

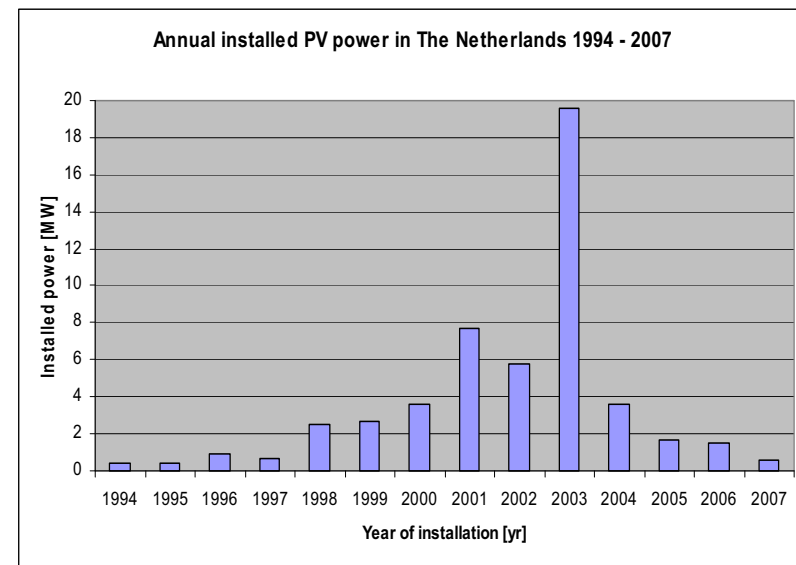
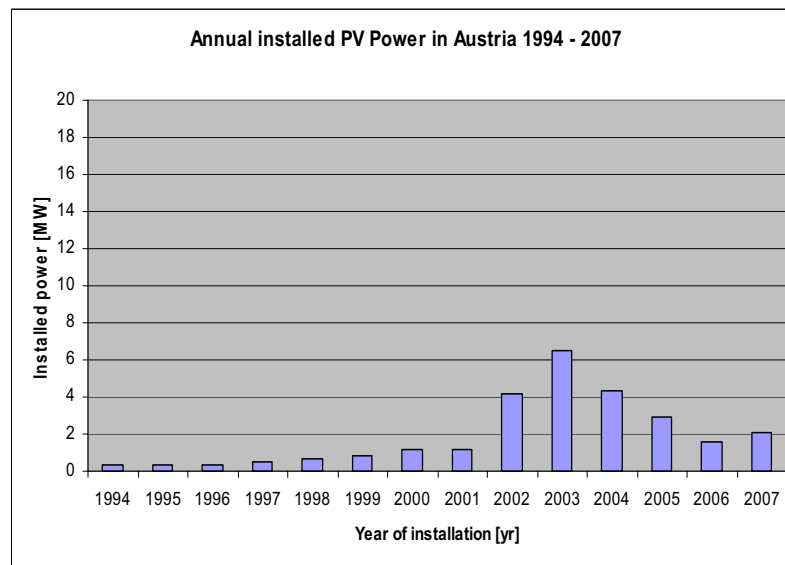


Joining Objectives
for Sustainable
World Energy
Solutions

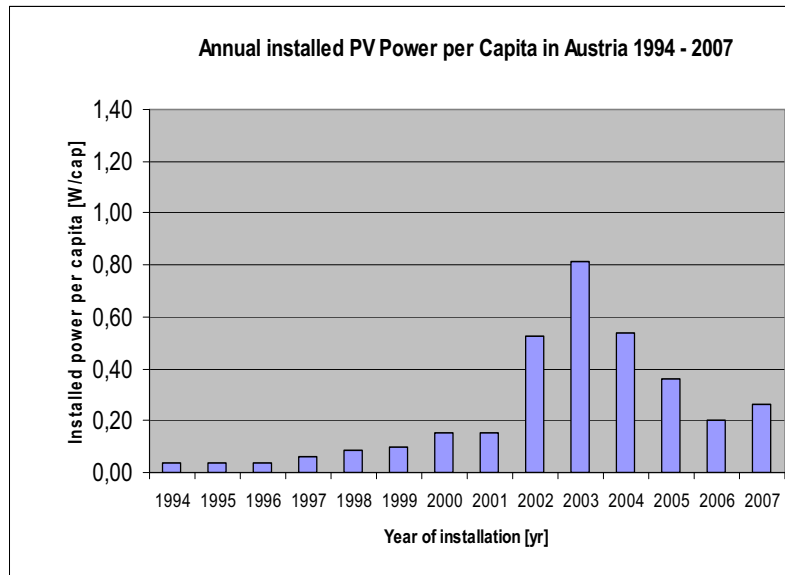
Impulses from Research for Industrial Development in the Netherlands

Job Swens
J-OB

Austria and The Netherlands - 1

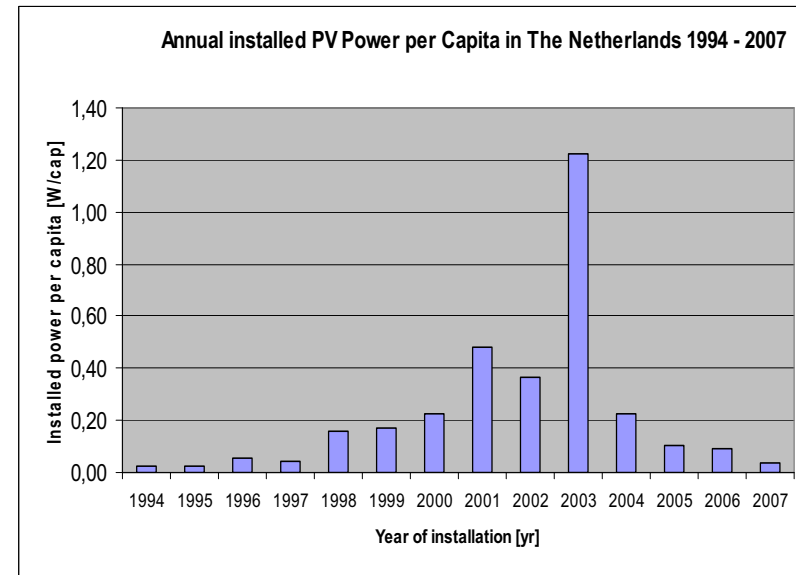


Austria and The Netherlands - 2



Cumulative installed power: 3,4 W/cap.

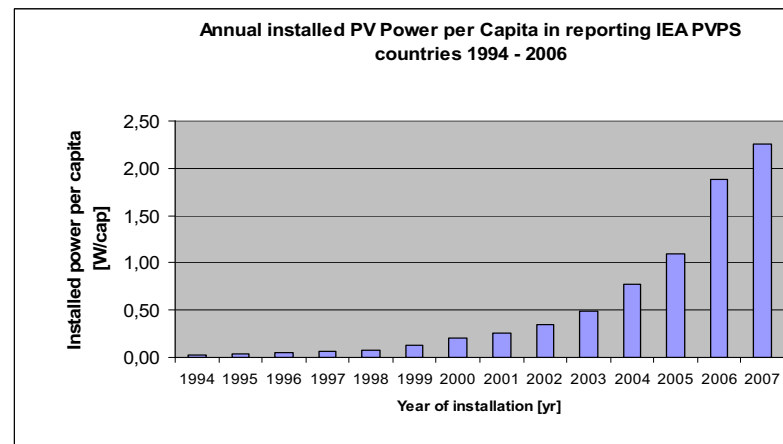
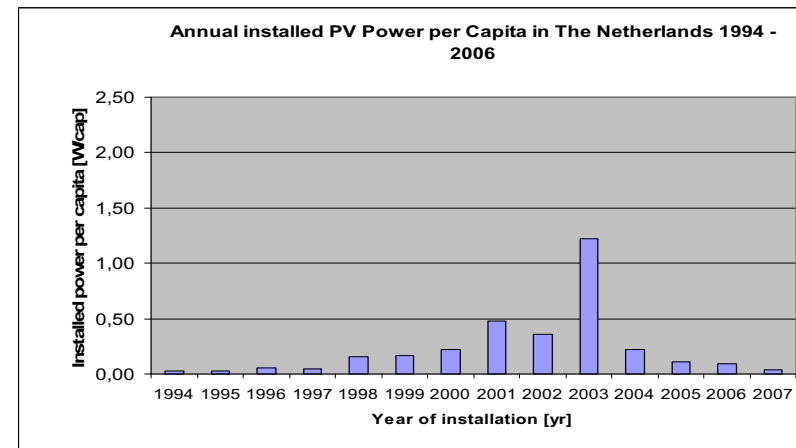
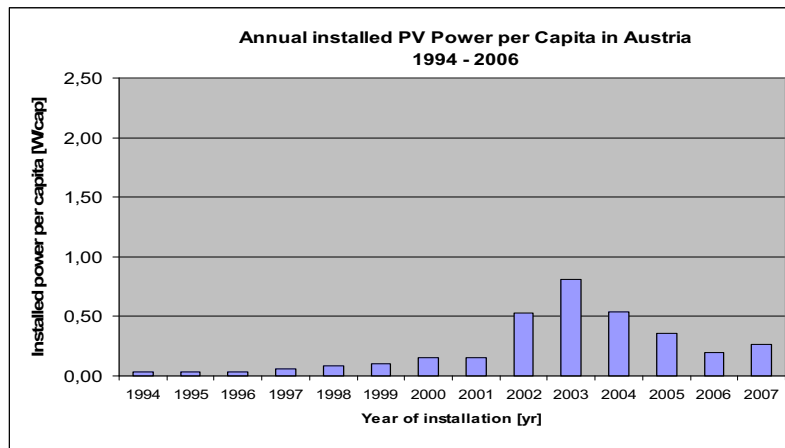
No. 6 on world ranking list



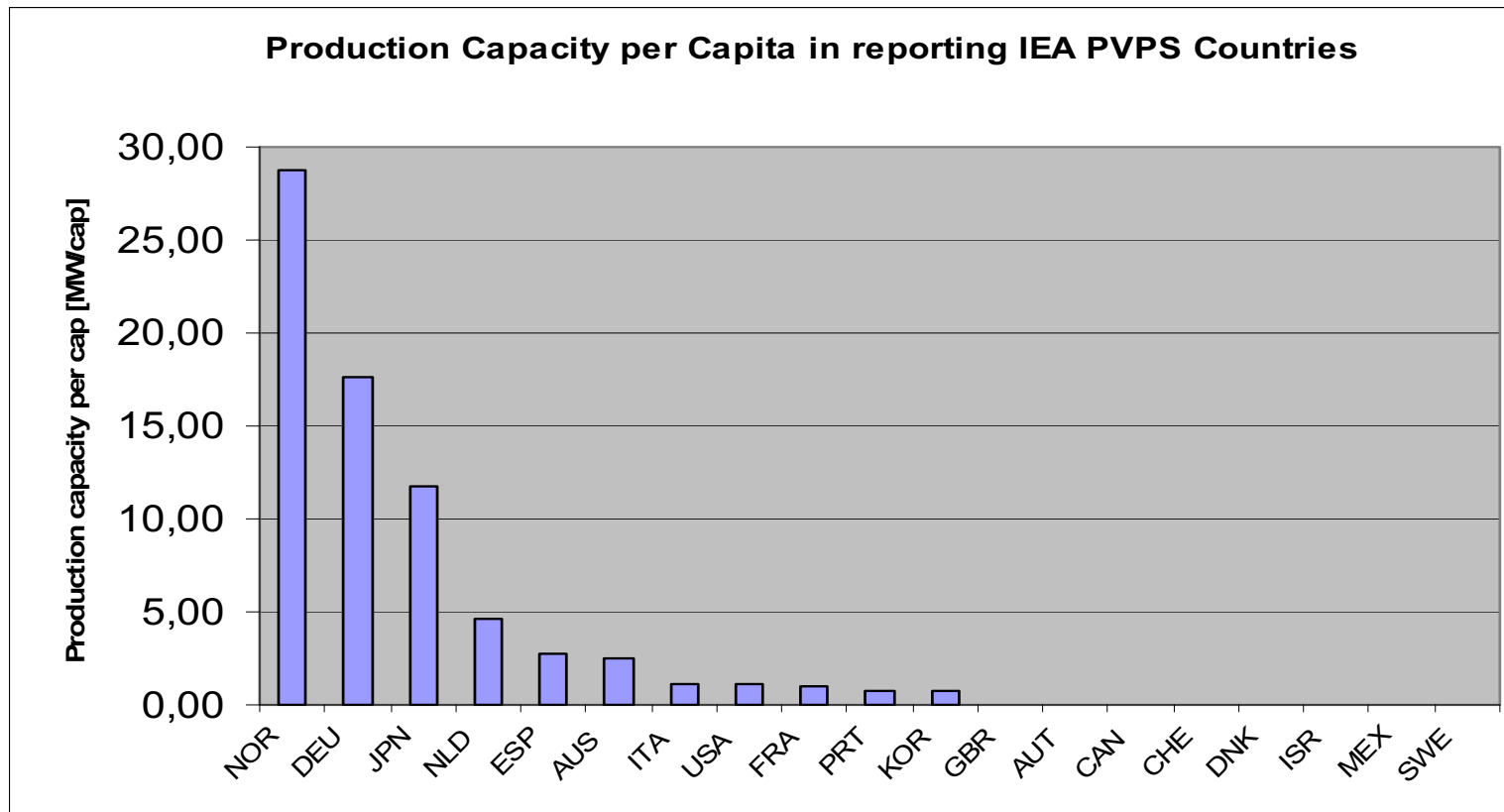
Cumulative installed power: 3,3 W/cap.

No. 7 on world ranking list

Austria and The Netherlands - 3



Austria and The Netherlands - 4



Content

- Dutch policies towards PV
- Implementation support
- RTD support
- Development of the Dutch PV Industry
- Conclusions

Dutch Policies towards PV

- 1982 - 2003:
PV is seen as an important RE option;
support slowly broadened from pure RTD to RTD, Demonstration and implementation
- 2003 - :
Kyoto and EU lead to a priority for competitive solutions
no support for PV implementation, focus on biomass and wind
PV RTD supported to enable long term contribution
- 2008 - :
Implementation support to complete product chain

PV implementation support schemes - 1

Historical overview

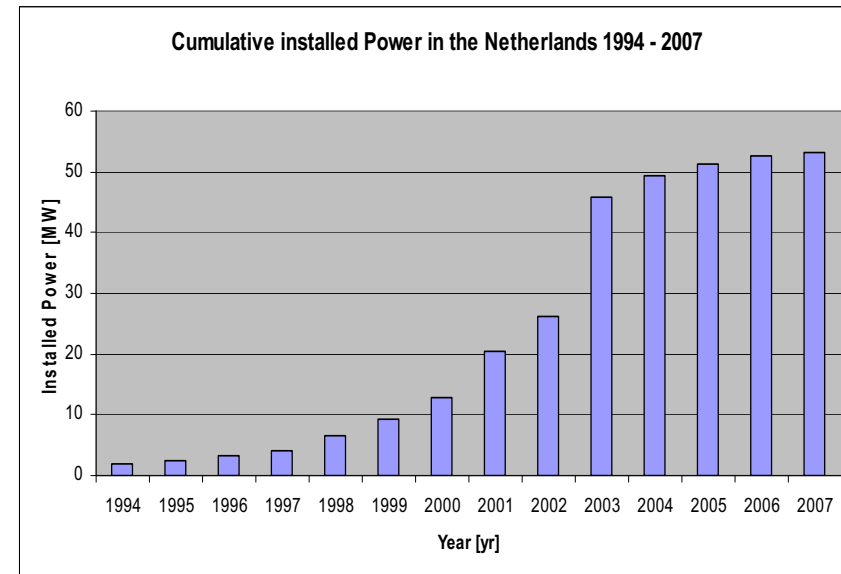
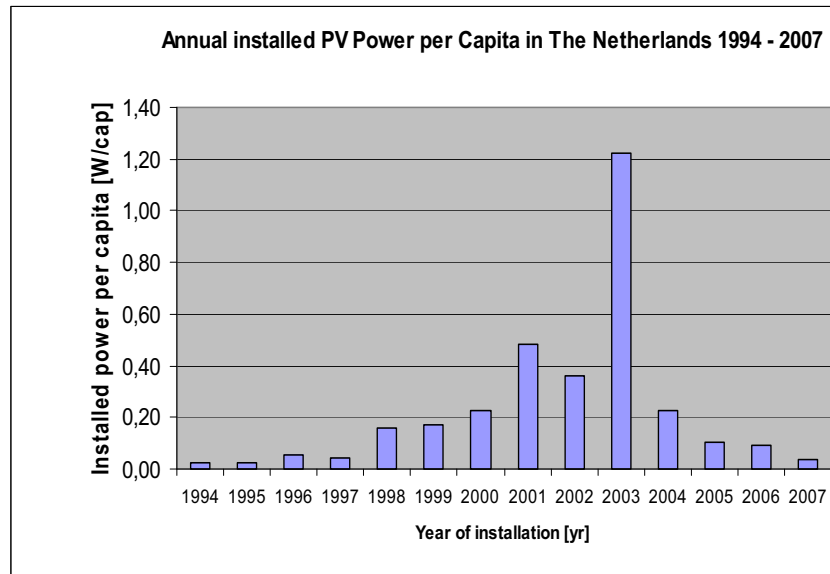
- 1997 – 2000: NOZ – PV : GO
tender programme, total budget: 20 M€
- 1998 – 2003: MAP (Environmental Action Plan):
investment subsidies, total budget 250 M€ for RE and EE
- 2001 – 2003: EPR (Energy Premium Regulation):
refund of € 3,50 - € 5,00 / W
- 2006 - : Net - metering:
up to 3000 kWh / yr (= 3 - 4 kW system), households only

Relation between market and instruments

Annual Dutch market

2000:	NOZ-PV:GO + MAP:	3,6 MW
2001:	MAP + EPR:	7,7 MW
2002:	MAP + EPR:	5,8 MW
2003:	einde EPR en MAP:	19,6 MW
2004:	--	3,2 MW
2005:	--	1,7 MW
2006:	Net metering:	1,5 MW
2007:	Net metering:	0,6 MW

Dutch PV market 1994 - 2007



PV installed in the Netherlands

Installed power (dec 2007):

- 53,3 MW
- 3,3 W/cap. (no. 7 in the world)
- Mostly small grid connected systems (0,4 – 0,6 kW)
- Large scale project in urban area's: Nieuwland (1,2 MW), HAL (-> 5 MW)
- Large scale roof-projects: Floriade (2,3 MW), Blijdorp (0,5 MW)

PV applications in the Netherlands



PV RTD support mechanisms

Historical overview

1984 – 2000: NOZ – PV (Dutch Research Progr. Solar energy – PV):

- RTD -> RTD + Demonstration -> RTD + Demo + Market Introduction
- from 5,5 M€/yr (1986) to 20 M€/yr (2000)

1996 – 2003: EET (Economy, Ecology, Technology):

- pre-competitive industrial research
- average PV: 5 M€ / yr

PV Support mechanisms

Historical overview (continued)

2001 – 2004: DEN (Renewable Energy for the Netherlands):

- RTD + Feasibility + **Knowledge Transfer**
- average PV: 2,5 M€ / yr

2002 – : NEO (New Energy Research):

- energy inventions
- average PV: 200 k€

PV Support mechanisms

Historical overview (continued)

2005 –: EOS (Energy Research Strategy):

- RTD and demonstration
- average for PV: 6 - 9 M€ / yr

EOS Programme - approach

New approach in Energy RTD Support:

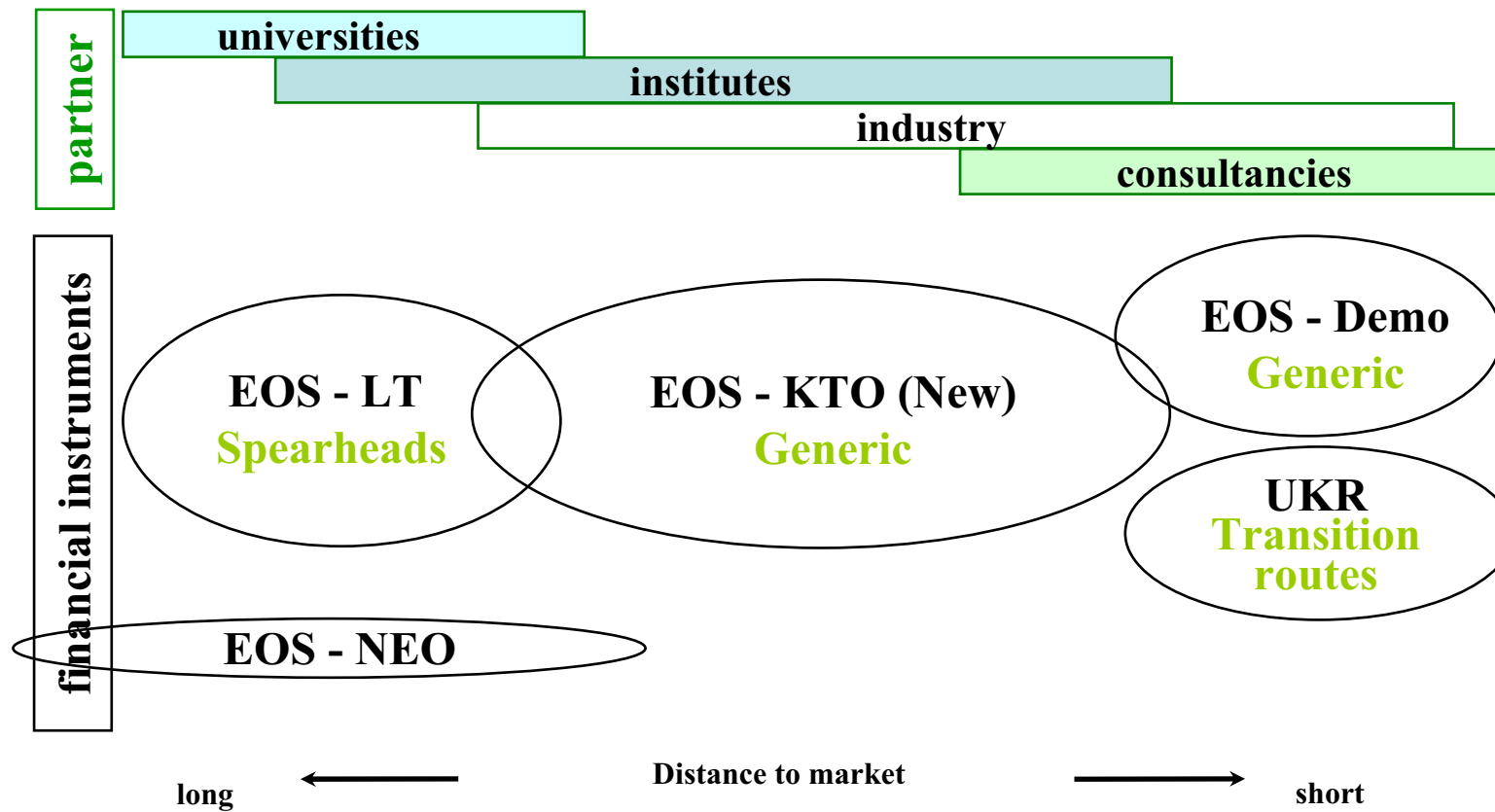
- One approach for energy research
- Coherent set of instruments
- Selection of spearheads in close consultation with market players
- Focus on areas of importance for future Dutch energy supply
- Division over strong area's and import area's

EOS Programme - characteristics

Programme aspects:

- budget: 100 M€ / yr
- 2 calls per year per sub-programme
- project selection by a appointed commission
- share of PV 9 % (2007: 9,4 M€)

EOS Programme - overview



EOS Programme – focal area's

- NEO: New Energy Research, focussing on new, unconventional ideas. Mainly intended for inventors.
- LT: Long Term, focussing on research on technologies, with impact between 2020 and 2050.
- **KTO: Short Term Research, focussing on transfer of research results to industry,**
- Demo: Demonstration, focussing on testing and demonstrating new applications in a realistic user environment.
- Transition UKR: Transition - Unique Opportunities Scheme, focussing on the application of renewables in general in unique situations.

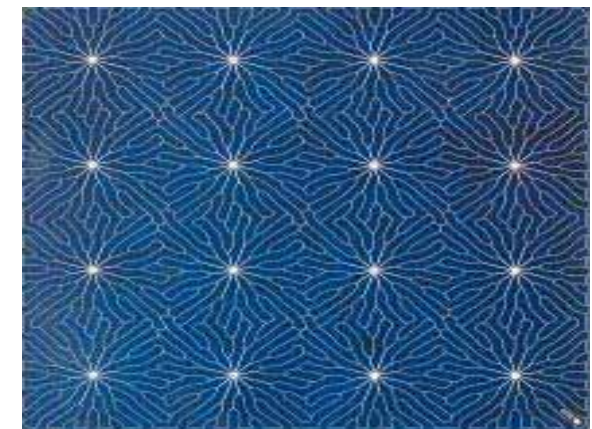
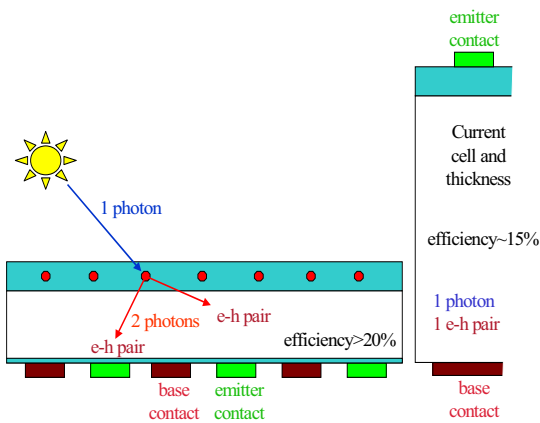
EOS Programme – KTO

Characteristics of the ES sub-programme:

- Proposal to be submitted by industrial entity
- Collaboration with at least 1 industrial or 1 scientific partner
- More than 1 industrial partner is preferred
- Funding for up to 25% of the development cost and 50% of the R&D cost
- Extra 10% funding when one of the partners is a scientific partner

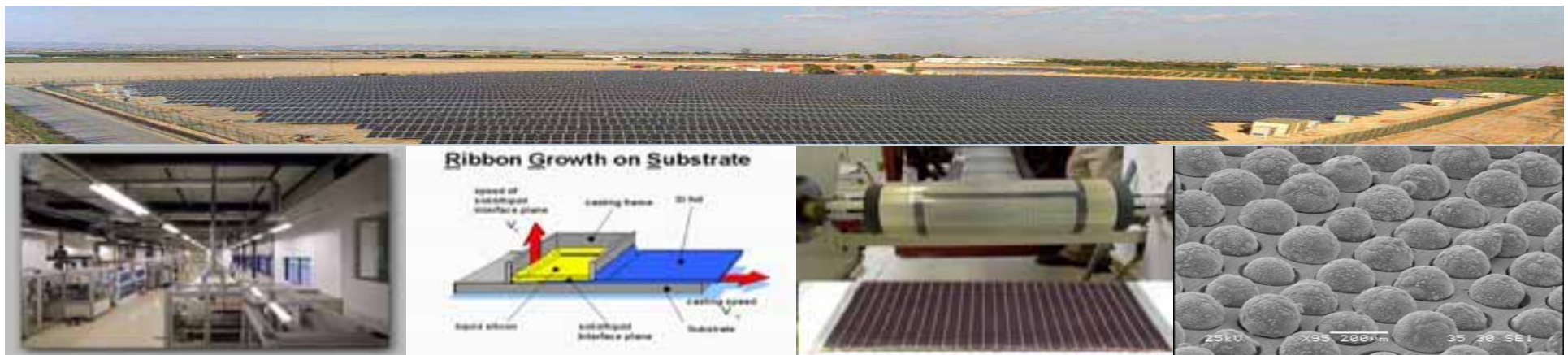
Dutch PV RTD (main players)

- ECN
- University of Utrecht
- University of Eindhoven
- University of Groningen
- Technical University of Delft
- TNO
- FOM - Amolf



Dutch PV Industry (main players)

- Solland Solar - Si - cell production (2007: >40 MW)
- Scheuten Solar - CIS – cell development, production in 2009
- NUON Heliantos - thin film Si – cell development, production 2009
- Ubbink - Si - module production (2007: > 5,6 MW)
- RGS Development - Si - wafer production development
- APA - CIS - cell development, production in 2009
- Econcern - Projects, mounting systems



Solland Solar

Started in 2005 on the Dutch / German boarder

Collaboration with ECN and University Utrecht

Cristaline Si; back-side-contact; PUM - cells

- 2005: Start production, production capacity: 20 MW/yr; 50 fte; ca 5 M€ turn over.
- 2006: 2^{de} line, production capacity 60 MW/yr; 90 fte; ca 50 M€ turn over.
- 2010: production capacity: 500 MW; > 500 fte; ca 1 miljard € omzet.

AkzoNobel

Research started in 1997; Construction Pilot line in 2005

Collaboration with University Delft and University Utrecht

Thin-film amorph Si; roll-to-roll process; η : 9% in 2010

- 2006: η (cell) = 5-6%, 30 cm wide, capacity of 0,5-1 MWp/yr capacity
- 2007/ 2008: Tandem cell on 1.20 m wide foiles; pilot capacity of 5 MW/yr
- 2009 -2013 : η = 9% cell, 1.20 m wide, capacity of ca. 90 MW/yr

Scheuten Solar

Nieuwe CIS process in NL

Collaboration with University Utrecht, ECN, TNO / Eindhoven

Sphere shaped CIS cells on metal foil, new sinter processes

2006: $\eta = 8\%$ for modules

2007: pilot line (10 MW/yr), $\eta = 8\%$ rendement, 30 fte

2008: capacity of 40MW/yr, 50 fte,

2009: production capacity: 290 MW/yr, 275 fte,

2011: production capacity: 590 MW/yr, 550 fte

2012: production line of 1 GW/yr, 1275 fte, production cost € 48/m²,
 $\eta = 10-14\%$, 0,55 €/W module cost prise.

Ubbink Solar

Strated March 2006 in Doesburg

Dutch / German company

Module production based on Solland Solar cells

- 2006: Start production, production capacity: 5 MWp
- 2010: production capacity 200 MWp

Conclusions - 1

- Implementation in the Netherlands has dropped dramatically since 2003, but is still in the top ten W/cap. list
- This drop has led to a number of bankruptcies amongst installers
- The drop was caused by an incoherent and badly structured support programme

Conclusions - 2

- The Netherlands still hold a very strong international position in PV RTD
- This position was created by careful programming in close consultation with stakeholders
- Based on the strong Dutch RTD position, a Dutch PV industry has grown against the absence of a national market

Conclusions - 3

An effective RTD support scheme has the following characteristics:

- covering as aspects of the innovation chain:
 - new idea's,
 - fundamental R&D,
 - applied R&D,
 - knowledge transfer,
 - demonstration and
 - production improvement
- taking into account the national expertise

Thank you for your attention

More information:

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