SPP TENDER MODEL

Sustainable construction

Positive energy boarding school in Rouillé, France

Purchasing body:	Région Nouvelle-Aquitaine
Contract:	1) Project management for construction of a boarding school at the Lycée Xavier Bernard - Awarded: December 2015 2) Construction works for the Lycée Awarded: July 2017
Savings:	• Primary energy savings: 0,09 GWh/a • CO_2 emission reduction: 5,1 tCO_2/a

SUMMARY

- Overall project goal to construct a positive energy building, and following the HQE green building certification scheme
- Comprehensive environmental criteria set, including the use of sustainable construction materials, minimising energy and water use, optimising user comfort and health, and minimising the disruption and disturbance of construction works
- 700m2 building, housing 50 beds
- Contract for design and project management awarded to Dauphins Architecture

Procurement Approach

For the construction of a new 50 bed boarding school, as an extension of the Lycée Xavier Bernard in the town of Rouillé, the Region of Nouvelle Acquitaine, as contracting body, decided to apply highly ambitious environmental goals. The approach taken was based on the main French green building certification scheme, HQE (*Haute Qualité Environnementale*)[1], with the further ambition of achieving a positive energy building[2].

The HQE scheme assessed 14 environmental indicators (see Fig 1. below). For each indicator it defines three levels of performance – very high, high, and regular. To fulfil the approach you must achieve the *very high performance* level for at least three indicators, and at least a further four at the *high performance* level. Which indicators to prioritise at the higher level is the choice of the contracting authority[3]. The Region of Nouvelle Acquitaine decided to fix the following indicators at the very high performance level: construction methods and materials, minimising maintenance and repair, and hydrothermal comfort. The full selection can be found in Fig 1 below.

Two stage procurement process

The procurement process was split into two stages:

- Selection of architect/project manager - Awarded December 2015
- Procurement of works contracts (12 lots) – Awarded July 2017

Works will start in April 2017, and are scheduled for completion by April 2018.

The selection of the right architect was central to the ambitions of the Region, in achieving the environmental standards desired. Given the overall goal of constructing a positive energy building and achieving the HQE defined performance targets listed in Fig 1 below, the bidding architects were evaluated on a range of criteria over a two-phase evaluation – the first phase assessing their experience and suitability for the project, and second their concept for the project itself.

The architect was tasked with designing a construction which met a specific performance level for 14 environmental parameters, as defined by HQE (see fig 1 below).

[1] “High Environmental Quality“ – for more information: www.behqe.com

[2] BEPOS: *Bâtiment à énergie positive*

[3] More information on HQE (in French) can be found here: https://certivea.fr/offres/certification-nf-hqe-batiments-tertiaires-neuf-ou-renovation

Fig. 1 – Environmental targets to be achieved by the selected architect

Target	Level 1 Very high performance	Level 2 High performance	Level 3 Regular
Eco-construction			
Harmonious relationship between buildings and their immediate environment			
Construction methods and materials			
Minimising disruption and disturbance of construction works			
Eco-management			
Energy management			
Water management			
Waste management in construction works			
Minimising maintenance and repair			
Comfort			
Hydrothermal comfort			
Acoustic comfort			
Visual attractiveness			
Control of odours			
Health			
Hygiene and cleanliness of the indoor spaces			
Air quality			
Water quality			

The final technical specifications of the building were then developed by the architect, in collaboration with the contracting authority. The construction was able to make use of an existing, biomass powered, heat network, which serves the school together with another public building.

To achieve the positive energy standard, one element of the design was to incorporate the production of renewable energy on site. The architect selected the installation of a small wind turbine, together with a number of solar panels on the roof.

The procurement process was

Straw as a construction material

For this project, the architect selected to use straw as one of the principle construction materials. Straw has two key advantages:

- Local material (particularly relevant for an agricultural school)
- Low energy material – little energy required to transform straw into a construction material

For using straw it was necessary to have prior consultation with the local fire department (SDIS) supported by the Nouvelle-Acquitaine Eco-Habitat Cluster[4], which brings together architects, project managers, construction companies, researchers, and public sector organisations, to promote sustainable construction through networking at the regional level. The Cluster helped distribute the tenders for construction work to appropriate companies, and additionally organised a thematic day on straw construction for its members (including a workshop and site visit).

Life cycle costing

In the assessment of overall cost during the design phase, a life cycle costing approach was implemented, which considered the costs of maintenance and building operation.

The following costs were considered:

1) Technical operation costs
   - Energy and water bills
   - Cleaning of the buildings and glass surfaces
   - Maintenance of green spaces
2) Routine maintenance
   - Facility inspection (including driving time)
   - Cost and time spent on routine maintenance and repairs
   - Costs of external contracts for maintenance and repairs (heating, elevators etc.)
3) Major maintenance works
   - Direct and indirect costs of corrective maintenance (breakdowns and repairs)
   - The costs of major maintenance works related to major repairs and renewal of building components.
4) Durability of the different components of the building

Tender specifications and Verification – Architect/project manager

DESCRIPTION OF WORKS

The final construction should be designed according to the following principles:

- Consideration given to the future evolution of the building according to its predicted lifespan and usage
- Ensure the disassembly/separability of products and construction processes with a view to optimising environmental management at their end of life

[4] www.cluster-ecohabitat.fr

- Select construction products with a view to limiting the environmental impacts of the structure.
  - Use materials and products with low CO_2 emissions in their supply chains, according to environmental product declarations[5] that provide the least CO2 polluting site supply
  - Use of materials and products to promote CO_2 capture
  - Prioritise the use of wood
  - Construction products should not be sources of pollution. Whenever possible, it should be requested that products have a European ecolabel (NF Environment, EU Flower, Blue Angel, Nordic Swan, or equivalent).
- Choose construction products to limit the health impacts of the building
  - Limit pollution by possible wood treatments
  - Synthetic materials must be used with restraint and the materials used containing critical, problematic or toxic components must be avoided (solvents, volatile organic compounds, halogenated substances, biocides, plasticizers, formaldehyde, non-zero ODP gases, etc.)
  - The selected materials (quartz concrete, varnished wood, mud brick wall, tiling, wood panels in ceilings, etc.) must be easy to maintain and will not require pollution-causing cleaning products. The diversity of materials must be limited.
- Design the building so as to facilitate maintenance and repair works during operation
  - ➢ Provide an approach for monitoring energy consumption, water and comfort conditions.

EVALUATION PHASE 1 (To select 3 bidders for the 2nd phase)

EVALUATION CRITERIA:

Bidders were asked to provide three previous project references, as well as a detailed description of the team proposed to carry out the project. The bids were then evaluated against the following criteria:

- Relevance of references provided to the proposed project in terms of technical and environmental expertise (30%)
- The quality of the references provided, in terms of their presentation and description (40%)
- The team dedicated to carrying out the project (30%)

[5] FDES - *Fiches de Déclaration Environnementale et Sanitaire*

EVALUATION PHASE 2 (To select the final contractor)

EVALUATION CRITERIA:

- Construction plans – A3 sheet providing, the overall building structure, the building layout, and a view of the façade (40%)
- An explicatory note, of maximum 2 pages (30%), including:
  - Overall interpretation of the defined construction challenge.
  - Architectural section: Presentation of the project and justification for the proposed solution, with the main elements of project design.
  - Environmental aspects with a description of the main principles to be applied to meet the positive energy (BEPOS) requirement.
  - A description of the proposed technical solutions, in particular the construction system to be applied
- Price (Architect/project manager fee) (30%)

VERIFICATION

Bidders were asked to provide the construction plans and explicatory note described above.

Tender specifications and Verification – Construction works (12 lots)

TECHNICAL SPECIFICATIONS

(Detailed technical specifications were provided by the project manager for each of the construction works lots, according to the final building design, as agreed with the contracting authority).

EVALUATION CRITERIA:

- Technical evaluation (30%, including 5% in relation to the materials proposed).
- Price (70%).

VERIFICATION

Bidders had to provide technical sheets to demonstrate compliance with the technical requirements

Results

Environmental impacts

The new building is estimated to achieve savings of **5.1 tonnes CO_2/year** in comparison to a standard school building – **a 75% reduction**.

Without considering the wind and photovoltaic electricity generated on site the building would consume 34 kWh/m² instead of 117 kWh/m² for a standard building. If we include this RES capacity the figure falls to just **4 kWh/m²**.

Table 1: Environmental savings

Tender	Consumption (kWh/year) (Nm^3/yr) (kg/yr)	CO_2 emissions (tCO_2/year)	Primary Energy consumption (GWh/year)	RES triggered (GWh/yr)
Benchmark (electricity, natural gas, wood biomass)	23 148 kWh 873 Nm^3 12 532 kg	6.8	0.12	0
Green tender (electricity, electricity RES, natural gas, wood biomass)	3017 kWh 4759 kWh green 293 Nm^3 4209	1.7	0.03	0.005
Savings		**5.1**	**0.09**	**0.005**

CALCULATION BASIS

- Energy consumption figures used in the calculation provided by the architect
- CO_2 emissions factor for electricity: 0.146 kg/kWh
- CO_2 emissions factor for natural gas: 2.503 kg/Nm^3
- CO_2 emissions factor for wood biomass: 0.099 kg/Nm^3
- Primary energy factor for electricity: 2.5
- Primary energy factor for natural gas: 1.1
- Primary energy factor for wood biomass: 1.1
- The calculation has been conducted using the tool developed in the GPP 2020 project (*www.gpp2020.eu*), and adjusted in the SPP Regions project (*www.sppregions.eu*). The detailed calculations can be found in Annex 1 of the present document.

Financial impacts

The focus on life cycle costing during the design phase has helped to reduce overall operating, maintenance and repair costs. In particular, energy consumption costs are considerably lower than for a conventional building.

The overall investment costs for the building have been estimated at €1,765,000.

Market response

Between 1 and 7 companies submitted bids for the various construction work lots, however, one lot had to be retendered as there were no responses (see section below).

Lessons learned and future challenges

- Overall, the work is proceeding very satisfactorily, although it will only be possible to assess operating conditions in a few years
- The project has also been successful in setting up participatory workshops with high school students (for example on the use of earth bricks and straw bales), combining pedagogy and environmental innovation.
- The approach for two of the lots (frame-straw, and sealant) could have been optimised. The straw insulation was included in the frame lot to ensure the appropriate integration of the straw bales into the structure (layout optimisation). However, the sealant lot initially received no bids, and even after relaunching only one company applied. The reason was concern about the quality of the straw and its installation.
- There could have been more emphasis placed on checking qualifications related to the laying of the straw.

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Annex 1 - Calculation of environmental savings

Calculations made using the tool developed within the GPP 2020 project (www.gpp2020.eu), and refined within the SPP Regions project. Available on the SPP Regions website.

Input & Results

Location of energy contracting	France	
CO_2-emissions per kWh electricity (kg/kWh)	0,146	*If you know your own rate, enter it on the sheet "General Assumptions".*
Lifetime of the measures implemented in the course of the contract	25	years

INPUT DATA					TOTAL EMISSIONS AND CONSUMPTION							
	Baseline		Green tender		Baseline				Green tender			
					Per year		Per lifetime		Per year		Per lifetime	
Energy source	Current annual energy consumption		Expected annual energy consumption		Primary energy consumption (GWh/year)	CO_2-emissions (t CO_2/ year)	Primary energy consumption (GWh)	CO_2-emissions (t CO_2)	Primary energy consumption (GWh/year)	CO_2-emissions (t CO_2/ year)	Primary energy consumption (GWh)	CO_2-emissions (t CO_2)
Electricity, conventional	23 148	kWh	3 017	kWh	0,1	3,4	1,4	84,5	0,0	0,4	0,2	11,0
Electricity, green		kWh	4 759	kWh	0,0	0,0	0,0	0,0	0,0	0,1	0,1	2,0
Heating oil		l		l	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Natural Gas	873	m³	293	m³	0,0	2,2	0,2	54,6	0,0	0,7	0,1	18,3
Wood pellets		kg		kg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Wood	12 532	kg	4 209	kg	0,1	1,2	1,4	31,0	0,0	0,4	0,5	10,4
District heating		kWh		kWh	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Coal Briquette		kg		kg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Lignite high quality		kg		kg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Lignite low quality		kg		kg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Coke/Anthracite		kg		kg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
				TOTAL	**0,12**	**6,8**	**3,0**	**170,1**	**0,03**	**1,7**	**0,9**	**41,8**

SAVINGS			
	Savings (Baseline / Green tender)		
Expected results	Per year	Per lifetime	Percentage
Primary energy savings, (GWh)	0,09	2,2	71,87%
Reduction of CO_2 emissions, (t CO_2)	5,1	128,3	75,43%

About SPP Regions

SPP Regions is promoting the creation and expansion of 7 European regional networks of municipalities working together on sustainable public procurement (SPP) and public procurement of innovation (PPI).

The regional networks are collaborating directly on tendering for eco-innovative solutions, whilst building capacities and transferring skills and knowledge through their SPP and PPI activities. The 42 tenders within the project will achieve 54.3 GWH/year primary energy savings and trigger 45 GWh/year renewable energy.

SPP REGIONS PARTNERS

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