ECN reference design bifacial module

April 15, 2016

Josco Kester, Mark Jansen (ECN)
josco.kester@tno.nl
Design Considerations for Bifacial PV in MGS

Laminate and system considerations for MGS (Modulair Geluids Scherm)
- All panels or elements in the barrier should be the same from barrier builder point of view
- Barrier may have lower and higher parts with different tilt angle
- Modularity should be maintained on both panel and system level
- Severe self-shading by panel frame and construction poles
- Bifacial PV technologies set higher requirements for all electrical components
- Application of additional layers of PVB may set additional requirements for laminate edges
- Legislation and norms for noise barriers and electrical installations and IEC for PV must be met
- Applicable electrical and other safety requirements must be met in case of road accidents or vandalism

Solar Highways - ECN reference design bifacial module – April 15, 2016
Predesign MGS-PV: Laminates

• Predesign for laminate: maximum number of cells
• Design measures for horizontal and vertical self shading
• Compliance with all considerations

• Discussed with manufacturer:
  manufacturable, cell spacing critical for production
• Decided to modify design: 90 cells → 85 cells

Solar Highways - ECN reference design bifacial module – April 15, 2016
Critical Aspects: Bypass Diodes & Junction Boxes

- Bypass diodes and junction boxes are critical components in many PV technologies.
- This is even more the case for bifacial technology because of the higher currents, and limited availability of components.
- Two options have been investigated:
  A. Inlaminate diodes; flexible in design but too limited current.
  B. Special high diode and current junction box; holes in glass required, current rating 20 A.
- Current ratings and temperatures for option B have been experimentally verified, and the option is approved.
Critical Aspects: Graffiti

- Graffiti is permanent and will very severely reduce yield
- The most solid approach against it seems a regular cleaning service; frequency and costs to be determined
- The cleaning demand might be reduced by means of (existing) anti-graffiti coatings; PV and other properties need to be investigated: transparency, reflection, effectiveness, durability
Final Design MGS-PV: Laminates

- Maximum number of cells for non-critical spacing
- Empty surface area preferentially on top and near poles
- Single-diode junction boxes, mounted on glass
- Two mirror-image laminates per one MGS element
- Vertical support stud added in middle of MGS element
Final Design MGS-PV: System

- 5 kW 3-phase inverters with wide (mppt) voltage range
- Two inverters per 18 m, in one cabinet
- Per inverter 6 MGS elements in series
- Cable duct at top of each MGS element
Disclaimer

“Although the information contained in this document is derived from reliable sources and reasonable care has been taken in the compiling of this document, ECN cannot be held responsible by the user for any errors, inaccuracies and/or omissions contained therein, regardless of the cause, nor can ECN be held responsible for any damages that may result therefrom. Any use that is made of the information contained in this document and decisions made by the user on the basis of this information are for the account and risk of the user. In no event shall ECN, its managers, directors and/or employees have any liability for indirect, non-material or consequential damages, including loss of profit or revenue and loss of contracts or orders.”