

CASE STUDY: The Emporium Case

SECTOR: Zero-energy, zero-emission and material saving

COUNTRY: The Netherlands

BACKGROUND

The Emporium plan contains a building concept for zero-energy or solar energy buildings with an economical energy and material construction.

These constructions supply the climatic facilities for housing living humans. A warm water storage and collectors deliver the space heating and hot water supply, and a cold water storage and collectors the space cooling and cooling source for the refrigerator. The water circuits run pumpless on thermosiphon, and demand no high-grade energy such as electricity or fuel. A lightweight construction carries the water storage. This mass of water also replaces the hot and cold accumulating capacity of the building mass. The Emporium building concept is suitable for free-standing, connected, high-rise house and utility construction in all climate zones. The technical feasibility has been proved and confirmed. The economic feasibility is characterised by: zero-emission, biodiversity, safety, health, comfort and lifelong durability.

At present the building sector causes a substantial part (30% to 50%) of the CO₂ emission, due to the cement production and the climatic services for example. This emission is simple to reduce by zero-energy buildings with light wooden constructions, in which water for seasonal storage replaces the building mass. The zero-energy buildings furnish a substantial reduction on the total CO₂ emission, and create room for market sectors with more expensive reduction options to let the CO₂ emission grow parallel to the economic growth. The lightweight construction also saves material and extraction of raw materials, and reduces building transportation -at present 25% of the building costs. The

energy, emission, material and transportation reduction contribute to the preservation of biodiversity. The building sector has the highest number of fatal accidents, disabled workers, and absentees. Replacement of the building construction from the building site to the workshop will improve the working conditions and safety. Therefore the building concept is industrially and sectionally manufactured. Prefabrication also saves building waste - at present the largest contributor in the waste stream. Heating and cooling ceilings in the rooms, with a low temperature which is favourable for solar energy, and in combination with a high position, avoid circulation of hot space air. By permitting a little lower space air temperature, the radiation ceilings have a lower natural ventilation energy loss. The energy saving newly-built homes of today cause an increase of asthma cases, especially among young people, due to a strong reduction of ventilation. This lifelong sickness can be avoided by better ventilation and less hot air circulation. Therefore the building concept combines natural ventilation with low temperature radiation ceilings and so furnishes a healthy and comfortable inner climate. The building concept is limited to the construction, and provides a flexible floor plan. Due to an increasing elderly housing demand, the government strives for homes suitable for lifelong habitability. The primary functions, living, sanitary and sleeping, are hereby easily accessible. A freestanding solar house, a ground based type of dwelling, has these functions on ground level and therefore has a lifelong durable floor plan. Sustainable building organisations characterise the Emporium plan as the following: exceptional in energy saving, an extremely efficient material building method, good conditions for an excellent quality of the inner environment, a multi-disciplinary innovation and therefore already special, and an example of

sustainable building that far surpasses the realised ambition levels of today.

The product development and market implementation of the Emporium plan will be supported by a business model. The business model will limit as much as possible the contemporary barriers for innovations within the building sector, the tax system, and the social process. The building sector strongly operates project-dependent and relation-oriented, while an innovation demands for project-independent and market-oriented approach. The Emporium business model serves this project-independent and market-oriented approach within the project-independent and relation-oriented building sector for transferring knowledge of the innovation and for contact with market parties. This innovation serves as a milestone for an unequivocal innovation direction, for longer term realisation, by which building parties, with sight of project-independent and market-oriented turnover possibilities, can invest in step by step adjustment of the building process toward the direction of the innovation. The business model also is a contact field where market changes arise and, with the equalling of expectations and settlement of ambition levels, buildings can be realised in shorter terms, whereby the first adjustment of the building process brings the innovation a step closer. The support of the business model will be determined by the combinations of the market parties. The participation of financiers and producers, the building clients and industry, will only strengthen this support.

Time, energy and material are three factors playing an important role in today's economy. Time is expensive because it is the most heavily taxed, while energy is less taxed and material almost not at all. Time saving by material and energy use is fiscally profitable. Nature however seems to strive to the most economical material use, by applying energy and time. This means that nature considers materials as the

most expensive goods. There is as much energy as the sun offers, and time plays almost no role. Therefore the material and energy economy of the building concept can also be a means to reform the tax system. This reformation is probably much more influential to the intended durable society than the reformation of only the physical system. At present, alteration of the tax system is blocked by the physical system-completely equipped for this tax system, and a gradual fiscal reformation has too little effect. The building concept offers a means for, step by step per market sector, complete reformation of the tax system. In today's building process a specific amount of tax is paid for time, energy and material. With the Emporium building concept, the same total amount per house will be paid; within an altered divisional structure, material and energy will be taxed more, and time less. Material and energy saving offers within the same building costs the possibility for extra time investments, without causing higher taxation. These time investments stimulate the employment. At present the European building sector is contending with decreasing employment and declining profit.

The implementation of important innovations of this century appears to be determined by two influential factors. The driving force is the integration of several disciplines, and the restraining force is the complexity of the social process. Due to the required communication, sometimes an interdisciplinary process is less efficient, while with an integral approach, the solution is often more effective.

EVALUATION

The COST C8 Key Questions and the COST Evaluation Indicators are used to present and evaluate the Emporium building concept.

Ecology	Economy	Social Aspects
Emissions	Cost effective	Participation
Zero energy house	Serial production	Business to business
Low transport costs	Material saving	Open floor plan
Natural resources	Willing to pay	Transparency
Renewable material	Zero energy costs	Low-tech building concept
Waste saving prefab	Tax reduction	Pumpless water system
Bio-diversity	Organisation	Safety
Wood and water	Market leaders	Healthy inner climate
No cement or brick	Largest cities	Low temperature heating
Total	Total	Total
Zero energy house	Material Saving	Healthy inner climate

- Outcomes. Realisation of solar houses in the four largest cities of the Netherlands, to evolve the construction form.
- Continuity. Consortium of partners to develop the first houses, which is open for new participants.
- Participation. Market leading companies such as the constructor and the project developer, and the four largest municipalities.
- Rationale. Integration of zero-energy and zero-emission house, with material saving construction, and healthy inner climate.
- Aim and Focus. A material saving construction is the task of each succeeding realisation of the building concept.
- Problem-oriented. Trend breaking solution within an incremental developing market sector.
- Multi-disciplinarity. Combination of sustainable architecture, climate physics, and construction engineering
- Organisation. Timing of the realisation is integrated with the planning and programming of new building sites in the cities.
- Research issues. The Emporium is characterized as exceptional in energy saving, an extremely efficient material building method, good conditions for an excellent quality of the inner environment, a multi-disciplinary innovation -and therefore already special - and far surpassing the realized ambition levels of today.

INDICATORS

- European added-value. Climatic services and cement production cause 30 to 50% of the CO₂ emission, which is reduced to zero.
- Complementarity. European research programmes 'City of Tomorrow', and 'Energy, Environment, and sustainable Development EESD'.
- Monitoring and Evaluation provisions. Projects of ten to twenty houses are planned after each other for a learning process.

