

**NSG**  
**GROUP**

# **The Solar Opportunity**

**14 November 2008**

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# The Solar Opportunity Agenda

- Solar Industry Background
- Glass as Part of the Solar Industry
- NSG Group as a Solar Player
- NSG Group Current Plans
- NSG Group Future Options

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# Drive for Renewable Energy

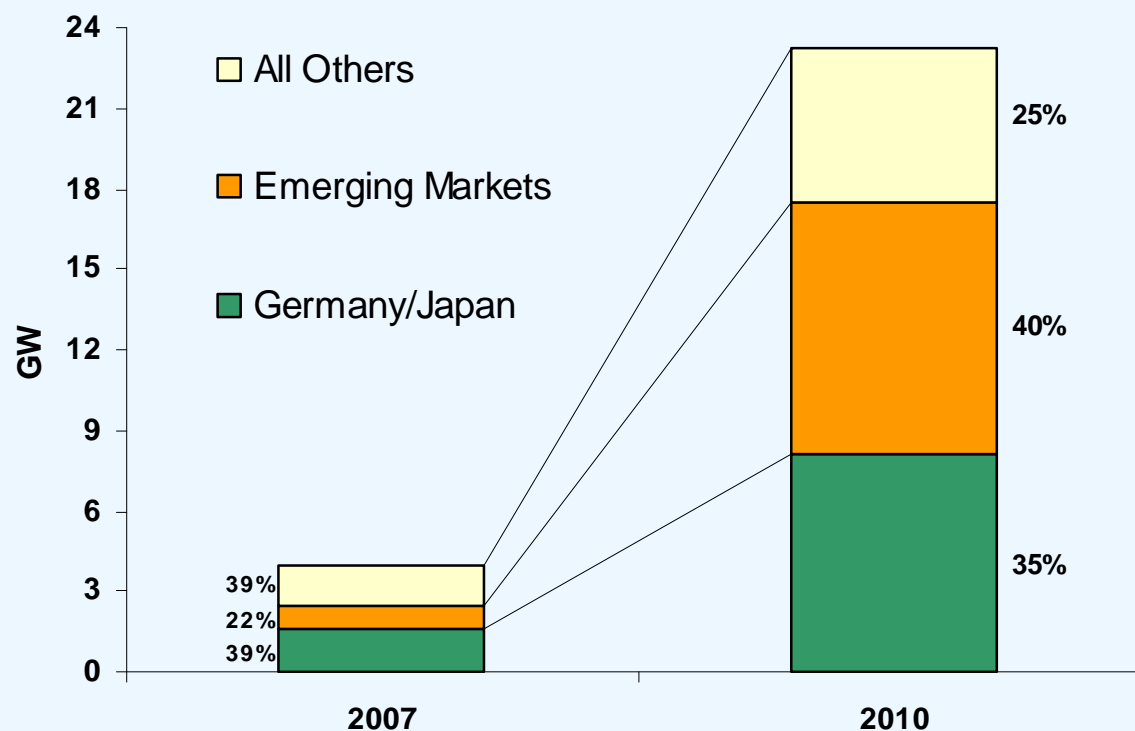
- Legislation
  - Kyoto and subsequent EU & national targets
  - Carbon Trading, EU ETS encourage CO<sub>2</sub> reductions
- Subsidies to achieve the above
  - Feed-in Tariff: Germany, Spain, Italy, etc.
  - Japan indicated likely support for 50% subsidy for homeowner installations
  - Many other schemes, such as US, emerging
- A move from hydrocarbons is essential
  - Supplies are not limitless
  - Climate change is a reality
- Many systems make economic sense without subsidy

# The Economics of Solar

- Fossil fuel costs will rise, increasing electricity prices
- PV costs falling through economies of scale and technology improvements
- Solar 'Grid Parity' has already been achieved in some sunny, high energy cost countries.
- Even without parity, investments can give good return, assisted by 'Feed-in Tariffs'
- Ideal for 'Off-Grid' where connection is difficult
- Power from solar is generated at time of peak demand and peak price

# Long Term Energy Outlook

Installations by Market, 2007 to 2010 (GW, Percent)



Source: PHOTON Consulting. Note: Rough estimates. Emerging markets include Spain, Italy, and North America

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# Grid Parity

Abundant sun, high electricity prices

**Already achieved** – California

**Within 4 years** – Japan, Italy, other Southern Europe & USA

**Future Outlook** – Australia, Germany, other Central Europe

- Fossil fuel cost continue to rise, whilst PV costs fall due to technology improvements and up-scaling
- Grid parity is quoted as the “magic \$1/Wp”. First Solar current costs are around \$1.08/Wp

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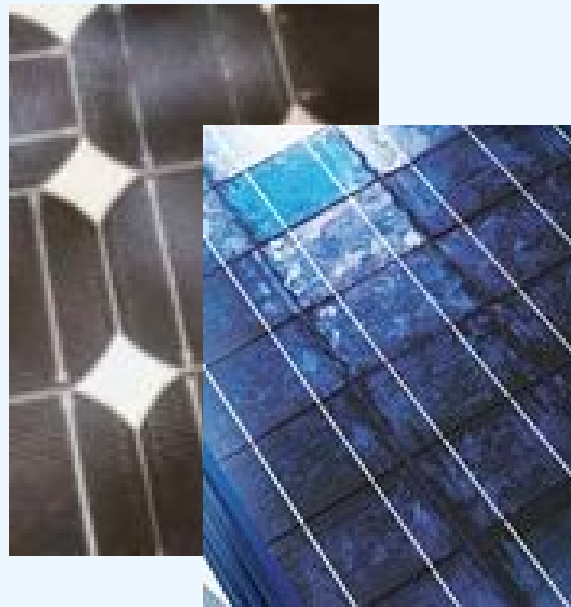
# Solar Technologies and Glass Usage

Concentrated Solar Power  
Large area, high sun



Low Iron Float

Crystalline PV  
High efficiency, high cost



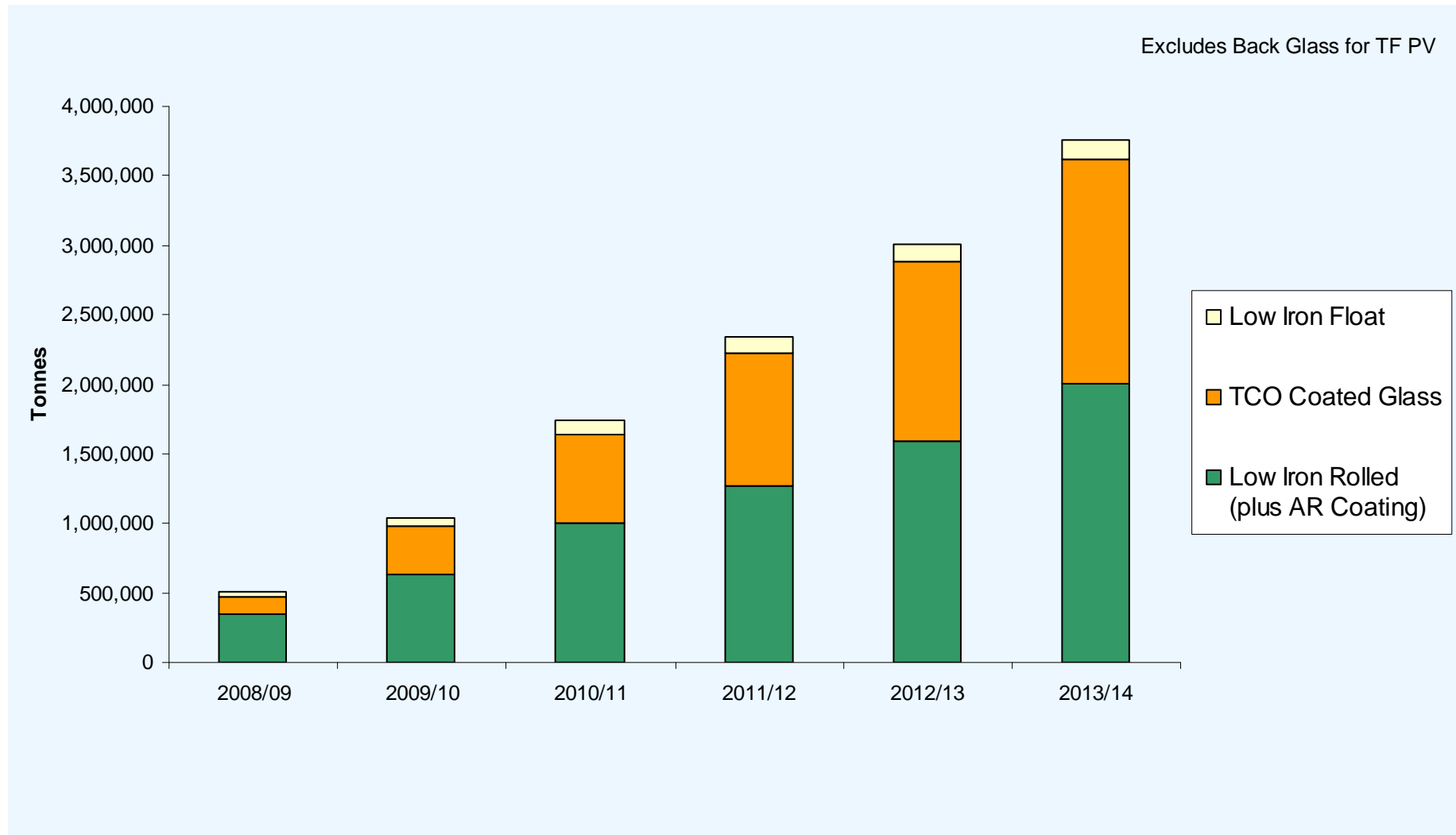
Low Iron Rolled  
plus AR Coating

Thin Film PV  
Low \$/W, large area



Transparent Conductive  
Oxide Coating on Float

# Solar-Related Glass Demand



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# 1. Low Iron Rolled and AR for Crystalline PV

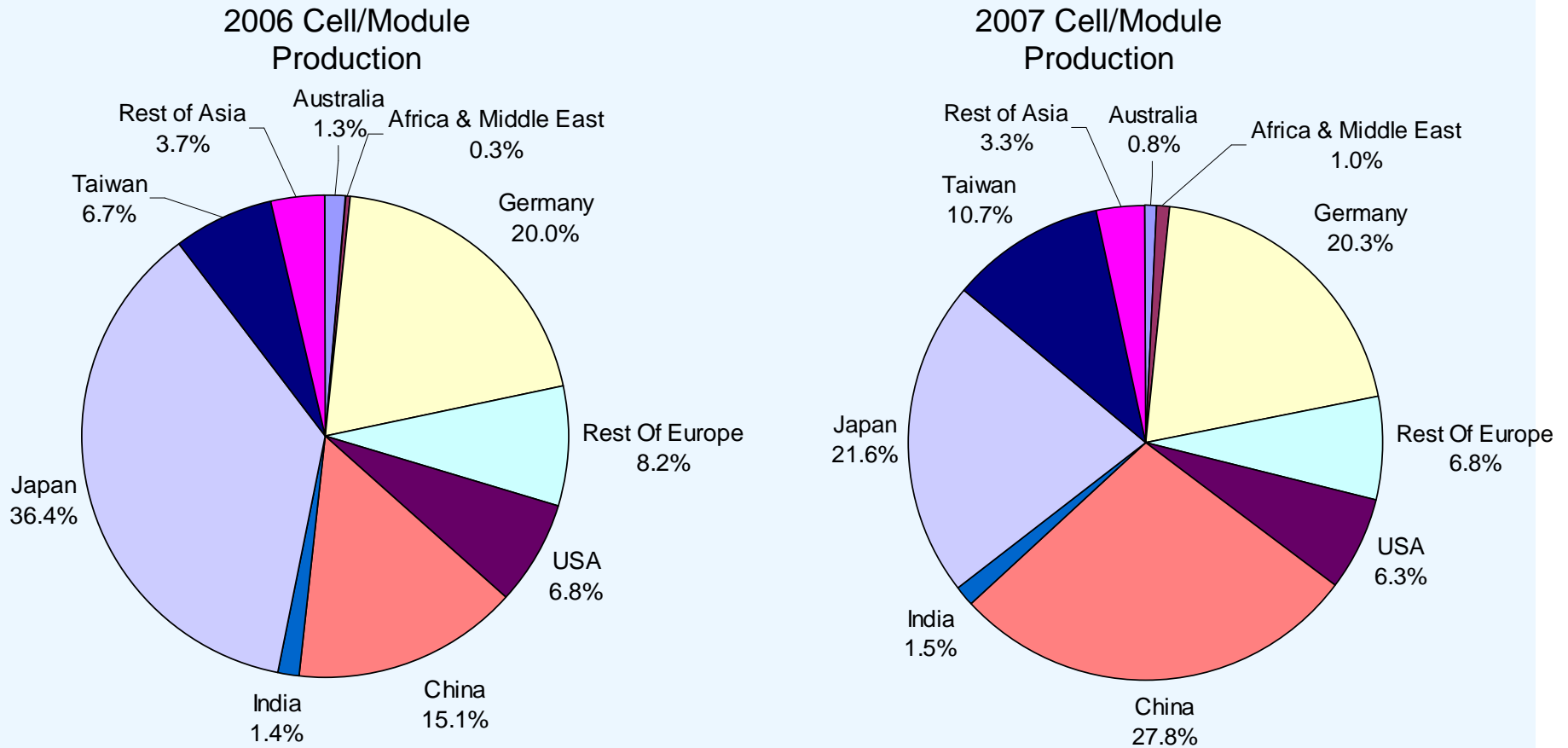


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# 1. Low Iron Rolled and AR for Crystalline PV

- Glass demand compound annual growth rate of close to 40% over the next 5 years\*
- Emergence of anti-reflection (AR) coating technology to enhance module performance
- Strong historical position through Pilkington operations
- NSG Group investment in China in response to module manufacturer expansion

# Crystalline PV Module Production



**Increasing move towards China for module manufacture**

Source: Photon International

## 2. TCO Coated Glass for Thin Film PV



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## 2. TCO Coated Glass for Thin Film PV

- Glass demand compound annual growth of around 65% over the next 5 years\*
- Market leading multi-layer, on-line coating technology which can be 'tuned' to customers' PV technology
- Current market share >70%
- Coating operations in North America, Europe and Japan
- Coating capacity expansion underway

\* NSG Group Estimate



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### 3. Low Iron Float for Concentrated Solar Power



Image courtesy of Flabeg GmbH

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## 3. Low Iron Float for Concentrated Solar Power

- Glass demand compound annual growth rate of close to 30% over the next 5 years\*
- Product of choice for parabolic trough market leader
- Forward look demand to be supplied from existing plants

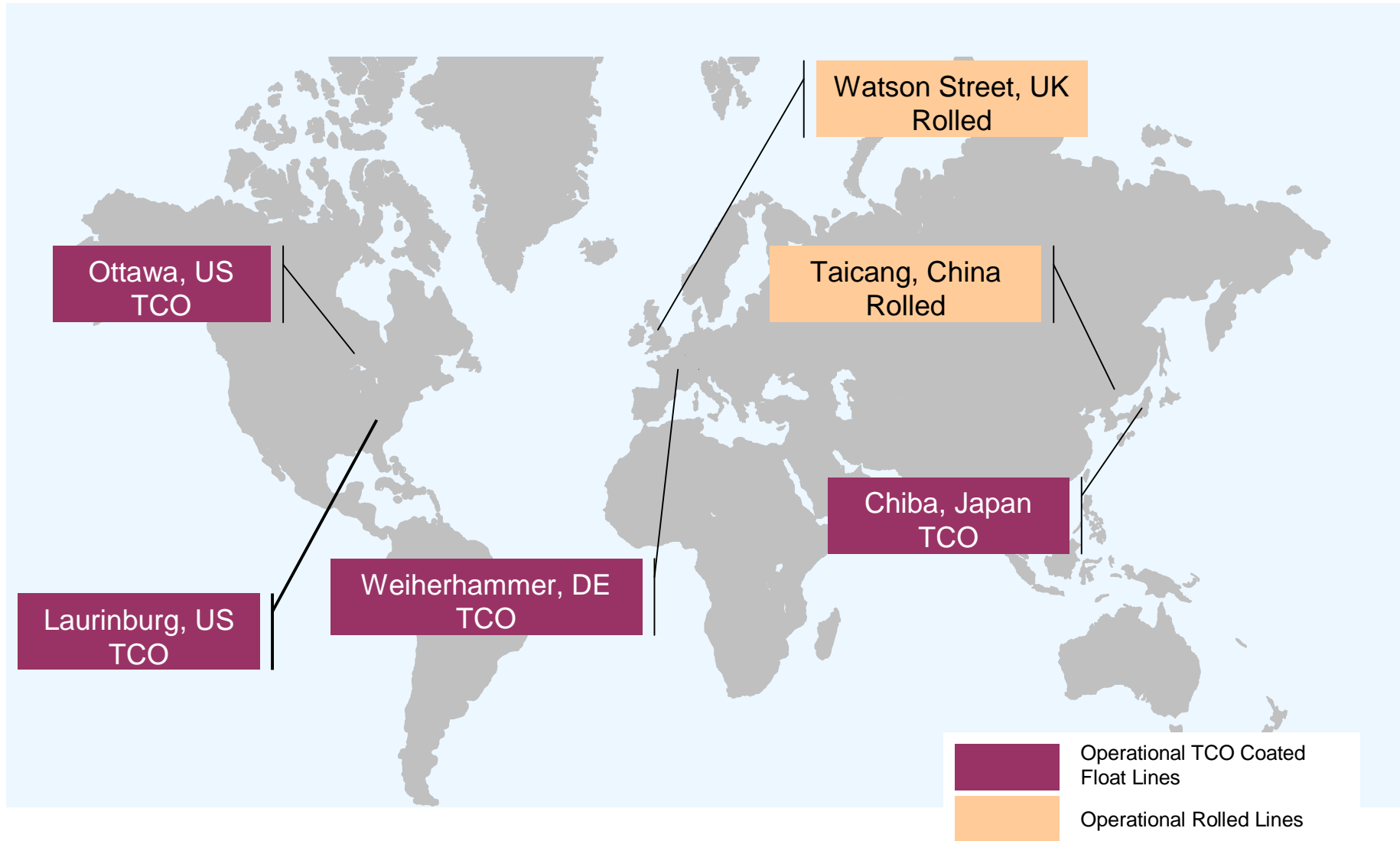
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# The Solar Opportunity Agenda

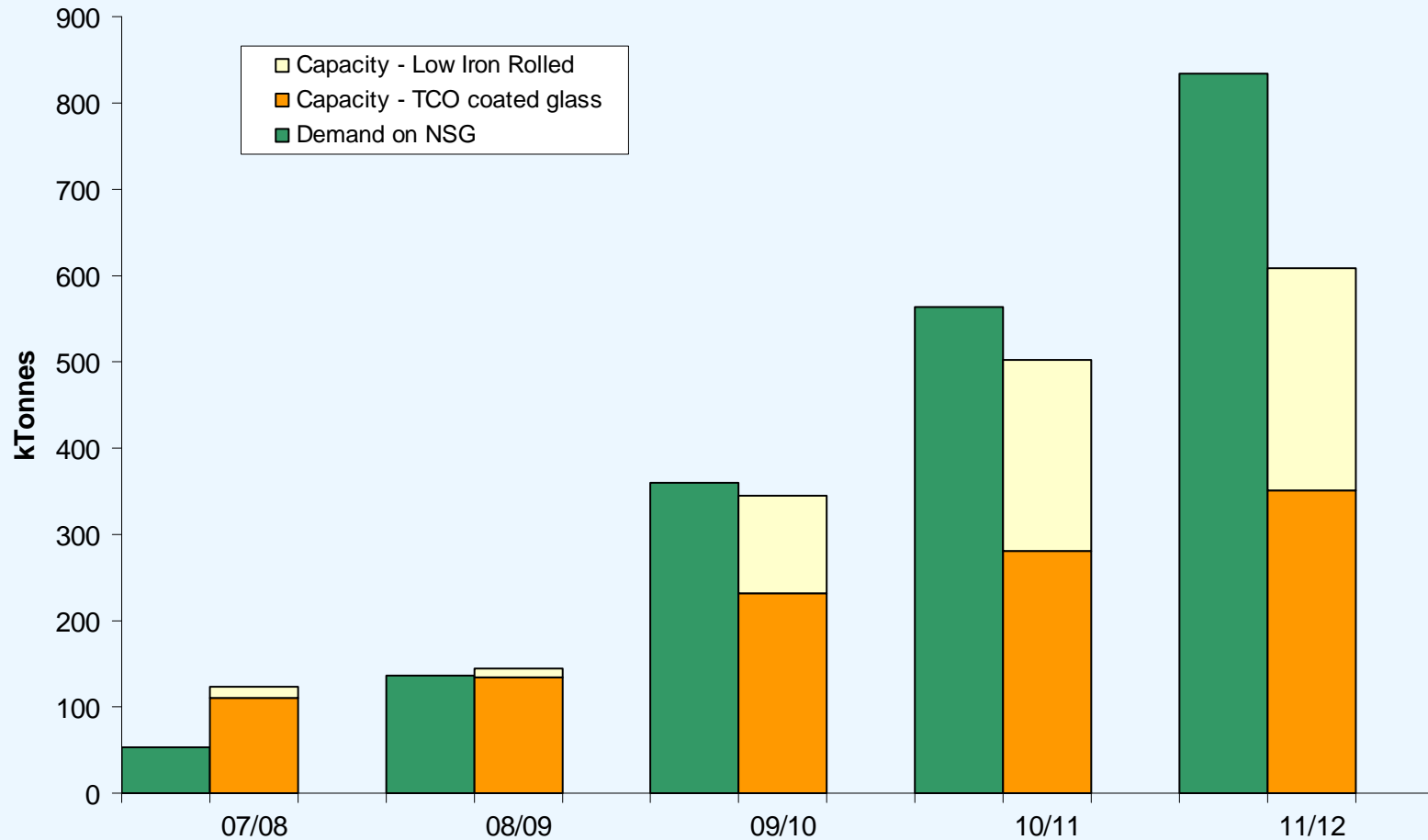
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# Solar Production Facilities

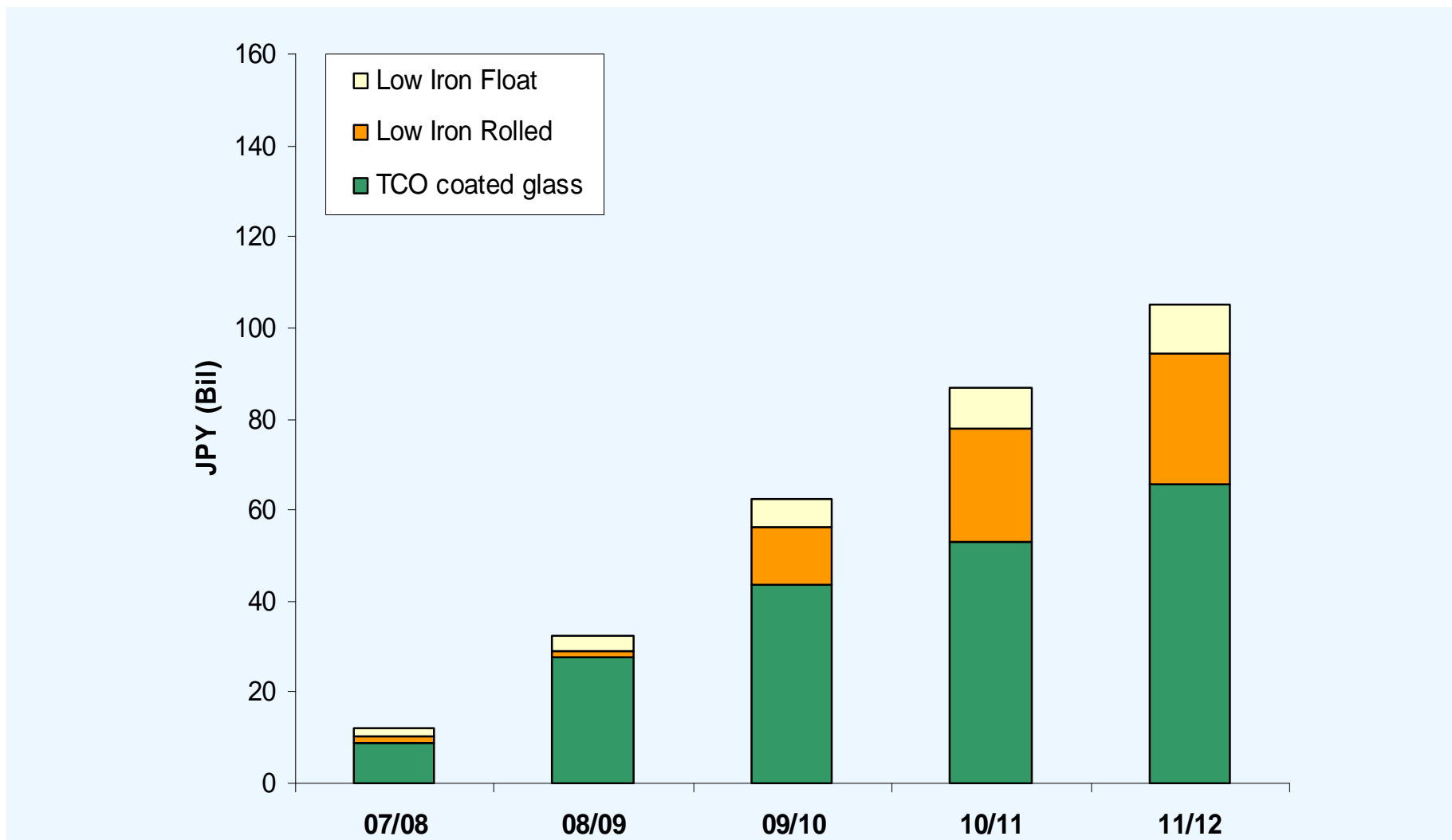
## Operational Plants



# NSG Group - Current and Planned Capacity



# NSG Group Sales from Solar Sector



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# NSG Group Future Growth Options

- Low Iron Rolled for Crystalline PV
  - Further additional capacity in China through JVs
- TCO coated float for Thin Film PV
  - Further conversion in US
  - Further conversion in Europe
  - Multiple conversions in Japan & Asia
  - New build opportunities dedicated to Solar



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# TCO Investment Metrics

- Greenfield TCO float
  - Around €180M investment cost
  - 100kT TCO per annum
  - 24 months minimum from approval to glass
- Float conversion
  - €25M cost, includes float and toughening
  - 60kT TCO per annum
  - 18 months minimum from approval to glass

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# Summary

- Substantial market growth expected in all solar sectors
- NSG Group has a leading position in the Thin Film PV sector and plans to expand capacity to maintain this leadership
- NSG Group well placed to enjoy strong share in the crystalline PV sector through JV partnerships and strong customer relationships
- 10% of Group revenue from Solar in FY11

# Notice

The projections contained in this document are based on information currently available to us and certain assumptions that we consider to be reasonable. Hence the actual results may differ. The major factors that may affect the results are the economic environment in major markets (such as Europe, Japan, the U.S. and Asia), product supply/demand shifts, and currency exchange fluctuations.

Nippon Sheet Glass Co., Ltd.

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