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WORLD ENGINEERING DAY FOR SUSTAINABLE DEVELOPMENT

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O Presidente da República

The challenges of renewable energy for sustainable agriculture regarding the SDGs of the 2030 Agenda

Aligning with the SDGs for a Greener Future

Lisbon

March 4th 2024

Executive Vice-President

WFEO

Ania LOPEZ

Engineering Solutions for a Sustainable World

Ordem dos Engenheiros

INTRODUCE

The types of renewable energy used in agriculture.
Overview of the 2030 Agenda and the Sustainable Development Goals (SDGs), linked to the agricultural sector.

Importance of renewable energy to achieve sustainable agriculture. The challenges of engineers in the agricultural sector

Agrivoltaics, an Italian Best Practice, engineering at the service of Agriculture.

Background:

Renewable Energy sources relevant to agriculture: SOLAR, WIND, BIOMASS, HYDROPOWER, and GEOTHERMAL ENERGY

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Solar energy involves harnessing sunlight to generate electricity or heat. In agriculture, solar energy can be utilized through photovoltaic (PV) panels to power various operations such as irrigation systems, lighting, and machinery. Solar panels can be installed on rooftops, ground mounts, or even integrated into agricultural infrastructure like greenhouses.

Source: The largest photovoltaic park in Italy in Troia (Foggia)

www.foggiatoday.it

Wind energy involves capturing the kinetic energy from wind to generate electricity. Wind turbines, typically installed in windy areas, convert wind energy into mechanical power which is then converted into electricity. In agricultural settings, wind turbines can be used to power farms or provide energy to remote locations where grid connectivity is limited.

Source: The Wind Farm in Italy in Portoscuso (Sardegna)

www.enelgreenpower.com

Biomass energy is derived from organic materials such as crop residues, animal manure, and dedicated energy crops. These materials are converted into biofuels like biogas, bioethanol, and biodiesel through processes such as fermentation, combustion, or gasification.

In agriculture, biomass energy can be generated from agricultural residues and waste products, providing an additional revenue stream for farmers while reducing waste.

Source: Electrical or thermal energy from woody biomass in Envie (Cuneo)

www.pezzolato.it

Background:

Renewable Energy sources relevant to agriculture

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Hydropower involves capturing the energy of flowing water to generate electricity. It can be harnessed through dams, turbines in rivers or streams, and other water infrastructure.
While not as directly applicable to traditional agriculture, hydropower can play a role in providing sustainable energy for irrigation systems and agricultural processing facilities in areas with access to flowing water sources.

Source: The Hydropowerplant in Sentino Sassoferrato (Macerata)
www.ergonbluenergy.org

Geothermal energy utilizes heat from the Earth's crust to generate electricity or provide direct heating. Geothermal power plants tap into hot underground reservoirs of steam or hot water to produce electricity.
While less common in agricultural settings, geothermal energy can be used for greenhouse heating, soil heating for crop production, and other agricultural processes in regions with geothermal resources.

Source: The Nuova Lardello Geothermal Power Plant (Toscana)
www.enel.com

Importance of renewable energy to achieve sustainable agriculture

Sustainable agriculture plays a pivotal role in achieving multiple Sustainable Development Goals (SDGs) outlined in the 2030 Agenda. Here's how it contributes to various SDGs:

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Sustainable agriculture ensures food security by promoting efficient and resilient farming practices.
By implementing sustainable agricultural techniques, such as crop rotation, integrated pest management, and agroforestry, farmers can enhance productivity and reduce the risk of crop failures.
Sustainable agriculture also emphasizes equitable access to resources and markets, which helps alleviate hunger and malnutrition, particularly among vulnerable populations.

Sustainable agriculture promotes the use of renewable energy sources, such as solar, wind, and biomass, to power farming operations.
By transitioning from fossil fuel-based energy to clean energy alternatives, agriculture can significantly reduce greenhouse gas emissions and mitigate climate change. Additionally, sustainable agricultural practices, such as conservation tillage and organic farming, enhance soil health and sequester carbon, further contributing to climate action.

Sustainable agriculture adopts climate-smart practices that reduce emissions, enhance resilience to climate change, and contribute to carbon sequestration.
Practices such as agroforestry, cover cropping, and conservation agriculture help mitigate greenhouse gas emissions by enhancing soil carbon storage and reducing the need for synthetic fertilizers and pesticides.
Sustainable agriculture also promotes adaptive strategies to cope with climate variability, such as drought-resistant crop varieties and efficient water management techniques.

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What may be the challenges of engineers in the agricultural sector ?

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Engineers in the agricultural sector face a variety of challenges, ranging from technological and environmental to social and economic.
Here are some key challenges they may encounter:

Source: Phd reseacher Ania Lopez

challenges

Technology Adoption


Source: produce.com

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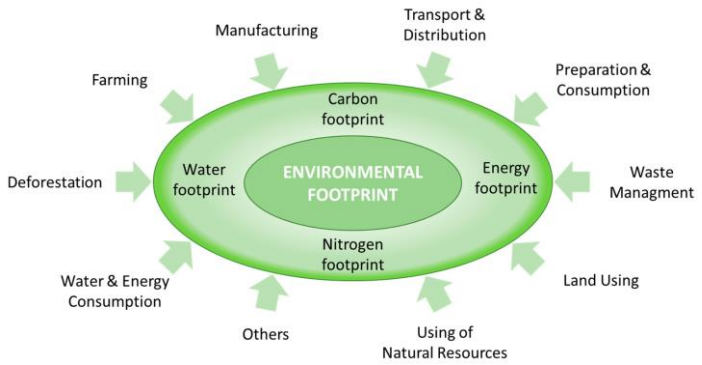
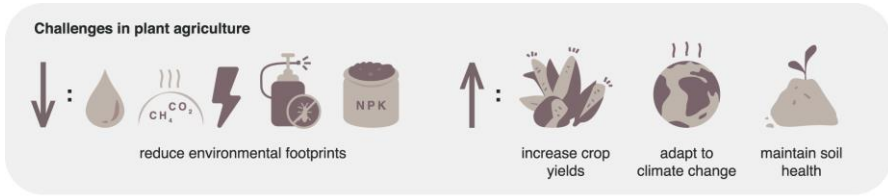
Encouraging farmers to adopt new technologies can be challenging due to factors such as cost, perceived risks, and lack of awareness or understanding.

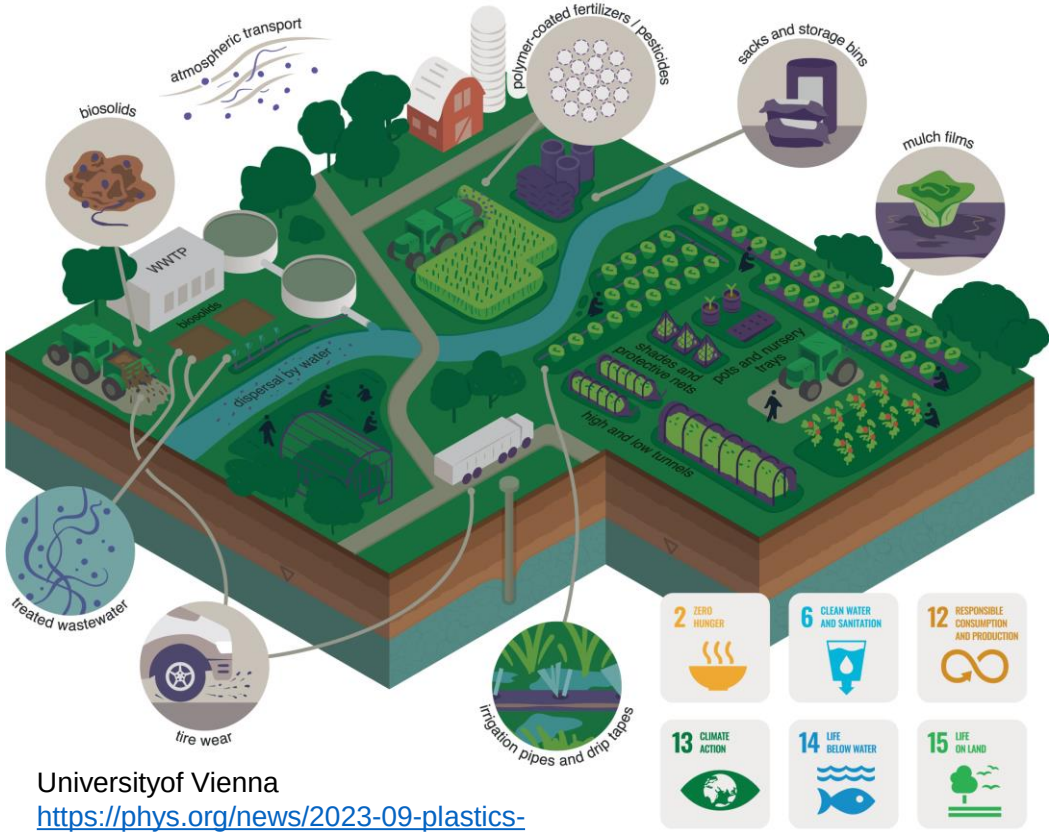
Engineers must design technologies that are user-friendly, affordable, and adapted to local conditions to facilitate adoption.


Source: Globalagriculturalproductivity



Mdpi.com Sustainable Development in the Agri-Food Sector in Terms of the Carbon Footprint





Universityof Vienna https://phys.org/news/2023-09-plastics-agriculture-sustainable.html

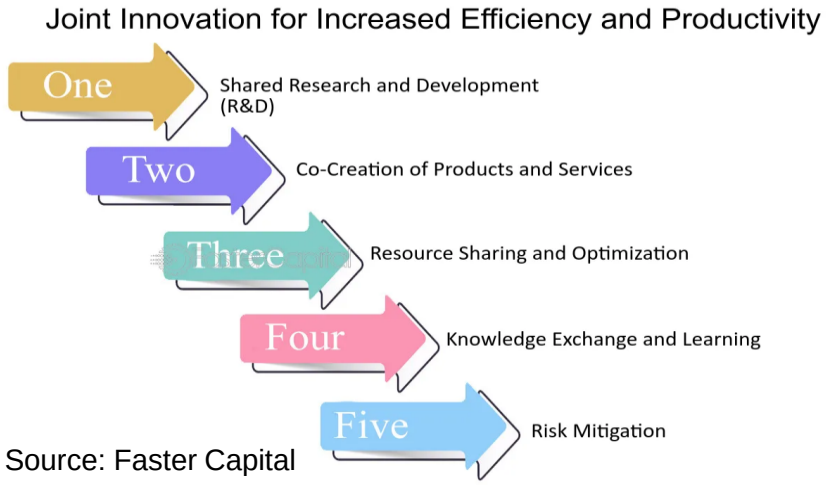
Agricultural engineering projects often operate in resource-constrained environments, where access to materials, equipment, and skilled labor may be limited.

Engineers must find innovative solutions to maximize efficiency and productivity while minimizing the use of resources, scientific research with the application of new technologies will be the key to sustainability in raw material processing and waste.

Source: FAO

Nearly 59 million tonnes of food (131 kg/inhabitant) are wasted in the EU each year with estimated market value of €132 billion. Over half of food waste (53%) is generated by households, followed by the processing and manufacturing sector (20%).

UE Commisiton
https://ec.europa.eu/commission/presscorner/detail/en/IP_23_3565



Source: Faster Capital

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challenges

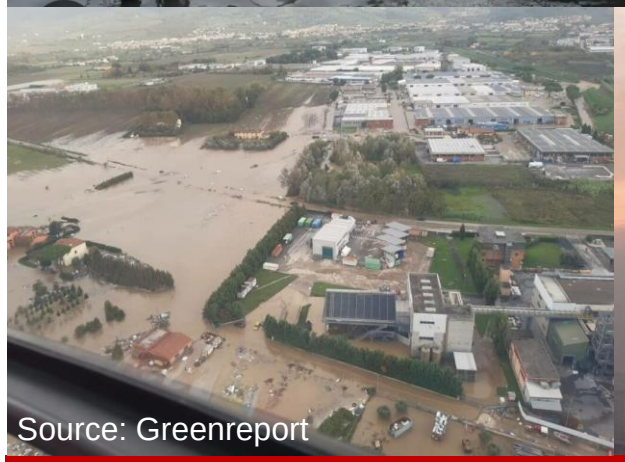
Resource Constraints

Source: Orage Fiber Ferragamo Capsule collection (Italy)

Climate Change and Environmental Sustainability

Climate change poses significant challenges to agricultural systems, including unpredictable weather patterns, water scarcity and land degradation, including periods of intense drought and landslides.

Source: el espanol


Source: Greenreport


Source: Eccodella città

challenges

Engineers must develop resilient technologies and practices that mitigate climate risks, preserve natural resources and minimize environmental impact, with periodic monitoring and control actions on the state of the areas most prone to landslides, avoiding illegal construction in unsuitable areas with high risk of dismantling and create natural barriers to contain it.

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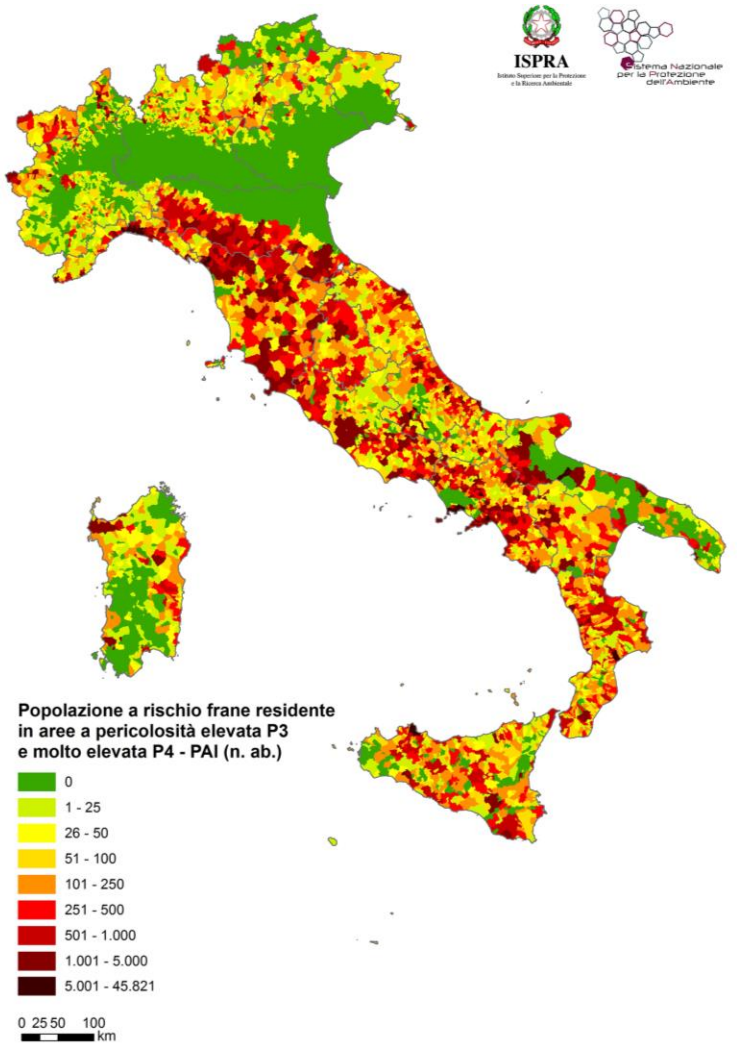
ISPRA · Sistema Nazionale per la Protezione dell'Ambiente



challenges

Infrastructure Development

Why Future of Work Startups are a Game ChangerSustainable Career Paths Balancing Environmental and Economic Concerns

Source: Faster Capital

In many rural areas, inadequate infrastructure such as roads, electricity, and water supply hinders agricultural development.

Engineers play a crucial role in designing and implementing infrastructure projects that improve access to markets, inputs, and services for farmers.

Source: Confetti Crispo/Dragee Crispo

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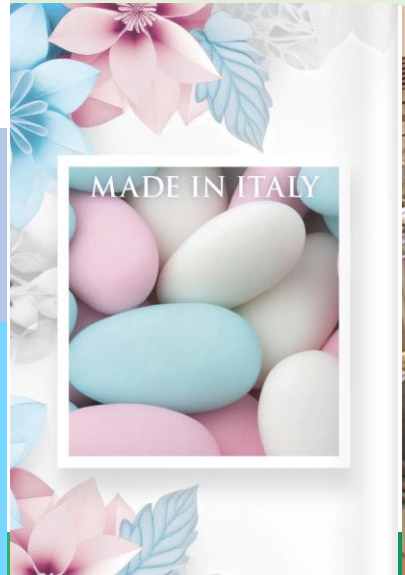
The company has two production plants for a total surface of mq. 20.000 and it reveal of a logistic warehouse with a capacity of 3.200 footboards.
It is the only producer of dragees with environmental impact zero, thanks to the use of a cogenerator for the production of energy, steam and water, which cover the total needs of the company.



challenges

Mechanization and Labor Issues

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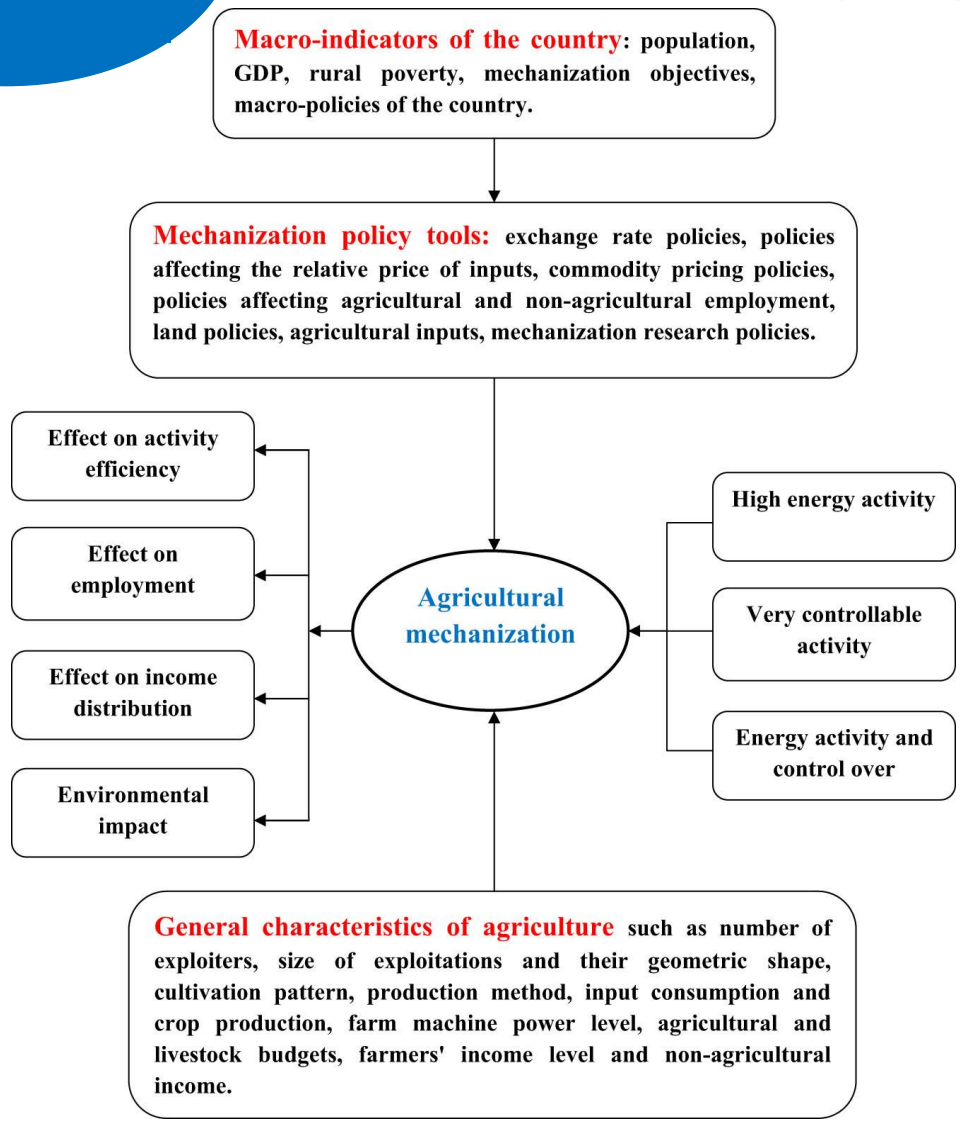
Source: Wikifarmer.com

Source: Biophysical Economics and Sustainability

Source: Niche Agriculture



Source:https://www.degruyter.com

As agriculture becomes increasingly mechanized, there is a growing concern about the displacement of rural labor and its impact on livelihoods.

Engineers must balance the benefits of mechanization with the need to create employment opportunities and support rural livelihoods.

The agricultural sector is increasingly reliant on data-driven technologies such as precision agriculture, remote sensing, and digital platforms.

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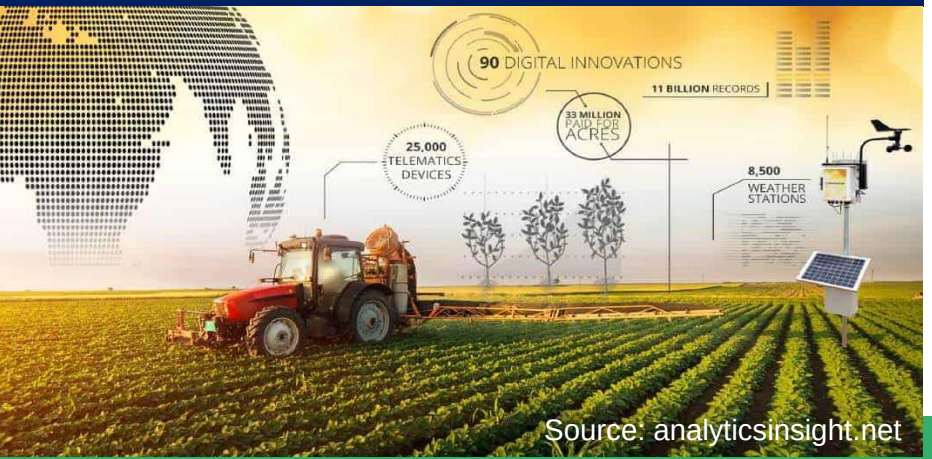
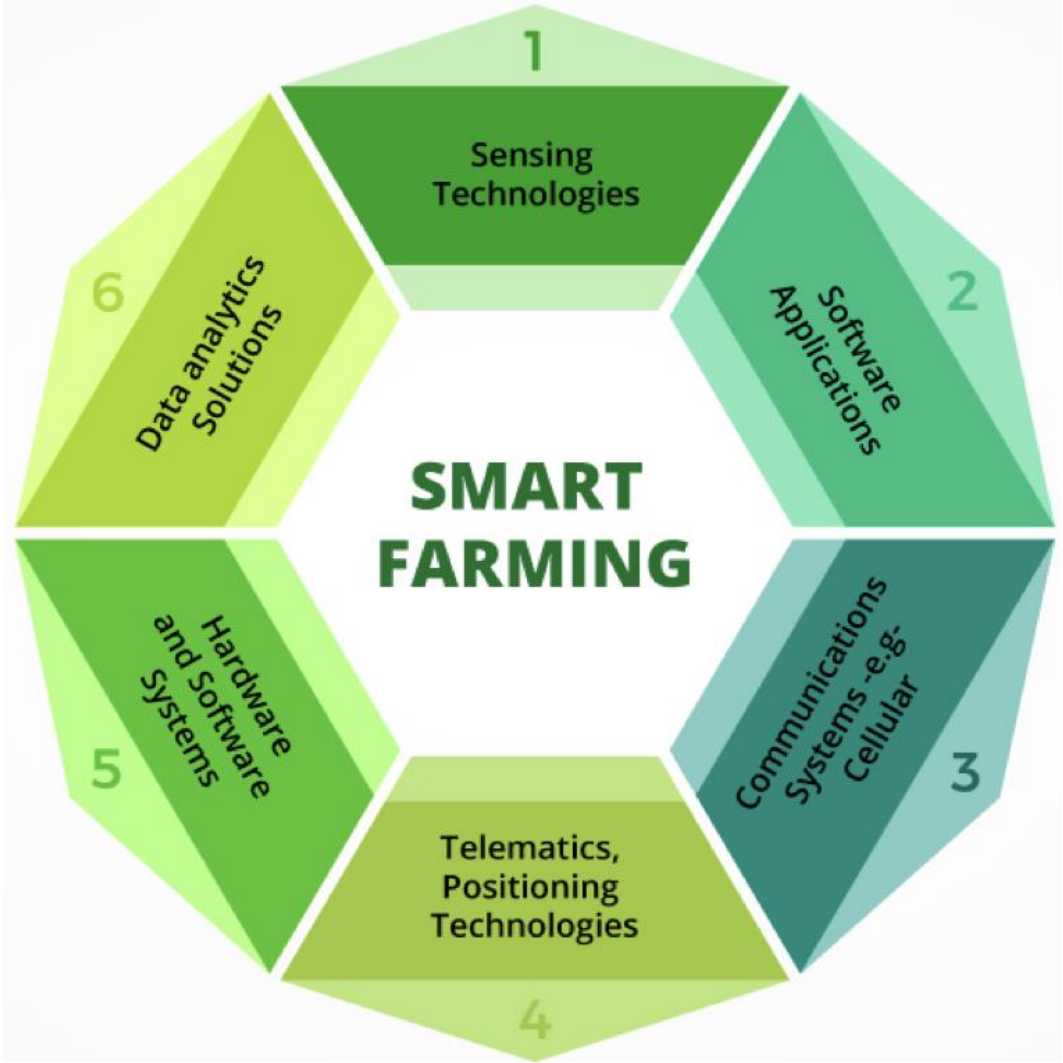
Engineers face challenges related to data collection, management, and analysis, as well as concerns about data privacy and security.





Source: Tesda .gov.ph Beecham Research

Data Management and Digitalization

challenges

challenges

Policy and Regulation

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Agricultural engineering projects are subject to a complex regulatory environment that can vary widely between regions and countries.

The common agricultural policy: 2023-27

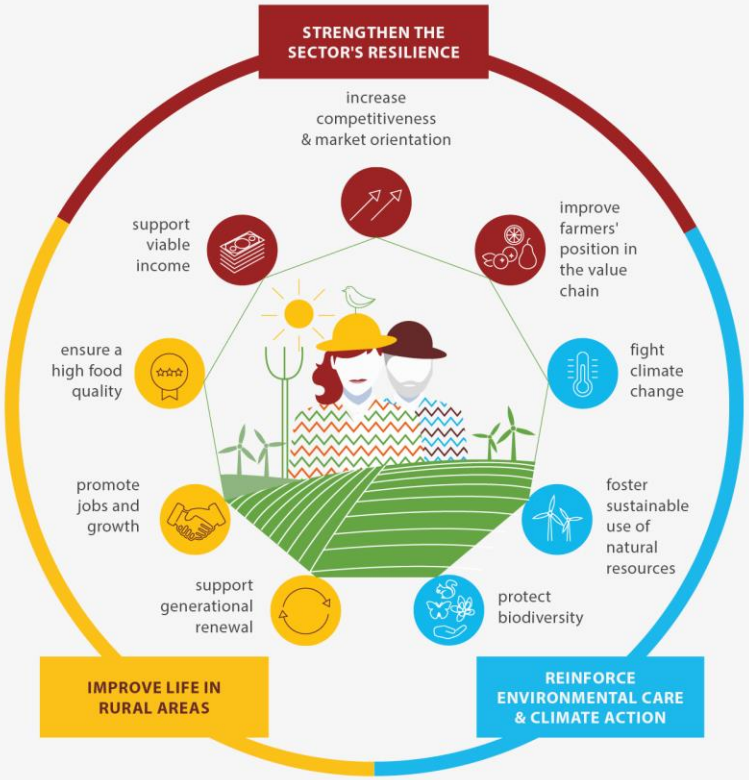
The European Commission has adopted a set of proposals to make the EU's climate, energy, transport and taxation **policies fit for reducing net greenhouse gas emissions by at least 55% by 2030**, compared to 1990 levels. More information on Delivering the European Green Deal.

Engineers need to navigate regulatory requirements and ensure compliance with relevant standards and guidelines.

The future of EU agricultural policy

The Common Agricultural Policy (CAP) has undergone several waves of reforms, in order to adapt the policy to a changing world.

WHAT ARE THE OBJECTIVES OF THE FUTURE CAP?



Council of the European Union
General Secretariat

Socioeconomic factors such as land tenure systems, market dynamics, and cultural practices can influence the success of engineering interventions in agriculture.

Slow Food is a global movement in which activists, organized in convivia, communities and thematic networks, promote the defense of biodiversity through taste education and advocacy activity, encouraging dialogue between civil society and institutions.

Engineers must consider the social context of their projects and engage with local communities to ensure their needs and priorities are addressed.

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Socioeconomic Factors

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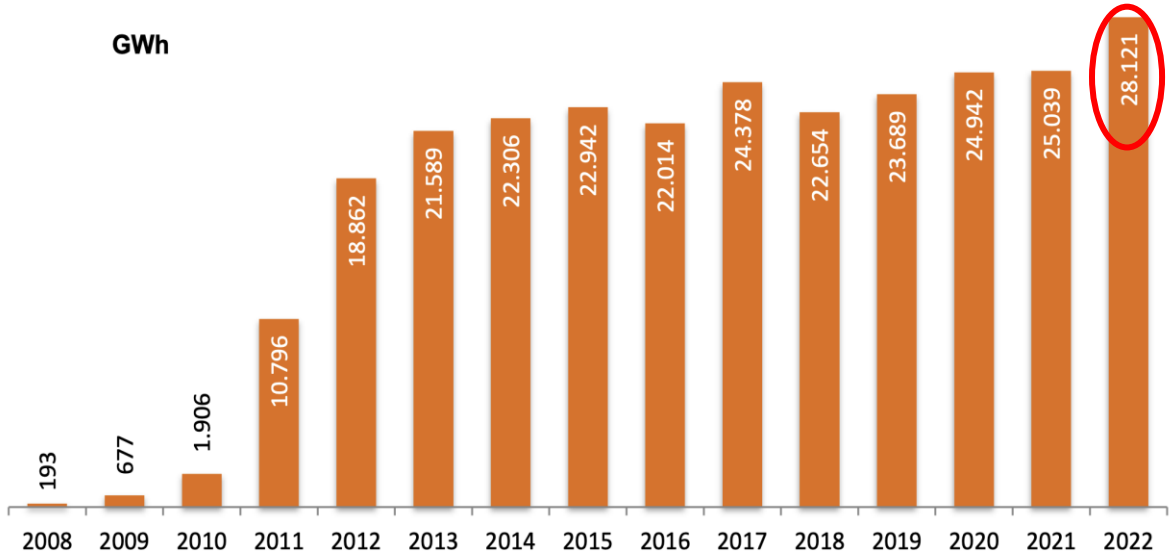
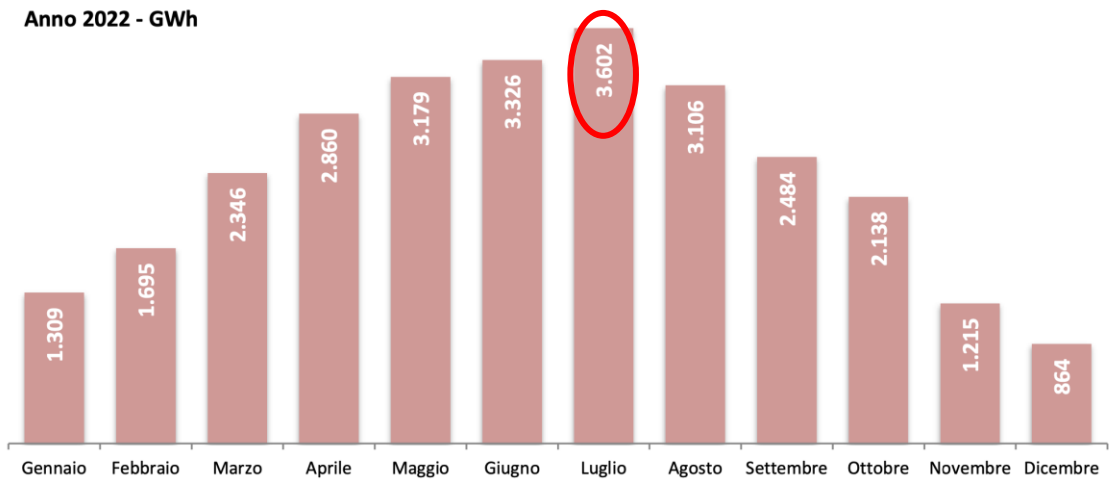
The Engagement Cycle

Engaging with patients and the public throughout the commissioning process

www.institute.nhs.uk/engagementcycle

2022 Annual and monthly production of photovoltaic systems in Italy





During 2022, the photovoltaic park in operation in Italy produced a total of **28,121 GWh** of electric energy; compared to the previous year, an increase in production of **+12.3%** was observed.

From the analysis of the monthly trend of 2022 production, the primacy of the central months emerges; **July, in particular,** it is the month characterized by the highest production (**over 3.6 TWh**).

Source:GSE/ Energy Services Manager

Information on Producibility of Wind Power Plants 2022

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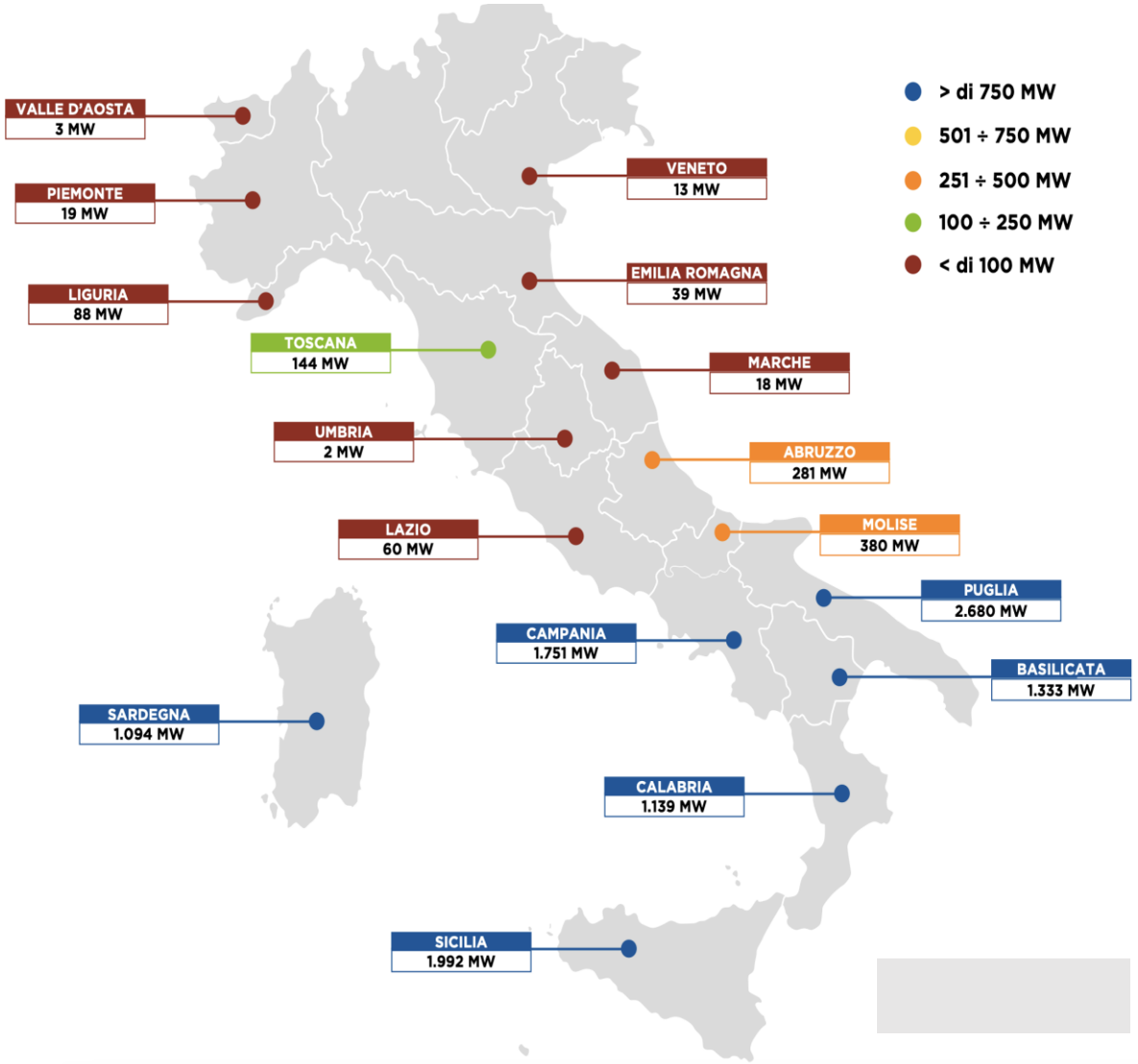
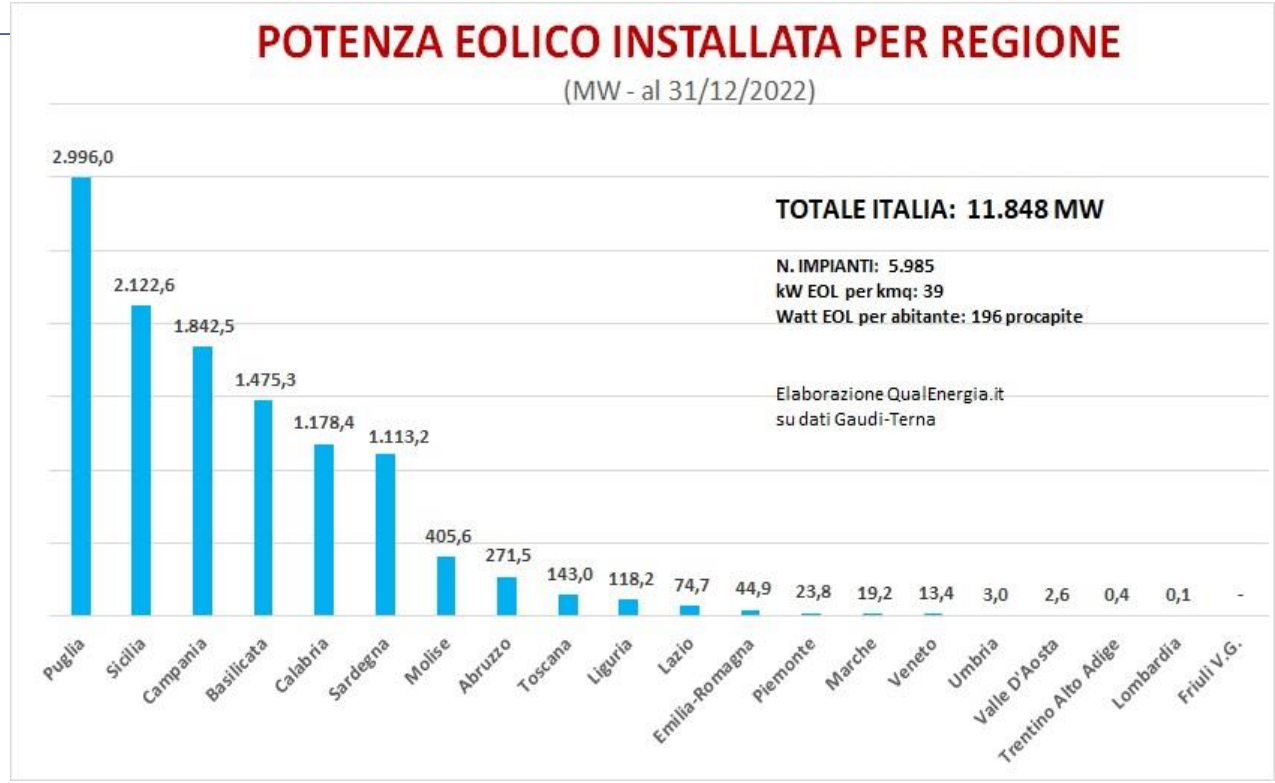


Source:ANEV /National Wind Energy Association



Source:GSE/ Energy Services Manager

The cumulative total of wind power in our country as of **31 December 2022 amounts, net of divestments, to 11,848 MW.** **The new wind power in 2022 is 30.2%** greater than that in 2021, when 404 MW of plants were connected to the grid.
In 3 years, just around 930 MW of wind power has been installed

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Tarquinia Solar Park (Viterbo)

ITALY

BEST

PRACTICE

RENEWAL

Piansano Wind Farm (Viterbo)

Technology	PV
Energy Production	280 GWh
Capacity	170 MW
Co2 emissions avoided	130.000 T/ year

Technology	Wind
Energy Production	80.000 MWh
Number of wind turbines	21
Co2 emissions avoided	130.000 T/ year
Efficient Power	42MW

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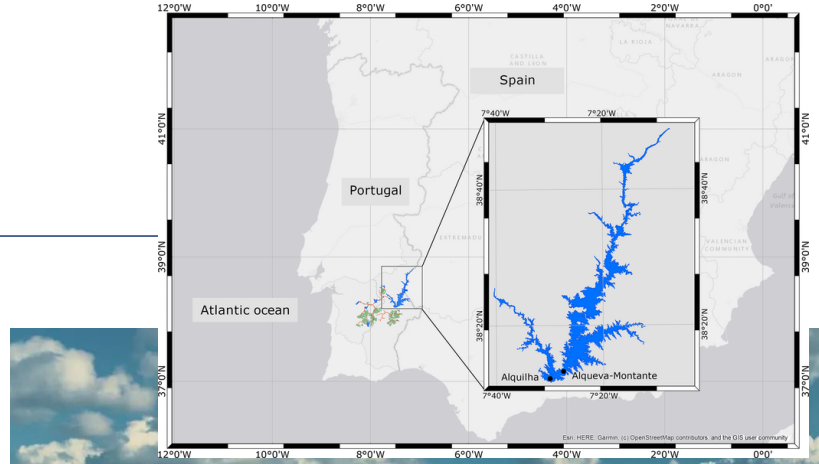
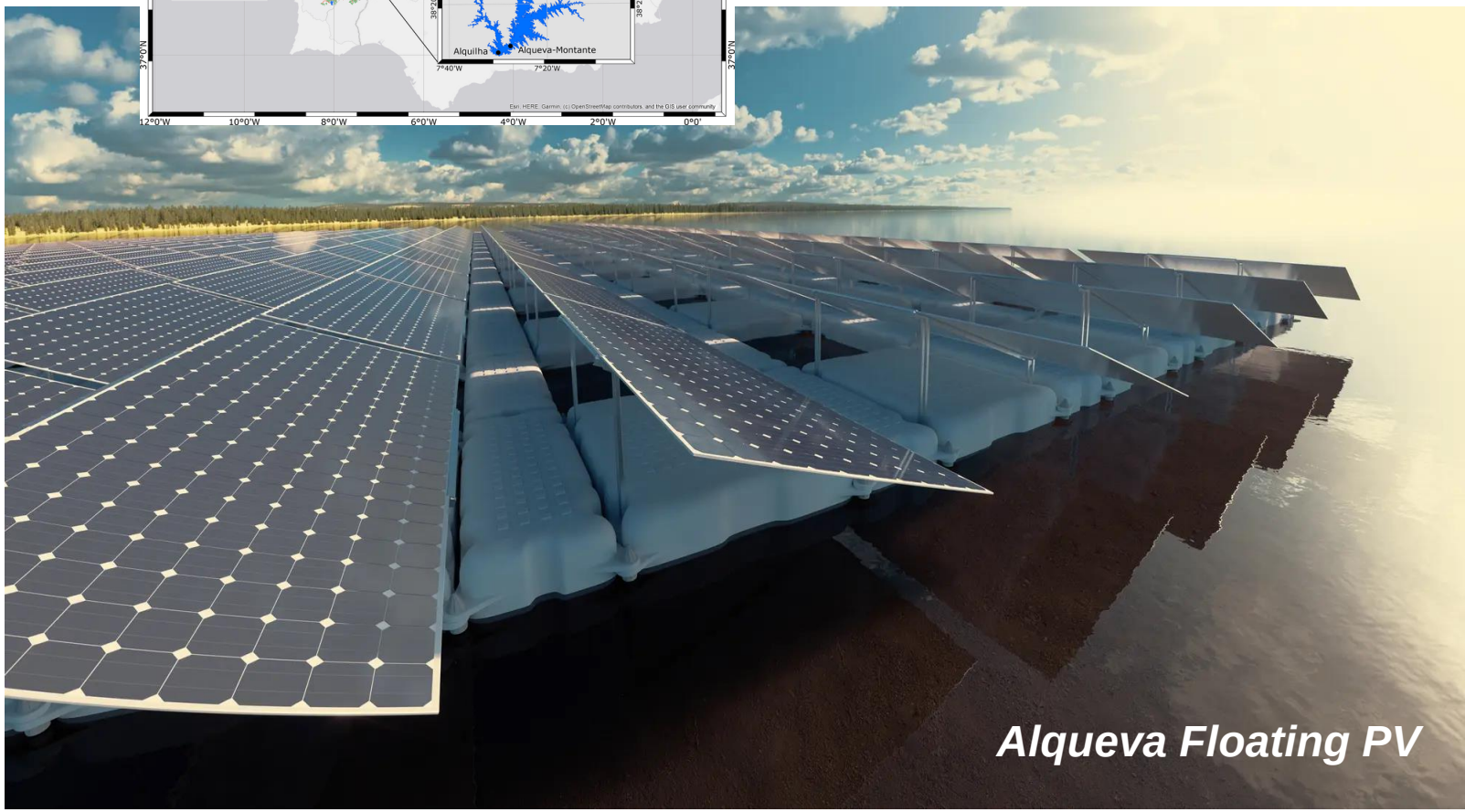
CONCLUTION

1.- Sustainable agriculture is essential to address interconnected challenges such as hunger, poverty, climate change and biodiversity loss.

2.- By adopting sustainable practices, agriculture can become a powerful catalyst to achieve multiple sustainable development goals and build a more resilient and equitable future for all, interdisciplinary collaboration, stakeholder involvement and a holistic approach that considers the social, economic and environmental of agricultural development.

3.- Engineers play a crucial role in driving innovation and sustainable growth in the agricultural sector.





The largest floating photovoltaic plant in Europe? It is being built in the Alqueva hydroelectric dam basin, Portugal.

Source Expedia: Praia da Rainha

What distinguishes people from each other is the strength to make it, or to let fate do it to us

Fernando Pessoa
1888-1935
Portuguese poet writer

O que distingue as pessoas umas das outras é a força para conseguir, ou para deixar o destino fazer isso conosco

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