Regional Influence on Module Design Quality:

Qualification Testing Failure Rate Results from Six Regional Labs of TUV Rheinland around the World

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1. MOTIVATION

Between 2011 and 2013, there was an immense price pressure/competition on/between the PV module manufacturers and this price pressure has steered many manufacturers to cutting corners with poor quality materials or introducing unqualified materials. This paper analyzes if these changes influence the module design quality from two perspectives:

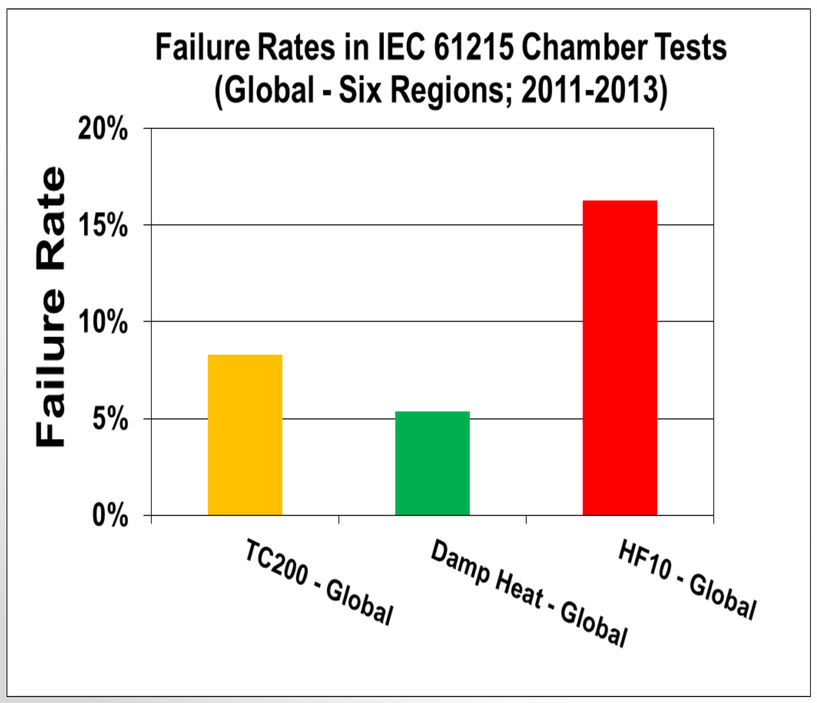
(i) is the failure rate in the 2011-2013 period dependent on the specific regions of the world where the modules were produced and tested?

(ii) is the failure rate in the 2011-2013 period dramatically changed as compared to the prior failure reported between 1997 and 2011?

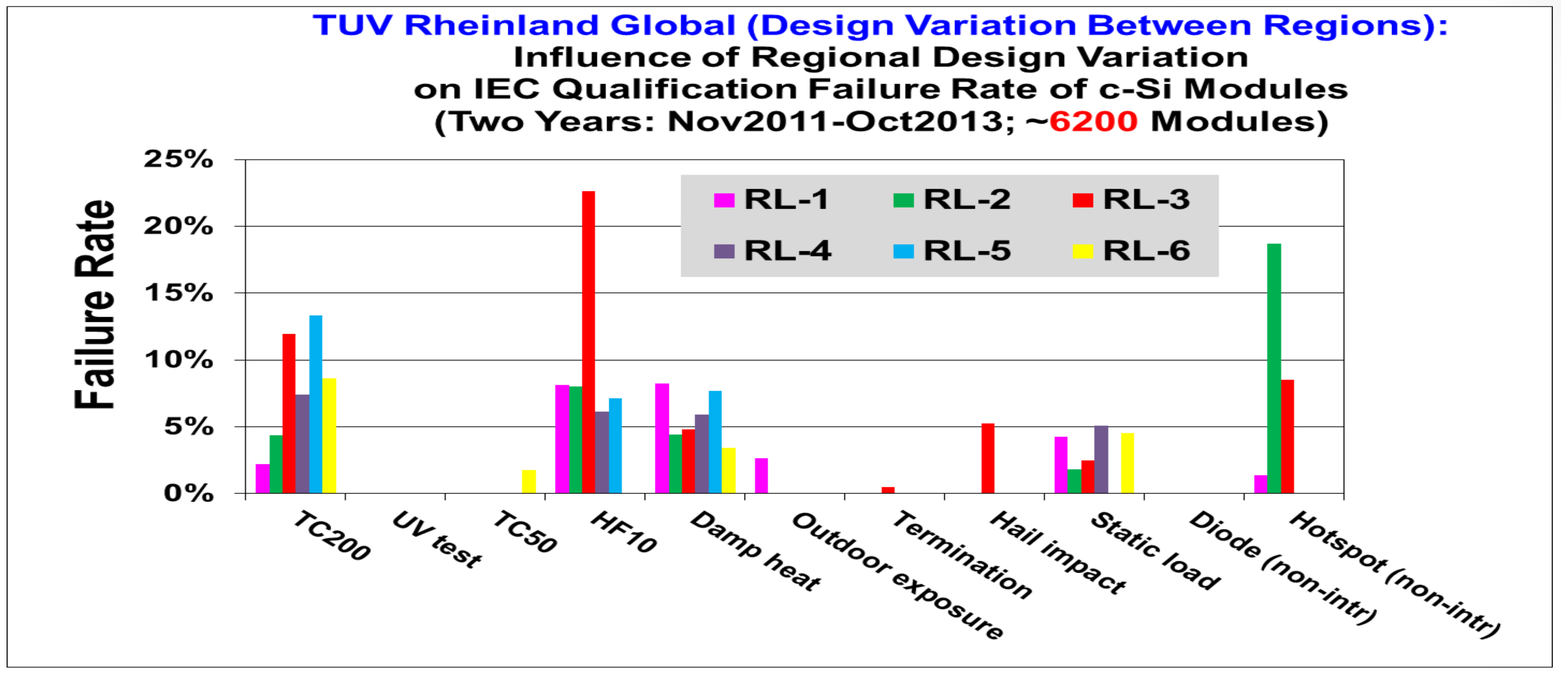
2. DATA ANALYSIS APPROACH

- To uphold a country-blinded approach for this publication, the locations of the six TUV Rheinland's Regional Laboratories (RL) are identified by the following randomly assigned codes:
  RL-1, RL-2, RL-3, RL-4, RL-5, RL-6.
- Only the failure rate analysis of crystalline silicon technologies is presented in this paper.
- The failure rate reported in this paper is calculated using the following formula: Failure Rate (%) = Number of modules failed in a specific test in a specific period ÷ Total number of modules tested in the specific test in the specific period.

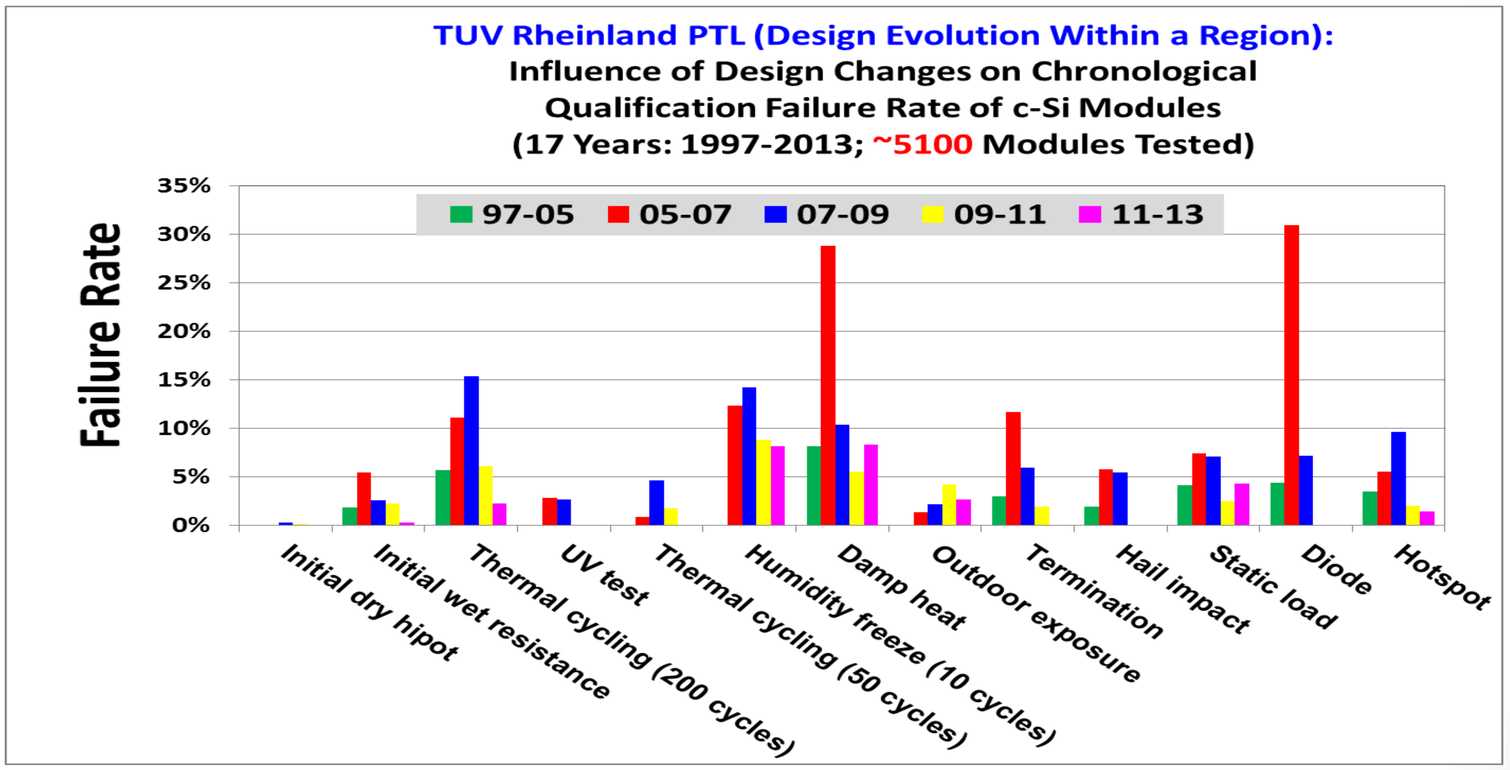
3. FAILURE RATES IN IEC 61215 CHAMBER TESTS (Global-Six Regions; 2011-2013)



4. DESIGN VARIATION between the REGIONS (all tests of IEC 61215 considered; 2011-2013)



5. DESIGN EVOLUTION within a REGION (all tests of IEC 61215 considered; 1997-2013)



6. CONCLUSIONS

- Between Regions - Regional variation influence on the design quality: Stark regional dependence on the failure rates has been observed for the three stress tests of thermal cycling (metallic material issue?), humidity freeze (polymeric material issue?) and hotspot (cut-cell issue?).
- Within a Region - Regional evolution influence on the design quality: Encouragingly, the test results obtained at TUV Rheinland PTL (United States) over the past 17 years indicate that the failure rates are generally lower in almost all the stress tests of qualification testing for the latest period of 2011-2013. To differentiate these products "Qualification Plus" testing, "PV+" Testing and/or "Comparative " testing are needed.

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