




Future Vision for PV

Photovoltaic Technology Research Advisory Council (PV-TRAC)



A Vision for Photovoltaic Technology for 2030 and beyond

- **1. Current situation**
 - **International agenda, European and national policies**
 - **PV in the context of Renewable Energies**
 - **Status of PV technology, industry and applications**
- **2. Vision for Photovoltaics in 2030**
 - **Technology, industry, economy and energy issues**
- **3. How to reach the Vision**
 - **PV Technology Platform**
 - **Strategic Plan (incl. SRA)**
 - **Main recommendations** 

Current situation

1. International agenda

- UN Framework Convention for Climate Change (industrialized countries to reduce emissions by a factor 4)
- Millennium Development Goals

2. European and national policy framework

- White Paper and RES-Electricity Directive
- National PV policies:
 - Little European R&D Coordination
 - Feed-in tariffs: e.g. Germany, 20 % price reduction in 4 years and production increase by a factor 10
- Comparison with Japan and USA: coherent long term policy in Japan, coordination limited to R&D in USA



Current situation

◆ PV technology :

Wafer-based crystalline silicon: dominant, proven technology, high material costs, energy intensive, but large and concrete potential for improvements;

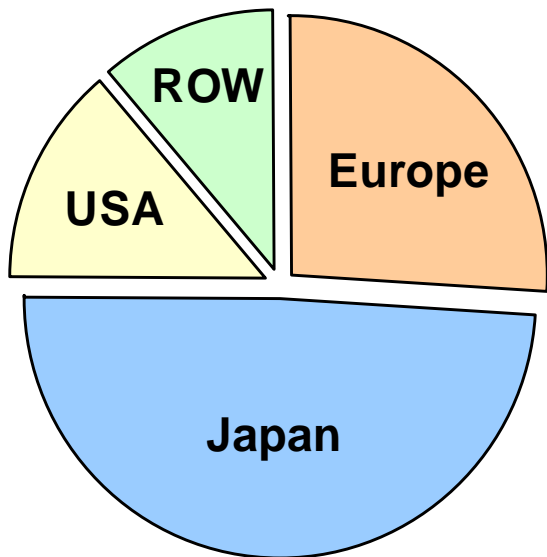
Thin-films: low materials and energy consumption, lower efficiency, further process development & upscaling will lead to major cost reduction.



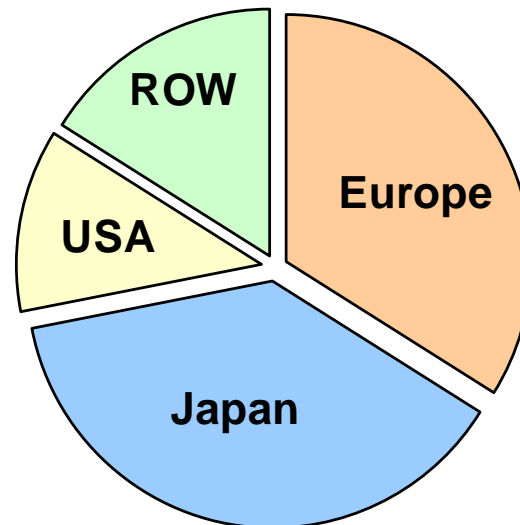
Current situation

◆ PV Industry (2003)

Production (re. PV-NET)



Market (re. EPIA)



Current situation

◆ Systems and Applications

- **Grid-Connected systems** : 80-200 kWh/m².year, 0.25-0.65 €/kWh
 - Decentralised generators (roofs, façades) → building integration
 - Central power plants
- **Stand-alone systems** :
 - Consumer and industrial applications
 - Decentralised Rural Electrification : 1.7 billion people without access to electricity services



A Vision for PV in 2030

- ◆ **2030 is only an intermediate milestone, robust on-going growth beyond 2030**
- ◆ **PV module efficiency : up to 25 %**
- ◆ **Systems lifetime > 40 years**
- ◆ **System energy pay-back time < 1 year**
- ◆ **PV modules and systems based on abundant and non-toxic materials**
- ◆ **Crystalline silicon, thin-films and new concepts all present on the market**



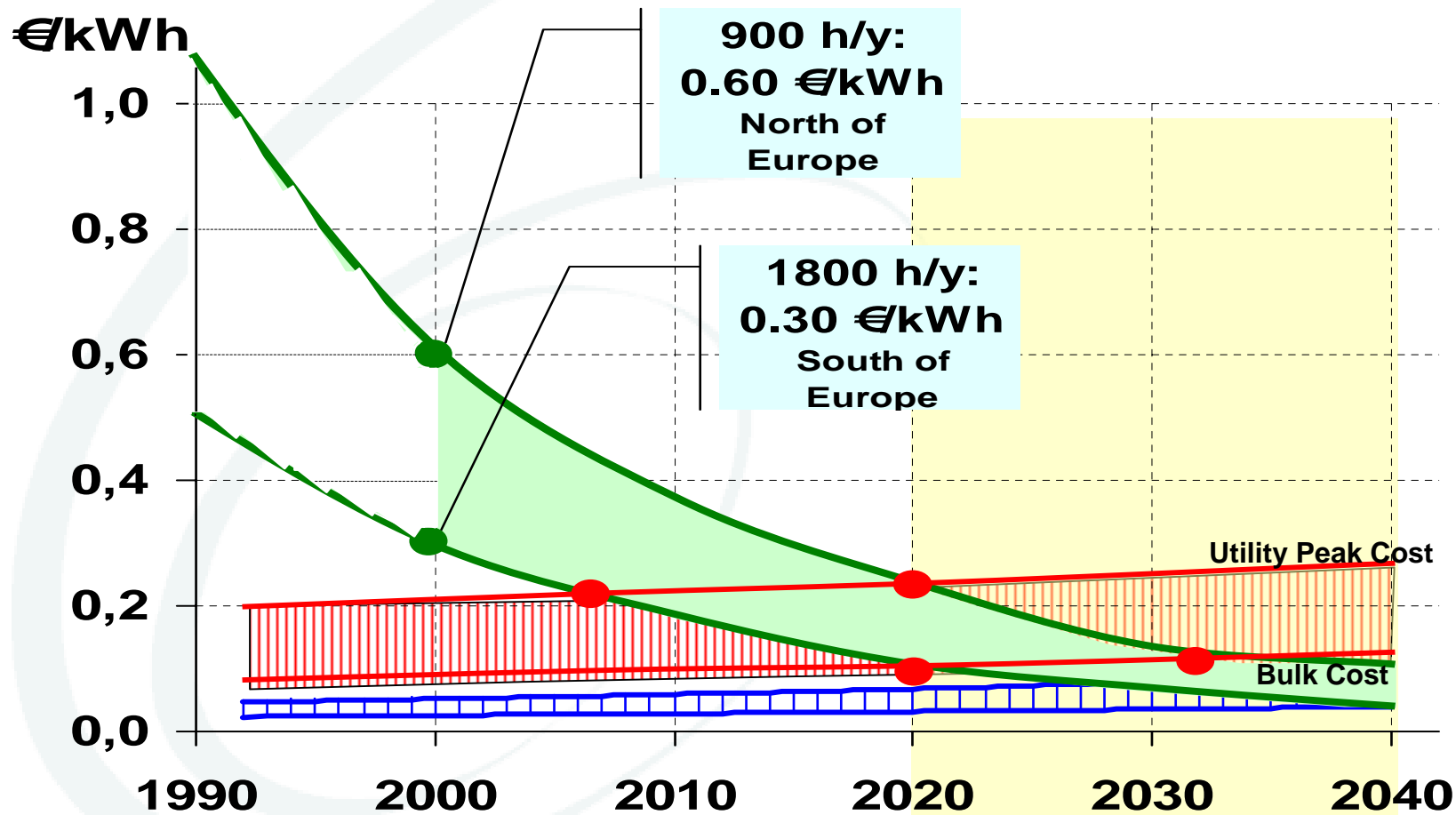
A Vision for PV in 2030

- ◆ **Virtually all new buildings fitted with PV, some of them net electricity producers**
- ◆ **PV electricity costs : factor 5 reduction (0.05 to 0.12 €/kWh in 2030)** *competitive with retail electricity prices within ten years in large parts of Europe*
- ◆ **Strong European industry with significant exports, 200 to 400 thousand jobs including installation activities**



A Vision for PV in 2030

Electricity costs



A Vision for PV in 2030:

PV in the 2030 energy picture

- ◆ **EU : 200 GWp installed capacity**
- ◆ **World : 1,000 GWp ~ 1,000 TWh/year = 4 % of the world electricity consumption ~ today's electricity consumption of Germany + France**
- ◆ **Large-scale dissemination of PV for rural use in Developing Countries : PV electricity provided to > 100 million families**
- ◆ **PV robust and safe supplier of energy on grid and in stand-alone mode.**



How to reach the Vision

◆ Issues

1. Increasing RTD efforts
2. Alignment of strategies and goals
3. Continuity and long-term action
4. Addressing the barriers
5. Improving technology transfer
6. Emphasising manufacturing issues
7. Enabling critical mass
8. Joining forces and competencies
9. Building sustainable markets
10. Involving stakeholders and decision makers
11. Defining adequate policy frameworks

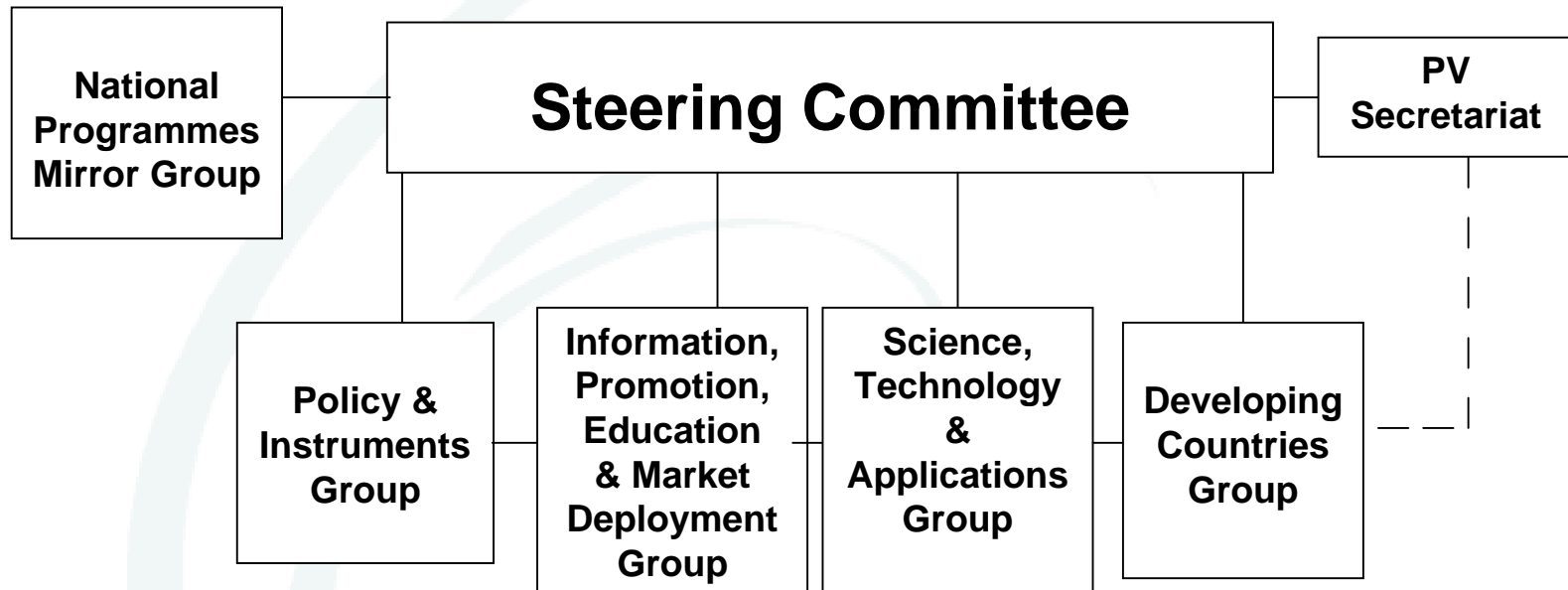


How to reach the Vision

- ◆ **Strategic plan covering :**
 - Research and technology
 - Industry and market
 - Policy and instruments
- ◆ **Establishment of a PV Technology Platform**
 - Strong connection between the 3 areas needed to accelerate the process



The PV Technology Platform



The Strategic Plan

- ◆ **The Strategic Research Agenda (SRA)**
- ◆ **Coordination of research programmes**
- ◆ **Implementation policies and support actions**



The Strategic Research Agenda

◆ Four main directions

- Basic research
- Applied research and development
- Demonstration
- Supporting research (socio-economic, etc.)

◆ Areas to be addressed

- Current technologies (wafer & thin-film technologies)
- New and emerging technologies
- Balance-of-systems
- Building integration
- Systems aspects (storage, grid optimization, buildings, etc.)
- Manufacturing issues



Co-ordination of RTD programmes

◆ **PV Technology Platform in FP 7**

- Joint Technology Initiative (to be explored)
- Dedicated budget line for PV collaborative RTD
- European Research Area instruments

◆ **Co-ordination of PV RTD programmes**

- EU: PV ERA-NET, Mirror Group
- International: USA, Japan and IEA Implementing Agreement on Photovoltaics

◆ **Networks of Excellence**



Implementation policies and market creation

◆ Policy Framework

- Incentives / support schemes
- Specificity of PV vs other Renewables
- Implementation of RES-e directive
- Optimisation, Co-ordination and Consensus building
- EU financial instruments (Structural and Cohesion Funds)
- Access to the grid, building codes, standards

◆ Developing Countries

- Strong partnership between development agencies, NGOs, finance sector

◆ Export and Trade

- Barriers to be addressed on global, EU and national levels

◆ Communication



Main recommendations

- 1. Implement the Strategic Research Agenda**
- 2. Strongly co-ordinate European PV research activities**
- 3. Facilitate coherent implementation of deployment measures and overcome barriers**
- 4. Foster joint initiatives and communication plan**
- 5. Support export and trade**
- 6. Strengthen partnership with developing countries**

