SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Guide to ISO 24194:2022

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4th IEA SHC Task 68 Expert Meeting, 2023-10-10

Guide to ISO 24194:2022


Guide to
ISO 24194:2022 -
Power Check

Draft Version 1.0

Date 2023-10-10

VERSION 1.0

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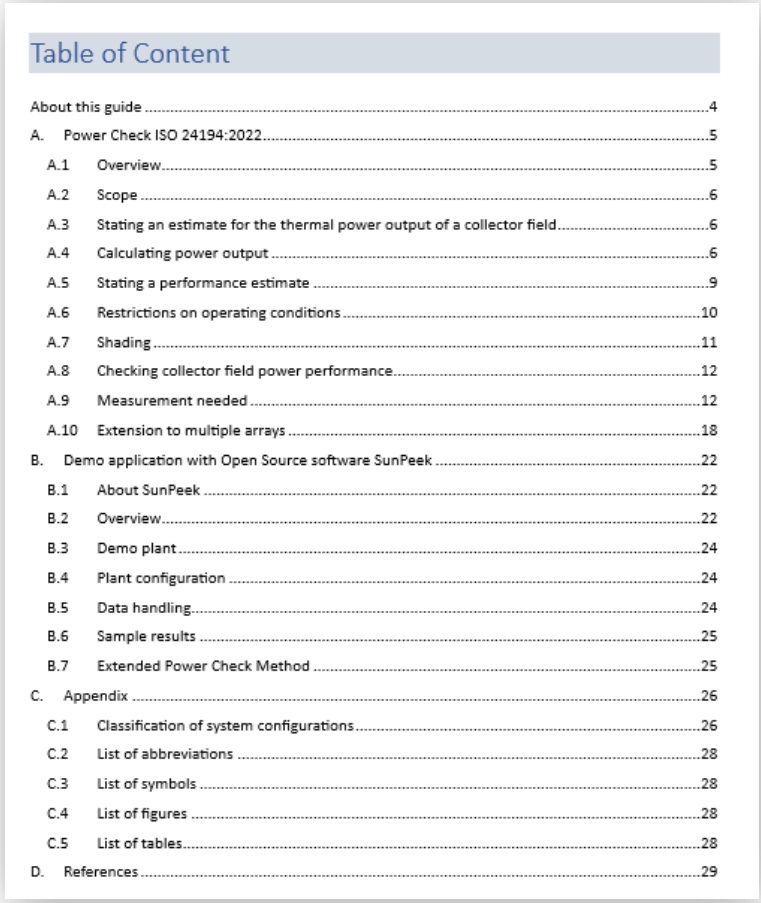
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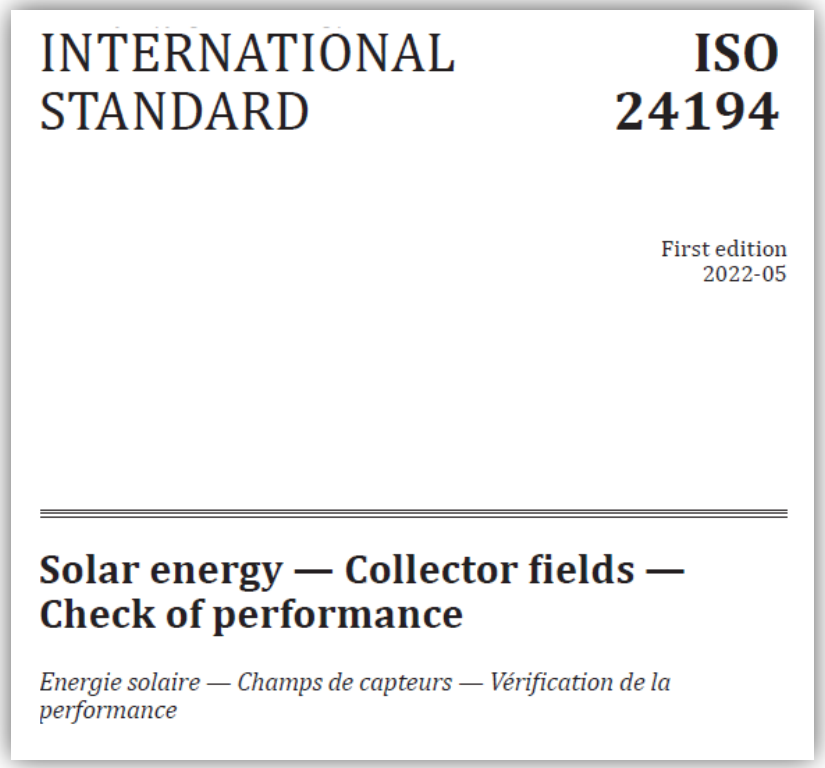
- Joint work by „IEA SHC Task 68 Working Group“
- Seeking more T68 experts to elaborate and improve this document!

About ISO 24194:2022

- New standard for **performance check of solar thermal collector fields**, first edition in **2022-05**
- Previous versions of the method were developed in Denmark 10-20 years ago and used for **guarantee procedures** for SDH plants
- Further development within **IEA SHC Task 45** and **IEA SHC Task 55** (Fact sheets: 45.A.3.1 ; 45.A.3.1 ; B-D2; B-D1.1)
- **DRAFT ISO/DIS 24194** Solar energy Collector fields — Check of performance (2020 / 2021)


INTERNATIONAL STANDARD

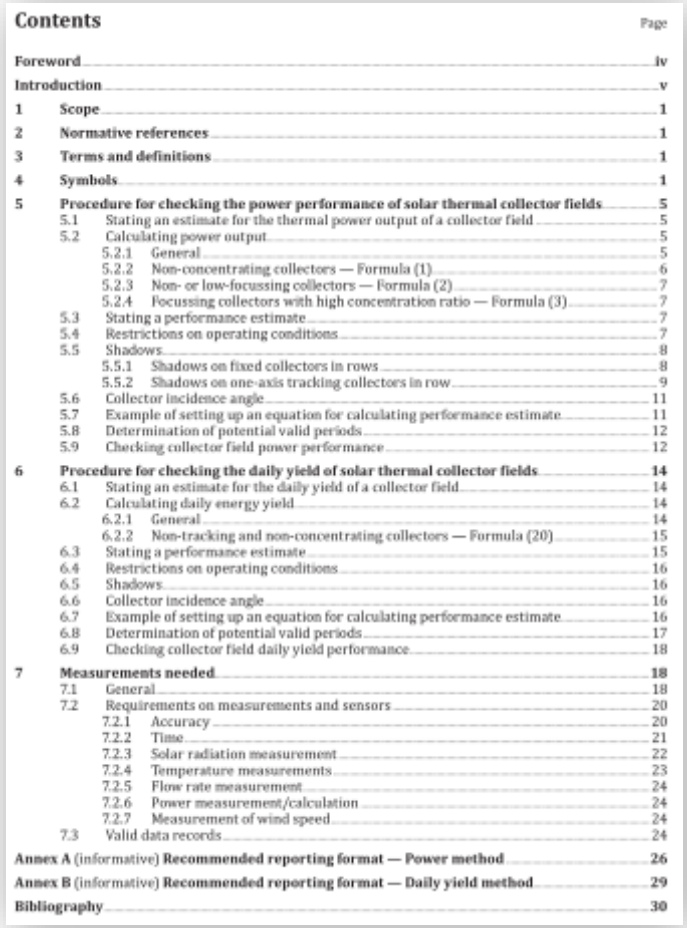
ISO 24194

First edition
2022-05

Solar energy — Collector fields — Check of performance

Energie solaire — Champs de capteurs — Vérification de la performance

Main methods ISO 24194:2022



Contents

⇨ Procedure for checking the **power performance** of solar thermal collector fields (Power Method)

⇨ Procedure for checking the **daily yield** of solar thermal collector fields (Daily Yield Method)

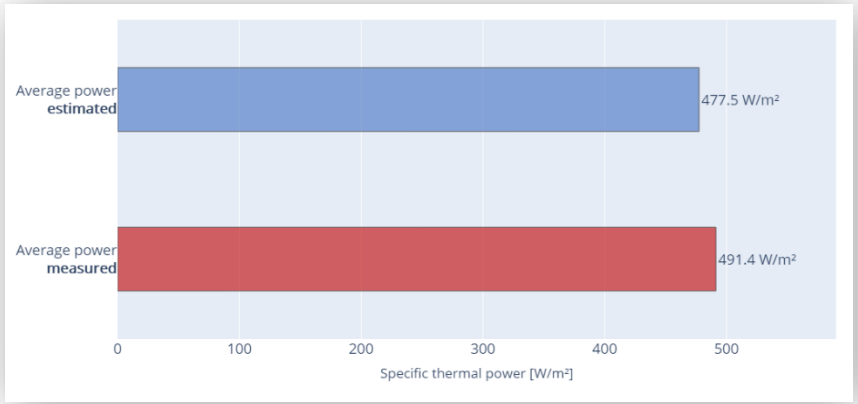
⇨ **Measurements** needed

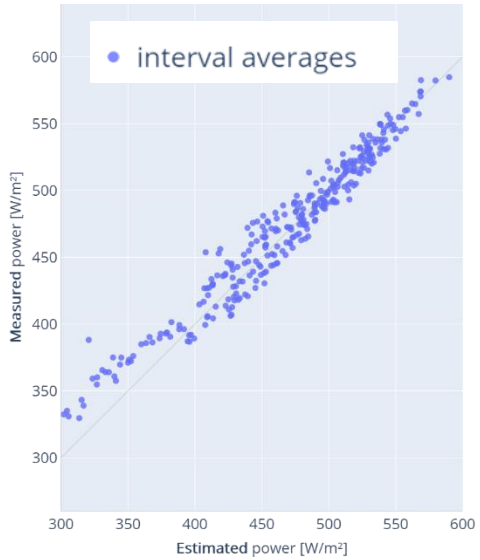
Power Method / Power Check

- **Measured/Estimated comparison** for thermal power output
- Conditions close to **full power operation** (high irradiance levels, minor change in collector mean temperature, no shadows), based on **1 hour intervals**
- Power output is calculated using **ISO 9806 collector parameter**

Estimated

Measured





Measured

Estimated

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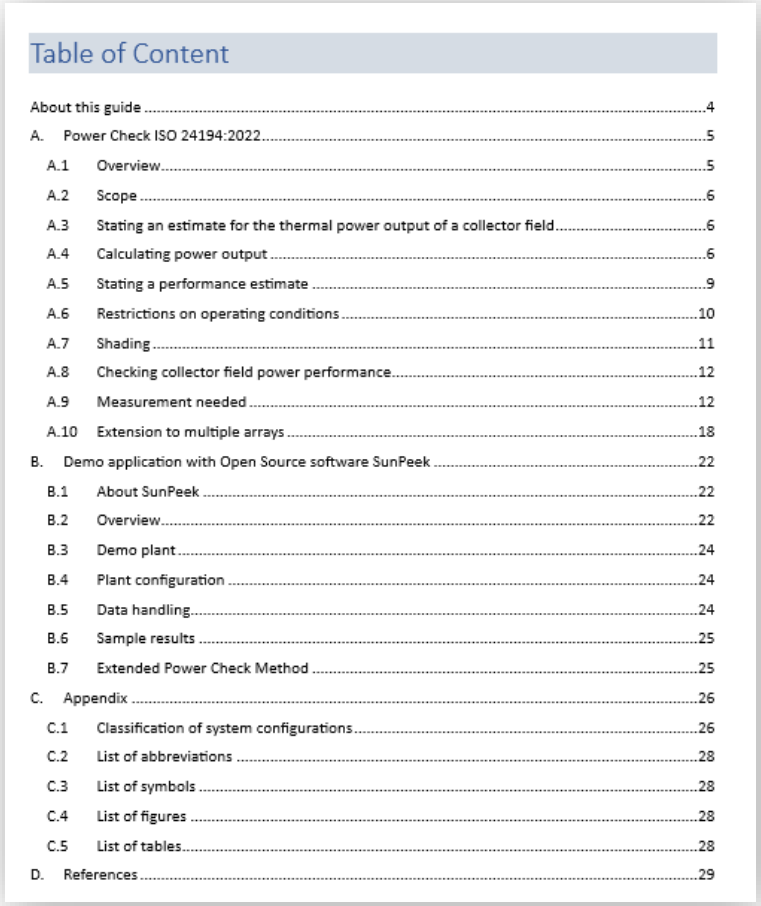
Motivation

- ISO 24194 is the first standard of its kind by targeting **solar thermal collector fields**
- **Practical application** shows need for **clarification**, further **improvements**, and additional **background information** for users
- **Additional use cases** require some adaptions (from guarantee procedure to on-going plant surveillance)
- Inspired by „Guide to Standard ISO 9806:2017“

Aims

- Make ISO 24194 more **accessible** and foster **widespread** use in the solar community
- Summarize **learnings** and **experiences** from T68 experts
- Outline software implementation / automated application with **SunPeek**
- Main target group: **plant operators**

Content of the Guide



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Power Check ISO 24194:2022

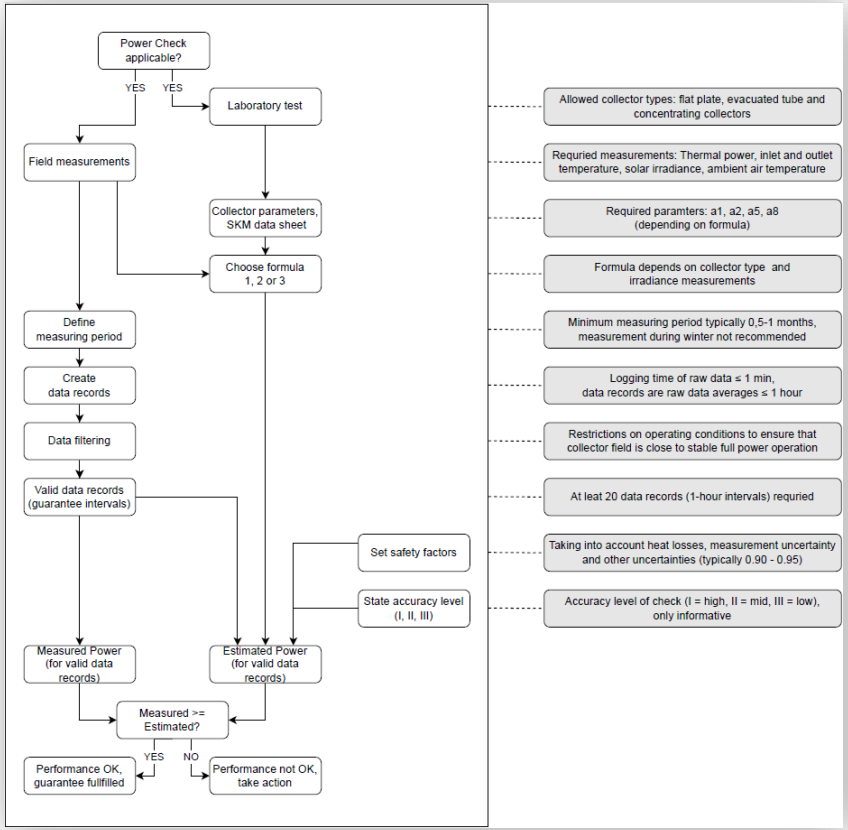
- Summary
- Remarks and recommendations

Demo application with Open Source software SunPeek

Limited to Power Method / Power Check.
Daily Yield Method not covered (TBD)

Example (1) – Summary

Overview



Accuracy Levels

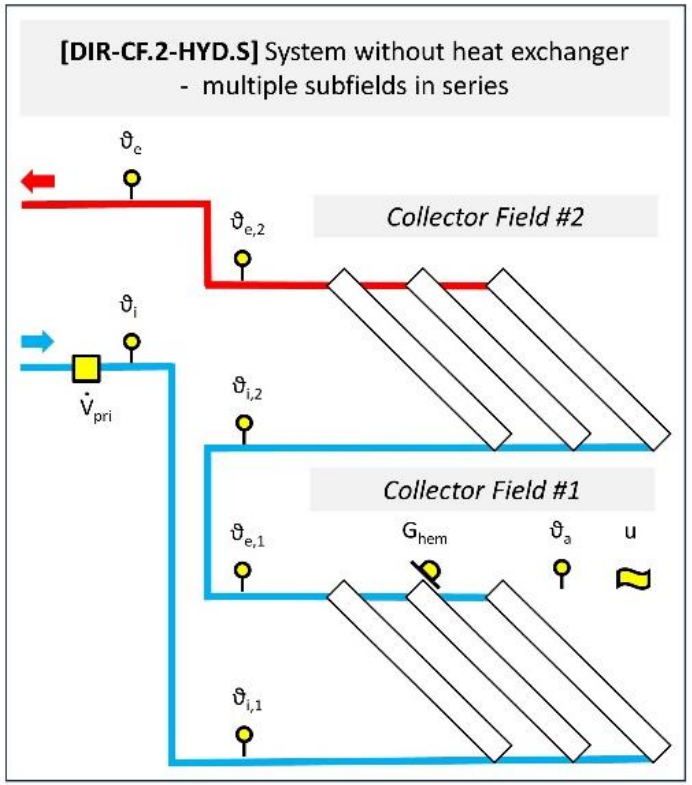
Table 9: Sensor specifications and measurement uncertainties for accuracy level I-III.

Measured quantity	Level I	Level II	Level III	ISO 24194:2022
Global irradiance	Pyranometer Class 2 or better (ISO 9060, recommendations of ISO/TR 9901) Satellite data not allowed	Sensors with accuracy ± 5 % in the range 600 W/m² - 1000 W/m² Satellite data not allowed[1]	Sensors with accuracy ± 5 % in the range 600 W/m² - 1000 W/m² Satellite data allowed	7.2.3.2
Beam / DNI and diffuse irradiance	Pyranometer for G_{hem} plus either Pyranometer Class 1 or better with shading ring for G_d or Pyrsheliometer for G_b	Not defined	Not defined	7.2.3.2
DNI	Pyrheliometer Class 2 or better (ISO 9060) for highly concentrating, tracking collectors (C_K > 3); field of vision ≤ 6°; tracking errors ≤ ±1°			7.2.3.1
Fluid temperature	<0,35 K (Class A)			7.2.4.2
Ambient air temperature	<0,35 K (Class A)			7.2.4.3
Volume flow rate	standard uncertainty in relevant range: < 1 %	< 2 %	< 2 %	7.2.5
Power (measured or calculated)	standard uncertainty in relevant range: < 2 %	< 3 %	< 3 %	7.2.6
Wind speed	< 1 m/s			7.2.7

[1] ISO 24194:2022, Chapter 7.2.3.2, says that satellite data can be used for Level II/III, but 7.2.3.3 and 7.2.3.4 only mention satellite data in connection with Level III. The later seems to follow the intention of the standard, as all other criteria regarding solar sensors are the same for Level II and III.

Example (2) - Remarks / Recommendations

Extension to multiple collector fields

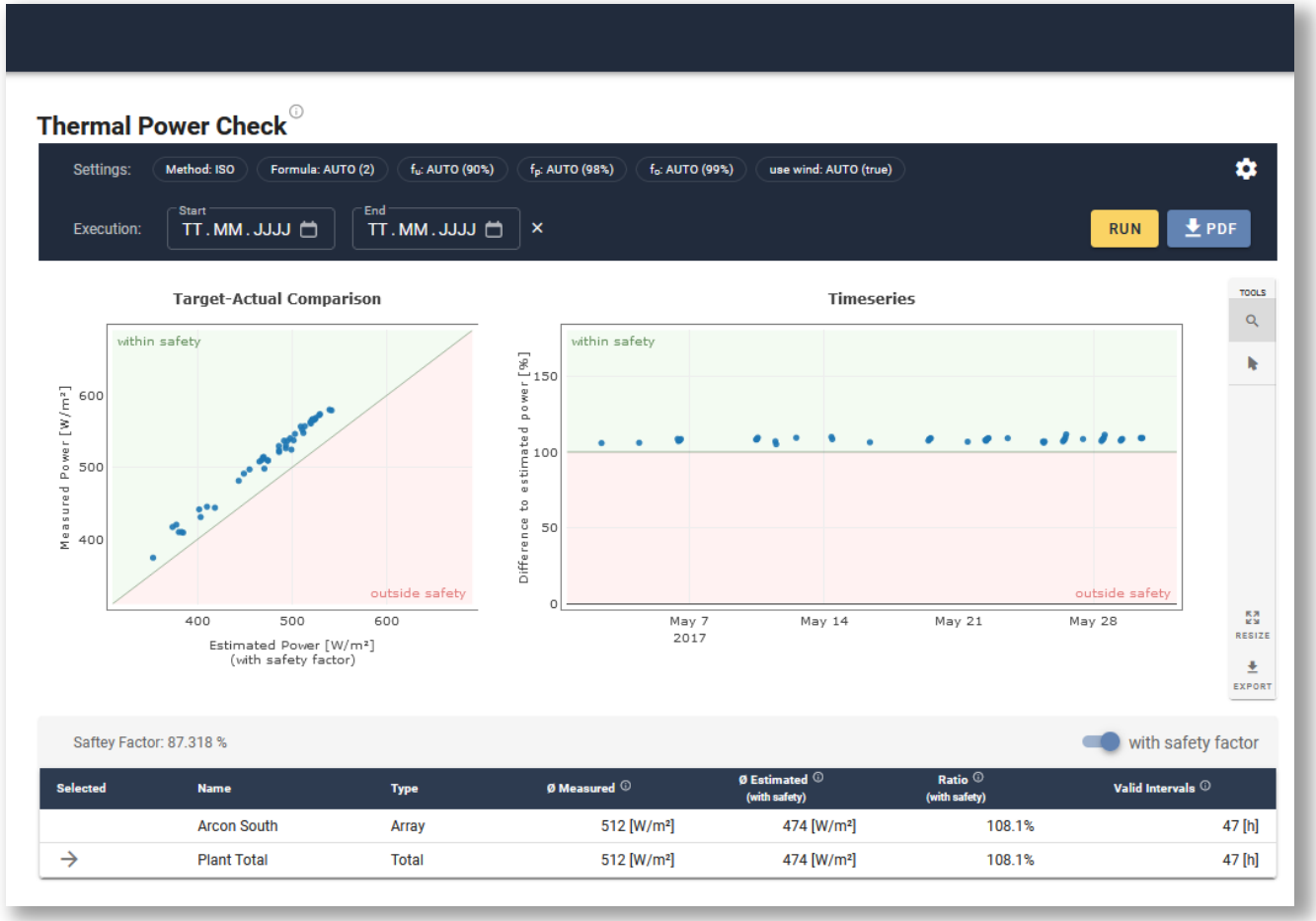


Parameter conversion

Table 3: Parameter conversion for QDT (Quasi-dynamic) and SST (Steady state) tests.

Collector test	Source
QDT (Quasi-dynamic test) Given parameter: $\eta_{0,b}, K_b, K_d$ Derived parameter: $\eta_{0,hem}, K_{hem}$	
$\eta_{0,hem} = \eta_{0,b}(0.85 + 0.15\,K_d)$	ISO 9806:2017 Annex B, Formula (B.2), (B.5)
$K_{hem}(\theta_L, \theta_T) = \frac{\eta_{0,b}}{\eta_{0,hem}}(0.85 K_b(\theta_L, \theta_T) + 0.15\,K_d)$	Derived from ISO 9806:2017 Annex B Formula (B.2), (B.5)
SST (Steady-state test) Given parameter: $\eta_{0,hem}, K_{hem}$ Derived parameter: $K_b, K_d, \eta_{0,b}$	
$K_b(\theta_L, \theta_T) = K_{hem}(\theta_L, \theta_T)$	ISO 9806:2017 Annex B, Formula (B.1)
$K_d = \frac{1}{W}\sum_{\theta,\gamma=0°}^{90°} K_b(\theta,\gamma)\sin(\theta)\cos(\gamma)$ $W = \sum_{\substack{\theta,\gamma=0°;\\ steps=10°}}^{90°} \sin(\theta)\cos(\gamma)$	ISO 9806:2017 Annex B, Formula (B.3), (B.4)
$\eta_{0,b} = \frac{\eta_{0,hem}}{0.85 + 0.15\,K_d}$	ISO 9806:2017 Annex B (B.5)

Demo application SunPeek



Status Quo & Next Steps

Join at menti.com use code 3648 9439

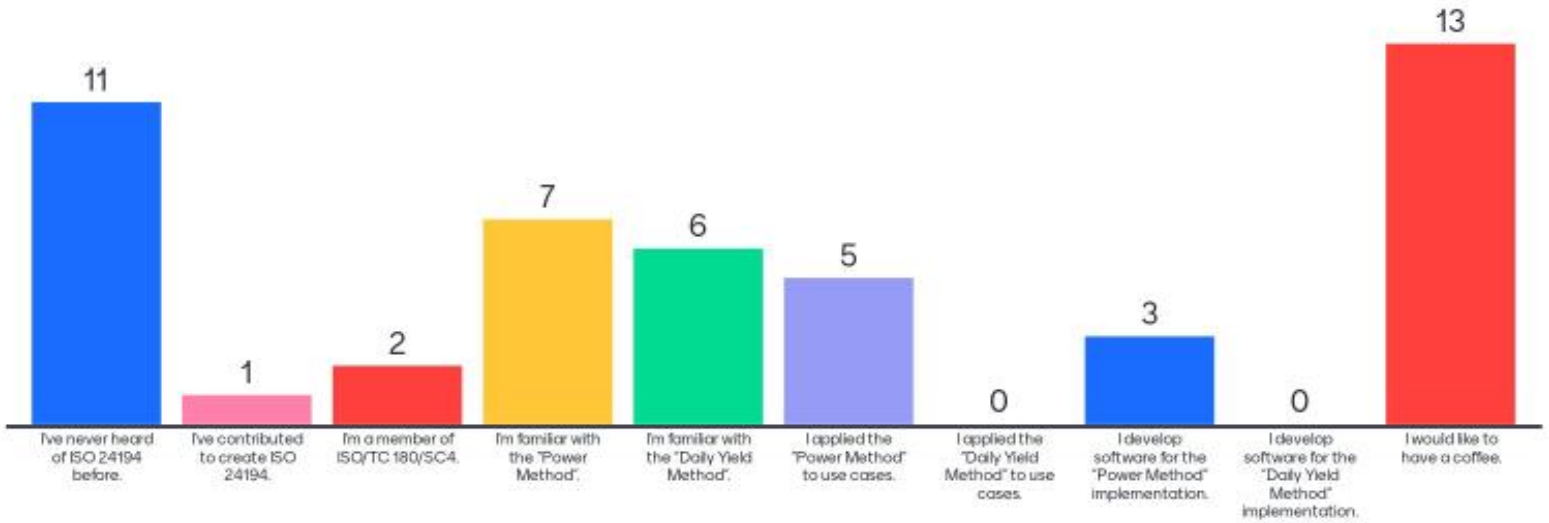
- **Status quo**: Draft version for Part A. „Power Check ISO 24194:2022" available, including discussion how to apply method to multiple arrays

- **Next Steps**
  - Discussion / MentiMeter Survey **(today!)**
  - Seeking **T68 experts** for further elaboration / review / use cases – coordination by Daniel Tschopp (d.tschopp@aee.at)

- **Timeline**
  - First draft: **2023-10-31**
  - Review: **2023-11-30**
  - Final version: **2023-12-22**

Mentimeter

Please indicate how familiar you are with ISO 24194 (Performance Check for Solar Collector Fields).



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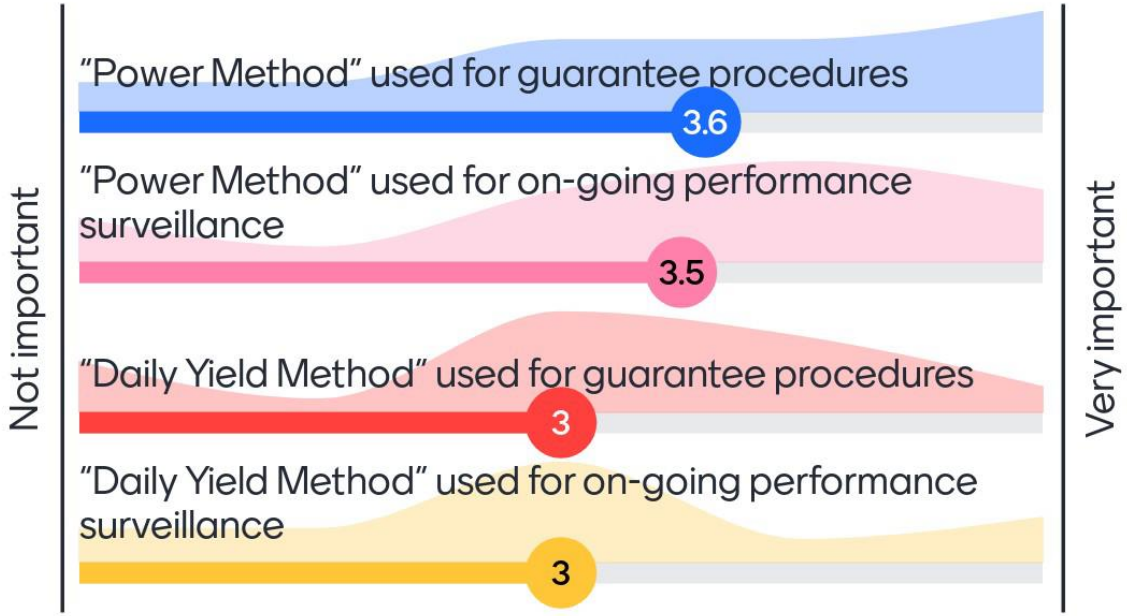
Mentimeter

Which importance do you assign the "Power Method" and "Daily Yield Method"?



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Questions?

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