KINETICA
A playful way through the world of moving facades

Kotryna Zvironaite
Alois Knol
Steven Kneepens
# Table of Contents

**Preface**  

**Table of reference projects**  

**Type 1: Folding Facades**  
  Project I  Al Bahar Towers  
  Project II  SDU Kolding Campus  
  Project III Kiefer Showroom  

**Type 2: Layered Facades**  
  Project I  DOHA Office Tower  
  Project II  Pola Ginza  

**Type 3: Turning Facades**  
  Project I  ThyssenKrupp Quarter  
  Project II  Council House 2  

**Type 4: Special Facades**  
  Project I  Institut du Monde Arabe  
  Project II  RMIT Design HUB  

**Conclusion**  

**References**
Acknowledgments

We like to thank Eric van den Ham and Peter Teeuw for their guidance as main teachers of the course AR0533 Innovation and Sustainability Designer’s Manual. Also we like to thank our team mentor Tillmann Klein for his recommendation on how to write this manual on a technical level. Finally our thanks goes out to Simon Droog, who came all the way from Barcelona to give us all a series of lectures on Infographics and book design.
Preface

This book talks you through a series of buildings based on their kinetic facade system. To be able to show you how these systems work they are divided into five types: folding facades, sliding facades, layered facades, turning facades and the so called special facades which either combine any of the previously mentioned types or are a whole new type of their own. These five types form the basis of the five chapters in this book. Each type itself is shortly introduced and in this introduction the book gives you the possibility to play with the current facade type. Movable pop ups are added in the introduction of each type to give you an experience of what a certain facade will do. To see the full potential of each type we highly recommend putting a strong light source next to the book, to see the numerous moving shadows each facade type will generate, while ‘playing’ with the pull me, push me and turn me handles. (notes+tips) Each of these five types has their own reference projects attached to it and this book will give you some general information about the project. Afterwards it will ask and answer a couple of questions for each project: What is the facade made of? what is the facade supposed to do? and What does the facade actually do? After these questions are answered a conclusion by the authors of this book is given for each project. The projects are carefully selected to give you an experience of the full scope of possibilities within the kinetic facade systems. After all projects of a type are introduced, questioned, answered, concluded and discussed the current chapter (type of facade system) is also discussed and concluded as a whole. Moving on to the next chapter an introduction, the projects, and a conclusion follows. At the end of this book the authors will give you their general opinion about kinetic facades. With few things being definite in the world of shape and form, there is nothing final about this book’s contents; We are confident that every reader will be able to find something with which to disagree. (A. Forty, 2012) Last but not least this book starts with a table where all the projects can be found under their own type and a description on how to use this table.
<table>
<thead>
<tr>
<th>Table of reference projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbols]</td>
</tr>
</tbody>
</table>
Explanation of icons

Shading: The sun shading performance of the facade.

Visibility: How well the visibility is through the facade.

Orientation: In which direction the facade can be best orientated.

Complexity: How complex the facade system is.

Maintenance: How much maintenance is needed for the facade and how well it can be maintained.

Cost: The cost building the facade

Recyclability: How well the facade can be recycled

Energy saving: How much energy the facade saves when in use

User control: The amount of control the user has in the building

Iconic: How iconic the building is because of the kinetic facade
Type 1: Folding Facades

Folding elements on a facade will add a third dimension to the facade by giving it depth, for architects this is a nice feature to create patterns not only in two dimensions but adding a third. The entire building can look different depending on how closed the facade is. We picked three facades that look completely different from one another to show you what shapes and patterns are able to come into being using this principle:

- Al Bahar Towers in Abu Dhabi, United Arab Emerates
- SDU Kolding Campus in Kolding, Denmark
- Kiefer Showroom in Bad Gleichenberg, Austria

Before going into the selected projects take a look for yourself at how the facades of the Al Bahar Towers and the Kiefer showroom work.
Project I The Al Bahar Towers

Location: Abu Dhabi
Completion: 2012
Owner: Abu Dhabi Investment Council
Architect: Aedas
Height: 145 meter
Stories: 29
Primary use: Office

General information
The Al Bahar Towers are located in Abu Dhabi. Abu Dhabi is the capital of the United Arab Emirates and the second largest city with a population of around 921,000. The city has a desert climate. Most days will have sunny blue skies. The months july through september are very hot and humid with the temperature averaging about 38 degrees celsius. During this time sand storms occur occasionally with visibility decreasing to a few meters. From November to March the temperatures vary from moderately hot to cold. During this time there can be dense fog on some days. Abu Dhabi has transformed to a large and advanced metropolis and today the city accounts for about two-thirds of the $400 billion United Arab Emirates economy. (Wikipedia, 2015)

The architect Aedas employs around 1400 staff at 13 offices in eight countries. and has become one of the five largest architectural firms in

Image #: The Al Bahar Towers (source: C. Rich-ters)
They provide a wide range of services and focus on high-density development in major world cities. (Wikipedia, 2015) The owner is The Abu Dhabi Investment Council, an investment arm of the Government of Abu Dhabi. It started operating in 2007 after it was splintered off from the Abu Dhabi Investment Authority. (Wikipedia, 2015)

Aedas designed a cylindrical form to maximize floor space and offer a view in all directions. A consequence with this choice of design is that the facade is open in all directions, which causes a lot of heat gain, which is a big problem in the Abu Dhabi climate. Therefore they designed the largest most-advanced interactive sun-shading skin system. The design of this system comes from the mashrabiya. This is a traditional wood-lattice screen. They created a scalable hexagon which will act as the solar barrier and can response to the position of the sun. (designboom, 2014) The towers were awarded the 2012 Tall Building Innovation Award. “The dynamic façade on Al Bahar, computer-controlled to respond to optimal solar and light conditions, has never been achieved on this scale before. In addition, the expression of this outer skin seems to firmly root the building in its cultural context.” Chris Wilkinson, Awards Juror
What’s it made of?
The kinetic facade is made of 1000 individual shading devices which are controlled via the building management system. Each unit has a series of PTFE panels and is driven by a linear motor and will open once a day by a pre-programmed sequence that has been calculated beforehand. The system is protected by sensors that will open the units in the event of high winds or overcast conditions.

What is it supposed to do?
Aedas claims that the effects of this system are comprehensive: reduced glare, improved daylight penetration, less reliance on artificial lighting, and over 50% reduction in solar gain, which results in a reduction of CO2 emissions by 1,750 tonnes per year.

Conclusion
When designing a building in a desert like Abu Dhabi the worst thing you can do is build a skyscraper from glass. Only the problem with these wealthy companies in The UAE is: ‘that is what they want’, because all the other wealthy companies around the world are doing it. Aedas goal was to design a skyscraper which is still comfortable to work in. In general skyscrapers in the Middle East relied upon designs coming from North America, but there they do not have to address with such a hot climate. Therefore these skyscrapers rely primarily on reflective curtain wall systems with tinted glazing. This system may deliver acceptable results, however it does provide poor external views, lack of daylight and a daylight glare problems. There are shading systems in use but they only offer positive results for one condition. (Council on Tall Buildings and Urban Habitat, 2013) This system will help to better external views and increase the amount of daylight. It is however a very expansive system and not a solution to this kind of climate. In the mind of the owner the building probably has exceeded expectations as it won several awards and is still comfortable to work in. From a sustainable point of view the shading system provides a decrease in energy demand compared to a full glazed skyscraper without an shading system but building with less glazing and more compact would have decreased the energy demand by a much larger amount.
Project II SDU Kolding Campus

Location: Kolding
Completion: 2014
Owner: The Danish University and Property Agency
Architect: Henning Larsen Architects
Floor area: 13,700 m²
Stories: 6
Primary use: University

General information
The architect Henning Larsen Architects is an international architecture firm based in Copenhagen. It houses around two hundred employees. The company is very active in climate and sustainable discussions and develops different design tools based on the newest technologies. The client is The University of Southern Denmark this is a research and educational institution with deep regional roots and an international outlook. The main focus of the university is engineering, health and science.

The building is located in Kolding, with a population of 58,021, it is the seventh largest city of Denmark. It is a Danish seaport with numerous industrial companies in general geared towards shipbuilding. The climate of Denmark is characterised by mild winters and cool summers. Most days it will be raining and autumn is the wettest season. Be-
cause of it northern location there are very short days during winter, around 7 hours of sun, and long days in the summer, around 17.5 hours of sun. (wikipedia, 2015)

The kolding campus is a new central plaza by the kolding river and will have an interaction with other educational institutions of the town. The shape and facades of the building showcase a dialogue between the people inside and the outside observer. The facade together with the inside of the building create a unique and varying expression. The triangular shape repeats itself from the facade through the different floors. (Henning Larsen, 2014)

What is it made of?
The system consists of 1600 triangular shitters of perforated steel. they are mounted on the facade and will adjust to the changing daylight with sensors which continuously measure the light and heat levels and are mechanically controlled by a small engine.

What is it supposed to do?
The kolding campus is fitted with a dynamic solar shading system. This system adjusts to the specific climate conditions and user patterns and provides optimal daylight and a comfortable indoor climate for spaces along the facade.

What does it do?
The system is mainly a dynamic solar shading system without any real improvements over other, less complex, shading systems. It does give a unique and varying expression to the facade. By opening and closing different parts, the facade will be unique every day.

Conclusion
SDU university is a very international orientated and impressive building and therefore very important. A lot of students will only know the university by images so the design had to be more impressive than sustainable. Because the location of the university is in Denmark the sun will be on a low angle throughout most of the year. The choice of a vertical kinetic facade is therefore a good one because a horizontal shading system wouldn’t block as much sun. The facade is perforated through and so the main aim for the facade probably wasn’t sustainability. They could have created a second skin where air could be heated up to help reduce the buildings heating load.
Project III Kiefer showroom

Location: Bad Gleichenberg
Completion: 2007
Owner: Kiefer Technic
Architect: Giselbrecht + Partner ZT GmbH

Floor area: 420 m²
Stories: 2
Primary use: Office and showroom

General information
The kiefer showroom is located in Bad Gleichenberg in Austria. This is a small village in the south of Austria. The climate here has mild winters and cold summers with the average temperature going from -1 in the winter to 20 degrees in the summer. (wikipedia, 2014) The Architect Ernst Giselbrecht is one of the leading figures of the Graz school. His early trademark was expressionism but then he gained international acclaim with a more rational design. The client Kiefer Technic provides high-quality solutions for the interior and needed an office with an exhibition space.

What is it supposed to do?
The kiefer technic showroom has a dynamic facade that changes to outdoor conditions to optimize the internal climate. It also allows users to personalize their own spaces with user control. (e-architect, 2015)
Conclusions Folding facades
As seen in the examples folding facades give the facade a third dimension and with it the ability to change the look of the facade. It doesn't come without problems though, as there are many moving parts the durability of such facades is still unknown. All these moving parts also add to the costs. It will be interesting to see how these facades will operate after ten years.

Conclusions
The kinetic facade is more a showcase of what the kiefer company can do then a clever sun shading system. The user control can be useful, so you can close the facade if you have direct sunlight. The company did however get what they want as there are many videos showcasing the capabilities of the facade and has been awarded the austrian architecture award in 2008.

What does it do?
The facade is primarily used as a showcase for the company. Ernst Giselbrecht helped with the design of the facade but the technical detailing is done by the company itself. The facade has also been called the ‘dancing facade’ as there are many video’s of the facade in all kind of unique movements. The advantage for the user is that they can control the facade.

What is it made of?
The facade is made of aluminium posts and transoms. The panels are EIFS-facade in white plaster. The sun screen moves on electronic shutters of aluminium panels. (archdaily, 2010)
Type 2: Layered Facades

Unlike many other kinetic facade the layered facade stays within its original perimeters. Designing such a facade is therefore not a lot different from designing a static building. Another advantage can be that a layered facade doesn’t have to be a double skin facade. The project we are showing are very different from each other and both had very different design goals. The project are:

- The DOHA Tower
- The POLA Ginza Building
Project I DOHA Tower

Location: Doha
Completion: 2012
Owner: Sheikh Saud bin Muhammed Al Thani
Architect: Jean Nouvel
Floor area: 110,000 m²
Height: 238 m
Stories: 46
Primary use: Offices

General information
The Doha Tower is located in Doha. This is the capital of Qatar and has a population of 1.3 million. Doha has a hot desert climate and in the summer the average temperature can surpass 38 degrees. Throughout the summer there is almost no precipitation. The DOHA Tower is the fifth largest tower in Doha and in 2012 it was awarded the Best Tall Building in Middle East & Africa by the Council on Tall Building and Urban Habitat. It is a helicoidal structure and is made in the same design philosophy as the Agbar Tower in Spain and the unbuilt Sans Fins in Paris both of which are designed by architect Jean Nouvel. The tower reflects the design language of the typical Islamic-style architecture, the mashrabiya, just like the Al Bahar Tower.

What is it supposed to do?
The curtain wall is surrounded by a complex geometric pattern of four layers which can move individual-
ly to change their pattern and act as a sun screen. The kinetic facade moves in a fixed path and doesn’t act on changing climate conditions. They do claim it helps in sun shading but don’t say how much energy this saves.

What does it do?
The kinetic facade in combination with the curtain wall, made out of reflective glass, and built with roller blinds make for the solar protection system. With both an kinetic facade for sun shading and reflective glass with roller blinds suggest that the outer layer of the facade is just for aesthetics and not really for sun shading. Other high rise buildings without a kinetic facade in this climate have the same reflective glass with roller blinds for sun protection.

What is it made of?
The inner facade is made of a reflective glass curtain wall combined with roller blinds. The kinetic facade is made of four butterfly aluminium elements of different scales. They follow a specific pattern and don't react to the outside climate.

Conclusion
The kinetic facade on the Doha tower is beautifully designed. Different from other kinetic facade buildings the architect here doesn't say how much energy it saves. They also designed the inner facade with roller blinds and reflective glass to help with the sun protection. With this it is actually saying the outer facade doesn't really help with the sun protection. This I actually prefer and therefore it's more a showcase of what is possible rather than claiming how sustainable the building is. Working in this building will be not so comfortable as the view is blocked by the kinetic facade and reflective glass. The shadows from the kinetic facade can also be distracting.
Project II POLA Ginza

Location: Tokyo
Completion: 2009
Owner: POLA
Architect: Nikken Sekkei + Yasuda Atelier
Collaboration: Adaptive Building Initiative
Floor area: 35.497 m²
Height: 65,90 meter
Stories: 12
Primary use: Offices

General information
The Pola Ginza building is located in Ginza which has the highest land price in Tokyo. Therefore the building is designed with a very small footprint. Pola is a cosmetic company in Japan. They find the quality of life very important and they employ the notion of beauties aesthetics, fine arts and gourmet. This is also the theme of the building represented with the words water, light and time. Water and light are the elements for shiny fresh skin and time means the image of life. The building is made to represent the image of the company towards the people walking past the building. Nikken Sekkei + Yasuda Atelier made the facade in collaboration with the Adaptive Building Initiative and Hoberman Associates. The ABI is a joint venture between Buro Happold and Hoberman Associates there aim is to create a new generation of buildings that can react in real
time to the climate and optimize the building.

What is it supposed to do?
The building has a double glazing facade with kinetic panels. The kinetic panels receive sunlight and the heated air is discharged by the chimney effect on the top of the building. This will improve the sun protection and keep a stable indoor climate. There are windows on the top and bottom of the double skin facade which can close or open depending on the thermal needs. This double glazing system reduces annual HVAC energy by 30%. The kinetic panels diffuse the sunlight to bring the light deeper inside. With sensors artificial lighting can be cut back. (World Buildings Directory, 2010)

What does it do?
Beside blocking the sun this system is made to engage the pedestrians on the street. The kinetics panels are made to be a living organism rather than a sustainable solution. It should bring more light in the building but that hasn’t been proven. The double skin does bring improved thermal insulation.

What is it made of?
The facade is made of a double glazing system and between the glass are kinetic polycarbonate panels with LED lighting that can provide a range of different colors. The panels have different patterns which illustrate the cells of life. They operate in a group of fourteen panels with automatic hinges placed on their tops and the horizontal shaft with rollers that push the panels along their curved profile. They are not connected directly, this way they operate on a different movement. (World Buildings Directory, 2010)

Conclusion
POLA wanted to a facade that represented the essence of the company. With this design Nikken Sekkei + Yasuda Atelier and The Adaptive Building Initiative definitely succeeded. The kinetic facade really is showing the light and moving image that POLA wanted. The double skin facade does bring improved thermal insulation but it could have done without the kinetic panels.

Conclusion layered facades
The advantage of layered facades is that they can be very compact. When the kinetic part is between two glass panels it can even be made without the need for cleaning. A problem is however that the glass is never 100% transparent since there will always be some kind of equipment inside the two glass panes, as with the Doha Tower. The use of these layers don’t have to stop with the facade as there are already examples of it being used indoor. Creating a presentation room by closing the glass
wall for example can be very useful.
Type 3: Turning Facades

Turning facades are one of the more common kinetic facades. For example lamellae have been used on facades for a long time. In most cases the lamellae would be fixed horizontally as they are placed on the south facade where the sun is at the highest position. Today we are seeing vertical lamellae more often as the use of lamellae is not only applied on the south facade anymore. The projects we are showing have been awarded several design awards because they do more than just turning.

- ThyssenKrupp Quarter
  Essen Q1 building

- Council House 2

Image #: ThyssenKrupp Quarter
(M. Wolff, 2012)

Image #: The Council House 2 front facade
(source: panoramio)
Project I ThyssenKrupp Quarter Essen Q1 building

Location: Essen, Germany
Completion: 2010
Owner: Thyssen Krupp AG
Architect: JSWD Architekten + Chaix & Morel et Associés

Floor area: 170,000 m2
Stories: 14
Primary use: Office

General information
On the grounds of the former Krupp cast iron factory from 1811 ThyssenKrupp AG continues to write its history. (Archdaily, 2013) The rules of campus architecture are applied here. An ensemble of various individual buildings on a “green carpet” with trees. The main requirement of the building would be the flexibility to react to changes within the company. The campus like accommodation symbolizes openness, coming together and communication. All new buildings within the quarter are composed of L-shaped elements enclosing a shared central space. The Q1 building has two types of facades: One open glass facade around the central open space in the middle, the other facade faces the L-shaped elements and looks more closed.

What is it made of?
ThyssenKrupp is famous for its steel product therefore the facade is made of steel as well. (JSWD et al,
The stainless steel sunscreen elements consist of approximately 3150 vertical elements and nearly 400,000 horizontal slats bolted into them. All of these rotating and foldable elements are engine driven and controlled.

What is it supposed to do?
The elements are all centrally controlled by engines depending on the situation of the sun. (JSWD et al, 2012) This combination allows for optimal light control with nearly unobstructed views.

“The division into trapezoid, triangular and rectangular individual elements creates a façade structure on which the reflected sunlight with its changing interplay of light creates an artistic interpretation of the architecture.” (JSWD et al, 2012)

Conclusion
From afar the facade tends to look like wood, although seen from up close it becomes clear that the facade is made of stainless steel. By creating the L-shaped masses around a more open volume the building looks calm and clear. There is so much going on in the detailing of the facade yet, from afar, it looks simple and clean. The kinetic facade’s contribution to the interior office spaces is shown by the lights reflection on the ceiling.
Project II Council House 2

Location: Melbourne, Australia
Completion: 2006
Owner: City of Melbourne
Architect: Mick Pearce with Designinc.

Floor area: 12,536 m²
Stories: 10
Primary use: Office

General information
The Council House 2 is a pilot design, launched by the City of Melbourne to influence future design to be more sustainable and efficient. (Wikipedia, 2014) The city of Melbourne aims to achieve zero emissions for the municipality 2020. A big part of this derives from the reduction in energy consumption by commercial buildings of 50%. Council House 2 required to rely on passive energy sources as much as possible while still being a premium grade building.

What is it made of?
The facade is constructed using timber louvres on an aluminum frame. These louvres are placed in front of a curtain wall. The system includes a lot of ways to get natural light as far into the building as possible. The Louvres need to be adjustable so they will not interfere with the system for the natural light supply when needed.
What is it supposed to do?
“The west facing façade is covered with a system of timber louvres that pivot to optimise the penetration of natural light and views. These louvres also protect the façade from the harsh western sun. The louvres open and close depending on the amount of sun that is hitting the western façade. The louvres are made from untreated recycled timber and are moved by a computer-controlled hydraulic system.” (Wikipedia, 2014)

What does it do?
As far as we can tell the system of the Council House 2 is still improving. The louvres of the building are reducing the energy consumption due to the fact that they transport daylight further into the building so less artificial light is needed.

Conclusion
A lightweight extra structure around your facade can be quite costly, but if you include the research and development a building like the Council House 2 gives, it can pay itself off in others ways than just reducing its own energy consumption.

Conclusion turning facades
There are a lot of examples for turning facades it is therefore a lot harder to stand out in. The projects shown here are very unique though and offer clever ways to use kinetics to improve the living quality of the building. Decreasing the amount of energy needed for the building isn’t the only way to improve the quality of a building and that is shown here very well.
Type 4: Special Facades

The special facades combine either any of the previously mentioned types or are a whole new type of their own. This is one of the more intriguing types as each one is very different. The projects we are showing are:

- Institut du Monde Arabe in Paris, France
- RMIT Resign HUB in Melbourne, Australia

These projects also have been designed in a very different time, with the Arab Institut du Monde being made 25 years before the RMIT Design HUB. The Arab institut du monde is the oldest building in this book and is a great example of how a kinetic building withstands after several years.

Before going into the selected projects too much take a look for yourself at how a detail of the facade of the Institute du Monde Arabe works.
Project I Institut du Monde Arabe

Location: Paris, France
Completion: 1987
Owner: The Arab World Institute
Architect: Jean Nouvel
Floor area: 16,894 m²
Stories: 12
Primary use: Office and museum

General information
The Arab World Institute is an organization founded in Paris, the capital of France, in 1980 by 18 Arab countries together with France to research and disseminate information about the Arab world and its cultural and spiritual values. (Wikipedia, 2015) The AWI is located in the building known as Institut du Monde Arabe. The building was constructed from 1981 to 1987 by architect Jean Nouvel. Jean Nouvel won the competition with the plan for the current building. This plan included risk-taking solutions that have proven themselves over the years.

The building is a combination of the free form of the Seine river and the rational blocks of the Jussieu Campus. (Architeam, 2014) The two facades of the building reflect this combination, as the north east facade travels along the curve of the waterway and therefore reduces the hardness of the rectangular block. The contrasting south west facade is uncompromisingly rectangular.
This eleven stores high facade is build up using moving rectangular geometric motifs. These motifs are actually 240 motor controlled apertures that act as sun shading. Reflecting Islamic architecture these motifs create interior spaces using filtered light. The building houses a museum, library, auditorium, restaurant and offices.

Climate
The south west facade of the building is the kinetic facade and therefore the most interesting one for this book. Paris counts an average of 1779 hours of sun a day. (ClimateData, 2014) A sun shading device was needed to build the rectangular facade on this location.

What does it supposed to do?
First and foremost sun shading was needed. Secondly the building needed an islamic or arab identity. By combining these two wishes Nouvel created the moving rectangular geometric motifs.

What does it do?
As said before the plan of Nouvel included some risk-taking solutions that have proven themselves over the years. The motifs have proven to be capable of shading the sun and giving the building its identity. But also to divide the interior spaces inside the building by using light as its primary source. The innovative use of technology and success of the building's design catapulted Nouvel to fame and is one of the cultural reference points of Paris. (Wikipedia, 2015)

Conclusion
The building was a great success. And after many years some of the motifs still work, which is quite an achievement compared to most kinetic facades. With this building Nouvel has proven himself to be capable of combining a great culture with technical finesse.

“This building catapulted Nouvel to fame and is one of the cultural reference points of Paris. It is also noted for receiving the Aga Khan Award for Architecture.” (Architeam, 2014)

The high costs of the south west facade are given back to the AWI as an entrance to their museum, a cultural reference to what they stand for and an iconic building that for its time stands as a benchmark for kinetic facades.

Image #: The Institut du Monde near the Seine Arabe (source: akdn)
Project II RMIT Design HUB

Location: RMIT University, Melbourne, Australia
Completion: 2012
Owner: Royal Melbourne Institute of Technology
Architect: Sean Godsell, Hayley Franklin
Floor area: 13,000 m2
Stories: 9
Primary use: Research and postgraduate education

General information
The two keywords for the design of the RMIT Design Hub building are adaptability and flexibility. (Archdaily, 2012) RMIT is a world leader in design research. (Wikipedia, 2014) Before this building was built the postgraduates were dissipated across various campuses and facilities. The Hub provides a combined research base where postgraduates in various design fields can work alongside each other in the same building. As in all these projects the facade of the Design Hub is the interesting part of the building for this book.

What is it made of?
The facade is build up out of panels with a size of 1.8 by 4.2 meters. (pta, 2013) These panels consist of a total of 21 glass discs and steel cylinders, which are supported on
a secondary galvanised steel frame. These panels are the second skin of the facade, and are set about 700 millimeters outside of the curtain wall facade system the building uses. Each panel consists of 12 operable discs and 9 static discs. At the ground level all glass discs are fixed.

What is it supposed to do?
The unusual thing about the facade is that it has the capability of collecting solar energy throughout most of the day. The surface of the facade is covered in movable disks that can rotate towards the sun direction. To achieve harvesting energy at an optimal level the disks are fitted with an actuator which allows the disks to be exposed to the sun as much as possible. (pta, 2013)

“The Hub has a large number of ESD features and incorporates strategies for water, waste and recycling management that are the equal of any ESD focussed building on the planet. In particular the outer skin of the Hub incorporates automated glass sunshading cells that include solar power infrastructure and evaporative cooling and fresh air intakes that improve the internal air quality and reduce running costs. The cells been designed so that they can be easily replaced as advances in the development of solar power result in improved technology and part of the northern façade is actually dedicated to ongoing research into solar energy to be conducted jointly by industry
and RMIT. The entire building façade, in other words, has the capacity to be upgraded as technology evolves over the coming decades.” (pta, 2013) (an ESD is a Ecologically Sustainable Development)

What does it do?
As of 2013 there are no solar panels installed, but they say it has the capability to accommodate this technology in the future. (Wikipedia, 2014)

“Perimeter air intakes and fine mist sprinklers incorporated into the double glazed inner skin provide passive cooling to the UFAD system. The water used in this ‘Coolgardie safe’ system is harvested from the roof. Fresh naturally cooled air provides a less expensive, lower energy consumption and more desirable thermal comfort alternative to a wholly conditioned work environment” (pta, 2013)

Conclusion
This 80 million australian dollar project (approximately 56 million euro’s) may be costly for a 13.000 square meter rectangular building, but it will earn itself back by being efficient and mostly self sufficient with energy. Of course the 28.6 million australian dollar granted from the Federal Government’s Education Investment Fund helped a lot to realize this RMIT design hub. Still a shame is that the solar panels have been removed since 2013, these are supposed to be one of the main features of the facade beside the evaporative cooling system. In a way this building proofs that if you want an iconic facade just like Jean Nouvel’s AWI you might as well take all the benefits from nowadays technology with it.

Conclusion type special
The two projects shown in the type special are both very different and both very unique. That’s why they probably are two of the better projects discussed in this book. The Institute du Monde Arabe has already proven itself as a very well made building and it will be interesting to see whether the RMIT design HUB can prove itself as well.
Conclusion of the book

During the creation of this book it became clear to us that all of these facades are very expensive and the choice for a kinetic facade comes mostly from a design standpoint to impress the world rather than to create a sustainable facade. Of course there are exceptions and by creating these kind of facades you will understand them more and for future buildings it will become easier to create kinetic facades. What also is impressive is that the Arab institut du Monde is still one of the better designed buildings even though it has been designed over twenty-six years ago. Melbourne has taken a big step forward when it comes to sustainable buildings, the RMIT Design HUB and the Council House 2 are both pilot projects to create affordable systems for future buildings. These type of projects are necessary to gain knowledge on what works and what doesn’t work.

The projects discussed in this book that have great sun shading capabilities seem to lack visibility, yet a project like the ThyssenKrupp Quarter does not have this problem. The designers found a good way of having both a good sun shading system and a good view throughout the facade.

Users of the all the discussed projects seem to have little input of what is going on in the facade. Most of the engines are computer controlled or have a certain schedule on when to do what. The Kiefer Showroom does not have this problem, it gives the building user a way to interact with the facade.
References


Flickr, 2004. Pictures used from authors: b00nj, --


JSWD Architekten + Chaix & Morel et Associes, 2012, facades


Timothee Rolin http://www.timotheerolin.net/fr/photos/keyword/4692/batiment/view access date: 19-01-2015


