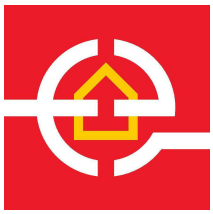

Part 2: Competition Task

2.1. Relevancy, Significance and Purpose of the Competition

2.1.1 Initial Situation

Historical turning point meets energy revolution! The age of Anthropocene has started, since for the first time in the history of the Earth, humans are affecting the destiny of the planet: although it has long been ignored, it is evident through climate change. We don't have a choice and we have no time to lose. We must take responsibility for saving our "spaceship Earth". It is a challenge no doubt, but we—still—have the chance. The top priority is to reduce CO2 emissions on all levels.

The important role of architecture in the frugal use of resources is uncontested. We all live somewhere and use buildings for work, consumption and leisure time, so that everyone can contribute to saving energy and resources. The strategies for saving energy in buildings has been refined over years. Currently further decisive developments are becoming evident, evoking new and better solutions.

With these observations we become aware to the correlation of building energy efficiency to the role of mobility. What can be more apparent than coupling these two basic needs—living and mobility—and to search for a sustainable solution for them both, that can be the foundation for a far-reaching awareness for the complexity and interdependence of our resource consumption and our personal ecological footprint?

This could open our eyes to our own possibilities to influence sustainable behaviour, that can contribute significantly, to give E-mobility the required kick-off.

2.1.2 Energieeinsparung und Energiegewinnung im Gebäude

In the meantime, buildings are no longer just energy consumers. The energy revolution in buildings is ubiquitous and the assets for this are sophisticated. Furthermore, there is the realisation, that buildings can be used to produce energy—virtual power plants. Direct or indirect regenerative energy production is today a matter of course: not only passive solar irradiation into the building but also actively through a multitude of technical systems. Energy production through decentralised wind energy plants for small buildings is today equally on the rise. The potential of energy storage is in this structure also obvious in helping to close the many gaps in a complimentary way.

We have gathered enough experience already to be able to harmonise the technical facility systems within a building. And there is potential to produce a surplus of energy beyond what the building itself requires, especially in the form of electricity. And this is the basis for sustainable E-mobility. In other words, the home can become an E-fuel pump. This is evolutionary: living and mobility form an exemplary symbiosis. The sustainability of the E-House concept doesn't depend on the direct production and usage of energy, but rather on the further potential of E-Autos as a form of energy storage to relieve loads on the public grid at peak times. This thesis becomes more viral with each further expansion of regenerative energy.

E-mobility is unquestionably a mega trend. Until the middle of the 2020's the prognosis is that 15% of all new cars will be E-cars, increasingly exponentially in the years after that. This idea competition should contribute to and support this fundamental development.

2.1.3 E-House as a Milestone

In summary the vision here is to define another milestone in sustainability:

"E-House" as a further evolution of the "passive home with surplus energy" should become established as an additional, vital component.

This should be visualised and exemplified in the form of a single-family house. Energy optimisation has the highest priority, supplemented with measure for energy production through regenerative sources, to guarantee quasi self-sufficient living and mobility. For this idea competition, the strategies for energy conservation und the potential of solar and wind power are to be brought conceptually and technically coherently together. The intention is—with the presentations laying the foundation—to show the bandwidth of possibilities and solutions. The competition should contribute in implementing these quickly developing and expanding requirements into architecture.

2.1.4 From the Passive Home to the E-House

Passive homes have become established over decades: they are a mega trend and inspire ecologically as well as culturally. Consequently, passive homes have developed further in the meantime into "passive homes with energy surplus". Additional components cover not only internal electricity demands but produce a surplus though active solar power and other regenerative sources. In this way, the passive home classes of "plus" and "premium" were defined by the Passivhausinstitut, which can only be achieved through energy production and an even higher energy efficiency.

The E-House should go a significant step further and mobility as an integral part of a modern lifestyle is also considered. For the E-House, typological solutions are needed with an independent design vocabulary: appropriate, innovative and future-oriented. It's all about developing passive strategies for energy production and to integrate the active technologies into the design. The regenerative sources (solar and wind) of the E-House must meet the demands of the home and furthermore secure energy for a moderate, daily commute with a small E-car.

For the production of regenerative energy, only sources on the building and the property are to be considered. Energy storage possibilities are also to be examined. A connection with the public electrical grid is planned, to feed in electricity from peak times as well as to withdraw electricity. A further complimentary aspect of the E-House is to use the E-car as temporary storage for the public grid. In order to avoid destabilising the grid, the loads should be kept as moderate as possible.

2.1.5 Complimentary Components

The E-House sought here needs to be more: it should be smart, holistic, comfortable, and needs-based. The E-House should not only connect with the environment pertaining to energy. It also must contribute to psychological and physical wellbeing.

Today we know more about the influence of daylight and sunlight on our wellbeing, and even on our health. The daylight cycle gives our activities a rhythm. The spectral composition of daylight in the morning makes us active, evening light prepares us for the night-time and balanced sleep. The more we can use natural light in living spaces, the better our day-night-rhythm can stabilise. The E-House can contribute here as well, since highly insulated vitrification components with special glass for passive homes can readily provide thermal insulation and light-flooded interior concepts.

Direct visual connections to green spaces have been proven to help relieve stress. This is a foundation for psychological balance and can contribute to our health. The E-House should in this way not become a hermetically sealed structure, separate from its surroundings. Rather, it should be open and refer to the environment, it should articulate the surroundings, and the environment should be incorporated into the overall concept.

The criteria of economic building should complement the energy efficiency.

The competition seeks solutions that combine and unify all these requirements in an exceptional way.

2.1.6 isorast-System

The organiser—isorast-System—is a supplier of special systems for the construction of passive homes. isorast is a high-quality building block of solid foam/ polystyrene for all applications in surface construction, where thermal insulation is paramount. The basis of the system are the numerous form pieces as formwork. The tongue and groove grid creates a connection structure for the single elements. As a lost form these elements are filled with concrete, creating a load-bearing core. This process guarantees a form-fit concoction between insulation and load-bearing core. Air gaps are thus avoided.

The tensile strength of the isorast System against the dissolution of the insulation layer is more than a hundred times the minimal requirement for glued systems. A further property of this system is that sustainability forms the basis for the construction.

The isorast-System allows for the realisation of different wall construction principles. The complete building block system assures a coherent construction, free of thermal-bridges. In its soundness, the isorast System is excellent for the realisation of passive homes. Furthermore, the building can be erected very quickly and thus economically.

In terms of economical construction, the system provides the best preconditions to enable safe and comfortable DIY construction, since the handling of individual elements guarantees a simple and secure connection. The advantages of this principle have become established in the meantime in general construction principles.

The requirement of the organiser is that the design is adapted to the isorast System. The book "Handbuch Technik isorast—Energiebewusste Bausysteme" can be obtained from the organiser and is available at the construction rate fairs mentioned above.

2.2 General Information and Requirements of the Organiser

The goal is the most freedom in design as possible in the development of ideas for a single-family home. The competition aims for as large a range of solutions as possible. In this sense an ideal property of 600 m^2 is to be assumed. The width and depth can be freely determined. The orientation of the property is also open. No shading from neighbouring buildings need to be considered.

A single-family home of 200 m^2 maximum is to be planned, a distribution over up to three floors is possible. The roof and building orientation can be freely chosen.
The offsets to the property line must meet the requirements of the Hesse Construction Law (Hessischen Bauordnung (HBO)). Possible garages and carports must also meet HBO requirements.

Basis for the idea competition is the basic passive standard defined by the heating demand parameter of a maximum of 15 kWh/m^2 a and the primary energy parameter (differing from the classic passive home definition) of a maximum of 30 kWh/m^2 a for all applications (heating, domestic hot water, electricity). To ensure mobility, the energy surplus (photovoltaic or micro wind plant) of up to 2500 kWh/a is to be provided. The basis of the calculation is the demand for a small E-car with a moderate daily commute as well as E-bikes that can be used as an alternative to an E-car.

As verification of the energy demand for the idea competition, the PHVP 2002 (Passivhaus Vorprojektierung) should be used, illustrating the energy balance process for preplanning of passive homes. The necessary documents are available free of charge at the website of the Passivhausinstituts: https://passiv.de/de/05_service/02_tools/02_tools.htm.

The PHVP is an instrument that ensures wide-ranging planning security already in the preplanning stage. The instrument allows for a high optimisation potential further on in the planning stages, nevertheless is well applicable in the exploratory phase. A heating demand of 15 kWh/m^2 a is the only required parameter for the passive home preplanning, which is the main formal and construction parameter of the building concept. A building that fulfils this base requirement (heating demand of 15 kWh/m^2 a maximum) in the building envelope is considered to be a passive home. This simplified process for the preplanning of passive homes considers only the building and ignores technical systems and the effects of the environment. This provides a rough picture of the construction requirements, but is sufficient for the basic verification, preplanning and the required calculations.

For the configuration of the PV system, an energy efficiency factor of 25% can be assumed. This is not yet today commonplace, but enormous advances can be observed so that this efficiency will soon be economical. For the calculation of the solar energy surplus, 1800 sun hours per annum can be assumed. In connection with the installation situation of the solar systems, the respective surplus is to be calculated.
For the calculation of a wind power plant, a wind velocity of 3.0 m/s at a hub height of 10 m is to be used: (https://www.klein- windkraftanlagen.com/basisinfo/windmessung/#tab-con-3)

The design should articulate an aesthetic vocabulary that reflects the specific tasks of the E-House. A central requirement is that the passive and active energy sources that fulfil the energy demand are articulated adequately and typologically. Answers need to be also found for the contemporary living needs, for example interior and exterior connections, sustainable wellbeing through flexibility as based on the isorast System.