TU WIEN

SOLAR DECATHLON 2013

SCHEMATIC DESIGN SUMMARY

Vienna University of Technology

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Mission Statement

Simple, excellent, smart – our "house of the future" performs at the highest level possible in every respect. The architectural design provides a wonderful interior space with interesting views inside and out that create a sense of living that is open well beyond what could be expected from such a small dwelling. It is built using a system of prefabricated, lightweight construction components that can be combined in different ways to adapt to different people's needs. The flexibility of the concept is demonstrated in a manual of instructive application scenarios. Virtually all the construction materials employed stem from renewable and/or easily recyclable resources to account for sustainability factors that impact the environment before and after its operative lifecycle. During its lifecycle as a home, it not only ensures a healthy, comfortable, and enjoyable environment for those who actively live in it, but also generates at least enough energy to fully power the daily lifestyle of its inhabitants, including their needs for mobility (in the form of e-bikes), heating and cooling, as well as warm water (through a highly efficient, compact service unit coupled with a solar cooling system). And the simplicity, flexibility, and component availability make it an affordable housing option for almost everyone, almost everywhere.

Competitition Strategy

Team Austria's goal is to maximize points in each and every of the ten contests.

Contest 1: Architecture

Considerations of social, environmental, and economic accountability are considered integral to the overall architectural quality, targeted as follows:

- *Achieving an "Energy Plus" building* by embedding an effectively optimized set of advanced technology components in an aesthetically pleasing design.
- *Economical construction that is easy to assemble and disassemble* by using pre-fabricated components that are comparatively small, lightweight and eco-friendly (wood-based), and sufficiently durable for repeated transportation and re-assembly.
- *Functional flexibility* by means of an adaptable design concept to meet the changing needs of potentials occupants.
- *Variably additive building units that can be scaled to denser urban structures* to reduce land use and commuting distances between workplace, social centers, and home.
- *Aesthetically satisfying and healthy environment* by offering moments of "surprise and delight" in architectural detail, daylight and sunshine in winter, agreeable temperatures and shading in summer, as well as high indoor air quality year-round.
- *Multi-dimensional integration of building levels* through a holistic design approach in trans-disciplinary collaboration between architects and civil engineers, electrical and mechanical engineers, physicists and artists, product and media designers, as well as specialists for timber construction, lighting design, accessibility and safety, and other contributing disciplines.

In order to establish values for comparison with other competition entries, the results of Life Cycle Analysis (LCA) evaluations and relevant building quality certification methods will be provided according to location and regionally applicable standards (see also "Contest 10: Energy Balance").

The architectural design approach behind the prototype initially focuses on an urban strategy: Our housing concept shall be suitable for higher density development aimed at the reduction of "(sub-)urban sprawl" and conserving land resources. The floor plan of the house includes an embedded atrium, which allows a finer differentiation of private-to-public gradients in higher-density housing developments. All service functions and spaces are compactly arranged to allow the main living area to remain as spacious as possible. This primary interior space enjoys ample and inviting daylighting from the south and north. It can be extended to include the private outdoor (atrium) spaces by opening large parts of both these glazed facades whenever the weather allows. Careful attention will be paid to further developing the interior design in this vein.

We hope to convince the jury of the merits of all these not-measured/immeasurable qualities in our prototype.

Contest 2: Market Appeal

Our architectural aims (see above) are tightly aligned with what we consider to be the "unique selling points" of the prototype in terms of market appeal as a concept.

More specifically, the concrete prototype targets both single and coupled individuals who are looking to live in a house of modest size, in other words, it targets a currently very large and rapidly growing sector of the housing market around the world. The prototype is built of lightweight, wood-based construction components that can be assembled in various combinations as needed. We will provide a manual of model variations to demonstrate the concept's potential range of applications for potential residents/homeowners so that they can see how to apply it to meet their individual needs and desires.

The thermal properties of the components can also be customized for adaptation to different climate zones, which will be illustrated in an easy-to-follow video. Day-to-day operation of the house's systems will be optimized for intuitive user-friendliness to ensure maximum market acceptance. Finally, complete information about such a home's sustainability in the larger context of environmental concerns, especially in comparison to "conventional" housing, shall provide further motivation for individual consumers to consider such a solution.

Again, we hope to convince the jury of the merits of these immeasurable qualities in our prototype.

Contest 3: Engineering

The goals of the engineering team encompass

- minimizing annual electrical energy consumption,
- exceeding competition comfort criteria,
- meeting or exceeding competition criteria for domestic hot water, and
- minimizing investment costs,

as well as

- achieving a "beautiful" engineering design (integrated, simple, robust, etc.) and
- implementing water saving measures (a priority in California).

Here again, we hope to convince the jury of the merits of these immeasurable qualities in our prototype.

Contest 4: Communications

A combination of highly informative, bilingual press kits, website, explanatory renderings, videos and other educational media will be provided to convince the jury of the quality of our efforts to communicate Team Austria's solar housing concept both in the United States and abroad.

Contest 5: Affordability

As declared in the mission statement, the simplicity, flexibility, and component availability of the systems demonstrated in our prototype shall make it an affordable housing option for almost everyone, almost everywhere. This also means that we will only equip it with "extras" if these can be economically justified for a large spectrum of potential occupants/homeowners in terms of lifecycle savings and/or performance gains in comfort and enhanced quality of living.

It is our hope that such intentions will favorably weigh in to the jury assessment methodology.

Contest 6: Comfort Zone

Our house is being designed for excellent thermal quality, using a range of proven simulation tools to guide the design process successfully to meet the thermal-comfort criteria of maintained temperature range and maximum relative humidity for the competition. The resulting design solution, including all mechanical system components, will have been thoroughly tested in Austrian labs before the Solar Decathlon 2013 competition in California.

We are also taking on the further challenge of maximizing less immediately measurable qualities of comfort by focusing our design decisions on employing environmentally friendly, low-emission materials to ensure optimal indoor air quality to occupants. This will also favorably influence the results of life cycle analysis and other assessment methods (LEED, ÖGNB Certificate of the Austrian Society for Sustainable Design & Building) for the final design prototype.

Contest 7: Hot Water

The renewable energy systems will be designed and engineered to ensure that sufficient quantities of hot water are available to house occupants and appliances on a daily basis.

Contest 8: Applicances

Our selection of energy-saving appliances in the prototype will demonstrate that this contest's requirements can be met or exceeded by affordable product technology currently available (at least) in Europe, especially if employed in combination with a suitable energy load management and control system, as well as with adequate training of the student demonstrators.

Contest 9: Home Entertainment

Though our house prototype will be relatively small in floor area, the spaces are conceived to afford a maximum of activity potentials to the occupants (see also "Appendix A: Architectural Design Drawings").

A generous main living area opens to delightful patios on two sides, which allow interior and exterior spaces to merge through glazed interfaces, inviting celebration with friends. There is plenty of room for a large table and a common cooking island to allow cooks and guests to interact and enjoy their time together. What everyone needs for a fun movie night is also there: a big screen and comfortable seating (close-by the kitchen for snacks).

The sleeping area by night doubles as a home office by day and can be visually and acoustically separated from the main living area whenever someone needs to concentrate or just simply be peacefully alone.

Some aspects of this contest are measurable, others not. We intend to have fun and make memories with whoever participates.

Contest 10: Energy Balance

Our "Energy Plus" building concept builds on physical principles for thermally optimizing the building shape and envelope structure, with particular attention to the sizing and placement of apertures in relation to site orientation and climate conditions (see also next section: "Architectural & Engineering Design Approach").

To achieve these goals as efficiently as possible, the thermal envelope, glazing, and shading devices are being designed to reduce both the heating and cooling loads to as close to zero as possible. The thermal storage mass of the house is being optimized to even out anticipated ambient temperature swings in order to passively ensure ideal indoor conditions.

Altogether, a comprehensive system of passive strategies is being employed to minimize the energy loads on any and all active systems that are to be engineered for the competition. The final results measured in this contest will be compared to findings obtained in the course of certification through the Passive House Institute of Austria prior to the competition.

Architectural & Engineering Design Approach

Our competition activities have focused on the following goals and approaches:

1. *Achieving an "Energy Plus" building* by embedding an effectively optimized set of advanced technology components.
2. *Economical construction that is easy to assemble and disassemble* by using pre-fabricated components that are comparatively small, lightweight and eco-friendly (wood-based), and sufficiently durable for repeated transportation and re-assembly.
3. *Functional flexibility* by means of an adaptable design concept to meet the changing needs of potentials occupants.
4. *Variably additive building units that can be scaled to denser urban structures* to reduce land use and commuting distances between workplace, social centers, and home.
5. *Aesthetically satisfying and healthy environment* by offering moments of "surprise and delight" in architectural detail, daylight and sunshine in winter, agreeable temperatures and shading in summer, as well as high indoor air quality year-round.
6. *Multi-dimensional integration of building levels* through a holistic design approach in trans-disciplinary collaboration between architects and civil engineers, electrical and mechanical engineers, physicists and artists, product and media designers, as well as specialists for timber construction, lighting design, accessibility and safety, and other contributing disciplines.

"Energy Plus" building concept

The concept builds on physical principles for thermally optimizing the building shape and envelope structure, with particular attention to the sizing and placement of apertures in relation to site orientation and climate conditions. The buildup of the construction components themselves will be adaptable to a range of climates requiring different characteristics in the thermal envelope, e.g., additional insulation layers for colder climate zones and at high altitudes, or reflective layers for hot climates. Similarly, the selection and placement of vapor barriers in the construction shall be adaptable to the local climates in order to ensure adequate moisture and mould protection. The passive energy concept is enhanced by integrating:

- precisely calibrated combination of advance mechanical systems to provide building services,
- renewable energy-collection systems to provide heat and electricity, and
- automated controls to harmonize passive solar energy flows with the energy demands of the active systems.

The project team will have the opportunity to employ Austria's cutting-edge photovoltaic technologies and products in the design prototype, as well as the most advanced load-management systems. An interactive user manual in the form of an e-learning application with audiovisual scenario-based walkthroughs will be available for visitors to explore the operating principles of the overall system during the public competition in 2013.

Development of a new timber construction system

Austria is well known for its advanced timber engineering and wood-based construction. As a "sub-project" within the framework of the competition, students of architecture from VUT and of the master course "Überholz" from the University of Art & Design Linz have the opportunity

to collaborate with civil engineers, architects, and the timber industry on the development of a new construction system of modular components designed specifically to meet the competition's objectives.

Design philosophy

Beyond the technical aspects of construction, design development fundamentally addresses functional issues of living in a modestly sized home: What do people essentially need for a satisfying lifestyle, despite limited income and space? How can we best apply ergonomic principles in an aesthetically desirable manner? What are the differences in needs for different occupant groups?

For student participants coming from different fields of study, the project affords a unique opportunity to explore building design methods across disciplines in an integrative context that spans the entirety of the design process, from preliminary concept to full-scale prototyping and testing. Such a holistic approach compels equal and unifying attention to all facets of design concern for form, aesthetics, functionality, and ecology.

Materials and technologies

All the materials used in the wood-based construction system must be carefully selected for their combined impact on the building's indoor air quality, dynamic thermal properties, and environmental footprint over the entire component lifecycle. Through our connections with Austrian manufacturing companies, we have excellent access to new technologies, exemplary products, and advanced systems for potential implementation in the prototype. These products and systems include engineered timber components, alternative insulation materials, integrated roofing and photovoltaic systems, high-performance windows, PCM's, lighting and building control systems, energy-efficient household appliances, as well as ecologically designed furniture.

Health, comfort, and environmental factors

Studies done at VUT have shown that occupants rate health and comfort as the most important criteria in their perception of a building's quality. The competition curriculum also stresses these expectations of a built environment's performance. Participating students will learn to design a house that safely and affordably offers excellent daylight and sufficient sunshine in winter, shading in summer, as well as agreeable temperatures and high indoor air quality all year round. In cooperation with colleagues and students from other faculties, we will be able to provide empirical evidence that the design exceeds the environmental requirements set out by U.S., European, and Asian standards for state-of-the-art, energy-efficient buildings. Additionally, experts from the Vienna University of Economics & Business will guide students in applying LCA and LCCA methods to assess the long-term environmental and economic impacts of competing design solutions.

Design balance between interior and exterior spaces

We intend to devote special design attention to the transitions through interior, semi-interior, semi-exterior, and – most public – exterior spaces in and around the Team Austria house prototype for the Solar Decathlon 2013. All dimensions of architectural elements will be designed to afford optimal accessibility and ergonomic functionality. Design decisions regarding orientation and multisensory perception of circulation paths into and out of, as well as through the house will be informed by the research findings of transdisciplinary experts. We aim to ensure that as many levels of perception that contribute to an understanding of "house" are respected and integrated in the design as possible.

System & Component Design

Foundations and anchors

Point foundations are planned for our prototype as per the following schematic (Fig. 1).

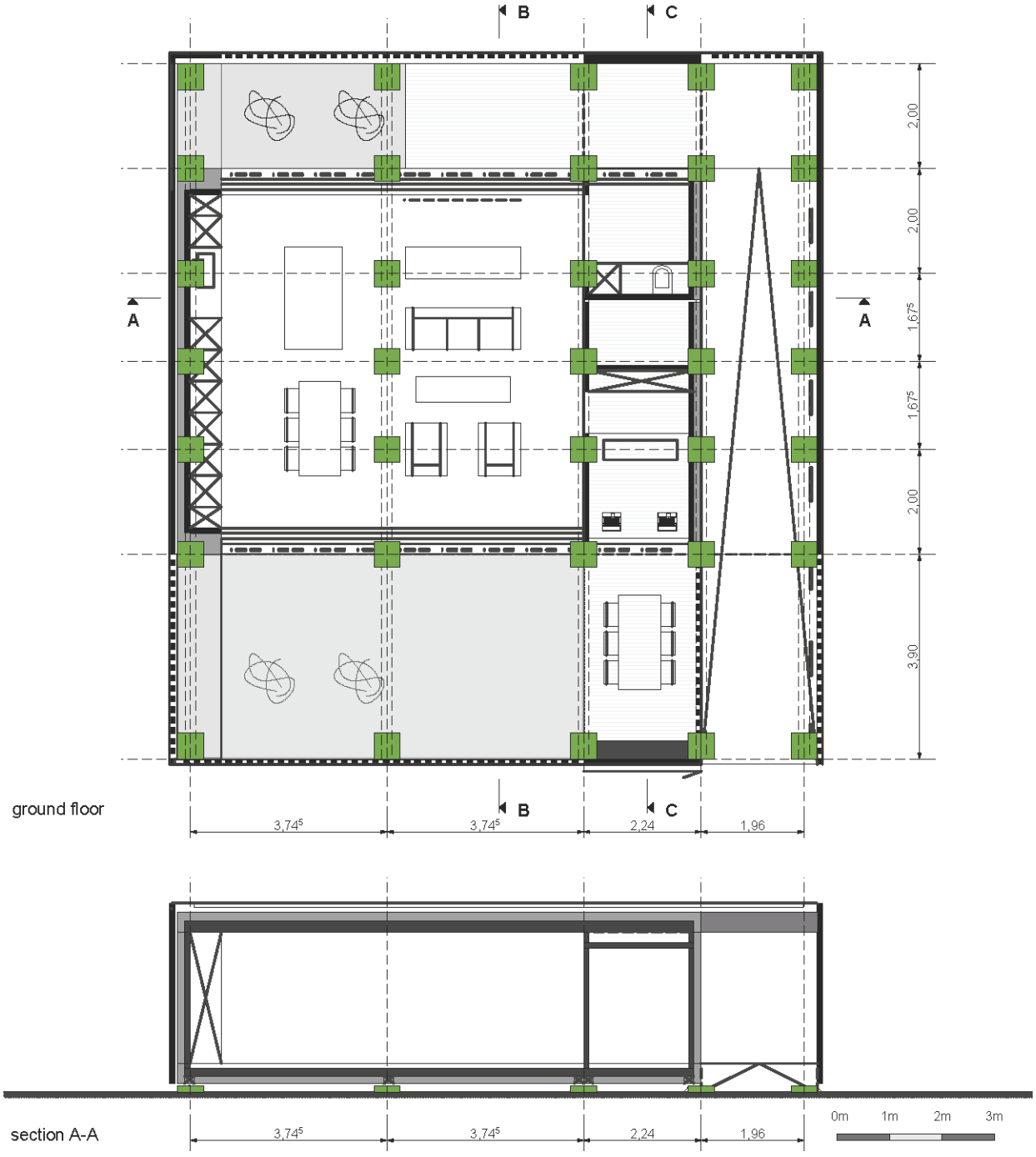


Fig. 1: Locations of point foundations/anchors.

Building structure & assembly

Exterior and interior structures are considered integrally connected, both functionally and aesthetically. The extension of living spaces into integrated "green rooms" affords a natural connection between interior and exterior, leading into and out of the building.

The interior room height is 2.5m in the main living area, 2.2m in the service spaces (indoor/outdoor bath/shower and toilet areas, sleeping/office areas, mechanical systems space). The modular assembly system is dimensioned to allow component transportation in standard shipping containers. Projected assembly steps (Fig. 2 and 3):

1. Place floor components.
2. Place completely prefabricated east service core (bath/toilet/mechanical/other).
3. Place prefabricated west service components (kitchen/storage).
4. Place ceiling/roof components.
5. Insert glazing.

Ramps, railings, and guards

The difference in walking level between the house floor at ground/entry level and the surrounding terrain is app. 50 cm. This vertical rise is surmounted by an exterior ramp with a slope of 4.5%, which is fully integrated in the architectural design, thus making the building accessible for all. The "landing platform" measures 2x2m (Fig. 4).

The walls/screens accompanying the ramp structure include integrated handrails and exhibition elements for the visiting public that introduce and explain the house they are about to see. The elevated patio spaces are enclosed by full-height screen/media elements.

Glazing types and location

Based on preliminary estimations of the building's thermal behavior during the winter and summer seasons, the following glazing classes have been selected for further design investigation (Fig. 5):

- north facades: triple-light insulated, U-value = 1.0
- south facades: triple-light insulated, U-value = 0.7

All glazing in the house is considered to be implemented at full room height without framing reductions in aperture light dimensions, in some sections as fully glazed sliding doors (requiring safety glass). Overhead shading devices over patio areas, especially on the south side of the building, shall contain integrated photovoltaic modules in combination with safety glass.

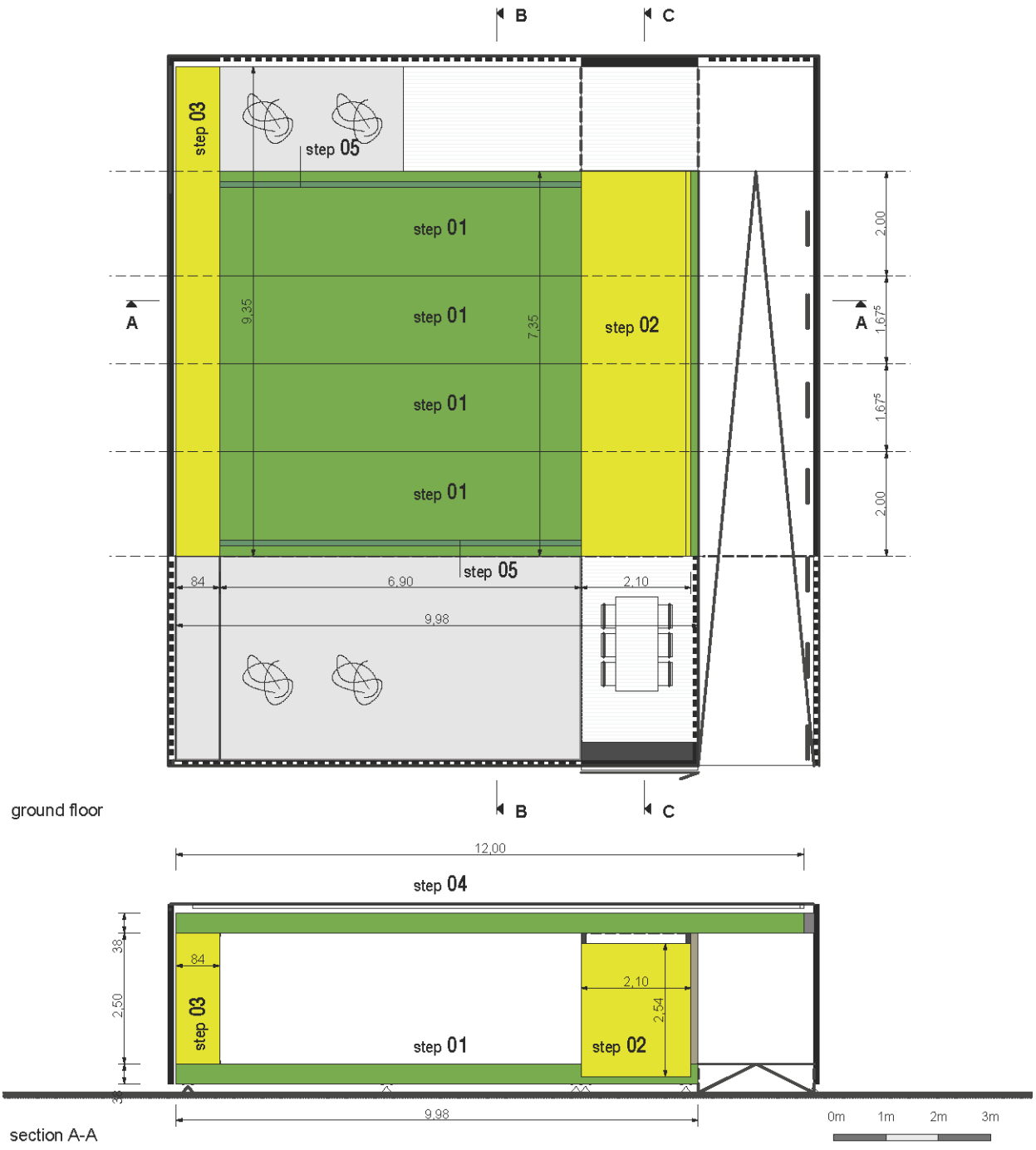


Fig. 2: Assembly step of interior structure.

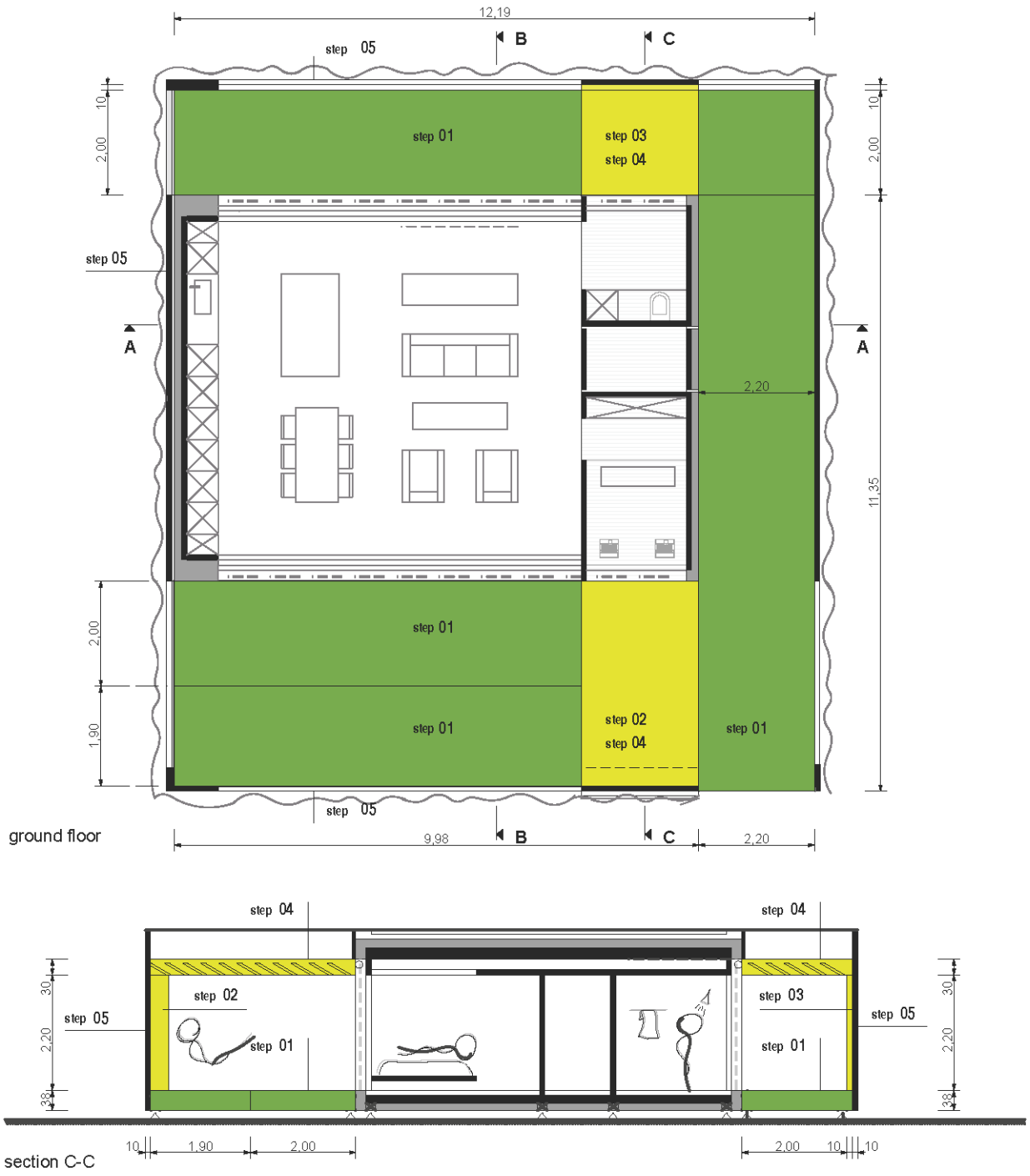


Fig. 3: Assembly of exterior structure.

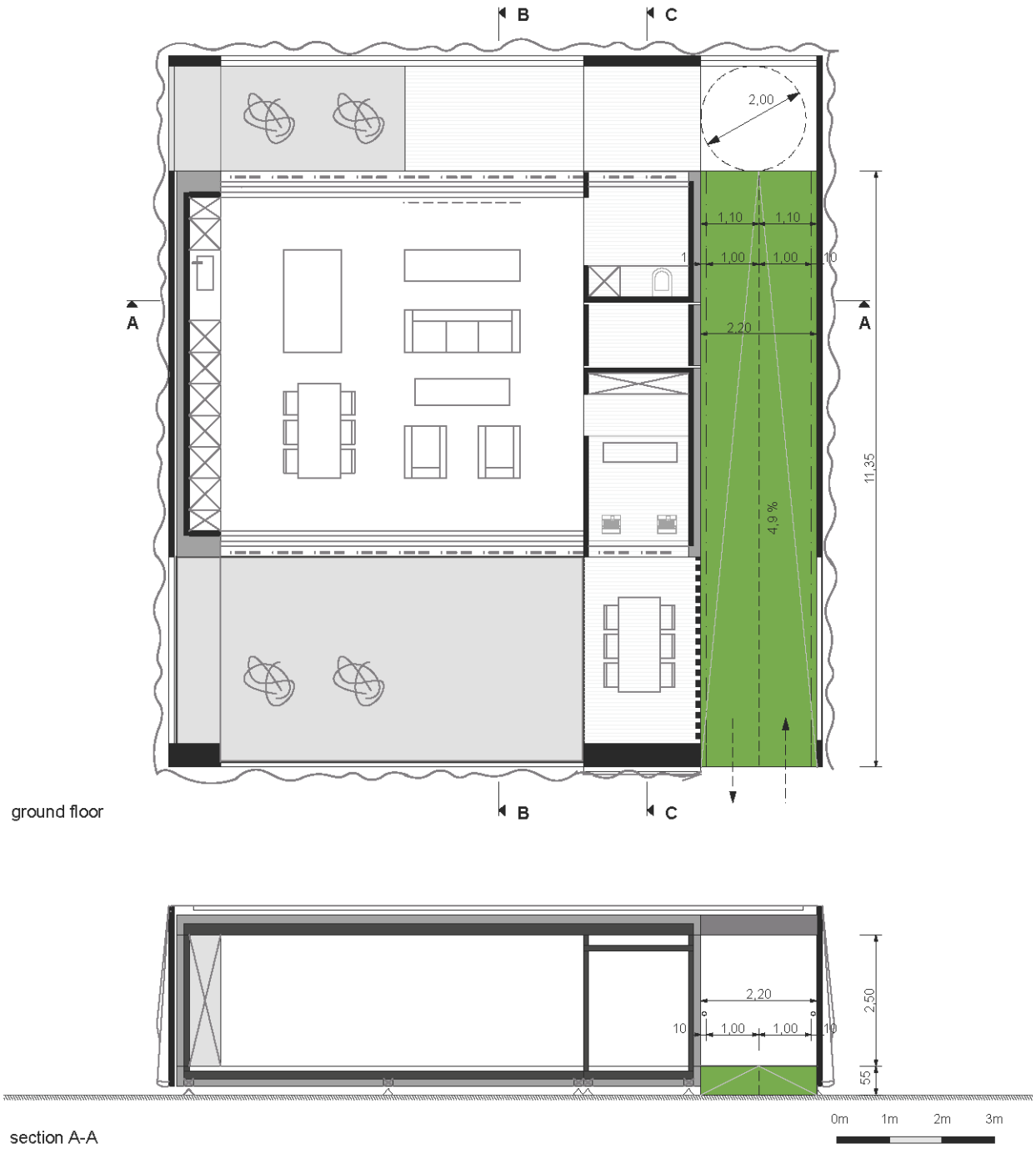


Fig. 4: Ramp structure.

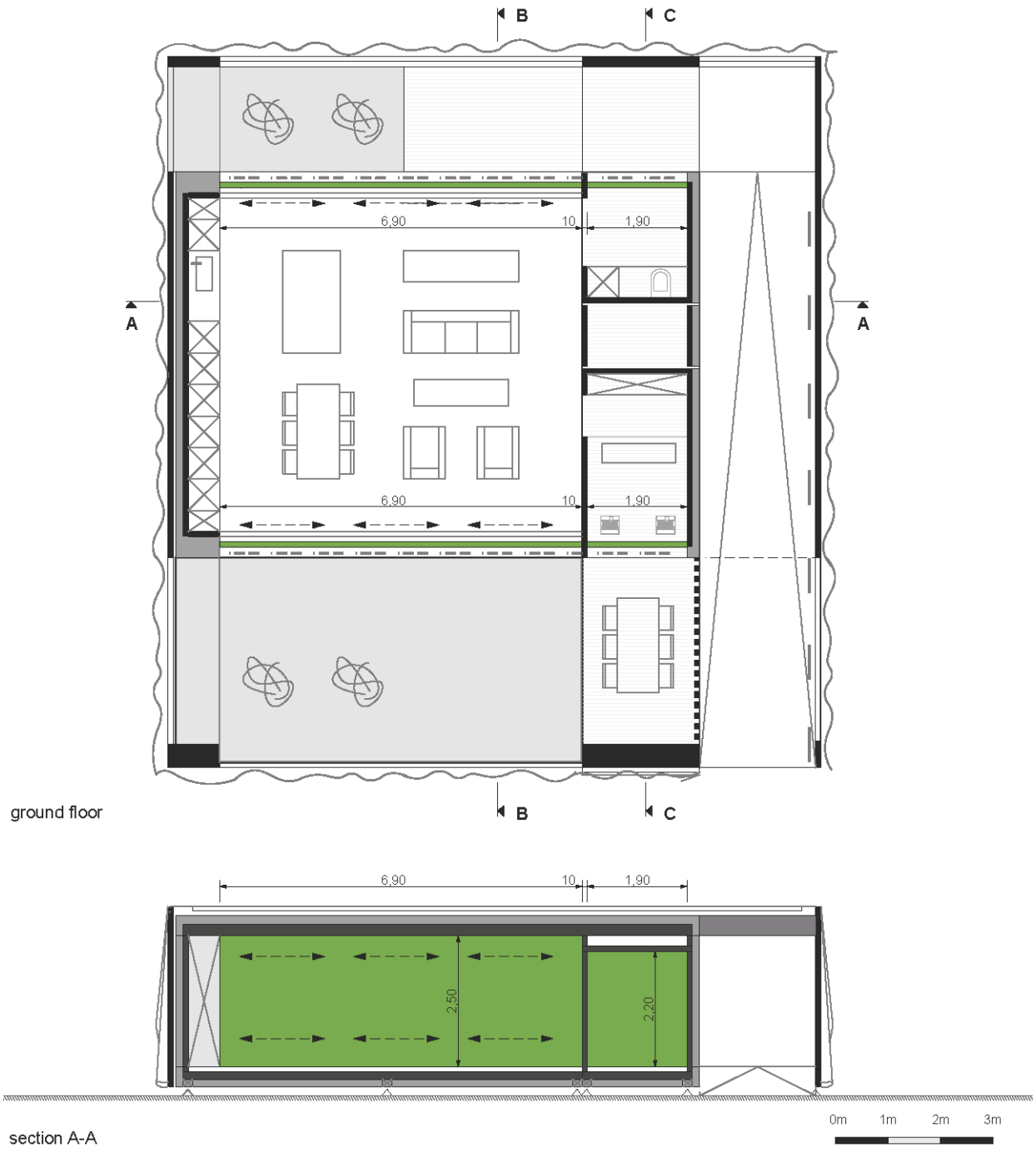


Fig. 5: Primary façade glazing.

Interior finishes

The design differentiates the atrium house into three primary zones: service core, living area, and patios (Fig. 6).

The main patio, the private courtyard, serves both as protected exterior area and as extension of the living area. Sliding elements in the façade (glazed) and flexible vertical and horizontal shading devices allow different spatial configurations as needed by the occupants to react to seasonal climatic and weather changes.

It is principally intended to select renewable resources for as many construction materials as is reasonably possible, in particular such that have no harmful emissions and thus do not compromise indoor air quality. Finished surface have to be treated or coated by ecologically sound means, with a preference for light colors in order to avoid unnecessary heat absorption in the summer months. Construction of the floor area will contain sufficient thermal storage mass to dampen the effects of ambient temperature swings on the indoor environment over the annual cycles.

In terms of materials, the service core shall be built in a visible wood finish, all other finishes will remain in neutral white, thus highlighting the service core in relation to the rest of the space. The white color of the main living space also helps avoid overheating in hot summer months.

Fire protection

The fire protection codes applicable in Austria (e.g., for Vienna: OIB Rule 2-330.2-092/11) will be used as an initial reference for compliance. These regulate the requirements for smoke alarm and fire extinguisher placement (see Fig. 7). An additional sprinkler system could also be implemented if necessary.

All construction components will be certified to the European fire-resistance class EI30, which means, for example, that solid-wood components can be assumed to have a burn-down rate of 0.7mm per minute. More importantly, this classification means that the construction layers must be dimensioned such that the components are proven to maintain their structural integrity for at least 30 minutes, thus allowing far more than sufficient time for any occupants to physically escape the house in case of fire.

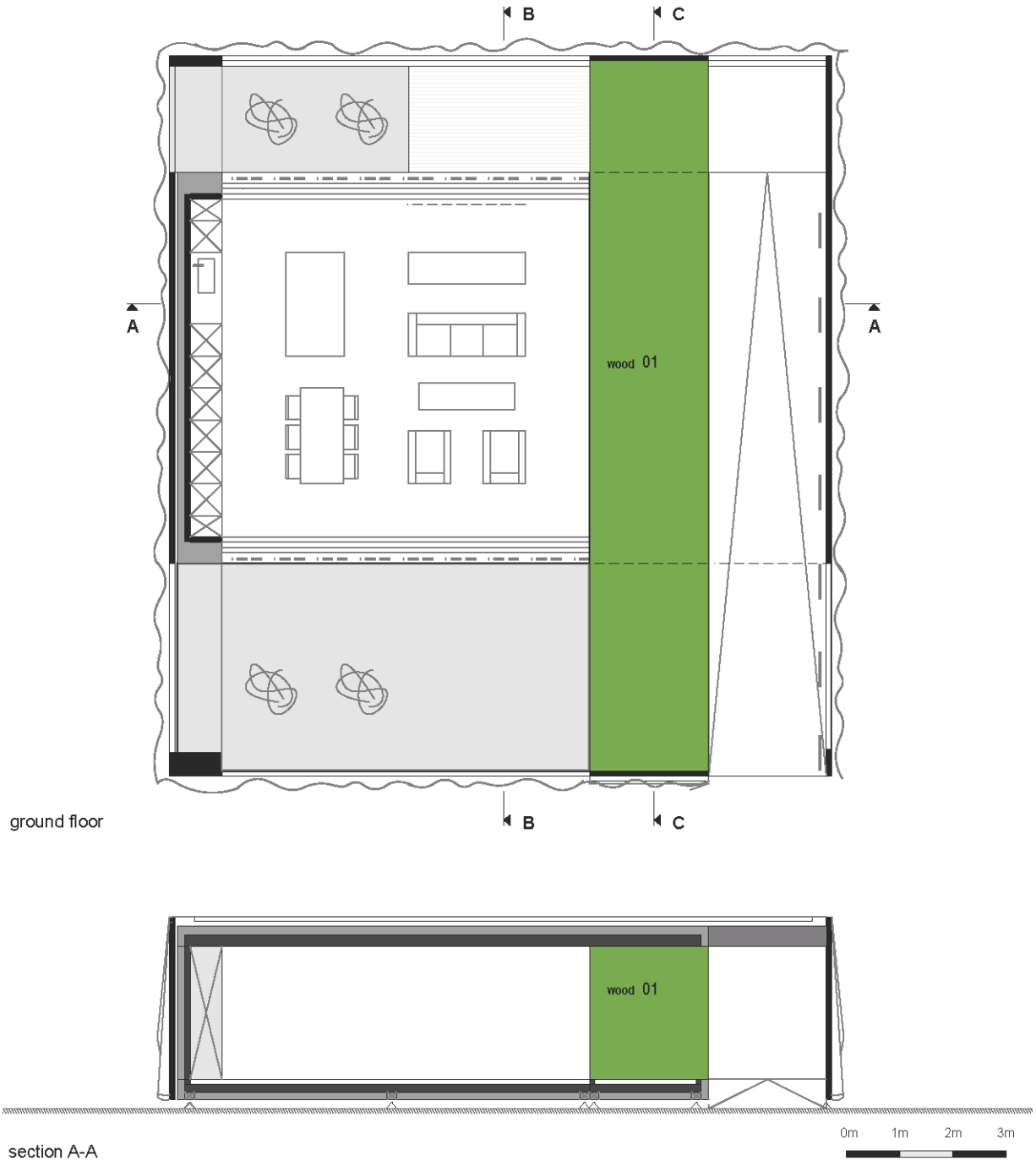


Fig. 6: Zones with different interior and exterior finishes.

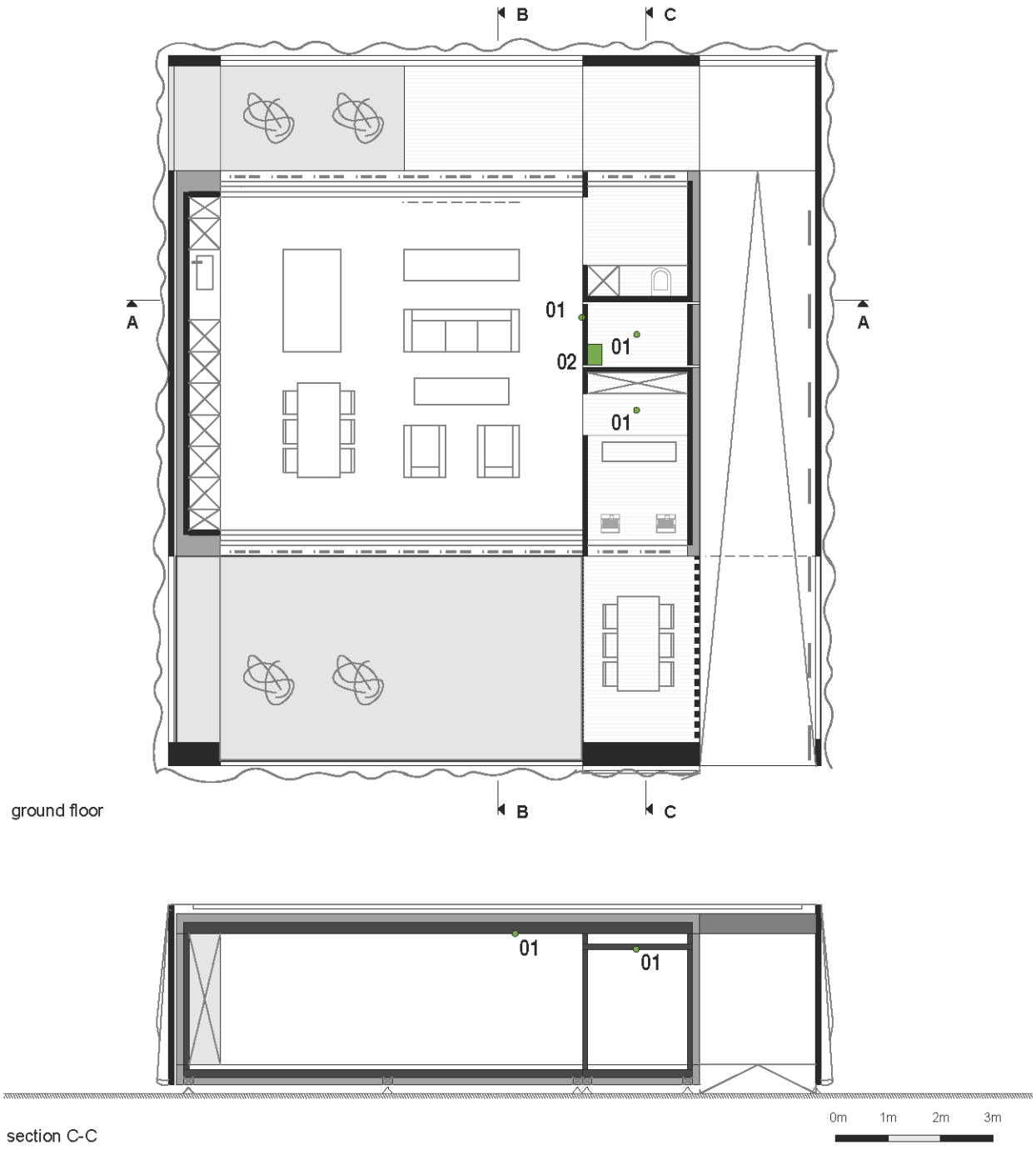


Fig. 7: Tentative locations of smoke alarms (01) and fire extinguisher (02).

DC electrical

Our base assumption is that 32 PV-modules with 250 Wp apiece will be provided in the prototype context (see also Fig. 8):

- For the testing phase, we will be using a power inverter with 230 V / 50Hz output, which will be replaced for the competition to output 120 V / 60 Hz.
- Auxiliary energy for sensors, house controls, and bus system will come from 24 VDC.
- By employing industry-proven SPS controls, we will be able to provide extremely comprehensive house controls at an exceedingly economical price.

AC electrical

Our electrical systems will be dimensioned according to the standards defined in ÖNORM E8001. Regarding loads, we will draw power independently at the European standard of 230 V / 50 Hz. Excess power will be supplied at 120V /.60 Hz for US grid input during the competition. Thus the consumption and generation circuits in the house are entirely separate (see also Fig. 8).

In our first estimation, we assume that the use of extremely efficient devices and intelligent control systems will keep the peak loads below 63 A. Maximal safety is ensured by protecting each circuit independently with selective circuit breakers. Further information on the electrical circuits can be found in the section "Utility Meter & Dataloggers."

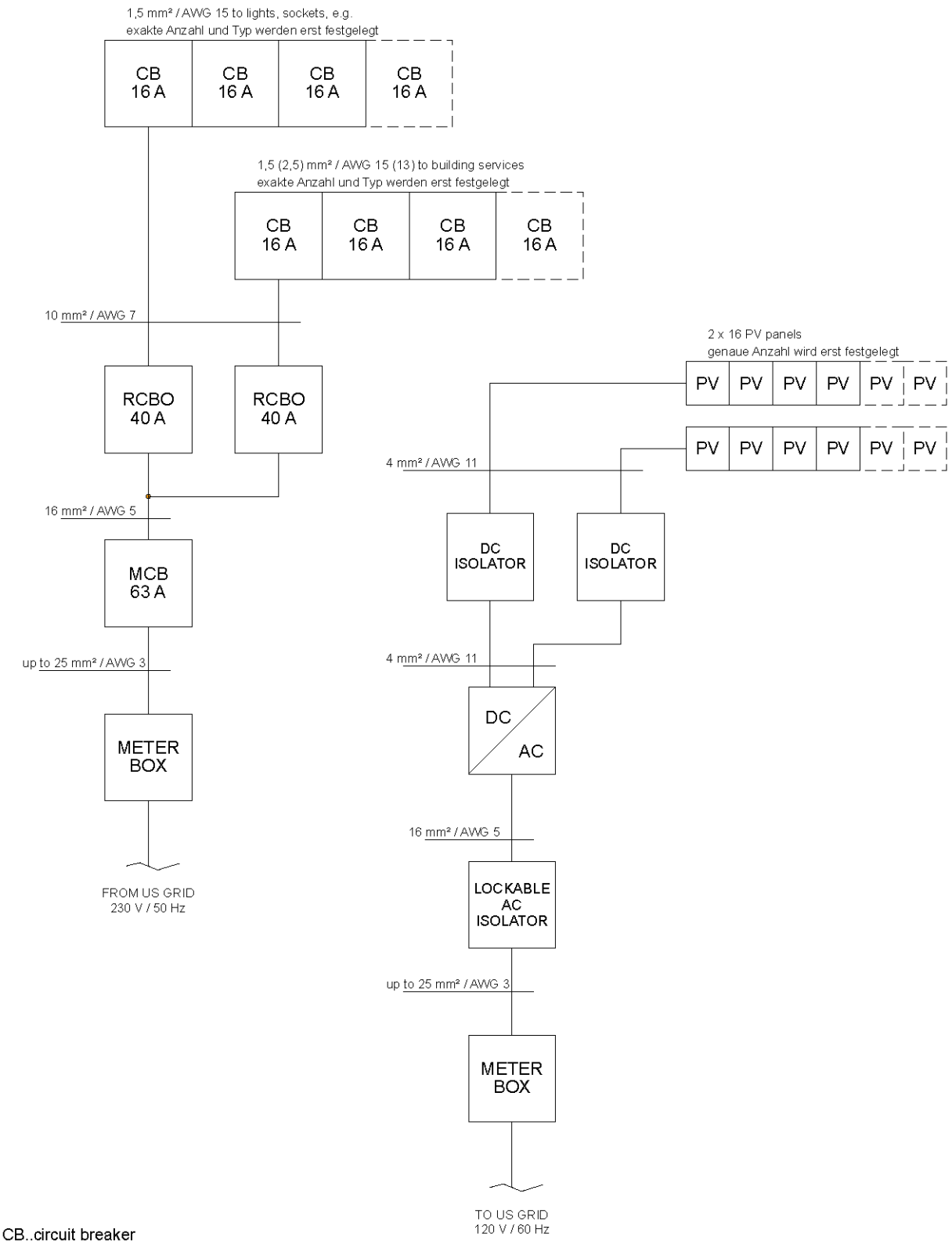
Water storage/service

Team Austria's decathlon entry will have provision for both fresh water and waste water bladders underneath the decking areas. The house is also designed to have one fresh water tank, which may be powered by solar thermal. Although rainfall is less frequent, a simple rainwater catchment system shall be incorporated for irrigation purposes. Furthermore, a grey water filtration and recovery is currently under consideration, leading to another potential water storage tank.

Plumbing

As discussed in the next section ("Mechanical"), Team Austria is performing a detailed analysis of several different concepts, both with and without solar thermal. Similarly, several innovative plumbing concepts are under consideration, taking into account the value of water in the region:

- grey water filtration and purification up to safe irrigation water standards;
- condensate collection, filtration, and use for irrigation;
- incorporation of heat recovery from grey water from i.e. dishwasher and laundry.



CB..circuit breaker
MCB..main circiut breaker
RCBO..residual Current operated circuit-Breaker with integral Over current protection

Fig. 8: AC/DC electrical circuits.

Mechanical

Based on a review of available technologies and concepts, the team has selected several concepts for further investigation. It is the intent of the team to perform a final selection with a true simulation based optimization method, where the building and system are simulated together using i.e. EnergyPlus and/or TRNSYS. The results of the simulation will provide a quantification of the annual energy consumption, the hours within the comfort zone, and the amount of hot water delivered. This will be combined with an estimate of the investment costs for the system. We then will select based on the trade-off (pareto optimum) set of objective functions, according to our competition strategy. The variants to be investigated include the following (Table 1):

1. The "All electric" variant explores using 100% solar photovoltaic electricity. This would be an off-the-shelf packaged residential heat pump, central air system, with ERV and recirculation air (Fig. 9).
2. The "All electric DOAS" variant is the same as variant 1, except splits the heat pump evaporator into a dedicated outdoor air unit to condition ventilation air, and a zone fancoil for sensible zone cooling (Fig. 10). This has the advantage of decoupling the dehumidification load from the sensible load.
3. In the "HP + Solar DHW" variant as a comparison, the all-electric heat pump system variants are modified by using solar DHW for the hot water production, to explore the trade off between sacrificing PV for solar thermal. The two systems are independent. The critical point will be the annual net present value of produced hot water.
4. Similar to variant 3, "HP DOAS + Solar DHW" explores the electric DOAS system with the addition of a solar thermal system.
5. With "HP + Solar Cooling" it is expected that in order for the solar thermal to better pay off, it should be integrated into the HVAC system (Fig. 11). Therefore, the team will explore using hot water on the regeneration side of a desiccant solar cooling system to take the humidity load. Furthermore, the solar hot water system will be used for space heating in the winter. The system is a central air system, with recirculation.
6. "HP + Solar Cooling DOAS" investigates-the solar cooling concept in a DOAS variant.

Solar mechanical

According to the current design status, solar thermal collectors and PV modules will be mounted at a fixed angle on the roof of the building. We want to emphasize the user-friendliness of our energy system. A reliable and smooth operation of all components is of highest priority and high maintenance needs of the system components should be avoided at any cost. Additionally, easy and straight forward installation strategies will help us ensuring best safety conditions for students during construction.

Therefore, we have decided on mounting systems without moving parts. Also, from a cost point of view tracking systems put an additional strain on the investment of a solar powered home.

All mounting will comply with IEC and ISO standards. Since most European manufacturers of solar thermal collectors and PV panels get certified for heavy snow loads in the winter, we hope not to encounter any problems with the structural integrity of our roof mounted systems in California.

Variant:	Ventilation			Zone equipment			Hot Water
	Heating	Cooling	Dehumidification	Heating	Cooling	Dehumidification	Water Heating
1 All electric	Electric	Heat pump	DX Recirculation	None	None	None	DX HP
2 All electric DOAS	Electric	Heat pump	DX DOAS	Fancoil	Fancoil	None	DX HP
3 HP + Solar DHW	Electric	Heat pump	DX Recirculation	None	None	None	Solar Thermal
4 HP DOAS + Solar DHW	Electric	Heat pump	DX DOAS	Fancoil	Fancoil	None	Solar Thermal
5 HP + Solar Cooling	Solar Thermal	Heat pump	Solar DEC	None	None	None	Solar Thermal
6 HP + Solar Cooling DOAS	Solar Thermal	Heat pump	Solar DEC	Solar Thermal Fan Coil	Fan Coil (DX)	None	Solar Thermal

Table 1: Engineering system variant summary.

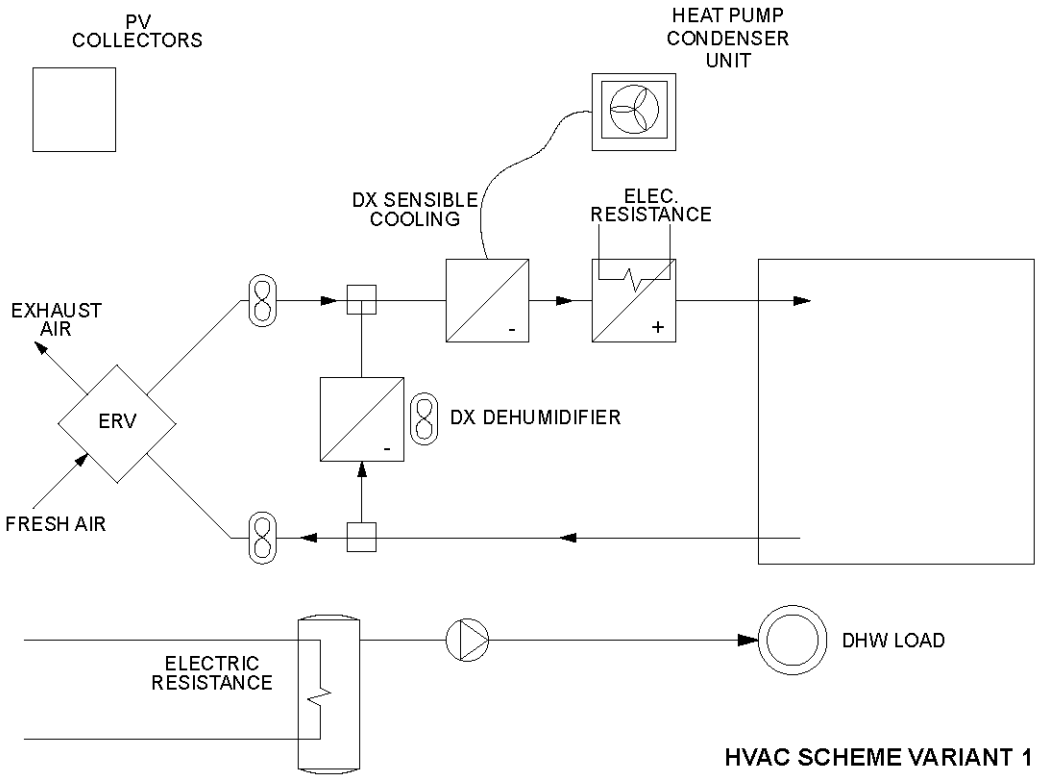


Fig. 9: "All electric" scheme.

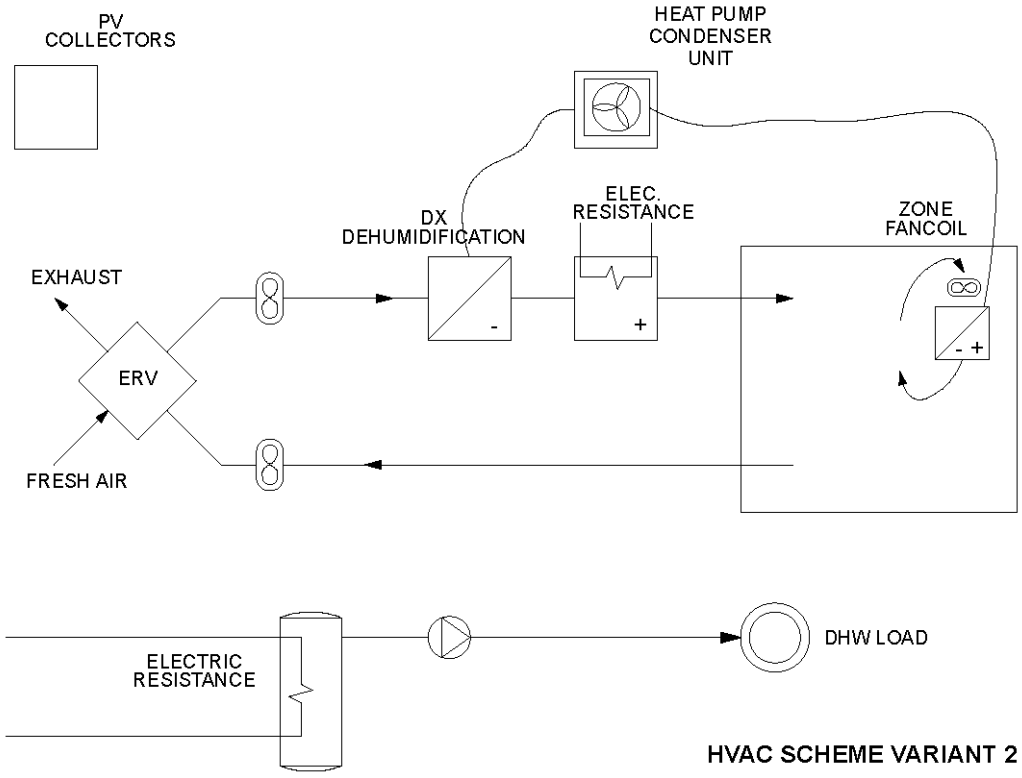


Fig. 10: "All electric DOAS" scheme.

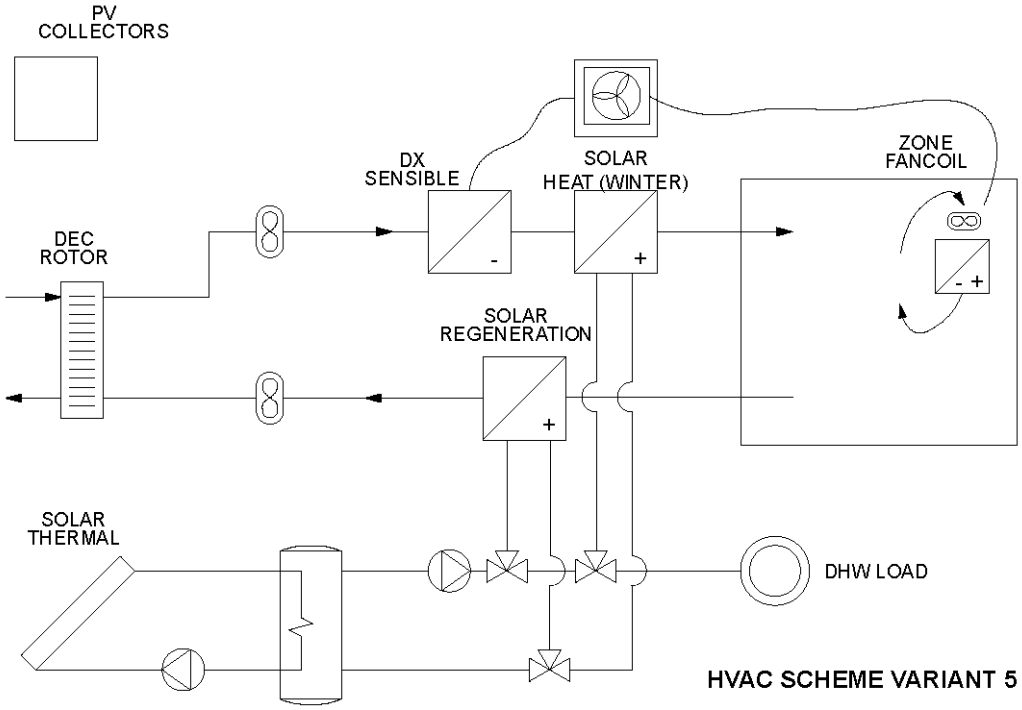


Fig. 11: "HP + Solar Cooling" scheme.

Utility Meter & Dataloggers

In order to maintain maximum design flexibility, we have decided to use the alternative power supply (230 V / 50 Hz) provided by the organizers. We will be working with bidirectional inverters during the testing phase. Since the grid feed-in during the competition must be supplied at 120 V / 60 Hz, we will then need a different inverter with a separate meter and datalogger (see also Fig. 8). The meters for both in-house consumption and grid feed-in will be located in the utility room. Sensor data will be logged for temperature, humidity, CO2 levels at several points in the house (Fig. 12).

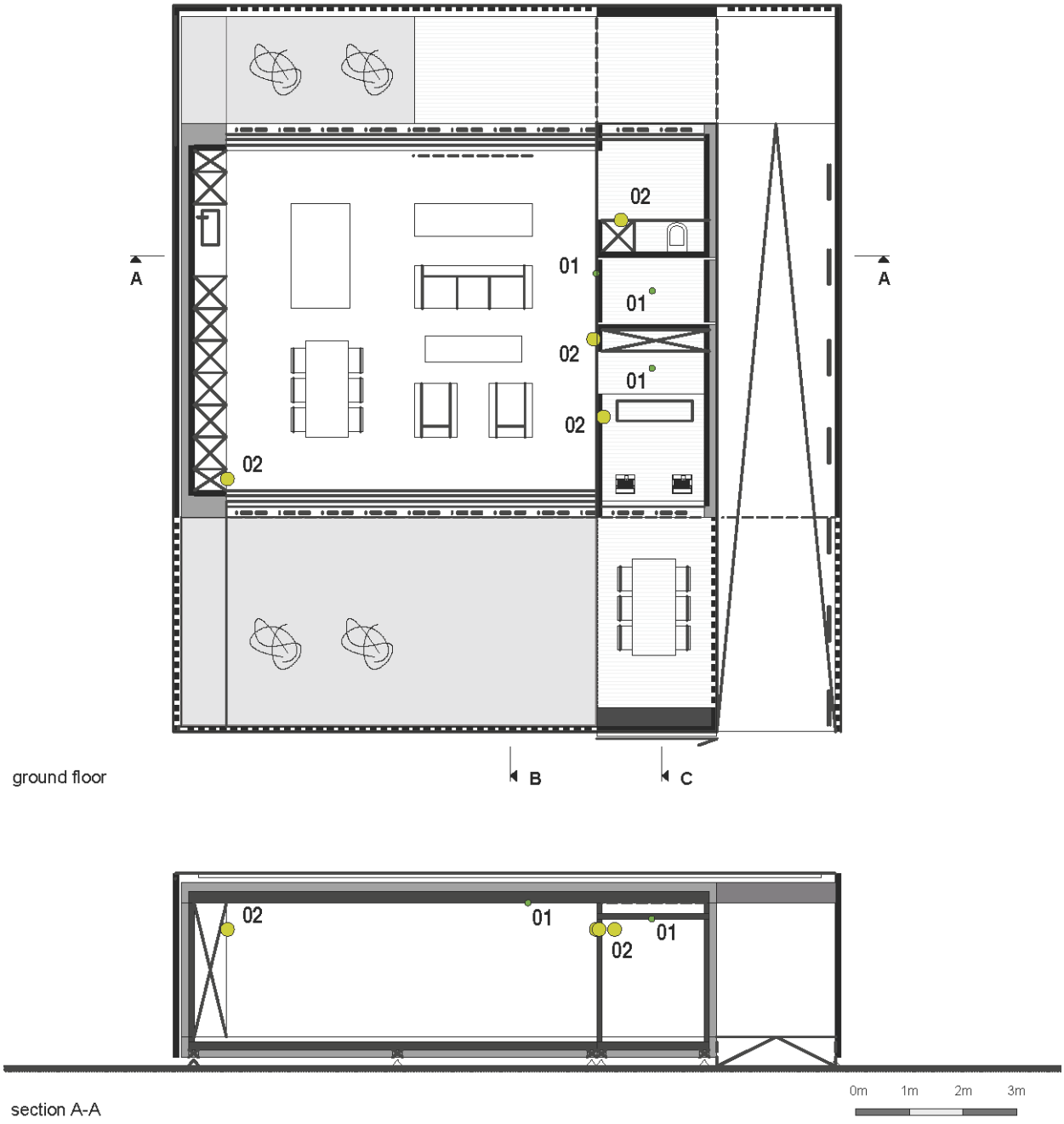


Fig. 12: Tentative locations of smoke detectors (01) and sensors (02).

Public Relations & Communications

Onsite exhibit during competition

Access to our house is proposed via a gradually inclined ramp (4.5% grade, see also Fig. 13), which will allows panels with introductory information about the prototype for approaching visitors to be located along the outer edge of the path, and more detailed information about the energy systems for exiting visitors to be displayed via panels and flat screens mounted on the exterior wall along the inner side of the path. The utility room containing all the mechanical and metering systems is accessible for viewing from this side.

During opening hours, informational videos will also be continuously played on the home theater system for visitors to view at their leisure in the main living area.

Sponsor package and press kit

We are putting together a bilingual press kit (German/English) to communicate our project design goals to media, potential sponsors, and other interested parties. The initial package includes informative 3D renderings of the prototype such that the major architectural and engineering concepts behind it can be readily understood especially by laypeople, who often have difficulty "reading" conventional design drawings and diagrams. Future information packages will include a collection of short films on DVD explaining various aspects of the design and construction process.

The public relations department of the Vienna University of Technology has been charged with the professional management of media relations and ensuring the regularity of publicized reports on a running basis throughout the duration of the "Team Austria" project. These efforts are also being actively supported by the Federal Ministry's PR department, IG Passivhaus (organization for the international promotion of sustainable building technologies), as well as several established journalistic periodicals in Austria (e.g., Architektur&Bauforum, H.O.M.E, architektur aktuell, Der Standard, Wettbewerbe).

Exhibitions in Vienna

A "Team Austria" presentation is planned for the upcoming annual tradeshow "Bauen und Energie" (building and energy) at Vienna's convention center in February 2013. This model exhibit will introduce our Solar Decathlon project to a broad domestic public.

Also leading up to the competition in the United States, an exhibition aimed at design practitioners, students, and the architecturally interested public should be held in conjunction with a panel discussion at the Architekturzentrum.Wien (architecture center in Vienna).

Supporting activities through the Austria Embassy

The Austrian embassy in Washington, D.C., the Austrian trade delegate in New York, as well as the General Consule in Los Angeles are very excited about Team Austria's successful bid to participate in the Solar Decathlon 2013. They are committed to actively supporting our project in raising public awareness of the project goals through media and helping us to establish contacts with further industry partners.

Outreach strategy

A series of activities are planned for the duration of the competition exhibit in Irvine:

- A "Science Week" symposium to bring together Austrian and American scientists for discussion and exchange will be organized in cooperation with Californian universities; a highlight of this event will be the closing reception at the Paul Getty Museum.
- The Austrian consul general will host a reception at the consular residence in Los Angeles.
- The patronage of former governor of California, Arnold Schwarzenegger, will be invited.

After the competition, we intend to take the Team Austria house "on tour" for display at different sites around the United States before it arrives at its final destination (either at the Austrian embassy in Washington or at the quarters of the trade delegation in New York) to serve as a guest house and publicly accessible exhibit for visitors.

Accessible Tour Routes

We propose a primary, fully accessible visitor route into, through, and out of our house as per the following schematic (Fig. 13):

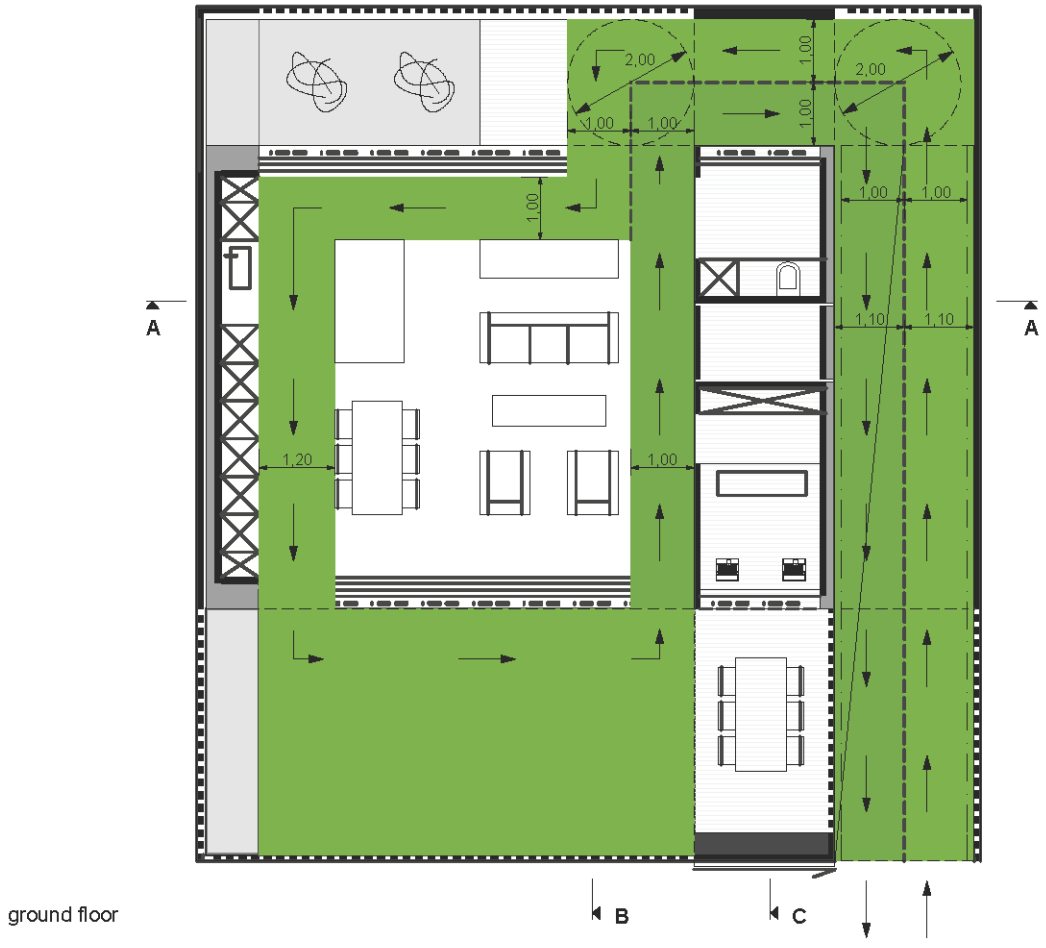


Fig. 13: Main route for visitors to access, tour, and exit the prototype.

Prototype Renderings

Health and Safety Plan

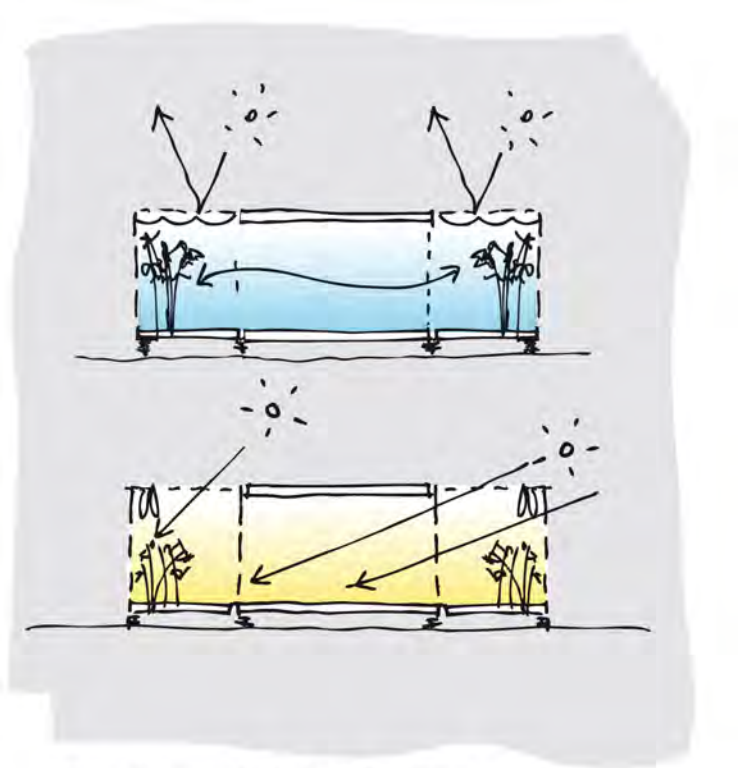
The required 30- hour construction safety training for OSHA certification will be completed through an appropriate online course by the designated project and construction managers, Gregor Pils and Andreas Claus Schnetzer, as well as the yet to be designated safety officer as soon as possible. A hazard analysis must be done for the following scope of work:

- Delivery: The building components are transported to the site in shipping containers (40' hi-cube) by truck. Mobile cranes are used to lift the containers from the trucks and set them on the assembly area of the site.
- Assembly: The building components are packed in the containers such that they can be lifted out of the open top and placed in final position in one maneuver with the mobile crane in the assembly sequence.
- Roofing and finishing: The assembled building is projected to be single storey with a flat roof, whereby the floor level is elevated approximately 50cm from the ground.
- Disassembly: The building will be taken apart and its components repackaged in the shipping containers by the same means as assembly (mobile crane), in the reverse sequence.
- Pickup: The packed shipping containers will be loaded onto the trucks by mobile crane.

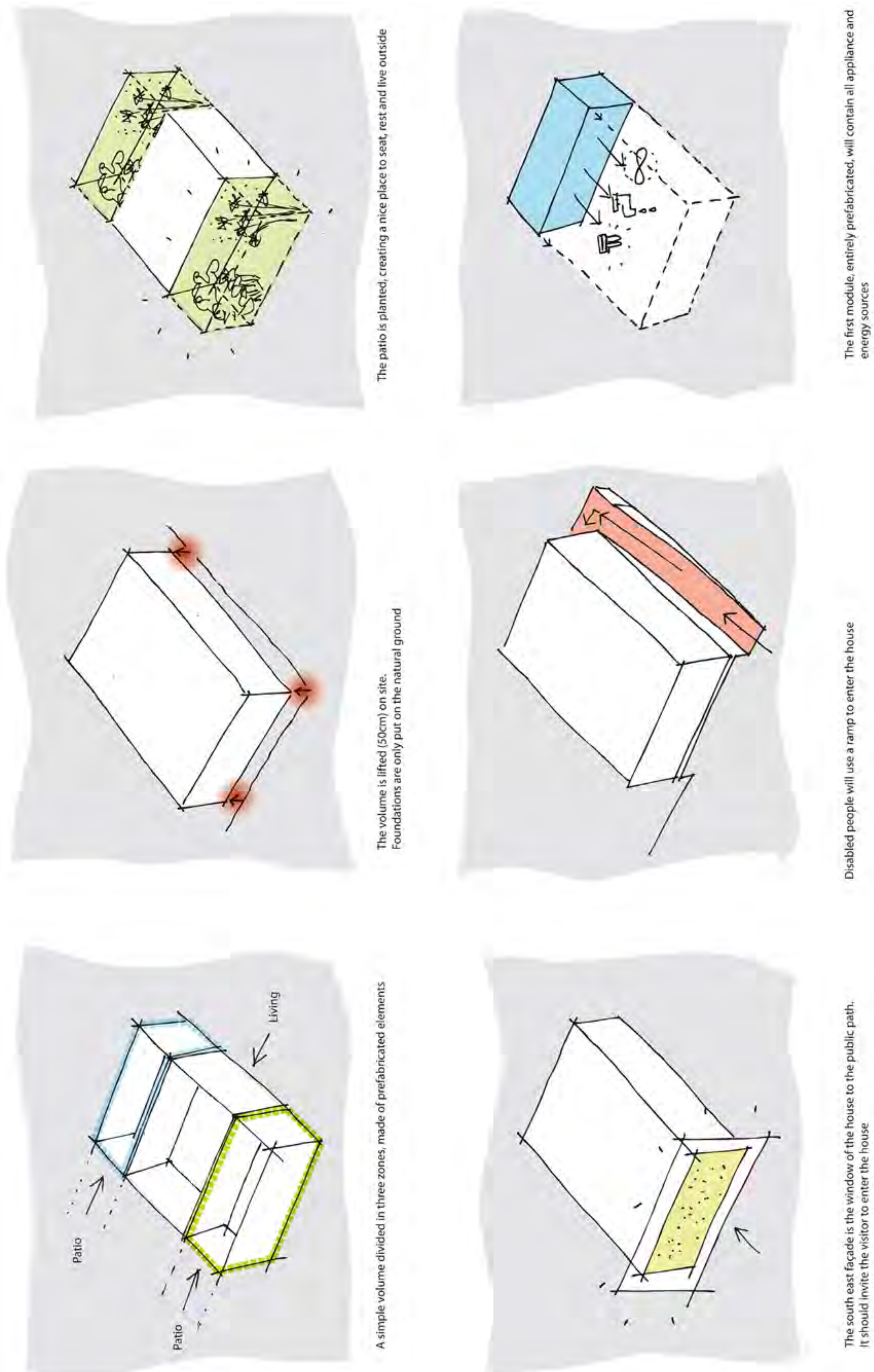
Licensed Design Professional

Team Austria will be working with the licensed structural engineer Dr. Karlheinz Hollinsky, whose firm in Vienna (Dr. Karlheinz Hollinsky & Partner Ziviltechnikergesellschaft m.b.H.) has done the engineering on over 1400 new and retrofit construction projects and expert assessments since its founding in 1988. A selection of this firm's new construction projects can be viewed on their website at:
http://www.hollinsky.at/index.php/neubau-pruefstatik/statik-neubau.

Appendix A: Design Sketches & Drawings



The patio acts as a buffer for climatic control



A simple volume divided in three zones, made of prefabricated elements

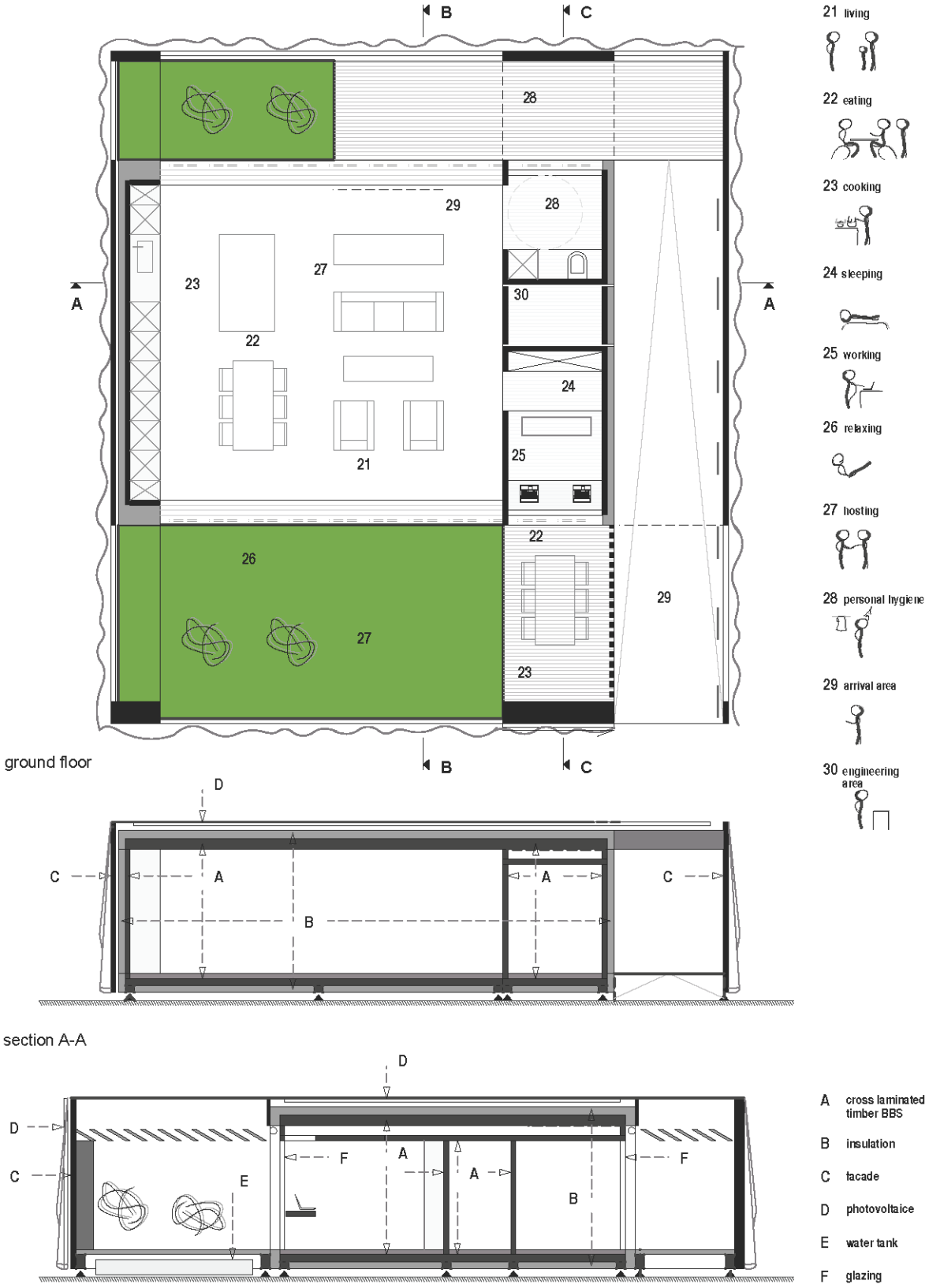
The volume is lifted (50cm) on site.
Foundations are only put on the natural ground

The patio is planted, creating a nice place to seat, rest and live outside

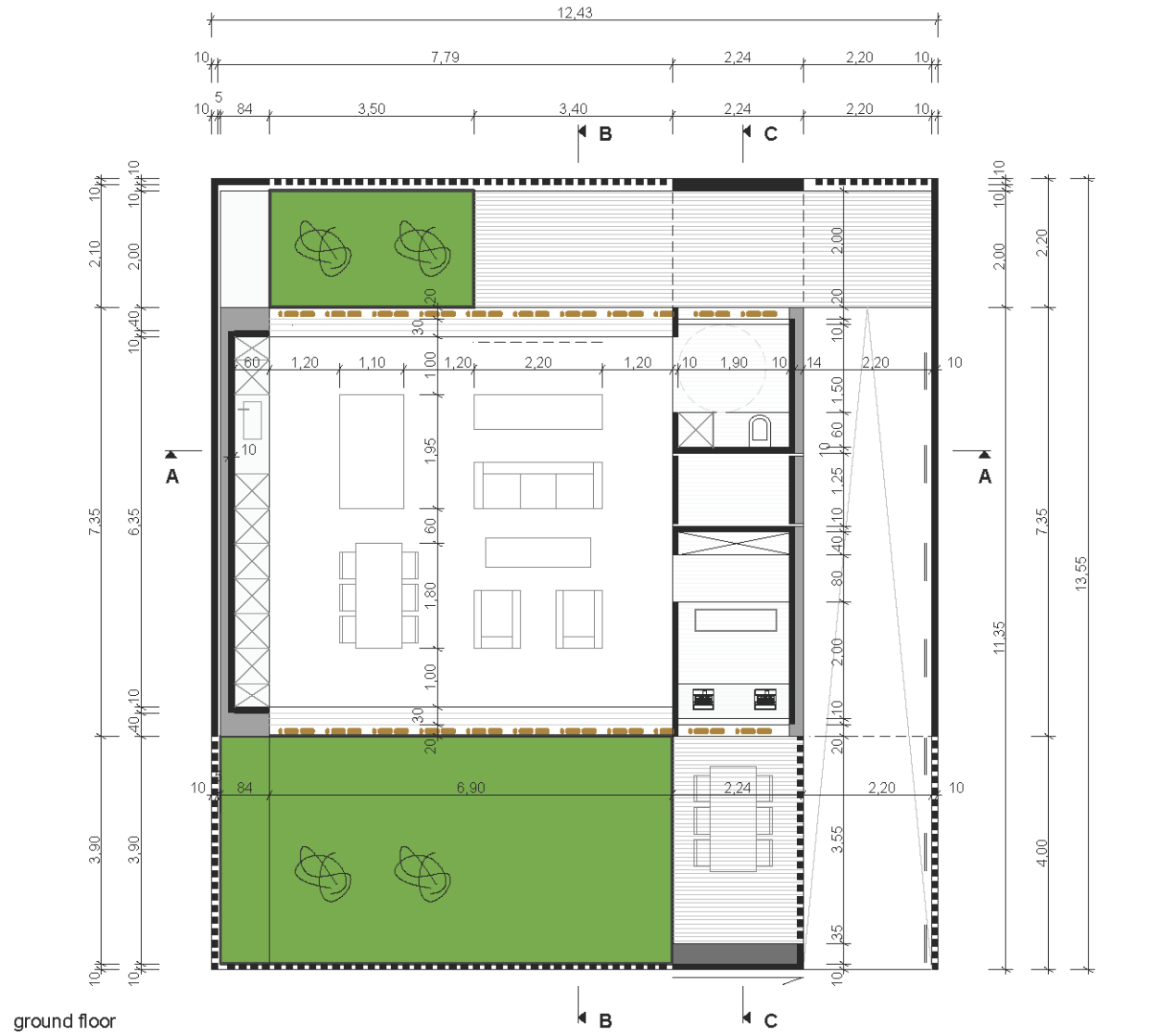
The south east façade is the window of the house to the public path.
It should invite the visitor to enter the house

Disabled people will use a ramp to enter the house

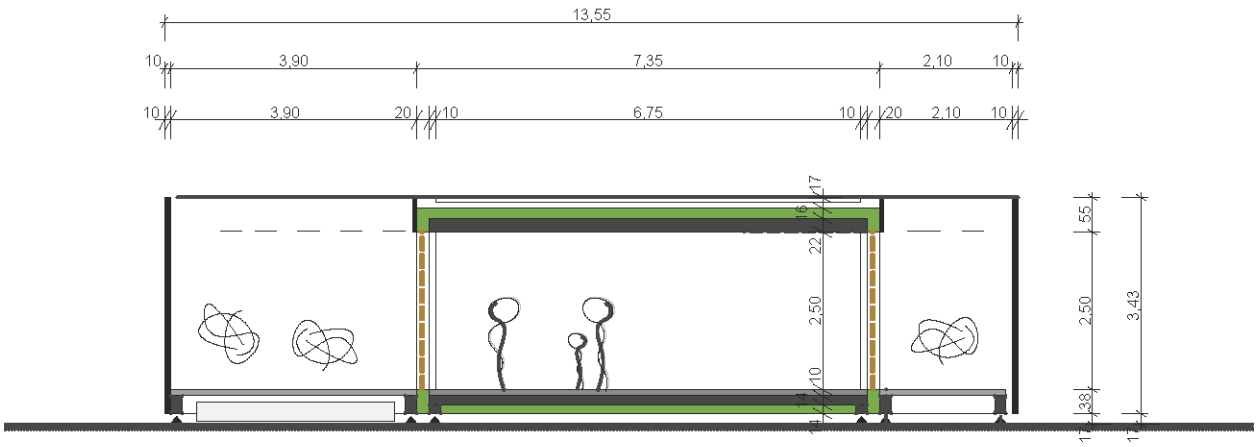
The first module, entirely prefabricated, will contain all appliance and energy sources



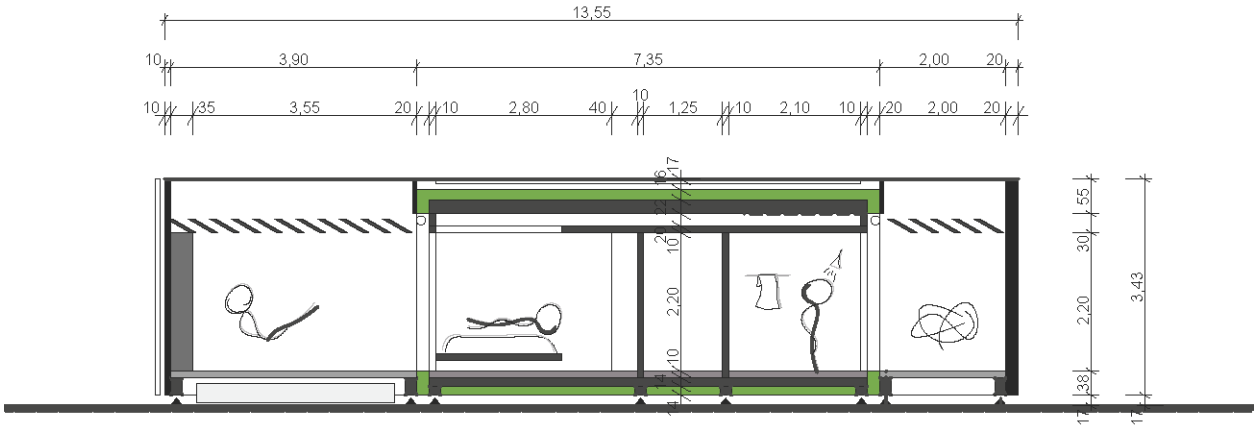
Activity areas in floor plan and section.



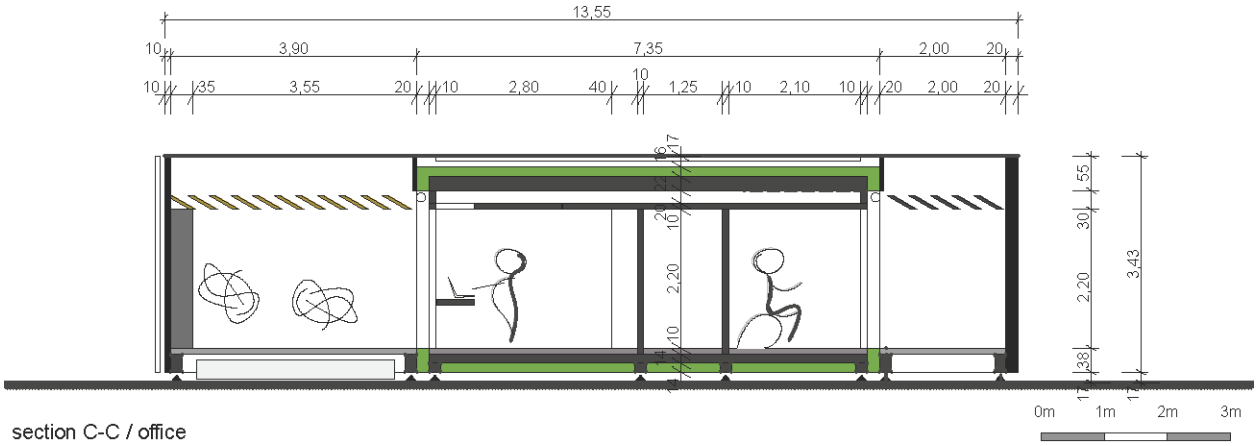
Design dimensions in floor plan and section (outdoor boundaries highlighted).



section B-B



section C-C / sleeping



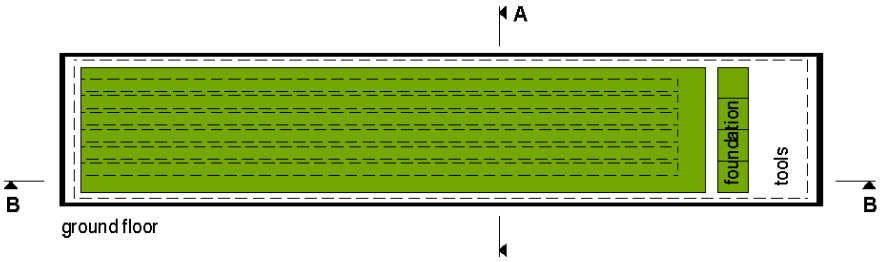
section C-C / office

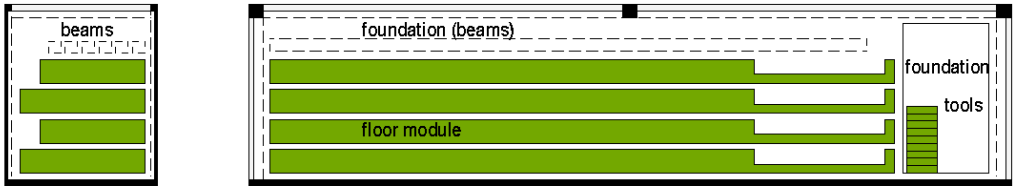
Design dimensions in sections (outdoor boundaries highlighted).

Appendix B: Shipping Logistics

All building components, systems, appliances, assembly tools, electric vehicles (e-bikes), etc. shall fit in six standard 40' hi-cube shipping containers.

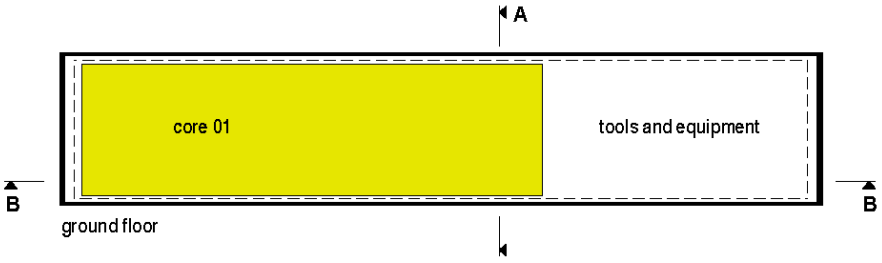
Container 01
foundation
and floor module

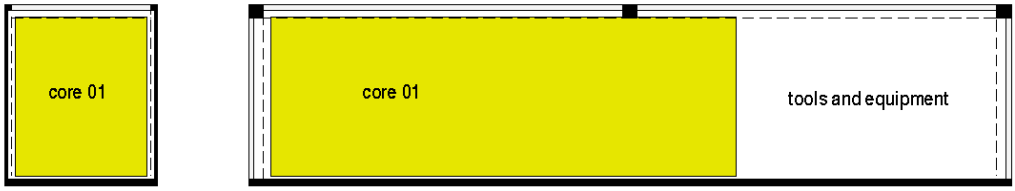




section A-A section B-B

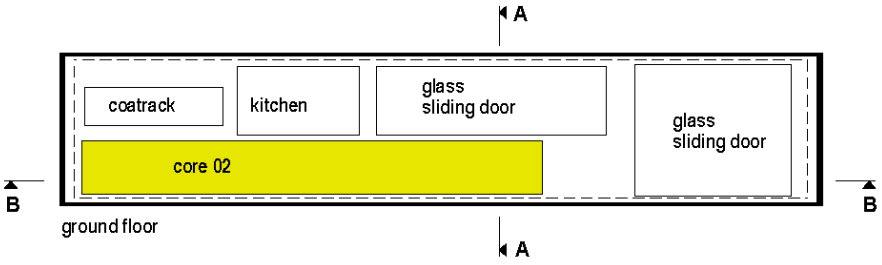
Container 02
core, tools &
equipment

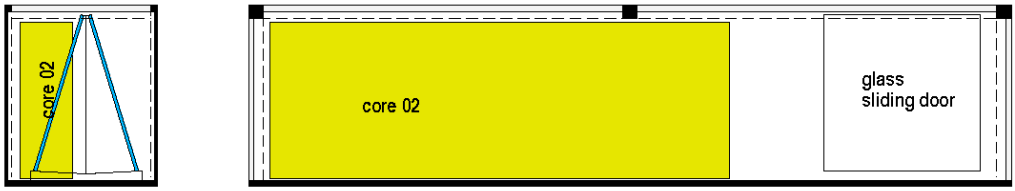




section A-A section B-B

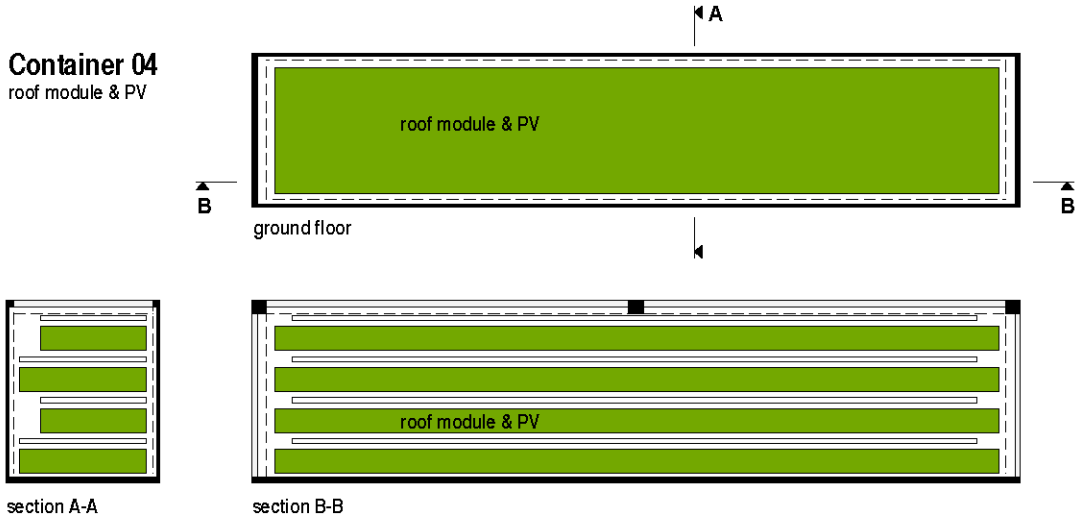
Container 03
core 2 and glazing



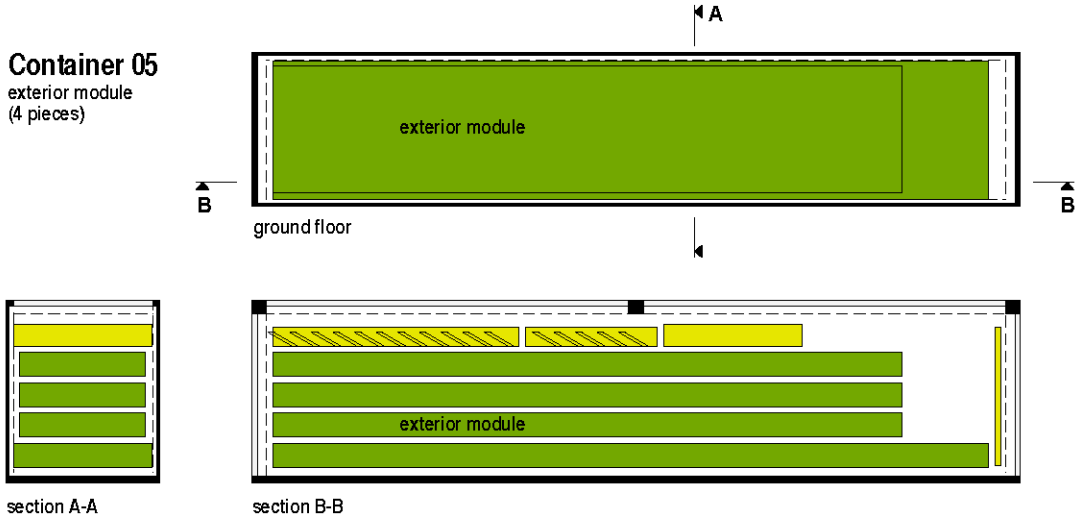


section A-A section B-B

Container 04
roof module & PV



Container 05
exterior module
(4 pieces)



Container 06
facade module