Bringing up new ecoscientists

Lycee Clos Maire
Beaune (France)

1st Esperino EPA L
Trikala (Greece)

Petko Rachev Slaveykov
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Parma (Italy)

Institut Ramon de la Torre
Torredembarra (Spain)

Co-funded by the
Creative Europe Programme
of the European Union

Erasmus+
2017-2019

AGENDA

1st INTERNATIONAL MEETING
11th October 2017 (Skype)
2nd TRANSNATIONAL MEETING
8th-11thNovember 2017 (Torredembarra)
1st LEARNING / TEACHING / TRAINING ACTIVITIES
January 29 - February 2 2018 (Beaune)
3rd TRANSNATIONAL MEETING
18th April 2018 (Skype)
2nd LEARNING / TEACHING / TRAINING ACTIVITIES
13th-19th May 018 (Trikala)
3th LEARNING / TEACHING / TRAINING ACTIVITIES
14th - 20th of October 2018 (Tryavna)
4th TRANSNATIONAL MEETING
26th September 2018 (Skype)
5th INTERNATIONAL MEETING
23 th January 2019 (Skype)
4th LEARNING / TEACHING / TRAINING ACTIVITIES
3rd - 9th February 2019 (Parma)
6th TRANSNATIONAL MEETING
15th-18th May 2019 (Torredembarra)

More information: **http://beecoserasmus.wordpress.com**

 @beecosproject

 @projectbeecos

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Erasmus + Programme 2017-2019
Reference: 2017-1-ES01-KA219-037977

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1. PREFACE

The project **Bringing up new ecoscientists (BEECOS) (2017-1-ES01-KA219-037977)** is an Erasmus + project co-funded by the European Commission.

The project is related with sustainability and different environmental topics. In this book we summarize the different activities carried out in the different mobilities.

v Visit of a methanation industry, Gaugry

2. DESCRIPTION OF THE PROJECT

Environmental Education (EE) according to Unesco is an ongoing process through which humanity will realize its environment and will acquire the knowledge, values, skills, experience, and also the will to be allowed to act individually and collectively to solve present and future environmental problems. Among the policies that the European Union is seen as able to fulfill its obligations under the Kyoto Protocol or Paris Agreement is the full exploitation of the potential for energy savings in buildings that will allow to reduce both our external energy dependence and CO2 emissions. In recent years the members of the European Union with the substantial support of the Centre for Renewable Energy Sources and other energy bodies and expert groups became very active in the establishment of a modern legal framework for energy saving in buildings, compatible with the requirements of the European Commission for the immediate application of the provisions of the SAVE Directive 93/76 EEC on energy certification of buildings and improving their energy efficiency
During the previous decades, Environmental Education became a primary political and social goal of European societies and specifically for all European educational systems. Schools are major consumers of energy, paper, food, water, and other resources, and generate waste, pollution, and greenhouse gas emissions. They also have the potential to use resources efficiently, become producers of their own power, and serve as models of environmental sustainability for their communities. This potential, combined with their ability to teach the next generation and communities of families by example, while providing spaces and opportunities for reflective and critical thinking, makes schools strategic actors in guiding the world towards a more sustainable model of development.

Therefore the first goal of our project will be to analyze the situation in schools from different countries and to compare their Energy Efficiency and their ecological footprint regarding six main aspects: buildings, energy, food, transport, waste and water. The discussions of the data obtained will result in an action plan to improve the most critical situations and in the definition of the actions and means of change that will reform schools through new good practice.

In our opinion, the three basic topics for a future sustainable society should be the use of R.E.S., recycling and the improvement of existing energy sources. At first,we will study the recycling process, more specifically focusing in school waste and e-waste.

Secondly, we will study the implementation of renewable sources of energy in the buildings, mainly school buildings and the conversion of energy in order to save surpluses or stocks.

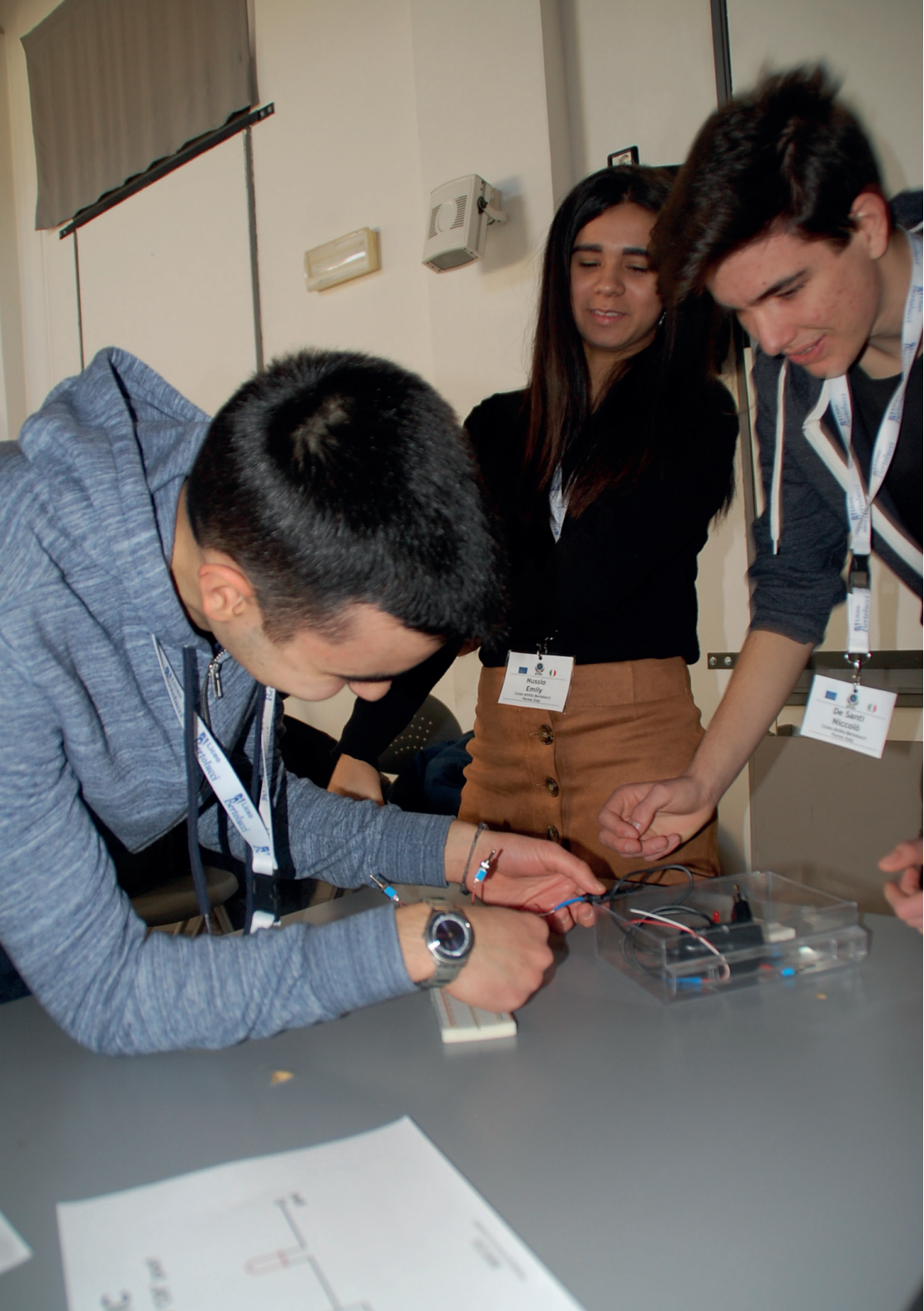
In a time where survival from global warming and its effects, climate changes, population growth and fossil fuel depletion make imperative any ecological action, many individuals and organizations are becoming increasingly concerned about energy use and are taking steps to reduce their consumption as well as looking for alternative, cleaner forms of energy production. When addressing energy through this project, students can develop a diverse range of knowledge and skills as well as participate in direct action. Energy can be incorporated into many curriculum areas including science, mathematics, technology and the arts.

Moreover, sustainable school buildings for us mean to look for examples of good practice in transforming schools to low-energy buildings and exchange these good practices. In comparing all this research we will always focus on local and regional identity. That's one of the main reasons it should be carried out transnationally, using in situ observation and bringing the students in contact with the use of R.E.S.

The **main objectives** of the project are:

- Raising ecological awareness and forming eco communities of young people.
- Promoting inclusive eco-education through concrete trainings and innovative practices.
- Upgrading teaching methods in science, math, technology and other relevant subjects.

- Providing an opportunity for exposure of new researches and developments.
- Defining and sharing good practices, providing guidance and triggering new future initiatives to be pursued in each school building.
- Helping students through their engagement with the project to open their minds, overcome prejudices and receive inputs.
- Developing transversal, entrepreneurial and organizational skills such as problem solving and critical thinking and enhancing the ability to work as part of a team, develop ideas and so promote change.
- Promoting the use of foreign languages and ICT together with the scientific knowledge and skills and a thorough awareness of local resources, and more generally, territories.
- Motivating and enhancing the teachers' skills in finding new ideas and suitable proposals and solutions through discussions and sharing.


Nussio
Emily
De Santi
Niccolò

3. ACTIVITIES

1st MOBILITY

Lycee Clos Maire
Beaune (France)

1st MOBILITY

Lycee Clos Maire
Beaune (France)

In the 1st mobility carried out in Beaune, France was organized by the Lycee Clos Maire. In this mobility the students worked about the reuse of the residues generated by the food. In this sense, the relevant activities were:

A. The dehydratation system (in this part you can see, the data of the machine and the location of the recycling plant, the questions for the students, and also the answers.)

B.The use of piezoelectrics materials (in this part you can see the teacher material and the students material)

C. The calculation of the foodprint.

BE ECOS	DEHYDRATATION
MOBILITY	BEAUNE (FRANCE)
AGE STUDENTS	14-18
Extra resources	Information of dehydrating machine Relevant information for the calculation

KEY SKILLS

- Calculation of the foodprint of the dehydrating machine.
- Calculate the energy needed by the dehydrating Machine
- Analyze the reduction of residues generated by the school using this machine.

ASSESSMENT

- The students are organized in groups of 3-4 students.
- The teacher explains the dehydrating process.
- The teacher gives the information of the dehydrating machine and also the relevant information to calculate the foodprint.
- After the students work in groups they should share the results with the rest of the class.
- Conclusions of the activity.

DATA:

The high school's dehydrating machine:

Geb solutions

Geb-100

Method of transformation:	Thermal dehydration
Configuration:	Standalone, movable
Load capacity:	50-110 kg
Average reduction:	80-90%
Processing time:	10-20 hr
Electrical connection:	Three-phase, 30 Amp / AC 380V * 50Hz
Power consumption:	3.0 kWh
Dimensions (L * W * H) cm:	115 x 100 x 105 (397 kg)
Material:	Stainless steel
Safety equipment:	Stopping the mixer when opening the door
Drying method:	Indirect with recirculation of air
Automated Control:	Smart touch control panel that automates the detection and control of dehydration process. Automatic shutdown at the end of the cycle with visual indication.
Odor treatment:	Integrated deodorization and total odor control
Processed food:	Food and organic waste
Untreated commodities:	Metal, plastic, glass, waste, petrochemicals ...

5 rotations per week

kWh cost: 0,04€

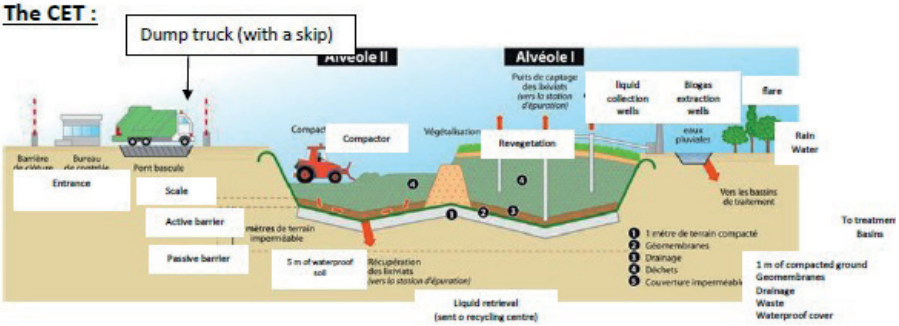
In our high school, 13 tons of waste are dehydrated per year.

A school year lasts 36 weeks in France.

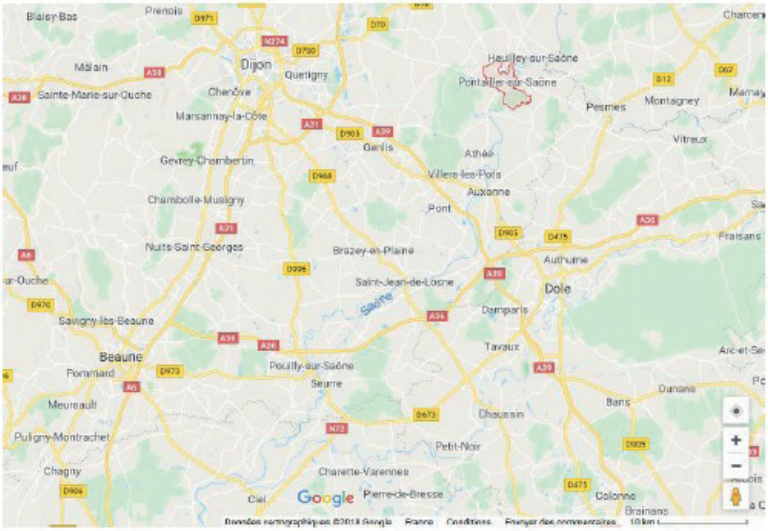
Comparability

- **Emissions of $C0_2$ for 1 electric kWh**
  1kWh = 0,06kg CO_2
- **Emissions of $C0_2$ for a vehicle**
  1L of fuel = 2,6kg CO_2
- **Emissions of $C0_2$ for 1 gas kWh**
  1kWh = 0,21kg CO_2
- **Density of waste**
  300 kg/m^3

The CET :



The waste of Beaune's inhabitants that can't be recycled is stored in a CET (**C**entre d'**E**nfouissement **T**echnique = garbage dump). In the area, the only one is in Drambon near Pontailler-sur-Saône.



A fully dump truck consumes on average 17 litres per 100 km and an empty one 13 litres per 100 km.

Volume of the skip: 11,5 m^3.

THE HIGH SCHOOL'S

DEHYDRATING MACHINE

HOW MUCH ENERGY DO YOU NEED TO EXTRACT 1 LITRE OF WATER FROM APPLES?

- How can we check if there is water in the fresh apple? in the dehydrated one?

- During the process what volume of water did you extract?

- What energy was used during the dehydration?

- What energy do you need to extract one litre of water from apples?

WHAT IS THE CARBON FOOTPRINT OF OUR (REAL) DEHYDRATING MACHINE?

- With the data, estimate the energy used annually in our high school to dehydrate our waste.

- Estimate the price of dehydration per year.

- Estimate the carbon footprint of our dehydrating machine.

IS OUR DEHYDRATING MACHINE ENVIRONMENTALLY-FRIENDLY?

- Estimate our carbon footprint if, instead of dehydrating our waste, we transported them to the CET (Centre d'Enfouissement Technique)?

- Conclude.

THE HIGH SCHOOL'S

DEHYDRATING MACHINE

HOW MUCH ENERGY DO YOU NEED TO EXTRACT 1 LITRE OF WATER FROM APPLES?

- How can we check if there is water in the fresh apple? in the dehydrated one?

Use Anhydrous copper sulfate

- During the process what volume of water did you extract?

Calculate the difference of masses:

m(extracted water)=(519.2-156.7)=362.5 g

Then calculate the volume using the density of water d=1000g/L:

V=m/d=362.5/1000=0.3625 L ; 362.5 mL

- What energy was used during the dehydration?

See Photos

1.426 kW.h

- What energy do you need to extract one litre of water from apples?

Use the proportionality:

To extract 0.3625 L we used 1.426 kW.h.

To extract 1 L we would use x kW.h.

x=1 * 1.425/0.3625=3.93 kW.h

WHAT IS THE CARBON FOOTPRINT OF OUR (REAL) DEHYDRATING MACHINE?

➢ With the data, estimate the energy used annually in our high school to dehydrate our waste.

36 (weeks) x 5 (days/week) x 15 (h) x 3 (kW.h per operating hour) = 8100 kWh

➢ Estimate the price of dehydration per year.

8100 x 0.04 = 324 €

➢ Estimate the carbon footprint of our dehydrating machine.

CO_2 emissions per electrical kW.h
1kWh = 0,06 kg of CO_2

Then 8100 x 0.06 = 486 kg of CO_2

IS OUR DEHYDRATING MACHINE ENVIRONMENTALLY-FRIENDLY?

➢ Estimate our carbon footprint if, instead of dehydrating our waste, we transported them to the CET (Centre d'Enfouissement Technique)?

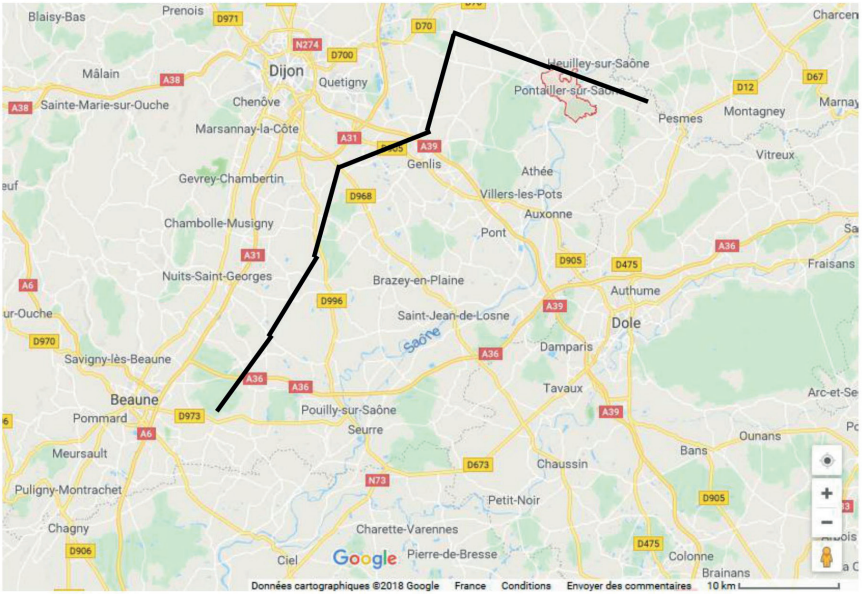
Density of raw waste:

300 kg/m^3 then the volume of 13t (13000 kg) is 43,3 m^3

Volume of the skip 11,5 m^3. We will need 3.76 skips → 4 return trips

A fully dump truck consumes an average 17 litres per 100 km and an empty one 13 litres per 100 km.

The trucks travel 70 km with full load (11.9 L) and 70 km enmpty (9.1 L) = 21L par return trip → 4 return trips 21 x 4 = 84 L



Equivalence in CO_2 consumption of one vehicle

1L of gasoline = 2,6 kg of CO_2

Then 84 L → 219 kg CO2

➢ Conclude.

This footprint seems to be low. But it's clearly underestimated:

- You need more than 4 trips because you can't stock the waste at school.
- Then the recycling centre also produces CO_2 to process the waste.
- To maintain roads or your trucks you also create CO_2
- Etc…

BE ECOS	WHAT IS PIEZZO ELECTRIC EFFECT? TEACHER MATERIAL
MOBILITY	BEAUNE (FRANCE)
AGE STUDENTS	14-18
Extra resources	http://www.buhltech.fr/Site/Erasmus/ERASMUS.html

OBJECTIVES

- Use piezoelectric materials for converting mechanical energy into electrical.
- Use the voltmeter and oscilloscope.
- Transforming the movement to electrical energy.

A) PREVIOUS QUESTION:

How can Zoëlie do to recover energy lost in common life ?
Students can watch the video:

https://www.youtube.com/watch?v=r4Lhjnh7dIl

B) THE THEORY

C) EXPERIMENTATION 1

- How long must Zoëlie work out on the steps to recharge her smartphone?

Objective:
- Plug a piezo sensor on an oscilloscope and activate it.
- The idea here is to plug your piezo to a capacitor with the aim of storing energy.

EXPERIMENTATION 2
Objective: Add a diode to the piezo sensor and draw the shape of the signal.

EXPERIMENTATION 3
Objective: Add a bridge rectifier to the piezo sensor and draw the shape of the signal.

F) CALCULATION AND CONCLUSION

Do you recover all the energy?
Conclude of the possibilities for Zoëlie to recharge her smartphone.

G) PAPER SHEET

The students have to fill out 2 paper sheets (see student material).

BE ECOS	WHAT IS PIEZZO ELECTRIC EFFECT? STUDENT MATERIAL
MOBILITY	BEAUNE (FRANCE)
AGE STUDENTS	14-18

1. First of all we have to listen to the teacher's explanation and watch some videos.

2. We'll make groups (four partners).

3. With the information that we have on the Internet, we have to follow the instructions.

4. The teacher gives us a piezoelectric board with some wires.

5. Each group have to do a circuit following the instructions.

6. After that, we have to connect the circuit to a voltmeter.

7. Then we'll connect again the voltmeter with a wood box.

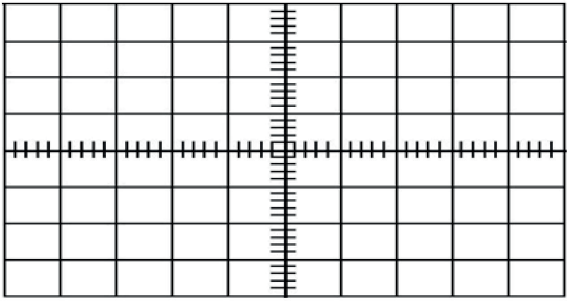
8. Finally we made steps and the voltmeter was calculating our electrical energy generate.

9.Fill out the dossier during the process.

Piezo Sensors

Response Sheet

1. Expérimentation n°1:



Voltage recovered :

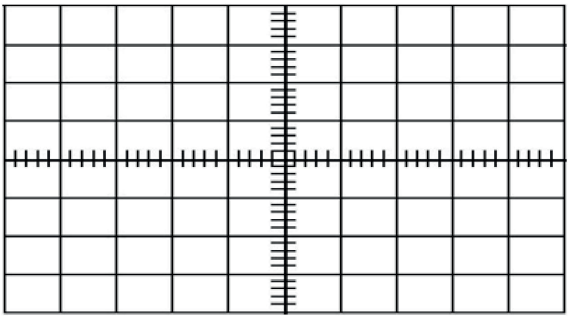
2. Diagram n°1 :

Explanation:

Voltage recovered:

Problem:

3. Experimentation n°2 with one diode :



What kind of change can you see?

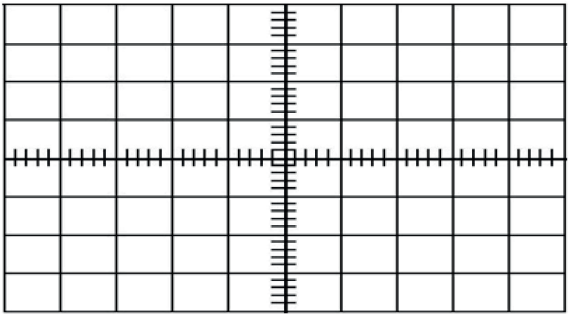
Diagram n°2 :

Explain the diagram :

Do you recover all the energy?

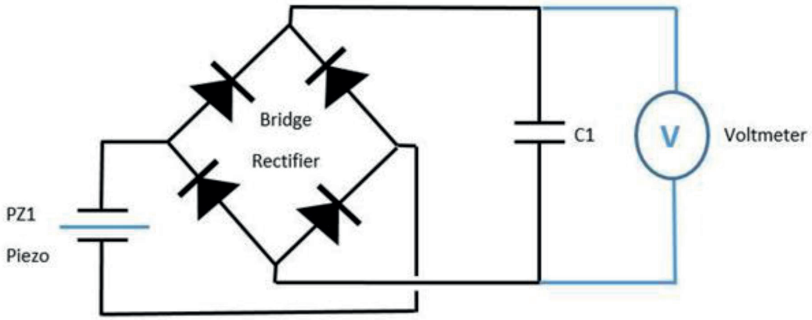
4. Experimentation n°3 with a bridge rectifier:

Add a bridge rectifier to the piezo sensor and draw the shape of the signal.



What kind of change can you see?

With color pencils, draw the path of the current.



5. Calculation

a. Footstep Energy :

Calculate the energy that you're going to recover each step.

b. Batteries energy:

Capacity of your battery in Joules:

c. Calculation:

How many steps will you need to recharge your smartphone?

6. Conclusion :

Current value :

Conclude of the possibilities for Zoëlie to recharge her smartphone.

BE ECOS	FOODPRINT CALCULATION TEACHER MATERIAL
MOBILITY	BEAUNE (FRANCE)
AGE STUDENTS	14-18
Extra resources	https://docs.google.com/spreadsheets/d/1CQn-fZfk39ryLYZH6Bw53Q7MJaTx7BiOigiKf-Q8ZZkw/edit?usp=sharing

OBJECTIVES

Calculate the foodprint of the school.

ASSESSMENT

- The teacher explains the activity and introduce the objective the activity.
- The teacher shows the information of the school: the menu and the useful data to calculate.
- The students have to work in groups of 3-4
- After that they have to think possibilities to reduce the foodprint of the school.

Questions for the students.

SCHOOL CAFETERIA FOODPRINT CALCULATOR

BEECOS 2017-1-ES01-KA219-037977_2

The diet is an important part of your carbon footprint. A large proportion of human emissions comes from food production, and meat is associated with much higher carbon emissions than plant-based food.

Q1: Among all the fruits and vegetables used at the school cafeteria, what proportion are seasonal?

- ○ Less than a quarter
- ◉ Approximately a quarter
- ○ Approximately half
- ○ Approximately three quarters
- ○ Almost all of them

Change in the ecological footprint **0,44** **tons of CO2**

Q2: How often are dairy products (milk, yogourt, cheese, butter, cream) served?

- ○ From 2 to 4 times per day
- ○ From 1 to 2 times per day
- ○ From 1 to 3 times per week
- ◉ Never

Change in the ecological footprint **0,02** **tons of CO2**

Q3: How often are meals with eggs (cakes, mayonnaise…) served?

- ○ More than 2 times per day
- ○ 1 or 2 times per day
- ○ 5 or 6 times per week
- ○ 3 or 4 times per week
- ○ 1 or 2 times per week
- ◉ Less than 2 times per week

Change in the ecological footprint **0** **tons of CO2**

Q4: How often are meals with meat or fish served?

- ○ From 2 to 3 times per day
- ○ Once a day
- ◉ From 4 to 6 times per week
- ○ From 1 to 3 times per week
- ○ Less than once a week

Change in the ecological footprint **0,34** **tons of CO2**

Our diet is usually based on vegetable foods. These bring us mainly carbohydrates (cereal products, potatoes, etc.), but also vegetable oils. These products all have a similar impact on the environment - giving up on them would not be reasonable because they are an integral part of a healthy and balanced diet.

Change in the ecological footprint **0,68** **tons of CO2**

Q5: What is the proportion of ecological food (Bio, MSC, fairtrade...) used at the school cafeteria?

- ○ Almost 0%
- ○ Approximately a quarter
- ○ Approximately the half
- ◉ Approximately three quarters
- ○ Only certified products

Change in the ecological footprint **-0,22** **tons of CO2**

Q6: How often do you throw expired food?

- ○ Often (almost every day)
- ◉ Time to time
- ○ Almost never

Change in the ecological footprint **0** **tons of CO2**

Transport weighs heavily on the climate. Vehicles use non-renewable fossil fuels that produce a lot of CO2

Q7: How many kilometers per year does a "terre azur" driver drive to deliver your food?

- ◉ More than 30000 km
- ○ Between 12500 and 30000 km
- ○ Between 7500 and 12500 km
- ○ Between 2000 and 7500 km
- ○ Less than 2000 km

Change in the ecological footprint **5,6** **tons of CO2**

Q8: What type of fuel is used in their trucks?

- ◉ Diesel/Unleaded/Hybrid
- ○ Natural Gas
- ○ Biogas
- ○ Electricity

Change in the ecological footprint **0** **tons of CO2**

Q9: What is the fuel consumption of their trucks?

- ○ More than 15 L/100 km
- ○ Between 10 and 14 L/100 km
- ○ Between 6 and 9 L/100 km
- ◉ Less than 5 L/100 km

Change in the ecological footprint **-0,56** **tons of CO2**

The heating of buildings and sanitary water also has an impact on the climate. We must therefore take into account the energy used for heating

Q10: What kind of energy do you use to heat your school cafeteria in winter?

- ◉ Fuel oil
- ○ Natural Gas
- ○ Electrical heaters
- ○ Wood
- ○ Natural gas with solar pannels

Change in the ecological footprint **1,44** **tons of CO2**

Q11: What is the energy standard of your school cafeteria building?

- ◉ Building built before 1980
- ○ Building built beween 1980 and 1990
- ○ Building built between 1990 and 2008
- ○ Building built after 2008
- ○ Low energy consuption Building

Change in the ecological footprint **0,1** **tons of CO2**

Q12: What is the surface of your school cafeteria building (including kitchen)?

- ○ More than 500 m2
- ○ Between 300 and 500 m2
- ◉ Between 200 and 300 m2
- ○ Less than 200 m2

Change in the ecological footprint **0,48** **tons of CO2**

Q13: What is the average number of people eating at every service?

- ◉ More than 400
- ○ Between 300 and 400
- ○ Between 200 and 300
- ○ Between 100 and 200
- ○ Less than 100

Change in the ecological footprint **-0,49** **tons of CO2**

Q14: At what temperature is the school cafeteria heated?

- ○ Over 23°C
- ○ Around 21°C
- ○ Around 19°C
- ◉ Never more than 17°C

Change in the ecological footprint **-0,01** **tons of CO2**

By turning down your central heating thermostat by just 1°C you could reduce the energy you use for heating by 10%.

Q15: How is water heated?

- ◉ Fuel oil
- ○ Natural gas
- ○ Natural gas with solar pannels
- ○ Wood
- ○ Electricity

Change in the ecological footprint **0,26** **tons of CO2**

Q16: What is the energetic class of the majority of your appliances (refrigerators, ovens...)?

- ◉ Lower than A
- ○ Minimum A
- ○ Minimum A+
- ○ Minimum A++

Change in the ecological footprint **0,07** **tons of CO2**

Q17: How are school cafeteria employees' clothes usually washed ?

- ◉ Mashine wash at 95°C
- ○ Mainly at 40°C ; the rest at 60°C
- ○ almost always at 30°C ; exceptionally at 60°C

Change in the ecological footprint **0,02** **tons of CO2**

Q18: How are school cafeteria employees' clothes usually dried ?

- ○ Excusively in an tumble dryer
- ○ In an tumble dryer and on a washing line
- ◉ Exclusively on a washing line

Change in the ecological footprint **0** **tons of CO2**

Power and evacuation networks

Your school cafeteria is automatically connected to drinking water, electricity and evacuation systems (including wastewater treatment facilities, waste incineration plants and recycling systems for newspapers, cardboard, etc.).

Change in the ecological footprint **0,22** **tons of CO2**

Other consumer goods

Considered separately, other consumer goods such as hygiene products, have an impact on the relatively small climate, but may play a greater role if they are added together.

Change in the ecological footprint **0,48** **tons of CO2**

Other consumer goods

Considered separately, other consumer goods such as hygiene products, have an impact on the relatively small climate, but may play a greater role if they are added together.

Change in the ecological footprint **0,48** **tons of CO2**

Your school cafeteria's foodprint

Clic to see your result

2nd MOBILITY

1st Esperino EPA L
Trikala (Greece)

2nd MOBILITY

1st Esperino EPA L
Trikala (Greece)

In this mobility the students worked about the evaluation of an energy certificate of each school and the creation of biodiesel. In this sense, the relevant activities were:

A. Performance of the energy certificate.

B. Elaboration of biodiesel using cooking oil.

BE ECOS	ENERGY PERFORMANCE CERTIFICATE
MOBILITY	TRIKALA (GREECE)
AGE STUDENTS	14-18
Extra resources	Powepoint: https://drive.google.com/file/d/0BzsJmlhPTJ8jW-Fd0c1hfZXZXSUNMbTJLX29wMkdGdllCSlpZ/view?usp=sharing

KEY SKILLS

An EPC gives a property an energy efficiency rating from the most efficient to the least efficient and it is valid for some years. Check how you could make your home/building/school more energy efficient.

ASSESSMENT

- The teacher explains the activity and introduce the objectives
- The teacher explains using the Power Point Presentation the main parts of the Excel sheet to calculate the energy certificate
- The students have to work in groups of 3-4
- After that they have to think possibilities to improve the energy efficiency of the school.

1. **Watch the Power point.**

Link

2. **Download the file and complete.**

First of all you will have to look for some parameters and values (surfaces, electricity consumption, fuel, ...).
The document is a spreadsheet file and it'll help you to calculate CO_2 footprint.

CALCULATION OF CO2

Conversion of Units for Heating Fuel — 2017

Consumption in (lit)	Consumption in (kg)	Consumption in (KWh)
44650	37506	447071,52

Emissions Calculation CO2

Fuel oil	Annual Consumption in KWh	Coefficient of conversion CO2 in (gr / KWh)	Emissions CO2 in (gr)
Heating Fuel	447071,52	236,6	105777121,6
Electric Energy	99680	850	84728000
			190505121,6
TOTAL CO2 in (Kg)			190505,12

Total Emissions CO2/ Surface

Total Emissions (Kg)	190505,12	
Total Surface (m2)	5800	32,85 Kg/m2/year

NOTE
In the above calculation tables we received the following:

Density Heating Fuel	p = 0,84 Kg/lit
Lower Thermogenic Power	11,92 KWh/kg

Transmission Conversion Factor CO2	
Heating Fuel	236,6 gr/KWh
Electric Energy	850 gr/KWh

According to Table 7.1 (p. 130)
for the characteristics of the Fuel
Technical Direction of TOTEEE

Spreadsheet

3. Complete your own certificate.

USE:	
SECONDARY SCHOOL	Year 2017
Building□ Department building □	
Number property (for building department)	
.....	
Climate Zone: D	
Address: 1 Vathykleos	T.K. 42100
City: Trikala	
Constructed after about 1967	
Total surface (m2): 7355,45	
Total Heating Surface (m2): 5800	
Owner name:	PUBLIC
ESPERINO EPAL TRIKALON	

MARKING OF ENERGY EFFICIENCY

ENERGY CLASS	Calculated CONSUMPTION [kWh/(m2*year)]
ZERO ENERGY CONSUMPTION	
A+ < 25	
25 ≤ A < 35	
35 ≤ B+ < 50	
50 ≤ B < 70	
70 ≤ Γ < 80	
80 ≤ Δ < 90	
90 ≤ E < 115	94,27
115 ≤ Z < 135	
135 < H	
Energy-inefficient	
	E
ANNUAL EMISSIONS OF CARBON DIOXIDE per m2 air conditioned surface [kg / (m2 * year)]	32,85 kg/m2/year
ANNUAL ENERGY CONSUMPTION per m2 air conditioned surface [kWh / (m2 * year)] based on the evaluation function	94,27 KWh/m2
ANNUAL EMISSIONS OF CARBON DIOXIDE per m2 air conditioned surface [kg / (m2 * year)] based on the evaluation function	32,85 Kg/m2
Energy Managers	
Otsios Vasilis	
Papapostolou Vasiliki	

Certificate file

4. Take note of the findings of the energy savings proposals.

BE ECOS	BIODIESEL
MOBILITY	TRIKALA (GREECE)
AGE STUDENTS	14-18

OBJECTIVES

- To make biodiesel from waste oil

ASSESSMENT

- The teacher explains the activity and introduce the objectives
- The teacher explains the importance of biodiesel and the reaction carried out during this activity
- The students works in groups of 4-5
- To carried out this practice you need 4-5 days

BIODIESEL FROM WASTE OIL

DESCRIPTION OF EXPERIMENT

- **Experiment Design**

In the context of the implementation of the specific program, experimental production of biodiesel from used frying oil will be carried out according to the procedure described below. The biodiesel produced will be used as a fuel for the testing of a conventional diesel engine.

- Experimental Materials

5 gr NaOH sodium hydroxide (Caustic soda)
125 ml of methanol
750 ml of used vegetable oil
a thermometer
a scales
a plastic funnel
a filter
a heating appliance
a heating container
a volumetric cylinder
two bottles for our biofuel
gloves
protective glasses
face mask

- Protection measures

Because both caustic soda and methanol are highly corrosive, when working with these elements we must take some measures for our protecion:

- We wear thick, elastic gloves, protective glasses and a face mask.
- When mixing these elements we do not inhale the gases created.
- We do the mixing process in a ventilated area with the window open or outdoors.

- **Run an experiment**

1. Wear your protective equipment.
2. Weigh 5 gr NaOH sodium hydroxide (caustic soda).
3. Measure 125 ml of methanol.
4. Slowly mix the methanol with NaOH sodium hydroxide (caustic soda).Without closing the lid, carefully turn the bottle around so that it does not drop out.
5. When you do not feel the grains of soda in the liquid, close the lid tightly and shake very well to completely dissolve the caustic soda in methanol. At this point the mixture will get warm and this is normal.
6. Measure 750 ml litres of waste oil.
7. Filter oil and heat it to 55 ºC. In the warmer months we leave the oil in the sun to warm up for a few hours until it reaches the desired temperature. Check the temperature of our oil in every case and be careful not to go above the ideal (55 ºC) because our oil will be lost.
8. Put the warm oil in the bottle and pour the mixture of methanol – NaOH in, close the lid very tight and shake very strongly. While dropping the mixture of methanol – NaOH in the oil notice the change in the color and composition of our fluids.
9. After shaking the mixture for a few minutes, open the lid to release the pressure into the container and close it again immediately.
10. In the hot months we leave our bottle in the sun for at least 3 days, in direct sunlight without moving it. After the third day we see that our fuel has become clear and the pH has fallen to 7 while a thick layer of glycerin is deposited at the bottom of our bottle. This means that our fermentation was successful.
11. So carefully pour our fuel into another bottle, taking care not to mix it with the glycerin at the bottom of the bottle. Then our fuel is ready.

* It is good to let the fuel mature for more than 3 days but all three days are enough to use. We do not need to store the fuel indoors, as long as we keep it outdoors in direct sunlight.

GOOD LUCK !!!!

3rd MOBILITY

Petko Rachev Slaveykov
Tryavna (Bulgaria)

3rd MOBILITY

Petko Rachev Slaveykov
Tryavna (Bulgaria)

In the 3rd mobility carried out in Tryavna Bulgaria was organized by the Petko Rachev Slaveykov. In this mobility the students worked about the different types of energy in different experiments. In this sense, the relevant activities were:

A. Relation between climbing stairs and the power of water falling in a water power plant.
B. Electric Circuits
C. Windmill
D. How calculate potential energy and kinetic energy
E. The spool racer

In this part, we show the material for the students and the description of the activities.

BE ECOS	WHAT IS THE RELATIONSHIP BETWEEN CLIMBING STAIRS AND THE POWER OF FALLING WATER IN A WATER POWER PLANT ?
MOBILITY	TRYAVNA (BULGARIA)
AGE STUDENTS	14-18

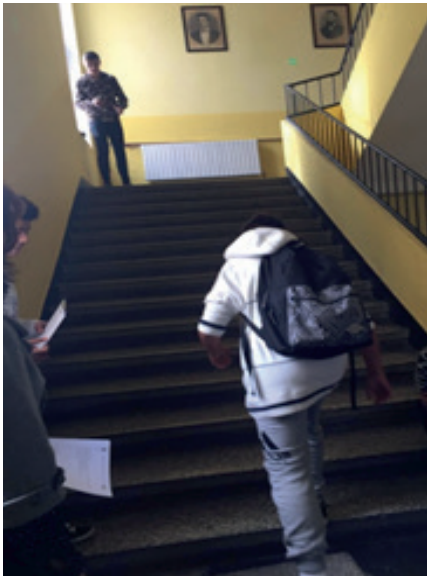
KEY SKILLS

In this activity we calculated what is our work, power and potential energy.

ASSESSMENT

1. We needed to know which was our mass during we weighed using the weighing scales to can do the activity correctly.

2. Later, we had to go upstairs two times: the first time we had to go upstairs slowly and the second time we had to do the same but this time fastly to can know how many time we take to go upstairs the two times.



3. Having done that, the person who was controlling the time, said the results and next we had to do some exercises that the bulgarian school teachers gave us.

4. The exercises consisted on the calculation of our potential energy when we were slowly and fastly and finally we compared the our two energies.

BE ECOS	ELECTRIC CIRCUIT
MOBILITY	TRYAVNA (BULGARIA)
AGE STUDENTS	14-18

KEY SKILLS

In this activity we want to set up a circuit to make work a light bulb and a windmill

ASSESSMENT

In this activity we had to connect a little engine with a cable to a small light bulb or to a small windmill to make it work. After that we tried to use the circuit with a lemon but i didn't work

BE ECOS	WINDMILL
MOBILITY	TRYAVNA (BULGARIA)
AGE STUDENTS	14-18
Extra resources	A reel, a pencil, a rubber band and a plastic toothpick https://drive.google.com/file/d/0Bzs-JmlhPTJ8jWFd0c1hfZXZXSUNMbTJLX29wMkdG-dllCSlpZ/view?usp=sharing

KEY SKILLS

The windmill had to spin with the water that the turbine had but it didn't work to us and we spilt most of the water and afterwards teacher tried to help us but we couldn't do it, but it was fun anyway!

ASSESSMENT

This activity was about a tiny windmill that worked with water, a tube made of plastic, and a turbine.
We started putting the tube of plastic in the water bottle and we introduced the other side of the tube in the turbine.
We tilted the water bottle to let it flow through the tube, when the water finally entered into the turbine it was supposed to spin and then the windmill react but that didn't happen to us.

BE ECOS	HOW TO CALCULATE KINETIC ENERGY AND POTENTIAL ENERGY
MOBILITY	TRYAVNA (BULGARIA)
AGE STUDENTS	14-18
Extra resources	A wood plank, 3 wooden blocks, and different types of balls.

KEY SKILLS

IIn this activity we had to calculate how many distance the wood block will move when it's beaten by a ball.

ASSESSMENT

In this activity the physics teacher form Tryavna gave us a page with the instructions of the activity, in that page we had to write the different masses that had each ball, the different heights and the mass of the wood block, then with a physic formula we could calculate the distance it will move. After that we had to measure the distance that had it move in the reality and check if our calculations were right.

BE ECOS	SPOOL RACERS
MOBILITY	TRYAVNA (BULGARIA)
AGE STUDENTS	14-18
Extra resources	A reel, a pencil, a rubber band and a plastic toothpick

KEY SKILLS

Learning to make a spool racer.
Making experiments.
Taking measurements.
Drawing conclusions with the measurements obtained.

ASSESSMENT

In this activity we were asked to build a spool racer using some common household supplies and then do some tests and measurements. Some interesting facts we discovered through this activity were that the distance and number of turns we applied to the spool racer were directly relationated.

We also enjoyed creating the spool racer for ourselves and found really interesting the way it worked.

4th MOBILITY

Liceo Attilio Bertolucci
Parma (Italy)

4th MOBILITY

Liceo Attilio Bertolucci
Parma (Italy)

In the 4th mobility carried out in Parma Italia was organized by the Liceo Attilio Bertolucci. In this mobility the students worked about the different types of energy in different experiments. In this sense, the relevant activities were:

a. FAB LAB:
- computer programming
- destroy electrical devices
- build electric circuits

b. Sharing of good practices already in use.

c. Planning of an e-waste reduction campaign.

BE ECOS	FABLAB (computer programming)
MOBILITY	PARMA (ITALY)
AGE STUDENTS	14-18
Extra resources	Bulbs, computers and cables.

KEY SKILLS

Learn more about computer programs and use them with external elements.

ASSESSMENT

1. We used the computer program to do different actions with external elements, like the USB cable.

2. We had to connect other objects and with the program we could switch on or switch off the different elements when we wanted and if we'd rather wait some seconds between the process, we could.

BE ECOS	FABLAB (destroy electrical devices)
MOBILITY	PARMA (ITALY)
AGE STUDENTS	14-18
Extra resources	Computers, projectors, scissors and screwdriver.

KEY SKILLS

Learn about the different pieces of some electronic devices.

ASSESSMENT

1. First, we broke the case of the electronic object.

2. We were breaking each part of the computer in order to reach the small ones.

3. To extract the codes from the most important elements of the electronic devices, and write them in a paper.

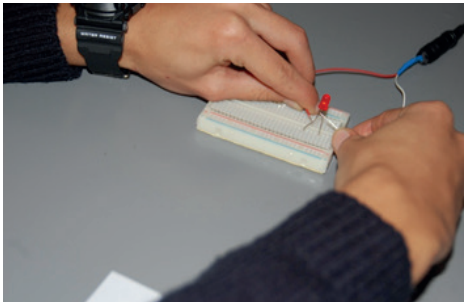
BE ECOS	FABLAB (build electric circuits)
MOBILITY	PARMA (ITALY)
AGE STUDENTS	14-18
Extra resources	3D printer, a screwdriver and some cables.

KEY SKILLS

Learn how to make series circuits or parallel circuits with electricity and observe their characteristics.

ASSESSMENT

1. We had to look a photo that showed us how to start it.
2. Then, it was our turn to try it and turn on the lights.
3. If we did it wrong, we had to do it again.



BE ECOS	SHARING OF GOOD PRACTICES ALREADY IN USE
MOBILITY	PARMA (ITALY)
AGE STUDENTS	14-18
Extra resources	A projector and some papers.

KEY SKILLS

Presentations of our school improvements to make our high school more efficient and have less pollution.

ASSESSMENT

1. First we had to analyze all our numbers in transport, water, recycling…

2. After that, we presented our conclusions and improvements for having a better centre of learning, with less pollution.

BE ECOS	PLANNNING OF AN E-WASTE REDUCTION CAMPAIGN
MOBILITY	PARMA (ITALY)
AGE STUDENTS	14-18
Extra resources	Computers

KEY SKILLS

Elaborate a logo of the Erasmus+, editing a previous image of one of the italian students

ASSESSMENT

1. We had to choose one of a lot of images and paste it in our editor.
2. There, we added and deleted all those things that we wanted in order to create a new photo.
3. At final, once our project was finished, we uploaded it to a website with all the other works.


FOOTPRINT


ONU - AGENDA 2030
SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD
SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
Antonella BACHIORRI
UNIVERSITÀ DI PARMA


FABLAB

4. GOOD MEMORIES


WE
ME


VERAIS
GRAINES
PESAGE
BROYAGE
TREMPAGE
TAMISAGE
STOCKAGE
STORAGE


METEORA. GREECE
FROM THE AIR


GAP


Bringing up new eco-scientists
My EcoEuropean Life


BE ECOS
BE ECOS