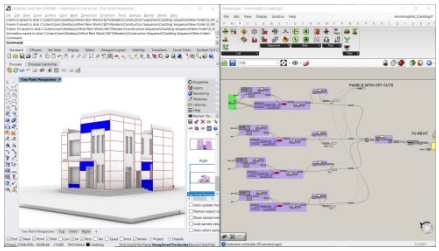
World of SMART HOMES

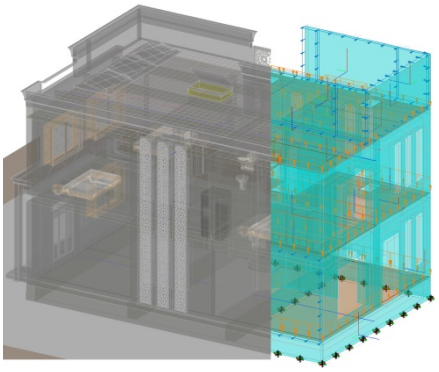
Energiehaus Luzern
Luzernerstrasse 131
Luzern 6014
Tel: +41 44 5863334
info@worldofsmarthomes.com

***World of Smart Homes* (WoSH)** pursues the goal of alleviating the global residential units shortage crises by constructing buildings faster, cheaper and with a high quality standard through a comprehensive planning and manufacturing concept. The concept is based on the consistent use of digital technology in combination with modern production methods and thus combines the fields of planning, production and assembly as well as sales in a new quality.

Already the most important protagonists of the Bauhaus made the largely unsuccessful attempt to make the historically very craft-oriented building industry cheaper, faster and more effective through standardisation and prefabrication. However, these goals could usually only be achieved where buildings were transformed into the conformity of a faceless and uniform building mass by the most far-reaching abandonment of architectural quality. Effective building in the pre-digital age was therefore almost inevitably accompanied by monotony. However, the achievements of the digital revolution made it possible to break with this context.



The second turning point in construction, by combining *Computer Aided Design* (CAD) and *Computer Aided Manufacturing* (CAM), made it possible to plan and manufacture geometrically highly complex components, so that the individual design of series houses was also possible from an economic point of view. Parametric Design allows the formulation of design principles and the parameterization of correlations in the creation process, so that different solution variants can be created quickly and checked by mutual comparison.



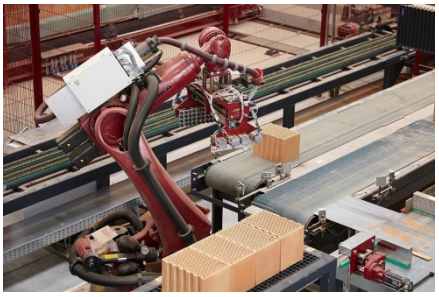
Building Information Modeling (BIM) extends the pure geometry by additional parameters, so that a series of additional information is linked to the individual components of a central 3D-model, such as length, width, height, area of application (load-bearing or non-load-bearing), materiality and associated properties, manufacturer or supplier, costs, phase affiliation, assembly sequence and other details. In addition, by defining mutual dependencies, the behavior of components in the case of changes can be determined. In this way, specialist planners from various disciplines are able to coordinate and, if necessary, correct their planning work already in this phase. Therefore, complete cost control is possible in real time, because all components and their handling are known.

In relation with the 3D model of the building, this provides a powerful sales tool. The marketing is carried out according to the model of the automotive industry with the help of a configurator, where the customer can combine different options combined with an immediate overview of the arising costs. This can be done on screen or, even more impressive, in the form of a virtual reality house inspection, where the customer can take a virtual tour of his house in advance. Special software is used to process the model data in such a way that the premises can be experienced in real time at different times of the day and year. Building experts will only be involved in the development of new house models, while sales will be handled by

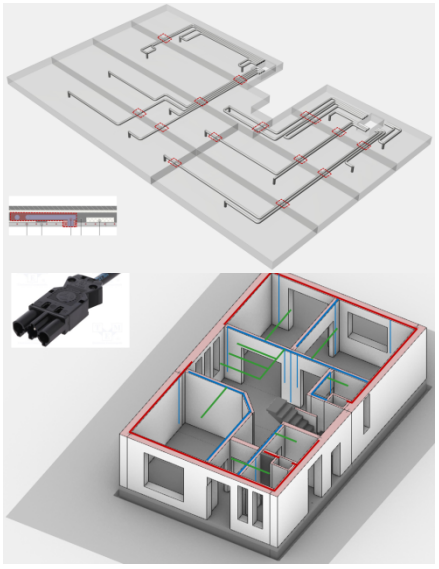
trained sales staff who will advise the customer on the configuration of his property within the framework of the selection options integrated in the system.

Consequently, the WoSH philosophy follows not only the integrative planning approach but also the increasing use of prefabricated components from the factory. This is intended to limit expensive and time-consuming work on the construction site to a necessary minimum. The installation time starting from the foundations to the completion of the building and handover to the customer is estimated at 8 days. An additional buffer for possible repair work is to be provided. Although the largely prefabricated components will be protected from damage by transport racks and other securing measures, minor damage may occur even with careful handling during installation, which a small specialist team can repair on site at short notice.

When selecting the building components, the focus was placed on the effective combination of modern and proven technology, so that a well-balanced advantage portfolio is created in terms of production and installation speed, flexibility, design, quality and maintenance, as well as the costs incurred. The walls are manufactured according to the patented redblocsystems™ in the form of storey-high wall elements, which are glued together from flat-ground bricks to form extremely dimensionally stable components. Window and door openings are already cut out in the building components in standardised dimensions and with high precision during manufacture. The walls are plastered at the factory and are equipped with an accessible electrical cable routing system, which allows the laying of pre-assembled wiring harnesses, which are plugged together after the elements have been assembled at the construction site.

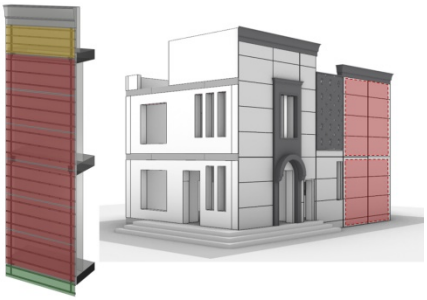


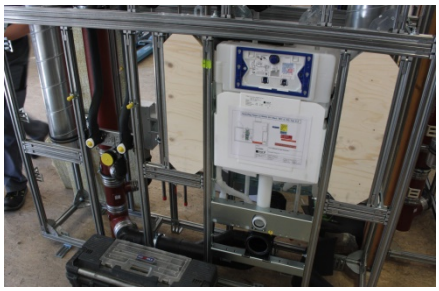
The ceilings are produced as air conditioning ceilings with integrated lines for heating and cooling as well as ventilation and electrical. Surfaces in visible quality can be used without further finishing. On the construction site, the friction-locked assembly of the elements is carried out. The flexible system also allows the selection and installation of different types of stairs made of concrete, steel or wood.

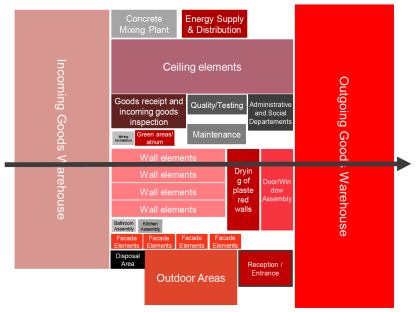


As the walls already have sufficient insulating functionality, the façade made of fibre cement panels is suspended as a visual closure in large-format, rear-ventilated elements. The automated production of individually planned, storey-high façade elements means that the house can be quickly clad on site. In this system, there are almost no limits to the flexible design and the integration of functions using solar or photovoltaic modules.

The installation of internal wet cells is carried out by means of facing with pre-installed wall components which can be connected to the already integrated lines of the supply shafts. In addition to the better quality and ease of installation, curtain components offer significantly







greater flexibility in terms of expansion and conversion compared to room-cell construction. Furthermore, the MEP room is arranged under the stairs so that it is accessible from the outside to save space.

Brick walls have both a static as well as a building physical utility value. In addition to their load-bearing function, bricks have a positive effect on the indoor climate, as their mass and vapour diffusion openness have a balancing effect on temperature fluctuations and the moisture content. At the same time, modern bricks already have excellent thermal insulation due to their low U-value. Their use means that there is no need for load-bearing floor frames made of concrete, which only use brick walls as infill. Outer walls are not broken through columns or beams and thermal bridges are avoided by a uniform materiality.

Concrete floors can be integrated particularly well with additional functions due to their additive production. For example, the inlaid registers enable effective temperature regulation of the interior by means of thermal radiation. As large unadjusted surfaces are activated by the ceiling, the supply temperature and heating power can be reduced by up to 18% compared to floor systems without any loss of performance. In warm countries, this principle enables energy savings of up to 80% with optimally coordinated house characteristics. This means that rooms can be cooled sustainably in summer and heated in winter. The heat radiation, which is perceived as particularly pleasant, ensures an even energy input in the room. Conversely, during cooling, excess heat is absorbed from the room and removed without noise and draughts.

The entire concept is also accompanied by a strongly pronounced concept of sustainability, as the parts that have been assembled can be dismantled or deconstructed again in the same way for final disposal. The production of the components in the factory protects the environment from noise and waste. The use of state-of-the-art plant technology enables resource-saving and flexible production. For example, 100% of the waste from the wall production is finely ground in the brick production and returned to the production process. The short assembly phase on the construction site and the targeted delivery of the components also relieve roads and the neighbourhood. Thanks to the interaction of high-performance materials with a sophisticated technical concept, the house is also very economical in operation.

The described procedure thus enables the metamorphosis of an ordinary building project into a product which can be manufactured according to the same rules due to the stable boundary conditions and the described procedure. By eliminating the usual risk factors in construction and efficiently streamlining the construction processes, significantly higher profit margins can be reliably achieved for the operators of WoSH systems. This is accompanied by a significantly improved financing situation, which can be achieved by the "product" house.

WoSH summary by:
Dr. Alexander Hub

Alfred Rein Ingenieure
GmbHFuchseckstrasse 7
D 70188 Stuttgart