# IEA PVPS Task 16

## Solar resource for high penetration and large scale applications

ISES Webinar,
May 23rd 2017

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Meteotest, Switzerland

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# Contents

- Main outcomes of IEA SHC Task 46
- The new IEA PVPS Task 16
  - Why a new Task?
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Resources


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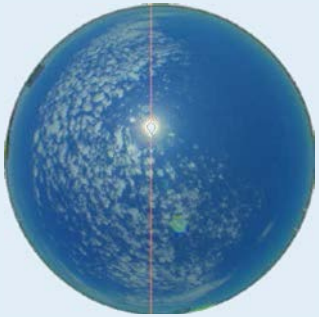

Dissemination


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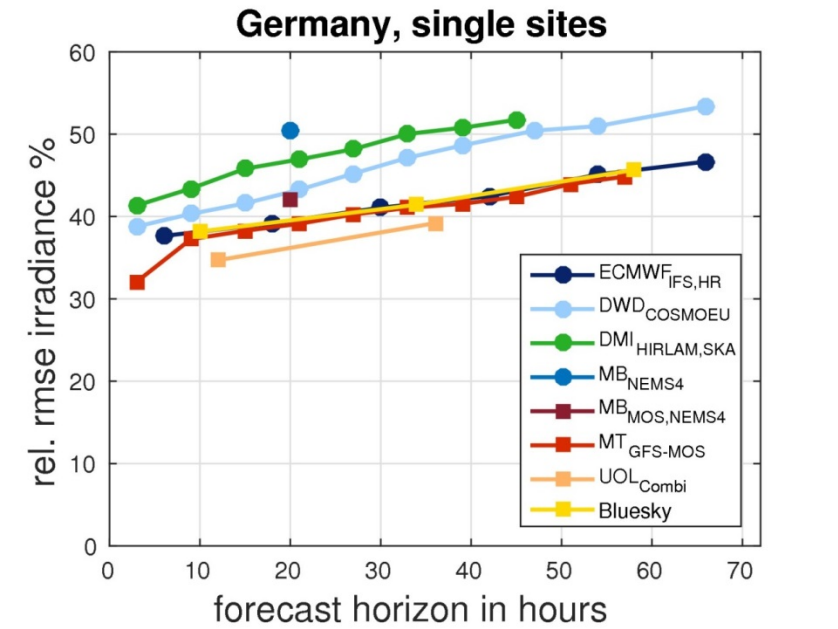
# International Energy Agency (IEA)

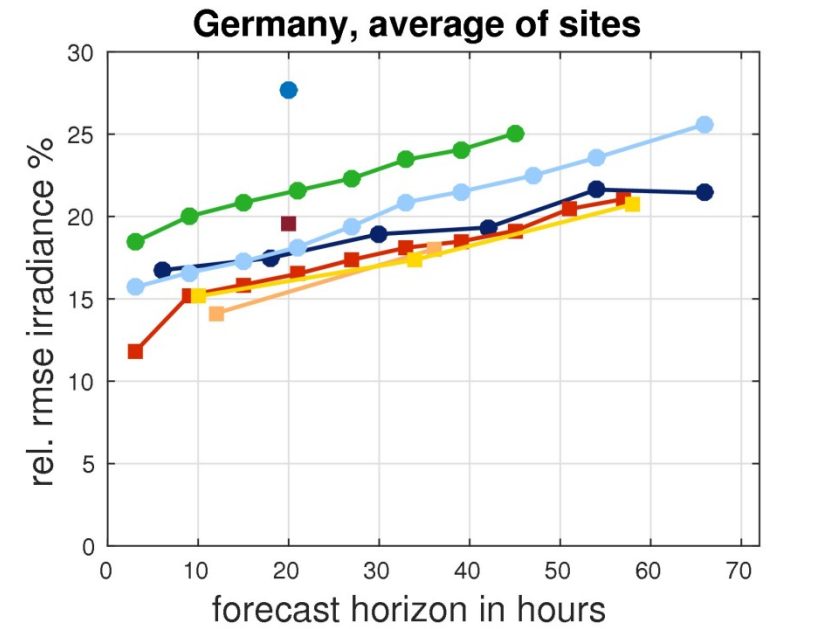
- International Energy Agency, Paris
  - Founded 1973 by OECD countries
  - Historically known as source for optimistic oil reservces and pessimistic renewable potentials
- 39 Technology Collaboration Programmes (TCP)
  - International exchange of state of the art knowledge
- Three solar programs:
  - Solar Heating and Cooling (SHC)
  - PV power systems (PVPS)
  - SolarPACES (solar chemistry and concentrating solar power)

# IEA SHC Task 36/46

- 2005 – 2015, lead by Dave Renne (NREL, ISES)
- Solar Resource Handbook (NREL) – Edition 2015
  http://www.nrel.gov/docs/fy15osti/63112.pdf
  - Update 2017 (in preparation)
- Benchmarks:
  - Satellite resources (P. Ineichen, Univ. Geneva)
  - Solar Forecasts (R. Perez et al, SUNY, E. Lorenz et al, Univ. Oldenburg)
- Modelling (three examples):
  - Definition of Circumsolar radiation and DNI (S. Wilbert, DLR, and P. Blanc, Mines Paristech)
  - Model for temporal and spatial variability (R. Perez et al., SUNY)
  - Integration of ground measurements with model derived data (→ J. Polo)

# IEA SHC Task 46: benchmark of solar forecast




Forecast error (rel. RMSE) in dependence of forecast horizons for single site predictions (left) and regional forecasts (right).

Prog. Photovolt: Res. Appl. 2016. DOI: 10.1002/pip.2799

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# IEA SHC Task 46: variability

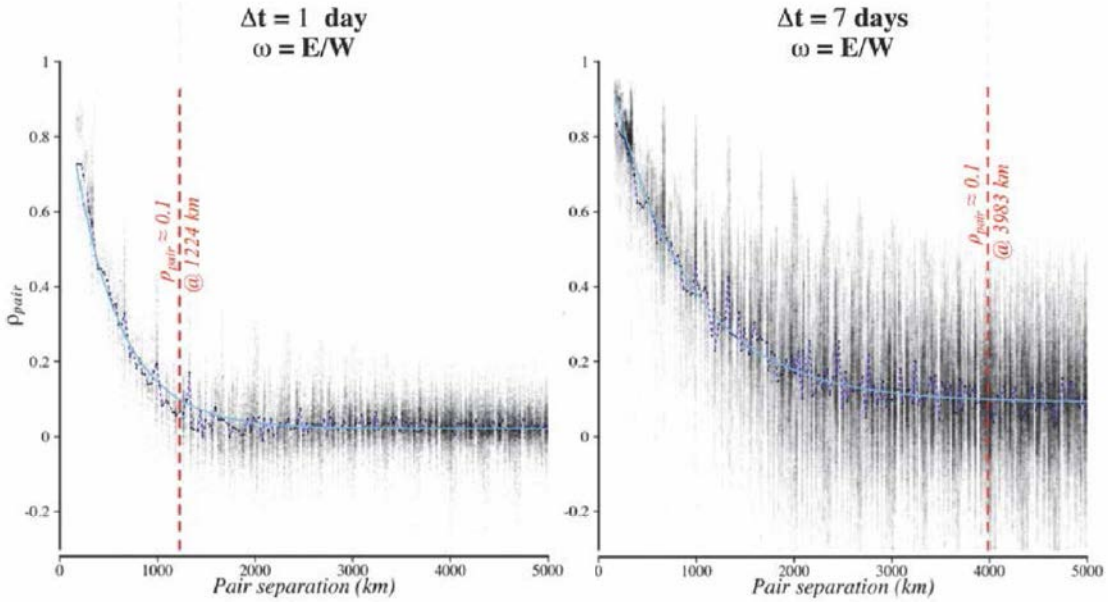


**Figure 3.6:** Site-pair correlation as a function distance for daily and weekly time periods. Station pairs are selected to have a predominantly east–west orientation [Perez and Fthenakis, 2015].

$$\rho = \frac{1}{1 + \frac{d}{(\Delta t)(V)}}$$

ρ= correlation coeff. of ramps
d = distance
t = time resolution
V = cloud speed

Foundations and Trends in Renewable Energy 1, DOI:10.1561/2700000006

IEA PVPS Task 14 report: http://new.iea-pvps.org/index.php?id=336

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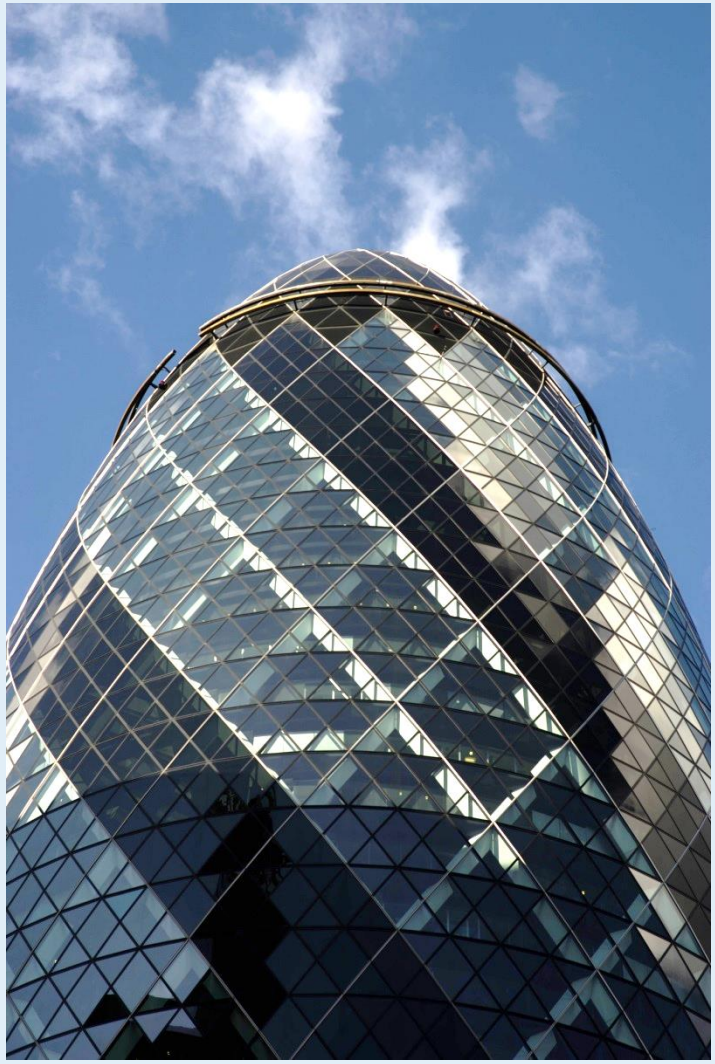
# Why a new Task?

- Solar resources are the fuel of PV
  - Uncertainty in solar belt still high
  - Lower uncertainty lowers costs of PV
- Big PV and high penetration need high quality of meteorological information
  - Finer spatial and temporal resolution of data
- Why PVPS:
  - main driver of solar development is PV
  - Joint Task for all 3 solar TCP's
    - SolarPACES, SHC, PVPS

# Target groups

- Banks
- Builders
- Developers
- Direct marketers
- Grid operators
- Investors
- Maintenance companies
- Planners
- Universities
- Utilities



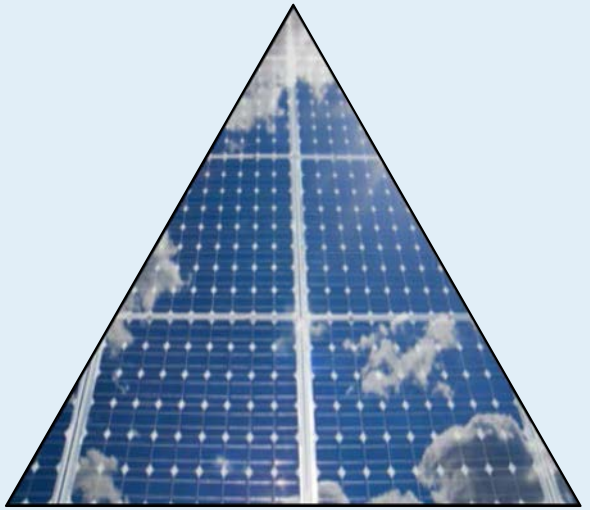
# Subtask 1: Resources

- Evaluation of current and emerging **resource assessment** methodologies:
  - Ground based methods (instruments, soiling)
  - Numerical weather models (NWP)
  - Satellite-based methods (uncertainties, modelling)
  - Benchmarking framework


E.g. New Himawari satellite (JMA)
→ more channels allow to enhance satellite-based models

# Subtask 2: Bankability

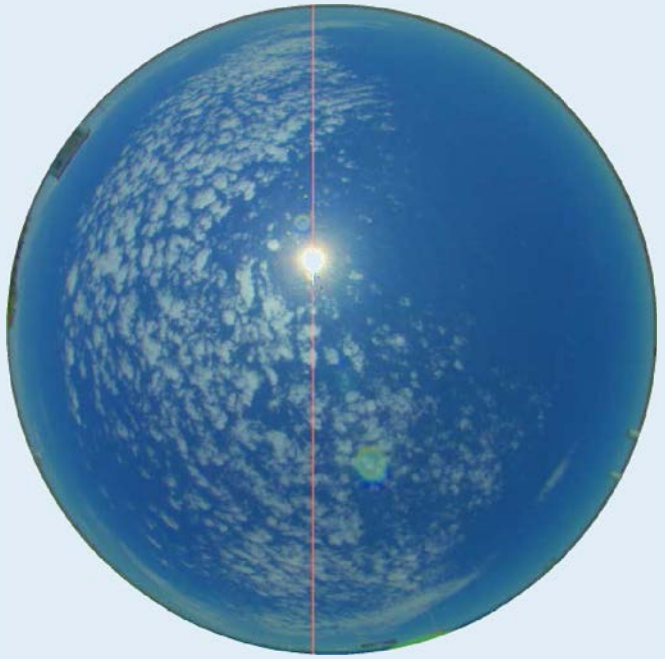
- **Enhanced data & bankable products**:
  - Data quality & format
  - Merging of satellite, NWP and ground data
  - Spatio-temporal high variability
  - Long-term inter-annual variability
  - Products for the end-users



E.g. Definition of P10&90 values
→ include only climate variability and/or uncertainties?

# Subtask 3: Forecasting

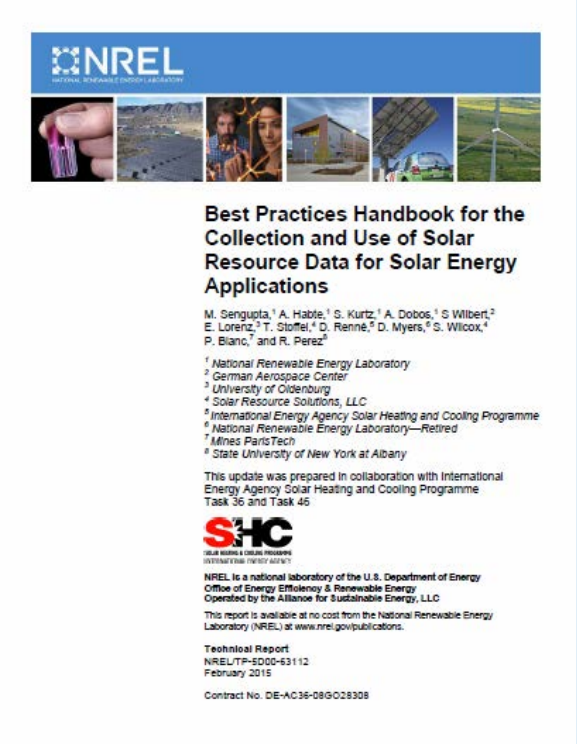
- Evaluation of current and emerging **solar forecasting techniques**:
  - Value of solar power forecasts
  - Regional solar power forecasting
  - Variability forecasting and probabilistic forecasting



E.g. Sky cameras: advance models and benchmark different camera systems

# Subtask 4: Dissemination

- **Dissemination and Outreach**:
  - Task Brochure & Newsletters
  - Conference and Journal papers
  - Webinars and/or conference presentations → connection to ISES will be used
  - Workshops (at major conferences)
  - Reports


NREL

Best Practices Handbook for the Collection and Use of Solar Resource Data for Solar Energy Applications

M. Sengupta,[1] A. Habte,[1] S. Kurtz,[1] A. Dobos,[1] S Wilbert,[2] E. Lorenz,[3] T. Stoffel,[4] D. Renné,[5] D. Myers,[6] S. Wilcox,[4] P. Blanc,[7] and R. Perez[8]

[1] National Renewable Energy Laboratory
[2] German Aerospace Center
[3] University of Oldenburg
[4] Solar Resource Solutions, LLC
[5] International Energy Agency Solar Heating and Cooling Programme
[6] National Renewable Energy Laboratory—Retired
[7] Mines ParisTech
[8] State University of New York at Albany

This update was prepared in collaboration with International Energy Agency Solar Heating and Cooling Programme Task 36 and Task 45

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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

This report is available at no cost from the National Renewable Energy Laboratory (NREL) at www.nrel.gov/publications.

Technical Report
NREL/TP-5D00-63112
February 2015

Contract No. DE-AC36-08GO28308

Update of the solar resource handbook (NREL)

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# Expected key deliverables

- Reports: 18 (9-12 concluded in handbook)
  - Update of the solar resource handbook
- Workshops&Webinars: 6-10

07/2017 2018 2019 2020

| Activity | M3 | M6 | M9 | M12 | M15 | m18 | M21 | M24 | M27 | M30 | M33 | M36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | R1.1.1 | | | | W1.1.2 | | R1.1.1 |
| 1.2 | | | | | | | | W1.2.1 | | | | R1.2.1 |
| 1.3 | | | | W1.3.1 | | | | | | | | R1.3.1 |
| 1.4 | | | R1.4.1 | R1.4.2 | | | | R1.4.3 | | W1.4.4 | | |
| 2.1 | | | | | | W2.1.1 | | | R2.1.1-4 | | | |
| 2.2 | | | | | | | | W2.2.1 | | | | R2.2.2 |
| 2.3 | | | | | | | | | R2.3.1 | | | R2.3.2 |
| 2.4 | | | | | | | | | R2.4.1 | | | R2.4.1 |
| 2.5 | | | | | | | | | | R2.5.1 | | R2.5.1 |
| 3.1 | | | W3.1.1 | | | | | R3.1.2 | | | | R3.1.3 |
| 3.2 | | | | | | | | R3.2.1 | | | | R3.2.2 |
| 3.3 | | | | | | | | W3.3.1 | | R3.3.1 | | R3.3.2 |
| | | R4.1.1 | | | | | | | | | | |
| Newsletters | | N4.2.1 | | N4.2.1 | | N4.2.1 | | N4.2.1 | | N4.2.1 | | N4.2.1 |
| | | | W4.3.1 | | | | W4.3.1 | | | | W4.3.1 | R4.3.2 |
| 4.4 | | | | | | | | R4.4.1 | | R4.4.1 | | R4.4.1 |

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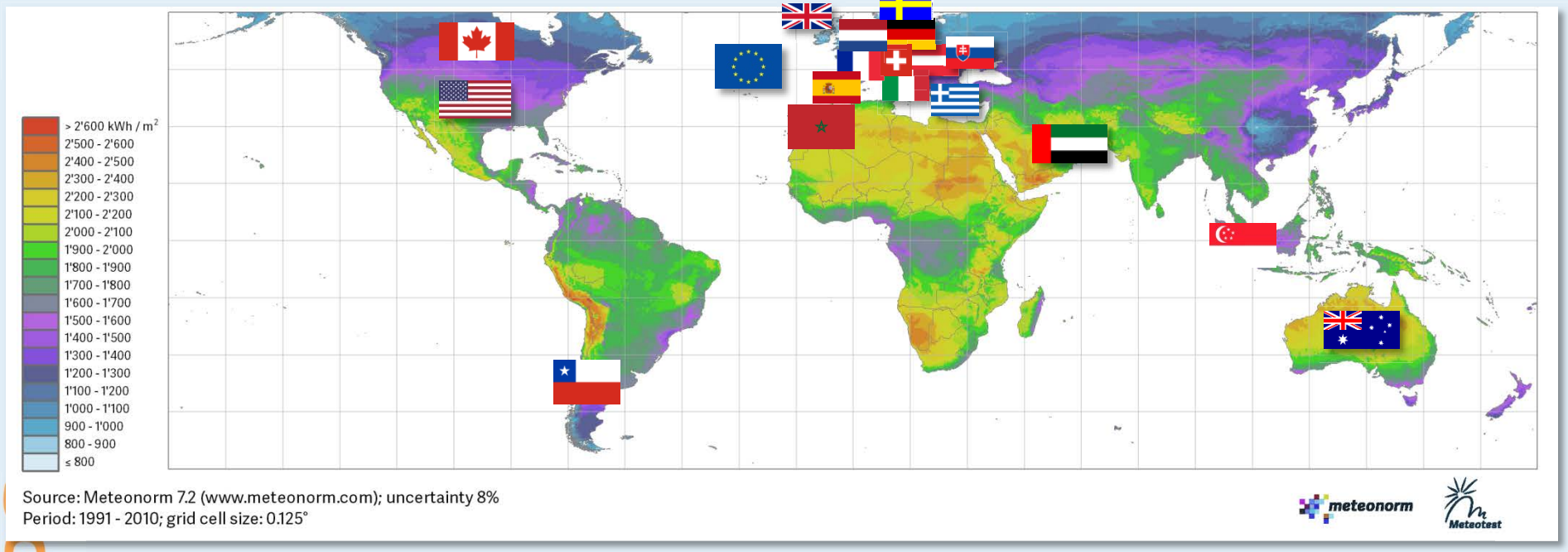
# Participation

SHC

SolarPACES

## 15 IEA PVPS members + SGP




Global horizontal irradiance. Source: www.meteonorm.com Verion 7.2

Potential partners: China, Japan, South Africa and Mexico

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# 52 institutions

Science (labs and universities)

Met Services

Utilities

Data providers

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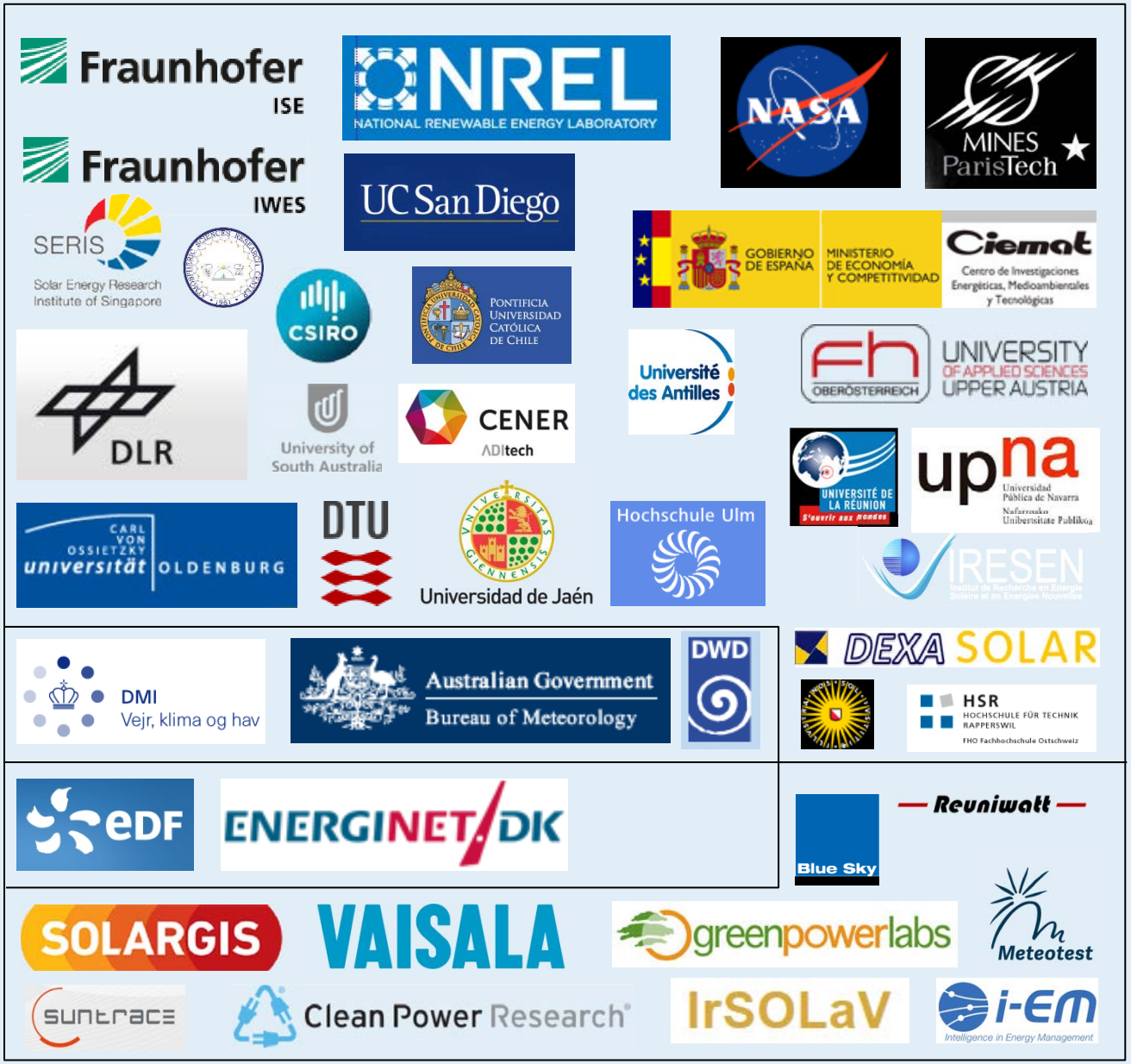
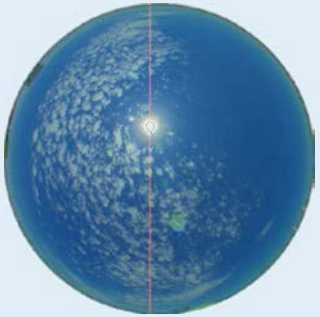


# Questions & Discussion

## Thank you for your attention!

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Energy SFOE

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