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## **NATURAL GAS:** Investing in the Revolution

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# NATURAL GAS: Investing in the “Revolution”

*Power Engineering* sat down with four executives to discuss the future of gas-fired generation in the U.S. and the potential impact of increasing environmental regulation.

BY JUSTIN MARTINO, ASSOCIATE EDITOR

Natural gas is becoming more important in the power generation industry each year. With increasingly strict regulations on emissions controls and growing concerns about the environment, more companies are looking to natural-gas fired generation as a reliable, clean source of energy.

Natural gas-fired plants can also quickly increase to peak load, making the fuel a good complement to renewable energy sources, and are also faster and less expensive to build than many other power sources. With the growing use of natural gas, however, many questions remain to be answered about the fuel source's cost, the increasing reliance on natural gas over other fuel sources and upgrading natural gas pipelines to cover the increased usage, among other issues.

I recently moderated a roundtable discussion with executives from American Electric Power, Electric Power Research Institute, Alstom and Bechtel.

The discussion centered on the future of gas-fired generation, the sustainability of today's low gas prices and the potential impact of increasing environmental regulation.

The participants were: Tom Alley, vice president of generation for EPRI; Scott Austin, manager business development for Bechtel's thermal business line; Amy Ericson, vice president gas product platform for Alstom Power; and Toby Thomas, vice president generating assets for AEP.

What follows is a transcript, edited for length and style, of that discussion.

**POWER ENGINEERING:** With the recent increase in the price of natural gas, do you see power plants continuing to turn to it as the preferred fuel choice as they have for the past several years?

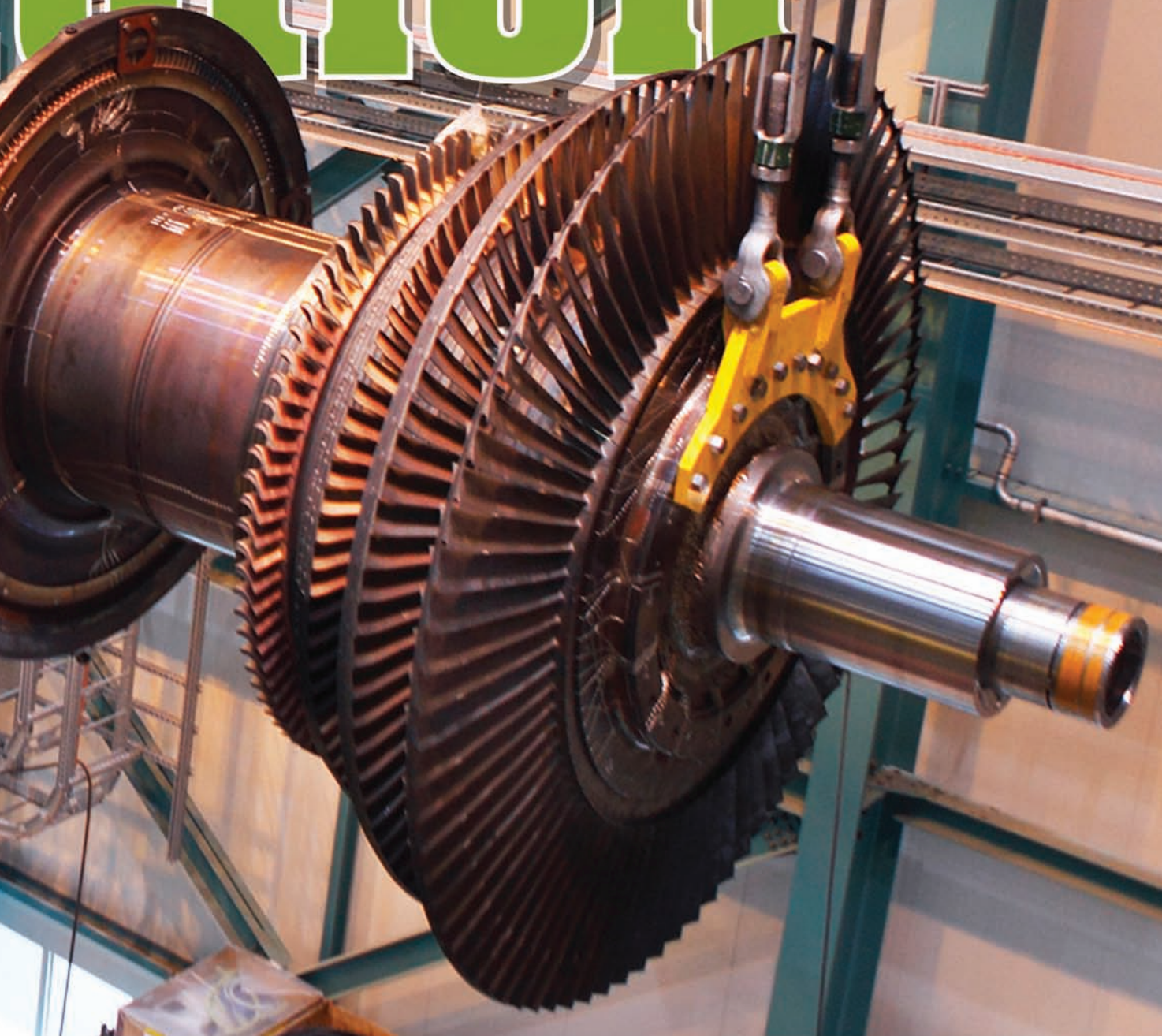
**AMY ERICSON:** There's one thing that we know for certain, and that's that fossil fuel prices are uncertain and will remain uncertain. It's interesting particularly

over the past several years that we've seen, not just in the US but globally, an obvious connection between coal and gas usage and pricing. We've seen gas generation go up in the US on the heels of the low prices, and we've seen that usage temper while there has been a comeback a bit in coal. I think these fluctuations are what we're going to continue to see. In fact, we hear from our customers that at this point, they're taking a long-term view. There's no doubt that their interest in using natural gas for electricity has grown steadily for the reasons that aren't likely



Alstom Power, which is working to create new technology for the power industry, recently delivered GT24 natural gas turbines to the El Sauz Plant in Mexico. Photo courtesy of Alstom.

# ution”



to go away, which would be the matching of renewables and the speed with which they can be constructed and commissioned. Personally, from an Alstom perspective, we definitely see the trend toward natural gas continuing.

**TOM ALLEY:** I think that the pricing change we see here for units that are operating on the margin, the coal units that are operating right on the margin, may come back into play, but for a regulated utility, I don't see that impacting their business very much. For the unregulated generators out there, it may open up a little opportunity for a highly-efficient, environmentally-controlled coal plant to come back into play, because they've been under a lot of pressure with the low gas prices. I don't see this pricing change really influencing the industry much.

**SCOTT AUSTIN:** Based on the information that we've received and interaction we're having with our customers, I would echo Tom's comments that what we're seeing here in the U.S. is a lean toward new builds from a natural gas perspective. Given the outlook of the relatively stable \$5 to \$7 range in the long term, we would see the gas-fired generation being the mid-term selection.

**POWER ENGINEERING:** EPA regulations are making it more expensive to operate coal-fired power plants. With some of the rules coming out, it may be almost impossible to build new coal-fired plants. With more companies building natural gas-fired facilities to compensate for that, does that raise concerns about maintaining fleet diversity?

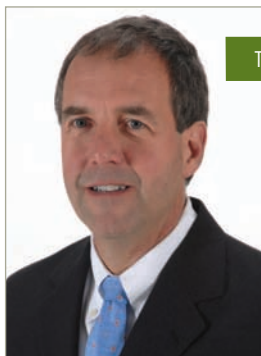
**TOBY THOMAS:** We certainly do have concerns from a fuel diversity perspective. In any long term view, if you focus too much on one fuel or one technology, you're going to potentially have problems long term. You definitely want to be diversified. The other side of it is that the more power plants you have relying on gas pipelines, the more potential risk you have to grid reliability. On those warm



Amy Ericson



Toby Thomas



Tom Alley



Scott Austin

summer days, you're starting to get close to peak flows on gas pipelines, similar to what you see with the winter heating load, and sooner or later somebody's going to have to get cut. You can build a gas-fired power plant, but you do have to line up the fuel supply – not necessarily the commodity but the transportation to make sure you can get gas when you need it. Also, if the pressure on that gas pipeline goes too low, all those gas plants are coming off.

**ALLEY:** I would say I'm definitely concerned about diversity. I think the industry is being led down a path toward natural gas as a "destination" fuel source. We hear it in the president's recent State of the Union Address. We see the EPA rulings for Mercury and Air Toxic Standards putting extra pressure on the coal plants and coal plants closing. We see the EPA proposed rulings for greenhouse gas emissions for the New Source Performance Standard, which put a lot of pressure on coal. I think the very efficient natural gas combined cycle plants can meet that standard at least as its proposed, but not coal plants. Plus, a gas plant is about one-third the cost of a nuclear plant and half the cost

of a coal plant, so when folks are trying to plan and build, gas is certainly one of the least cost options. Smaller staff, easier to site – gas is just an easy decision, and it really concerns me that the industry doesn't have the flexibility to provide more diversity. Again, I think everybody is kind of being led in that direction.

**ERICSON:** I can tell you from a technology development perspective that we preach diversity. We invest in diverse technologies, and it's exactly for this purpose, and for the protection of supply and price and policy – and even public attitudes – because they change in time. But I would have to say that the prospect of all gas and renewables in the future is probably not the optimal prospect for the U.S. and for the industry, and I think people probably agree with that.

**AUSTIN:** From a Bechtel perspective, we've been around for about 115 years. We've seen the peaks and the valleys of gas pricing over that time and the desire to move forward with gas in the current environment. I would concur with Amy's comment that maintaining diversity from a capability perspective is an important



The 550-megawatt combined cycle natural gas-fired J. Lamar Stall Unit at AEP's Arsenal Hill Power Plant in Louisiana went into commercial operation in June 2010. Photo courtesy of AEP.

element that we strive for, to be able to facilitate the diversity that's needed in our energy mix as a nation. We look to our customers to make those decisions as demand warrants, and we stand ready to implement those technology solutions as they're appropriate.

**POWER ENGINEERING:** The EPA is starting to look at the affects of hydraulic fracturing on the environment. Is there a concern the EPA may make rules that make fracking an uneconomical source for obtaining natural gas and cut down on the current gas reserves?

**ALLEY:** The EPA and other government agencies are all sorting out the jurisdiction over fracking and everything associated with it. We've seen a lot of discussion about the water use and cleaning up water from fracking – we're sitting at a water conference right now in Atlanta and some of the technologies we're looking at are actually coming out of that industry – so I think the industry is trying to manage that situation pretty well. I don't foresee that EPA rulings are going to heavily impact the business. I don't think you can say there will be no impact, but I just don't see a heavy impact. I'm more concerned, when it comes to gas pricing, with the demand side of the equation, with as many industries as we see moving toward gas. It's not just the electric sector. It's transportation. We've seen some announcements recently on locomotives being converted to natural gas. The automobile industry is looking at it. The chemical industry is looking at it. There is a lot of discussion about whether the U.S. ends up being a exporter of natural gas. I see all of this having a much greater impact on the pricing than I would EPA regulations.



**POWER ENGINEERING:** One thing it seems people are concerned about on the volatility of natural gas is so many other places uses natural gas as well, while coal is predominately used for power generation. How much does that factor into the equation?

**THOMAS:** There are a lot of petrochemical refineries and others that can use natural gas, and you could potentially increase demand quite a bit. On the power generation side, we've spent hundreds of millions, if not billions, to build a power plant, you're kind of stuck with it for a while, so it's certainly a concern to add to the volatility. We have a lot more supply now, but it wasn't that long ago we had double digit gas prices because the market thought supply/demand was tight. It doesn't take too many traders and others that feel things are tightening up to really start pushing the market. Will it happen? I certainly don't know. I'm not an expert on that, but it's a concern.

**POWER ENGINEERING:** What benefits do you receive from a natural gas-fired plant as opposed to a coal-fired plant using state of the art technology that would cut down its

emissions, or a power project using renewable resources?

**ERICSON:** Many plants are operating with daily starts and stops or on a seasonal basis, and this operating is changing throughout the lifetime of these plants, which are coming up on their 10-year or 12-year installation date. The reasons that are driving that are the renewables penetration and, again, the fluctuation of fossil prices. Those aren't likely to change, and the beauty of natural gas is that it's always available. Not just that it's always available, because certainly so are nuclear and coal, but that it can actually deliver large amounts of electricity directly onto the grid in a short period of time – for example, 450 MW in 10 minutes. And so I do think that given the changing market conditions and the need for flexibility, natural gas generation is being chosen because it can respond when it needs to respond. It can be flexible.

**AUSTIN:** I would concur with Amy's remarks there. From a general perspective, it was alluded to earlier that the initial capital cost of a combined cycle plant is much lower than a coal plant. The time frame to implement the construction is probably on the order of magnitude of half of the schedule. The obvious environmental benefit we've spoken about

and the operability flexible that Amy just described, I think, are very important variables when you speak about natural gas. At Bechtel, we're currently building several combined cycle plants. We're building three significant plants in Texas for Panda Power Funds, which are good examples of this technology in operation or in deployment. These projects have state of the art environmental controls and will be some of the cleanest plants in the nation when they're built. One of the things they're able to do is respond to fluctuations in the grid. For example, within 10 minutes the plants will be to 50 percent capability, and within 30 minutes be at base load. When the wind stops blowing in west Texas, there are plants that are going to be able to support the grid and provide an opportunity for more deployment of renewable resources.

**THOMAS:** The number of people it takes to run a comparably sized combined cycle natural gas plant are far less, so my fixed costs are lower. Most of my bigger costs are variable costs, so if I'm not running the plant I'm not incurring those costs. Operational flexibility is probably the biggest piece of it, meaning that when I'm not making money I can shut down. Whether you're in the regulated or competitive power business, you still try to dispatch your units economically to either save customers money on the regulated side or maximize profitability on the competitive side. Having a lower fixed cost is a big benefit. The amount of time you spend on fuel and waste handling at a solid fuel facility is significant, meaning you have a lot of people at coal-fired plants that basically take coal off the rail, off the river or off the truck, however it comes in, get it onto the pile, move it from the pile into the units, and then once you come out you have ash and after treatment byproduct, mainly from SO2 scrubbers, that you have to manage. The amount of time and effort it takes to move the material going in and out of the plant is significant. Having a gaseous fuel that basically comes in, is consumed and

goes out the stack means you don't have to really touch it, so cost savings are realized there as well. The benefits of natural gas generation are lower fixed costs, high operational flexibility and low costs for fuel handling.

**POWER ENGINEERING:** One thing I've heard multiple people mention already is the uncertainty right now, the need to finalize some of these rules. Coal plants are certainly affected by this right now because they're not sure what the EPA rules will be. For gas plants that come under these standards, it's easier for them to meet the new emissions rules and they are less affected, but what role does that uncertainty play right now when you're trying to design a long-term strategy?

**AUSTIN:** You're seeing decisions on new generation units or retrofitting of existing facilities delayed until there is regulatory certainty and until people can make the appropriate decision knowing all the facts. However, while there may be delayed decisions, I think the time is coming in many areas of the country when those decisions can't be put off any longer.

**THOMAS:** A long-term strategy with today's uncertainty and regulatory structure is almost an oxymoron, because you can't have a long-term strategy when you don't yet know the rules of the game. We've had instances where, based on the proposed rules and the timeline for implementation, we start down a path, then those rules either get remanded or changed after we've spent time and resources and money, and then the timelines don't change for implementation, so we're always left trying to juggle implementation timelines. We often end up spending more time and money than we would have if the rules were clear. A long-term strategy, given where we are from a regulatory structure, in my mind, is almost not attainable because even to build a gas-fired plant, it still takes a reasonable

amount of time and obviously sizeable investment – less than nuclear or coal, but still sizeable. We have all the regulations coming at us and we're preparing for those. On the regulated side, we can't get cost recovery for investments unless there's a clear rule that says we need to do it. So when they change the rule after we've spent the money, that's money that can be stranded because the rules changed. I do believe there is a strong need for a national energy policy for our economy, for our country and so many other things. We need to have clear rules so we can invest money properly and we can employ people in the most efficient manner. Like I said, it's anybody's guess where we're going to end up, and that leaves those of us who have to make those long term decisions in a difficult position. Even the OEMs, the Alstoms of the world, are trying to decide what technology to invent or make. Well, that depends on the problem they're trying to solve.

**ERICSON:** So it sounds like you want to add some adjectives to long-term: certainty, constant, not changing, sensible.

**THOMAS:** Exactly. Long term now could be a matter of months, not years. When you're talking about hundreds of millions if not billions, of dollars to comply, that's a big bet. And, if you bet wrong, it's not a good situation for us, our customers, our vendors or anyone. We need a national energy policy that sets clear goals and rules on a forward-looking basis, and then I think we could be effective as a nation and as individual companies. Until then, we are just in reactionary mode, and that is just not good.

**POWER ENGINEERING:** When you're starting a plant, is there a tough balance between investing money in a plant to reduce emissions and making sure you don't invest so much money you either send rates up or lose profits in the merchant business?

**THOMAS:** If you're a competitive power producer, the wickets you sell are

EPRI is working to maximize the efficiency and lifespan of natural gas-fired plants as well as looking at CCS technologies to reduce emissions from all plants. Photo courtesy of EPRI.

electrons. Anything you put on the back end that increases the cost of making that widget with no way of compensation, it's like building a car and adding 10 different options that nobody really wants. That's going to cost 20 percent more, or whatever the number is, to make the same car, and those investments are very hard because there's no incremental revenue. Even if you're building a new plant, you certainly don't want to spend more capital if there's not a clear need. You might do some design changes to accommodate something in the future, but whenever we get to those rules, the technology or approach changes so whatever you design up front to try to accommodate the future may not be the right thing. If the rules were clear, maybe the Alstoms and others could say, "OK, I will design this plant so that 10 years from now you can add these other things to it and reduce carbon," but if the rules change, they could design something and it may not fit the bill and nobody is going to want to pay for it. Regulators do not want to pay for anything that is not needed by law. They simply will not pay for it. And competitive producers obviously don't want to do it because it raises their price of production. Those decisions are extremely difficult to make.

**ERICSON:** I'll try to put myself in our customer's shoes, and in your shoes, and it's got to be pretty scary looking out there, saying, "Over the next 20 years, I don't know whether I can count on any nuclear license renewals, I don't know whether I can plan coal without carbon capture and storage or what it will cost with CCS." Yet at the same time, as I said before, the prospect of only gas and renewables is probably not the best choice for you or our nation.

**ALLEY:** We really don't have the economic framework together that supports



the capture technology that is available. Certainly EPRI and a lot of other organizations are using a lot of resources trying to find an answer to that problem, but right now that answer doesn't exist. Until it does, it's going to be a very difficult decision, as Toby mentioned. What it adds to the cost of generation is going to be pretty stiff. The economics obviously do not support the development of these technologies.

**THOMAS:** We struggle with this a lot. Whether it's on the generation side, the transmission side or the distribution side, we could deliver a product, with the help from the OEMs – the Alstoms, the EPRIs, the Bechtels, all over the world – we could give you the cleanest, best megawatt ever, but nobody could afford it. We could do it. There's no doubt, technologically, we could figure it out, but then nobody could afford what we produce. If you want 100 percent reliability, we can give it to you, but your price is going to go up because we have to go out and add a lot of new technology to the wires to be able to deliver that. We could do it, but we always ask our customers, "Are you willing to pay for it?" and the answer is always "No, we are not."

**POWER ENGINEERING:** Do you see natural gas as a solution for the foreseeable future or as a stepping stone toward a more renewable-based environment?

**ERICSON:** Pretty much everywhere around the world, not just the U.S., gas is going to be needed for safe and economical, relatively environmentally sound, and certain reliable electricity. There is, I suppose, a game changer out there in the future. Right now we're certain renewables are intermittent and hard to plan and not terribly predictable. What could change is the possibility of commercial large-scale, affordable storage. Now, that probably could change the role of gas in the future, but right now we absolutely see it in more in the cornerstone department of your definition.

**AUSTIN:** Similar to Alstom, we're planning to continue to have the ability to support a diversification of power generation sources. Having said that, I think EIA forecasts over the next 25 to 30 years you're going to see renewable rise to 16 percent of U.S. consumption, which is a pretty significant amount. I think gas, nuclear and coal are going to continue to play a major role in the generation of power in the U.S. Like some of the other comments made, natural gas will continue to be a cornerstone, not only in the U.S. but worldwide. Again, I think as Amy has said previously, the mix of renewable and gas dependent grid is probably not the long-term solution. That's why we're continuing to invest in our capabilities to support a more diverse mix.

**POWER ENGINEERING:** What natural





Bechtel is working on a large number of natural gas products and has about 5,000 MW of capacity being built or under development. Photo courtesy of Bechtel.

gas products are you working on or have completed recently?

**THOMAS:** We brought our Dresden Power Plant online last year, which is a two-on-one 7FA combined cycle. That construction started 10 years ago with Dominion, and we bought that facility from Dominion and then finished the build out. We also brought online the combined cycle Stall Unit down in Louisiana, which is a two-on-one Siemens Westinghouse technology. Other than that, really, it's still an interesting game of making sure that we can make these units operate the way they're designed to operate and mitigate operational risks as we cycle units.

**ERICSON:** For us at Alstom, we've recently delivered our GT24 to the El Sauz Plant in Mexico. Additionally, we're seeing some activity in terms of steam add-ons and conversions of simple cycle to combined cycle where we're supplying those technologies that are part of the water-steam cycle or heat recovery steam generator to Dominion as well as our large steam

turbines for the conversion of simple cycle to combined cycle. I know that we've been in this discussion so far and we've talked a lot about new builds and adds, but I do want to point out, and we've seen this as an emphasis from our customers in the past few years due to the economic situation as well as the uncertainty in regulation, that there is an ongoing upgrade emphasis to the existing gas turbines. As the existing gas fleet becomes 10 years old and 15 years old, there are opportunities to upgrade turbines in efficiency and output and extension of life, which all move in the right direction, and we've been busy doing that. Finally, Alstom as well as other OEMs are really innovating in terms of hybrid designs between renewables and gas, basically matching the best of both worlds to get 24 hour power.

**AUSTIN:** From a Bechtel perspective on natural gas, we're seeing a lot of activity in the marketplace, particularly in North America. We are currently building close to 3,000 MW of

combined cycle plants here. We have also been selected to or are developing our own combined cycle plants totaling about a little over 2,000 additional MW. We expect those to go under construction sometime this year as well. So we have quite a healthy portfolio of projects in the U.S.

**ALLEY:** Our projects are certainly on a different scale than the other panelists. We anticipated a move to gas about three to four years ago and re-structured the research we do at EPRI around gas. We're taking a holistic look at the entire plant and many of the items Toby has mentioned, particularly in regards to running plants, and stretching the boundaries of the the plant operations. We're trying to stay ahead of the carbon capture technologies, so we're working with members and pushing our carbon capture technologies and keeping an eye on natural gas plants and the flexibilities of those technologies. We have a large interest in looking at the older fleets and how they can be maintained. **pe**

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