IMPLEMENTATION GUIDE

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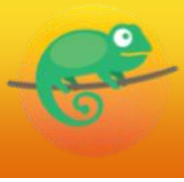


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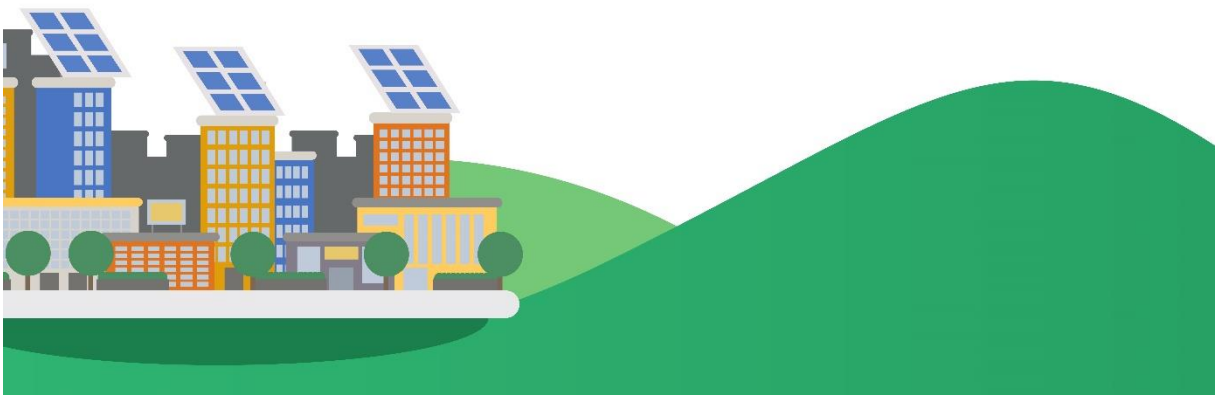
Content



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Foreword

The energy turnaround and thus the sustainable generation of energy is becoming increasingly urgent in order to achieve the climate targets agreed at the climate conference in Paris, to limit the global temperature increase to a maximum of 2 degrees Celsius or to make every effort to stay below +1.5°C if possible. The climate crisis requires swift action.

Solar thermal energy is a very efficient use of solar energy. After 14 solar camps for the construction of solar thermal systems with pupils were held in Styria (as at February 2021), the idea was born to take the concept to a new level and make it accessible to interested teachers. In this way, pupils from the age of 10 onwards can not only learn about the energy transition in theory, but also build their own solar thermal systems at school in other European countries.

Thanks to ERASMUS+ Strategic Partnerships for Innovation funding, it has been possible to produce educational materials within the framework of Our Solartown, which are now available free of charge in English, German, Greek and Slovenian. We hope this guide will inspire you and help you to take up the topic of solar thermal energy in your school and implement a Solartown project. The experiences from Austria show that a solar thermal project is perfectly suited to make this important topic understandable for children and young people. It would be nice to see many more self-built solar systems for hot water production on our roofs in the future. Students who have built such a system themselves will certainly remember it for the rest of their lives. Some may even use this technology themselves and consider it as an environmentally friendly energy source for their own future home.

The project partners would like to thank all the schools and communities that have worked so enthusiastically on the Our Solartown project and tested the developed materials in practice.

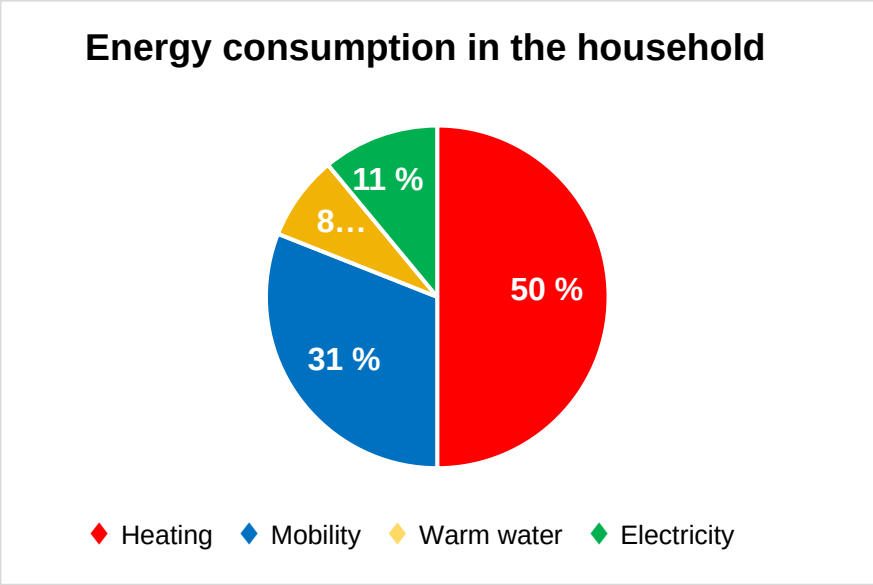
With sunny greetings

The Our Solartown project team

Introduction

Rising energy consumption worldwide and the increasing burning of fossil fuels are leading to a continuing increase in greenhouse gas emissions by humans. This is exacerbating the greenhouse effect and leading us further and further into the climate crisis. The first consequences are already noticeable in many places.
An important step towards overcoming this crisis is to switch to renewable energy sources in order to ensure a sustainable and secure energy supply in the future. Renewable energies lead to significantly lower greenhouse gas emissions and slow down climate change. These topics will also occupy future generations and thus also have great importance in school lessons.

Our most important renewable energy source is the sun. Photovoltaics, electricity generated with the help of solar energy, is very well known by now. On the other hand, knowledge about the second major way of using solar energy, the production of heat, is less widespread, although the so-called solar thermal energy is actually the much more efficient use of solar energy. In addition to the high efficiency, there is another good reason in favour of solar thermal energy: heating accounts for by far the largest share of total energy consumption:



Source: www.umweltberatung.at

The Our Solartown implementation guide is intended to show ways to teach the topic of solar thermal energy to pupils aged 10-14 years in school lessons and to use the developed Solartown materials. The focus is not only on conveying theoretical knowledge about climate change and solar thermal energy. The areas of planning a system, PR work and practice - the construction of solar collectors - are also part of the Our Solartown project.

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About this guide

In this guide you will find all the details for carrying out a project on solar thermal energy with young people:

- A description of the different learning units, role plays and materials can be found in the chapters „**Theoretical part**“ (p. 22) and „**Practical part**“ (p. 27)
- From conducting individual school lessons on the topic to a Solartown project with the construction of solar panels - the project can be implemented in different time scales. On page 29 we have compiled some examples of how the materials can be used.
- Instructions on how to use the ***Planning Tool*** to select the best site for the installation are on page 25. The ***Process Guide*** for documenting your project is described on page 26.
- Information for municipal representatives, legal aspects, tips for implementation and much more are detailed in the chapter "Good planning is the key to success" (p. 13).
- Examples of how solar panels built by students are already being used can be read on page 31.

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Two almost finished collectors, built by students
of the New Middle School Heiligenkreuz (Austria)

For more information on technical details, see the Our Solartown ***Guide for Technicians*** (Download: https://solartown.eu/symfony/public/download/teaching/78).

Who do we want to reach?

The main target group of our project are schools and teachers who would like to use the topic of solar thermal energy to raise awareness and increase knowledge among their students about the socially relevant topics of climate protection and sustainable energy production. As a very advanced and efficient technology, solar thermal energy is excellently suited for this purpose.
For all teachers who like the principle of "learning by doing" as a teaching method, ***Our Solartown*** is particularly well suited, as in this concept the pupils plan and build a solar thermal system or solar collectors themselves - of course with the guidance of adults.

A Solartown project could also be exciting for **municipalities** and **cities**, as in addition to raising awareness about climate protection and sustainable energy production, solar collectors are built that are fully functional and can be installed on or near a municipal building. At the community level, schools and other public buildings are among the biggest energy consumers, which can account for up to 60% of the municipality's total consumption. So, this is also a way to contribute to achieving the climate goals.

For all **students** involved in implementing a Solartown project, we hope to offer a slightly different and exciting way of learning. The solar panels that are then installed somewhere in the home community will hopefully remind everyone involved of their Solartown project for a long time to come.

In addition to schools and communities from Greece, Slovenia and Austria, we would also like to encourage **people from other EU countries** to implement a Solartown project.

Pupils of the New Middle School Bruck/Mur (Austria) with the finished collectors

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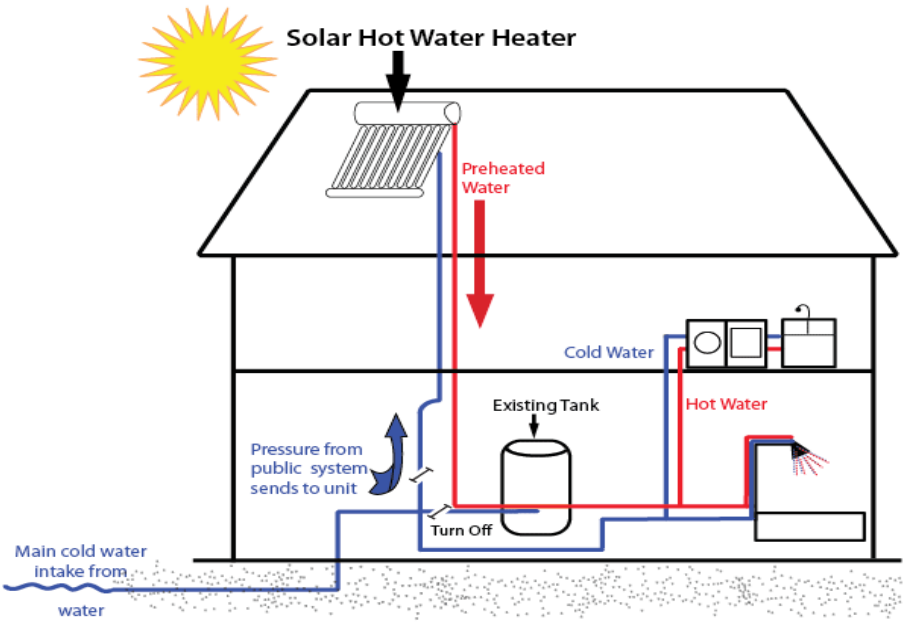
What is *Our Solartown* all about?

Solar thermal energy

The basic principle of solar thermal energy is simple: solar radiation is "collected" with the help of solar collectors and the heat generated by this process is transferred to a heat transfer medium - usually a liquid. The heated fluid is either used directly (when tap water is heated directly as in warmer countries) or indirectly via a heat exchanger that transfers heat from the fluid to tap water or the fluid in the heating circuit (for space heating). The efficiency of solar thermal systems is between 70 and 85 percent.



Solar thermal energy is therefore clearly distinguished from photovoltaics and concentrated solar power systems (CSP), both of which provide electricity, while solar heat is adaptable to different conditions and can be used in many areas:

- Hot water production
- Space heating
- District heating
- Industrial process heat
- Air conditioning and cooling

Most solar thermal systems in operation today, are used to provide hot water and space heating. The solar heat can be generated on the spot for individual houses or supplied via a district heating network. Using this very efficient method more widely could make an enormous contribution to achieve the 2030 climate goals.

The Erasmus + projekt *Our Solartown*

Our Solartown is a project that aims to show students aged 10 to 14 and teachers how crucial renewable energies are for climate protection. Using **solar thermal energy** as an important method for using the renewable energy source "sun", teachers and pupils can deal with these topics in an experiential and practical way with the help of the learning materials. In our so-called ***LUs***, the **l**earning **u**nits, they can learn a lot about the theoretical background and deepen their knowledge with interactive methods.

Beyond that, however, it is also about gaining practical experience:

- Building solar panels requires a lot of preparatory work and planning.
- The right location must be found and the right size of the plant is also important in order to make the best use of it.
- The decision about the location can only be partially supported by tools with the preparation of facts; it often takes place through weighing and weighting other influencing variables.
- Costs need to be calculated and financing has to be organised.
- By building their own solar collectors, pupils can learn to understand very well how the plants work.
- The pupils, especially the girls, get a positive experience with technology and develop handicraft skills.
- Collector construction is a good example of teamwork.
- Negotiating with the people involved and convincing stakeholders, such as municipal representatives, companies, installers, financiers, etc., teaches skills that are always helpful in business life.
- Teachers get to know their students from a completely new side.

Mounting the protective glass

In addition to teaching materials that can be used offline, there are also online tools and e-learning units. For more information and all materials and tools, please visit:

https://solartown.eu/

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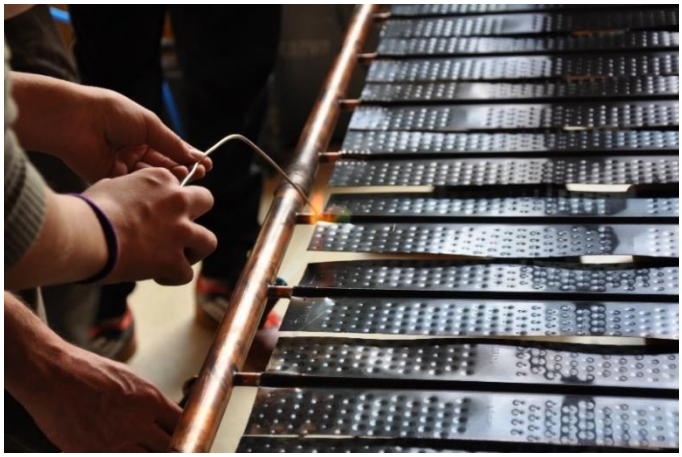
Educational goals

Students:

- can experience the principle of "**learning by doing**": building solar panels will provide knowledge and experience with a technology that uses a renewable energy source.
- also gain theoretical **knowledge about climate change, renewable energy and solar energy:**
    - They can explain the difference between fossil and renewable energy and correctly classify the different energy sources.
    - They understand the greenhouse effect, climate change and its causes.
    - They know what the consequences of climate change are for living things on earth.
    - They will learn about the different technologies for using solar energy.
- get excited about **research, technology and innovation** (RTI) in the context of (renewable) energy.
- learn about **scientific ways of thinking and working methods** and conduct their own research with experiments on renewable energies.
- learn various techniques for presenting a project (PR in social media, print media, video platforms, blogs, etc.).
- independently plan an event to present the project results.
- learn to put themselves in different situations and people's points of view, and to discuss disagreements.
- learn about the job of an installer and **possible career paths in the field of renewable energy.**



Soldering the copper manifolds to the absorber strips

For teachers there are the following advantages:

- Offline teaching materials for cross-curricular education on climate change, renewable energy, and solar thermal energy.
- All materials are available in 4 languages (English, Greek, German and Slovenian).
- Materials that can be used in variable time frames - from single school lessons or multi-day solar thermal projects to year-long projects.
- Online e-learning for pre- or post-processing of what has been learned.
- Online tools offer you a modern way to prepare the topics for the students.
- In the project, extracurricular experts can be involved (linking school & economy).
- Theoretical knowledge can be put into practice and "grasped".
- Cooperation with the necessary stakeholders (politics) can be practiced (role plays or in reality).

Curriculum reference
Students:

- get an insight into the application of knowledge taught in technical and socio-political subjects such as physics, mathematics, geography & economics, biology as well as computer science.
- learn about the importance of interdisciplinary action.
- learn responsible and reasonable planning of solar thermal systems to enable optimal use of energy.
- benefit from awareness raising in terms of society's goals in the context of energy and climate protection & acquire practical knowledge in this regard.

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9 good reasons to start a Solartown project at the school in your municipality

1. The Solartown project can be easily implemented in any municipality and demonstrates how simple **climate protection** can be.
2. The self-built solar system **can be used in a variety of ways in your municipality's public buildings**, such as water heating, building heating, swimming pool heating, or cooling.
3. The project can raise **awareness on renewable energies**, especially solar thermal energy, for climate protection and the energy transition in the municipality.
4. Numerous **teaching materials and an online platform** on the topic can be used by schools in your municipality as part of the project. An **online Planning Tool** to identify the best locations for a solar installation in your municipality in terms of energy and cost efficiency is also available free of charge.
5. By using solar thermal energy, your municipality makes itself **less dependent on fossil fuel suppliers** and the often highly **fluctuating commodity prices** of gas and oil.
6. A successful Solartown project at a school in your municipality can become **a model for other schools or even public buildings** in the region. It inspires citizens and local stakeholders to follow your good example and become more energy efficient.
7. A solar system reduces the cost of providing hot water or, in the case of partially solar heating, the cost of heating as well. Thus, **energy costs can be saved** from day one of installation.
8. Installing a solar energy system in your municipality is usually supported by **government grants** due to its environmental impact.
9. The Solartown project helps **reduce CO_2 emissions in your municipality** and meet local/regional climate and energy goals. It also shows your commitment to a sustainable future and an energy-conscious society.

Good planning is the key for success

Before you start planning a ***Solartown project*** in your school, you should clarify a few things. This will ensure success, both in your work with the students and in the later use of the self-built solar panels.

A Solartown project can be implemented on a wide variety of scales. From individual school lessons, over project days to a project week or even a year-long project, everything is possible (see Usage examples, p. 29). It is important to decide whether you also want to build collectors with the school class or limit yourself to the theoretical learning units and role plays. The latter, of course, requires less preparation (only the procurement of the materials specified in the learning units and a time schedule). However, experience from previous projects has shown that building solar collectors on their own is a very special experience for the students that they will certainly not forget any time soon.
If you want to build solar panels with the school class or a group of students, consider the following points:

1. WHO ARE THE PARTNERS AND STAKEHOLDERS?

For the implementation of a Solartown project it is good to have a strong **team**. Important partners for the implementation could be:

- **The municipality:** Often the municipality is responsible for the building and may be willing to provide some of the funding.
- **The municipality's energy or heat supplier** (public utility company, etc.): Solar collectors use solar energy efficiently, require relatively little maintenance and can be used for a long time. For the energy supplier, they may represent an interesting extension of the energy supply.
- **Installers:** The installer companies in the region are competent partners for the installation of the system, especially those with experience in the field of solar thermal energy. They may also be able to support the students during construction.
- **Energy agencies:** The local energy agency is also a good partner for the Solartown team. They are experts in the use of renewable energy and are probably very interested in a solar thermal project.
- **School:** The head teacher should definitely be part of the project team. Teachers of the subjects biology, physics or technical handicrafts, for example, can be considered as responsible teachers. More important than the subject, however, is the commitment or enthusiasm for the project.

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2. WHAT NEEDS TO BE CONSIDERED WHEN SETTING UP A SOLAR ENERGY SYSTEM?

In addition to the structural requirements of the building, it is important to consider the function and use of the solar thermal system. For optimal use, the correct dimensioning, the type of collectors, storage of the generated heat, as well as connection and maintenance of the system are important, too.

What collectors are used?

As part of our Solartown projects, **flat plate collectors** are built. There are ready-made kits for this kind of collector, which make the procurement of the material and also the construction very easy, as all parts have already the right size.

Where should the solar thermal system be installed?

Often there are several options for the future location of the solar thermal system. When comparing the options and determining the best location, the ***Our Solartown Planning Tool*** can help you (see p. 25). On page 31 you can see some examples of places, where they self-made solar panels can be installed.

Which constructional requirements have to be considered?

- Size of the building
- Type of construction of the building (bungalow, multi-storey, etc.)
- Is the system being built as part of a new construction or renovation, or is it being retrofitted?
- Where can the collectors be placed or mounted? On the roof of the building or an outbuilding? On the ground next to the building? On the facade?
- How large is the available area?
- What is the inclination of the surface (for a roof)?
- Is the area facing south? That would be optimal! Or does the orientation deviate from south?
- Is the roof shaded at times?
- What type of mounting is chosen for a system on the roof? Raised on the roof to improve the angle of inclination or in-roof (integrated into the roof)?
- Does the building meet the static requirements?
- Is there lightning protection?
- Where can a hot water tank/buffer tank be placed?

For what use is the plant intended?

Will the solar panels be used for **hot water production**, to support **heating**, or a combination of both? In addition, the heat produced can also be used for **solar cooling** and air conditioning of buildings.

System components:

For efficient operation of the solar system, the main questions are as follows:

- Should the plant be integrated into **an existing system**? Then it should be clarified which materials and requirements are necessary for this.
- Where is the **heat stored**? Is a buffer tank available or does it have to be purchased?
- Which **pumps** are used? High-efficiency pumps are favorable, the performance of the pumps should be matched to the system.
- To keep heat losses low, the **pipes** should be **insulated**.
- Should **monitoring** take place? Especially in school buildings, but also in other public buildings, the installation of a **heat meter** is exciting. This way, the installation can also serve as an illustration for teaching in further classes and year groups after the building has been completed.

Dimensioning of the solar system:

The dimensioning of the system depends on the type of use and the number of people to be supplied.

Dimensioning of the system for hot water:

- How many people use the hot water and what is the hot water demand per day?
- How is the building used during the summer months/holidays?
- Is there a hot water connection for washing machine/dishwasher?

Dimensioning of the system for additional heating support?

- What is the heating demand of the building? Is it below 45 kWh/m² or above?
- Is there an energy certificate for the building? Is a low heating flow temperature possible (up to 35°C)?

Maintenance of the plant:

Once the solar system is in operation, it usually provides thermal energy immediately. In order to have a trouble-free performance over a long period of time, the system should be maintained on a regular basis. It is also possible to arrange a maintenance contract with an installer company in the area.

Legal aspects depending on the country

Consider some legal aspects before installation depending on the country.

In **Slovenia** all we have to acknowledge is the **Law on Construction of Buildings**, and it is not necessary to acquire approvals or permits, unless we interfere with the building construction or the spatial plan. These are only investment maintenance works. It is recommended to obtain location information and a school permit or **permit from the municipalities** if we do not own the building.

In **Austria,** the regulations of the **respective building code**, the **provisions of monument protection** and, if applicable, the **local building codes** must be observed when installing a solar thermal system. In Austria, these are regulated on a federal state basis.

Up to a size of 100 m2, you do not need a building permit for the installation. Nevertheless, it is advisable to inform the responsible authorities of the upcoming construction work in the event of uncertainties, regarding monument protection etc. in order to prevent any problems.

In all cases, it should be noted that the appropriate **accident prevention measures** should be taken for all installation work on the roof. An authorized person should carry out the installation and commissioning of a solar system.

In **Greece,** for the construction and operation of a solar thermal system, the **rules of the Building Regulation**, the **provisions for the protection of monuments** and, where appropriate, **local rules on construction** must be observed.
Appropriate **accident prevention** measures should be taken for all mounting operations on the roof.
Assembling and first operation of a solar thermal system should be performed by a professional.
All regulations are included detailed in the following laws:

- Building Energy Performance Regulation [Κανονισμός Ενεργειακής Απόδοσης Κτιρίων (ΚΕΝΑΚ 2017) (ΚΥΑ Α.Π. ΔΕΠΕΑ/οικ. 178581/30.06.17, ΦΕΚ 2367/Β/12–07–17)]
- New Building Regulation Law No.4067/2012 [Νέος Οικοδομικός Κανονισμός ΝΟΚ Ν.4067/2012]

In **Belgium** no other particular measure should be taken into account to install a solar thermal system. As all the other European countries, you need **the permission of the landlord** and you have to respect the **security measures**, the **monument protection measures** (if it is the case) and any other normal measure as you were installing anything else.

3. POSSIBILITIES OF FINANCING A SOLAR THERMAL SYSTEM

Once the location and size of the plant are established, **the costs can be calculated**. The ***Our Solartown - Process Guide*** can be helpful here.
Now you can start to think about the financing. There are various possibilities, some of them depending on the country.

In **Slovenia** there are the following possibilities:

1. The School Fund - there are funds raised by grants, parents and pupils themselves.
2. Municipality - as the owner of the school or through a local public call for dedicated funds.
3. Eco Fund - Environmental Public Fund for co-financing environmental projects where you can obtain 20% subvention or loan to buy and install the solar thermal system. This also applies to public institutions.
4. Organisation of performances and events - admissions to the school dance, theatre performances, singing performances, sporting events, markets with children's products, bingo ...).
5. The collection of waste paper jams, appliances ...
6. Sponsorships - Finding local businesses that work in a similar field.
7. Crowdfunding: Multiple investors simultaneously contribute funds and help entrepreneurs, groups or individuals to realise their planned project, or to find different crowdfunding plat-forms through donations (raising money for charity without donors receiving rewards).
   It is important how you present the project in the selected web platform. You have to set a period for collecting sources and fundraising goal (how much of the founding you want to obtain). Since each online platform has its own way of crowdfunding, it is necessary to know the conditions of the campaign, how much financial contribution they require (how much percentage of the raised funds and the cost for each transfer). You also need to consider what happens if the campaign is successful or not (whether the money is paid anyway), and what your chosen platform provides (assistance with the campaign…)
   Possible Crowdfunding platforms are:
   - https://wemakeit.com/
   - https://www.gofundme.com/
   - https://www.crowdfunder.co.uk/
   - https://donatemyschool.com/

In **Austria** there are various possibilities for financing a solar thermal system:

1. Funding from the municipality: The municipality supports or finances the project as a school maintainer, or the municipality applies for funding from Communal Credit Public Consulting.
2. Submission as a climate-school project in the program "model regions for climate and en-ergy" of the "Klima- und Energiefonds".

   https://www.klimaundenergiemodellregionen.at/

3. Apply for funding at "Talents regional" - FFG. It is a joint project with a regional focus: part-ners from business and research cooperate with educational institutions.

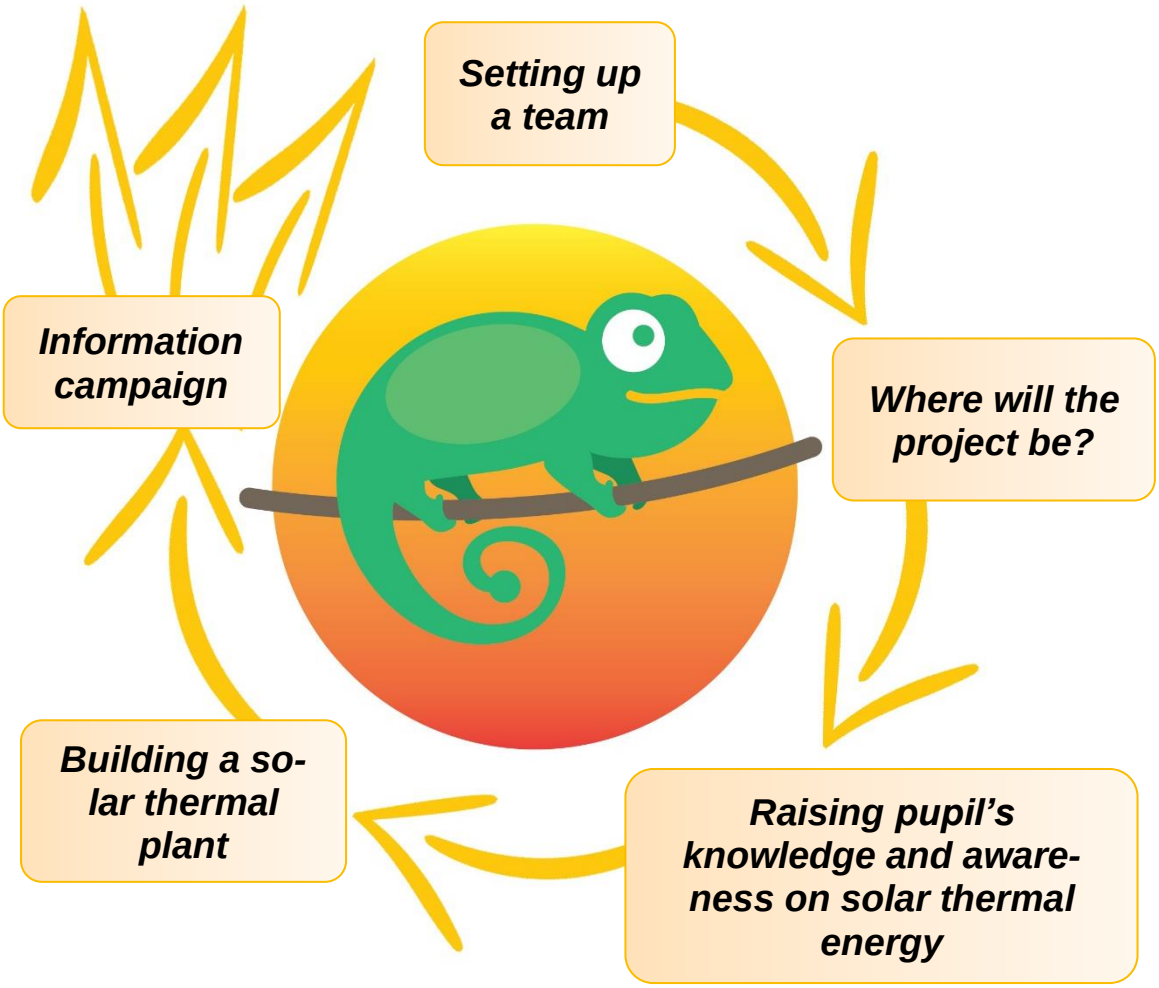
   https://www.ffg.at/talente-regional
4. Support from the parents' association of the school.
5. Organize fundraising and/or auctions
6. Performance of plays and musicals
7. Organizing flea markets, selling pastries and other home-made or hand-made items.
8. Sponsorship by regional companies or banks.

In **Greece**, there are all-saw various possibilities for financing a solar thermal system:

1. Public Investment Program
2. National Strategic Reference Framework (NSRF)
3. National programs e.g. ILEKTRA Program for Energy upgrade of public buildings
4. Consignment Deposits and Loans Fund
5. European funding sources
6. Own funding by the local municipality …. probably from special duties (e.g. Special RES Duty, Duty for the Development of Industrial Areas with Power Generation from Lignite plants. etc.)

Necessary steps for a successful project

After the implementation of the first two steps, the formation of a project team and the creation of the necessary conditions (site selection, technical requirements, financing, as described above), it can go to the practical implementation in the school. The Solartown project can be implemented with one or two school classes. Of course, it is also possible to implement the project with a group of particularly interested students from different classes. A great possibility is also to invite a class from a partner school to the project. In this case, however, it may be necessary to arrange for accommodation and meals for the guests.



Teaching the necessary background knowledge, building the solar panels with the pupils and public relations work are described in more detail in the following chapters.

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Overview of all materials and tools

In the framework of the project ***Our Solartown***, some learning and teaching materials and tools have been developed to support interested people in implementing a project on solar thermal energy:

Learning units:

- LU 1_1_Energy sources
- LU 1_2_Solar energy
- LU 1_3_Climate change
- LU 2_Solar energy technologies
- LU 3_1_Site selection
- LU 3_2_Solar thermal systems_planning installation
- LU 3_3_Solar thermal system costs
- LU 4_1_Public relations

Role plays:

- RP 1_3_Greenhouse effect
- RP 3_1_Site selection
- RP 3_2_Installation_pros and cons
- RP 3_3_Financing a solar plant

Practical units:

- LU 4_2_Solar newspaper
- LU 5_1_Practical realization
- LU 5_2_Presentation
- LU 6_Excursions

You can download all documents under:
https://solartown.eu/symfony/public/teaching

E-Learning:

- E-Learning_1_1_Energy sources
- E-Learning_1_2_Solar energy
- E-Learning_1_3_Climate change

You can find all e-learning lessons under:
https://solartown.eu/elearning/user/login

Planning Tool: Online tool to find the best spot for your solar plant
You can find the Planning Tool under: https://solartown.eu/symfony/public/map/

Process Guide: If you want to take part in the Solartown award use the Process Guide.
You can find the Process Guide under: https://solartown.eu/processmanual/

What is there beyond this?

There is another document on our website that might be very helpful: The ***Guide for Technicians*** of ***Our Solartown***. If you want to build a solar thermal system with your students, you may need the help of a technician. In this guide, technicians will find helpful information about the building process, tools, materials and working with children.

On the ***YouTube channel*** of ***Our Solartown*** you can also find helpful videos that document and explain the individual construction steps and introducing the project.

https://www.youtube.com/channel/UCagi9EYkafhEO0zNMTjaw0A

Theoretical part: Educational materials and e-learning

The LUs – our learning units

Before solar collectors can be built with pupils themselves, the theoretical background should be covered. In the case of projects lasting several days, it is of course also possible to carry out the theory in parallel with the practical part, the construction of one or more solar collectors. In this case, the class is divided into two groups that alternate between theory and practice. This adds some variety to the project for everyone.

As part of the project ***Our Solartown***, some teaching materials in the form of **learning units** (**LUs**) have been developed to help you cover the necessary theoretical basics.

LU 1_1_Energy sources

This unit deals with energy sources and the differences between non-renewables and renewables. The different energy sources can be discovered by the pupils with all their senses.

LU 1_2_Solar energy

The sun is our most important source of energy and the subject of this unit. Pupils learn that visible white sunlight is made up of all the colours of the rainbow and that the different types of sunlight have different effects on us and our environment. Furthermore, they can find out how we can protect ourselves from dangerous solar radiation in an experiment.

LU 1_3_Climate change

In this learning unit, students learn a lot about climate change, global warming and its consequences. With the help of a quiz, the knowledge is shared in a fun and interactive way.

LU 2_Solar energy technologies

Solar energy can be used in different ways. The various technologies with their different methods and working principles are the subject of this learning unit.

Free-standing solar collectors in St. Ruprecht an der Raab (Austria)

The learning units with the number 3 deal with the planning of a solar thermal system.

LU 3_1_Site selection

The selection of the optimal location is particularly important when planning a solar thermal system. In this unit, the pupils learn about the different aspects that have to be taken into account. They decide for themselves on the importance of the different factors. They also work with the ***Planning Tool*** from ***Our Solartown*** (see p. 25) and can directly compare several locations.

LU 3_2_ Solar thermal systems_planning installation

After choosing the location, there are other things to consider when planning, such as required material, tools needed, legal aspects and general conditions. The students also get to know the ***Process Guide*** of ***Our Solartown*** (see p. 26), which supports them in planning and documenting the project.

LU 3_3_ Solar thermal system costs

After choosing the location and considering the other aspects, the costs for the planned system can be calculated. The Process Guide from Our Solartown can be used here, too. In addition, financing options are also part of this learning unit.

LU 4_1_ Public relations

LU 4_1 deals with the basics of public relations. Part of a project is always to present it to the outside world and to make it known. This unit deals with creating newspaper articles, blog posts, radio reports and producing videos on the topic.

Inform the others with a poster

The e-learning units

On the **website** of ***Our Solartown*** there is the possibility to do three ***e-learning courses***. For this, a user account must be created first. After logging in, the courses on the topics of energy sources, solar energy and climate change can be completed. The content is similar to the course units LU 1_1 to LU 1_3 (see above), but is presented differently. Therefore, the e-learning units can be used well for pre- or post-processing or also for homeschooling.

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The role plays

Within the framework of the Our Solartown project, four ***role plays*** - matching the respective ***LUs*** with the same number - were developed, especially to make the interaction with stakeholder tangible for the students. In different scenarios, the students have to take the position of a stakeholder group and argue like them. The aim is to find a solution that all parties can "live with".

RP 1_3_Greenhouse effect

In this role play, the pupils become sun rays and greenhouse gases and act out the greenhouse effect. This allows a better understanding of the mechanism that leads to global warming.

RP 3_1_ Site selection

In this role play, the city council meets to select a school to install solar panels to heat water. Three different schools are considered. Several stakeholders participate in the meeting: the city council, the school management, representatives of the parents' associations, representatives of the installation company and representatives of an environmental organisation.

RP 3_2_ Installation_pros and cons

An installation company wants to build a solar water heating system in a public swimming pool that currently runs on natural gas. In the municipal meeting on this issue, their representatives present the plan. The meeting is attended by several stakeholders: the town council, representatives of the citizens, of the swimming pool, of the gas supplier that supplies gas to the swimming pool and, of course, representatives of the solar thermal company.

RP 3_3_ Financing a solar plant

A school with high hot water consumption (heated swimming pool, much used gymnasium) wants to change the hot water generation system and install solar panels to reduce costs. Unfortunately, the school lacks the financial resources, so a sponsor is sought to cover the costs. The school turns to the media to gain public attention. It then contacts some businesses and the municipality and tries to convince them to finance the project.

The Tools

The tools have the following learning objectives for students:

- Learning to use new software
- Use manuals for software
- Collect data from different sources
- Interpret results
- Writing (newspaper) articles

The Planning Tool

As part of the project, a ***Planning Tool*** was programmed that is fully functional and can calculate the free planning of self-build solar thermal systems. This functionality can be used in the school project, and is also available to all other interested parties after registration. Thus, it is possible that the parents of the pupils - inspired by the enthusiasm of their children - can plan solar thermal systems for their private homes.

Transport of the finished collector

On the planning tool page there is a quick guide in a few steps, and a more detailed guide as well as an explanation of the outcomes is available for download there.

In the second step, the weighting can be used to create a ranking. This step can be used by teachers to explain the weighing of facts and to clarify that decisions do not only depend on numbers; they merely facilitate the discussion about a topic.

In the third step, one of the projects must be selected in the results column so that the values are transferred to the Process Guide.
You can find the planning tool at: **https://solartown.eu/symfony/public/map/**

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The Process Guide

This tool accompanies the project and illustrates to the students, which steps are necessary to implement it.

Learning

It starts with the theoretical part. The learning units and materials are available for download on our ***Teaching Materials page*** (https://solartown.eu/symfony/public/teaching).

On the ***Learning page***, the learning progress can be documented by clicking on the corresponding icon and writing an article about it.

Preparing

This page summarises the steps to consider before building the plant, the steps can be documented to keep an overview of what still needs to be done.

Costs

There is some playing with numbers on this page - the key point is that the investment will pay for itself at a certain point in time and from then on energy can be provided without any further costs. Solar thermal energy is not only good for the environment, but also a good long-term investment.

Construction and activities

More articles can be written on these two pages to document the progress of the project. If it is not possible to actually build a plant, there is still the possibility to put together a solar newspaper with the other activities or to submit it to the Solartown Award by May 31, 2021.

Tell a friend

„Do good and talk about it": All PR activities (in social media, print media, video platforms, blogs, etc.) can be recorded here.

Solartown Newspaper

Here all the articles entered in the previous steps can be compiled into a newspaper.

Award Submission

A project can be submitted until May 31, 2021 to win the European Solartown Award. Three short questions and articles from the Solartown newspaper are enough to win material prizes of up to 500 euros for your class.

Practical part: How to build a solar thermal plant

„Learning by doing! - The practical learning units

Experience from previous Solartown projects shows that the practical part is particularly liked by the participating pupils! The practical learning units deal with exactly these things, where the students can take action themselves. Two learning units are dedicated to public relations, one to the construction of the plant and an-other to the topic of excursions.

LU 4_2 Solar newspaper

On the one hand, producing a solar newspaper is a good way to promote the project, but on the other hand, a newspaper about the Solartown project is also a nice summary and reminder for all participants. It can contain background information from the theoretical learning units and summarise the contents. Photos of the construction of the plant as documentation of the work steps carried out by the pupils themselves and of excursions round off the whole newspaper. For this learning unit, it is again possible to work with our ***Process Guide***, which facilitates the collection of articles and photos as well as the compilation of the newspaper.

LU 5_1 Practical realization

This learning unit is about the construction of solar collectors. In addition to the necessary preparations, requirements for the workplace and tools needed, all materials are also listed. Each step is described in detail and illustrated with photos. We recommend that a technician or professional service provider be involved in the construction of the system to support the teachers and students. Additional technical information can be found in the Our Solartown ***Guide for Technicians***, which can be downloaded by clicking on the link below: https://solartown.eu/symfony/public/download/teaching/77

The insulation of the collector is important to prevent heat loss.

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LU 5_2 Presentation

The construction of one or more solar panels by pupils and the realization of a Solartown project is a great achievement. It is a good idea to recognise this achievement at an official presentation. For the students it is a good experience to plan an event. They learn to speak freely in front of an audience, to do interviews and to organise an event. Building solar panels is also a nice topic for the local press, who will probably be happy to report about the project with the help of the information from the event.

The success should be celebrated!

LU 6 Excursions

Excursions are a welcomed change from everyday school life for students, because in addition to imparting knowledge on the topics of climate, renewable energy and the construction of the solar plant, students should also be made aware of a sustainable energy economy in an experience-oriented way. The learning unit contains information for the preparation of an excursion, ideas for possible excursion destinations and worksheets with the help of which the pupils can record the information they have received.

Excursion to the district heating of the municipality

Usage examples for the materials from Our Solartown

1. The overall project

If all the materials and tools provided are used in the class and also a solar thermal system is built, this might be a project for a year or half-year programme:

- 1 theoretical learning unit (**LU**) per week (duration: 1 - 2 school hours)
- and 2 whole days for the practical part – the construction of a plant.

2. If you want to **focus on the practical part - building the solar system** - we recommend the following learning units:

LU 2_Solar energy technologies	45 min.
LU 3_1_Site selection	45 min.
LU 3_2_Solar thermal systems_planning installation	45 min./90 min
LU 5_1_Practical realization	approx. 6 – 8 hours/collector
LU 5_2_Presentation	**Preparations:** 45 – 90 min **Final rehearsal**: 30 -45 min **Event:** max. 60 – 90 min

3. If you cannot or do not want to do the construction, but still have plenty of time:

LU 1_1_Energy sources (or e-learning LU1)	45 min.
LU 1_2 Sonnenenergie (oder e-learning LU2)	45 min.
LU 1_3_Climate change (or e-learning LU3)	45 min
LU 2_Solar energy technologies	45 min.
LU 3_1_Site selection	45 min.
LU 3_2_Solar thermal systems_planning installation	45 min./90 min.
RP 3_1_Site selection	45 – 180 min.
RP 3_2_Installation_pros and cons	45 – 180 min.
RP 3_3_Financing a solar plant	45 – 180 min.
LU 6 Excursions	Depending on excursion type and distance

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3. If you cannot do the construction and have limited time:

LU 1_1_Energy sources (alternative e-learning LU1)	45 min.
LU 1_2_Solar energy (alternative e-learning LU2)	45 min.
LU 1_3_Climate change (alternative e-learning LU3)	15 – 30 min.
LU 2_Solar energy technologies	45 min.
RP 3_1_Site selection	45 – 180 min.
LU 3_2_Solar thermal systems_planning installation	45 min./90 min.
RP 3_3 Financing a solar plant	45 – 180 min.

4. If you cannot do the construction and have very little time:

LU 1_1_Energy sources (alternative e-learning LU1)	45 min.
LU 1_2_Solar energy (alternative e-learning LU2)	45 min.
LU 1_3_Climate change (alternative e-learning LU3)	45 min.
LU 2_Solar energy technologies	45 min.
RP 3_2_Installation_pros and cons	45 – 180 min.

5. Replacement lesson:

The learning units are generally designed in such a way that they can also be used as "stand-alones" within the framework of a replacement lesson - with old-er pupils, for example, you can also work through them in English lessons.

LU 1_1_Energy sources	45 min.
LU 1_2_Solar energy	45 min.
LU 1_3_Climate change	45 min.
LU 2_Solar energy technologies	45 min.
RP 1_3_Greenhouse effect	15 – 30 min.
RP 3_1_Site selection	45 – 180 min.
RP 3_2_Installation_pros and cons	45 – 180 min.
RP 3_3_Financing a solar plant	45 – 180 min.
G 3_1_Collector construction game	25 min.

Where can the self-built solar collectors be installed?

The self-built solar collectors can be used in many ways by the municipality in public buildings. They can be used exclusively to heat water, to support heating, to heat swimming pools or even for solar cooling. Depending on the needs, they can also be combined and used as follows:

- **for solar water heating**

In order to reduce the energy costs for hot water production in public buildings, it makes sense to install the system where a lot of hot water is needed in the period from May to September, such as for the **showers of a gymnasium in a school** or a **sports centre**, which are also used by sports clubs during the summer holidays.

Self-built solar system on the clubhouse
of the sports field of Stubenberg (Austria)

- **for solar support of the buildings' heating system**

Solar thermal energy can also be used to support heating. Since solar radiation is strongest in summer, but the heating demand is greater in winter, the heating demand of a house can rarely be completely covered by solar heating. Heating with solar energy is therefore not a replacement for an existing heating system, but mainly a support system that covers a certain part of the heating demand, especially in the transition periods.

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- **for the expansion of an existing solar system for hot water preparation or heating support**

If an already existing solar thermal system was too small to cover the required hot water demand, it can also be extended by the self-built solar collector system.

Self-built solar collectors expand the existing system of the Karl Morré secondary school in Graz (Austria)

- **for solar heating of swimming pools**

The water of a public outdoor swimming pool is very suitable for heating by a solar thermal system, but must be dimensioned accordingly. However, larger swimming pools that are heated all year round require an additional main heating system. In this case, it is again possible to expand an existing system with the self-built solar system and integrate it into the existing heating system.

Solar system at the outdoor pool of Liezen (Austria)

- **for solar cooling**

When using solar thermal energy for cooling, a refrigerating machine is driven by the solar heat. Solar cooling can be particularly useful in a **public office building or retirement home**, for example, where there is a great need for air conditioning in the summer.

Contacts

WEBSITE: https://solartown.eu/

NATIONAL CONTACTS:

akaryon GmbH, Austria

Website: http://www.akaryon.com/

Climate Alliance Austria

Website: http://www.klimabuendnis.at/

Solar Heat Europe/ESTIF

Website: http://www.solarheateurope.eu/

KPE Pertouliou Trikkeon, Greece

Website: https://blogs.sch.gr/kpepertoul/

VseUK Institute, Slovenia

Website: http://www.vseuk.si

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