Agrovoltaico®
REM Tec

2022

www.remtec.energy

Summary

REM Tec is a globally leading photovoltaic technology company, having developed its own, innovative, patented solutions, allowing to combine energy production & agriculture

REM Tec in a Nutshell

- Spinoff and foundation in 2015, based on a technology having its roots back in 2009
- Having a >10 years track record of agrivoltaic plant operation, with combined agriculture and PV production on >45 ha
- Technology deployed in 4 different countries on different crops and fruits in different climate zones
- Constant innovator with more than 10 active patents and trademarks

Agrovoltaico

REM Tec‘s Target

1. Sustainable, carbon-free electricity production supporting society’s energy transition
2. Preservation of agricultural reality and land for food production
3. Integration of energy production and agriculture creating a win-win situation for all relevant project stakeholders and society

REM Tec has entered several different partnerships with research institutes, and other business partners, to support its R&D activities from a scientific point of view

Overview of R&D Partners

- UCSC – Università Cattolica del Sacro Cuore
- CNR – Consiglio nazionale delle Ricerche
- INRAE - Institut national de recherche pour l'agriculture, l'alimentation et l'environnement
- CIRAD - Centre de coopération internationale en recherche agronomique pour développement
- IFV - Institut Français de la Vigne et du Vin

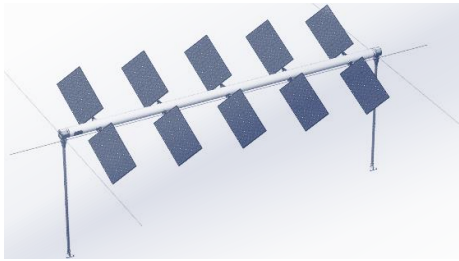
Overview of Technology and Business Partners

- Notus Solar (Japan)
- EDF R&D
- Renergetica
- Altergie Développement
- Derasp (Aspiravi Group)
- HERA
- France Agrivoltaïsme — Founding Partner
- ADEME

Summary

REM Tec has developed different patented mono and bi-axial agrivoltaic technologies; dedicated maintenance team ensures servicing of plants over project lifetime

1 Tracker 1.0



- Power: from 2.5 to 4.35 kWp per Tracker
- 10 PV modules installed on each tracker
- Tracker length: 12 m
- Height: 4 – 5 m

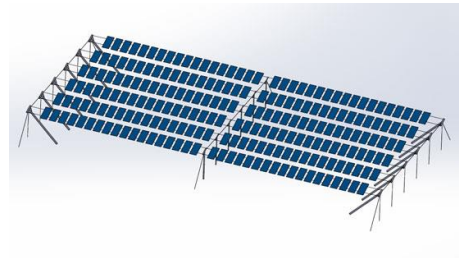
First dedicated Agrovoltaico® biaxial technology developed by REM Tec back in 2009

2 Tracker 2.1

- Power: up to 16.8 kWp per Tracker – up to 700 kWp/ha
- 24 PV modules, 78 cells per tracker (Mono – or bi-facial)
- Tracker length: 14 m
- Height: 4.5 - 6m

Second generation of biaxial Agrovoltaico® technology developed by REM Tec back in 2015

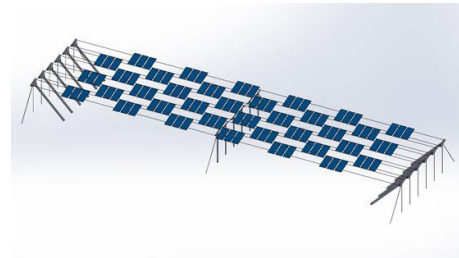
3 AGV LINEAR



- Power: up to 830 kWp/ha
- Spans: 15 - 25m (on the ground) each, being repeatable
- Distance between rows: 6 m
- Height: 4 - 5 m

First generation of linear fixed Agrovoltaico® technology developed by REM Tec in 2021

4 AGV CHESSBOARD



- Power: up to 830 kWp/ha
- Spans: 15 - 25m (on the ground) each, being repeatable
- Distance between rows: 3 m
- Height: 4 - 5 m

First generation of chessboard fixed Agrovoltaico® technology developed by REM Tec in 2021

REM Tec's technology portfolio is complemented by a one-stop-shop service offering

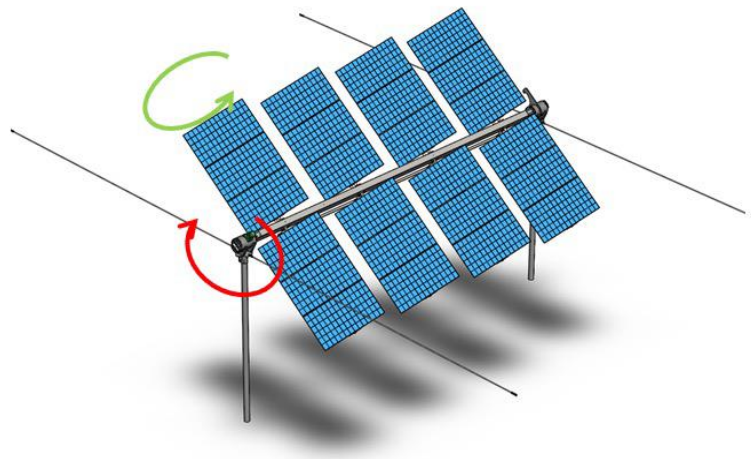
- Plant design and engineering support
- Agronomic analysis
- Commercial and technical support
- Maintenance
- Continuous R&D and software improvement

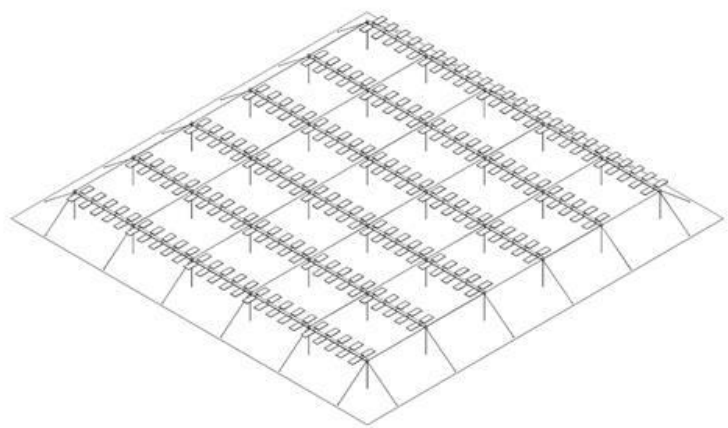
Zoom-in Tracker 2.1 Technology: Second generation of tracking Agrovoltaico® consists of single or double axis trackers designed to create a dynamic and controlled shadow on the ground

Agrovoltaico® T2.1 is a single or double axis tracking system, tailored to be used in the following use cases:

- Large cultures / surfaces
- Precise and dynamic shadow management
- Very low footprint
- Usage of agricultural machines with width span till **18m** is possible
- High efficiency: **up to 45% more** energy compared to a fixed system
- High availability and low O&M costs

AGROVOLTAICO® T2.1 Illustration





AGROVOLTAICO® T2.1 Technical Specifications

- **Height**: 4.5 m or more allowing agricultural machinery to work underneath
- **Support structure:** 2 vertical poles with a distance of 14 m
- **Rotation:** Horizontal steel profile able to rotate around its axis, 14 m long (tracker)
- **Profile type:** 4 smaller profile mounted perpendicular to the horizontal axis, able to rotate around their axes;
- **PV modules:** 24 bi-facial PV modules, 78/132/144 cells, per tracker, meaning around 13 - 17 kWp per tracker depending on module peak power
- **Distance between rows:** 12 – 18 m
- **Shadow:** Dynamic and controlled shadow to reduce hydric stress of the plantation underneath
- **Land topography**: Ideal for flat surfaces with max slope of 3%

Agrovoltaico® is a proven technology already in operation on industrial scale for more than 10 years

Source: Drone photography of Virgilio site by REM Tec

The biaxial Agrovoltaico® system allows the most precise management of the shadow generated on the ground

The knowledge of crops' behavior in response to certain shading scenarios allows to optimize electricity and agricultural production

Shadow management

The Agrovoltaico® system allows to:

- Guarantee a sufficient solar irradiation for the underlying crops, varying the percentage of shading on the ground, even making it zero if necessary, in order to optimize agricultural production
- Manage the tracker movements in order to maximise the energy production

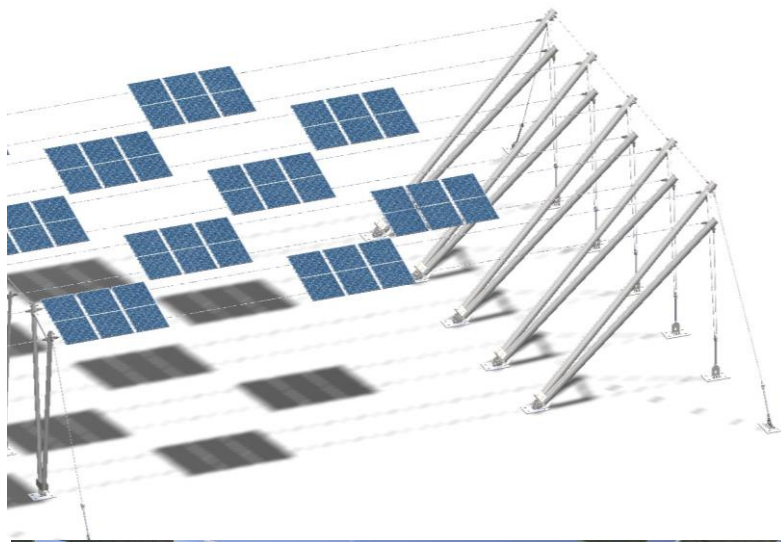
Zoom-in AGV linear and AGV chessboard technology: New fixed system with PV modules mounted on suspended wire ropes, developed by REM Tec in 2021

The fixed suspended system is suitable for slopes up to 15% and south facing

Fixed mounted systems are especially suitable for the following use cases:

- Large cultures / surfaces
- Cultures which are less sensitive regarding shadow management
- Very low footprint
- Usage of agricultural machines with width span till **25m** is possible
- Lower initial investment required compared to tracking systems

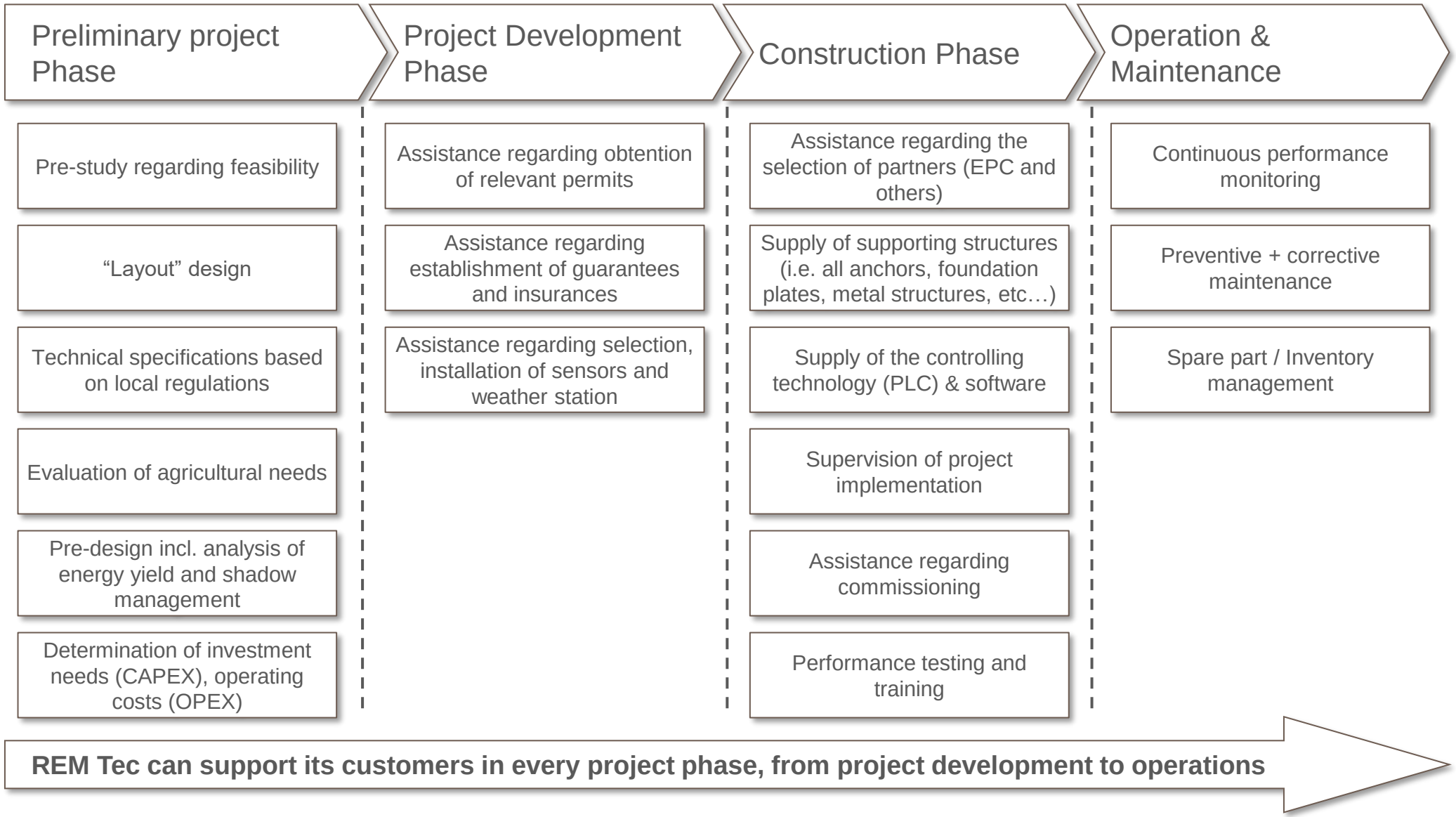
Fixed AGROVOLTAICO® illustration



Fixed AGROVOLTAICO® technical specifications

- **Height**: 4 - 5 m allowing agricultural machinery to work underneath
- **Support structure:** 2 inclined poles with a distance between 15 – 25 m (variable)
- **PV modules:** single or in a group, are placed almost continuously along the row or with misalignment between the rows in order to create a chessboard design
- **PV modules tilt:** up to 20°
- **Distance between rows:** 3 m for chessboard configuration, 6 m for linear configuration
- **Shadow:** Dynamic shadow to reduce hydric stress of the plantation underneath
- **Land topography**: Ideal for flat surfaces and max slope of 15%

REM Tec‘s services provide a one-stop-shop solution tailored to assist project developers and asset managers in all relevant project phases



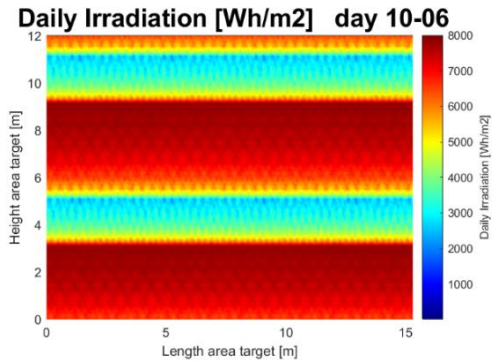
Summary

The choice between fixed vs. tracking systems depend on various factors, with irradiation reduction and shadow management being one of the most important ones

The graphs show the cumulative irradiation on the ground on a summer day under different configuration of Agrovoltaico® plants

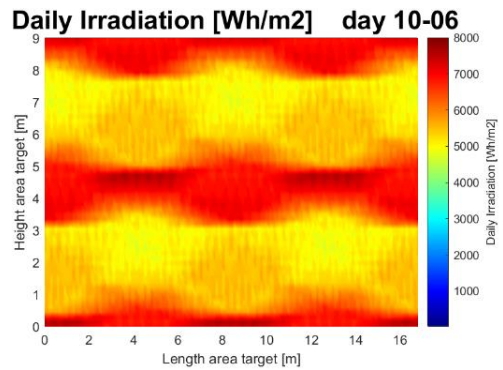
The area considered is the target area, which is representative of the irradiation over the entire plant. The dimension of the target area varies with the distance between the rows

Fixed stripe AGV



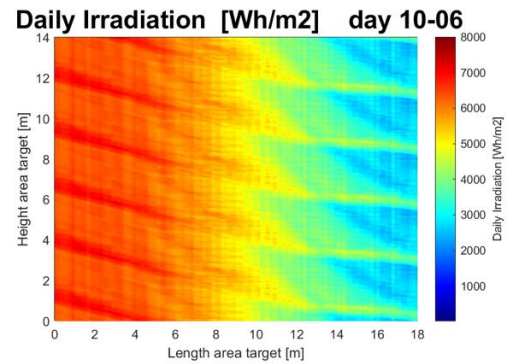
The linear configuration of the fixed AGV produces a very static shadow on the ground. Therefore, the gradient of irradiation is marked

Fixed chessboard AGV



The chessboard configuration of the fixed AGV allows all part of the ground to receive high amount of irradiation

Tracker



The tracker configuration produces a dynamic shadow on the ground and allows the highest level of shadow management, up to full light on the ground

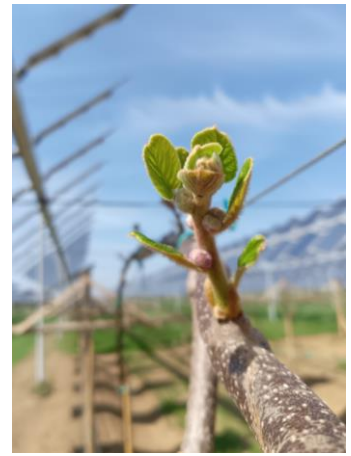
Irradiation control leads to more moisture and humidity in the soil – Thus less irrigation is required for agriculture, lowering the water consumption of up to 60%

The experience gained by REM Tec gives us a deep knowledge on the behavior of several crops and their interaction with Agrovoltaico® systems

R&D has been performed by REM Tec on the following crop sorts (selection):

- Maize
- Wheat
- Tomatoes
- Pumpkin
- Melon
- Rice
- Alfalfa
- Protein pea
- Soy
- Tea
- Berries
- Grapes
- Hemp
- Kiwi
- Ornamental plants
- Etc.








Based on research conducted by REM Tec and its partners on Maize, studies have proven that average yield of Agrovoltaico® surfaces is higher compared to open field

REM Tec's goal is to understand the interaction between different types of crops and the shadow produced by a PV system

Through dedicated software it is possible to manage the operation of the system to favor both electricity and agricultural production

The Agrovoltaico® system offers protection for crops from intense irradiation, reduces water stress, and thus increases crop yield compared to crops in open field

Simulation results

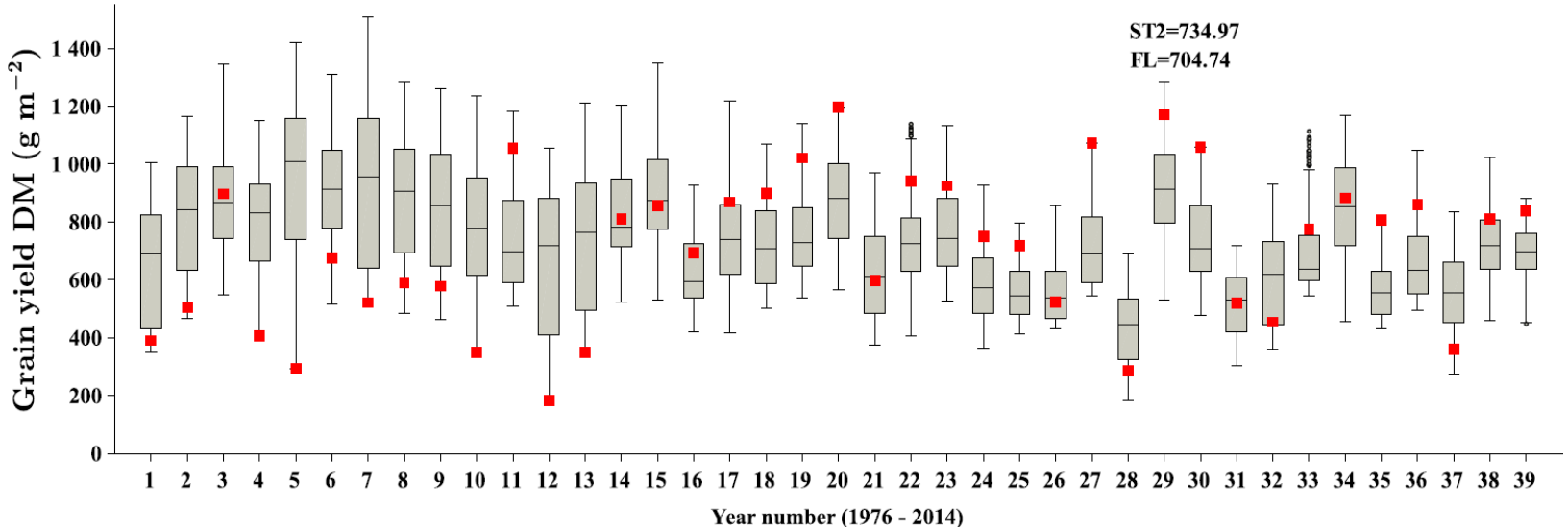
- Accurate studies held together with the University of Piacenza (Department of Sustainable Crop Production) showed that:
  - After PV system installation, the production for wheat and corn does not show significant changes in yield compared to the same crops in open field
- The simulation over 39 years (see graph below) for maize shows that Agrovoltaico® reduces the year-to-year variability in yields that occurs for open field crops due to climate conditions
- In fact, Agrovoltaico® technology is helpful for crop production under drought conditions, because it **reduces the evapo-transpiration**, therefore reducing the water consumption

Simulation for Maize[1)]

Average yield: + 4.3%

– Agrovoltaico 2.0: **734,97 g/m²**

■ Open field: **704,74 g/m²**



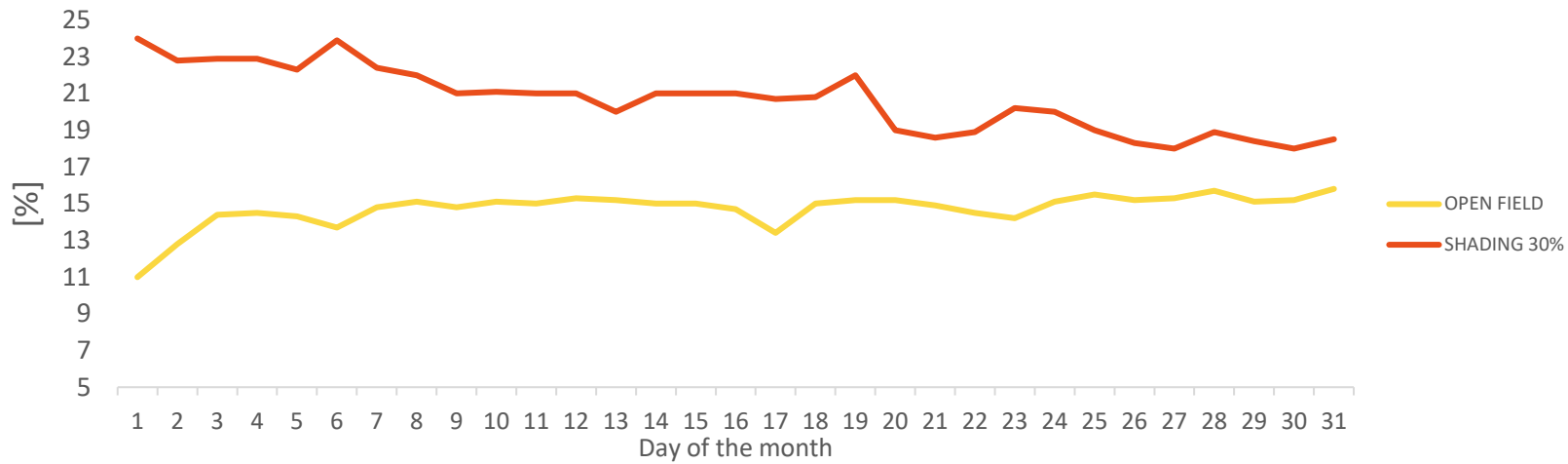
Note: 1) Amaducci S., Xinyou Y., Colauzzi M. Agrivoltaic systems to optimise land use for electric energy production, Applied Energy 220 (2018)

Agricultural research conducted by REM Tec on the Borgo Virgilio (MN) showed positive impact of the Agrovoltaico® system on soil humidity and temperature

30% shading show higher soil humidity due to a significant reduction of evapo-transpiration under the Agrovoltaico® system

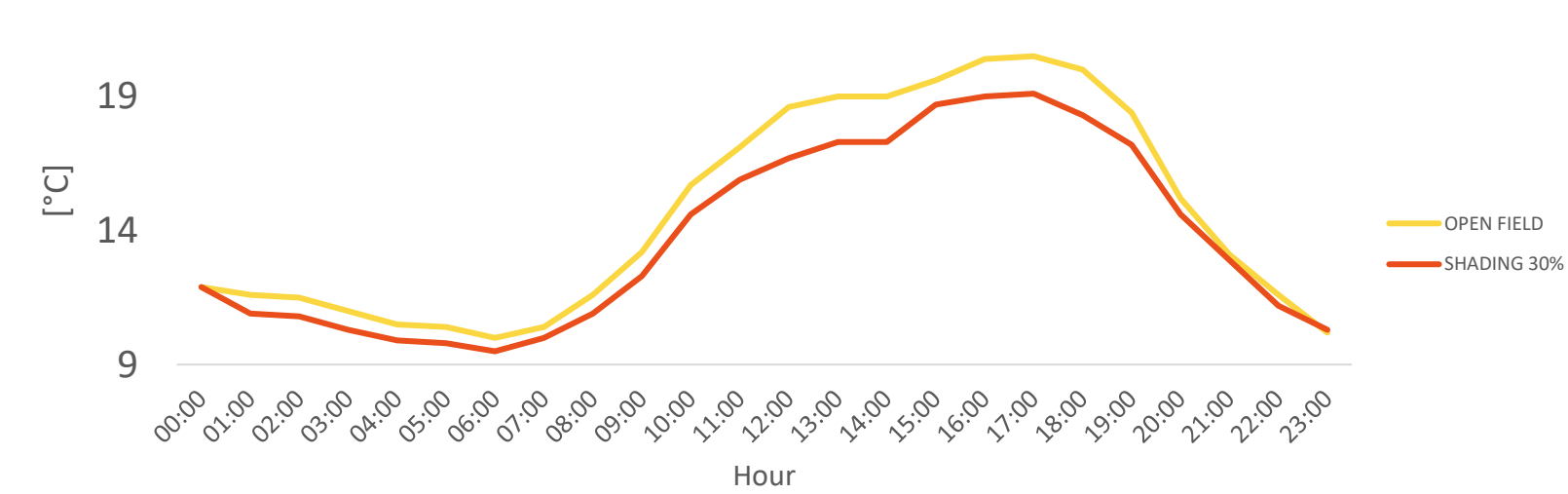
Significant reduction of irrigation can be achieved through the usage of Agrovoltaico® systems

Average soil humidity in August



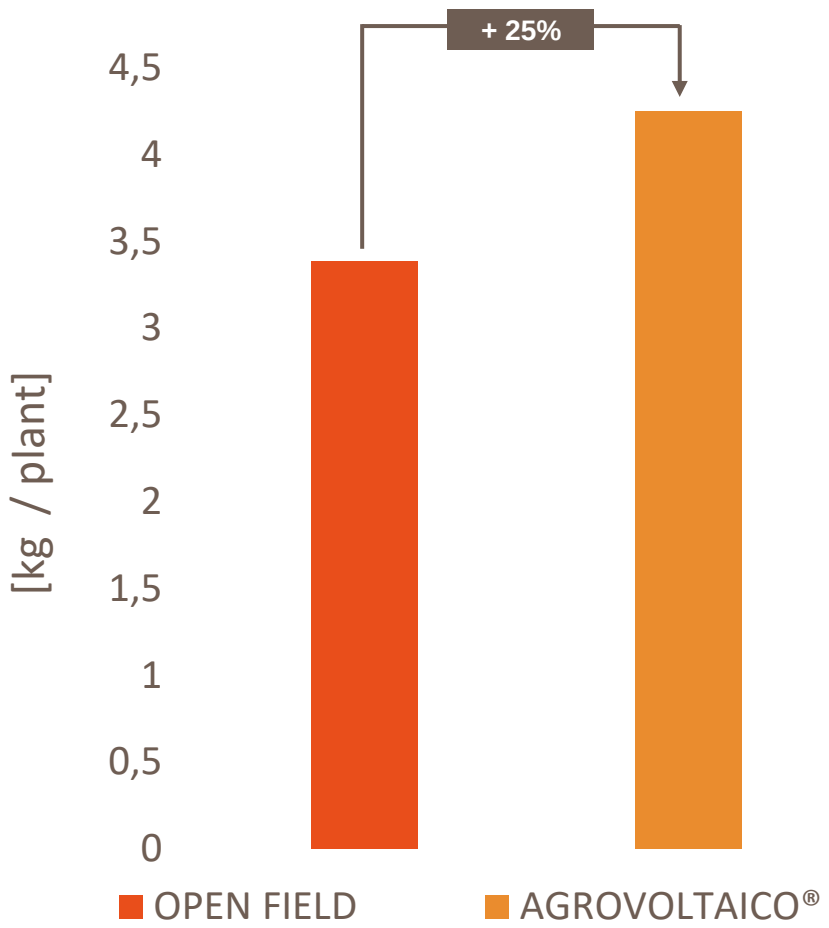
Measurements have shown a significant decrease of air temperature between the control area and the plantations under the Agrovoltaico® system: 1.0 to 5.0 °C between open field and shading 30%

Example of intraday temperature variations (3rd May 2021)



Field trials since 2021 have shown a significant increase in grapes weight under the Agrovoltaico® system compared to open field

Wine: average weight of grapes per plant



1st Agrovoltaico® wine worldwide

Summary

In Italy, currently 6.7 MWp are in operation since 2011 with the first release of trackers

The first release of Agrovoltaico® trackers is 12 m long

Each tracker support 10 PV modules

Castelvetro (PC)

- Technology: 3D[1] T1.0
- Nominal Power: 1293 kWp
- Tracker Nr: 462
- Plant surface: 6,8 ha
- Ground cover ratio: 14 %

Virgilio (MN)

- Technology: 3D[1] T1.0
- Nominal Power: 2150 kWp
- Tracker Nr: 768
- Plant surface: 11,4 ha
- Ground cover ratio: 14 %

Monticelli D'Ongina (PC)

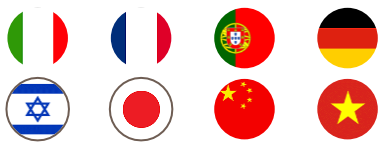
- Technology: 3D[1] T1.0
- Nominal Power: 3229 kWp
- Tracker Nr: 1154
- Plant surface: 17,1 ha
- Ground cover ratio: 14 %

Note: 1) 3D refers to double axis systems

Further Agrovoltaico® plants are installed in China, France and Japan

REM Tec operates directly in Europe on a project base and in the world through dedicated cooperation

Currently REM Tec has ongoing project developments based on fixed, 2D (new technology for high slopes currently developed) and 3D:



Projects comprise different types of agriculture such as:

- Vineyards, Kiwis…
- Lemons, Oranges, Apples, Hazelnuts…
- Alfalfa and Cereals…
- Potatoes, Salads, Tomato…

China - 2016

- Technology: 3D[1)] T1.0
- Nominal power: 544 kWp
- Tracker Nr: 168
- Ground cover ratio: 14 %

France - 2019

- Technology: 3D[1)] T2.0
- Nominal power: 117 kWp
- Tracker Nr: 12
- Ground cover ratio: 40 %

Japan - 2020

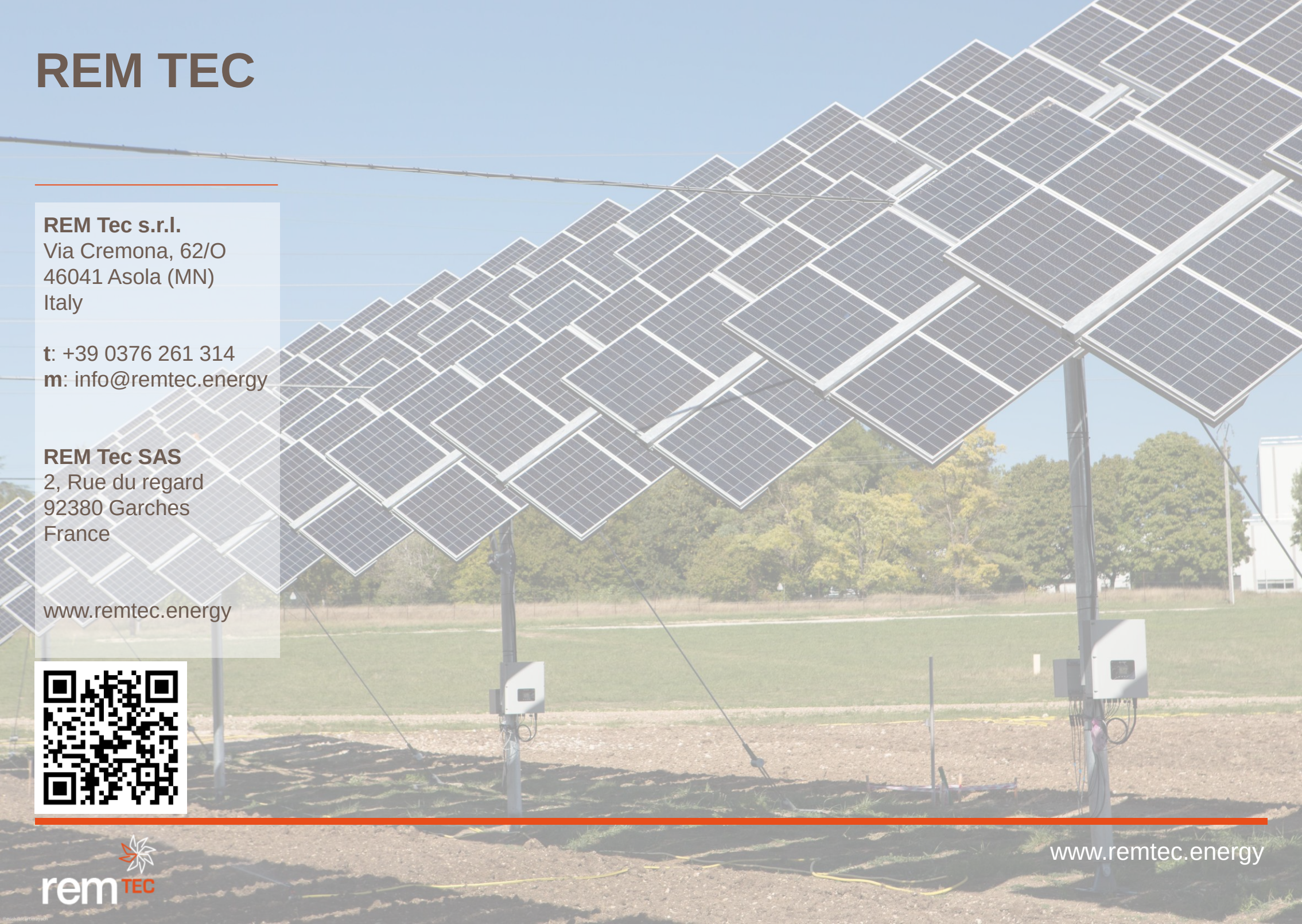
- Technology: 3D[1)] T2.1
- Nominal power: 834 kWp
- Tracker Nr: 64
- Ground cover ratio: 40 %

France - 2022

- Technology: Fixed suspended (demo plant)
- Nominal Power: 100 kWp
- Ground cover ratio: 27 %

Note: 1) 3D refers to double axis systems

REM TEC



REM Tec s.r.l.
Via Cremona, 62/O
46041 Asola (MN)
Italy

t: +39 0376 261 314
m: info@remtec.energy

REM Tec SAS
2, Rue du regard
92380 Garches
France

www.remtec.energy