



Surveys on quality and reliability of solar PV power plants 2017

Büro
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pV magazine
PHOTOVOLTAIK. MÄRKTE & TECHNOLOGIE



Surveys on quality and reliability of solar PV power plants 2017

1. Survey among European investors
2. Survey among the readers of the pv magazine newsletters

Telephone survey from March to May 2017 among technical experts of institutional investors

Approach

Telephone survey between March 2017 and May 2017 among institutional investors into solar PV assets.

Objective: identify relevant topics on PV component quality from an investor's point of view for the run-up of the next Quality Roundtable of pv magazine.

English and German questionnaire with 3 questions on quality issues related to photovoltaic components.

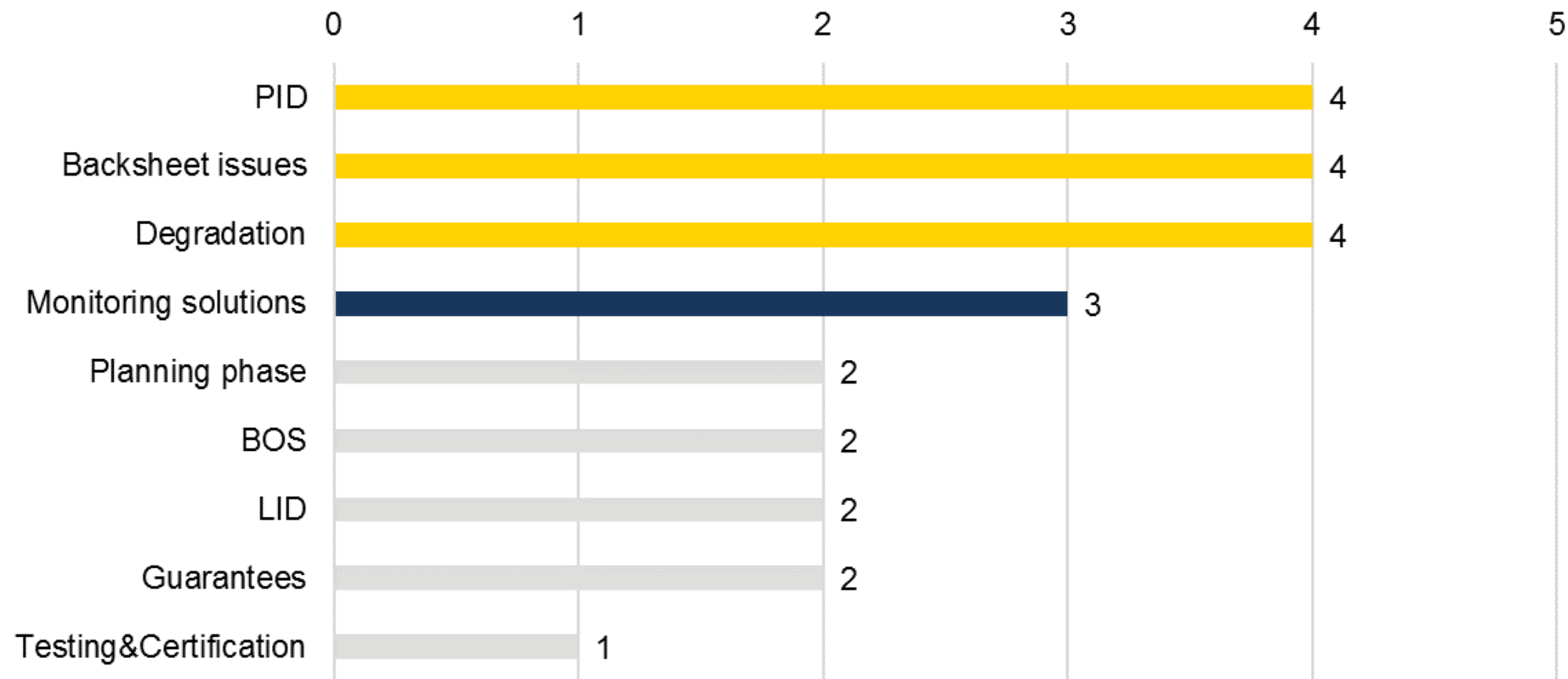
8 qualitative telephone interviews in total:

- 6 from Germany,
- 2 from other European countries.

Answers to open questions were coded by using MaxQDA.

PID, backsheet issues and degradation are the most relevant topics for investors, followed by monitoring solutions

Topics mentioned in answers to open questions



Investor statements indicate that a multitude of quality issues occur in existing PV assets

Investor statements (1/2)

PID

- PID – it's still interesting. ½ year ago in the UK did not know, what it was. Now they know it – it's still a tricky one. Many, many angles. How to deal with it – and how broad is the issue? 20% of all the sites are affected
- PID is still a topic. Still there are no widely accepted tests, furthermore, occurrence depends heavily from the location of the plant. And: bad communication on the topic from many involved parties!
- PID is a major topic in existing pv parks, not so much in new projects. Affects O&M activities in Germany, and many PV parks in Italy.

Backsheet issues

- UV-irradiation & Backsheet?
- Stable quality of the EVA that is used by module manufacturers? Always the same EVA? Bonding? Storing of EVA?
- Backsheet laminates made of polyamid from a certain manufacturer are not UV stable. Was not noticed in standard tests, only during operation. This could happen with other issues as well.
- Module appearance: many issues, yellowing, delamination, bubbles, optical changes. Often correlating and all phenomena occur. Not always relevant for the energy yield, but one has the feeling that the module might not last for 20 years.

Degradation

- Increased degradation – always, all manufacturers, 50% of the modules are affected.
- Minimization and/or predictability of degradation. No one likes surprises on that issue. Happens quite often.
- Degradation standard module crystalline: 0.5%/a, has not changed.
- Degradation after different time periods.

Investor statements indicate that a multitude of quality issues occur in existing PV assets

Investor statements (2/2)

Monitoring solutions

- monitoring data for each individual module: we try to implement this, but does not always make sense from an economical point of view. Here as well, the sweet spot between additional costs and additional yield has to be found.
- Cost effectiveness of thermographic analyses? With the 300€ lense for smart phone, this technology becomes viable for a first assessment. It becomes much more expensive with specialized drones. Thermographics are very helpful, especially in existing assets.
- Infrared and drones work well. Not always 100% clear, but the big errors can be identified immediately. The DIY version with a smart phone works well for a quick check.
- Electroluminescence is very difficult in the field (darkening of the modules, working at night time) Cost effectiveness is difficult to achieve.
- Data for each individual module á la Sunsniffer, Skytron & Co. – measurement of the current in the module. Is a good trend, because it allows for an early detection of degradation and an exchange of individual modules. Not always clear, how they achieve the data.

PID and backsheet issues concern PV investors – and a multitude of other issues

Sum-Up

- PID, backsheet issues and degradation are the most relevant quality-related topics for investors, followed by questions on (new) monitoring solutions.
- In general, the statements of the investors indicate that a multitude of quality issues occur in existing PV assets.
- According to a parallel online survey among readers of pv magazine's newsletters, hot spots are the main quality threat in 2017. However, PID and backsheet issues followed on rank #2 and #3 respectively – and more comments were made on these issues.
- Participants of the online survey put more emphasis on the quality of testing and certification than the institutional investors. The latter stated more often, that they would like to see quality improvements on the side of the module manufacturers and the EPC companies.

Surveys on quality and reliability of solar PV power plants 2017

1. Survey among European investors
2. Survey among the readers of the pv magazine newsletters

Online survey in April/May 2017 among readers of the pv magazine newsletters

Approach and sample

Online Survey between 13 April 2017 – 10 May 2017 among readers of the pv magazine newsletters.

Objective: identify relevant topics on PV component quality for the run-up of the next Quality Roundtable of pv magazine.

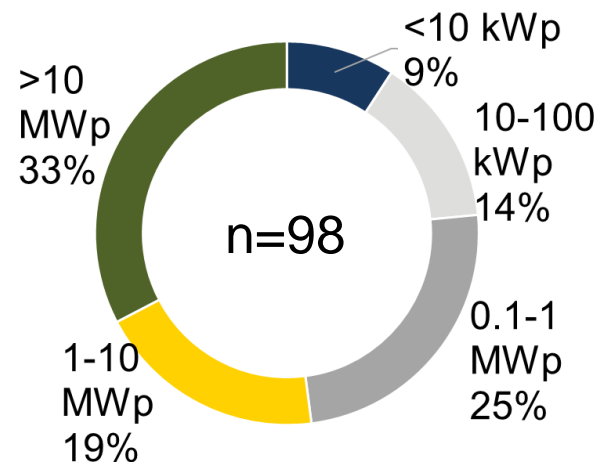
English and German questionnaire with 12 questions on quality issues related to photovoltaic components.

98 survey participants in total:

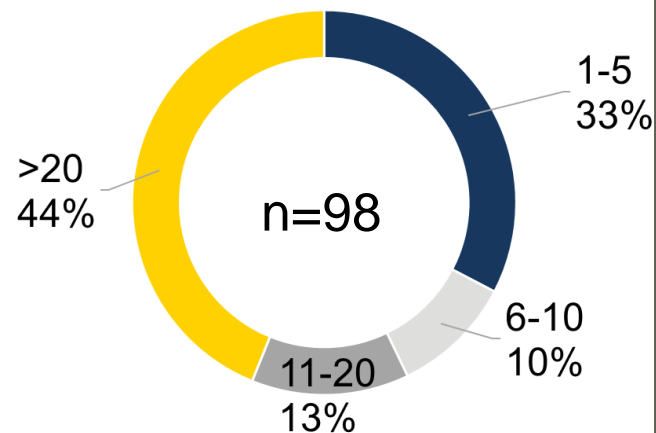
- 26 from countries outside of Europe,
- 44 from Germany,
- 28 from other European countries.

Answers to open questions were coded by using MaxQDA.

Capacity handled 2016



Number of employees

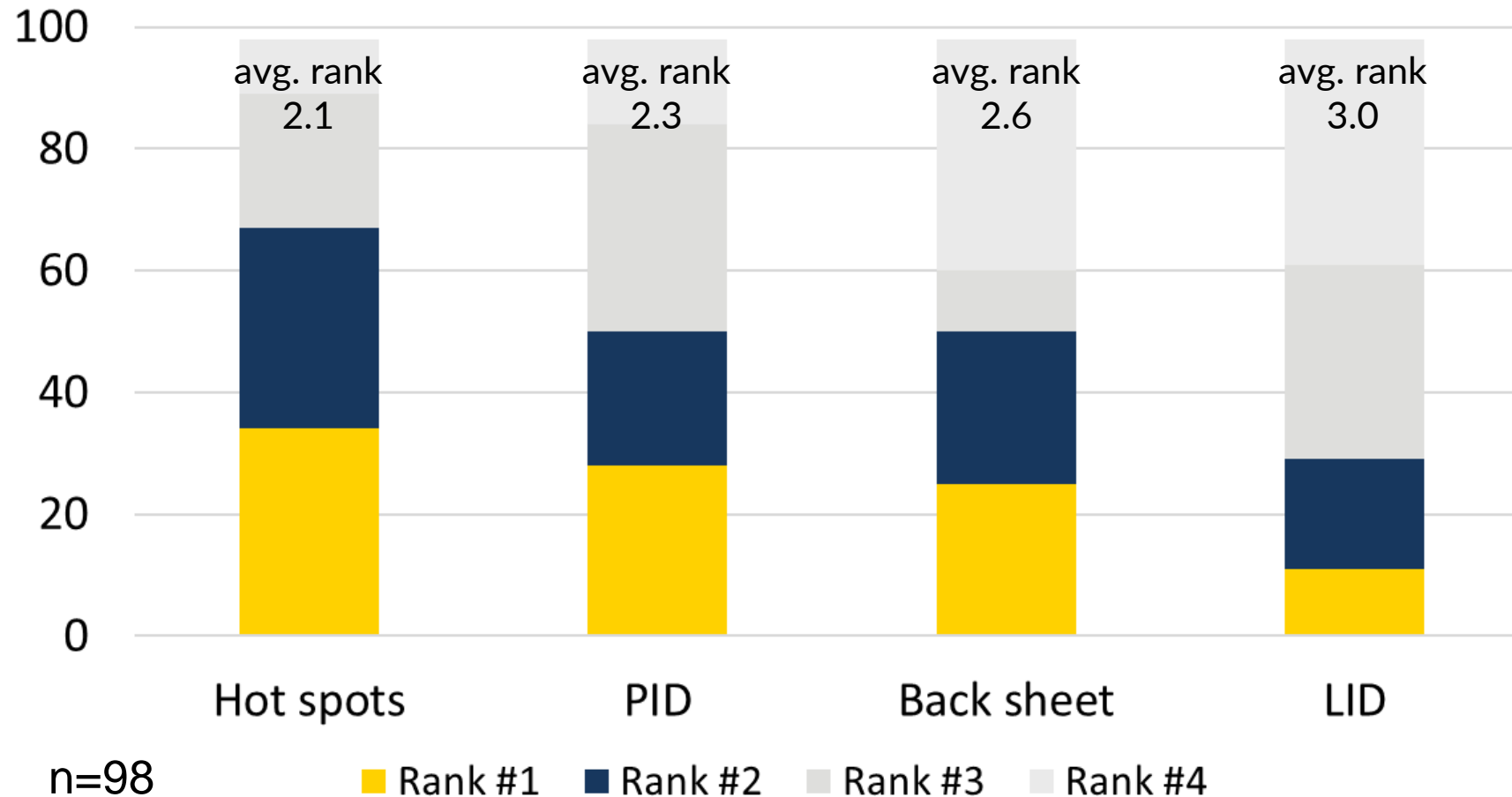


Survey participants per country



Hot Spots and PID are seen as the most important quality issues, comments highlight PID and back sheet problems

Which of the following quality issues would you consider the most dangerous for long-term reliability in plants which you install in 2017? Please rank the following topics according to your experience (1-4).



Comments per category:

23 comments on PID
(8 stating that PID is not a major issue)

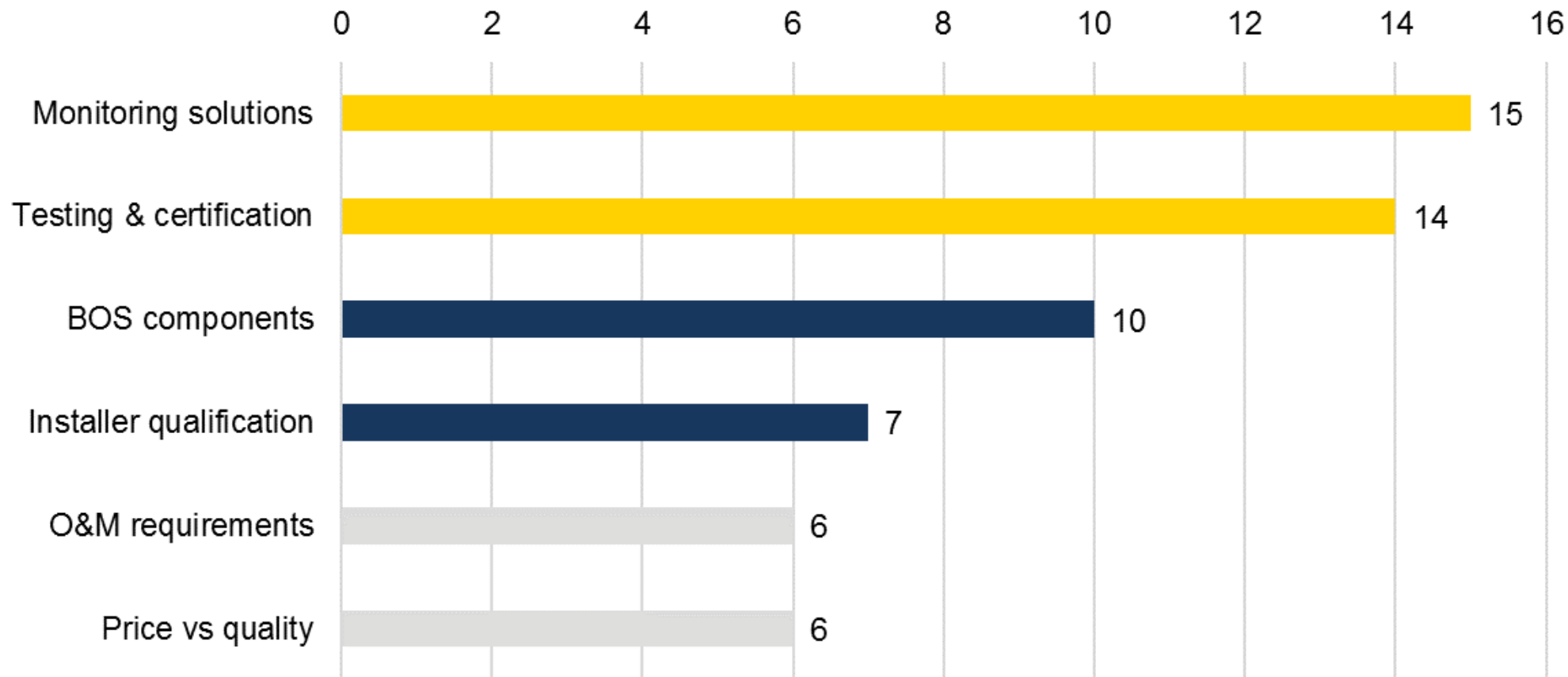
11 on backsheet issues
(1 stating that backsheet problems are not a major issue)

11 qualitative comments on hot spots (2 stating that hot spots are not a major issue)

14 on LID (7 stating that LID is not a major issue)

Other statements go beyond the known module flaws: monitoring, testing, BOS, installer qualification...

Further topics mentioned in answers to open questions



Quite some statements focus on monitoring solutions and smart module electronics

Statements in the category “monitoring solutions”

Documentation and monitoring

Possibilities for a cost-efficient check-up of the module quality

Proper monitoring of microcracks/ snail trails in harsh environments

How can the problem be resolved at a 1st time visit at the site

How to track quality issues?

Which is the best way to identify LID in PERC cells in the field?

Very hard to explain why proper monitoring and/or after-service is needed. Therefore a large number of customers rely on monitoring which comes with the inverter or does not want any monitoring whatsoever. Obviously in that case it's nearly impossible to recognize the problems or take actions in time.

For a reliable PID diagnosis and exclusion of other causes of lower yields, often complex measurements are required.

Comparative analysis of micros vs optimizers vs string for residential solar

Micro inverter and optimizer **Smart module electronics**

problem monitoring at the module level

Discussion of actual failure rates in the field for micros, optimizers and string inverters

We are using panel level monitoring across the board but even then we only notice large production differences between adjacent panels

Lowering of the impact of shading through optimizers

Thermographic test are becoming a standard procedure, is this a must? **Thermographic tests?**

flight thermography still demanded and profitable?

check-up through thermography

Many participants raised questions on tests and certificates

Statements in the category “testing and certification” (selection)

Compulsory compliance with the basic requirements according to VDE 0126 independent tests are often out-dated when published

Which tests are important? is IEC testing enough?
is beyond the norm testing important for buyers?

Which tests & certificates?

Select the components based on warranty or on quality test reports?

how to conduct a reasonable performance measurement?

What additional in factory test are critical.

There needs to be more awareness on the importance of regular testing.

Certification institutes have to be obliged to take responsibility
– why aren't they stricter?

Quality of components varies from company to company and country to country. do this solar industry needs an international regulator like IAEA to control the quality of components as these solar components r for 25 years, otherwise a lot of waste on planet earth

Certification & reality

Certifications like TUV don't say anything about long term reliability. If manufacturers can choose the modules they send to be tested, the tests don't say anything about the quality of the modules that are being produced. Only about the quality of that one selected module.

Reliability & consistency across methodology of certification and sample tested as compared to actual product delivered, change of materials from certified products to actual products delivered.

Beside the quality issues of PV modules, some comments cover BOS components and installation flaws

Statements in the category “BOS components”

Can we use Chinese Inverters?

Inverter issues

How does inverter loading (over or under) affect long term reliability

Micro inverter and optimizer

Number of companies providing BOS, but how we can sure these companies are genuine

other BOS

which components in the BOS play a very crucial role in the life of a PV plant

Which are the best cabling options (modules, but also tubes vs. underground cables)

Screws and fasteners

Statements in the category “Installer qualification”

I have mainly found planning and assembly errors in our plants.

Qualification of installers.

Installation flaws as the main quality issue – or not?

Training programs

Professional installers

How big is the effect of difference in installation over planning?

Unfortunately, it has become very easy to quickly blame the installer for any flaws that might occur

Installation procedures, care given to the modules during installation

When will be possible to automate the module installation on site in order to reduce handling problems? Any robot all ready in the market?

The way the modules are handled and how they are installed (low level of training, stepping on the modules etc.)

Quite some participants raised the relation between PV component prices and quality issues

Statements in the category “O&M Standards”

What are the exact standards for inspection and maintenance?

O&M standards and best practices

Set a standard minimum

Preventive maintenance plan, record of corrective maintenance interventions

What are the major faults that a Site Engineer should look for while doing a maintenance of a PV plant?

Will there be a uniform standard for maintenance?

Which binding requirements (aaRT) apply in terms of easiness of maintenance?

Statements in the category “Price vs. Quality”

How the price pressure is affecting the quality in the selection of components?

Unfortunately, the strong price pressure negatively impacts quality.

Price battle hindering quality?

Installing quality panels are more expensive and the market just go for cheapest products, this will have serious consequences on the long run for our industry.

Price to Quality for PV panels

Premium modules = better quality?

What case studies and evidence is there that installing premium quality and reliability equipment will save time and money during the post-installation phases of a system?

Soft costs are the leading expenses facing installers, yet we also often focus so much on equipment costs. What metrics and case studies might we cite to understand that using premium products for their reliability and quality might actually save us money during planning and installation?

Does panel price predict and or affect reliability?

Differing statements were made on backsheet issues

Statements in the category “Backsheet issues”

Over the time period of 10 years, the biggest issue is referred to backsheet problems

Backsheet is yellowing **a major quality issue**

Aktuelle Erfahrungen zeigen, dass die Zulieferkette bei der Rückseitenfolie oft nicht sauber kontrolliert wird. Aus meiner Sicht weiß man zu wenig über die Langzeitstabilität von bestimmten Materialien.

With backsheet problems we have cases at the end of the product warranty where the operate correctly but the actual condition does not give confidence for 20 additional years of safe operating.

if you have one backsheet issue, its most likely to affect the whole batch

With the amount of degradation and backsheet problems in the sector, when will stronger quality standards be applied

For our application backsheets must be hermetic and encapsulants must be high barrer

Delamination etc. aktuelle Probleme in Altanlagen

In one plant, we observed yellowing of the back sheet foil, but no yield loss

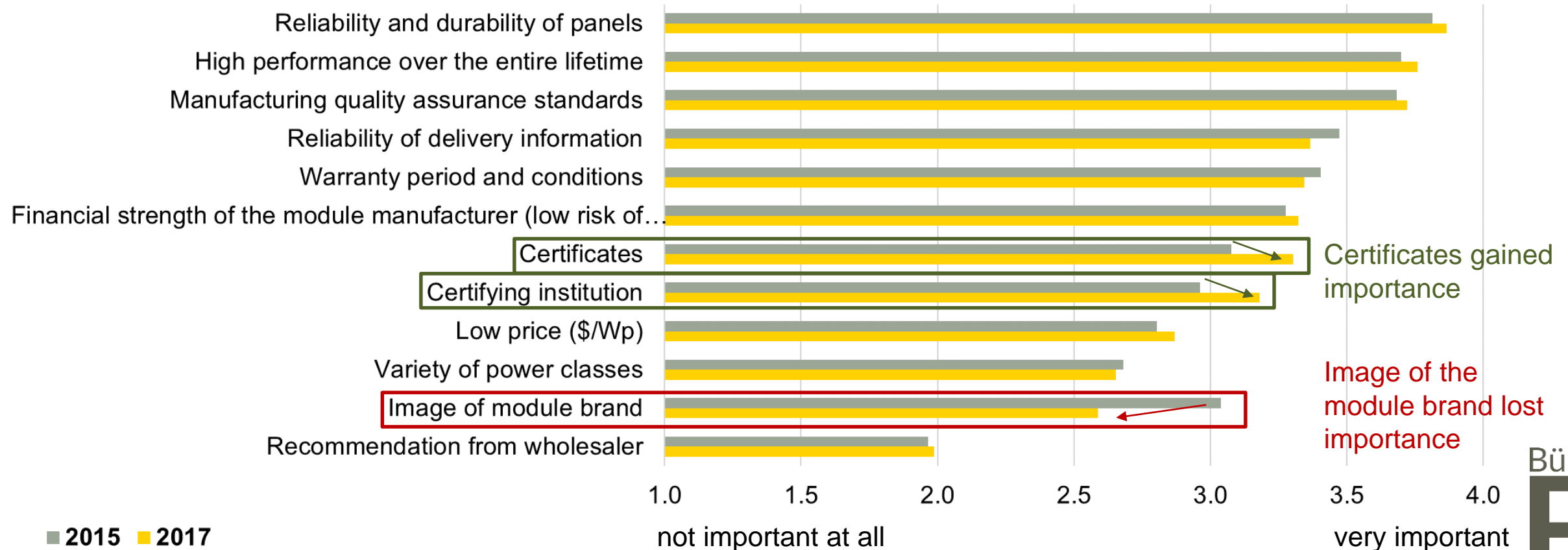
Backsheet is not a major quality issue

The quality of material and processing has increased. Therefore, fewer problems with hotspots and backsheets.

Backsheet foils on #4, as we never had problems so far

Purchase decision criteria are all in all stable, when compared to a similar 2015 survey

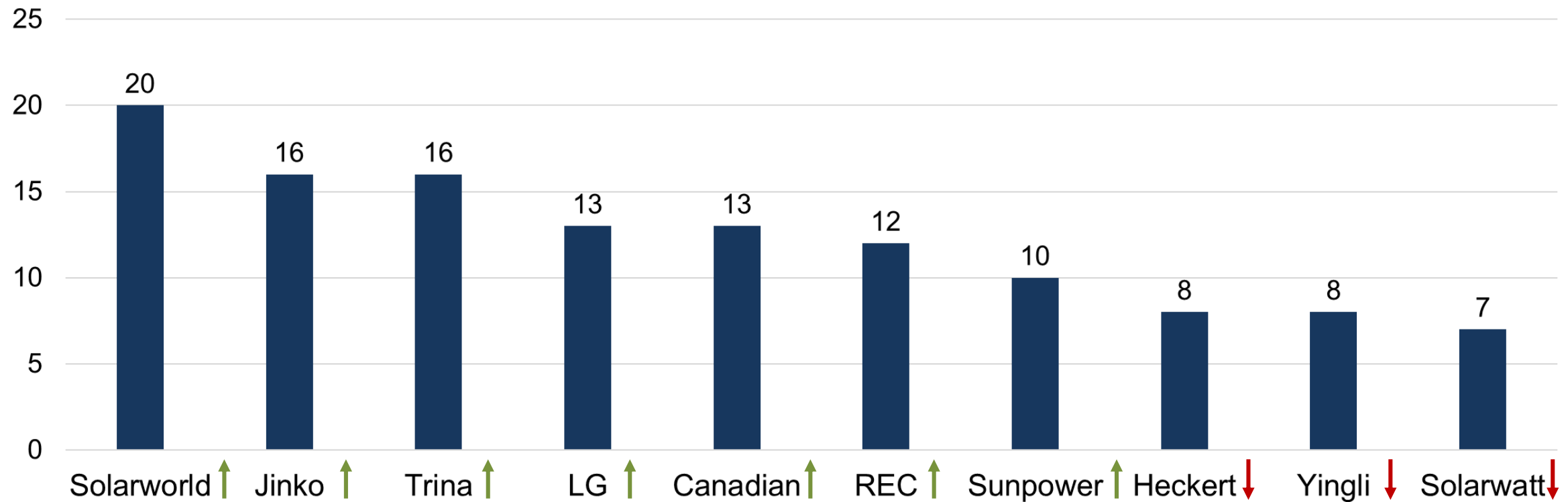
How important are the following factors in your decision to recommend solar panels?
(1 = not important at all to 4 = extremely important)



■ 2015 ■ 2017

Solarworld, Jinko, Trina, LG and Canadian are the top module brands, according to pv magazine readers

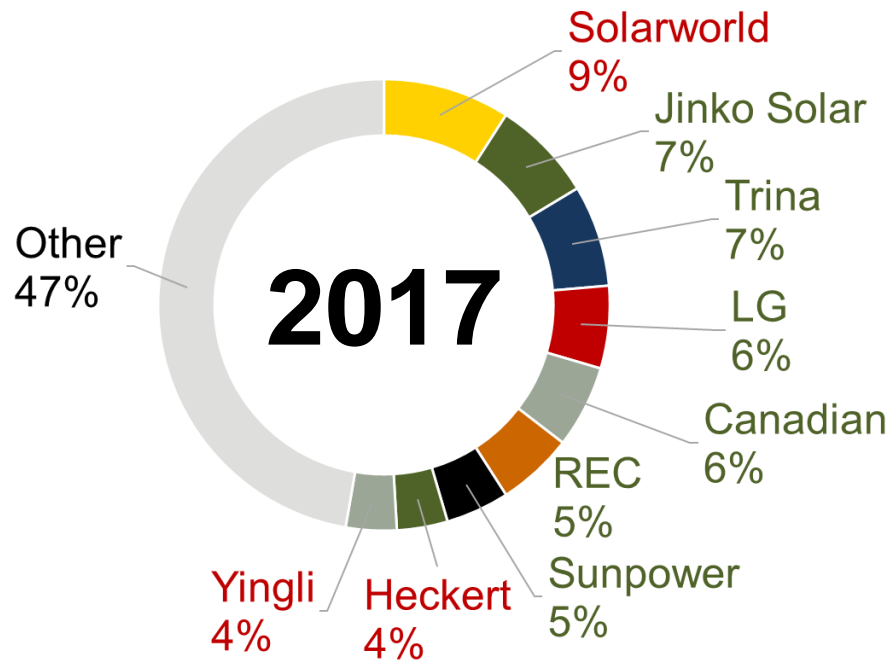
Please name the three brands of solar panels you recommend most highly



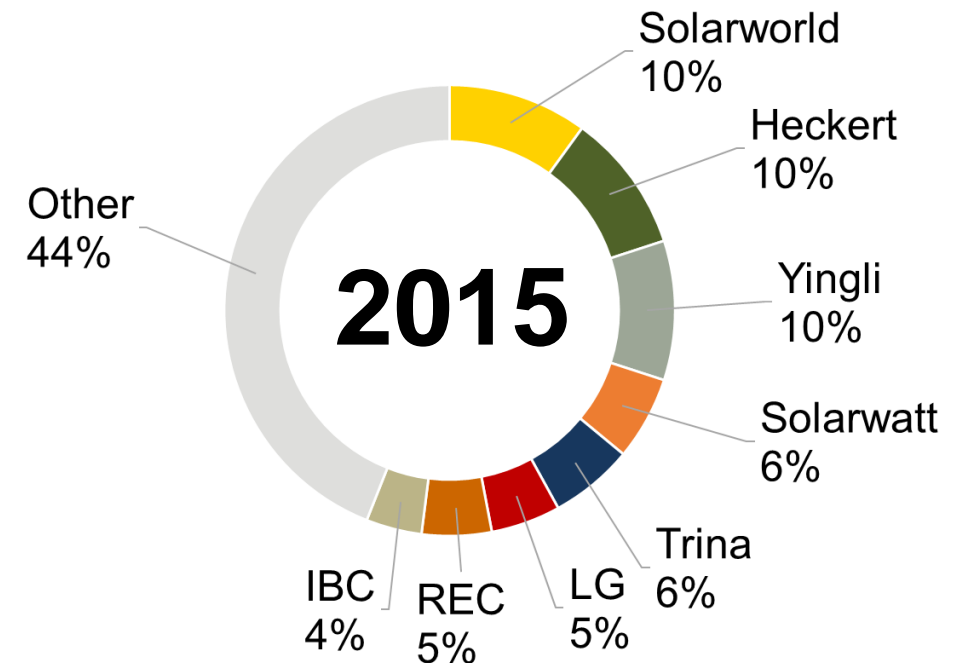
n=78,
up to 3 mentionings

Solarworld remains the top module brand among pv magazine readers, other German companies decrease

Please name the three brands of solar panels you recommend most highly



n=78,
up to 3 mentionings



n=211,
up to 3 mentionings

Some participants gave reasons for their preference of certain module brands

Comments on the module brands

Solarworld:

- German module with good warranties
- experience
- Locally manufactured, good reputation for quality
- top quality
- We've installed the most of these with few quality issues

Jinko:

- Reputable Chinese company ensuring PV module quality
- Quality of delivery and commitment to transparency
- Solar Edge power optimizers are already integrated into the modules
- Best chinese modules
- Economic price

Trina:

- Trina offers highest quality, the modules with high and stable yields
- Duomax Glass/Glass is OK for our application
- Price-value

LG:

- Very high efficiency, sturdy frames, solar warranty is backed by LG
- Best quality in cells and workmanship
- good value for the price

Canadian:

- Good quality in most references (not all) and relatively efficient service.
- Lower cost, good reputation for quality
- Reputation

REC:

- reliable supplier, high quality and good experiences in the past
- good experiences regarding longevity
- good yield with low degradation
- Price to Quality
- Reputation

Broad range of quality issues in the PV sector leads to an increasing demand for certificates and tests

Sum-Up

- Hot spots and PID are seen as the most important quality issues, qualitative comments highlight PID and back sheet problems.
- Other statements go beyond the known module flaws: monitoring, testing, BOS, installer qualification... Many participants raised questions on tests and certificates for PV components
- The purchase criteria of the surveyed are all in all stable, when compared to a similar 2015 survey. However, certificates have gained importance in the purchase decision, and the image of the module brand has lost relevance.
- Solarworld, Jinko, Trina, LG and Canadian are the top module brands, according to pv magazine readers. Other German companies decrease in comparison to a similar 2015 survey.

Please get back to us, if you have any questions!



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