Performance and Reliability of Floating PV Technology

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Outline

1. Introduction
2. Performance of Floating PV Systems
3. Standardization, Bankability and Insurability
4. Conclusions
5. Future Work of F-PV in Task 13

1. Integration of PV

"PV going everywhere"

Desert PV

Vehicle integrated PV

Agri PV

Building integrated PV

PV in transport infrastructure

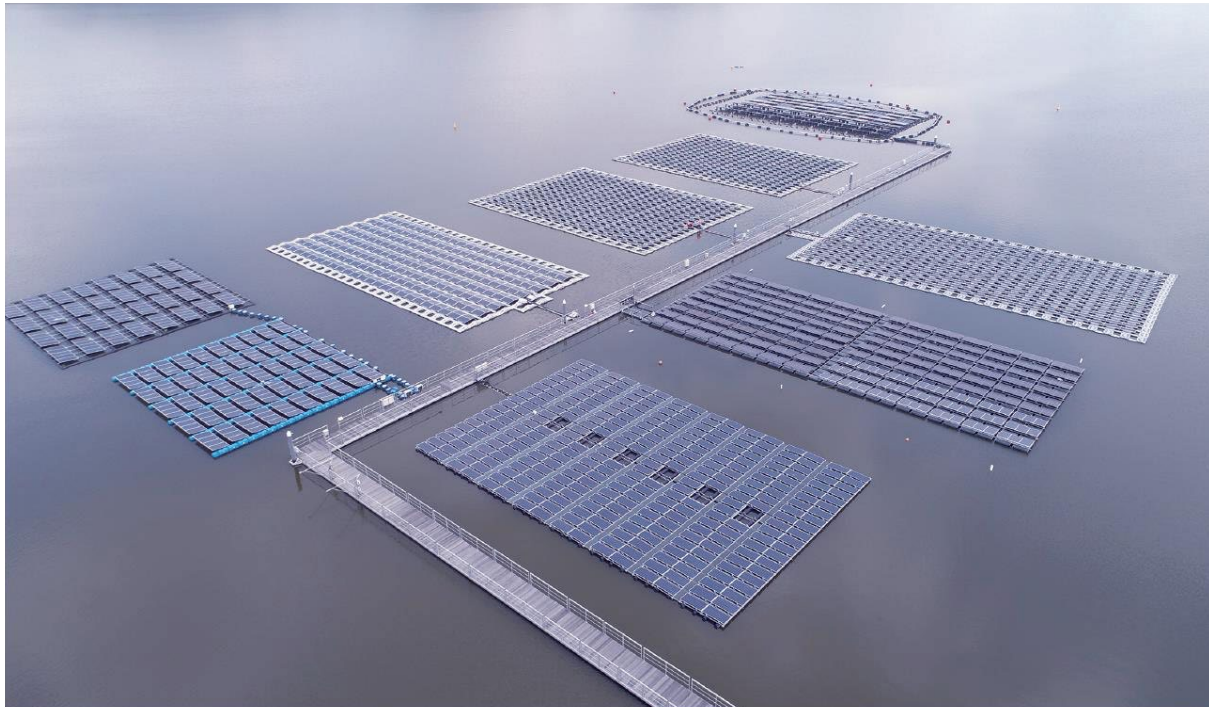
Floating PV

PVPS

1. Introduction

- FPV offers a unique possibility to deploy PV without interfering with urban development.
- Typically, the local climate around lakes provide slightly lower ambient temperatures and higher wind speeds than dry land.
- Other potential benefits for FPV:
  - Reducing water evaporation
  - Decreased algal growth
  - Hybridization with hydropower
- Huge potential offshore, half of the worlds population lives within 100 km from sea shore

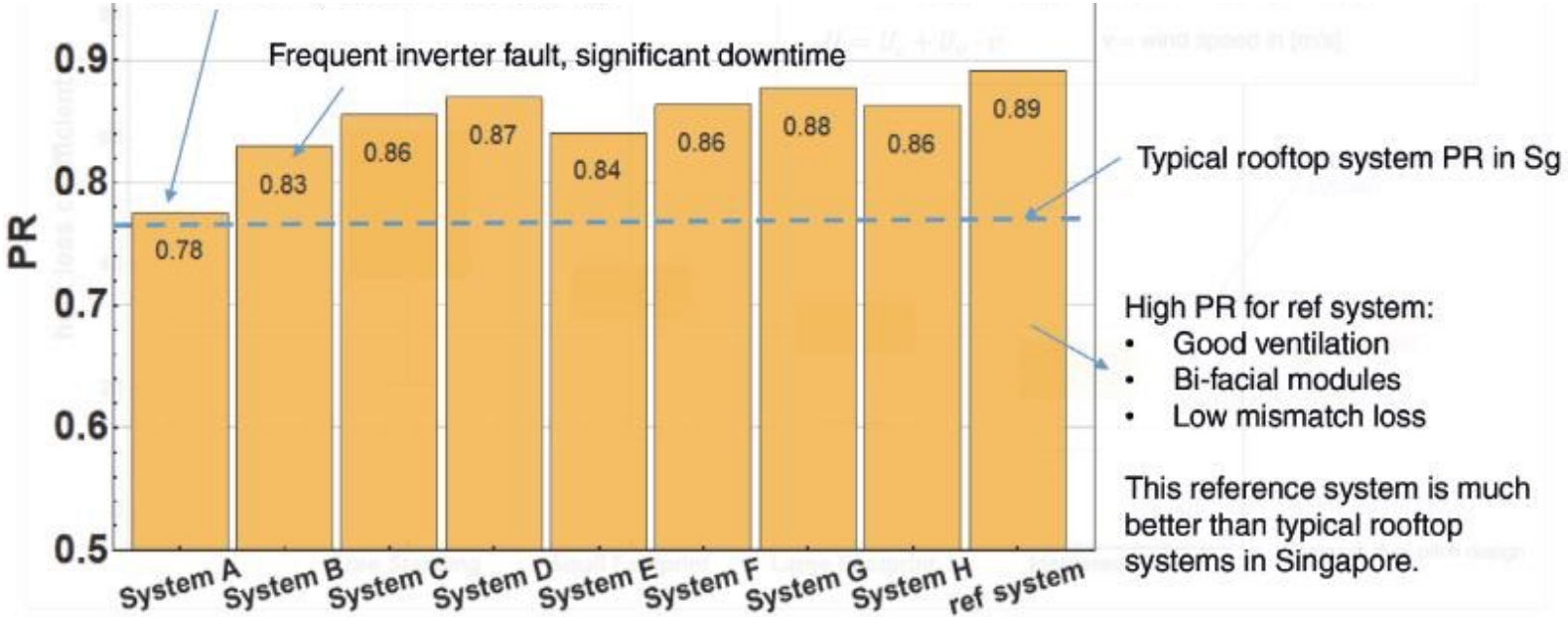
2. Performance of Floating PV Systems



PVPS Aerial photograph and details of the Singapore Tengeh Reservoir test-bed with different Floating PV technologies [Reindl, 2018]

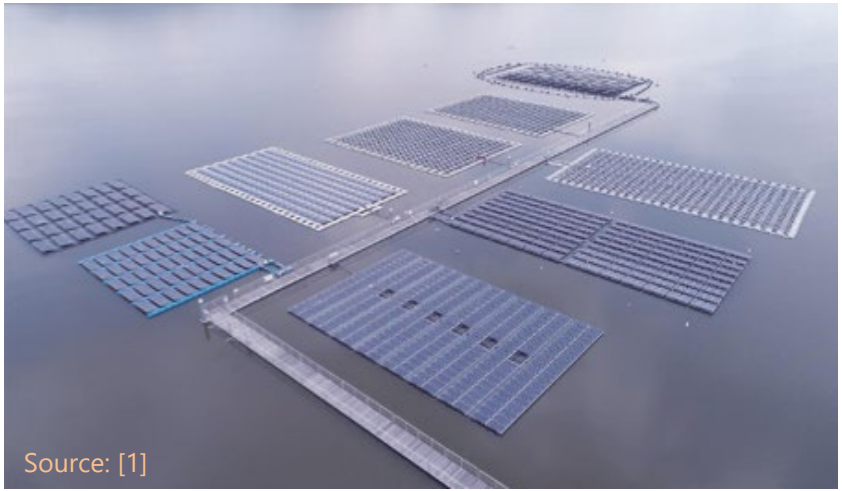
2. Performance of Floating PV Systems

Performance Ratio Comparison



PR 10-15% higher than typical rooftop PV systems in Singapore (with PR of 75 ~ 80%) [Reindl, 2018]

2. Performance of Floating PV Systems



Source: [1]

[1] T. Reindl, "At the heart of floating solar: Singapore," *PV Tech Power*, vol. 14, pp. 18–23, 2018.
[2] H. Liu, *et al.*, "Field experience and performance analysis of floating PV technologies in the tropics," *Prog. Photovoltaics Res. Appl.*, vol. 26, no. 12, pp. 957–967, 2018.
[3] M. Dörenkämper, *et al.*, "The cooling effect of floating PV in two different climate zones: A comparison of field test data from the Netherlands and Singapore," Solar Energy 214 (2021) 239–247, 2020.

- Module temperatures about 3°C to 15°C lower than land based systems [1], [2], [3]
- Published yield gain:
  3% larger than land based PV in Netherlands, 6% larger than rooftop in Singapore [3]

Additional potential benefits for on-shore FPV

- Reducing water evaporation
- Decreased algal growth
- Avoiding land-use conflict

→ KPIs for double use benefits have to be developed; Verification and further R&D necessary

3. Standardization, Bankability and Insurability

High uncertainties in the implementation and evaluation of floating PV concepts:

- Suitability of components
- Possible risk in case of multiple use of water bodies
- Handling in the event of faults, risk due to electrical potentials
- Earthing, lightning and overvoltage protection

No specific standards for floating PV systems exist

Many questions depending on individual concept rather than FPV application.

3. Standardization, Bankability and Insurability

Process for developing new standards to ensure quality and electrical safety

1. Analysis of the current situation
2. Formation of standardization committees with market participants
3. Definition of scope of application
4. Research and delimitation to similar/overlapping subject areas to avoid double standardization
5. Definition of requirements - Transfer of the current state of knowledge and new criteria into a new set of regulations

Typically, this process takes at least 3 to 5 years.

3. Standardization, Bankability and Insurability

The VDE Pyramid of Quality – to keep up with the dynamics of the market

Top-tier players

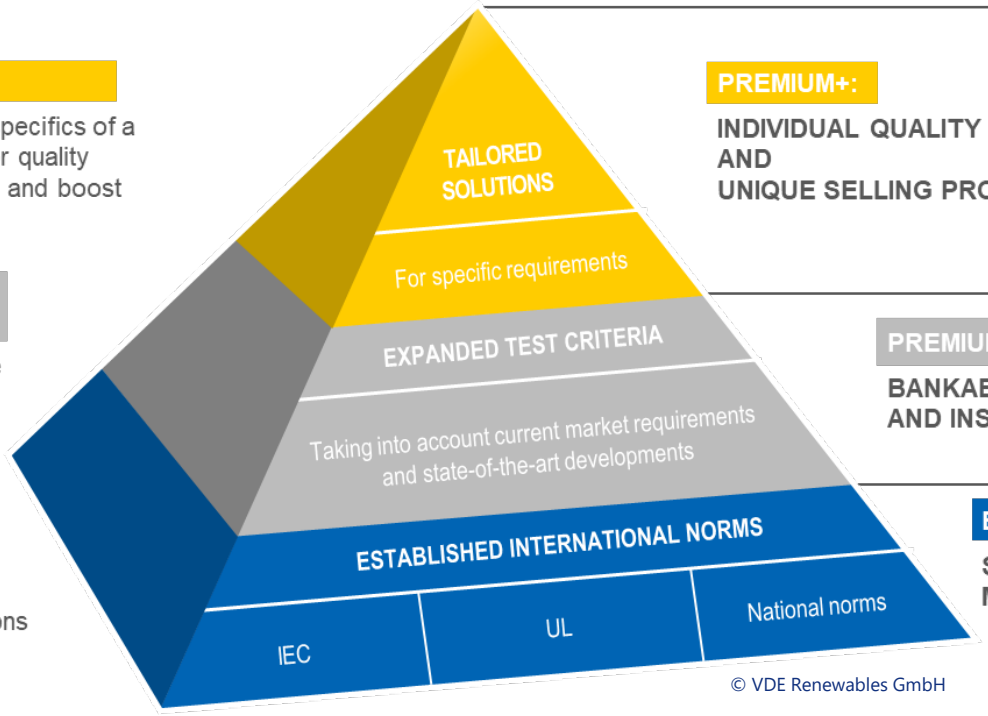
Fully understand unique specifics of a project, engage in superior quality assurance, minimize risks and boost profitability

Competent and responsible businesses

Keep their pace with state of the art developments, create high quality, financially sound projects

Companies with short term focus

Only follow basic regulations



PREMIUM+:

INDIVIDUAL QUALITY CRITERIA AND UNIQUE SELLING PROPOSITIONS

PREMIUM:

BANKABILITY AND INSURABILITY

BASIS:

STANDARD MARKET CRITERIA

PVPS

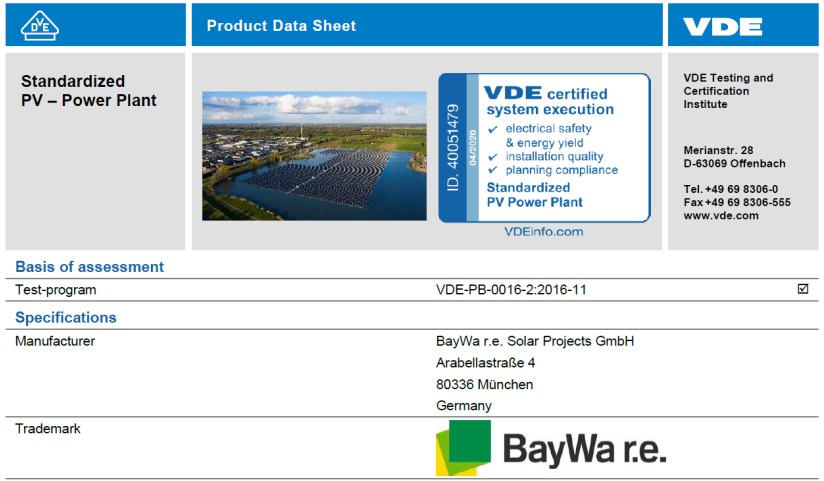
3. Standardization, Bankability and Insurability

VDE Renewables has developed procedure to certify floating PV power plants.

The program takes into account existing standards from a wide variety industries.

Remaining gaps are closed with own criteria based on the expertise from standardization and input by the international network.

The program supports industry to achieve bankability and insurability of the projects.



Product Data Sheet

VDE

Standardized
PV – Power Plant

VDE Testing and Certification Institute

Merianstr. 28
D-63069 Offenbach

Tel. +49 69 8306-0
Fax +49 69 8306-555
www.vde.com

Basis of assessment		
Test-program	VDE-PB-0016-2:2016-11	☑
Specifications		
Manufacturer	BayWa r.e. Solar Projects GmbH Arabellastraße 4 80336 München Germany	
Trademark	BayWa r.e.	

3. Conclusions

- Floating PV is not a new technology
- FPV is a promising application to support energy transition
- Potential of higher performance than ground mounted or other intergrated systems exist
- No international floating PV standard exists – but defined programs and corproate standards can support bankability and insurability

4. Future Work of Floating PV in Task 13

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Activity focus:

- Performance of FPV systems (collection of existing data)
- Global Survey of FPV Technologies for different conditions (lakes, sheltered ocean, nearshore, offshore)
- Loss mechanisms which differ from ground-based PV towards model for floating PV
- Meta study of documented degradation modes
- O&M of FPV (New challenges, increased importance of autonomy, Soiling mitigation)

- **Report:** *Performance and reliability of FPV systems (M30)*
- **Workshop:** *Performance and reliability of commercial (large pilot phase) FPV technologies (M20)*

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Work towards common guidelines for modeling and selection of input parameters for floating PV, onshore and offshore

Thank You for Your Attention!

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