



The electrical engineer who worked his way up

Greg Tremelling

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Greg Tremelling is a Senior Manager of Electrical Engineering at NEC Energy Solutions in Westborough, Massachusetts. Here, he discusses his work with large-scale energy storage systems, the importance of safety in the industry and the steps he and his teams have taken to ensure it, and his hopes for a productive future together with NEC.

Starting in design, ending in management, and building teams to pull it all together

First, please tell me a little bit about your background.

Greg: I'm from Berlin, Massachusetts. I grew up in that area and I've lived there my whole life. I went to school at Worcester Polytechnic Institute in Worcester, Mass. While I was there I worked on two major projects, one for two months in Switzerland and one at the Goddard Space Flight Center, where we re-designed an optical encoder for NASA.



Can you fill us in on your work history?

Greg: Prior to joining NEC Energy Solutions, I designed uninterruptible power supplies at a manufacturing company in the U.S. Since joining the NEC team as an electrical design engineer, I have architected and designed a number of battery management systems including a 200KW hybrid bus energy storage system and NEC's large scale multi megawatt Energy Storage Systems. After working in the design team, I transitioned into a new role to create and manage a Platform Engineering team. The Platform team provided sustaining engineering support for the products that I had just designed. When this team became stable, I had the opportunity to start another team within the company called the Smart Grid Integration team. Smart Grid Integration was responsible for managing the installation of large scale energy storage systems for our customers from the time of purchase order through commissioning the systems in the field. Now I'm back on the new product development side of the business, running the Electrical Design and Test Engineering departments. The significance of all this is that I was able to start in design, and then go downstream and actually support and manage the products that I had designed, and then come back full-circle from the customer projects back to design. This has given me an interesting perspective on how products should be defined and designed and architected to improve the product life cycle—specifically, to make them serviceable, manufacturable, and testable.

That sounds like a very holistic approach. What are some of the benefits of going through the process in this way?

Greg: Ultimately, it comes down to having a bigger-picture view of product design. A higher-level view that is not limited to just the electrical aspect or the product design itself. It's enabled me to place an emphasis on manufacturability, on testability. On what our customers are going to actually do to this product in the field. It helps us think, "How can they break it? How can this product fail?" You get to see a lot of things firsthand. I got to go out in the field and talk to a lot of customers and deal with real issues—that's really where you learn.

Architecting the next generation of battery management



Explain what you're currently responsible for.

Greg: My teams and I are responsible for designing all of the electronics and electrical systems needed to manage our large scale energy storage products as well as the battery management systems for NEC Energy Solutions' commercial product line. The Test Engineering team also report up through my organization.

Please go into more detail about what these teams do.

Greg: The test equipment group designs the test equipment that will test the product in production for quality control. At the same time that we're developing the products and the electronics, we also have to develop test infrastructure to support it, so that when we manufacture it, we have a way to test the quality and the functions before shipping. With the electrical engineering team, depending on the needs, we jump back and forth between working on various commercial products or the large scale grid energy storage battery management. So, we have some new designs that we're working on that we're very excited about. Some new technology that will reduce costs and make the products more flexible, higher-performing—essentially, more connected. We're actually architecting the next generation of battery management.

Making the most of renewable technologies

What exactly are large scale energy storage systems? How do they work?

Greg: Large scale energy storage systems are essentially shock absorbers for the electrical grid. They are able to pull energy from the grid when there is an excess, and push that same energy back onto the grid at a later time when it is needed. By adding the dimension of time into the grid stability equation, many problems can now be solved. The widespread adoption of distributed solar and wind power generation is just one area where grid scale energy storage can provide tremendous value. NEC's energy storage is able to smooth out the rapid power fluctuations introduced by these renewable technologies. Other energy storage applications include frequency regulation and spinning reserve.



How are they utilized now?

Greg: NEC Energy Solutions now has over 110MW of Energy Storage installed worldwide performing a wide variety of applications for our customers. NEC is actually serving more energy storage applications than I have time to talk about during this interview, but I can comment on a few of them. We have multiple energy storage sites that have been integrated with wind power to control the ramp rate of the power generated. We also have Energy Storage sites that provide spinning reserve. This is in addition to several smaller distributed energy storage systems we provide.

Can you explain some features of these systems?

Greg: Normally these systems are watching the frequency, voltage, and current levels at the site where the system is installed. Using these inputs, NEC Energy Solutions' AEROS controller controls the entire site to manage one or more of these parameters to be within a specified range. At one particular site we have no less than 16 "53-ft containers" all working together in unison as a single 32MW power source.

Please give us a usage example from Japan.

Greg: Sure. A great example is solar. Solar energy changes its output very quickly. The base load generation on the grid cannot change its power level quickly, so, there's a gap. And that gap is actually preventing solar applications from turning on. What this means is that there's solar projects that people have built that they can't turn on, because in certain areas of the grid, they're concerned about stability. This is of great interest in the wake of some of the power issues that are unique to Japan. There have consequently been changes in the desire to deploy solar. Overall, solar is really ramping up.

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Turning lemons into lemonade

What was the most significant struggle you had in a past project?

Greg: Recently we were getting close to wrapping up a design effort when we were informed that UL (a third-party safety and quality certification agency) had made some changes to its requirements. Basically, they upped their requirements after we had already met the previous ones. This meant we had to go back and redesign the product to meet those new regulations.



Sounds tough. How did you overcome this situation?

Greg: It was painful and a little disruptive, but we were committed to obtaining the UL recognition so we made the necessary design changes to comply. In the meantime we created a customer beta test program to put the previous design into customers' hands to obtain feedback that we could roll into the new design. That was very valuable because we were able to collect that feedback and actually include it in the next revision. In a way, we were turning lemons into lemonade.

Creative problem solving as a basis for strong teams

Any other challenges that you've overcome...?

Greg: Oh, there are problems every day! The nature of the work is problem solving. So, that's a key focus. It's how you deal with those problems that differentiates you as a company. As a team, you're successful if you're able to identify root cause and learn, move forward, and correct the issues. For example, in the Platform team, where we were responsible for analyzing all of the product return, root cause and structured problem solving was extremely important. So by using a structured problem solving process, we were able to permanently close issues, document them, and move on without having those issues recur. We're very focused on avoiding those types of mistakes.

What is the most important thing in terms of building large scale energy storage systems?

Greg: Safety. These are very large systems that contain a tremendous amount of energy. Care must be taken to ensure that the products are scalable, serviceable, and available while maintaining the safety of the operators as well as preventing equipment damage. We have taken great pride in the safety of our systems—safety is “number 1” for us. NEC's long duration Energy Storage system has a 3rd party TUV safety certification. As far as I know, we're the only ones in the industry who have achieved that. We've led the market in that area.

Can you talk about other ways in which you are or hope to become a leader in this industry?

Greg: We have a vision of creating very connected products that are cost-effective and scalable. By achieving those design goals, we will be able to scale our products up and down the product line depending on the needs of the region. Now, what we're going to do is design our products

such that we don't have to re-design the architecture to scale to that level, or to then deploy systems up at a much bigger level. In essence, it'll be the same technology.

Working together to maximize value

What is your working philosophy?

Greg: I am very passionate about what I do. I believe in getting the job done. I have a “whatever it takes” type of mentality. I've had a lot of great mentors, a number of people that I've learned from, and that has been very helpful in my career. As for my working style, I'd say that, while I like to be independent, I also see the value in—and enjoy—working in a team.



What is your road map in the future as a member of NEC?

Greg: I'm looking forward to working with my teams to develop more industry leading products, evolving our technology, and continuing to fill out our product portfolio. We're currently in the process of fully integrating with NEC. NEC is a large organization compared to ours, and so it does take time to connect with people. That was one of the goals of my trip over here—not just to attend the iEXPO [exhibition organized by the NEC C&C Systems Users Association and NEC to foster technical innovation], but also to meet with people at headquarters, where I connected with my counterparts and discussed how to approach certain markets and how our designs might look. It has a lot to do with working together, and not duplicating efforts. We want to make sure we can leverage the work that NEC has already done and not repeat that work. We're enthusiastic about helping our products and their products come together to maximize the value.

What are your hobbies?



Greg: I enjoy mountain biking and tinkering with things. All kinds of things! For example, I tuned up my lawnmower to make it work better so I could reduce the amount of time it took to cut my grass. I modified it to make it go faster and work better. I've made some other things, as well—we built a boat a number of years ago, before I had kids. I converted a snowmobile into a chopper-style motorcycle and use that on the lake.

How do you enjoy your holidays?

Greg: I spend my time off with my family. We'll be flying out to see my brother soon for the upcoming holidays and do some skiing.