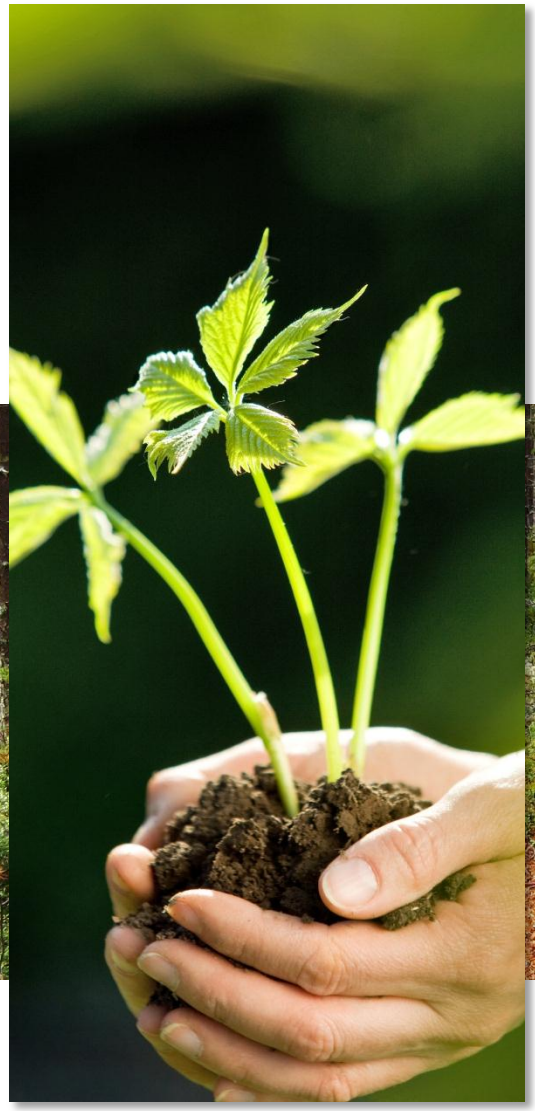

New Energy in China

A Policy Perspective

Presented to TDA

March 2012

APCO worldwide®

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Overview of New Energy in China

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Wind Power in China

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- Background
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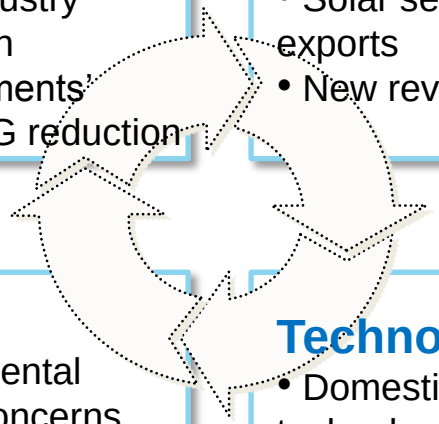
Overview: New Energy in China

Why New Energy: Market Driving Forces

Political
- Stimulus package
- Revision of Renewable Energy Law
- New Energy Industry Revitalization Plan
- Foreign governments' pressures on GHG reduction

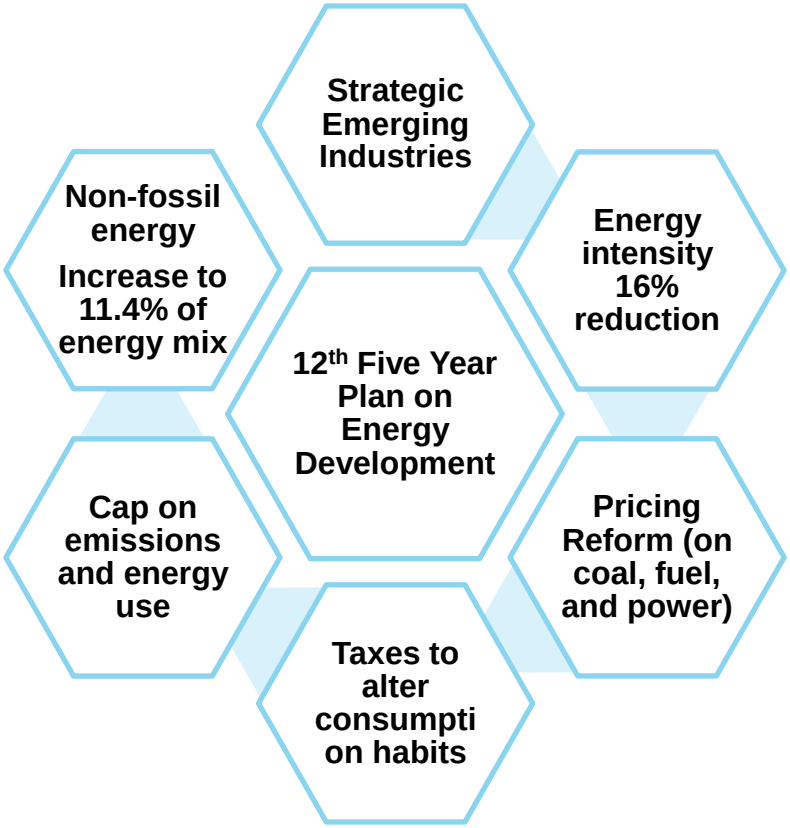
Economical
- Power companies anxious to meet RE quotas
- Solar sector driven by exports
- New revenue streams



Social
- Rising environmental awareness and concerns
- Public opinions influencing commercial decisions

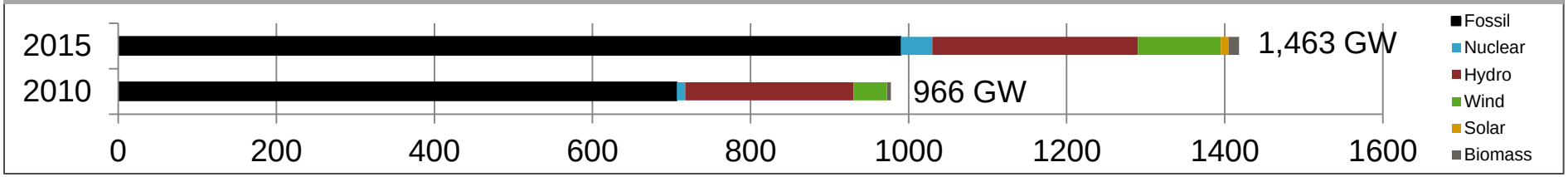
Technological
- Domestic use of military technology
- Increasing international cooperation
- Indigenous innovation

12th Five Year Plan



12th FYP Renewable Energy Targets

Role of Renewable Energy in China's Overall Power Generation Mix



China's Renewable Energy Sources (2015E)

Hydro (~70%)

2015 Targets:
- Installed capacity of 300 GW, up from 213 GW in 2010

Opportunities
- Equipment
- Services
- China largely self-sufficient

Wind (~23%)

2015 Targets:
- Installed capacity of 100 GW, up from 41.8 GW in 2010
- 5 GW off-shore

Opportunities:
- Turbines and blades
- Critical components
- Off-shore expertise

Solar (~3.5%)

2015 Targets:
- Installed capacity of 15 GW, up from 0.8 GW in 2010

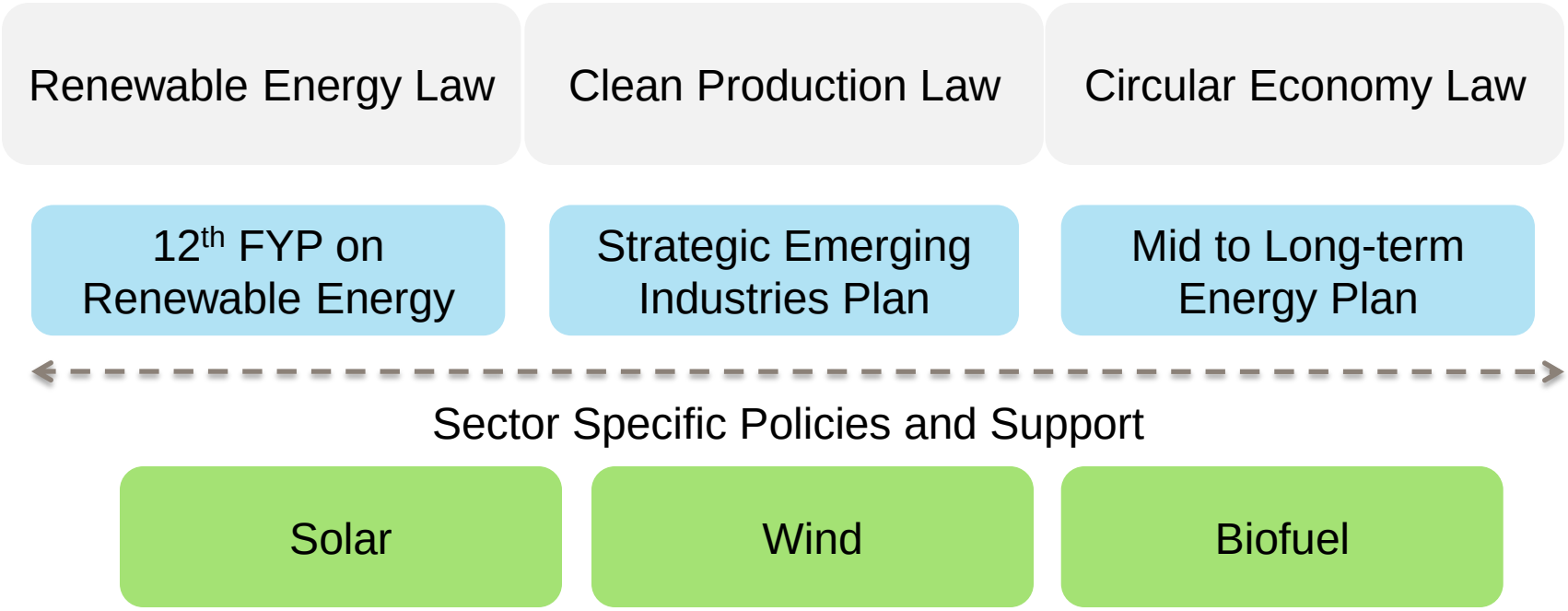
Opportunities:
- Upstream materials
- Key components
- Capital equipment
- Utility-scale solar

Biomass (~3%)

2015 Targets:
- Installed capacity of 13 GW, up from 5.5 GW in 2010

Opportunities:
- Pellets, fuels, electricity, gas technologies
- Tax and FiT support

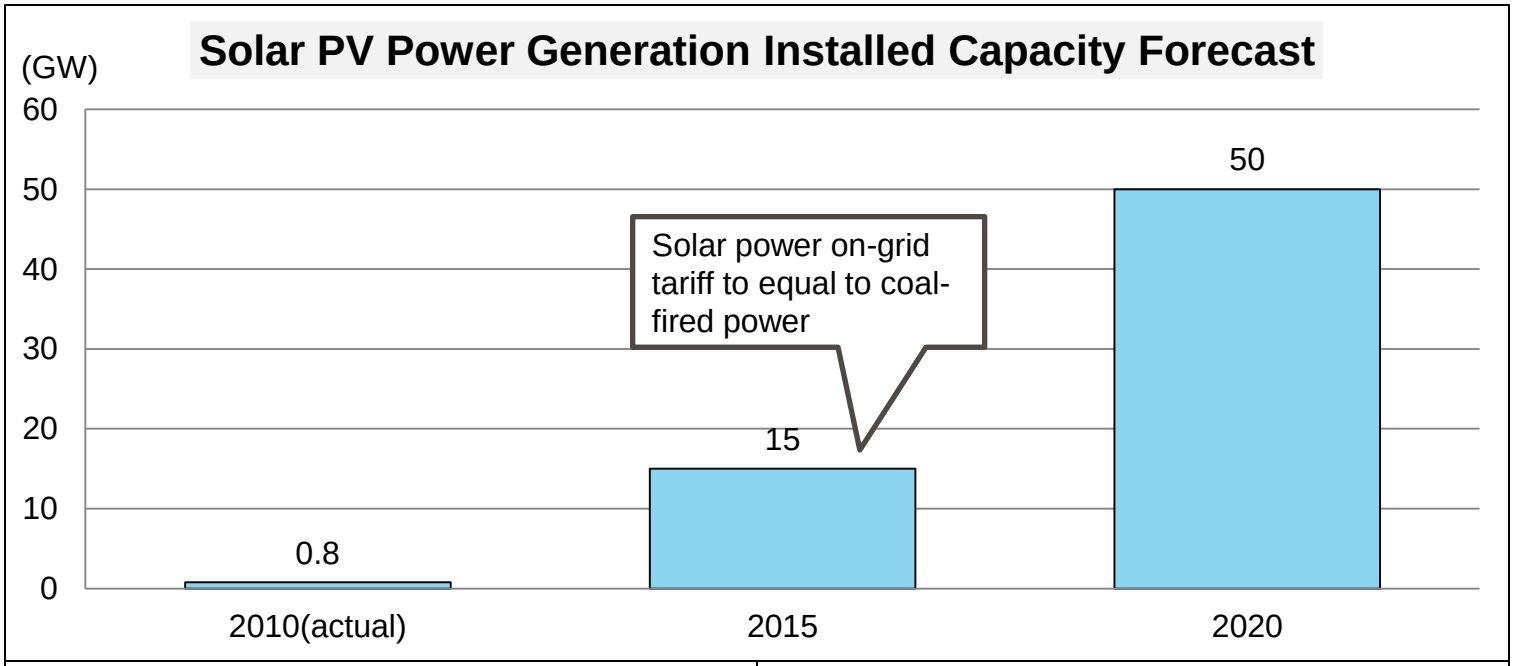
New Energy Policy Framework



Solar Power in China

China's Solar PV Development Roadmap

2011-2020 development forecast



2011-2015

- To develop China into a large solar energy manufacturer and consumer, with strong government support and subsidies

2015-2020

- To develop China into a strong solar energy manufacturer and large consumer, with fewer government supports and subsidies

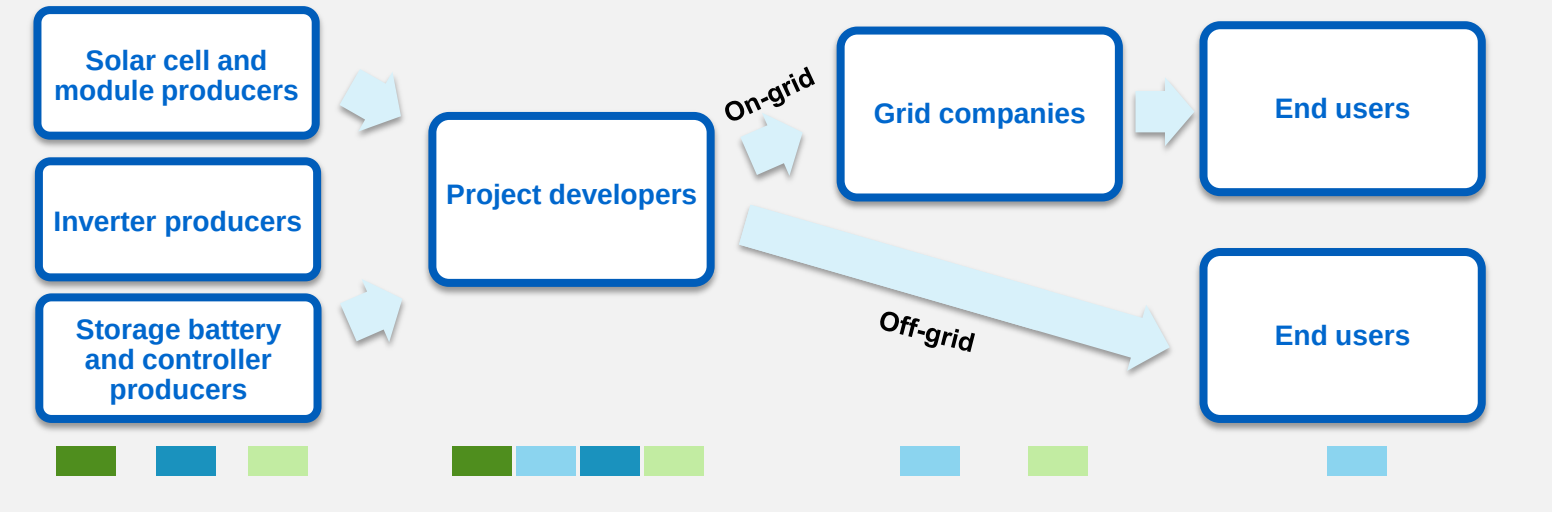
It is expected that newly-added solar PV installation capacity in 2012 will reach 4-5 GW, while that of 2011 is 2.2 GW.

Solar *Policy framework*

Renewable Energy Law

Objectives	Investment guidance	On-grid tariff and cost share mechanism	Guaranteed-purchase mechanism	PV inverters BIPV Crystalline silicon cells	Concentrated PV (CPV) Silicon ingot/ silicon wafers Thin film solar cells	Renewable Energy Development Fund
Overall planning		**Grid integration mechanism**		**Indigenous R&D and technical development**		**Government incentives**

Relevance to different industrial players



Solar *Investment guidance*

Guiding Catalogue of the Renewable Energy Industry (2006)[*1]

- **Encouraged items:**
  - On-grid (including BIPV) and off-grid solar power generation systems
  - Charge and discharge controllers for storage batteries
  - DC/AC inverters for on-grid and off-grid systems

Guiding Catalogues of Industries for Foreign Investment (2011)[*2]

- **Encouraged items:**
  - Whole set and core solar PV power generation equipment
  - Construction and operation of solar power station

Business Implications:
•In the next five years, China will continue to highly encourage foreign investment in the whole set and core solar power equipment including DC/AC inverters and storage battery controllers.
•Therefore, foreign investment in solar sector will be able to enjoy favorable FIE policies and measures regarding land use, tax and import, among others.

**1 http://www.tianneng.com.hk/attachment/200905121721542_sc.pdf*
**2 http://www.sdpc.gov.cn/zcfb/zcfbl/2011ling/W020111229379511927834.pdf*

Solar *geographic focus*

Geographic Layout of Solar Industry in China

- Thus far, China has shaped solar PV manufacturing clusters in provinces/cities including Sichuan, Jiangsu, Hebei, Jiangxi, Zhejiang, Shenzhen, Henan, Inner Mongolia and Ningxia.
- Besides, China has identified 13 industrial parks as its solar PV power generation application demo zones, in Beijing, Shanghai, Liaoning, Tianjin, Hebei, Shandong, Henan, Hubei, Hunan, Anhui, Zhejiang, Jiangxi and Guangdong.

Solar *Grid Integration Mechanism*

Interim Measures for On-grid Tariff and Cost Share of Renewable Energy (2006)

- Clarifies solar power prices are decided by government.
- Sets the regulation that additional cost in comparison with coal-fired power should be shouldered by end electricity users, charged so-called "renewable energy surcharges".

Interim Measures for Management and Allocation of Renewable Energy Surcharges (2007)

- Specifies the collection and allocation of "renewable energy surcharges".

Regulatory Measures for Grid Enterprises' Full Purchase of Renewable Energy (2007)

- Specifies how grid companies should coordinate with renewable energy generators to ensure full purchase of all the renewable energy generated.

Concessionary bidding program (Golden Sun Program and BIPV Demonstration Projects) (2009-)

- From 2009 onwards, China initiated several rounds of competitive bidding programs for solar PV projects in order to create clear tariff structures and to develop the industry.

Notification to Improve On-Grid Solar PV Pricing Mechanism (2011)

- Introduces benchmark solar PV tariffs for non-bidding projects:
  - RMB 1/kWh for projects approved before July 1, 2011 and completed before Dec.31, 2011 and all projects in Tibet;
  - RMB 1.15/kWh for projects approved before July 1, 2011 and completed after Dec.31, 2011, and approved after July 1, 2011.

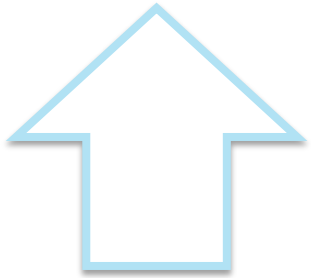
Renewable Energy Quota System (to be established)

- To allocate specific renewable energy generation and purchase quotas to power generators and grid companies.
- To ensure at least a certain amount of power generated by renewable energy will be purchased and consumed.

Business Implications:

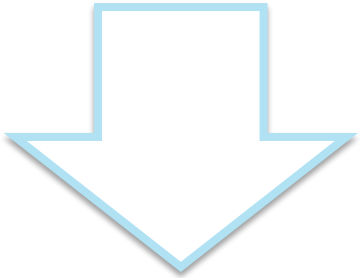
- As a leading country in solar cell and module manufacturing, China is at the preliminary stage of solar PV application. Thus far, the high feed-in-tariff of solar PV is still one of the major barriers to large-scale application of solar PV in China. In 2011, China introduced the benchmark tariffs for solar PV projects after two rounds of concessionary bidding programs. Industry insiders believe that it is very likely that the solar PV sector will see a robust development in the following years, similar to the development path of wind power.
- While making modest progress in on-grid pricing, the industry still sees reluctance from grid companies to purchase solar power voluntarily. As such, the National Energy Administration is currently developing the Renewable Energy Quota System to ensure at least a certain amount of solar power will be purchased and consumed in the 12th FYP.

Solar *Indigenous R&D and Technical Development*



PV inverters

- According to the *National 12th FYP on Energy Science and Technology Development*, China aims to develop on-grid inverter equipment with capacity over 1MW through indigenous R&D.



Concentrated PV

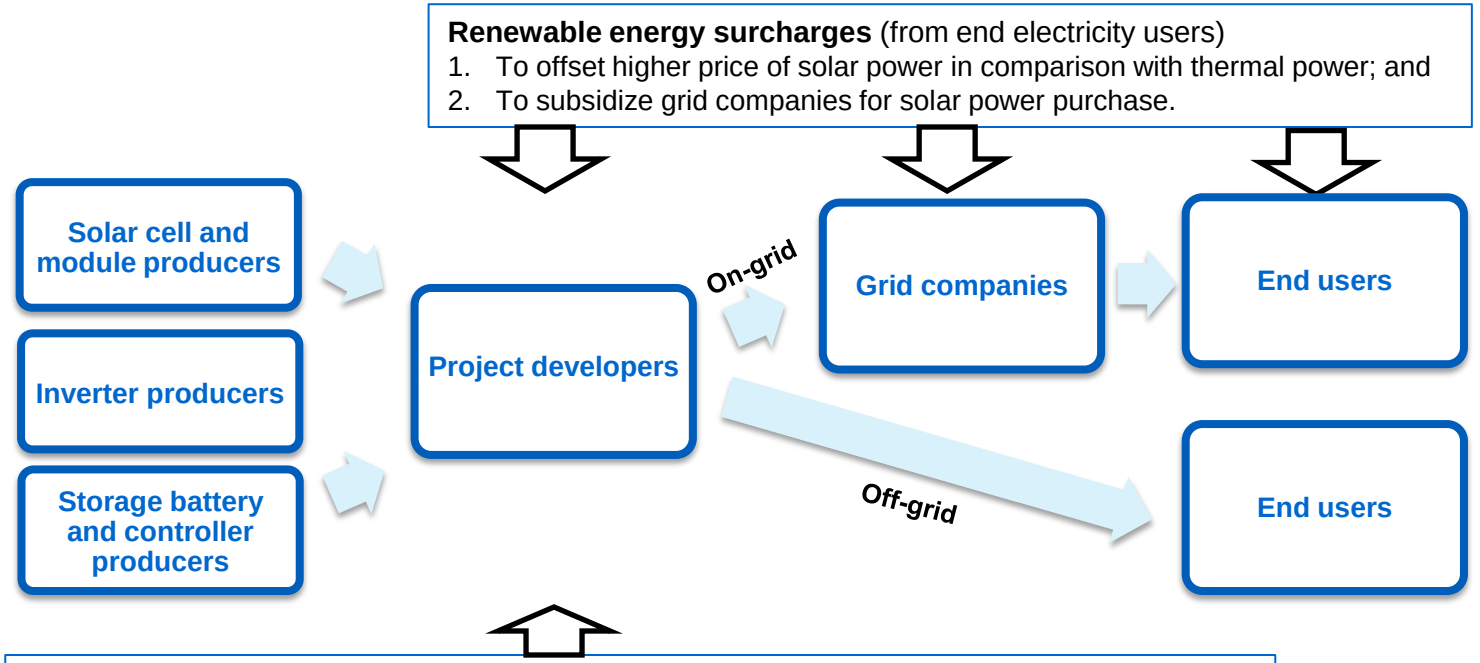
- Though the CPV sector is still at its nascent stage, China's industry experts have high expectations for this market segment because CPV thermal plants do not require costly silicon PV panels and are also compatible with the current national power grid infrastructure.
- China ambitiously targets to reach an installed capacity of 3 GW of CPV-derived energy by 2020 from the current capacity of 1 MW.
- The Chinese government is actively supporting CPV development, and is open to foreign participation in this segment.

Business Implications:

- PV inverter is a critical equipment for solar power generation. China is still a blue sea market for inverter products with Sungrow Power as the market leader enjoying over 40% of the domestic PV inverter market share. Foreign businesses can expect huge potential in this market segment in the next five years. Foreign companies may also seek opportunities to conduct joint R&D with Chinese companies in large capacity inverters.
- CPV is regarded as a highly promising solar PV technology to replace silicon PV products. Thus far, CPV is still at demonstration stage given its relatively high costs. Foreign companies may participate in the CPV technical development and demonstration projects.

Solar *Government Incentives*

China has established the national ***Renewable Energy Development Fund*** with solar power sector as one of the key beneficiaries. Key sources of the Fund are specialized renewable energy development fund and renewable energy surcharges.



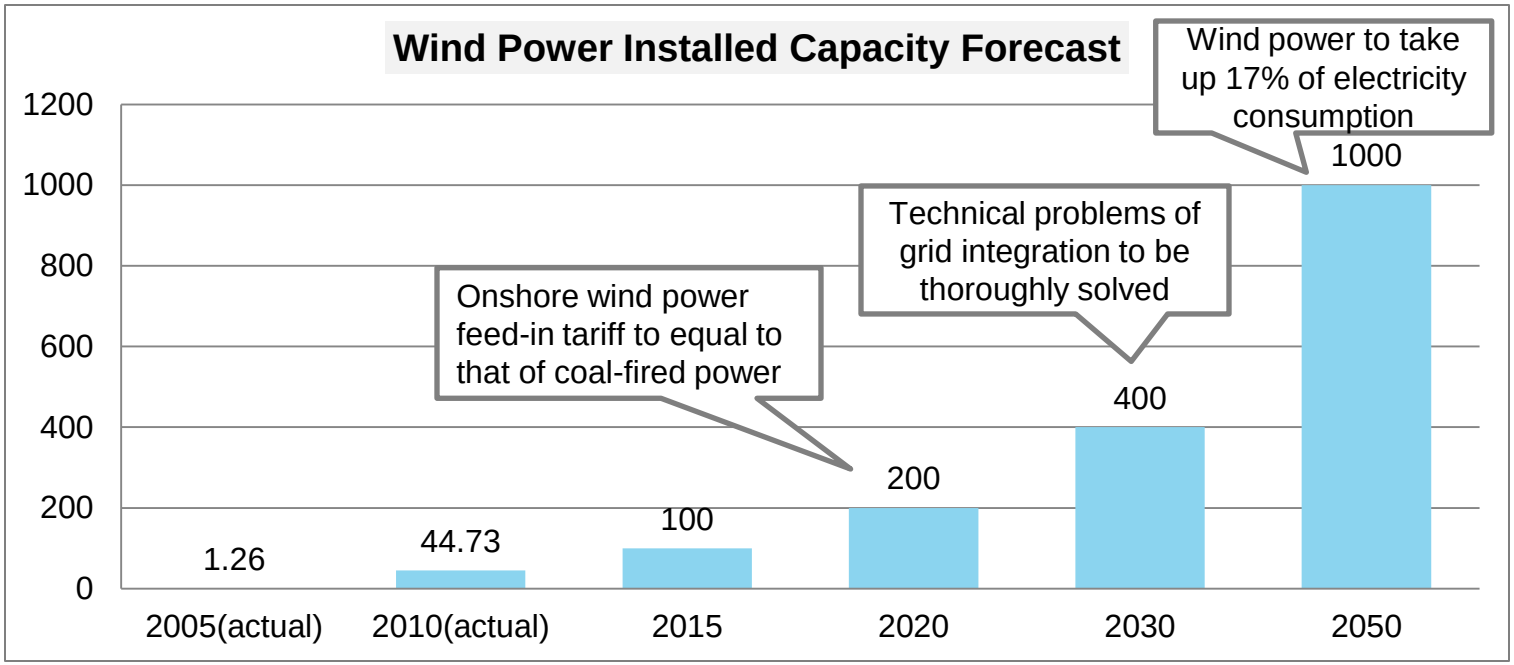
Business Implications:

- In January 2012, the "renewable energy surcharge" was doubled from RMB 0.4 cent/Kwh to RMB 0.8 cent/Kwh, collected from end users with higher electricity price.
- The surcharge will be allocated to solar project developers and grid companies, but not to equipment manufacturers.


Wind Power in China

China's Wind Power Development Roadmap

2011-2020 development forecast



2011-2020	2021-2030	2031-2050
• Onshore wind power as main focus; with • Offshore demo projects	• Dual focuses on onshore and near offshore wind power; with • Far offshore demo projects	• Comprehensive development of onshore and offshore wind power

Total investment in wind power from 2011 to 2050 is expected to achieve RMB 12 trillion.

Source: *China Wind Power Development Roadmap 2050,* Energy Research Institute of NDRC and International Energy Agency (IEA)

Wind *Policy Framework*

Renewable Energy Law

Objectives	Investment guidance	On-grid tariff and cost share mechanism	Guaranteed-purchase mechanism	Production localization	Offshore expertise development	Renewable Energy Development Fund
Overall planning		**Grid integration mechanism**		**Indigenous R&D and technical development**		**Government incentive**

Relevance to different industrial players

Wind power component suppliers

WTGS producers
- Sinovel
- Goldwind
- Dongfang Electric

Wind power generators
- Longyuan Power
- Datang
- Huaneng Group

Grid companies
- State Grid
- Southern Power Grid

End users

Wind *Investment Guidance*

Guiding Catalogue of the Renewable Energy Industry (2006)*1

- Encouraged items:
  - Off-grid and on-grid wind power generator systems
  - Blade
  - Hub
  - Power transmission system
  - Yaw system
  - Brake system
  - Wind power turbine
  - Wind power generation control system and converter
  - Safety protection system

Guiding Catalogue of Industries for Foreign Investment (2011)*2

- Encouraged items:
  - Hydraulic multiport valve with working pressure ≥25MPa
  - Electric-hydraulic proportional servo component
  - Gear transmission
  - Whole set of wind power equipment over 2.5 MW
  - Construction and operation of wind power station

Wind Power Equipment Manufacturing Market Access Standards (draft)

- Market access threshold for new projects:
  - Project investment: at least 30% of total funding for new wind equipment manufacturing projects must come directly from project owners;
  - Production capacity: annual production capacity should reach 1 GW and should be capable of manufacturing WTGS with unit capacity >= 2.5 MW.
  - R&D expenditure: R&D expenditure should take up over 5% of sales revenue.
  - Technical priority: manufacturers are encouraged to develop WTGS >= 2.5 MW and offshore WTGS.

Business Implications:

- In the next five years, China will still highly encourage foreign investment in the wind power industry from WTGS and critical components manufacturing. Foreign companies will still see favorable FIE policies, in terms of land use, VAT and import tariff.
- Once released, the new market access standard will effectively curb overcapacity of WTGS. Nevertheless, top WTGS companies will not be impacted, instead they will benefit from an improved market environment. Therefore, foreign companies should target at large WTGS players in China such as Sinovel and Goldwind.

**1 http://www.tianneng.com.hk/attachment/200905121721542_sc.pdf*
**2 http://www.sdpc.gov.cn/zcfb/zcfbl/2011ling/W020111229379511927834.pdf*

Wind *Geographic Focus*

Geographic Layout of Expected Wind Power Installed Capacity in 2015

- 70GW in 8 major wind power generation bases in Xinjiang, eastern Inner Mongolia, western Inner Mongolia, Gansu, Jilin, Hebei, Shandong and Jiangsu; and 30GW in other regions.
- Demo offshore wind power projects in 9 costal cities including Hebei, Jiangsu, Shandong, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi and Hainan.

Source: *12th Five-year Plan on Wind Power Development (draft),* Energy Research Institute of NDRC

Wind *Grid Integration Mechanism*

Interim Measures for On-grid Tariff and Cost Share of Renewable Energy (2006)

•Clarifies wind power prices are decided through concessionary bidding.
•Sets the regulation that additional cost in comparison with coal-fired power should be shouldered by end electricity users, charged as so-called “renewable energy surcharges”.

Interim Measures for Management and Allocation of Renewable Energy Surcharges (2007)

•Specifies the collection and allocation of “renewable energy surcharges”.

Regulatory Measures for Grid Enterprises' Full Purchase of Renewable Energy (2007)

•Specifies how grid companies should coordinate with renewable energy generators to ensure full purchase of all the power generated from renewable energy.

Notification to Improve On-Grid Wind Pricing Mechanism (2009)

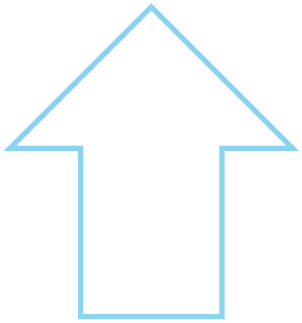
- Introduces benchmark onshore wind power tariffs for four different regions in China: RMB 0.51, 0.54, 0.58 or 0.61 per kWh.
- Power costs above the cost of coal-fired generation are split among end electricity users through “renewable energy surcharges”.

Renewable Energy Quota System (to be established)

•To allocate specific renewable energy generation and purchase quotas to power generators and grid companies.
•To ensure at least a certain amount of power generated by renewable energy will be purchased and consumed.

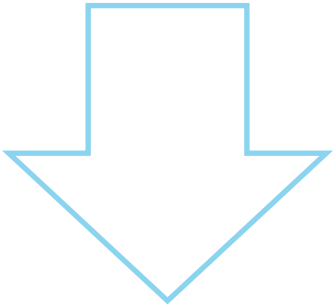
Business Implications:
•China is dedicated to reduce wind power on-grid tariff and push grid companies to purchase all the wind power generated. While making modest progress in on-grid pricing, the industry still sees reluctance from grid companies to purchase wind power voluntarily. As such, NEA is currently developing the Renewable Energy Quota System to ensure at least a certain amount of wind power will be purchased and consumed in the 12th FYP.

Wind *Indigenous R&D and Technical Development*



Notification to Remove Requirements to Procure Domestically Produced Equipment for Wind Power Projects (2009)

- In 2005, China required all wind projects to have 70% of its equipment and related components be produced in China, whether by domestic or foreign manufacturers.
- Though this requirement was annulled in 2009, it achieved its purpose of forcing more foreign companies to license technologies to Chinese partners.



Interim Measures for the Administration of Off-Shore Wind Energy Development and Construction and its specific implementation rules (2011)

- Stipulates that companies that develop and operate off-shore wind farms must be at least 50% owned by Chinese entities, and that contracts will be awarded through a concessionary bidding process.

Business Implications:

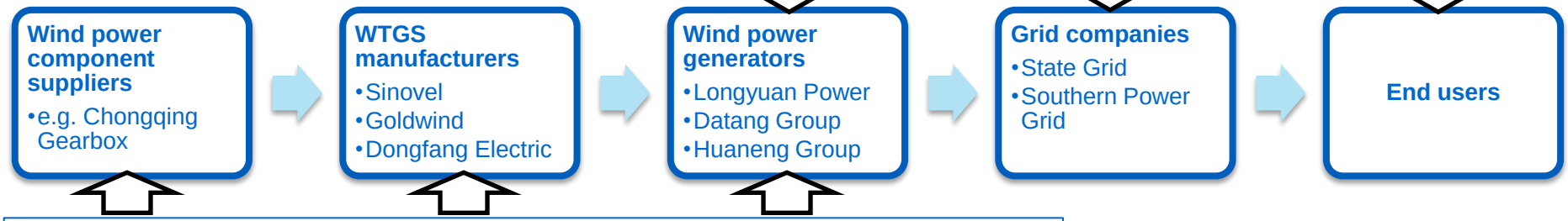
•Through the protectionist requirements for wind power projects to bear “at least 70% domestically produced content” carried out in 2005, Chinese companies have developed indigenous R&D and manufacturing capabilities for the majority of onshore wind farm WTGS and key components. However, foreign companies’ products will still be competitive given the reliable quality assurance and large unit capacity.

•Over the next five years, a major technical bottleneck is the offshore wind power generation, where Chinese companies still lack expertise. China is putting to tender offshore concessionary projects for 11 costal provinces/municipalities. Foreign companies may seek opportunities to participate in these demo projects.

Wind *Government Incentives*

China has established the national Renewable Energy Development Fund with wind power sector as the largest beneficiary. Key sources of the Fund are specialized renewable energy development fund and renewable energy surcharges.

Renewable energy surcharges (from end users)
1. To offset higher price of wind power in comparison with thermal power; and
2. To subsidize grid companies for wind power purchase.



Specialized renewable energy development fund (from annual central government budget)
1. Technical research, standards development and demo projects;
2. Renewable projects for residential use in rural areas;
3. Independent power systems construction in remote areas and islands;
4. Renewable energy resources exploring; and
5. Local production of renewable energy equipment.

Business Implications:
- In January 2012, the "renewable energy surcharge" was doubled from RMB 0.4 cent/Kwh to RMB 0.8 cent/Kwh, collected from end users with higher electricity price. However, it will be allocated to wind power generators and grid companies, but not to equipment manufacturers.


Biofuel in China

Biothanol and Biofuel *Background*

- Currently, China produces 1.73 million tons of bioethanol per year
- Since 2007, China started to support 1.5 G and 2G biofuel
- China currently mandates 10 provinces implement an E10 program (10% ethanol blended into fuel)
- Many challenges exist in supply chain and technology

China's Fuel Ethanol Production

Year	Production Quantity (MT/year)	% Increase from Previous Year
2004	300,000	1,400%
2005	920,000	206%
2006	1,300,000	41%
2007	1,370,000	5%
2008	1,580,000	13%
2009	1,720,000	8%
2010	1,680,000	-2%

Biothanol and Biofuel *Evolution*

1G and 1.5 G Bioethanol (2000-)

- China began bioethanol production in 2000 using surplus grain
- Established 5 large scale state-owned bioethanol plans
- NDRC began restricting 1G biofuel production in 2007

2G Pilot Stage (2007-)

- Government supporting research of R&D projects
- COFCO Bio-Energy started 2G plant using corn stover in 2006
- Novozymes currently building 2G plant with COFCO, to be operational this year

Commercialization (?)

- Barriers exist before bioethanol can be widely commercialized
  - Cost is still too high for production of 2G biofuel
  - Barriers in supply chain
  - Social and enviornmental issues

Biothanol and Biofuel *Policies*

Target to 2020

- Utilize 3.5-4 million tons of bioethanol
- 100% E10 mandate nationwide

Food security concern

- Since 2007, NDRC banned expansion in existing cereal-based bioethanol plants; stopped issuing new production licenses
- Focus on 1.5 G and 2G bioethanol using marginal land only

Financial incentives

- E10 ethanol consumption tax (5%) waived
- “Flexible subsidy for loss” – subsidies given to ensure producers make profit; subsidy amount linked to oil prices
- Producers receive “old grain” reserved in national stocks for feedstock
- Subsidy of RMB 1880/ton ethanol gasoline produced

Pilot E10 mandates started in select areas

No clear support policies yet for 2G biofuel production

Biothanol and Biofuel

Barriers to Commercialization

Supply chain	R&D and technology	Social and environmental
• Limited feedstock supplies constrains growth in scale • In order not to compete for arable lands producing grain, feedstock is supplied from marginal and less arable lands, which adds land reclamation and transport costs • Competing use of feedstock	• Disconnect between academic research and industrialization • Sentiment of indigenous innovation slows down progression of international R&D cooperation – heavily SOE dominated • High enzyme costs for 2G production – as much as 60% of bioethanol produced	• Possible increase in prices of competing feedstock and livestock • Large-scale land reclamation for energy crop production can create water shortage, especially in northern provinces → need further investigation

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Questions & Comments

Thank you

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