Siemens Grid Software Podcast <de>coding the future of energy – Episode 3: Completely <in>dependent with Michael Schwan and Thomas Gottschalk

Speaker 1 [00:00:00] I find it really great that your grandpa has maintained his camper so well. What year is it again?

Speaker 2 [00:00:05] I think it's from 2027 or so. Anyway, he's still proud of having bought one of the first eDrive campers back then.

Speaker 1 [00:00:12] Hmm. Over 16-years-old then. Not bad at all. And we're going to the European Championships in Spain with it. I'll just close my eyes for a bit. You can wake me up at the next stop. Then I'll take over again.

Speaker 2 [00:00:31] Hey. Enough sleep. It's your turn again.

Speaker 1 [00:00:35] Oh, I was totally out cold.

Speaker 2 [00:00:38] Can you put my wallet in the glove compartment?

Speaker 1 [00:00:41] Will do. Hey, there's a wallet in here already. What are all these cards?

Speaker 2 [00:00:49] My grandfather kept all the access cards for the various charging providers. He always thinks he might need them again.

Speaker 1 [00:00:57] Okay. But since we have the European Energy Union, you can pay with your user ID at all charging points in Europe, right?

Speaker 2 [00:01:05] Yeah. But I think that if you experience charging in person before the EU, then you'll know why he kept them. Every country used to do its own thing. And then you'd stand around like an idiot in front of a charging station that you can't pay for. I think my grandfather's generation still experienced what dependance means.

Speaker 1 [00:01:29] Why dependance?

Speaker 2 [00:01:30] Well, the Energy Union was founded because after the crises in the 2020s, it was clear that we have to be independent of gas or oil. And that meant, on one hand, decentralizing the energy supply.

Speaker 1 That's ten million solar panels.

Speaker 2 And to make the network of decentralized systems so large and diverse that it is as independent and resilient as a swarm, so to speak. And on the other hand, to control the network centrally.

Speaker 1 [00:02:01] True. Without central energy control for the whole of Europe, we wouldn't be able to access solar power from southern Spain on demand.

Speaker 2 [00:02:10] But we only need it in dark periods, because otherwise we have 20 million small power plants that produce and store electricity.

Speaker 1 [00:02:20] That's right. You can't completely control the sun and wind. If you really think about it, that was a huge step when all European countries merged their electricity grids as well as the regulation of them.

Speaker 2 [00:02:33] No country could have managed energy independence on its own. Hmm. But that's how it works.

Speaker 1 [00:02:41] In any case, your grandfather probably won't need all those plastic cards anymore. There is absolute unity in Europe when it comes to energy.

Speaker 2 [00:02:49] Yes. But thankfully not when it comes to football. Otherwise, we might as well get rid of the European Championship.

Gerard [00:03:01] What you've listened to is our utopia; the best-case scenario. A potential future world full of collaboration across the energy sector. In all our podcast episodes, we will kick off with a short introduction to set the scene on what a bright future could look like. And then we will dive into a discussion on how to get there.

Welcome to Decoding the Future of Energy, a Siemens Accelerator podcast. My name is Gerard Reid. I work in the finance industry with a focus on both the energy transition and the digital energy revolution. As your podcast host I want to explore a range of facets on how we can develop a more or even fully sustainable energy world. Today's episode is all about independence. For this topic we have two great guests. Thomas Gottschalk, founder of the Access to Energy Institute, and Michael Schwan, head of Power Technologies International at Siemens Smart Infrastructure.

Michael, Thomas, it's really great to have you on the show here.

Michael [00:03:27] Yeah, great to be here. Thanks.

Thomas [00:03:29] Thanks for inviting us to it, Gerard.

Gerard [00:03:31] I'd really love to talk about energy independence, and also this sort of centralization versus decentralization and how you see that. And maybe I'd sort of kick off the whole decentralization versus centralization theme. I mean, we're all working from home today. And the reason we're able to do that and do this podcast virtually is because of decentralized technologies. And I'd love to really hear your views on how you see decentralized energy technologies, and will it have similar impact as the Internet has had on our lives going forward?

Michael [00:04:11] Maybe if I can start; it's always difficult to compare to the very, very, very big thing like the Internet. But for sure, in the energy sector, decentralization is really a key topic. And I mean, we are there already. In Germany today, we already have more than two million rooftop installations on residential homes connected to low voltage. And this will increase. For everyone who thinks, yeah, now we have done it let's look into something else. This is just plain wrong. We will all be surprised how much and how fast we will see more decentralized active energy elements come up in our systems.

Thomas [00:04:49] Well, I spent the last 12 years supporting how the electrification of a million people was decentralized, really off-grid, decentralized energy devices. And looking at my house and looking at the situation today, I have around 50 kilowatt peak solar and there's snow outside. So, there's zero power coming from my PV modules. So, so much to

be decentralized, right? So I think it's a bit like how decentralized or the definition of decentralized is. For me today, I'm very happy that there's a centralized energy network around me.

Thomas [00:05:22] So does that mean going forward, guys, that we're going to still have a centralized network? Or do you see decentralized taking over, or is it going to be a mix of the two?

Michael [00:05:33] It will be a mix, I think, because of some special characteristics in our reach. And also, we all know we are now in the winter seasons. So unless houses have impressive 50 kilowatt peak like you have, Thomas, and there is less production on such technologies like PV, sometimes even wind when we have stable weather, and this is when we will need to have some backup resources. And for the backup resources there might still be economies of scale as long as we talk about things like gas fired, power plants fired, of course, eventually on green hydrogen or even larger things for the shorter cycling like pump storage plants. So, there is economy of scale and for overall stability from the networks, from the system perspective, the central grid definitely does has advantages over the individual islanded grids. That's the important thing, and there is no contradiction between these two statements. Generation will become decentralized to a very large extent, but the management of the system and the network, there are big advantages of having this centralized solution.

Thomas [00:06:46] Are we talking about electricity or energy? I just ordered a heat pump which will hopefully arrive before Christmas. But again, the heat pump was solar modules which are covered in snow - it doesn't really help. So at the moment I have a wood fire, I have a natural gas heating as well. So I'm a little bit doubtful that at least for the northern part of Germany, the complete decentralized path is actually viable. For many regions in the world it's very viable. As I said, we electrified around a million people with a completely off-grid solar device and that worked very well. I think you have to differentiate where you're talking, which region you're talking about.

Michael [00:07:30] What the situation is, Thomas, I assume that the examples that you referenced here, it is people who first time get access to electricity, and then of course it is a very viable option to not wait for the large central infrastructures to be built, which takes time, which is expensive anywhere in the world. And so then, of course, completely decentralized, fully autonomous islanded solutions are faster and very efficient. But in places where we have the central grid already, there are these advantages and we have it. I mean, the grid is existing and we see it also looking at the same figure, two million houses with rooftops P. A very, very, very small, really negligible share of these houses has actually isolated from the grid. So, some of we also see is just in real life and on. Yeah, there is at the moment and, for the time being, no real advantage to separate from the grid if the grid is existing already.

Gerard [00:08:33] I the only thing I would add, though, is, is a whole team of energy independents. And I had a very simple example, actually, my little village - I live outside Berlin in a small little village. I recently visited a neighbor who's basically gone off-grid. And the reason he's gone off-grid is not because of economics or anything like that. It's just energy independence. That was his drive. He's not thinking about economics. He's thinking of energy independence. And I could imagine that that trend now intensifies going forward. Because you know, I think people are realizing ‘I can actually do without coal. I can do without oil. I can't do without electricity’. We can't do anything without electricity, right?

Michael [00:09:16] That's right. Electricity is the key form of energy that is most versatile in usage. And I mean, also all the discussions, the big background of renewables, of the decentralization is, of course, decarbonization. And as a matter of fact, by far most of the technologies to convert renewable energy sources into some form of energy that that we can use means we generate electricity. And it's right that you mentioned it is a good example that, yes, very few houses in places like Germany, very few people did disconnect from their systems. And if they do, it is today for sure, not for economic reasons, because you need a lot of special control equipment to manage a stable island grid on your own. But yes, autarky as a value in itself is becoming important to people. And I fully agree if people in places like Europe will disconnect from the grid, it's most likely for such reasons.

Gerard [00:10:18] And I don't know if they're necessarily going to decouple from the grid. It's just they're going to use it in a completely different way. It's more, hey, listen, I just want to be dependent on myself or my neighbors for this electricity because it's so important. But I would like to hear, Thomas, your thoughts. And in Africa going forward, how do how do you see the future of the of the African electricity system? That's where you've done a lot of work.

Thomas [00:10:42] You know, I think that as well, you have to differentiate whether you are in. In a city like Kigali or Nairobi or Dar es Salaam, or whether you are on the outskirts, you know, whether you're 50km away from Nairobi, where the chances that there's no grid are pretty high, and the chances that the grid is arriving there in due time is maybe not so high. And, you know, the available sunshine is a very different story than the available sunshine here in the winter in Germany. It makes a lot of sense, to go for an island solution. We see that in Australia that, you know, where if sunshine is available, if it's not so seasonal like in Germany, it makes actually quite some sense to go independent from the grid or you are actually able to go independently from the grid supply. So, I think for many regions where there is steady sunshine throughout the year, the major share of energy will be produced under their own roof. They might be connected to the grid, they might not be connected to the grid. I think that's the beauty of living in warmer regions, that you don't have those cold and gray days as you have here in Germany or northern Europe. Where, you know, if you want to include storage into your house, you need so much storage because you have to bridge a few days or a few weeks without much sunshine, that it's only possible for very affluent people.

Gerard [00:12:16] Michael, what are your thoughts?

Michael [00:12:18] That's very true. And as Thomas said, I mean, the question is how much renewable energy is provided at your place from the sun, via wind, whatever. And how long is the period when most likely renewable generation because of the weather conditions will be below the current demand? And we also see it in the Middle East, for example, where of course we have also lots of sunshine and up to very large scale developments. The Neom project in Saudi Arabia, for example, I mean, there even a multimillion-person city which will be able to be supplied completely from renewable energies. And the dark periods where generation is below demand, it is not two to three months like we have it here in Europe. It is not even two weeks. Then we are coming into a range when even this period can indeed be covered mainly from storage.

Gerard [00:13:18] Can I ask you, sort of, we take independence to a European level. I think what you see across Europe now is governments realizing, wow, we need to become more energy independent. Can I ask you both just how you think we do that?

Thomas [00:13:35] Well, you know I think it's interesting that that needed to have to for governments to understand that independence is important, that we needed to have a war for that for governments to understand that. I think, you know, if you can't one-on-one together, you know, even ten, 15, 20 years ago, you know, would have said, well, you know, what is important for Europe? Oh, it's energy. And, you know, what can we do? Ah, there's wind, solar. We can have interconnected grids, we can build supply in the north. And in the south with wind. We can have our solar areas connected. It's sad that we need to have a war for governments to basically say, hey, you know, let's be energy independent. I mean, all the billions and billions of dollars which I spend on gas imports or coal imports or whatever, energy imports, if we would have left them in Europe, you know, they would have been, I think, such a success story for an economic growth and economic development within Europe, but that was politically not wanted, I think, in the early 2000s. So yeah, I think let's go more renewable, let's interconnect the windy regions with the hydro regions, with the sunny regions and really reduce the dependance on energy which is not created renewably within Europe. And I think that we have so much potential to do so. I mean, Michael is referring to the two million solar systems on German house rooftops. So, let's have ten, 15, 20, 25 million or 40 million of those. And, you know, let's move that needle. Let's have more windmills where the wind is blowing, let's interconnect with other countries. And I think that's what we could have done ten, 15 years ago, really pushing for it when it was clear that the price of renewable electricity will come down. It's only a function of mass production. So, I think that's what we need to concentrate on.

Michael [00:15:37] That's fully right. And definitely we are suffering nowadays because we did not progress as fast. In retrospect, not even nearly as fast as we could have moved, if there had been more focus and more push and support for renewable generation. The thing is, in Europe, and we discussed this before already, the key thing is not only the renewable generation, but these winter seasons when whatever renewable generation we will build, and of course, overbuilding to extreme cases, suddenly the gap will become lower, but there will remain a gap. And where we need to have additional energy delivered, also electricity when we start on the electricity system. During times when we do not have enough wind and PV generation, and this is the question - will we be able to build enough electrolysis capacity, for example, to produce our own green higher hydrogen? Or do we continue to import primary energy in the form of green hydrogen also from other countries? But if we would do so, and I think this is indeed what politicians hopefully have learned the hard way by now: Do not focus on one or two more or less difficult countries and regions where to get the supply from, but diversify and make sure that you have a lot of sources from, let's say, stable countries. And the good thing is, in general, there is more potential around the globe to produce green hydrogen than we have natural gas resources, for example. So, in principle, we are all set to have a much more diversified infrastructure here.

Gerard [00:17:24] Yeah. I think the one thing that keeps coming to my mind is cooperation, and the reason I say that if I think of my neighbor going and trying to go off grid, it is at an incredible cost. It would have been much better if he decided to supply some of his neighbors. And if I take it beyond that, actually, that's what we should be doing in Europe. We need to be working with each other across borders to make sure that Europe can gain this energy independence. And I think that's a key thing, right?

Thomas [00:17:51] I think that's the absolute key thing. And, you know, I think it's funny how the combination of being decentralized - your neighbor having his or her solar panels on the roof and having a battery somewhere, but as well being interconnected to Portugal, to the coast of France and to the Scandinavian countries to really benefit from the regional renewable energy availability. I think it's both, it goes hand in hand to reduce the energy needed per household by just increasing their energy, renewable energy, share production on the roof or in the garden or wherever they do it. But as well, just really interconnect, interconnect, interconnect. I think that's the secret. There's so much renewable sunshine and wind on the European continent, plenty more than we actually need. We just have to realize it and have to ensure that the electrons which are produced in Ireland with Irish wind are somehow transported to Poland and vice versa. So I think that's the magnificence of the job, which is ahead of us, to be connected.

Michael [00:19:02] That's very true. And this is really the background of all the energy transition. And I always have this slide in the presentation when I talk about energy transition, the famous Desert Study from 2005-2006 and we're already back then. The technology to create energy is available. It is really more a challenge of distributing the energy to where it's needed from the places where we generate it, and to make sure that we cover those periods. But in total, the energy balance in itself is, honestly speaking, less of a challenge.

Gerard [00:19:40] Can I ask you both about … You both are engineers, I'm not. And I'd love to hear your view on the most exciting technologies you see going forward in this whole area of decentralized energy and energy independence - and why.

Michael [00:19:59] That's a very good point. And I would have asked you to go first, because indeed, this makes us engineers think, obviously. And the other key statement when I talk about energy transition is that we have all the technologies available. So, this is why I need now to think about your question and, honestly speaking, I think we have much more of a challenge really in the secondary systems and technologies, meaning communication control and between all the different and now many more active players in the energy system, because this is what we don't have at the moment. And so we somehow need to talk to these again, two million rooftop PV installations in Germany, which we are not doing today. And of course, in principle, we would know how to talk from one computer to the other. But, somehow, we don't do it. And this is really a key thing that's blocking us. The primary technology really is less of a problem. Obviously, we have these installations, we have tons of home storages already. But making sure that all these things work together smartly for the benefit of the overall system. And of course, meeting the needs of the individuals. This is still a key challenge.

Gerard [00:21:19] So I understand that. So, you're talking really about digitalization software and controls, really, and how that works going forward - which is not clear at present.

Thomas [00:21:29] I'm not a very good engineer, but, you know, I believe that most of or actually all we need is available, right? We have really efficient wind turbines. We have very efficient solar panels. We have batteries which work. I just recently had a conversation with a colleague in France and he couldn't believe that, you know, we don't have our smart meters rolled out across Germany. He was sure that Germany must be so ahead because, you know, apparently it's done in France. Everybody has their smart meter or a digital meter. And, you know, when you heard that, that we are lagging so far behind in Germany. He was wondering about this engineering nation. And for me, it's sort

of like what is lacking is not a technology development or an innovation. You know, we see that is happening as we are speaking. Solar panels become more efficient and batteries become cheaper. Windmills became so much more efficient over the last year. So all of that is happening and is available. And actually, in the end, it's mostly regulations. With two friends, I have a large solar array on the roof of a of a storage unit and we have tenants underneath it. And it's impossible for us to sell the electricity which is produced on the rooftop to those tenants underneath there without, like, crazy hurdles. And those hurdles are only made through regulations. It's not that we have to invent more technology to sell the electricity, which is produced on the rooftop to the tenants which are working underneath it. It's just simply a regulatory nightmare, which we have at least in Germany and probably as well across Europe. So, I think what we need is, like, deregulation or a different regulation and we need to have politicians who really say, well, let's imagine how the future could look like or should look like and let's work towards it. And I think that has happened. That hasn't happened over the last 15 years, at least in Germany, where it was, I feel in many ways actually in the opposite side, you know, how can we make it more difficult for renewables to actually be utilized? And, you know, how can we spread the distribution of them?

Michael [00:23:56] Yeah. So, I also rephrase my answer and fully agree with Thomas here. Yes, the biggest challenge actually is on the side of processes and regulation, because, I mean, on top of the examples that you've just mentioned, it is even to the point that technical capabilities, technical potentials that we have already today in the installations that are out in the field are not even used, not fully leveraged. I mean, everyone is also talking about flexibility, just thinking about flexibility in renewable generation to use the potentials that today's at least modern wind turbines, modern PV inverters can offer. And we are not doing it, because it is not foreseen in the regulations. So, this is really a big chunk of work that's ahead of us there.

Thomas [00:24:42] You know, I have a 72 / 75 kilowatt battery in my electric car. My perfect home storage opportunity, right? Vehicle to grid. Is that possible in Germany? No, it's not. And, you know, that's just, like, you wonder why isn't it? Why isn't it working? So why can't you use that battery storage as grid balancing, as an as a solution when there's snow on my PV panels? So, I think that is the issue. It's not the technology, it's not the innovation which is which is lagging behind. It's the regulations which are too complex.

Gerard [00:25:16] But surely the good news is that this drive for energy independence across Europe, starting with governments, but also to the end customers who are all putting in solar, they're putting in heat pumps, they're putting in batteries. Surely that's now going to force change in these regulations to make this transition easier.

Thomas [00:25:37] And I think what's going to be really important is the influence of lobby groups, right? I mean, what was Gazprom putting - $100 million - of lobby investment every year into the European continent? So, I think that needs to stop. We need to really think through how this energy transition can be done without trying to please big corporations, but trying to ensure that there is energy independence, and then that it works for the households in the countryside or in the cities, and that, you know, energy regulations are not made by big and large cooperatives.

Michael [00:26:20] So we are seeing the first steps. Thomas, you also mentioned smart meters, for example, where indeed I can only confirm, internationally, no one can understand why we in Germany do not have smart meters. But just now really going on right now and our government is trying to do a restart of the smart meter rollout by

simplifying the requirements and making it more practical. And let's see whether the spirit a) successful and b) transported into other areas.

Gerard [00:26:52] Can I ask one thing? Just as me is the non-engineer. I mean, I'm surprised neither of you actually mentioned storage, right? Because I would have thought that's like the holy grail of decentralized energy, right? Am I looking at this wrong, or…

Thomas [00:27:10] Yeah, I know. It's certainly the holy grail. I have 33 kilowatt hours of storage in my house, so it's there, right? It was expensive to put it in, but, you know, I put it in three years ago. So today it would be, I think, 30% less. So it's just scaling it, right? Just making it available. And the innovation around is happening. So, again, the technology is there. It's not that, you know, we still have to wait for it. We still may have to wait for it so that it becomes extremely cheap, but it becomes, you know, it will become extremely cheap to scale. That's what we saw with PV panels, right? You could have bought PV panels like 15 years ago for $1,000 each panel. Today, you buy it for $100. So, similar developments will wait for us in the battery sector, but it needs to be empowered, you know, it needs to be enabled and that more and more people are doing it. I think this year we will see a huge chunk of batteries being installed in Germany. So, we will see quite a price drop over the coming years just due to more capacity building in the production side and more innovation in product development.

Michael [00:28:19] So for sure, storage is important. And I mean, we talk about storage, by the way, maybe we didn't name everything ‘storage’. And I mean, as Thomas said, yes, we will have. And part of the story is I think we already have much more storage in our system more than a few years ago and much more than maybe most people would actually imagine. It is home storage connected to a lot of these rooftop PV plants. It is the electric cars that are now coming. I mean, this is electricity storage and we are getting storage in conventional power plants, by the way. We're today already a large share of our balancing power is sold by the entity that is named Power Plant, but it's actually coming out of the battery, not of the coal-fired generator. And I mean, ultimately, I was talking already about the gas fired plants for the dark period in winter in Germany. And of course, it should be green hydrogen. And then we need storage because green hydrogen, if we produce it in Germany, in Europe, it will be produced during summer, when we have lots of wind and PV. It will be stored in the gas caverns that we do have available already. We only need to do it. We know this since ten, 20 years or even longer, but we need to get going and we need to get faster.

Gerard [00:29:33] Can I switch themes a little bit and talk about centralization, which is, right, If I look at, say, what's going on in the North Sea, what we're doing is we're building out a whole pile of offshore wind. And actually the most sensible thing seems to be that you would connect countries together and you would also then realize what actually a lot of the loads is not in, you know, in northern Europe. It's actually it's down in northern Italy, it's in southern Germany. So, this means you have to sort of build out the grid, right? Which has been troublesome up to now. And I suppose I'd love to hear your views on that and whether there's technical solutions that we can use to actually get more, you know, more power down existing lines, etcetera.

Thomas [00:30:18] You know, I'm living close to you, Gerard, right? I'm living east of Berlin, 60km east of Berlin. And I was traveling up and down Brandenburg where Nord Stream 2 was built. And I don't know actually how long it took, but it didn't take very long to build that massive pipeline going through federal state things in Germany. So, you know, so it seems to be possible to build infrastructure if it is pushed. So, the question is, is it so

difficult to build power lines from the north of Germany to the south of Germany? Is it regulatory? Is it emotional? What is it actually? So the pipeline was built in quite some speed, right? So whenever we drove down those streets, we saw ‘wow’, you know, and a kilometer further, this is done and that is done. So again, I think that we don't have to invent as well as some technology to make it happen. We have great DC power lines which are extremely efficient and which need to be put in place.

Michael [00:31:25] Yeah, it's a good example. And most likely the story is the same not only for gas pipelines, but for electricity transmission lines as well. Building these things actually is not a problem and it doesn't take too much time. But the approval process to come to the point that you can start building; this is where in Germany it still takes us ten to 15 years, which obviously is a timeframe that's completely out of range for the pace of change that we require here and as we're discussing. But I mean, Gerard, to your point, of course, you're right. Offshore wind is obviously something which is not decentral at all. I mean, the individual wind turbine still is small and part, of course, just giving the situation of the installation offshore, it is connected to the onshore systems or to any form of power system in large chunks and we need to transport it. And we did not discuss so much. We always discussed about more of the households, the rooftop PV. Germany is a rather industrialized country. Across Europe, we have a lot of heavy industry, also a lot of modern industry. By the way, datacentres are huge consumers of power, large data centers, easily five, six, 700 megawatt. So we have these large consumers that will have no chance to produce energy locally. So we need to transport. We can do it. We need to think how to do it cleverly. And as a matter of fact, power lines. Today, even in the transmission space, you're actually constrained by technology to a few gigawatt per line system. A gas pipeline has an order of magnitude higher capacity in energy if you convert the value of gas, for example, to electricity. So we need to think how to route cleverly. But again, technology is there and what is important to understand, it might not add to decentralization what we were discussing today, but for independence it is important to have a generation mix, so to use offshore wind power because the characteristic of generation, meaning when is the wind available out at sea, is significantly different from the onshore wind characteristics. So, in general, this is helping a lot to increase the independence of our energy supply.

Gerard [00:33:45] Michael, can I can I ask you about something that you mentioned earlier on, which was just the whole hydrogen thing. And I'd like to ask you your views on power to gas, and whether you're actually going to produce it essentially or decentralized. Or is it going to be a mix of that?

Michael [00:34:04] That's a good question. And I know there's a lot of people who say it needs to be central for economy of scale. But honestly, I think we will see a mix, to put it short, because it's the same like with PV or with wind, the individual electrolyzer is a rather small module. So yes, you may have some scaling effects, but it is not huge and we easily can imagine applications where also on a smaller distributed level it will make sense to use the flexibility for balancing in a local area and not only on the large central system.

Gerard [00:34:39] Thomas, do you have any view on that?

Thomas [00:34:43] I'm not very deep in green hydrogen. I've been adopting green hydrogen for a long time, but it really depends. I'm so far away from it. So, you know, I hope it's not only just a new technology which is brought in by the big corporates to, you know, replace natural gas, but with green hydrogen to have another story which they can sell.

Gerard [00:35:05] That's fine.

Michael [00:35:06] And I think we see first examples, by the way. So, the green hydrogen installations that we have by today, I don't know yet, the gigawatt scale installation, there's always discussions on these things, but it has not materialized. But for example, some villages in Germany, some communities who are already looking very actively into the energy topic, they are starting to get electrolyzers on their own because it helps them to store energy for the winter season and to also produce heat. This is, by the way, also very important to produce heat out of the green hydrogen, which is much easier than to replace fossil fuels on these use cases.

Gerard [00:35:53] What I'm hearing from both of you is that it's not one or the other. So, in other words, it's not centralized or decentralized. It's both. And in fact, if we want to become more energy independent, we actually have to embrace both decentralization and centralization, which is sort of something new, if I may say. Am I hearing that right from both you?

Michael [00:36:15] Definitely. Yes. For me, like I said before, it sounds like a contradiction and it is not. As a matter of fact, we will have a massive decentralization on the generation site, but we need to distribute some of the generation across the country, even across countries. And this is most efficiently done in a central system, which will not do all of the job. We might even see local hydrogen applications, for example, like we just discussed. But there will, let's say, remain enough work to do for the big system.

Thomas [00:36:48] I think it's decentralized energy production distributed centrally or distributed to where it is needed.

Gerard [00:36:57] Okay. Very good. Thank you very much. That was enjoyable.

Michael [00:37:02] Yeah. Thank you.

Gerard The statement Michael made, and Thomas underlined, fits the episode’s topic really well. Generation will become decentralized to a large extent, but there’s a big advantage to having a central solution for the management of the system. Bottom line is that it’s not about decentralized versus centralized solutions or independence versus dependence, but instead about the best way forward. And the truth is in the middle between all of these variables.

If you’d like to learn more about what we’ve talked about today, I can recommend a visit to the Siemens Grid Software website, at siemens.com/grid-software, as well as the Siemens Smart Infrastructure LinkedIn and Twitter channels. You’ll find all the links in the podcast description, and if you have any questions concerning the topics discussed in today’s episode, please feel free to email us at grid.software.si@siemens.com