# ELIA NEW SBK IN BRUSSELS

SABINE LERIBAUX[1], BRAM DE MEESTER[2]

[1] sca Architectes Associés sprl, www.architectesassocies.be
Avenue de l'Observatoire 11e, B-1180 Brussels, Belgium
Phone : +32 2 410 76 77 Fax : +32 2 411 35 19
E-mail : s.leribaux@architectesassocies.be

[2] ARCADIS Belgium nv, www.arcadisbelgium.be
Kortrijksesteenweg 302, B-9000 Ghent, Belgium
Phone: + 32 9 333 84 57 Fax: +32 9 242 44 45
Email: b.demeester@arcadisbelgium.be

## ABSTRACT

Elia's future extension in Brussels called New SBK completes the existing industrial site called Old SBK, where both the national and regional survey centers of the entire Belgian electrical network are situated. The BREEAM certified ensemble in progress (scheduled end 2013) includes a 10 000 sqm technical-administrative zero-energy building surrounded by 3 hectares of densely landscaped grounds, parking space, a cable park, and various depots. Positive urban impact and recreating biodiversity on the heavily polluted brownfield site are key challenges. Also, design for re-use, waste management, water treatment, material choice, and a photovoltaic parking canopy wholly covering the buildings energy consumption all contribute in reaching high environmental standards.

## 1. TEAM

It would be impossible to attain the ambitious goals described above without the pro-active and open-minded teamwork prevailing from the onset between all actors, from client down through to the men and women working on site. The authors wish to stress this point, being themselves no more than the representatives of this team (see Table I).

| | |
|---|---|
| Client | Elia Asset (M. Nederlandt, G. Vervack et al.) |
| Project Manager | Forum (S.Steinier, C. Pisarski, M.Tsas et al.) |
| Architect | Architectes Associés (S. Leribaux, M. Lacour, M. D'Hooghe, E. Léonard, L. Claeys et al.) |
| Structural Engineer | Arcadis Belgium (R. Keersmaekers et al.) |
| Technical Engineer | Arcadis Belgium (C. Albrecht, P. Devos et al.) |
| Sustainability Engineer | Arcadis Belgium (B. De Meester et al.) |
| Certification PEB and BREEAM | IBAM (E. Deruwe, S. Cailler et al.) |
| Main Contractor | CFE Brabant (P. de Kerckhove et al.) |
| Other Contractors | Kyotec, Machiels Building Solutions, Brantegem, VMA, et al. |

**TABLE I:** TEAM MEMBERS

**FIG. 1:** EARLY MORNING ON SITE, JANUARY 2012

## 2. INTEGRATED DESIGN PROCESS

### Methodology

*The competition project* entered beginning 2009 was designed according to a precise brief prepared by Elia that included quantified requirements addressing space use, environmental considerations, and budget. During this first stage and after critical exam of the brief, architects and engineers laid down and then tested multiple open-ended options, be it concerning function layout, form, or techniques. For example, window scaling and design underwent lengthy scrutiny and debate: how to capture the best of daylight (resulting in ledged windows and lintels extending above ceiling), or how to reduce time spent behind lowered blinds (resulting in exterior sun-fins).

At *permit stage*, again new spatial organizations were imagined then tested with the client, resulting in a definite upgrade: a more fluid organization around main lifts, high ceilinged meeting rooms on the top floor with magnificent views, and an adequately positioned and serviced conference room at ground level.

Energy performance was weighed in comparison with interior temperature control. Elia accepted to rethink its expectations integrating environmental criteria, resulting in a passive concept it could validate.

Even material resourcing (for example for the opaque façade cladding) was re-examined and re-tested non-stop, to eventually be finalized only once on site once discussions with contractors was possible.


**FIG. 2:** FACADE PANEL ON SITE, JUNE 2012

*Tender documents, detailing,* and on through now to ongoing *work on-site* all benefit from the same collaborative process, with the added help of FORUM (project manager) from this stage on. Shared individual insights shape the synthetic whole. Synergies with the main contractor CFE BRABANT and sub-contractors are frequent: optimizing detailing, cost-effectiveness, efficiency, environmental performance.

**Difficulties encountered**
This is a highly unstable mode of functioning … none can say what the end result will be. It demands continuous attention, global thinking covering the vast bulk of intertwining design constraints inherent to such projects (zoom out), and all the while maniac attention to details (zoom in). There can be no certainties, no pre-conceived outlook. Descartes est roi. Nonetheless this infinitely rich boundary-less breeding ground must produce a totally finite and delimited end product: a real building that works, on budget, and on time … the difficulty lies here: accepting the dual nature of the process.

**Result**
The rule, and hopeful result, of an integrated design process is pertinence. Pertinence is sovereign. Each aspect tested on New SBK is deformed then modified following interaction with other aspects … each actor's thinking is deformed then modified following interaction with other actors' thinking … the

design proposal gradually morphing into a pertinent answer materialized by the built form appearing on site today.

## 3. WORKING ON A BROWNFIELD SITE

**Context**
Ground pollution (of industrial origin) on site has been known since Elia negotiated land purchase (heavy metals throughout and hydrocarbon in concentrated zones). Obviously interested in extending their existing installations on Old SBK, Elia has readily accepted IBGE's requirements which consists essentially in covering 100% of the plot with an impermeable membrane or slab, thereby avoiding groundwater contamination by rainfall percolation thru ground or subsoil.

**Implications**
Heavy metal pollution spread through-out the site meant that all excavated earth is depolluted at heavy cost. Excavation therefore is limited. This constraint coupled with obligatory waterproofing has proved to be much more engaging than imagined: not only does the building have to be airtight … but landscaping also has to be watertight, and as shallow as possible … that means no trees, barely more than bushes.
So the marsh-landscape was imagined, crisscrossed by timber decks and resting areas constituting a network of off-angled pedestrian routes ambling thru the site. Neither decks nor marshes call for extensive digging, and the marshes themselves are made of reed-beds and planted retention ponds for waste-water treatment and runoff-water management. Planted gabions (requiring no digging) give structure and scale, visually organizing the vast 3 hectare site. Planting itself, using only indigenous species and stimulating biodiversity, requires no irrigation system. Ornamental grasses, prairie grasses, and hedges offer havens for flora and fauna.

**Tenders**
Tenders for landscaping have just begun. All planting has been organized in a separate tender, the responsibility here being so specific that liabilities need to be clearly outlined.
Overlapping between tenders is inevitable and necessary, for example the parking canopy (a separate tender) has foundations that are part of the landscaping tender because of obvious watertightness issues, implying de facto coordination between the two, showing once more the critical necessity of efficient and continuous communication between actors.

## 4. HYBRID COOLING STRATEGY

### Challenge

The insulation and airtightness levels of a passivhaus building, reducing installed heating power to about 330 kW for this 10,000 sqm building, entails a challenge of limiting the overheating risks. This is certainly the case in an office building in which internal heat gains are in the order of magnitude of 20-30 W/m² during daytime. A peak input of solar heating power or electrical equipment would lead to a swift temperature rise, due to the thermos created by the building envelope.

### Source control

As the ambition was to implement passive cooling strategies, the first task was to eliminate or reduce the heat gain sources.. Solar gains were mainly reduced by optimizing window dimensions and by applying of external solar protection. In a next step , internal heat gains were addressed by limiting the installed power for lighting (efficient fittings and lamps), integrating efficient lighting controls (daylight sensors, absence detection) and paying attention to electrical equipment (multifunctional printers in separate rooms, selection of energy efficient appliances), all of them reducing both direct energy consumption and internal heat gains.

### Triple strategy

These adjustments enable the omission of cooling units in the offices, as the cooling load is tackled by a triple strategy. First stage is the intensive nighttime ventilation, rinsing the office spaces with five volumes per hour of cool outside air. If room temperature after working hours exceeds a threshold temperature, the building management system will open a window panel and the mechanical extraction ventilation will pull the fresh air through the room, thereby evacuating the heat stored in the thermal mass of the ceiling. Room by room sensors and variable frequency ventilators ensure that the nighttime ventilation is demand-controlled.

The second cooling stage is the adiabatic cooling of ventilation air during daytime. By evaporating water, a temperature drop is realized in the extraction air, passed on to the supply air by the heat exchanger. This can peak off supply air temperature with about 5K, providing comfortable 21-22°C supply air temperatures necessary to avoid gradual overheating of the room during working hours.

Only on hot summer days (outside temperatures surpassing 26-27°C), a third cooling stage is activated and additional mechanical cooling is provided. The chiller (energy class A), which is necessary to provide cooling for high and variable loads in the conference room (over 100 persons) and meeting rooms, can then support the adiabatic cooling with an additional temperature drop. The efficiency of this triple cooling strategy has been studied intensively through dynamic thermal simulations in early design stages.

## 5. STRIVING TOWARDS 0-ENERGY

In order to combine both landscaping and energy ambitions, a photovoltaic canopy for the car parking was integrated into the project. As the heating demand is very limited due to passivhaus principles, electricity is by far the dominant vector of the projected energy consumption of the office building. The photovoltaic panels, which have a peak power of about 380 kW, will produce about 330 $MWh_{el}$/yr, almost entirely compensating the buildings electricity demand – estimated at 340 $MWh_{el}$/yr.

## 6. FACADE DESIGN

### Philosophy

*« **Making** is the most powerful way that we solve problems, express ideas and shape our world. What and how we make defines **who we are**, and communicates **who we want to be.** », D. Charney,, oct 2011*

**FIG. 3:** SOUTH ELEVATION, AUGUST 2012

## The beginnings

During the past 5-10 years, several factors have pushed the architects to develop an alternative to standard façade cladding:
- *airtightness* pleads for frame-cladding instead of traditional transom-and-mullion cladding;
- *quality control* calls for prefabrication off-site in a monitored environment;
- *ecological material sourcing* leads to alternative choices, like timber;
- *low maintenance* implies highly resistant skins, inside and out;
- *sheer cost* of the envelope, that is 30% of total budget, imposes multifunctional design… and *reducing duration and environmental impact* once work starts on site means thinking thru almost everything beforehand.

The design & build process with the façade cladder KYOTEC has proved here invaluable. Elia is the third timber-aluminum project developed with the firm, and represents a definite upgrade of its two predecessors, Loi 227 (2006-2009, Rue de la Loi, Brussels) and Aeropolis (2005- 2010, Boulevard Lambermont, Brussels).


**FIG. 4:** PREFAB PANEL PRODUCTION LINE

## Logistics

Facade panels are one story tall, 540cm wide. Compared to Aeropolis whose panels are 90cm wide, that's 6 times less airtight vertical junctions to worry about when airtightness is considered. The wood components are mounted by MACHIELS in Beringen 75km east of Brussels; all aluminum and glass components (windows, sheeting, …) are produced by KYOTEC 50km north, then transported to Beringen where the ensemble is fitted together there by a

KYOTEC team working hand in hand with their hosts. So if something goes wrong the two of them are there to see it, and solve it.
Indeed in an industrial milieu where time and money counts, efficiency is a prerequisite for survival, not a vain environmental whim. This is essentially the reason why the architects are convinced that close collaboration with those actually getting the thing done (be it facades, or other) is the single best way to provide cost effective and efficient building solutions when the givens, both economic and environmental, are so exceedingly complex.
Panels (without their fins) are transported to the Elia site by truck (about 3 per truck), fins are added, and then with millimeter precision each frame is delicately eased to its pre-slotted position. Then and there airtightness is effective between panels, needing no further intervention (tape or other).

## Detailing

27cm of mineral wool are flanked by acoustic backing, an osb panel, and a vapor barrier inwards, and by another osb panel, an air-and-water tight vapor-control barrier outwards (that does let vapor out), all of it wrapped in an embossed and perforated aluminum skin. *Every* 135cm façade module (90cm wide glazed elements coupled with 45cm opaque ones) offers optimum daylight and acoustic performance for the corresponding office space. This, along with increased width up to 540cm, is one of the biggest upgrades since Aeropolis, bringing Elia even closer to standard office criteria widely imposed on the very standard Brussels office market.

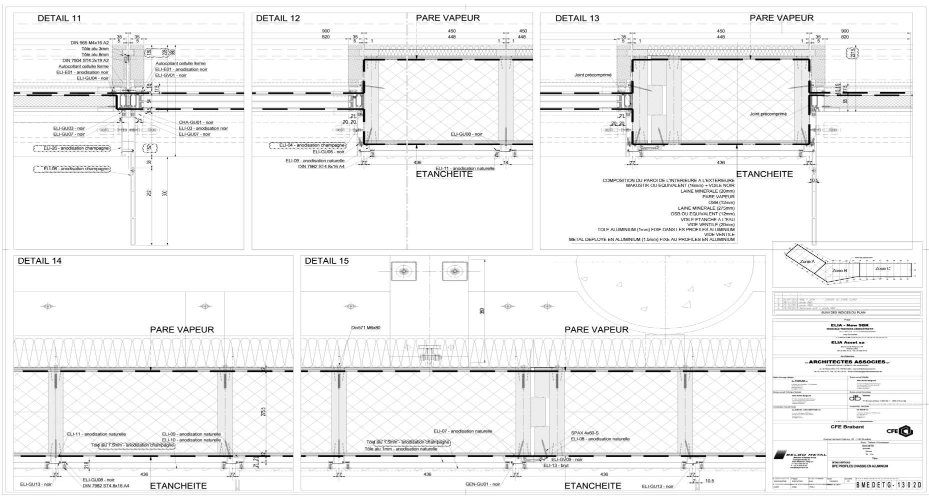


**FIG. 5:** KYOTEC WORKING DETAILS

**Drawback**
While from a technical and logistical viewpoint the façade performs wonderfully, the single but severe drawback is the consequential price tag attached. Elia's facades are technically more straightforward, and faster to install than Aeropolis… but tendered 43% higher, rocketing from 630€/sqm to 900€/sqm. Let it be said that 900€/sqm is far from abnormal on the European market for high-end energy-efficient prefabricated facades (Ingenhoven would say they're a good deal), that these do "multi-task" (fulfilling many crucial roles from air-tightness to controlled solar-shading), and that KYOTEC offers Elia budget, delivery, and technical guarantees no other façade offered.
Yet even though the architects limited interaction with KYOTEC during design stage, hoping that perhaps other cladders would put their R&D departments to the task, and even though both architect and client were open to alternative solutions at tender stage, the market did not react, and only KYOTEC turned in a viable proposition. None have regrets: the facade almost magically appearing today alongside the Pont van Praet exceeds expectations, the global budget has so far been respected, and all realize that understanding how a market works would have required inside information no one had nor has. It is nonetheless believed that future projects must continue striving towards an open and thereby healthy, fair, and competitive market.

## 7. INTEGRATING BREEAM METHODOLOGY

**Early integration**
As the BREEAM very good ambition was already put forward in the competition brief, BREEAM criteria were integrated in the design from the early sketches. This required a holistic approach, not only pushing towards high energy performance, but adding a whole spectrum of requirements. As end-user of the building, it was in Elia's best interest to have good performance in the categories Health&Wellbeing – yielding high occupant satisfaction and productivity -, Energy, Water and Waste – reducing future running costs – and Pollution – giving a green image to the building.

**Passivhaus versus BREEAM**
Lack of clarity on the overlap between the two certification types (passivhaus and BREEAM) often arises. The main distinction is the scope: where the passivhaus criteria focus on energy and to a lesser extent comfort levels, BREEAM'S scope is much broader reaching towards materials, water, pollution, etc.

Passivhaus certification as such is not validated in BREEAM scores, however the reduction of net and primary energy demand, the attention to overheating, the airtightness levels connected to passivhaus performance will result in better BREEAM scoring, mainly in the Energy and Health&Wellbeing sections.
The only point where BREEAM and passivhaus criteria really come into collision, are ventilation rates.
Passivhaus objectives, setting out an absolute figure for the net energy demand, will be easier to obtain with lower ventilation rates, while BREEAM (Hea8) demands higher ventilation rates. In this project, these high ventilation rates are countered by a very elaborated façade design.
In the future, intelligent demand-controlled ventilation (for instance, rates controlled through $CO_2$ sensors) could solve this conflict.

## 8. CONCLUSION

The design team, together with a motivated client, hope to deliver a reproductible example of large-scale budget-controlled zero-energy construction. Work on site with committed contractors has so far proved that these ambitions will be met.
And contrary to what could be expected, technical issues (although complex) are not the hardest to handle. The real challenge is the scope of continually evolving information and constraints to be integrated into the design, the intricate mesh of intertwining criteria to be untangled. Consequently only open ears, open minds, and an unfailing quest for the root problem lead to pertinence.