Office Franco Allemand des EnR

Conférence du 12 avril 2016:

Bilan environnemental et impact environnemental des installations photovoltaïques

Le projet d'Écolabel Européen pour des modules photovoltaïques

Proposal for EU ECOLABEL for SOLAR PHOTOVOLTAIC panels

Yvonnick Durand
Ingénieur R&D
Marché PV

Françoise Burgun
Dpt technologies Solaires
Program Manager

PARIS, 12/04/2016

Proposal for EU Ecolabel for solar Photovoltaic Panel

How to support Industry and secure investors and consumers

CONTENT

1. ADEME and PV, LCA contribution – CEA-INES
2. PV Market Growth and Challenges
3. European Ecolabel Initiative: framework and stakeholders
4. Status and relation to other initiatives: PEFCR, and Ecodesign Directive
5. Conclusion & Perspectives

About ADEME

- ADEME is active in the implementation of public policy in the areas of the environment, energy and sustainable development.
- The agency helps finance projects, from research to implementation, in its areas of action.

- Four vocations
  - Developing knowledge: animation and financing of research and innovation;
  - Convincing and mobilising: public information and awareness;
  - Advising: businesses, local authorities and communities, government bodies and the public at large;
  - Assisting with implementation: financial support and promotion of implementation of regional and national references.

- Organisation:
  - Around 1000 employees;
  - 3 sites for the central departments in Angers, Paris and Valbonne;
  - 26 regional divisions and 3 representative bodies in overseas territories;
  - 1 office in Brussels.

CONTEXT

- Environmental impacts of PV systems can vary significantly according to different parameters like the module technology, the electrical mix used for PV components manufacturing, the system yield and the lifetime of the system, independently of irradiance.

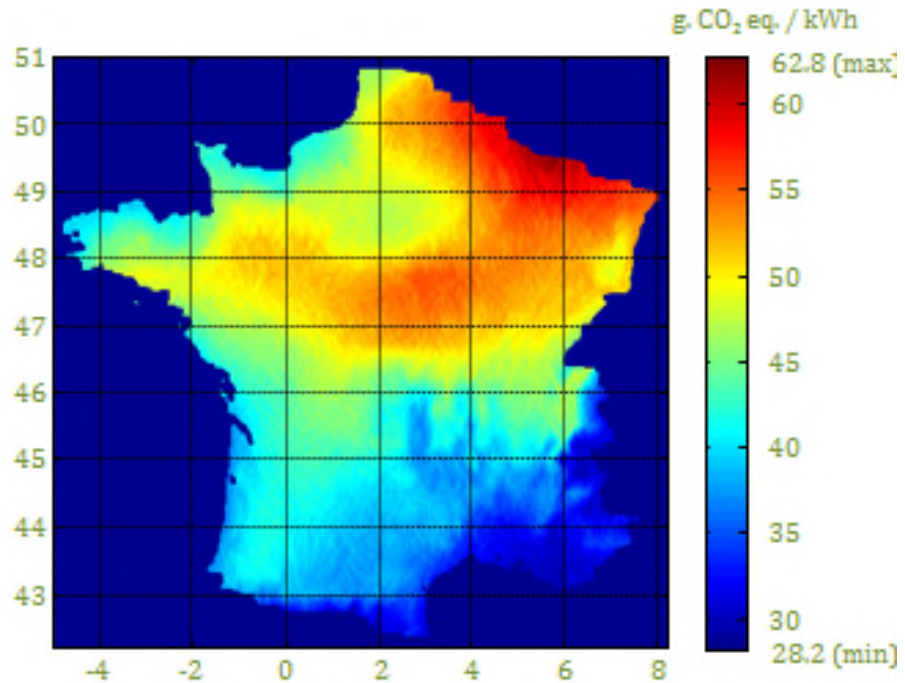
- PV systems will be over time one of the main contributor in term of renewable electricity production and greenhouse gas reduction .

- Renewable energies and Photovoltaics in particular have also to be exemplar in terms of environmental performances, in a context of important development of PV installations at an international level.

Environmental Assessment of PV Systems

- Contribution of ADEME to LCA of PV: project ESPACE from 2008 to 2013 (photovoltaic system eco-design through Life Cycle Analysis and its environmental impact).

  - Development of a panorama of environmental performances of PV installations;
  - Identification of the key environmental aspects for the different technologies;
  - Integration of environmental aspects in the design or improvement steps of photovoltaic process and products;
  - Highlight sensitivity of the main points susceptible of reversing expected benefits of the different PV projects.



Empreinte carbone de l'électricité produite par des installations de technologie mc-Si intégré au bâtiment (résultat ESPACE 1) (ecoinvent 2.0)

Environmental Assessment of PV Systems

- Thanks to this project, ADEME develops a reference document in order to compare environmental performances of PV systems.

- ADEME also contributes to the definition of the Product Environmental Footprint Category Rules (PEFCR) related to PV modules, supported by the European Commission
  - Tool based on Life Cycle Analysis approach which provides a method for environmental impacts assessment of PV systems.

Why an Ecolabel Initiative supported by ADEME?

- ADEME is also involved in the carbon footprint methodology implemented in the French PV tenders:
  - In charge of the validation of specific emission factors provided by PV materials or components manufacturers;
  - Goal: encourage and valorize alternative process and products with low environmental impact in term of $C0_2$-Equivalent emissions.

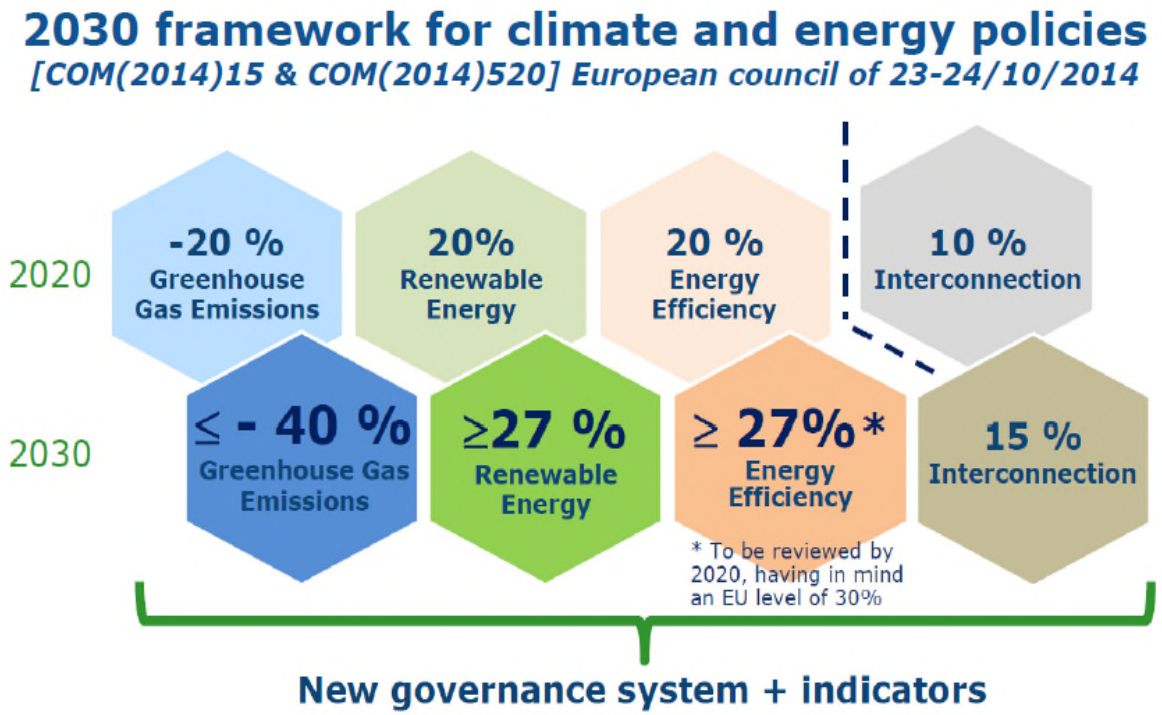
- In order to accelerate the promotion of high quality PV products, ADEME committed early 2015 to supporting the Ecolabel initiative dedicated to PV modules:
  - Ecolabel is a tool based on a multi-criteria approach (reliability, technical and environmental performances), which aims at helping professionals and consumers in identifying high performance modules on technical and environmental point of views;
  - Could contribute to sustain European photovoltaic industry because of high quality requirements;
  - Mid term proposal: implementation of Ecolabel in the French PV tender instead of simplified carbon footprint assessment.

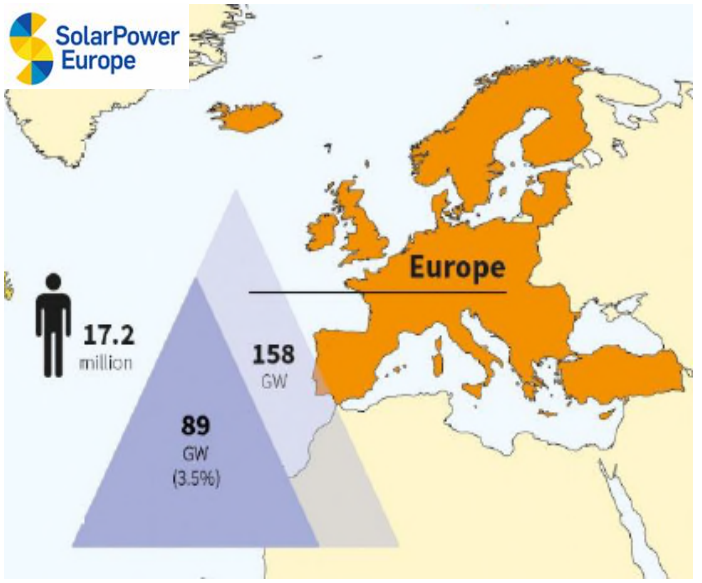
Proposal for EU Ecolabel for solar Photovoltaic Panel

How to support Industry and secure investors and consumers

CONTENT

Framework



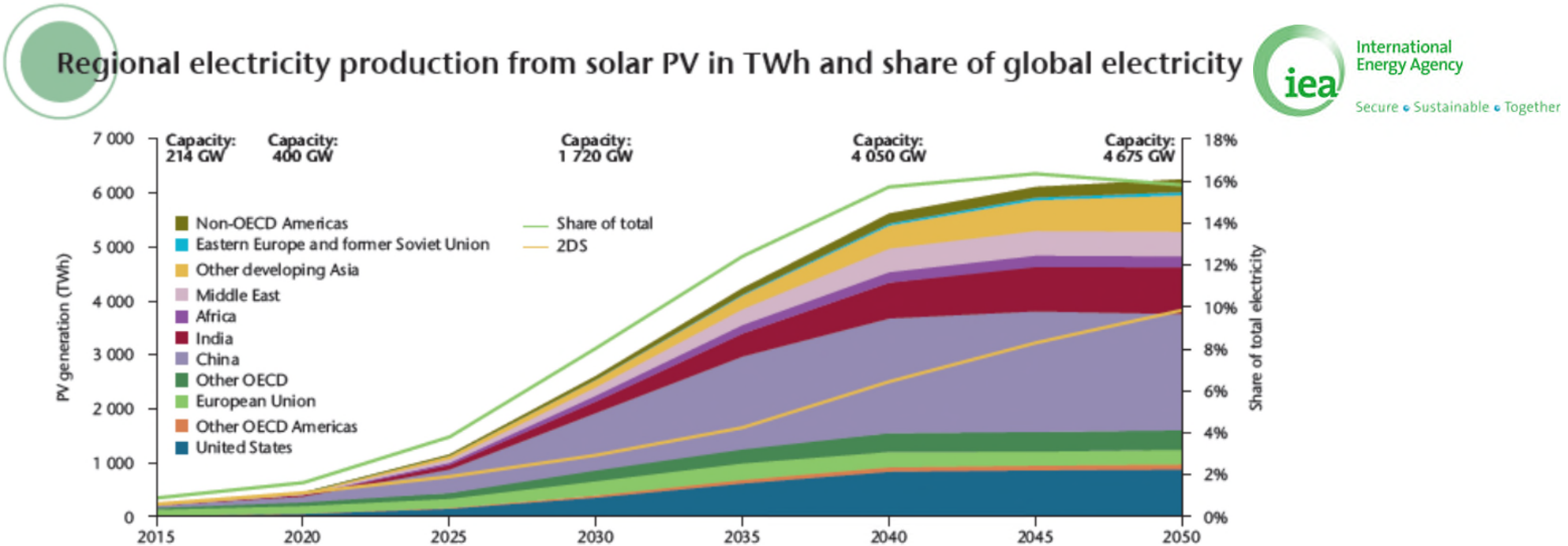


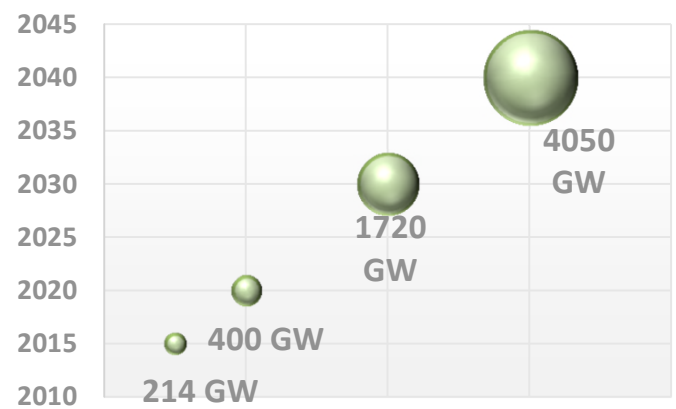
2014 PV cumulative Capacity : **89GW**
2019 scenario **: + 69GW**

To meet RE target, PV is essential

- To maximise environmentally friendly energy production
- To provide reliable, eco-relevant information to consumers

The breakthrough of solar Photovoltaics worldwide





- Photovoltaic is a fast growing market:

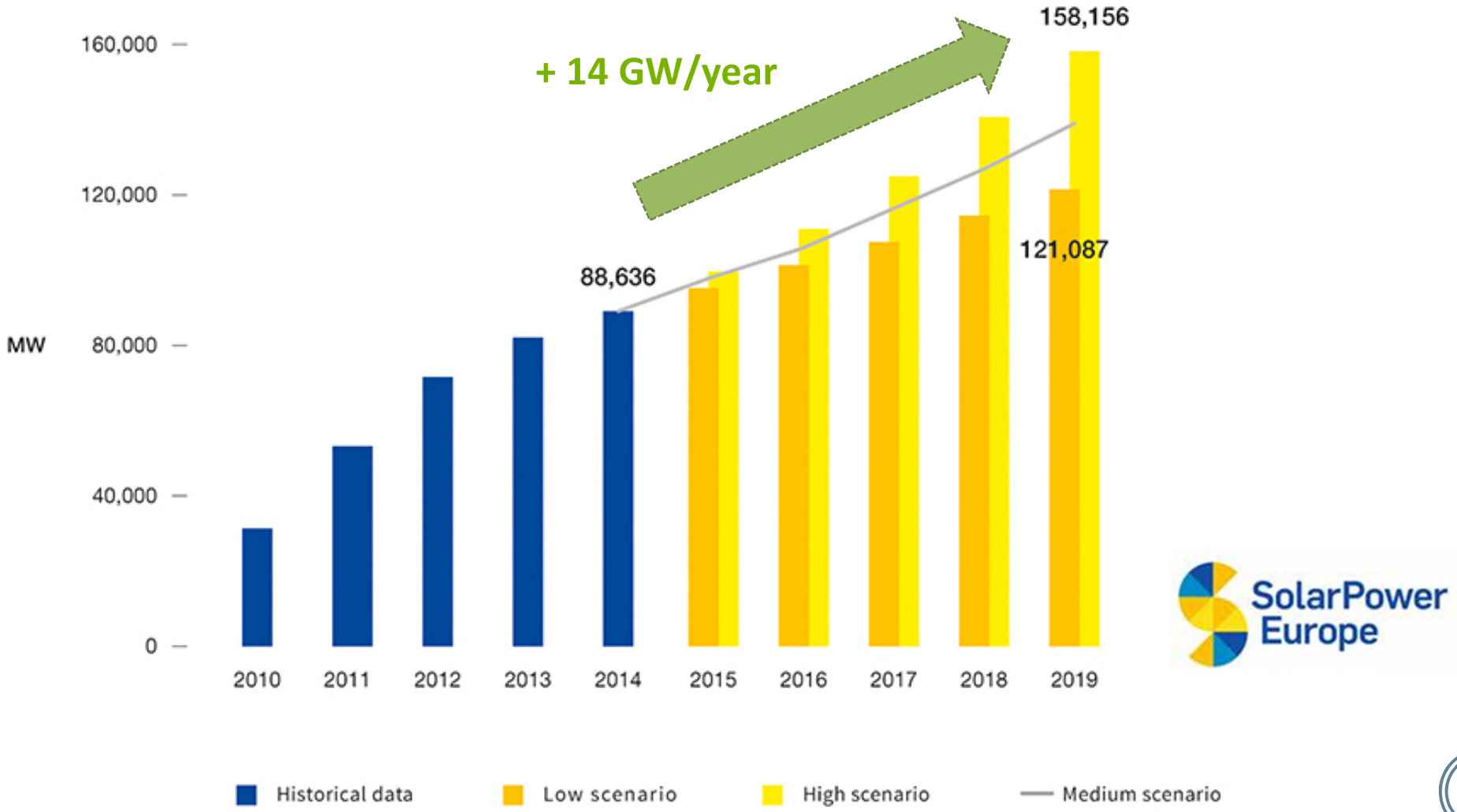
Compound Annual Growth Rate (**CAGR**) of PV installations

- 2000 -2014 : + 44%, in 2014: + 45 GW
- in 2015: +59 GW, +34%/2014; 255GW globally
- **forecast end 2016: 320 GW globally**

- **Towards 100 GW/year in 2020 & 200 GW/year in 2030**

Forecast of Solar PV European Market

- EUROPEAN CUMULATIVE SOLAR PV MARKET SCENARIOS until 2019

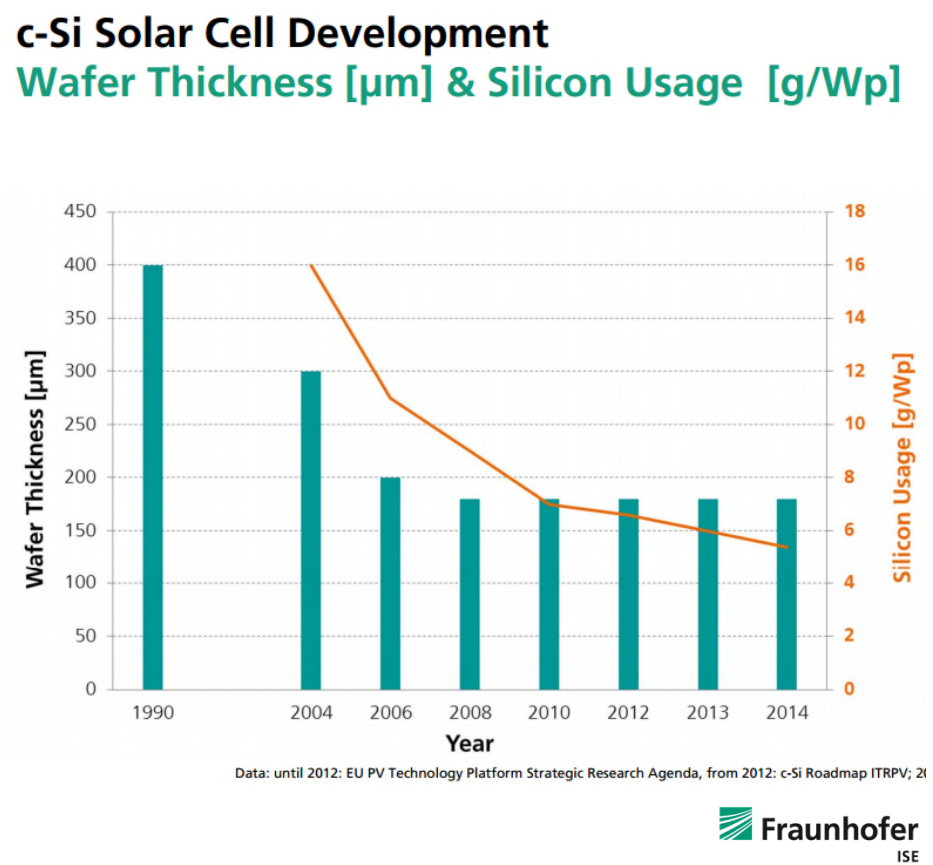


Market key Issues, Challenges and Objectives

- ISSUES
  - Lack of product-specific, reliable information on environmental performance, and durability
  - Need for methodologies and criteria to qualify and guarantee the better products
- CHALLENGES
  - Compliance with environmental regulations (REACH, CLP, RoHS, WEEE)
  - Methodologies for assessing Performance / Reliability / Lifetime
  - Life cycle analysis : in link with EU PV PEF Product Environmental Footprint
- OBJECTIVES :
  - Reliability and environmental quality of PV panels :
  - Comprehensive information for consumers and investors
  - Market Trust
  - Solar industry's green credibility

Market Growth and other Environmental issues

- Reduction of energy consumption during the manufacturing phase
- Limitation of land use
- Reduction of material use
  - c-Si Solar Cell :
    - ↘ silicon Usage [g/Wp] > 50%
  - Rare earth and metals :
    - tellurium, indium, gallium
- Recycling:
  - Encourage application of results of on going research for recycling of silicon panels and thin film solar panels



3. EU Ecolabel Initiative

http://ec.europa.eu/environment/ecolabel/

- *Framework*
- Consortium & Stakeholders
- *Scope*
- *Prerequisites*

- *"The EU Ecolabel helps you identify products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw material through to production, use and disposal. Recognised throughout Europe, EU Ecolabel is a voluntary label promoting environmental excellence which can be trusted."*

Fraunhofer ISE ines INSTITUT NATIONAL DE L'ENERGIE SOLAIRE ENEA

- Panel + Junction Box + Cables

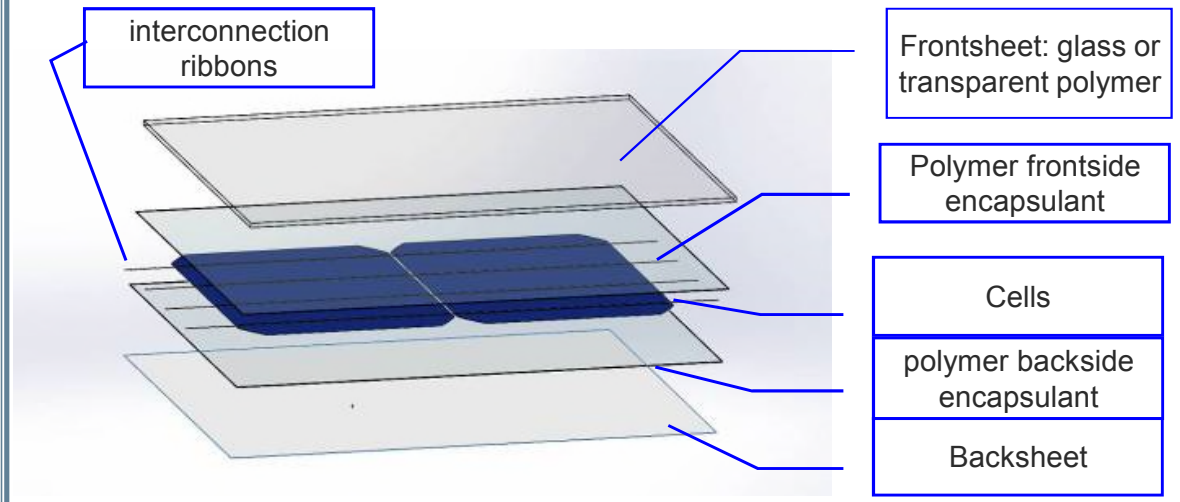
- Compliance with EU Ecolabel Regulation: Articles 6(6)/(7) on SVHC: REACH & RoHS
- Demonstration of stakeholders' interest
- Fulfillment of consumers' needs

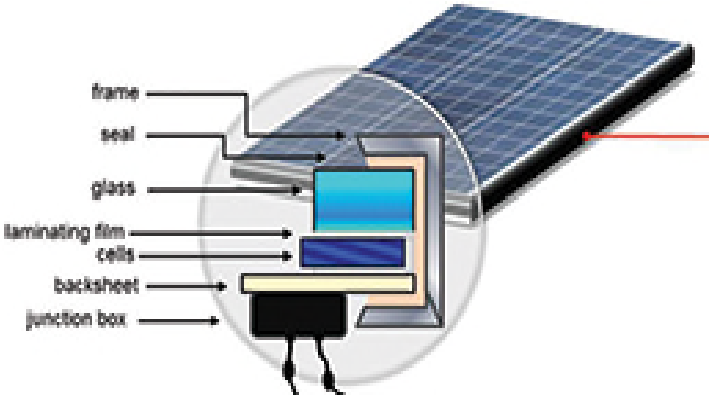
Ecolabel Prerequisite : Stakeholders' interest

- PV Manufacturers and Solar Power Europe support the launch of the PV Ecolabel initiative → **letters of interest**
- Public Authorities in the EU want to be able to ascertain that their support for PV is in conformity with all their environmental objectives.
- Investors and consumers want to know if their investment is durable and environmentally optimal /responsible.
- If decision of the EUEB is positive : the consortium is looking forward to an inclusive and fruitful cooperation with all competent interested parties

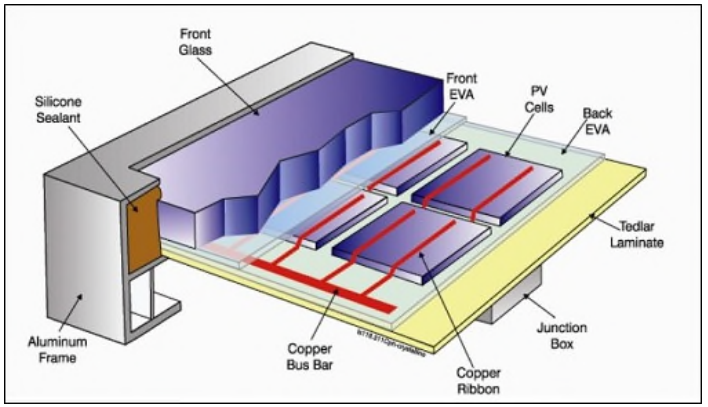
Product scope

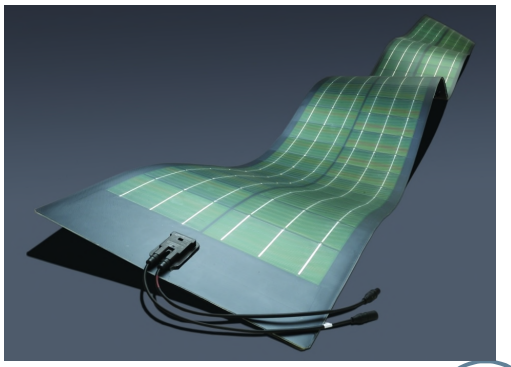
- Module + frame + junction box + cables





- Typical Crystalline Si panel and thin film modules





Ecolabel Regulation Articles 6(6)/(7) CLP, REACH & RoHS

- Objective of Art.6(6)/(7) ((EC) 66/2010): **to avoid the presence of inherent hazards**
  - **Criteria for Substances of Very High Concern (SVHC) in accordance with:**
    - **CLP** (classification, labelling and packaging) : Regulation (EC) No 1272/2008 ,
    - **REACH** : Substances listed in accordance with Article 57 (1) of Regulation (EC) No 1907/2006
  - Approach based on the substitution of inherent hazards as opposed to reducing the risk of exposure.

  - REACH Directive: Registration, Evaluation, Authorisation and Restriction of Chemicals
    - REACH candidate List : 168 SVHC (last update Dec. 2015)
    - **maximum concentrations : 0,1 % weight by weight**

- RoHS Directive: Restriction Of Hazardous Substances Directive (Recast 2011/65/EU (RoHS 1 & 2)
  - restricts the use of six hazardous materials in electronic and electrical equipment :
    - Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr6+), Polybrominated biphenyls (PBB), Polybrominated diphenyl ether (PBDE);**And from 2019, phthalates DEHP, BBP, DBP, and DIBP (RoHS 2),**
  - **maximum concentrations** : **0.1% or 1000 ppm by weight**, except for cadmium, 0.01% or 100 ppm

  - **NB : PV panels are currently excluded from RoHS compliance**

Results of the SVHC scoping study: compliance with REACh and RoHS

Objective :

- to assess if it is possible to produce solar photovoltaic panels :
  - **without SVHC referred to in Article 57 of REACH and CLP**
  - **without SVHC referred to in RoHS (1&2)**

Data & Methodology

- **Bill of materials** from Smartgreenscan, expert, Mrs. Mariska De Wild-Scholten
- Foreground of the two institutes Fraunhofer ISE and CEA-INES, interview of manufacturers and suppliers & thorough quantified analysis.
  - Ref : JRC –IPTS of 24th February 2014, ***"Findings of the EU Ecolabel Chemicals Horizontal Task Force Proposed approach to hazardous substance criteria development"***

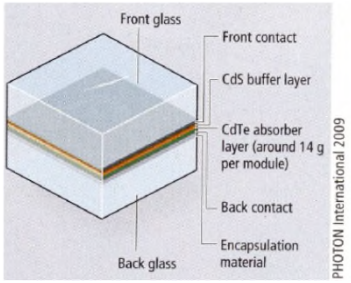
SVHC in REACH : CdS & some Phthatlates

- **Cadmium Sulphide is in REACH**

- **CdS in CIGS solar cells**
  - copper indium gallium selenide active layer
  - buffer layer of **CdS**

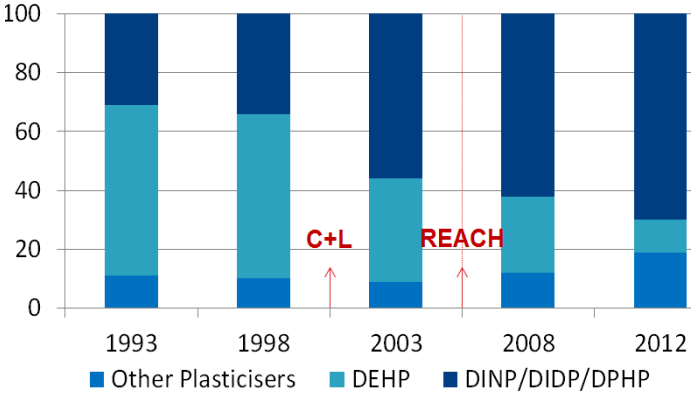
➡ **under the threshold of 0,1%**

- **CdS in CdTe solar cells**
  - Cadmium Telluride active layer
  - buffer layer of **CdS**



➡ **under the threshold of 0,1%**

- **Some phthalates are in REACH**
- **Often used plasticisers in cables are phthalates** ("DINP", "DIB", "DEHP", "DBP", "BBP")
  - DEHP, DPP, BBP and DBP => REACH
  - Trend : Replacement of DEHP by DINP increase of DIDP and new alternatives



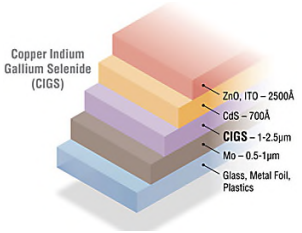
[plasticisers.org]

- **An ECOLABEL initiative may help to create awareness and visibility on the actual amount and use of REACH compliant plasticisers**

A general REACH compliance is possible

SVHC in RoHS : Cadmium & some Flame retardants(PBDE)

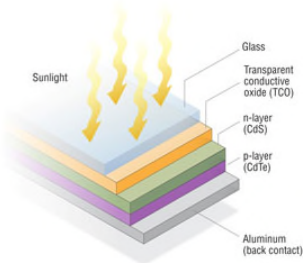
- **Cadmium in thin film CIGS solar cells**
  - copper indium gallium selenide active layer
  - buffer layer of **CdS**



0,0004 wt.% Cd **< 0,01% ROHS limit**

⇒ **cadmium free CIGS commercially available (*Solar Frontier, Stion…*)**

- **Cadmium in thin film CdTe solar cells**
  - Cadmium Telluride active layer
  - buffer layer of **CdS**



0.05 wt.% Cd > 0,01% ROHS limit

⇒ Recycling programs with an estimated cadmium recovery of about 95%.

- **Some of the Flame retardants (FR) used e.g. in back sheets and junction boxes are restricted:**
  - halogen-containing additives (e.g. polybrominated biphenyl ethers), restricted under ROHS

➡

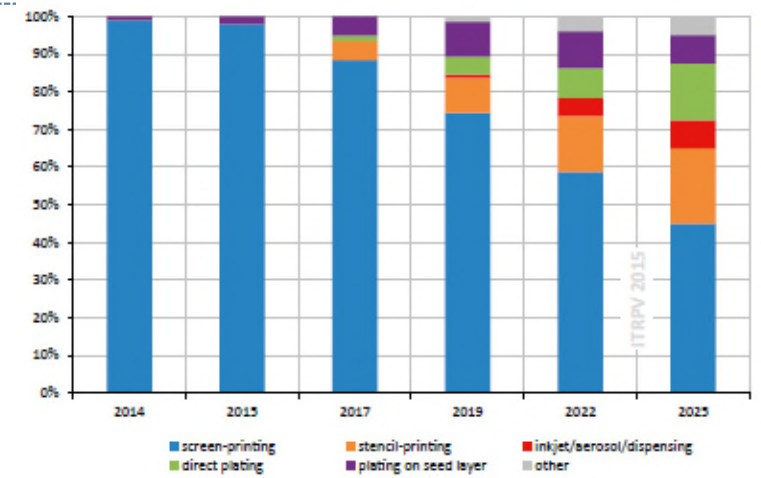
⇒ **Alternatives : halogen-free additives or inorganic additives**

⇒ **An ECOLABEL initiative may help to create awareness and visibility on the actual use of ROHS compliant flame retardant**

SVHC in RoHS: Lead (Pb) status & roadmaps

- Lead (Pb) used in Ag based **cell metallization (c-Si)**
  - this accounts for **0.003 wt.% Pb (< 0,1% limit)**
  - Pb-free metallization pastes become available

➢ **cell technology moving away from Pb/Ag screen-printing paste: ITRPV metallization roadmap ➔**



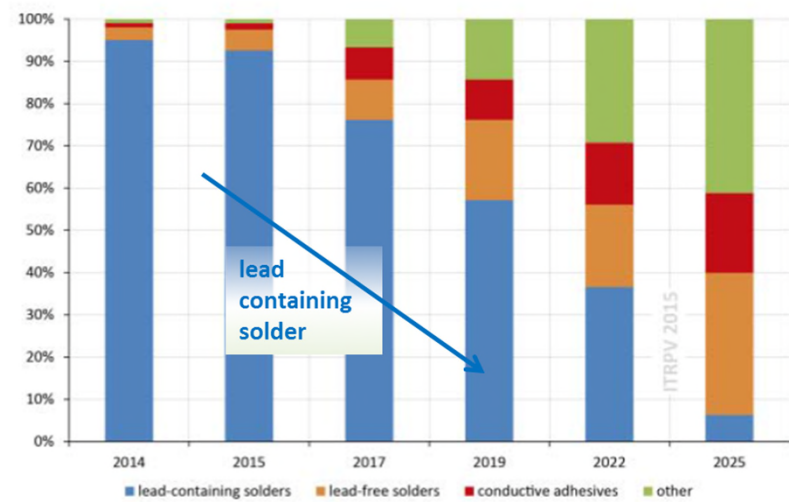
© ITRPV

- Pb used in **solder joints** interconnecting cells **(c-Si)**
  - c-Si module designs range :

  => **0.05 < wt% Pb < 0.25 ,** typically 0.08 wt.% Pb

➢ **Lead-free technical solutions are available** with proven industrial feasibility.

ITRPV roadmap to leadfree solder ➔



Roadmap for cell connection technologies

- **The ECOLABEL PV initiative would accelerate the transition towards lead-free processing**

A general RoHS compliance is possible

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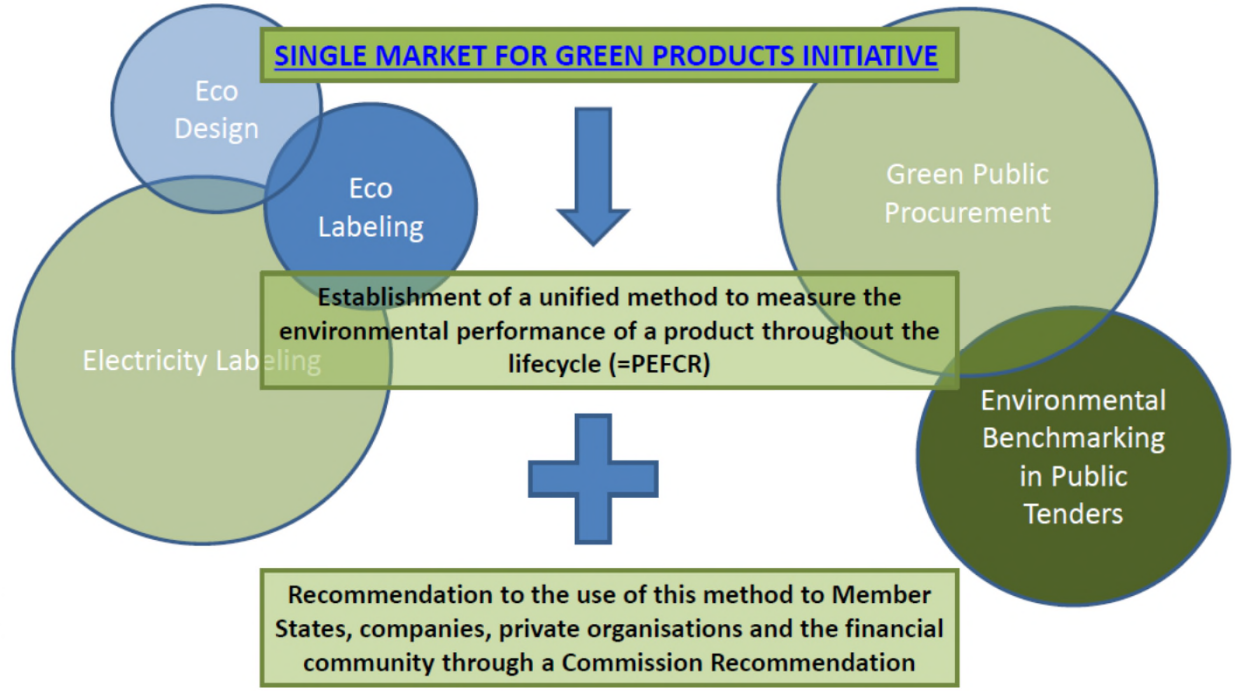
Other Environmental initiatives on PV

- **Product Environmental Footprint Category Rules on Photovoltaïc:**

=> PEFCR Pilot Project "Photovoltaic Electricity Generation"

- Unified method to measure the environmental performance of a product throughout the lifecycle.
- Validated by national bodies before the CE



[PEFCR EUEB Presentation, Andreas Wade - First Solar]

- ECODESIGN Directive:
  - **Inclusion of PV discussed**

- US NSF NSF Standardisation I
  - Sustainability Leadership
  - Standard for Photovoltaic Modules
  - Initiative lead by industry, investors, installers, utilities, consumer organizations, scientists

⇒ Objective : SYNERGY

- implement findings of PEFCR in the criteria development process and of all the other initiatives

Ecolabel Initiative : Current Status

- European Union Ecolabelling Board – **EUEB** : 25 Member States
  - Vote procedure

EUEB Meetings

Proposal for inclusion of PV panels in the EU Ecolabel

Presentation of the scoping study & stakeholders interest

Feasible

? Ecodesign ?

?Development of criteria for Ecolabel (and Ecodesign)?

Criteria-Setting Process

June 2015 — *January 2016* — *was due for march?* — *June 2016*

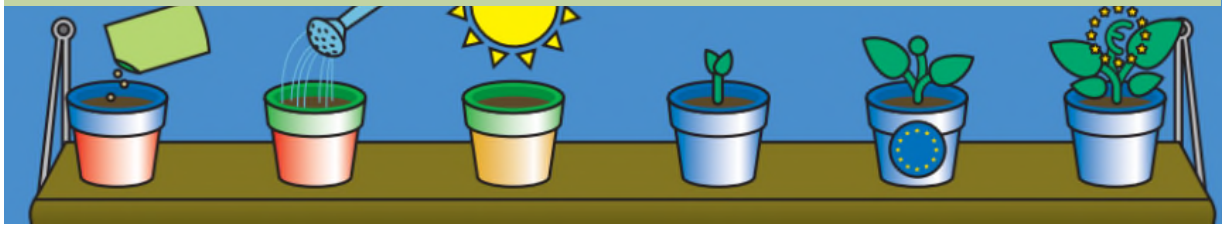
paramount prerequisites:
- Feasibility to comply with REACH & RoHS
- Industry interest

Approval subject to the launch of ECODESIGN for PV

?Authorisation to draft EU Ecolabel criteria for PV panel ?

EUEB Answers

EU Eco-Label Criteria Setting-Process



http://ec.europa.eu/environment/ecolabel/documents/general.pdf

PV panel ECOLABEL criteria : 3 pillars

TECHNICAL PERFORMANCES
- Efficiency
- Performance Ratio
- Long term productivity

QUALITY & WARRANTY FOR LONG SERVICELIFE
- Long term reliability
- Quality of module manufacturing
- Level of warranty provided

ENERGY & CLIMATE VALUE
- Cumulative Energy Demand
- Carbon footprint

- **Basis : existing standards** (IEC61215)

+ "advanced testing" in process of standardization

⇒ Ex. Fraunhofer ISE, NREL: QUAL-Plus, PV-Durability

- **Ultimate Goal :**

➢ **estimation of service life,**

➢ **Climatewise perf.**

➢ **Ecolabel would be the 1st step**

Conditions for the UPTAKE of PV panel ECOLABEL

- Market conditions :
  - **2030 wide biding RE target**

- Industry situation :
  - Industry is seeking for positive differentiation :
    - Trigger to those making the effort to improve their practices and products.

- Political & societal context: increased environmental awareness and economy's responsiveness
  - Enormous investments in PV required to meet COP21 objectives
  - Holistic approach of environmental impact ➔ Especially requested for RE

Conclusions

- An EU Ecolabel for PV modules is **not only feasible but needed** by a variety of stakeholders (authorities, investors, consumers, Industry…)
- A growing share of PV modules marketed today in Europe appears already compliant with REACH and RoHS directives (art. 6,(6)/(7) of the Ecolabel) or could become so at competitive cost. ***(e.g. leadfree soldering, replacement of hazardous phthalates in plasticizers).***
- A PV EU Ecolabel would contribute to accelerate Eco compliance and reward the first movers.
- Along with other instruments, a PV EU Ecolabel would powerfully contribute to reaching EU objectives on Environment protection and Climate-Energy.
- The consortium is ready to deploy its expertise and resources to assist in developing the most relevant criteria, **provided it is funded**.

THANKS FOR YOUR ATTENTION

CONTACT PERSONS:

- **ADEME:** Yvonnick Durand
- yvonnick.durand@ademe.fr www.ademe.fr

- **CEA-INES :** Françoise Burgun,
- francoise.burgun@cea.Fr www-liten.Cea.Fr