



ClimACT



CLIMACT - ACTING FOR THE TRANSITION TO A LOW CARBON ECONOMY
IN SCHOOLS – DEVELOPMENT OF SUPPORT TOOLS

E3.4.1 Report of the implementation of action plans

August 2018

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Executive Summary

This deliverable **3.4.1, titled “Report of the implementation of action plans”**, is part of the Activity 3.4 – Implementation of action plans, and it contributes towards the objectives of the products of the **WP3 - Implementation of a methodology conducting to a low carbon economy in 39 pilot schools**.

The aim of this document is to report about the implementation of low-carbon retrofit solutions in all ClimACT pilot schools on the road to an efficient low-carbon economy transition. Implemented solutions are based on available actions and smart control strategies reported in the portfolio carried out in Task 3.3 (WP3). They have been selected according to the results obtained from pre-audits, technical inspection and monitoring audits carried out in 35 pilot schools within the Task 3.2 (WP2).

This deliverable informs about the selected actions, retrofitting processes and initial benefits, and it will be uploaded in the ClimACT gateway.

Glossary

Acronym	Full name
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
DH	Percentage of discomfort hours (%)
DHW	Domestic Hot Water
ED	Annual energy demand (kWh/m ² a)
EER	Energy Efficiency Ratio
FEC	Final energy consumption (kWh/m ² a)
HVAC&R	Heating, Ventilation, Air Conditioning and Refrigeration
IAQ	Indoor Air Quality
KPI	Key Performance Indicator
LCE	Low Carbon Economy
PEC	Primary energy consumption (kWh/m ² a)
T	Temperature
O&M	Operation and Maintenance

Introduction

Acting for the transition to a low-carbon economy in schools, the objective of the present document is to report the actions implemented in pilot ClimACT Schools towards a low-carbon economy retrofitting of school buildings.

The portfolio has been divided into seven groups, one per environmental sectors. The environmental sectors, in which the Interreg SUDOE ClimACT project works, are reported in Table 1.

Table 1 – Environmental sectors, leaders and participants

Sector	Leader	Participants
Energy	ISQ	EDGR, USE
Water	ISQ	IST
Waste	ISQ	IST
Transport	IST	UniGib
IAQ	ULR	IST
Green Space	IST	VLR
Green Procurement	IST	UniGib

Taking into account the results of technical inspections and audits carried out in task 3.2 (WP3), and the portfolio of best available retrofit solutions for pilot schools defined in task 3.3 (WP3), leader and participants of all environmental sectors worked in the implementation of proposed solutions.

The content of each low-carbon retrofit action is as follows: firstly, action plan solution and objective is defined and characterised, and a pilot school is chosen for its application. Then, the methodology for the implementation of action plan solution is defined, step by step, finishing in in most of cases with an awareness campaign by means a poster, with the aim of increasing awareness and encourage all students, teachers and school community towards a low-carbon economy transition. Finally, preliminary results are showed and discussed.

All proposals are coordinated by different professors from ClimACT pilot schools and supported by ClimACT research members.

1 Actions implemented in waste

1.1 Waste action 1: shared composting

Description: Installation of a shared composting bin on the IUT campus

Objective: Reduce the school waste and promote waste recycling

Selected pilot school: Institute of Technology, La Rochelle (France).



Figure 1 – shared composting bin at IUT of La Rochelle

Characterisation: Two composting bins installed on the IUT plot (Figure 1). The green waste coming from the permaculture garden and other waste produced in the school are thrown to the bins. On the other hand, the compost will be used onsite, especially to maintain the permaculture garden.

Organised by: Action decided by the board of the institute of technology of La Rochelle, which includes representatives of students. The use of bins is under the responsibility of the students who are in charge of operating the permaculture garden (see action 3.1: shared permaculture garden). Representatives of the association “Compost’age”, an association appointed by the city of La Rochelle, supervise the operation.

N° of students involved: 10

Actions addressed for the implementation of LCE solution:

1. Purchase of two composting bins by the school
2. Students are operating the bins all year long.

1.2 Waste action 2: cleaning the school surroundings

Description: Students, staff and teachers clean the school surroundings and weight the collected waste by category.

Objective: Raise the awareness of students to the need to throw the waste in the bin and to waste sorting

Selected pilot school: High school Rompsay, La Rochelle (France).

Characterisation: All classes and teachers of the school participated to the collect of waste in the school surroundings, from November 6 to December 22, 2017. A supermarket provided the adequate material. After each collection, the waste were sorted and weighted. Up to 6 kg of waste were collected within one hour.

Organised by: a mathematics and science teacher suggested this initiative, which was then fully supported by the high school administration. The students of another vocational high school, Doriole high school, which is next to Rompsay high school, also participated to these cleaning days.

N° of students involved: 570

Actions addressed for the implementation of LCE solution:

1. The school administrators made an agenda of the cleaning days
2. A supermarket promoting waste cleaning provided the bags and gloves
3. The students and their teachers collected the waste for one hour. They were sorted and weighted
4. The students attended a conference about the lifetime and environmental impact of different types of waste.

1.3 Waste action 3: waste reduction and improvement of waste sorting

Description: Several actions were undertaken to make the waste production of the school visible to students.

Objective: Raise the awareness of students to the amount of waste produced by the school, and the need to improve sorting

Selected pilot school: High school Rompsay, La Rochelle (France).

Characterisation: Various measures were taken in 2017 regarding 1/ the food waste reduction: a daily weighting of the food waste at the school restaurant was made by the restaurant staff. Then the students made posters in plastic art classes to highlight the main facts (Figure 2); 2/ the improvement of waste sorting: sorting, according to a color code (Figure 3), of the waste produced by all the activities of the school: restaurant, workshops ... (Figure 4). This color code and the principles of waste sorting and recycling are integrated into the lessons. Paper and cardboard are sold to a recycling company that manufactures sneakers, bags, etc. It can be noted that the school recently obtained the blue wave label awarded by boating professionals in partnership with the port facilities for its industrial waste management.



Figure 2 – Posters made by students to raise awareness on the cost of food waste



Figure 3 – color code indicating which waste to throw in which coloured bin



Figure 4 – examples of posters displayed in the classrooms as a function of their activities

Organised by: these actions were decided and coordinated by the school administration

N° of students involved: 570

Actions addressed for the implementation of LCE solution:

1. Daily weighting of food waste at the school restaurant by the restaurant staff
2. Creation of posters to raise the students' awareness on food waste in their school
3. Creation of a color code to ease the understanding of waste sorting in the school

1.4 Waste Action 4: Food waste reduction program

Description: Creation of a specific committee to decide actions in order to reduce the food waste from the school canteens

Objective: Reduce the food waste produced by the school canteens

Selected pilot school: Primary and kindergarten schools Berthelot and Bongraine, La Rochelle (France)

Characterisation: A task force gathering all people from the school community involved in waste was created (Figure 5). It includes the cooker, children, parents, teachers, and the municipal staff operating the canteen and in charge of looking after the kids during and after lunch-time.

The schools made a diagnosis of the food waste produced by the end-user (the children). 4 bins have been placed and weighted every day: one for bread, one for first course, one for main course and one for desert. This diagnosis showed which dishes generated more waste.

Then the task force decided several action in order to improve the situation, considering the way each stakeholder can do better.

Organised by: The municipal canteen of the municipality of La Rochelle and the two school LCC.

N° of students involved: 586

Actions addressed for the implementation of LCE solution:

1. A theater play related to food waste was held in the school for all the students
2. Acoustic ceiling tiles were installed in the restaurant of Bongraine school to reduce noise in the lunch room
3. A formation was organised for the adults who look after the children during lunch as a way to learn about how to develop their curiosity about food.
4. A cooking committee thought about new recipes containing vegetable that kids do not really appreciate
5. The kindergarten schools discover a new vegetable or fruit every week: how does it grow? Where? What is the taste, the touch, the smell, the colour, etc?
6. New decoration of the lunch rooms: posters containing food waste prevention messages were purchased and installed in the rooms (Figure 5).



Figure 5 - Poster displayed in the lunch room (left) and the food waste team developing a new idea (right)

1.5 Waste Action 5: Recycled bin in classrooms

Description: Install recycling bins in the classrooms

Objective: To sort waste more efficiently

Selected pilot school: Primary school Bongraine, La Rochelle (France).

Characterisation: There is one large bin for recycled waste in the entrance of the school. In each classroom, there is only a paper bin and a normal bin. The yellow bins (Figure 6) are dedicated to cardboards, plastic bottles or other wrapping plastics. The installation of a yellow bin in each classroom avoid sorting mistake and promote recycling by using the same color code.

Organised by: the University of La Rochelle, which purchased the bins, and the LCE comity of the school.

N° of students involved: 104

Actions addressed for the implementation of LCE solution:

1. Installation of a sorting bin in each classroom



Figure 6 - Yellow sorting bins installed in Bongraine classrooms

1.6 Waste Action 6: Composting with the canteen waste

Description: Organization of a composting cycle

Objective: Reduce the amount of waste which is thrown to the bin. Improve the soil quality of the school garden.

Selected pilot school: Primary School Marie Marvingt (Laleu), La Rochelle (France)

Characterisation: The school has a garden and a chicken house. It also hosts rabbits from time to time. To feed those animals, the LCC decided to cooperate with the canteen staff as a way to sort and keep the peels and the waste for the school animals. The school also installed a composting bin to throw waste when animals have enough food. The soil coming from the composting is used in the garden. The composting bin is also filled out with the green waste from the garden. A nongovernmental organisation comes every 4 months to the school to turn over the compost. Moreover, the school gives the pupils a fruit every morning. The peeling coming from these fruits are also thrown to the composting bin. The compost bucket is brought by student every day based on a specific order decided by the LCC (Figure 7).

Organised by: the LCC

N° of students involved: 174



Figure 7 – Composting at Marie Marvingt (Laleu) school

Actions addressed for the implementation of LCE solution:

1. Decision of the action by all the stakeholders involved (the cook, students, teacher, cleaning staff and neighbours)
2. Purchase of two composting bins, filling of one of them with some wood shaving
3. Organization of a turn to look after the compost
4. Use of the compost for the garden

1.7 Waste action 7: Implementation of paper recycling in school

Description: setting up a bin for paper recycling in a classroom, with the aim of measuring paper recycling amount along a month and carrying out a communication campaign with the obtained results through a poster with the potential of paper recycling of school.

Objective: increasing the amount of recycling paper in whole school community.

Selected pilot school: ITACA in Seville (Spain).



Figure 8 – Paper recycling bin

Characterisation: paper recycling bin of 30x30x50 for indoor spaces, with a cost of 15€/bin.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 35



Figure 9 – Picture of coordination meeting for the definition and implementation of action plan solution

Actions addressed for the implementation of LCE solution:

1. Setting up a bin for paper recycling
2. Measurement of the amount of paper that could be recycled by a classroom along a month.
3. Calculation of potential paper recycling of all school building if this strategy is addressed by all classrooms.
4. Deployment of an awareness campaign by means a poster, with the aim of increasing awareness and promote paper recycling.

1.8 Waste action 8: Recycling of roller shutter slats

Description: Construction of a geodesic structure using reused roller shutter slats by students.

Objective: Raise awareness in students about the potential of recycling.

Selected pilot school: IES Chaves Nogales (Spain).

Characterisation: used roller shutter slats, specific equipment for student protection along construction, and construction tools.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 100



Figure 10 – Picture of geodesic structure built with roller shutter slats



Figure 11 – Picture along construction of geodesic structure by student.



Figure 12 – Picture of students and ClimACT researcher members involved.

Actions addressed for the implementation of LCE solution:

- 1.** Ctrl+Z company was contracted to support the construction process of the geodesic structure.
- 2.** Students were divided into different groups with different tasks
- 3.** Ctrl+z company and ClimACT researcher members explained the procedure for construction.
- 4.** Construction process
- 5.** Assessment of results and playtime with the geodesic structure.

1.9 Waste action 9: participation in environmental educational programs

Description: active involvement of every members of school community to collect paper, plastic, metal, batteries and electrical and electronic waste used in a school, with the purpose to promote recycling and good environmental practices between students. For that, all the participants have access to awareness actions, as visiting the installations and observe the process that the materials collected are subjected, for instance. The schools that gather more material wins a money-prize.

Objective: increasing the recycling good-practices in whole school community.

Selected pilot school: all the ClimACT schools in Portugal.

Characterisation: encourage the participation of the entire school community in collecting recycling goods (Figure 1 to Figure 3), with the bonus of getting a prize.



Figure 13 – Picture of several recycling bins in a classroom and spread throughout the school.

Organised by: students and teachers of the ClimACT pilot schools and supported by ClimACT research members.

Number of students involved: all the students from ClimACT schools in Portugal.



Figure 14 – Picture of several recycling bins in a classroom and spread throughout the school.

Actions addressed for the implementation of LCE solution:

1. Decision about the location of the containers in the schoolyard and setting them for each recycling good (collect paper, plastic, metal, batteries and electrical and electronic waste).
2. Pick up of the amount of recycling goods by each organizing enterprise -Valorsul (paper, plastic and metal for: “Separa e Ganha” - Figure 1), or Ecopilhas (batteries for: “Pilhão vai à Escola” - Figure 1), or ABAE (electrical and electronic waste for: “Geração Depositirão” - Figure 2), or Lipor (plastic caps for: “Operação Tampinhas” - Figure 3).
3. Measurement of the amount of recycling goods collected by each school.



Figure 15 – Collection of plastic caps by the Escola EB1 Padre Manuel de Castro that were then delivered to Lipor in exchange of helping an institution.

1.10 Waste action 10: building a Christmas tree reusing packaging

Description: recovery of used packaging to build a Christmas tree by the students and with the help of all the school community. This action is part of a contest sponsored by Tetra Pak, being this year associated with Guloso.

Objective: promotion of recycling and good environmental practices between students.

Selected pilot school: all the ClimACT schools in Portugal.

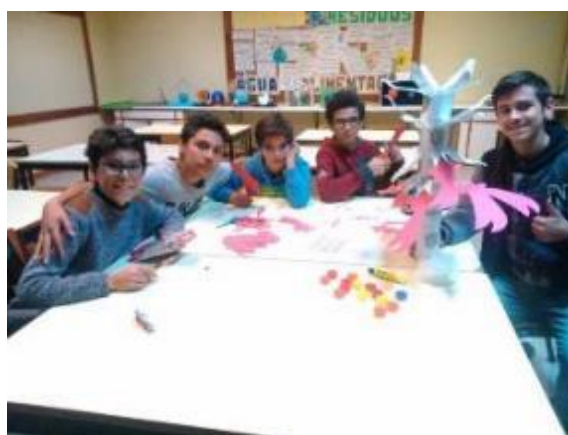


Figure 16 – Building of the Christmas tree.

Characterisation: collecting various packages and magazines, giving them a second life as a Christmas tree (Figure 4 and Figure 5).

Organised by: Low-Carbon Committee (LCC) of the pilot school and supported by ClimACT research members.

and supported by the Tetra Pak and Guloso in collaboration with ABAE.

Number of students involved: all the students from ClimACT schools in Portugal



Figure 17 – The Christmas tree built by the students in Escola Básica Maria Velela.

Actions addressed for the implementation of LCE solution:

1. Awareness of the students to the project.
2. Collection of packages and magazines by students and professors, also mobilizing the students' families in this quest.
3. Reuse of the packages and magazines to build the Christmas tree, in order to participate in the contest.
4. All the materials not used in the construction were recycled.

1.11 Waste action 11: market of recycled materials

Description: preparation of several school supplies and toys by the students, using recycled materials, in order to sell them to parents after parent-teacher conferences.

Objective: promote consciousness for the collection of waste.

Selected pilot school: Escola Básica Maria Veleda (Portugal).



Figure 18 – Preparation of toys and school supplies using recycled materials.

Characterisation: give a second life to recyclable materials (Figure 6), using them to create profitable products (Figure 7).

Organised by: LCC from ClimACT pilot school Escola Básica Maria Veleda.



Figure 19 – Selling of the recycled materials after a parent-teacher conference.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Gathering of recyclable materials by students and professors.
2. Manufacture of school supplies and toys using the materials collected.
3. Selling of the recycled materials in a small market, after a parent-teacher conference.

1.12 Waste action 12: book crossing

Description: exchanging books between students, with the purpose of recycling books that were already read, with the additional advantage of sharing points of view and increase the enthusiasm for reading.

Objective: reuse of old books, promoting recycling of goods.

Selected pilot school: Escola Básica Maria Veleda and Escola EB1 Padre Manuel de Castro (Portugal).



Figure 20 – Students exchanging books between them in both Escola Básica Maria Veleda and Escola EB1 Padre Manuel de Castro.

Characterisation: collection of *old* books by students and professors, that would posteriorly be exchanged between them (Figure 8).

Organised by: professors and students from ClimACT pilot school Escola Básica Maria Veleda and Escola EB1 Padre Manuel de Castro, both supported by the school library.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Collection of *old* books by students and professors.
2. Gathering of the books collected.
3. Exchange of books between students and professors, increasing not only the sustainability, but also the passion for reading.

1.13 Waste action 13: “Treasure Hunt” of the packages

Description: *Global Action Days* are an excellent opportunity for the schools to show the many actions they take each day to promote the environment. Each participating school organized an activity within this year theme “From CO₂ to O₂”. As a waste action a game was created and played, consisting in a “Treasure Hunt” of packages where puzzles involving collection of packages for recycling.

Objective: exchange of ideas/actions in order to continue pursuing inspiration and motivation to encourage people towards a more sustainable way of life, here focused in collection of waste and its correct separation.

Selected pilot school: Escola Básica Maria Veleda (Portugal).



Figure 21 – Students of Escola Básica Maria Veleda playing “Treasure Hunt” in the scope of *Global Days of Actions*.

Characterisation: organization of “Treasure Hung” game under the scope of “From CO₂ to O₂” for the *Global Action Days* (Figure 9 and Figure 10).

Organised by: all students, teachers and community of participating school.



Figure 22 – Solved puzzles and answers of the game “Treasure Hunt”.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Creation of a game that consisted in solving puzzles.
2. Students playing this “Treasure Hunt” needed to give the correct answer that was related to good environmental practices as well as collecting packages for recycling in each level.
2. During the *Global Days of Actions* share it through a small text with photos and/or videos in specific internet platforms.
3. Exchange ideas and take inspiration from other shared actions.

1.14 Waste action 14: “Let’s clean the school”

Description: Cleaning of some areas of the school by the students.

Objective: awareness of the students to the importance of having good habits and manners to the environment.

Selected pilot school: Escola Básica General Humberto Delgado (Portugal).



Figure 23 – Students of Escola Básica General Humberto Delgado cleaning the school.

Characterisation: students from all school organized to maintain the school cleaner (Figure 11).

Organised by: LCC from ClimACT pilot school and supported by ClimACT research members.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Organization of a timetable with students shifts.
2. Cleaning of a different area of the school each week by a class of students.
3. Consciousness of the students about good environmental practices (throwing the garbage in the specific site, ...).

1.15 Waste action 15: Christmas decoration

Description: reuse of materials to build Christmas decoration by the students and with the collaboration of the whole school community.



Figure 24 – Christmas cribs made by the students of Escola Básica Júlio Dinis.

Objective: promotion of recycling and good environmental practices between students.

Selected pilot school: several schools (Portugal).



Figure 25 – Christmas decorations made by the students of Escola Básica 2,3 Mário Sá Carneiro and Escola Superior de Tecnologia da Saúde de Lisboa.

Characterisation: to celebrate the holiday season, several LCC from ClimACT schools asked the students to reuse daily items as egg cartons, caps, yogurt bottles, or coffee capsules, recycling these materials, giving them a second life as Christmas decorations (Figure 12 to Figure 15).

Organised by: LCC of the pilot school and supported by ClimACT research members.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Awareness of the entire school community to the project.

2. Collection of several used materials (wine corks, coffee capsules, CDs, ...) with the contribution of the students' families.
3. Reuse of these materials to build Christmas decoration.
4. Use this decoration to adorn the schools with some Christmas spirit.



Figure 26 – Christmas trees and decoration made by the students of Escola EB1 Padre Manuel de Castro.



Figure 27 – Christmas decoration made by the students of Escola EB1 Padre Manuel de Castro.

1.16 Waste action 16: REUSE – celebrate special days by recycling daily goods

Description: students from Escola EB1 Padre Manuel de Castro were inspired by their school's motto, reuse, and created original gifts to celebrate special days of their lives or their community.

Objective: promotion of recycling and good environmental practices between students.

Selected pilot school: Escola EB1 Padre Manuel de Castro (Portugal).



Figure 28 – Preparation of the Father's Day gift. It was reused Styrofoam cuvettes and waste paper. The work resulted in beautiful, original and personalized frames.

Characterisation: to celebrate special days the LCC from ClimACT school EB1 Padre Manuel de Castro thought of reusing materials to create new and imaginative gifts. For instance, in Father's Day the first-grade students made a picture frame to offer to their Father, as seen in Figure 16. To celebrate Saint Martin's Day, they made original packages for the chestnuts by reusing materials (Figure 17). Another representation of these activities was done for the Memorial Day of school Patron, Abel Salazar, where students elaborated a heart made up of the reuse of materials (e.g., paper, fabric, reeds, cardboard box), as shown in Figure 18.



Figure 29 – Personalized packages for the chestnuts made by the students of the school EB1 Padre Manuel de Castro, to celebrate Saint Martin's Day.

Organised by: LCC of the pilot school and supported by ClimACT research members.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Awareness of the entire school community to the project.
2. Collection of several used materials (wine corks, coffee capsules, CDs, ...) with the contribution of the students' families.
3. Reuse of these materials to build the purposed items to commemorate special days.
4. Offer or exposition of the items made with recycled materials.



Figure 30 – Heart made by the students of EB1 Padre Manuel de Castro school to commemorate their Patron's Day.

1.17 Waste action 17: “The Gnomes of Gnù”

Description: students of the second grade of Escola EB1 Padre Manuel de Castro prepared an adaptation of the book written by Umberto Eco “The Gnomes of Gnù”, with the help of their teachers. This was an opportunity for the school to raise awareness to the problem of the pollution of planet Earth.

Objective: awareness of the whole school community to the importance of having good habits and manners to the environment.

Selected pilot school: Escola EB1 Padre Manuel de Castro (Portugal).



Figure 31 – Students of Escola EB1 Padre Manuel de Castro during and after the play “The Gnomes of Gnù”.

Characterisation: if inhabitants of another planet could observe the life on Earth, what would they think of us? The students of the second grade tried to answer this question with a beautiful dramatization of the story “The Gnomes of Gnù”, by Umberto Eco, sensitizing their parents to the problem of the pollution in our planet. This action had as its slogan “*Do not leave for tomorrow what can be separated today - be part of Geração Verdão!*”. At the end of the presentation, informational pamphlets were handed out (Figure 19).

Organised by: all students, teachers and community of Escola EB1 Padre Manuel de Castro.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the second-grade teacher to perform this play, with the support of the school LCC.
2. Preparing the performance with the students, with the purpose of raising awareness to the pollution in our planet.
3. Reuse of these materials to build the scenario and garnish the clothes of the young actors.
4. Performing the play for the whole school community.
5. During the *Global Days of Actions* share it through a small text with photos and/or videos in specific internet platforms.
6. Distribute pamphlets to the audience in the end of the play, exchanging ideas with them.

1.18 Waste action 18: design of a *Spring Tree*

Description: students from Escola Básica e Jardim de Infância do Prior Velho design and created a *Spring Tree* reusing materials.

Objective: promotion of recycling and good environmental practices between students.

Selected pilot school: Escola Básica e Jardim de Infância do Prior Velho (Portugal).



Figure 32 – *Spring Tree* (“A Árvore da Primavera”) made by the whole community of Escola Básica e Jardim de Infância do Prior Velho.

Characterisation: to celebrate the beginning of the Spring, the LCC of Escola Básica e Jardim de Infância do Prior Velho suggested the creation of a *Spring Tree*. The idea was very well received by the whole school community that help gathering the materials and create this beautiful tree made of tires and embellish with recycled good (Figure 20).

Organised by: LCC of Escola Básica e Jardim de Infância do Prior Velho.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. The LCC with the help of the school community decided to celebrate the beginning of the Spring building a tree with recycled materials.
2. Collection of several used materials (tires, plastic cups, ...) with the contribution of the students’ families.
3. Reuse of these materials to create the “*Spring Tree*”.
4. The beginning was commemorated with the presentation of the tree to the students’ families.

1.19 Waste action 19: Carnival parade

Description: students from Escola Básica e Jardim de Infância do Prior Velho design and made costumes to celebrate Carnival, reusing materials.

Objective: promotion of recycling and good environmental practices between students.

Selected pilot school: Escola Básica e Jardim de Infância do Prior Velho (Portugal).



Figure 33 – Carnival Parade of Escola Básica e Jardim de Infância do Prior Velho.

Characterisation: to celebrate the Carnival, the LCC of Escola Básica e Jardim de Infância do Prior Velho suggested the reuse of materials to create the costumes that would be used in the parade (Figure 21).

Organised by: LCC of Escola Básica e Jardim de Infância do Prior Velho.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the LCC to design and make the Carnival costumes using recycled materials.
2. Collection the materials with the contribution of the students' families.
3. Making of the costumes by the students, with the help of the teachers.
4. Carnival Parade through the streets around the school.

2 Actions implemented in transports

2.1 Transport action 1: promotion of cycling as a transport mode to the school

Description: Construction of equipments and communication campaign to promote cycling as a daily transport mode to school.

Objective: Incite students to go to school by bike rather than by car.

Selected pilot school: Institute of Technology, La Rochelle (France).

Characterisation: Several measures were taken to incite the students and staff to go to IUT by bike, including 1/ the construction of new spaces for bikes and motorbikes (Figure 8), 2/ the design and manufacturing of a 38 m² wooden bike shed (Figure 8), 3/ a photo campaign to promote cycling as a daily transport mode at the IUT (Figure 10), and 4/ the distribution to all new IUT students and staff of a welcome bike pack including a bell and a notebook (Figure 9).



Figure 34 – left: new spaces for bikes and motorbikes, right: construction of a wooden bike shed

Organised by: the measures were decided by the school administration. The wooden bike shed was designed and built by students from the civil engineering department

N° of students involved: 1200



Figure 35 – bike kit offered as a welcome gift to all IUT students and staff



Figure 36 – Example of a poster made in the frame of the communication campaign for the promotion of cycling as transportation mode at IUT

Actions addressed for the implementation of LCE solution:

1. Construction of a wooden bike shed
2. Construction new spaces for bikes and motorbikes
3. Communication campaign to promote cycling

2.2 Transport action 2: Reducing the car traffic in the street next to the school

Description: The street along the school is closed to cars at rush hours (dropping and picking up of pupils)

Objective: To promote active transportation mode. To incite the families to go to school by foot or bike

Selected pilot school: Primary School Marie Marvingt (Laleu), La Rochelle (France).

Characterisation: A barrier is installed twice a day (in the morning and the evening) in order to stop cars from going through the school streets (Figure 11).

Organised by: The municipality of La Rochelle

N° of students involved: 272

Actions addressed for the implementation of LCE solution:

1. Get the municipal authorisation to close the street at some times of the school days.
2. Create and install a barrier to stop cars from going through the street



Figure 37 – Barrier used to close the street with information on closing hours

2.3 Transport action 3: Solar car racing. Design of solar cars by students

Description: Workshop with student to design and build a solar car.

Objective: Raise awareness in students about the potential of renewable energy in transport sector.

Selected pilot school: IES Chaves Nogales (Spain).

Characterisation: Solar car kit

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 50



Figure 38 – Picture of students zuilding a solar car

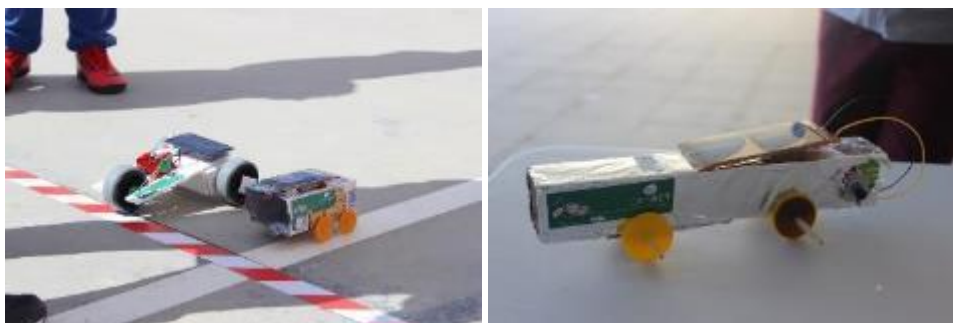


Figure 39 –Solar cars developed by students

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups to design a solar car.
2. ClimACT researcher members explained the procedure for construction of solar car.
3. Construction process
4. Assessment of results and playtime with the solar cars.
5. Solar car racing. All cars were tested in a racing.

2.4 Transport action 4: Workshop of sustainable transport strategies in school

Description: Workshop for the evaluation of sustainable transport strategies in school surroundings by students and development of poster with results.

Objective: Raise awareness in students about the potential to reduce environmental impact associated to transport sector.

Selected pilot school: Students from different ClimACT pilot schools in Seville.

Characterisation: simulation by computer

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 6



Figure 40 – Session with student to evaluate transport sector in school

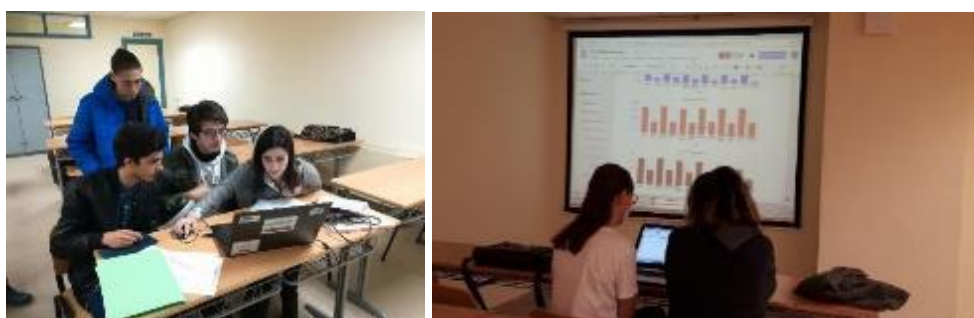


Figure 41 – Working process to evaluate transport sector in school

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different tasks
2. ClimACT researcher members explained the procedure.
3. Each group had different weeks to complete the work
4. Assessment of results and development of poster for dissemination

2.5 Transport action 5: cycling tour “Eco-Bike”

Description: organisation by the school of a cycling tour through the closest neighbourhoods, allowing the students to create their own path to school, with no traffic and without pollution under the slogan: “Less CO₂ more O₂”.

Objective: raising awareness to alternative and sustainable modes of transport for school.

Selected pilot school: Escola Básica e Jardim de Infância do Prior Velho (Portugal).



Figure 42 – (top) Invitation by the LCC of Escola Básica e Jardim de Infância do Prior Velho to the entire community to join the “Eco-Bike” (“Eco-Bicla”) Tour and (bottom) the day of the cycling activity.

Characterisation: after the initial inquiries performed by the LCC, it was found that most students live within walking distance of the school. In order to reduce the carbon footprint, this activity was suggested to the students: to learn alternative ways to go to school walking or cycling, which was very well received by the whole community. With the support of the Municipality of Loures and the Police Department (Figure 22, top), some streets were closed to traffic during this activity. On the morning of 19 June, students and their family took this cycling tour through the streets near the school (Figure 22, bottom).

Organised by: the LCC of Escola Básica e Jardim de Infância do Prior Velho.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Organisation by the school LCC of inquiries to understand the habits of the school community.
2. Suggestion of this activity to the whole school community to reduce the carbon footprint.
3. After the acceptance of everyone, organisation of the tour with the help of the Loures municipality and the local Police Department.
4. On the morning of 19 June, everyone who wanted to participate on this activity gathered and performed this cycling tour.

2.6 Transport action 6: “Swap the car for an electric... bike?”

Description: LCC of Escola Superior de Tecnologia da Saúde de Lisboa, in collaboration with *Bicicultura* and *Cenas a Pedal*, organised training courses and driving lessons for electric bicycles.

Objective: raising awareness to alternative and sustainable modes of transport for school.

Selected pilot school: Escola Superior de Tecnologia da Saúde de Lisboa (Portugal).



Figure 43 – Invitation by the LCC of Escola Superior de Tecnologia da Saúde de Lisboa to the entire school community to join the training courses and driving lessons about electric bicycles.

Characterisation: training courses and driving lessons were given to whoever wanted to participate in order to raise motivation in the school community to swap their cars by (electric) bicycles (Figure 23).

Organised by: the LCC of Escola Superior de Tecnologia da Saúde de Lisboa with the collaboration of *Bicicultura* and *Cenas a Pedais*.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Organisation of these activities by the school LCC with the support of *Bicicultura* and *Cenas a Pedais*.
2. Advertising of this activity to the whole school community, explaining the importance of reducing the carbon footprint.
3. Participation of the school community in the proposed activities

3 Actions implemented in green spaces

3.1 Green space action 1: shared permaculture garden

Description: creation of a shared permaculture garden / organization of communication campaigns to promote healthy food from local agricultural production

Objective: Raise awareness of students to alternative production and consumption modes

Selected pilot school: Institute of Technology, La Rochelle (France).



Figure 44 – Permaculture garden at IUT of La Rochelle

Characterisation: Open permaculture garden in the middle of the IUT plot with boards indicating the objectives and type of cultures (Figure 12)

Organised by: 10 students from a student organization called “Cultive ta tête et ton assiette”. Support provided by the IUT administration and ClimACT partners (City of La Rochelle and University of la Rochelle) who provided the soil and a water tank (99 €), respectively (Figure 13). The students received a regional award and a national award for their initiative (Figure 14).

N° of students involved: 1200



Figure 45 – Water tank for the permaculture garden



Figure 46 – IUT student receiving the second prize of the national challenge “L’agitateur”, promoting students initiatives (June 7, 2018, left), and the regional award of citizen mobilization (June 13, 2018, right)

Actions addressed for the implementation of LCE solution:

- 1.** Files made by students to ask for support from the Institute of Technology and ClimACT partners
- 2.** Creation of the garden on falls 2017.
- 3.** First crop on spring 2018
- 4.** Deployment of an awareness campaign from posters and messages on the electronic screens located in the five buildings of IUT.

3.2 Green space action 2: Preservation of biodiversity

Description: Installation of two bee hives on the campus and late mowing of the IUT lawns to preserve and develop biodiversity

Objective: Preserve biodiversity and raise awareness on the importance of biodiversity

Selected pilot school: Institute of Technology, La Rochelle (France).



Figure 47 – Bee hives at IUT of La Rochelle

Characterisation: Two beehives installed on the school plot and operated by four skilled staff of the IUT (Figure 15). Only one mowing of the IUT lawns a year to promote biodiversity.

Organised by: administration of IUT of La Rochelle, including representatives of students

N° of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Decision of the IUT board to promote biodiversity on the school plot
2. Purchase of two beehives
3. Contracting with an external company for the late mowing of the IUT lawns each year

3.3 Green space action 3: a garden in the school yard

Description: Install a garden in the schoolyard

Objective: Increase the green surface area in the school as a way to reduce its carbon footprint. Create a closer link between nature and students.

Selected pilot school: Bongraine primary school

Characterisation: A vegetable and decorative garden was created in the middle of the schoolyard. This garden is cultivated by children during school time and is open to all students during free time.

Organised by: the LCC of the school

Nº of students involved: 158

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCE to create a garden, decision about its location in the schoolyard
2. Purchase and installation of the garden cases
3. Delivery of soil and planting by the municipality
4. Operation of the garden by the school users

3.4 Green space action 4: “Trame Verte et Bleue”

Description: Activities related to biodiversity that students can find in their school environment.

Objective: Raise awareness of the student about biodiversity in their school. Install equipments to develop biodiversity in the school environment.

Selected pilot school: Primary school Bongraine, Primary school Berthelot (France)

Characterisation: This action is a part of the “Trame Verte et Bleue” project that aims to create a biodiversity corridor through the city of La Rochelle. Educational activities have been organized to supplement the technical actions implemented in the city area.

During those activities children had to think like an emblematic animal (a magpie, a hedgehog, a dragonfly, a shrew). They had to find, in the close environment of the school, where the animal can live, where they can find food, etc. At the end of four activities of 2 hours each, students were asked to make recommendations to the mayor of La Rochelle in order to improve the life of those animals and, at a larger scale, to improve the biodiversity in the city. A special event was organized with all schools involved in this program and the mayor of La Rochelle. The latter listened to the proposals and validated some of them (Figure 16).

Organised by: The municipality of La Rochelle

Nº of students involved: 60

Actions addressed for the implementation of LCE solution:

1. Activities lead by local a non-governmental organization
2. Organisation of an event with invitation of stakeholder



Figure 48 – Final event of the project. Left: students presenting solutions to develop biodiversity; Right: The Mayor of La Rochelle and elected representatives examine the proposals made by students

3.5 Green space action 5: Creation of a natural pond

Description: Creation of an open natural pond at Berthelot school

Objective: Develop biodiversity in the neighborhood of the school. Create a link between nature and the school users (students, adults, activity leader, etc.)

Selected pilot school: Primary school Berthelot, La Rochelle (France)

Characterisation: The municipality of La Rochelle established a partnership with a non-governmental organisation to create the pond, which is part of the “Trame Verte et Bleue” project described above as well as the “10000 coins nature” project. The school neighbourhood, the technical department of the city, parents and students were involved in the construction of the pond. Activities dedicated to all stakeholders are often organized.

The pond space is also used to grow vegetables and aromatic plants. Fruit trees will also be planted in 2019 (Figure 17).

Organised by: The municipality of La Rochelle. The University of la Rochelle purchased the tanks to collect rain water

N° of students involved: 135

Actions addressed for the implementation of LCE solution:

1. Creation of the pond
2. Installation of two water tanks to collect the rain water coming from the school roofs
3. Installation of facilities to create a pleasant environment and host more biodiversity.



Figure 49 – up left: the pond and the two water tanks; up right: the aromatic spiral built by students and school neighbours; down left: a hedgehog shelter built by students; down right: construction of a birdhouse by students

3.6 Green space action 6: AgroBIO

Description: *Global Action Days* are an excellent opportunity for the schools to show the many actions they take each day to promote the environment. Each participating school organized an activity within this year theme “From CO₂ to O₂”. As a green space action, a biological vegetable garden was cultivated, and its growth was accompanied by the students.

Objective: exchange of ideas/actions in order to continue pursuing inspiration and motivation to encourage people towards a more sustainable way of life, here focused in the importance and maintenance of green spaces.

Selected pilot school: Escola Básica General Humberto Delgado (Portugal).



Figure 50 – Growing of a biological vegetable garden, in the scope of *Global Days of Actions*.

Characterisation: growing and maintenance of a biological vegetable garden, under the scope of “From CO₂ to O₂” for the *Global Action Days* (Figure 24).

Organised by: the LCC of General Humberto Delgado school.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create a biological vegetable garden, decision about its location in the schoolyard.
2. Collection of plastic bottles to use as vessels.
3. Delivery of soil and planting by the municipality.
4. Maintenance of the biological vegetable garden by the students, with help of whole school community.
5. During the *Global Days of Actions* share it through a small text with photos and/or videos in specific internet platforms.
6. Exchange ideas and take inspiration from other shared actions.

3.7 Green space action 7: pedagogic garden

Description: the students brought strawberries from a visit to plant nurseries to start their fruit and vegetable garden. These strawberries quickly flowered with the care of the students, so it was added lettuces and aromatic seeds to the garden. Due to the success of this activity, the students start to germinate several seeds and increased their fruit and vegetable garden.

Objective: awareness to the importance and maintenance of green spaces.

Selected pilot school: Escola Básica Maria Veleda (Portugal).

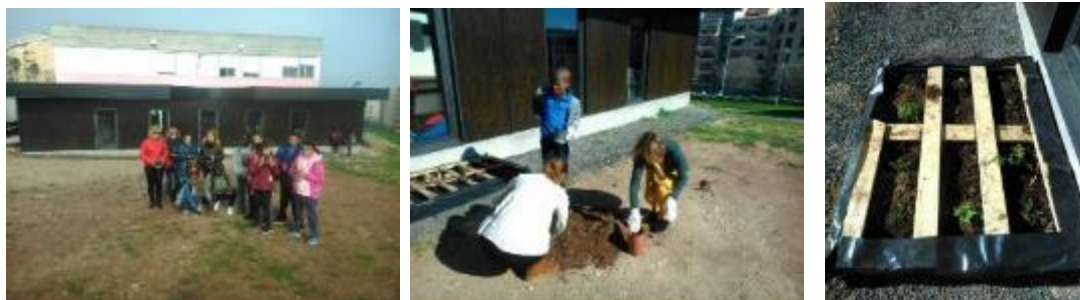


Figure 51 – Growing of strawberries in the pedagogic garden.

Characterisation: growing and maintenance of a pedagogic vegetable garden by the students (Figure 25 to Figure 27).

Organised by: the LCC of Escola Básica Maria Veleda.



Figure 52 – Plantation and maintenance of the vegetable garden.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Visit the plant nurseries of the City Hall of Loures, where were offered strawberries for the students to start their vegetable garden.
2. The school LCC helped to create the pedagogic vegetable garden, and decided about its location in the schoolyard.

3. Maintenance of the vegetable garden by the students, with help of whole school community.
4. The strawberries quickly flowered with the care of the students. Lettuces and aromatic seeds were added to the vegetable garden.
5. Germination of several seeds in transparent gloves with moistened cotton.
6. Due to the success of this initiative the pedagogic garden was a reality in the end of the school year.



Figure 53 – Germination of several seeds in transparent gloves with moistened cotton.

3.8 Green space action 8: planting trees – “A minha árvore”

Description: celebration of the International Day of the Forests and Arbour Day with the plantation of trees by students.

Objective: awareness of the importance of conservation and use of green spaces.

Selected pilot school: Escola Básica General Humberto Delgado (Portugal).



Figure 54 – Plantation of trees by the students of the school General Humberto Delgado in the scope of the International Day of the Forests (21st of March).

Characterisation: tree planting and maintenance of this new green space by students with the help of the entire school community (Figure 28).

Organised by: the LCC of Escola Básica General Humberto Delgado, with the support of *Redescobrir a Terra* project.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create this action and decision about its location in the schoolyard.
2. Delivery of soil and planting by *Redescobrir a Terra* project.
3. Maintenance of the new green space by the students, with help of whole school community.

3.9 Green space action 9: “*Juntos pela floresta*”

Description: *Global Action Days* are an excellent opportunity for the schools to show the many actions they take each day to promote the environment. Each participating school organized an activity within this year theme “From CO₂ to O₂”. To celebrate the International Day of the Forests and Arbour Day a panel focused on how to protect the forest was created by the students.

Objective: exchange of ideas/actions in order to continue pursuing inspiration and motivation to encourage people towards a more sustainable way of life, here focused in the importance protection of the forests.

Selected pilot school: Escola Básica Maria Veleda (Portugal).



Figure 55 – Creation of the panel by the students of Escola Básica Maria Veleda to celebrate the International Day of the Forests (21st of March).

Characterisation: creation of a panel to alert to the need of protecting forests, under the scope of “From CO₂ to O₂” for the *Global Action Days* (Figure 29 and Figure 30).

Organised by: the LCC of Escola Básica Maria Veleda and with the support of whole school community.

Number of students involved: 35



Figure 56 – The final panel and some of the students that helped in its elaboration.

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create the panel to celebrate the International Day of the Forests and Arbour Day.
2. It was asked to each class in the school to elaborate sentences on how to protect the forest.
3. Construction of pieces of a puzzle with the abovementioned sentences, that when joined together they showed fruits.
4. The final panel was fixed in the schoolyard.
5. During the *Global Days of Actions* share it through a small text with photos and/or videos in specific internet platforms.
6. Exchange ideas and take inspiration from other shared actions.

3.10 Green space action 10: mock-up models on the greenhouse effect

Description: learning about the greenhouse effect and the importance of the forests.

Objective: awareness to the importance of conservation of the forests.

Selected pilot school: Escola Básica Maria Veleda (Portugal).



Figure 57 – Greenhouse effect mock up models design and made by students.

Characterisation: development of oral presentations on the Greenhouse Effect and its consequences by the students, that were complemented by mock-up models to illustrate it (Figure 31).

Organised by: students from the ClimACT pilot school: Escola Básica Maria Veleda.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Learning about the greenhouse effect in the Sciences class.
2. Creation of groups of students to perform a presentation about the theme. Additionally, it was asked to make a mock up model.
3. Presentation of the oral talks to the other classes, with further discussion.

3.11 Green space action 11: planting autochthonous trees – Earth Day

Description: celebration of the Earth Day with the plantation of autochthonous trees by students.

Objective: awareness to the importance of conservation and use of the forests.

Selected pilot school: Escola EB1 Padre Manuel de Castro (Portugal).



Figure 58 – Research of the Portuguese autochthonous trees made by the students of Padre Manuel de Castro school in the scope of the Earth Day (22nd of April).

Characterisation: after researching the autochthonous trees in the Portuguese forest (Figure 32), the students made informative posters that were exhibit in the school. On April 23, the students of the Padre Manuel de Castro school celebrated World Earth Day by planting one of studied Portuguese native trees: stone pines. As shown in Figure 33, they used recycled materials as vases, *i.e.*, milk packages and residues resulting from their snacks.



Figure 59 – Plantation of stone pine trees by the students of Padre Manuel de Castro school in the scope of the Earth Day (22nd of April).

Organised by: the LCC of Escola EB1 Padre Manuel de Castro

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create this action and decision about its location in the schoolyard.
2. Researching about the Portuguese autochthonous trees by the students.
3. Elaboration of informative posters with the result of the research that were exposed in the school.
4. Plantation of an autochthon tree -stone pine- using recycled materials as vases.

3.12 Green space action 12: “O nosso cantinho” – “Our little corner”

Description: creation of a pleasant corner in playground, reusing old materials and making better use of available space.

Objective: awareness of the importance of conservation and use of green spaces.

Selected pilot school: Escola EB1 Padre Manuel de Castro and Escola Básica e Jardim de Infância do Prior Velho (Portugal).



Figure 60 – “Our little corner” as designed and made by the students of EB1 Padre Manuel de Castro school.

Characterisation: the students, in collaboration of Parents' Association, painted tires and pieces of tree trunk to create and beautify the playground. Thus, they built a pleasant and appealing "corner", which they called "O Nosso Cantinho" (“Our little corner” - Figure 34) at Escola EB1 Padre Manuel de Castro. In the other school (Escola Básica e Jardim de Infância do Prior Velho) they did not name it, but it was very well enjoyed by the pre-school children (Figure 35).



Figure 61 – Garden made by the students and teachers of Escola Básica e Jardim de Infância do Prior Velho.

Several activities took place in this embellish green spaces, as the annual “Books Fair” of Escola EB1 Padre Manuel de Castro (see Figure 36).



Figure 62 – “Book Fair” took place in “Our little corner” of EB1 Padre Manuel de Castro school.

Organised by: the LCC of Escola EB1 Padre Manuel de Castro

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create this action and decision about its location in the schoolyard.
2. With the help of the Parent’s Association tires were painted and decorated, as well as pieces of tree trunks.
3. Design of the new “Our Little Corner” by the students to better enjoy the green spaces of their school.

4 Actions in green procurement

4.1 Green procurement action 1: Awareness in green procurement to professors

Description: Definition of green procurement meaning and awareness campaign to school professors

Objective: Raise awareness about the potential of green procurement

Selected pilot school: All ClimACT pilot schools of Andalusia (Spain)

Characterisation: -

Organised by: professors from ClimACT pilot schools and ClimACT research members.

Nº of students/professor involved: 30



Actions addressed for the implementation of LCE solution:

1. Seminar about green procurement organised by the University of Seville for teacher of ClimACT pilot schools.

4.2 Green procurement action 2: optimization of the paper use

Description: use of draft paper sheets and when there is the need to print a document use both sides of the paper.

Objective: awareness to the waste of paper.

Selected pilot school: Escola Básica Maria Veleda (Portugal)

Characterisation: save the papers that are only used on one side, and then use it as draft papers. Another way to save on paper is to print on both sides of the sheet.

Organised by: the LCC of Escola Básica Maria Veleda.

Number of students involved: all schools

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to collect sheets of used one-sided paper.
2. Make these draft papers available to the entire school community.
3. Alert for printing on both sides of the sheet of paper.

4.3 Green procurement action 3: “Distribution of carrot on sticks”

Description: the students performed an awareness campaign “Distribution of carrots on sticks”, where they prepared and distributed carrots skewers throughout the school community.

Objective: promote a sustainable diet without food waste.

Selected pilot school: Escola Básica Maria Veleda (Portugal).



Figure 63 – Distribution of the carrots on sticks by the students of Escola Básica Maria Veleda throughout the school community.

Characterisation: Students prepared and distributed biological carrots in the school community (Figure 37), raising awareness for the preference of food with biological certificate and from local suppliers.

Organised by: the LCC of Escola Básica Maria Veleda.

Number of students involved: all EBMV school

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform this awareness campaign.
2. Ask for support from the local suppliers.
3. Preparation of the carrots on sticks by the students, with the teachers support.
4. Distribution throughout the school community.

4.4 Green procurement action 4: celebrating the “World Food Day” – The Bread Cycle

Description: to celebrate the “World Food Day” the students from Escola EB1 Padre Manuel de Castro were taught about the evolution of the Bread Cycle over time. This learning was enriched with the opportunity of making their own bread that in a local bakery.

Objective: promote a sustainable diet.

Selected pilot school: Escola EB1 Padre Manuel de Castro (Portugal).



Figure 64 – The history of the evolution of the bread through the years, as told by the students of Escola EB1 Padre Manuel de Castro.

Characterisation: as part of the celebration of “World Food Day” it was explained to the students the history of bread over time. It was then asked for them to do some research and present it as shown in Figure 38. Following this work, it was given them the opportunity to make their own bread, which after being cooked, they took home. This activity had the collaboration of the bakery São Mamede and has been carried out by all students of the school.



Figure 65 – Students of Escola EB1 Padre Manuel de Castro making bread as part of the celebration of the “World Food Day”.

Organised by: the LCC of Escola EB1 Padre Manuel de Castro.

Number of students involved: all EBMV school

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform this activity.
2. Collaboration from all school community with the support of the bakery São Mamede.
3. Learning of the history of bread and preparation of the works to present to the school community.
4. Going to the bakery to make and cook bread.

4.5 Green procurement action 5: “Pastry for a day”

Description: students of Escola EB1 Padre Manuel de Castro participated in a workshop about healthy food. In the end, they were taught to make healthy desserts.

Objective: promote a sustainable diet without food waste.

Selected pilot school: Escola EB1 Padre Manuel de Castro (Portugal).



Figure 66 – Participation of the students of Escola EB1 Padre Manuel de Castro in a healthy food workshop where they learned to prepare healthy deserts.

Characterisation: students of the third grade of Escola EB1 Padre Manuel de Castro participated in a workshop about healthy food. They learned about the importance of the Food Balance Wheel, giving prominence to foods that are more and less healthy, which should be eaten more or less frequently, in order to have a more balanced consumption of food. The workshop ended with the preparation of easy and healthy desserts by the students (see Figure 40). This activity had the collaboration of the local bakery and the support of the school LCC.

Organised by: the LCC of Escola EB1 Padre Manuel de Castro.

Number of students involved: all EBMV school

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform this activity.
2. Collaboration from all school community with the support of a local bakery.
3. Participation in the workshop to learn about the Food Balance Wheel.
4. Application of what they learned to prepare a simple and healthy desert.

4.6 Green procurement action 6: Food Balance Wheel

Description: Like other schools, students of Escola Básica e Jardim de Infância do Prior Velho and Escola E.B. 2,3 Mário de Sá Carneiro participated in a workshop about healthy food and learn about the Food Balance Wheel.

Objective: promote a sustainable diet without food waste.

Selected pilot school: Escola Básica e Jardim de Infância do Prior Velho and Escola E.B. 2,3 Mário de Sá Carneiro (Portugal).



Figure 67 – Students of (left) Escola Básica e Jardim de Infância do Prior Velho learning about the Food Balance Wheel and (top right and bottom) Escola E.B. 2,3 Mário de Sá Carneiro.

Characterisation: students from these schools participated in a workshop about healthy food. They learned about the importance of the Food Balance Wheel, giving prominence to foods that are more and less healthy, which should be eaten more or less frequently, in order to have a more balanced consumption of food. The workshop ended with the preparation of easy and healthy desserts by the students (see Figure 40, top). The students from Escola Básica e Jardim de Infância do Prior Velho also learnt about the importance of the local farmers food. In the end,

they ate a healthy and balanced meal, where they had the opportunity to decorate the dessert dishes (Figure 42).



Figure 68 – Healthy meal prepared with the help of the students of Escola Básica e Jardim de Infância do Prior Velho that also decorated the dessert dishes.

Organised by: the LCC of Escola EB1 Padre Manuel de Castro.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform this activity.
2. Collaboration from all school community with the support of a local bakery.
3. Participation in the workshop to learn about the Food Balance Wheel.
4. Application of what they learned to prepare a simple and healthy desert.

5 Actions implemented in IAQ

5.1 IAQ action 1: CO₂ sensors to promote window openings during the class

Description: Installation of portable CO₂ sensors in the classrooms to indicate the users when the air stuffiness level becomes high and window openings are needed to control indoor air quality (Figure 18).

Objective: Reduce the occupants' exposure to indoor air pollutants and improve the students' educational performance by promoting adequate air exchange rates in classrooms having no mechanical ventilation system.

Selected pilot school: High school Dautet (France)



Figure 69 – Class'air sensors indicating the air stuffiness from coloured leds

Characterisation: Four Class'air sensors were provided to voluntary teachers from May to September 2018. The sensors monitor the CO₂ concentrations every 1 minute. If the concentration exceeds 1250 ppm, the light turns from green to orange. If the concentration is over 2500 ppm, the light is red. The students attending the class are in charge of opening the windows to promote natural ventilation and keep the CO₂ levels below the limits. After some time, teachers and students get familiar with the CO₂ variations in their classroom and anticipate the window openings without the help of the sensor.

Organised by: University of La Rochelle suggested the action. The low carbon committee of the school decided to go into it after discovering the results of the indoor air quality audits. University of La Rochelle provided 4 Class'Air sensors (350 € each).

N° of students involved: potentially more than 2000 (all the students of Dautet high school)

Actions addressed for the implementation of LCE solution:

1. Purchase of four Class'Air sensors by University of La Rochelle
2. Call for voluntary teachers to experiment the sensors in their classrooms
3. Use of sensors from the beginning of May to the end of September 2018

5.2 IAQ action 2: Installation of a mechanical ventilation system

Description: Installation of a mechanical ventilation system in one building

Objective: Improve indoor air quality in the classrooms where window openings are difficult

Selected pilot school: High school Dautet (France)

Characterisation: The installation of a mechanical ventilation system in building N of the school (Figure 19) will promote indoor air quality by establishing compulsory ventilation rates in classrooms (18 m³/h/person) during the class hours. The first series of indoor air quality audits revealed poor air quality in building N. The second series of ClimACT audits will show the impact of the new system on the occupants' exposure to pollutants.



Figure 70 – Installation of a mechanical ventilation system in building N of high school Dautet

Organised by: The installation of a mechanical ventilation system was decided and funded by the school administration. The works have begun in July 2018, immediately after the end of classes.

N° of students involved: 2000 (all the students will benefit from the new system)

Actions addressed for the implementation of LCE solution:

1. Installation of the mechanical ventilation system

5.3 IAQ action 3: Improving of natural ventilation rate through different strategies

Description: This action consists of improving the indoor air quality (IAQ) of a classroom by means of the implementation of operating strategies based on different windows opening periods, with the aim of increasing ventilation rate over peak periods of CO₂ concentration. Implemented IAQ management strategies are based on window openings between classes and along the school break, with the aim of achieving a higher mean of air changes per hour (Ach/h).

Objective: improve the school air environment avoiding high concentration of air pollutants.

Selected pilot school: ITACA in Seville (Spain).

Characterisation: -

Organised by: professors and students from ClimACT pilot school and supported by ClimACT research members.

Nº of students involved: 25



Figure 71 – Students, professors and ClimACT research members involved in action plan implementation

Actions addressed for the implementation of LCE solution:

1. Concepts about indoor air quality in school and its relationship with health, wellbeing and human performance are explained to students and school teachers involved.
2. Measurement of a reference scenario in the selected pilot classroom is carried out along two days. One student is in charge of controlling IAQ monitoring equipment.
3. Action plan scenario is addressed and measured along two days. Along this scenario, operating strategies were implemented. Different students were in charge of opening windows along selected periods (between classes and along school break).

4. The results are assessed, obtaining the percentage of CO₂ concentrations between 1000 and 1700 ppm during occupancy (%) and percentage of CO₂ concentrations over 1700 ppm during occupancy (%) for each scenario.
5. Finally, an awareness campaign is deployed by means a poster, with the aim of increasing awareness and promote a better management of windows to reduce air pollutant concentration in school environment.

5.4 IAQ action 4: Novel smart ventilation systems for schools

Description: Installation of a smart ventilation system in a new building school

Objective: improve the school air environment avoiding high concentration of air pollutants.

Selected pilot school: new school building: CEIP El Almendral (Spain)

Characterisation: The system consists of smart windows openings through CO₂ concentration sensors and roof stacks connected to each classroom to increase the cross-ventilation rate in the classroom.

Organised by: Agencia Pública Andaluza de Educación (APAE, stakeholder of ClimACT project) and ClimACT research members.

Nº of students involved: 200



Figure 72 – Smart windows openings through CO₂ concentration sensors



Figure 73 – Roof stacks connected to each classroom to increase the cross-ventilation rate

Actions addressed for the implementation of LCE solution:

1. Design, simulation, verification and construction of smart ventilation system to improve Indoor Air Quality in school.

5.5 IAQ action 5: assessment of IAQ

Description: assessment of air quality in at least one space representative of each of the existing ones in the school (classrooms, laboratory areas, offices and common areas). This evaluation was performed by the students of the third year of the Environmental Health course.

Objective: know and communicate data on indoor air quality of the school.

Selected pilot school: Escola Superior de Tecnologia da Saúde de Lisboa (Portugal)

Characterisation: during one semester the students used a GrayWolf sensor to assess the IAQ in the representative spaces of the school.

Organised by: students from the ClimACT pilot school: Escola Superior de Tecnologia da Saúde de Lisboa.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Meeting with the students and the ClimACT LCC to decide about the dates and the spaces that should be studied.
2. Measure of air of the representative spaces using a GrayWolf sensor during a semester.
3. Assessment of the IAQ by the student of the third year of the Environmental Health course.

6 Actions implemented in Energy

6.1 Energy action 1: Improvement of the school thermal insulation

Description: Energy works and fittings to decrease energy losses in falls and wintertime.

Objective: Save energy and improve the occupants' comfort.

Selected pilot schools: High school Dautet, school Marcellin Berthelot, school Laleu, school Barthélémy Profit, school Grandes Varennes and school Bongraine (France)

Characterisation: The building envelopes of the schools were entirely or partially retrofitted as a way to increase their insulation. The works included the replacement of single glazing windows by double glazing windows in some buildings (Figure 20), the installation of insulating and soundproofing ceiling tiles in some rooms or light shaft, and the installation of solar screens on windows facing south and west.



Figure 74 – Replacement of single glazing windows by double glazing windows in building N of high school Dautet

Organised by: The works were decided and funded by the municipality of La Rochelle. Some of them were achieved before the initial date so that improvements could be observed from the second series of ClimACT audits.

N° of students involved: all students from the aforementioned schools will benefit from the retrofittings

Actions addressed for the implementation of LCE solution:

1. Replacement of single glazing windows by double glazing windows in some parts of the school building Marcellin Berthelot (2017), and in building N of high school Dautet (2018)
2. Installation of insulating and soundproofing ceiling tiles in some rooms of schools Laleu, Berthelot and Bongraine (2017), Grandes Varennes (2018), and light shaft of school Barthélémy Profit (2017)
3. Installation of solar screens on windows facing south-west to reduce overheating (school Bongraine, 2017)

6.2 Energy action 2: low energy lighting systems

Description: Replacement of fluorescent lights by led lights and installation of smart lighting control systems

Objective: Save electric energy

Selected pilot schools: High school Rompsay, school Grandes Varennes and school Bongraine (France)

Characterisation: all the lights of the classrooms and corridors were replaced by led lights in schools Rompsay and Grandes Varennes (Figure 21). In addition, smart lighting control systems based on occupancy and light sensors were installed in schools Grandes Varennes and Bongraine. Lighting can represent up to 50% of the electricity consumption of French schools. The second series of ClimACT audits should therefore show significant electricity savings in these schools.



Figure 75 – led lightings at vocational high school Rompsay

Organised by: The works were decided and funded by the administration of school Rompsay, and by the municipality of La Rochelle for schools Grandes Varennes and Bongraine, respectively.

N° of students involved: -

Actions addressed for the implementation of LCE solution:

1. Replacement of fluorescent lights by led lights in schools Rompsay (2017) and Grandes Varennes (2017 and 2018)
2. Installation of smart lighting control systems in schools Grandes Varennes (2017 and 2018) and Bongraine (2017)

6.3 Energy action 3: Initiation of children to sustainable construction

Description: Ten students in civil engineering and two teachers of the Institute of Technology of La Rochelle trained a 10 years old class of school Bongraine to sustainable building construction.

Objective: Raise the awareness of pupils to sustainable construction: show children the environmental impact of buildings, implement citizen actions to reduce this impact, discover different materials to build houses.

Selected pilot schools: school Bongraine and Institute of Technology (France)

Characterisation: The children built a scale 1/10th model of house with the help of students (Figure 22, Figure 23). The external walls of the house are of different types (concrete, wood, bricks) and it has a green roof. The house was inaugurated on the 17th of May, 2018. The pupils were then invited for a visit of the Institute of Technology (Figure 24). They discovered topography, resistance tests on materials, and the way the infrared camera works, among other activities. The pupils could also watch a video and visit the experimental house “Casa Fenix”, which was designed and built by students for the Solar Decathlon 2014.



Figure 76 – weekly visits of IUT students to the Bongraine school



Figure 77 – house model built by pupils and students



Figure 78 – Bongraine pupil's visit of the Civil Engineering department of the Institute of Technology

Organised by: This action was organised by the civil engineering department of the Institute of Technology and the school Bongraine together, in the frame of the ASTEP program (academic program to promote sciences in primary schools).

Nº of students involved: 25 pupils + 10 students

Actions addressed for the implementation of LCE solution:

1. Weekly visits of the IUT students and their professors to school Bongraine, from the beginning of April to the middle of June 2018, to give speeches and help the pupils in the construction of the house model.
2. Pupil's visit of the IUT, including various activities and workshops supervised by students

6.4 Energy action 4: Installation of photovoltaic panels

Description: Installation of solar panels on the roof of the school

Objective: Produce and consume renewable energy. Reduce the consumption of fossil fuels

Selected pilot school: Primary and kindergarten school Les Grandes Varennes, La Rochelle (France)

Characterisation: The municipal energy department of La Rochelle has a long-term action plan regarding renewable energy. 123 panels having a surface area of 1.69 m² were installed on the roof of the school. They represent a total peak power of 36 kW and an expected electricity production of 40 000 kWh/year. The works were entirely funded by the city, which is the owner of the school building.

Organised by: The municipality of La Rochelle

N° of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Audit for solar energy possibilities in public buildings
2. Installation of solar panels on the school roof from July 2018 (the operation is planned to start on October 2018), communication on the project.

6.5 Energy Action 5: The Solaris Contest

Description: A solar oven contest in French ClimACT School.

Objective: To raise awareness of students about renewable energies, especially solar energy.

Selected pilot school: Primary school Grandes Varennes, Primary school Bongraine, Primary school Profit, Primary school Marie Marvingt (Laleu), Institute of Technology, La Rochelle (France)

Characterisation: The solar contest was launched by the municipality of La Rochelle in September 2017. All French pilot schools were asked to join the contest. Five decided to compete. During the year, the student had classes on the sun and solar energy. They built their own solar oven. University students from the Institute of Technology provided some help to students of school Bongraine. In addition, these students were invited to visit the IUT and its sustainable house.

On June 21, 2018, all schools and students involved in the contest participated to a Solaris Day (Figure 25). In the morning, they carried out many activities in relation to solar energy: they learnt how to make a fire with a magnifying glass, how to keep the heat from the sun, how to cook with solar heat, how to generate electricity, what the impact of the sun on animals, etc. In the afternoon, a Solaris jury examined the oven built by students. The elected the best oven based on the capacity of the oven to heat water, the design, and the CO₂ footprint of the materials implemented for the construction. The winning school received a gift card to buy furniture for the school and all the children received recycled wooden pencils. The winning class will join the final event of the ClimACT Project in Lisbon in May 2019.

Organised by: The municipality of La Rochelle

Nº of students involved: 100



Figure 79 – The Solaris Day activities in La Rochelle. Up left: demonstration on how to dry fruits from the sun; up right: How to make a fire with the sunrays; down left: The solar oven made by Marie Marvingt primary school; down right: Illustration of the sun power by a nongovernmental organisation

Actions addressed for the implementation of LCE solution:

1. A call to participation to the contest
2. Construction of solar oven by children and lesson lead by their teacher regarding renewable energy, the solar system and the greenhouse effect.
3. Final event : Solaris Day

6.6 Energy Action 6: The city commitment for renewable energies

Description: Poster and activities to inform the users about the energy consumptions in school buildings

Objective: Inform the school community about the energy consumption of the school and about the program of the city of La Rochelle for renewable energies.

Selected pilot school: Primary schools Bongraine, Berthelot, Profit, Grandes Varennes, Jean-Bart, Marie Marvingt (Laleu before), La Rochelle (France)

Characterisation: The energy department of the municipality of La Rochelle made posters showing and explaining the energy consumptions of the schools as a way to promote the city commitment to reduce energy consumptions and increase the part of renewable energies (Figure 26). This information was also requested by some school boards.

Moreover, the energy department of La Rochelle organized a Science Energy Day in Marie Marvingt primary school (Figure 27). Various activities dealing with energy were proposed to students by non-governmental organizations, students from a local high school and their science teacher. The “Enercoop” company, that provides renewable energy to the city of la Rochelle was also involved in the organisation of this science day. The local press was invited.

At the end of the day, parents were invited to join the event for a presentation about energy savings at home. A snack was offered to all.

Organised by: The municipality of La Rochelle with the help of the Enercoop company and the LCC of Marie Mavingt primary school.

N° of students involved: 1659 students for the poster, 272 for the science day and 60 parents

Actions addressed for the implementation of LCE solution:

1. Creation of poster
2. Organisation of the science Day in one school. Activities about renewable energy
3. Invitation of the local press
4. Conference for parents about energy savings at home.



Figure 80 - Example of a poster showing the energy consumption of schools



Figure 81 – the science day. Left: conference about energy savings at home for parents; right: activities about renewable energies for students

6.7 Energy Action 7: Solar oven contest

Description: A solar oven contest in Spanish ClimACT School.

Objective: To raise awareness of students about renewable energies, especially solar energy.

Selected pilot school: IES Chaves Nogales (Spain)

Characterisation: The solar contest was organised by the University of Seville (Spain). All required material were provided to different groups of students: scissors, paper, oven templates, markers, aluminium, etc.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 50



Figure 82 – Construction of solar oven by student



Figure 83 – Testing of final solar oven prototype

Actions addressed for the implementation of LCE solution:

1. A call to participation to the contest. Students were divided into different groups. All materials to carry out the oven were provided.
2. Construction of solar oven by students.
3. Testing of ovens

6.8 Energy Action 8: Workshop of potential lighting retrofitting in school

Description: Workshop for the evaluation of potential lighting retrofitting in school surroundings by students and development of poster with results.

Objective: Raise awareness in students about the potential environmental and economic benefits associated to the reduction of energy consumption.

Selected pilot school: Students from different ClimACT pilot schools in Seville.

Characterisation: The workshop was divided into different stages: collecting of energy data by means of a template for audits, assessment of potential lighting retrofitting using a excel tool, evaluation of results and development of poster for dissemination.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 6



Figure 84 – Students selected for the evaluation of energy sector in school

PRACTICA 1. AUDITORIA ENERGÉTICA

Tipo de consumo	Intensidad, I (A)	Tensión, V (V)	Potencia, P * (W)	Consumo durante 10 horas (Wh)	Conversión (de Wh a kWh)	Precio energía ^b (€/kWh)	Facturación al mes (23 días laborables)

* Relación: Potencia (W) = Tensión (V) · Intensidad (A)

^b Precio de la energía: 0.124862 €/kWh

Figure 85 – Template for energy audit

Calculadora Consumo de Energía Eléctrica						
Tipo de consumo	Unidades	Potencia (W)	Promedio funcionamiento al día (horas)	Energía Consumida al mes (kWh _{final})	Emisiones (kgCO ₂)	Coste (€/mes)
Iluminación	10	36	5	41.40	15.40	5.17 €
Radiador	2	1000	2	92.00	34.22	11.49 €
Proyector				0.00	0.00	- €
				0.00	0.00	- €
				0.00	0.00	- €
				0.00	0.00	- €
				0.00	0.00	- €
				0.00	0.00	- €
				0.00	0.00	- €

Variables de cálculo fijadas:	
Precio de la energía:	0.124862
Conversion kgCO ₂ /kWh _{€final} :	0.372
Días de clase al mes:	23

Figure 86 – Excel tool for energy, economic and environmental assessment of school

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different tasks
2. ClimACT researcher members explained the procedure.
3. Each group had different weeks to complete the work
4. Assessment of results and development of poster for dissemination

6.9 Energy action 9: assembly of solar cars

Description: assembling of a solar car by the students, with the offered kits. Recyclable materials and a lot of imagination allowed the construction of several types of the vehicles, since fire trucks to tourist buses.

Objective: awareness to the importance of using solar energy.

Selected pilot schools: all the ClimACT schools in Portugal.



Figure 87 – The students of Escola Básica Maria Velela created these solar cars using recycled materials.

Characterisation: all the ClimACT schools received kits with solar cars to be assembled by the students. The activity was then scheduled by the LCC of each school, asking the students to bring recycled materials to embellish the structures of their cars. The assembly and subsequent decoration of the solar cars gave origin to very original results (Figure 43 to Figure 45) that reflect the work of the students.

Organised by: ClimACT project and the LCC of each ClimACT pilot school.



Figure 88 – Solar cars done by the students of Escola Básica e Jardim de Infância do Prior Velho.

Number of students involved: all the students in ClimACT schools in Portugal.

Actions addressed for the implementation of LCE solution:

1. Delivery of “solar car” kits to the LCC of each ClimACT pilot school.
2. Schedule of the activity by the LCC.
3. Ask the students to bring recycled materials to embellish the structures of their cars.
4. Assembling of the solar cars by the students.



Figure 89 – Fire truck assembled by the students of Escola EB1 Padre Manuel de Castro, using recycled materials.

6.10 Energy action 10: construction of solar ovens

Description: construction of solar ovens by the students, with reused or recycled materials.

Objective: awareness to the importance of using solar energy.

Selected pilot schools: all the ClimACT schools in Portugal.



Figure 90 – Solar ovens done by the students of Escola Básica Maria Veleda.

Characterisation: all the ClimACT schools could choose between two solar kits: one of them consisted of solar cars (already presented in section 6.1) while the other contained all the instructions to build solar ovens. Then the LCC of each school scheduled the chosen activity in coordination with the Visual Arts Education teachers for the construction of the ovens (Figure 46 and Figure 47).

Organised by: ClimACT project and the LCC of each ClimACT pilot school.

Number of students involved: all the students in ClimACT schools in Portugal.



Figure 91 – The students of Escola Básica Júlio Dinis did these solar ovens with the help of their teachers.

Actions addressed for the implementation of LCE solution:

1. Delivery of “solar oven” kits to the LCC of each ClimACT pilot school.
2. Schedule of the activity by the LCC.
3. Assembling of the solar ovens by the students in the Visual Education class.

6.11 Energy action 11: climate action code

Description: development of a climate action code by all the students, aiming to instil feelings of ecological/environmental responsibility in the school community through the adoption of healthy attitudes and behaviours.

Objective: awareness to environmental responsibility.

Selected pilot schools: all the ClimACT schools in Portugal.



Figure 92 – Posters done in the scope of the *Climate Action Code* by the students of Escola Básica General Humberto Delgado.

Characterisation: all the ClimACT pilot schools created a prolific and healthy contest between students to evaluate the best climate code sentences and/or posters. This code consists of ten key-sentences and intends to transmit an environment where there is harmony between the human being and nature. Some of the final works are shown in Figures 48 to 50.

Organised by: ClimACT project and the LCC of each ClimACT pilot school.



Figure 93 – Posters done in the scope of the *Climate Action Code* by the students of Escola Básica Maria Veleda and Escola Básica Júlio Dinis.

Number of students involved: all the students in ClimACT schools in Portugal.

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create a contest and select the classes that would be involved in this action.
2. Ask the students to write sentences focused on an environment where there is harmony between the human being and nature.
3. Selection of the ten best sentences to create the “Eco-Code”.
4. Elaboration of posters with the “Eco-Code” to publicize the school's climate action code.

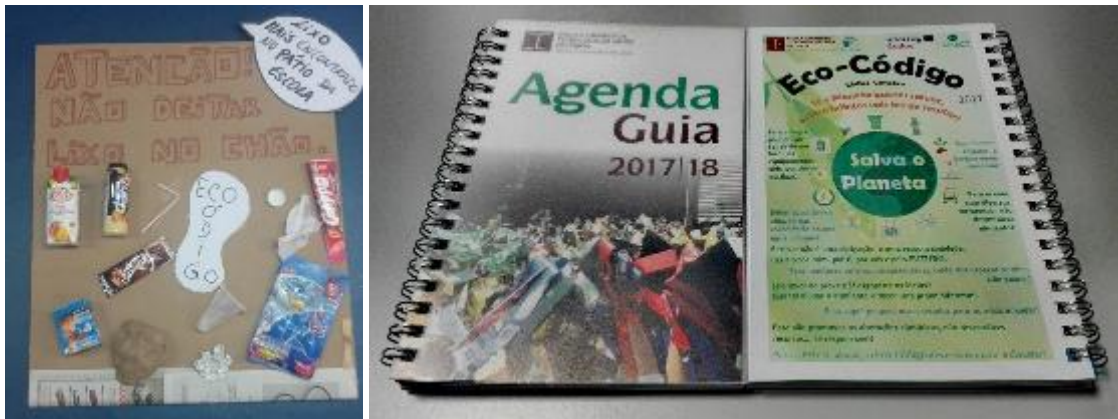


Figure 94 – Posters done in the scope of the *Climate Action Code* by the students of Escola E.B. 2,3 Mário de Sá Carneiro and Escola Superior de Tecnologia da Saúde de Lisboa.

6.12 Energy action 12: *Círculo Mágico (EcoCAMPANHA)*

Description: *Global Action Days* are an excellent opportunity for the schools to show the many actions they take each day to promote the environment. Each participating school organized an activity within this year theme “From CO₂ to O₂”. To promote civic and social responsibility to the Earth's environmental sustainability; involving the community in matters related to the preservation of the environment.

Objective: exchange of ideas/actions in order to continue pursuing inspiration and motivation to encourage people towards a more sustainable way of life, here focused in promoting the importance of Earth's environmental sustainability.

Selected pilot schools: Escola Básica General Humberto Delgado (Portugal).

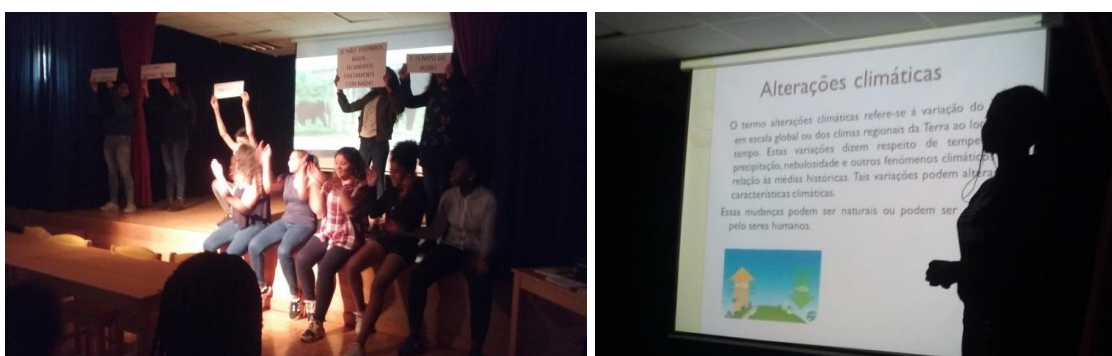


Figure 95 – Eco-campaign done in the scope of the *Círculo Mágico* and *Climate Action Code* by the students of *Escola Básica General Humberto Delgado*.

Characterisation: “*Círculo Mágico*” (“Magic Circle”) program is implemented according to the theme “Decarbonising the Society”, by performing the one of the suggested actions. The one selected by this school was an eco-campaign of environmental character (Figure 51 to Figure 53).

Organised by: Loures Municipality and *Liga para a Protecção da Natureza* (LPN), in this ClimACT pilot school the activities were coordinated by the LCC.



Figure 96 – More images from the eco-campaign done in the scope of the *Círculo Mágico* and *Climate Action Code* by the students of Escola Básica General Humberto Delgado.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to participate in the “*Círculo Mágico*” program and prepare an application to send to the organization of this program.
2. After being selected, the LCC developed the project.
3. Mobilization of all the school community to attend and intervene in the Eco-campaign during the *Global Action Days*.
4. At the end of the scholar year: elaboration of a collective exhibition and public presentation with the knowledge and experiences acquired throughout the development of the project.



Figure 97 – Exhibition of posters sharing the knowledge acquired throughout the development of the project by the students of Escola Básica General Humberto Delgado.

6.13 Energy action 13: awareness campaigns

Description: After analyzing the students answers to some enquiries about the energy consumptions practices, it was found necessary to implement actions to reinforce the creation of eco-friendlier habits.

Objective: awareness of the importance of saving energy.

Selected pilot schools: all ClimACT pilot schools.



Figure 98 – Creation of awareness signage by the students of Escola Básica e Jardim de Infância do Prior Velho.

Characterisation: Mobilize students to save energy in their daily routine, showing them that little gestures can have a big impact in the environment (Figure 54).

Organised by: ClimACT project and the LCC of each ClimACT pilot school.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform the enquiries about consumption practices to the students.
2. Analysis of the results and defining the best approach to reach the students.
3. Using that awareness approach to motivate students to save energy in their daily routine.

7 Actions implemented in water

7.1 Water action 1: replacement of health facilities for water savings

Description: Replacement of the health facilities in all toilets of a building to reduce water consumption.

Objective: Reduce the water consumption and water bill of the school

Selected pilot school: Institute of Technology, La Rochelle (France).



Figure 99 – Ultrasonic flowmeter used to monitor the water consumption in the toilets before and after replacing the health facilities

Characterisation: toilets contribute a lot to the water consumption at IUT. Consequently, the health facilities were changed in the toilets of the Biological Engineering department. The water savings were assessed by using an ultrasonic water flowmeter connected to a data logger (Figure 28).

Organised by: The action was decided by the board of the institute of technology of La Rochelle, which includes representatives of students. IUT paid for the new facilities and their installation. The University of La Rochelle supported the action by purchasing the ultrasonic flow meter (3853 €).

N° of students involved: 250

Actions addressed for the implementation of LCE solution:

1. Installation of the new health facilities in the Biology department
2. Monitoring of water consumptions from the toilets before and after replacing the health facilities

7.2 Water action 2: Installation of a rain water tank

Description: Installation of a rainwater tank in the school garden

Objective: Reduce the water consumption.

Selected pilot school: Primary School Marie Marvingt (Laleu) and primary school Berthelot, La Rochelle (France)

Characterisation: The LCC decided to take measures to reduce the water consumption of the schools. The main idea was to change the habits regarding the operation of the school garden. Consequently, rainwater tanks collecting water from the building roof were installed next to the garden (Figure 29). The University of La Rochelle purchased the tanks, which were then installed by the technical department of the municipality of La Rochelle.

Organised by: The LCC community and the municipal department.

N° of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Decision to save by the LCE and elaboration of the action plan
2. Purchase of the rainwater tank
3. Installation of the rainwater tank



Figure 100 Marie Marvingt's school garden (left) with rainwater tank (right)

7.3 Water action 3: Awareness about water consumption

Description: Activities to raise children's awareness about water consumption

Objective: Raise awareness about water consumption

Selected pilot school: Primary school Marie Marvingt (Laleu), La Rochelle (France)

Characterisation: The LCC decided to take measures regarding the water consumption in the school. They installed a rainwater tank but they also wanted to work with students on water sources and the waste water cycle. Various educational activities were initiated on this topic by the school teachers for their class.

Organised by: the LCC of the school and the municipality of La Rochelle

N° of students involved: 60

Actions addressed for the implementation of LCE solution:

1. Decision to address water consumptions by the LCC
2. Visit of a water treatment plant (Figure 30)
3. Diagnostic of the consumption of one class by the observation of the consumption with a bottle of one liter.
4. Selection of students' proposals to reduce the water consumption, such as the change of the tap system from pushbutton to regular tap. Those proposals were sent to the municipality.
5. One class built a model of water tower to understand the way it operates (Figure 31)



Figure 101 - The visit of a water treatment plant



Figure 102 - Construction of a water tower

7.4 Water action 4: Tree planting in Varaize

Description: Tree planting program in the village of Varaize

Objective: To raise awareness about the quality of the municipal water

Selected pilot school: Primary school B.Profit, La Rochelle (France)

Characterisation: The water department of the municipality of La Rochelle is developing the “re-source” project. This project aims to improve the quality of drinkable water for the citizens of La Rochelle. In La Rochelle, the water comes from various villages surrounding the city. The city is working with local farmers in order to raise awareness about water pollution. Some farmers agreed to plant trees and natural hedges to promote biodiversity and better filtrate the water. The municipality invited students to join the tree plantations in order to raise their awareness (Figure 32).

Organised by: the municipality of La Rochelle

N° of students involved: 60

Actions addressed for the implementation of LCE solution:

1. Pupil’s visit of the water fetching site
2. Tree plantations



Figure 103 - Children planting trees in Varaizes

7.5 Water Action 5: Evaluation of potential water savings in school by student

Description: Workshop for the evaluation of water consumption in school and development of poster with results.

Objective: Raise awareness in students about the potential of school community to reduce water consumption.

Selected pilot school: Students from different ClimACT pilot schools in Seville.

Characterisation: The workshop was divided into different stages: collecting data by means of a template for audits, assessment of water consumption, evaluation of results and development of poster for dissemination.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 6



Figure 104 – Students and ClimACT members in workshop of potential water savings

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different tasks
2. ClimACT researcher members explained the procedure.
3. Each group had different weeks to complete the work
4. Assessment of results and development of poster for dissemination

7.6 Water action 6: awareness campaigns

Description: After analyzing the students answers to some enquiries about the water consumptions practices, it was found that they have a lack of knowledge concerning the saving of water resources. Several actions were originated to fill this lack of information and with the purpose of creating new “eco-habits”: through awareness campaigns (as “How much water do you spend?”) or using a more playful approach with simple games where the students acquired several skills to use in everyday life.

Objective: awareness of the importance of conservation and use of this natural resource.

Selected pilot schools: Escola Básica General Humberto Delgado (Portugal), Escola Básica Maria Veleda (Portugal) and Escola Básica e Jardim de Infância do Prior Velho.



Figure 105 – Graphics showing the results of the enquiries to the students of Escola Básica General Humberto Delgado (“How much water do you spend?”).

Characterisation: Several campaigns were purposed by the LCC of different schools in order to aware students to the importance of water, mainly according their age. For instance, in the “Water Party” it occurred through experimental activities, theatrical performances and by playing games, using various objects containing water (Figure 56 to Figure 58), they experimented and explored content previously taught as well as increasing their knowledge through manipulation and discovery. As for the “How much water do you spend?” they used scientific methodology to learn about their water consumption and how to reduce it (Figure 55).



Figure 106 –Construction of a water xylophone by the students of Escola EB1 Padre Manuel de Castro, after playing it is used to water the school plants.

Organised by: ClimACT project and the LCC of each ClimACT pilot school.

Number of students involved: 35



Figure 107 – Scheme made by the students of Escola Básica e Jardim de Infância do Prior Velho after learning about the “Water Cycle” (“Ciclo da Água”).



Figure 108 – The students of Escola EB1 Padre Manuel de Castro presented a dramatization of the story “The Little Water Drop Girl” (“A Menina Gotinha de Água”, written by Papiniano Carlos), reminding the school community of the water journey in nature.

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to perform the enquiries about consumption practices to the students.
2. Analysis of the results and defining the best approach to reach the students.
3. Using that awareness approach to motivate students to reduce their water consumption.

7.7 Water action 7: educational games

Description: The students idealized and developed a game called “*Pesca o lixo no oceano*” (“Fishing the garbage in the ocean”) that -as the name implies- consisted of “fishing” the garbage from the ocean, protecting the marine species.

Objective: awareness to the conservation of this natural resource.

Selected pilot schools: Escola Básica Maria Veleda (Portugal).



Figure 109 – Students of Escola Básica Maria Veleda preparing the game “*Pesca o lixo no oceano*” (“Fishing the garbage in the ocean”).

Characterisation: Using recycled materials (Figure 60), the students from the LCC created a game that consisted in “fishing” garbage from the ocean (Figure 61). In order to do so, they used magnets to build fishing rods and insert metal in marine animals and polluting packages.



Figure 110 – Students of Escola Básica Maria Veleda playing the game “*Pesca o lixo no oceano*” (“Fishing the garbage in the ocean”).

Organised by: the LCC of Escola Básica Maria Veleda.

Number of students involved: 35

Actions addressed for the implementation of LCE solution:

1. Decision of the school LCC to create a game to raise awareness about ocean pollution.
2. Idealization of the game by the students.
3. Collection of recycled material to build the game.
4. Construction of the game that was then presented to the other school students.

8 Global actions implemented

8.1 Global action 1: Information of the school communities on ClimACT

Description: Installation of boards in pilot schools to inform the school community on the school commitment to ClimACT and the ongoing actions.

Objective: Communicate on the ClimACT project in pilot schools.

Selected pilot school: All French pilot school

Characterisation: At the beginning of the project, billboards and kakemonos have been installed in all French pilot schools to inform the school community about the commitment to the project (Figure 111). Then the billboards / kakemonos have been updated to communicate on the actions, activities and measures related to ClimACT.

Organised by: The University of La Rochelle and the Municipality of La Rochelle.

N° of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Create and install billboards



Figure 111 : Billboards and kakemonos at the school entrances

8.2 Global action 2: Eco-code contest

Description: Contest for the creation of an eco-code decided by the school community

Objective: Commitment of the school community for green behavior.

Selected pilot school: Primary school of Berthelot, Bongraine, Profit, Grandes Varennes and Marie Marvingt (Laleu), La Rochelle (France).

Characterisation: The municipality of La Rochelle launched a contest between schools for the creation of the most efficient eco-code, designed as a poster (Figure 112). The Eco-code had to be made by students and to be approved by the LCC. Five primary schools participated. The jury selected the first prize and gave a special price for all posters.

The eco code is displayed in all schools. It is visible to pupils, their parents and the school staff.

Organised by: The municipality of La Rochelle

N° of students involved: 771



Figure 112 – The French eco-code contest: jury examining the posters (left) and eco-code of primary school Bongraine (right)

Actions addressed for the implementation of LCE solution:

1. Call for the eco-code contest
2. Creation of the eco-code poster by students
3. Vote of the eco-code by the school LCC
4. Presentation of the price by the jury

8.3 Global action 3: “My low carbon school”

Description: Activities for student related to the school building operation

Objective: Understand their school building operation in order to behave for low carbon emissions.

Selected pilot school: Primary schools Jean Bart, Bongraine, Berthelot, Marie Marvingt, B. Profit, Grandes Varennes, La Rochelle (France)

Characterisation: The municipality of La Rochelle created several activities related to the environmental impact of the school building operation: electricity and gas consumptions, heat, waste (Figure 113). Questions trying to answer were such as where does the heat come from? Where do the water go after flushing the toilets? What happens to my waste? etc. The municipality of La Rochelle lead those activities. At the end, the municipality gave a model of the school building to the class (Figure 114). The point is to do an enquiry in their own school to learn about its operation).



Figure 113 – Educational activities to understand the operation of a building

Organised by: The municipality of La Rochelle

Nº of students involved: 160

Actions addressed for the implementation of LCE solution:

1. Activities for students about the operation of a building
2. Each class received a wooden-made model of their own school building
3. Back to their school the students tried to add a model of the heating system to their school model.



Figure 114 - The model of Marie Marvingt primary school, observation with students

8.4 Global action 4: Raising awareness to green IT

Description: Promotion of the comics “Le poids d’un clic”

Objective: Raising awareness of high school and university students on all the environmental impacts of the excessive use of computers and other connected electronic devices

Selected pilot school: High school Rompsay, high school Dautet and Institute of Technology

Characterisation: The excessive use of electronic and connected devices has a huge impact on the environment starting from the ore extraction to make the electronic components to the energy consumption of computers servers and the recycling of devices. 10 books “la revue dessinée” containing the comic entitled “le poids d’un clic”, were purchased for the French pilot high schools and university department. The students were encourage to read this comic from information displayed on posters and the electronic screens in the schools.

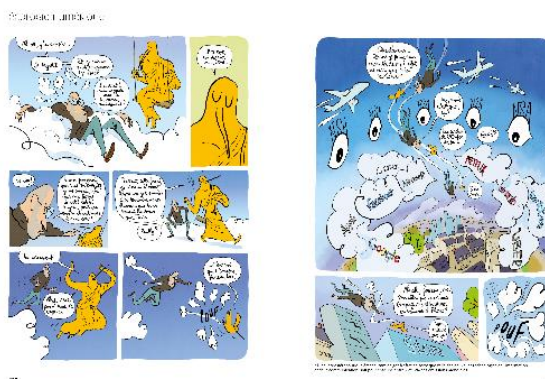


Figure 115 – two pages of the comics “le poids d’un clic”

Organised by: University of La Rochelle

Nº of students involved: potentially all students and staff from the high schools and computer department of the institute of technology

Actions addressed for the implementation of LCE solution:

1. Book purchase by University of La Rochelle and distribution in the school libraries
2. Promotion of the comic from posters and electronic screens in the schools

8.5 Global action 5: Students & ClimACT Researchers Program 2016

Description: Workshop between ClimACT members and students of ClimACT pilot schools to carry out a research associated to ClimACT project.

Objective: Raise awareness in students about the potential actions towards a low-carbon school

Selected pilot school: Students from different ClimACT pilot schools in Seville.

Characterisation: The workshop was divided into different stages: definition of different research topics, collecting data by means of a template for audits, assessment of potential actions, evaluation of results and development of poster for dissemination.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 6



Figure 116 – Workshop: Students & ClimACT Researchers



Figure 117 – Poster with the results of the workshop

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different research topics.
2. ClimACT researcher members explained the tasks and aims.
3. Each group had different weeks to complete the work
4. Assessment of results and development of poster for dissemination

8.6 Global action 6: Students & ClimACT Researchers Program 2017

Description: Workshop between ClimACT members and students of ClimACT pilot schools to carry out a research associated to ClimACT project.

Objective: Raise awareness in students about the potential actions towards a low-carbon school

Selected pilot school: Students from different ClimACT pilot schools in Seville.

Characterisation: The workshop was divided into different stages: definition of different research topics, collecting data by means of a template for audits, assessment of potential actions, evaluation of results and development of poster for dissemination.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Nº of students involved: 6



Figure 118 – Workshop: Students & ClimACT Researchers

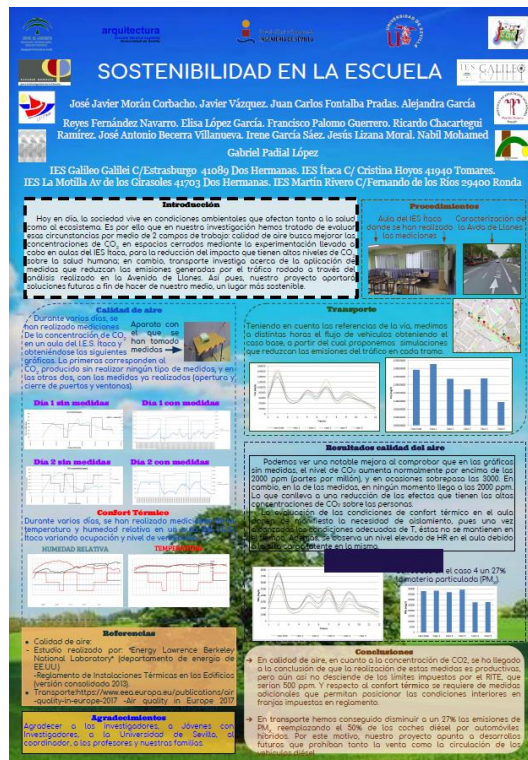


Figure 119 – Poster with the results of the workshop

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different research topics.
2. ClimACT researcher members explained the tasks and aims.
3. Each group had different weeks to complete the work
4. Assessment of results and development of poster for dissemination

8.7 Global action 7: workshop for teachers

Description: workshop between ClimACT members and teachers of ClimACT pilot schools to carry out a research associated to ClimACT project.

Objective: raise awareness in students about the potential actions towards a low-carbon school.

Selected pilot school: teachers from different ClimACT pilot schools in Portugal.

Characterisation: presentation of several online courses to the teachers, allowing them to learn and choose the methodologies to use in their classes.

Organised by: professors and students from ClimACT pilot schools and supported by ClimACT research members.

Number of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Teachers were divided into different groups with different research topics.
2. ClimACT researcher members explained the tasks and aims and help in the choice of the best approach.

8.8 Global action 8: workshop for students – creation of the LCC

Description: workshop between teachers and students of ClimACT pilot schools to carry out a research associated to ClimACT project.

Objective: raise awareness in students about the potential actions towards a low-carbon school.

Selected pilot school: students from different ClimACT pilot schools in Portugal.



Figure 120 – Students of Escola Básica Júlio Dinis learning how to be part of a low-carbon school.

Characterisation: explaining the students how they can help in the transition to a low-carbon school. At the end of the first meeting it was defined who integrated the school's LCC (Figure 62).

Organised by: professors and students from ClimACT pilot schools.

Number of students involved: all the students from ClimACT schools in Portugal.

Actions addressed for the implementation of LCE solution:

1. Students were divided into different groups with different research topics.
2. ClimACT researcher members and teachers explained the tasks and aims.
3. Creation of the LCC.

8.9 Global action 9: dissemination of the ClimACT through the schools

Description: installation of several dissemination materials through the pilot schools, informing the school community on the school commitment to ClimACT and the ongoing actions.

Objective: communicate on the ClimACT project in pilot schools.

Selected pilot school: all Portuguese pilot school.

Characterisation: at the beginning of the project, billboards and kakemonos have been installed in all Portuguese pilot schools to inform the school community about the commitment to the project.

Organised by: the LCC of each ClimACT pilot school.

Number of students involved: 0

Actions addressed for the implementation of LCE solution:

2. Creation and installation of billboards through the school.

8.10 Global action 10: energy audits in schools

Description: ClimACT project performed energy audits in 39 schools in order to find potential for energy efficiency solutions and developed a platform to facilitate the implementation of these measures and also the investment on renewable energy sources.

Objective: help the schools understand how to transition to a low-carbon economy.

Selected pilot school: all ClimACT pilot schools in Portugal.

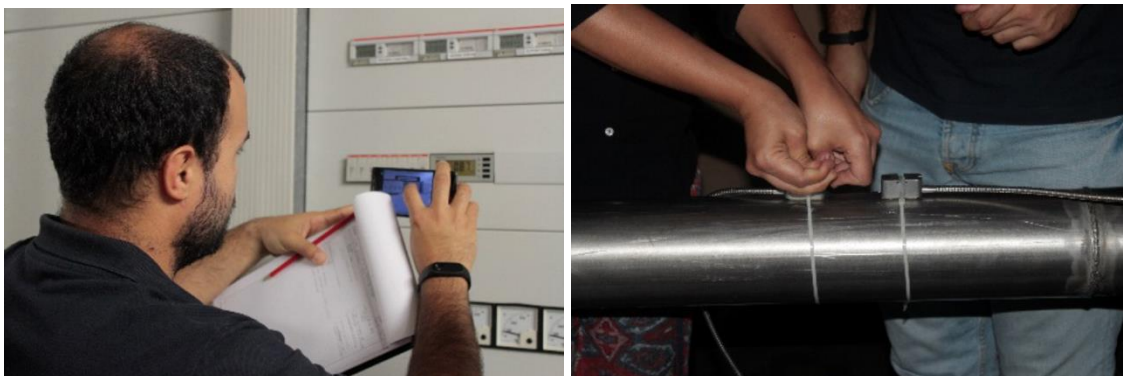


Figure 121 – Pictures of some of the energy audits that occurred in all ClimACT pilot schools.

Characterisation: ClimACT energy audits were performed with the objective of understanding the energy performance in school buildings (Figure 63). These inspections considered all energy sources and the power of equipment, allowing to calculate deviations to regular energy consumption conditions. They were also used to determine better energy management strategies. Since most of these types of buildings lack a building/energy manager, there is potential to minimize the energy consumption just by disseminating energy efficiency practices.

Organised by: ClimACT project with the collaboration of the schools involved.

Number of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Meeting with the school LCC to arrange the visit of the experts.
2. Technical visit of the team of experts to evaluate the behaviour of the energy intensive systems.
3. Dissemination of the results to the school LCC, presenting ways to improve them.

8.11 Global action 11: assessment of IAQ

Description: assessment of air quality in two classrooms in each school.

Objective: awareness to the importance of the IAQ.

Selected pilot school: all ClimACT pilot schools in Portugal (Portugal)

Characterisation: during one week each school had in two classrooms the equipments to assess IAQ (Figure 64). These measurements are of particular concern because students and teachers spend several hours per day in classrooms. The presentation the results to the schools LCC had the purpose to create awareness among school staff to prevent IAQ problems, and address IAQ problems as they occur. Some of the solutions are as simple as open one window, others require more expensive approaches as acquire air-conditioning systems.



Figure 122 – Pictures of some of the equipments used to measure IAQ in the ClimACT pilot schools.

Organised by: ClimACT project with the collaboration of the schools involved.

Number of students involved: 0

Actions addressed for the implementation of LCE solution:

1. Meeting with the school LCC to arrange the visit of the experts.
2. Technical visit of the team of experts to install the equipments in the classrooms.
3. Dissemination of the results to the school LCC, presenting alternatives to improve them.

8.12 Global action 12: gamification

Description: two games were launched this last year, one electronic (that runs in the kahoot platform) and other physical (a role play).

Objective: raise awareness in students about the potential actions for a low-carbon economy.

Selected pilot school: all ClimACT pilot schools in Portugal (Portugal).

Characterisation: ClimACT games give students the opportunity to put their knowledge into practice and hone their problem-solving skills on climate change.

Organised by: ClimACT project.

Number of students involved: all the students from ClimACT schools in Portugal

Actions addressed for the implementation of LCE solution:

1. Presentation of the games to the students.
2. Students could play both games whenever they wanted and learn about biodiversity and climate change at the same time.

9 References

9.1 References

ClimACT webpage: <http://www.climact.net/>

Electronic game: <https://play.kahoot.it/#/?quizId=3b6c17a7-444b-413a-a8ad-2dc4d83a7db1>

Physical game (EN): <http://www.climact.net/siteclimact/wp-content/uploads/2018/07/Livret-A4-Anglais.pdf>