

Trends of PV Market and Technology



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SHARP Corporation

November 18th, 2008

Outline

- 1. Introduction of SHARP**
- 2. Market Trend of PV**
- 3. Outline of SHARP's PV**
- 4. Target of Cost Reduction**
- 5. Development by SHARP**

1. Introduction of SHARP

Outline of SHARP Corporation

1) Foundation:

September 15, 1912, founded as a private company by Tokuji Hayakawa.

2) Management Representatives:

Katsuhiko Machida, Chairman & CEO
Mikio Katayama, President & COO

3) Capital Stock:

204,675 million yen (\$1,986million)

Note: Any fractional sum of less than a million yen shall be discarded

(as of end of September, 2008)

*1\$=103.02JPY

4) Sales:

3,417,736 million yen (consolidated) (\$33,175million)

2,768,797 million yen (unconsolidated) (\$26,876million)

(Fiscal 2007 Financial Results)

*1\$=103.02JPY

5) Employees:

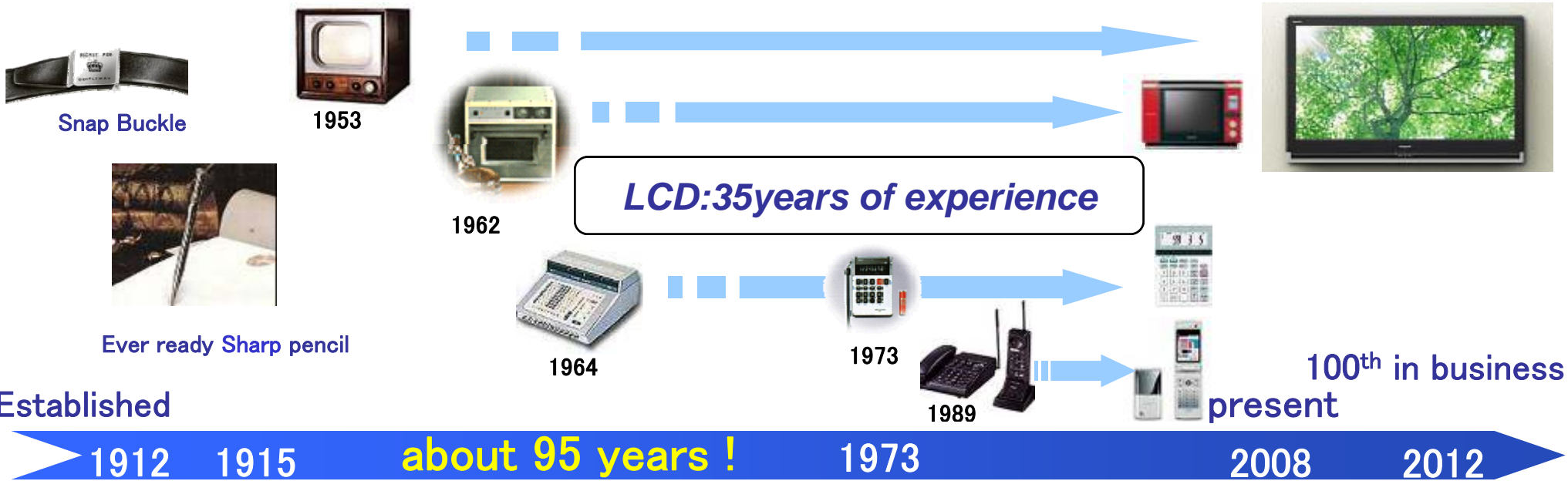
Sharp Corporation: 23,200

Consolidated: 55,500

Entire Sharp Group: 60,600 (31,500 in Japan and 29,100 overseas)

(as of April 1, 2008)

SHARP History



*Invented Si PV cells
By Bell Laboratory*



PV: 45 years of experience



source: JAPAN COAST GUARD

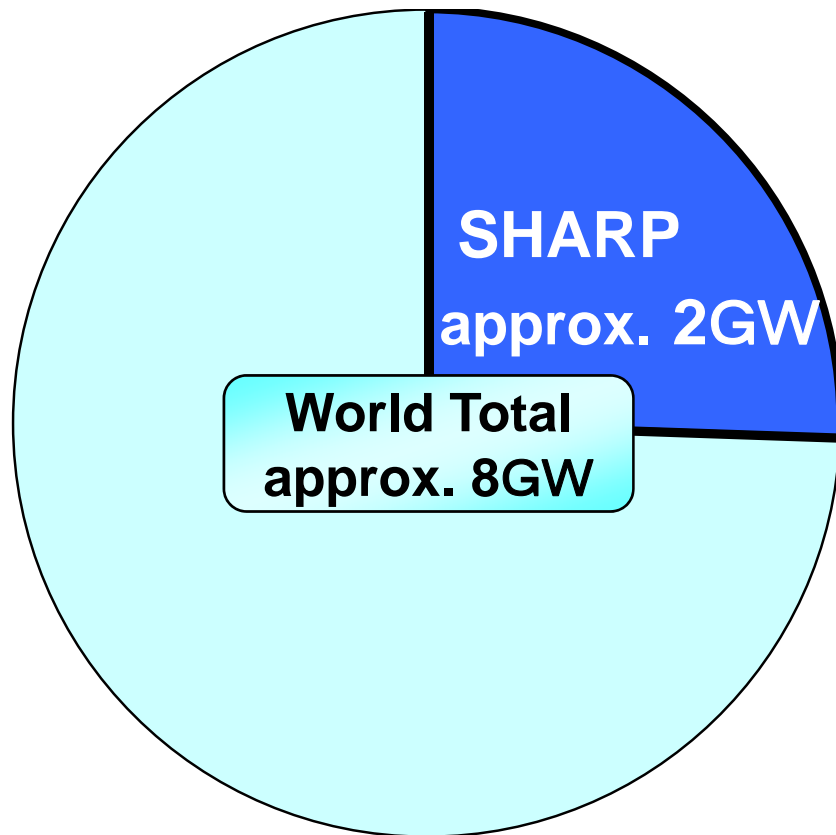


source: JAXA



SHARP PV Production to Date

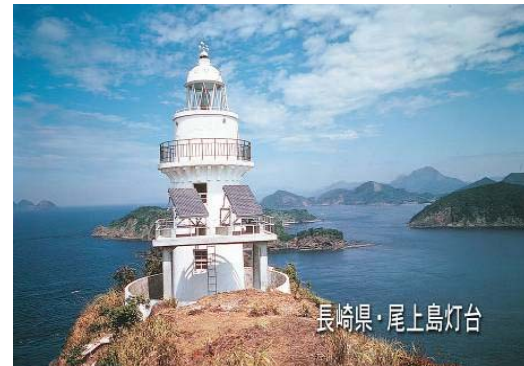
◆ Accumulated Production (~2007)



Source : estimate based on IEA PVPS 2007

◆ Abundant records

Lighthouse: 43 years of experience



Source: JAPAN COAST GUARD

Installed on more than 1,900 lighthouses
(February, 2008)

Satellite: 32 years of experience



source: JAXA

Installed on more than 160 satellites
(February, 2008)

Super Green Factory 'KAMEYAMA'

PV system capacity 5.21MW



Zero Discharge to Landfill

Reusing, recycling, and controlling discharged waste



Water Resources

Recycling all water used in manufacturing



Fuel Cells

Minimizing environmental burden with fuel cells

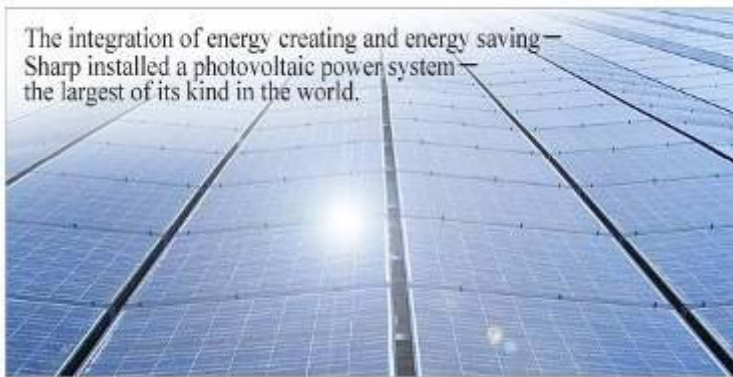


Cogeneration

Reducing CO₂ emissions with a cogeneration system



The integration of energy creating and energy saving —
Sharp installed a photovoltaic power system —
the largest of its kind in the world.



The amount of CO₂ emission reduction



About **3,400** tons of
CO₂



The amount of CO₂ absorbed by
about 960 hectares of forest

2. Market Trend of PV

Policies in the world(1)



【Germany】

- Target: renewable energy rate; 20% in 2020
- increase in defrayal: 2007; €2.1/month/home



2014; €2.8/month/home

- FIT has spread from Germany to the surrounding 20 countries.



【France】

- Target: renewable energy rate; 20% in 2020
- Spread Forecast: 6GW by 2020



【USA】

- Target: 3GW by 2017 in California (California Solar Initiative)
- "Energy Policy Act" passed in December, 2007
- The tax of 30% of the PV system cost deducted.

Policies in the world (2)



【The Middle East】

- PV Power Plant Project of Special Economic Zone, “Masdar City” in Abu Dhabi (MAX 160MW)



【China】

- Target: renewable energy rate; 15% in 2020 (PV: 1.8GW by 2020)
- “The renewable energy mid/long term plan” published in August, 2007



【Australia】

- Approach expansion about “Kyoto Protocol” based renewable energy in December, 2007

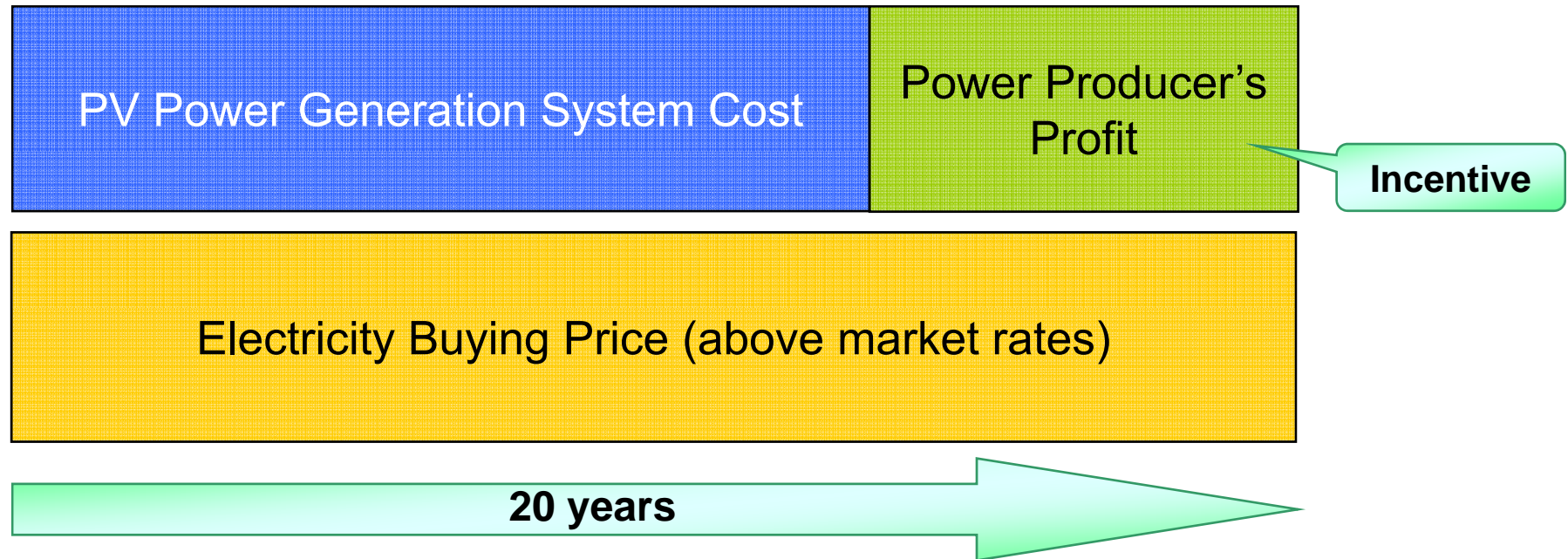


【Korea】

- Target: 1.3GW Installation by 2012
- FIT (5-7 times of electricity cost)

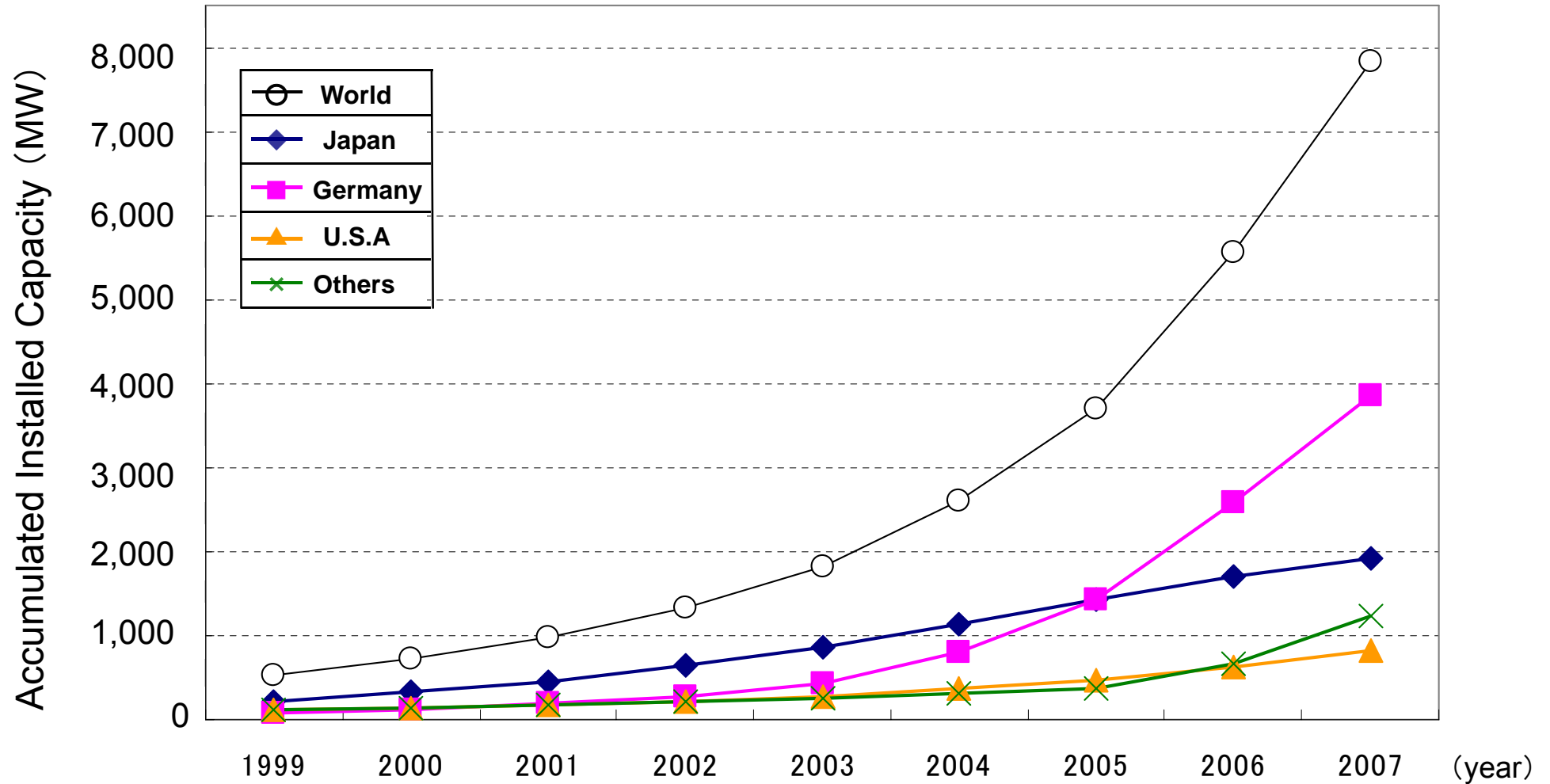
FIT System in Germany

FIT...an incentive structure that obligates electric power companies to buy renewable electricity at above market rates



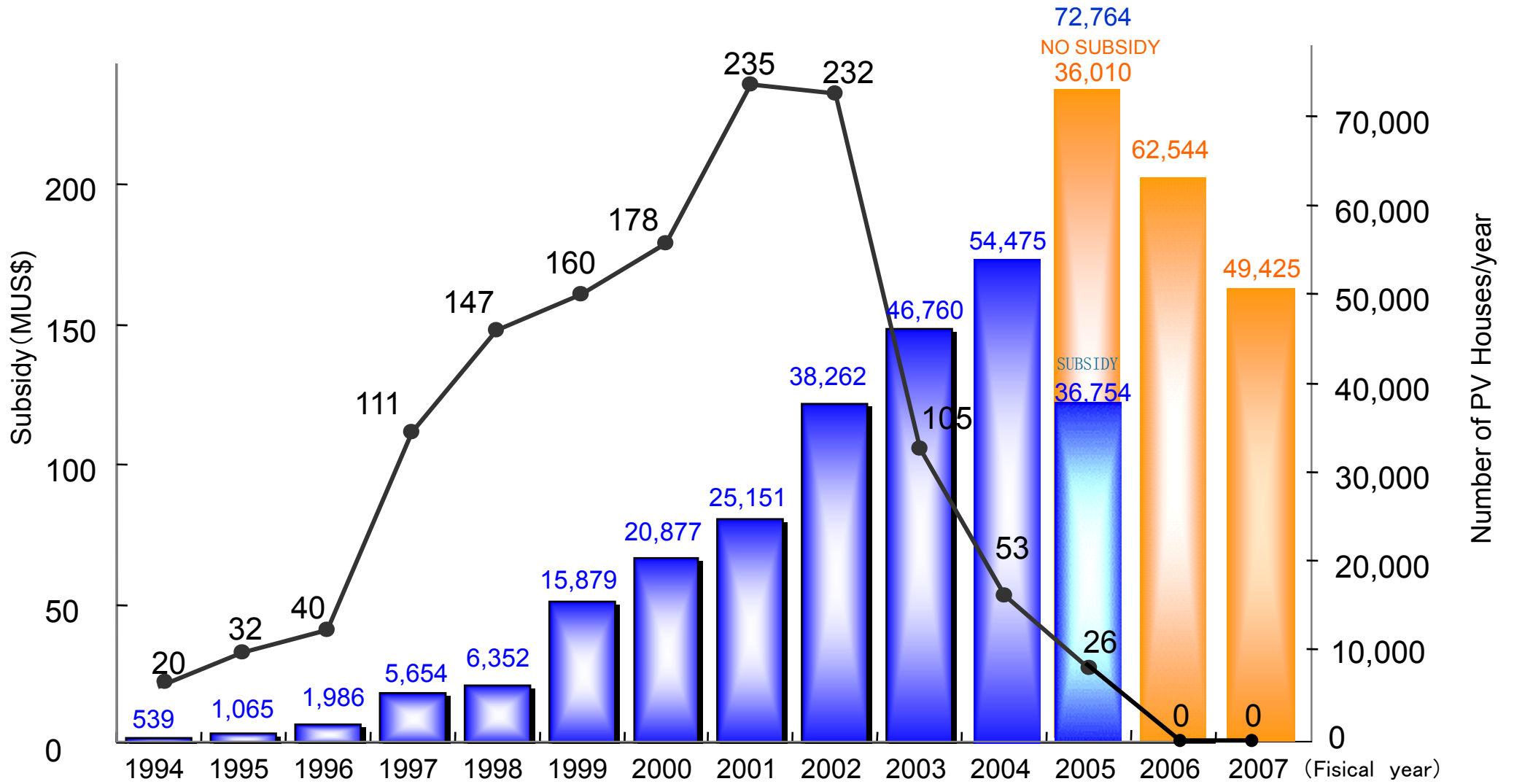
PV Power Generation System Installation in Key Markets

<Accumulated Installed Capacity >



source : by Sharp based IEA PVPS T1-17:2008

PV Market in Japan

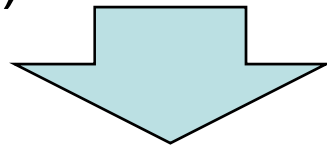


Fukuda Vision

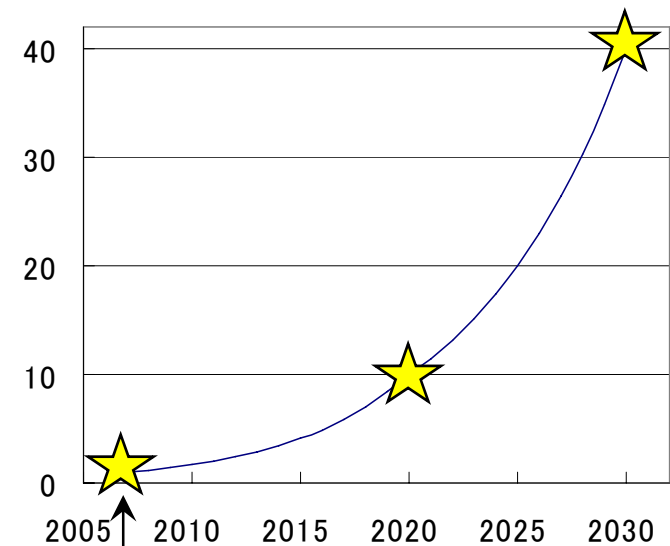
Former Prime Minister Fukuda Proposed “Low-Carbon Society, Japan”

【Outlines】

- Cut of 60-80 % of greenhouse gas emissions by 2050 based on current levels
- Cut of 14 % CO₂ emission by 2020 based on 2005 level (mid-term target)

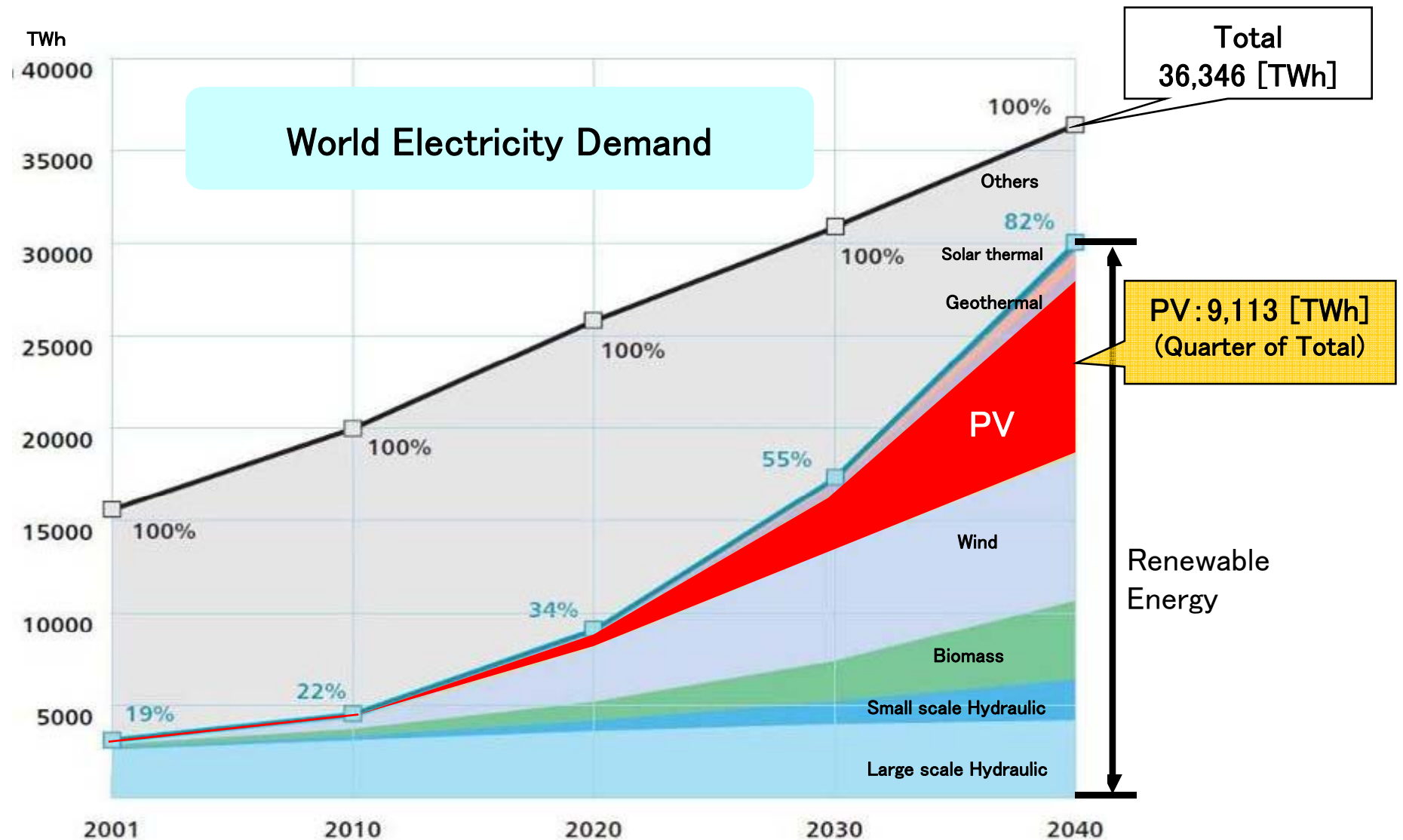


- “Zero-Emission Power Source” rate
⇒ above 50%
- PV installation
⇒ 10 times of current amount (2020)
40 times of current amount (2030)



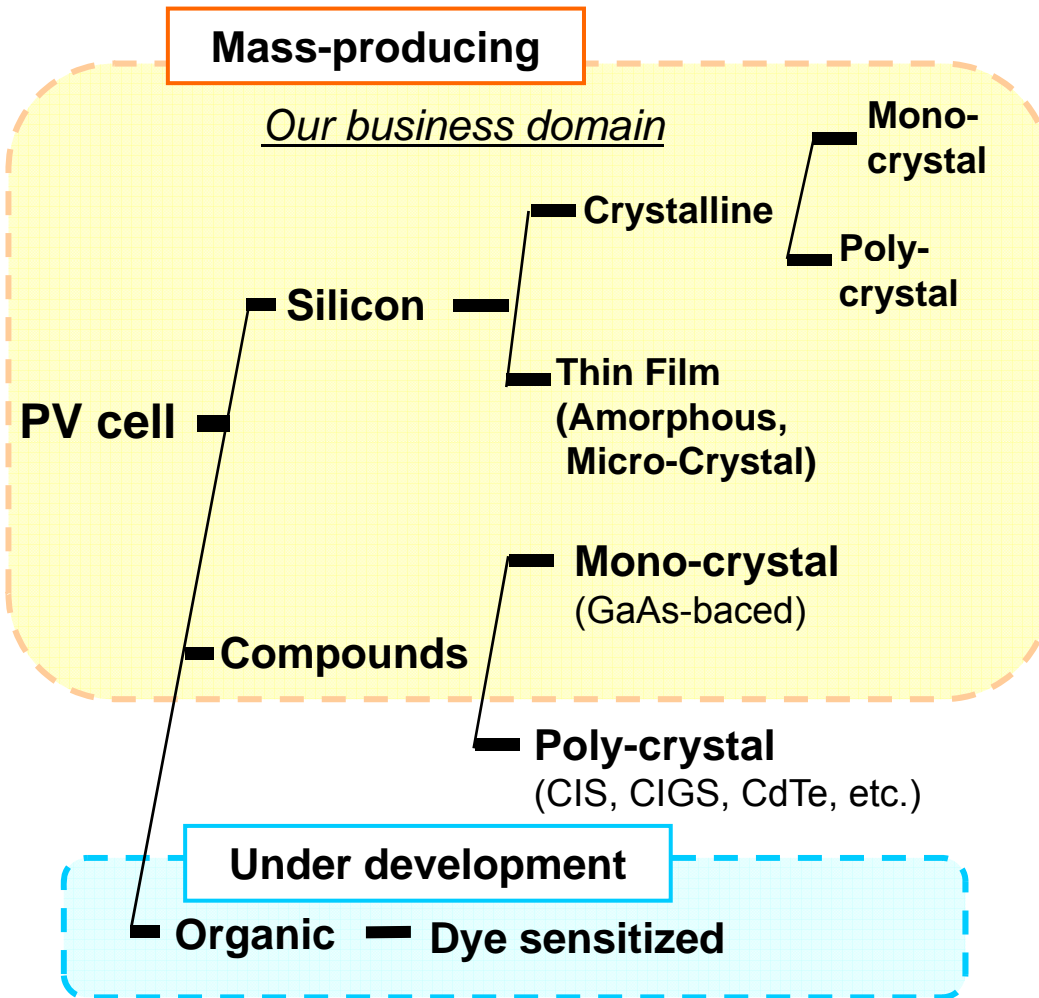
Present installation amount = 1

Electricity Demand and PV Power Generation



3. Outline of SHARP's PV

Classification of PV Cells



Material	Conversion Efficiency	Cost	Feature
Mono-crystalline silicon	○	○	High conversion efficiency
Poly-crystalline silicon	○	◎	Suitable for mass production
Thin-film silicon	△	◎	Few volume of Si materials
Mono-crystal compound	◎	△	Highest conversion efficiency
Poly-crystal compound	△	◎	Few resources
Organic (Dye-sensitized)	—	—	New type photovoltaic

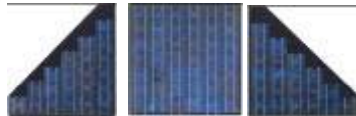
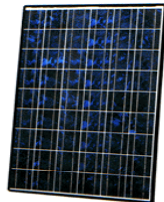
Production Line-Up

Module

Crystalline Si type



Mono-Crystalline



Multi-Crystalline



Tile-integrated type

Thin-Film Si type



Standard type



See-Through type



LED integrated
See-Through type

Power Conditioner (Inverter)



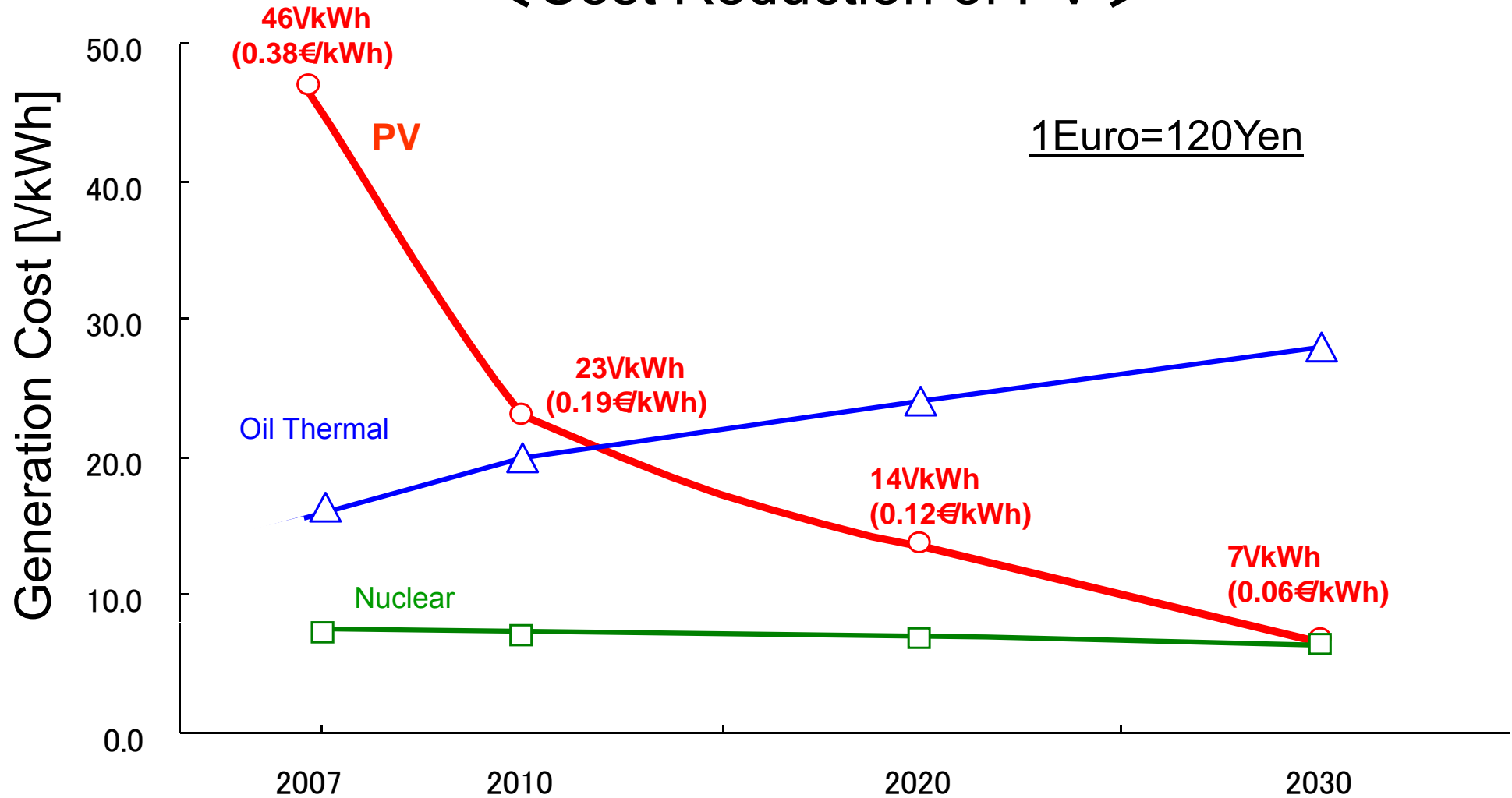
Solar Street Light



4. Target of Cost Reduction

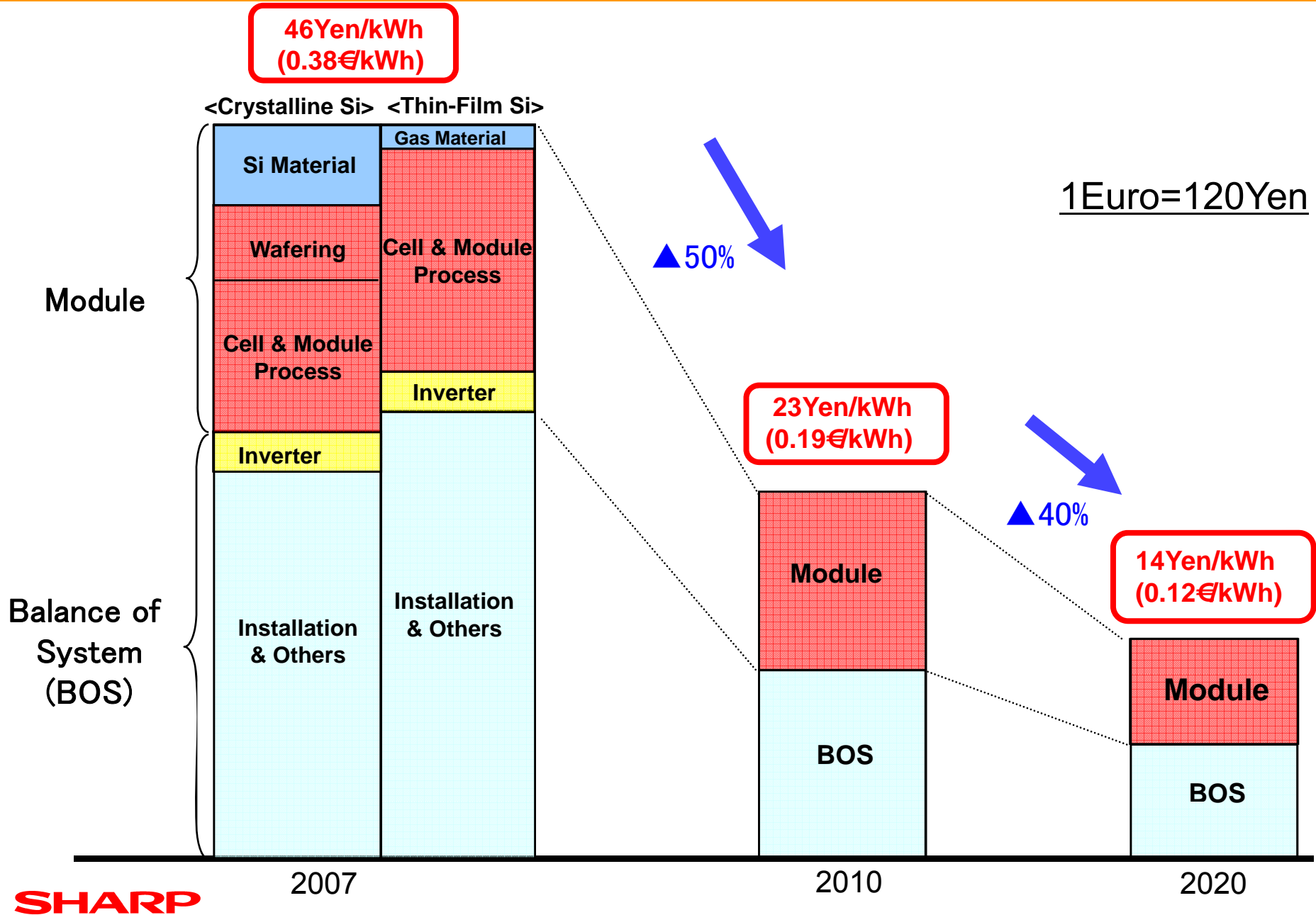
Targeted Cost for PV Power Generation

< Cost Reduction of PV >



source: SHARP estimate based NEDO PV2030

Efforts for Total System Cost Reduction

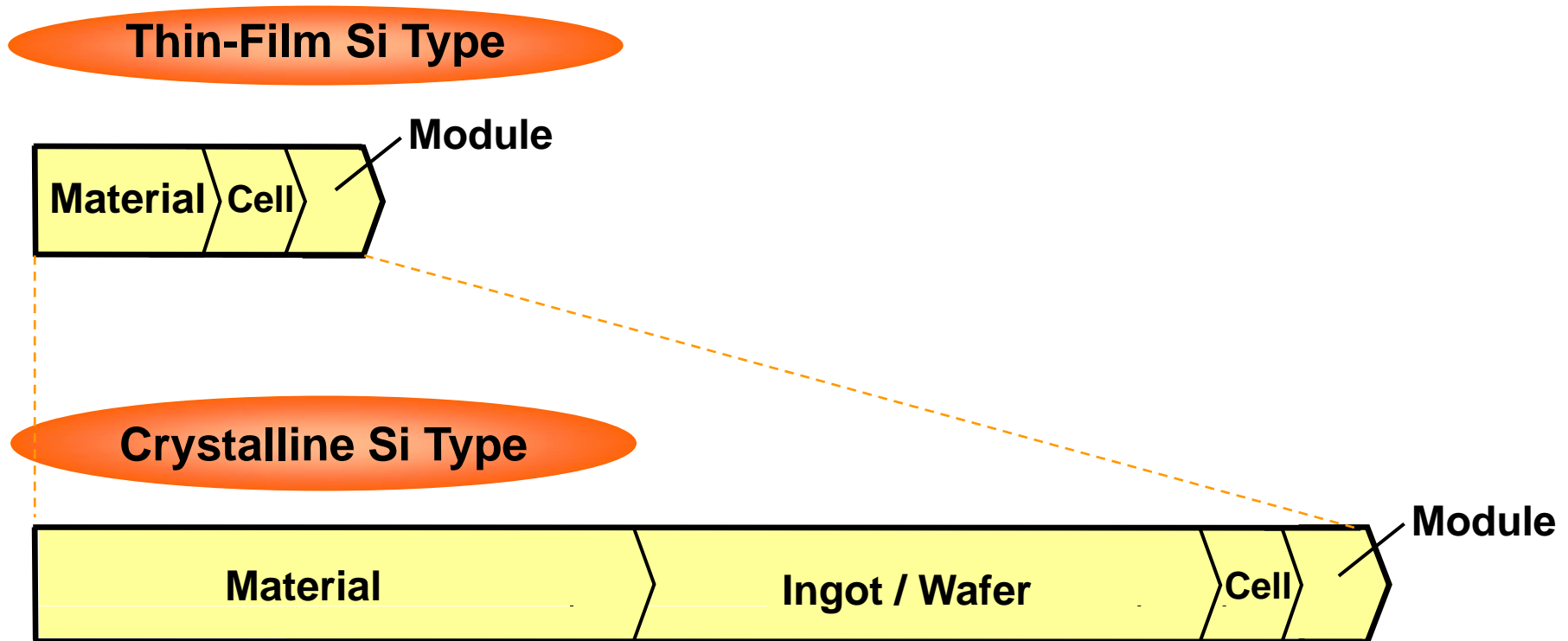


5. Development by SHARP

5-1 Thin-Film Si Type

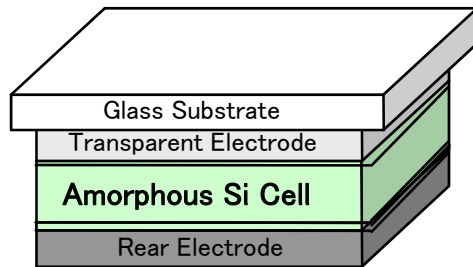


Simple Production Process



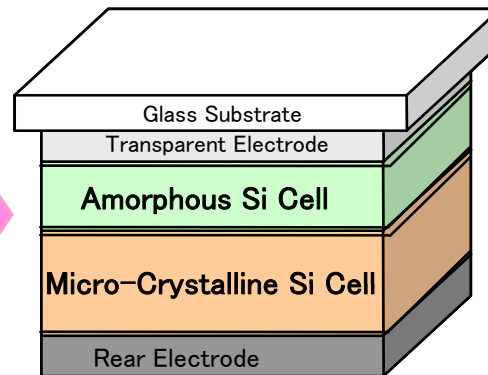
Improvement of Conversion Efficiency

Single structure



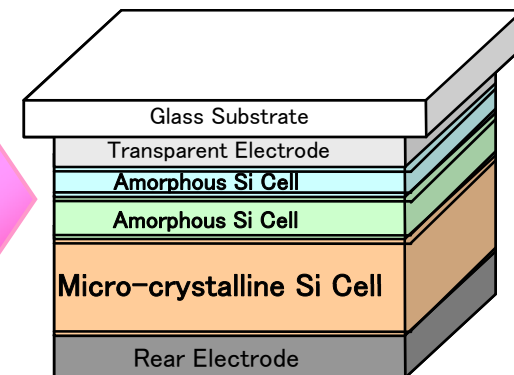
5~7%

Tandem structure



8~10%

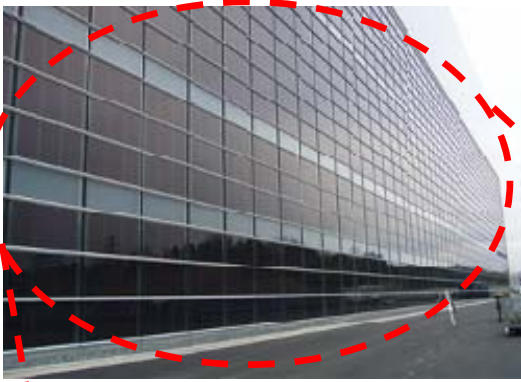
Triple structure



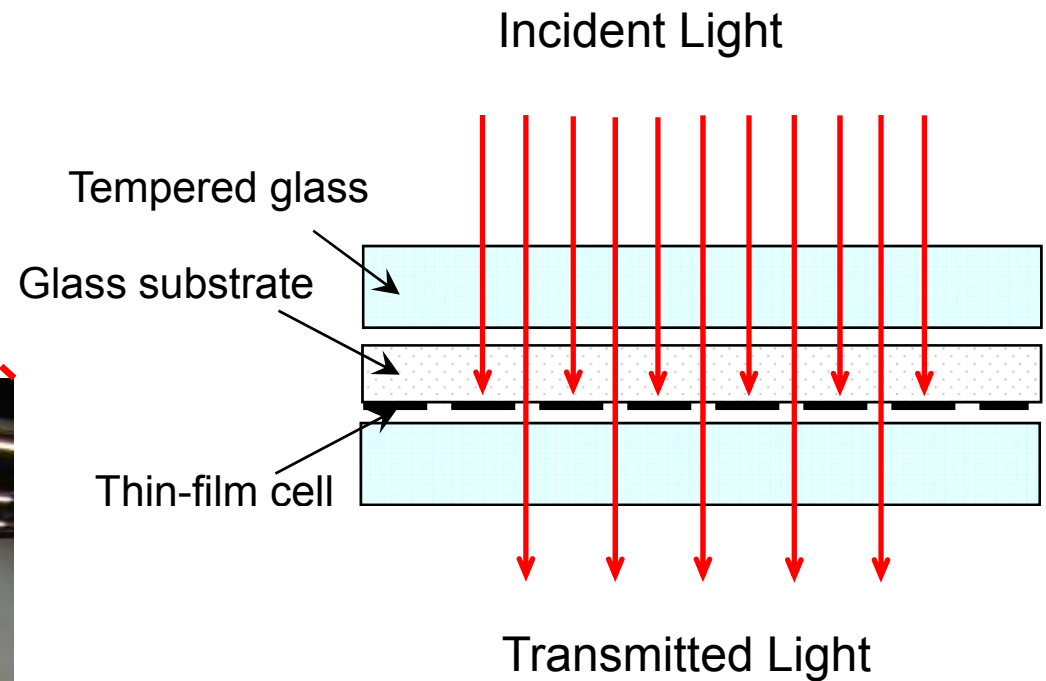
Over 10%

Improvement of conversion efficiency

Wide Range of Applications (See-Through Type)



(Sharp Kameyama Factory)



Installation Example (1)

Type: Thin-Film Si, Capacity: 340kW



Installation Example (2)

Type: Thin-Film Si (See-Through)
Capacity: 30kW



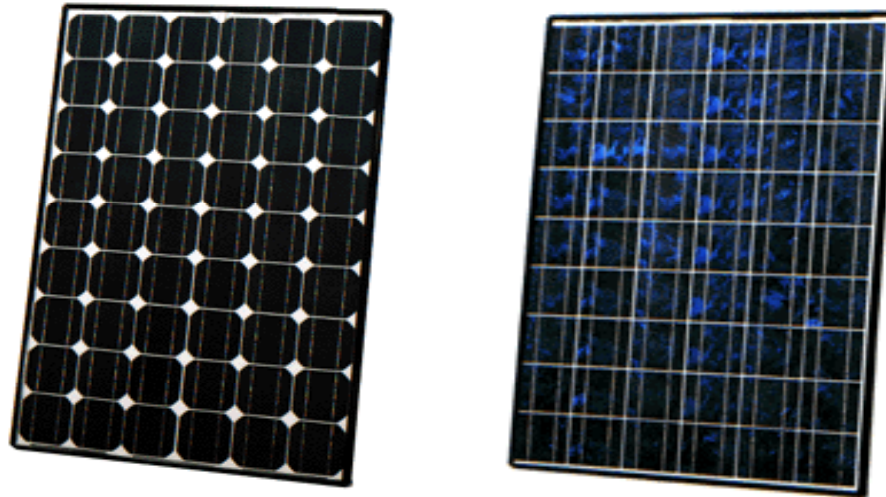
Manufacturing Complex for the 21st Century

Solar Cell and LCD Panel Plants

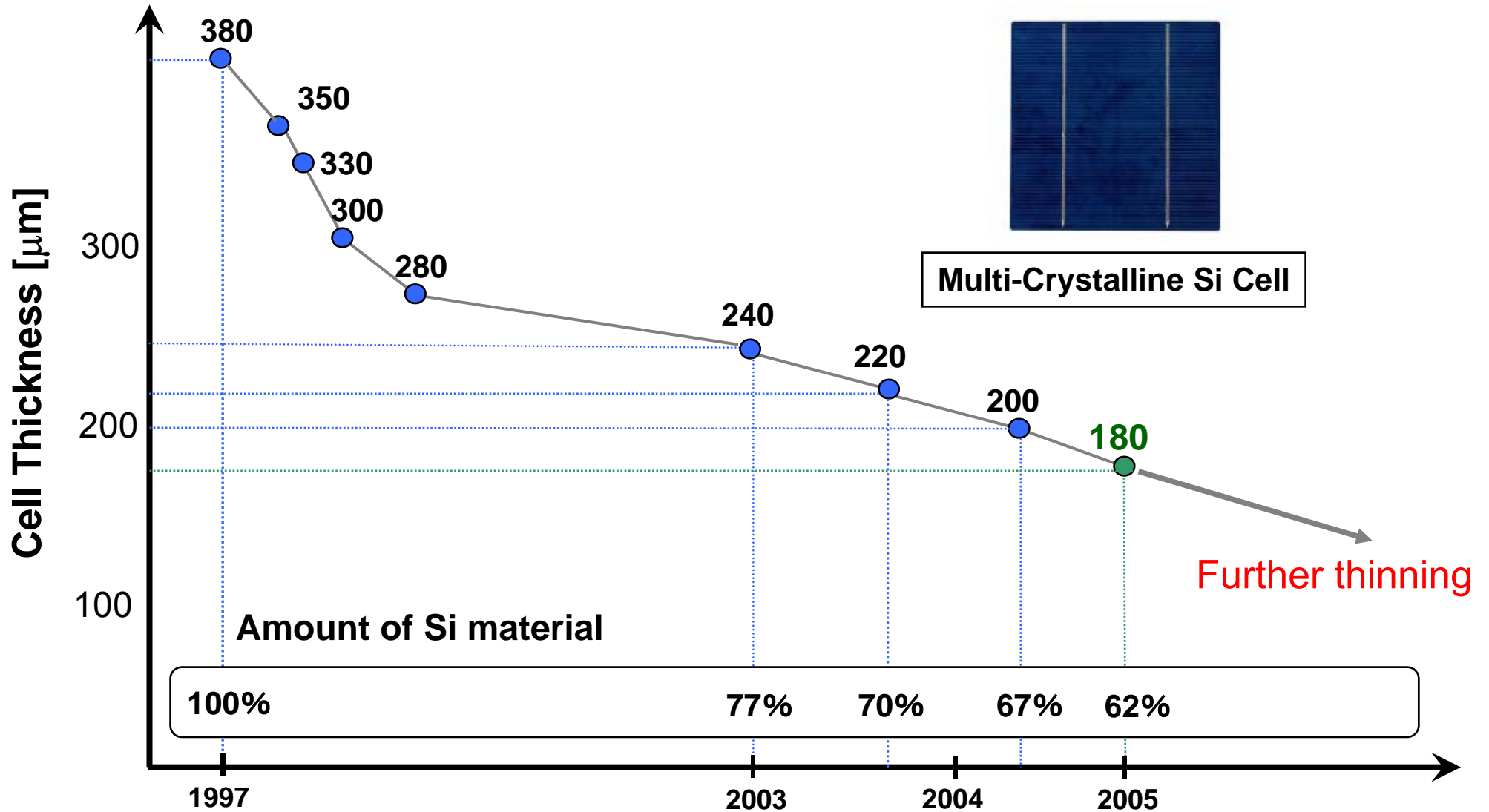


Start of operation : By March 2010
Production item : Thin-film solar cells
Place : Sakai City, Osaka Prefecture, Japan

5-2 Crystalline Si Type

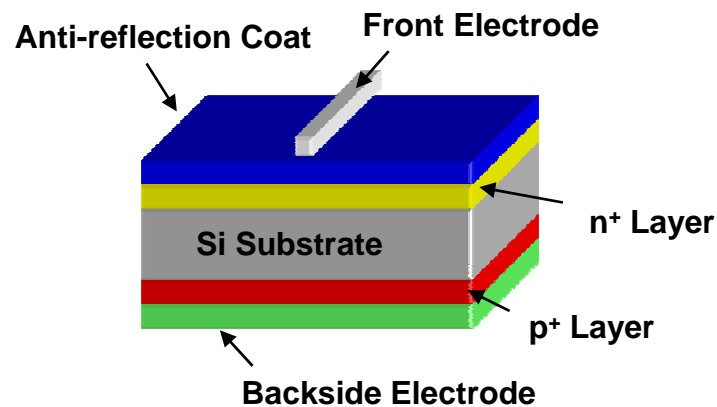


Development of Thin Multi-Crystalline Si Cell



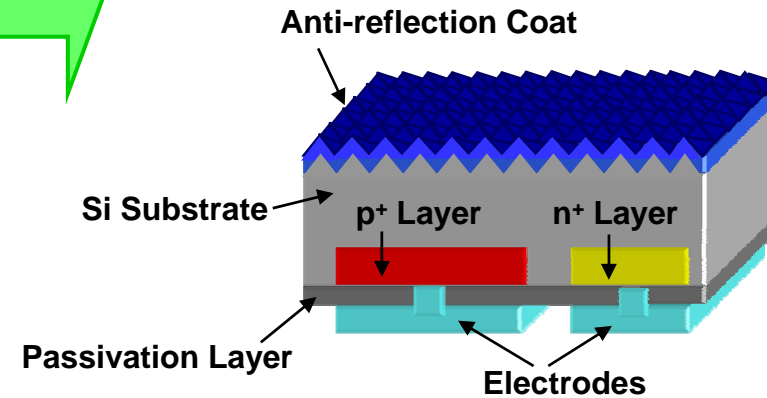
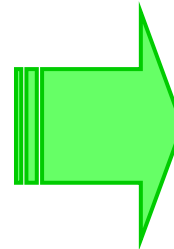
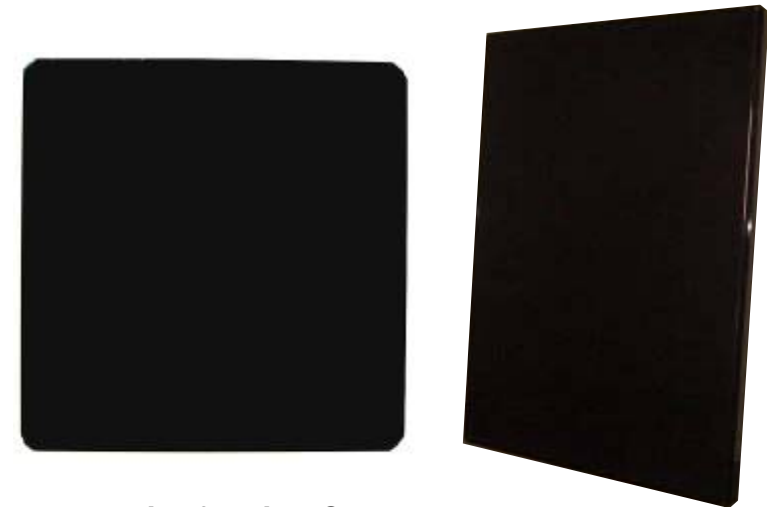
Development of Back Contact Type

Conventional Type



• Conversion Efficiency : ~15%
(Module)

Back Contact Type



- Conversion Efficiency : over 20%
- Excellent Appearance
- Easy assembling

PV system installation to all domestic factories

Katsuragi Factory



Hiroshima Factory



Nara Factory



Tenri Factory



Tochigi Factory



Kameyama Factory

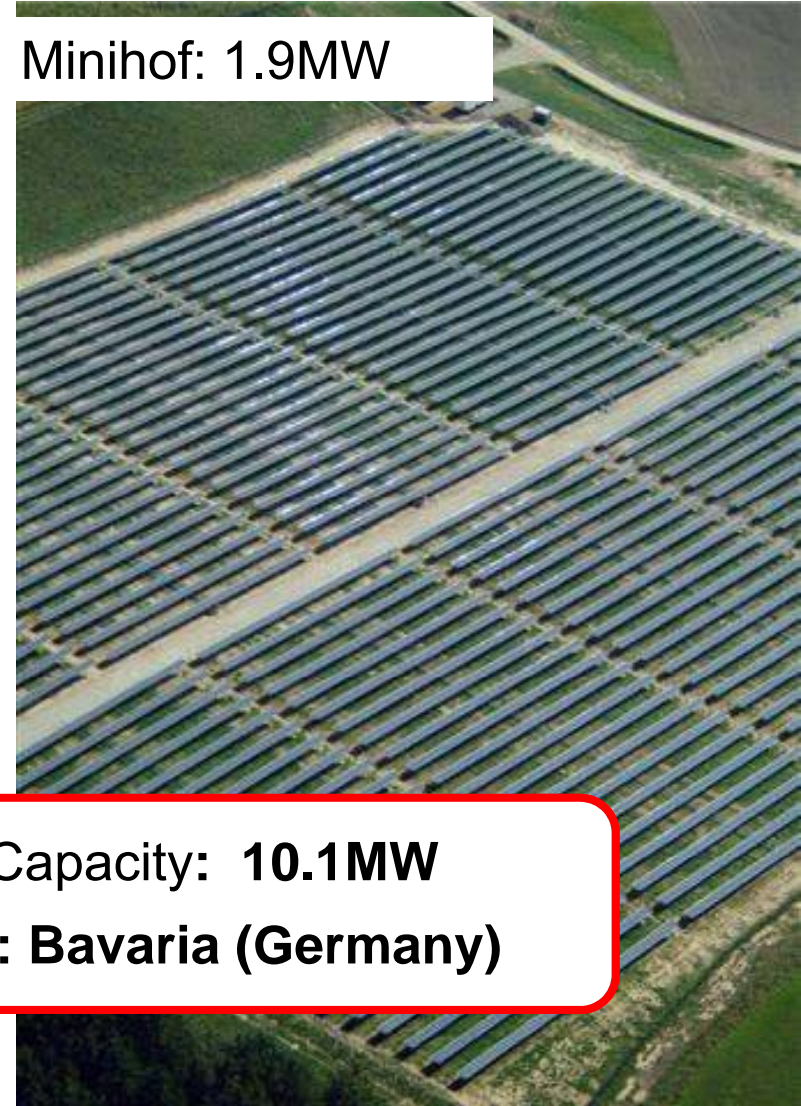


Installation Example (3)

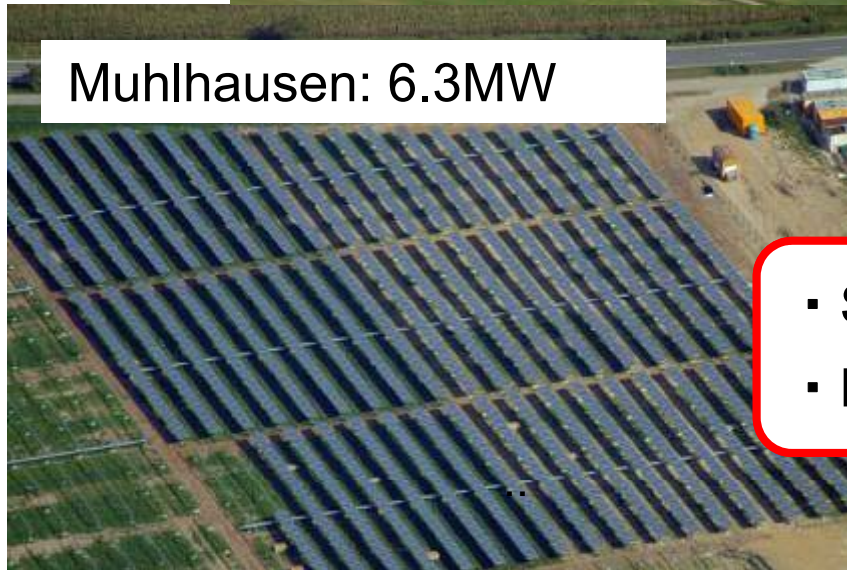
Gunching: 1.9MW



Minihof: 1.9MW



Muhlhausen: 6.3MW

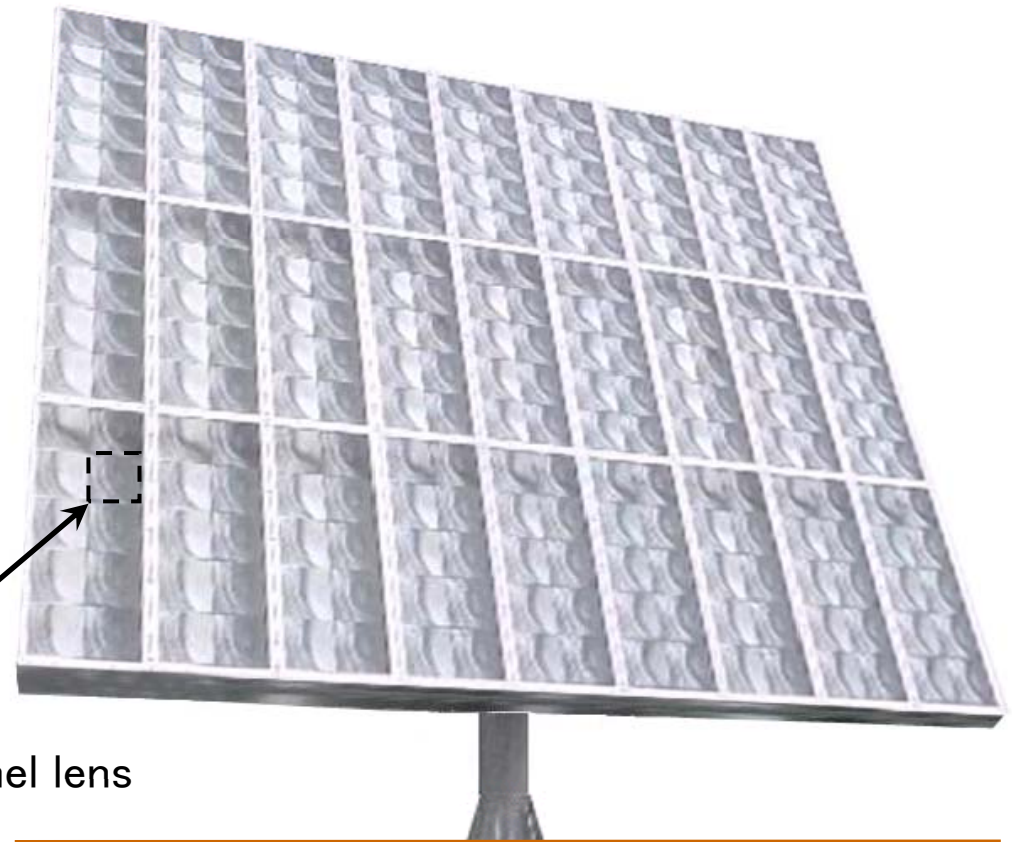
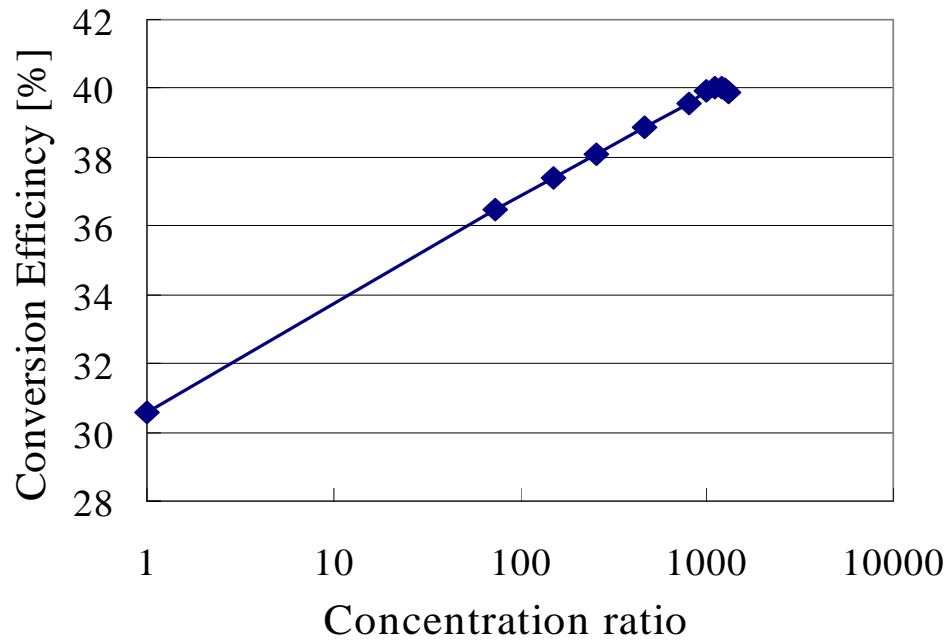


- System Capacity: **10.1MW**
- Location: **Bavaria (Germany)**

5-3 Concentrated PV



Concentrated PV (CPV) System



Fresnel lens



Compound Solar Cell

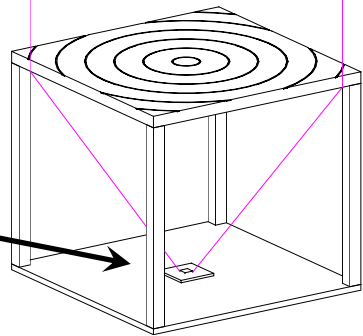
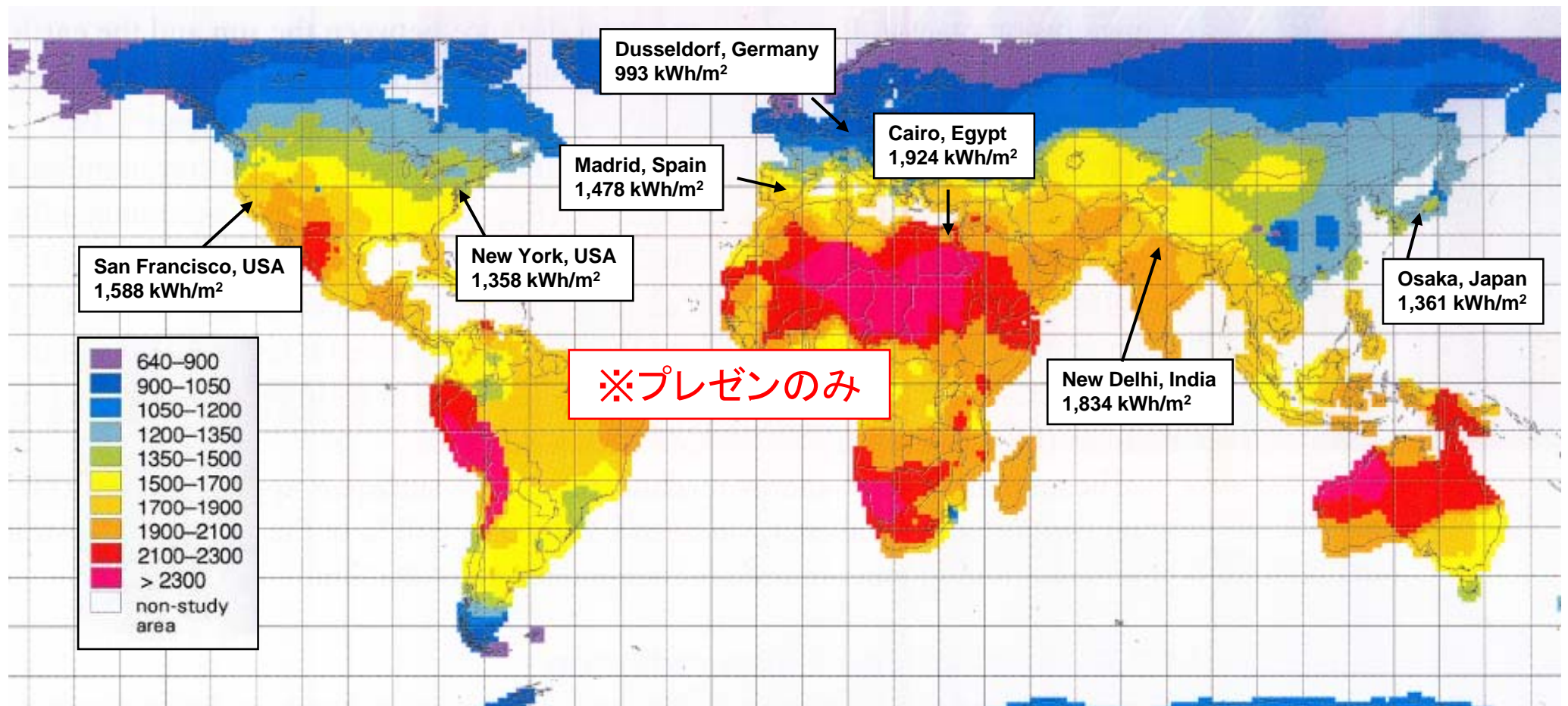


Image of CPV Plant



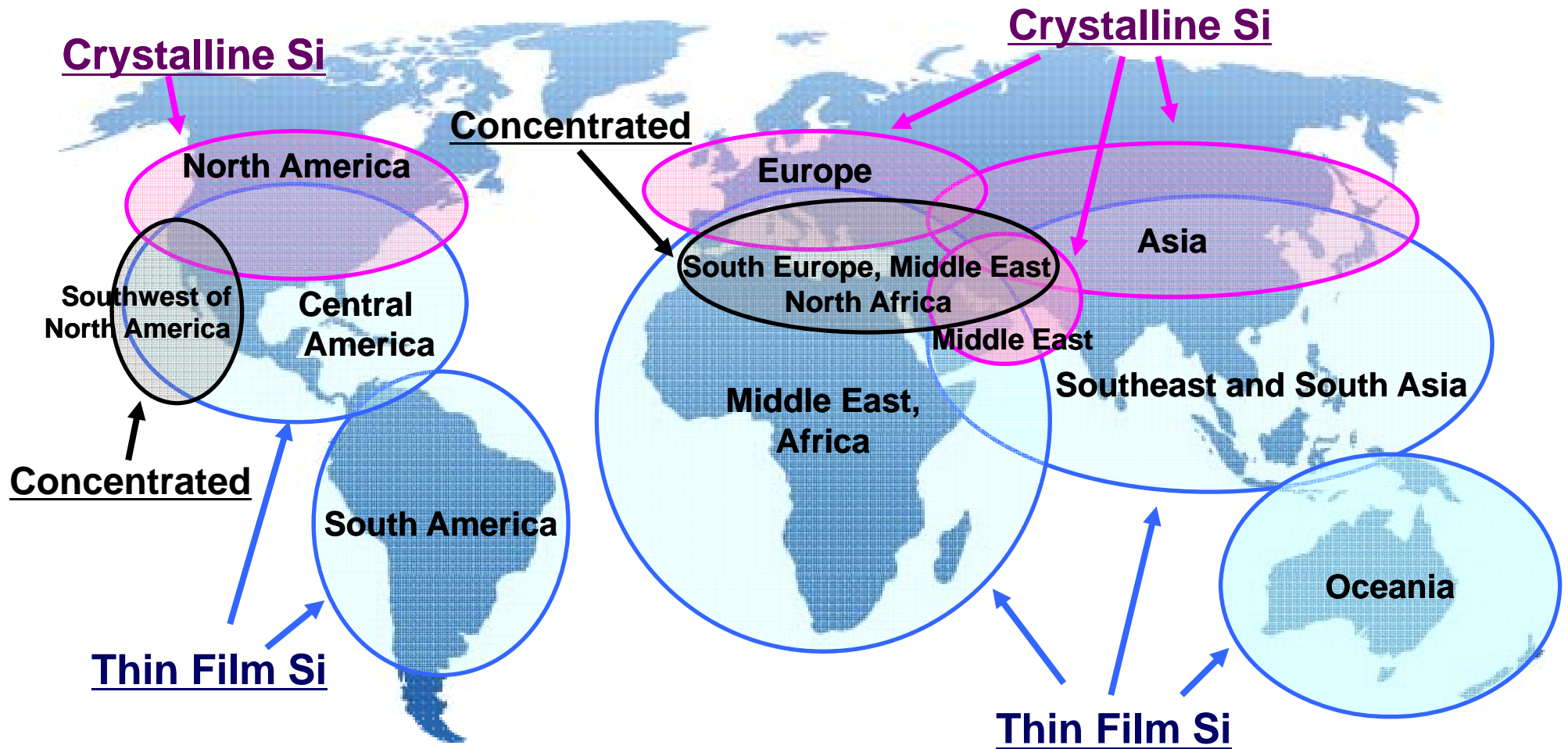
Distribution of Solar Radiation



Source : METEONORM

Different Regions Require Different PV Technologies

BEST PV-SYSTEMS, in BEST PLACE, and by BEST WAY



SHARP