

PV priorities *and the* **Strategic Research Agenda (SRA)**

WG3: Science, Technology & Applications

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on behalf of WG3

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A strong sense of urgency is needed

- ***the coming decade is expected to be decisive for the future position of the EU PV industry***
- ***the global PV sector will grow to maturity and impressive turn-overs***
- ***competition will be fierce, rapid innovation and high volume are crucial***
- ***short-term research should be fully dedicated to competitiveness of EU industry***

Outline

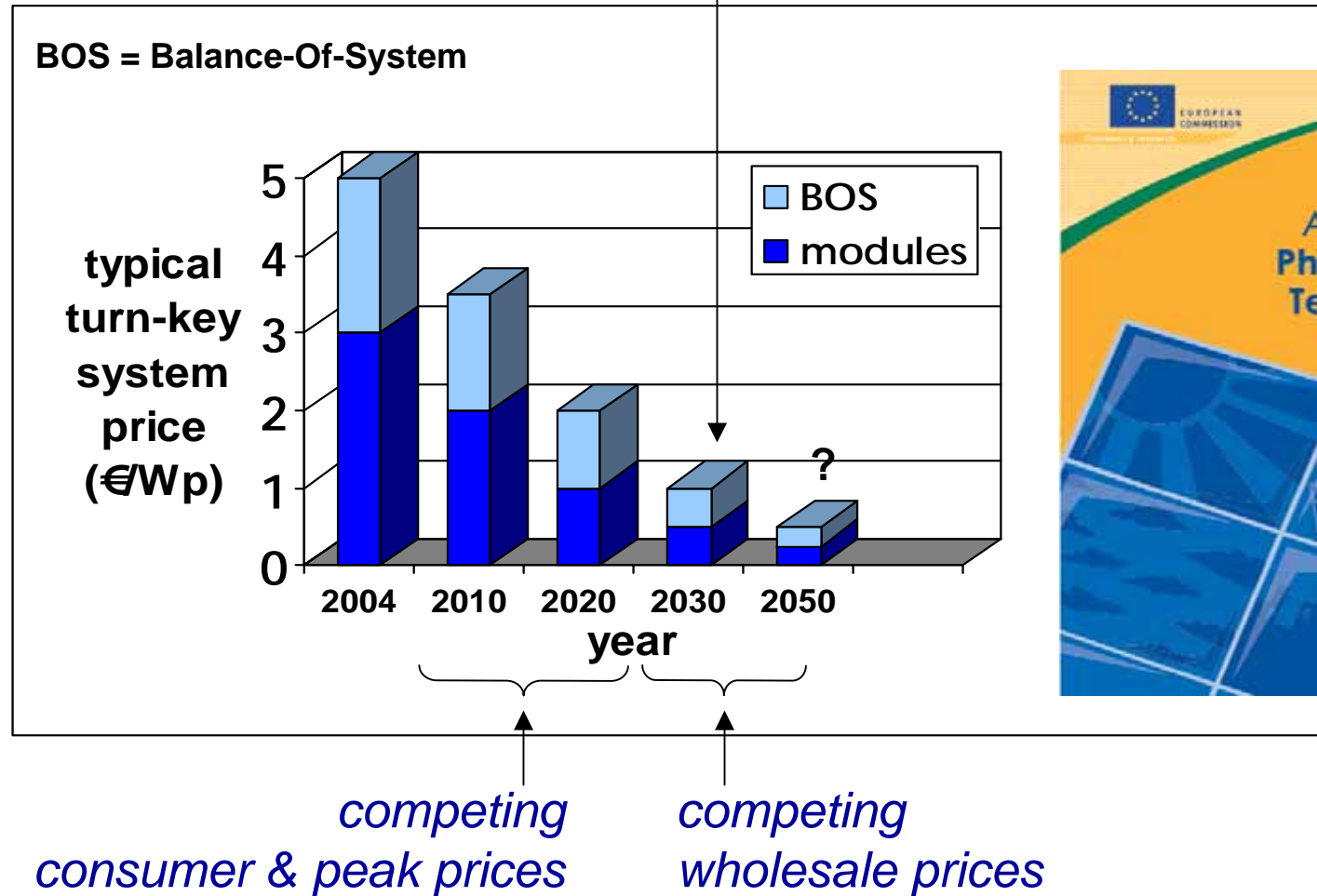
- **Challenges faced**
- **Objectives of the Working Group**
- **Considerations SRA and drivers for PV**
- **Achievements first year:**
 - **selected elements from the draft SRA**
- **Future plans**

The challenges

- **Secure a firm position of the EU PV industry in a rapidly innovating and highly competitive global growth sector**
- **Enable PV to become a major sustainable source of electricity a.s.a.p.**

The challenges

*1000 GWp globally
200 GWp in EU (200,000 jobs)*



➤ **Define widely accepted *technological and scientific* needs for development of PV and realisation of the Vision**

⇒ **develop a Strategic Research Agenda, as input for FP7, but also for broader use**

⇒ **contribute to the establishment of a EU PV Research Area (PV-ERA)**

Considerations SRA

- **need to address modules *and* BOS**
- **need to address all parts of the value chain(s), as well as manufacturing issues**
- **need to address ST, MT and LT research separately (i.e. firewalled) – typical budget shares 4 (2+2) : 2 : 1**

ST = short term = 2008 ~ 2013

MT = medium term = 2013 ~ 2020

LT = long term = 2020 ~ 2030+

Message 1

No exclusivity

➤ *PV comes and will come in different forms, SRA does not exclude technologies, but sets overall boundary conditions & targets and describes priorities per option*

Drivers for PV development

- **electricity generation costs** (notably turn-key system price) ***and* value**
- **environmental sustainability**
- **applicability**

Achievements 1st year

➤ Active working groups on:

1. Wafer-based crystalline silicon technology;
2. Existing thin-film technologies (Si, CIGS, CdTe);
3. Emerging and novel technologies (dye, organic, QD's, ..);
4. Concentrator technologies;
5. BOS-components and systems / Application-specific aspects, certification, a.o.;

have consulted stakeholders, discussed and defined research targets and priorities, drafted chapters of the SRA

Message 2

Some important research issues are shared

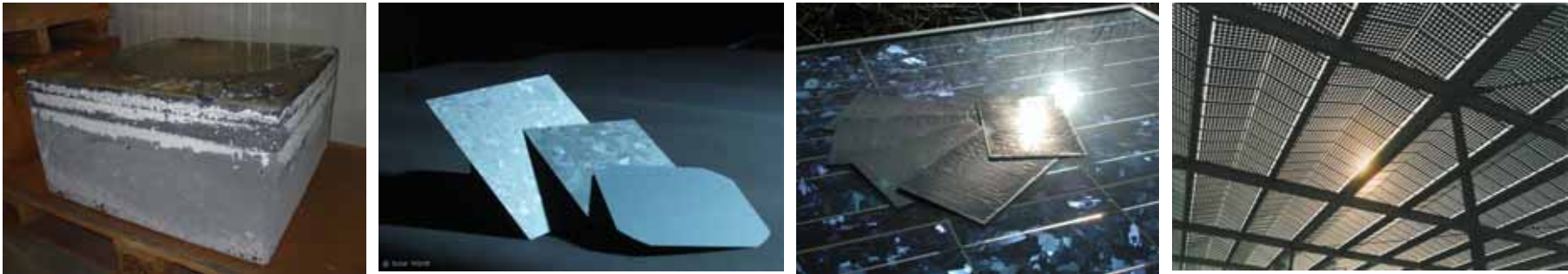
- ***efficiency, stability and lifetime***
- ***materials use (quality & quantity)***
- ***high-throughput manufacturing***
- ***in-process monitoring & control***
- ***environmental sustainability***

Wafer-based silicon technology

- **walking down the learning curve by a combination of innovation and volume**
- **large potential for further cost reduction to ≈ 1 €/Wp (ST/MT) and < 0.5 €/Wp (LT)**
- **module efficiencies of 18 – 20% in the long term**
- **time-to-market of research results needs to be reduced**

Selected research issues

➤ Wafer-based crystalline silicon



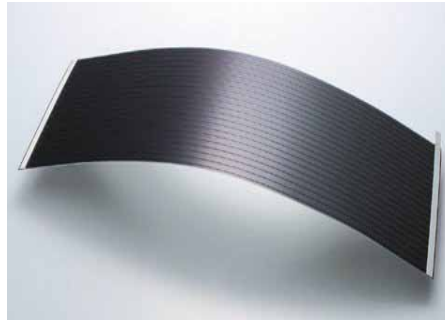
- high efficiency
- low overall silicon consumption
- feedstock quality / cost optimum
- low-cost encapsulation materials and module concepts

Existing thin-film technologies

- *a large number of manufacturing initiatives and plans seen recently*
- *inherent potential for low cost at high volume ≈ 1 €/Wp (ST/MT) and < 0.5 €/Wp (LT), synergies with other industries*
- *module efficiencies of 13 – 18% in the long term*
- *new application possibilities for flexible, light-weight module varieties*

Selected research issues

➤ Existing thin-film technologies



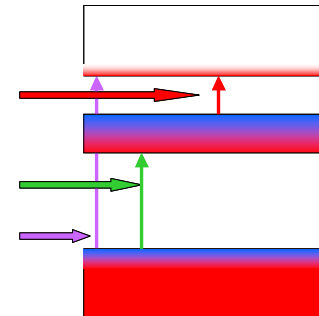
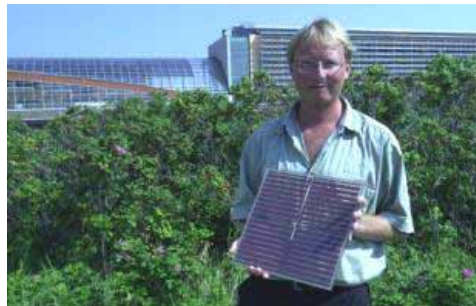
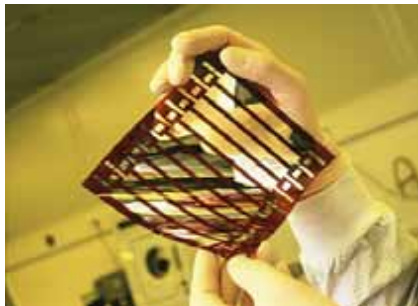
- high-efficiency (multi-junction) concepts
- low-cost transparent conductors
- low-cost encapsulation
- dedicated and standardized manufacturing equipment

Emerging and novel technologies

- ***range from scientific conversion concept to technology-near-market-introduction***
- ***aim at very low cost, very high efficiency, unique properties or applications (not necessarily combined)***
- ***may supply ‘boosters’ to other technologies***
- ***cost and performance potential often still difficult or impossible to give***
- ***need protected cradle / playground to demonstrate vitality and to grow to maturity***

Selected research issues

➤ Novel and emerging technologies



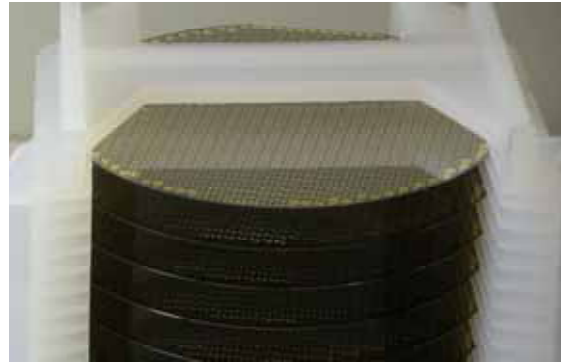
- proof-of-principle (enhanced performance) new conversion concepts
- efficiency of low-cost approaches
- sealing/stability of organics-based concepts
- breaking the 40% / 50% / 60% barriers

Concentrator technologies

- *the natural home of high-cost, super-high efficiency cells*
- *concrete way to high system efficiencies (>30%)*
- *manufacturing and applications are now taking off*
- *unique applications opportunities in sunny regions*

Selected research issues

➤ Concentrator technologies



- **super-high efficiency cells for use at high concentration ratios**
- **high-quality, low-cost optics and trackers**
- **automated manufacturing and assembly**
- **high reliability and zero maintenance**

Systems, BOS-components, a.o.

- ***BOS represents 40-50% of turn-key system price and is key in overall system reliability***
- ***has shown excellent cost reduction so far, but needs dedicated efforts to achieve MT & LT cost goals, at equal or improved specs***
- ***urgent need for harmonization and standardization (cost reduction, flexibility, building integration, etc.)***

Selected research issues

➤ Systems, BOS-components, etc.



- low-cost, long-lifetime electronics and other BOS-components
- system yield and availability
- small capacity (few kWh's) storage options
- microgrids

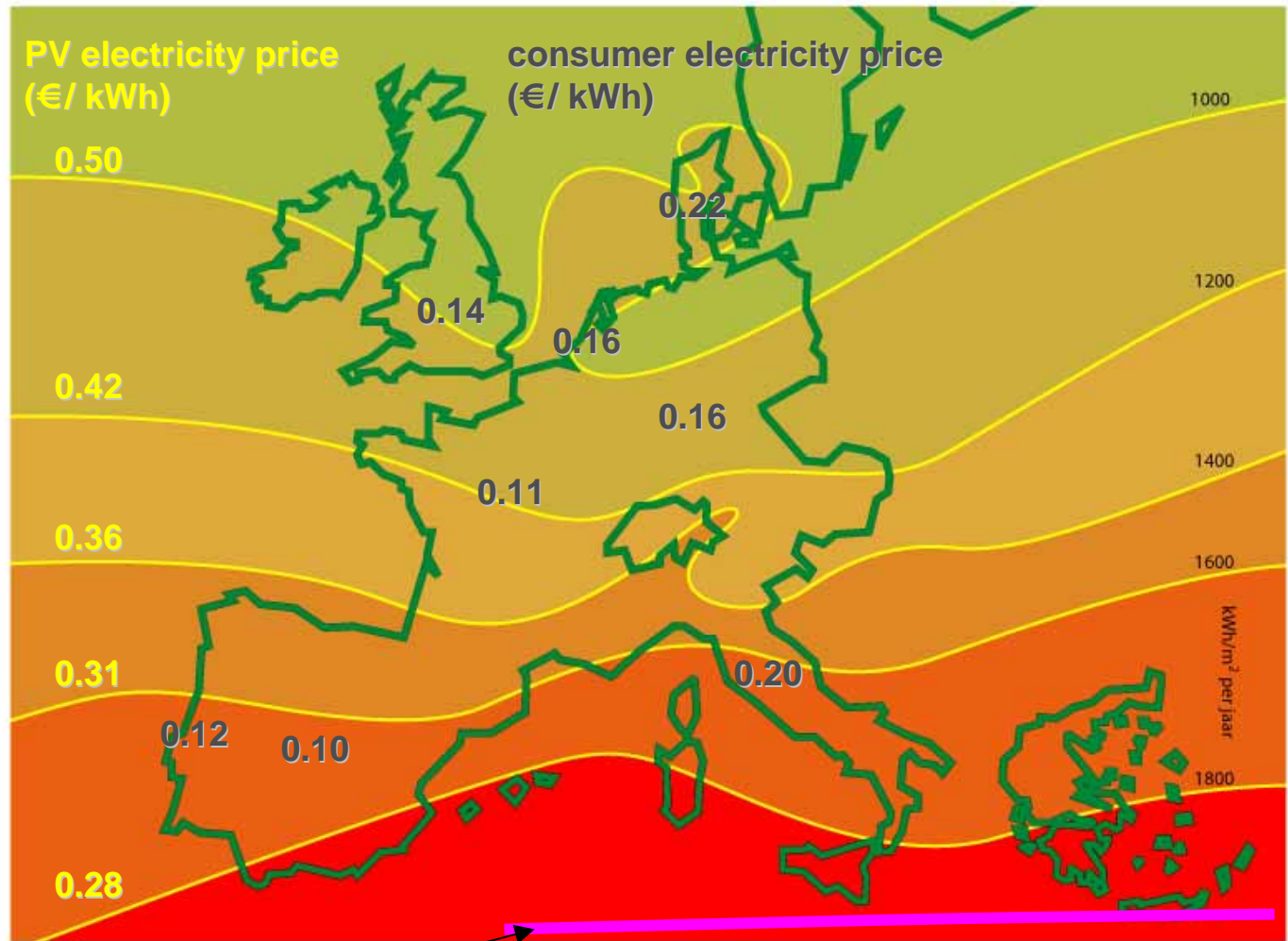
Feedback solicited

- ***first draft* of the SRA will be available on PVTP website on June 1st**
- **comments welcomed until June 11th**
- **WG3 will meet on June 16th**
- **(summary of) second draft discussed with the Commission end of June**
- **SRA will be further developed in the 2nd half of 2006**

To conclude

- **Europe has a large, but distributed potential in PV science, technology and applications**
- **(only) by joining forces and adopting high levels of ambition we can build a strong PV sector**
- **the PVTP SRA aims to support this process**

2005



PV electricity prices*)
compared with
typical **consumer**
electricity prices

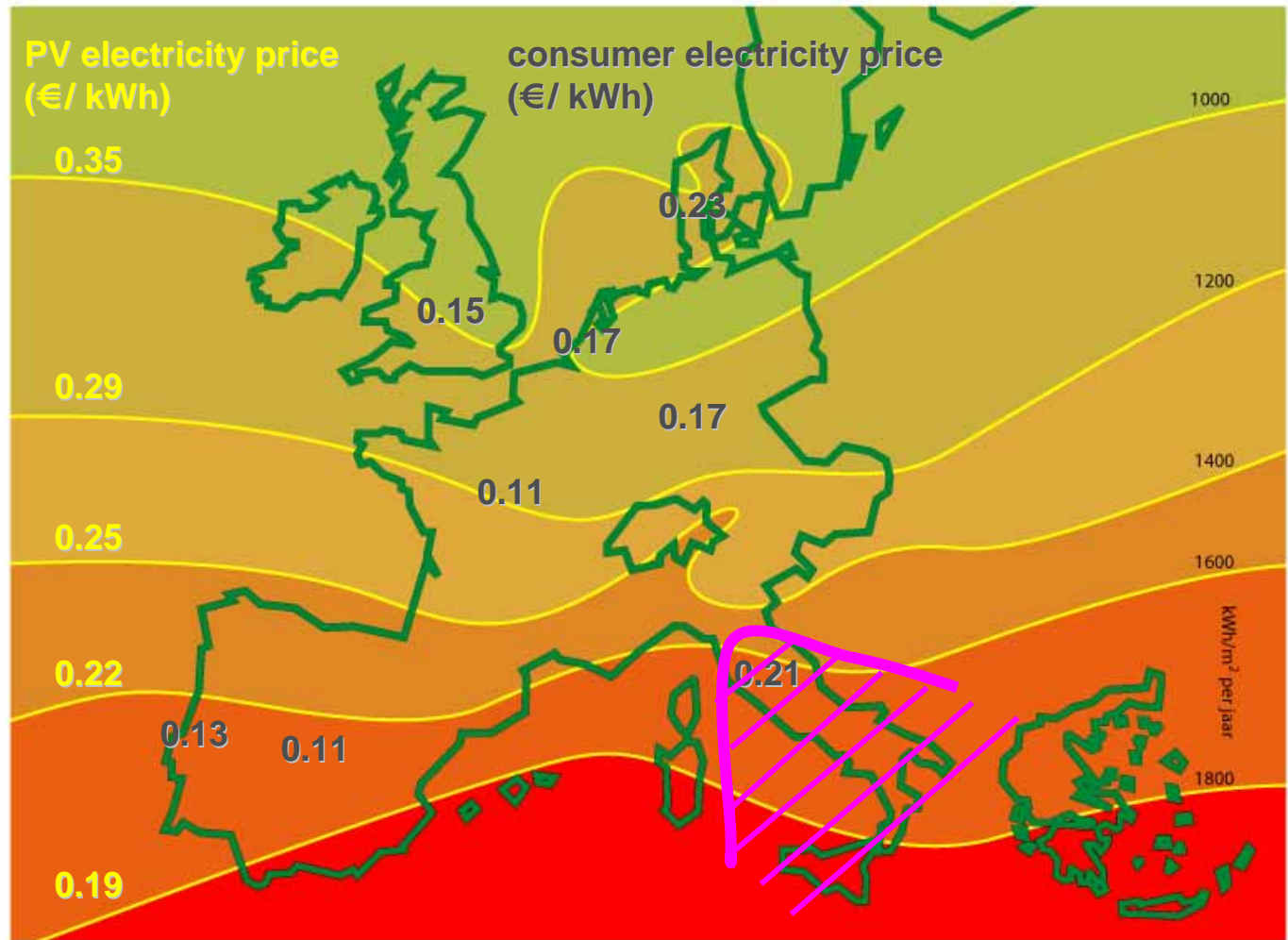
*) depreciation 25 yrs,
real interest rate 4%,
O&M cost 1%/yr,
PR 0.75 (example)

break-even boundary

2010



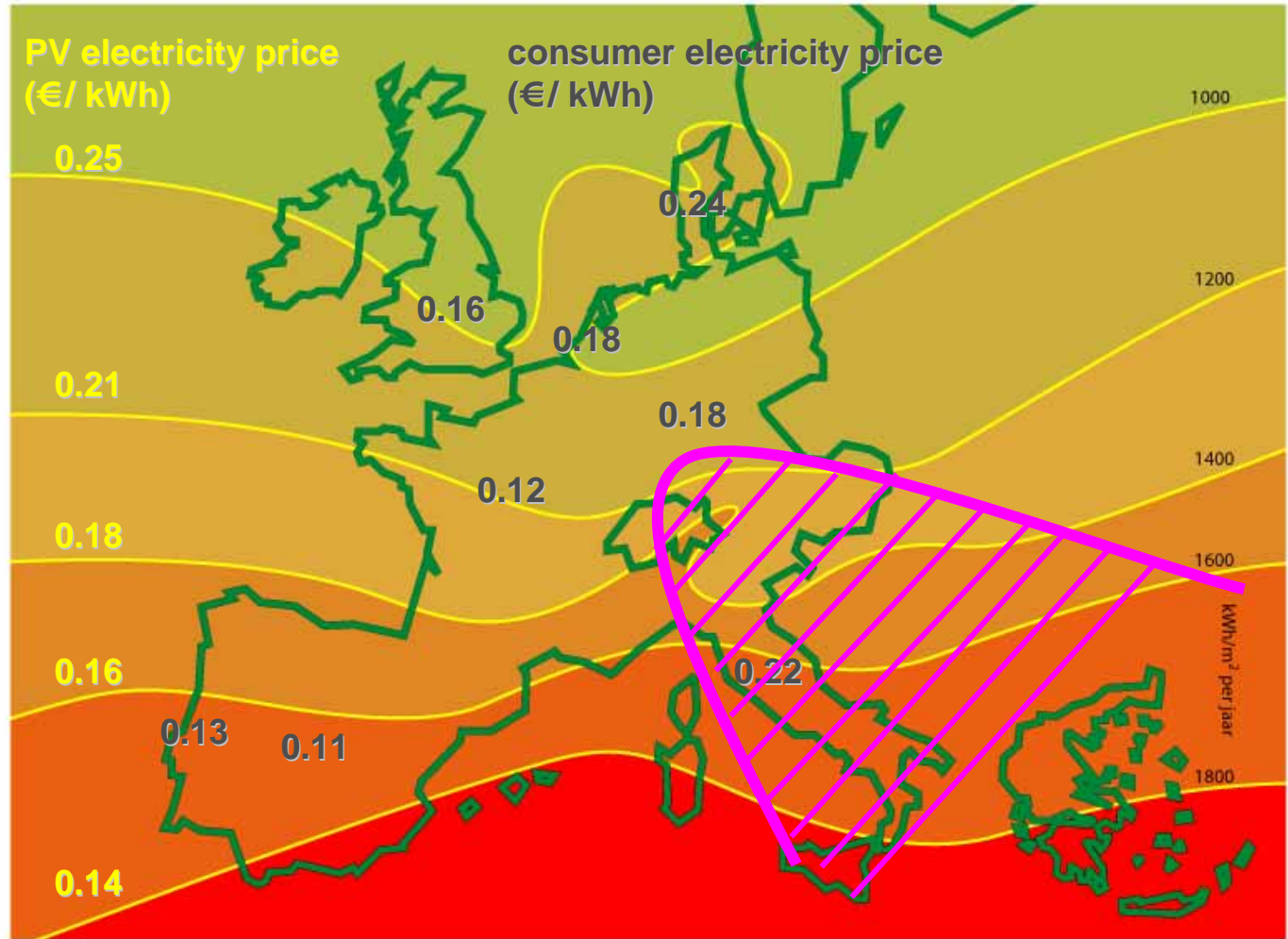
PV electricity prices
compared with
expected **consumer**
electricity prices
(+ 1%/yr)



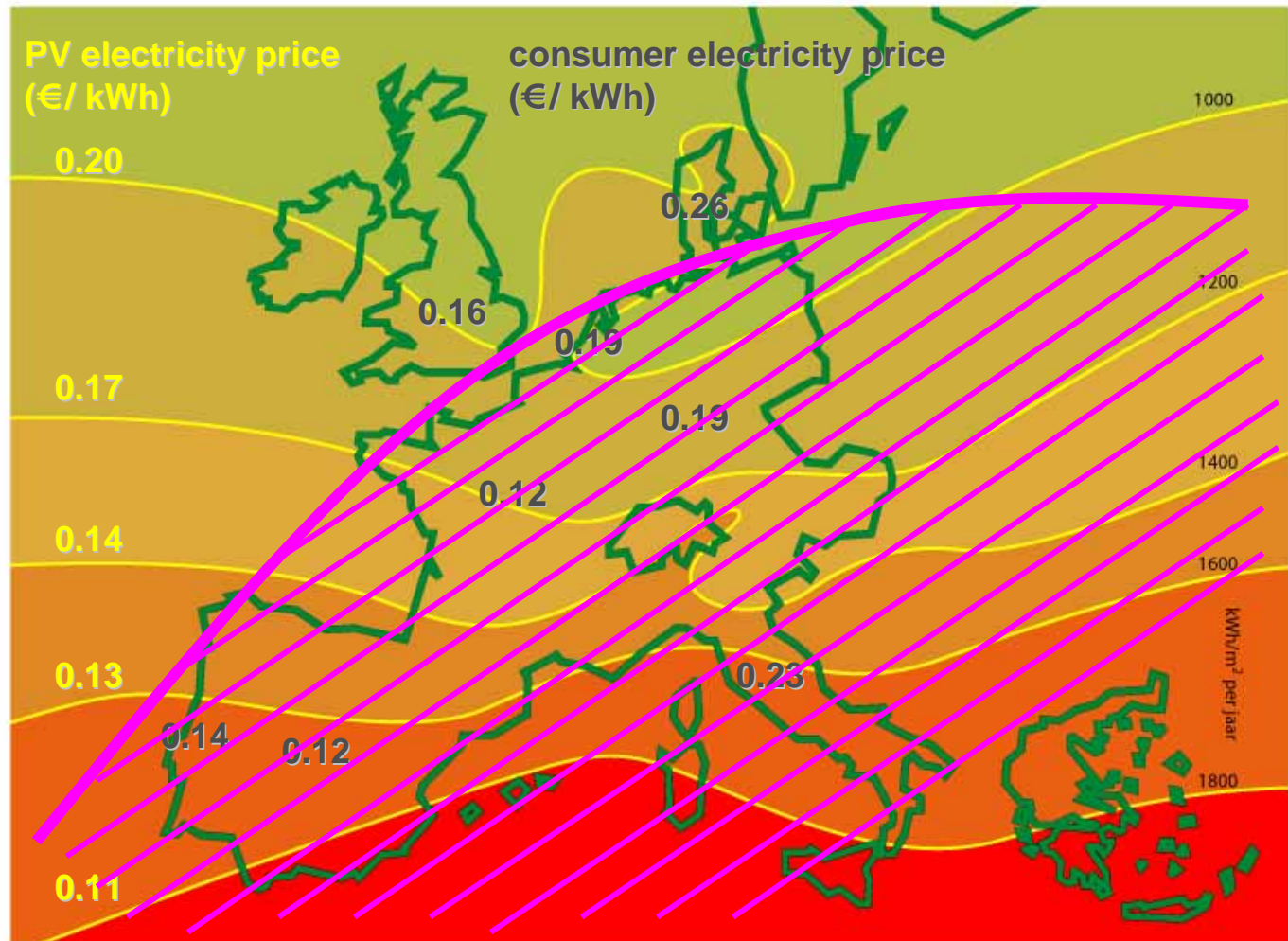
2015



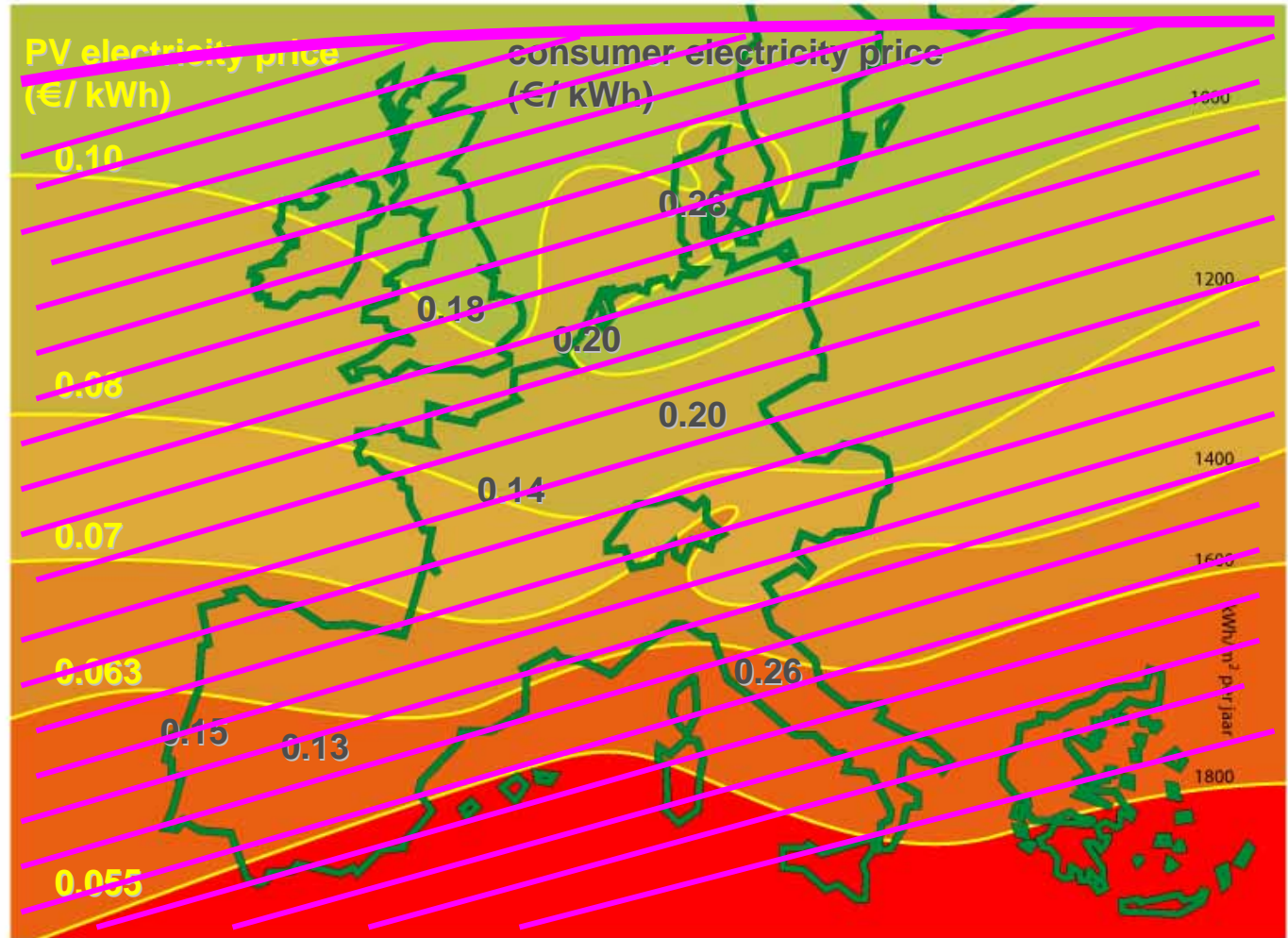
PV electricity prices
compared with
expected **consumer**
electricity prices
(+ 1%/yr)



2020



2030



PV electricity prices
compared with
expected **consumer**
electricity prices
(+ 1%/yr)