

# Overseas Activity of Photovoltaic Power Business

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## Article Introduction

Today, photovoltaic power, which does not emit CO<sub>2</sub>, is attracting considerable attention around the world as an effective means of combating global warming. Mitsubishi Electric entered the photovoltaic power business starting with applications for space satellites in 1976 and has been developing related technologies ever since. We started commercial mass production of multicrystalline silicon cells in 1998 and have expanded the business worldwide from Japan to Europe, the U.S., and Asia, to help preserve the global environment.

## 1. Introduction

Today we face unprecedented problems such as global warming and depletion of fossil fuels such as petroleum. In the 21st century, we must reduce our dependence on fossil fuels and focus on renewable energy.

## 2. Photovoltaic power: Demand is increasing worldwide

The needs for renewable energy, particularly photovoltaic power, are rapidly increasing. The work underway in advanced countries is described below.

- Europe: Improvement of FIT (Feed-In-Tariff = trading system for renewable energy in Germany, Italy and other countries)
- U.S.: Improvement of RPS (Renewable Portfolio Standard = special law for using new energy by electric power businesses) and tax benefits
- Japan: Administrative guidance and assistance by the national government and local public authorities
- Asian countries and Australia: Promotion of introduction of power generation facilities in unelectrified regions by the government

Table 1 Worldwide market demand (estimate by Mitsubishi Electric)

Global demand by district (estimated by MELCO)		
District	Demand scale in 2008 (percent distribution)	Demand scale in 2010 (percent distribution)
North America	310MW (12.3%)	660MW (18.2%)
Europe	1,810MW (71.8%)	2,280MW (63.0%)
Asia and Oceania	150MW (6.0%)	330MW (9.1%)
Japan	210MW (8.3%)	290MW (8.0%)
Others	40MW (1.6%)	60MW (1.7%)
Total	2,520MW (100%)	3,620MW (100%)

- Middle East countries: Construction of power generation facilities to reduce dependence on oil

The scale of demand has been estimated by many organizations; Mitsubishi Electric estimates that actual demand will grow by 20 to 30% annually, reaching about 2.5 GW in 2008 and 3 to 4 GW in 2010.

## 3. History of Mitsubishi Electric's photovoltaic power business

Mitsubishi Electric entered the photovoltaic power business starting with applications for space satellites in 1976 and has been developing various types of photovoltaic cells ever since. We started commercial mass production of multicrystalline silicon cells in 1998, and have steadily improved the conversion efficiency and introduced new technologies and products, including a lead-free solder module for the first time in the industry. In 2007, Mitsubishi Electric positioned the photovoltaic power business as the core of its "Strategic Business Solutions for Global Warming" and reinforced related programs. The detailed history of Mitsubishi Electric is presented below.

## 4. Mitsubishi Electric's measures for overseas businesses and future challenges

### 4.1 Technologies and products

The most important factors to promote photovoltaic power are to reduce the power generation cost and create a wide range of products to meet diverse needs. Accordingly, Mitsubishi Electric has engaged in various business plans and projects.

- Multicrystalline cells: The present experimental cells have reached a conversion efficiency of 18.0%, and the technology will continue to be developed toward commercial mass production. A wafer thickness of 180 μm has almost been achieved, and will be reduced to 160 μm in the future.
- Module: Currently eight types are available including a 190-W model (max. output). We plan to improve output levels by using high-conversion efficiency cells, and to expand the product line-up.
- Power conditioner: We have achieved a conversion efficiency of 96.2%, which is the highest level in the industry for products for export to Europe. We will further improve the efficiency and expand the product line-up.

Table 2 History of Mitsubishi Electric's photovoltaic business

History of Mitsubishi Electric's Photovoltaic Power Business			
1974	Started related research in response to the Sunshine Project led by the government.	2001	Started overseas business.
1976	Involved in space satellite applications.	2003	Started selling lead-free solder modules for the first time in the industry.
1996	Provided the domestic residential application market with multicrystalline modules.	2005	Reached a production capacity of 135 MW.
1998	Started commercial mass production of Mitsubishi Electric's original cells and modules at Nakatsugawa Works Iida Plant.	2006	Started selling power conditioners with the highest conversion efficiency in the industry in Europe. Started the set sales of Mitsubishi Electric's original modules and power conditioners for the first time in the industry.
1999	Received Good Design Award for BIPV roofing modules for the domestic residential market.		
		2007	Achieved the highest cell conversion efficiency of 18% (laboratory figure) in the industry. Started overseas sales of 190-W modules (max. capacity). Started domestic sales of power conditioners having a conversion efficiency of 97.5%, the highest in the industry. Reached a production capacity of 150 MW.
		2008	Reached a production capacity of 220 MW.

- Installability, etc.: For accelerated diffusion, the operability and weight reduction will have to be improved. We also plan to consider BIPV (Building Integrated Photovoltaic) applications.
- Mitsubishi Electric will consider developing thin film cells in accordance with the market trend as they have been increasingly receiving attention.

#### 4.2 Production capacity

The Nakatsugawa Works in Gifu prefecture is the headquarters of Mitsubishi Electric's photovoltaic power business, which now has a production capacity of 150 MW. Mitsubishi Electric plans to expand the capacity to 220 MW in October 2008. As demand grows, Mitsubishi Electric aims to increase the capacity to 500 MW per year by fiscal 2013.

#### 4.3 Sales

Mitsubishi Electric started doing business overseas in 2001 with Germany, which was actively introducing photovoltaic power systems. Since then, operations have expanded from Europe to the U.S. and Asia; today we deliver our products to many clients including power generation plants.

Future challenges for our business include the following: In Europe, we will sell module & power conditioner sets especially for residential homes, and will expand sales in southern European markets which are expected to grow rapidly. As for operations in the U.S., which have focused on California in the past, we will expand into other states. In Asian and Oceania countries, we will promote power plant facilities in their un-electrified regions. Furthermore, Mitsubishi Electric plans to enter the fields of large commercial complexes and power generation plants, including system technologies, from the current operations centering on residential home applications.

### 5. Conclusion

To spread photovoltaic power systems, long-term cooperation among national governments and the private sector is indispensable, such as to reduce the power generation cost. However, the key to increasing photovoltaic power systems is worldwide public awareness of environmental conservation. We hope the day will come in the near future when photovoltaic power systems play an important role in energy supply for the world.

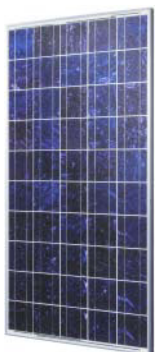


Fig. 1 190-W module



Fig. 2 Power conditioner



Fig. 3 Installation sample of residential use



Fig. 4 Installation sample of small-scale power generation