

ACT Facade

Active Cavity Transition Facade





Background

More and more contemporary office buildings are built as fully-glazed high-rise buildings due to client's wishes or architectural intents, such as maximum visual contact to the outside or brand image of the companies. However, high transparency ratios in the façade bring along energy saving problems while maintaining the same comfort levels inside the buildings.

In contemporary office buildings cooling accounts for the majority of the energy consumption because of internal heat sources. High solar income during summer or at low winter sun heat up the inside of these buildings additionally.

As is known solar control glazing alone is not sufficient to guarantee summer heat protection and meet the guidelines of workplace regulations concerning sun protection and anti-glare protection

ACT *Facade*

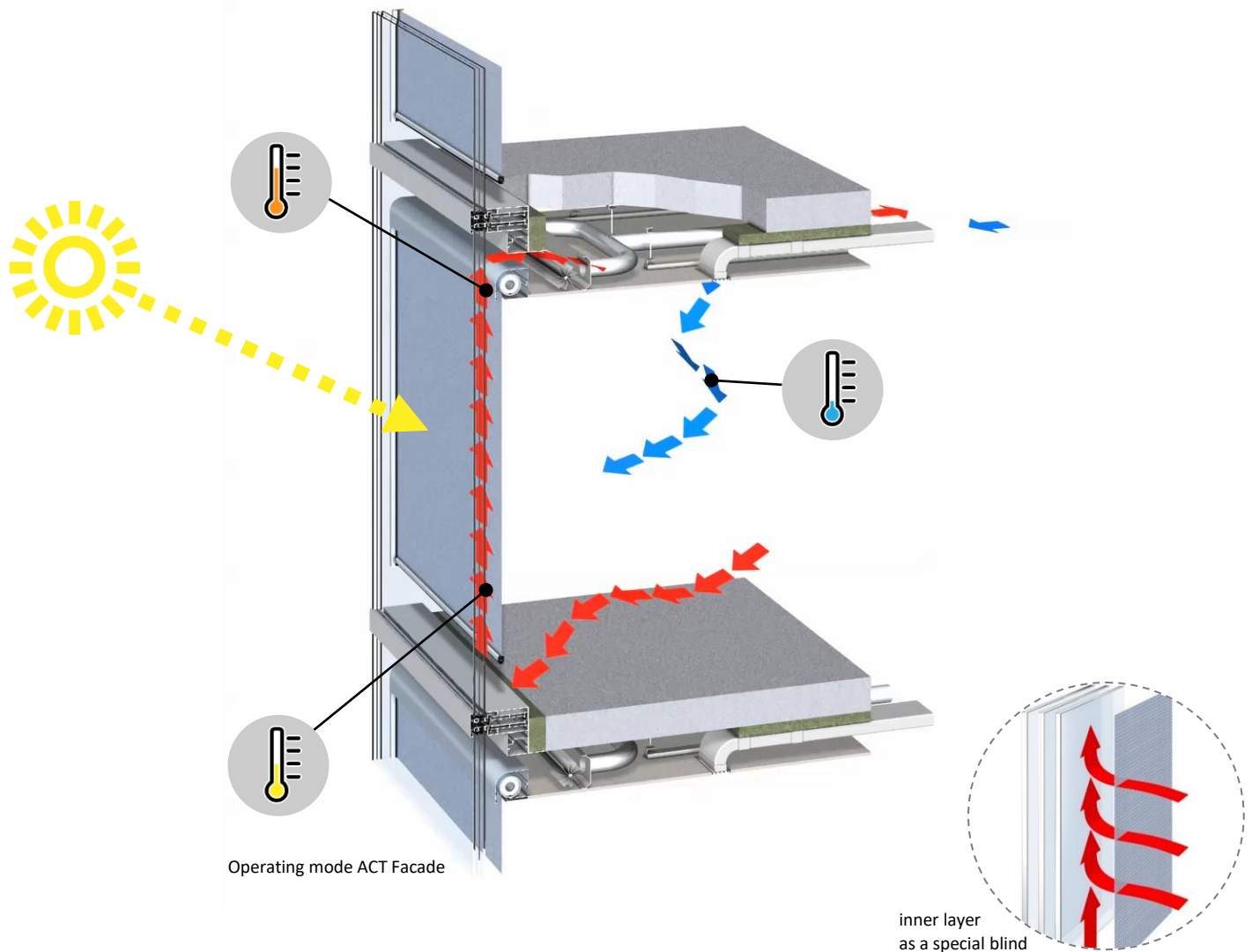
Active Cavity Transition Facade – Concept

Based on the classical air-exhaust façade out of an external insulated glazing plus an internally ventilated glazing, which was yet successfully realized by Priedemann Façade Experts at the “Treptowers” high-rise buildings in Berlin in the early nineties, a new concept of an internal blind was developed to act as adequate sun shading.

The mandatory inner blind for anti-glare is being activated and becomes a separation layer in the façade system to generate an air-exhaust corridor between blind and external glazing.

Enabling an internal sun-shading by generating a buffer zone for the exhaust of heat from solar radiation and at the same time without any external influences like wind etc.

Implementation & Operation



Operating mode ACT Facade

inner layer
as a special blind

The newly developed Active Cavity Transition (ACT) Facade is an efficient combination of typical façade components such as insulated external glazing, glare control blinds and mechanical ventilation.

Solar radiation causing overheating of the interior space is captured within the given corridor between blind and glazing. On the surface of the blind the solar radiation is being absorbed and changed into long-wave heat radiation.

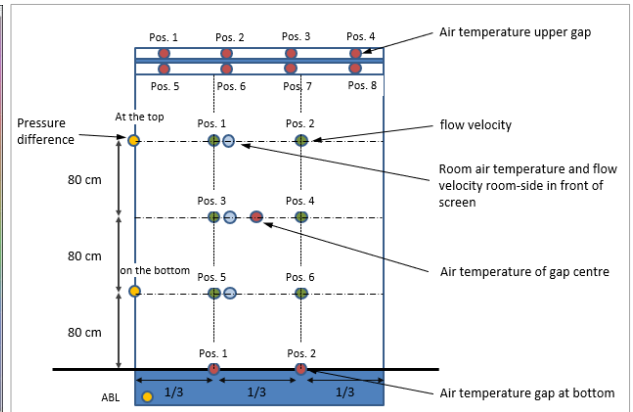
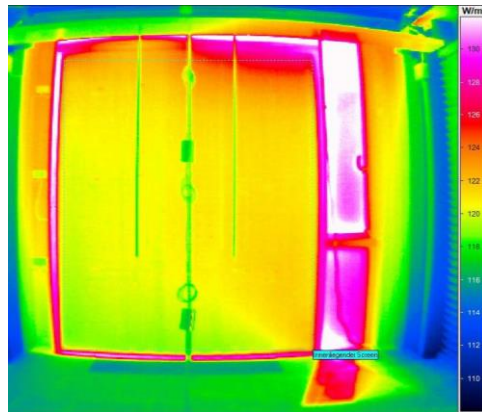
The exhaust air from the office is then sucked into and through this interspace leading away the generated heat by its air flow. Thus preventing unnecessary heating-up of the indoor space.

In addition the surface of the blind facing the interior is cooled creating lower surface temperatures. This enables a higher quality in comfort because it prevents radiation asymmetry within the building.

As a result less cooling energy is needed and a higher user comfort can be ensured.

Since the blind and exhaust air system can be operated individually this façade solution creates a dynamically g-value of the all-over system regardless of weather conditions.

Testing & Benefits



Testing of ACT FACADE at Fraunhofer IBP VERU building

To verify the efficiency of the ACT FACADE and to define the ideal layout and combination of parameters such as screen choice, dimensions for the corridor and the intake width for the exhaust air etc. several simulations and scientific testing have been yet executed.

At the Fraunhofer Research Institute on Building Physics in-situ testing facility (VERU) close to Munich, Germany, different set ups had been analyzed. Testing a unitized façade element with the ACT FACADE system (see Fig. above) to pre-select and evaluate construction details, material properties and exhaust air volume and velocity.

Showcasing that with the right air speed, constructional detailing and blind materials a majority of the solar radiation could be exhausted before entering the room. During October having a high direct solar radiation towards the façade because of the low angle of the sun in Germany from a global radiation of 800 W up to 380 W could be extracted through the exhausted air not including the reflection from the external glazing.

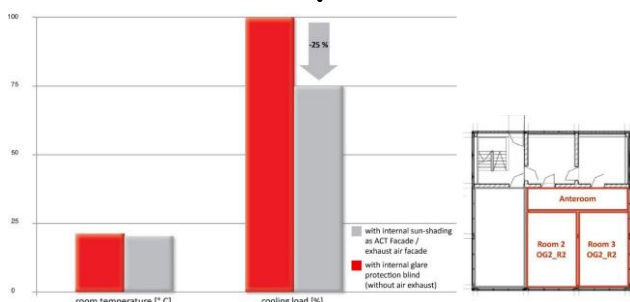
In addition to this testing also a parallel measuring at the Fraunhofer IBP Twin-Rooms has been done. Giving a direct comparison between a ventilated inner blind, as Exhaust Air Façade, and a non-ventilated inner blind, standard system only for glare protection, behind the glazing.

During these measurements for the ACT FACADE a reduction of energy for cooling of up to 25 % compared to the standard system could be quantified. Taking specific climate conditions in Dallas and standard facade systems even significantly higher savings in cooling load of the all-over building can be expected.

Besides the in-situ testing also several simulations and calculations had been done. These also confirm the effect of the ACT FACADE as a fully working sun-shading generating a dynamic g-value, enabling summer heat protection and lowering the indoor temperature as well as cooling loads.

The undertaken measuring and simulation shows that the Exhaust Air Façade ensures high values of comfort and energy efficiency and at the same time can be executed cost and especially space-efficient. Using standard components such as insulated glazing, zip-guided blinds and mechanical ventilation, that have to be implemented in up-to-date building offices anyhow, and at the same time generating floor space till the glazing, minimizing the space consumption of the façade to mullion and the depth of the insulated glazing.

25% Cooling load reduction



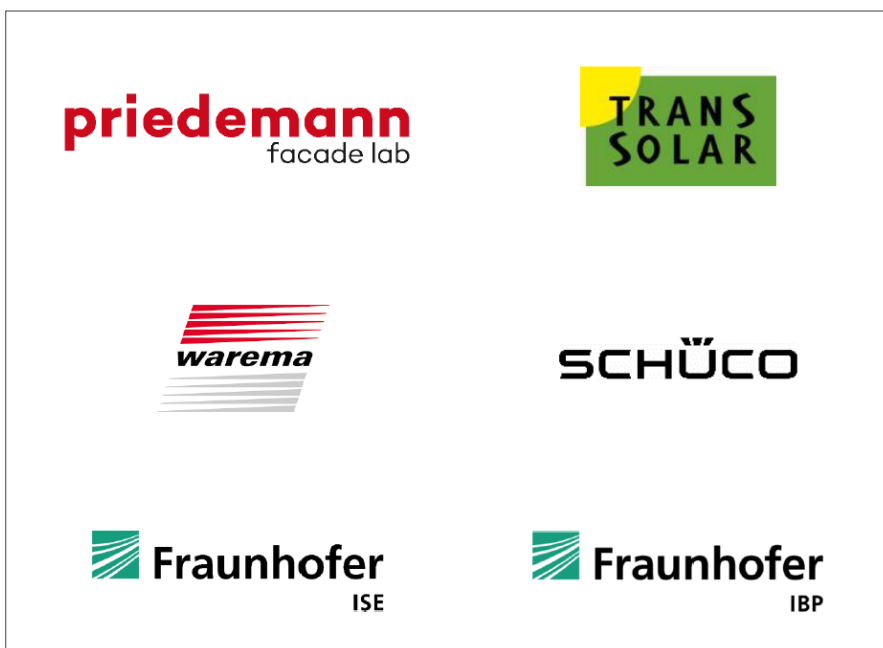
Measured result at VERU building, Fraunhofer IBP (© Fraunhofer IBP)

ACT Facade



To view the animation on your browser,
please click here [“ACT Facade”](#)

Consortium of Experts

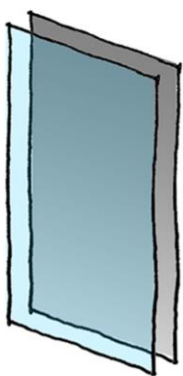


Ever since then we have been working on further projects and new and advanced solutions. As a team with various research partners, we continue to explore the ACT potential. For this we brought together the expertise of Priedemann Facade-Lab, Transsolar, Warema, Schüco, the Fraunhofer Institute for Building Physics IBP and the Fraunhofer Institute for Solar Energy Systems ISE.

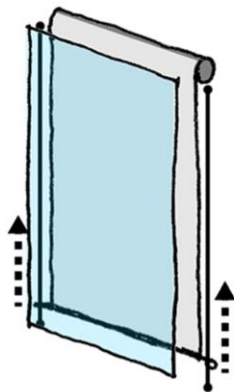
Further *Development*

With new construction projects and architectural façade design intents **new demands on the ACT Facade arise**. However within this further developments on operation, materiality and components a compromise between view, glare, daylight autonomy and solar heat gain must be found to improve user comfort as well as energy efficiency.

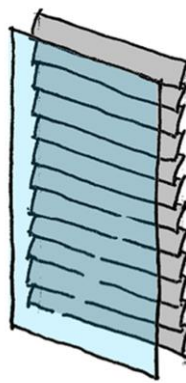
Therefore different variations for the screen layer seem possible for the ACT Facade as well as relevant to gain wider acceptance of the system by architects and clients through design and component flexibility. These include screens of various colors and openness factors, with ZIP or rope guidance, as venetian blinds as proposed for the Active and Adaptive concept but also as vertically relocatable curtains.



Textile variations



Rope guidance



Venetian blind



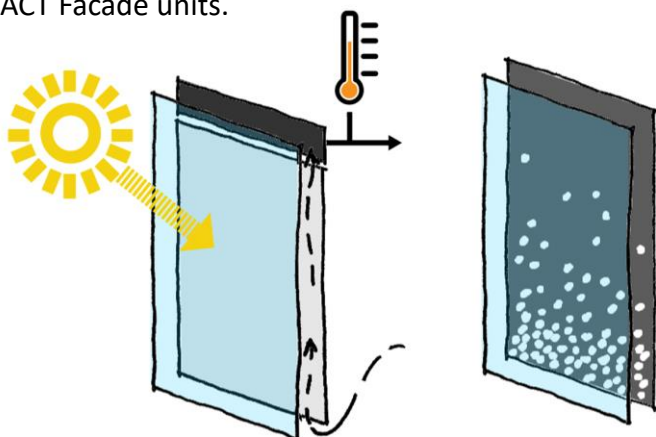
Curtain

For future applications of ACT Facade the combination with further technologies is envisioned. Such as newly developed textiles for the screen including colored low-e coating, integrated PV and/ or OPV, adaptive textiles through smart material integration etc.

Moreover the whole façade unit can be enriched by using special energy harvesting technology such as translucent amorphous photovoltaic or PV integrated in the spacer within the exterior glazing – also enabling self-sufficient decentralized ACT Facade units.

The inner layer has a high degree of flexibility.

In case of for example the refurbishment of a single skin facade the ACT Facade system could be implemented by solely exchanging the inner facade layer. By this not only ease of construction is given but also the potential of individual design by the architect but also the user/tenant.



Solar thermal air collector

Smart textiles/ foils

Active glass/ photovoltaic

Decentralized/autarky

Active and *Adaptive*

The finalist concept of the Metals in Construction 2020 Design Challenge focuses on reducing effort and resources on building refurbishment whilst still enhancing the façade performance of 63 Madison Avenue in New York – an archetype for US office buildings struggling with high energy demand and low user comfort.

For this purpose “Active and Adaptive” carries the concept of ACT Facade forward which is already known to IGS readers from 2016’s Festo AutomationCenter project report.

Focusing on what is necessary

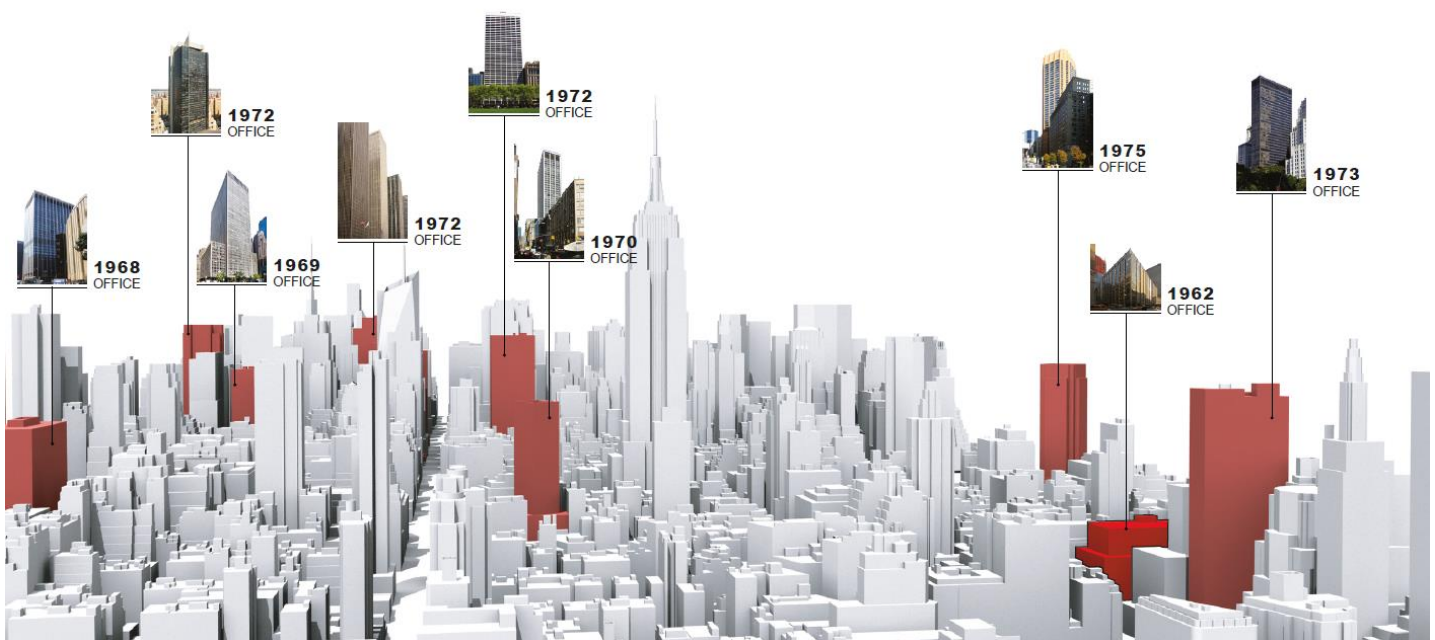
Following the basics of a circular economy the Active and Adaptive concept aims for reducing construction and demolishing efforts to a reasonable minimum while at the same time increasing overall building performance and therefore extending the buildings life-span.

Goal of the Metals in Construction Design Challenge was to develop visions for transforming the facade of one of Manhattan’s 60-year-old buildings to reduce carbon emissions and address the city’s Green New Deal - also presenting concepts as role model for broader application.

Concluding

within the ACT Facade concept lies a wide variety for broad application not only in new construction but also in refurbishment (see Figure below) as it has also been awarded by the Metals in Construction Jury.

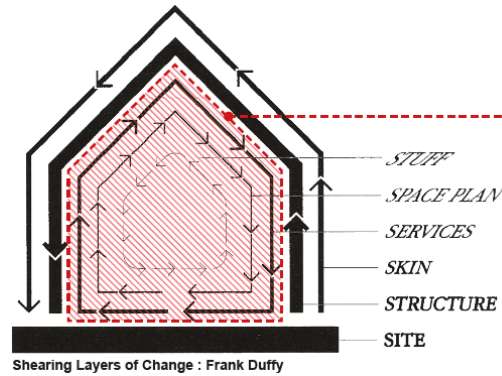
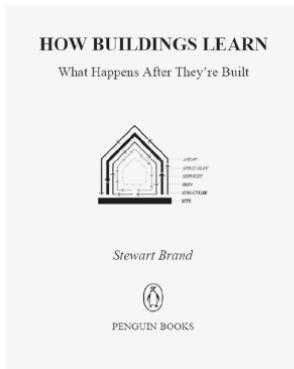
To view the competition submission with more information, please click here [“Active and Adaptive”](#)



Active and Adaptive/ ACT Facade concept for broad application

Active and Adaptive

Shearing Layers of Change

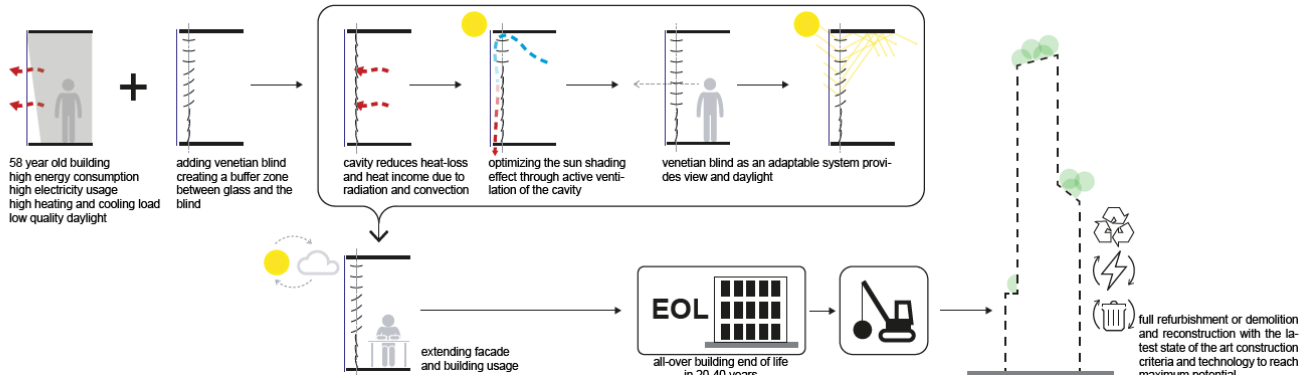


Area of Refurbishment

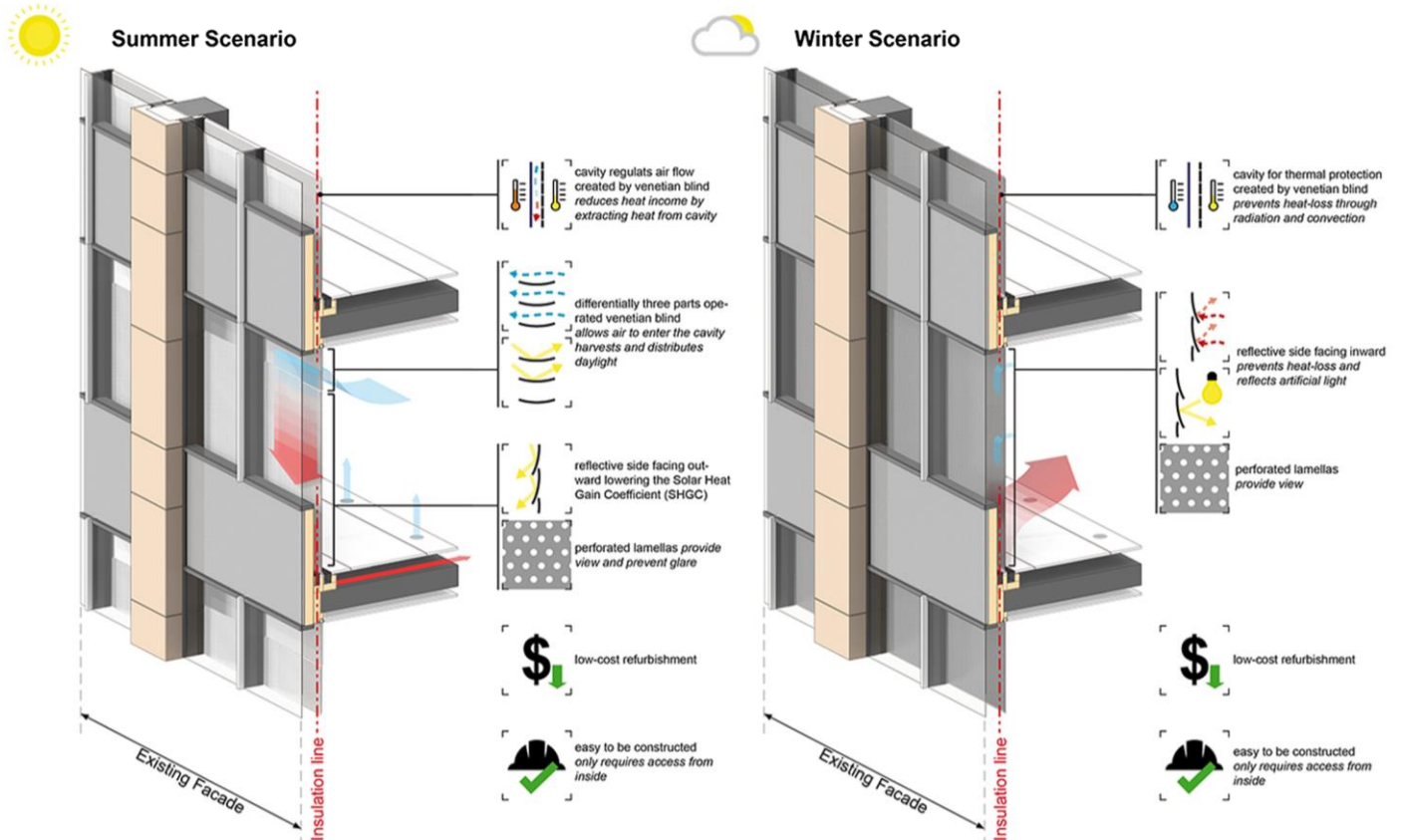
Optimizing and balancing "effort" and "possible improvement" results in an intermediate refurbishment that does not include building envelope and structure but services and interior.

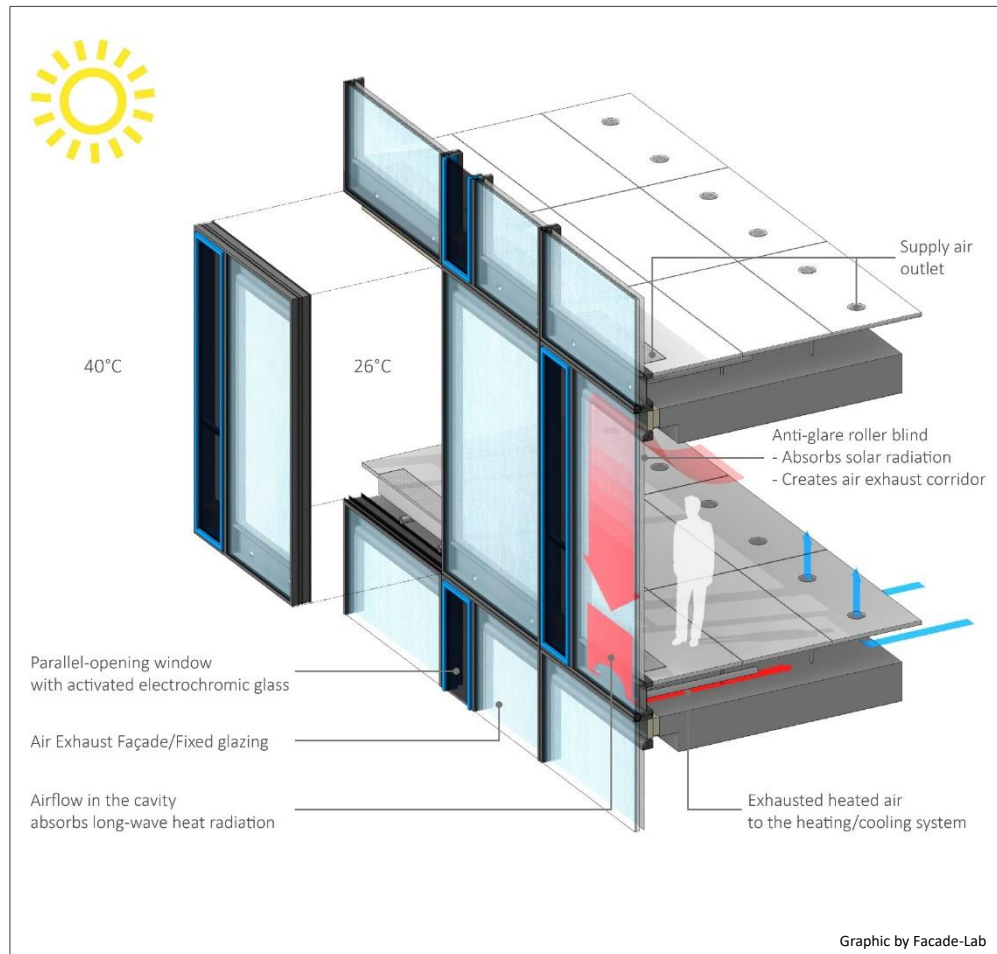
Shearing Layers of Change : Frank Duffy

Refurbishment Concept

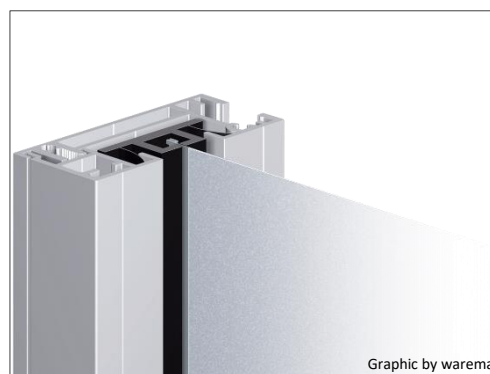


Operation Principle

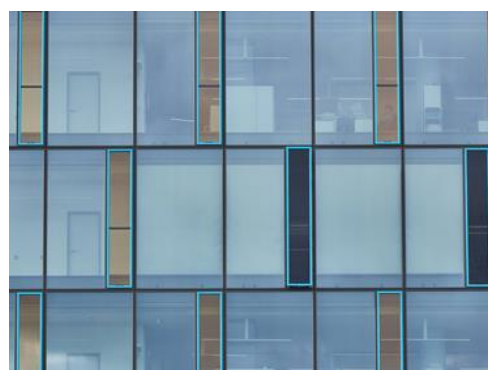




Innovative Exhaust Air Façade, system sketch



Inner layer as a special blind, flexible function



Exhaust Air Façade with closed anti-glare roller blinds



FESTOAutomationCenter after finalization in 2015

Client

Festo AG

Owner ▪ Developer

Festo AG

Architect

architekturbüro jaschek

Project Data

- ca. 68 m building height
- ca. 8.500 m² facade surface

Building Function

Office

Technical Features

- ACT Facade
- Parallel-opening windows
- Sunshade, electrochromic glazing
- Automated robot cleaning
- DGNB Platinum

Consultancy Services

- Project Objectives and Brief
- Concept/Schematic Design
- Detailed/Developed Design
- Technical/Construction Design
- Specification/Tender Documentation
- Tender Evaluation
- Design Compliance Control
- Mock-Up Association
- Execution Compliance Control
- Handover, As-Built Documentation

Facade-Lab

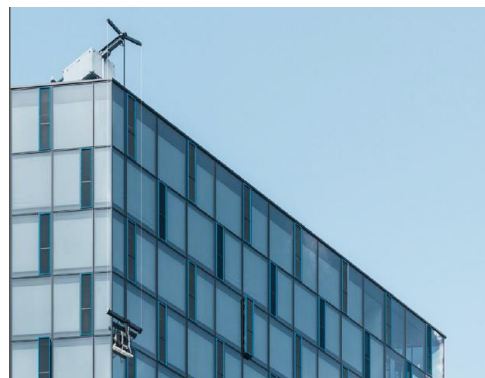
Research & Development

Status

Completed 05/2015



Automated robot cleaning, view from inside



Automated cleaning system, view to the top



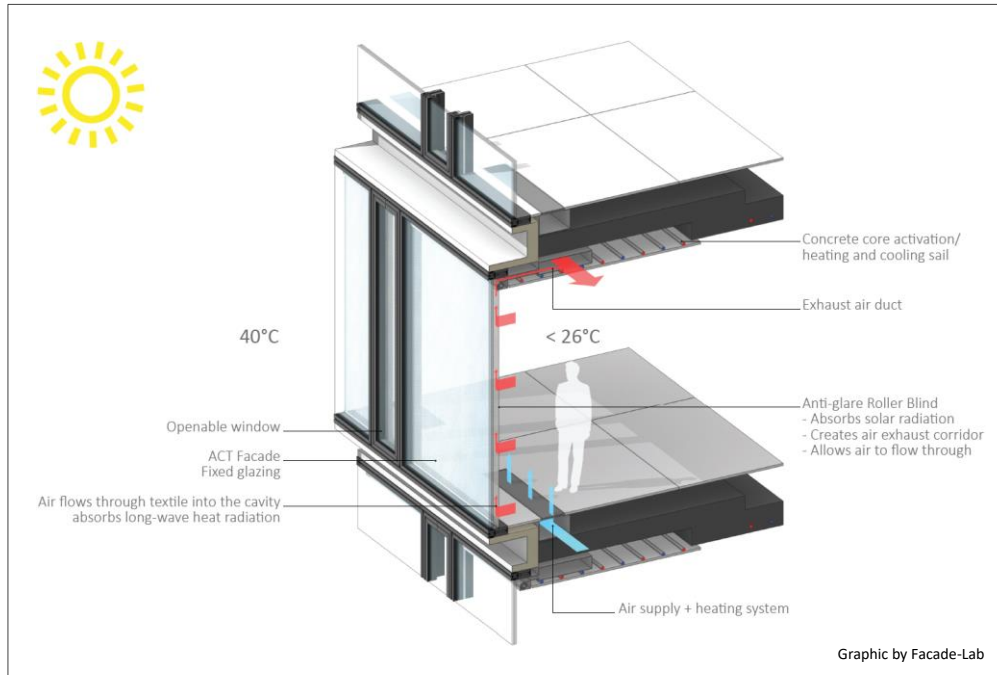
Cleaning – automated with robot, outside elevation

The construction of the facade is realized as a 7.50cm thick two-part modular system. A layer of permanent glazing (2.4 x 4.0m), and a layer of slim operable windows 70cm wide by 4.0m in height. These windows operate via electrochromic glass panels by EControl, which incorporate electric current to adjust their level of opacity. Due to the building orientation, only two of the four sides have to be “activated” at the same time. Thus always two sides are open for best view and the other two sides activated for the exhaust air.

To keep this newly generated absolute view clear at all times a new self-sufficient cleaning robot was implemented – cleaning the whole 8.500 sqm of façade within 24 hours.

The system has now been operated since July 2015. Even as exterior temperatures have reached up to 40° Celsius, the room temperature remains at a constant mid to upper 20's degree, saving 10-20 % of energy required for cooling, and providing a consistent environment for user comfort.

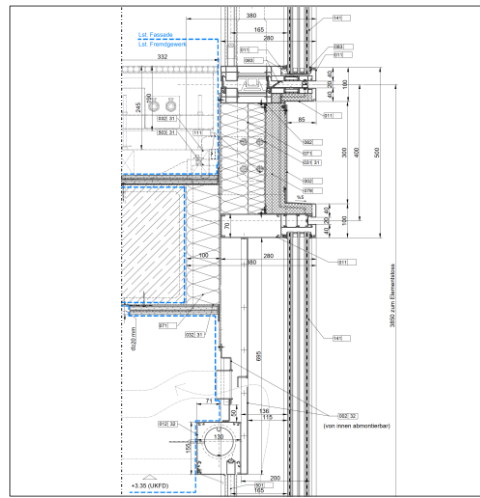
To view the animation on your browser, please click here [“Festo Automated Cleaning”](#)



Competition rendering by HENN Architects



VERU test facade



Vertical section



Facade rendering by architect

Client

Continental AG/ HENN GmbH

Owner • Developer

Continental AG

Architect

HENN GmbH

Project Data

- ca. 14 m building height
- ca. 15.000 m² facade surface

Building Function

Office

Technical Features

- Act Façade
- Unitized curtain wall

Consultancy Services

- Project Objectives and Brief
- Concept/Schematic Design
- Detailed/Developed Design
- Technical/Construction Design
- Specification/Tender Documentation
- Tender Evaluation
- Design Compliance Control
- Mock-Up Association
- Execution Compliance Control

Facade-Lab

Research & Development

Status

In planning



Facade elevation before refurbishment

Client

RFR Propoerty

Main tenant

European Banking Authority

Architect

- Richard Heil (1971)
- Christoph Mäckler
Architekten
(Reconstruction)

Project Data

- ca. 148 m building height

Building Function

Office

Technical Features

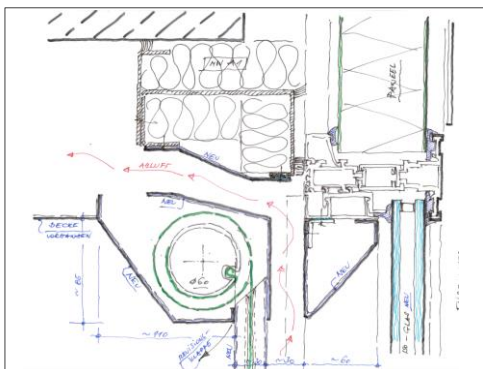
- Refurbishment
- Facade system with inner blinds with upgrading to an ACT Facade

Consultancy Services

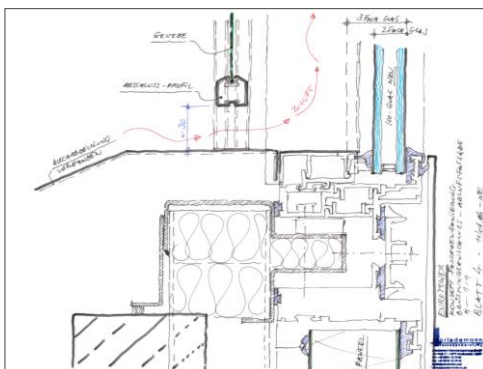
- Project Objectives and Brief
- Concept/Schematic Design
- Detailed/Developed Design
- Technical/Construction Design
- Specification/Tender Documentation
- Tender Evaluation
- Design Compliance Control
- Execution Compliance Control

Status

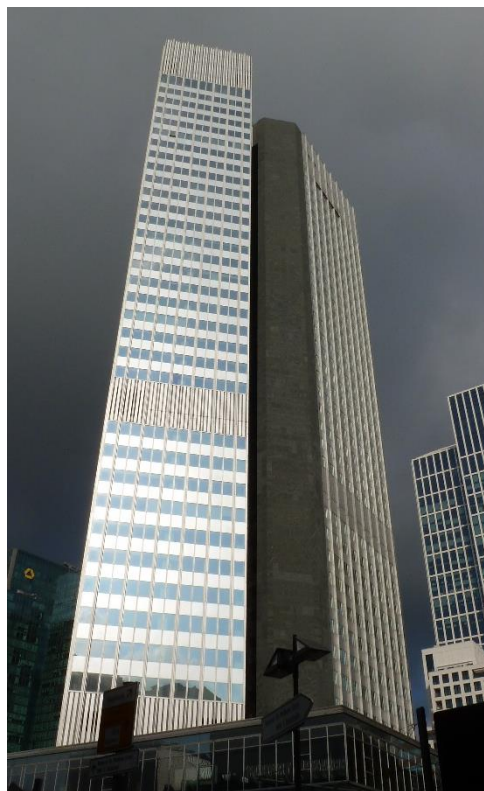
Completion in 2015



Concept design – variation of an exhaust air facade



Concept design – variation of an exhaust air facade



The Eurotower after refurbishment



Rendering by Architect

Rendering of the ARDEX-Tower

Client

Gerhard Spangenberg
Architekt
ARGE Spangenberg / Koch

Main tenant

ARDEX

Architect

- Gerhard Spangenberg
Architekt

Project Data

- Tower with 24 storeys
- ca. 90 m building height

Building Function

Office

Technical Features

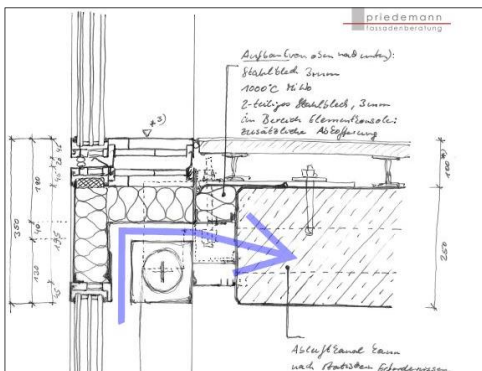
- Exhaust air facade
- Unitized curtain wall
- Stick system facade, double height
- Parallel vent windows
- Sloped facade elements

Consultancy Services

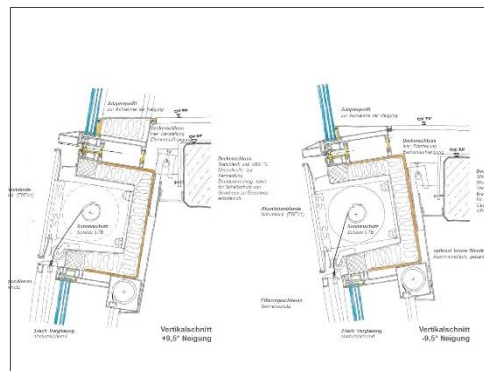
- Facade consultancy
- Concept design
- Design development
- Typical detailing
- BMU Concept
- Tender/specification

Status

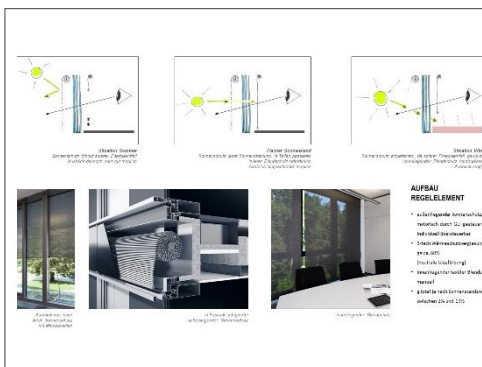
In planning



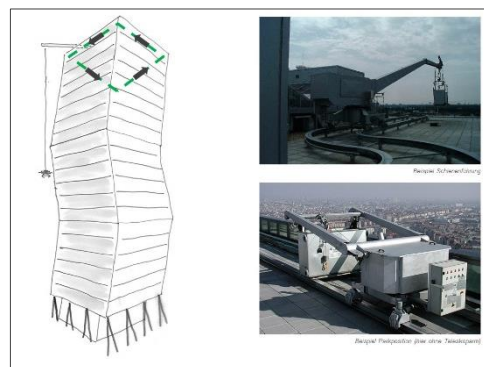
Exhaust air facade – concept sketch of vertical section



Facade concept, vertical section



Study of the sun protection and glare protection



BMU concept – progress at the very beginning



Facade *Experience*

Priedemann was founded in 1993, since then, a simple mission moves us: **To do the ONE thing, that makes our heart beat – FACADES.**

Our knowledge is rooted in German craftsmanship, but we constantly strive to extend our horizon by using the latest technologies, focusing on research & development and learning from our daily challenges.

We take over responsibility from inception all the way beyond realization.

Building *Skins*

Facade Consultancy & Engineering Services

We are focused on Facades: Priedemann Facade Experts are global operating engineering offices with the focus specifically on the building envelope. In a unique way we make our holistic full-service facade competency available to investors, architects and building contractors. Beside façade consultancy and third-party execution control, we develop the system design and prepare the final shop drawings. Mastered facade techniques, brave to own responsibility and the passion to chase nearly impossible objectives are our strengths.

Services

Whether it is the comprehensive consultancy package or a single engineering discipline; our clients can rely on Priedemann's competency from project conceptualization to the stages beyond commissioning. We understand the envelope as an interface to almost all adjacent trades and we consider ourselves as the partner of all five main construction participants, namely the investor/ developer to the architect/ general consultant,

the general contractor and the façade fabricator extending finally to the supplier of the envelope's components and materials. Over 1,000 successfully completed projects world over and long-term client relationship tells its own tale.

Beyond standard Solutions

Dare to tackle something new, exceed expectations – Priedemann Facade Experts stands for innovative solutions with a practical approach. Beside applied implementation of sophisticated facade projects in all climate zones, we contribute in research and engage in professional knowledge exchange. The Facade-Lab, a subsidiary of Priedemann, drives the quest for innovative facade solutions and develops specific and customized products. We develop and test these products together with our partners from the science and research industry. In addition, a separate facade forum offers a platform for the exchange with colleagues and manufacturers. In a showroom of 750 sqm we exhibit over 60 mock-ups, material samples and information.

Continuous *Support*

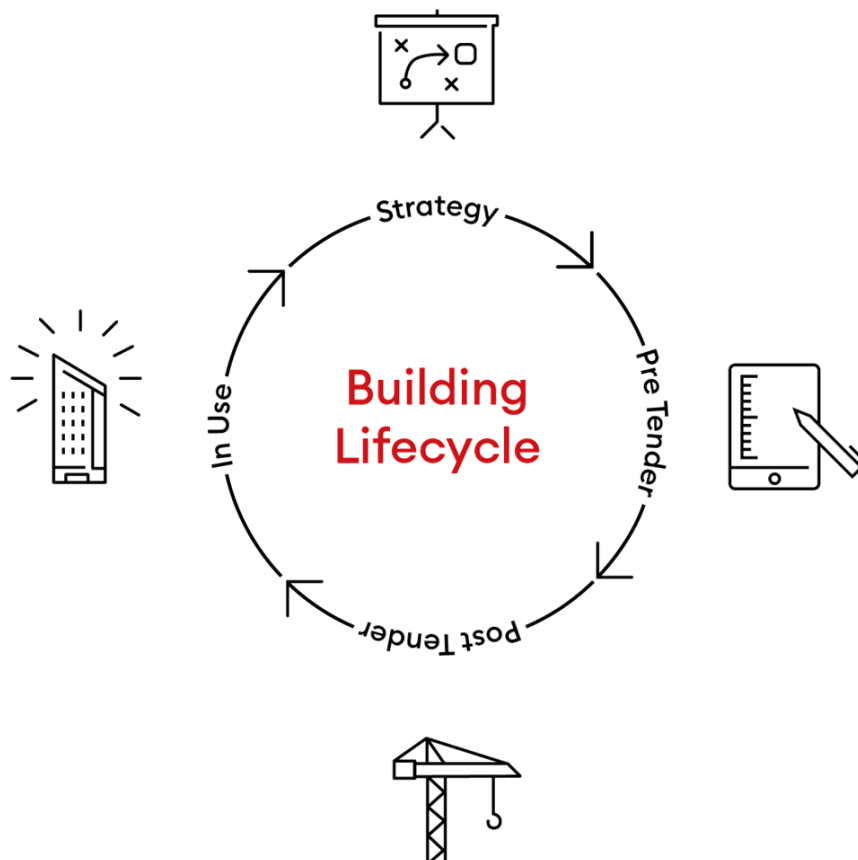
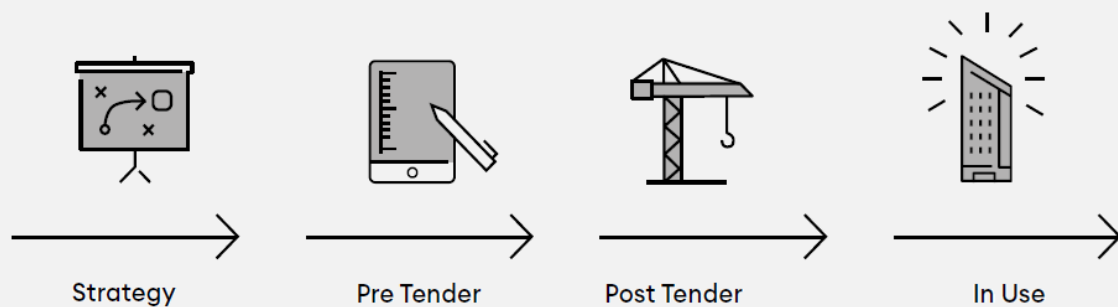
So when a project begins - or at any time in the planning phase when Priedemann Facade Experts are involved - we clarify the need of intentions.

As we guide from A-Z, we believe a guide needs to have the practical execution experience; to the extend that if the party who executes shows any kind of resistance, the façade consultant shall be able to take over the challenge to show forward.

As an independent practice, we are obliged to the entire life cycle of a building skin.

We love to start as early as possible such as with an architectural competition and we do not stop where the interfacing starts.

Responsibility from concept beyond completion



Continuous Support

With more than 250 realized projects we are apt to be the responsible partner for all facade matters, thus you can have the peace of mind that we do close the gap between design and execution.

This avoids losing key project information and enables the team to achieve a higher level of efficiency, quality and cost certainty.



Fabricators



Investors



Continuous Support



Main Contractors



Architects

Our Services

Consultancy

- Strategy**
 - 1101 Architectural Competitions
 - 1102 Refurbishment Concept
 - 1103 Feasibility Study
 - 1104 Project/Peer Review
 - 1105 Due Diligence
- Pre-Tender**
 - 1201 Project Objectives and Brief
 - 1202 Concept/Schematic Design
 - 1203 Detailed/Developed Design
 - 1204 Technical/Construction Design
 - 1205 Specification/Tender Documentation
 - 1206 Tender Evaluation
- Post-Tender**
 - 1301 Design Compliance Control
 - 1302 Mock-Up Association
 - 1303 Execution Compliance Control
 - 1304 Approval of As-Built Documentation
 - 1305 Variation Claim Evaluation
 - 1306 Handover
- In Use**
 - 1401 Monitoring
 - 1402 Defect and Failure Investigations

Engineering

- Strategy**
 - 2201 Factory Layout
 - 2102 Prequalification
- Pre-Tender**
 - 2201 Bidding Stage Association
 - 2202 Value Engineering
- Post-Tender**
 - 2301 Construction Objectives and Brief
 - 2302 System/Concept Design
 - 2303 Mock-Up Development
 - 2304 Provision/Shop Drawings
 - 2305 Material Take Off
 - 2306 Production Documentation
 - 2307 Installation Documentation
 - 2308 As-Built Drawings

Specials

- Sustainability**
 - 3101 Thermal Building Physics
 - 3102 Building Acoustics
 - 3103 Simulations
 - 3104 Decentralized Energy
 - 3105 DGNB, LEED, BREEAM / Green Building
- Digital**
 - 3201 3D Modelling
 - 3202 BIM
 - 3203 Parametric
 - 3204 Digital Production
 - 3205 Media Facade
- Sub-Service**
 - 3301 Maintenance
 - 3302 Structural Design
 - 3303 Design and Cost Optimization
- Diverse**
 - 3900 PI Insurance

Facade-Lab

- Collaborate**
 - 4101 Research & Development
 - 4102 Showroom
 - 4103 Forum
 - 4104 Mock-Up & Prototype
 - 4105 Model Workshop

Priedemann Facade Experts

Thinking global – Acting local



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