Energy People:

Arshad Mansoor

We talked with Arshad Mansoor,
Senior Vice President, Research and Development
for the Electric Power Research Institute

ARSHAD MANSOOR, WITH STEVE MITNICK

Arshad Mansoor is senior vice president of research and development for the Electric Power Research Institute, responsible for EPRI's portfolio of R&D and demonstration programs. Mansoor is a senior member of the Institute of Electrical and Electronics Engineers and is a member of the board of The Energy Production and Infrastructure Center (EPIC) at UNC Charlotte.

PUF's Steve Mitnick: You have a very visible role at EPRI. What are the driving priorities or particular interests that you want to emphasize?

Arshad Mansoor: EPRI is great! We have almost eight hundred folks in different offices, and that gives me energy and drive for my work.

If you ask anybody at EPRI about our mission, they'll say that together we can shape the future of electricity. And make sure that it remains a reliable, affordable, sustainable, and safe form of energy for the foreseeable future.

Our priority is making sure that our research looks at how electricity can remain the driver of growth for the economy, for individuals, for heating our homes, and for lighting our life. I'd put that as a main focus that drives all of us.

PUF's Steve Mitnick: EPRI is a super-lab of hundreds of world-class scientists and engineers. How do you decide what to prioritize? Or whether to bring in some people in one particular area and de-emphasize another area that's not as important anymore?

Arshad Mansoor: The engine that drives EPRI is what we call the collaboration process. We have more than fifteen hundred advisors. The advisors are folks who work in electric utilities.

They're experts in their subjects. They range from someone who is an expert on transmission line insulators to a senior V.P. of strategy.

We take that advising very seriously. We listen to the priorities that we have from our members. We also have an advisory council, which is made up of non-utility members. We have regulators that engage with us on a two-year term. They're giving us guidance from a societal perspective. They advise on some of the key areas of public benefit they think we should be engaged in.

With their input, we engage in almost fifty percent of the work we actually do with universities and with other experts. We very much engage with the national labs and some of the other places where primary research is going on.

Our research focus is a bit different than what you see in a national lab or at the National Science Foundation or a university. We're trying to bring technologies from early stage to actual adoption. We're also trying to create all the guidelines and tools that are needed so the technology can be widely applied.

Interfacing with national labs and universities is key for us. You've got fourteen hundred utility practitioner experts, as well as the Natural Resources Defense Council, other non-governmental organizations, and the national labs and universities. We have a very structured research portfolio management process that we update every year.

PUF's Steve Mitnick: Some issues can be divisive. You mentioned environmental groups, and maybe you have coal companies. They may have very different views on what to emphasize in the research. Whether it's nuclear power or climate change or all sorts of other divisive issues. Hopefully you don't have too many fisticuffs at these meetings.

We research how electricity can remain the driver of growth for the economy and our life.

Arshad Mansoor: No. I think all of those divisive issues in the organizations come to the same conclusion. They agree that we should make sure that electricity for the foreseeable future remains a viable, reliable, affordable, environmentally sustainable and safe form of energy.

We bring the science behind it. It's not one versus the other. The technology sets the research and we bring the results to the different groups. We get their input, but we pride ourselves on being listeners who lead.

You're right in that we get a lot of input. Then we go to our core mission and align what our portfolio would be based on that input and our core mission.

I used the phrase listen and lead. The listening piece is a big piece for us. You're right in that we have a very diverse group. In many cases we'll have divergent advice. I think the advice converges from a public benefit and societal point of view, when we look at our mission.

PUF's Steve Mitnick: EPRI is taking early science and bringing it all the way to where it's actually used in the field. It's out there changing the industry in some way. I bet there's always a tug between let's do this early science, it's really cool and maybe it'll have a use. Other people are saying no; we want more stuff that we're actually going to be rolling out in the next year or so. That seems pretty hard to try to do all at once. How do you do that?

Arshad Mansoor: We're looking at a roughly four hundred-million-dollar research portfolio. I'd say a big piece of that is really

focusing on a three-to-five-year window of how technologies that are coming from different places could be adopted.

I'll give you a good example. We all talk about smart inverters and how smart inverters could one day become a huge benefit. We're not the organization who's making the circuit, or the product that makes a smart inverter, but we are the organization making smart inverters work smartly when integrated with the electricity network.

We say, "If I have smart inverters from fifty different companies and they all talk this old language, how do we get interoperability established? What should be the communication protocol when we're using the smart inverters widely across the distribution system? What should be the standard language? It's not just IEEE or others who have to do it. Somebody's got to do the real work."

If I'm using a smart inverter for voltage control, but I'm not using a voltage regulator, do I have the same level of reliability? That would be between an age-old but established product like a voltage regulator and a relatively new technology like a smart inverter? What's the risk that I'm taking?

Our research focus is how do we bring technology from an early stage TRL, or Technology Readiness Level, to an advanced stage TRL where it could be widely deployed?

We have twelve percent of our funding dedicated towards a program that we call technology innovation. Technology innovation is like you're driving your car at night, and you've got your headlights on high beam. Technology innovation is the future: it's the high beam for EPRI and our members.

We're looking at fifteen, twenty, twenty-five years, thirty years down the road. We're looking at things that we think could be the norm for energy in the year 2040. We spend around thirty million dollars out of our four hundred million, at least, on making sure we are not always looking just three to five years out, but that we also have a high beam.

PUF's Steve Mitnick: Now, what about the tension? I assume that all your discoveries and findings, they're pretty much available to everyone, or all the members.

The discoveries are socialized, and yet there are companies that want to have proprietary interests. They are vendors, or there are a couple of the big utilities that have their own research shops.

Arshad Mansoor: Which could be very focused to one client. But that's not what EPRI is about. We have the expertise to do some of that work. We try to limit that work to a very manageable piece. You engage with EPRI if you believe in the knowledge, the information, the tools, and the processes that you will gain.

You will also contribute towards the larger good. All of the benefit goes to the public. That's one of the reasons why, if you look at our members, that most of them serve the public from a regulated utility.

That public benefit mission unifies a lot of our members. That's why you don't see a fear of product vendors. We believe we are trying to improve your technology. We may not be the right place to go.

We're trying to bring technologies from early stage to actual adoption.

You have other opportunities to go there, but the research results are what many of our members and stakeholders do embrace. That's truly the engine that drives EPRI. I have been asked to do focused proprietary research, but we try to keep it at a very small percent of our overall portfolio.

PUF's Steve Mitnick: I imagine there's some prioritizing that you do. What are the biggest problems you're trying to solve?

Arshad Mansoor: There are a lot of things that are needed by the utilities, by our members, and by the stakeholders. We have a process through which we identify what we call research imperatives.

Research imperatives are the subset of the work that we've got to execute. That makes it not more important than other work, but strategically important for the society, for the electric sector.

That is the main work that really needs to happen. We have five near to mid-term research imperatives. Let me just identify one of them.

We are all talking about the distribution system of the future and the utilities of the future. If you look at the utilities of the future, whether you're in California or New York, one thing is clear.

The entire communication system that the utilities now currently use will have to evolve. You don't want to use thirty different telecom systems for thirty different applications, and

when you have the thirty-first application, then you need another telecom system.

Instead, we want an entire communication architecture that will evolve at a different pace and in different places to the utility of the future. That is one of our key research imperatives. What is that communication architecture? What are the interoperable requirements? How do you design something that supports smart metering, voltage regulators, distribution automation, so we are not holding on to application-specific telecom that goes obsolete?

That's one of the five research imperatives. We have five; you asked, why not six or why not three? Well, we went through this process of gathering input from our members, our external stakeholders, regulators, NGOs, other research organizations, universities, and national labs to formulate what we call our research imperatives.

PUF's Steve Mitnick: People in the industry universally love EPRI, but the public itself doesn't hear about EPRI much. What would you want the public to know about why there is an EPRI and why the industry devotes resources to it?

Arshad Mansoor: The work we are doing with the industry and the stakeholders guarantees that everybody enjoys electricity as a desirable, affordable, safe, and environmentally responsible product over a very long time.

What we are doing in our work on connected appliances will improve the value of the connected appliance to an end user. He or she will be able to manage their energy better because of the EPRI research. We are making sure that we can operate our nuclear plants safely, from forty to sixty, even eighty years from now.

Regarding the very detailed findings we have about the degradation of steel or other materials, the public will not necessarily appreciate that. But what the public will appreciate is that when we operate this plant sixty to eighty years from now, a lot of the EPRI research will have helped to make sure we are doing that safely.

I think if you look at the output of our research, which is focused on safety, reliability, affordability, and environmental responsibility, that's what the public should see. They may not know it's EPRI doing it, because we are one of many organizations that looks into technology from an electricity sector point of view. What we bring to the public is our core mission of keeping electricity safe and environmentally responsible.

PUF's Steve Mitnick: What are some changes in the way we use electricity that EPRI has tracked over recent years?

Arshad Mansoor: Sometimes there are things that happen, shifts that happen in the economy, and in society. We try to understand what the impact has been. If you're looking at energy efficiency, our big impact was what we call a first wave of energy efficiency that was initiated in DOE and other organizations, focused on appliance standards and building standards. In the 70's, that's how it started. It's those 70's standards that are resulting in significant energy efficiency.

The second wave was in the late 80's, or 90's, when utilities entered the demand side management programs, focused on technology. About three years ago the electric utilities in the U.S. and Canada spent ten billion dollars to advance energy efficiency technologies, to advance insulation and building materials. Now, this happens every year. That brings energy efficiency to the forefront.

We're looking at things that we think could be the norm for energy in the year 2040.

We're saying the third wave is what's happening organically that could have a more profound impact than the first and second wave. We use 2006 as the benchmark. That's when there was a big shift in research focus for the semiconductor industry. We are moving from faster processors and bigger hard drives to more energy-efficient circuits because the tech designers moved into mobile. 2006 is when the iPhone was rolled out.

The new focus on mobile by the semiconductor industry also changed their focus on R&D. So when you get into the mobile product, you are trying to make the chips as efficient as you can.

You are trying to make all the circuits as low-power as you can. You're trying to make the display as low power as you can. You're really not focusing on, "I need a much faster processor on my iPhone." You are focusing on how long the iPhone can run without running out of battery life.

So power consumption reduction through advanced

James Wu, Engineer, showing Arshad Mansoor the internal features of the solar powered RF Sensor Suite Base Station.

technologies, through advanced circuits, through advanced displays, became a big, huge research focus. You talk with the semiconductor industry; they call it "lopomo", low power mode.

That's where they're spending the bulk of billions of dollars of research money. Just like in the 90's, this industry showed us that when they focus on something, they drive performance better and they drive costs lower. That's why the processors got faster and faster and faster, and hard drives got bigger and bigger and bigger, but at a cheaper cost.

Now circuits, displays, power electronics, power supplies, and all these things that we use on an iPad and an iPhone are getting much more efficient. The same circuit that they use in LED light bulbs, and the same display that becomes more efficient in the iPhone, migrates to the television set.

They're driving costs down while improving efficiency. Over a period of one, two, or three years, those are the same technologies that are migrating to appliances and heat pumps, and are migrating to electric vehicle power circuits.

This organic efficiency that's happening because of the drive from the semiconductor industry is going to be beneficial. If you look at electric transportation, you can say that's energy efficiency as well.

It depends on how you define energy. But these products that are becoming much more efficient could actually usher in a new era of electrification. Heat pumps will now get better because they can operate in a lower temperature. Electric vehicles will be able to run more miles from the same battery.

This mobile evolution also changed the recent focus of the semiconductor industry on batteries, not just low power mode. In order to get more functionality on an iPad or an iPhone, you need to do certain things.

One is to reduce power consumption or increase your battery. If you look at 1995, you see how much IBM, Apple, Intel, and Samsung were focusing on batteries plus low power consumption.

If you had a desktop you really didn't care about low power because you were hooked up to the wall outlet. Even if you had a laptop, it started to get better, but still in laptops you had a pretty decent size battery.

As soon as they went to mobile you got to focus on efficiency and batteries. Billions of dollars of research got diverted from other needs to improve battery efficiency.

PUF's Steve Mitnick: That's pretty exciting. Does that mean there could be a big impact on homes and how we live our lives from this third wave, say ten to fifteen years out?

Arshad Mansoor: I think absolutely. It's not just the impact of energy efficiency. You have different statistics.

There will be billions of connected appliances; one hundred million light bulbs and lamps will be connected to the Internet. You may ask, "Why do I care if my light bulb is connected or my thermostat is connected?"

Billions of dollars of research got diverted to improve battery efficiency.

Consumers will be able to either deliberately or through a third party, manage their energy consumption, their appliances' troubleshooting column, and the dishwasher. A massive cloud system will enable that interactivity, which ultimately would benefit customers.

So it's not just that things are getting more efficient. It's that this connectivity trend emerged over the last five to ten years.

Some of us doubt that, because we say, "Oh, I don't care. All I need is the light to come on." But look at the customer profile twenty years from now. Just look at those customers who are now in third grade, fourth grade, sixth grade, seventh grade, how they interact in their life with mobile devices.

I think we should be contemplating a future where the customer demographics are changing. So are the technologies and the way they interact with technologies.

PUF's Steve Mitnick: What's EPRI's role in the third wave?

Arshad Mansoor: First we need to have an understanding of

how much the third wave could impact future energy demand and energy growth. Because the third wave, in one sense, could reduce electricity consumption.

But if it enables electric vehicles, or a better heat pump, you could also have increased electricity consumption. As a planner, I think we need to have a good understanding of which it is. But more importantly, another area where our research would help is in this whole connected device ecosystem.

How will connected devices interact with the telecom architecture of utilities in the future? And how much of the device ecosystem will be the result of good management? That is the big unknown.

I could have a smart thermostat just because I want one and I want to change my setting when I go upstairs or downstairs. But there could be people who would be willing to get a smart thermostat at half the price they paid today, if they also agreed that five times a year that thermostat setting could change five degrees from what they signed up for.

Now they're getting the thermostat at half price. You could make an argument that a one hundred-fifty-dollar thermostat could be completely free, because over the lifetime of the thermostat, you could have a cost savings of one hundred-fifty dollars.

How do you do that? What's the communication infrastructure? What's the big system that connects this system with the grid management system? That's a big unknown.

What we have to do is bring in tools. We have to bring in the reliability aspect. You're going to get planners' assurance about how they can address this. We need operators' assurance about reliability because operators may be relying on some of this in the future.

I think all of those things are opportunities to really look at with our members and stakeholders in a way that shapes the future of electricity. Adding the third wave of energy efficiency and the advances that are happening in the semiconductor world is an opportunity for the energy sector.

PUF's Steve Mitnick: You've just set the stage for discussing EPRI's latest initiative, the Integrated Energy Network. Can you talk a little about that?

Arshad Mansoor: We went through our strategic plan process over the last twelve months. Typically, in the organization when we do the strategic planning with our members, the outcome is a vision of the future. Or a vision of the technology of the future that we can orient our members and our research product to.

What we're finding out is the networking ability is key. Things will be more interconnected, things will be more integrated, central and distributed resources will be more integrated.

At some point in time the gas pipeline industry and the transmission industry will be more integrated because the reliability of each affects the other. We could have a power plant that doesn't need electricity in the nighttime producing water through desalination. That means now we're bringing water and electricity closer.

We're not just looking at electricity. We're looking at an integrated energy network. As electricity becomes cleaner and more reliable, more affordable, it becomes the fuel that actually changes some of the other forms of energy that we use.

This integration of energy into a network is what we're saying is the vision of the future. We'll be rolling out that vision soon. Then we'll be orienting our research to that, to make sure we're working to achieve an integrated energy network.

PUF's Steve Mitnick: Please talk a little about your background and any turning points that got you to this point at EPRI. Who are one or two people that really influenced you that brought you to this point?

Arshad Mansoor: I grew up in Bangladesh. That's where I did my undergraduate work in electrical engineering. I came here for graduate school in 1990, at the University of Texas, U.T. Austin.

Another area where our research would help is in this whole connected device ecosystem.

Power was my focus, even though when I came here telecommunication and microelectronics were the more popular electrical engineering areas. But I wanted to focus on power.

It's kind of interesting. My engagement with EPRI started the second day I landed in the U.S. I went to the professor and he said, "Hey, we have a project going on with EPRI. Would you want to be a research student working on it?"

This was 1990, and my second day in the U.S. So that got me engaged in power-related research, and I really enjoyed the breadth and scope.

Another thing that was impactful was the American Public Power Association. They had something called the DEED Scholarship. It was for students who proposed unique, creative ways to do things.

I was a DEED Scholarship recipient in the early 90's. Then I worked with EPRI throughout graduate school. My U.T. professor, Dr. Mack Grady, is now at Baylor. He is one of the premier power experts in the world. He was one of the people who guided me.

Ever since I've been working with EPRI, from the early days right after my graduation, I think I had a calling. To learn from our members and to work with hundreds of utilities worldwide, helping shape the future of electricity and doing something for society.

Plus, I get the ability to work with eight hundred very smart people. I think all of those things brought me to EPRI, and they keep me there. PUF