ELFORSK PSO - PROJECT NUMBER 343-044 - DYNAMIC FAÇADE SYSTEM - ENERGY FRAMES
PROJECT SUMMARY - DECEMBER 9, 2014

Reducing the energy consumption and heat loss in buildings holds a huge potential. Therefore new and considerably tougher energy and environmental requirements will be included in future building regulations. Consequently there is a significant need for new industrial products which increase the energy efficiency in buildings.

On this background, in 2009, the idea emerged - based on Art Andersen's know-how and patents within dynamic, movable facade screening - to develop an industrial, commercial, dynamic window screening system that reduces energy consumption in buildings. The project was named Energy Frames - A Dynamic Facade System - and it achieved support by ELFORSK PSO early 2011.

Ever since 2009 Energy Frames has been developed - and continues to be further developed - by Art Andersen - in collaboration with PRO TEC Windows, Inwido Denmark, Kjeld Johnsen from the Danish Building Research Institute SBI/Aalborg University and juularchitects.com. Frederik Winther from Aalborg University/Ramboll joined the project as a primary research and development partner in 2011.

Energy Frames is an industrial, mass produced standard system of moving, dynamic, window screening shutter frames in different versions with composable energy saving and climate improving features: daylight control, solar protection, visual screening, (night) insulation, natural ventilation, noise reduction etc. The goal was to create a standard system to a realistic price to "button-on" the window frames. Preassembled from the factory - if requested. With the choice between different surfaces, materials and architectural expressions. For new buildings as well as for projects with facade renovation within corporate headquarters, office buildings, institutional buildings and homes. And for windows from different window manufacturers.

The movable, frame-based, motorized Energy Frames screening elements are controlled via touch panel, remote control, mobile phone, computer or building management system. They provide electronically adjustable screening and (night) insulation - and by request - at extra cost - natural ventilation, particle filtration, noise insulation and energy production. The edge-profiles of the frames are fitted with synthetic seals, so the Energy Frames elements close tightly when the frames drive to their end-positions. Thereby the air layer between the windows and the Energy Frames is stationary. This is important for Energy Frames' ability to (night) isolate.

During the development process a series of experiments, tests, measurements and studies on Energy Frames was carried out - at the Danish Building Research Institute, at Aalborg University, in a single-family house in Nibe and in a pavilion building at Rigshospitalet, demonstrating a potential reduction of up to 50% on energy consumption for heating, mechanical/electrical ventilation, cooling and lighting. And also a significant improvement in indoor climate.

With Energy Frames, it is no longer an absolute necessity to reduce the window area to bring down energy consumption. Through the motorized, electronically controlled, movable screening frames a dynamic adjustment tool has been created, that can adapt intelligently to the varying and fluctuating outdoor climate conditions.

Analyzes and calculations were carried out during the development process on the possibilities of making Energy Frames a "stand-alone" system, ie. driving the movable frames with solar energy - using solar cells integrated in Energy Frames. Unfortunately, the conclusion was, that - with the climatic/light conditions in the Nordic countries - it is not realistic - not even on south-facing facades.

The Energy Frames model range includes panel frames with plastic, metal or glass panels. Textile frames with self-tensioning, weather resistant and translucent fabric. Louver frames with adjustable louvers and synthetic sealing lips on the edges of the louvers. Energy Frames are offered in different, varying materials and colors, so they can be applied to windows and buildings with different architectonic expressions - and so the architects feel that they "have something to choose from."

Fortunately, the development of Energy Frames has led to a decision to put Energy Frames in production. After the first two years of initial development and mockup tests - the latest three years have been used for further design detailing, product development and production maturation of Energy Frames. And Energy Frames were market-introduced in 2014 - initially in Denmark. Energy Frames starts out with a modest model program - and a modest control and operating system. But of course the plan is - in an ongoing process - to continue working on the development of the variants and versions - and on a more advanced control system, because it is already known by now that there will be a commercial and additional energy-/climate-improving potential for this. Moreover, there are already concrete thoughts and plans for derived concepts/products that could become successful as the consequent next steps.

Inwido Denmark, which "took over" Energy Frames from PRO TEC Windows three years ago, has established a special company "Art Andersen Cph A/S - Energy Frames A/S" which stands for the marketing and sales of Energy Frames - with its own sales-, service- and technical staff.

The introduction of Energy Frames is in full swing - not least towards the Danish architects. So far it has led to the use of Energy Frames in Rigshospitalet’s new pavilion building and Green Tech Lab in Vejle - with a number of additional projects in the pipeline.

There are still - to this day - five years after start of Energy Frames project - no other concepts/ product programmes, neither in Denmark nor abroad, that can do what Energy Frames can: At a reasonable price combine a variety of façade/window screening functions in an aesthetic, light and elegant way - in one single minimalist, universal product system, "buttoned on” window frames, significantly reducing energy consumption and improving the indoor climate.

By now an Energy Frames brochure is on the street - and an Energy Frames website is in the air: www.energy-frames.dk

A configurator is under development - and a more detailed control system - based on the advanced Energy Frames calculation core that was already developed during the development process - and also based on the measurements and calculations which were already been made. The configurator and the more sophisticated control system will be introduced in 2015.

In the coming months and years - Energy Frames will be subjected to additional tests, measurements and practical challenges (including Rigshospitalet and Green Tech Lab - but also elsewhere) on all Energy Frames product variants to gradually develop and optimize Energy Frames - and the Energy Frames control system - into a sophisticated energy saving and climate improving product range.

But it will also be necessary and appropriate to generate and document further test and measurement results, supplying arguments - and safety - to architects, engineers, other consultants, contractors, building owners and authorities, so they take Energy Frames into really serious account - and thus improve the commercial opportunities for Energy Frames.

On 24 November 2014, Energy Frames was awarded INGENIØREN's Sustainability Prize 2014.