CO2 PACMAN | Interreg Euro-MED | Co-funded by the European Union

CO2 PACMAN TOOL



MANUAL

TOOL



https://co2pt.unisi.it/

PURPOSE OF THE DOCUMENT

The purpose of this document is to provide a manual for the use of the CO2 PACMAN Tool, to be distributed to students and stakeholders for their use. This manual contains both technical information on the practical use of the tool and more in-depth information regarding the categories of greenhouse gas emissions considered for the preparation of the pilot islands' inventories, as well as the de-carbonization policies implemented."

INTRODUCTION

Developed within the Interreg Euro-MED CO2 PACMAN project, the Tool is grounded in the IPCC Guidelines (2006, updated 2019), ensuring that the data and simulations are consistent with international standards.
Each GHG Report has been developed through collaboration between international research institutions and local authorities on the pilot islands, ensuring accuracy and relevance to local contexts.

TUTORIAL

WELCOME PAGE

When you open the tool, you'll see the Welcome Page.
At the top, you'll find the project name and partner logos.
In the middle, there's a short message explaining the purpose of the tool.
On the right, you'll see some images, and in a box, a section called **"How to Play"**, which gives you the basic instructions.
When you're ready, click **Start** to begin.

START: SELECT AN ISLAND

Next, you'll choose the island you want to work on. The islands of Elba (Italy), Crete (Greece) and Brač (Croatia) have been selected as the project's pilot islands.
For each island, you'll see:

- Its name
- Some key facts like size, population, and tourist arrivals
- A short description
- An image or map

Click Load to confirm your choice and move to the next step.
At any time, you can click the Help button to get more information about each step. This button will be available in every step.

STEP 1: LAND USE MAP

Here, you'll see your island divided into tiles.
Each tile represents a certain amount of land and has a colour and icon showing what it's used for; for example, buildings, forests, farmland, or coast.
On the right, there's a summary of how much land is used for each category.
This gives you a clear picture of the island before you start working on its emissions.
Click Go to GHG Balance to continue.

STEP 2: GREENHOUSE GAS EMISSIONS INVENTORY

In this step, you'll see the island's CO_2 emissions.
On the left is the land-use map from Step 1. On the right, you'll see emissions shown as tiles – each representing the amount of forest that would be needed to absorb that CO_2.
The tiles are grouped by category, like electricity, transport, heating, or agriculture.
On the right-hand panel, you'll see the total emissions and the breakdown for each category.
Click Go to Apply Mitigation Policies to move on.

STEP 3: APPLY MITIGATION POLICIES

Now it's time to take action.
At the bottom, you'll see icons for different strategies, like:

- Reducing energy use
- Promoting sustainable travel
- Improving efficiency
- Using public transport

Click on the strategies you want to try. As you select them, you'll see the emission tiles on the right decrease in real time.

The tiles are a visual unit of equivalent forest surface for CO_2 equivalent emission removal.
They make complex data simple to understand:

- Each tile stands for a specified equivalent forest surface needed for CO_2 equivalent emission removal.
- They let you "see" the impact of each policy.
- They help compare different decarbonization strategies.

The goal is to bring emissions down as much as possible.
When you're happy with your choices, click Apply Absorptions

STEP 4: RESIDUAL CO_2 AND AFFORESTATION

Finally, you'll see what's left – the residual emissions after your policies.
First, you'll be able to see how much of these emissions are already compensated by the forests currently present on the island.
Then, you can try one more measure: planting new forests. The tool will calculate how much land is available and how many emissions the trees could absorb.
You'll see whether you can reach climate neutrality with your policies and tree planting combined.

STEP FINALE: FINAL REPORT

When you finish, the tool will generate a summary report of everything you did – the island you chose, the strategies you applied, and the final results.
You will also have the option to download the report, which is provided in JSON format.
If you prefer a more user-friendly view, you can open this file using various dedicated software tools that can display the data in a clearer and more visual way.

That's it!
You're ready to start using the CO2 PACMAN Tool.
Click Start and begin your journey
to decarbonise your island

LAND USE

BUILT-UP AREAS



A built-up area is a region that has been developed with buildings and infrastructure, such as houses, roads, and commercial spaces. It typically includes towns, cities, and suburbs where human activity is concentrated.

CROPLANDS



Croplands refer to land used for plants that grow and are harvested within one year, such as wheat, corn, or rice. Measured in km^2, this area highlights the extent of seasonal agricultural activity.

FORESTS



Forests comprehend all the km^2 of area covered mainly by trees and undergrowth.

URBAN GREEN AREAS



Urban green areas are open spaces with grass, flowers, or trees found in cities or rural zones. They support biodiversity, improve air quality, reduce heat, and offer recreational space for people.

ORCHARDS, OLIVE GROVES AND VINEYARDS



Orchards, olive groves, and vineyards are cultivated areas where fruit trees, olive trees, and grapevines are grown. Measured in hectares, these lands support food production, local economies, and traditional agriculture.

OTHER
(rocky areas, beaches, etc.)



"Other" includes natural areas like rocky zones, beaches and cliffs. Measured in km^2, these landscapes are often undeveloped but play key roles in tourism, biodiversity, and coastal protection.

EMISSION'S SECTOR

RESIDENTIAL ELECTRICITY

Residential electricity (MWh) refers to the amount of electrical energy used by households, measured in megawatt-hours. It includes power for lighting, heating, cooling, and appliances in homes.



Residential electricity consumption (MWh)

ELECTRICITY FOR OFFICES/SERVICES

Electricity for offices/services measures the electrical energy used by non-residential buildings like offices, shops, and public services. It includes power for lighting, equipment, heating, and cooling, expressed in megawatt-hours.



Electricity consumption for services and offices (MWh)

INDUSTRIAL ELECTRICITY

Industrial electricity refers to the amount of electrical energy used by factories and industrial facilities. Measured in megawatt-hours, it powers machinery, production lines, and other industrial processes.



Industrial electricity consumption (MWh)

RESIDENTIAL HEATING

Residential heating measures the amount of fuel (like diesel, wood, pellets, or gas) used to heat homes. It's expressed in tons or cubic meters, depending on the fuel type, and reflects household energy needs for warmth.



- Residential heating consumption – Natural gas (m^3)
- Residential heating consumption – Diesel (tons)
- Residential heating consumption – LPG (tons)
- Residential heating consumption – RES biogas (m^3)
- Residential heating consumption – RES biomass/wood (tons)

HEATING FOR SERVICES/OFFICES

Heating for services/offices refers to the amount of fuel used to heat non-residential buildings like offices, shops, or public facilities. Measured in tons or cubic meters, it indicates energy consumption in the service sector.



- Services/offices heating consumption – Natural gas (m^3)
- Services/offices heating consumption – Diesel (tons)
- Services/offices heating consumption – LPG (tons)
- Services/offices heating consumption – RES biogas (m^3)
- Services/offices heating consumption – RES biomass/wood (tons)

HEATING FOR INDUSTRIES

Heating for industries refers to the amount of fuel used to provide heat in industrial facilities. Measured in tons or cubic meters, it reflects energy consumption for manufacturing processes and industrial operations.



- Industrial heating consumption – Natural gas (m^3)
- Industrial heating consumption – Diesel (tons)
- Industrial heating consumption – Fuel oil (tons)
- Industrial heating consumption – LPG (tons)
- Industrial heating consumption – Coal (tons)
- Industrial heating consumption – Other petroleum (tons)
- Industrial heating consumption – RES biogas (m^3)

INDUSTRIAL PRODUCTION

Industrial production refers to the amount of the production of materials, in tons, from the glass, cement, paper, chemical, and metallurgical industries, and their quantification in tons of CO_2 equivalent.

- Production of glass (tons) - Glass Industry
- Production of cement (tons) - Cement Industry
- Production of paper (tons) - Paper Industry
- Production of chemical (tons) - Chemical Industry
- Production of metallurgical (tons) - Metallurgical Industry

AGRICULTURAL FUEL CONSUMPTION

Agricultural fuel consumption measures the amount of fuel used in farming activities, such as operating tractors and other machinery. It's expressed in tons.



Agricultural diesel consumption (tons)

BUS MOBILITY

Bus mobility refers to the number of buses in use, helping estimate fuel consumption in the public transport sector. It reflects the scale of bus operations and their impact on energy use and emissions.



Number of buses/trolleybuses

CAR AND SCOOTER/ MOTORCYCLE MOBILITY

Car and scooter/motorcycle mobility refers to the number of cars and scooters/motorcycles in use, used to estimate fuel consumption in the private transport sector. It helps assess energy use, emissions, and the environmental impact of personal vehicle travel.





Number of cars
Number of scooters/motorcycles

TRUCK MOBILITY

Truck mobility refers to the number of trucks in operation, used to calculate fuel consumption in the freight transport sector. It indicates the energy demand and environmental impact of goods transportation by road.



Number of trucks

MARITIME MOBILITY

Maritime mobility refers to the amount of fuel consumed by ferries, measured in tons. This data helps calculate energy use and emissions in the ferry transport sector, highlighting its environmental impact on island and coastal areas.



Ship diesel consumption (tons)

AIR MOBILITY

Air mobility refers to the amount of fuel consumed by airplanes, measured in tons. This information helps assess energy use and emissions in the aviation sector, highlighting the environmental impact of air travel on both private and commercial flights.



Aircraft fuel consumption – JET A1 kerosene (tons)

Aircraft fuel consumption – AVGAS 100 (tons)

WATER

This section tracks water loss as a percentage and daily water consumption in litres. These metrics help calculate CO_2 emissions from water treatment by showing how much water is wasted and used, which affects energy demand and environmental impact in the water sector.



Daily water consumption (l/person/day)

WASTE

This section tracks total waste produced (tons) and the percentages of waste sorted, landfilled, composted/selection plants, sent to waste-to-energy plants/ incinerators, and recycled. These data help calculate CO_2 emissions from waste treatment by showing how waste is managed and its environmental impact.



- Total waste produced (tons)
- Waste sorted (percentage %)
- Landfilled (percentage %)
- Composting (percentage %)
- Waste-to-energy plant/incinerator (percentage %)
- Recycled (percentage %)

LIVESTOCK FARMING

This section records the number of cattle, pigs, chickens, sheeps/goats and horses and to estimate CO_2 emissions from livestock farming. These figures help assess the sector's environmental impact by measuring greenhouse gases produced through animal agriculture.



- Number of cattles
- Number of pigs
- Number of sheeps/goats
- Number of chickens
- Number of horses

AGRICULTURE

This section tracks land use and production of cereals, roots, tubers, and fodder, along with the use of chemical fertilizers and urea. These data help estimate CO_2 emissions from crop cultivation by assessing agricultural intensity and inputs that contribute to greenhouse gas emissions.



- km^2 of Cereals colture
- Production of cereals (t of fresh mass)
- km^2 of roots and tubers colture
- Production of roots and tuber (t of fresh mass)
- km^2 of temporary fodder colture
- Production of fresh mass from temporary fodder (t)
- km^2 of permanent fodder colture
- Production of fresh mass from permanent fodder (t)
- t of chemical fertilizers used
- t of urea
- km^2 of forest fires

DECARBONIZATION POLICES





REDUCTION OF DOMESTIC AND OFFICE CONSUMPTION





The policy aims to lower household emissions. You will be able to reduce water consumption by 10%, electricity consumption by 10%, and heating consumption by 10%. You can choose the percentage of buildings and offices that will adopt this policy.

- Reduction of electricity use in residential buildings and offices/services
- Reduction of heating use in residential buildings and offices/ services
- Reduction of water use in residential buildings



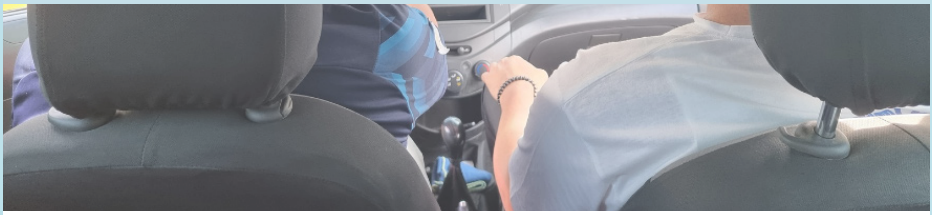
100 0

A higher value indicates a greater quantity of tons of CO_2 equivalent saved





ADOPT SUSTAINABLE MOBILITY HABITS





The policy promotes sustainable mobility habits and healthier lifestyles, encouraging biking for medium distances, carpooling (each reducing fuel consumption by 25%) and walking for short distance (reducing fuel consumption by 4%). Choose the percentage of people (residents and tourists) who will adopt these habits.

- **Walking for short distances (0- 2 km)**



A higher value indicates a greater quantity of tons of CO_2 equivalent saved

- **Using an electric bike for medium distances (2–10 km)**

(rebound effect)



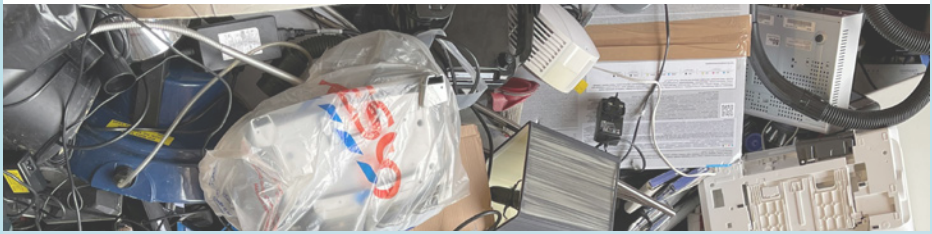
By selecting a positive value for this policy, you will reduce CO_2 equivalent emissions from fossil fuels, while slightly increasing emissions associated with electricity consumption.

- **Carpooling**



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





WASTE REDUCTION





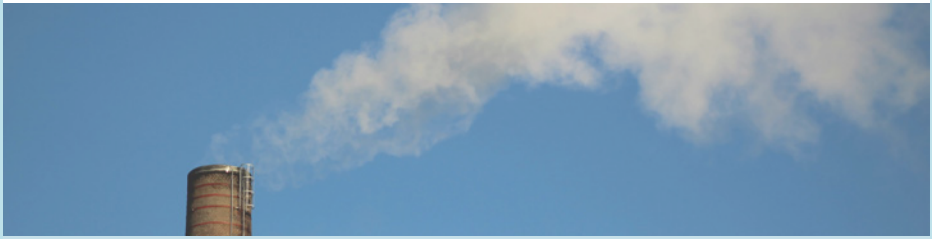
The policy focuses on increasing household recycling and minimizing non-recyclable waste. By encouraging sorting and reusing materials, it aims to reduce the emissions of undifferentiated waste by 20%. Choose the percentage of people (residents and tourists) who will reduce their unsorted waste-quantity is split between recycling (50%) and composting (50%).

Reduction of unsorted waste in houses



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





REDUCE INDUSTRIAL CONSUMPTION



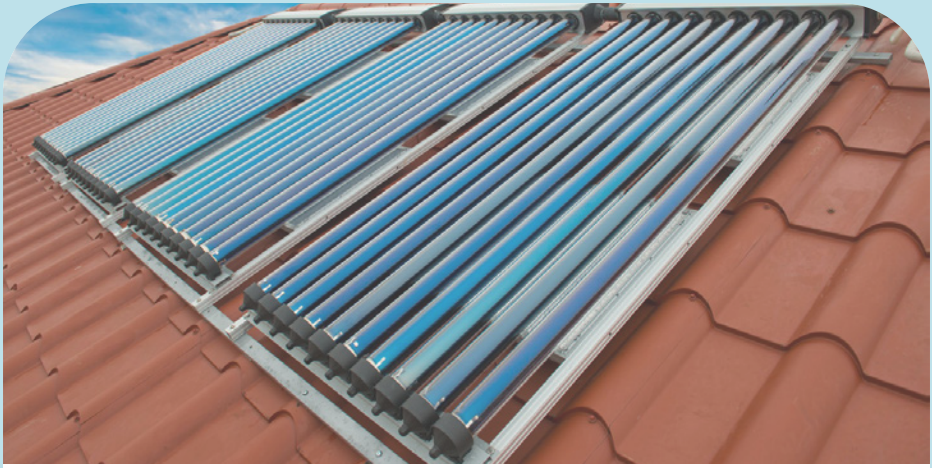


The policy aims to optimize industrial processes to use less electricity and heating. By improving efficiency, e.g. through waste heat recovery, better insulation, and more efficient machinery, it lowers energy and heating demand (20% each). Choose the percentage of local industries that will optimize their industrial processes.

- **Optimize industrial processes to consume less electricity**
- **Optimize industrial processes to consume less heating**



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





INSTALL SOLAR THERMAL SYSTEMS





The policy promotes the using of solar thermal technology that allow reduction by 45% of fossil fuels consumption for residential heating and hot water. Choose the percentage of buildings that will adopt this policy.

Solar thermal for residential



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





RESIDENTIAL EFFICIENCY IMPROVEMENT





The policy focuses on upgrading homes to reduce electricity and heating use. Through better insulation, it cuts energy and heating demand by 25% each and improves comfort and savings. Choose the percentage of buildings that will improve their energy efficiency.

Energy efficiency improvement in residential buildings for electricity and heating



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





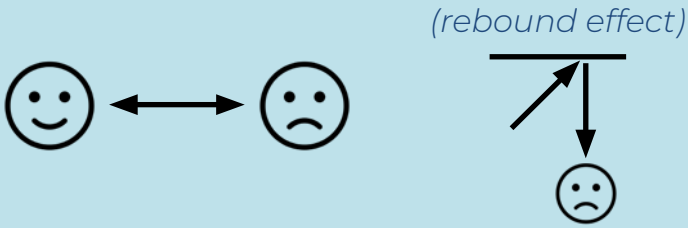
INVESTING IN PUBLIC TRANSPORTATION





The policy aims to increase the number of buses, making public transit more accessible and efficient. Each new bus can replace up to 20 cars, reducing car use and supporting more sustainable urban mobility while cutting related fuel consumption. Choose the amount of new buses that will be available on your island.

Increase the number of buses



By selecting a positive value for this policy, you will reduce CO_2-equivalent emissions from fossil fuel use in cars, while slightly increasing those associated with fossil fuel consumption due to a higher number of buses





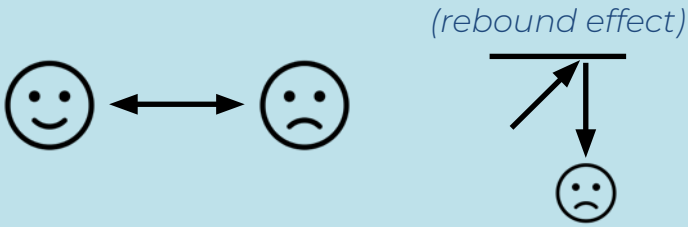
INVESTING IN E-BIKE SHARING SERVICES





The policy aims to expand access to e-bikes by increasing their availability for shared use. It promotes sustainable, low-emission transport, reduces traffic, and supports healthier urban mobility. This also means the reduction of the related fuel consumption by 25%. Choose the amount of bike-sharing to be introduced in your island.

Number of e-bike for sharing



By selecting a positive value for this policy, you will reduce CO2-equivalent emissions from fossil fuels, while slightly increasing emissions associated with electricity consumption.





INVESTING IN WASTE MANAGEMENT





This step aims to reduce landfill waste through public policies that strengthen recycling systems, composting facilities, and efficient waste processing infrastructure. Choose the percentage of sorted waste on your island as part of the municipality's recycling program.

Reduction of landfill waste (structural)



A higher value indicates a greater quantity of tons of CO_2 equivalent saved





CONSERVATION AGRICULTURE





The policy promotes conservation agriculture, a more sustainable farming system that protects soil from erosion, boosts biodiversity, and cuts emissions by 20%. It improves soil health, increases yields, and supports long-term productivity. Choose the percentage of traditional local agriculture to convert into conservation agriculture practices.

Conservation agriculture



100 0

A higher value indicates a greater quantity of tons of CO_2 equivalent saved





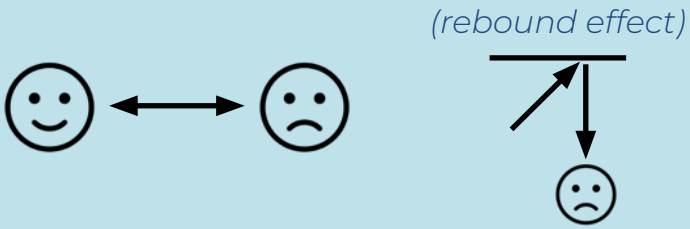
ELECTRIC-POWERED HEAT PUMPS (REDUCTION IN GAS USE)





The policy encourages using heat pumps, which efficiently heat or cool spaces with renewable energy, reducing gas consumption. Switching to these electric systems supports a shift to cleaner energy. Specify the percentage of households switching from traditional heating to heat pumps.

Electric-powered heat pumps (reduce in gas use)



By selecting a positive value for this policy, you will reduce CO_2-equivalent emissions from fossil fuels due to house heating, while slightly increasing emissions associated with electricity consumption.



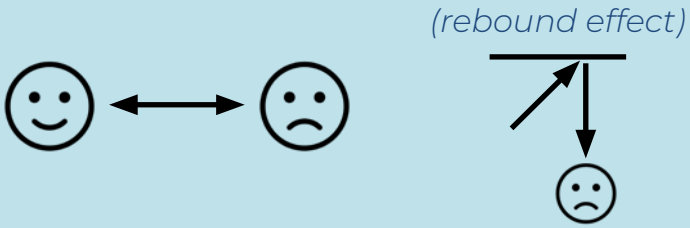


SUBSTITUTION WITH ELECTRIC CARS INSTEAD OF TRADITIONAL CARS



The policy aims to boost the number of electric vehicles on the road. This shift reduces fossil fuel use and lowers greenhouse gas emissions. Specify the percentage of electric cars that will replace traditional vehicles.

Substitution with electric cars



By selecting a positive value for this policy, you will reduce CO_2-equivalent emissions from fossil fuel use in cars, while slightly increasing emissions associated with electricity consumption.





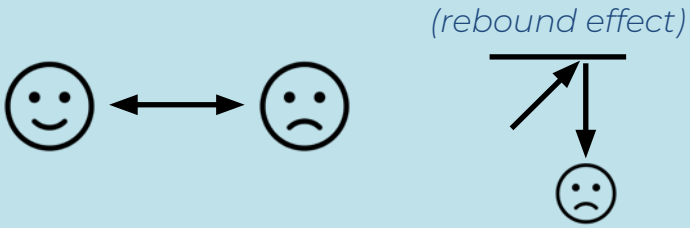
SUBSTITUTION WITH ELECTRIC TRUCKS INSTEAD OF DIESEL TRUCKS





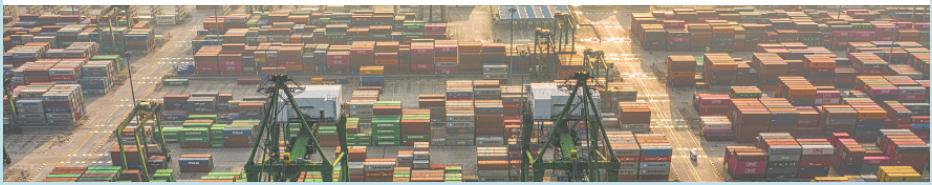
The policy promotes the adoption of electric trucks to replace diesel ones. It reduces fuel consumption and cuts greenhouse gas emissions. Specify the percentage of electric trucks that will replace diesel vehicles.

Substitution with electric trucks

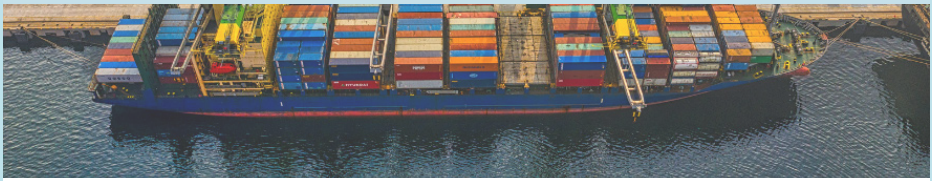


By selecting a positive value for this policy, you will reduce CO_2-equivalent emissions from fossil fuel use in trucks, while slightly increasing emissions associated with electricity consumption.





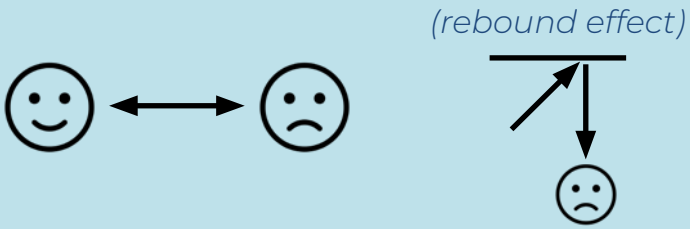
SUBSTITUTION WITH ELECTRIC MARITIME TRANSPORT





The policy aims to expand the use of electric-powered vessels. By replacing traditional fuel-based ferries, it reduces emissions, lowers noise pollution, and supports sustainable sea transport. Specify the percentage of electric vessels that will replace traditional vehicles.

Substitution with electric maritime transport



By selecting a positive value for this policy, you will reduce CO_2-equivalent emissions from fossil fuel use in ferries, while slightly increasing emissions associated with electricity consumption.





INVEST IN WIND POWER PLANTS





The policy supports deploying various wind energy technologies, including microwind (onshore), 2MW onshore and offshore turbines, and 6MW offshore turbines. This boosts renewable energy production, reduces carbon emissions, and advances clean power generation. Choose the amount of each type of wind power plants to install.

- Microwind (on-shore)
- 2MW Onshore wind turbine (80 to 120 meters high)
- 2MW Offshore wind turbine (80 to 120 meters high)
- 6MW wind turbine (100 to 140 meters high) (Offshore)

(rebound effect)



By selecting this policy, you will rely on renewable energy sources that significantly reduce CO_2 emissions from fossil fuels. However, at the initial stage, there will be minor emissions resulting from their production and installation.





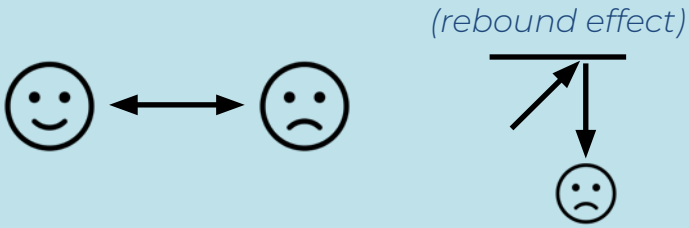
INVEST IN BLUE ENERGY PLANTS





The policy promotes ocean-based renewable energy like wave power and near-shore wave energy converters. These harness marine energy to produce clean electricity, reduce emissions, and support sustainable coastal development. Here are harbor and buoys wave energy systems. Choose the amount of each type of blue energy plants to install.

- Oscillating water column system (20 meters long)
- Near Shore Wave Energy plant (3 meters wide)



By selecting this policy, you will rely on renewable energy sources that significantly reduce CO_2 emissions from fossil fuels. However, at the initial stage, there will be minor emissions resulting from their production and installation.





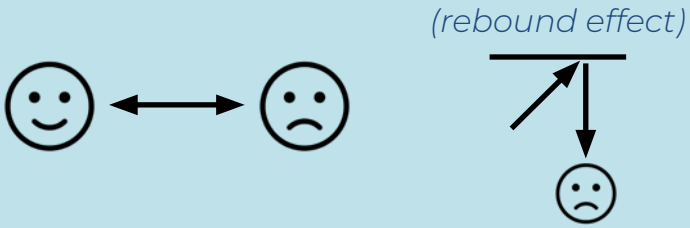
INVEST IN PHOTOVOLTAIC PLANTS





The policy supports expanding solar energy through ground-mounted (field) and rooftop photovoltaic systems. It increases renewable electricity production, reduces fossil fuel use, and promotes clean, sustainable power generation. Choose the amount of each type of photovoltaic plants to install in addition to the current ones.

- Renewable electricity by PV (Field, km²)
- Renewable electricity by PV (Roof, m²)



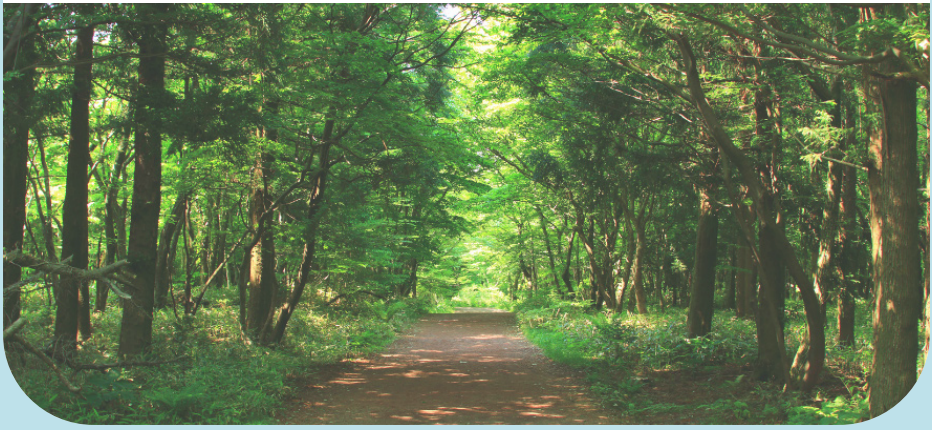
By selecting this policy, you will rely on renewable energy sources that significantly reduce CO_2 emissions from fossil fuels. However, at the initial stage, there will be minor emissions resulting from their production and installation.





UPTAKE CAPACITY





Forests already present on your island naturally capture CO_2 from the atmosphere. Each square kilometer acts as a carbon sink, helping to offset emissions. This step shows how much of your remaining pollution can be absorbed thanks to existing forests, the only natural removal option.

Planting of new trees



Every additional km² of forest has a positive effect on reducing CO_2 emissions

In addition to existing forests, new areas can be planted with trees to absorb even more CO^2. Based on available land, select how many km² to dedicate to reforestation. More forest means greater carbon uptake, less pollution, and a stronger path toward climate neutrality.

Uptake capacity of the island



Every additional km² of forest has a positive effect on reducing CO_2 emissions

At the end of the simulation, a summary report will be displayed. It includes an overview of all the information concerning land use (Step 1), greenhouse gas emissions (Step 2), and the values selected for the decarbonization policies, along with their respective emission reduction effects.

At the conclusion of the report, you will find the outcome of your simulation, showing the total emissions you managed to reduce compared to your island's initial baseline, as well as the scenario you fall into:

You've achieved Climate Neutrality!

You have reduced emissions, and your surplus CO_2-eq reductions help support nearby territories.

You've reduced emissions!

Your surplus CO_2-eq reductions support nearby areas. Just a few more steps to reach climate neutrality!

Not there yet.

To achieve Climate Neutrality you need to take further steps, let's try again!

WEBSITE



https://co2pacman.interreg-euro-med.eu/



CO2 PACMAN | Interreg Euro-MED



Co-funded by the European Union