

# Cristina Cochero Interview

Sat, 4/2 11:58AM 55:26

## SUMMARY KEYWORDS

energy, people, building, companies, system, bamboo, algorithms, research, instance, demand, technology, super, industry, consumers, typically, work, communities, difficult, easy, flexibility

## SPEAKERS

Cristina Cochero, Michael LaBelle

---



Michael LaBelle 00:02

Building the smart grid algorithms of entrepreneurship interview with Christina Crucero episode 59 Welcome to the My energy 2050 podcast where we speak to the people building a clean energy system by 2050. I'm your host Michael LaBelle. This week we speak with Professor Christina Cochero, who is the Sarah Hunter professor at the University at Buffalo, Nia, the gotta Lusia she is the founder and chief technology officer at Bamboo energy, we begin our discussion about her experience, taking research and placing it within a startup company. Christina is a great example of reluctant but dedicated entrepreneur. Her company bamboo energy is a key component of making the smart energy system work. It is a software platform that communicates with devices in the home or factories, and interfaces with the grid to ensure things like the time of day pricing can be accomplished to save users money and help balance the grid. So it's talking to refrigerators, talking to appliances in the home, or maybe big machines and factories, and then communicates that with the grid and understands how to either for example, heat up a home before the peak period or cooled down a home. For example, air conditioning in the summer, before the peak in the demand for electricity begins her software interfaces with the electric bluish cold system. And with the consumer side. Hopefully over the long term, a much more efficient energy system can be built. Christina story is special because she is originally a statistician who found love in the energy sector, okay made that love bit up. But still, she found what was the ability to use statistics in the energy sector to solve problems. She's taken her research and brought it out from an academic environment, and is now working to scale it up in a commercial environment. We go into detail of why and how she decided to make this change. It's really interesting discussion. This is a double episode in one, because you get to learn how the smart grid works, why energy communities are essential for sustainable energy systems to develop. I was really surprised actually to hear some of the information here. And you'll hear an entrepreneurial story of Christina and her bold move to transfer her research to the real world. If you are interested to know what is taken to make a smart energy system work, then this episode delivers, because it's going to take a lot of innovation and entrepreneurs to bring new technologies into the energy sector. As we discussed in the last episode last week with Gerard Reed. There are lots of technologies out there that can make a huge difference. Just some of the obstacles to deployment are there including big companies, and they need to get out of the way and let the innovators act. For me this episode is special people like Christina are the people creating a

better energy system for us. I want to thank our mutual friend Bartok Cova offski, who was a guest on episode 45. I think I pronounced his name almost right in that episode. For both episodes, we talked about virtual power plants, which serve to balance supply and demand. And in both these episodes, you'll hear firsthand the benefits of decentralized and cooperative energy systems. Overall, after speaking with Christina, I'm more optimistic than we that we do have the right people and technologies to go zero carbon. But we do need to unleash the pent up innovation that is ready to go. The intent of the my energy 2050 podcast is to spread the knowledge about how the energy system can assist our transition towards a greener future. And now for this week's episode. Today we have Professor Cristina cord cero, who is the Sarah Hunter professor at the University of Polit. Cynthia, the Catalonia she is the founder and chief technology officer at Bamboo energy and also the head of the research group of energy systems analytics. Christina, welcome to the My energy 2050 podcast.

**C** Cristina Corchero 04:13  
Thank you so much.

**M** Michael LaBelle 04:15  
Thanks, I first we have to thank our mutual friend Bartok for putting us in touch. So he was he was a mutual. He's a mutual friend of ours. And he was also on the podcast before. So

**C** Cristina Corchero 04:26  
nice. Yeah, he's so nice. And that was a great opportunity to be that day.

**M** Michael LaBelle 04:31  
Yeah, no, it's great. But the reason I wanted to talk to you though, is that really discuss your experience in entrepreneurship. So I'm really interested to talk about bamboo energy, but also understand better the software interface looking at your research and also your work. I would say business work. It's really this this interface between the distribution grid and consumers. And you really go into the data and you also develop the interface and have to deal with hardware issues. So I'm very interested in talking about these issues today. But the first question I have is, how did you get involved in energy research?

**C** Cristina Corchero 05:10  
Well, a long time ago. In fact, my background is statistics. So I'm honest decision. And when I started my master thesis, I worked with a professor that was involved in all regarding energy markets, he deals with bidding in that time, thermal units, hydro units, and how they should work at the energy markets. And I started there. And then I realize that I was typing gauge with the with the subject. So I started my PhD on optimization and modeling for energy systems and

energy markets. So this was the start. It was just, yeah. Because he was there. And it was interesting, because he said, decisions I always said we are to, and we work in many, many sectors, and I end up in energy. But it really gets me and it's been almost 20 years now. So

M

Michael LaBelle 06:10

Excellent. Well, it right. I mean, this is why I love energy is just because it's so practical, right? It has every day impact. But then we all have our different niches and expertise that we can apply to the energy sector.

C

Cristina Corchero 06:25

Yeah, indeed. In fact, it was one of the most powerful things I found, it was like, my background was super useful in the energy side. So it was it was not engineer. I was not, let's say, energy person at that time. But the background I had was useful. And that was one of the main main aspects that I found. Interesting for following up on the on this. Yeah.

M

Michael LaBelle 06:53

Yeah. And I'm interested in because you're inspired and brought into this field by a professor. And then now you're a professor, as well, as I write, and we see this impact we have on our students and their careers as well. I was just wondering, maybe, how do you because you have that experience? How do you deal with your students, and those students that are really interested in in energy?

C

Cristina Corchero 07:15

Why don't five I have brought many of them to my research group. So I think I do this again, all the time. As I said, I'm, while I teach in the front, I did also to the engineers and the and the energy engineers, but when I'm not getting to them, when I'm on the computer side of the science side, or on the statistics and data science, which is the name now side, I try to to inspire them, not not only my energy, for sure, in my case is energy, but also other different subjects, that the ones that they kind of foresee, and to see how the how building up teams with different backgrounds, how interdisciplinary teams work, is I would say, the most powerful tool that we have right now for for seeing all the the challenges that we have in front of us. So and I try to to make them understand that even that they typically at the first moment do not differentiate between megawatt and mega tower, differentiated power and energy, which is always a dog I do. They can do things and their knowledge is is important. And they can improve how things are being doing in other sectors. And this is something that they think is important.

M

Michael LaBelle 08:38

And these skills of working in a multidisciplinary team. This is one thing I've learned through experience as well. Sometimes it's difficult to work with people with different we could say educational background or educational focus. And how do you maybe maybe there's not a good

educational background or educational focus. And now do you maybe maybe there's not a good answer to this, but how do you work in the in these multidisciplinary teams to communicate with each other? Maybe that that'd be a best way to ask?

**C** Cristina Corchero 09:05

Yeah, super difficult. I mean, I typically my team, my research team, and now in in bamboo, so we typically merge people from the math side. So mathematicians, statistics and data science and those those were the engineers for engineers, even I mean, electrical engineers, energy engineers. And the as you said, the background at the end makes us think in a different way. When we face a problem. And the first months working together, there should be this misunderstanding all the time, because it's like, you are not going to do the things like I'm saying we have to do it. And it's only a matter of how we have been the to face the problems. So it's a different way of thinking, let's say. So, I always said that. This is the beginning and it always happen. So it's very, it's very difficult that I find a mathematician that joins the group and everything is smooth and nice at the beginning, or other or the other way around. I mean, it's not a maths people think it's when you when you get into this kind of groups, now I have a gal that comes from the social science and political science for regulation issues and so on, and is the same. So, we, we deal with the problems in a different way. So I think this is only a matter of community education, a matter of patience. So at the end, you will converge, and you will know how the other works and how you can help the others or join forces. And obviously, it's a matter of interest. So there is people that want work on this framework. So I have realized also with the with the years that even that you make it easy, there is people that cannot or is not able to adapt themselves to work with other profiles that are super different to them. And they are more comfortable working in areas that are specifically on their, let's say, way of thinking and doing things and so on. And that's okay. It's not a problem. But there are other people that can adapt themselves. And and then you build up this strong teams.

**M** Michael LaBelle 11:22

I think that's an excellent way to put it. No, both in Yeah, there are people that can do this, but also recognizing there's people that can't do this. Yeah. Yeah,

**C** Cristina Corchero 11:31

I think that there is I mean, or I mean, probably they, they are able to, but they don't want to. So it's it's also it's also a decision. And they do not feel or they do not feel comfortable with with this situation. And I have feel it myself. So I have failed. Sometimes, for reasons that were not comfortable discussing some super specific things within a statistician. It was like, Okay, what's the decision 20 years ago, but now I have been working on this for several years. So I have more or less the same knowledge or the same kind of Yeah, information to make the decision as well as you. But sometimes we are kind of mark by, yeah, some levels. Right. And it's difficult to avoid them.

**M** Michael LaBelle 12:20

And is this skill, this awareness, you have this great awareness? I think of, yeah, what people

can do professionally in these teams? does, how does that translate into bamboo energy? Because here, it's, you know, hiring and firing and trying to work with people is really essential. Even more much more than academia, we kind of get by, you know, who was ever around, we have to learn to live with them. But but if you have your own company, you're the founder and chief technology officer. How does this play into it?

**C** Cristina Corchero 12:54

I've tried to break my lessons learned here. So try to Yeah, what building up the team. So the first year and a half, we have the most of time to build up a small team for, let's say, building up the product in an industrial way, we have a result of the research, which was not the silver that we must put in place. And I've tried to Yeah, bring these lessons learned when finding or trying to find the right people for joining Mambo. I must say that it's very difficult right now, for a technological startup to hire people, because of the high competition in cities like Barcelona or others, there are many opportunities for them. So at the end, you have to engage them. And here for instance, energy is a good high because if you find people that is compute computer scientists now, but also the, they somehow feel that they need to do something, and that this is an opportunity for reading the knowledge to I mean, energy transition, climate change, or wherever you can find this gatesman Let's say this, this this added value, or the position that you have offered different than the others, let's say, and they have kind of used this. And at the end, what I have emphasized a lot is that we are not just programming code. But we are working, as I said, with other people that are working on data science and thinking how to forecast data and how to use it. And we also in in our side with commercial people, right, and we have to explain them what we are doing because they have to sell it. So yeah, it's been a challenge, a different challenge.

**M** Michael LaBelle 14:52

And would we classify bamboo energy as a startup or is it beyond that? Okay,

**C** Cristina Corchero 14:58

well, it's a spin off of the research center. And he's a startup right now.

**M** Michael LaBelle 15:01

Yep. Okay. And actually, maybe maybe we could talk about that was how did you get it to the point where it was able to be spun off? Yeah. That was a long story.

**C** Cristina Corchero 15:12

Yeah. I will. I will try to short it. Yes. Though, Dave. Yeah. I mean, it's kind of funny thing, because I'm a researcher. And I'm I that, as I'm not at this distinction, a pure one MIP. Researcher. So I technically apply it one but the researcher, and then it was almost three years ago, there are some programs that try to go research centers and identify the technology that

is being developed to see if it's potentially transferred to the industry. So it's, yeah, they can try to find this uniqueness, right. And there is one problem here in Barcelona, that is built up, right, the Mobile World Congress and the mobile world capital, which is the investors from this Congress. And they do this. So they will go around the research centers in Europe and check the technologies that are being developed. And let's try to see if there is something and they identify bubble of one opportunity. So that was, let's say, the seat, the beginning. But at that time, I always say, I don't want to make a company, I don't want to make an enterprise. I mean, I'm not interested. So we started there is kind of six months of training and exploring business case, experiment, business model and see if there is something there or not. And during this six months, then I somehow get engaged again. It's funny, because people that know me said, Okay, you always are like, you have the necessity of learning all the time. And you are now learning a lot on entrepreneurship. In that that moment. So is that what happened? Like, gather you and probably through? So when we finished this excess months, the decision was made? And we were going to build up the thought. And that's it. Yeah.

M

Michael LaBelle 17:07

So you got to this point, where in the six months, you learned about how to do a company, what was it? What was that type of training?

C

Cristina Corchero 17:14

Yeah, so what they do is you have a product, right you have or even an idea, because there are some of the other colleagues that they had there, that they only have the idea, or in my case, I have the software developer kind of develop. And, and then what they do is that you have to bring this, you have to think how to bring this really talk to a business. Yeah, so you have to build up the end up to end with, with a business model of your product. And with kind of your trip or the decision. So what you're going to do, okay, I'm going to found or not the company, or you're going to transfer the technology to a company that is already working or wherever. And, and then you always speed and do those things, and they decide if they invest on you or not. Okay, so I pass also this, this second filter, I was one of the selected companies there. But also, you know, energy, which is investor for European Commission, well, it's a public private investor. European one, they were also interested in bamboo. And at the end, we reached the agreement with their and they were the first investors of, of a bull. But you ended up with this business model. So if you already have the idea on how to sell it to who you must sell it, which is yeah, the structure you must build up on your company, what do you need, what resources you need? And all those things that you don't know before?

M

Michael LaBelle 18:48

So So you were, I mean, I can use the word cautious, but you were a bit reluctant. And I mean, you you learned the process, and then you got the confidence through this process. And then it didn't seem such a big risk going forward, then is that right?

C

Cristina Corchero 19:04

Well it is. It is a big risk. Because at the end, you know, you stop what you're doing most of the

well, it is. It is a big risk. Because at the end, you know, you stop what you're doing most of the time, even that you combine them, but at some time, on the beginning, it absorbs your energy at 100%. The other things you do, let's say by business as usual, but your energy is super focused because it's everything new. And there is a risk I was I was at some point I was afraid that my group or my activities or my teaching or whatever suffers from this other activity. Luckily, I have a great team with me. It was not myself alone. I work with two other colleagues that I would say that helped me but we are a team that work together. And obviously that that makes let's say things work. But there is at the end there is a risk But Well, somehow I I love risks. So it's not. It's not an issue.

M

Michael LaBelle 20:05

It sounds perfect. It sounds it sounds like it had built up over time. Right. And you develop the software. Yeah. And and then this was like the next natural step. Yeah, it

C

Cristina Corchero 20:15

was. Yeah, in fact, the idea was, I mean, for me as as researcher, is, the best thing that can happen is that you have done something for almost six years. And suddenly, this is going to work in the real world, it's going to really make things change. This is I mean, in a personal feeling, it's wonderful. So you feel super good. Because typically, you do many things that end up in the closet, right? And having this feeling of trying to bring them to really the and not by selling them to the utility that you typically do, but do yourself. For me, it's I mean, it's an amazing way of doing it. I don't know if I will repeat this. But it's being an opportunity for for for having these feelings of doing research that is, yeah. being used. Let's see.

M

Michael LaBelle 21:14

No, it's excellent. And actually, I realized we haven't actually explained what bamboo does. But I have I have one more. One more question before we get there. And this was actually, yeah, the question is, how is it different from research? So you've established? Yeah, maybe I'll just leave it that how is it different during the startup from from the actual just research process itself?

C

Cristina Corchero 21:36

Well, for me, it's kind of funny, when I started this training, the best thing I understand is that when I when when I was doing research, I want to do it. Perfect. And I want to do it, let's see, what's the for right? And the best that was in place and, and, and doing everything that the server can do? Okay, so it was Yeah, I was this this server was developed in European projects. And I always want to cover all use cases, all technologies, all things, all protocols are okay. Then when I started, bamboo, first thing was okay, learning what is an MVP, so minimum viable product, it was like, Okay, you have to minimize what you have done to the minimum thing that you can sell. And this minimum thing is the one that should work perfectly. And did what this was a disruption for me, because it was like, let him behind a lot of things interesting and amazing that they have done that we're not useful, because the industry didn't want them because it was like it is for five years or or in 235 years, they will be useful, but not now. And

you have to focus in in a smaller specific thing. So that was was first shocking thing. And the next one I would say that is even that my research is applied one I work with an industry and I always have design and thought on my algorithms and my my, my developments in an applied way it was research. So if it doesn't work, it say nothing happens obviously happen, but you can you can deal with it right? Now, it should work, it should work well because someone is paying you on their business or for having this over there. And also on the other side, you have bring these people to the, to this adventure, and we are eight now. And you have like kind of responsibility even though they have my group. Right, but it's different responsibility that you have here. So your selling is something more important than before. As I said, having something that works and interests the industry now is I would say the key thing and the key different thing.

M

Michael LaBelle 23:58

Hmm, excellent. And maybe we should actually not discuss what what is right. Yeah, yeah.

C

Cristina Corchero 24:05

Okay. bambooe Energy is as I said, sometimes it's a silver right. So, what what I would like to start from from the bustle, what I do is algorithms for energy management, optimal energy management, so all based on optimization, artificial intelligence and mathematical models for what I say novel energy system, so how this other things that we are introducing in the classical energy systems should work. At one point, as I said, Now, seven years ago, we started to discuss what the aggregator was, and what an aggregator we cater for the demand side should work. What do they need? What how do they perform, how do they participate in the market? So this was a discussion like philosophically A discussion or designing discussion from these a ticket to my knowledge, and then I started to develop these algorithms that I thought that the aggregator will meet. So it's okay, if I'm thinking of an aggregator What do I need for perform my activity. And that was the development that I did. And it ends up in a set of algorithms that builds up the platform, which is bamboo, that is able to forecast the flexibility of my demand for tomorrow. So I have a set of assets of demand consumption, okay, or selves, buildings, industry, so all the consumers, but who is able to forecast the flexibility and what is the flexibility flexibility of the demand at the end is the ability to change the consumption profile. So I always put like an example that is quite easy to understand that I'm now in the in the campus right and there is a temperature that is, I don't know 23 degrees or wherever, if I change it one degree, more or less, probably 90% of the people will notice this, but what what will certainly not is it is a smart meter. So the smart meter will take will change. And this is what I take advantage for. This is a flexibility. So this kind of changes on our consumption that we can do without affecting the comfort without affecting the industry production, for instance, and that we can offer them to the energy system. So number one is able to is to forecast this flexibility to build up the bidding that should be done to the flexibility markets that are nowadays open around Europe, and also in Spain. And then during the day, when I receive a signal from the TSO, nowadays, or from the DSO in the next future, so the distribution system from the system itself, then I know how to send a signal to the devices. So I know how to say the battery, hey, stop charging, or start discharging. Or I That way the temperature, or I switch off fridge that I know that can switch off for one hour, or it won't happen nothing to the to the food that is inside, for instance, some some example. And this is what bamboo said, bamboo, and what our idea is that we want to be a technology. So we want to be the technology that



enables any company to become an aggregator. So any company that has, I don't know, energy service companies, retailers, so those companies that already have the assets already have the consumers bring this consumers really to the center of the energy system, and enables them to participate and take benefit from the energy markets through their flexibility. And those companies typically don't know how to do this. So the idea of bamboo is being this technology that enables them to do this new business, let's say in a kind of, with minimal investment because of the earnings of servers and systems. So or platform as a system as a service. Sorry. So as with low investment, you can Yeah, bring this opportunity to your customers.

M

Michael LaBelle 28:25

I think this is so great, because you know, so many questions, because because this is really the heart of what the smart energy system basically this this, can I call it a software, that's the right term. Okay, so the software sitting right at the middle and controlling communicate, not just controlling but communicating between what the supply side and the demand side and you're essentially the Yeah, the software provider for other companies that would go out and sell the service does that description

C

Cristina Corchero 28:58

Yeah, it depends I mean, the way of implementing it depends on the customer then okay, we can somehow join forces with the hardware side and go together with the inverters, our or self consumption solutions or charting solutions or wherever because they want to aggregate their assets let's say or, we have now for instance, some customers that are retailers that typically retailers are energy traders, so they do not deal with the electricity. This is something that people do not realize but the retailers typically they only deal with money, not with the electricity itself, even though they are an energy company. And I'm doing this new activity they have to deal with added with the electricity itself and they do not know how. So yeah, Bill, I mean, putting this software in place helps them to do this other things that they are not used to

M

Michael LaBelle 29:59

these retailers then would be I mean, it depends on the market. But traditionally the distribution companies, but not what companies, yeah, optimisation companies,

C

Cristina Corchero 30:10

because the distribution companies typically are regulated ones in most of the countries. So we move to the, to the was a commercialize the entity. Yeah, so that sells it to the to the end user.

M

Michael LaBelle 30:24

Okay to the end user? And those are the companies are able to play with, I don't know, what time of day pricing or hedging this type of Yes, activity. And yeah, so my Oh, and the other side

time of day pricing or hedging this type of res. activity. And yeah, so my On, and the other side of this would be like a virtual power plant. Yes. Is this that is

C

Cristina Corchero 30:43

on the consumption side? This is this definition. So virtual power plant typically is what we have done on the generation side. And now we should move the idea and everything to the consumption side. Yep. The demand side?

M

Michael LaBelle 30:58

And on this demand side, then, how difficult because it seems in my interpretation impossible, but so this is why I'm glad that you're working on this is communicating with the different devices like refrigerators, batteries, you know, whatever it can be, the loads shifted a bit and communicated with how difficult is it to, to write the software and to develop the systems for this communication?

C

Cristina Corchero 31:23

Yeah, at the end, it depends on the on this, obviously, on the size of the situation. So if we, nowadays No, we can focus on industry, small, even small, but industry, then there should be buildings, offices, hospitals, capitals, schools, wherever, and then households, right. So it's like this three, three areas. If we start from households, it's super difficult. Okay. Here, you have to go hand my hand with, as I said, with this hardware manufacturer that is already installing this smart meters, these smart devices that can be easily manage, okay? Because if if not, I mean, at the end is super disaggregated. So, it's difficult to foresee even that there, there are companies that are doing this in Europe, I mean, with great success, success. It's difficult, okay. Now, this is kind of being so I don't know, if solved is the world, but faced through the entity communities. So if we start on thinking that this households or this small end users are joined on an entity community, then suddenly, things kind of are easier, okay. And also easier for the energy system, because we don't have to forget that there are many people as me that believe that the demand should be the center. But we haven't done this traditionally. So at the end, you will have this kind of other side. So transmission system operator, energy market, all these agents that see these as a problem doesn't solution, because it's kind of wow, is super disaggregated, this super difficult to join them to, to engage them, to bring them here to make them understand what they have to do. So it's like, okay, better we avoid this. We don't make trouble. But, I mean, I'm super convinced that we are not able to, to meet the challenges that we have in front of our foot 2030 4050 Without the demand, which is impossible. I mean, it's it's not putting in place more renewable. Well, this is not only the solution, so we should do it. But it's difficult for sure. When we move to the other two, let's say to sectors that have said industry or tertiary building is easier because this have been on the last years. Let's say that they have learned about energy efficiency, they have learned that they should somehow invest on the thing, do things better. Also, now we have this high prices of electricity, which always help and that is at least

M

Michael LaBelle 34:22

good for some businesses. Yeah. Well, not really because

C

Cristina Corchero 34:25

people is quite afraid for investing in anything but but at the end they make for me, it's important that I've been in the I've been in the TV or the radio more in the last four or five months that in my life at this not because I'm better is because nowadays, everyone is talking about energy prices, and that's good. Because at the end, we need something to make people realize that they have to do something. Well, if it's energy prices, welcome. I mean, at the end, what I need is that this guy on the old industry realizes that she should or he He should invest on energy efficiency and energy monitoring.

M

Michael LaBelle 35:05

And I want to go back to the comment about putting demand at the center. What do you mean by that? Can we explore that?

C

Cristina Corchero 35:12

Yeah, because typically the demand is a passive thing, right? We are passive consumers, the demand is there, if you think on the energy models, traditional energy models, the man was the data was information that was there, but nothing has to be done here. It's like, okay, we'll be 3030. Okay, are we 2535? Okay, but it's like something that is there. inactive, so it's, it's that and we focus a lot on the grids, smart grids, we should make smart grids we have been working on and I have been working on this for many years, even more smarter, more, and we also focus on the generation renewables, more renewables and changing generation and then asking how to manage it and how to we will incorporate it to the grid, and so on, so on, so on, but no one's really focused on the demand side, and is one half of all these we are talking about. And for me, putting them on the center is really taking care of, which is the role that the man should have, how we teach the demand, or how we do this, this process, so that they may realize that they should be active consumers, they should realize, when they consume energy from where, which energy, at which price, obviously, but under they are an active part of those energy transition. Because if the only thing that we hear about energy transition is avoiding co2 By means of renewables, or I mean, at the end, the consumer thing, okay, then I still do it myself, whatever I want. And it's not the way so but on the other side, they need to see the benefits. So for me being in the center is not only Hey, you should do energy efficiency, Yousuf save energy, hey, there is no guys or wherever then shut up, shut down your your heating, or your houses, okay? Okay, perfect. No, I also want the benefits. So the generation side has benefits for for balancing the grid for years. So why I'm not taking advantage of these benefits. So I, when I say in the center is obviously for the responsibilities, but also for the benefits. So I should sell my flexibility. And I should get money for it, because I'm changing my behavior for you for the energy system. So baby. And this is something that we have also to learn us as consumers. And it's funny, because when you go as ago as bamboo to fun industries here in Spain or wherever. And I say that, hey, but not only take talking about saving money, by saving energy, which also bad, I'm talking about getting money getting paid for what you do. And it's like, Oh, okay. That's interesting.

**M** Michael LaBelle 38:17  
So the industry is very open to this

**C** Cristina Corchero 38:20  
was I want to say very often, I would say they can be trusted.

**M** Michael LaBelle 38:26  
Uh huh. Do you think maybe this is a bit out of where we're talking and your expertise, but for example, ETS mission credit systems? For industry itself? Do you think this is prompting them and the increasing price that they have to pay for emissions? Do you think this is prompting them into this more demand side management?

**C** Cristina Corchero 38:47  
Yeah, I would say that the good thing is that all those policies, yeah, frameworks that are being put in place, have bring them to this energy awareness. So they know half this? Yeah, they know, half the energy on the management board. And this is the big change. And not only energy companies, I mean, not all companies, obviously. But those energy intensive companies, they have now the energy on the table all the time. So that makes easy, obviously, that the going there, even as researcher of us, or a startup or wherever, but going them as a two layer to both them in this in this new in this new business. Yeah.

**M** Michael LaBelle 39:38  
And then my follow up questions are areas that I don't understand. So help me here, but I want to kind of get into like, how does the software work and you don't have to give away any secrets but, but how? How, for example, modeling like you're attempting to model the behavior of being Yeah, looking forward even to the user behavior, and then you can take the data from from the market itself and see how the, for example, time of day pricing will affect that, how, what kind of data do you need? And how does that work?

**C** Cristina Corchero 40:14  
Yeah, so we are not I mean, we, I think people in the energy sector, sometimes is not aware of the huge amount of data that we have, and that we do not use a lot. And that was something that they realized some years ago. And that was what I use. So at the end, we have on bamboo, what do we use, we use metal data. So formation about the weather itself, obviously, market prices, data, co2 data, okay, so this is, let's say, the public side one or the system one. And then on the other side, we use the data from or distributed assets. So that might be for the worst case scenario, only the Smart Meter information, okay? For the best one, we have even behind the meter information. So for instance, the birth years inside the building, or battery,

state of charge, or the we deal with charging points, the car, or state of charge, or wherever. So it depends on what we have the best wood or algorithms perform. And this is something that we explain to our customers. So what if you have, let's say, biggest amount of data, it will all perform better, because we have more information. So how the algorithms work at the end is combining all this data at depending on the asset that we are managing for sure. So we have buildings or batteries, or electric vehicles or wherever, what we know how to do is to forecast based on historical data, and through artificial intelligence algorithms, and those always change depending on the asset that we have in front of us, we are able to foresee the behavior of this asset for the next 24 hours, okay. And within this forecasting, we also have learned how we can estimate the flexibility that this asset can have, obviously, we are talking, for instance, on an industry, this is I would say almost 100% fixed by the customer, because the customer is the one that would say, Hey, you can stop this, or this times or this, or you can, I don't know what I was talking about the fridge, right? You can shut up, shut out the shutdown the fridge for 20 minutes, or one hour or whatever. But between these hour this hour, or my production can be move because these are this hour or whatever. So the underside, I would say that that certainty is lower, because it's super determined by the business, the business itself, but we move for instance, to a hospital to a campus to or to households, then it's the idea is that it's kind of automatic that they can foresee and focus your behavior and your flexibility and then play with it, or play or trade with it.

M

Michael LaBelle 43:25

Yes. And how, how difficult? And maybe it is difficult but but forecasting human behavior is essentially what you're doing then partly. And how do you do that?

C

Cristina Corchero 43:43

Well, I'm not I mean, it's, it's there are many people in Europe dealing with this. I think that everyone's will agree on what we talk on tertiary buildings is pretty easy. They're pretty. It's a if you know, the calendar, it's pretty easy to forecast, obviously with with a small forecasting error for sure. But it's pretty easy to forecast the behavior of this, of this. Yeah, buildings, okay. Or what is about offices? I will say yes to all hospitals or schools, commercial buildings, all these kinds of things is, is pretty easy to work as it would borrow. When we move to households, the forecasting error is quite high. And the most important thing is not the forecasting error. Because typically, if if you're forecasting for tomorrow, for instance, and it behaves quite different from yesterday, it is a small error. Let's see. The boy does that worry disappears. He was like, Okay, why you don't see me that you're going on holidays? Oh, yeah, yes. So it's going to zero it was like okay, Ship is a big forecasting error. Yeah, it's like, okay, count on your flexibility for tomorrow, and you are not at home. That good, I would say that this is the most difficult part. And I have, I have talked a lot with many people that is dealing with this. The good point is when you aggregate it, so at the end, I don't really need to know what my neighbor is doing tomorrow. But what I do know 1000 houses in this neighborhood are doing, and we compensate one with the other at the end. So when you aggregate everything is easier to forecast that when you go, let's say super specific to one.

M

Michael LaBelle 45:43

Okay, so this gets back to your point. And then I wanted to follow up with energy communities,

actually. So and I know that you use making a big push on energy communities and different countries as well. So maybe you could speak to the Yeah, the importance of energy communities within within your Yeah, within these parameters for your company. Yeah. So

**C** Cristina Corchero 46:02

I would say that the energy communities, I think that would be the tool. Now, that will help us to involve all this is more than users. Because being part of something is something that is tangible, right? So you fill it, and you somehow have I don't know, I shared BB shelf portable, typewriter, shared, renewable, they're in place that you're sharing with the neighbors, and you somehow make this energy savings, and then you see how everything is going. I think that this is really an easy way or easy. It's not easy, but easier way of involving them in all those system, then what the one. Okay, so for this site is, is super interesting. And also, what I feel is that from the market operators on the grid operators, it's also easier to accept the small demand side because they have accepted the big one. And also, it's interesting from them, but not the small one. But accepting this small one through the energy communities is also easier. It's like, okay, you're telling me that I can focus on the meter of the community somehow? Yeah. Yeah. For having this. Yeah. So and then they see, okay, then that could be interesting for me. So it's from the two sides that I think that we are, we are is a win win situation. From the consumer side, because being part of something that is already doing things is easier, and is already from the first minute, giving benefits is easier. And from the other side, from the system side, it's also easier to think that they are dealing with a community. Okay, come on, and not with all small end users.

**M** Michael LaBelle 48:05

Yeah, they need things at scale, so that the profits are there, rather than individual households. Okay. And I just, we have a few minutes left, but I just want to maybe talk about the research side of things and and the data I would just maybe ask you kind of expand on on your research center, and and what you're doing there and what people are doing what, as I understand from the internet, it's really this, both hardware and software integration. And yes, if you could expand on a show, appreciate it,

**C** Cristina Corchero 48:38

as I said, What I mean by Boo is a result of there. So what we do is similar things that we have experienced on on optimization, what I learned was okay, there is a huge amount of data, I know how to do optimization arm, so I know how to do management algorithms, but we are not using this amount of data that we have there. And things will work better. And that was like the mindstream of building up the group. I would say some years ago, and and we continue doing this. So the idea is okay, we have information, how we use it, to make this new energy systems work better. And specifically, for instance, we work on energy communities, but thinking inside the energy community, so how we distribute this renewable source that we have installed them, how would you view it if there is a battery battery so they use it of the battery? And how we forecast the things inside the community and how we manage it. This is a challenge that we have in front of us. We have worked a lot on electric vehicle integration. So we have a great experience on vehicle to grid. And now we are working. We are working also with the European

Commission. During the research center and thinking, how we should, let's say, build up or how we analyze the impact that redist penetration of these technologies would pose on the local energy systems, because if we go to a transmission level to country level, probably has no impact there. But if we move to the, to the field to to the local distribution rates, that we should analyze how it will work, and how it will perform there. So we are working on this for the public side so far, as I said, government and so on, but also for some of the companies that are building up these solutions. We have industrial contracts with them, to showing them how to optimally manage this technology there and integrating with other devices that might be on place, because for instance, typically you have a PV installed, and then you install the parking, right, the parking for the latest vehicles. And that's it and you let it there, you are not taking all the benefit that you can have. So the idea is to integrate everything and operate them in a coordinated way. So that I take advantage. And we have shown that these increase for instance, we have demonstrated, yeah, so a year ago, more or less, that combination, combining this can increase the renewable use it so that your own renewable use it almost 15%. And obviously, you can reduce to the energy bill because you're using more renewables that you're producing, and so on. So the idea is can we make it up algorithms or software that combine the integration of the different devices? Now, obviously, we are working with view and directors new energy solutions to see the same to see how we should model them, how we can manage them, and how we integrate them with the with the devices that we have, for instance, there's a project we're working on that they are building a new heat pump solutions. And the idea is okay, that when I put this heat pump in place, is not only how the heat pump itself has obviously it has this management itself, the machine itself, the hardware, but also integrated in all the building system or the or the energy system. We should manage it, let's say that coordinate way.

M

Michael LaBelle 52:38

So it's more of a well, in one sense, or a geographic focus. I mean, everything is a bit of geographic focus. But this is a very micro geographic focus.

C

Cristina Corchero 52:47

Yeah, it's at the end is micro grids. So yeah, yeah. Okay. Okay.

M

Michael LaBelle 52:51

And so so for example, if I have an electric car, and I pulled into a neighborhood, and I was like, oh, I need some more electricity here, I plug it in, it would actually like just he would come from a solar panel nearby, maybe?

C

Cristina Corchero 53:02

Yep. That's the idea. That's what we should do. Right? Because, for instance, we had a funny thing that many public buildings have invested in PV in uninstalling PBS, but there are some of them, for instance, libraries and others that open on the afternoon. And it was like, Okay, I have a huge amount of PV that is not being used, or at least by me, or Yeah, no one near me. Yes.

And, and it's also okay, what if we have what if we installed the battery, what happened? Which is the return of investment, right? So I have to be the material but when I have it, say, have it covered by the cost of they have hat Crusher, this PV with my levels, or even share it? How do they pay me or how do we manage this share of of renewables? Yeah, this the things we try to deal with?

 Michael LaBelle 54:01

Excellent, okay. I won't get into that. But that would probably maybe be blockchain technology and but not only Yeah, not only

 Cristina Corchero 54:10

the trustee thing, we are exploring this now, blockchain has been thought for and again for for money. So for economic transactions, and we are working on entity transaction so it's how we combine them and we are doing this on Simba boo. We are trying to use there was a platform in place of blockchain, we are trying to use the same technology for sending energy signals. So for activating these activating energy things because at the end, we we cannot install several technologies there Right. So it's, we should combine

 Michael LaBelle 54:48

forces. So you start getting credits as energy, like you could have extra energy deficit of energy and you

 Cristina Corchero 54:55

can somehow use the same secure information For sending the signal to the battery, for instance.

 Michael LaBelle 55:04

Wow. Oh, that's great. Okay, for the sake of time, we'll stop our conversation there, but I'm definitely looking forward to well, hopefully meeting you in person someday. Part two, so, okay. Kristina, thank you so much for coming on the podcast.

 Cristina Corchero 55:20

Thank you for invitation. Yeah, looking forward to meet you sometime

 55:24

for sure.



