



PLANET
CHANGE

Energy Efficiency: Solar panels from space

Teachers manual



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Erasmus+ Programme
of the European Union

Planet change is the short name of an EU Erasmus+ project aimed at VET teachers and their students. With small activities, the idea is to create awareness about sustainability and acquire 21st century skills. All this is done in a technical context, mostly from space technology.

www.planetchange.eu



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1. General information

Duration: 2 sessions of 45 minutes each.

Target group: 16-20 y.o.

European qualifications framework level: 1-4

Teacher preparation: No need for previous background on the topic (just knowing how to use an internet browser).

Topic

Theme: Energy Efficiency: Solar Panels from space

Keywords: sustainability, solar panel, Google Maps, Google Earth, Earth observation

Activity

Goals

The student will get a better knowledge and training about:

- 1) What are solar panels and how are they installed
- 2) How to use Google maps in satellite mode and how to make measurements on Google Maps and Google Earth
- 3) How google maps and earth imagery is created
- 4) The potential for solar panel installation in our cities
- 5) Training of 21st Century skills including:
 - a) Media literacy: find and gather relevant information
 - b) Critical thinking
 - c) Collaboration
 - d) Communication

Summary

Firstly, the teacher will explain the two main ways to seize solar energy by means of solar cells: photovoltaic cells to produce electricity and thermos-solar cells to heat water. An explanation will be given on how to differentiate between them based on their physical aspect (the water tank for thermos-solar).

Students will then use Google Maps to check their neighbourhoods in order to identify how many square meters of solar cells are installed.

Then they will propose the location of new cells according to the requirements the teacher will explain, regarding installation techniques (orientation, inclination, shadows, etc.).



2. Introduction

The EU has turned solar energy into a building block of its transition towards clean energy through the [European Green Deal](#) (whose key objective is to achieve Europe becoming the world's first climate-neutral continent by 2050) and the newly publicised [REPowerEU Plan](#) (to replace fossil fuels in homes and to speed up the transition of a sustainable future in Europe with the aid of renewables so that the 2030 climate targets can be achieved). Also, due to uncertainties in the oil and gas supply due to conflicts, the EU is faced with the challenge to reduce its energy dependence from other countries.

This wiki page has valuable information on the solar power production by countries:

https://en.wikipedia.org/wiki/Solar_power_by_country

Solar energy is one of the most attractive renewable sources of energy. In order to increase solar energy production, new sites must be selected. A cost and time efficient method to do this is by using Very High Resolution (VHR) satellite imagery for energy site selection.



(Source: [European Space Imaging](#))

There are few satellite constellations that can provide VHR resolution, and free imagery (i.e. Copernicus) is far from the required resolution (30cm) when it comes to installing solar panels on rooftops.

The VHD satellite imagery can be fed into AI software to automatically detect the presence of empty roofs and existing solar panels.

The activity we plan to do is to measure the total solar panel Surface that is deployed in our neighbourhoods, and to compare it with the total power that potentially could be installed.

In order to do that we are going to be the AI software, detecting roofs, solar panels, and measuring them first. Then we will create new solar panel surfaces, and measure the potential of solar power generation our neighbourhood has.



Description of the activity

Part 1: Understanding solar energy uses: photovoltaic vs solar thermal

→ Preparations: The classroom needs a screen or a projector to visualize the media content, and needs computers/tablets with internet connection, at least for $\frac{1}{3}$ of the pupils (they will join groups of 3).

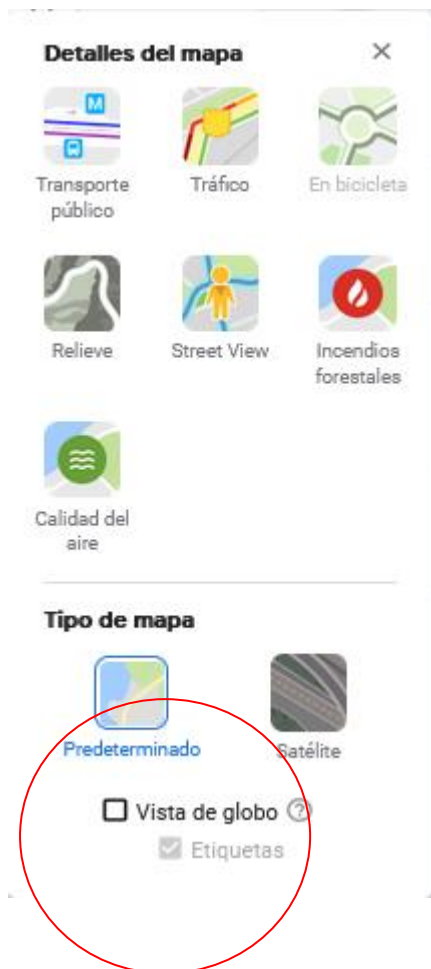
→ Activity 1 (10 min): Through a video the pupils will learn the different kind of solar panels, and the best way to identify them by their aspect.

Part 2: How are solar panels oriented?

→ Activity 2 (10 min): Through a video the pupils will learn what is the optimal orientation solar panels must have.

Part 3: Checking your neighbourhood for solar panels

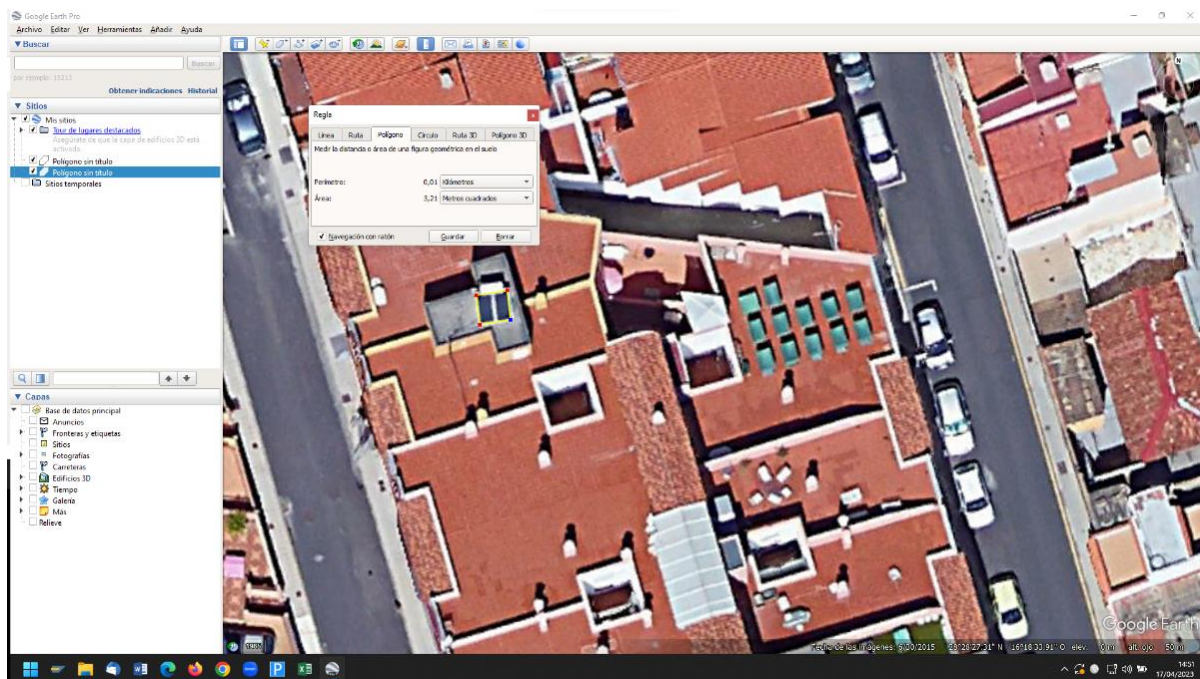
→ Activity 3 (25 min): **Work in groups** (up to 4 pupils). Each group uses Google Maps to centre pan an image of their desired neighbourhood, using the maximum resolution available in Maps (zooming in as much as possible, taking away the Globe effects -which allows 3D view- and the tags from the views menu)



Then they will identify any solar panel that they can identify in the image.



In order to measure the dimensions of the solar panels that appear in the image, it is necessary to see the image in Google Earth. Then using a polygon, the area of the panel is deduced.



Part 4: Searching for the best location for new solar panels

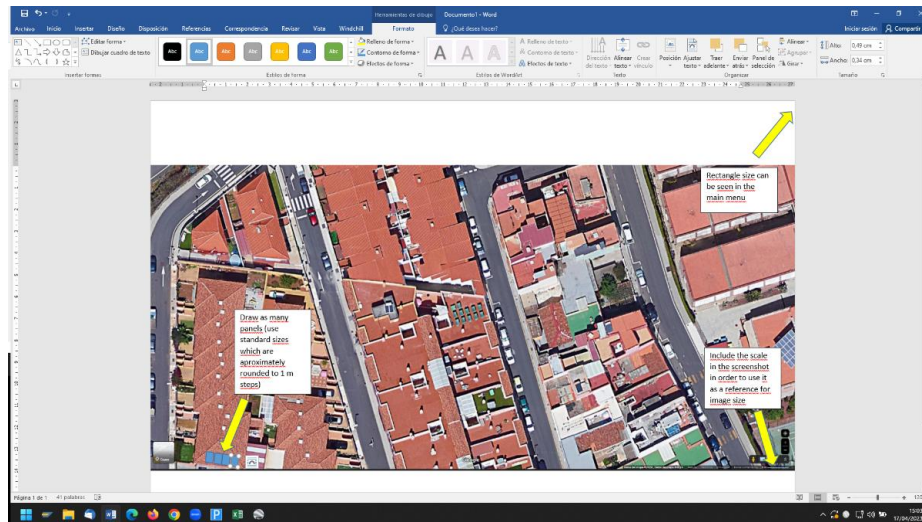
→ Activity 4 (45 min): Once all the surface of solar panels is computed, we are going to look for possible locations of more solar panels. In order to draw and then compute the area we drew, we need to take a snapshot of the Google Maps image we want to deal with, including the scale rule in the bottom right of the window. This will help us converting the size of the rectangles we will draw in Word into real dimensions.



The task can be as simple as drawing solar panels computing twice the capacity seen in the images, or going for the total capacity of a certain roof, or set of houses.

In order to understand the best location for solar panels (facing south and inclined), the best approach is to use Google Maps (or Earth) 3D orientations.

In Word, the size of rectangles can be computed easily:



3. Annex I:

Information to the teachers

The European Forest Fire Information System (EFFIS) has valuable statistics regarding the effects of fires in Europe: <https://effis.jrc.ec.europa.eu/>

Wildfires in the Amazon Rainforest <https://www.greenpeace.org/international/story/55533/amazon-rainforest-fires-2022-brazil-causes-climate/>

VET Schools

All kinds of VET schools could do this activity.

