# Rebuttal to Quality Related points brought by National Solar Energy Federation of India by Indosolar

NSEFI published the following quality related issues in Business Line on March 26th 2014 with regard to crystalline silicon solar cells manufactured in India:

"India-made solar cells are of poor quality, less efficient and more expensive than imported cells, solar power project developers have said in a letter to the government."

"Now, the developers feel that the 375 MW with domestic cells cannot be put up — primarily because there is not enough capacity to produce that many cells, but also because whatever is produced is not of quality. "Domestic Solar Cells stand at a higher risk in terms of reliability issues. Visual defects in the form of Print Defects, Bowed Cells and finger interruptions are common. Electroluminescence (EL) Image of cells reveals lot of defective cells with Body and Edge Shunts and Dead Cells which actually impacts reliability," said the Managing Director of a leading solar plant builder."

Following is the response of Indosolar Limited, the largest solar cell manufacturer in India.

1. It may be noted that most Indian cell and module manufactures started their operations in India somewhere in 2009-10 when demand of these cells and modules was miniscule in the country. Consequently most of the cell and module manufacturers exported their produce to European countries after meeting the strict quality criterion and going through the rigorous IEC certification processes.
2. Indosolar exported its cells to European countries as well as Chinese and Taiwanese companies. The total export of Indosolar has been more than 200MW.
3. Indosolar has supplied cells to almost all Indian module manufacturers who in turn exported modules to European countries
4. The best criterion to ensure cells quality in PV industry is the IEC certification obtained for modules made from particular vendor's cells. The list of 13 known customers who have got IEC certification with Indosolar cells in India and abroad is given in Annexure "A".

5. In the JNSM phase 1 part 2, wherein domestic content requirement for crystalline solar cells was put in, Indosolar and other Indian cell manufacturers have supplied cells for the program to various module manufacturers including Emmvee and Vikram Solar. Modules made out of these cells are already installed in solar farms and understandably performing very well.
6. With regards to lower efficiency of Indian solar cells please note our following points,
    a. Worldwide the efficiencies of polycrystalline silicon solar cells for main stream cell producers range from 17.0% to 17.8%.
    b. Indian cell producers are producing polycrystalline silicon solar cells with average efficiency of 17.4% (range 16.8% to 17.8%)
    c. It may be noted that efficiencies at Indosolar are measured with Golden cells calibrated at ISE, Fraunhofer, Germany. Indosolar continuously interacts with ISE Fraunhofer, Germany for benchmarking quality and reliability of its cells. The measured results at ISE, Fraunhofer can be shared on demand.
    d. It may be noted that the technology and materials used for manufacturing solar cells by all mainstream producers globally is same today as used by Indian cell manufacturers. In fact, in Indosolar a state-of-the-art technology from M/S Schmid, Germany have been imported which is totally automatic ensuring manufacturing of cells untouched by hands and still remains the leading technology in the world.

7. With regard to reliability issues following points can be taken into the consideration:
    a. IEC certification in addition to certifying quality also ensures the long term reliability of modules and cells through accelerated life time tests.
    b. Recently modules made from Indosolar cells have been rigorously tested for reliability by one of the largest module manufacturer customer in China. These modules have performed exceedingly well with ZERO CTMPL (Cell to Module Power Loss). The results can be shared on demand.

8. “Visual defects in the form of Print Defects, Bowed Cells and finger interruptions are common. Electroluminescence (EL) Image of cells reveals lot of defective cells with Body and Edge Shunts and Dead Cells which actually impacts reliability,” said the Managing Director of a leading solar plant builder.”……

Indosolar has been supplying solar cells to globally as well as domestic customers. Indosolar provides to customers its own evolved quality criterion for acceptance of cells based on strict benchmarking with competing cell manufacturers. These criteria are incorporated in purchase agreements with each customer after mutual discussions. These criteria can be supplied on demand and can be compared with any company globally.

The defects mentioned based on EL imaging of cells cannot be absolutely absent on cells however these are perfectly in order if these are within the acceptance criteria. Indosolar has a well structured and globally benchmarked CCR (Customer Complaint Register) system which takes care of any complaint with respect to visual quality issues as raised and complaints are attended speedily.

Indosolar has never received any complaint with regard to body, edge or dead cells. These words have been used by some vested interest to increase the impact value.

9. **Additional points:** further In order to allay the concerns with regard to the quality and reliability of cells produced in India, Indosolar would like to enlist the plethora of quality and reliability tests routinely carried out during production of cells in in-house laboratory equipped with all modern equipment:
    a. Solderability on front and back bus bars
    b. Moisture ingress test
    c. Cell bow
    d. Cell thickness
    e. LID
    f. Peel-Off test for back side Al metallization
    g. Cell level shunt resistance
    h. Cell level mechanical strength

i. Printing parameters i.e. finger and bus bar width and height, Al thickness
j. Grid resistance
k. SiNx thickness uniformity
l. Intensity dependence test

In addition to the above in-house cell level tests, Indosolar also conducts periodically several tests on cells as well as module level in external laboratories. Some of the periodic tests which are conducted are as follows,

a. Peel-Off test
b. Humidity Freeze test
c. LID
d. High Pot test
e. PID
f. Measurement of temperature coefficients
g. Spectral response
h. IQE
i. EQE
j. Diffusion profile
k. Intensity dependence
l. Low light behavior

**Potential Induced Degradation (PID) test: Recently the industry has become quite sensitive to the potential induced degradation of modules due to continuous application of high voltage under high temperature and high humidity conditions. This type of degradation is quite relevant in India as here very high temperature and high humidity are faced by the modules.**

**The problem of PID has to be solved by improvement of the processes both at cell and module level. Many manufacturers abroad are offering PID free cells on premium as they have to modify their equipment and processes to produce the PID free cells. Indosolar has developed in-house unique technology which enables the production of PID free cells without any modification in the line and any additional costs. Therefore cells offered from Indosolar are all PID free and Indosolar does not charge any additional price for this feature from its customers.**