

# **12<sup>th</sup> Five-Year Plan for the Solar Photovoltaic Industry**

**Note:** The government of the People's Republic of China has not released an official translation. This translation was commissioned by Wiley Rein LLP, a law firm in Washington, D.C., from an independent outside source.

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## **Introduction**

Solar energy resources are abundant, widely available, and are a kind of renewable energy that has the greatest development potential. As global energy shortages and environmental pollution have become increasingly prominent, solar photovoltaic (“PV”) power generation has received worldwide attention and has become a key emerging industry because it is clean, safe, convenient, and highly efficient.

In this context, the global PV industry has grown rapidly in recent years; the industry continued to expand and the product costs continued to decline. In 2009, worldwide solar cell production reached 10.66 GW and polycrystalline silicon production reached 110,000 metric tons. In 2010, production reached 20.5 GW, or 160,000 metric tons, respectively. The prices of components dropped from \$4.5/Watt in 2000 to \$1.7/Watt in 2010.

During the period of the 11<sup>th</sup> five-year plan, China’s solar PV industry developed rapidly and became one of our country’s few industries that could compete globally and could be expected to reach an advanced level internationally. The expedited development of China’s solar PV industry is of great importance in achieving industrial transformation and upgrading, adjusting energy structure, facilitating social and economic development, and promoting energy conservation and emission reduction. The “Decision of the State Council on Accelerating the Fostering and Development of Strategic Emerging Industries” has already included the solar PV industry as an important emerging strategic industry that our country will develop in the future.

According to the requirements of the “Industrial Transformation and Upgrading Plan for 2011-2015,” the “12<sup>th</sup> Five-Year Plan for Information Industry,” and the “12<sup>th</sup> Five-Year Plan for Electronic Information Manufacturing Industry,” on the bases of comprehensive research, in-depth study, and extensive discussion, we hereby compile the “12<sup>th</sup> Five-Year Plan for the Solar PV Industry” to be the guiding document for our country’s PV industry development during the 12<sup>th</sup> five-year period.

### **I. Review of the 11<sup>th</sup> Five-Year Plan Period**

#### **(a) Overview of China’s PV industry**

##### **(i) The Scale of the Industry Increased Rapidly and Ranked Near the Top in Global Market Share**

During the 11<sup>th</sup> five-year plan period, our country’s solar cell production grew rapidly, with the annual growth rate exceeding 100%. For four consecutive years, between 2007 and 2010, production of solar cells ranked No.1 in the world. In 2010, production of solar cells was around 10GW, accounting for 50% of total global production. More than 90% of our solar cell products were exported. The export value amount in 2010 reached \$20.2 billion.

##### **(ii) Leading Chinese Enterprises Mastered Production Technology for Key Materials and the Industrial Base Gradually Solidified**

During the 11<sup>th</sup> five-year plan period, our country’s annual production of

polycrystalline silicon grew from 200-300 metric tons to 45,000 metric tons; the PV industry's raw materials self-sufficiency rate increased from almost 0% to 50%, with production output value reaching tens of billions of yuan. Leading Chinese polycrystalline silicon enterprises have mastered key technology required by thousand-ton production capacity through a modified Siemens process. The stability of large-scale production has gradually improved.

**(iii) With Mainstream Product Technology in Sync With the World, Product Quality Increased Steadily**

At the end of the 11<sup>th</sup> five-year plan period, China's crystalline silicon cells accounted for more than 95% of total solar cell production. The quality of solar cell products has improved year by year. In particular, leading enterprises have made rapid progress in the aspect of conversion efficiency. Now, the conversion rate for monocrystalline silicon solar cells has reached 17%-19%; that of polycrystalline silicon solar cells is 15%-17%; and the conversion rate of thin-film and other new types of cells is 6%-8%.

**(iv) Along with Significant Achievements in Energy Conservation and Emission Reduction, the Resource Utilization Rate Improved Dramatically**

Energy conservation and emission reduction in the PV industry achieved remarkable results. Comprehensive utilization of by-products steadily increased, and the overall resource utilization rate improved significantly. In 2006, the average consumption of materials required to produce 1 kg of polycrystalline silicon was: 1.8-2.0 kg of industrial silicon, 1.8 kg of liquid chlorine, and 300-250 kWh of total electricity consumption. In 2010, the figures fell to: 1.3-1.4 kg of industrial silicon, 1 kg of liquid chlorine, and 160-180 kWh of total electricity consumption (some leading enterprises' total electricity consumption dropped to 130-150 kWh). Usage of polycrystalline silicon to produce crystalline solar cells fell from 11 gram/watt in 2006 to 7-8 gram/watt in 2010.

**(v) Through Continuous Breakthroughs, Localization of Production Equipment Continued to Increase**

Domestically manufactured equipment like monocrystal furnaces, polycrystalline silicon ingot casting furnaces, and ingot squaring machines gradually realized industrialization, accounting for a larger domestic market share. Except for automatic printing machines and cutting equipment, the industry was basically able to manufacture special equipment for crystalline silicon solar cells domestically, and home-grown enterprises are now capable

of running “turnkey” production lines.<sup>1</sup> For the production of silicon-based thin-film cells, Chinese enterprises have preliminarily built complete-line production capacity for small-scale products. In 2010, sales revenue from specialized manufacturing equipment for the PV industry exceeded RMB 4 billion, and the export delivery value reached RMB 100 million.

**(vi) The Domestic PV Market Is Still in the Startup Phase, with Installed Capacity Increasing Rapidly**

China has successively introduced policies such as the “Interim Measures for the Administration of Financial Subsidies for Application of Solar Building-Integrated Photovoltaics” and the “Notice on Implementing the ‘Golden Sun’ Demonstration Project.” China also launched two batches of concession bidding projects for PV power stations, involving a total of 290MW. As of 2010, China’s cumulative PV installed capacity reached 800MW. New installed capacity reached 500MW in 2010, a 166% increase from the previous year.

**(b) Development Characteristics of China’s PV industry**

**(i) Fully Utilizing Domestic and Overseas Market Factors, the Industry is Highly Internationalized**

China’s PV industry fully utilizes domestic and foreign capital and human resources. By the end of the 11<sup>th</sup> five-year plan period, dozens of enterprises were listed at home or abroad, and their products are now sold globally. Domestic PV enterprises are mainly privately-owned. Leading enterprises’ capabilities grew stronger. Four Chinese enterprises rank among the world’s top ten by output of solar cells.

**(ii) Through Independent Innovation and Introduction of Foreign Technology, Domestic Enterprises Have Built an Industry System with Chinese Characteristics**

Through a combination of independent innovation and the introduction of foreign technology, domestic enterprises have built a PV industry with Chinese characteristics. The level of manufacturing of polysilicon, battery modules, and controllers continues to improve. The localization rate of manufacturing equipment now exceeds 50%. In terms of the quality and technology level of solar cells, China is gradually gaining a leading position in the world.

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<sup>1</sup> “Turnkey” ability refers to the ability to undertake turnkey projects.

**(iii) Coordinated Development of Upstream and Downstream Enterprises Helped Decrease Costs**

During the 11<sup>th</sup> five-year plan period, China's PV industry broke development bottlenecks in materials, markets, and human resource development. The size of the industry grew rapidly, and a complete upstream and downstream industrial chain was emerging. The rise of China's PV industry led the development of the global PV industry, effectively promoting technological progress, reduced costs of PV products, and accelerated industry application of PV around the world.

**(iv) Industry Clusters Have Developed Which Have Enhanced Regional Competitiveness**

The trend of cluster development has emerged in China's PV industry. By leveraging regional resource advantages and industrial bases, Jiangsu, Hebei, Zhejiang, Jiangxi, Henan, Sichuan, and Inner Mongolia have become regional industrial centers. A number of renowned representative enterprises also emerged. After completing their vertical integration, leading enterprises have accelerated overseas mergers and acquisitions, set up factories, and developed into internationalized enterprises.

**II. Situation During the 12<sup>th</sup> Five-Year Plan Period**

At present, developed countries provide strong support for the development of the PV industry. These countries promote market application and industrial development by enacting feed-in tariff laws or implementing the "Solar Roof" program. International investors are optimistic about the PV industry: on the one hand, many large enterprises in the PV industry announced new investment plans and continued to expand production; on the other hand, enterprises from other fields, such as semi-conductor and display devices, which bring a variety of market capital, are entering, or are about to enter, the PV industry.

From the perspective of the strategic path of China's social and economic development, promoting the solar PV industry is essential to guarantee energy supply, establish a low-carbon society, promote economic restructuring, and foster strategic emerging industries. During the 12<sup>th</sup> five-year plan period, China's PV industry will continue to maintain rapid development, facing great opportunities and formidable challenges.

**(a) China's PV Industry Has Vast Room for Development**

The world faces an increasing shortage in the supply of conventional energy. The massive exploitation and utilization of fossil fuels has become one of the major causes of environmental pollution and degradation of the human living environment. The search for new energy sources has become a global issue. Among various new energy sources, solar PV power generation receives a great deal of attention from all

countries because it is pollution-free, sustainable, and widely available. It can also generate a large amount of power, and has diversified application forms. China's PV industry has a solid foundation in the areas of industrial systems, technology R&D, and manufacturing. The outlook for China's PV industry is promising in both domestic and foreign markets. By seizing development opportunities, accelerating transformation, and upgrading, Chinese enterprises will gain even wider room for development in the future.

**(b) Interaction Between the PV Industry, Policy and the Market Needs to be Strengthened**

From a global perspective, it will take some time before PV power generation becomes competitive in the market price-wise. In the near future, growth in demand for solar cells will be fueled mainly by policy support and price subsidies provided to the PV industry by governments in all countries. The continued growth of the market will also facilitate expansion of the industry size and reduction in product costs. This will further promote the healthy development of the PV industry. At present, China is adopting policy systems to promote PV applications and the long-term interactive mechanism facilitating the sustainable development of PV power generation. Most solar cell products are exported to overseas markets, and as a result, the development of the industry is largely impacted by the financial crisis and changes in overseas markets. Excessive dependence on external markets is not conducive to healthy and sustained development.

**(c) The Industry Faces Serious Challenges of International Economic Turmoil and Trade Protection**

In recent years, there has been global economic turmoil. Some countries have adjusted their new energy policies and decreased subsidies, which has had a large impact on the development of China's PV industry. Meanwhile, our country's PV industry has been involved in several trade disputes with European countries and the United States. Similar disputes will continue to occur in the future. The main reasons are: 1) China's solar cells have clear cost advantages, putting pressure on foreign products; 2) the domestic PV market has not yet developed; most products are exported, which may raise concerns about dumping; 3) China's standards system is imperfect, and there are problems of uneven product quality.

**(d) New Techniques and New Technologies are Evolving Rapidly and International Competition is Intensifying**

The global PV industry is experiencing rapid technological development: on average, the conversion efficiency of crystalline silicon cells grows by 1% annually; thin-film cell technology continues to improve; emerging technologies like nano material cells advance quickly; and production and testing equipment for solar cells is constantly upgraded. The domestic PV industry still lags behind in many areas as pressure from

international competition intensifies: China still lags behind international advanced levels of polysilicon key technology; high-end equipment used for manufacturing crystalline silicon cells still needs to be imported; and Chinese enterprises notably lag behind in thin-film cell processes and equipment.

**(e) While Market Applications Continue to Expand, Cost Reduction is the Main Issue Facing the Industry**

Solar PV market applications will diversify, and will involve a broad range of fields. PV products that meet various needs will continue to emerge in the market. In addition to large scale grid-connected PV power plants, small-size PV systems, off-grid PV systems, and PV power generation systems that are connected to buildings will emerge rapidly. The cost of solar cells and PV systems will continue to decline and will gradually approach conventional power generation costs. Prices of silicon materials, modules, and ancillary parts will rapidly decline as a result of market pressure. Solar cells will continue to evolve toward high efficiency and low cost.

**III. Guiding Ideologies, Basic Principles and Development Goals**

**(a) Guiding Ideologies**

Thoroughly implement scientific concepts of development, and seize opportunities as countries around the world emphasize the development of new energy; focus on the goal of reducing the costs of PV power generation; improve the quality of PV products; strengthen China's PV industry; endeavor to promote the innovation of key technologies; improve production techniques; break bottlenecks of equipment R&D and promote mass applications, so as to significantly enhance the overall competitiveness of China's PV industry.

**(b) Basic principles**

**(i) Work Out Overall Planning and Support Leading Enterprises**

Strengthen national macro policy guidance, persist in overall industry planning and reasonable industrial deployment, and set norms for the healthy development of the PV industry. Concentrate efforts on supporting leading enterprises to grow in strength. Encourage key PV enterprises to promote resource integration, mergers, and reorganization.

**(ii) Support Technological Innovation to Reduce the Cost of Power Generation**

Let enterprises play a major role in technological innovation and industrial development, strengthen the R&D for key technologies, and enhance the

production process. Endeavor to reduce the costs of PV power generation through the mass production of high-purity silicon materials, enhancement of cell conversion efficiency rates, localization of production equipment manufacturing, R&D of new types of cells and raw materials, and system integration.

**(iii) Optimize the Industrial Environment and Expand the PV Market**

Promote the implementation of favorable policies for the PV industry. Utilize all types of resource advantages to optimize the industrial development environment. Give full play to market mechanisms, consolidate the industry's position in the international market, and promote diversified applications in the domestic market so as to provide support for the stable development of China's PV industry.

**(iv) Strengthen the Service System to Promote the Industry's Healthy Development**

Step up efforts to develop the public services platforms. Establish and improve PV standards and product quality inspection and certification systems. Strictly abide by environmental protection and production safety regulations. Promote energy conservation, emissions reduction, and utilization of resource recycling to conduct clean and safe production.

**(c) Development Goals**

**(i) Economic objectives**

During the 12<sup>th</sup> five-year plan period, the PV industry will maintain stable and fast growth. Polysilicon, solar cells, and other products can meet the installed capacity requirements set by the national development plans for renewable energy, and can also meet demand in the international market. Support will be provided to major enterprises to grow stronger so that by 2015, leading polysilicon enterprises will reach 50,000 metric tons per year, and major enterprises will reach 10,000 metric tons per year; leading solar cell enterprises will reach the 5GW level, and major enterprises will reach the 1GW level. By 2015, in China there will be one PV enterprise with annual sales revenue exceeding RMB 100 billion, 3-5 PV enterprises with annual sales revenue exceeding RMB 50 billion, and 3-4 enterprises specializing in PV equipment manufacturing with annual sales revenue exceeding RMB 1 billion.

**(ii) Technology Goals**

Along with the growth of the polysilicon industry, product quality and environmental standards will improve. The recovery rate of silicon tetrachloride, hydrogen chloride, and hydrogen shall be no less than 98.5%, 99%, and 99%, respectively. By 2015, average total power consumption shall be lower than 120 kWh/kg, the conversion efficiency for monocrystal silicon cells will reach 21%, that of polysilicon cells will reach 19%, and that of amorphous silicon thin-film cells will reach 12%. New types of thin-film solar cells will be industrialized. The localization rate of production equipment and auxiliary materials for PV cells will reach 80%, and Chinese enterprises will master key technologies involved in PV grid connection, manufacturing of energy storage equipment, and system integration.

**(iii) Innovation Goals**

By 2015, Chinese PV enterprises will have significantly enhanced innovation capabilities. A number of brand enterprises with advanced core technologies will emerge, and they will grasp all key technology and production techniques in the PV industry. The conversion rate of technological achievements will rise significantly. The standards system will gradually improve. Chinese PV enterprises' international influence will be greatly enhanced. National key laboratories and inspection platforms will be established by fully utilizing the existing foundation.

**(iv) Targets for the Cost of PV Power Generation**

By 2015, PV power generation will have a certain degree of economic competitiveness as the cost of PV modules will drop to 7,000 yuan/kW, that of PV systems will drop to 13,000 yuan/kW, and that of PV power generation will drop to 0.8 yuan/kW. By 2020, PV power generation will become economically competitive as the cost of PV modules will fall to 5,000 yuan/kW, that of PV systems to 10,000 yuan/kW, and that of power generation costs to 0.6 yuan/kW.

**IV. Main Tasks For the 12<sup>th</sup> Five-Year Plan Period**

**(a) Promote Technological Progress and Achieve Transformation and Upgrading**

Develop clean, safe, low energy consumption, high-purity, large-scale polysilicon production technology. Enhance the comprehensive utilization rate of by-products. Narrow the gap with international advanced production technology. Innovate and develop production technology of solar cells, encourage mass production, and enhance the PV industry's core competitiveness. Promote energy conservation and

emission reduction within the industry. Pay close attention to technological advancements in new, clean, and environmentally friendly PV cells and materials, and strengthen technology R&D.

**(b) Enhance R&D and the Application of Domestically Manufactured Equipment and Integration Technology**

Support the R&D and industrialization of key production equipment used for polysilicon, silicon ingots/silicon wafers, cells and modules, thin-film cells, and power generation applications in order to enhance product quality and PV conversion efficiency, and to reduce energy consumption during production. Strengthen the application of locally-manufactured equipment. Promote technical cooperation and exchanges between equipment enterprises and PV enterprises.

**(c) Improve the Performance of Solar Cells and Continue to Reduce Product Costs**

Strongly support R&D and industrialization of low-cost, high conversion efficiency, and long-life crystalline silicon solar cells. Reduce costs of cell products and ultimate power generation costs. Strive to achieve grid parity. Promote technological advancement and industrialization of silicon-based thin-film cells and copper indium gallium (di)selenide (CIGS) thin-film cells. Improve the conversion efficiency of thin-film cells.

**(d) Promote PV Application and Expand the PV Power Generation Market**

Actively promote the formulation and implementation of feed-in tariff policies. Strengthen R&D and applications of PV products in industries such as agriculture, transportation, and architecture. Support the establishment of a number of distributed PV power stations, off-grid application systems, building integrated photovoltaic systems (BIPV), small PV systems, and PV-based multi-energy supplement systems. Encourage the establishment and application of large grid-connected PV power stations. Promote and improve technology systems and management mechanisms fit for PV power generation.

**(e) Improve the Supporting Service System for the PV Industry**

Establish and improve standards, patents, inspections, certification, and other supporting service systems. Strengthen management and services for the PV industry, and support the industry's self-regulation and collaboration. Actively participate in the setting of international standards. Establish national industry standards systems that are in accordance with China's actualities, including product standards for polysilicon materials and cells/modules, and inspection and acceptance standards for PV production equipment and PV systems. Accelerate the establishment of public service platforms for domestic certification and inspections.

## **V. Key Focus Areas For the 12<sup>th</sup> Five-Year Plan Period**

### **(a) High-Purity Polysilicon**

Support solar-level polysilicon production technology involving low energy consumption and low cost. Based on the existing foundation, through further research and systematic improvement, support the R&D of stable production techniques for electronic-grade polysilicon, and establish kiloton electronic-grade polysilicon production lines. Achieve breakthroughs in techniques, technologies, and equipment for energy-efficient large-scale purification, high-efficiency nitrogen recovery and purification, high-efficiency chemical vapor deposition, and the comprehensive utilization of polysilicon by-products. Construct 10,000-ton high-purity polysilicon production lines, with total energy consumption below 120 kWh/kg.

### **(b) Silicon Ingots/Silicon Wafers**

Support high-efficiency, low-cost, large-size ingot technology, focusing on the development of quasi-single crystal ingot technology. Achieve breakthroughs in key technologies for new-type slicing below 150-160 micron, such as cutting technology for silicon carbide and steel wires, in order to improve the quality of silicon wafers, the number of wafers per unit of silicon materials, and to reduce silicon material losses during slicing.

### **(c) Crystalline Silicon Cells**

Aggressively develop and industrialize crystalline silicon cells with a high conversion rate and a long service life. Provide key support for the research and application of low-reflectivity texturing technology, selective emitter technology, electrode alignment technology, plasma passivation technology, low-temperature electrode technology, and full back junction technology. Pay attention to key technologies of thin-film silicon, crystalline silicon heterojunction solar cells, as well as other new types of solar cells.

### **(d) Thin-Film Cells**

Focus on the development of laminated and multi-junction thin-film cells, which combine amorphous silicon (a-Si) and microcrystalline silicon ( $\mu\text{c-Si}$ ). Reduce light-induced degradation of thin-film cells. Encourage enterprises to research and develop 5.5th generation or above high-efficiency and large-area silicon thin-film cells. Develop roll-to-roll production techniques for flexible silicon-based thin-film solar cells. Closely follow the industrialization progress of copper indium gallium (di)selenide (CIGS) and organic thin-film cells. Develop and master the preparation technologies and techniques for low-cost, non-vacuum CIGS thin-film cells, magnetron sputtering cells, and vacuum co-evaporate cells.

**(e) High-Concentration Solar Cells**

Focus on the development of production technology for high-concentration compound solar cells, which can concentrate sunlight by more than 500 times. Industry-produced cells' efficiency rate can reach 35% under non-concentration conditions, and 40% under concentration conditions; substrate lift-off high-concentration cells' conversion rate can exceed 25% under non-concentration conditions. Achieve breakthroughs in substrate glass technology used for high-concentration solar cells, high-efficiency high-concentration compound solar cell technology, analysis and stability control techniques of high-concentration cells, and promptly develop Fresnel lenses, parabolic mirrors, and other ancillary equipment.

**(f) BIPV Modules**

Focus on the development of production technology for BIPV modules, including building materials that can be directly integrated into buildings, double-glass BIPV modules and insulating glass components that are applied to factory rooftops, agricultural greenhouses, and curtain walls. Address and solve the problems related to BIPV modules' light transmission and heat insulation. Design BIPV components that are beautiful, practical, and can be directly used as building materials and components. Expand the applications of building-attached photovoltaic (BAPV) modules.

**(g) Specialized PV Production Equipment**

Support key polysilicon production equipment such as equipment for reduction or hydrogenation of polysilicon, large, low energy consuming, fully-automatic monocrystal furnaces, metric ton-grade polysilicon ingot casting furnaces, large, ultra-thin silicon wafer multi-wire cutting machines, and silicon wafer automatic sorting machines. Support crystalline silicon solar cell production line equipment and thin-film solar cell production equipment such as multi-slot etching cleaning equipment, automatic plasma-enhanced chemical vapor deposition (PECVD), laser engraving machines, dry etching machines, ion implanters, automatic printing machines, and fast sintering furnaces. Promote the integration of production techniques with PV production equipment that are low in energy consumption, high in efficiency, and automated.

**(h) Ancillary Materials**

With regard to key ancillary materials, realize domestic production of crucibles, high-purity graphite, high-purity quartz sand, carbon-carbon composite materials, glass, ethylene-vinyl acetate copolymer (EVA), backplane, electronic paste, and line cutting fluid.

**(i) Grid and Energy Storage System**

Master the system integration technology for solar PV power generation and the design integration and engineering technology for 1 million kilowatt PV power generation bases. Develop high-power, PV grid-connected inverters, energy storage cells and systems, PV auto-tracking devices, statistics collection and monitoring systems, and wind and solar complementary systems.

**(j) Establishment of Public Service Platforms**

Support capable enterprises and public sector organizations in establishing public service platforms for national-level PV application system inspections and certifications, including examination and testing of polysilicon, cells and modules, thin-film cells, and PV systems engineering. Support relevant service platforms to study common problems that the industry is facing, develop and promote industry standards, and develop key generic technology.

**VI. Policy Measures**

**(a) Enhance the Status of PV Energy and Strengthen Strategic Industrial Deployment**

PV energy is a new green energy that is sustainable, pollution-free, and can generate a large amount of power. It is necessary to fully understand the significance and strategic value of solar PV power generation, and to give solar PV power generation consideration in the overall planning of national energy economy and sustainable social development. Enhance the strategic position of the solar PV industry in the national economy. By implementing relevant planning on industrial transformation, upgrading, and renewable energy, map out policies in the areas of industry, taxation, and finance to actively promote the healthy development of China's PV industry.

**(b) Strengthen Industry Administration and Standardize the Development of the PV Industry**

According to industry policy and the actual needs for industrial development, take measures to strengthen industry administration, promote energy-saving and emission reduction, standardize the development of China's PV industry, establish and improve the access standards of the PV industry, guide local governments to resolutely curb low-level repetitive construction to avoid a mass rush into the industry, which would lead to vicious market competition. Prompt relevant departments' joint efforts to strengthen product inspections. Enterprises that do not meet environmental protection standards, sell poor-quality products, or disrupt normal order of market competition should be penalized and rectified in accordance with relevant regulations.

**(c) Focus on Overall Planning and Promote Reasonable Industrial Layout**

Strengthen overall industrial planning, promote industrial transformation and upgrading, adhere to the combination of “led by the market and guided by the government,” support leading enterprises that have already achieved industrial chains and brand awareness to allow them to grow stronger. Encourage leading PV enterprises to expand through technological progress, inventory optimization, implementing the “going out” strategy, and actively participating in international competition. Implement differentiated policies and guide industries like polysilicon to move toward the western regions. Promote resource integration and encourage enterprises to engage in intensive development and operations. Support highly competitive enterprises with low production costs to merge and transform ailing PV enterprises.

**(d) Actively Foster a Diversified Market and Promote the Industry’s Healthy Development**

Promote the formulation and implementation of detailed rules for feed-in tariffs. Continue to implement the “Golden Sun Project” and other supporting measures. Encourage PV enterprises to strengthen communications and cooperation with the power system. Accelerate the development of the domestic PV market. Insist on a combination of grid-connected power generation and off-grid application. With the goals of “going to the country side, enriching people, supporting the frontier, and controlling desertification,” develop a variety of PV products, and support the application of small PV systems, off-grid application systems, and PV power generation systems. Through reasonable tariffs, moderate financial subsidies, and active financial support, actively expand the domestic PV market.

**(e) Support Enterprises’ Independent Innovation and Strengthen the Industry’s Core Competitiveness**

Support PV enterprises’ transformation and upgrading. Through technological innovation, support key enterprises with proprietary technology to reinforce and boost core competitiveness. Enhance support for the PV industry’s technological innovation. Focus support on energy-conservation in polysilicon production, comprehensive utilization of by-products, R&D, and industrialization of efficient and high quality solar cells and low-cost new techniques. Strengthen cooperation between industry, academic, and research institutes. Support the R&D of key generic technology. Improve the technology level of domestically-manufactured PV equipment. Enhance efforts to cultivate professionals and support the establishment of technology R&D centers and post-doctoral research stations.

**(f) Improve the Standards System and Promote the Establishment of Inspection Certification and Monitoring Systems**

Attach great importance to establishing the standards systems for PV products and systems. Based on China's proprietary technologies, and by integrating the domestic industry's technology, promote the establishment of relevant standards for polysilicon, silicon ingots/silicon wafers, solar cells, and PV systems. Actively participate in the establishment of international standards, and establish and improve product inspection, certification, and monitoring systems. Promote the development of industry standardization. Strengthen industry administration of PV product quality standards compliance to prevent poor-quality products from entering the market. Encourage PV enterprises to enhance the recycling (recovery) of PV products.

**(g) Strengthen Industry Organization and Actively Participate in International Competition**

Establish and improve PV industry organization, promote the industry's self-regulation, strengthen industrial exchanges and collaboration, reflect the industry's visions of development, and create cooperation and innovation platforms for the domestic PV industry. Improve the industry's capability to cope with international competition and market risks, allow market mechanisms to fully function, use industry organizations as the link, use enterprises as the main players, and use the market as the guide. Strengthen international exchanges and cooperation, optimize the industry's development environment, improve export risk insurance mechanisms, encourage enterprises to actively seek overseas investments, and reinforce and expand domestic enterprises' presence in the international market.