1 – 3% Module Efficiency Increase with MWT Technology and a Module Assembly Line for Back Contact Solar Cells

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Company

- SIBCO is a Dutch company with offices in:
  - Roosendaal, The Netherlands
  - Franklin, MA, USA
  - Kunshan, Jiangsu, P.R. China
- Engineering company specialized in BC c-Si cell and module processing solutions
- Process Optimization and Lean Manufacturing
Reduction of Module Cost

- Less Silicon usage: Thickness 130-100 µm
- Increase cell efficiency with double print
- Larger cells: 210 mm
- Increase Module Efficiency from 15 to 18%
- Easy manufacturing
  New cell and module design

Cost Reduction of mc-Si PV Module Technology
Back Contact Cell Technology

- **MWT – Metal Wrap Through**
  - Ag fingers are connected to the back side through holes in the silicon wafer, in P-type and N-type

- **EWT – Emitter Wrap Through**
  - A large number of holes provides a larger emitter surface and the contacts are on the back side

- **IBC - Interdigitated Back Contact**
  - A complex emitter buildup with contacts on the back side of the cell
Market Forecast

![Graphs showing market forecast for wafer thickness and back contact cell production. The graphs are sourced from INEMI and IMAPS Technology Roadmaps and German Working Group.](image-url)
Benefits of MWT BC Cells

- MWT BC means No Busbars but Via Connections
  - Less shadowing, shorter finger connection lines and a lower series resistance
    -> higher efficiency
- Less process steps in module assembly
  - Less damage to the cell -> higher efficiency
- Easier module assembly
  - Allows the use of thinner cells
  - Allows the buildup of intelligent modules
  - Allows the buildup of custom layouts
Increase Module Efficiency with MWT BC Cell

- MWT BC cell before and after lamination
- Cells are glued with conductive adhesive to the back contact sheet
BC Module Buildup

- The BC module consists of the following layers:
  - Top Glass
  - EVA
  - BC c-Si Cells
  - EVA
  - Flexible Printed Circuit Board Back Contact Sheet
Biggest Advantage of BC Modules

• In the standard H-pattern module assembly the efficiency loss is typically 2.7 – 5% due to high internal resistance & cell damage in the tabber/stringer assembly process

• In the BC module assembly the efficiency loss is <1% with the EUROTRON BC module assembly process

A Gain in Module Efficiency of 1.7 – 4%!!

** with the Eurotron module assembly line
Excellent BC Module Efficiency

- Proven high module efficiency
  17.13% from 17.37% cell efficiency

- Assembly efficiency loss of 0.24%

- 75% Fill Factor
7 Benefits of BC Modules

1. High speed 150 MW = 3 x common speed of a Tabber/Stringer line
2. High yield % by carefull cell processing
3. Minimum amount of operators required
4. Small footprint saves on building costs
5. Thinner cells can be processed
6. High output & fill factor
7. Better looking modules
8. Lower cost/Wp
Summary

1. High speed production: 1x 150MW BC module line = 3 tabber/stringer assembly lines
2. High Efficiency Modules, > 17% P-type cells, > 18.5% N-type cells
3. High yield % by carefull cell processing < 0.01% breakage, <1% efficiency loss
4. Minimum amount of operators required
5. Small footprint saves on building costs
6. High fill factor ≥ 75%
7. Thinner cells can be processed 120um with 0% breakage*
8. Better looking modules
9. Lower cost /Wp € 1.04/Wp vs € 1.08/Wp

The Result: Lower costs and higher module efficiency ➔ more profit!

* depends on upstream handling of the wafers.