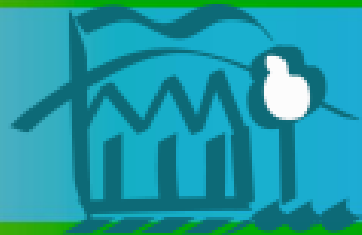


GREEN POWER TO THE PEOPLE



Genesee/Finger Lakes
Regional Planning Council

May 17th, 2019





DO WE HAVE A NEED FOR PRESERVING AGRICULTURAL LAND?

**DO WE HAVE A NEED FOR INTRODUCING ALTERNATIVE
ENERGY TECHNOLOGIES TO ENHANCE OUR ENVIRONMENT?**



A BIG CHALLENGE WE FACE IS WHEN GROUND MOUNTED POST DRIVEN

SOLAR PV IS INSTALLED IT TOO OFTEN TAKES GOOD AGRICULTURAL

LAND OUT OF CROP PRODUCTION FOR TYPICALLY 25-40 YEARS





**CAN WE HARVEST AGRICULTURAL CROPS AND
SOLAR kWh'S ON THE SAME ACREAGE?**

**YES! THERE IS A PROVEN TECHNOLOGY
I WANT TO MAKE YOU AWARE OF THAT DOES BOTH ON
THE SAME ACREAGE**



Agrovoltaico®



WORKING WITH THE TEAM OF:



Nick Masucci



ABOUT US



Rem Tec is an Italian company active in the renewable energy sector for agricultural applications.





OUR TARGET

Our target is to produce clean energy leaving the land available for agriculture, this is

Agrovoltaico®

- ❖ **Sustainability:** producing electric energy to preserve the environment.
- ❖ **Preserve** the agricultural reality.
- ❖ **Integrate** new technologies in the surrounding environment.



WHAT IS AGROVOLTAICO® ?

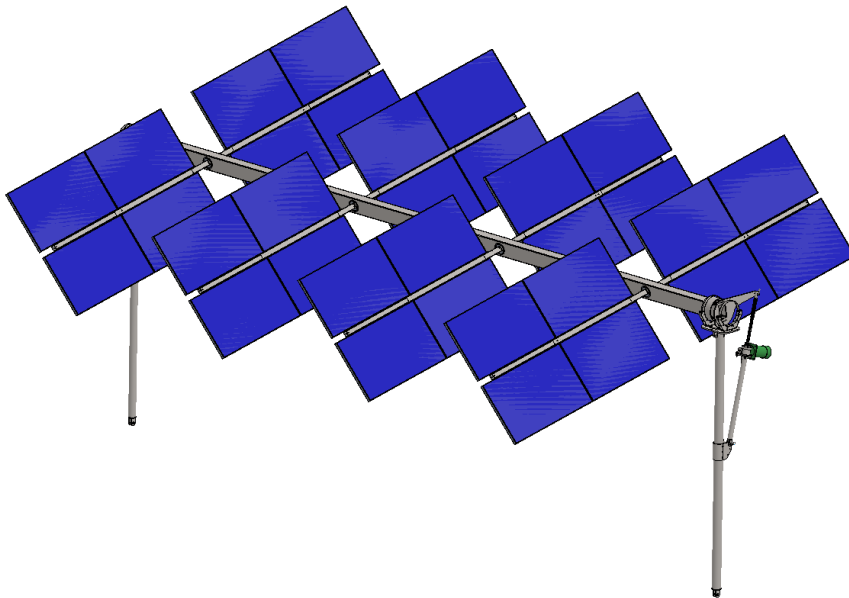
- ❖ An **innovative** PV system that combines two fundamental needs: **food** and **energy** production.



THE TECHNOLOGY

Agrovoltaico® is a modular system, based on the main unit, called **tracker**. Each tracker is composed by:

- ❖ A support structure made by 2 vertical poles;
- ❖ An horizontal steel profile able to rotate around its axis;
- ❖ 4 smaller profile mounted perpendicular to the horizontal axis, able to rotate around their axes;
- ❖ 32 PV modules, which rotates to follow the sun path during the day.



ADVANTAGES

- ❖ HIGH EFFICIENCY (+45% compared to a fixed plant)
- ❖ INTELLIGENT SHADOW MANAGEMENT
- ❖ NOT INVEISIVE
- ❖ RESISTENT TO HARSH CLIMATES



LAND VALORIZATION



100 % agriculture

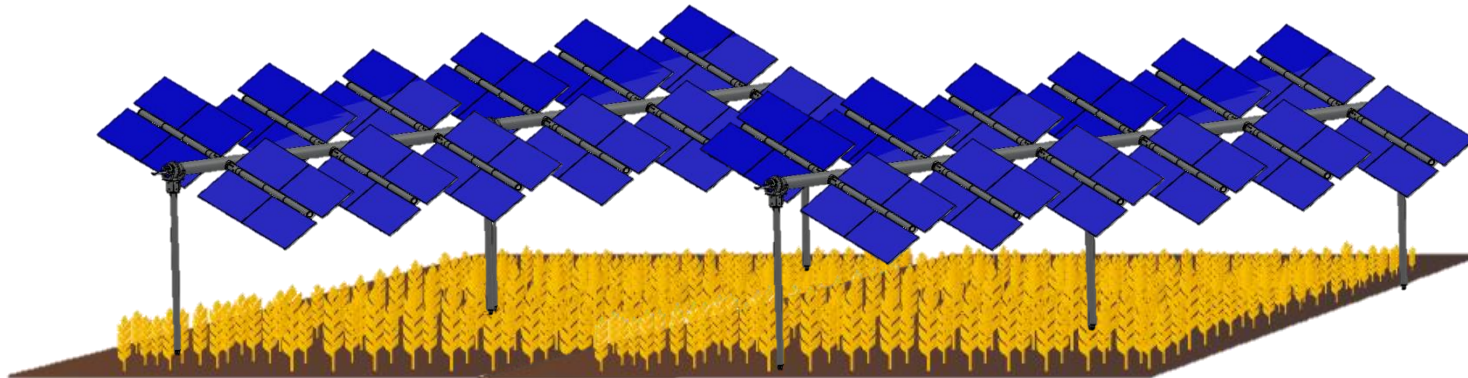
+



100 % energy

=

100 % agriculture
100 % energy



95-105 % agriculture
100 % energy

+

95-105 % agriculture
100 % energy

=

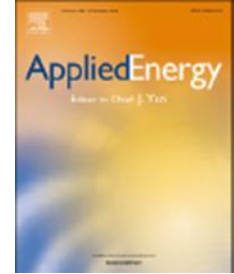
190 -210 % agriculture
200 % energy

Agrivoltaic systems to optimise land use for electric energy production

Stefano Amaducci^{a,*}, Xinyou Yin^b, Michele Colauzzi^a

^a Department of Sustainable Crop Production, Università Cattolica del Sacro Cuore, via Emilia Parmense, 84, Piacenza, Italy

^b Centre for Crop Systems Analysis, Department of Plant Sciences, Wageningen University & Research, Droevendaalsesteeg 1, Wageningen, The Netherlands



Goals

1. To realize a simulation platform to optimize vegetable and energy production under Agrovoltaico[®];
2. To simulate corn yield in Agrovoltaico[®] scenarios;
3. To compare the efficiency in land use of existent system (biogas from corn and ground PV) and Agrovoltaico[®] for energy production.



rem TEC

AGROVOLTAICO® VS BIOGAS

Piacenza Province



331 Acres = 75.4 GWh



3459 Acres = 36.44 GWh

**JUST THINK OF THE BENEFITS-ADVANTAGES OF BEING ABLE TO
HARVEST**

AGRICULTURAL CROPS AND SOLAR kWh's OFF THE SAME ACREAGE?

FIELD TEST RESULTS:

→ Plants with more shadow have experienced a better efficiency in water management.

→ The higher shadow does not mean less production.

→ Sometimes in drought-low rainfall scenarios we sometimes get higher crop production!

AGROVOLTAICO® CROPS



- Corn
- Wheat
- Rice



- Medical herb
- Rape
- Protein pea



- Soy
- Coffee
- Tea



- Berries



IMPLEMENTATIONS:

AGROVOLTAICO[®] GREENHOUSES



To optimize the climatic conditions of the greenhouse and increase the production.

The goal is to reach the best balance between electric and agricultural production.

SHADING/HAIL NETS

The nets can be moved manually or automatically during the day, depending on season, weather and crop, leading to a significant improvement of the agricultural practice.



Miniwind

Involves the combination of wind and solar energy in the Agrovoltaico® system, increasing the nominal power of the plant without using more land.



OTHER APPLICATIONS

HANGAR AGROVOLTAICO

The Agrovoltaiico® system can be integrated into the hangar structure for shelving agricultural vehicles and storage of hay.



PARKING

Agrovoltaiico® is a very versatile system that can be installed on any space, providing clean energy for every need.



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AGROVOLTAICO® IN THE WORLD

China

Agrovoltaico® plant on rice crops
(2016)

3 new plants (2019)



Japan

Agrovoltaico® plant on
green matcha tea

2 plants (2019)





ONGOING PROJECTS

Italy

500 kW Agrovoltaico® for University Cattolica of Piacenza
(2019)



AGROVOLTAICO® CROPS IN THE WORLD

Africa

Agrovoltaico® plant on cacao crops – Ivory Coast
(2019)



France

Demo plant for EDF (2019)
Agrovoltaico® plant on wine grapes (2020)



Japan

2 MW plant on rice crops (2019)



A glowing incandescent lightbulb is shown against a black background. The bulb is illuminated from within, casting a warm, yellow light. Its reflection is visible on a dark, reflective surface below it. The text "An Interesting Option To Consider" is overlaid in white, bold font across the middle of the image.

An Interesting Option To Consider

Energy Storage Overview

March 2019



CLEANEST, LOWEST COST LONG-DURATION STORAGE WITH NO CAPACITY DEGRADATION

ENERGY STORAGE FOR CRITICAL PROJECTS

Utilizing earth-abundant iron, salt and water for its electrolyte, and simple materials for battery components, the Energy Storage (ES) from Jabez Solar LLC is a durable, environmentally safe, long-duration storage solution that is ideally suited for:

- Time-shifting renewable energy on a daily basis.
- Managing a facility's demand or TOU charges.
- Smoothing the intermittency of renewables on a constrained grid.
- Increasing resiliency and fuel efficiency for remote locations.

The ES has a lifespan that exceeds 20,000 cycles, low maintenance requirements, and an energy capacity of 4+ hours. It is complementary to the 25-year life span of solar and wind projects, and supports those applications' low levelized cost of energy requirements.

Concurrent with serving these applications, the inherent quick-response power electronics can perform ancillary services such as voltage and frequency support on microgrids and utility-scale applications.

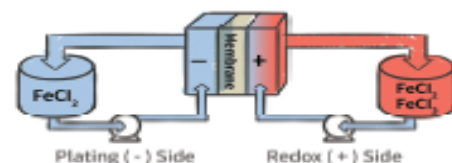
TECHNOLOGY

The all-iron redox (reduction-oxidation) flow battery technology is based on the simplicity of the electrochemical ferrous/iron plating reaction on the negative side and the ferrous/ferric redox reaction on the battery's positive side.

The ES is a flexible long-duration energy storage system that safely and effectively addresses the broadest range of energy and power applications at a lower Levelized Cost of Storage (LCOS) than other technologies on the market.

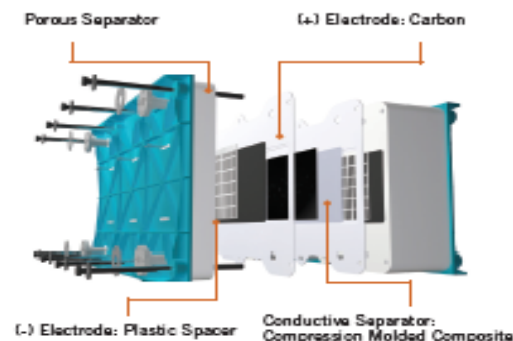
LIMITLESS CYCLING

This simple, yet elegant all-iron electrochemistry. The patented electrode design and control system allow the battery to operate at high efficiency over literally an unlimited number of deep charge and discharge cycles, with no degradation or capacity fade over a 20+ year operating life with minimal annual operations & maintenance (O&M).



With the same electrolyte running on both the negative and positive sides, there is no cross contamination.

IDEAL FOR MULTIPLE USE CASES



Unlike typical batteries that are packaged as fixed cells or modules, a flow battery allows the power (the rate of electricity flow) to be decoupled from the capacity (the total amount of energy held). As a result, users have the flexibility to use the battery for a variety of use cases simultaneously on a project.

FEATURES AND BENEFITS

- Cost-effective, made of Earth's basic elements.
- Environmentally safe, non-toxic electrolyte; non-flammable – non-corrosive – no hazardous materials – no noxious fumes.
- Long-duration storage (4+ hours) for renewable shifting and demand charge reduction.
- Provides flexibility for power and energy use cases.
- Long life, >20,000 cycles, low maintenance.
- Can be shipped in dry state and hydrated onsite.

SPECIFICATIONS

FEATURE	DATA
Performance	
Peak Power:	100 kW
Maximum Energy:	400 kWh
Roundtrip Efficiency:	75% (DC-DC), 70% (AC-AC)
Voltage:	600-850VDC up to 1000VDC Open circuit voltage (OCV) 480VAC, 3-phase, 60Hz
Response time:	Full power in <1 sec.
Cycle Life:	>20,000 cycles
Communications:	Data/control Modbus interface/TCP Ethernet
Mechanical	
Footprint	320 ft ² or 29.7 m ²
Weight (Dry)	15,700 kg
Weight (Wet)	36,200 kg
Environmental	
Battery	Recyclable components
Electrolyte	FeCl ₂ , KCl, H ₂ O; non-flammable, non-corrosive
Ambient Temperature	-5°C to +50°C
Warranty	1 year comprehensive defect warranty
Certification	NRTL field label per UL9540, IP54, CE mark (EU version only)

LOWEST LEVELIZED COST OF STORAGE



Long-duration storage improves project economics, serving multiple energy and power use cases over project's long life span.



For more information, contact:



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www.JabezEnergyLLC.com



Electrical

Storage

That

Is

Environmentally

Safe

Economically

Feasible



rem **TEC**

ENERGY AND AGRICULTURE: AGROVOLTAICO®

GREEN POWER TO THE PEOPLE



THANK YOU FOR YOUR ATTENTION

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