U-Light -
Ultra lightweight PV modules and their applications in innovative PV systems achieving lowest levelized cost of electricity (LCOE)

ISC Konstanz (Coordinator) - Germany
Isovoltaic – Austria
PCCL - Austria
ZHAW - Switzerland
Objectives

- Light weight PV systems may enable new applications
- Reduced weight may result in lower module and/or system cost
  - Less material consumption
  - Lower-cost mounting solutions, lower transport cost,…
  - Cheaper material?
- Basic structure of c-Si PV modules unchanged for decades
  - Innovative approaches with regard to module materials, design
- Novel cell technologies which also affect the module concept
  - Highly efficient cell concepts & integrated bypass diode
- Module materials which enable increased efficiencies
- Reduced levelized of cost of energy (LCOE)
Main approaches: Weight / Materials / Cell & Module Design

- Standard module: Stability based on thick glass and/or aluminium frame
  - Glass and frame have considerable weight; lower weight $\Rightarrow$ reduced stability
  - Approach: Novel module design and/or use of alternative materials

- Also other materials still have potential for reduced weight/material consumption
  - Encapsulant & Backsheet (also new standard)

- Lower module weight may result in lower BOS cost and enable new applications
  - Mounting solutions adapted to novel module design concepts

- Backsheets with improved reflectance; encapsulants with improved clarity

- Bifacial & highly efficient cells
  - Increased yield at module and system level

- Omit/integrate bypass-diodes
  - Integrated shunting path to prevent hot spots (reduce cost and failure susceptibility)
Individual work packages related to:

**Material**
- Glass
- GRP
- Encapsulant, backsheet

**Module**
- CTM
- Bifacial, monofacial
- Light weight, alternative design

**Cell**
- Intrinsic bypass diode
- Bifacial Bison
- IBC Zebra

**System**
- LCOE (levelized cost of energy)

Module reliability, performance and cost effectiveness
Individual work packages related to:

**Material**
- Glass
- GRP

**Encapsulant, backsheet**

**Ultra light weight -> thickness below 2 mm**
- Weight < 19 kg (glass/glass)
- Conforms to IEC 61215 standard

**GRP with a specific module weight of 2.5 kg/m²**

**Backsheet reflectivity by 20% increased (> 90%)**
- Higher transmissivity of encapsulant
- Shorter lamination time (< 10 minutes)
- Thickness reduction of backsheet and encapsulant
Individual work packages related to:

- **Module**
- **CTM**
  - Bifacial, monofacial
  - Light weight, alternative design

- **Material and cell development leading to CTM losses <2%**
- **Bifacial: cost reduction on LCOE level up to 30%**
- **Novel module design to realize light weight devices**
  - New materials and material combinations
  - Applications: Green houses, cable mounting, etc.
Individual work packages related to:

- Defined reverse characteristics in order to avoid the need of bypass diodes
- Bifacial: cost reduction on LCOE level: 30%
- Bison, Zebra and standard cells for project goals
  - Bifacial solar cells with an efficiency of 20.7%.
  - IBC Zebra solar cells with an efficiency of 21.7%
Individual work packages related to:

System

LCOE (levelized cost of energy)

Cost reduction on LCOE level for the bifacial setup close to 30%
Scientific, technical and commercial challenges

- Technical goals in general (weight, reflectivity, transmission,…)
- Very thin (< 2 mm) suitable glass is no standard product. Properties have to be tested. Stability, hail test,… availability!
- Alternative materials and their combination in laminates have to fulfill the requirements on durability and stability (IEC standards)
- Throughout revision of the module design for alternative module concepts
- Suitable production processes have to be found (e.g. lamination of GRP / c-Si)
- The (price) competitiveness has to be shown
- Challenges concerning the material development, e.g. pigment particles in the sub micrometer-range with very high refractive index,…
Experience with and suggestions for SOLAR-ERA.NET joint calls

- For all partners it is the first SOLAR-ERA.NET project
- The project only started -> feedback up to now only to the application phase
- Feedback of the partners can be summarized as follows:
  - All partners are extremely happy to have the opportunity to work within the frame of this international project
  - Dependency of the overall project granting on several national deciding entities is not ideal