EXEGER

Dyemond Solar
LAYMAN REPORT

LIFE Project Number
LIFE09 ENV/SE/000355

PROJECT CHARACTERISTICS

Project Data		Beneficiary Data	
Project location	Stockholm	**Name Beneficiary**	Exeger Sweden AB
Project start date	01/09/2010	**Contact person**	Mr Alexandre Askmo
Project end date	31/12/2013 **Extension date:** 31/03/2015	**Postal address**	P O Box 8144, SE-104 20 Stockholm
Total Project duration (in months)	55 months (including **Extension of** 15 **months**)	**Visit address**	Brinellvägen 32, SE-114 28 Stockholm
Total budget	€ 3,522,312	**E-mail**	info@dyemondsolar.com
Total eligible budget	€ 3,484,567		
EU contribution	€ 1,735,846		

INTRODUCTION

Pilot plant project in the city centre of stockholm

Project Scope

In 2010, EXEGER set out to demonstrate the potential of producing Dye Sensitized Solar Cells (DSC) using screen printing as a production method.

The project was led by serial entrepreneur Giovanni Fili, CEO of EXEGER and DSC pioneer Dr. Henrik Lindström, CTO of EXEGER.

Together they recruited the necessary competence to design and build the new state of the art pilot plant in Stockholm, Sweden.

DSC Technology

DSCs are ideally suited for a variety of real life conditions thanks to their inherent characteristics.

They are based on the principle of photosynthesis allowing for light to be captured in a variety of sub-optimal lighting conditions.

This means they are less sensitive to the angle of incident light and higher temperatures than previous generation solar technologies.

They also excel at low light conditions which means fog, smog, cloudy weather have little effect on efficiency.

Results

The pilot plant demonstrated successful results in November 2014 with a production of 50m^2 per day during a period of 5 subsequent days.

Throughout the project, visits to the pilot plant were conducted with positive reactions.

The public, academia, government officials, media, industry, all have been continuously impressed at the potential of this solar technology and the method chosen for production of the solar cells.

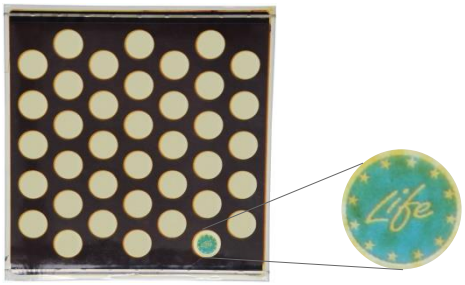
PROJECT LOCATION

City centre of Stockholm

The pilot production plant is located in the Stockholm city centre
This pilot plant has been developed with the financial support from the European Commission

THE SOLAR CELL

A technology to disrupt the solar market



Superior real-life output

Superior design

Superior manufacturing

The DSC characteristics are ideal for a variety of real-life conditions.
They are less sensitive to the angle of incident light in comparison to other technologies. They have stable efficiencies in all light conditions.
They have higher efficiency than competing technologies in higher working temperatures. This makes them ideal for applications where even output is preferable.

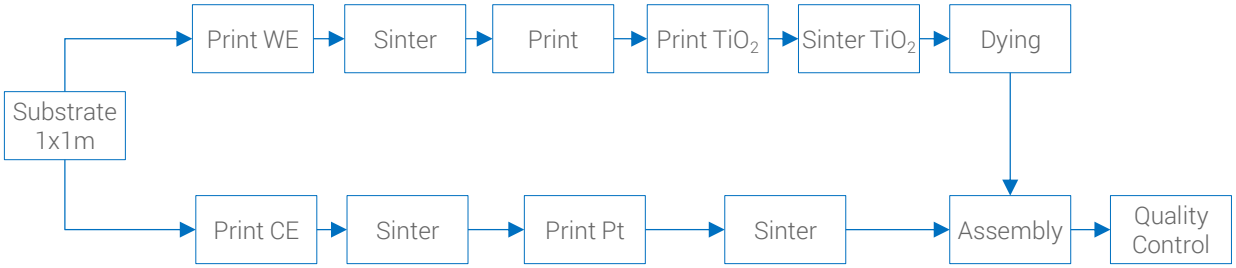
Design is where this technology is truly unique. We have constructed the solar cell with a completely new patented architecture allowing for elimination of the current collectors seen in all other technologies.

Using screen printing as a production method enables the manufacturing of solar cells in a variety of colours, shapes, with logos and on any material.

Since 2009, EXEGER has developed and produced third generation solar cells (dye-sensitized solar cells, "DSC") using screen printing which is an established, low-cost and simple production technology which allows for lower embodiment of energy from production with an energy payback time of less than 1 year.
No scarce or toxic raw materials and no toxic emissions from manufacturing makes the production of DSC's truly environmentally friendly.

MACHINES & PROCESSES

Preparation of the facility



Preparations of the facility

In order to install the pilot production line several things needed to be in place. This work started with the finalization of the layout planning of the pilot plant and included hypermedia such as compressed air, ventilation and power supply.

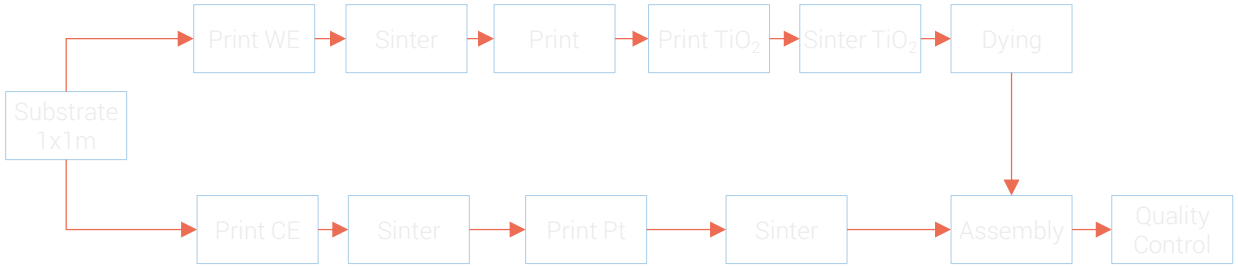
All processes were developed and tested in the laboratory before the production machines were designed, constructed, and ordered.

No toxic or scarce materials are found in the production process or the solar cells produced at the Stockholm pilot line. The mere output and location of the factory is a true testament to this. No

The embedded energy of the produced solar cells is at levels which translate to an energy payback time of less than 1 year, further increasing the positive environmental impact.

PROCESSES RUNNING AS ONE

Developing the machines to run as a unit: the pilot plant



Before running the pilot line as a unit according to specifications, the different parts from corresponding processes needed to be tested, both stand-alone and as a unit. Logistics and transfer between different machines needed to be optimized.

Parts of the demonstration focusing on each process step was integrated with the installation of the pilot production line. The next step was running the line for one week demonstrating the overall capacity.

The specification of the line was to:

- Prove production of 50m^2 per day
- During a demonstration period of 5 subsequent days
- Certain efficiency, lifetime, bill-of-material & appearance

The design regarding transparency was chosen after workshops with potential customers.

PILOT PRODUCTION LINE

Demonstration

Screen printing is a well established, proven and cost efficient production method.

A modular design of the factory enables scalability for future plans of setting up large scale manufacturing in target markets.

In 2014 a yearly production capacity of 20,000m^2 was demonstrated. Scalability was confirmed.

Inauguration of the new factory by the Swedish King HM Carl XVI Gustaf

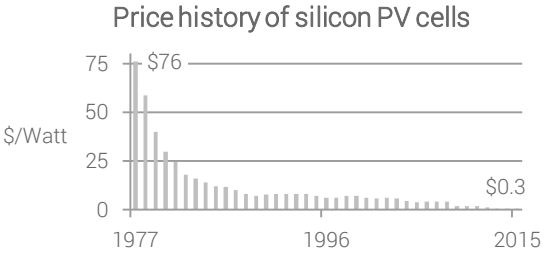
1st & 2nd GENERATION SOLAR CELLS

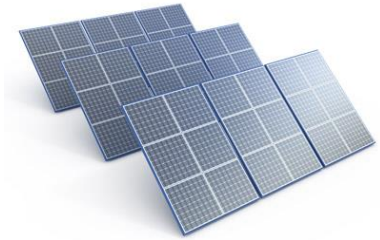
A comparison to the new 3rd generation technology

There are two dominant solar outdoor markets: solar farms and building integrated photovoltaics (BIPV).

Solar farms and BIPV have been installed since the 1970's and are a competitive market with silicon solar cells dominating the market.

Because of strong competition, these two markets are often reliant on state subsidies and regulations for successful growth.





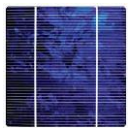
The DSC technology and the pilot plant developed at EXEGER with part-financing from the EU Commission under the Life+ Project led to a novel way of producing solar cells.

The technology and production process are more cost efficient.

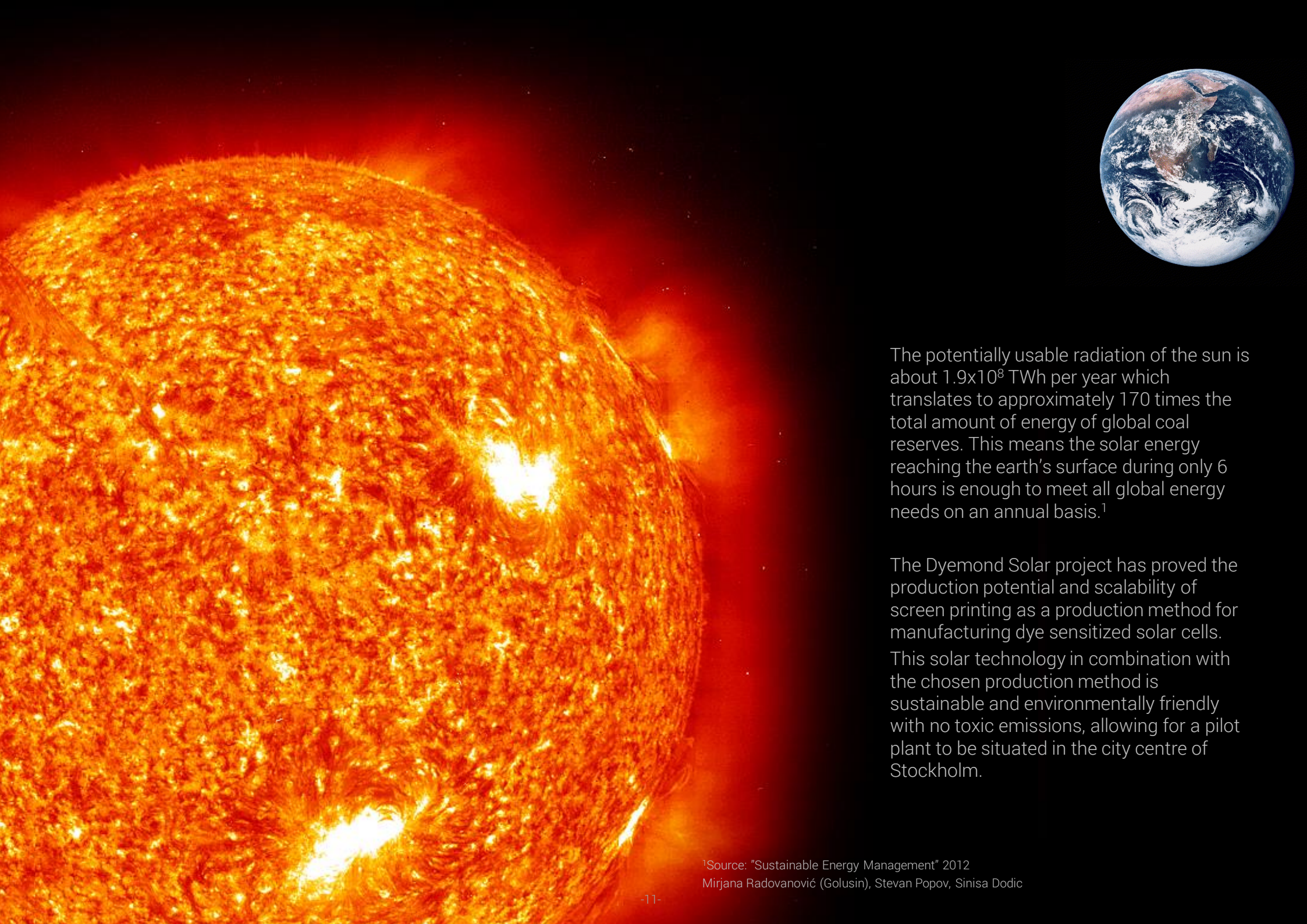
Aesthetically superior solar cells also allow for broader market penetration in design sensitive markets such as BIPV where traditional solar cells often negatively impact the architectural beauty of buildings.

EARLY GENERATION SOLAR TECHNOLOGIES

Commercially available solar cells and their niches

	Design:	Performance:	Niche market:
 Silicon based solar cells	- Rigid - Extremely fragile - No customization options	+ High outdoor efficiency - Uneven power production - Minimal power density	Suited for use in power farms where aesthetics are of no consequence
 a-Si & CIGS	+ Flexible + Very thin + Beautiful from far - Current collectors - Few customization options	+ Even power production - Poor power density - Medium outdoor efficiency	Ideal for rooftop installation as they are lighter and less sensitive to light conditions than mono and polycrystalline silicon solar cells.

Conclusion: Unlike the solar cells produced from the Dyemond Solar project, the above mentioned PV technologies are either solely suited for power farms or have great limitations in design.



The potentially usable radiation of the sun is about 1.9×10^8 TWh per year which translates to approximately 170 times the total amount of energy of global coal reserves. This means the solar energy reaching the earth's surface during only 6 hours is enough to meet all global energy needs on an annual basis.[1]

The Dyemond Solar project has proved the production potential and scalability of screen printing as a production method for manufacturing dye sensitized solar cells.

This solar technology in combination with the chosen production method is sustainable and environmentally friendly with no toxic emissions, allowing for a pilot plant to be situated in the city centre of Stockholm.

[1]Source: "Sustainable Energy Management" 2012
Mirjana Radovanović (Golusin), Stevan Popov, Sinisa Dodic

CONTACT INFORMATION

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