China's Renewable Energy Legal Framework and Emissions Reductions Potential from "Strong, Smart Grid"

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Overview

- Renewable energy
  - Growth in China
  - Importance of legal and policy framework
- Strong, smart grid development
  - Progress and future plans
  - Significance and emissions reductions potential

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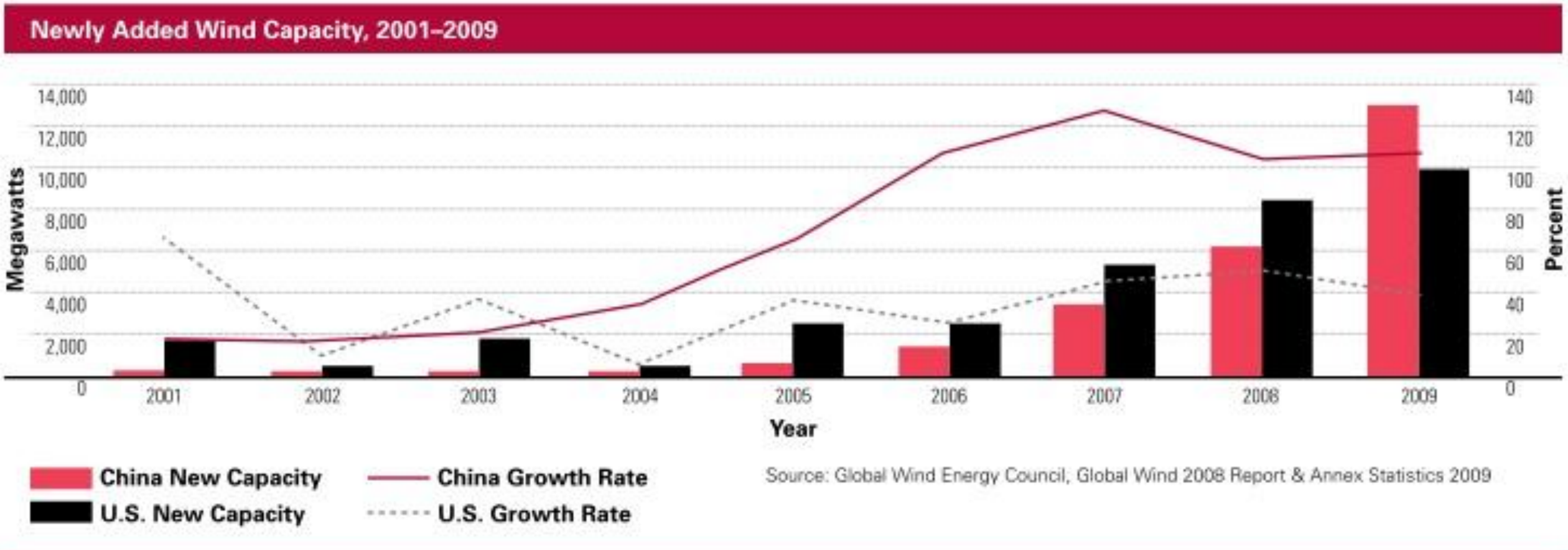
Growth in China's Wind Capacity 2001-09



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Renewable Energy Legal and Policy Framework

Renewable Energy Law (2005) established:

(1) a national renewable energy target

(2) a mandatory connection and purchase policy

(3) a feed-in tariff system, and

(4) a cost-sharing mechanism, including a special fund for renewable energy development.

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National Renewable Energy Targets

2007 Mid- and Long-Term Development Plan for Renewable Energy.

Two main targets:

- Renewables as % of China's primary energy consumption: 10% by 2010 and 15 percent by 2020.
- "Mandatory Market Share" (MMS) requirement: Set target for non-hydro renewable power generation out of total power generation: 1% for 2010 and 3% for 2020

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RE Targets: “Old” and Revised

RE	Existing in 2005	2007 Goal for 2010	2007 Goal for 2020	Likely Revised Goals
Wind	1,260	10,000	30,000	150,000
Solar	70	300	1,800	20,000
Biomass Power	2,000	5,500	30,000	

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Mandatory Connection and Purchase Policy

- Requires grid companies to connect and purchase all renewable power generated in their coverage area
- *Measures on Grid Company Full Purchase of Electricity from Renewable Energy*
  - Requires grid companies to promptly provide connection services to the renewable generator
  - Established a “priority dispatch” system, in which renewable generators are given priority in the electricity dispatching sequence
  - Allow the dispatcher to manage the renewable power generator (e.g., curtail transmission from a generator) in cases where grid stability is threatened.

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National Feed-in Tariffs

Renewable Source	FIT
Wind	Set in August 2009. Divided into four tiers ranging between **0.51 to 0.61 RMB/kWh**. Areas with the least abundant wind resources receive the highest tariff and areas with the most abundant resources receive the lowest tariff.
Solar	**No nationwide feed-in tariff currently exists**, but specific solar projects can receive a FIT through a tender process. Recent solar projects in Ningxia have received a tariff of 1.15 RMB/kWh.
Biomass Power	The national feed-in tariff is equal to **0.25 RMB/kWh plus the 2005 benchmark desulfurized coal price** in the area where the facility is located for a period of 15 years.

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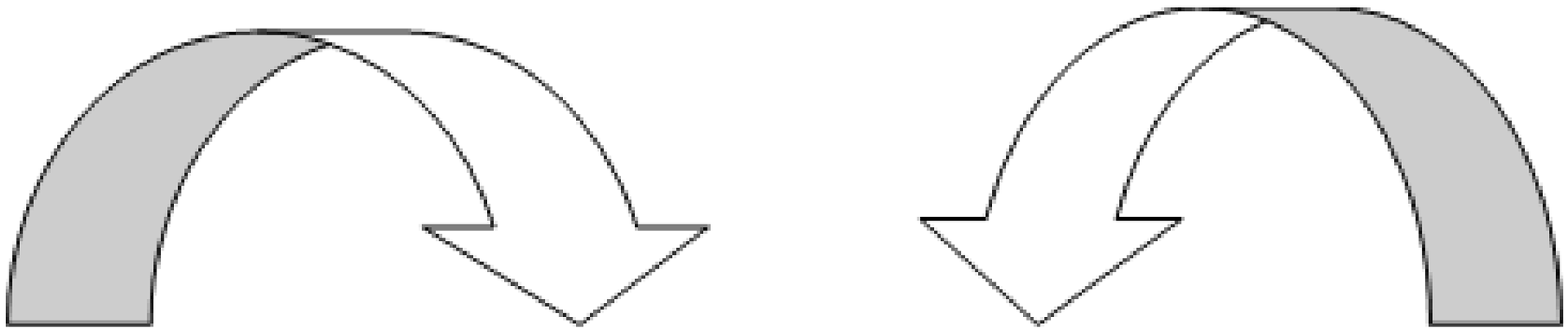
2009 H2 FIT Payment Schedule

	附件一：2009年7月-12月可再生能源发电项目补贴表				
					单位：兆瓦，万千瓦时，万元
省份	类别	项目名称	装机容量	上网电量	补贴金额
冀北	风力发电	张北国投满井风电场一期、二期（中节能张北风力发电）	94.50	11460.5800	2447.9799
		康保卧龙山风电场	30.00	3808.3600	813.4657
		国华（河北）尚义风电场二期	49.50	5303.5700	1132.8426
		（国华）尚义风电三期	49.50	5184.5600	796.3484
		淞杉风电工程（红松风电三期）	52.50	5738.7000	881.4643
		沽源狼尾巴山风电场一期	10.60	1274.8500	272.3080
		沽源狼尾巴山风电场二期	20.00	2405.3800	369.4664
		龙源（张家口）风力发电有限公司尚义石人风场	49.50	8285.1800	1272.6036
		中节能风力发电（张北三期）运维有限公司	49.50	10239.9000	1572.8486
		崇礼清三营风电	49.30	5251.9500	806.6995
		万全博德玉龙风电	36.00	4426.4900	679.9089

Funding mechanism under 2005 RE Law



Challenges in the Existing Framework

- ~30% wind turbines not connected to grid (yet)
- Difficulties in integrating larger amounts of variable renewable power
  - Need for greater transmission capacity
  - Curtailment

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2009 Amendment to RE Law

Changes to the Mandatory Connection and Purchase Policy

- *Renewable Power Quota – Specific Targets*
- *Priority Dispatch – Added to RE law*
- *Technical Requirements for Grid Connection for generators*

Increased Central Government Oversight of Provincial RE planning

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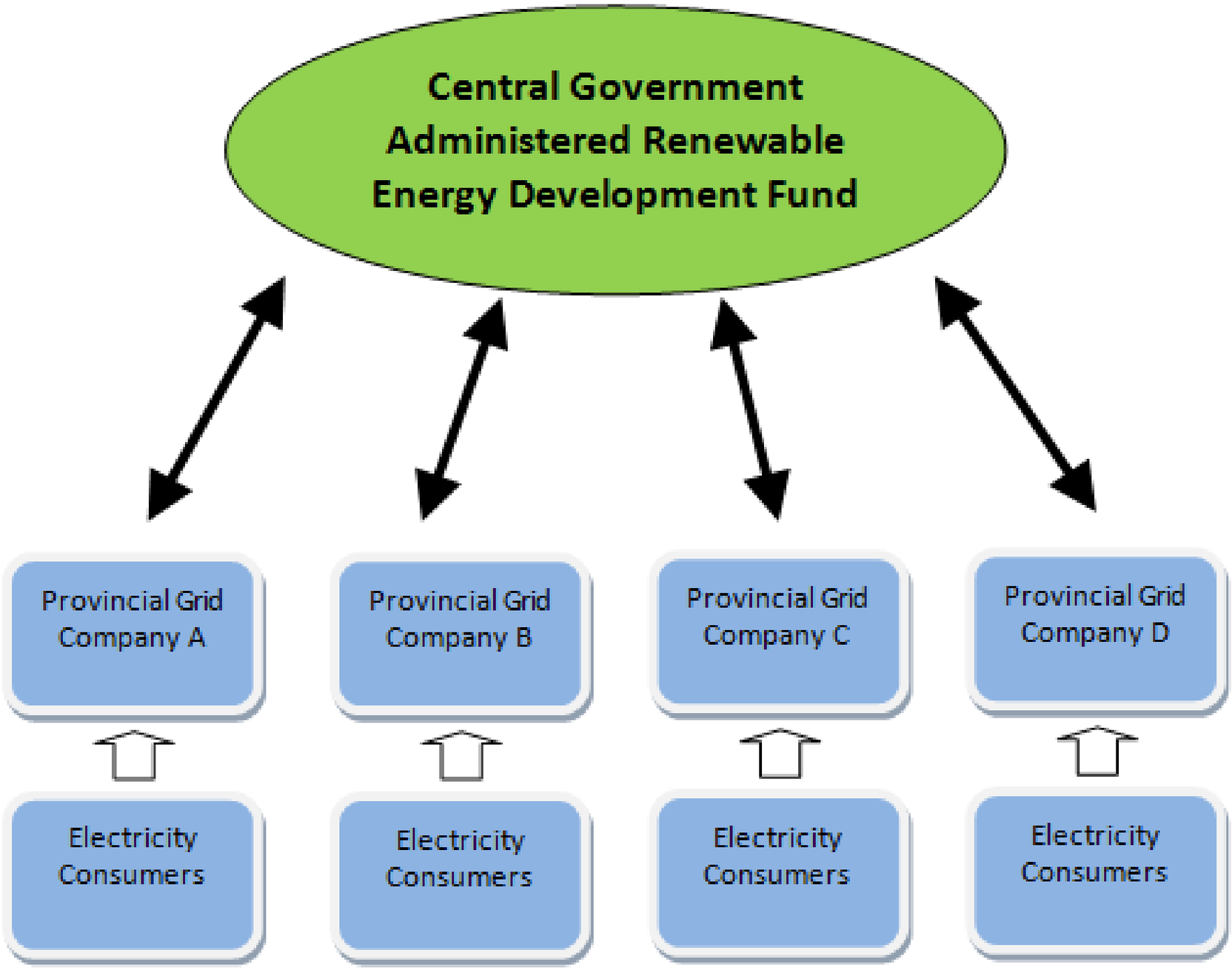
2009 Amendments to RE Law

Streamlining of the Renewable Energy Fund



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Recommendations for Strengthening Implementation of the Amended Renewable Energy Law

- **Establishing and Implementing an Effective Renewable Power Quota System**
  - Targets should be set high enough to incentivize growth.
  - Differentiate between different kinds of RE
  - Tracking of performance, possible future trading
  - Target responsibility and evaluation system
  - Penalty provisions – high enough and automatic
- **Devising an Effective Priority Dispatch Policy**

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Recommendations for Strengthening Implementation of the Amended Renewable Energy Law (2)

- **Setting Appropriate Technical Standards for Interconnection – Transparent process**
- **Improving the Functioning of the Renewable Energy Development Fund**
  - More frequent distributions of subsidies
  - Transparent funding criteria for projects
- **Increased Central Oversight over Provincial Planning**

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(Strong) Smart Grid and its Potential for Reducing GHG Emissions in China and the United States

Definition: A strong, smart grid is an interconnected system of (a) information and communication technologies and (b) electricity generation, transmission, distribution, and end-use technologies that will:

- enable consumers to manage their power usage and choose the most economically efficient products and services (*two-way communications*);
- maintain electricity delivery system reliability and stability enhanced by automation (*intelligent monitoring and control*); and
- integrate the most environmentally benign generation alternatives including renewable resources and energy storage (*two-way power transmission*, *renewable integration*).

Adapted from Roger Levy, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory.

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China's UHV Transmission Plans

- China plans to install 10-15 UHV transmission lines within fifteen years, using a total investment of 400 billion RMB. UHV is defined by SGCC as +/-800 kV DC and higher or 1,000 kV AC and higher.

- SGCC has a "Two Vertical, Two Horizontal" plan for connecting large areas of the country with UHV transmission lines.

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SGCC's plans for strong, smart grid through 2020

- **2009-2010 – phase 1 – planning and pilot projects**
  - Set technical and management standards
  - Develop technology and equipment
  - Set development plans and initiate pilot projects
  - Specifically, in 2010, China plans to start construction on the "Two Vertical, Two Horizontal" plan and reach inter-region transmission capability of **12.9** GW by the end of the year.

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SGCC's plans for strong, smart grid through 2020

- **2011-2015- phase 2 – comprehensive construction phase**
  - Construct UHV grid and city-rural distribution grid
  - Construct smart grid operation/control and interactive service system
  - Key technologies and equipment breakthroughs and widespread usage of those breakthroughs
  - By 2015, UHV and other intra-regional transmission capacity will be **240 GW**. Distribution and power provision will reach a reliability rate of 99.915% or higher in the cities and 99.73% or higher in rural areas. Smart meters will be in widespread use and EV charging stations will have been deployed in numbers that will satisfy demand

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SGCC's plans for strong, smart grid through 2020

- **2016-2020- phase 3 – leadership phase**
  - Basically complete strong, smart grid
  - Become world leaders in management, technology and equipment
  - By 2020, UHV and other intra-regional transmission capacity will reach **400 GW**, enough to connect all of the planned coal, hydro, nuclear and wind power to areas of high demand

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SGCC: China's Estimated Annual CO2 Reductions From Strong, Smart Grid

Mechanism	2005 Figure	2020 Figure	Difference between 2020 and 2005 figures	Avoided CO_2 emissions, 2020 ($Tg\ CO_2$)
Raising the consumption of "clean energy"[14]	89 GW	411 GW	320 GW	1,018
Decrease in transmission losses	6.59%	5.7%	Save 14.17 million TCE	39
Increase Efficiency of Coal Burning for Generation	343 grams/kWh	305 grams/kWh	38 grams/kWh; save 188.859 million TCE	524
Increase in Energy Efficiency of Electricity Sector and Consumers	18% of consumer energy consumption is in the form of electricity	26% of consumer energy consumption will be in the form of electricity	N/A	Not yet calculated
Promotion of electric vehicles	0 EVs	30,000,000 EVs	35.5 million tons of petrol use will be avoided	68.7[15]
			TOTAL	**1,649**

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Improving Wind Integration with the Grid

- Improving wind forecasting
- Demand Response
- Storage – Large scale storage versus distributed storage such as EVs
- Regional Grid Integration

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Thank you!

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