

Even greener solar power on the way: Eco-Solar Factory

40% plus eco-efficiency gains in the photovoltaic value chain with minimised resource and energy consumption by closed loop systems

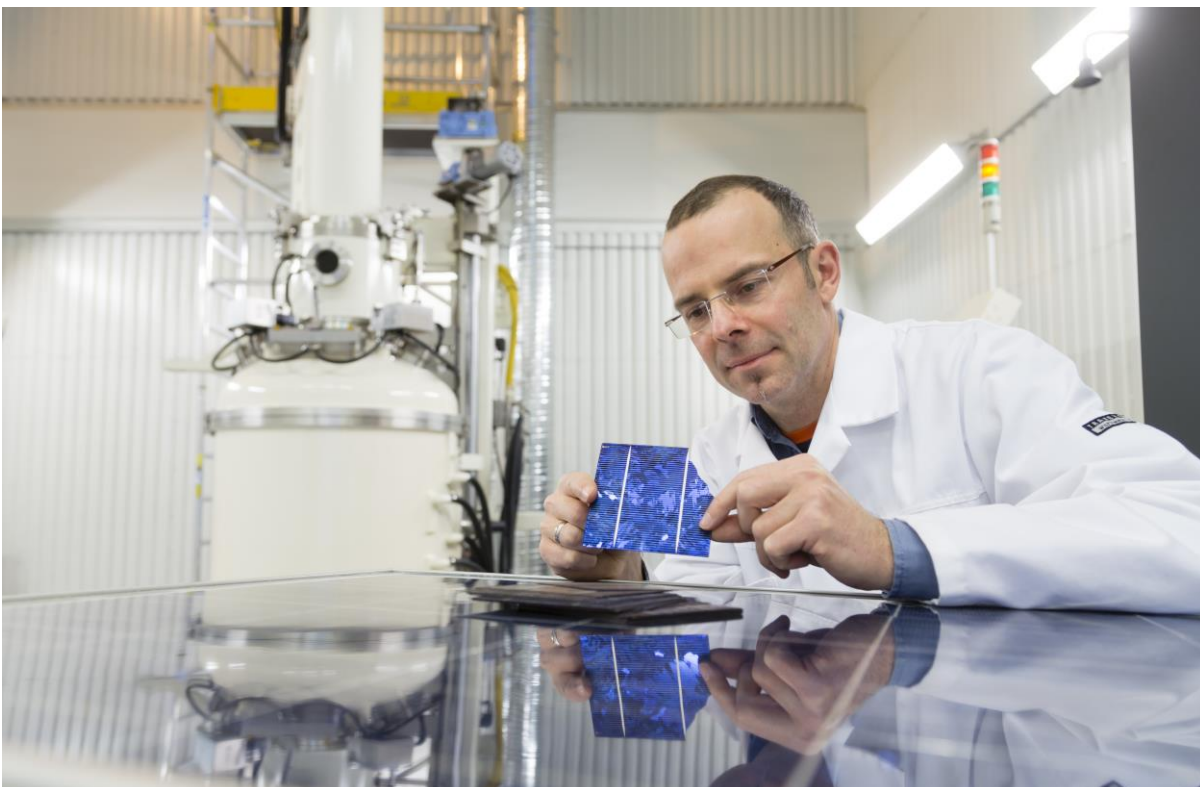
Europe wants to reduce its needs for raw materials and raise the level of recycling of resources in all industries, including the solar power industry.

The solar industry is one of the fastest growing economic sectors, as it provides reliable, secure and sustainable energy. However, production of PV-modules consumes considerable energy and natural resources. Besides, as long as recycling is hardly considered during module production, it will remain cumbersome and inefficient.

If this project is successful, greenhouse gas emissions from solar panel manufacture will fall by 25 to 30 per cent.

Our aim is that the solar cell industry should utilise materials that would otherwise end up on waste sites once solar cell panels are disposed of. We also want to make it possible to produce solar cell panels using less raw materials than we currently do.

To realise this, Eco-Solar will develop an integrated value chain to manufacture and implement solar panels in the most ecologic way, taking into account reuse of materials while manufacturing and repurposing solar panel components at end of life stage. Moreover, the project will demonstrate defaulting panels to be spotted, repaired or replaced.



Caption to figure:

Utilising solar cell materials that would otherwise end up on waste sites, is an important aim of the EU "EcoSolar" project, which is coordinated by SINTEF Research Scientist Martin Bellmann. Photo: SINTEF / Thor Nielsen

Cheaper and greener panels, through recycling

Reusing materials and reducing the consumption of raw materials will make solar cell panels both cheaper and greener. When less new materials are needed, the emissions of greenhouse gases from their production will decrease. Likewise, the energy consumed by these processes will be paid off faster than it is today.

Therefore, Eco-Solar aims to recycle resources used in solar-panel production that are currently treated as waste, such as:

- argon gas, used in furnaces in silicon wafer production
- crucibles, used to smelt silicon
- silicon dust, created when wafers used in solar cells are sawn up
- pure water from solar cell production.

Moreover, The current generation of solar panels is difficult to recycle. The project will develop modules that lack current forms of encapsulation. This reduces costs of materials, but also allows panels to be dismantled easily without damaging their individual components, thus enabling glass, solar cells, electrical contacts, etc. to be reused or recycled.

Smaller footprint by reducing consumption of raw materials

The aim is to reduce the consumption of raw materials by which the carbon footprint will shrink by 25 - 30 per cent for panels using the more common type of solar cells, which are known as multicrystalline cells. Eco-Solar aims to reduce the consumption of resources, by:

- modifying cell design so that the use of silver in contacts can be reduced
- developing frameless panels that do not require aluminium
- developing modules whose rear surface is also enclosed in glass, so that these do not need to be encapsulated in organic materials such as EVA (ethylene vinyl acetate) or PVF (polyvinyl fluoride).

Solar-cell “doctor” on the way




A further aim of the project is to develop a solar-cell “doctor”: a fully automated system capable of identifying defects in finished cells and repairing those that are capable of being rescued. This is intended to ensure the best possible performance of panels once they have been installed on the premises of clients.

Strengthening the European PV market

The overarching aim is to strengthen European companies who are driven by innovation and who are able to secure Europe's power supply in a sustainable way. Companies will benefit from:

- cost reductions while reducing materials consumption and recycling,
- novel applications for materials that would otherwise been casted away
- improving power production from solar panel installations, by incorporating sensors that will give a warning signal when a panel is damaged, so that it can be replaced promptly.

It is envisioned that the results of the project will be on the market within year two of the completion of the project.

strategy		resource	current consumption	Ecosolar consumption	savings
recycling Argon gas		Ar^{18} Argon gas	9.3 kg	0.46 kg	95%
recycling Argon gas		Ar^{18} Argon gas	0.43 kg	0.02 kg	95%
re-using crucibles		crucibles	0.5 kg	0.06 kg	88%
utilizing Si kerfloss		Si silicon	1.25 kg	0.88 kg	70%
recycling DI water		DI water	200 liter	14 liter	93%
process efficiency		Al^{13} Aluminium	2.5 kg	1 kg	60%
		Ag^{47} Silver	8.5 gram	2.9 gram	66%
		 process chemicals	1.84 kg	0.2 kg	89%

EcoSolar process savings
strategies, input resources, units, state of the art (current) process usage, Ecosolar savings



Caption to figure: Impact: reducing carbon footprint of solar energy panels

About the project

Eco-Solar is a three-year project with a budget of €5.64 million, which is fully financed by the European Union's Horizon2020 research and innovation programme under grant agreement No 679692.

Project website: <http://ecosolar.eu.com>

Participants

- Project coordinator:
SINTEF Materials and Chemistry
- Other participants:
Norsun AS (Norway)
UAB Soli Tek R&D (Lithuania)
International Solar Energy Research Center Konstanz (Germany)
Apollon Solar (France)
Garbo Srl (Italy)
Boukje.com Consulting BV (The Netherlands)
bifa Umweltinstitut GmbH (Germany)
Asociacion de Investigacion Metalurgica del Noroeste (Spain)
Steuler Solar Technology AS (Norway)
Ingesea Automation SL (Spain)