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The analysis on photovoltaic electricity generation status, potential and policies of the leading countries in solar energy

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A B S T R A C T

Energy, which is the main agenda of our world, is crucially important for the people. Many countries frequently held meetings and discussions with energy agenda. These countries are working to balance the energy demand and supply. For finding the solution are researched, researches should be attempted to present a more efficient way to use energy as well as renewable energy resources effectively.

Photovoltaic energy power systems take place as the most dominant source among renewable energy technologies. The most important reason is that it is unlimited and clean energy of the solar power systems. Many studies show that photovoltaic power systems will have an important share in the electricity of the future.

In this study, to generate electricity from solar energy using photovoltaic systems have a leading position in some European countries, United States of America, China and Japan's current status and future policies will be analyzed in various comments were made.

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1. Introduction

In recent years, the world economic growth and population increase need more energy, is an essentially important for the socio-economic development of developing, as well as developed countries [1]. Therefore, the usage of energy is of great importance. General agreement exists that an effective energy efficiency policy requires a combination of measures including regulatory instruments, financial incentives, information provision, and that the mix of measures needs to be adapted to the situations of each particular country [2].

Renewable energy is a sustainable and clean source of energy derived from nature [3]. Renewable energy technology is one of the solutions, which produces energy by transforming natural phenomena (or natural resources) into useful energy forms [4]. Concern about the development of applications of, and the teaching about, renewable energies have increased markedly in recent years. Some university centres have established complete courses on renewable energies [5]. Fig. 1 depicts that fossil fuel prices and accordingly also electricity prices have continuously increased in the near past [6].

A large amount of energy will be saved and a great contribution will be made to the environment through an increase in users'

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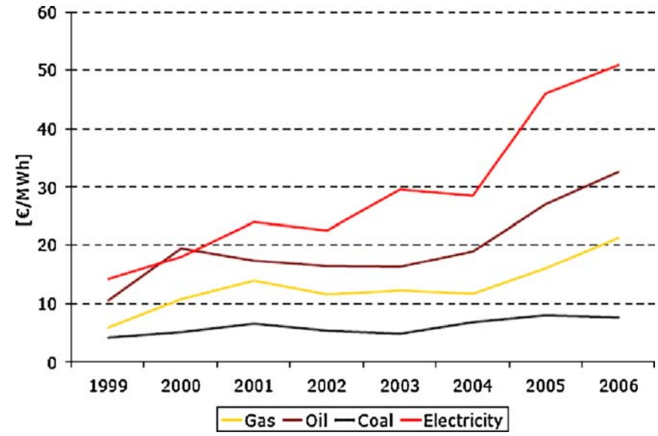

Fig. 1. The price development of fossil fuels and electricity from 1999 until 2006 [6].

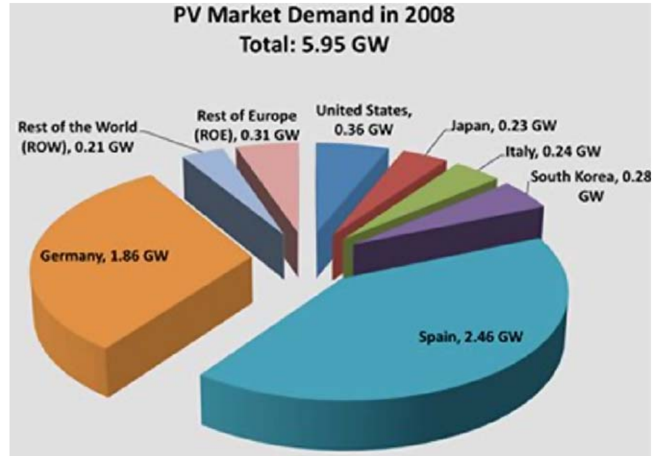

Fig. 2. PV market demand in 2008 [18].

awareness of energy saving and environmental protection as well as through the effect of the direct reduction of carbon dioxide with renewable power generation systems [7].

The environmental issue such as global warming by exhausting carbon dioxide [8] has been rising in the worldwide scale. In most countries, the economic activity that emits the largest amount of CO_2 is electric power generation [9]. This has significant impact on the climate change which is now a major issue that has been widely discussed and debated throughout the world. One of the major causes of climate change is the excessive emission of global greenhouse gases (GHGs), such as carbon dioxide and methane, into the atmosphere as a result of human activities [10].

In recent years, environmental problems have attracted worldwide attention and solar power generation system has been gaining unprecedented attention as a method to solve the energy problem [11]. Solar energy is obviously environmentally advantageous relative to any other energy source, and the linchpin of any serious sustainable development program [12]. The design of a solar energy conversion system needs exact knowledge regarding the availability of global solar radiation. Sunshine hours are measured at many locations around the world, while global radiation is measured at selected locations only [13]. Obviously to ensure that this energy is usable in the night time hours, an adequate storage system must exist which is capable of accumulating this energy efficiently [14].

Among various solar energy technologies of sustainable energy sources, photovoltaic (PV) appears quite attractive for electricity generation because it is noiseless, no carbon dioxide emission during operation, scale flexibility and rather simple operation and maintenance [15]. The photovoltaic (PV) power system has received considerable attention for the clean energy resource to solve the environmental problem in the worldwide scale [8]. One key argument for an accelerated deployment of renewable energies in general and PV in particular is besides environmental benefits the avoided risk of disruption in fossil fuel supply and of the associated price instability. Therefore renewable energies have a significant contribution towards supply security [6].

The electricity from photovoltaic cells can be used for a wide range of applications, from power supplies for small consumer products to large power stations feeding electricity into the grid [16]. World photovoltaic industry has an average growth rate of 49.5% over the past 5 years [17]. Fig. 2 shows that World solar photovoltaic (PV) market installations reached a record high of 5.95 gwatts (GW) in 2008, representing growth of 110% over the previous year [18].

Solar energy, including solar photovoltaics (PVs), has a vast sustainable energy potential in comparison to global energy demand. The IEA envisaged solar power accounting for 11% of global electricity production by 2050 and solar electricity contributes about 20% of the world's energy supply by 2050 and over 60% by 2100. [19]. It is clear that electrical generation with PV cells will play an important role in future of the energy. PV systems developments will increase and focusing more and more on the PV industry that is poised for exponentially decrease their cost. This development will make it major in few years.

The International Energy Agency (IEA) estimates that solar power could provide as much as 11% of global electricity production in 2050. But this is conditional on many countries putting in place incentive schemes to support solar energy in the next 5–10 years so that investment costs come down. The share would be roughly divided equally between photovoltaic and concentrating solar power [20].

In the early days of photovoltaics, some 50 years ago, the energy required to produce a PV panel was more than the energy the panel could produce during its lifetime. During the last decade, however, due to improvements in the efficiency of the panels and manufacturing methods, the payback times were reduced to 3–5 years, depending on the sunshine available at the installation site. Today the cost of photovoltaics is around $2.5 US per watt peak and the target is to reduce this to about $1 US/W peak by 2020 [21]. Fig. 3 shows global solar cell module production from 1990 to 2006, although the global photovoltaic market grew by more than 40% in 2006 [19].

Cost reductions will be achieved through the following measures: (ii) higher conversion efficiency, (ii) less material consumption, (iii) application of cheaper materials, (iv) innovations

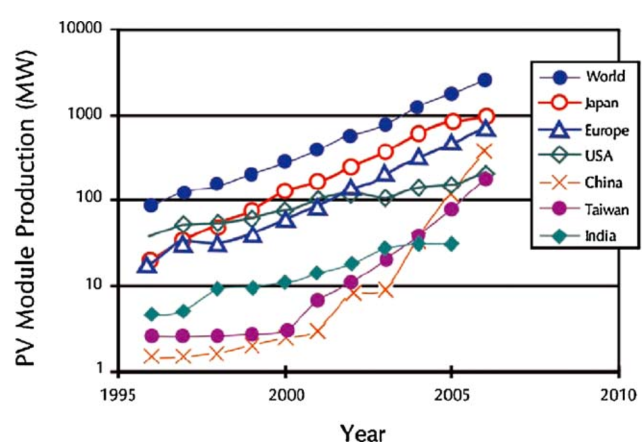

Fig. 3. World photovoltaic module production from 1990 to 2006 [19].

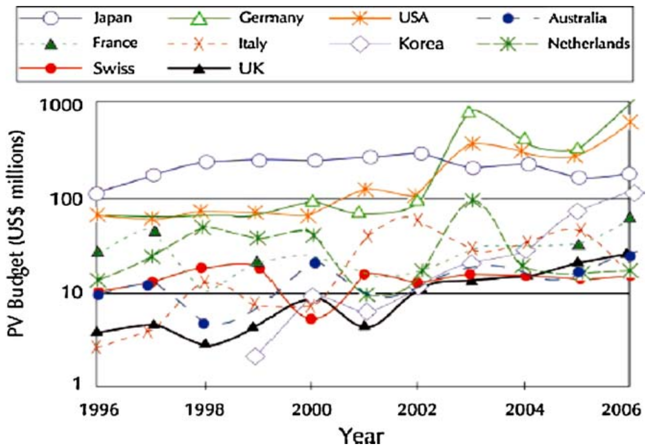

Fig. 4. Development of the total PV budget in selected countries on a logarithmic scale. Currency conversion: 1 yen = 0.008259 US$, 1 euro = 1.3092 US$, 1 aud = 0.78 US$, 1 krw = 0.001065 US$, 1 chf = 0.804699 US$, 1 gbp = 1.95 US$ [19].

in manufacture, (v) mass production and (vi) optimised system technology. Total PV budgets over a 10-year period in 10 major countries are shown in Fig. 4 [19].

The rapid development of photovoltaic industry and the continuous reduction of photovoltaic cost gradually establish a sustainable development of energy system. Scientific, effective and operational net pricing law is quickly agreed, accepted and followed by many countries around the world. Right now there are around 40 countries and areas where implemented net pricing law, thus, photovoltaic market soon expands from Germany to the whole Europe, United States of America, South Korea and continues to expand largely. Table 1 shows parts of countries and areas where implement net pricing law [17].

Many countries, such as Germany, Japan and the USA are positioning themselves to have a technological lead by implementing national programmes to promote the use of PV, which will undoubtedly result in an expansion in manufacturing capacity and in cost reductions [22]. More widespread application of PV technology will be the driving force in the global PV market. Four countries, Germany, Japan, Spain and the USA, have contributed most to PV market growth [19]. During different workshops, the participants were asked to give their view about the estimated growth of the PV market as a whole and the respective market share of the different solar cell technologies. The base for the growth estimate was the existing EPIA, US Industry and the Japanese PVRoadmaps [69]. Fig. 5 shows the evolution of the solar electrical capacities until 2030.

Some key actions for the development of PV industry; provide long-term targets and supporting policies to build confidence for investments in manufacturing capacity and deployment of PV systems. There is a need to expand international collaboration in PV research, development, capacity building and financing to accelerate learning and avoid duplicating efforts. Implement effective and cost-efficient PV incentive schemes that are transitional and decrease over time so as to foster innovation and technological improvement. Governments and industry must increase R&D efforts to reduce costs and ensure PV readiness for rapid deployment, while also supporting longer-term technology innovations. Increase R&D efforts to reduce costs and ensure PV readiness for rapid deployment, while also supporting longer-term innovations [70].

Table 1
Parts of countries and areas where implement net pricing law [17].

Country and area	Net pricing, euros/kWh	Implementary time
Germany	0.55 (average)	20
Belgium	0.45	20
Greece	0.49	20
Italy	0.45	20
Portugal	0.44	15
Spain	0.42	25
Washington (US$)	0.43	10
California (US$)	0.50	3
Korea	0.58	15

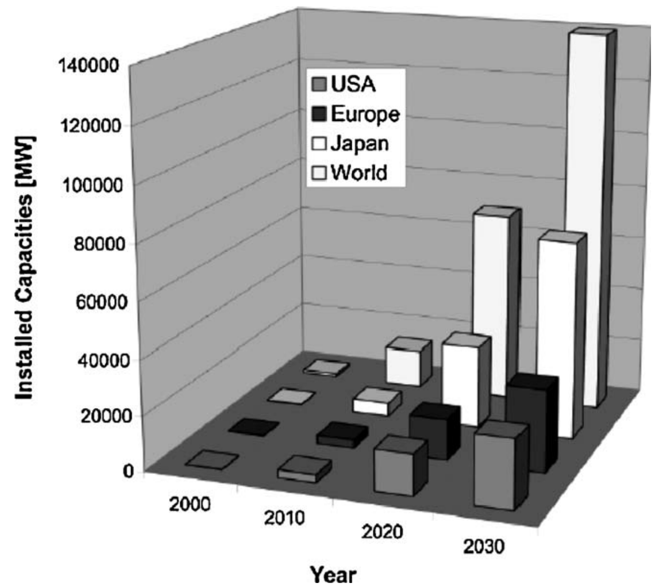

Fig. 5. Evolution of the solar electrical capacities until 2030.(*Sources*: Japanese, US and EPIA roadmap) [69].

2. European countries

In 2008, cumulative global photovoltaic capacity hit 15 GW, a growth of 5.6 GW on the previous year. Europe is a clear leader, as 65% of installed capacity lies within its borders [20]. European countries have big potential solar energy that is free. Solar energy consumption is getting among the European countries but this increase is not sufficient to demand electricity.

Starting from system costs of photovoltaics in 2004 (grid-connected systems) of 5 €/Wp or 0.25–0.65 €/kWh, depending on irradiation across Europe, the vision for 2030 is a cost for solar electricity between 0.05 and 0.12 €/kWh. The following cost development is the basis for Table 2 [23].The photovoltaic panels efficiency increases as their prices decrease. Solar energy is free and is a huge expandable source. Last decades, lots of European countries introduced variety incentives for using the photovoltaic panels and is now getting increased. Especially, people should be aware of the global warming or changing and lots of problems that have being huge solar energy potential in EU. This chapter introduces about electricity generation status, potential and policies of based solar energy of some European countries such as are Spain and Germany.

Roadmaps are an important tool for future planning of energy demand developments. To do so, expert meetings, workshops and

Table 2
Cost development of photovoltaics [23].

Year	Module costs [€/Wp]	System costs [€/Wp]
2010	2	3
2020	<1	2
2030	<0.5	1

symposia are organised to stimulate communication and discussion within the European PV community. The preparation of the roadmap is an interactive and ongoing process. It points out major research areas for the short and long term, including cross fertilisation with other R&D fields. It will cover marketing, product and standardisation aspects, environmental issues as well as the issue of human resources for PV [68]. The European Commission establishes a binding target of 20% for renewable energy's share of energy consumption in the EU by 2020 [24]. To achieve this vision, substantial technological development needs to occur, accompanied by a rapid and sustainable industry and market deployment [23].

2.1. Spain

The Spanish energy system is characterized by its high dependence on imports: 80% of energy consumption is from imported sources. On August 26, 2005, the Spanish government approved the Renewable Energy Plan 2005–2010. Its overall aim is to meet the target of supplying 12% of Spain's primary energy needs and 30% of its demand for electricity from renewable sources by 2010 [25]. Spain has a very abundant solar resource (1200–1800 kWh m^{-2} $year^{-1}$) [26].

The most important solar resources in Europe are to be found in Spain. Global solar irradiation on a horizontal plane is estimated at between 1.48 and 3.56 kW/m^2 day in Spain. Additional aspects, such as continual lowering of costs and prices in most system components, institutional economic support, versatility and modularity, and minimum maintenance cost, mean that installed PV power in Spain is estimated to rise to 3000 MW by the end of 2009, with more than 14,000 grid-connected systems. About 70 companies in the region are active in the PV industry. They generate a turnover of s500 million and account for 1300 jobs [25]. In this sense, Spain is in a position to play a key role in the implementation of renewable energy technology in Europe due to its surface area, investments in large solar energy plants, and numerous research projects funded by public and private organisms [71].

Spain became the PV market leader, with 2.6 GW of new grid-tied installations [27]. As a result, the global PV market has grown by around 5600 MW. But, with a cap of 500 MW in 2009, it also means that the Spanish market will decrease in size by at least 80% (or more than 2100 MW) this year [28]. Spain's low ranking here means that the country still has a long way to go to fully benefit from this type of energy, and that greater use should be made of solar power in the design and construction of houses [29].

Consequently, a strong growth potential is widely assumed. According to experts, Spain has been considered as number two in Europe behind Germany, with the potential to become number one [30]. Major innovation projects are currently underway, with a concerted effort being made in research. New technologies are being increasingly deployed with ever greater importance in this sector [31].

The EU's first commercial concentrating solar power (CSP) plant was inaugurated in Seville, Spain in 2007. It uses hundreds of mirrors, called heliostats, to focus sunrays on a receiver at the top of a tall tower, converting the beams into steam that drives a turbine. The plant is expected to supply enough power to serve the needs of the 600.000 citizens of Seville [20].

Large solar parks have already been built in Europe, the biggest being the 60 MW Olmedilla photovoltaic park in Spain. However, these installations still need government support and the farms take up considerable space, inviting the wrath of environmentalists [20].

With several new large-scale projects in the pipeline, Spain has taken the lead on CSP but several projects are being planned and developed in the US too. A study published by Greenpeace International, the European Solar Thermal Electricity Association (ESTELA) and the International Energy Agency's SolarPACES in May 2009 estimated that CSP could meet up to 7% of the world's power needs by 2030 [20].

Spain not only has not reduced its share in emissions, but also has tripled its emissions due to the huge economic growth. To palliate this tendency, Spanish government has approved a new Plan to develop renewable energies, buys shares of CO_2 emissions to seller countries, buys foreign reforest and establishes saving and energetic efficiency strategies [32].

2.2. Germany

The cumulative installed PV power in Germany increased to 5.3 GW by the end of 2008. Annually installed power in 2008 was approximately 1500 MW. Germany remained one of the leading PV markets worldwide just after Spain. More than a third of the global cumulative PV power installed is located in Germany. Although the absolute market figures keep growing in Germany, the market share of Germany in Europe has been shrinking during the last year as markets like Spain and Italy finally followed the successful German path. Germany has a diverse mix of PV applications. In 2008, 40% of the German PV systems were installed on residential homes (1–10 kW). 50% were installed commercial roof top systems (10–1000 kW) and 10% of the PV systems were installed as very large ground mounted systems. Considering current installation rates, PV will be a major electricity source in Germany within a few years [33]. Fig. 6 shows the employment in Germany (PV and Solarthermic Technology). Developments of solar energy technologies along with number of people have employed and are getting increase such these sectors.

Germany promulgated and implemented "renewable energy net pricing law" which was corresponding to "average share within the whole network" in January 2009 and they adopted 0.99 marks/kWh net pricing for the photovoltaic power generation [17].

Through generous financial support, Germany has dramatically increased electricity production from renewable Technologies since the outset of this century. With an estimated share of about 14% of total electricity production in 2007, Germany has already significantly exceeded its minimum target of 12.5% set for 2010 [35]. Fig. 7 shows the cumulative solar PV installation data for Germany and world during the period 1994–2006 [36].

The government of the Federal Republic of Germany has decided to reduce CO_2-emissions into the atmosphere by 25% by the end of 2005, as compared to the level of 1990 [37].

In Europe, Germany is leading a group of countries interested in bringing solar electricity from North Africa to meet their climate goals and diversify their energy mix. The most prominent example is the Desertec project, which has created a large political buzz in Germany and has the backing of European Commission President José Manuel Barroso and French President Nicolas Sarkozy [20].

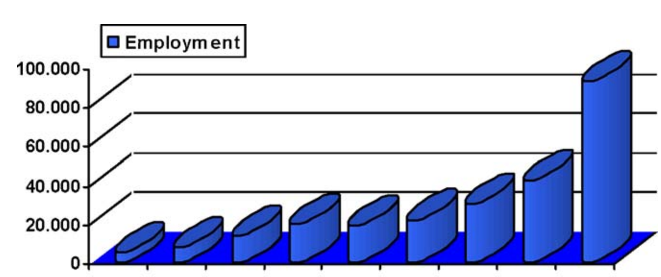

Fig. 6. Employment in Germany (PV and solarthermic technology) [34].

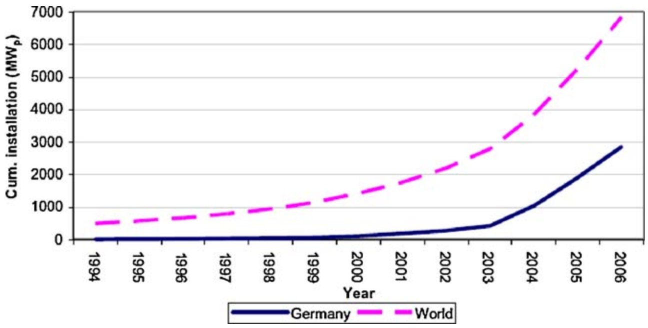

Fig. 7. Cumulative PV installation in Germany and the world, 1994–2006 [36].

3. United States of America

The third largest PV market was the US with 624 MW of PV installations in 2006, and a cumulative installed PV capacity totalling 1.45 GW [19]. Between 2000 and 2008, annual installed grid-connected PV capacity in the U.S. grew from 4 MW to 290 MW at an average rate of 71% per annum. This rapid growth made the U.S. the third-largest global demand center behind Germany and Spain. Only the U.S., however, has the potential to engender a truly sustainable, long-term market. With high insolation, the greatest electricity demand in the world, and ample available land for PV development, the U.S. presents an attractive longterm growth opportunity for developers, installers, financiers, and other PV service providers. Most global industry players recognize this potential and are seeking to develop and refine a U.S. market strategy. Over the next 4 years, the U.S. will experience the most rapid demand growth of any major PV market. Base case U.S. PV demand will grow to 1515 MW by 2012, with annual growth from 2008 to 2012 averaging 48%. The upside scenario sees demand reaching 2022 MW in 2012. During this period, the U.S. surpasses Spain to become the second leading PV market in the world behind Germany. Fig. 8 annual PV demand in the United States, 2000–2008 [38].

The goal of the industry is to meet 10% of U.S. peak electricity generation capacity by 2030. Within the next 25 years the PV industry expect to employ more than 150.000 people in the US and grow to a $15 billion industry in 2020. To reach these goals the following scenario has been developed. A close look onto the production targets of the US PV-Industry Roadmap (Fig. 9) reveals that 70% of the production capacities are aimed for export. A strong home market like in Japan, where it accelerated the expansion of production capacities is missing in the US. This might be one of the reasons why the US lost its market leader position held for many years and is now at third place behind Japan and Europe. In addition it should be noted that four out of the five biggest US PV manufactures are owned by European companies [72].

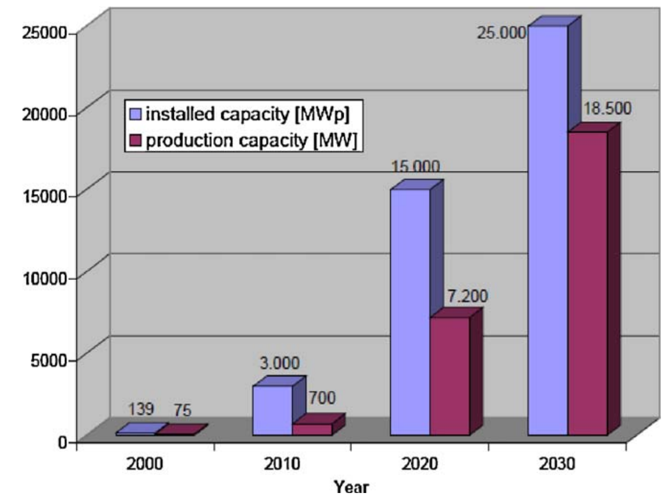

Fig. 9. USA PV-Industry Roadmap [72].

The government is asked to continue a reasonable investment in the nation's intellectual and research resource at national laboratories, universities and other research organisations. This investment is needed to improve existing technologies and develop new and better technologies. These next-generation photovoltaic devices and products are vital for meeting future energy needs and maintaining US leadership [72].

Base-case investment in U.S. PV projects will reach $6.12 billion in 2012, up from $2.35 billion in 2009. Average annual growth will be 37.6%. Utility-scale project investment expands the fastest at 56% per annum, reaching $1.48 billion in 2012. In the upside scenario, total investment reaches $8.17 billion in 2012 at an average annual rate of 41.1% [38].

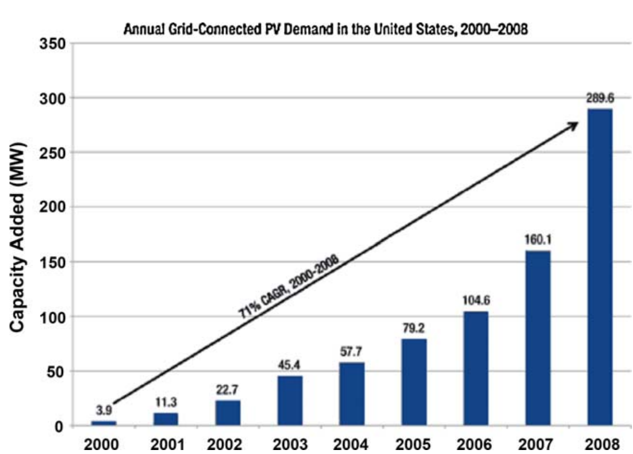

Fig. 8. Annual PV demand in the United States of America, 2000–2008 [38].

4. Japan

In Japan, primary energy supply in 1960s was heavily dependent upon imported petroleum, that is, approximately 80% of total primary energy supply [39]. The production of photovoltaic (PV) cells has rapidly increased in Japan following the development of roof-type PV technologies and the introduction of a subsidy system to encourage the spread of PV systems. Despite the recent recession in Japan [40], cumulative installed capacity of PV system in Japan has been steadily increasing. Accumulated installed

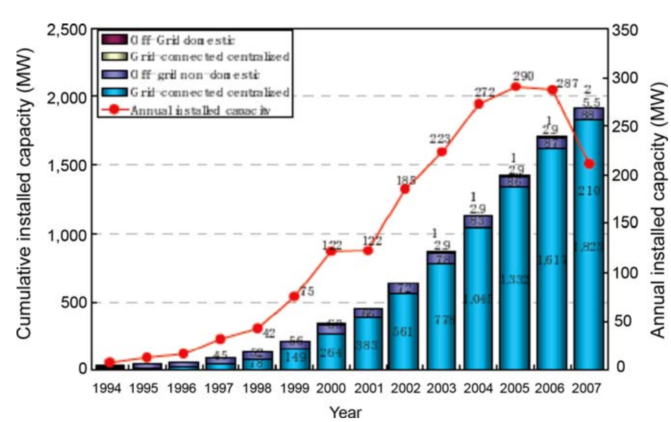

Fig. 10. Accumulated installed capacity of the PV system in Japan [41].

capacity of the PV system in Japan in 2007 was 1.918.894 kW, close to 2 GW level as shown in Fig. 10 [41].

Japan is an important market player with respect to both the global supply, i.e. its domestic PV industry, and the demand for PV, i.e. its strong domestic market. This country was the worldwide market leader until the end of 2004 and after this year changed its first place in favour of Germany [18]. The Japanese PV market was the second largest, with 287 MW of new installations in 2006, primarily using grid connected residential systems under the Japanese PV residential programme. The cumulative installed PV capacity in Japan reached 1.71 GW in 2006 [19]. There has been a remarkable progress in Japanese PV industry over the last decade [42].

The main issues in this period have been the manufacturing cost reduction, the improvement in solar cell performance, and the development of mass production processes and Japan is now the global leader in both PV shipments and total installed capacity. Japan's PV market is now expanding rapidly [43].

The total number of private houses in 1987 was 42 million in Japan. If 22% of those houses can accommodate a 3 kW PV system for each, it makes 27.6 GW potential. In addition, 580,000 multi-family houses give another 8.13 GW assuming that a half of building area can be covered by 10% efficiency modules. Therefore, residential application can potentially accept 35.73 GW PV systems [44]. The Japanese house-building industry is rather different from that of other countries and is characterized by large house builders who build over 10,000 homes per year to a number of fixed designs [45].

Recently in May 2004, Japan set up a long-term roadmap called "PV2030" through discussions by the NEDO's PV 2030 Roadmap Study Committee. Assuming that the domestic PV installation will reach around 100 GW up to 2030 and according to a study about practically available potentials in Japan as well as their competitive electricity prices, cost targets for 2010, 2020 and 2030 were decided as 23 JPY/kWh, 14 JPY/kWh and 7 JPY/kWh, respectively. These levels correspond to present average single-family electricity price, industrial price and whole sale price [46].

An improvement in cell efficiency is also directly connected to cost-reduction in photovoltaic systems [47]. Both the polycrystalline and amorphous silicon solar cell manufacturing technologies in Japan are strongly advanced since 1986 with the progress of the Sunshine Project which is implemented by the MITI (Ministry of International Trade and Industry) and NEDO (New Energy Development Organization) [48]. MSK Corporation in Japan that is the world's largest independent PV module manufacturer, having 200 MW capacity in three factories in Japan. The company has over two decades of experience in PV, and has been manufacturing solar modules since 1984 [45].

The price of PV modules is steadily falling thanks to both technology development and reductions in manufacturing cost due to mass production. The price reduction is similar to a learning curve in line with mass-production price changes [40]. For further deployment of PV system after 2010, drastic reduction in manufacturing cost of solar cell modules compared with the state-of-the-art PV Technologies will be required [39]. Development of such technologies will have been an important condition to prevent global warming. Also, presently in Japanese power system, the intensity of CO_2 emission corresponds to 360 g-CO/dk/Wh and will become 300 glk/Wh up to 2040 [46].

5. China

Energy is a significant and core sector. The PRC has the second largest electricity supply system in the world [49]. Approximately 65% of primary energy is derived from coal, which results in a significant contribution to global warming [50]. In 2005, coal made up about 68.7% of China's total primary commercial energy consumption, while in the OECD countries in the same year it was only 21% [51]. Coal has the highest carbon intensity among fossil fuels, resulting in coal-fired plants having the highest output rate of CO_2 per kWh [52]. This situation creates a serious threat to global warming and is a very important case because the effects of global warming are clear.

Energy, such as food and shelter, is a basic need of people throughout the world. Particularly in China, as a developing country with a population of 1.25 billion, energy is hugely needed for its fast economic growth [53]. Along with economic growth of nearly 10% per year over the last two decades, China's energy use has been rapidly increasing [54]. Considering the energy requirement and its features, energy technology development is significant for sustainable development in China [55].

Although China has extremely rich solar energy resources [56], China's new electricity generation capacity is still coming predominately from fossil fuels. As a result, renewable electricity capacity and generation considered as a share of total capacity and generation decreased instead of increasing. With this fact in view, we have a reason for not being optimistic about China's carbon emission future [57].

China is at a critical crossroads for action on renewable energy development [58]. In recent years, Chinese government has implemented State Technical Problem Tackling Plan, high technology research plan, industrialized development special item and key equipment special item, etc. Through these doing, the government is to support the use of solar energy, photovoltaic power generation and in terms of photovoltaic power generation products [59]. There are also many case studies on China's solar energy economy and its important situation among all of the countries.

China's PV industry is growing faster than perhaps any other country in the world [60]. So, there are many encouraging signs, as well as many critical challenges, for both the international and indigenous photovoltaic industries in the energy markets in China [61].

It is well known that China has abundant solar energy resources in large country [62]. Its land surface receives an annual solar radiant energy of 1.7×10^{12} tce. More than two-third of the country receive an annual radiation of more than 5.02×10^6 kJ/m^2 and sunshine of more than 2000 h. [59]. These data that should be taken into account for applications of PV power generation because it is so important.

In 2007 China announced goals to install 300 MW of PV by 2012 and 1.8 GW by 2020. Given recent policy developments and project announcements, China will be well on its way to exploding past those goals and in fact is expected to announce new targets later this year. Depending on the timing of these announcements and the success of several pilot projects, the Chinese market has very real potential to ramp well beyond 1 GW in 2011 [63]. Although the PV market in China is currently quite small, it is expected to grow drastically within the next 5 years in order to meet its targets to supply 15% of total primary energy in 2020 from renewable energy sources [19].

At present, the PV industry of China has a huge development in past 10 years. For example, the yield of Chinese PV in 2007 is more than 1200 MW, and which has share of 35% in whole world, which ranks the first in the world. Fig. 11 shows that the yield of solar cell is increasing rapidly in the last 9 years [62]. The government encourages the development of new and renewable energy in the built environment. Also, The UNDP (United Nation Development programme) supports the Chinese government in its obligations in the field of environment and energy. It focuses on the promotion of sustainable energy for sustainable development, for example, the promotion of renewable energy and energy efficiency [64]. The

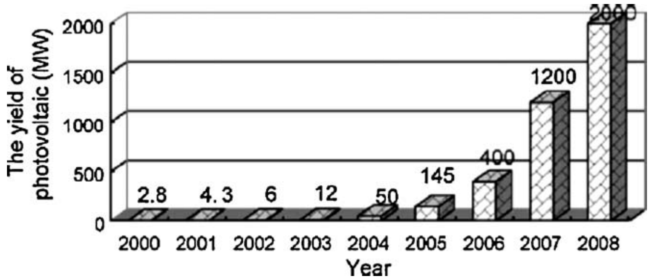

Fig. 11. The yield of solar cell in the last 8 years [62].

market share of Chinese PV has increased from 1% to 35% in the last 8 years, and the quality has step up at the same time [62].

At present, the PV market in China is mostly used to the electric energy supply of remote villages and communication and solar energy manufacture and PV generating electric power (PGEP). Some productions are used to improve the daily life of common people, such as solar energy street lamp, solar energy lawn lamp, solar energy traffic signal lamp and solar energy sight lighting. The grid-connect energy production is located in demonstration moment due to the costly price of PV generating electric power [62].

PV power generation will play a significant role in China's future energy supply. According to the present plan, total PV power installations will reach 300 MWp by 2010, 1.8 GWp by 2020 and 1000 GWp by 2050. According to forecasts made by the Chinese Electric Power Research Institute, renewable energy installations will account for 30% of total electric power capacity in China by 2050, of which PV installations will account for 5% [65]. At present, the biggest photovoltaic plant is established in Shilin of Yunnan province. The capacity and the investment are 66 MW and 0.6 billion dollars, respectively. Consequently, the market and development potential of solar energy are startling in the future China [66].

6. Conclusion

In our world increasingly affected by global warming constitutes a significant hazard if this case progress may bring about important life situations in the future. Especially, some countries should be identified and worked on the issue. So, the countries should leave one side current fossil energy sources and should research and improve renewable energy technologies.

Solar energy sources are the most dominant sources among the renewable energy resources. Electricity from solar energy because it does not increase carbon dioxide emissions production, does not harmful for the environment also PV technologies have nature friendly.

To achieve a measurable impact on market growth and to reach a diverse cross-section of users, retail financing terms need to be flexible [67]. Investor should be given variety of important incentives for increased use of solar energy, for example, increasing prices of solar energy purchases by the governments, to be exempt from purchase of PV panels can be increased.

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