Interreg
Danube Transnational Programme
EcoVeloTour

Study on SMART bike rest places concept development

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Year 2020.

The material presented in this publication is the Spatial Programming Study for Objects temporary residence of pedestrians and / or cyclists using the routes through the Republic of Serbia, mainly along the Danube River, but also beyond.

CONTENT:

spatial site representation

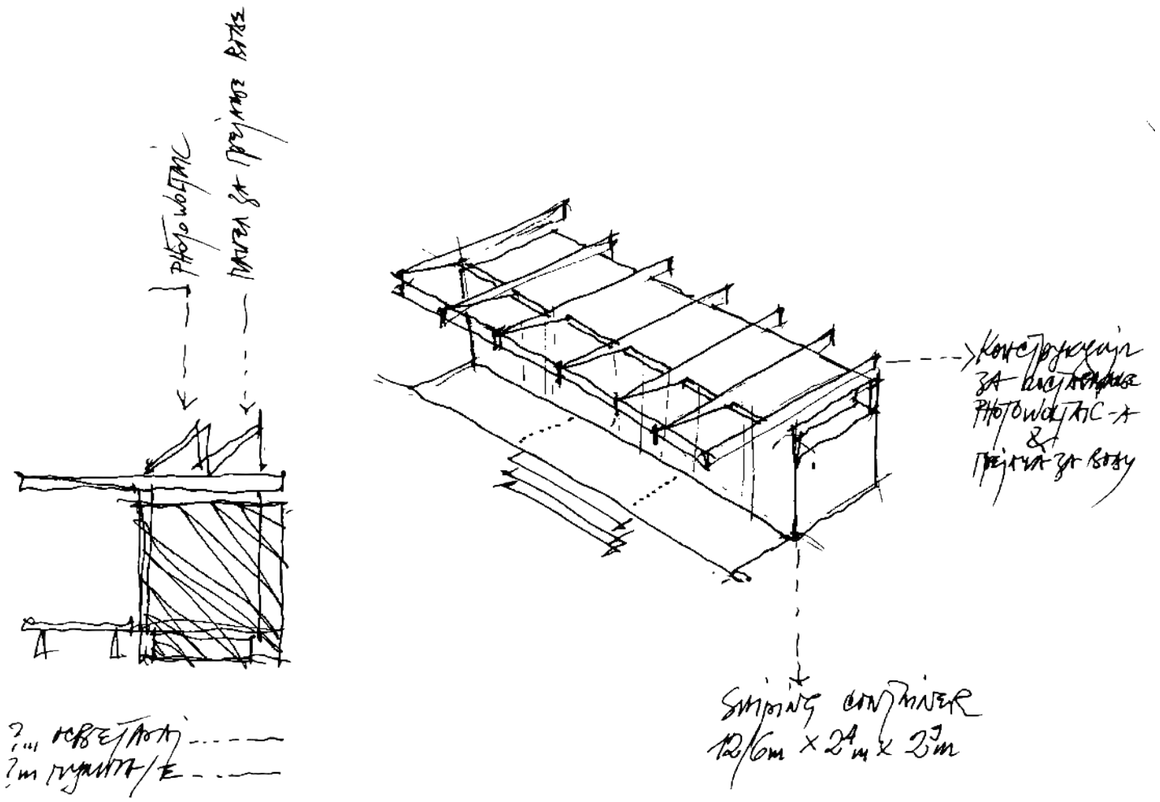
The spatial-program study aims to consider the resource and spatial possibilities and limitations of the construction of these objects, with the task of adopting the general conception, the selection criteria of location and spatial disposition of the object through the evaluation procedures.

At the same time, the basic functional, technological and technical characteristics of the building, the method of construction, the conditions of exploitation, the relation to space and the environment, as well as the bases for economic analysis should be determined.

During the design of the study, several variant solutions are analyzed, as shown here, and then the choice of the optimal variant is made based on natural, technical, technological, economic, functional, ecological and other conditions.

The result of this study should be a series of directives, the common characteristic of which is directed towards the optimization of a large number of these factors, the most important of which is the ratio of invested resources and the overall impact that the project will have in its realization. In addition to the verbal explanations and instructions, the study should contain a solution of the typed program elements, in terms of defining the necessary common characteristics of future temporary residence facilities, foreseen by this project.

On the basis of such conditions, the study also contains graphic documentation that represents the spatial distribution of content, the way they are used and the movement of users in the exploitation of typed objects, as well as the definition of its materialization and the necessary visual identity as a whole and the necessary details.



02.1 Concept

The problematization of the task involved several equally important items:

-Difference of ambient environments in which new objects of this kind are envisaged is just one of them, but it is very important. Its totality can be viewed through the analysis and relationship of physical / material and metaphysical / intangible factors.

The primary and certainly important set of problems relates to the proper distribution of the required program elements and their circuits (traffic, movement of the expected number of people at certain intervals, different modalities of functioning in competitive, recreational, or other parallel mode), whose capacities require careful sizing in addition to correct sizing orientation (according to insolation as well as other physical parameters) and disposition (according to appropriate scenes, vistas, related contents, commonalities related to these types of activities, etc.).

The special dimension of the new infrastructure (physical) culture system, for their part, has the obligation of a careful attitude towards the existing physiognomy of different environments, in terms of moderation in performance, that is, a balance between the preferably strong physiognomy of the new benchmark and the intervention that seeks to fit without excessive gesticulation.

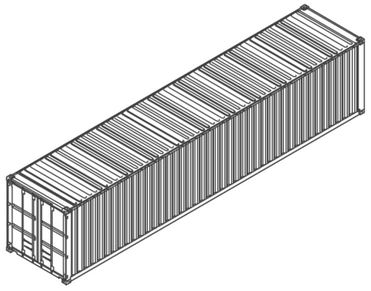
Also, an important determinant is the visibility and visibility of future infrastructure, both from close, direct positions, and from remote, viral vistas, which imply that each object of this type significantly contributes to the impression of "self-understanding" of the environment, or of how others present their own building culture paradigms and visions of future flows and movements.

Taking all this into consideration, the methodology for solving these problems was related to the optimization of these differently oriented constituents, while thematization tends to establish new "points" that people will recognize and love, at the same time seeing as their own national team, sufficiently special and yet oriented towards global trends and tendencies.

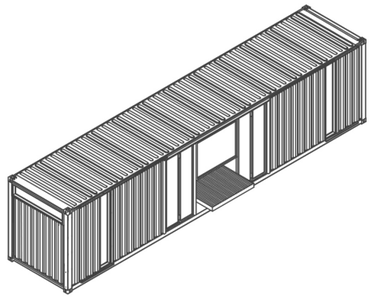
Some variety is desirable, but to the extent that the proposed variants have common programmatic elements and their physical characteristics, in order to meet the criteria of economy and efficiency.

More specifically, in specific circumstances a specific solution should be offered, but by properly combining the same or similar "patterns" one can also control the investment value of the project, both in the construction phase and in the exploitation phase.

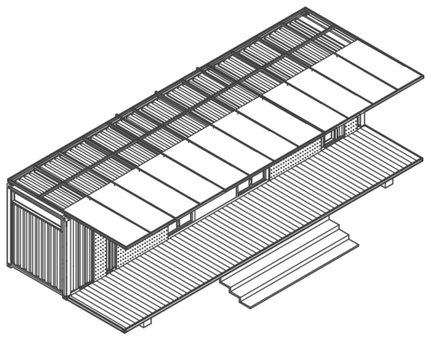
PHASE 1 - container



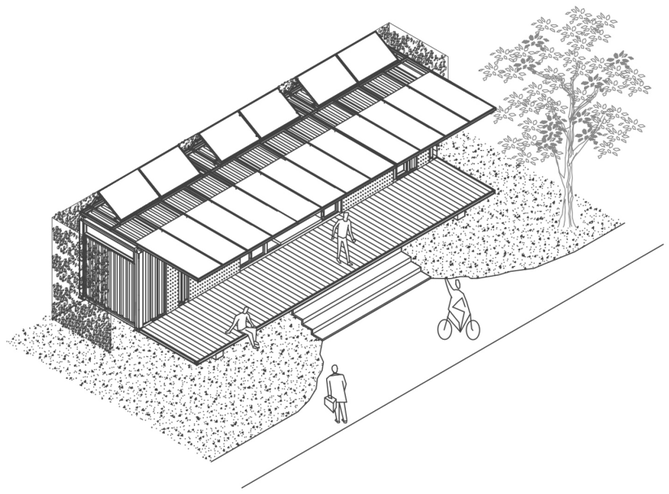
PHASE 2 - openings



PHASE 3 - awning / platform with stairs



PHASE 4 - solar energy / container in use



- BASE

The basic configuration is generated by the ready-made structure of shipping containers, as a "chassis" capable of accommodating all the necessary elements for this type of content. In addition to the economic aspect, which is significant in the case of a number of similar project situations, this decision is also grounded in other feasibility issues.

First of all, it is a high degree of strength of the basic construction of the container, both in terms of load capacity and self-bearing, which is important when positioning at the intended location, as well as possibly moving to another, more attractive place. Also important is the ability to equip and carry out much of the work on preparing a future facility in the workshop, minimizing the need for on-site engagement.

Organizationally, two circuits have been formed that can function in different specific circumstances and their expected changes. At the same time, the economic aspect should remain within minimum deviations.

The differences between them primarily relate to the capacity that each of these two options should carry in relation to the needs of the users:

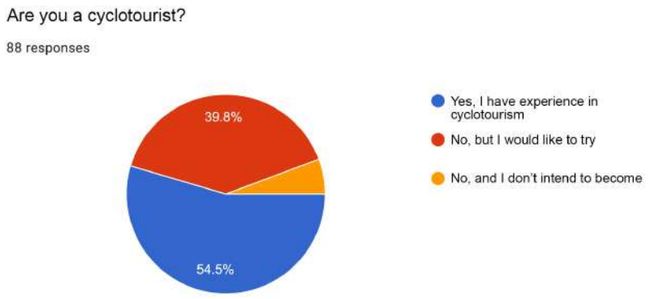
The first, called Set A, is based on a "high cube shiping container", measuring 12.20 / 2.43 / 2.89m. In this sense, Set A, by its volume, allows for a more complex configuration and provides accommodation for more persons, as well as an adequate degree of their "isolation". It is primarily a functional and acoustic comfort, with minimal impact on the quality of daily communal activities, which can often be compromised.

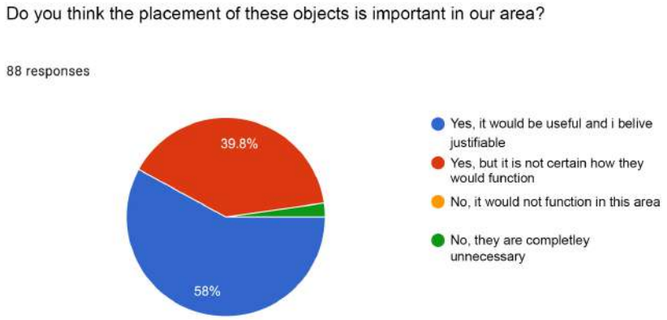
The second option, Set B, is compact because it is based on a "high cube shiping container", measuring 6.60 / 2.43 / 2.89m, so it is designed for less capacity to use and / or possibly increase it further to certain positions, where relevant content already exists (eg, Set A or the like).

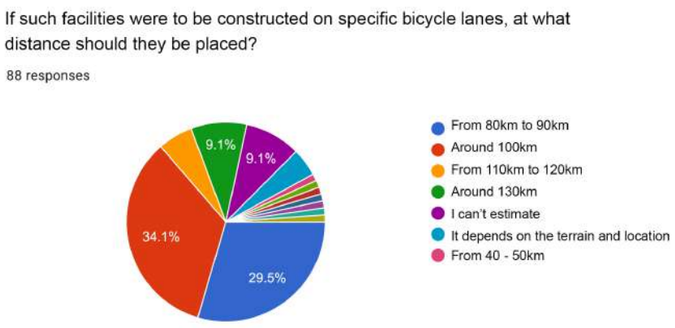
The assumed variants are the result of a project assignment formed during oral exchanges of information between the Investor and the Designer, as well as the requirement for their minimal dependence on utility infrastructure systems.

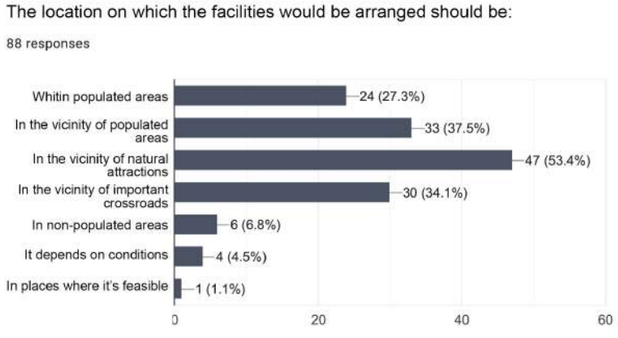
In the further work, the directions of research were at the following levels:

- reviewing the survey of cyclo-tourists and considering their criteria and priorities,
- reviewing the term self sufficient, that is, its concretization in the context defined here,
-technical-technological solutions that enable the above stated points of view.









03.1 Survey – Temporary accommodation for cyclists

03.1.1 General information

The survey was conducted in an open form with anonymous access from February 6 to February 12, 2020, via an online form completed on different devices (mobile phone, tablet, laptop or personal computer). The invitation to participate in the survey has been placed on several internet portals used by cyclists and cycling enthusiasts.

The total number of respondents is 88. Survey is accessible online on the following web adress:
https://docs.google.com/forms/d/1y2FWsrd-6k7LOt1AGuRl1TuBw2f_-su5K-DkZQx6hcF4
Portali na kojima je anketa objavljena:

1. Forum „2bike.rs"
https://www.2bike.rs/forum/topic/11827-objekti-za-privremeni-sme%C5%A1taj-biciklista/?hl=%2Bobjekti+%2Bsme%C5%A1taj#entry249917
2. Facebook Page „Ciklonaut"
https://www.facebook.com/milan.ciklonaut
3. Facebook Group „Ulice za bicikliste"
https://www.facebook.com/groups/ulicezabicikliste
4. Facebook Group „Udruženje Biciklista "Drumski Vozači"
https://www.facebook.com/
groups/515556338510582
5. Facebook Group „Rekreativni biciklisti Kragujevac"
https://www.facebook.com/
groups/2157801831142455
6. Biciklistička aplikacija „Strava"
https://www.strava.com/athletes/17089634/posts/8089574

03.1.2 Target group and survey relevance

Since the invitation to participate in the survey was published in the targeted places with voluntary participation, the largest number of survey participants showed a significant interest in the issues and problem of solving temporary accommodation for cyclists.

The target group in the survey is primarily cyclists themselves, especially cyclists who are interested in cyclotourism, ie. multi-day two-wheeled trips.

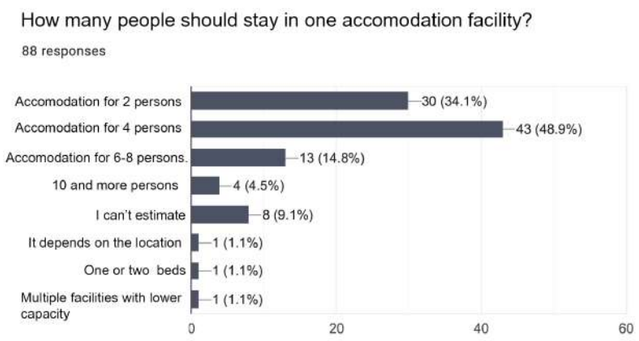
A large number of survey participants stated that they already had experience in daily and multi-day cycling trips (48/88 respondents, 54.5%), while a significant proportion of those surveyed showed interest in the same (35/88 respondents, 39.8%). This indicator indicates the significant relevance of the survey participants, as more than half of the respondents provide answers from their own experience about the problem and the way of accommodation on cycling trips.

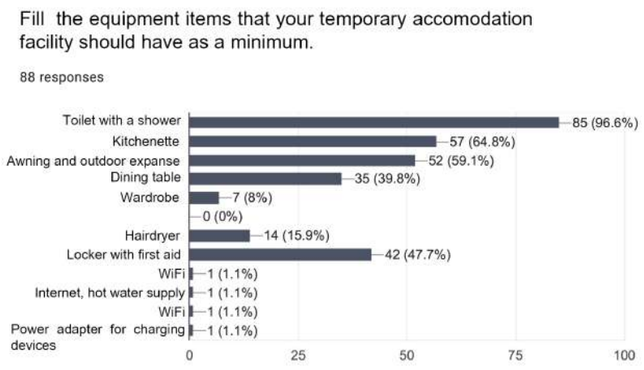
03.1.3 Argument for temporary accomodation for cyclists

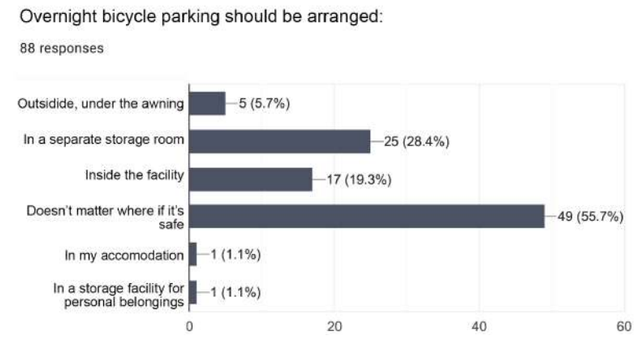
In accordance with the above indicators, it also logically corresponds to the position on the justification of the proposed concept of temporary residence of cyclists. The majority of respondents believe that they make full sense in our surroundings (51/88 respondents, 58%), while other survey respondents overwhelmingly agree with justification with skepticism about how these facilities can function in our environment (35 / 88 respondents, 39.8%).

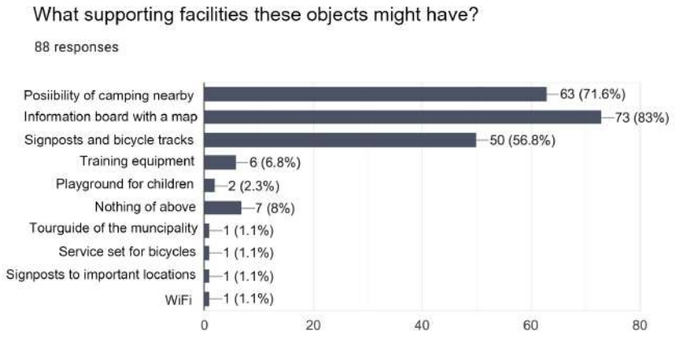
03.1.4 Selection of sites

The majority of those surveyed chose the option for the positioning of these objects should be at a distance of one another, which corresponds to the projection of a one-day distance traveled on a particular bicycle









route. 26/88 respondents (29.5%) consider the positioning of objects at a distance of 80 90km, while slightly more 30/88 (34.1%) see a desirable distance about 100km.

Individually significantly fewer survey participants chose larger or significantly smaller distances, or on the other hand stated that they could not assess the issue.

In the opinion of the respondents, the desirable location of these objects should be in the vicinity of some characteristic places, whether they are attractive sites (47/88 surveyed, 53.4%), near populated places (33/88 surveyed, 37.5%) or important intersections and cross sections of bicycle lanes (30/88 surveyed, 34.1%). A slightly smaller number of respondents chose a location within populated areas or in uninhabited areas, so it can be concluded that the first mentioned characteristic sites are the optimal position in the choice of locations.

03.1.5 Capacity and equipment of the facility

An important segment of the survey relates to the issue of equipment and contents of checkpoints with accommodation facilities for cyclists. The largest number of survey participants opted for the concept of smaller capacity facilities: 43/88 respondents (48.9%) and 4/30 respondents (34.1%) for 2 persons capacity for a capacity of 4 persons per accommodation unit.

A significantly smaller number of survey participants chose the concept of larger accommodations (6-8 people or more than 10).

Regarding the equipment of the facilities themselves, the survey participants agree that the facilities must have the conditions for maintaining hygiene, while they mostly stated the need for owning a kitchenette (57/88 respondents, 64.8%), roofs and places for outdoor living. (52/88 surveyed, 59.1%), first aid cabinets (42/88 surveyed 47.7%), and dining areas inside the units (35/88 surveyed, 39.8%).

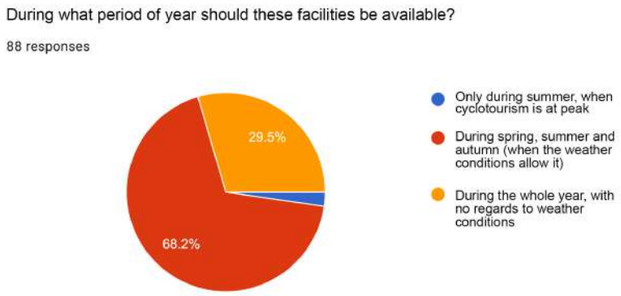
With regard to the safety aspect of bicycles and their overnight disposal, the majority of survey participants emphasized the importance of addressing safety regardless of how it was offered (49/88 respondents, 55.7%). In the individual view, among the solutions offered (inside or outside the facility), the largest number chose the solution with a special storage for bickles (25/88 respondents, 28.4%).

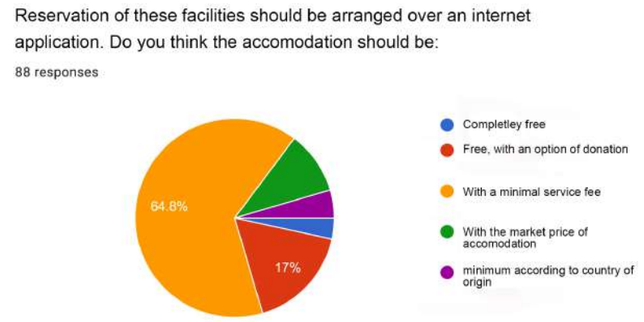
Among the accompanying contents of the cyclist accommodation facility were largely supported by the following: camping and outdoor space (63/88 surveyed, 71.6), information board with map (73/88 surveyed, 83%) and signposts with well-maintained trails attraction (50/88 surveyed, 56.8%).

03.1.5 Terms of use of the facility

Survey participants mostly believe that the use of bicycle accommodation facilities should be available for the largest period during the year, when weather conditions allow (60/88 respondents, 68.2%). Surprisingly, some survey respondents believe that facilities should be open year-round regardless of weather conditions (26/88 surveyed, 29.5%), while a negligible number of respondents (2/88 surveyed, 2.3%) believe facilities should be open only flies when cyclotourism is at its peak.

When asked about the financial conditions of using these facilities, the majority of respondents believe that accommodation allowance should cover the minimum maintenance costs of these facilities (58/88 respondents, 64.8%), while far fewer participants opted for free accommodation with a voluntary donation (15/88 respondents, 17%) and the economic (market) price of accommodation (9/88 respondents, 10.2).

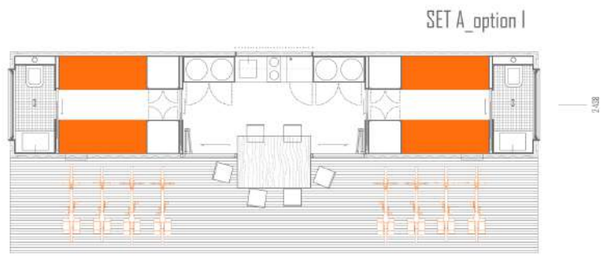




Provided capacities:

8 PERSONS

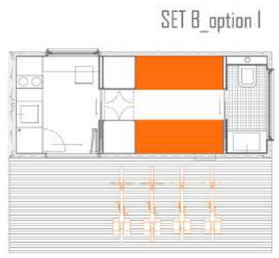
SET A_option I



bicycle outside

4 PERSONS

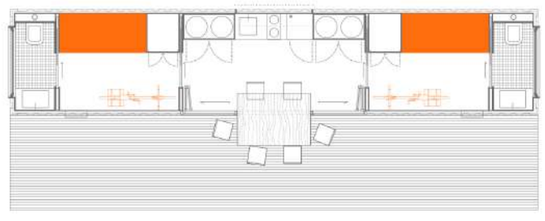
SET B_option I



bicycle outside

4 PERSONS

SET A_option II



bicycle inside (one above the other)

2 PERSONS

SET B_option II

bicycle inside (one above the other)

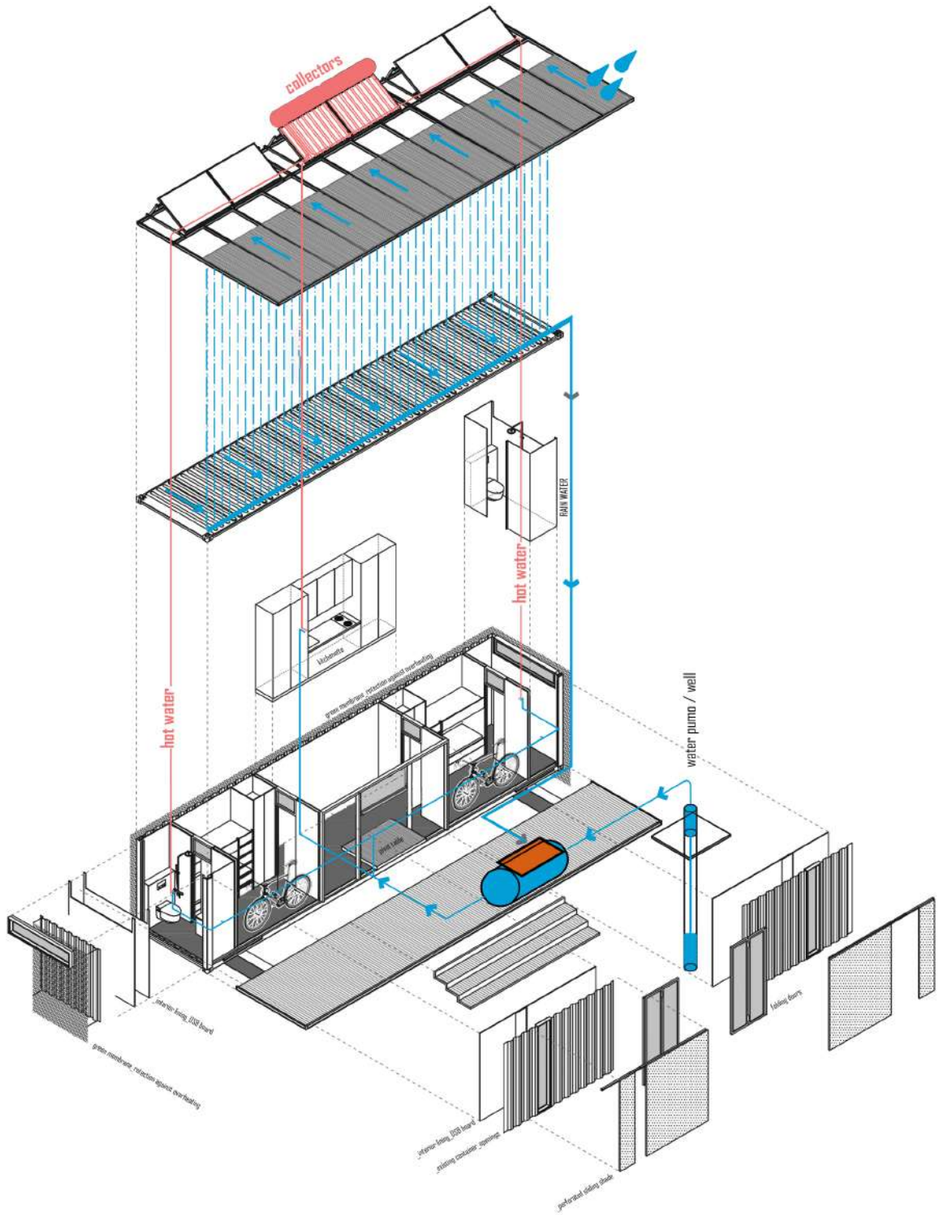
03.1.6 Conclusion

Overall, the survey results show, first and foremost, the significant interest of the survey participants in the possibility of constructing accommodation facilities for the temporary stay of cyclists. The absolute majority of respondents believe that their construction is justified, but also a certain reservation regarding their functioning in our environment. According to the majority, the facilities should be in operation for most of the year (spring, summer and autumn), respectively in appropriate weather conditions for cycling. The construction of such facilities should be in their characteristic places, especially near attractive natural sites, intersections or populated areas.

Individually, the facilities themselves should not be large accommodations, but with the concept of smaller units (for 2 to 4 people), with basic accommodation conditions, hygiene maintenance and meal preparation options. It is advisable to have a place to eat and stay in front of the outdoor units. For cyclists, it is a significant and safe place to store bicycles during the night. The possibility of camping outdoors, environment maps and signposts are important supporting elements of the accommodation facilities themselves, in the opinion of the participants of this survey.

container TYPE_12m

SET A - WATER SUPPLY



04.1 Hydrotechnical installations

04.1.1 Water supply

The supply of the facility with technical water can be realized in several ways depending on: the location of the facility, the number of users of the facility, as well as the economic justification of the chosen solution.

The average water consumption per person for one day is 75-150 liters / day, in this case - approximately 125l / day.

There is no water supply at the site, so installations for independent water supply on site are designed for individual needs. Water is taken from the rainwater storage tank, or, or, if more economical, from the well. Water is drawn from these springs and thrust into the network. The functioning of the water supply system requires the pressure provided by the water tank on the roof of the building, from which water is gravitationally discharged through the water supply network by means of an electric or manual pump.

Rainwater collection:

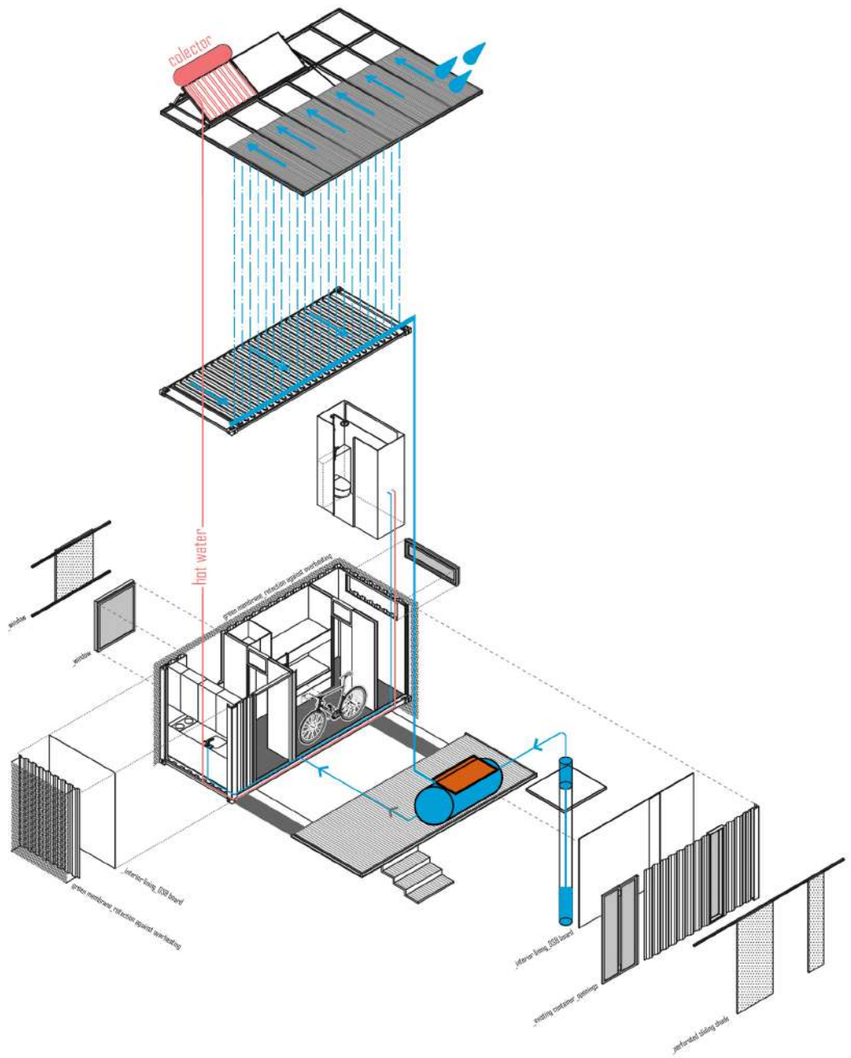
The project foresees that water is collected from the roof surface of the building (6.06 / 12.20 m x 2.44 m). For the purpose of increasing the amount of water, it is envisaged to construct a canopy, which has several roles in the project.

The tank is located off-site, above ground or underground. For our climatic conditions, a better solution is to place the water tank in the ground, to prevent freezing of the water, provided that the composition and configuration of the terrain allow it. Alternatively, the water tank for supplying the sanitary block and the kitchen should be designed and located below the building, or terrace, as its extension. This option dictates that the object should be raised 60-80 cm above the ground.

Rainwater should not be collected from

container TYPE_6m

SET B - WATER SUPPLY



covers that have a toxic composition (asbestos and other similar materials). As it is a prefabricated flat roof building, rainwater collection will go through the solar panels that will be installed on the roof or through an additional sloping metal surface with a corresponding drop that, as already stated, would be erected for this purpose.

Rainwater collection takes three steps:

1. collecting over roof surfaces

Rain falling on a sloping metal roof or solar panels is collected in horizontal and carried by vertical gutters (Ø100 or Ø125) to the tank, previously passing through a filter on the vertical gutter that stops larger dust, twigs and leaves, thereby preventing impurities from entering the tank. And other parts of the system. This initial form of filtration can extend the life of the pump, additional filters as well as minimize the need to clean the sediment collected in the tank. At the same time, vertical storm water lines must have their own pump to allow as little undesirable material as possible to flow into the tank.

1a. groundwater exploitation

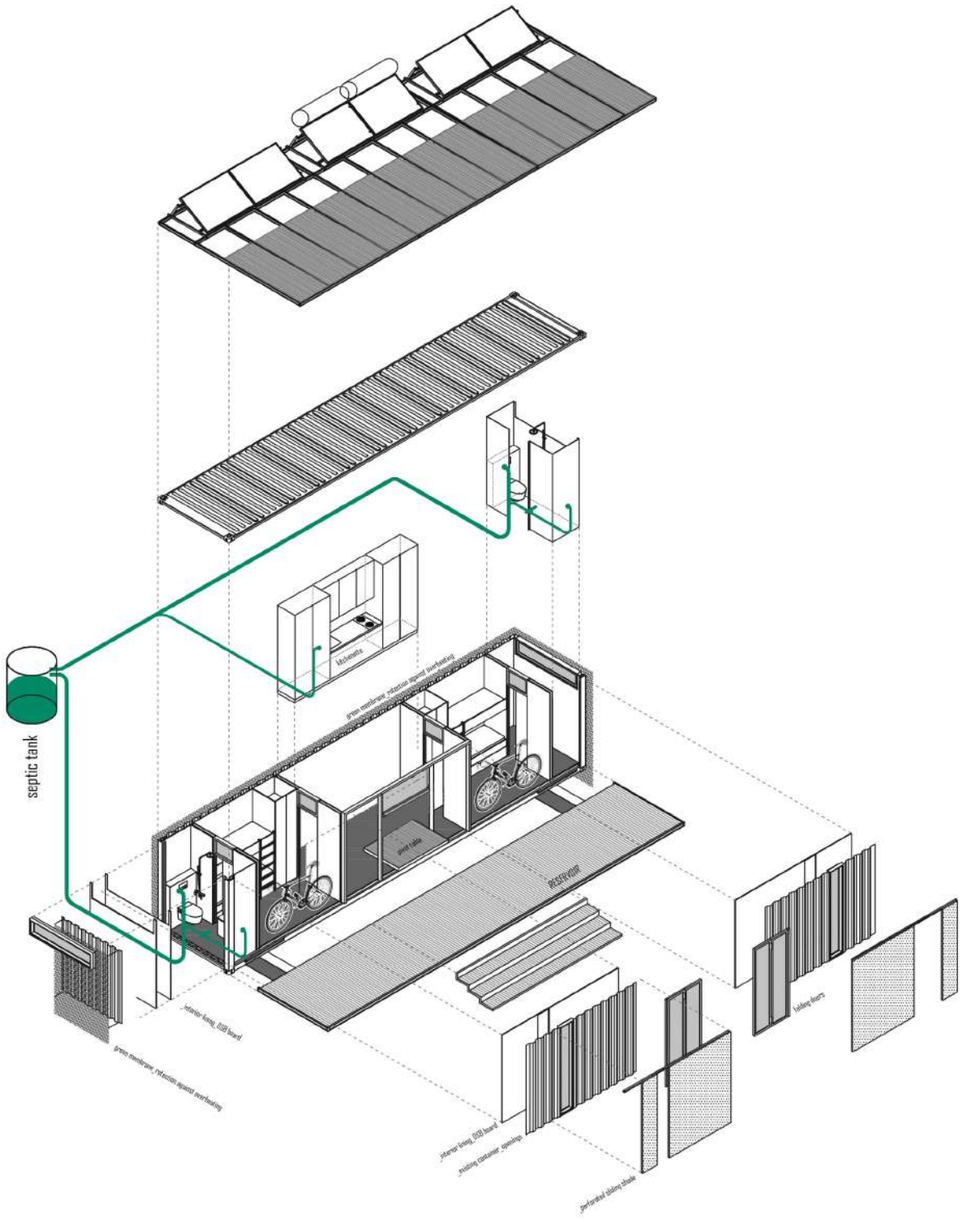
As another possible solution for water supply, it is possible to approach the exploitation of water below the ground by drilling wells, if it is previously established that there is sufficient groundwater at a specific location, that it is chemically and bacteriologically correct, and that such exploitation is economically justified given that it is an object of smaller size (6.06 / 12.20 mx 2.44 m) and capacity (2-4 persons). The well must be provided with ancillary equipment, which firstly relates to the filtration and pumping of water to the primary reservoir.

2. repository

The water prepared is not for drinking, but is used as technical water for toilet flushing, showering and washing. The volume of the primary-primary tank should not be less than 3000 liters, depending on the space available to accommodate the tank, the amount of precipita-

container TYPE_12m

SET A - DRAINAGE OF WATER (SEWAGE)



tion for a given location, the access and possible replenishment of the tank with water from the tanker, as well as the number of persons using the facility.

When filling the reservoir, the water must be directed upwards at the inlet of the reservoir in order not to raise sediment and disturb the pump operation. A "floating" filter must be installed in the tank, which additionally filters the water entering the pump, which additionally protects it and facilitates the flow of water through the pipe network to the consumer. Certainly, an overflow element must be installed, which will allow the excess water to be drained from the tank.

3. distribution of water to consumers

Water from the primary reservoir to the point of consumption, which, as stated, relates to flushing the toilet, showering and washing (laundry and dishes), is pumped into the secondary (upper) tank, mounted on the roof of the building. During this flow, the process water passes through panels which absorb the heat energy of the solar radiation and heat it. Thus prepared, the technical water is stored in a secondary tank and then, where necessary, used at the positions of the flowing places, as required.

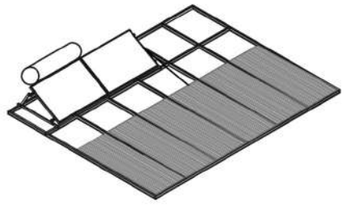
04.1.2 Drainage of used water

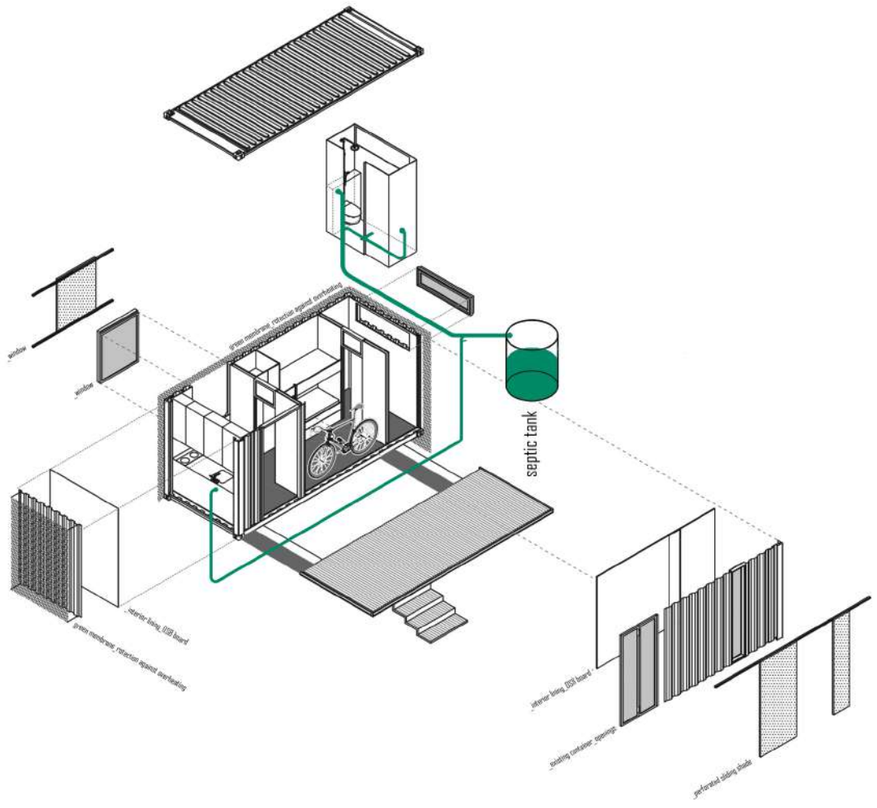
Generally, for this type of facility, a dry septic tank / toilette of at least 2m^3 capacity with regular emptying can be installed. An impermeable tank (built or prefabricated) with a larger volume could be set, depending on the type of facility, how much water is consumed, and the number of users of the facility.

The smaller the tank, the more often it needs to be cleaned in reverse. For small capacities of up to 10 people, a standard of 0.4 m^3 volume per person and cleaning period is approximatley every 2-3 months. In both cases, the pit must have internal chambers, a 60x60 cm cleaning opening, and a ventilation pipe.

container TYPE_6m

SET B - DRAINAGE OF WATER (SEWAGE)



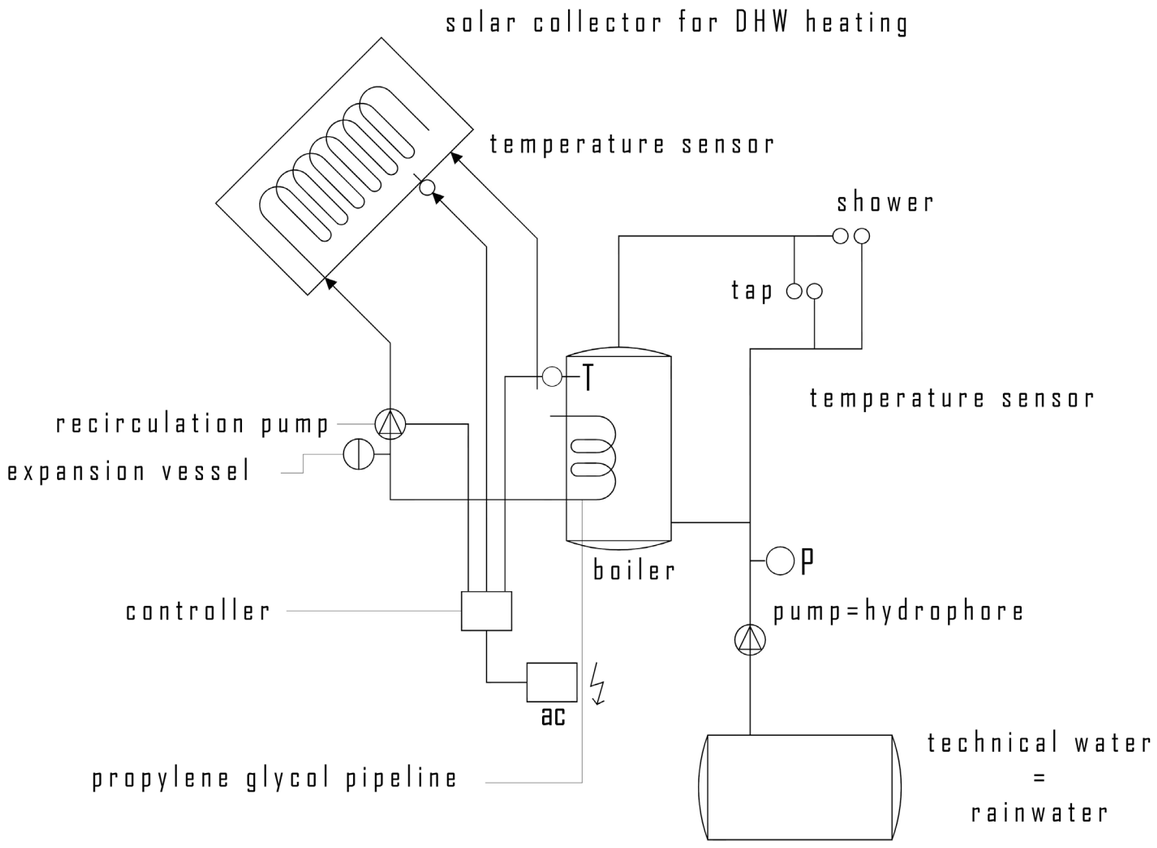


Prefabricated septic tank

In this case (objects for temporary residence), a (horizontal or vertical) precast septic tank should be installed, as the most acceptable solution for this type of facility. All of the above applies to this case. This type of reservoir for fecal matter placement is easier and quicker to set up, which puts the object into operation more quickly.

This solution, designed and implemented according to all regulations, standards, and recommendations, can satisfy the need to store a certain amount of used water, as well as the need to protect nature and the environment. Ventilation should be provided to conduct gases and odors. Also, this solution requires defining the drainage interval of the pit, which implies adequate vehicle access for this purpose.

It is envisaged that the pit will be placed at a certain distance from the object, not less than 5 m.



04.2 Mechanical installations

Technical description of thermo technical installations in the cyclist accommodation facility

04.2.1 General data

The cyclist accommodation facility is designed in two sizes: for two people and for four people.

The facility for 2 persons is a modified thermally insulated shipping 20 " container. Inner dimensions: length 5.89 m; width 2.33 m; height 2.38 m.
The facility for 4 persons is a modified thermally insulated shipping 40 " container. Inner dimensions: length 12.01 m; width 2.33 m; height 2.38 m.
The facility is set up right next to the bike path.

The facilities include thermo technical installations:
- Heating and cooling installation
- Sanitary hot water Installation

04.2.2 Heating and cooling installation (two persons)

An air-to-air heat pump is installed for heating and cooling, with an indoor wall unit and an outdoor unit mounted on the outside wall of the building.

The capacity of the device is 9 kBtu, or about 3 kW. This capacity provides heating at ambient temperatures up to -15 ° C and cooling up to 40 ° C. A device with an inverter compressor is provided.

A remote control mounted on the inner wall of the container is used to control the operation of the device.
The condensate is drained into a rainwater tank.
The power consumption is 0.9 kW / h

04.2.3 Heating and cooling installation (four persons)

An air-to-air heat pump is installed for heating and cooling, with an indoor wall unit and an outdoor unit mounted on the outside wall of the building.

The capacity of the device is 2 x 9 kBtu, or about 2 x 3 kW. These capacities provide heating at outdoor temperatures up to -15 ° C and cooling up to 40 ° C.

Devices with an inverter compressor are provided.

Remote controls mounted on the inner wall of the container are used to control the operation of the device.

The condensate is drained into a rainwater tank.
The power consumption is 1.8 kW / h.

04.2.4 Installation for hot sanitary water (two persons)

A solar system with one 2 m^2 solar collector mounted on a flat roof is planned to heat domestic hot water.
200 l tank of hot water will be installed in the facility.

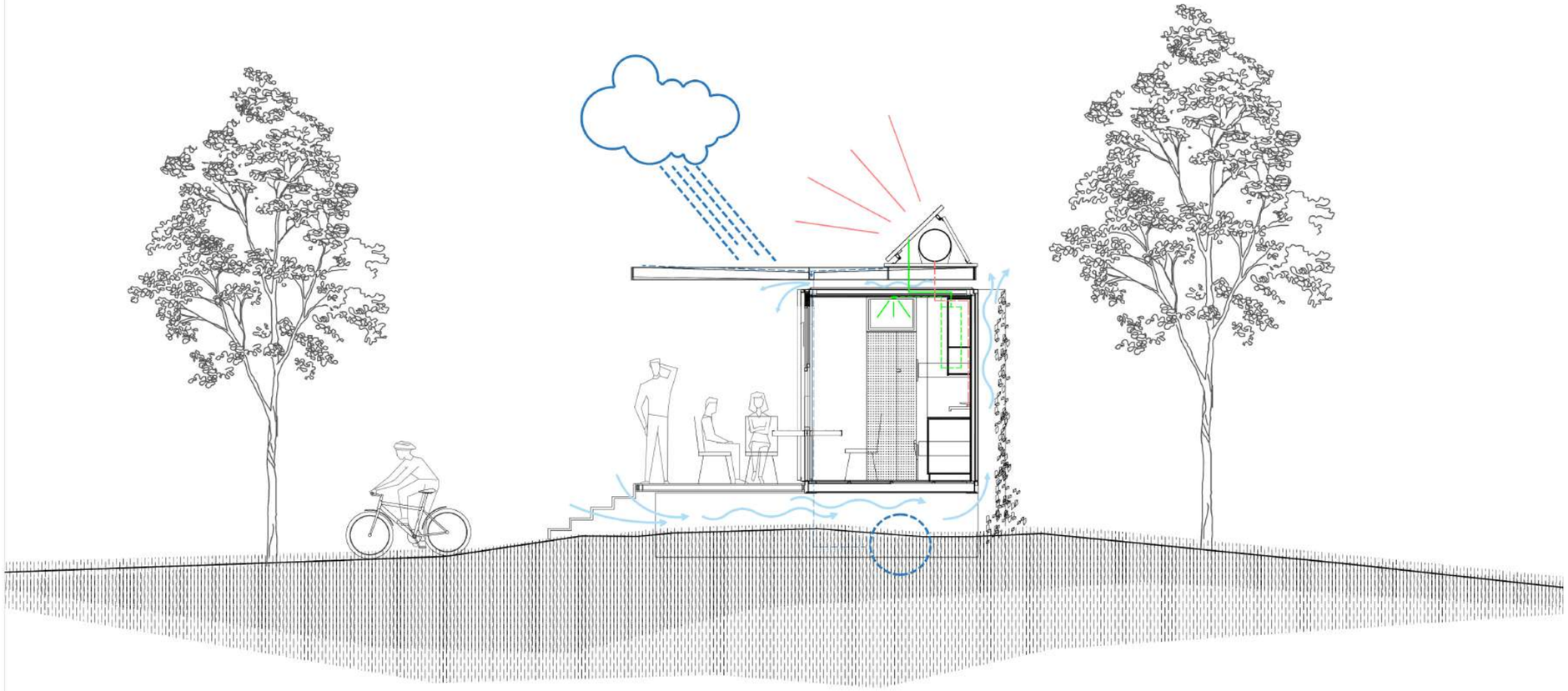
The connection between the reservoir and the solar panels will be made by copper tubes filled with water with propylene glycol freezing point -25 ° C.

A hydrophore unit (circulating pump with expansion vessel and safety valve) is provided for water circulation.

A temperature controller with temperature sensors is provided to control the DHW temperature.

The power consumption of this unit is about 0.25 kW/h.

Diagram of the circulation of the system



04.2.5 Installation for hot sanitary water (four persons)

For the hot water heating, a solar system with two solar collectors, measuring 2 x 2 m^2, is placed on the flat roof of the building. 300 l tank of hot water will be installed in the facility.

The connection between the reservoir and the solar panels will be made by copper tubes filled with water with propylene glycol freezing point -25 ° C.

A hydrophore unit (circulation pump with expansion vessel and safety valve) is provided for the circulation of water.

A temperature controller with temperature sensors is provided to control the DHW temperature.

The power consumption of this unit is about 0.25 kW/h.

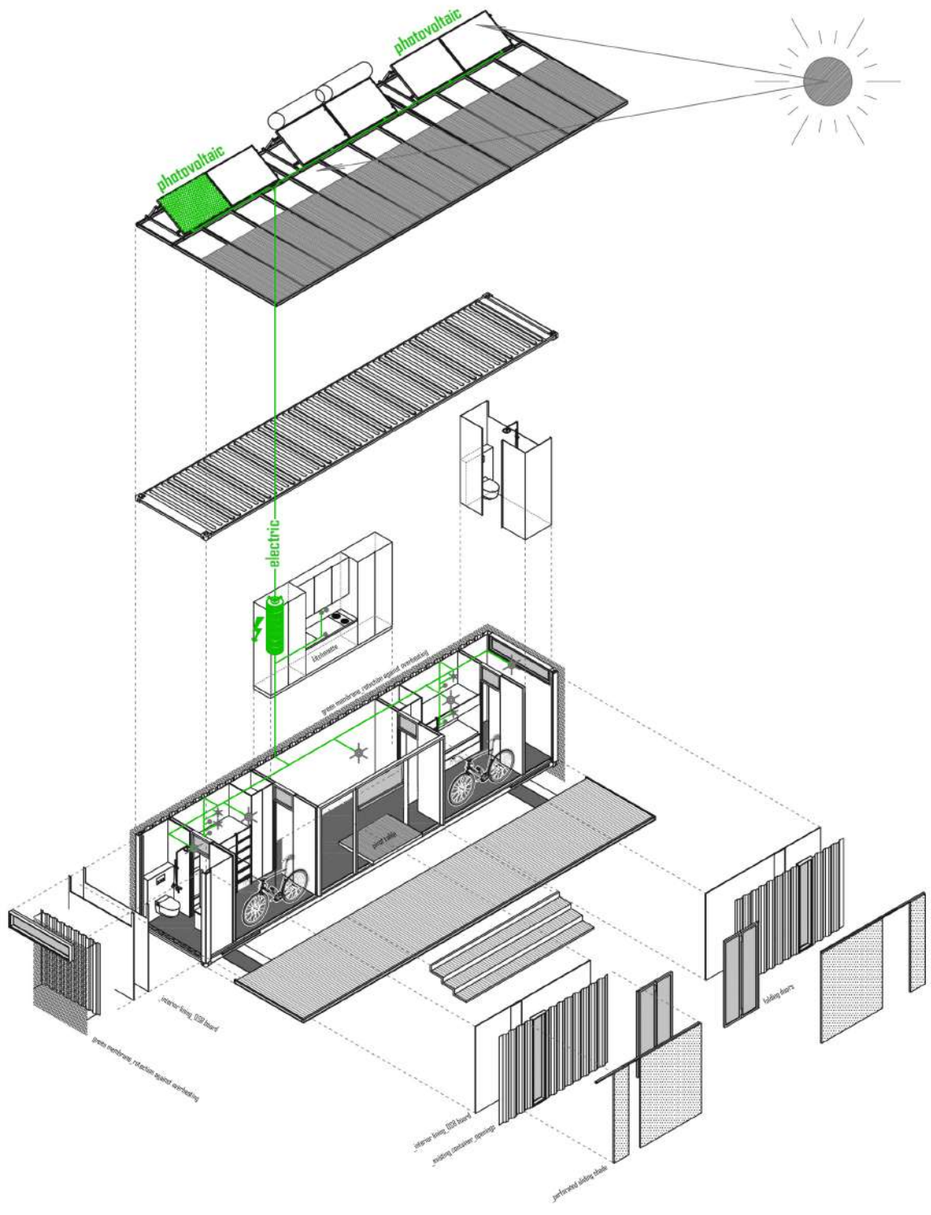
Additional architectural measures are planned: thermo insulation, sun protection blades, north-south orientation, active shelters with ivy, double pane windows filled with argon and a five chamber PVC profiles.

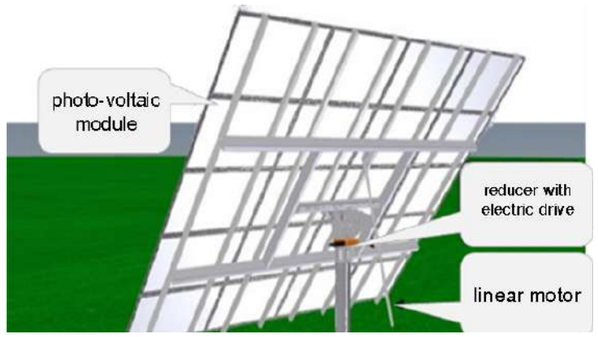
Facility ventilation:

The ventilation of the building is foreseen by opening the window.

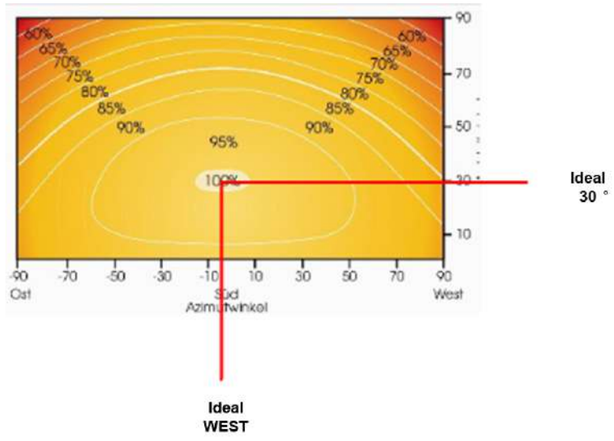
container TYPE_12m

SET A - ELECTRICAL INSTALLATIONS





Schematic diagram of a stand-alone photovoltaic system



Energy efficency, depending on orientation and incline of PV panel

Installation of PV module on metal substructure

04.3 Electrical installations

04.3.1 Supply of electricity

It is planned to supply electricity to the facility through an independent (automatic) solar power plant (SPP). In the event that the facility is impossible to connect to the public low-voltage power grid, there are three options: powering through gas or diesel, installing a wind turbine or using solar energy. Considering all the advantages and disadvantages of potential solutions, we decided to find, in our estimation, the optimal solution, which is an independent solar power plant.

Independent solar power plant

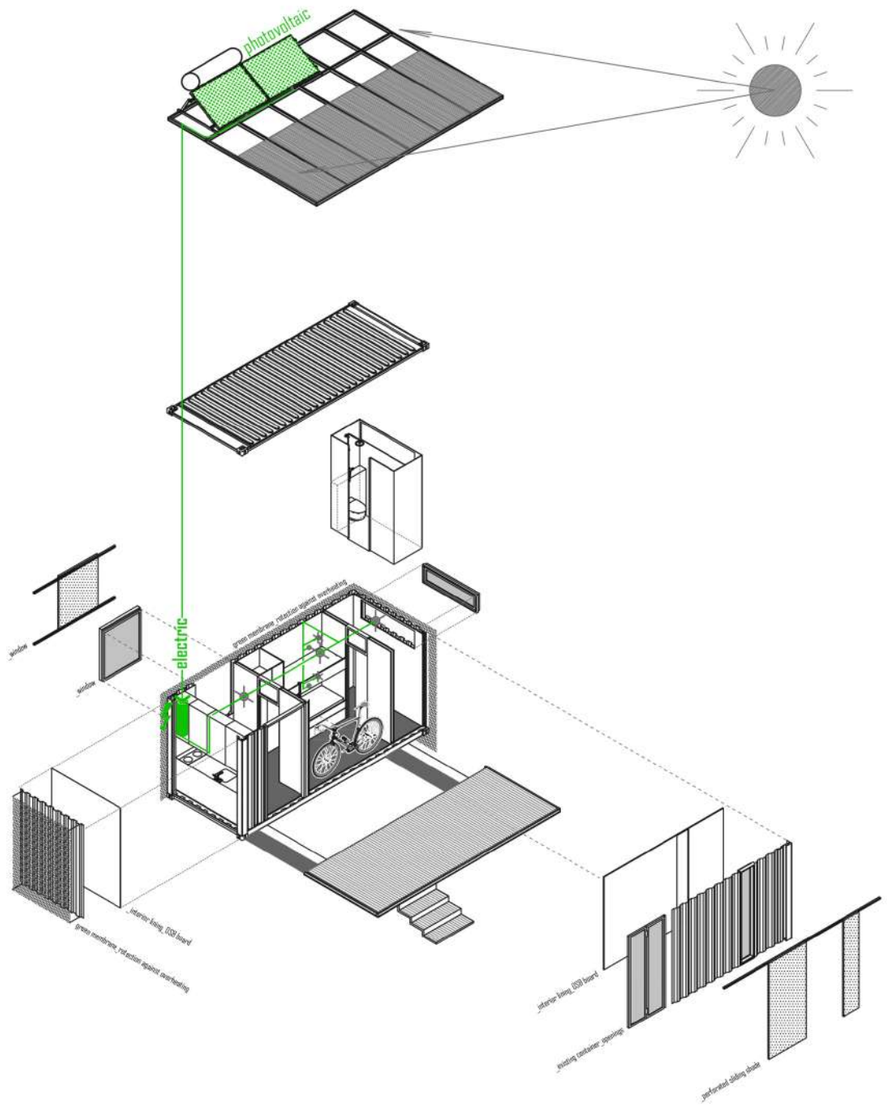
A solar power plant is made up of elements that convert light energy into electrical energy, the elements that store that energy, and the elements that convert direct current electricity into 230 V alternating current electricity, which is used to power electrical consumers in everyday use. In our example, these are: photovoltaic (solar) modules (panels) 310 W, hybrid inverter MPPT 5 kW 230V, rechargeable battery (LiFePO2) and mounting material, cables, substructure for PV,...

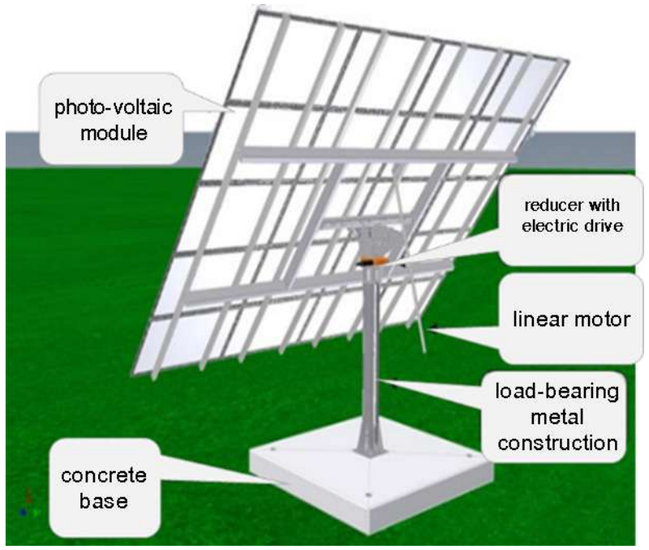
Solar modules

The photovoltaic panels, which directly convert solar energy into DC power, are positioned on the roof of the building and mounted on a metal constriction, which provides a tilting installation angle of 30 °. The metal sub-structure is galvanically connected to the metal roof of the building. The modules are mounted vertically in a single line and face south. The arrangement of the panels ensures that there is enough space in the roof of the building for solar collectors to heat the water. BISOL Premium BMO 310 W single-crystal solar modules have high low light efficiency and a 25-year

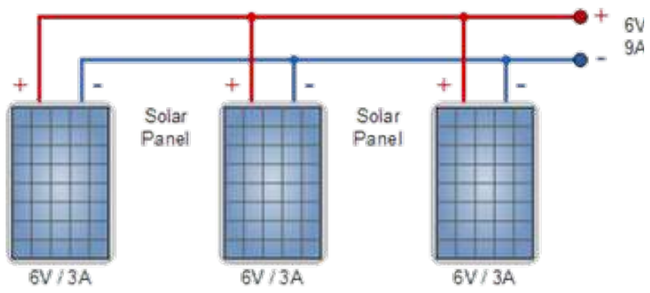
container TYPE_6m

SET B - ELECTRICAL INSTALLATIONS

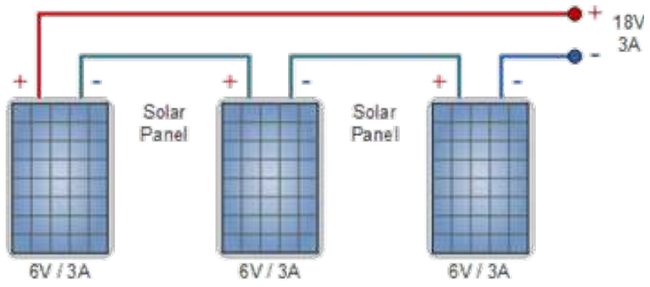




Stand alone PV panel mount



Parallel connection of PV panels



Serial connection of PV panels

linear warranty. Dimensions: (H x W x D) 1.649 mm x 991 mm x 35 mm, weight 18.3 kg, module conversion efficiency ηM = 19%. Connecting solar modules is possible in parallel, in series, or a combination of both.

The solar modules can be optionally mounted on a stand-alone photovoltaic panel mount (for 4 and 8 modules, respectively), which is located in the immediate vicinity of the building. In the case of this option, it is necessary to choose the mounts of solar modules with two-axis control of the position of the panel, which allows about 25-30% increased efficiency of the system as a whole. Certainly, the option of combined installation of solar modules on the roof of the building and on a stand alone panel support is also possible.

MPPT 5 kVA 230V hybrid inverter, 40-145V solar inverter

The multifunction 5KVA hybrid MPPT inverter is a device that combines the functions of a pure sine wave inverter, an MPPT solar controller and a battery charger. The pure sine converter converts direct current from the solar modules to alternating current, allowing direct power to 230 V electrical installations and connected electrical consumers.

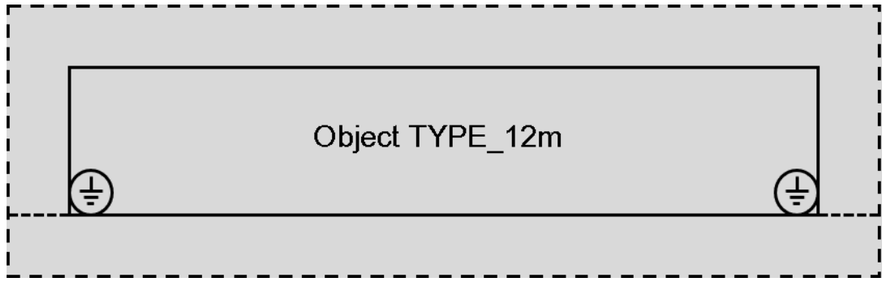
Hybrid devices have the ability to choose the priority for powering consumers directly from the solar system, from the battery pack or from the AC distribution network, should the facility be connected to a public power grid. In case of lack of charge from the solar modules and if the batteries are discharged, they can be supplemented by the use of a transmission unit.

LiFePO4 rechargeable batteries

The operation of LiFePO4 batteries is based on basic Li-ion chemical technology, where LiFePO4 (lithium Fe sulfate) was used as the cathode material. Unlike Li-ion batteries, LiFePO4 batteries are extremely stable and reli-

Hybrid inverter MPPT 5 kVA 230V

Rechargeable battery (symbolic image)



Positioning of the grounding

WiFi router

Switch with multiple sockets

able. Also, overcrowding, short circuits or physical damage cannot cause an explosion. The main advantages of LiFePO4 technology are safety, significantly higher number of charge cycles, charge rate and resistance to high temperature discharge. A rechargeable battery (LiFePO2) 52V 5 KWh for TIP 6m and a rechargeable battery (LiFePO2) 52V 10 KWh for TIP 12m are provided.

The rechargeable battery and the hybrid inverter should be placed inside the facility in the space provided for the project (niche, cabinet) and which enables the natural cooling of these devices.

Electric consumers

Lighting in all rooms will be done with LED light sources and the main reasons for this are the low electric power of the lamps and the significantly long maintenance-free life. All LED bulbs have a white light color (light color temperature 4000 K, type 840), and the lamps have a protective cap. The degree of protection for luminaires at the entrance to the premises and in the sanitary facilities is IP 65.

Designated electric power of individual luminaires: living room and sleeping block 40 W, toilets 30 W, outdoor lighting (in front of the entrance to the building) 30 W. Installation is upgraded to the ceiling; necessarily out of space. Number of lamps required: TYPE_12 m: living room 2 x 40, sleeping block 1 x 40 W, toilet 1 x 30, entrance (outside) 1 x 30 W; TYPE_6 m: living room 1 x 40, sleeping block 1 x 40 W, toilet 1 x 30, entrance (outside) 1 x 30 W.
A fridge with an electric power of up to 100 W. is provided as standard equipment in the facility.

The number of three-pole sockets (L, N, PE) has been optimized and provides 4 sockets in the living area, two in the sleeping block and one on the outer wall of the building for additional charging of electric bicycle batteries. The sockets are primarily intended for connection to electrical installation of equipment such as laptops, tablets, phone chargers and the like.

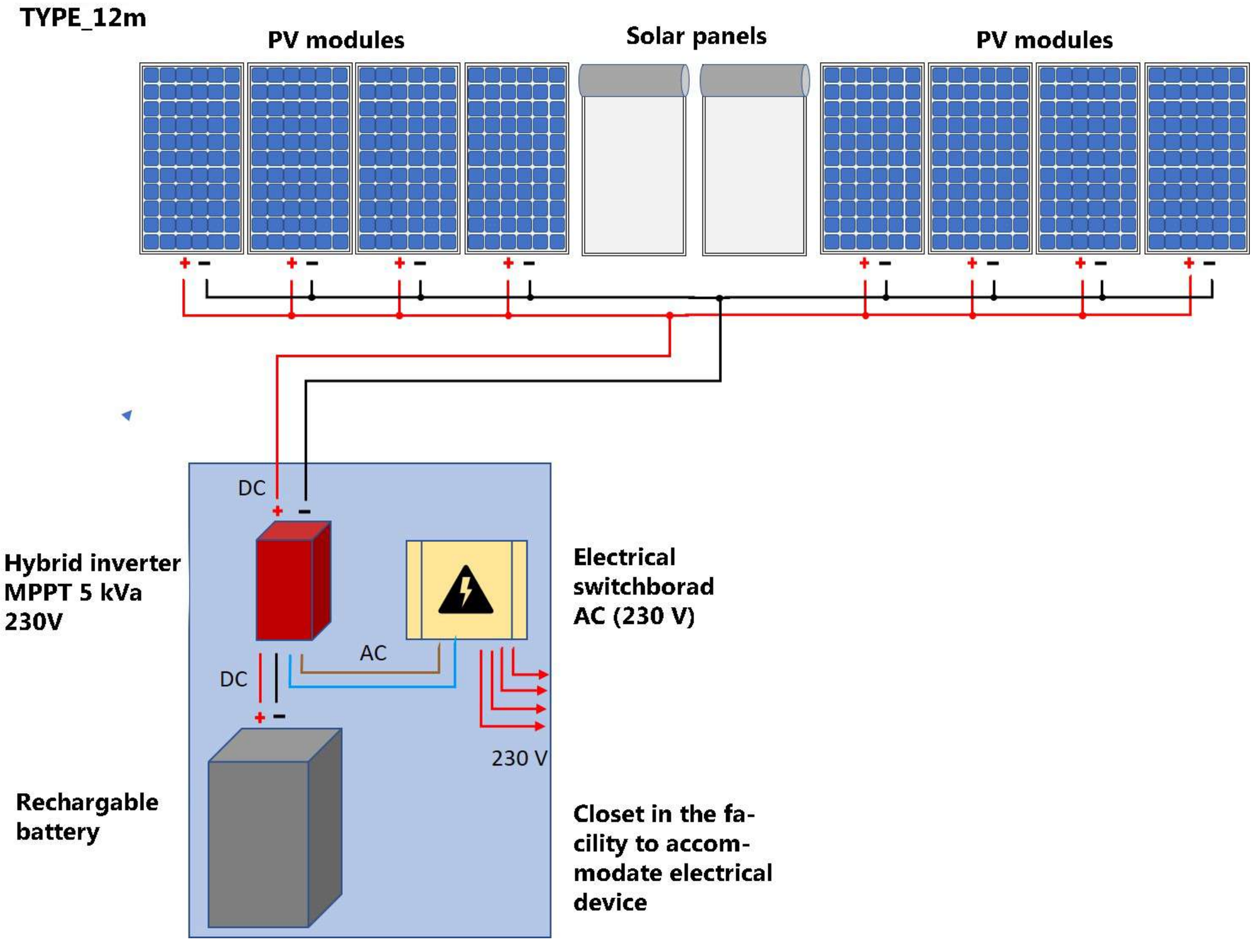
A circulation pump of rated electrical power up to 100 watts is provided for water circulation.
For the purposes of heating and cooling the building, a device with a power of about 3 kW, electrical power up to 1000 W is foreseen.

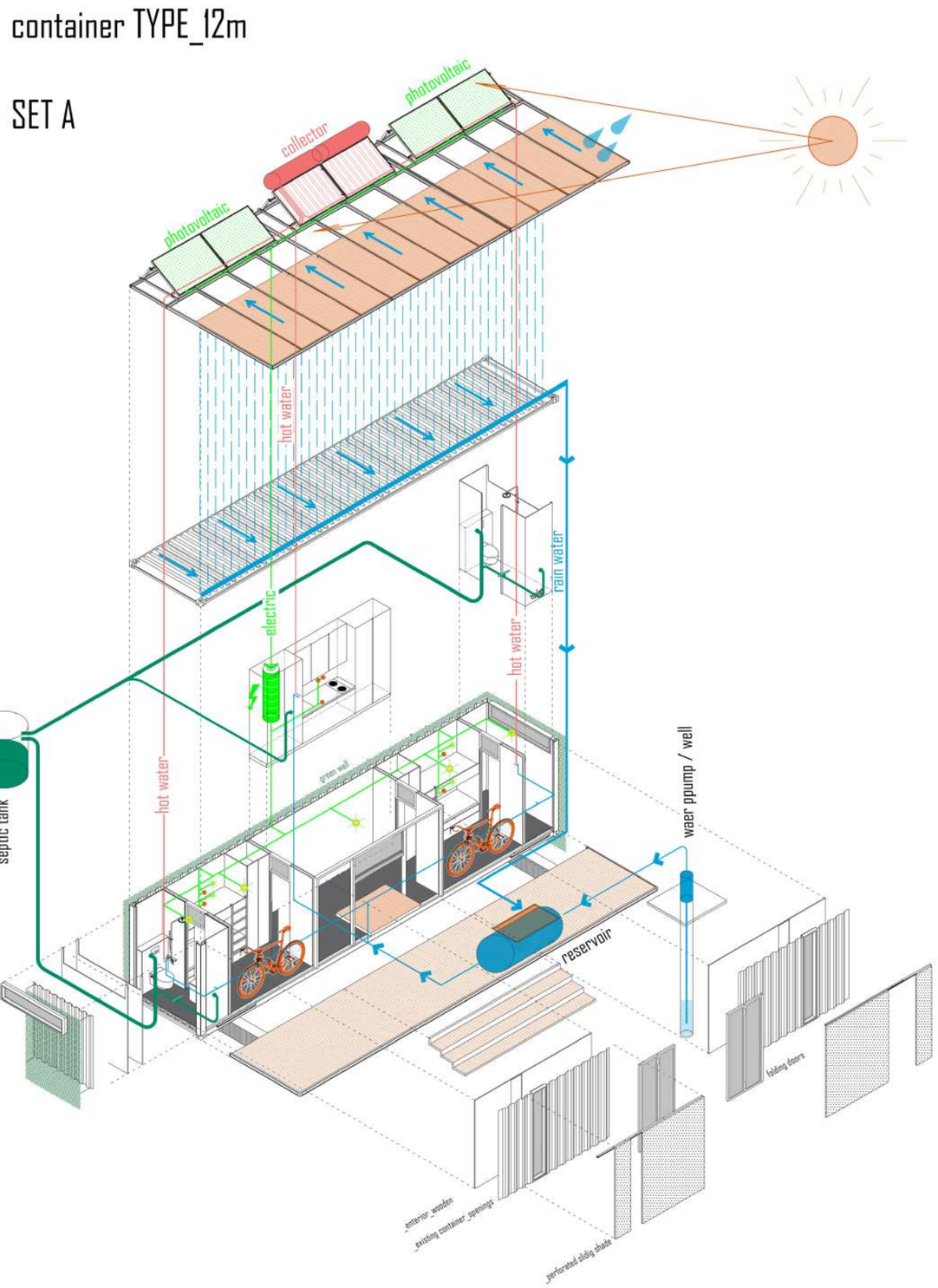
Grounding

The ring ground is made with 25 mm x 4 mm hot dip galvanized steel strip (FeZn). The earthing device is placed in the form of a closed ring at a distance of 1 m from the object and laid in the ground at a depth of 0.8 m. The FeZn strip is laid upright, which ensures good contact with the ground and therefore low electrical grounding resistance. On both fronts, an opening for fixing the grounding contact was made in each corner of the floor of the building. The earthing contact is mounted using the M10 screw and can also be fitted with a welded part of the FeZn strip and a cross-ground grounding clutch.

WiFi – wireless internet connection

WiFi (Wireless-Fidelity) is a wireless data transfer method. WiFi internet connection requires a WiFi router to connect the necessary equipment to enable wireless or wired connection of IT devices. The router can be installed inside or outside the object. If an external receiving antenna is used to improve the reception of the mobile signal, which is a recommendation, then the router is placed inside the living room. In the building itself, we foresee already wired (LAN) connections, in each space one socket RJ45 and therefore it is necessary as an accessory to connect to a router switch with several sockets. Wireless signal reception is achieved via a mini SIM card (2G, 3G or LTE). When selecting a mobile internet provider, the following aspects should be considered: facility location signal coverage and availability of 4G (LTE) signals and be sure to arrange unlimited data transfer without limiting the transmission speed.


TYPE_12m
PV modules
Solar panels
PV modules
DC
Hybrid inverter
MPPT 5 kVa
230V
AC
DC
Electrical
switchborad
AC (230 V)
230 V
Rechargable
battery
Closet in the fa-
cility to accom-
modate electrical
device



05.1 Superstructure – Application

In a specific context, the application of the previously explained analyzes would have the following results:

05.1.1 Set A

It is based on a high cube 40` shiping container, whose dimensions are 12.20 / 2.43 / 2.89m. It is a container that has already been used for basic purposes, which is recycled and serves as a base for upgrading.

In this sense, Set A, by its volume, allows for a more complex configuration and, according to the conclusions drawn from a survey of potential users, provides accommodation for 4 people, as well as an adequate degree of their "isolation". It is primarily a functional and acoustic comfort, with minimal impact on the quality of daily communal activities, which can often be compromised.

The space is organized to accommodate bicycles in the interior, as this is also one of the imperatives, according to the survey. All elements of work surfaces and storage areas, as well as toilets and kitchens have been typified so that they can be used in both assemblies and in other configurations.

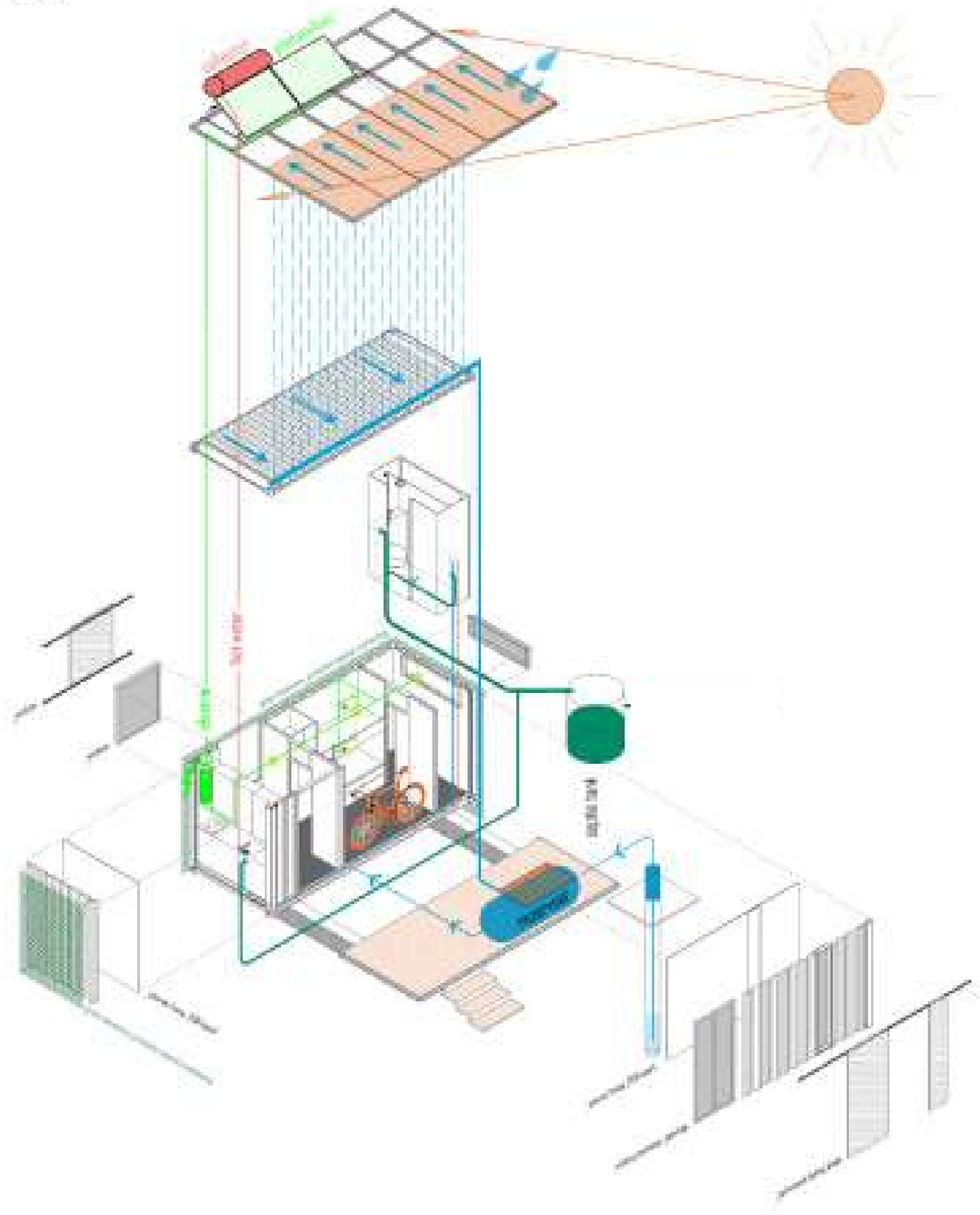
The materials used are selected to look attractive, but with a high degree of durability and long life without requiring maintenance (except for basic cleaning and replacement of consumables).

05.1.2 Set B

The other option is compact, because it is based on a high cube 20` shiping container, whose dimensions are 6.06 / 2.43 / 2.89m, so it is intended for smaller capacity of use and

container TYPE_6m

SET B



/ or its possible increase in certain positions. where relevant content already exists (eg, Set A or the like). As in the case of Set A, this is a container that has already been used for basic purposes, which is recycled and serves as a base for upgrading.

Set B provides accommodation for 2 people, as suggested by the results of a survey of potential users, allowing a high degree of "isolation". It is primarily a functional and acoustic comfort, with minimal impact on the quality of daily communal activities, which can often be compromised.

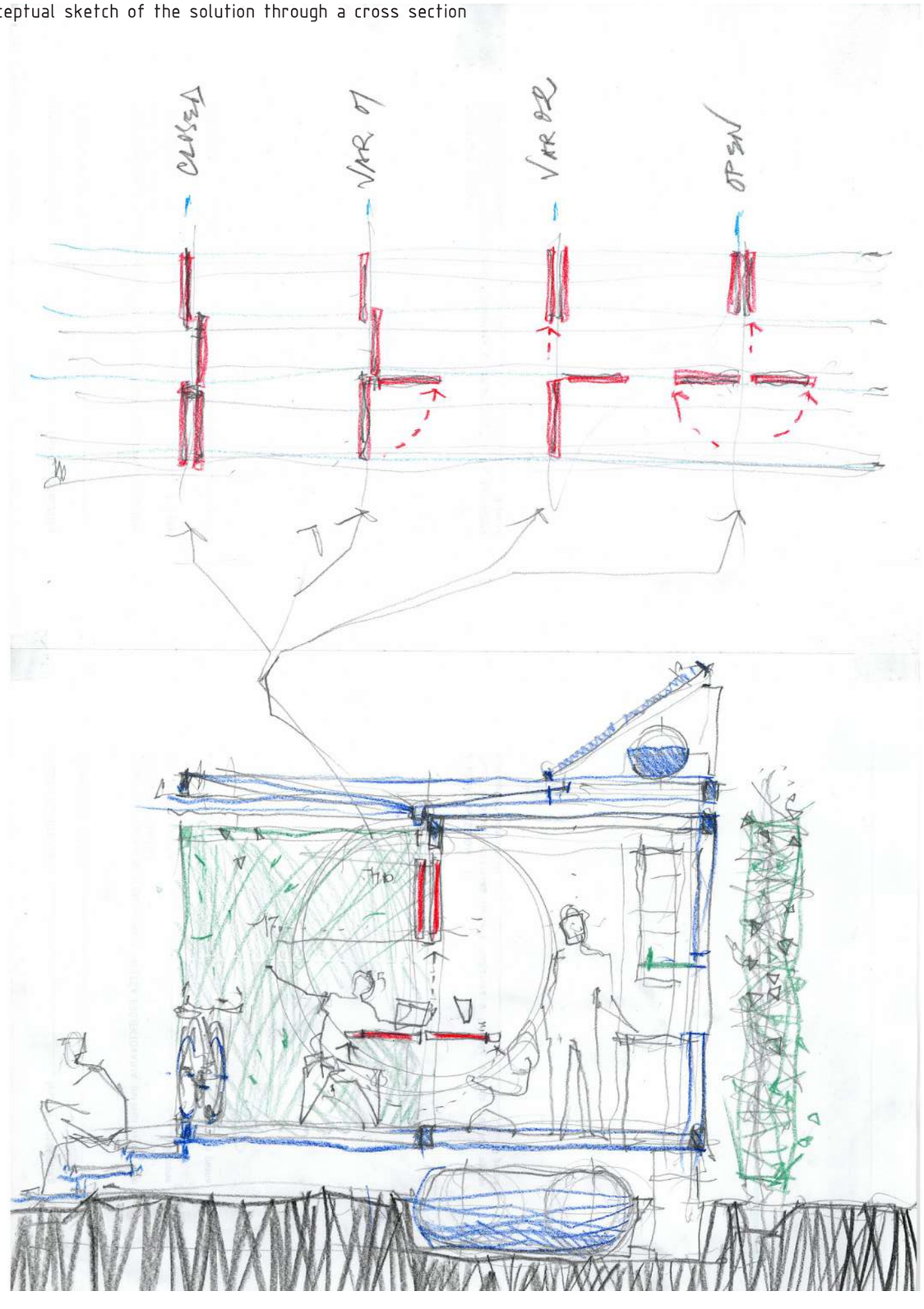
The space is organized to accommodate bicycles in the interior, as this is also one of the imperatives, according to the survey. All elements of work surfaces and storage areas, as well as toilets and kitchens have been typified so that they can be used in both assemblies and in other configurations.

The materials used are selected to look attractive, but with a high degree of durability and long life without requiring maintenance (except for basic cleaning and replacement of consumables).

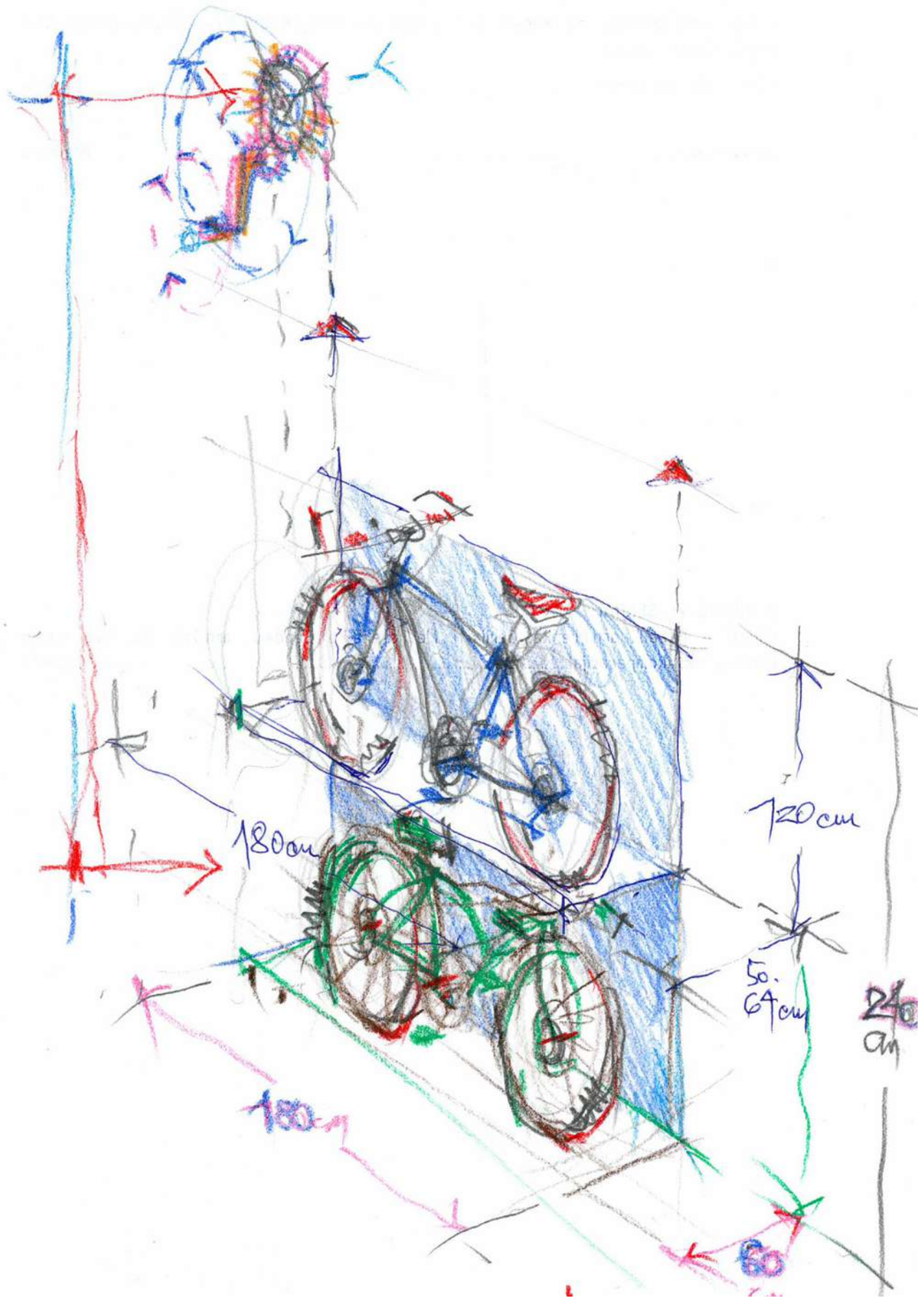
Both assemblies can be prepared for installation at the selected location, and then transported and laid on pre-primed foundations, with connection to also pre-prepared supply systems. The exterior assemblies, canopies and porches are then installed on site.

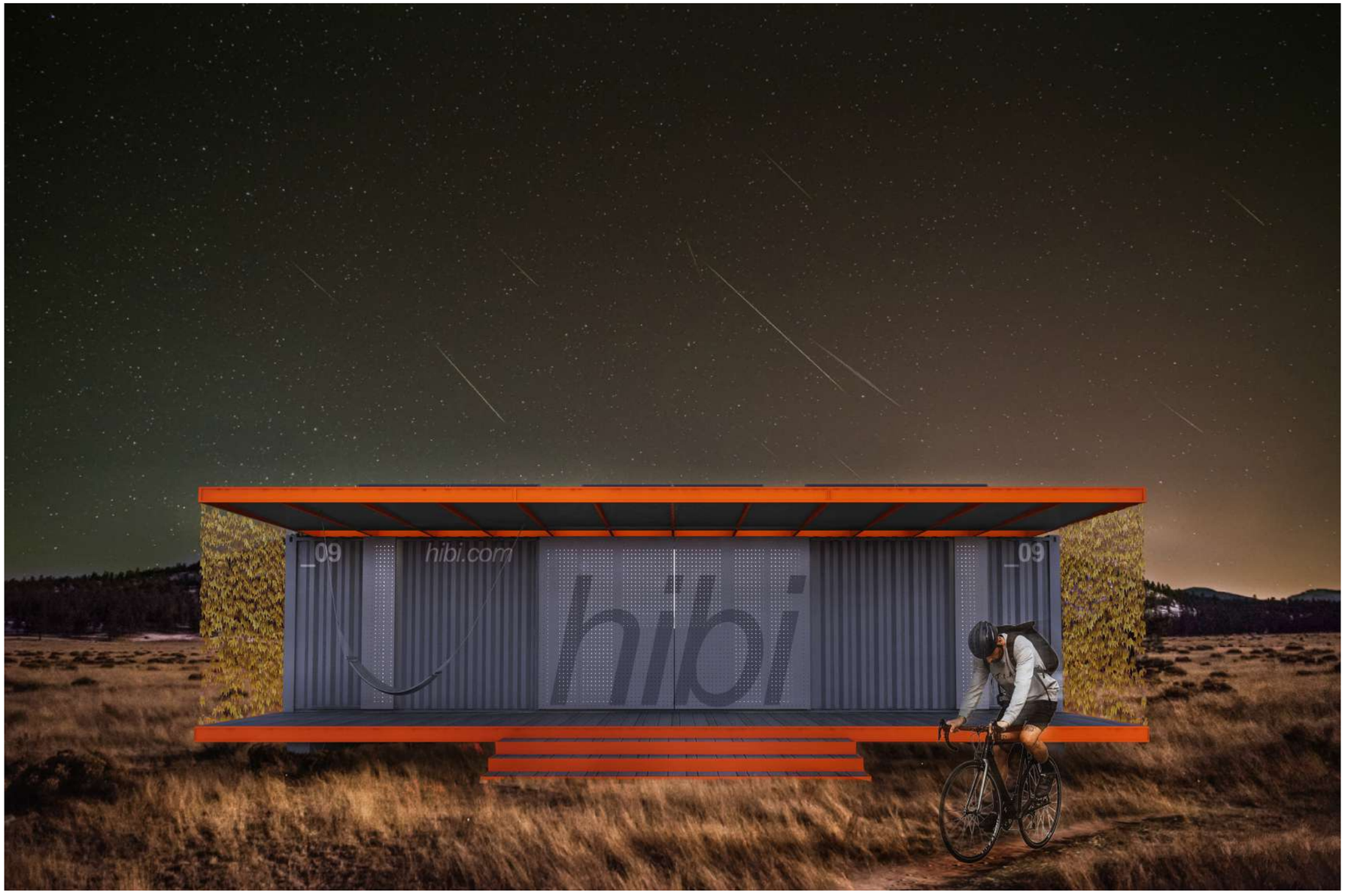
The canopy is part of the roof "exoskeleton" (the system of line, cantilever brackets), whose role is multiple. In addition to forming a canopy base, this element of the assemblies also serves for the installation of horizontal and vertical stormwater pipes, as well as solar panels for electricity generation and water heating, as explained earlier.

conceptual sketch of the solution through a cross section



conceptual sketch of bicycle positioning solutions





spatial representation

For its part, the canopy also has a multifunctional role. Primarily, it increases the surface area from which water can be collected and thus provides the required amount of technical water. At the same time, the canopy serves as an element of the assembly, which prevents overheating of the living space, both in the interior and the exterior. Since, according to the survey, the warm period of the year (spring-summer-autumn), the center of thermal comfort, is defined as the period of use, it is generally located to avoid the heating of the assembly, as well as to ventilate it, that is, to create conditions for air circulation.

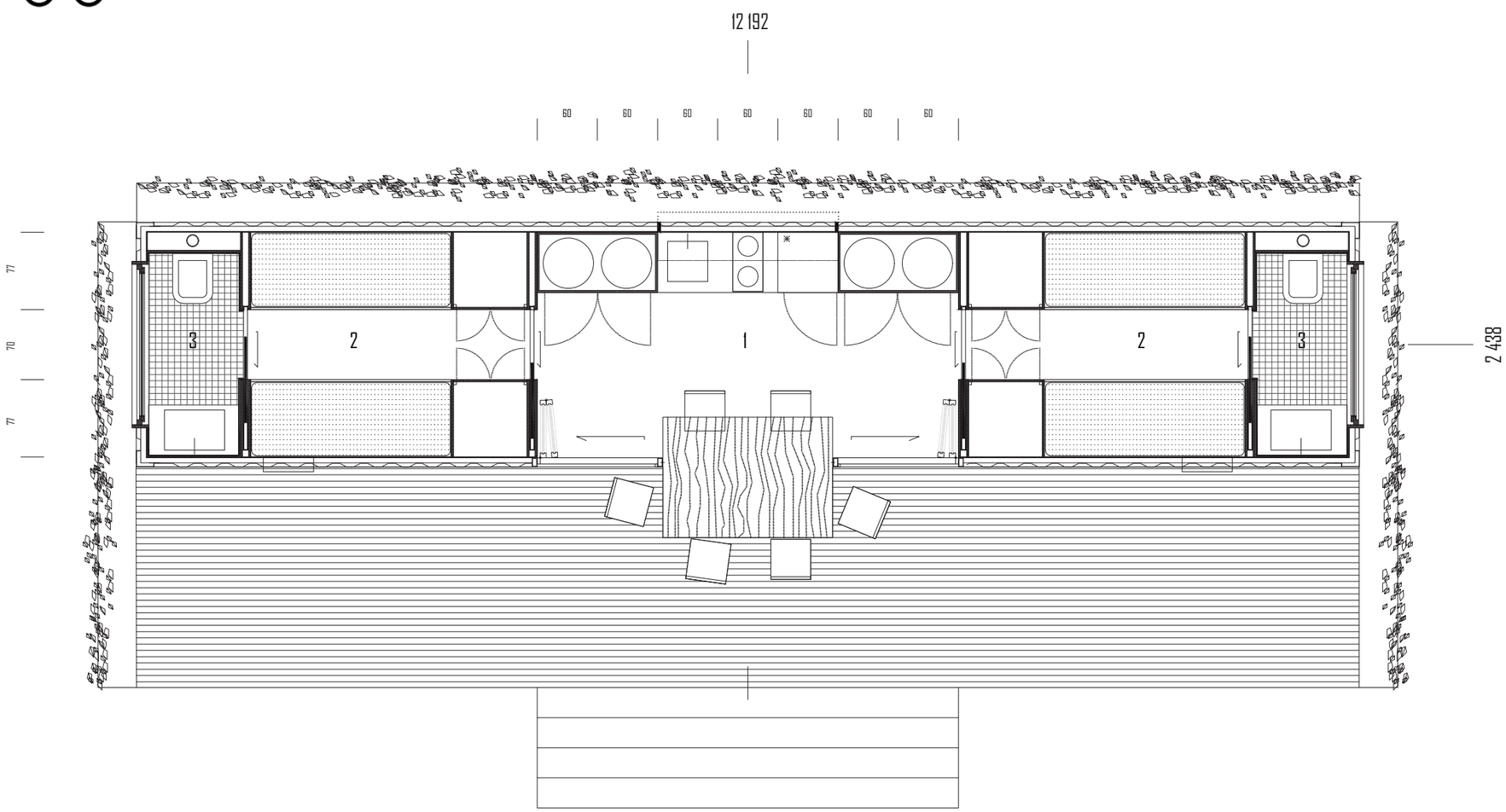
In this sense, the container was erected on a foundation that distanced it from the ground. The sides of the assembly, as well as its rear surface, are protected by a green curtain, which prevents exposure to sunlight, and at the same time forms a space for directional air circulation and, consequently, cooling of the assembly. In contrast, during colder days and periods, heating with solid fuel vines, designed and installed according to the project, is foreseen.

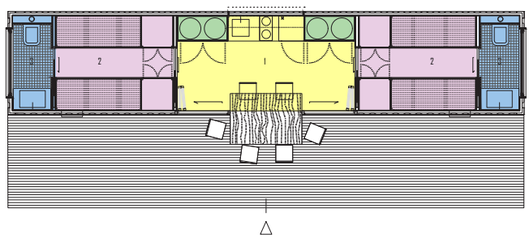
The porch also has a multifunctional role. In addition to the obvious comfort of its use as a place to ensure a comfortable stay in the exterior, it also serves to house water tanks, as well as sewage tanks, allowing them to be easily serviced and preventing, to some extent, freezing their contents during the winter.

In accordance with the initially explained methodology of the project, which refers to the multifunctional optimization process, all elements as well as circuits as a whole represent exponents of the principles of efficiency, in terms of their necessity and roles that are multiple and equally important.

8

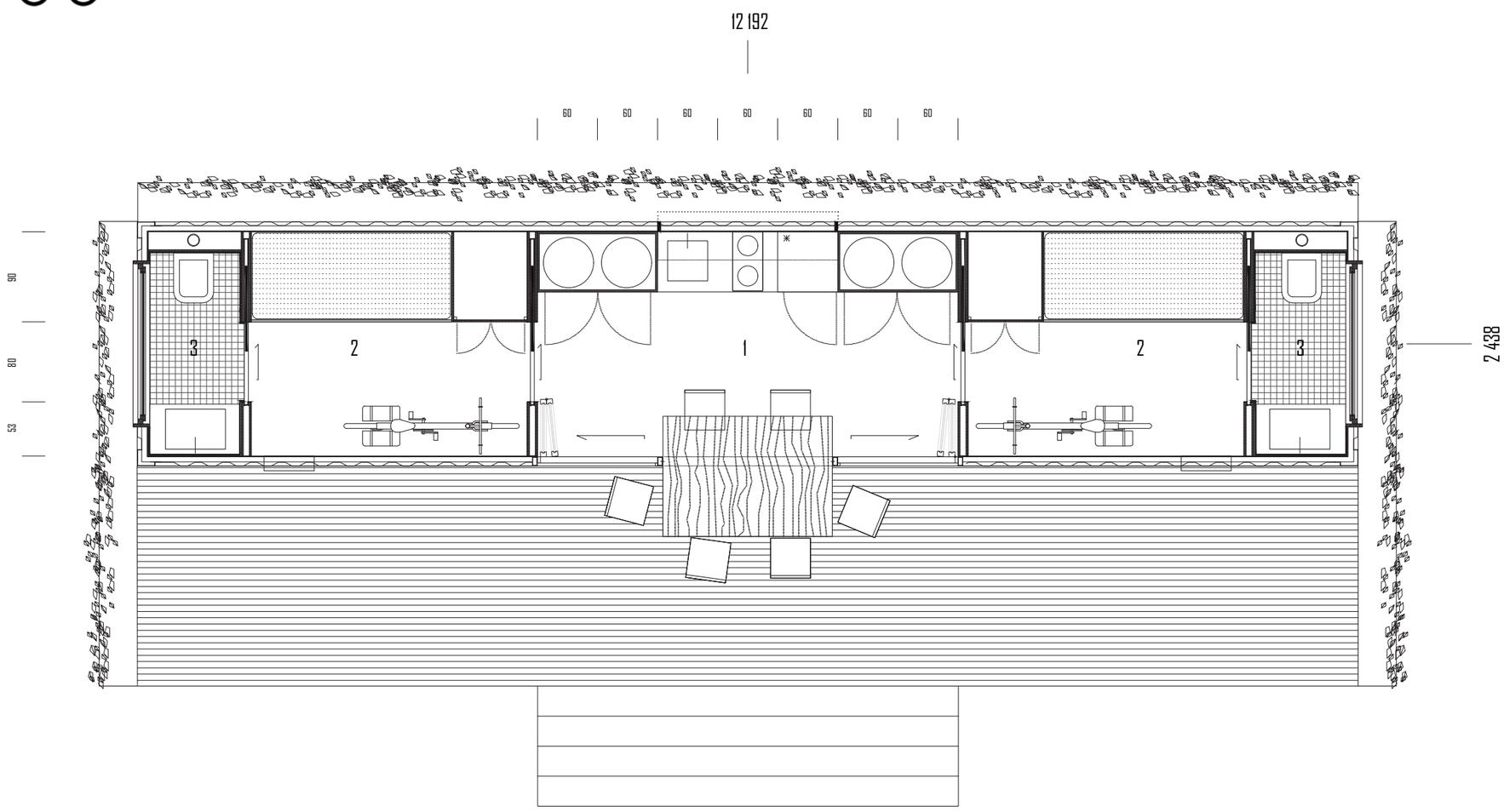
SET A_type I

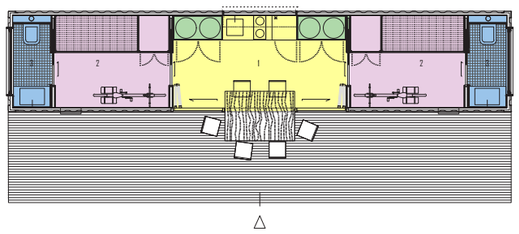




1 _kitchenette with dining
2_sleeping block
3_toilet
4_systems

4 SET A_type II

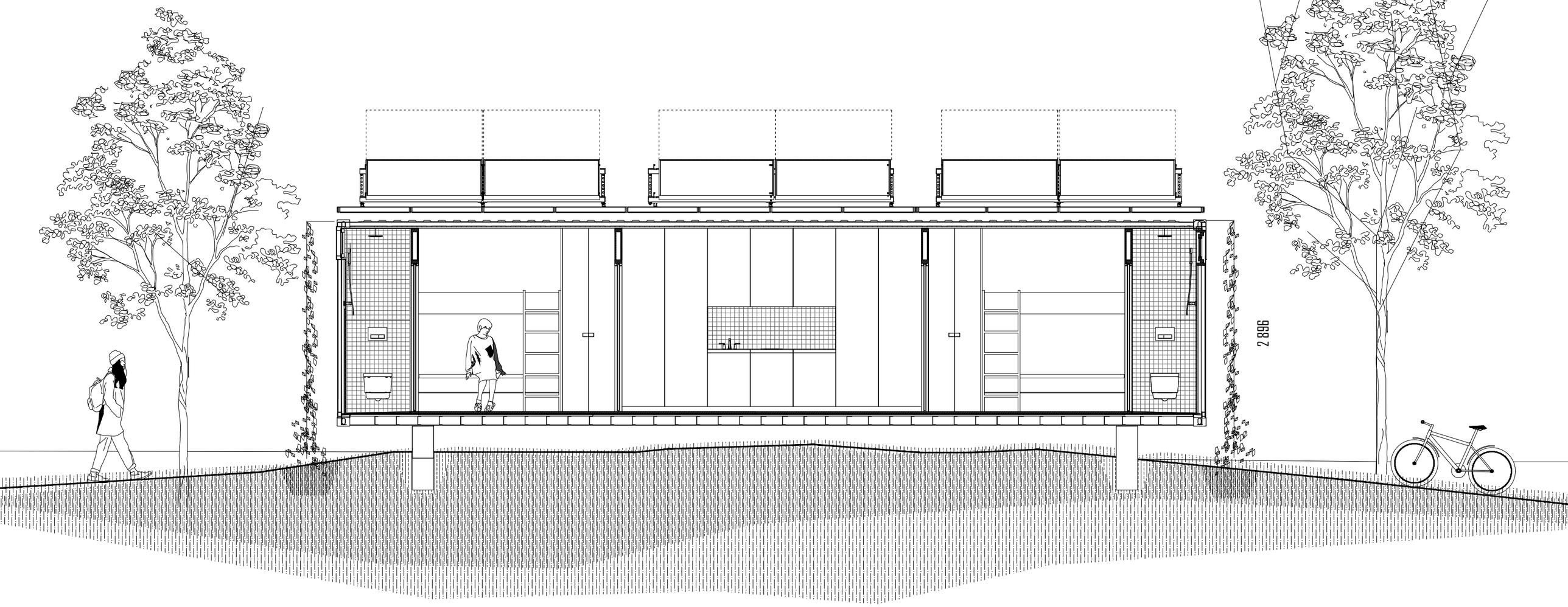




1 _kitchenette with dining
2_sleeping block
3_toilet
4_systems

SET A_transverse section

SET A_longitudinal section



Set A – spatial representation

Set A - spatial representation

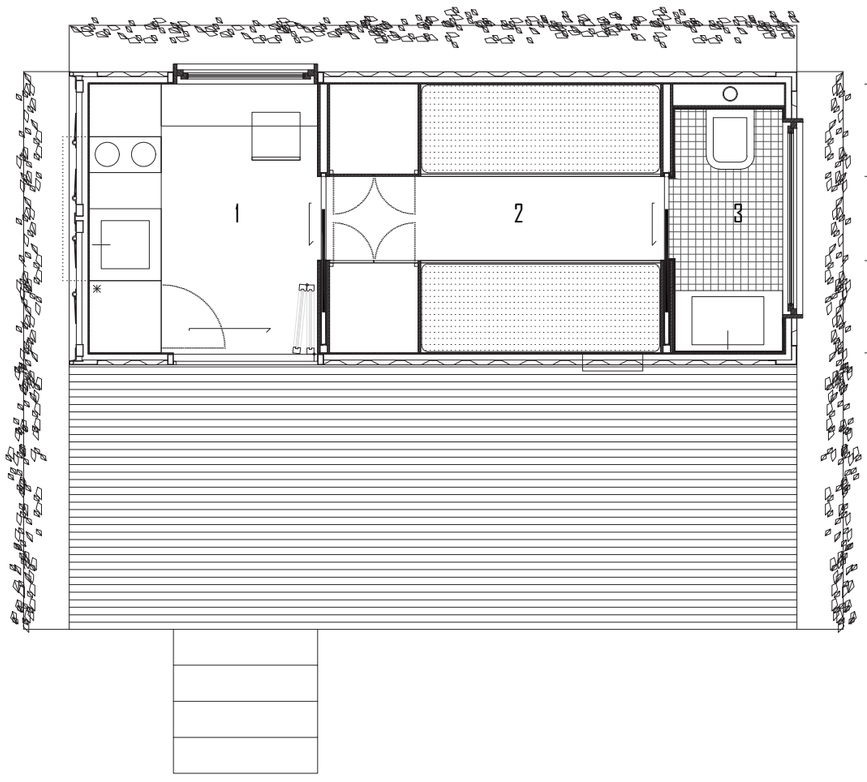
Set A – interior solution

Set A – interior solution

4 SET B_type I

6 058

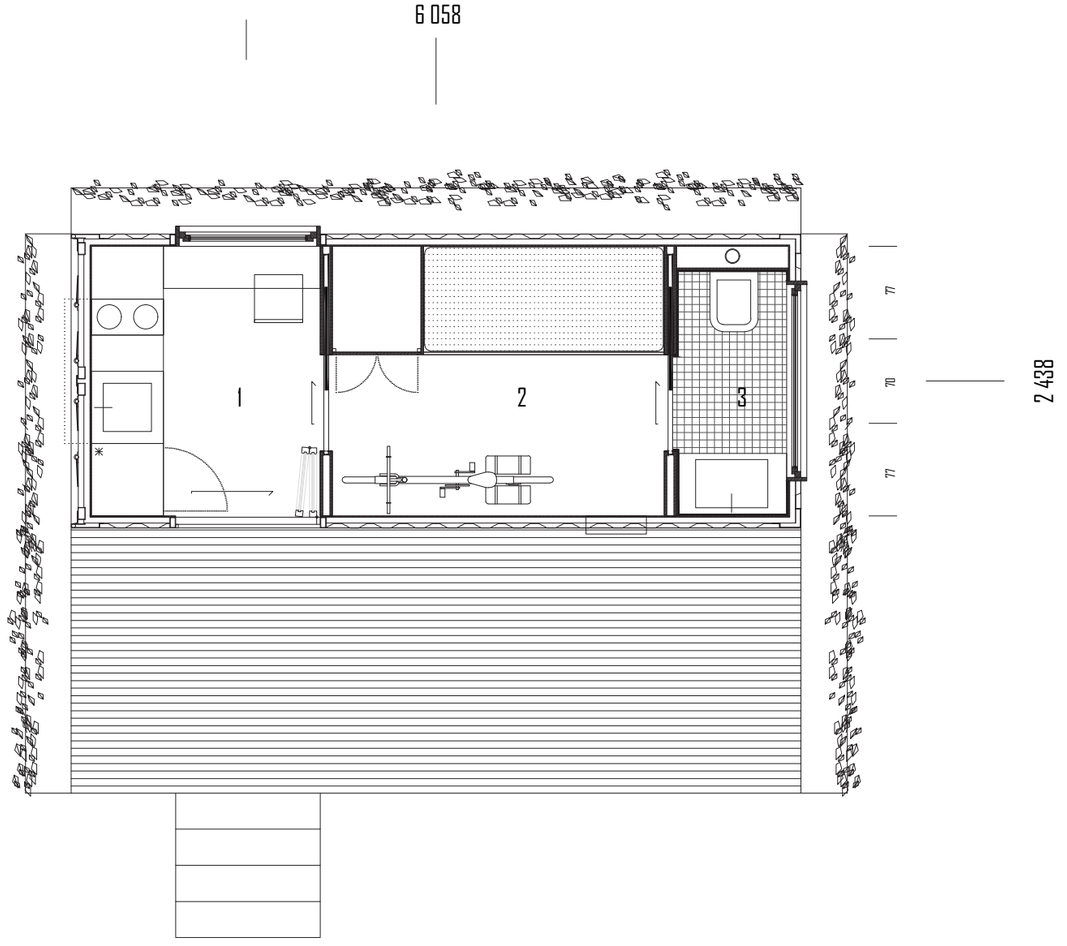
2 438



entrance

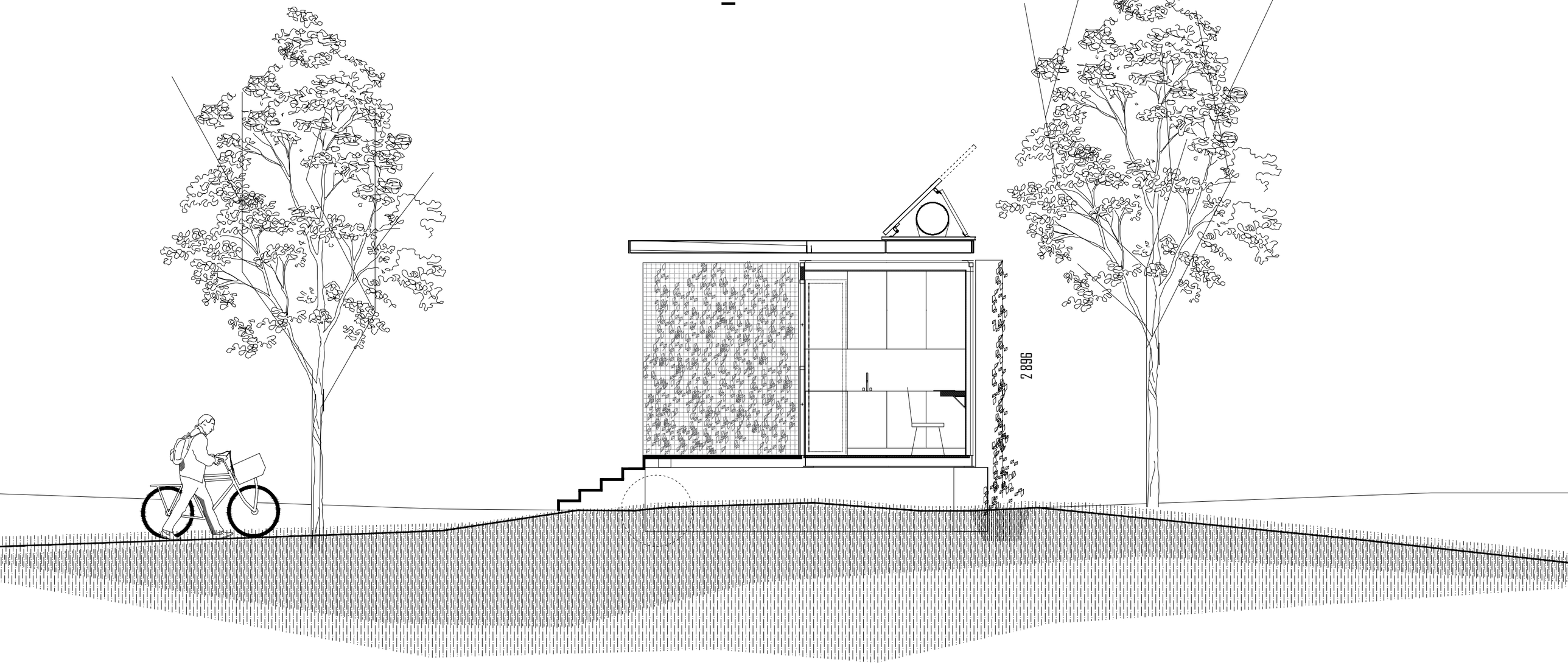
1_kitchenette with dining
2_sleeping block
3_toilet

2 SET B_type II

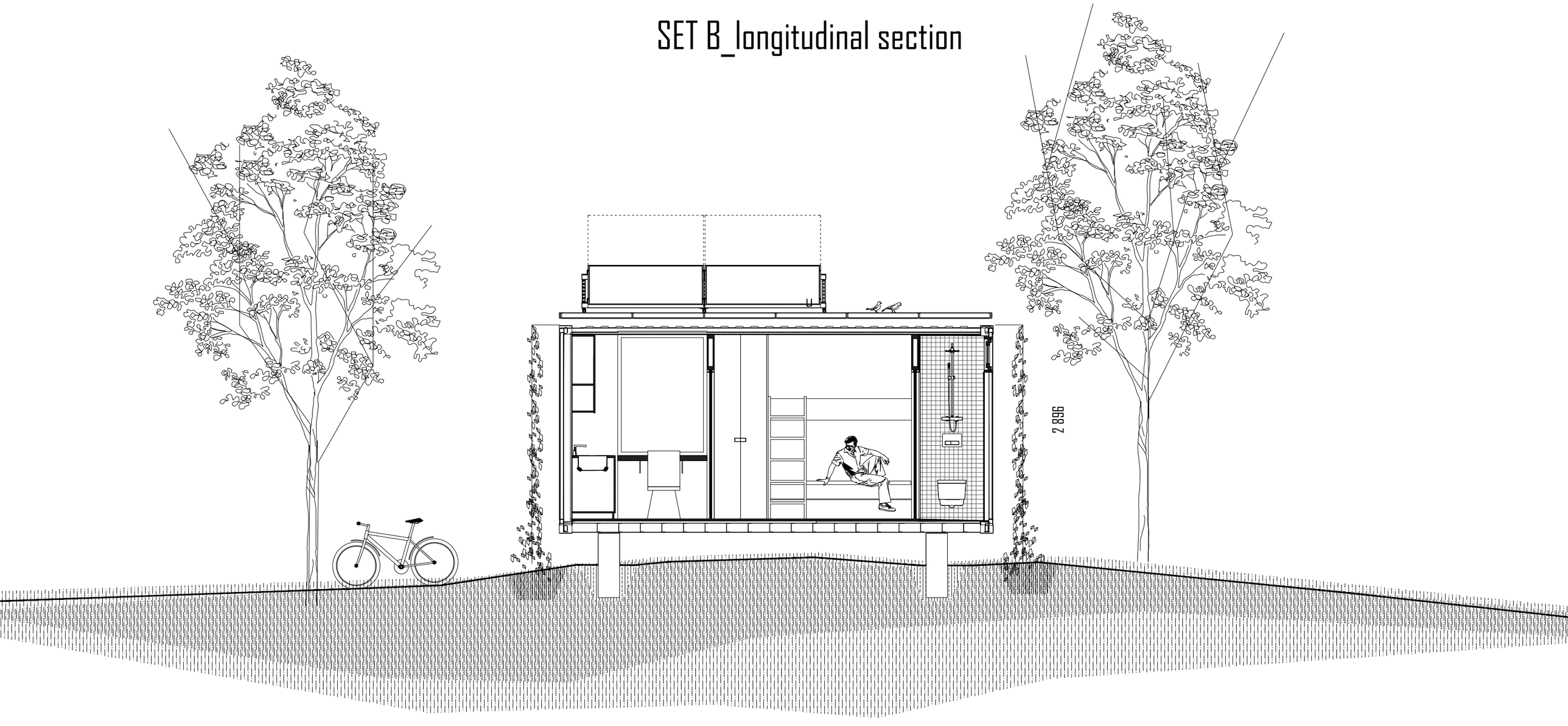


1_kitchenette with dining
2_sleeping block
3_toilet

SET B_transverse section



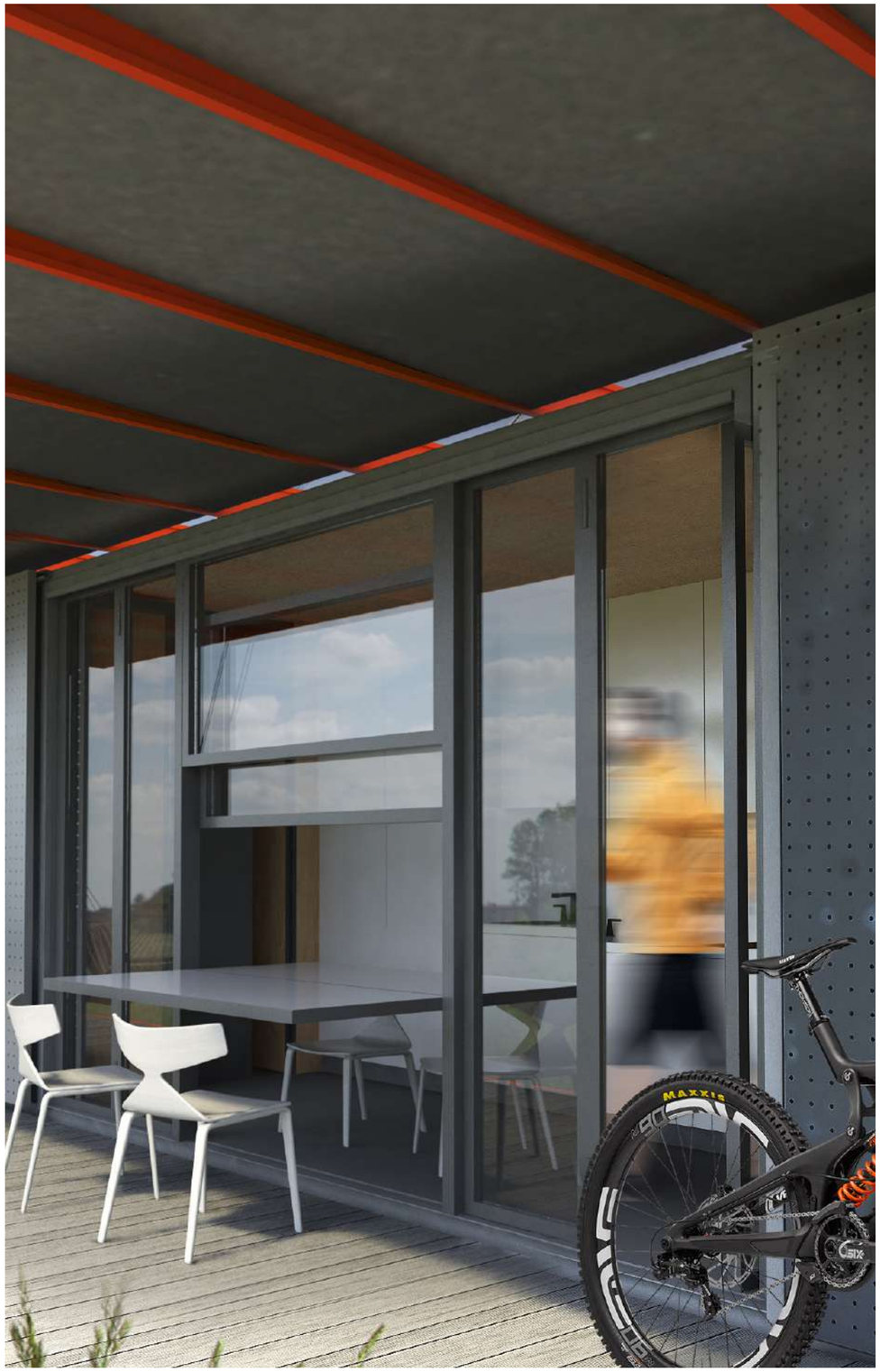
SET B_longitudinal section



Set B – spatial representation

Set B – spatial representation

Interior solution



Interior solution

	INVESTMENT VALUE ASSESSMENT	SET A (euro)	SET B (euro)
	Note: The investment estimate was made on the basis of the Study, and more accurate data can be obtained only after detailed projects are developed. The final cost of construction will be greatly influenced by the factors of the location selected.		
I	**CONSTRUCTION AND FINISHING WORKS**	14,330.00	8,020.00
1	Earthwork on clearing the ground in the size of the building and part of the ground adjacent to the building, excavation of the surface layer of humus and poor quality soil, removal of shrubs and weeds, with loading of excavated material in trucks and transportation to an approved landfill up to 10 km away. Excavation of the ground, with proper cutting of the bottom and sides of the excavation, for the buffer layer ("cushion") of strip foundations, with the disposal of part of the earth to the side for later filling, and the rest to a construction site. Spreading and compacting the tampon layer of natural gravel below the foundation.		
2	Pouring reinforced concrete strip foundations, concrete M30, in a suitable formwork, over the buffer layer of gravel.		
3	Procurement and transportation of containers to the planned location, with placement on previously concreted foundation strips.		
4	Ironmongery works for cutting openings in container walls, dimensions according to project.		
5	Manufacturing, transportation and installation of a complete set of steel structures, for window and door frames, canopy, entry platform and staircase. It is made of steel profiles, boxes and sheets in everything according to the scheme, static calculation and details, as well as the contractor's workshop details, certified by the designer. Protect all steel elements in detail by corrosion protection, both workshop and site, and finally paint with metal paint in tone of the choice of the designer.		
6	Design and installation of windows and glazed doors, with fixed and opening wings, according to the given scheme, made of three-chamber aluminum profiles with thermal break. The profiles are coated in tone of the designer's choice. Glazing with double insulating glass 4 + 16 + 4 mm. The outer glass is transparent and the inner is low emission. The gap is filled with argon. The quality of the fittings, the way of opening the field and other details should be harmonized with the designer.		
7	Production of a base for ceramic floors, cement liner of cement mortar 1: 3. Use the jacket with the Q-126 reinforcement mesh in the middle of the layer.		
8	Fabrication of roof and wall insulation on the inside of the container, made of extruded polystyrene foam (XPS) sheets, thickness and characteristics defined by EE calculation and according to the manufacturer's recommendations.		
	elastic, solvent-free, sealant for wet and wet rooms. Waterproofing is performed over a dry cement liner on the floor. Adequate primer is first applied to dry surfaces and then the first coat of BD-50. Dip 10 cm wide mesh into the corners and joints of the floor and wall, as well as around penetrations and sinks. After drying over the first coat, apply a coat of coatings. Waterproofing should be lifted by 15-20 cm holkers. Waterproofing should be done according to the manufacturer's instructions and specifications. made waterproofing, kit.		
10	Design and installation of one-leaf, full and partially glazed doors. The stock and frame wings are of three-chamber aluminum profiles without thermal break, plasticized in tone of the choice of the designer. The full part of the door leaf is made of thermo-insulated aluminum panels, treated as frame and frame. The glazed parts are glazed with safety glass 3 + 3 mm. Provide quality shackles and all necessary trims.		
11	Paving of external entrance platform and staircase with wooden, waterproof floor covering - decking, in tone of choice of the designer, on steel substructure.		
12	Tiling of interior floors with class A granite ceramics, color, size and surface finish of the designer's choice. The tiles are applied jointly to the joint in the adhesive layer, to the prepared cement liner and waterproofing.		
13	Wall cladding with Class A ceramic tiles, color, size and surface finish chosen by the designer. The tiles are laid jointly on the joint in the adhesive layer, on the prepared gypsum plasterboard walls.		
14	Production and installation of partition walls and ceilings in interior spaces, gypsum plasterboards d = 12.5 mm thick, on prefabricated metal substructure, and bandage all joints of ceiling and wall panels. In sanitary blocks, install moisture resistant gypsum plasterboards.		
15	Painting of walls and ceilings, on gypsum plasterboard base, dispersive color in tone chosen by the designer.		
16	Painting the outside of the walls of the container and all other metal elements, with a quick-drying anti-corrosion coating for metal 3in1 in the tone of the designer's choice, including all necessary preconditions, as well as a suitable lightweight moving scaffold.		
17	Procurement and installation of sanitary block: toilet, sink, shower, mirror and other small elements of the bathroom interior		
18	Procurement and installation of mini kitchen equipment with the necessary elements: sink, gas hob, mini refrigeration unit, and production of kitchen elements from refined chipboard, in all according to the schemes provided by the designer.		
19	Procurement, production and design of interior elements: bed structures, mattresses, ladders, tables, chairs, closets, all according to the schemes provided by the designer.		
II	**HYDROTECHNICAL INSTALLATIONS**	2,200.00	1,800.00
III	**ELECTRIC POWER INSTALLATIONS**	7,440.00	4,720.00
IV	**THERMOTECHNICAL INSTALLATIONS**	2,700.00	1,900.00
	TOTAL	**26,670.00**	**16,440.00**

Set A – spatial representation in urban enviroment

Set A – spatial representation

Set A - installation in urban enviroment

Set A – spatial representation

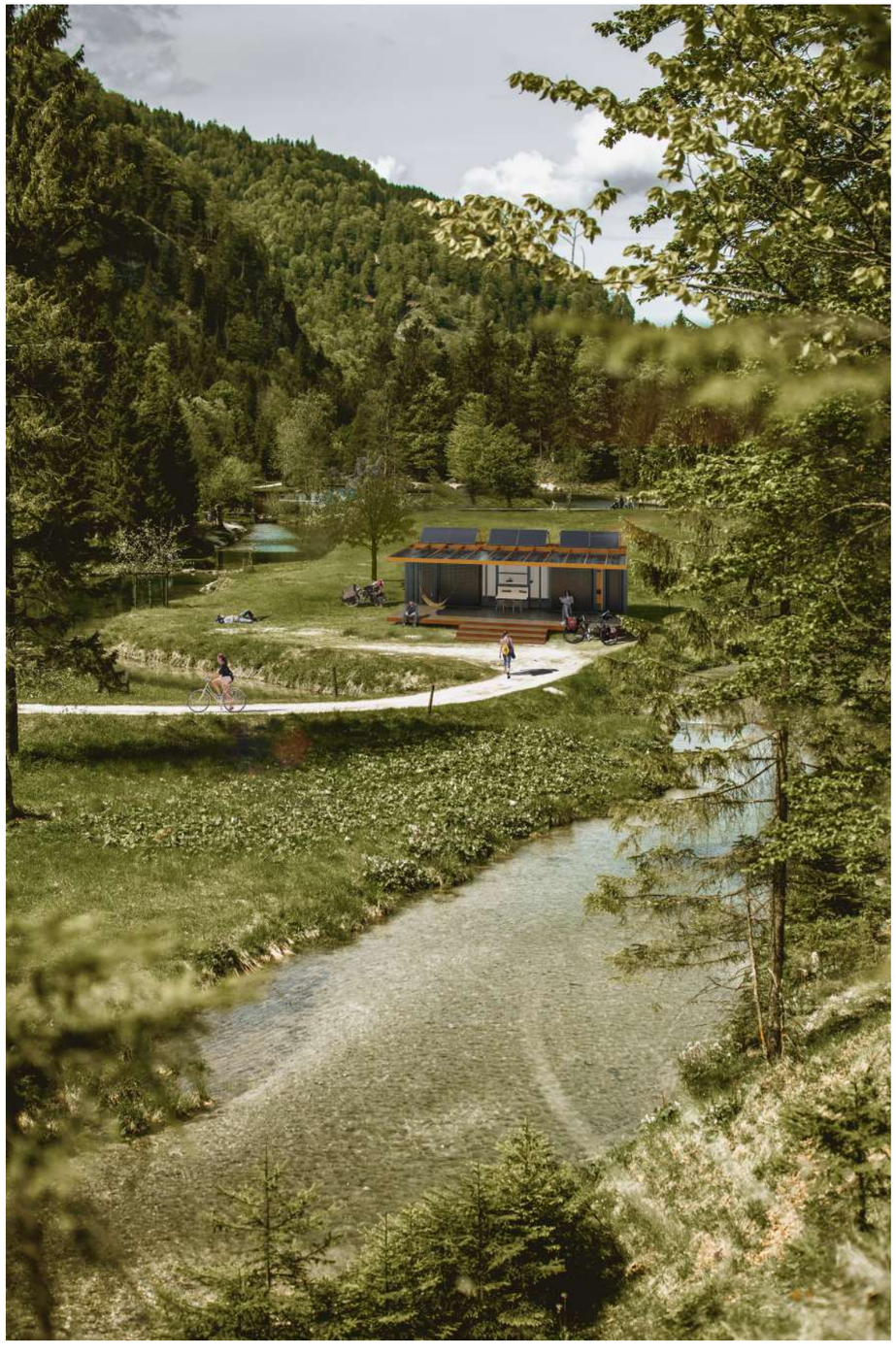
Set A – spatial representation

Set A – spatial representation

Set A – spatial representation

Set A – spatial representation

Set A – spatial representation



Set A – spatial representation

Set A – spatial representation

Interreg
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