smart skills
smart sustainable agriculture

Course 4: Renewable Energy Integration in Agriculture

M2: Solar–Powered Solutions for Farms

Co-funded by the European Union

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What will you learn?

This module aims to provide a broad understanding of photovoltaic (PV) panels and their role in modern agriculture. The practical applications of solar energy on farms will be discussed using an example of it in modern agriculture. The module includes information on how to maintain and optimise the performance of photovoltaic panels, including cleaning techniques and preventive maintenance strategies. By the end of this module, you will have a clear understanding of how to effectively configure and manage solar panel systems, ensuring long-term performance and reliability in agricultural settings.

Understand…

… setting up solar panels for irrigation systems and storage units

Identify…

… maintenance and performance optimisation of solar equipment

Explain…

… how photovoltaic panels can be used in agriculture

contents

This module is dedicated to solar energy. It will include information on equipment and its maintenance, as well as spotlighting case studies to enhance learning and understanding.

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01

SETTING UP SOLAR PANELS FOR IRRIGATION SYSTEMS AND STORAGE UNITS

Overview

Integrating solar panels with irrigation systems and energy storage units increases the efficiency and autonomy of agriculture. Depending on the energy demand and available space, the systems can be configured in different ways:

Direct supply to water pumps – solar panels supply energy directly to irrigation pumps, eliminating the need for a power grid. This works best with drip systems and pumps that operate during peak sunlight hours.

Solar-Powered Solutions for Farms

Hybrid systems – To ensure operational stability, especially on cloudy days or at night, photovoltaic systems can be connected to energy storage batteries or to the power grid as a backup source.

Energy storage units – Batteries enable the storage of surplus solar energy, allowing for a constant supply of water to irrigation systems and other agricultural equipment regardless of the weather conditions.

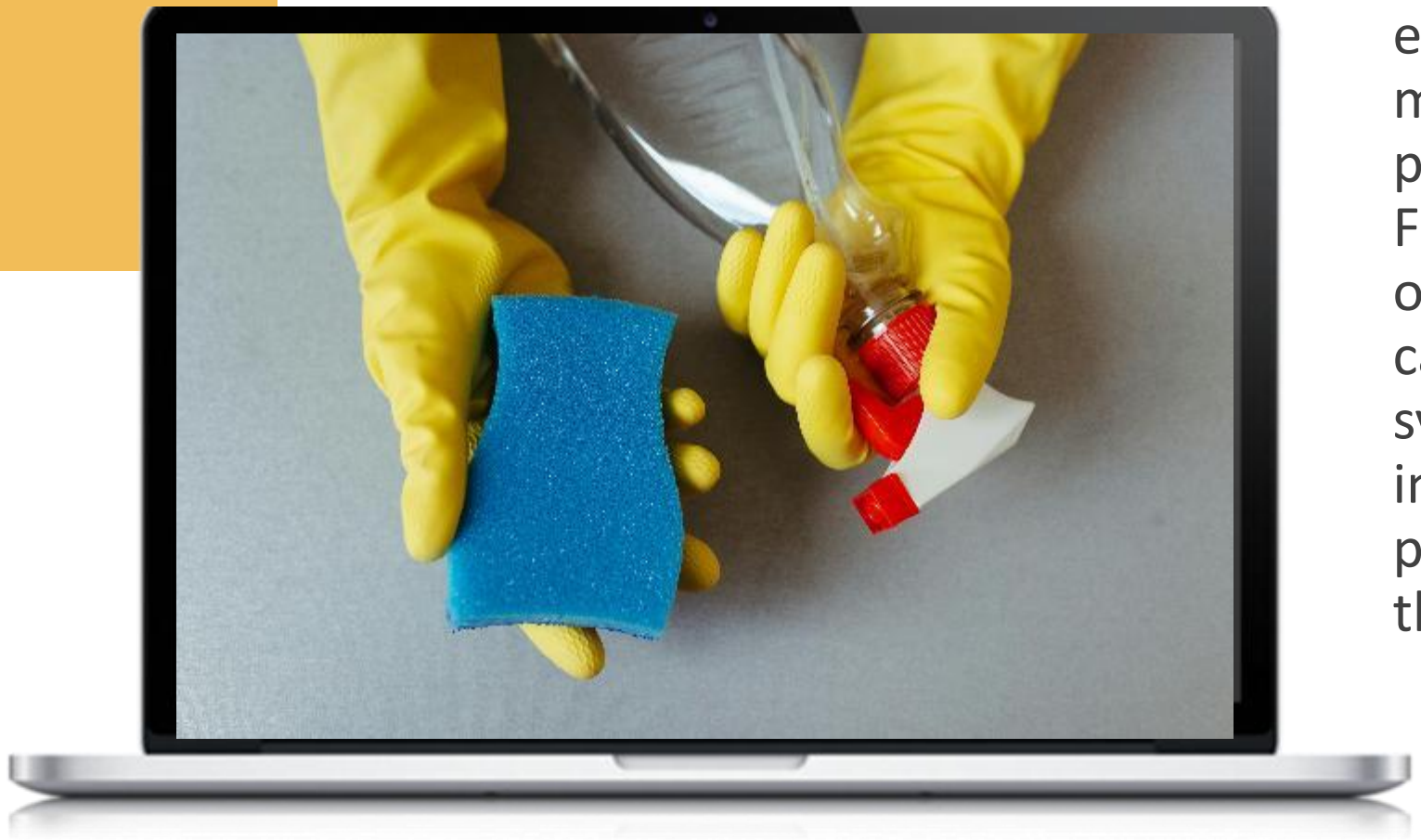
Intelligent control – Modern monitoring and control systems allow for automatic regulation of pump operation based on the level of sunlight, soil moisture and water demand, which increases efficiency and reduces waste of resources.

The correct configuration of solar panels in agriculture can significantly reduce operating costs as well as support sustainable development by reducing CO_2 emissions and a dependence on traditional energy sources.

02

MAINTENANCE & PERFORMANCE OPTIMISATION OF SOLAR EQUIPMENT

Maintenance and optimisation of solar equipment



In order for solar panels to work effectively for many years, regular maintenance and optimisation of performance are necessary. Factors such as dust, dirt, shading, or wear and tear of components can reduce the efficiency of the system, so it is worth implementing appropriate practices to keep the equipment in the best possible condition.

Maintenance and optimisation of solar equipment efficiency

Clean the panels regularly

•Contamination such as dust, leaves or bird droppings can block the light from reaching the cells, reducing efficiency by up to 20%.
•It is recommended to clean the panels with demineralised water and a soft cloth or special brushes to avoid scratches.

Inspection and maintenance of electrical components

•Regularly checking cable connections and plugs prevents energy losses caused by loose or damaged cables.
•Inspecting the inverter every few months allows you to detect any drops in system performance. The inverter should be kept in a dry and well-ventilated place.

Optimising the tilt angle and orientation of the modules

•The efficiency of the cells/ modules depends on their alignment with the sun. It is recommended to tilt them at an angle close to the latitude of the location.
•Seasonal adjustment of the tilt angle allows for maximum utilisation of solar radiation – the angle should be steeper in winter and flatter in summer.

Weather and damage protection

•Extreme weather conditions such as hail, strong winds or heavy rain can damage panels. Invest in solid mounting and hail protection.
•Lightning and surge protection systems protect the system from the effects of lightning.

03

CASE STUDIES OF FARM ACHIEVING ENERGY INDEPENDENCE TROUGH SOLAR POWER

Farmers benefiting from photovoltaic systems

In the face of rising electricity costs, fuel prices, fertilisers and pesticides, farmers are counting the money spent on their farms more and more. They are looking for alternative sources that will allow them to apply savings. The use of energy from renewable sources such as solar radiation is one of the very important elements of sustainable development, bringing measurable ecological and energy effects.

Be Inspired: Bronisław Zybała from Poland

Bronisław Zybała from Biadki in the Poland decided 8 years ago to install a photovoltaic system on the outbuildings:

'When we installed the panels, the market in this area looked completely different than it does today. There were few installation companies, and the knowledge provided by the representatives was not backed up by many examples. The market for these products in Poland was just beginning to develop. But I decided that we should take advantage of the sun and I decided to install 8.32 kW panels,' says Mr Bronisław.

Photo source: https://wiescirolnicze.pl/iekoilogicznie/rolnik-korzysta-z-instalacji-fotowoltaicznej/

The farm uses solar energy in various aspects of its agricultural activities, including:

- **Irrigation systems** - photovoltaic panels supply energy to water pumps that irrigate the fields, reducing energy consumption from the grid.
- **Power supply for outbuildings** – the electricity generated by the solar panels covers the energy requirements of the outbuildings, including stables, warehouses and cold storage rooms for agricultural products.
- **Lighting systems** – the farm uses energy-efficient LED lighting, which is powered by the energy generated by the solar panels.
- **Charging electric vehicles** – the farm has electric vehicles that are charged using photovoltaic panels.

Be Inspired: Emerald Greens farm in Ireland

The **Emerald Greens** farm in Ireland is an innovative vertical hydroponic farm that has achieved energy independence thanks to **photovoltaic panels** and a wind turbine. Solar energy powers LED systems, water pumps and ventilation in the growing tunnels, where herbs, lettuce and microgreens are grown. As a result, the farm operates completely independently of external power sources, reduces CO_2 emissions and produces food sustainably throughout the year.

Find more in our Good Practice Compendium

How Agri-Voltaics are Changing Agriculture

This video explores the idea of integrating solar technology into farmland, examining potential benefits and challenges.

Watch here How Agri-Voltaics are Changing Agriculture | The Power of Solar Panels

04

LET’S PRACTICE

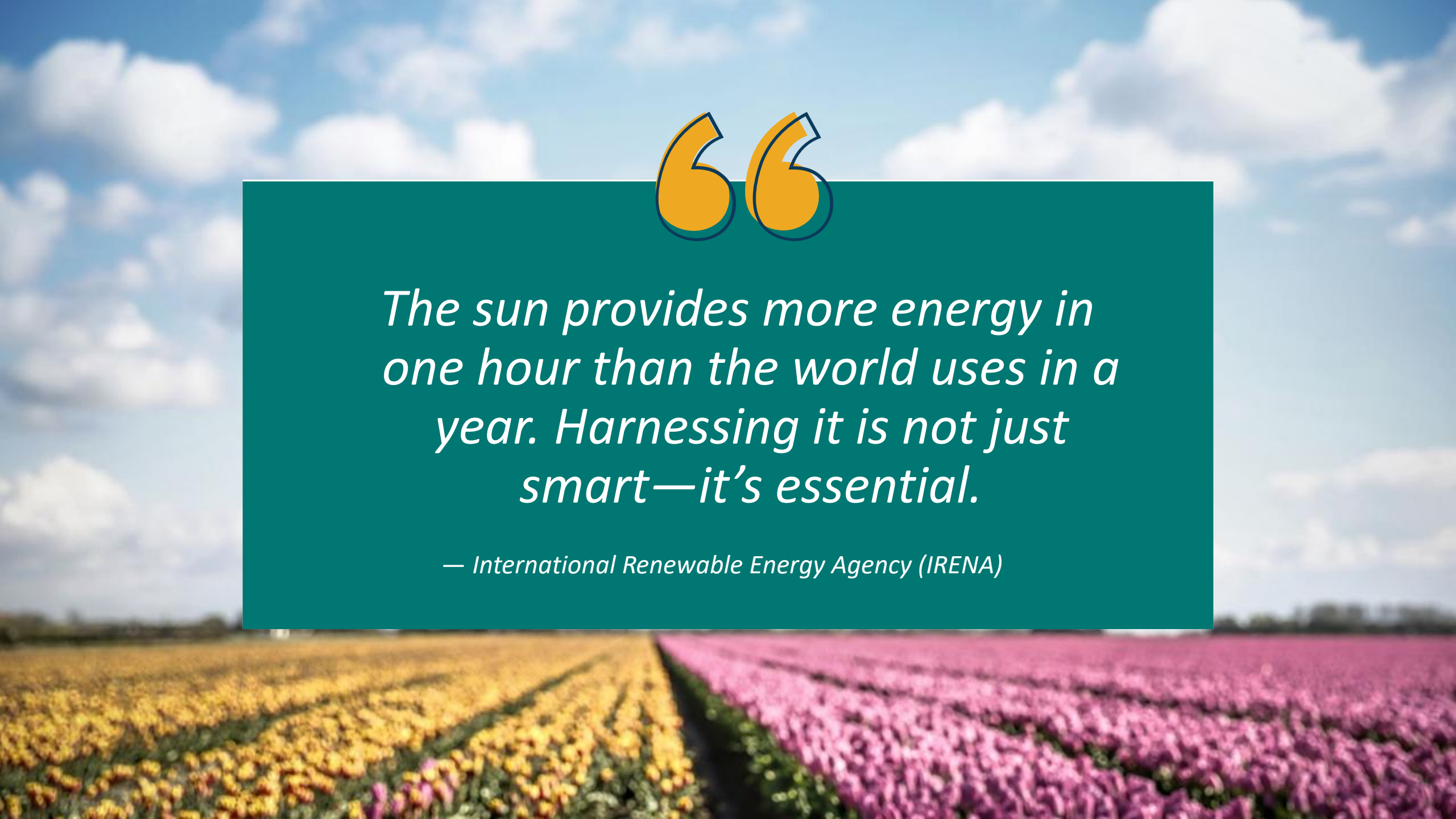
Match the maintenance methods for solar panels to their objectives:

Regular cleaning of the panels - Checking the electrical connections - Protection against shading

Prevent energy losses caused by loose cables and corrosion - _____

Ensure access to full sunlight by eliminating obstacles, e.g. tree branches - _____

Removal of dust, leaves and dirt to increase the efficiency of the panels - _____



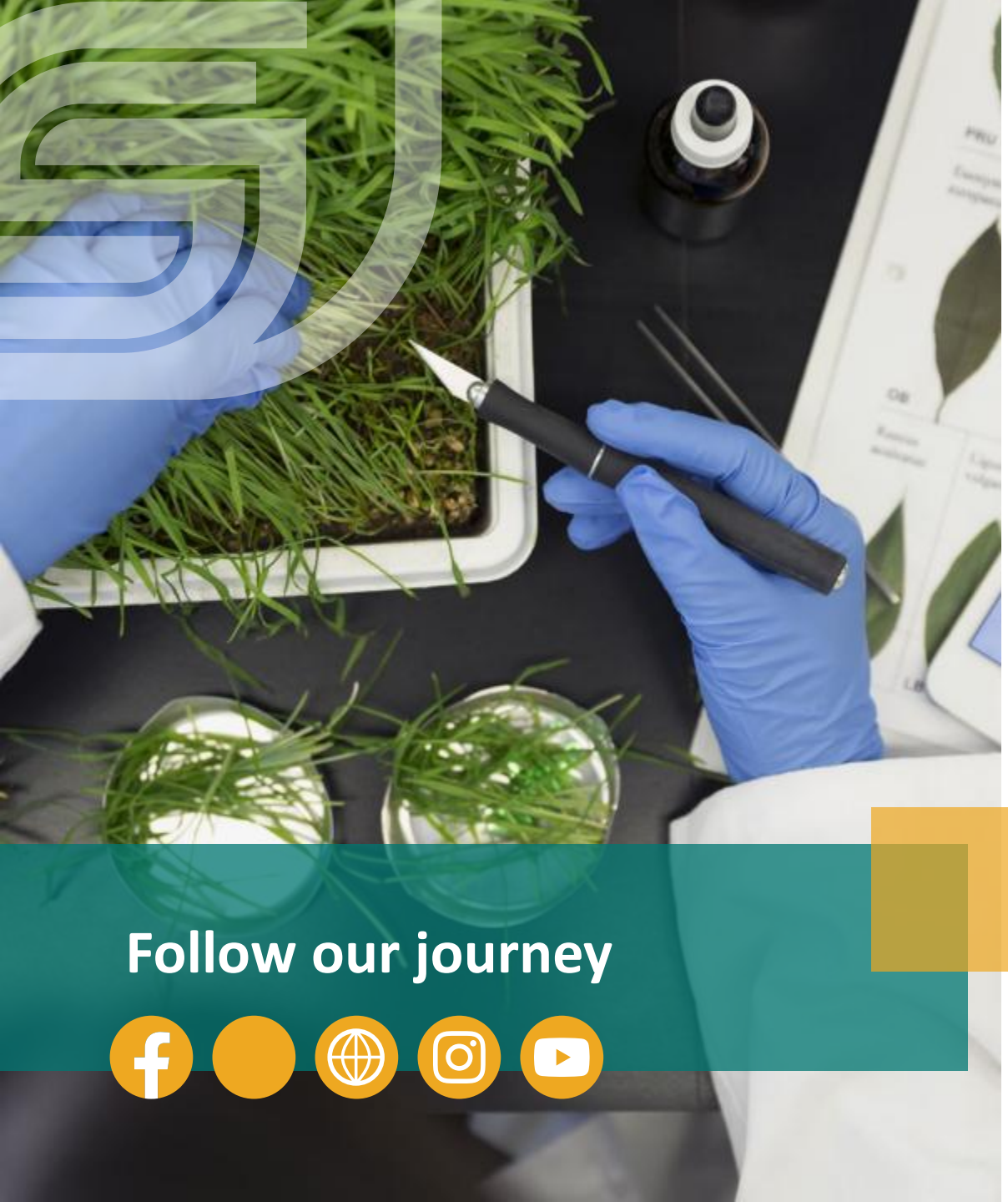
The sun provides more energy in one hour than the world uses in a year. Harnessing it is not just smart—it's essential.

— International Renewable Energy Agency (IRENA)

Well Done!!!

You finished the second module of **Course 4**! Keep going on this learning journey.

In the **next module** you will learn about **Wind and Biomass Energy Applications.**



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