China Action: Energy Efficiency

## Energy Intensity

- **Target:** 20% reduction from 2006 levels by 2010
- **Status:** 15.6% by end of 2009

## Actions:

- Successful shutdown of small factories and power plants (71GW through July 2010)
  - ~ 1/2 a power plant a week
- “1000 Enterprise program”
- Incentivize high-tech sector growth
- High coal-fired power plant efficiency standards

*Currently exhausting all alternatives to achieve target*

# China Action: Building Efficiency

- Current standards: 50% reduction for new buildings
- Energy retrofit target: 150 mil m<sup>2</sup> cold-climate residential by 2010
- **Under development:** energy rating and labeling for residential and commercial

*If they successfully meet 11<sup>th</sup> FYP's targets: 540 MtCO<sub>2</sub> reduction*

Source: NRDC calculations based on LBNL, "Assessment of China's Energy-Saving and Emission-Reduction

Accomplishments and Opportunities During the 11<sup>th</sup> Five Year Plan" (2010).



# Modernizing Transportation

## Vehicle Fuel Efficiency Standards

- Among strictest in world

## Electric Vehicles:

- **Target:** EV and electric bus production 500,000 / yr by 2011
- 20 pilot programs to incentivize city governments and 5 programs for private consumers
- China will launch 20,000 new energy powered autos into public transit by the end of 2010

## High-speed rail

- 4000 miles (#1 in world)
- 6200 miles under construction

# Now Is the Time for Global Innovation

# Thank you!

- Thanks to Adam Scherr for help with this presentation.
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