



# Discover the Art of Flexibility Adaptable – Reliable – Bankable



Dear Stakeholders,

The following pages provide you with an in-depth overview of Energy Conversion Devices (ECD), United Solar Ovonic ("United Solar") and Solar Integrated as a base for a sound investment decision.

United Solar is the world leader in the manufacture of lightweight, flexible solar modules and the second largest thin-film supplier worldwide. Solar roofing systems using *UNI-SOLAR*<sup>\*</sup> brand products are generating clean electricity in more than 19 countries around the globe. Together with its subsidiary the turnkey solutions provider Solar Integrated, United Solar has decades of experience in solar cell manufacturing and project management.

Our valued blue chip end customer base includes companies like Airbus, Coca-Cola, General Motors and Lidl.

Our cadmium-free amorphous silicon solar cells render higher energy yield under real outdoor conditions. The lightweight, flexible PV-laminates are particularly suitable for the roof integrated market and special applications. Together with our building materials channel partners we provide products for virtually every roof type.

Our proprietary roll-to-roll production process is ideal for mass production and allows us to scale capacity quickly according to demand.

Based on the current global economic stimulus plans we expect the economy and our industry to rebound and to lead to a renewed growth in the renewable energy market. ECD, United Solar and Solar Integrated complement one another and are well positioned to operate successfully on the solar and the developing electric mobility and smart grid markets by providing best possible system solutions and know-how.

Striving to provide you with highest product and service standards, we are looking forward to working with you.

Yours Sincerely,

Mark Morelli President and CEO Energy Conversion Devices, Inc.



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This document may contain forward-looking statements within the meaning of the Safe Harbor Provisions of the Private Securities Litigation Reform Act of 1995. Forward-looking statements include statements concerning our plans, objectives, goals, strategies, future events, future net sales or performance, capital expenditures, financing needs, plans or intentions relating to expansions, business trends and other information that is not historical information. All forward-looking statements are based upon information available to us on the date of this release and are subject to risks, uncertainties and other factors, many of which are outside of our control, which could cause actual results to differ materially from the results discussed in the forward-looking statements. Risks that could cause such results to differ include: our ability to maintain our customer relationships; the worldwide demand for electricity and the market for solar energy; the supply and price of components and raw materials for our products; and our customers' ability to access the capital needed to finance the purchase of our products; and risks associated with integrating Solar Integrated Technologies, Inc. The risk factors identified in the ECD filings with the U.S. Securities and Exchange Commission, including the company's most recent Annual Report on Form 10-K and most recent Quarterly Report on Form 10-Q, could impact any forward-looking statements contained in this document.

# **Company Overview**



### UNITED SOLAR -

### Flexible thin-film technology at its best

United Solar is a wholly owned subsidiary of Energy Conversion Devices, Inc. (ECD) (NASDAQ:ENER). ECD is an American technology leader in renewable energies and holds a vast range of patents. United Solar draws on ECD's extensive and fundamental know-how from materials and production technology to the final product.

The company's roots go back to the 1970s making United Solar one of the most experienced companies in photovoltaics ("PV"). UNI-SOLAR PV-laminates are offered through a global network of roofing material manufacturers and solar system integrators.





The innovative PV-laminates integrate easily with membrane, modified bitumen and metal roofing to create ideal solutions for commercial, governmental, military and educational institution rooftops.

United Solar's proprietary roll-to-roll manufacturing process enables mass production for mass markets.

# **Energy Conversion Devices**

Energy Conversion Devices is a leader in renewable energy technology.

The company has almost 50 years of experience with amorphous materials and 18 years of experience in the field of lightweight, flexible thin-film module production.



In addition to its solar activities, Energy

Conversion Devices is also active in the fields of energy storage and information technologies. The company invented the nickel hydride battery, which is used in every hybrid vehicle manufactured today, and is actively developing nickel hydroxide, fuel cell and other hydrogen technologies.

These technologies are expected to play a vital role in the further development of the market activities to offer automotive, electro mobility and smart grid solutions.

Energy Conversion Devices' total consolidated revenues for FY 2009 were \$ 316 million.





Energy Conversion Devices' main areas of corporate activity



# United Solar

### The Company

United Solar's global headquarters are located in Rochester Hills, Michigan. The European headquarters is in Paris, France, with branch offices in Germany, Italy and Spain.

### **Company Milestones**

1977: ECD develops the first flexible solar cell

- 1981: Prototype roll-to-roll production machine
- 1990: Foundation of United Solar
- 1996: 5 MW PV-laminate production capacity
- 1997: First rooftop PV-laminate installation
- 1998: PV-laminates on the Mir space station

2008: Construction of world's largest rooftop PV-system on the GM plant in Zaragoza, Spain

#### Quality

Up to today, United Solar has produced and delivered more than 400 MW of thin-film products with less than a 0.01 % return rate.

United Solar's manufacturing facilities have currently a combined capacity to produce 150 MW annually and its products are accorded BIPV status in all major sales markets. Patents and Intellectual Property We maintain an extensive patent portfolio presently consisting of approximately 300 U.S. and foreign patents to which we are regularly adding new patents based upon our continuing research and development activities. Importantly, our portfolio includes numerous basic and fundamental patents covering not only materials but also the production technology and products we develop. Based on the breadth and depth of our patent portfolio, we believe that our proprietary patent position is sustainable notwithstanding the expiration of certain patents. We do not expect the expiration of any patents to materially affect the business prospects of any of our business segments.



# Market and Distribution

### **Target Segments**

United Solar focuses on rooftop applications, mainly Building Integrated PV (BIPV) but also provides products for the large Building Applied PV (BAPV) market and solutions for residential and certain ground-mounted applications.

### **Regional Distribution of Sales for 2009**



The regional distribution of United Solar's sales underlines its global presence and focus on markets, which favour BIPV.

This broad base of distribution reduces United Solar's dependence on individual markets and subsidy programs.

Particularly the installations in Asia prove that United Solar does not only possess an attractive technology but also the means to overcome administrative hurdles, which pose a market entrance barrier to other solar companies.



# Differentiation

### **Integrated Supply Chain**



United Solar is fully vertically integrated from cell deposition through to module production and project implementation via its sister company Solar Integrated.

The advantage of this strategy is direct customer access with limited logistic expenditure, thereby reducing cost to market.

### **Differentiation and Cost Reduction**

In the global thin-film market, United Solar holds the position of a well-established leader with a highly differentiated product. This strategy secures a solid position in future markets (e.g. BIPV) and further underlines United Solar's approach to developing innovative products / concepts for new large-scale markets. United Solar also concentrates on reducing the overall costs of the PV-laminates by streamlining its production process as well as increasing its capacity to enable economy of scale effects. Additionally, reduction of balance of system costs was one of the major drivers for the integration of Solar Integrated into the ECD group.



Source: EuPD Research 2009



# Sales Strategy

# Lean Distribution Channels

United Solar focuses on four specific distribution channels:

- Building materials / roofing supply companies
- System integrators and solar wholesalers
- EPC contracting
- Utilities / developers

System integrators and solar wholesalers sell or integrate the UNI-SOLAR PV-laminates directly.

Building materials and roofing supply companies serve as OEM partners and integrate the UNI-SOLAR PV-laminate to their specific building or roofing products to sell as a complete product.

For large, complex projects United Solar maintains the option of serving these directly or via its Solar Integrated business, using channel partner products to provide the best possible system solution for the specific customer project.

United Solar focuses on long-term relationships with renowned key accounts and has been doing business with many U.S. and international partners for more than a decade.



# **Channel Partners**







SOLAR DEPOT - Mannie





# Solar Integrated

The Turnkey Solutions Provider

The newly acquired Solar Integrated plays a vital role in completing large and complex projects.



Solar Integrated was founded in 2002 and is the expert on rooftop PV-installations. As a spin-off of Southern California Roofing, Solar Integrated draws on more than 80 years of experience in construction and project management. Through the end of 2008 Solar Integrated had more than 350 projects with a capacity of over 30 MWp installed.



Regional distribution of sales 2005–2008

### We've Got You Covered ...

As a global solar solutions provider, Solar Integrated combines various technologies to develop the best PV-system for every customer's specific needs. While focusing on building integrated or building applied systems, Solar Integrated also offers innovative solutions for special applications, which demonstrate Solar Integrated's expertise with intricate projects. Solar Integrated incorporates channel partners products to offer many different solutions with the *UNI-SOLAR* PV-technology. Additionally, a roof tracking system for high-efficiency crystalline modules complements the portfolio for roofs without weight constraints.











# Meeting Customer Expectations

### **Buyers Value Our Product Characteristics**

Customer research was conducted by EuPD Research based on 19 interviews with channel partners from different regions. The following graph shows that the three main UNI-SOLAR PV-laminate product attributes are also the most commonly associated product characteristics.



Source: EuPD Research, November 2009

### **Importance of Product Characteristics**

These product attributes are of highest importance in the purchase of UNI-SOLAR PV-laminates.



Source: EuPD Research, November 2009

UNI-SOLAR.

# **Customer Perspectives**

### Image

United Solar's image with customers is positive. Particularly the unique selling point of the lightweight, flexible PV-laminate and the high product quality are appreciated by our customers and considered an important contribution to the market success of their solar products.



# Quotes from Customers

"The UNI-SOLAR product is uniquely suited for rooftop applications because it is lightweight, provides superior electricity generation and integrates directly into the roof structure."

"If I would recommend it, then my competitors would also buy UNI-SOLAR modules and I do not want that to happen." "We have obtained very positive feedback from our customers on the UNI-SOLAR product."

"UNI-SOLAR laminates are a natural fit for us, because they can be integrated directly into roofing materials and provide a faster return on investment than competitive solar products."

"Higher prices are generally justified because of good quality."

"Great product."

# Blue Chip End Customers

Retailers
Aldi
Carrefour
Colruyt
Condis
K-Mart
Ikea
Intermarché
Lidl
Metro
Rewe
Super U
Target
Tesco
WalMart
Westfield

### Manufacturers

Boeing Brillux Coca-Cola Coperfil Chevron Texaco Diesel Frito-Lay General Electric General Motors Honeywell Pepsi Cola Picard Schindler Johnson Controls

Siemens

Toyota

vw

# Logistics FM-Logistics ProLogis

# Miscellaneous

Serena Pacific

Impernovo Republic Services Unibail-Rodamco UPC Solar Veolia

## **Institutional Customers**

Energy Australia Fiera di Roma New Fairground Munich U.S. Airforce U.S. GSA U.S. Navy

# **PV-Module Technology**



UNI-SOLAR PV-laminates are composed of a thin-film photovoltaic material encapsulated in UV-stabilized, weather-resistant polymers.

The PVLs are manufactured using a proprietary vacuum deposition and large-scale, roll-to-roll manufacturing process, depositing amorphous silicon as a series of thin-film layers onto a large roll

of stainless steel. Contrary to conventional PV-modules, *UNI-SO-LAR* PV-laminates are flexible, lightweight and contain no glass that could potentially break.

The UNI-SOLAR PV-cells are embedded between layers of proven encapsulation materials. The front surface is constructed of durable ETFE (e.g. Tefzel<sup>®</sup>), a "Teflon-like" material. The ETFE polymer is high light-transmissive allowing optimal sunlight absorption.

The modules are self-cleaning due to the low frictional resistance of the structured surface minimizing dirt build-up and soiling. Furthermore, the surface structure promotes easy water drainage by lowering the water's surface tension, facilitating the module's self-cleaning capability.



# The high quality of UNI-SOLAR PV-laminates is ensured in several ways:



The PV-laminates are certified according to international standards for PV-modules and may only be applied to approved substrates. Based on outdoor performance results, we guarantee that *UNI-SOLAR* PV-laminates produce more than 80% of the rated minimum power after 25 years.



# **Triple-Junction Technology**

Each *UNI-SOLAR* PV-laminate utilizes unique triple-junction thin-film solar cells made from amorphous silicon and silicon germanium. Each cell absorbs the blue, green and red light of the sun through the three layers of the cell. *UNI-SOLAR* PV-laminates convert a wider spectrum of light into electricity than conventional amorphous silicon modules.





UNI-SOLAR PV-laminates produce energy when the sun is low in the sky, through cloud cover and when installed at non-ideal angles to the sun's path.



# High Efficiency Under Real Operating Conditions



### Shadow Tolerant

Bypass diodes between each cell allow the module to produce power even when partially shaded or soiled.

In a *UNI-SOLAR* PV-laminate all cells are connected to each other via bypass diodes. Therefore, if one cell is shaded or soiled, only the power output of this one shaded cell is lost – usually less than 4.5%.



UNI-SOLAR PV-laminate

In a conventional crystalline silicon PV-module cells are connected across a string. Hence, if one cell is shaded or soiled, the power output of the total string is lost, usually 30% or more.



Conventional crystalline silicon PV-module



### High Temperature Performance

Due to the low temperature coefficient of UNI-SOLAR PV-laminates, rising module temperatures have only a little effect on the power output.



In fact, as module temperatures rise above 40 °C an annealing effect occurs and UNI-SOLAR PV-laminates continue to produce high energy yield in summer or in hot climates. This makes UNI-SOLAR PV-laminates particularly attractive for building integrated applications.



# Initial Stabilization

All amorphous silicon-based solar modules experience a predictable initial light-induced degradation (LID), which stabilizes after a few hundred hours of light exposure (usually 3–10 weeks of outdoor exposure). United Solar has done extensive studies, showing that even after 1000 hours of use UNI-SOLAR PV-laminates produce 88% of their initial power.

At the time of flash testing, performed on all *UNI-SOLAR* PV-laminates prior to shipment, a 15% assumed stabilization allowance is built in, based on 12% with an additional 25% safety factor. In this way, United Solar ensures that all modules perform as per rated power stated on the data sheet. Such 15% allowance in initial power leads to *UNI-SOLAR* PV-laminates having a significantly higher output than the rated power when first installed.

Accordingly, our data sheets state "during the first 8–10 weeks of operation, electrical output usually exceeds specified ratings.

Power output may be higher by 15%, operating voltage may be higher by 11% and operating current may be higher by 4%". As a result, we can ensure that UNI-SOLAR PV-laminates are within our stated power tolerance of +/-5% after light-induced degradation.

The minimum power of any product shipped from our factories is therefore:

Rated power x (1-tolerance)/(1-% LID allowance)

In case of a product with a rated power of 144 Wp, +/-5% tolerance and 15% LID allowance the minimum acceptable measured power before stabilization is: 144 Wp x (1-0.05) / (1-0.15) = 160.9 Wp.



# Degradation Over System's Lifetime

Degradation occurs in all photovoltaic modules irrespective of their technology. According to papers published by National Renewable Energy Laboratory (NREL) of Golden, Colorado, the degradation rate of PV-systems using UNI-SOLAR PV-laminates is comparable to those using state-of-the-art crystalline silicon products. 3rd party studies on worldwide installations with UNI-SOLAR PV-laminates have shown an average annual degradation rate of 0.42%.

With this low annual rate of degradation the UNI-SOLAR amorphous silicon triple-junction technology can compete with crystalline silicon solar modules. Compared to other thin-film modules, the average degradation rate of UNI-SOLAR PV-laminates is significantly below competitive products. The shown test results in temperate as well as hot and dry climate confirm the slow degradation rate, which leads to significantly higher long-term yield.



TISO-ISSAC, Lugano, CH, 0.5 kWp, 1998–2007, 0.33%/a degradation



KfZ, Jülich, DE, 0.032 kWp, 1998–2004, 0.14%/a degradation



Fh-ISE, Freiburg, DE, 2.0 kWp, 2002–2007, 0.10%/a degradation



NREL, Golden, Co, USA, 0.032 kWp, 1997–2006, 0.39%/a degradation

# Side-by-Side Comparisons

*UNI-SOLAR* PV-laminates show excellent performance compared to other photovoltaic technologies, whether crystalline silicon or thin-film.

The comparatively high specific annual energy yield is due to the aforementioned exceptionally low and diffuse light performance, bypass diodes across each cell and the high energy yield achieved at high module temperatures due to the low temperature coefficient and the annealing process (healing radiation induced structural damages – the so-called Staebler-Wronski effect) – making them ideal for use in hot climates or BIPV.



UNI-SOLAR.

# UNI-SOLAR Versus Other Technologies



Eindhoven, Netherlands Irradiance: 961 kWh / m2 Tilt angle: 15° Installation: 1998 *UNI-SOLAR* surplus: Avg. mono-Si: +14 % Source: Ecofys, Netherlands



Santa Cruz, California, USA Irradiance: 1738 kWh / m2 Tilt angle: 3° (a-Si)–30° (c-Si) Installation: 2003 *UNI-SOLAR* surplus: Avg. poly-Si: +24 % Source: Solarquest Report



Tucson, Arizona, USA Irradiance: 2 000 kWh / m2 Tilt angle: 30° Installation: 2003 *UNI-SOLAR* surplus: CIS: +11% Avg. mono-Si: +10% Avg. poly-Si: +18% Source: Tucson Electric, Arizona, USA

# Projected Versus Actual Energy Yield

PV-systems using UNI-SOLAR PV-laminates perform according to the predicted measurements given to each customer as a base for decisionmaking. This demonstrates that these PV-laminates perform according to expectation and achieve the energy yield and related income planned on.



UNI-SOLAR.

# **Reliable Estimates in Different Conditions**

*UNI-SOLAR* installations provide a safe and secure return as projected due to their reliable energy production rate under actual conditions. Combined with government supported feed-in tariffs they offer a stable and predictable return on investment.







Actual energy output

Projected energy output (PV SOL)

Irradiance: 1999 kWh/m<sup>2</sup> Size: 2 MWp Tilt angle: 3° Installation: 2008 Specific annual energy yield: Predicted: 1355 kWh/kWp Measured: 1488 kWh/kWp

# **Unique Product Attributes**



## Lightweight

UNI-SOLAR PV-laminates are extremely lightweight with only 3.6 kg/m<sup>2</sup> or 0.7 lbs/sq. ft.



### Easy to Install

*UNI-SOLAR* PV-laminates are easy to install using common roofing techniques. PV and roofing can be installed at the same time.



# Flexible

UNI-SOLAR PV-laminates are flexible, offering freedom of design to architects and they can also conform to curved surfaces.

### Durable

Glass-free, encapsulated in UV-stabilized, weather resistant polymers, *UNI-SOLAR* PV-laminates are resistant to wind and hail.

The combination of these characteristics allows currently unused space to become available to photovoltaic systems' renewable energy production.



This is particularly true for low-load bearing industrial or commercial rooftops. These are usually unable to be fitted with conventional solar systems made of glass-framed, tilted modules, which not only add their direct weight, but also further wind loads to the statics.



UNI-SOLAR PV-laminate conventional system

As UNI-SOLAR PV-laminates are flexible, they can adapt to settling ground, they can even be installed in areas prone to surface movement, such as landfill sites.





# Structural Advantages

### **Engineering Advantages**

Easy assembly without roof penetration maintains the integrity of the roofing material and its respective roofing guarantees.

The low visual impact, its direct fixation to the roofing material paired with a glass-free encapsulation make the UNI-SOLAR PV-laminates impervious to vandalism or theft.



The textured module surface has a self-cleaning effect and by being anti-glare increases light absorption. While this attribute increases energy yield it also makes the UNI-SOLAR PV-laminates a perfect choice for reflection-sensitive applications such as at airports.







### System Advantages

UNI-SOLAR PV-laminates offer cost advantages inherent in the system due to

- reduced installation time
- reduced logistics expenditure
- reduced balance of systems (BoS) costs

Particularly attractive is the fact that no additional substructure is required for mounting reducing material and handling requirements.

### **Higher Return on Investment**

The advantages described combined with the high energy yield of the shadow- and heat-tolerant triple-junction cell technology ensure a high rate of return on the investment over the system's lifetime.

### **Three-Step Performance Warranty**

Our confidence in the long-term performance of our products allows us to offer a three-step performance warranty, which guarantees that the UNI-SOLAR module will produce

- 92 % of minimum power after 10 years
- 84% of minimum power after 20 years
- 80% of minimum power after 25 years

# **Production Process**



UNI-SOLAR thin-film solar cells are made in a roll-to-roll vacuum deposition process on a substrate of stainless steel, exceptionally suitable for high-volume production.

The process can be divided into four steps:

## Step 1: Deposition

- Washing, back reflector coating
- Deposition of the PV-layers (a-Si)
- Anti-reflective coating



### Step 2: Cell Cut

- Cutting into individual solar cells
- Passivation of the solar cells
- Application of grid wires



## Step 3: Lamination

- Application of ETFE (top encapsulate layer) and back polymer
- Curing, testing of laminates



### Step 4: Bonding to Roof Materials

• Factory or field bonding of the PV-laminate to various roofing materials by channel partners



# **Continuous Stringent Quality Control**



### QC 1: Incoming Inspection:

Objective: verify incoming materials

Method: inspection according to incoming inspection test plans (IITPs). Records are saved in the manufacturing execution system (MES), a centralized database storing machine process parameters, raw material and in-product characteristics. Records of supplier conformance are retained, such as certificates of compliance.

### QC 2+3: In-Process Inspection:

Objective: quality control at all process stages

Method: multiple checkpoints throughout the manufacturing process. Checks are performed before cells are cut to size, after cells are cut, after cells are finished and after connection to form solar laminates. One out of every 100 cells is tested for electrical charac-

# Substrate Qualification and Approval Process

UNI-SOLAR BIPV products are a combination of the light weight, flexible PV-laminate and roofing material substrates.

To ensure the long-term stability of the bond between these two elements, United Solar has developed specific test procedures based on standards of the American Society for Testing and Materials (ASTM).

Every channel partner product has to comply with minimum standards defined by United Solar.

### UNI-SOLAR Test Protocol for BIPV Substrates

teristics (I–V curve), film adhesion strength, low light performance and visual defects.

### QC 4: Final Inspection:

Objective: delivery of flawless products

Method: testing of 100% of all finished products through a final flash test, an

insulation test (wet hi-pot) and visual inspection for cosmetic defects. Each laminate or module is given a unique serial number and the inspection data is entered automatically in the MES. If at any point in the final inspection process the laminate does not pass the listed criteria, it is rejected and segregated as non-conforming for secondary review.

### **Ongoing Validation**

• Validation that raw materials and finished products meet expected long-term performance through accelerated environmental testing

### **Quality Management Systems**

- Quality management compliant with ISO 9001:2000
- Process documentation within the document control system (DCS)

The test program focuses on the bonding behavior of the PV-laminate to the substrate material under various conditions. The program consists of peel and shear tests at different temperatures before and after environmental aging, such as different thermal cycling, humidity and freeze testing as well as damp heat conditions.

The list of approved substrates encompasses materials from various manufacturers, such as:

- TPO membranes
- PVC membranes
- aluminum
- copper
- galvalume coated steel
- modified bitumen membranes
  EPDM membranes
- aluzinc-coated steel
- stainless steel

Shear Test		ASTM D1002-05		Salvalance coated steel	
Peel Test		ASTM D903-98 (2004)			
Environmental Aging		ASTM E1171 (2004)			
	Pre-	Test	Test	Temperature Tested	Sample Size
Initial Non (		ng Toot	Peel	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
mua	Non-Aging Test		Shear	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
Final	After Environmental Aging	Thermal Cycle (30 days/200 cycles)	Peel	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
			Shear	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
		Humidity Freeze (10 days/10 cycles)	Peel	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
			Shear	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
		Damp Heat (1 000 hrs)	Peel	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp
			Shear	–40 °C, RT, 40 °C, 60 °C and 85 °C	5/temp

Additional Notes:

Bonding surface of the substrates is cleaned with Naphta solvent. After sample preparation testing to be performed after 1 week or after aging cycles.

ASTM Test Protocol

# **Certification Process and Approval**

The UNI-SOLAR PV-laminates are certified according to IEC 61676 Edition 2 and IEC 61730 as well as UL and CSTB standards and can carry the CE mark. Recent certifications were obtained by TUV-RL (2009) and ASU-PTL (2008). Already in 1997 JRC-Ispra certified UNI-SOLAR products.

Therefore, any combination of an approved substrate with a top-connect, peel and stick PV-laminate possesses the required certifications and can be applied to suitable roofs in the respective markets.

Channel partners, having developed their own roofing material and adhesive or using an alternative connection type, need to certify their product. However, as they only need to conform to the re-testing guidelines, the required sample size is reduced to three samples.

The described certification process is very time and cost effective and provides a broad variety of roofing solutions to the market.





# **Environmentally Friendly Production**

*UNI-SOLAR* PV-laminates are produced under efficient, ecologically friendly production parameters with lower material and energy input compared to conventional crystalline silicon modules.



Due to the volatility of the cost of silicon, crystalline manufacturers stress their improvements in material usage due to increased cell efficiency and reduced wafer thickness. Nevertheless, best in class crystalline manufacturers still require up to 6 g/W of silicon material input compared to 0.15 g/W of the UNI-SOLAR PV-laminates, i.e. 40x less than the best crystalline manufacturers.

Contrary to other thin-film technologies UNI-SOLAR PV-laminates are produced without toxic cadmium and do not contain materials heavily used in the semiconductor industry that could be subjected to raw material shortages.

The vacuum deposition process uses lower process temperatures leading to lower energy consumption during production.

The energy and material input is further reduced as UNI-SOLAR PV-laminates are encapsulated in polymers instead of glass. Glass encapsulation contributes up to 12% of the total PV-module carbon footprint (Mariska de Wild-Scholten, ECN – Energy research center of the Netherlands, May 2009). Compared to conventional glass-based modules, UNI-SOLAR PV-laminates offer a better energy balance, providing higher contribution to the protection of the environment.



# Life Cycle Management

While our drive to helping the environment is inherent in all of our products, United Solar's commitment to environmental sustainability moves beyond product development.

As an environmentally responsible company of the global community we strive for our facilities, processes and products to exceed governmental regulations by implementing state-ofthe-art expertise on environmental sustainability.

United Solar continues to reduce its carbon footprint and greenhouse gas emissions and increases its energy efficiency efforts throughout its corporate offices and production facilities.

Within the framework of our product life cycle management we take care from conception to completion to the end of life management of our installations.

As members of the PV CYCLE Association United Solar works at the forefront of ensuring that photovoltaics deserve to be called a clean energy resource.





Research on fellow inhabitants powered by clean UNI-SOLAR solar technology

# A Sustainable Strategy

In the 1960s Energy Conversion Devices was founded on our pioneering work in amorphous and disordered materials. During the early years, the company was focused on R&D and technology development.

In 1996 we built our first 5 MW PV-manufacturing line and began production of the UNI-SOLAR PV-laminate product. Over time we grew our nameplate capacity to 150 MW, with the capability to produce more than 12 miles of finished product every day.

Today, Energy Conversion Devices with its subsidiaries United Solar and Solar Integrated is the global leader in BIPV solutions. Longer term we aspire to lead wide scale acceptance of solar by integrating solutions smoothly and cost effectively into everyday applications.

Accomplishing this longer term target requires an evolution of our strategy along several dimensions:

- Evolving Business Model extend the value ECD can deliver in the solar process through extending into "downstream" activities
- Expanding Market Reach build on strong presence in BIPV markets to grow the position into rooftop markets, both commercial and residential
- Driving to Grid Parity relentless focus on system cost reductions (module + BOS + installation) to deliver solar energy competitive with electricity grid pricing
- Leading on Technology continue to build on flexible PV-technology lead targeting lowest LCOE (\$/kWh)

# **Evolving Business Model**

Over the past 18 years, United Solar has been a leader in flexible PV-technology with its advancements in amorphous silicon. We've built the first commercially available flexible PV-product and have worked extensively with leading building material companies in Europe and the US to develop and sell rooftop solutions that are unmatched in the solar industry.

More recently the market has demanded complete turnkey solutions especially for large multi MW installations. In summer of 2009 we announced the acquisition of Solar Integrated to enable ECD to deliver on this demand.

Our acquisition of Solar Integrated allows us to:

- better support our channel partners
- implement large projects directly where appropriate and have initial capabilities to develop projects
- accelerate the reduction in total installed cost
- and add to our rooftop expertise

With Solar Integrated's acquisition, ECD has expanded its capabilities downstream offering project implementation and direct site control (where appropriate) for large projects.



UNI-SOI AR

# Expanding Market Reach

United Solar and Solar Integrated are the leading names in building integrated solar products and solutions. Together we have sold and installed over 400 MWs of PV-products. We believe this successful start is only a small part of what is possible.

We have the products and solutions to effectively sell into any rooftop PV-market. For the new and re-roofing segment we sell BIPV solutions through the building materials channel.

We define BIPV as a condition in which the PV-product is an integrated part of the waterproof roofing material. We have developed this channel over a number of years and it includes many partners, including the most trusted names in our target regions. Our channel partner companies are the rooftop experts they own the rooftop and are very particular about what goes on or into their roofing solutions. They choose UNI-SOLAR for its light weight, flexibility and ease of incorporating into their products.

We are the leader in selling BIPV solutions through the building materials channel and we have spent many years co-developing solutions with our partners for this channel. Our BIPV products include metal, membrane and direct-bond applications.





New/Re-roofing Segment



The graph on the opposite side shows that these BIPV solutions are something that just can't be done with a glass panel product.

For the existing roof segment we offer two solutions. These products are also sold through the buildings material channel, but are also well suited to system integrators and project developers.

The first is our direct-bond application and the second is a new product we are introducing for BAPV applications. BAPV is where solar is "applied on top of an existing roof and is not part of the roofing material".

The PV-laminates are bonded to a tilt metal support and installed on existing roofing. This new tilt application increases the energy output by 10% to 20%.

In 2009, the mid range estimate for the annual PV-rooftop market is 3 GW globally. We estimate the total addressable market is more than 15 GW of PV-opportunity on low-load commercial rooftops in our top 5 markets. This is our "sweet spot", where our lightweight PV-laminate is the clear leader. The balance of the addressable commercial rooftop market – shown here as more than 50 GW – is where we are launching our new metal tilt solution that maximizes kilowatt hour per kilowatt energy production.

We believe the rooftop market is very large and we have the right product and distribution channels to succeed in this market.

# Driving to Grid Parity

LCOE is the cost of generating energy for a particular system including all the costs over its lifetime. The bottom figure shows a simplified equation of (Total Installed System Cost) divided by the ("Energy Yield") of the system. The better the LCOE of a project, the more interested a customer is in the project, as it is a key factor in determining project returns and available roof rents.

The United Solar advantage is seen on two fronts in the equation. First, our installed system costs are lower than the average c-Si installation. We accomplish this by directly bonding our product to roofing substrates. Second, our core thin-film technology delivers more kWh in real world conditions. This has been tested and



Our longer term goal is to get our cost structure down low enough that we can succeed in selling products and projects at an attractive rate of return compared to grid electricity. Simply stated, to achieve this "grid parity" we must continue to reduce our cost structure and improve our product efficiency.



We have made excellent progress over the past two years and still have a lot of opportunity to reduce more costs. We are targeting a

> substantial total installed cost reduction in calendar year 2010, with an LCOE approaching grid parity in key markets such as Southern California.

Achieving this will require:

- Reduction of PV-laminate per watt cost, which will be driven by reduction in material costs, improvement of production throughput and yield and continued improvement in conversion efficiency
- Reduction in total installed costs, our acquisition of Solar Integrated has improved our ability to focus on reduction of balance of system (BOS) costs and reduction of installation costs

Project Development Economics



Our path to grid parity

A key aspect of reaching this goal is to continue our expansion plans to drive scale efficiencies. Today, United Solar has production facilities in U.S., Mexico and China:

- Auburn Hills, Michigan 30 MW facility
- Greenville, Michigan 120 MW facility
- Tijuana, Mexico 180 MW finishing facility
- Tianjin, China 15 MW finishing facility

Our operational footprint currently centralizes the core technology to leverage our know-how production in Michigan and distributes our most labor-intensive portion of the manufacturing process to low-cost countries. As we expand our footprint we will focus on localizing manufacturing (where appropriate) closer to our end markets.

We are confident that a focus on driving to grid parity will be a key enabler in achieving our longer term aspiration.



# Leading on Technology

### 1981: Prototype Machine



1986: 0.5 MW Machine

1991: 2 MW Machine



1996: 5 MW Machine



2003: First Auburn Hills Facility



2009: Acquisition of Solar Integrated Technologies



1994: NREL Validation





2007: Greenville



Over the years we have introduced many innovations to develop these products. We recognized the importance of developing roll-to-roll production to reduce manufacturing costs many years ago.

We improved the technology, solved problems with scale-up and introduced our first BIPV application in 1997. This was our flexible product bonded to a metal pan in the factory. Since then we have diversified our application portfolio to provide peel and stick solutions that can be applied in the field to a variety of roofing materials. The recent acquisition of Solar Integrated will enhance our capabilities even further.

With the success of United Solar's flexible products in the rooftop market, other companies are attempting to enter the market. When you compare our product to new entrants United Solar is a clear leader.

	UNI-SOLAR a-Si	Flexible Competition			
Manufacturability	Proven	Unproven			
Reliability	Proven	Unproven			
Bankability	Proven	Unproven			
kWh/kW	>20% higher	-			
Best Cell Efficiency	15.4%	19%			

We have a proven manufacturability. In fact, we produce more than 12 miles of laminates per day. We have produced and installed 400 MW globally, building not only production but application expertise.

Our products have been out in the field for more than a decade and have been accepted / financed by many leading banks globally.

Our kWh/kW advantage, with more than 20% kWh/kW advantage, means that a 10% UNI-SOLAR product will produce the same electricity as a 12% competing flexible product.

We therefore believe that our flexible, light-weight products will continue to offer significant advantages to the customers in the rooftop market.

# **Income Statement**

(Figures in millions, except shares and EPS)	Year Ending 30 June 2009	Year EndingYear Ending30 June 200830 June 2007		CAGR 2007–2009	
Revenues					
Energy Conversion Devices	\$ 316.29	\$ 255.86	\$ 113.56	66.9%	
UNI-SOLAR	\$ 302.76	\$ 239.39	\$ 98.36	75.4%	
Gross Margin %					
Energy Conversion Devices	34.1%h	32.0%	28.5%	9.5%	
UNI-SOLAR	32.0%	29.4%	23.6%	16.3%	
Operating Margin %					
Energy Conversion Devices	6.5%	—	—	—	
UNI-SOLAR	14.7%	13.2%	2.0%	171.7%	
Net Income	\$ 12.46	\$ 3.85	-\$ 25.23	-	
Diluted Wtg. Avg. Shares Out.	\$ 42.71 \$ 41.14 \$ 39.39		4.1%		
EPS	\$ 0.29	\$ 0.10	-\$ 0.64	—	

Energy Conversion Devices and United Solar have grown into a sound financial business, reflected by the increase in R&D ratio from 3.9% in FY 2008 to 6.2% and a growth in general administrative costs by 15% mainly due to enhancement of sales activities and support services.









# Balance Sheet

Balance Sheet as of 30 June 2009



Energy Conversion Devices' balance sheet as of 30th June 2009 shows a solid equity ratio of 61.9% and a strong current ratio of 7.5%. Cash, cash equivalents and short-term investments reached \$ 301.6 million in FY 2009.

Current liabilities of \$ 59.6 million include accounts payable and accrued expenses of \$ 52.2 million.

2009 saw a moderate increase in receivables, up from \$53.5 million in FY 2008 to \$69.4 million.

A positive operating cash flow of \$ 11.1 million was achieved, while the negative investment cash flow of \$ 440.5 million was due to expenditures for the expansion of United Solar Ovonic's manufacturing capacity during the first half of FY 2009.

The RoE reached 1.9%.



# A Low Risk Wall Street Company

### A Wall Street Company

Energy Conversion Devices, Inc. (ENER) is traded on the NASDAQ Global Select Market.

Recent public offerings and convertible senior notes include:

Public offering of 7,000,000 shares completed in March 2006.

Total gross proceeds of \$ 375.6 million.

Managed by UBS Investment Bank, Cowen & Company, First Albany Capital, Piper Jaffray, Jeffries & Company, Merriman Curham Ford & Co.; Tejas Securities Group Inc.

Public offering of 2,723,300 shares and convertible senior notes completed in June 2008.

Total net proceeds of \$ 404.5 million.

Managed by Credit Suisse Securities LLC, UBS Securities LLC, JPMorgan Chase & Co., Deutsche Bank Securities, Lazard Ltd.

### Dun & Bradstreet Ratings

Dun & Bradstreet is a provider of credit information on businesses and corporations. The DUN System<sup>®</sup> is utilized by many major banks/lenders, insurance and finance companies as well as municipalities, Federal Agencies and endorsed by the European Union.

Energy Conversion Devices' D-U-N-S<sup>®</sup> number is 00-652-2080.

According to the D&B Credit Rating, Energy Conversion Devices is rated 5A2.

Below table provides a guideline how to read the rating:

Composite Credit App		redit Appr	aisal		
Rating Classification	Company Size	High	Good	Fair	Limited
5A	\$ 50,000,000 and over	1	2	3	4
4A	10,000,000-49,999,999	1	2	3	4
3A	1,000,000-9,999,999	1	2	3	4
2A	750,000-999,999	1	2	3	4
1A	500,000-749,999	1	2	3	4
BA	300,000-499,999	1	2	3	4
BB	200,000-299,999	1	2	3	4
СВ	125,000-199,999	1	2	3	4
СС	75,000-124,999	1	2	3	4
DC	50,000-74,999	1	2	3	4
DD	35,000-49,999	1	2	3	4
EE	20,000-34,999	1	2	3	4
FF	10,000-19,999	1	2	3	4
GG	5,000 - 9,999	1	2	3	4
НН	Up to 4,999	1	2	3	4

Source: Dun & Bradstreet, "A Guide to D & B's U.S. Ratings and Scores"

# Major Projects Financed by Renowned Investors

Major banks financed large projects with UNI-SOLAR PV-technology worldwide. In addition to the references below, Crédit Agricole financed a 950 kW system at Airbus, France – installed by our partners Solar Integrated and Urbasolar.

Also, Caisse de Dépôt financed a 270 kW system at Aerocomposite in France from Solar Integrated and Urbasolar.



San Diego Unified School District 4.8 MW San Diego, California, USA Partner: Solar Integrated Financed by General Electric Finance



Rome Trade Fair 1.4 MW Rome, Italy Partners: Solon, Green Utility, ISCOM Financed by Unicredit Bank GM Opel plant 12 MW Zaragoza, Spain Partners: Veolia Environment, Clairvoyant Financed by HSH Nordbank



Flanders Expo

1.8 MW

Gent, Belgium

Partner: Debigum

Financed by Enfinity





# **Further Reference Projects**

In addition to the projects below, following projects were realized by Constellation: Energy Projects and Services (a division of Constellation energy group) headquartered in Baltimore, Maryland.

- Alcoa/Kawneer Facility in Visalia, California; 588 kW
- General Services Administration in Sacramento, California; 520 kW
- McCormick Spice in Baltimore, Maryland; 560 kW

FM Logistics

1.4 MW

Laudun, France

Partners: Solar Integrated, Urbasolar

Financed by Caisse de Dépôt



La Poste

900 kW

Montpellier, France

Partners: Solar Integrated, Urbasolar

Financed by Crédit Agricole





Prologis – General Electric

1.1 MW

Portland, Oregon, USA

Partner: Solar Integrated

Financed by General Electric Finance



MD Logistics 700 kW Lokeren, Belgium Partner: Solar Integrated Financed by Dexia Bank

# **Further Reference Projects**

Malagrotta Landfill 1 MW Rome, Italy Partner: Solar Integrated





Paramount Farms 1.1 MW Lost Hills, California, USA Partner: Solarcraft, California, USA

Lunghezzina 1 MW Rome, Italy Partner: Solar Integrated



Tessman Road Landfill 135 kW San Antonio, Texas, USA Partner: Republic Services Photo courtesy of Republic Services



Poon Gi 650 kW Young Joo, Korea Partners: Keumo, Energia



UNI-SOLAR.



Marcegaglia Factory 2.1 MW Cremona, Italy Partner: Marcegaglia



Beijing Museum 300 kW Beijing, China Partner: Dawson International



VW Headquarters

2.4 MW

Wolfsburg, Germany

Partner: Suntimes

Photo courtesy of Volkswagen AG



Posco Warehouse

Po Hang, Korea

Partner: Airtec, KC Energia



Logistic Parc 147 kW Barcelona, Spain Partner: Alwitra



# Get In Touch – Start Generating Your Own Pollution-Free Energy Now

## Your United Solar Team At Your Disposal

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