

## Transcript - Episode 46: Integrating Emerging and Cross-Cutting Technologies: Electric Vehicles with Kevin Cooper

### Mike Lesiecki

Our series on the Future of Work is continuing with the focus on integrating emerging and cross cutting technologies. We are hearing from educators on exactly how they are creating changes and new opportunities for learners in partnership with industry. Note that this presentation does not necessarily reflect the views of our sponsor, the National Science Foundation. A video version of this presentation is available on our website, Preparing Technicians dot org now it's time to introduce our speaker Kevin Cooper, from the National Electric Vehicle Consortium, the navc welcome, Kevin, you've been involved with technical education for a long time have an interesting background in engineering and semiconductors. Tell us a little bit about yourself to our to our audience.

### Kevin Cooper

Thank you, Mike Lesiecki. And thank you all for having me today. So I'm Kevin Cooper. I actually have a doctorate in chemical engineering with a specialty in electro chemistry which comes full circle because I'm working on electric vehicles and batteries again, I spent about a decade in the semiconductor industry as a process engineer and then spun off a chemical company and developed chemistry, supported semiconductor industry. And from there I owned a small business. And after that, I've been at Indian River State College for about a decade as well and very heavily involved in the ag community, a lot of energy projects and you know, electric vehicle projects

### Mike Lesiecki

At Indian River. Kevin, are you what is your title that are you a dean or administrator? Well, how does it work?

### Kevin Cooper

I was the senior administrator for many years. And now I focus back on grants again. So this is my career path, the electric vehicle and some mentoring work

### Mike Lesiecki

I do. Great. Okay. Take it away, Kevin.

### Kevin Cooper

Thank you, Mike Lesiecki. First, I want to give you a tiny bit of kudos here. So your work that you were doing is very forward thinking the two parts. I mean, you started it three, four years ago, and you were very focused on cross disciplinary and you were very focused on the business skill three, as you said, the business knowledge and processes, and that that was ahead of its time, and it's showing relevance now in two industries, I'm going to be talking about one of them. But the two that are going through a once in a century type transition are renewable energy, and the automobile industry or available in general industry. Now the energy industry is going towards renewables and automobile and vehicle in general industry is going towards electrification, which has a lot of definitions. Today, we're focused on a lot of those convergence in the electric vehicle industry. And I'm gonna go through this slide for a

couple minutes. And then I'm going to come back to this slide at the end. And one of the reasons I want to spend some time on this slide is we work with a lot of colleges and universities 200 plus of them from this work, the work that CREATE those the mentorship work, and every time I bring up Eevee presidents administrators, and most people push me towards the automotive program, which is the automotive maintenance, repair and operations. That is a field within EV but there are a lot of fields and a lot of jobs across all the fields. And they all do have some converging skills, but they all have independence. So when you study your ecosystem, your local ecosystem as a community college or university workforce, really try to identify which area you should start if they're building a manufacturing facility in your area to make cars, you probably want to focus on mechatronics. We just had the opportunity to tour Tesla's giga factory in Austin, Texas. And it could have been making gadgets, they were taking huge cars, and it's so neat to see a huge model wide picked up by a robot, and within a second precisely placed within submillimetre resolution to be manufactured, but it was entirely mechatronics. The battery and analog part has other parts, but the manufacturing of its car itself is very mechatronic based. And that goes across a lot of these disciplines, we got to understand what the needs are. I'm gonna go on to the next one. But I wanted to make sure Mike Lesiecki, if you had any questions, you just interrupt me when you see fit.

### **Mike Lesiecki**

Well, it's interesting, because you know, in today's world with all the chip act and all the focus on semiconductors, if you talk to those workforce, people at the companies what they want is Mechatronics isn't that interesting? You know, we're talking about cross disciplinary skills. And you mentioned it that, that each of them has their own thing, but they also have at the core many similar things. I think that's fascinating.

### **Kevin Cooper**

One other thing I wanted to point out, just come full circle with what you were saying at the beginning, Mike Lesiecki, when we were at Tesla, one of the things that they wanted every technician to know is the business process and the that what is co located on site. Their margins are all with every technician understanding the full business case process. And if they have to do or appear to a robot, they have electricians in shop, they have robotic repair in shop, all their waste stays on site all, you know, gets reprocessed. And so they wanted the technicians to know the full cycle. And it's funny because my origins is semiconductor in the day I started at I was at Motorola semiconductor. I took a two week semiconductor processing course. And every employee took that to understand the full semiconductor process as well. Understanding the business knowledge is super important. It

### **Mike Lesiecki**

It was funny I was it, we're just talking about business knowledge and processes in industry, factory metrics are important, right? What's driving us? What are our key performance indicators, and they anticipate their technicians to be aware of those things and to participate in that. And yet, sometimes if you go into college programs, we don't address things like that at all, you know, metrics. So I think there's a lot that we can learn from looking at both sides about seeing a place like the Gigafactory and understanding some of their drivers. Anyhow, we're getting off the topic. So I should let you get back to the presentation I'm

## Kevin Cooper

just gonna go through these bins here. But Mike Lesiecki, I just want to reiterate your point, data literacy, and understanding data science is becoming more and more prevalent across all manufacturing realms. And I think there's a lot of ATE projects actually focus on, you know, putting, you know, contextual math into the projects. Okay, good. So the second, the second bin here is maintenance, repair and operations. And this bin is what I started talking about, which is repairing of electric vehicles. But as you think about it, and if you're thinking about it holistically, I want you to think about aviation, Marine, and automotive. And then there's a huge category that everyone ignores, which is bigger than all them combined, which is the light electric vehicle, and which LEV for short. And there's actually certifications in that. If you look in the US, there's already something like 170 million light electric vehicles. The definition is rough, but it's normally under 60 volts, which is golf carts, bicycles, scooters, a whole lot of other things and their certifications. And they do need a lot of repair. And quite frankly, a lot of risk in the industry. And a lot of the risks that insurers are worried about on a light electric vehicles because homeowners are trying to repair them. And they're not using certified batteries. And they're causing fires, you read about this every day, there was a container ship. And that burned down there was an apartment building in New York that burnt down. So I think as a community college, there's certifications that are attainable, and are good entry points. A lot of folks should think about adding a light electric vehicle type certification as well. If we go on to emerging technologies, and this is what's interesting on the convergence, and I have a slide coming up on this, I think, is when you talk about EV you talk about autonomous vehicles as well. So you have to understand the radar, the LIDAR, the optical sensors in the car and make sure those are aligned and that the technology is there. So there's four technologies that emerge into EV, the battery technology, you have the automotive technology, you have the autonomous technology, and then EVs actually don't offset carbon footprint, any more than like regular cars right now, if it's not coupled with renewable, so as you build this whole idea of getting more and more EV cars and all these cars that states have standards, it's super important to couple it with renewable. Which brings us to the next one. And the next one probably has as many jobs in these five bins as all the as the other four bins combined, which is the charging and charging infrastructure. And it can go anything from utility scale, where you build fields for fast charging, and that's part of the NEVI (National Electric Vehicle Infrastructure) money that went out there the infrastructure money to build the electrification highway, or it could be local charging inside the house inside the garage. inside, you know, parking deck, and at the high level, it's really, really similar to the jobs that people that have substations and high voltage training in solar and solar industries and just utility in general. But in the charging garage, it's really just an electricians helper that's doing the work. And it's another area that a lot of schools can scale up, because it's an attainable, easy to get credential to go out and install. And there's just a huge need across here. And I'm gonna go more into the convergence on this in the next slide. But the last area, I wanted to discuss a little bit is fleet conversions. And, you know, if you look at Fleet conversions, it's not obvious what the skill sets you need are because it is high voltage. It's a lot of economics, like you said in your skill three, you know, the business knowledge is it makes sense to convert, you know, what makes sense to convert. Like some things that makes sense to convert like mail trucks because they brake a lot and most EVs have regenerative braking, so you're saving a lot of energy from the braking. When you're converting large fleets like school buses, you got to really look into not just the electric power draw you have and if there's a supply chain for the equipment, you're going to need to install. But these equipment gets really hot. And in the winter, you're going to heat your garages so that it maintains a temperature for charging.

And it's summer, you're going to air conditioned garages. It's not going to no longer going to be open air. So you really have to also learn a lot of HVAC skills. Mike Lesiecki, any questions? Before we go on?

### **Mike Lesiecki**

It's a it's a fascinating discussion. You know, I have to admit, you mentioned not many people recognize the light electric vehicle market. I have an electric bike, certainly. And I'm aware of some of the issues that you mentioned about the dangers of fire and things like that for, for poor charging systems and so on. It seems an area that I haven't really realized there's an opportunity for technicians now. Yes,

### **Kevin Cooper**

Mike Lesiecki. That's correct. And what's nice about that, and just to stay on this, like for one second, the light electric vehicle has an industry recognized certification. So there's something that exists that the industry recognizes. And then in maintenance, repair and operations, there are industry recognized certifications from each of the vendors, Tesla has a certification key info, where they all have their own certifications. And then NSF actually funded a couple projects, Ken Mays leading one of them, which is the EV Pro Plus, that offer a certification in conjunction with the Society of Automotive Engineers. So in that box, there's a lot of industry recognized certifications. Mechatronics has certifications, but in the other bins, infrastructure, charging, charging infrastructure for the conversion, we're still kind of in the wild, wild west. And that's one of the things we're working on as a consortium, we're helping create those standards. And we're helping create those certifications so that students don't just come out with the skills but something industry recognizes. Perfect, let's go for, let's go for it. So I wanted to show this picture, Mike Lesiecki, if you're not familiar with what this picture is, it's seen about on 40% of charging stations across country, and it's kind of a crazy stat 40% of charging stations are down at any point in time and 2023. Imagine 40% of gas stations shut down, you know, so. And the reasons that they are down are all across the board. But before we really get large adoption of the EV. across the whole United States, we had to overcome this charging anxiety that people have this range anxiety that people have. So properly training people to install charging stations and having certification standards matters. And I want to just take you through an example, if you were to install a charging station at your local grocery store, the first person that comes out this site analysis, and this is the convergence of technologies, they have to look at CAD drawings understand what the electrical is where the plumbing is, where the traffic is everything else they have to understand CAD after that they have to model what it would take, you know, probably in CAD as well to build the charging station at a certain location and do some business modeling. Does it make sense to run high voltage lines this far? Can we bring it any closer? The next person once you decided to location and cut in all the permits, the next person is really an excavator. It's a lot of construction skills they use they had to dig the ditch and run the lines, you know, it's excavation and, and conduit. The person after that is a high voltage electrician who installs high voltage lines on this charging station. Now it's electrified. Now you have to network it. So that person needs to know cat 5 cabling, they need networking. And last but not least, it has to have an IT interface. So you can charge for the charging or have it free or keep track of it. So when you look at the skill of charging technician has its cat, it's high voltage, it's excavation, it's IT, it's networking, and the last element is cyber. So those are just convergence of all these skill sets that fit into a charging installer. And quite frankly, the closest that's out there is someone who's certified in like solar like

NABCEP certification because they have the voltage, they have the communications and they have the excavation portions of it. So an activity to the connectivity. Yep.

**Mike Lesiecki**

That is a fascinating example, it just covers everything. It's like one of the best examples of cross disciplinary STEM stuff I've heard it's really good. Mike Lesiecki,

**Kevin Cooper**

let me see if you can guess what is the number one reason a charging station is down? It is Internet connectivity. It is you are right Mike Lesiecki. It was a wild guess. Yeah, its the IT world is the main reason they're down. And there's just so many meta interfaces on it. So like so many software updates can have an effect on it because there's no uniform. I think a lot of manufacturers have now switched to Tesla. I think it's up to 12 automotive manufacturers are now switching to the check Tesla. So there they are standardizing it somewhat, but right now, there's a lot of different stations out there. And then the number two reason actually is just the vandalism. You know that and one of the challenges different states have is like a fast chargers had to have an auto button that you can hit to go off a case it's gonna be anything. People come by and just hit that button a lot. And you can't just have anybody undo that button. You had they actually send out a certified electrician to hit the button. And that is actually why Tesla forms these partnerships with WaWa and BP because they certify people at the gas stations to go, you know, that's why it's not just standalone charging stations. Cool. Next slide. Oh, I

**Mike Lesiecki**

like this. Yeah,

**Kevin Cooper**

this is probably outdated already. This is from about six months ago. So I've never seen anything like this in my professional career before working on electric vehicles and renewable, I worked in the nuclear world, and nuclear world had slow growth. I think in the last two years in the United States, there's over \$100 million going into manufacturing of, you know, electric vehicles. And every place they're building electric vehicles, they need a battery source next door. So you know, they're built, every one of these has a battery place next door to it. And in the battery world, there's batteries for automotive, which are called automotive batteries. And then they also provide batteries for the grid, which are called ES storage batteries. So most of these spots that are building batteries are doing both actually, which is good for both scenarios. They're building batteries for automotive and they're building batteries for the grid about 80% automotive lot, a lot higher margins in the automotive battery world is the reason.

**Mike Lesiecki**

The term Gigafactory appears several places. Here's that's unique to Tesla?

**Kevin Cooper**

It is unique to Tesla, it's just I think it's their marketing term. And what's interesting about this is the skill set for a battery manufacturer is much closer to a chem tech than it is to an automotive tech. So if you're building these programs around these spots, and a lot of them are built in the southeast here,

and there are a lot of programs opening in Alabama, Georgia, South Carolina, North Carolina, Tennessee, South Carolina has its own consortium working with a lot of these companies headed by Robert Elliott. And then Clemson has done a lot of work in the area as well. But they're they're building Mechatronics programs or chem tech programs to help with the battery world. I'll go back to my original statement, a lot of schools have focused on automotive programs, but they really need to transition in these other areas. In fact, those states that are building them on the right side of the US, those are very late adopting states in terms of adopting EVs themselves, they may be building them, but it's the states on the West Coast, California, Oregon, part of Washington that are early adopters of EVs and need more automotive technicians the other side, they really don't need them yet. So I'm going to come back to this for just two more minutes and tell you about a couple of things that are going on, that people should be aware of, and that are cross cutting across all these. And I'm going to just throw some names out there so that people know who to go to. So one thing that is unique that is really far behind this, there's 800 High School automotive academies. And probably a dozen maybe two doesn't have EV resources, you know, it just they're expensive to build. And then they're fairly expensive to transition to EV. And you need different criteria and different you know, it even infrastructure, you need more high voltage, you need more safety, you need a lot of stuff. But there is a school, Weaver University out of Utah, got a large grant to convert like 16 high schools in Utah. And they built a really, really good model of what the knowledge skills and attributes you need coming out of high school so that you can come into college Academy across a lot of these fields in EV. So the first group I would talk about is the group that I'm going in order of from high school through college to forward. So the Utah group has done a fantastic job of helping build the high schools and it's very systematic, they go in and do an analysis. And then after the analysis, they find the money for the equipment, then they train the faculty at Weber state and then they launch it and they've been very successful at scaling this up. And it's a model worth replicating. The other group that you hear all the time and EVs have become sexier and better like in like from an automotive perspective, more people want to work in it because it's hot check. It has addresses issues, but it still suffers with diversity issues. And specifically women. There's not a lot of women in the automotive world in general. And Tesla actually even struggled very heavily to get women into their START academies. And I asked them, you know, what, why do they focus so much on it besides just diversity and they actually had good data, which I found interesting, that productivity goes up when you have a diverse workforce, you know, people try to, you know, learn from each other and different mindsets and everything else. But they funded a program at a Rio Hondo and John Frala where he has whole cohorts of women training to be automotive technicians and he's been very successful at it. So that's one other model worth copying like you add something or

**Mike Lesiecki**

Does he use a women only cohort. He has he had both

**Kevin Cooper**

women only and he has mixed cohort but he's been very successful having you know a huge ratio of women compared to the national average. He helps others replicate .

**Mike Lesiecki**

I'll make sure we put a link to that in our show notes. Yeah,



**Kevin Cooper**

please. So I would keep a link to that into Weber State, you know. And then the I'm going to jump just to the college programs. I mentioned earlier that Ken Mays has the NEVTEK program and they have tech class now. And what he does is he goes into this time around with his new grant 15 schools gives them the equipment and everything to launch an audit to convert your automotive in the training on the EV plus, so in the operations, maintenance and repair, it's well taken care of in automotive, but in aviation, you have NCAT, which is out of you remember, we're in cat Jonathan Beck's center in Minnesota, is that a Minnesota I forget the name of the school. Northland Community College. That's right. That's right. And they're quite leaders in the autonomous world, they have quite a lot of amazing equipment. And because a lot of it is aviation related there are taking the lead on creating the aviation standards in the aviation maintenance and repair portion of it. And then we are working on some of the marine because we have quite a number of boat manufacturers interested in you know, converting and forming EV cars. So in the operation side, you have those on the manufacturing side, the manufacturing center and Karen Birch actually have really good Mechatronics curriculum. And then on the manufacturing of batteries, you have Andy Macmahan and the EARTH center who's doing a lot of work not just on the mining of lithium for the future, they worked with several the mines in North Carolina, like Alba Morley, but also on the battery manufacturing, because it's a very heavy environmental process. So you have people addressing all these. And then on the emerging technology side, I'm just trying to make sure everyone's familiar with the resources that are happening in our healthcare, you have like Natalia and LASER-TEC, that are doing a lot of modules on on the sensors in cars to make them autonomous. And then I want to come back to the cyber side, because John Sands and NYcTE Center has really, really good curriculum on EV or renewable, both of them in the cyber interface. And every year related to this. They have their cyber across disciplines, where they train folks, people come in to get training professional development on it, I actually went to it last year. And what they did in the cyber was fantastic. Mike Lesiecki, you have any questions?

**Mike Lesiecki**

Well, John Sands, as you mentioned, is coming up in our webinars series. So we'll be hearing more from him. And once again, I'll put links to all of the resources that you just mentioned, so that people can access .

**Kevin Cooper**

One of the things I want to mention there, one of the things interesting about cyber is because of the supply chain issues we have both in the EV and in renewable energy. It's interesting, because we're trying to build as fast as humanly possible. But the supplies come in sporadic. So what happens is you design an EV, charging station, or renewable or solar field a certain way, but you get whatever parts you can get. And those parts don't communicate well. So then you do like this off the shelf fix to it, you just try to figure out how to communicate. But when you do that, you create all these cyber challenges. So that's the need to really teach, you know, you think cyber, such a high level, but it's the communication between pieces that are always the risks in cyber, and you need to teach technicians how to secure those. So it's really the cyber is a very important topic here.

**Mike Lesiecki**

You know, as we're getting near the end here, I have a question that many of our audience members are thinking about. They're thinking about how do I how do I bring this stuff in and what their thoughts are, as you mentioned a lot about certificates. Should they think about integrating this into their existing courses? Should they set up a separate standalone certificate program? Or should they create a new degree? What advice might you have?

**Kevin Cooper**

Mike Lesiecki, it's not universal is the answer. It's based upon what your ecosystem needs. You know, I would say the easiest thing to do on what we're working on the most is creating a high voltage safety certification that goes across all these disciplines, that commonality across them all is it's all high voltage. It's surprising that an attainable safety certification does not exist. So the easiest thing to do would be to work with us and help us embed the high voltage safety certification into your program. That's a good starting point. Yeah, as a starting point, and it's also an exit point. If a student has the high voltage safety certification, they can get an entry level job, you know, yeah. The only other thing I want to mention here, before we go on is Chris McNally. And Hudson Valley up in New York is building charging certification for the infrastructure side. Oh, he has a nice NSF grant on it. All right, good. That's my last slide. Please scan this QR code. We communicate almost exclusively through LinkedIn that will let you join our LinkedIn group. And it's, you know, a method of keeping in touch. We have a lot of annual meetings and towards the various facilities and we can that work with you with anyone on the list that I've talked to today.

**Mike Lesiecki**

We've just perfect presentation in the sense that it really, I think you hit it right from the beginning right? People think of cars auto automotive, on the EV. But there's this whole other spectrum from you mentioned light EV to, to the blue economy, the Marine economy right onto everything else. So I think it's a really good example of how cross disciplinary skills can actually work in this case. So thank you again for the presentation.

**Kevin Cooper**

I appreciate it. Mike Lesiecki, thank you.

**Mike Lesiecki**

Let me wrap up today with a couple of resources that folks can get from Preparing Technicians, all one word, dot org we have a framework for across display some course like a white paper, five or six pages, but it's a good way of grounding yourself on what this is. There are instructional cards that instructors can use exactly in classes, they're short, little things that that help you do learning activities with your classes. You can listen to our podcasts in the series and share recorded webinars from this series. Oh, here's some of those instructional cards. For example, let's look at the center column advanced digital literacy, network communications. You talked about that today, automation, basic programming skills, network architecture. So these are short activities that can be brought right into the classroom to help people start talking about these things. I mentioned our podcast series there on the upper left is technicians in the new blue economy, Internet of Things in the center so you can see a number of podcasts that may spark your interest and help you move forward in your own professional development. And recordings of this webinar series are there you can see the link preparing



technicians.org webinars, you'll find a series in addition to those recordings, additional professional development, resources and instructional resources and everything to help you future proof those technicians and bring yourself up to speed as well. Kevin, thank you again it just a pleasure working with you. And that's the conclusion of our webinar for today.