TBB. The Business Booster BY KIC INNOENERGY

New Era of Efficiency for PV-Cells

Optimized photon-management by optical nano-antennas

Marian Neusser (Dipl.-Math.)

Oct. 20th 2015 TBB Berlin

10-9 NTS NANO TECHNOLOGY SOLAR GmbH

Market demands and NTS-Solutions

PV-Market demands

→ **Increasing efficiency of PV-Moduls/Cells**

→ **Permanent cost reduction in ct/W**

↓

NTS-Solutions: 3 Technologies für optimized Photon management

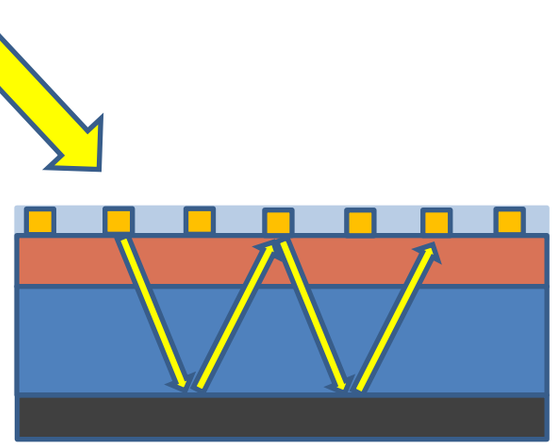
→**Catching Sunlight optimally and keeping Photons longer in PV-Cell**
→**Increasing share of useable photons in PV-Cell**
→**Increasing „Photon-Input“**

↓

Focus on NTS-Technology 1:
Functional surface on PV-Cell with optical nano-antennas

→**Increasing efficiency for +10% by means of ideal Photon-management**
→**Upgrade for installed cell-production-lines**
→**ROI for cell-manufacturers within 3-10 months**
→**NTS-Technology replaces the standard micro-structure of pyramids on PV-cells**
→**NTS-Technology sets new standard**

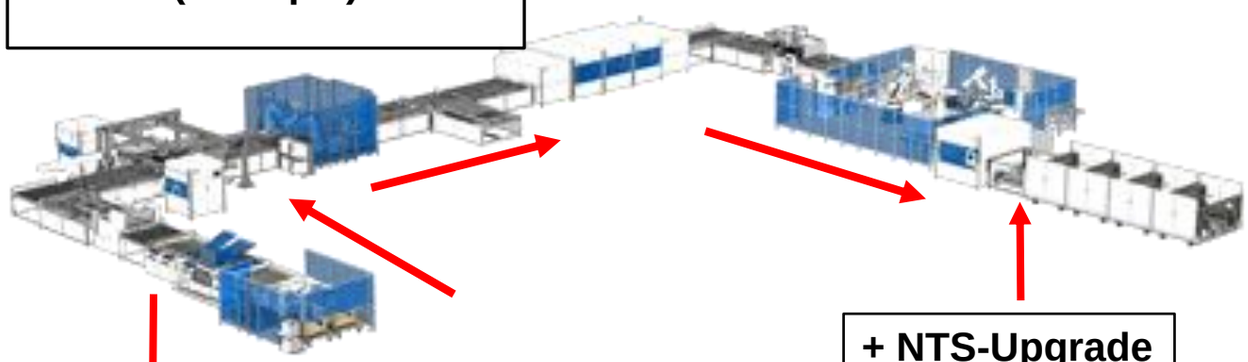
NTS-Technology 1:
optical nano-antennas



To catch more light
To keep photons longer in cell
= „Light Trapping“

NTS-Technology 1 – Target-market

Cell production line (example)



- **Process-Step Mikro-structuring**

+ NTS-Upgrade

NTS NanoTechnologySolar GmbH

Target market

Machine manufacturers for PV-Cell-production

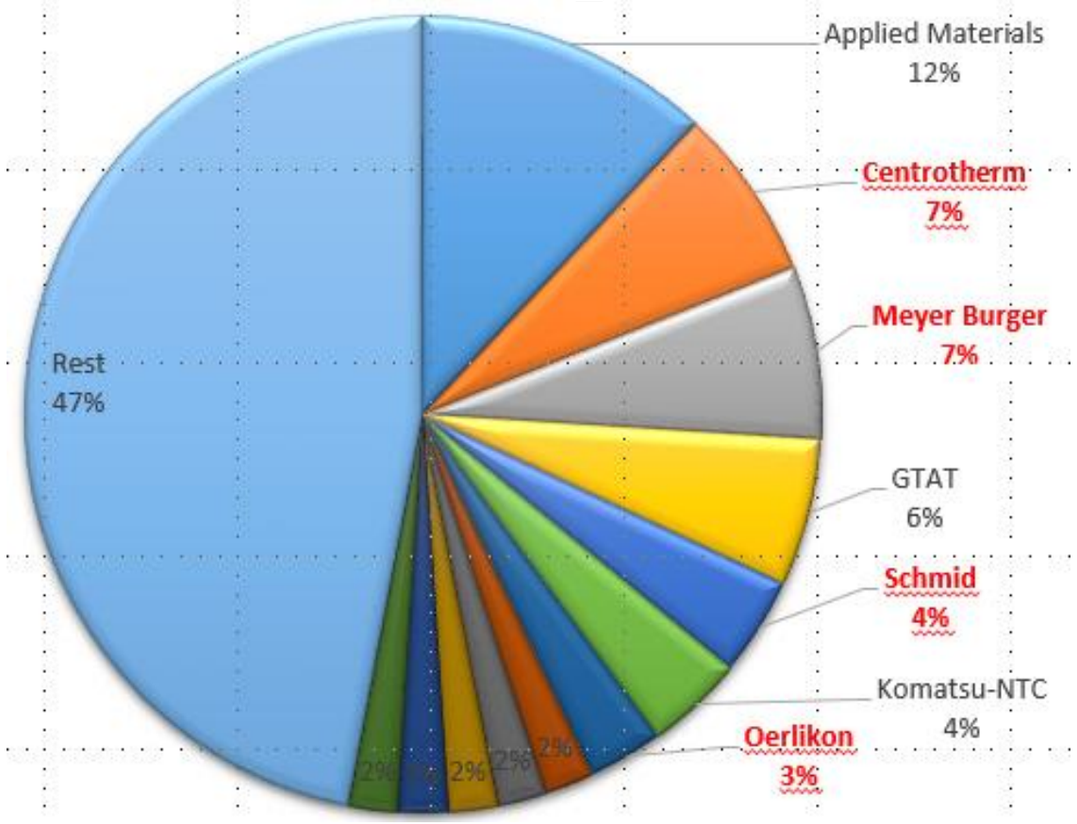
- **mono-/ multicrystalline Cells/Moduls**
- **Organic cells**
- **Thin film solar cells**

Challenges for Machine manufacturers:

Offering improved production lines (Turnkey-Line) and Process-Steps (Upgrade) for:

- **increase in efficiency** of the produced PV-cells
- **decreasing production costs** of the produced PV-cells

NTS-Technology 1
Market analysis and sales planning: Upgrade



SOM (Serviceable Obtainable Market):

→ 1 Named Account as pilot customer, more 2017 ff

→ Readiness for production planned for 2017

→ **Licence fees: 2017: 0,5 Mio. € with pilot cust.)**
2017: 2,0 Mio. €
2018ff: 7,5 Mio. € p.a.= 10% market

TAM (Total Available Market global) 2014:

Installed Production-Lines:	45 GW
→ Able to upgrade 2/3:	30 GW

→ **Licence-Potential: with 1 ct/W** (Minimum Case)
= 10 Mio. € /GW
= **300 Mio € for total market of 30 GW**

→ Market growth p.a. 15% = 4,5 GW p.a.

SAM (Serviceable Available Market) 2014:

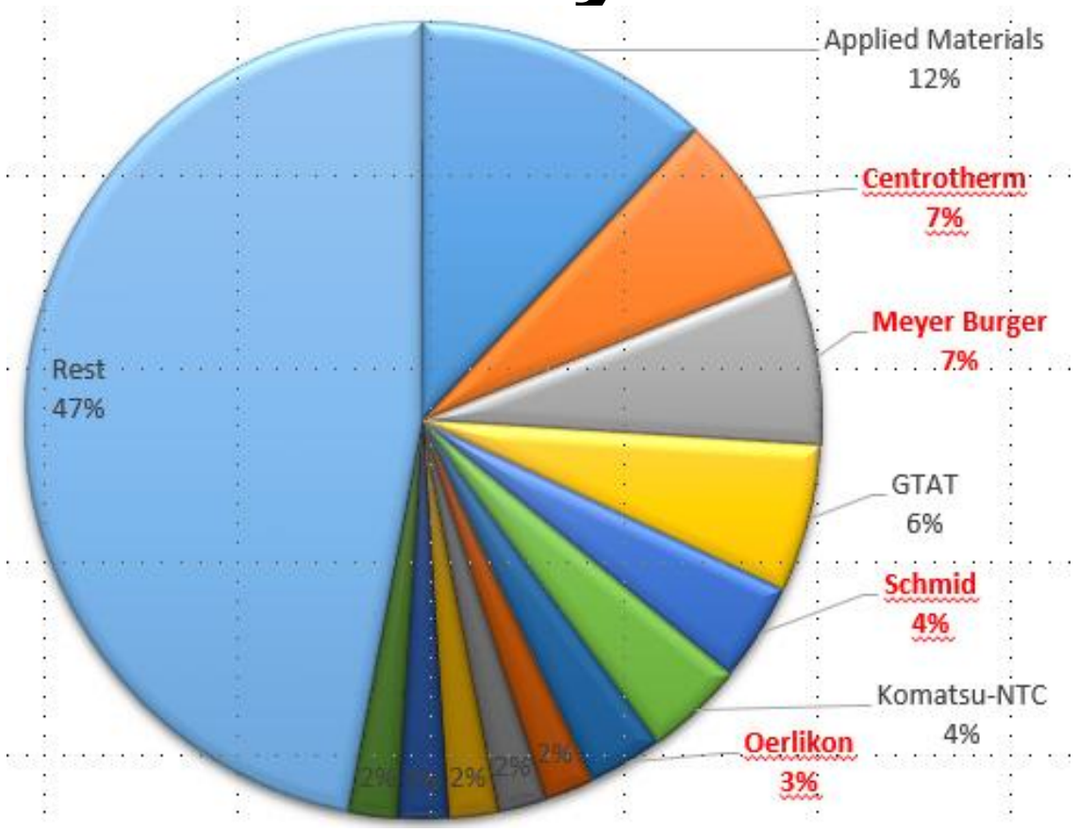
Market share Mach. Manufacturers D+CH:	60% = 18 GW
Market share Top12 global:	50% = 15 GW
Market share in Top12 from D+CH:	25% = 7,5 GW

→ **Target market regional 7,5 GW (6 Named Accounts)**

→ **Licence-Potential = 75 Mio. €** (target market regional)

TBB. The Business Booster BY KIC INNOENERGY

NTS-Technology 1
Market analysis and sales planning: New lines



SOM (Serviceable Obtainable Market):

→ 1 Named Account of target market as Development-partner and Pilot-customer

→ Readiness for production planned for 2017

→ **Licence-fees: 2017: 1 Mio. € with Pilot-customer**
2018ff: 2,25 Mio. € p.a.
(= 10% of target market)

TAM (Total Available Market global) 2014:

New Production lines: 9 GW

→ **Licence-Potential: with 1 ct/W** (Minimum Case)
= 10 Mio. € /GW
= **90 Mio € p.a. for total market of 9 GW**

→ Market growth 15% = 4,5 GW p.a.

SAM (Serviceable Available Market) 2014:

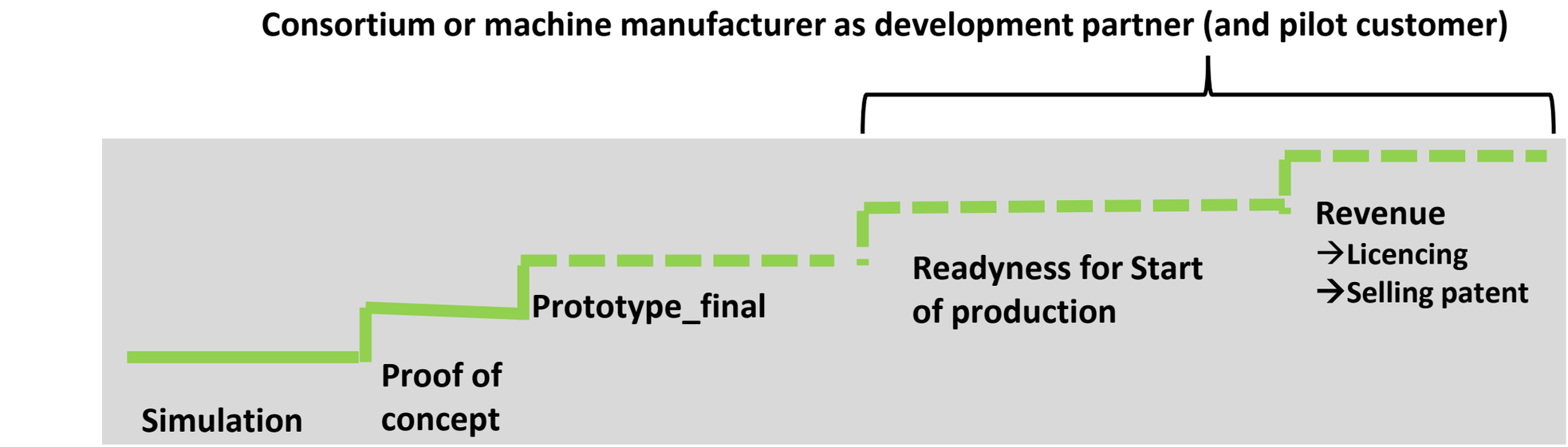
Market share Mach. Manufacturers D+CH:	60% = 5,4 GW
Market share Top12 global:	50% = 4,5 GW
Market share in Top12 aus D+CH:	25% = 2,25 GW

→ **Target market regional 2,25 GW p.a. (6 Named Acc.)**
Licence-Potential = 22,5 Mio. € p.a. (target market)

TBB. The Business Booster BY KIC INNOENERGY

10-9 NTS NANO TECHNOLOGY SOLAR GmbH

NTS-Technology 1
State of development and forecast



to market →

State at 10/2015:
- Simulation finished
- Labor-Prototype
- Patent filed (D +PTC)
- Investor for Prototype final

Next steps:
- Prototype_final
- Development readiness for production/ Integration in production line within Consortium/Joint Venture
- Revenue (Licencing)

Roadmap and capital-needs for Technology 1

Optimistic-Case:	Prototyp_final:	T0 + 3 M.
	Readyness for Start of production:	T0 + 15 M.
	Market entry = First Installation.	T0 + 18 M.
Business-Case:	**Prototyp_final:**	**T0 + 6 M.**
(T0 = 01.08.2015)	**International patents: Capital-need: 100.000 €**	**Feb. 2016**
	Readyness for Start of production:	**T0 + 21 M.**
	Capital-need: 250.000 €	
	Market entry = First Installation:	**T0 + 24 M.**
	Capital-need: 50.000 €	
Pessimistic-Case:	Prototyp_final:	T0 + 12 M.
	Readyness for Start of production:	T0 + 33 M.
	Market entry = First Installation:	T0 + 36 M.

Thank you
Any questions?

facebook.com/kicinnoenergy
twitter.com/KICInnoEnergy
linkedin.com/company/kic-innoenergy
youtube.com/user/InnoEnergy

eit | European Institute of Innovation & Technology

KIC InnoEnergy is supported by the EIT, a body of the European Union