Module Makers' Perspective

International PV Module Quality Assurance Forum

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THE JAPAN ELECTRICAL MANUFACTURERS' ASSOCIATION

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CONTENTS

2. Desirable lifetime for PV modules (1/2)

Desirable lifetime of PV modules is determined by customer's demands.

- For example, desirable lifetime of PV modules for LED key holders, light sets for gardening, etc. is 1-2 years

⇔ Long lifetime is required for PV power systems for residences and industries.

Desirable lifetime in each country's policy is not uniform.

- In European countries, FIT requires 20-25 years

⇔ In Japan, surplus electricity buyback program and FIT require 10 years.

⇒ It should be recognized that desirable lifetime of each PV system is different.

2. Desirable lifetime for PV modules (2/2)

- The lifetime for PV modules is defined as the time when prescribed output in the warranty contracted with each customer is not generated.

- For keeping the desirable lifetime of PV modules, there are two methods as the following that:
  1) Only securing the PV modules reliability
  2) Securing the PV modules reliability + after-sales service
     ex.) Desirable life time: 20 years =>
     PV modules life time: 5 years
     Replace the modules every 5 years

3. Necessity of method for evaluating lifetime of PV modules

In PV power systems such as mega-solar plants,
the lifetime of PV modules is required in 25 years.

- For Example: after 10 years, 90% of the initial output and after 25 years, 80% of the initial output.

But, the test methods and conditions for evaluating 25 years' lifetime are not defined and established.

PV manufacturer guarantees the output power based on the each test method and condition.

Recently,

- The market is rapidly growing
- The participation of new manufacturers is remarkable

⇒For protection of consumers, and also industries, it is necessary to establish and standardize the suitable evaluation method of 25 years' lifetime of PV modules.

4. Problems for evaluation of lifetime of PV modules

The following items are mainly given.

4.1 Test conditions for evaluation of lifetime of PV modules

4.1.1 Test duration
4.1.2 Stress conditions

4.2 Quality assurance

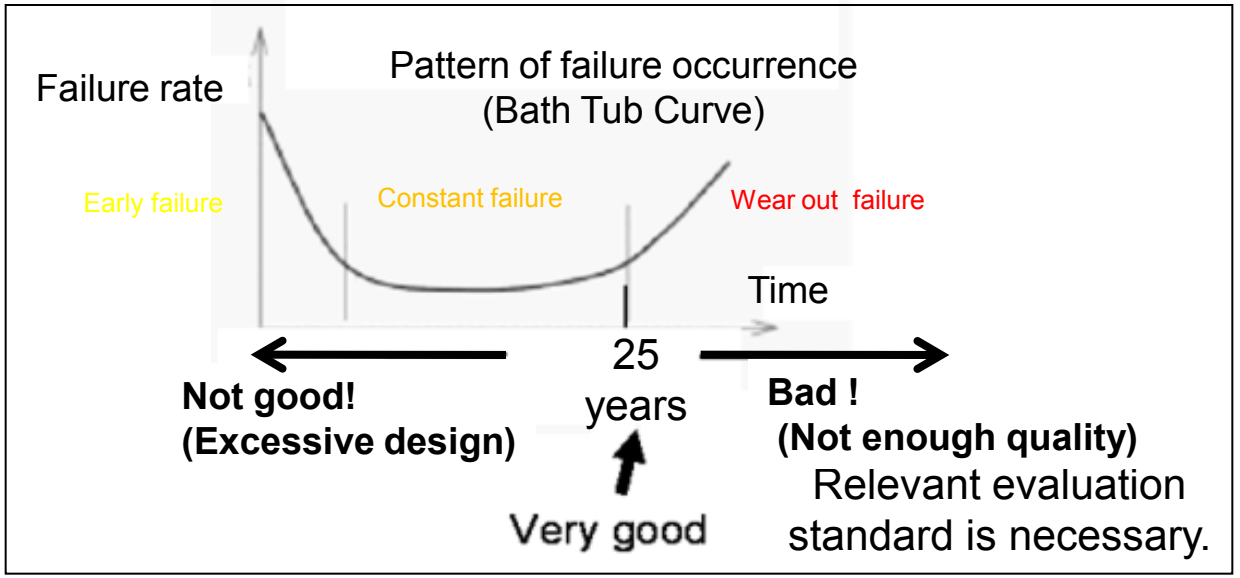
4.2.1 Process quality control in PV module manufacturers
4.2.2 Design standard of PV modules

4. Problems for evaluation of lifetime of PV modules

4.1 Test conditions for evaluation of lifetime of PV modules

4.1.1 Test duration

- There are two IEC Standards for evaluating performance, that is, IEC 61215 and IEC 61646.
  However, they are insufficient for evaluating a long-term life of 25 years.
- If test duration is made longer, stress can be increased.
  But, the longer evaluation time causes the increase in expense and excessive evaluation causes excessive cost.



4. Problems for evaluation of lifetime of PV modules

4.1.2 Stress conditions

It is necessary to determine test conditions for evaluation. But there are the problems as the following that:

- Environmental condition is different in every installation area. Therefor it is difficult to define a single test condition.
- Various stress factors, such as temperature, humidity, light, mechanical load, etc, affect the life of PV modules. So it cannot be evaluated under a single stress.
- It is difficult to define the Acceleration coefficient for every installation area.

Present
- A single test method (IEC 61215/61646)
- Acceleration coefficient is unknown.

<Problem>
It takes long time to determine an acceleration coefficient, so that it cannot be determined in 1-2 years.

Ideal
Life shall be evaluated using acceleration coefficients which meet specific installation environment.

4.2 Quality assurance

4.2.1 Process quality control in PV modules manufacturers

Performance quality of PV modules is greatly affected by manufacturing conditions such as production, quality control, etc.

Therefore, manufacturing conditions and control in processes are important factors.

Quality control shall be evaluated by the independent certification body .

4.2.2 Design standard of PV modules (1/2)

- Design standard of PV modules greatly affects lifetime.
- But each individual company has each standard, and use different construction and different materials for PV modules.

For example, even PV modules of the same superstrate construction have:

- Manufacturer A: Mechanical damage and humidity-resistance protected by backsheet.
- Manufacturer B: Mechanical damage protected by back sheet, humidity-resistance maintained by encapsulant.
- Manufacturer C: Mechanical damage protected by back sheet, humidity-resistance maintained by cell endurance.
- Manufacturer D: Back surface/ humidity-resistance maintained by backsheet/encapsulant in one piece.

4.2.2 Design standard of PV modules (2/2)

- Because each company has each standard, there are the problems as the following that:
  - Since design standard and used materials of each manufacturer are different, evaluation shall be made according to each acceleration coefficient for each product.
  - Evaluating the performance quality of PV modules is more important than that of single materials.
  - Design standard is a know-how of each company, and so common ownership is not possible.

  ⇒ Acceleration coefficients cannot be obtained.

Therefore, test standard should be prepared to take account the highest common factor which reflect design standard for each manufacturer and each installation condition.

5.1 Proposals for Optional Qualification Test (for regional characteristics)

According to the IEC Global Relevance (EDR*) policy, JEMA is ready to propose to add the test requirements covering regional climatic conditions in the IEC standard, such as;

EDR*: Essential Differences in Requirements

- **under the wide temperature variation (in desert etc.) ;**
  increase thermal cycle from 200 cycle to 400 cycle for thermal cycling test
- **under the high temperature and humidity (in tropical regions);**
  increase damp heat at 1000 hours to 2000 hours
- etc.

⇒ The customer can be convinced that the PV modules have cleared the test under the regional climatic conditions.

5.2 Proposals for Quality Assurance Program

Program consists of product quality assurance authorized by the independent certification body in accordance with the manufacturers declaration on the following items;

(A)Process quality controls approved on process quality audit.

(B)Quality management system covering

requirement for design of PV module structure based on warranty condition.

(C)Product warranty system including after-sales service.

5.3 Coefficients of Acceleration

It is requested that research bodies such as AIST, NREL, JRC, etc. shall offer fundamental data such as those of long-term endurance tests and exposure tests. Using the data, we would like to determine acceleration coefficients in cooperation with each research body and the IEC /TC82/ WG2.

5. JEMA's Proposals

1. Accreditation by the independent certification body

Proposals for Optional Qualification Test (for regional characteristics)

IEC61215 / IEC61646
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- requirements for regions where having wide temperature variation (in desert etc.)
- requirements for regions where having high temperature and humidity (in tropical regions)
- · · · ·
- etc.

Proposals for Quality Assurance Program

(A) Process quality controls approved on process quality audit
(B) Quality management system covering warranty of PV modules. (Including the management system of design review of PV module structure)
(C) Product warranty system including after-sales service

The customers can obtain the independent (third party) certification concerning the contents of warranty, and they will rely on the PV modules

2. Requested that research bodies such as AIST, NREL, JRC, etc. offer fundamental data such as long-term endurance tests and exposure tests.

6. Conclusion(1/2)

Establishment of the method for evaluating lifetime of PV modules is indispensable for protecting consumers and industries. Although it is necessary to obtain an acceleration coefficient to evaluate lifetime, endurance tests over a long term shall be done.

For this, it is requested that research bodies such as AIST, NREL, JRC, etc. shall offer fundamental data such as those of long-term endurance tests and exposure tests.

- Using the data, we would like to determine acceleration coefficients in cooperation with each research body and the IEC TC82 WG2.

6. Conclusion (2/2)

The following two proposals were made as provisional measures until acceleration coefficients are determined.

•Proposals for Optional Qualification Test

- Fulfilled test standards for covering the highest common factor of every region based on the IEC Standards. Adding optional test shall be prepared conforming to climate conditions, for example, in desert areas, in the tropics, etc.
- Accurate data about every climate condition must be collected and examined to determine the varieties and conditions of the test.

•Proposals for Quality Assurance Program

The independent certification body conducts

- inspections of the system on which design and warrant of PV modules can be relied based on the self declaration of PV manufacturers.
- process quality audit (such as ISO 9001) and certifies the PV manufacturers.

Thank you for your attention.