



# National Survey Report of PV Power Applications in CHINA 2014



## PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

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PVPS

## **Cover story**

On August 1st, 2015, the world largest international solar car race, IFA Suzuka Solar Race, was held at the Suzuka International Racing Circuit in Japan. The Osaka Sangyo University (OSU) Solar Car Team, equipped with Trina Solar's newly developed Interdigitated Back Contact (IBC) cells and modules for OSU's Solar Car, the "OSU-Model-S", has won the champion of "2015 FIA ALTERNATIVE ENERGIES CUP Solar Car Race". The "OSU-Module-S" developed by OSU's Solar Car Team was 100% powered by IBC solar cells developed by the State Key Laboratory of PV Science and Technology of Trina Solar.

**Photo by: Trina Solar**

## TABLE OF CONTENTS

Cover story .....	1
<b>TABLE OF CONTENTS</b> .....	<b>2</b>
<b>Tables</b> .....	<b>4</b>
Foreword.....	5
Introduction .....	6
<b>1</b> <b>INSTALLATION DATA</b> .....	<b>7</b>
1.1      Applications for Photovoltaics.....	7
1.2      Total photovoltaic power installed .....	7
<b>2</b> <b>COMPETITIVENESS OF PV ELECTRICITY</b> .....	<b>9</b>
2.1      Module prices.....	9
2.2      System prices .....	10
2.3      Cost breakdown of PV installations .....	11
2.3.1      Residential PV System < 10 kW .....	11
2.3.2      Utility-scale PV systems > 1 MW .....	11
2.4      Financial Parameters and programs .....	12
2.5      Additional Country information .....	12
<b>3</b> <b>Policy Framework</b> .....	<b>13</b>
3.1      Direct support policies.....	13
3.2      Direct Support measures.....	14
3.2.1      Support measures exiting in 2014 .....	14
3.2.2      New support measures implemented in 2014.....	16
3.2.3      Measures currently discussed but not implemented yet .....	19
3.2.4      Financing and cost of support measures .....	19
3.3      Indirect policy issues .....	19
3.3.1      International policies affecting the use of PV Power Systems .....	19
3.3.2      The introduction of any favourable environmental regulations .....	19
3.3.3      Policies relating to externalities of conventional energy.....	19
3.3.4      Taxes on pollution.....	19
3.3.5      National policies and programmes to promote the use of PV in foreign non-IEA countries..	19
<b>4</b> <b>Highlights of R&amp;D</b> .....	<b>20</b>
4.1      Highlights of R&D .....	20
4.1.1      Ordinary solar cells become more efficient, high efficiency solar cells with industrialization	20
4.1.2      Module efficiency has been constantly increased .....	20
4.1.3      Improvement on quality and efficiency of LS-PV plant .....	20
4.1.4      Key technology of high penetration distributed PV system .....	20
4.2      Public budgets for market stimulation, demonstration / field test programmes and R&D.....	21

5	Industry .....	22
5.1	Production of feedstocks, ingots and wafers .....	22
5.2	Production of photovoltaic cells and modules .....	23
5.3	Manufacturers and suppliers of other components .....	26
6	PV IN THE ECONOMY .....	28
6.1	Labour places .....	28
6.2	Business value .....	28
7	Interest from electricity stakeholders .....	29
7.1	Structure of the electricity system .....	29
7.2	Interest from electricity utility businesses.....	29
7.3	Interest from municipalities and local governments .....	29
8	Standards and codes.....	30
9	Highlights and prospects.....	31
9.1	Highlights.....	31
9.2	Prospects .....	31
	Definitions, Symbols and Abbreviations .....	32

## Tables

Table 1 PV power installed during calendar year 2014.....	7
Table 2 Data collection process: .....	7
Table 3 PV power and the broader national energy market .....	8
Table 4 Other information.....	8
Table 5 The cumulative installed PV power in 4 sub-markets. ....	9
Table 6 Typical module prices for a number of years .....	10
Table 7 Turnkey Prices of Typical Applications – local currency.....	10
Table 8 National trends in system prices (current) for different applications – local currency .....	10
Table 9 Cost breakdown for a residential PV system – local currency.....	11
Table 10 Cost breakdown for a utility-scale PV system – local currency .....	11
Table 11 PV financing scheme .....	12
Table 12 Country information .....	12
Table 13 PV support measures .....	13
Table 14 China PV industry relevant policies in 2014 .....	16
Table 15 Production information for the year for silicon feedstock producers .....	22
Table 16 Production information for the year for silicon wafer producers .....	23
Table 17 Production and production capacity information for 2014.....	24
Table 18 Value of PV business .....	28
Table 19 The Newly Added Photovoltaic Industry Standards and Code Published in 2014.....	30

## Foreword

The International Energy Agency (IEA), founded in November 1974, is an autonomous body within the framework of the Organisation for Economic Co-operation and Development (OECD) which carries out a comprehensive programme of energy co-operation among its member countries

The IEA Photovoltaic Power Systems Programme (IEA-PVPS) is one of the collaborative R & D agreements established within the IEA and, since 1993, its participants have been conducting a variety of joint projects in the applications of photovoltaic conversion of solar energy into electricity.

The participating countries and organisations can be found on the [www.iea-pvps.org](http://www.iea-pvps.org) website.

The overall programme is headed by an Executive Committee composed of one representative from each participating country or organization, while the management of individual Tasks (research projects / activity areas) is the responsibility of Operating Agents. Information about the active and completed tasks can be found on the IEA-PVPS website [www.iea-pvps.org](http://www.iea-pvps.org)

## Introduction

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to promote and facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of PV power systems. Task 1 activities support the broader PVPS objectives: to contribute to cost reduction of PV power applications, to increase awareness of the potential and value of PV power systems, to foster the removal of both technical and non-technical barriers and to enhance technology co-operation. An important deliverable of Task 1 is the annual “*Trends in photovoltaic applications*” report. In parallel, National Survey Reports are produced annually by each Task 1 participant. This document is the country National Survey Report for the year 2014. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

The PVPS website [www.iea-pvps.org](http://www.iea-pvps.org) also plays an important role in disseminating information arising from the programme, including national information.

## 1 INSTALLATION DATA

### 1.1 Applications for Photovoltaics

In 2014, with a number of national support measures, China PV application market further expanded. China annual PV grid-connected installation capacity in 2014 was 10.6GW (8.55GW of PV plant and 2.05GW of distributed PV), maintaining the same level as 2013, and accounting for a quarter of the world. China has been the largest PV application market in the world for two years.

By the end of 2014, China's accumulated PV grid-connected installation capacity was 28.05GW, a 60% increase over last year and ranked second in the world after German. China's annual PV power generation capacity was about 25 billion kWh, increasing 200% over last year.

In 2014, PV power generation developed simultaneously in the east and west of China and gradually shifted the production from the west to the east. Newly added annual installation capacity in the east reached 5.6GW, accounting for 53% of total installation capacity. Jiangsu and Hebei are both on top of the list of annual PV installation capacity.

In 2014, with constant innovation of PV power application model, 30 distributed PV power pilot regional projects included in the program of Encouraging Social Investment in Infrastructure Project by National Development and Reform Commission, played a leading demonstration role, with 500MW installed and 600MW under construction, the projects brought about government investment of over 10 billion RMB. Among the projects, the combination of PV with farming and fishing has become a new hot spot. PV power construction projects combined with ecological restoration including harnessing degenerative hills and slopes, restoration of coal mine goaf and desertification are continuing with constant innovation.

### 1.2 Total photovoltaic power installed

**Table 1 PV power installed during calendar year 2014**

AC			MW installed in 2014 (mandatory)	MW installed in 2014 (optional)	AC or DC
Grid-connected	Building PV	Residential	2050MW		DC
		Commercial			DC
		Industrial			DC
	Ground-mounted	cSi and TF	8550MW		DC
		CPV			DC
Off-grid		Rural Electrification	20MW		DC
		Comm.&Indus.	10MW		DC
		PV Products	10MW		DC
		<b>Total</b>	10640MW		DC

**Table 2 Data collection process:**

If data are reported in AC, please mention a conversion coefficient to estimate DC installations.	N/A
Is the collection process done by an official	Data on annual and accumulated PV grid-



body or a private company/Association?	connected installation capacity in 2014 were published by National Energy Administration. Off-grid installation accounts for a very small scale in China so the data was estimated by PV experts.
Link to official statistics (if this exists)	<a href="http://www.nea.gov.cn/2015-03/30/c_134108941.htm">http://www.nea.gov.cn/2015-03/30/c_134108941.htm</a>

**Table 3 PV power and the broader national energy market**

<i>MW-GW for capacities and GWh-TWh for energy</i>	2014 numbers	2013 numbers
Total power generation capacities (all technologies)	1360.19GW	1247.38GW
Total power generation capacities (renewables including hydropower)	424.16GW	355.50GW
Total electricity demand (= consumption)	5523.3TWh	5322.3TWh
New power generation capacities installed during the year (all technologies)	103.50GW	94GW
New power generation capacities installed during the year (renewables including hydropower)	N/A	N/A
Total PV electricity production in GWh-TWh	25TWh	9TWh
Total PV electricity production as a % of total electricity consumption	0.45%	0.17%

Source: National Energy Administration

**Table 4 Other information**

	<b>2014 Numbers</b>
Number of PV systems in operation in your country (a split per market segment is interesting)	10.64GW including Rural Electrification 20MW (0.19%) ; Comm.& Indus. 10MW (0.09%) ; PV Products 10MW (0.09%) ; Building PV 2050MW (19.27%) ; Ground Mounted LS-PV 8550MW (80.36%)
Capacity of decommissioned PV systems during the year in MW	N/A
Total capacity connected to the low voltage distribution grid in MW	N/A
Total capacity connected to the medium voltage distribution	N/A

grid in MW	
Total capacity connected to the high voltage transmission grid in MW	N/A

Source: National Energy Administration

**Table 5 The cumulative installed PV power in 4 sub-markets.**

Sub-market	Stand-alone domestic	Stand-alone non-domestic	Grid-connected distributed	Grid-connected centralized
2000	3.00		0.00	0.00
2001	4.50		0.01	0.00
2002	18.50		0.01	0.00
2003	10.00		0.07	0.00
2004	8.80		1.20	0.00
2005	6.40		1.30	0.20
2006	9.00		1.00	0.00
2007	17.80		2.00	0.20
2008	29.50		10.00	0.50
2009	17.80		34.20	108.00
2010	27.00		190.00	283.00
2011	20.00		680.00	2000.00
2012	40.00		1360.00	1800.00
2013	40.00		10950 <sup>1</sup>	
2014	40.00		2050.00	8550.00
TOTAL (MW)	280.00		4670.00	23380.00

## 2 COMPETITIVENESS OF PV ELECTRICITY

### 2.1 Module prices

Rapid expansion of PV market is leading to further expansion of module production, with continued module transfer efficiency and decreased module cost. By the end of 2014, module production cost reduced to USD 0.45 dollars/W, and process cost reduced to USD 0.16 dollars/W.

<sup>1</sup> PV grid-connected installation capacity in 2013 was modified to 10950MW by National Energy Administration in 2014.

**Table 6 Typical module prices for a number of years**

Year	2008	2009	2010	2011	2012	2013	2014
Standard module price(s): Typical (Yuan/Wp)	30.0	19.0	13.0	9.0	4.5	4.2	4
Best price	-	-	-	-	-	-	4
PV module price for concentration (if relevant)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: PV power station owner

## 2.2 System prices

**Table 7 Turnkey Prices of Typical Applications – local currency**

Category/Size	Typical applications and brief details	Current prices (Yuan) per W
OFF-GRID Up to 1 kW	Flashlight, calculator, street lamp and other PV products	15
OFF-GRID >1 kW	Rural stand-alone PV system	15
Grid-connected Rooftop up to 10 kW (residential)	Distributed PV system built on residential rooftop	13
Grid-connected Rooftop from 10 to 250 kW (commercial)	Distributed PV system built on commercial rooftop like malls	10
Grid-connected Rooftop above 250kW (industrial)	Distributed PV system built on industrial rooftop	9
Grid-connected Ground-mounted above 1 MW	Large-scale ground-mounted PV power plant	8
Other category existing in your country (hybrid diesel-PV, hybrid with battery...)		-

Source: Questionnaires to PV power station owner

**Table 8 National trends in system prices (current) for different applications – local currency**

Price/Wp	2008	2009	2010	2011	2012	2013	2014
Residential PV systems < 10 KW(RMB Yuan/Wp)	-	-	-	-	-	-	10
Commercial and industrial	-	-	-	18	14	12	8
Ground-mounted	50	30	20	15	12	10	8

Source: Questionnaires to PV power station owners

## 2.3 Cost breakdown of PV installations

### 2.3.1 Residential PV System < 10 kW

**Table 9 Cost breakdown for a residential PV system – local currency**

Cost category	Average (local currency/W)	Low (local currency/W)	High (local currency/W)
<b>Hardware</b>			
Module	4.0	3.8	4.2
Inverter	1	0.8	1.2
Other (racking, wiring...)	2	1.5	2.8
<b>Soft Costs</b>			
Installation	1	0.8	1.5
Customer Acquisition	0.8	0.6	1
Profit	1	0.8	1.5
Other (permitting, contracting, financing...)	0.5	0.3	0.8
<b>Subtotal Hardware</b>	<b>7</b>	<b>6.1</b>	<b>8.2</b>
<b>Subtotal Soft costs</b>	<b>3.3</b>	<b>2.5</b>	<b>3.9</b>
<b>Total</b>	<b>10.3</b>	<b>8.6</b>	<b>12.1</b>

Source: Questionnaires to PV system integrator

### 2.3.2 Utility-scale PV systems > 1 MW

**Table 10 Cost breakdown for a utility-scale PV system – local currency**

Cost Category	Average (local currency/W)	Low (local currency/W)	High (local currency/W)
<b>Hardware</b>			
Module	4.2	4.1	4.2
Inverter	0.32	0.3	0.35
Other (racking, wiring, etc.)	-	-	-
<b>Soft cost</b>			
Installation Labor	0.3	0.25	0.5
Customer acquisition	-	-	-
Profit	-	-	-
Other (contracting, permitting, financing etc.)	-	-	-

<b>Subtotal Hardware</b>	-	-	-
<b>Subtotal - Soft cost</b>	-	-	-
<b>Total Installed Cost</b>	8		

Source: Questionnaires to PV power station owner

## 2.4 Financial Parameters and programs

**Table 11 PV financing scheme**

Average Cost of capital per market segment	N/A
Description of a specific PV financing scheme (leasing, renting...)	N/A

In China, PV power project investment consists of equipment investment, construction and installation, roof lease and land cost. Equipment and installation cost accounts for the majority of total investment which is about 70%, and percentage of equipment investment of roof PV project is little higher than ground PV plant project. Next is construction and installation cost, accounting for around 15%.

Investors of PV plant are mainly from national and provincial electric power companies. With existing loan policy and financial condition, in case there are appropriate PV projects, investors could have access to project and company financing by comprehensive credit line, bank loan, corporation bonds, and stock market financing, etc.

Advantages of distributed PV power project include flexible and adjustable project scale, small investment and without long distance transmission and large-scale grid investment. Because of its poor economic efficiency, most local governments publish extra feed-in tariff policy to guarantee economic benefit of local distributed PV projects.

## 2.5 Additional Country information

**Table 12 Country information**

Retail Electricity Prices for an household (range)	RMB 0.45-0.65 yuan/KWh
Retail Electricity Prices for a commercial/ industrial company (range)	RMB 0.8-1.2 yuan/KWh
Retail Electricity Prices for an large-scale industrial company (range)	RMB 0.6-0.8 yuan/KWh
Population at the end of 2014 (or latest known)	1367820000
Country size (km <sup>2</sup> )	9600000
Average PV yield (according to the current PV development in the country) in kWh/kWp	25TWh
Name and market share of major electric utilities.	N/A

Source: National Bureau of Statistics of China

### 3 POLICY FRAMEWORK

#### 3.1 Direct support policies

Table 13 PV support measures

	On-going measures	Measures that commenced during 2014
Feed-in tariffs (gross / net?)	<p>PV plant : RMB 0.9,0.95,1 Yuan/KWh divided by resource areas;</p> <p>Distributed PV:RMB 0.42 Yuan/KWh(tax included );</p> <p>The duration is 20 years.</p>	<p>Distributed PV power projects can choose from benchmark price policy and whole power quantity subsidy policy.</p> <p>Distributed PV power project had only one way that was “self-generating electricity for self-consumption and put excess capacity on-grid” before 2014. There is another choice “put all power capacity on-grid” added in 2014, and project owner can apply for adjustment once in operation period.</p>
Capital subsidies for equipment or total cost	None.	
Green electricity schemes		Energy Development Strategy Action Plan (2014-2020): By 2020, non-fossil energy will reach 15% of primary energy consumption, hydropower installation will reach 350GW and wind power installation will reach 200GW.
PV-specific green electricity schemes		PV power installation capacity will reach 100GW in 2020.
Renewable portfolio standards (RPS)	None.	
PV requirement in RPS	None.	
Investment funds for PV	None.	
Income tax credits	PV power generation value-added tax will be 50% refundable as soon it is imposed.	Government has further issued relevant policy to solve the problem that some PV project owners can't issue value-added tax invoice.
Prosumers' incentives (self-consumption, net-metering, net-billing...)		Distributed PV power projects can choose from benchmark price policy and whole power quantity subsidy policy.
Commercial bank activities e.g. green mortgages promoting PV	People's Bank of China and China Banking Regulatory Commission is guiding financing institution to strengthen credit support and financing service and to support key enterprises to grow stronger.	
Activities of electricity utility businesses	State Grid Corporation Of China and China Southern Power Grid have established one-stop service system with free grid-connected service to distributed PV project.	
Sustainable building requirements		Same as distributed PV power subsidy policy.

## 3.2 Direct Support measures

### 3.2.1 Support measures exiting in 2014

#### 3.2.1.1 Description of support measures excluding prosumers, BIPV, and rural electrification

In 2014, the central authorities formulated and issued new PV power development goal, project management policy, feed-in tariff policy, financing policy and relevant standards, and carried out regional distributed PV power demonstration construction. Government and grid companies clarified PV power grid-connected service regulation and many local governments formulated local feed-in tariff policy.

##### (1) Development plan and goal

In November, 2014, The Energy Development Strategy Action Plan (2014-2020) was published: By 2020, PV power installation capacity will reach 100GW in 2020. **U.S.-China Joint Announcement on Climate Change** that issued in November, 2014 mentioned non-fossil energy will reach 20% of primary energy consumption by 2030, at that time solar power (including PV and solar thermal) installation scale will reach at least 400 GW.

##### (2)Scale index and project management

**PV projects management system was changed from approval by the state to local filing and the measures are being carried out gradually.** After the second half of 2014, over 20 provinces published local filing methods for implementation. In some provinces, the filing of distributed PV projects has been delegated to lower level government departments.

**Continue to formulate and implement annual construction index management.** National Energy Administration (NEA) issues PV plant construction implementation plan to each province annually, and carry out gross balance and annual scale management guide. Capacity within the plan and guided scale may enjoy price or feed-in tariff subsidy from Renewable Energy Development Fund. And if there is no limit to PV power development that requires no support on price or feed-in tariff subsidy.

##### (3) Feed –in tariff policy

**The establishment of PV plant benchmark price and distributed PV full power subsidy system.** See 3.2.1.2 for details.

##### (4)Finance and taxation policy

**Solution of tax issue on distributed PV power.** In June, 2014, the State Administration of Taxation issued an announcement, saying that in case grid enterprises buy electricity from distributed PV power project of nonbusiness generator, they are entitled to issue regular invoice. If they need to pay value-added tax according to tax law, grid enterprises can calculate and collect value-added tax according to simplified method and issue regular invoice at the same time. This policy solved the problem that some PV project owners can't issue value-added tax invoice.

##### (5) Industry policy

**Emphasize technological innovation and equipment upgrading.** In March, 2015, the Ministry of Industry and Information Technology (MIIT) published revised edition of **PV Manufacturing Industrial Standard** which added requirement on inverter capacity and adjusted some indexes, set higher requirements on newly built, renovated and expanded PV projects and put emphasize on technological innovation and equipment upgrading.

##### (6)Grid-connection policy

**Grid-connection policy was refined and implemented gradually.** In October, 2014, the State Grid adjusted regulations on distributed PV plant according to **Relevant Policy on Distributed PV Power**. China Southern Power Grid released internal document **Guideline Opinions on Further Supporting Development of Photovoltaic and Other New Energy**, providing principle stipulations on grid-connection services, electricity purchasing and selling services and grid-connection dispatch. In February, 2014, China

Southern Power Grid again released Detailed **Service Operation on Distributed PV Power (Trial)** that refined regulations on grid-connection of distributed PV power.

Over the past year, policy implementation of power grid has been improved greatly. Newly added annual grid-connected distributed PV power capacity reached 2.05 GW in 2014 through thousands of projects.

#### (7) Market promotion

**Pilot New policy and mechanism in regional distributed PV power demonstration.** With 12 regional distributed PV power demonstrations added in November, 2014, the planned capacity of 30 regional demonstrations in 2015 is 3.35 GW. Many policies have been piloted in regional demonstrations, such as new financial model and product for distributed PV designed by China Development Bank, and the planned power transfer and supply in regional demonstrations by NEA.

**Design and implement PV poverty alleviation projects.** In October, 2014, the NEA and the State Council Leading Group Office of Poverty Alleviation and Development (LGOP) jointly issued **Work Program on PV Poverty Alleviation Construction Implementation**. For six PV poverty alleviation pilot provinces including Hebei, Shanxi, Anhui, Gansu, Qinghai, Ningxia, matching PV power plant construction scale was clarified in the implementation plan of 2015 which amounts to 1.5 GW.

##### 3.2.1.2 Prosumers' development measures

In August, 2013, the National Development and Reform Commission (NDRC) issued the "Notice of taking advantages of price leverage in promotion of healthy development of photovoltaic industry". It adjusted the benchmark price of photovoltaic power station (electricity price is RMB 0.9 yuan/KWh, 0.95 yuan/KWh, 1 yuan/KWh based on regional solar resource locations), set the new feed-in tariff policy of the distributed photovoltaic power generation (subsidy as whole power quantity: RMB 0.42 Yuan/KWh (tax included), the benchmark price and feed-in tariff policy has become one of the most powerful distributed PV generation policies to encourage photovoltaic power generation.

Distributed PV full power subsidy policy was designed to give incentive to customers with high retail price and high proportion of PV power to encourage self-consumption of self-generated PV power directly. But the policy faced lots of obstacles in the last year, such as proportion of self-consumption of self-generated electricity of some distributed PV combined with farming, fishing and industrial parks was too low, poor implementation of energy management contracts, and decreased project benefit caused by difficulties in collecting electricity fees. As a result, in September, 2014, the policy was adjusted to provide choices between "self-generation and consumption, surplus capacity on grid" and "full power capacity on-grid" instead of the only way of "self-generation and consumption, and surplus capacity on-grid". Compared with the previous policy, the benefit of distributed PV projects became more predictable.

##### 3.2.1.3 BIPV development measures

In September, 2014, the NEA issued "Notice on Further Implementation of Policies of Distributed PV Power" that clarified "encouragement to carry out distributed PV power application of various types, taking full advantage of building roof resources with suitable conditions (including free land), and development of PV power application for large-scale industrial development districts and commercial enterprises with large roofs high electrical load and high grid power price. Local governments are encouraged to formulate supporting financing subsidy policies and reinforce support to public agencies, indemnificatory housing and rural areas. Public facility systems such as railway stations, highway service areas, airport terminals, large-scale comprehensive transportation junction buildings, large-scale stadiums and parking lots are also encouraged to generalize PV power and to integrate PV power application as an important factor in planning and design of relevant constructions. The notice also encourages large enterprises to organize and build unified distributed PV power facilities for subordinate company. Construction of local consumption distributed PV plants on locations like waste lands, barren mountains and slopes, agricultural greenhouses, beaches, fishponds and lakes according to local conditions."



### 3.2.1.4 Rural electrification measures

In October, 2014, the NEA and the LGOP jointly issued **Work Program on PV Poverty Alleviation Construction Implementation**. First, distributed PV power system will be installed for registered poor households in poverty-stricken area with rich solar resource to increase the poor people's basic life income by means of saving their electricity expenses. And secondly, agricultural PV power poverty alleviation program will be carried out by means of constructing PV power stations in waste slopes, agricultural greenhouses and facilities to increase poor households' income directly.

### 3.2.1.5 Other measures including decentralized storage and demand response measures

### 3.2.2 New support measures implemented in 2014

China PV industry newly added policies in 2014 are shown in the following table.

**Table 14 China PV industry relevant policies in 2014**

Department	Date	Name of Documents	Main Contents
MIIT	2013.9	Standard Conditions on PV Manufacturing Industry	Continued implementation in 2014, issued three times, 175 enterprises enter the list.
MIIT	2014.12	Opinion on Further Optimizing PV Enterprises Merging And Restructuring Market Environment	Optimize approval process of merging and restructuring, strengthen financial support, improve relevant taxation and land use policies, and optimize PV enterprise merging and restructuring market in such aspects as debt disposal and staff resettlement. policies
NEA	2014. 1	Notice on Publishing the List (First Batch) of construction of New Energy Demonstration Cities (Industry Parks).	81 cities, 8 industry parks were included in first batch of new energy demonstration cities/ industry parks to facilitate higher proportion or larger scale application of renewable energy.
NEA	2014.1.17	Notice on Issuing Annual Newly Added PV Power Construction Scale in 2014	The annual newly added scale on filed capacity was decided at the level of 14GW, consisting of 8 GW distributed PV and 6.05 GW PV plants.
NEA	2014. 3	Notice on Strengthening Work Program of PV Industry Information Monitoring.	Construction of PV industry information monitoring system.
NEA	2014.4	Notice on the Clarification of Relevant Issues on Power Business License Management.	Distributed energy projects on record and PV, wind or other new energy power project under 6 MW was exempt from power business license.
NEA	2014. 5. 20	Notice on Strengthening the work on PV power project Information Statistics and Reporting.	Strengthen the work on PV power project Information Statistics and Reporting.

SAT	2014. 6. 3	Notice on Relevant Issues such as Purchase of Electric Products from Distributed PV Power Project by State Grid Corporation.	In case grid enterprises buy electricity from distributed PV power project of nonbusiness generator, they are entitled to issue regular invoice. If they need to pay value-added tax according to tax law, grid enterprises can calculate and collect value-added tax according to simplified method and issue regular invoice at the same time. This policy solved the problem that some PV project owners can't issue value-added tax invoice.
NEA	2014. 9. 2	Notice on Further Implementation of Policies on Distributed PV Power.	<p>To initiate distributed PV plant market and encourage construction of local consumption distributed PV plants on locations like waste lands, barren mountains and slopes, agricultural greenhouses, beaches, fishponds and lakes.</p> <p>To expand construction scale of PV power projects and encourage promotion of PV power in public facility systems such as railway stations, highway service areas, airport terminals, large-scale comprehensive transportation junction buildings, large-scale stadiums and parking lots.</p> <p>Distributed PV power projects with high proportion of self-consumption of self-generated power should use "self-generation and consumption, surplus capacity on grid" model with subsidy based on full power output: RMB 0.42 Yuan/KWh (tax included). Projects with low proportion should use "full power capacity on-grid" model with local benchmark price of PV plant.</p>
NEA	2014.9	Notice on Relevant Requirements on Acceleration of Cultivation of Regional Demonstration Of Distributed PV Power Application.	Research and promote solutions on problems in distributed PV development on roof use, loan and financing, benefit of selling power and grid-connection.
NEA	2014.10.9	Notice on Further Strengthening Construction and Operation Management of PV Plants.	Standardize construction and operation management of PV plants to promote industrial resource deployment and management, regulate market behavior, improve PV plant base construction, innovate construction and operation of PV plant, coordinate power grid development, strengthen construction quality management and facilitate healthy and continued industrial development.
NEA	2014.10.28	Notice on the Normalization of PV Power Station Investment and Development Order	Forbid to resell "road pass" for profit, and normalize power station development order.

NEA, LGOP	2014.10.11	Notice on Circulation of the Implementation of the Program on PV Poverty Alleviation Construction	Sponsor poor households to install distributed PV power system to increase their basic life income; and engage in pilot PV installation in 30 counties in provinces with certain work foundation including Hebei, Shanxi, Anhui, Gansu, Qinghai, and Ningxia.
NEA	2014.11.21	Notice on Promotion of Construction of Regional Distributed PV Power Application Demonstration.	With 12 newly added industry parks such as Jiaying PV high-tech zone, the number of total regional demonstrations reached 30. The notice also emphasized tracking of the progress of demonstration construction and related management and monitoring.
NEA	2014.12.16	Notice on Completion of Grid-Connection Work for PV Power Projects.	The notice put forward requirements to accelerate PV power construction to realize timely grid-connection and efficient utilization and requested competent energy departments and agencies in each province to push and coordinate PV power grid-connection and operation work.
NEA	2014.12	Notice on Completion of the Compilation of the 13 <sup>th</sup> Five-Year Plan on Solar Energy Development.	The notice required each province and relevant research institute to conduct research on their own local Solar Energy Development during the 13 <sup>th</sup> Five-Year Plan and engage in monographic study.

### ***3.2.3 Measures currently discussed but not implemented yet***

It is reported that newest renewable portfolio standards has been reported to the State Council and is hopeful to be published in 2015. It will lead the absorption task in 2015-2020 served to absorption of PV and wind energy.

### ***3.2.4 Financing and cost of support measures***

The sources of China's PV subsidy come from renewable energy tariff surcharge. Since 2006, the government started to levy renewable energy tariff surcharge from power sales except residential and agricultural electricity. The amount of such surcharge was increased from RMB 0.1 cent/KWh to 0.8 cent/KWh. From 25<sup>th</sup> September, 2013, the surcharge was increased from RMB 0.8 cent/KWh to 1.5 cent/KWh due to rapid development of renewable energy.

## **3.3 Indirect policy issues**

### ***3.3.1 International policies affecting the use of PV Power Systems***

In the beginning of 2014, American started its second anti-dumping and anti-subsidy investigation on China's crystalline silicon PV products, imposing a severe challenge to Chinese PV industry. However, such challenge also stimulated China's industrial upgrading and adjustment, and expansion of the country's domestic market.

### ***3.3.2 The introduction of any favourable environmental regulations***

China began to study Waste Electrical and Electronic Equipment (WEEE) Act from Europe, including research on environment control in PV manufacturing process and life circle, and established module recycling mechanism and increased investment in research on harmless module.

### ***3.3.3 Policies relating to externalities of conventional energy***

There is no explicit policy.

### ***3.3.4 Taxes on pollution***

There is no explicit policy.

### ***3.3.5 National policies and programmes to promote the use of PV in foreign non-IEA countries***

In 2014, Chinese PV enterprises actively developed emerging markets with explosive growth of PV plant installation, such as Southeast Asia, India, Middle East, Central Asia, Africa, etc.. Because of power shortage, governments in these markets have imposed strong supported to new energy development.

## **4 HIGHLIGHTS OF R&D**

### **4.1 Highlights of R&D**

The following are highlights of China's PV technological R&D in 2014:

#### ***4.1.1 Ordinary solar cells become more efficient, high efficiency solar cells with industrialization***

Driven by the market, China's solar cell industry shows a development trend of "high efficiency of regular solar cells and industrialization of high efficiency solar cells". On one hand, while average conversion efficiency of regular multicrystalline cell wafer is still around 17.5%, efforts have been made to increase the efficiency through optimized processing technology and using high efficiency silicon wafer. Some monocrystalline cell enterprises have increased conversion efficiency to 19.5%-20% through PERC and MWT. Industrialized conversion efficiency of high efficiency solar cell has reached 17.8% and some leading enterprises even reached over 18%. On the other hand, the industry is developing towards industrialization of high efficiency solar cells. .

#### ***4.1.2 Module efficiency has been constantly increased***

To achieve high efficiency of PV cells and modules and reduce efficiency loss from cell to module, PV module manufacturers have actively adopted methods including utilization of welding belt reflection and backsheets, reduction of internal module friction, and double glass module with aluminum-free frame.

Other new product design is emerging continuously, such as improving performance of heat dissipation and corrosion resistance by using separate junction box and improving insulation and heat-conduction property of filler material in junction box.

#### ***4.1.3 Improvement on quality and efficiency of LS-PV plant***

Affected by policy, there was an explosive expansion of LS-PV plant in China, and accumulated installation capacity reached 23.38 GW by the end of 2014. Construction of PV plant will continue to keep at a high level, but major quality problems of established plant have caused compelling attention. Problems that must be solved include how to test and assess plant quality and how to improve operational efficiency.

Focus on these problems, the Institute of Electrical Engineering of Chinese Academy of Sciences (IEECAS) developed engineering design software for large-scale grid-connected PV plant that filled the blank in domestic relevant software. PV and Wind Power System Quality Test Center of Chinese Academy of Sciences (TCCAS) developed PV plant mobile detection vehicle, the first field test platform in China that integrated test on PV module, component and system.

On the other hand, the first guideline in China on performance testing and quality assessment of PV plant, "Guideline of Performance Testing and Quality Assessment for Grid-connected PV Power Plants" has completed filing and technical examination in the Certification and Accreditation Administration of China, and serve as China's first technical standard of the kind through CQC, and now is listed in the National Energy Administration's plan to become the industry standard in China in 2015.

#### ***4.1.4 Key technology of high penetration distributed PV system***

##### ***4.1.4.1 Grid-connection and integrated technology of regional high penetration distributed PV system***

China Electric Power Research Institute (CEPRI) has built a generalized simulation model based on headroom model, time series model of solar resource with fluctuant radiation and distributed PV power. IEECAS has conducted in-depth research on operation mode and capacity configuration of dispatchable PV plant and storage power plant in distributed network with high proportion PV power. It also put forward the control strategy of grid-connected active power and local voltage.

#### *4.1.4.2 Design and control technology of multifunction convertor*

IIEECAS and Beijing Corona Science & Technology Co., Ltd have jointly developed 100 KW scale storage convertor and smooth handoff control technology , realizing smooth handoff between different charge conditions, and charge and discharge conditions of energy storage device with transient time less than 10 ms.

On the basis of virtual synchronous power generation, CEPRI has successfully realized coordinated parallel operation of voltage-source power electronic equipment (energy storage PCS) and traditional rotating electric machinery (small hydropower).

IIEECAS is the first in the world to complete the development of grid-connected 100 KW scale direct current high-voltage PV converter, utilizing adjustable phase shifting control strategy to reduce current circulation and loss of switching devices.

#### *4.1.4.3 Distributed measuring and controlling technology of distributed grid-connected PV/energy storage system*

IIEECAS has completed development of distributed PV measuring and controlling equipment, with measuring accuracy of 0.2 level, greatly improving interactive ability and easy grid-connection of distributed PV system.

CEPRI has put forward layered self-adaptive reactive coordination and control method based on capability of reactive power regulation of convertor of distributed PV power system, and developed reactive power control system for distributed PV power system based on power prediction.

## **4.2 Public budgets for market stimulation, demonstration / field test programmes and R&D**

There are no related data.

## 5 INDUSTRY

### 5.1 Production of feedstocks, ingots and wafers

- **Multicrystalline silicon material**

In 2014, mc-Si industry maintained constant growth. Production reached 136000 tons, a 60.7% increase over 84600 tons in 2013, accounting for 45% of total production in the world, and a 10% increase over last year. Apparent consumption of mc-Si was 232000 tons. There is still a gap between supply and demand and more import is needed.

**Table 15 Production information for the year for silicon feedstock producers**

Manufacturers (or total national production)	Process & technology	Total Production	Product destination (if known)	Price (if known)
Jiangsu Zhongneng Polysilicon Technology Development Co. Ltd	mc-Si	66876 tons		
Tbea Solar Co. Ltd	mc-Si	17500 tons		
China Silicon Corporation LTD.	mc-Si	9200 tons		
DAQO New Energy Corp.	mc-Si	6500 tons		
Sichuan ReneSola Silicone Materials Co., Ltd.	mc-Si	5825 tons		
Yichang CSG Polysilicon.Co.,Ltd	mc-Si	4700 tons		
ORISI Silicon Co.,Ltd	mc-Si	4450 tons		
Asia Silicon Co., Ltd	mc-Si	4200 tons		
Shanxi Tianhong Silicon Co., Ltd	mc-Si	3000 tons		
DunAn Holding Group Co., Ltd	mc-Si	3000 tons		
Rest	mc-Si	10749 tons		
Total	mc-Si	136000 tons		

Source: CPIA, 2015.3

- **Silicon wafer**

By the end of 2014, the total capacity of silicon wafer in China reached 50.4 GW and production reached 38 GW, a 28.8% increase over last year and accounting for 76% of total production in the world.

There's a high industry concentration, production of top 10 enterprises accounted for 76% of total production and capacity was 34 GW, 67.5% of the total. Capacity utilization of the whole industry was over 72%, and that of the top 10 was over 85%.

**Table 16 Production information for the year for silicon wafer producers**

<b>Manufacturers (or total national production)</b>	<b>Process &amp; technology</b>	<b>Total Production</b>	<b>Product destination (if known)</b>	<b>Price (if known)</b>
GCL-Poly Energy Holdings Limited	Silicon wafers	13000 MW		
Yingli green energy holding Co., Ltd	Silicon wafers	2800 MW		
RENESOLA LTD	Silicon wafers	2100 MW		
JinkoSolar Holding Co., Ltd	Silicon wafers	2000 MW		
Xi'an LONGI Silicon Materials Corp	Silicon wafers	2000 MW		
Jiangxi LDK Solar Hi-Tech Co. LtdLDK	Silicon wafers	1700 MW		
Trina Solar Co., Ltd	Silicon wafers	1600 MW		
Huantai Group	Silicon wafers	1400 MW		
Inner Mongolia Zhonghuan Solar Material Co., Ltd.	Silicon wafers	1300 MW		
Jinglong Group	Silicon wafers	1100 MW		
Rest	Silicon wafers	9000MW		
Total	Silicon wafers	38 GW		

Source: CPIA, 2015.3

**Describe briefly the overseas activities of any key companies also operating in other countries.**

Mc-Si imports were about 102000 tons in 2014, a 25.9% increase over last year. The products were mainly imported from Korea (36000 tons), German (30000 tons) and America (21000 tons), accounting 85.3% of the total.

Silicon wafer export reached about 9.27 GW, mainly to Taiwan, Korea, Malaysia, and the Philippines.

**5.2 Production of photovoltaic cells and modules**

● **Solar cell**

By the end of 2014, mainland China's solar cell production capacity was 47 GW and production reached 33 GW, a 32% increase over last year, accounting for 65.4% and ranking the first in the world. Now, China mainly produces mc-Si cells with over 82% market share. Although the proportion of mc-Si cells is still low, it will steadily increase with rapid decline of production cost in recent years.

Production of top 10 solar cell enterprises was 17.5 GW, accounting for 53% of total production in China. The production capacity of these enterprises was 20.5 GW, accounting for 43.7% of total capacity. Industry concentration ratio was to be further increased. Capacity utilization of the whole industry was slightly lower than 70. Some new technologies such as multi-printing, new grid line technology, PERC, black silicon technology were already in use or developed.



● **PV module**

In 2014, China's total PV module production capacity was 63 GW and the output reached 35.6 GW, a 30% increase over last year, accounting for 68.5% total production of the world. Of the 35.6 GW production, c-Si module accounted for 35.5 GW, 98.8% of total production, while production of thin-film cells was 260 MW and production of concentration cell' was 100 MW.

Total PV cell and module manufacture together with production capacity information is summarized in Table 18 below.

**Table 17 Production and production capacity information for 2014**

Cell/Module manufacturer (or total national production)	Technology (sc-Si, mc-Si, a-Si, CdTe)	Total Production (MW)		Maximum production capacity (MW/yr)	
		Cell	Module	Cell	Module
<i>Wafer-based PV manufactures</i>					
Trina Solar Co., Ltd		2700	3600	3000	3600
Yingli green energy holding Co., Ltd		3100	3400	3200	4200
Canadian Solar Co., Ltd		1500	2600	1650	2500
JA Solar Holdings Co., Ltd		3100	2500	3200	2800
JinkoSolar Holding Co., Ltd		1950	2300	2000	3200
Hanhua Solar One Co., Ltd		1200	1500	1750	2070
Hareon Solar Technology Co.,Ltd		1560	900	1280	1200
EGing Photovoltaic Technology Co.,Ltd		885	878	1000	1000
Chint Solar Co. Ltd		599	830	700	900
RENESOLA LTD		-	820	-	1200
Shunfeng Photovaltic International Limited		1000	-	1500	-
Tongwei Group		850	-	1600	-
Hongxi PV		700	-	750	-
Zhongli Talesun Solar Co. Ltd		700	-	1000	-
Risen Energy Co. Ltd		693	-	800	-
Motech (Suzhou) Renewable Energy Co. Ltd		580	-	600	-
Rest		12163	12542	22690	34780

Total		33000	35300	47000	63000
<i>Thin film manufacturers</i>					
Hanergy Holding Group Ltd.		-	-	-	-
Hunan Gongchuang PV Science & Technology Co., Ltd.		-	-	-	-
Advanced Solar Power ( Hangzhou ) Inc.		-	-	-	-
Total		-	260	-	-
<i>Cells for concentration</i>					
Total			100		
<b>TOTALS</b>		<b>33000</b>	<b>35600</b>	<b>47000</b>	<b>63000</b>

Source: CPIA, 2015.3

In 2014, China's solar battery piece exports reached about 2.6 GW to 92 countries or regions. Korea became the largest destination with 756 MW export.

China's PV modules exports reached about 22 GW in 2014 to 192 countries or regions. Among them the largest country was Japan, followed by Europe. China had over 1500 export enterprises in 2014.

### 5.3 Manufacturers and suppliers of other components

- **PV inverters (for grid-connection and stand-alone systems) and their typical prices**

Driven by strong growth of China's PV market, shipment of Chinese inverter enterprises reached more than 16 GW, increasing to 30% of the world market share. Estimating at RMB 0.3 Yuan/W sale price, the total sales revenue could reach 3.9 billion Yuan in 2014.

**Dramatic inverter price drop led to fierce market competition.** Price of centralization inverter fell from 0.8 Yuan/W in 2012, 0.4 Yuan/W in 2013 and 0.32 Yuan/W in the beginning of 2014 to 0.24 Yuan/W in the end of 2014.

**Inverter enterprises began to develop foreign market gradually.** China's medium-power inverter manufacturers have occupied a certain market share in regions with more residential PV system and PV plant on roofs of industrial and commercial facilities such as Australia, and started to explore emerging markets like Netherlands, Denmark, Southeast Asia, Eastern Europe and Africa.

**A new force of stringing inverter market rose rapidly.** With the gradual transformation of terminal application market from LS-PV plant to distributed PV, PV station owners are paying more attention on how to increase power output per watt for better investment return instead of initial investment cost. The application of stringing inverters followed suit of such transformations, and resulted in expanded market.

**Inverter enterprises transform from product to service.** Traditional inverter enterprises mainly supply products, but they have started to transform from selling products to services due to domestic market transformation. According to operational characteristics of stringing inverters, Huawei has provided extended services including monitoring, data collection and analysis on operation and maintenance, introduced cloud monitoring and cloud management services, and put forward the concept of intelligent power plant. The company has changed from a component supplier to a professional supplier of integrated power plant solution and services. The innovation of such service mode has subverted operation concept of traditional manufacturer, improved operation and maintenance efficiency and reduced cost in the process.

- **Supporting structures**

Without entry threshold and industry barriers, the rapid development of domestic installation market has led to dramatic rise of PV mount enterprises fierce market competition. Since 2013, PV plant quality has received more and more attention and as a result, a number of PV mount enterprises with certain strength and brand and quality advantages developed rapidly.

With low technical content, low industrial entry threshold and fierce homogeneous competition, the cost of raw material accounts for over 70% of PV mount production. Affected by the relative concentration of mating resources including proximate matter and hot galvanizing suppliers, PV mount manufacturers and processors mainly concentrated in Wuxi and Hebei provinces, while PV plant projects are distributed in western provinces. With over 2000 kilometers of shipping distance, high transportation cost and long transportation time, the average profit rate of the industry is less than 10%.

Development trend of PV mount industry:

**Diversification.** Primary mounting application systems at present include LS-PV ground power station, PV system in rooftops and BIPV. Different application systems require different mounting performances and materials.

**Precision machining.** The mounting products will develop from rough structure and simple process to precision machining manufacturing.

**Lightweight.** At present, the weight of a solar module mounting structure is 16 to 30kg and installed outside, so durability and lightweight is the development trend of the future.

**Tracking system.** Tracking system, as a future development trend, will develop towards the important direction of high stability and low cost.

## 6 PV IN THE ECONOMY

### 6.1 Labour places

There are no related data.

### 6.2 Business value

**Table 18 Value of PV business**

Sub-market	Capacity installed in 2014 (MW)	Price per W (from table 7)	Value (Yuan)	Totals
Off-grid domestic	40	15	600000000	
Off-grid non-domestic	-	-	-	
Grid-connected distributed	2050	10	20500000000	
Grid-connected centralized	8550	8	68400000000	
				89500000000
Export of PV products				-
Change in stocks held				-
Import of PV products				-
Value of PV business				-

## 7 INTEREST FROM ELECTRICITY STAKEHOLDERS

### 7.1 Structure of the electricity system

<p>Short description of the electricity industry landscape</p> <ul style="list-style-type: none"> <li>- structure – vertically integrated or separate generation, transmission, distribution;</li> <li>- retailers and network businesses – integrated or separate;</li> <li>- ownership – private – public (state owned or municipal)</li> <li>- Electricity industry regulator?</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>- structure – vertically integrated;</li> <li>- retailers and network businesses – integrated;</li> <li>- ownership – public (state owned)</li> <li>- Electricity industry regulator? Yes</li> </ul>
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### 7.2 Interest from electricity utility businesses

The State Grid Corporation of China and Southern Power Grid has formulated a series of distributed PV power grid-connection policy to propel grid-connection progress since 2012, including **Typical Design of Distributed PV Power Grid Connection System, Relevant Policy on Distributed PV Power, Detailed Rules of Operation and Service of Distributed PV Power (Trial), etc.**, providing principles on grid connection services, electricity purchasing and selling services and grid-connection dispatch. At the same time, policy implementation of power grid has been improved greatly. However, explosive growth of LS-PV plant installation leads to more and more severe grid-connection and consumption problems. There were higher proportion of abandoned wind and solar power in some provinces in 2014.

At present, there're three development models of distributed PV power system in China. The first is installation on top of property owners' roofs, for "self-generation and consumption, surplus capacity on grid". The second is energy performance contracting, which means PV project development enterprises build construction in owner's roof that supplies power to the owner but can also provide surplus capacity to the grid. The third is to sell all power to the grid.

### 7.3 Interest from municipalities and local governments

In 2014, the central authorities formulated and issued 13 policies supporting PV development, emphasizing implementation of published policies and handling of practical problems in PV market development through compilation of detailed rules for implementation. Based on taking full advantage of national feed-in tariff policies and found, local governments have formulated policies on local privilege, subsidy stimulation, and tax preference to promote local PV manufacturing, project development and system operation to realize a multi-win situation for all interested parties.

## 8 STANDARDS AND CODES

PV industry chain is split into PV equipment, PV material, solar cell and module, PV component, PV power system and PV application according to production process and products. China has published a total of 94 standards covering PV manufacturing, PV application, material and equipment, including 67 national standards and 27 industry standards. In addition, there are 65 national standards and 21 industry standards in formulation.

**Table 19 The Newly Added Photovoltaic Industry Standards and Code Published in 2014.**

No.	Standard Name	Standard codes	Standard Level	Remarks
01	Germanium single crystalline wafer and germanium substrate slice used in solar cells	GB/T 30861-2014	National Standard	Current
02	Test methods on thickness and variation in thickness of silicon wafers used in solar cells	GB/T 30859-2014	National Standard	Current
03	Test methods on flexure strength and cutting stria of silicon wafers used in solar cells	GB/T 30860-2014	National Standard	Current
04	PV drip irrigation system	NB/T 32021-2014	Industrial Standard	Current
05	Portable PV power	NB/T 32020-2014	Industrial Standard	Current

## 9 HIGHLIGHTS AND PROSPECTS

### 9.1 Highlights

China's newly added grid-connected PV installation capacity was 10.6GW in 2014, accounting for a quarter of the world's newly added capacity. China has been the largest PV application market in the world for two consecutive years. The same year, China's accumulated grid-connected PV installation capacity has reached 28.05GW, an increase of 60% over last year and ranked the second in the world after Germany. China's annual PV power output was about 25 billion kWh, increasing 200% over the previous year.

Industrial scale has maintained the global leading position. Multi-crystalline silicon production accounted for 47.7% of the world and proportion of silicon wafers, solar cells and modules accounted for over 50% of the global output.

### 9.2 Prospects

In November, 2014, the State Council published **Energy Development Strategy Action Plan (2014-2020)** which announced that PV power installation capacity will reach 100GW in 2020. And the **U.S.-China Joint Announcement on Climate Change** jointly released by the leaders of the two countries in 2014 stated that China's non-fossil energy will reach 20% of primary energy consumption by 2030.

With continued expansion of downstream application market, China's industrial scale will be constantly expanded as well. In 2015, multi-crystalline silicon production is expected to reach 140000 tons and price will maintain at the level of USD 22 /kg. PV modules production is estimated to reach 35 GW, along with overall improvement of PV market and drop of module price which has resulted in PV power cost approaching parity price.



## Definitions, Symbols and Abbreviations

For the purposes of this and all IEA PVPS National Survey Reports, the following definitions apply:

PV power system market: The market for all nationally installed (terrestrial) PV applications with a PV power capacity of 40 W or more.

Installed PV power: Power delivered by a PV module or a PV array under standard test conditions (STC) – irradiance of 1 000 W/m<sup>2</sup>, cell junction temperature of 25°C, AM 1,5 solar spectrum – (also see ‘Rated power’).

Rated power: Amount of power produced by a PV module or array under STC, written as W.

PV system: Set of interconnected elements such as PV modules, inverters that convert d.c. current of the modules into a.c. current, storage batteries and all installation and control components with a PV power capacity of 40 W or more.

CPV: Concentrating PV

Hybrid system: A system combining PV generation with another generation source, such as diesel, hydro, wind.

Module manufacturer: An organisation carrying out the encapsulation in the process of the production of PV modules.

Off-grid domestic PV power system: System installed to provide power mainly to a household or village not connected to the (main) utility grid(s). Often a means to store electricity is used (most commonly lead-acid batteries). Also referred to as ‘stand-alone PV power system’. Can also provide power to domestic and community users (plus some other applications) via a ‘mini-grid’, often as a hybrid with another source of power.

Off-grid non-domestic PV power system: System used for a variety of industrial and agricultural applications such as water pumping, remote communications, telecommunication relays, safety and protection devices, etc. that are not connected to the utility grid. Usually a means to store electricity is used. Also referred to as ‘stand-alone PV power system’.

Grid-connected distributed PV power system: System installed to provide power to a grid-connected customer or directly to the electricity grid (specifically where that part of the electricity grid is configured to supply power to a number of customers rather than to provide a bulk transport function). Such systems may be on or integrated into the customer’s premises often on the demand side of the electricity meter, on public and commercial buildings, or simply in the built environment on motorway sound barriers etc. They may be specifically designed for support of the utility distribution grid. Size is not a determining feature – while a 1 MW PV system on a rooftop may be large by PV standards, this is not the case for other forms of distributed generation.

Grid-connected centralized PV power system: Power production system performing the function of a centralized power station. The power supplied by such a system is not associated with a particular electricity customer, and the system is not located to specifically perform functions on the electricity grid other than the supply of bulk power. Typically ground mounted and functioning independently of any nearby development.

Turnkey price: Price of an installed PV system excluding VAT/TVA/sales taxes, operation and maintenance costs but including installation costs. For an off-grid PV system, the prices associated with storage battery maintenance/replacement are excluded. If additional costs are incurred for reasons not directly related

to the PV system, these should be excluded. (E.g. If extra costs are incurred fitting PV modules to a factory roof because special precautions are required to avoid disrupting production, these extra costs should not be included. Equally the additional transport costs of installing a telecommunication system in a remote area are excluded).

Field Test Programme: A programme to test the performance of PV systems/components in real conditions.

Demonstration Programme: A programme to demonstrate the operation of PV systems and their application to potential users/owners.

Market deployment initiative: Initiatives to encourage the market deployment of PV through the use of market instruments such as green pricing, rate based incentives etc. These may be implemented by government, the finance industry, electricity utility businesses etc.

Final annual yield: Total PV energy delivered to the load during the year per kW of power installed.

Performance ratio: Ratio of the final annual (monthly, daily) yield to the reference annual (monthly, daily) yield, where the reference annual (monthly, daily) yield is the theoretical annual (monthly, daily) available energy per kW of installed PV power.

Currency: The currency unit used throughout this report is RMB Yuan

PV support measures:

Feed-in tariff	an explicit monetary reward is provided for producing PV electricity; paid (usually by the electricity utility business) at a rate per kWh that may be higher or lower than the retail electricity rates being paid by the customer
Capital subsidies	direct financial subsidies aimed at tackling the up-front cost barrier, either for specific equipment or total installed PV system cost
Green electricity schemes	allows customers to purchase green electricity based on renewable energy from the electricity utility business, usually at a premium price
PV-specific green electricity schemes	allows customers to purchase green electricity based on PV electricity from the electricity utility business, usually at a premium price
Renewable portfolio standards (RPS)	a mandated requirement that the electricity utility business (often the electricity retailer) source a portion of their electricity supplies from renewable energies
PV requirement in RPS	a mandated requirement that a portion of the RPS be met by PV electricity supplies (often called a set-aside)
Investment funds for PV	share offerings in private PV investment funds plus other schemes that focus on wealth creation and business success using PV as a vehicle to achieve these ends
Income tax credits	allows some or all expenses associated with PV installation to be deducted from taxable

	income streams
Compensation schemes (self-consumption, net-metering, net-billing...)	These schemes allow consumers to reduce their electricity bill thanks to PV production valuation. The schemes must be detailed in order to better understand if we are facing self-consumption schemes (electricity consumed in real-time is not accounted and not invoiced) or net-billing schemes (the electricity taken from the grid and the electricity fed into the grid are tracked separately, and the electricity account is reconciled over a billing cycle). The compensation for both the electricity self-consumed and injected into the grid should be detailed. Net-metering schemes are specific since they allows PV customers to incur a zero charge when their electricity consumption is exactly balanced by their PV generation, while being charged the applicable retail tariff when their consumption exceeds generation and receiving some remuneration for excess electricity exported to the grid
Commercial bank activities	includes activities such as preferential home mortgage terms for houses including PV systems and preferential green loans for the installation of PV systems
Activities of electricity utility businesses	includes 'green power' schemes allowing customers to purchase green electricity, operation of large-scale (utility-scale) PV plants, various PV ownership and financing options with select customers and PV electricity power purchase models
Sustainable building requirements	includes requirements on new building developments (residential and commercial) and also in some cases on properties for sale, where the PV may be included as one option for reducing the building's energy foot print or may be specifically mandated as an inclusion in the building development

