RENEW SCHOOL

D2.3 LESSONS LEARNED FROM FRONTRUNNER BUILDINGS

PHOTO: Neumarkt after renovation, Austria

SOURCE: Arch. Gerhard Kopeinig

Co-funded by the Intelligent Energy Europe
Programme of the European Union

CONTENTS

PHOTO CREDENTIALS FRONT PAGE: Neumarkt after renovation, Austria

INTRODUCTION

The project has selected 18 school buildings to be RENEW SCHOOL frontrunners. These case studies with high energy performance have been collected from all European project partner countries.

For choosing the right buildings as frontrunners, the project consortium of the RENEW SCHOOL project set some prioritized criteria in their first project meeting in Graz. The two main criteria were the selection of typical educational buildings (also incl. kindergartens) and the use of prefabricated timber elements during the renovation or construction of the buildings. The rest of the criteria which were defined in the scope of the project, including if renovation or not, indoor air quality, the use of renewables etc., came in second line.

Only 7 of the 18 frontrunners which have been chosen are renovation projects. But the technical solutions and cooperation models used in all the frontrunners, not only in the renovation projects, can serve as an inspiration to future renovation projects in the RENEW SCHOOL sense all over Europe.

This document focuses on the lessons learned from the renovation/construction process, interviews with the decision makers and from what we learned about the visits of the frontrunners. Monitoring data of the building's operation, interview and questionnaire results as well as user feedback available before, during and after the renovation/construction process are used to compile the lessons learned documentation.

Data from identified frontrunners of the RENEW SCHOOL project was collected to get an in-depth understanding of the composition of funding sources as well as complexity of cooperation, of the renovation processes and experiences with the use of prefabricated timber technology. To this end, tools used were: survey questionnaire, individual interviews and visualization tools.

For more information about the different frontrunner buildings, please visit the project website
www.renew-school.eu.

LESSONS LEARNED

FINANCING

The majority of the frontrunners had to combine several financing sources, each of which had their own requirements.

The majority of financing came from funds, subsidies and grants, followed by preferential loan programmes and VAT reductions. Importantly, novel forms of financing were used, although in small number of cases, as third party financing ESCO Energy Service Company and energy guarantees (contracts which guarantee a certain level of energy savings).

Each source was bound to requirements; application of innovative or sustainable technologies or materials, achieving comfort criteria, etc. In nearly all projects evaluated in the RENEW SCHOOL project, the time needed to develop the financial model took several years, resulting in organizational burden and costs. Therefore, it is necessary to streamline all activities in financing and target-setting for the renovation from the early design phase of the school renovation.

Positive and negative aspects with the used financing methods and possible ways for improvement:

- Unfavourable conditions of lending money from the traditional banks.
- EU grants gave a systematic approach with good organization, but the procedures were complex and resulted in delays or even non-use of already appropriate funds.
- The regional government needed to be convinced by a comprehensive way of renovation, which resulted in additional hours of work.
- When using own municipal funds there is no need for any application processes to obtain external funds, resulting in an investment process being simpler and faster.
- Using own municipal funds can result in a lack of requirements, which may lead to the maintaining of common bad practice ignoring environmental effects of the investment.
- A negative aspect was that, should the intended project go beyond the valid building codes, the municipality must on its own obtain additional funds that would come from different sources, including EU funds.
- In some countries there is no separate funding for thermal renovations, therefore thermal renovation application must compete against e.g. applications of removing asbestos or connection to sewage system.

OVERVIEW OF THE COSTS OF THE RENEW SCHOOL FRONTRUNNERS

SCHOOL	TYPE OF PROJECT	EURO / M2 GFA (NET COST)
Backsippan Preschool (Sweden)	New building	2400
Capriva Del Friuli Kindergarten (Italy)	New building	2000
Detmold Vocational College (Germany)	Renovation	452 (incl. building structures and technical systems)
Heusden-Zolder Adult School (Belgium)	New building	3034 (incl. TVA, architects, engineers + renovation of a part of a historic mine building without prefab-technology
Kalmthout Kindergarten (Belgium)	New building	2869 (incl. TVA, architects, engineers + landscaping
Kekec Kindergarten (Slovenia)	New building	1308
Lavrica Kindergarten (Slovenia)	New building	1323
Neumarkt School Center (Austria)	Renovation	1450[1]
Rainbach Primary and new Secondary School (Austria)	Renovation	1153[1]
Reutershagen Gymnasium (Germany)	Renovation	2126 (incl. preparation/on-site infrastructure works, building structures, technical systems, outdoor facilities/ installations, furnishings and artwork and "Incidental Building Costs" (DIN))
Risør Technical College (Norway)	Renovation	4993 (incl. new facades and additional insulation of the roof)
Schwanenstadt Secondary School (Austria)	Renovation	1046[1]
Siemianowice Kindergarten (Poland)	New building	610 (incl. walls, roofs, floors and "hard" installations (boiler, central heating and ventilation, light integrated)
St. Leonhard Primary School and Kindergarten (Austria)	Renovation	1201[1]
Storžek Kindergarten (Slovenia)	New building	1667 (incl. all costs of investment (project documentation, earth work, foundation slab, building construction, building furniture, furniture of playground)
Søreide Primary School (Norway)	New building	3006
Tišina Kindergarten (Slovenia)	New building	2090

[1] Actual building costs – no expenses like planning, financing, VAT are included

COOPERATION

Internal driving forces

Having a strong driving force behind the project, can be crucial in persuading the project to use prefabricated timber elements.

Extended design phase

The winning proposal of the renovation project of Søreide primary school in Norway was based on a cooperation of the contractor and the architect. In an extended design phase 'Planning and detailed planning' after the contracts were established (see 'P' and 'C' in Figure 1 below) the architect, engineers and contractors optimized the prefabricated elements and the solution set.

Communication

In some cases, when a deep renovation project is planned, the tender is fragmented. This could result in sub-optimal situations and end products if the different partners do not exchange information and communicate sufficiently in the early stages of the planning process. The usage of **'central information sharing system'** or **'cloud programme'** for the project management can prove to be beneficial for project progress and cooperation.

Integrated planning with the building owner, architect, structural engineer, designers, mechanical and electrical installations and management of the construction is crucial to ensure an optimal final result.

Many changes that might occur during the construction phase and completion of the building could end up much less expensive if the changes are taken into account at the design stage of the building.

Personal meetings and dialogues enabled a better mutual understanding and induced consequently a better atmosphere of trust and confidence. Teachers should be encouraged through **participation** so that they can stand behind the project.

An example of the importance of communication can be found in the Heusden-Zolder new-built project, where good communication between the main contractor, the producer of prefabricated elements, the producer of the cladding-system (corten-steel) and the window producer resulted in a zero-error project.

Early integration of experts

The information flow between design and execution or the integration of experts in early planning phases is crucial, resulting in short construction times, trouble-free renovation process and school operation.

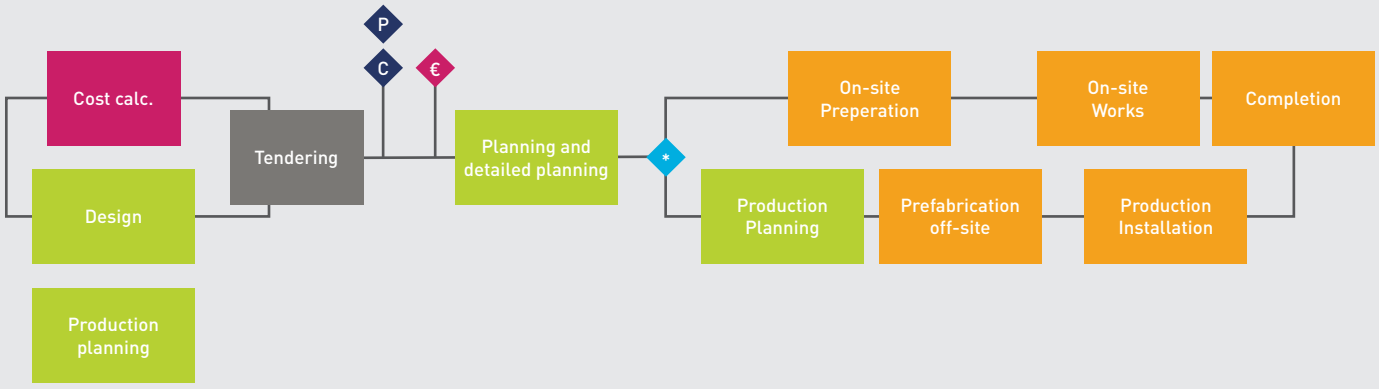
In Neumarkt the architect was very experienced in prefabrication from previous projects. Nevertheless, the public procurement regulation hindered them to optimize the elements in terms of production capabilities given by the manufacturer. Hence many of the implemented cooperation models had to neglect possible (and radical) optimization options.

Handover and documentation

Precise and understandable documentation of how to operate and maintain the building must be given to the users in order to be able to take advantage of a high quality renovation.

Lowest price principle

All demo projects were driven by the 'lowest price' principle. This was due to the obligation of the public procurement. The tender should identify the bidder being able to realize the solution proposed by the design team to the lowest possible price. Hence, there was less room to think about an alternative solution that might be even easier to realize.



Figur 1
Action chain of the renovation in Søreide (primary school in Norway)
P – Contract, planning team, C – Contract, contractors, € - Cost statement, * - Design freeze

TECHNICAL SOLUTIONS

Building envelope

Degree of prefabrication

The majority of the renovated school cases used prefabricated facade systems with integrated insulation, windows and electrical cables. Only a few integrated ventilation ducts, heating, sanitary hot water, wastewater and rainwater pipes.

The most advanced prefabricated solutions additionally integrated shading system or prepared first internal finish layers and came with fixation points ready, while some of the projects opted for partially prefabricated solutions.

Each renovation project is unique, and in some cases partially prefabricated façade elements can be the way to go, whilst in other cases fully prefabricated facades is the better choice.

The renovation project of Detmold in Germany opted for partially prefabricated elements which were open on one side (towards the existing wall), as the architect requested to apply the cavity insulation material on site, in order to prevent the formation of gaps between the existing wall and the timber element.

The cellulose insulation was applied on site by a subcontractor of the timber construction company; problems arose during the filling of some compartments, which could have been avoided if the filling had been performed during prefabrication.

Some designers do not want to work with interior finishing because of bad experiences in the past (damaging during mounting and/or finishing the rest of the building).

Moisture

The regulations regarding the construction sector in Sweden as defined by Boverket's Building Regulations (BBR) includes a moisture safety regulation as follows; "if the material moisture level for a material is not well-researched and documented, a relative humidity (RH) of 75% shall be used as the critical moisture level." Regarding external walls, the protection layers against rain and the ventilated air gap may be an exception for this criterion. This regulation seems to inhibit the use of prefabricated wooden facades in renovations as it is very difficult to ensure that the RH requirement is met, due to exterior weather conditions during installation, climatic variations, etc.

In Denmark there's currently a moisture scandal because cheap wind barriers have been used for some years in light wooden constructions. The production of the wind barriers has left over magnesia (MgO) in it, which is strongly hydrophilic. This means that the plates are dripping salty water, which turns wood to rot and metal fittings to rust in just a couple of years. Wooden constructions are much more sensitive to moisture than concrete/stone constructions. It is important to obtain guarantees from the wooden element manufacturers, that their elements or combination of materials can withstand the conditions they will be subjected to. I.e. it is much better or secure to buy a complete facade system from renowned producers that has been extensively tested than to leave it to the contractor to put the facade elements together themselves in some temporary factory on site from materials they have collected in various unknown places.

PHOTO: Kalmthout, Belgium

PHOTO: Kecek, Slovenia

Fire safety/regulations

It is very important to have an experienced fire protection expert in timber construction, because not all state building codes clarify everything in regards to differentiated wooden constructions applied in the frontrunners or similar buildings. The experts have a crucial role in the fire prevention assessment.

Market uptake

- There is a lack of knowledge in the use of wooden constructions.
- Information to and education of architects and real estate companies / housing associations with large properties in order to raise awareness of this renovation principle among builders could make this type of building renovation more popular and thus more successful.
- Focus on price alone can exclude innovative solutions or prefabricated timber constructions because the construction companies often deliver the lowest possible quality.
- Focus on environmental aspects, sustainability and user comfort in addition to price is important to achieve a sustainable building.
- In-house experts (designers, architects,..) in bigger construction companies can exclude smaller architect firms with knowledge on prefabricated timber facades.
- The number of suppliers for prefabricated wooden elements in European competitions is very low, so market related prices are even higher than generally required. Companies tend to be a bit too small to cope with larger projects with the existing workforce.

Construction/design

- The 3D acquisition of the building dimensions can significantly improve the planning reliability, but leads to very large amounts of data and thus greatly increases the IT requirements.
- 3D scans should be performed as early as possible in the planning phase.
- Experienced construction managers with very good knowledge in timber (carpenters, construction engineer) are desirable.
- The use of prefabricated timber facades reduces the construction time on-site considerably. The whole on-site construction process can be done during the summer holidays.

Ventilation and indoor air quality

The majority of the frontrunners have a centralized, mechanical ventilation system with heat recovery (13/18)

2 of the frontrunners have decentralized, mechanical ventilation system with heat recovery (Detmold and Schwanenstadt)

1 of the frontrunners has a semi-decentralized, mechanical ventilation system with heat recovery (2 units per floor level) - Heusden-Zolder

1 has a hybrid solution (combination of mechanical and natural ventilation) – Vibeengen

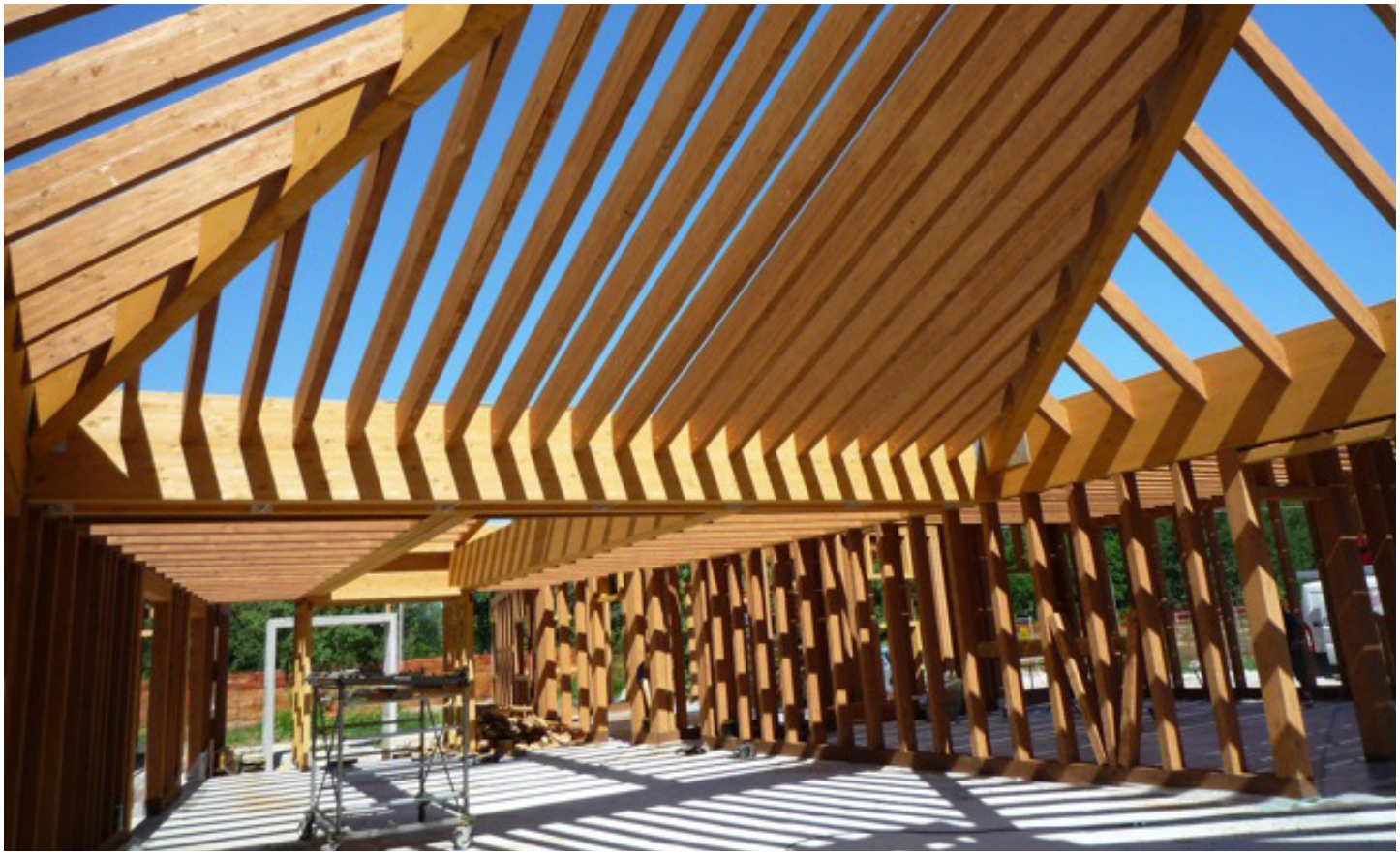
1 has natural ventilation only (Risør).

Average heat recovery rate in frontrunners: 84,6 %

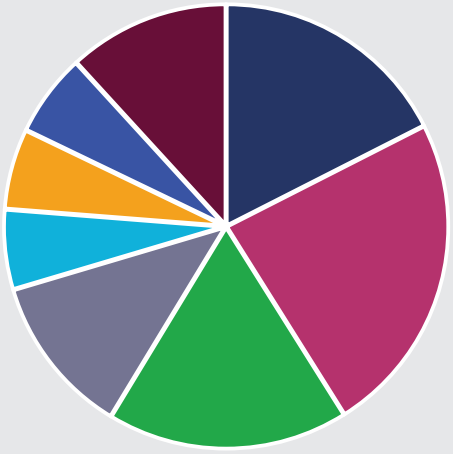
Important measures to ensure that the installed ventilation system operates as planned

- Quality assurance (during construction phase, after completion of the construction, during the operation of the building)
- Sufficient commissioning of all the technical installations

PHOTO: Capriva, Italy



Energy supply

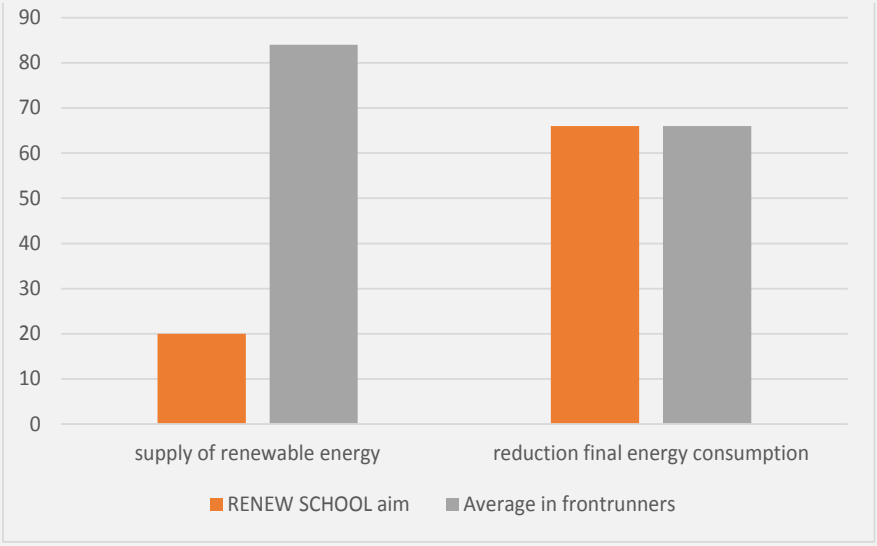


- Heat pump
- District heating
- Biomass
- Natural gas
- Heat pump + natural gas
- Biomass + solar thermal
- Heatpump + solar thermal
- No renewables

10 out of 18 frontrunners use PV-modules

1 has its own wind power plant (Reutershagen in Germany)

The electricity bought for the frontrunners in Norway and Sweden is based on wind/ hydropower.



The percentage of renewables in the frontrunners vary from 0-100% - the average being 84 % (Project aim: 20 %)

The average reduction of the final energy consumption for the renovated frontrunners is 66 % (Project aim: 66 %).

FRONTRUNNER VISITS

One of the tasks in the RENEW SCHOOL project was and still is to organize visits to frontrunner buildings. The aim of these visits is to motivate mainly the school providers and financiers, but also architects, planners and professionals to carry out similar renovation projects, and also school users to learn about the process and the energy efficient buildings.

Some lessons learned for the importance, the planning and organization of such visits:

- Frontrunner visits and visits to nZEB are one of the most important instruments to convince school owners and decision makers of the importance using new technologies and implementing high indoor quality.
- To motivate school owners like mayors and heads of building departments one has to invite them personally and to highlight the benefit of such a visit in face-to-face meetings or on the phone.
- It is important to organize tailored visits for the main target group. But this does not in any case guarantee that decision makers are on board but can bring additional synergies and benefits for future collaborations.
- It is easier to bring architects and planners to the visits than representatives of the school owners. Probably architects and planners see more direct benefits from the visits.
- Bringing the media to the visits offers broad publicity but needs very good contacts, supporting activities for them and personal invitations.
- Direct collaborations with universities or schools can bring more students to the visits.
- It is recommended to highlight the innovations of the buildings directly in the announcement of the visits, so that the people know what they can expect and also get interested in the visit.
- Multi-day visits need co-financing and good partnership with co-organization/ events in order to guarantee a high number and quality of participants.
- Linking visits to other relevant events like conferences or workshops of a specific topic increases visibility and draws participants from a coherent pool of interested parties.
- Co-organising with other organisations improves visibility and gives direct access to a broader pool of persons from the main target group. Building and architect associations, scientific committees, local authorities allow direct access to their members.
- The best communication channel is direct e-mail solicitations and personal invitations, either by partners or co-organisers or partner event organisers.
- No clear consensus on the decision to impose a fee for participants was reached. The length and type of buildings visited, the country and the partner events are all factors to be considered before deciding to impose a fee.
- When international participants are expected, translation becomes necessary. A basic food service should also be provided during visits.

PHOTO: Storžek, Slovenia

SOURCES

PHOTO: Risør after renovation, Norway

SUSTAINABLE SCHOOL BUILDING RENOVATION - school's financial signpost – RENEW SCHOOL deliverable D4.1 2015.

Harald Semke, Dipl.-Ing architect AKNW, pape or Semke ARCHITEKTURBÜRO, Integrated Design "renovation Detmold vocational colleges to Plus energy school"

Various interviews with different stakeholders from the chosen RENEW SCHOOOL frontrunners

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Asplan Viak AS (NO)

National Energy Conservation Agency (PL)

Chalmers University of Technology (SE)

Fraunhofer-Institute for Building Physics (DE)

Informest - Centro Di Servizi E Documentazione Per La Cooperazione EC (IT)

Autonoom Gemeentebedrijf Stedelijk Onderwijs Antwerpen (BE)

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