

**Note:** The main interviewee, Interviewee 13.A, and his/her colleague, Interviewee 13.B, preferred to provide combined insights together to the interview questions based on their experience in the company.

### 5 to 8 Minutes Introduction

- Collection of information about the interviewee (educational and technical background, field of professional experiences, professional years of experience, involvement in different types of projects).
- Brief introduction about the interview.

### Interviewer

So now I'll move to the opening questions. So first of all, in your experience what is the current level of knowledge in the building industry regarding the application of multifunctional facade components integrating solar cooling technologies?

### Interviewee 13.A

Not that high to be honest. It always feels like a pilot when somebody comes up with something like that. It's not common.

### Interviewer

I see. So now I'll move to the following question. So in your experience, what are the motivating factors for the application of multifunctional facade components integrating solar cooling technologies?

### Interviewee 13.A

Well the biggest motivation should be the environment. It's sustainability, environment, that something where why we should look into all this interesting technologies.

It depends who you are asking this, because if you're asking this one of the other stakeholders, which is probably the most important is the one who has to pay the money, the investor. The motivation should be return on investment. So yeah.

### Interviewer

OK.

### Interviewee 13.A

Depending on who you're asking this.

### Interviewer

Yeah, it's based on your experience. From your point of view.

### Interviewee 13.A

Yeah, but that's exactly where the experience as well goes. The experience is that when you're asking us, and when you're asking architects, we are willing to really dive deep into these topics from the moment somebody has to pay or somebody's talking about return on investment or purchasing departments and stuff like that. The motivation is kind of gone.

**Interviewer**

OK, I see. So now I asked what are the motivations. So now I'll ask you from the other point of view. So in your experience, what are the concerns regarding the application of multifunctional façade components integrating solar cooling technologies?

**Interviewee 13.A**

Cost. So return on investment, and complexity. Who's installing? Who knows about it? Who guarantees? And so on. So there is cables in the facade that we are not used to that.

**Interviewer**

OK. So how you define the complexities from your point of view?

**Interviewee 13.A**

The integration of different players which are traditional facade builders.....but as well electricians or.....manufacturers from other types.....plumbers.....I don't know who's all needed.....air conditioning technical specialists. So that's the complexity.

**Interviewer**

OK, got it. So do you have something in mind how we can address such concerns you talk about?

The return on investment, the complexities of.....what are the potential ways to address such concerns?

**Interviewee 13.A**

Well the complexity.....first of all I think that it has to become somehow common and by communicating in building teams. So you really need building teams. Not a traditional. How do you say it....'Aanbesteding' [English: tender]

**Interviewee 13.B**

Yeah, that's the traditional tender, yeah.

**Interviewee 13.A**

Tender tender projects but more like building teams who have a common goal from the start and everybody knows why and how are we doing this. So that's the complexity part and for the return on investment part, for the cost part, we have to....you need digits, you need figures to show really data.

**Interviewee 13.B**

I would say the same. At the beginning phase for architects that we would add analysis to show them that it is profitable, but then we should do this as advisors yeah at this in the beginning 2 hour advice but most of the time we don't have had a capacity or the time for it to go into this material that deep so yeah.

**Interviewer**

OK. Great. So now I'll move to the following question. So you know we have different types of projects in the building industry. We have new building construction and we have renovation projects. So the question is how can the type of project such as new building construction or

renovation projects influence the applicability of façade products integrating solar cooling technologies?

**Interviewee 13.A**

So the difference types between renovation or new build.

**Interviewer**

Yes.

**Interviewee 13.A**

Well, in the renovation I see a possibility for a manufacturer like Schueco to design an integrated facade solution. So I can imagine that when we have for example, in the renovation, it's also a lot of transformations. So office building where buildings being transformed to residential buildings and we've got a problem with the floor to ceiling heights for example. So you have to take all the.....You don't have enough room to have this hidden ceilings behind which we put all the technical spaces. So we need to put all these technical parts of heating, cooling, cables, electricity, and everything we have to put it in a facade because the façade, the shell of the building we have to renovate anyway because U-value of the facade is mostly wrong. So in that case it's up to the manufacturers, I'd say, to come up with a product which has everything in it. Maybe a modular solution where you can plug and play. OK, I need this, this, this, this, this. This was something that we already designed 10 to 15 years ago, and not only the WICONA solution there. Schueco had a solution like that as well 10 to 15 years ago the was called...What was the name again? I can send it to you after but maybe it was too early, I guess, because only also the WICONA solution was also. Never really build as a product. And in the new build, back to the building teams, has to become on the table. All intelligence on the table and what is the goal of this building and start designing it altogether.

**Interviewee 13.B**

Yeah.

**Interviewer**

OK. So now I will moved to the following question. So I asked you about the new building construction or renovation project. Now focusing on the building type. We have residential buildings. We have office buildings. So the question is how can the building type such as office, residential, healthcare, educational, etcetera influence the applicability of such facade products?

**Interviewee 13.A**

Influence the applicability.

**Interviewer**

The building type.

**Interviewee 13.A**

Yeah. Well, in the coming years in these industries that I called Belgium, Netherlands, Luxembourg residential is the main building type of buildings that have to be built. And we're in small countries with a lot of people.

Heating and cooling is a problem and residential is also a problem because we have to build, build, build, build. We have not enough dwelling. So in that combination I'd say it's an opportunity.

Depending as well on the technique, because I'm not too deep in the technical part of your solution. Is this something that can be best applicable where I can imagine we have how do you call it....We have sunshine during the usage of the building. Then it's more interesting in an office building because in a residential building we used the building mostly when there was no sunshine. I don't know if that's.....

#### **Interviewer**

OK, so now we will move to the following question. In your experience, how do the locations and the climate conditions of buildings affect the performance of solar cooling integrated facades?

#### **Interviewee 13.A**

I think that's something that's often on [Name of Interviewee 13.B] table as well, and most of the architects, I would say they take already into account the orientation of the building, north-south, sun shading and all that kind of stuff. I'd say in most of the architects vision it is incorporated at the moment. Isn't it?

#### **Interviewee 13.B**

Yeah it is but I think they are not aware of the fact what the influences of the technical details. So what they do is they design slender and fully transparent facades and they also have these high durability aims that do not align with each other. So, and yeah then of course we will try to help them with it and yeah. But that's the challenge here. Most of the time.

#### **Interviewee 13.A**

Yeah. Yep.

#### **Interviewer**

OK. So generally what are the suggested locations or which locations and climate conditions would you suggest for applying facade products integrating solar cooling technologies?

#### **Interviewee 13.A**

I'm thinking about our markets.

#### **Interviewee 13.B**

Yeah.

#### **Interviewee 13.A**

What would be the locations? If the technique and profitability is proven then....I don't know if there is a different location where you should use it or not use it. I can't think of anything actually.

#### **Interviewer**

OK, so now I'll move to the following question.

**Interviewee 13.B**

Yeah maybe in a bit bigger cities because they're, yeah, there the heat will accumulate there. Yeah. I don't know this.

**Interviewee 13.A**

The heat of the air conditioning.

**Interviewee 13.B**

Yeah, yeah.

**Interviewee 13.A**

So there if you don't need all the air-cons, it's probably better than that's what you mean. Yeah, yeah.

**Interviewee 13.B**

Yeah, yeah could be. I'm just thinking out loud.

**Interviewer**

OK. So I will moved to the following question. So this is the last question in the opening questions before moving to the key questions. So do you think the choice of solar cooling technology, namely electrically driven or thermally driven would affect the application of such facade products in a particular project?

**Interviewee 13.A**

Well. Yeah, I think you always need....how do you say these guys that that walk up front...So the investors that see the possibility to start with it and you have to have people starting with it. So I think first of all, you should.....It's probably easier to start with, let's say, office buildings with an investor having a brilliant vision of sustainability and innovation and stuff like that, and he wants to put some money on the table and do a little bit of marketing with it. That's probably the easier start with these products then the residential business.

**Interviewee 13.B**

Yeah.

**Interviewer**

OK, got it. So now I'm done with all opening questions. So now I'll move to the key questions. So in the key questions, I have questions about technical and product related aspects, then financial aspects and then finally and I'll end up with the questions about process and stakeholders.

So now I'll move to the technical and product related questions. Now I'll skip the first two questions because they were related to how we can define complexities and how we can address them. But we already talked about them in the second or third question. We already talked about them. So and let you elaborate more to just save the time.

**Interviewee 13.A**

Perfect.

**Interviewer**

So now I'll move to another question. So how could we address challenges related to the space availability or interrupting other building services when we integrate solar cooling technologies into facades?

**Interviewee 13.A**

Well, I'm not sure how much it will be, yeah, interrupting with that. But in my point of view, if you have the solution and it doesn't interrupt in a wrong way, then we can convince that it doesn't matter. So I'm not sure how it interrupts with the conventional technical, but if you have the solution, it would convince them.

**Interviewee 13.B**

Yeah.

**Interviewer**

OK. So now we'll move to the following question. So what are the key aspects to consider for the maintenance and the durability of façade products integrating solar cooling technologies?

**Interviewee 13.A**

Maintenance should directly be integrated in the cost price. So That's something that people are always afraid of. When you go too technically, it will probably cost a lot of money to maintain. So in one or another way it should be integrated and there should be a good guarantee on the complete product. So let's say 10 year or 25 year, no hassle façade. Everything is covered for something like that because you really need it.

**Interviewer**

OK, I will move to the following question. So how do you see the role of aesthetics in the widespread application of building facades integrating solar technologies?

**Interviewee 13.A**

Aesthetics are always important. Nobody builds an ugly building.

**Interviewee 13.B**

No.

**Interviewee 13.A**

Only if, let's say, like, what's it called again in France in Paris, Centre Pompidou, if you just say, OK, let's build an ugly building, but we put just all the technique outside and let show the technique. But that's the vision. But normally aesthetics are important.

**Interviewer**

So are there key aspects that we should consider for the aesthetics?

**Interviewee 13.A**

You mean like slim design or something like that...or sleek or something.

**Interviewee 13.B**

Yeah, I would say that for architects, it's important that they can choose. So in the beginning they would like to have several options and see what the result is of that. So sometimes they prefer slender design, but sometimes they want a robust appearance. So show them what the relation is with the result, and then they also have the feeling that they yeah, can tweak it a bit so.... can influence that so.

**Interviewee 13.A**

Yeah, that's correct. They want there a manuscript. They're feeling that it's not just copy paste our product on a facade but....they did something to it.

**Interviewee 13.B**

Yeah.

**Interviewee 13.A**

Yeah. Yeah, that's correct.

**Interviewer**

OK, great. So now I'll move to the second category of key questions. I'll ask two questions about the financial aspects. So in your experience, how can the industry develop affordable and financially feasible facade products integrating such technologies?

**Interviewee 13.A**

In our market here, you would really need calculation or return on investment calculation or something like that. Like a proof of principle. Unfortunately nobody would spend a euro more just for having a sustainable façade. In one or another way you have to calculate that in 25 years it's gonna be more economically or affordable or whatever.

**Interviewer**

OK. So now I'll move to the following question. So what are the potential financial incentives that can support the widespread application of solar cooling integrated facades?

**Interviewee 13.A**

Thinking of two things. First of all, it's of course the first out of pocket cost. So the investment cost. If I can reduce my investment cost. So thinking about.....In the product maybe because I can imagine that this product from cost price will be much more expensive as a standard façade. So instead of having to invest this huge cost price now, I think in the product you should think about for example leasing construction or some other financial benefits, subsidies or whatever that you can reduce the initial cost price and maybe spread more the cost price in some kind of maintenance program or something like that or leasing program or I don't know what and that could be a financial benefit or drive to buy this façade.

**Interviewer**

OK, great. So now I'm done with the financial questions. Now I'll move to the last category of the key questions before we move to the closing questions. So the follow questions will discuss aspects related to the stakeholders and processes. So as you can as you can see from this chart, we have

different stakeholders and the relationship between different stakeholders involved in the design and construction industry. So in your experience, which of these stakeholders can support the application of solar cooling integrated facades?

**Interviewee 13.A**

Actually all of them and that's what I said. You need all of these guys on one table. Once you start discussing a product like this or a solution in a building like this without the general contractor or without an architect or without the investor, no wouldn't work.

**Interviewer**

OK, so now I will move to the following question. How can we increase the knowledge and experience of architects and engineers regarding the technical aspects of integrating such technologies into the facade?

**Interviewee 13.A**

I would say it's supplier with this combined product who has to bring the knowledge on the table or there would be a role for the consultants who have this know how because I think you can't expect an architect or a general contractor or an investor to have this competence, but we as supplier or consultants have to have the competence to provide and convince in these processes. Well [Name of Interviewee 13.B] do you see that different or for example an architect? I don't think...

**Interviewee 13.B**

No. Yeah, I agree on that. I think the importance of our role, but also the consultant is very important in this one. And for example, if you compare it with sound insulation or sound reduction levels in cities and their norms and standards, that's also quite complex. And the solution that we have for that. So DGMR [Dutch engineering and consultancy agency] is helping architects with these relatively simple principle sketches and we try to make the link together with DGMR to make it more simple for the architect to understand it. So I think diagrams and principles sketches that, yeah, should....Yeah we should offer them to help them with the big analysis and reports to make it more visual.

**Interviewer**

OK, so I have the following question which is somehow close to what you are talking about. So what are the key elements that should be included in standards or guidelines for architects and engineers which are related to the integration of solar cooling technologies into facade?

**Interviewee 13.B**

Diagram, sketches....really you should make it more visual. All these text with these figures and the tables and the graphs are too complex. Sometimes they are not too complex but you want to catch it in one eye to see it and understand it immediately. So back to the basics I would say.

**Interviewee 13.A**

And with norms and standards you mean definitely laws. So a figure which says you have to be below this or below that.

**Interviewee 13.B**

Yeah, yeah.



**Interviewee 13.A**

Yeah, I think that's we talked about incentives before or what could be incentive to go into this and in these kind of things it's mostly we talked about return on investment at cost. But of course the law is another standard is another incentive. If you have to, then you need to.

**Interviewee 13.B**

Yeah, yeah.

**Interviewer**

Yes, I have a question about the building regulations. It's coming in few minutes. So now the following question, how can the industry increase the variety of products that would attract customers to apply such facade products?

**Interviewee 13.A**

I'd say in one or another way if you want to go in these deep dive in these integration, integrated facades, they kind of have to be modular in one or another way. Speaking the same language. Not just everybody doing their own little thing. Schueco is doing something. WICONA is doing something. Then somebody from technical or the plumbing industry, they are doing something. It has to talk with each other. All these solutions that we are thinking in this, yeah, holistic integrated facade.

**Interviewer**

OK so now I'll move to the following question. So generally, how can we increase the interests of designers, developers and the clients in solar cooling integrated façades? How we can increase their interest?

**Interviewee 13.A**

At the end I think a proof of principle would very much help. So which means first building, second buildings.....The references. That would open eyes.

**Interviewer**

OK, now I will move to the following question which is related to the building regulations. So how can changes in building regulations affect the widespread application of solar cooling integrated facades?

**Interviewee 13.A**

I'm not too deep into the solar cooling. Let's say that way. But what really interests me is the fact that if you have the real solar cooling, I thought it doesn't need extra electricity. It's a process where you don't need extra electricity to bring in because in my point of view the worst that's happening now is that we have a regulation which is kind of OK. If we don't know what to do anymore, but we have to get to a certain point level, we just put some extra BIPV on the rooftop or we just put some extra air conditioning system in it and we're fixed. We're done. I think you kind of have to lower that down that you really have to think about. Yeah. What do you call it passive. Is it a passive system like the solar cooling system that you don't need to bring export energy to it. You don't need any cables or something like that. You don't need extra electricity.

**Interviewer**

OK. I'll move to the following question which is somehow related to the previous question. How can changes in energy policies affect the widespread application of solar cooling integrates facades?

**Interviewee 13.A**

Like an increased law. An increase in a higher level that you have to reach before being able to build. That would affect that people have to go into that direction....But in detail?....I don't know.

**Interviewer**

OK. So now we'll move to the following part in the process stakeholders, I'll ask questions about the processes. So you know that in the facade design construction, we have various processes. You know you have the processes in design phase, production phase, assembly, operation and then we have end of life. So in your experience, which phase is key for boosting the integration of solar cooling technologies into building facades?

**Interviewee 13.A**

I think that....Can I call more?

**Interviewer**

Yeah, yeah, sure.

**Interviewee 13.A**

I think the design phase is very important and the operational phase. I think production and assembly, OK, it'll work out. If it's much more complex, but then at the end of the day the operational phase works out that it's better, easier, cheaper, more comfortable or whatever. So design, operation, and end of life, because the question "is there an end of life?" should be on the table or do we have recurring façade or circular facade or something like that.

**Interviewer**

OK, so now I'll move to the following question. What are the main aspects to consider during the design phase of solar cooling integrated facades?

**Interviewee 13.A**

Well, I think [Name of Interviewee 13.B] called the most important one is flexibility. So really the design aspect that the architect has the opportunity to still make his own design, his autograph.

**Interviewee 13.B**

Yeah, just said to. That's important, yeah, and if you think of a future proof, then it would be great if it's also demountable, but yeah, that maybe that's a step too far, but that that would be great.

**Interviewee 13.A**

And in the system design, I would say that it's a modular system.

**Interviewee 13.B**

Modular. Yeah, yeah. That's what I meant. The modular system that you have it in a modular system and then demount it and then install it somewhere else, yeah.

**Interviewer**

OK, so in your experience, how can we achieve a closer collaboration between various stakeholders and disciplines during the early design stages of solar cooling integrated facades? How we can achieve a closer collaboration between stakeholders and disciplines?

**Interviewee 13.A**

But back to one of my first comments that if we are building, we have to build in a in a building team or a DBMO [Design, Build, Maintain, & Operate] or one of these. Well new collaboration ideas of building a building together with all stakeholders and all knowledge on one table.

**Interviewer**

OK, now I will move to the following question. So what are the key aspects to consider during the production phase of solar cooling integrated facades?

**Interviewee 13.A**

The production....So that's really at the manufacturers side....I'd say that it's....Back to what I said before that you need more manufacturers who are talking the same and products which are talking the same language so you can connect connectivity between different products. At the end I don't think that this is one product from one manufacturer and is more manufacturers and kind of plugging into each other.

**Interviewer**

OK. Now the same question but....what about the key aspects to consider for the assembly phase?

**Interviewee 13.A**

Connectivity and modular plug and play in one, let's say, element facade or whatever. You just put it on the building plug some new things on it, in it, or whatever. We put the façade elements, then somebody else comes and plug their connectors in it, I don't know.

**Interviewer**

So I started, design, production, assembly. So now what are the key aspects we need to consider for the operation phase?

**Interviewee 13.A**

Comfort or the users of the building....and comfort for the owner of the building....and comfort I mean it's cost but also maintenance and durability.

**Interviewer**

OK, So what about the end user knowledge? Do you have something in mind about key aspects we need to consider for the end user knowledge?

**Interviewee 13.A**

The end user knowledge.

**Interviewee 13.B**

You mean that they need to know how they should maintain it, and yeah, I think that's important.

**Interviewee 13.A**

Operate it.

**Interviewee 13.B**

Operate it. Yeah.

**Interviewee 13.A**

Shouldn't that be...how do you call that?.....Where you actually.....When I'm thinking about the façade like this is the façade that I don't need to operate as an end user because this facade adapts on what my needs are. This façade should know that I am [Name of Interviewee 13.A] and when I'm coming home, I want a living room which is 20 degrees and I want fresh air every day and this façade would look in my agenda, whether I'm coming home at 6:00 o'clock or at 12:00 o'clock. Something like that because I think I don't need to operate this façade, but this facade should....Well, there is a name for that. What's it called again? That it's not need touching the buttons and saying I want this and this and this, but this façade already knows it.

**Interviewee 13.B**

Yeah that's automatically controls.

**Interviewee 13.A**

Yeah. Yeah, something like that's.

**Interviewee 13.B**

Also, if something gets broken, then yeah.

**Interviewee 13.A**

Sensors and Yeah.

**Interviewee 13.B**

Yeah, sensors will see it.

**Interviewer**

OK, so now what are the key aspects we need to consider for the end of life?

**Interviewee 13.A**

Well, that's circularities of course, the keyword at the moment in the industry and is no waste. So in one or another way we have to be sure that this fancy and techniques can be dismantled and reused or something like that, and that's very important. I think, again because I don't know too much about the technique, but I can imagine that....Therefore, we need this modularity because I can imagine that the photovoltaic have end of life, but our let's say façade doesn't have an end of life. That lifespan of 50 years but these BIPV have to be disassembled after 10 years and plug new into it and kind of like that because you have to have a.....There's different technical lifespans of the materials being used in this façade and techniques being used.

**Interviewer**

OK, so now I'm done with all key questions. So I have just a few questions in the closing part. So do you have any final remarks about the widespread application of solar cooling integrated facades as building products in the construction market?

**Interviewee 13.A**

Let's go for it. I find it very interesting, but it's, I think, a big step to go. This step could be covered by having the first pilot projects or projects to see how it works. To really see how it works.

**Interviewee 13.B**

Yeah, I agree and I think it would be very great if a well-known architect or developer or a metal fabricator can share this experience about this pilot. So if you can, yeah, ask them to collaborate on the pilot. That would be great and to share their ideas about it.

**Interviewee 13.A**

I think investors who's doing quite some of these very. Also they have their own innovation team as well.

**Interviewer**

OK, so now we'll move to the following questions. So generally, what do you think about the application of solar cooling integrated facades for enabling energy transition?

**Interviewee 13.A**

It's a good thing, yeah.

**Interviewer**

Now finally, so do you mind to propose potential participants that can be interviewed for the study?

**Interviewee 13.A**

I would have to think about.....