PV MODULE QUALITY –

CHALLENGES FOR THE AUSTRALIAN MARKET

All-Energy Australia

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OUTLINE

Reporting of PV module quality issues in Australia

- PV module Fault Reporting Portal
- Reports to CEC

Structural reasons for low quality modules in the market

- Nature of supply chain
- Size of systems
- Nature of government support

CEC PV module approvals

- New Terms & Conditions for listing
- Testing Program results

Technical due diligence in purchasing modules

- How the rest of the world handles quality
- What does a TDD program look like

Conclusions

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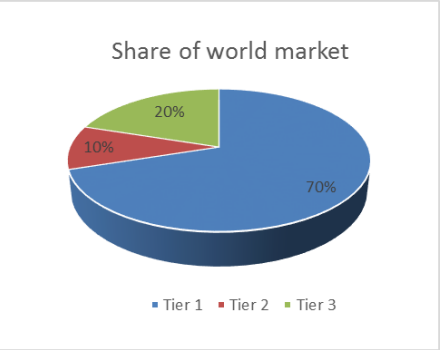
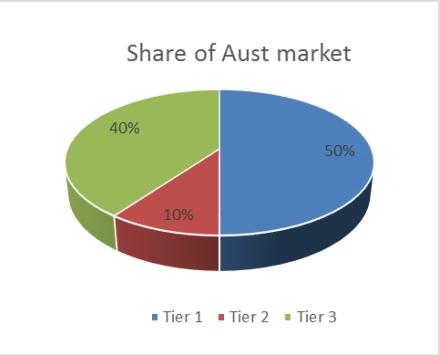
INTRODUCTION

Some challenges

- Around 70% of PV modules worldwide are manufactured by the top 10 manufacturers
- The other 30% is shared by hundreds of others
- In Australia, an estimated 40% of modules come from relatively small manufacturers
- This suggests Australia may be attracting a disproportionate share of lower quality PV modules
- If so, what are the reasons?
- What can we do about it?





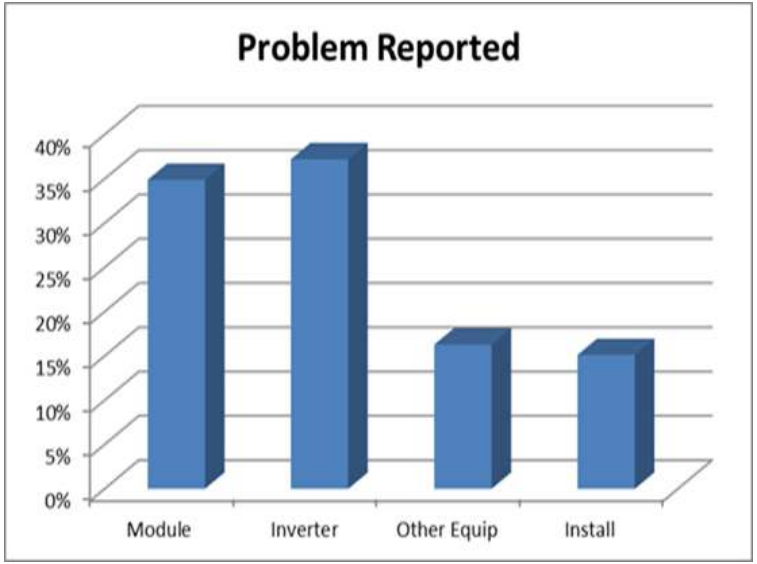
REPORTING OF QUALITY ISSUES

PV Fault Reporting Portal

- Web-based survey on PV module and system faults
- Established in 2014 -funded by ARENA
- Part of international project with APVI, Murdoch Uni, UNSW, CAT and CEC working on PV module quality
- Aimed to collect data particularly on module issues

Analysis of Portal Reports

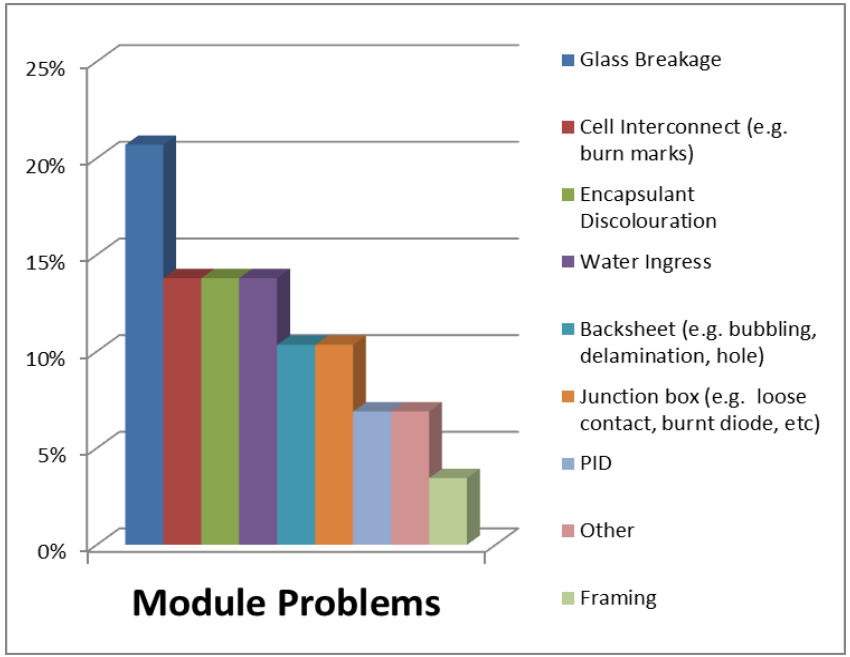
- 86 reports received in 15 months
- 35% reported a module problem
- 37% reported an inverter problem
- 31% reported an installation or BOS issue



REPORTING OF QUALITY ISSUES

Analysis of Portal Reports

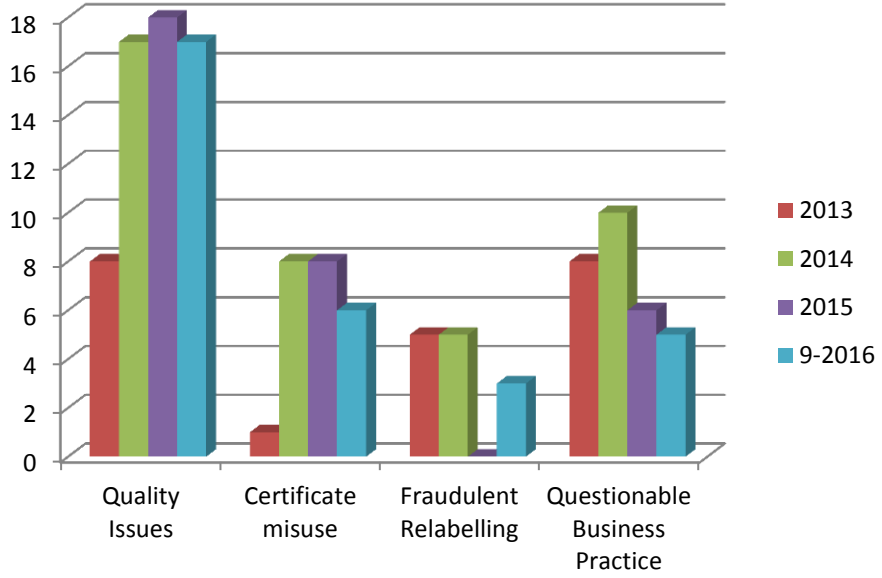
- Glass breakage was the leading report
- Water ingress and delamination was 24%
- Water ingress creates low resistance to earth
- Soldering faults account for 14%
- Two reports of Potential Induced Degradation (PID)



REPORTING OF QUALITY ISSUES

Reports to CEC

- 32 reports last year – 31 so far this year
- Quality issues reported are still high
- Fraudulent relabelling still a problem
- Certificate misuse and dodgy practices are still significant
- Certificate misuse includes companies putting their own brand on modules without their own co-licence certificate
- Certificate misuse includes claiming STCs using a different model number from the label



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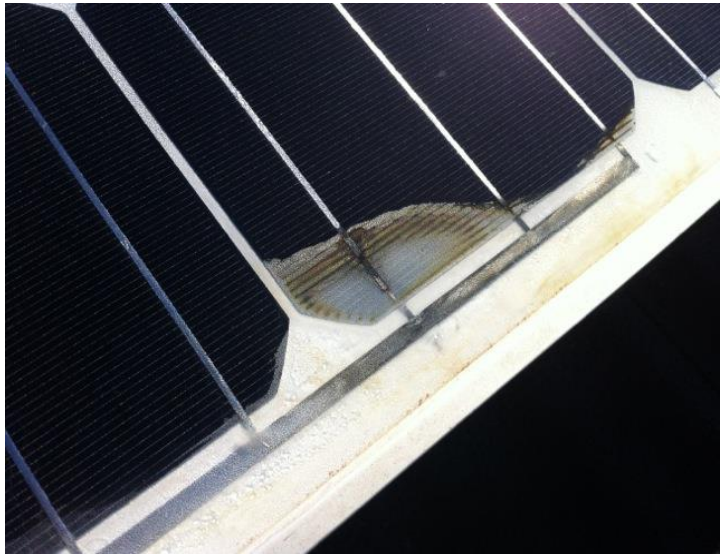
REPORTING OF QUALITY ISSUES

Reports to CEC

- 17 Quality issues reported 2016 to date
  - Problems appearing after 2-4 years
  - 35% reports related to water ingress and low resistance to earth – lamination failure
  - 35% are cell hotspots, busbar or junction box burn marks
  - Poor warranty support from Tier 3 manufacturers
  - $0.5m court case won against a manufacturer for module yellowing
  - CEC take note of all reports and take action where possible
  - CEC now testing for wet leakage



STRUCTURAL REASONS FOR QUALITY ISSUES

- Size of systems
  - Average system size in Australia growing but still small by world standards
  - Technical due diligence in purchasing is often only done on large systems due to cost
- Nature of supply chain
  - Australian market dominated by distributors
  - Some do not have a vested interest in quality
- Nature of government support
  - STCs paid upfront – do not encourage quality
  - Feed-in tariffs paid on long term performance

STRUCTURAL REASONS FOR QUALITY ISSUES

- International standards and certification
  - IEC 61215 and 61730 are over 10 years old
  - Designed only to catch infant mortality faults and basic safety
  - Minimum standard, but does not mean modules will last 25 yrs (5 yrs?)
  - Both replaced in 2016 – CEC will require compliance late 2017
- Lack of international standards for long-term reliability
  - CEC is part of international PV-QAT to address this since 2012
  - Developed IEC 62941 Guideline for increased confidence in PV module design
  - Published 2016 – yet to see how many companies will adopt this
  - CEC is encouraging manufacturers to certify by offering an Enhanced Listing

IEC 61215-1

Edition 1.0 2016-03

IEC 61730-1

Edition 2.0 2016-08

IEC 61730-2

Edition 2.0 2016-08

IEC TS 62941

Edition 1.0 2016-01

CEC PV MODULE APPROVALS

	Introduced
• **Strategies to deal with compliance issues**	
Module Testing Program	Jul-14
Require Construction Data Form	Sep-14
Only brand names owned by the licence holder	Sep-14
Require Certifier Mark on label	Mar-15
Require module labels to conform to samples provided	Mar-15
New Terms & Conditions for listing	Mar-16
All modules must conform to IEC 61730 amendments	**31 Oct-16**
Serial number validation	under considn
• **Strategies to deal with quality issues**	
Enhanced listing for modules with further testing	Mar-14
Module Testing Program	Jul-14
Require Construction Data Form	Sep-14
Require transparency for power rating tolerances	Mar-15

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CEC PV MODULE APPROVALS

- Strategies to deal with long term reliability issues

CEC membership of PV Quality Assurance Taskforce	Mar-12
CEC PV System and Module Fault Reporting Portal	Mar-14
CEC offer Enhanced Listings for higher quality spec modules	Mar-15
New IEC 62941 standard for reliability published	Jan-16
New IEC 61215:2016 & IEC 61730:2016 required for CEC listing	Nov-17

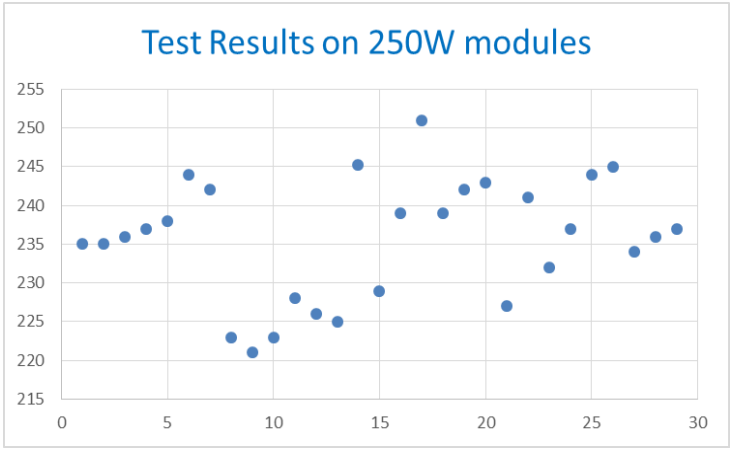
- Enhanced Listings on CEC list
  - Aims to show higher quality modules
  - Extended Testing Programs and Extended Quality Certification
  - Atlas 25+, PV Durability Initiative, TUV Thresher Test, DNV-GL
  - Do the modules shipped to Australia have the same materials?
- VDE Quality Tested
  - Daily, quarterly and annual testing to verify production quality
  - Hanwha Q-Cells and some Suntech modules certified

CEC PV MODULE APPROVALS

- CEC module testing program
  - **Targeted for maximum effectiveness at removing lower quality products**
  - Informed by fault reporting portal & reports to CEC
  - Test selection matrix based on a range of risk factors
  - Two labs in Australia with required accuracy for measuring Pmax
  - Verified against overseas lab
  - So far 35 modules tested
  - Ramped up since new Terms & Conditions
  - **High proportion of "plus rated" modules tested fail to meet their rating for Pmax**
  - **High proportion of modules tested are substituting components not on CDF**
  - **High proportion of modules tested are outside the scope of their certification**

CEC PV MODULE TESTING

- CEC module testing program findings
  - Significant substitution of construction materials
  - Up to 12% under performance on power ratings
- **11 Manufacturers delisted as a result of Testing Program**
- New Terms & Conditions for listing
  - Based on roots and branch review
  - Higher standards
  - Tighter procedures
  - Misleading info on datasheets
  - Warranty performance included
  - Strengthened ability to delist modules
  - CEC will be able to inform industry of issues



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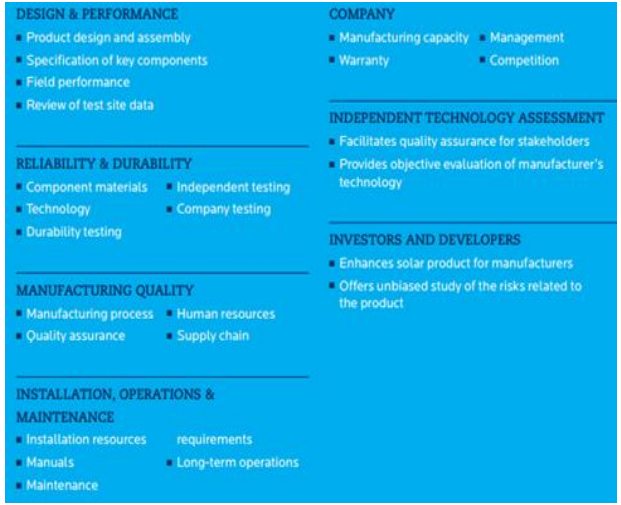
TECHNICAL DUE DILIGENCE IN PURCHASING

- How the rest of the world handles quality
  - Larger projects
  - Tighter contract terms
  - Specify actual materials used
  - Direct relationship between customer and manufacturer
  - Factory supervision of actual production
  - Contract a due diligence company
  - eg DNV-GL, Black & Veatch, Sgurr Energy
- What does TDD mean?
  - Assess manufacturer capability and product quality
  - Specify materials to be used
  - Use agent at factory during manufacturing & shipping
  - Post production testing to ensure all standards are met
  - Test modules in Australia – accurate and affordable – eg PV Lab Australia



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TECHNICAL DUE DILIGENCE IN PURCHASING

- What does a due diligence program look like?
  - Engaging a specialist company
  - Based on in-depth understanding of manufacturer
  - Detailed understanding of the manufacturer's processes
  - Specify what features and additional tests are required
  - Detailed specification of materials used
  - Assessor present during production run

- The whole supply chain needs it
  - Wholesale distributors are the key controller of quality
  - Retailers can generally only buy what is in the warehouse
  - Retailers need strict contract terms and conditions on their ordering
  - Need to use the exact model number on ordering and invoicing at all stages
  - Get in writing whether the modules have the additional certifications required
  - Eg PID, ammonia, salt, sand, snow

CONCLUSIONS

- Inherent limitations to the approval process
  - Standards do not cover long term reliability
  - What is shipped may not be what was certified
  - Structural factors working against quality in the Australian market
- Why wholesalers and retailers need to take more responsibility for quality
  - A model number may be certified for multiple sets of materials
  - These will vary in quality
  - Additional features on the datasheet (eg salt mist corrosion or PID resistance) may not be in your modules
  - The sales contract needs to specify the actual materials used
  - What is shipped may not be what was certified

THANK YOU

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