Say hello to solar. Wherever you are

"Solar Film" Introduction



Say hello to solar. Wherever you are

Executive Summary



Background	• Specialized in the production of organic solar films based on proprietary IP		
	 Founded in 2006 out of two leading universities 		
	 HQ in Dresden (Germany), the leading organic electronic cluster in Europe Development Centers in Dresden (Physics) and Ulm (Chemistry) 		
Achievements	 World leading OPV efficiency of 10.7 % 		
(04/2012)	 Successful proof of concept with its first R2R production tool in Dresden 		
	 Backed by leading industry (Bosch, BASF, RWE) and venture capital (Wellington Partners) 		
	 Raised €28 M to date, plus >€10 M in public funding 		
Objectives	• Commercial ramp-up by Q3 2012		
	 Raise €60 M in round C by Q3/Q4 2012 to expand capacity 		
	 Invest in R2R line with 1 m width and 75 MW_p capacity 		
	- Fab-2 invest starting in Jan 2013		

Our 4 Core Competencies

Unique in-house feedback loop for continuous improvement



Materials development

Chemistry lab in Ulm with 11 chemists specialized in organic materials

OPV business development

Experienced management and solar specialists for market entry



Stack architecture

Physics lab in Dresden with 14 physicists specialized in organic electronics

R2R production

First production site in Dresden with 23 engineers and operators

Organic Electronics: A Disruptive Technology The future starts now





Development History of Photovoltaics Towards the third generation of photovoltaic technology





Chemistry: Materials Development

Powerful absobers with superior properties



Heliatek develops and synthesizes Smolecules[™] at its own chemistry lab:



 \blacklozenge Accelerated cycle of learning \rightarrow Faster efficiency improvements

Patented Smolecules[™] → Defendable barriers

Physics: Tandem Devices Patented, highly efficient tandem cells



Heliatek designs and optically engineers tandem cells:



Efficiency Development Continuous progress meeting business plan milestones





Lifetime: Stable Oligomer Cells Glass-glass encapsulation

Say hello to solar. Wherever you are



Aging tests performed on 8.3% record cell

Still > 95 % efficiency after 1,800 hrs both in light soaking test and at 85 °C

- Extrapolated light soaking lifetime T80: 13,600 h (equals approx. 24 yrs.)
- Extrapolated heat lifetime T80: 12,200 h
- Even the 9.8 %-cell can stand 1,000 h at 85 °C with less than 5 % degradation

Vacuum deposition of small molecules

Oligomers vs. Polymers: The right choice

Oligomers enable the use of well defined, high purity materials

- They have defined lengths
- No need of extended solvating side-groups
- Purification by gradient sublimation
- No need for solvents (chlorinated, potentially toxic)
- Oligomers enable the preparation of optimized multilayer devices
 - Ideally suited for preparing tandem cells
 - Avoid interface degradation by adding dedicated (doped) interlayers
- **Established, reliable method** for large scale manufacturing (e.g. OLED)
- Linear sources up to 2 m wide are available for homogeneous deposition
- In both cases, cost structure is not dominated by equipment costs but by material costs







Polymers

Unique R2R vapor production

Precise and homogenous production process for little upscaling losses





Roll-to-roll process

- Continuous process
- 500 m long rolls
- 0.30 m wide web



Vapor deposition

- Linear sources
- Homogenous
 deposition
- Multi-layer stack
- Low temperature (120 °C)



Laser structuring

- Precise process
- Ultra narrow scribes
- Minimum area losses

© Heliatek GmbH www.heliatek.com

Our Factory: Line 1

Scalable and modular manufacturing

- Only 1,200 m² foot print
- Only 6 operators/shift
- Only 1 g/m² organic material
- 🌻 Only grey room
- Only 120 °C process temperature
- 🜻 No indirect material
- 🌻 No gas
- No obsolesence of capex with efficiency improvement



Test

Winding

Gate

Laser P1

Vacuum

Roll Coater



Material Flow

Front End Back End

Quality

Support



Control Center

Key Benefit #1: Ease of integration The future is light



Robust, ultra-thin and ultra-light solar films allow for easy integration



June 2012

Key Benefit #2: New Solar Aesthetics The freedom of possibilities



Our solar films can be tailored to your design requirements:



- Custom-designed dimensions
- 🌻 Flexible
- Numerous colors
- Adjustable transparency levels
- 🎐 Homogeneous surface
- Less than 1 mm thick solar films

Key Benefit #3: Superior Harvesting Factor



Smolecules™ with a big impact

Superior low light characteristics

put others in the shade:



Perfect for northern regions, façades or applications with poor orientation.

High temperature resistance

to stay cool under pressure:



Perfect for hot, southern regions or applications with little ventilation.

Key Benefit #4: The TRULY green solar technology Consistently green solar energy

- Extremely short energy payback time (< 6 months)</p>
- Only 1 gram organic material per m2
- Low energy used in production thanks to low process temperatures
- Toxic-free manufacturing process
- Only organic materials, no heavy metals in cells
- Produced with abundant materials, without risk of shortages
- Easy disposal at end of life cycle







B2B Business Model

Adding functionality to traditional applications





Range of Possible Product Applications Solar films can be integrated in a variety of materials



Foils Concrete Polycarbonate Text. membrane **PVC membrane** Metal of state same AAN Glass Electronics

iDistributor Our B2B•2C Concept: Added Value for your portfolio







Development Scenario On our way to "Say hello to solar. Wherever you are"



	Short Term	Medium Term	Long Term		
	2012-2014 Energy-2-go, small off-grid systems	2015-2017 BIPV, Larger off-grid, automotive & transport	2018 ff On-roof standard PV, large PV power plants		
Volume	 Efficiency: 58 % Lifetime: 8 yrs Capacity: 2 to 3 MW_p Costs > industry average 	 Efficiency: 1012 % Lifetime: 20 yrs Capacity: 50 to 300 MW_p Costs = industry average 	 Efficiency > 12 % Lifetime > 25 yrs Capacity: > 500 MW_p Costs < industry average 		
	Time				

The future is light Organic Photovoltaic Films

Thank you for your attention.

www.heliatek.com



Say hello to solar. Wherever you are