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Tuesday, October 18, 2011 2:46 PM CT Exclusive

CEFCO Global Clean Energy CEO and President Robert Tang

By Dan Testa

Robert Tang is president and CEO of CEFCO Global Clean Energy LLC. He and CEFCO Chairman Donald Degling invented a process they say is capable of selectively capturing and removing more than 99% of flue gas pollutants and more than 90% of CO2 from industrial emissions. CEFCO successfully patented the process at the end of 2010, and Tang believes the technology, which can convert pollutants into usable materials such as fertilizer and rare earth metals, may alter how industries including cement production, oil and gas refineries and coal-fired power plants grapple with emissions by "moving pollution control from the concept of being a cost center to a profit center." Tang spoke with SNL Energy on Oct. 13 about CEFCO's process. Below is an edited version of that conversation.

Robert Tang
President and CEO,
CEFCO Global Clean Energy
Source: CEFCO Global Clean Energy

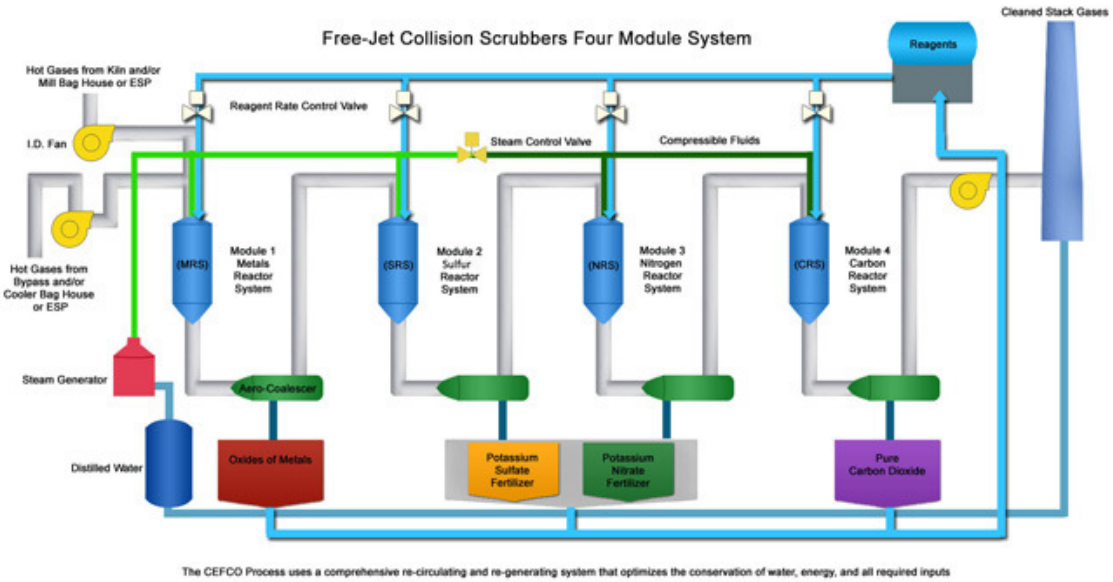
SNL Energy: How does the process work?

Robert Tang: We use steam to attack both the pollutants in the flue gas and the reagents that we use in our selective capturing process. We can then cause what physicists call molecular surface chemistry to make reactions happen in a split-second, much faster than in conventional chemistry or conventional thermodynamics. What we do is when the flue gas is moving through a system of ductwork and chambers, they are attacked from behind by a series of supersonic shockwaves through sonic nozzles that we place within that system of ductwork, forcing that gas now, having been attacked, to go through a nozzle into a vast opening. What happens is that under that condition, both the pollutants in the flue gas as well as the reagents, chemical reagents that we put in, become so energized and so activated that they bump into each other or collide into each other, and within a split-second they form both the capture of the pollutants as well as a formation of a product at the end of the reaction.

When gas is being forced through this kind of situation, it first is highly energized by the shockwave, which is very, very high energy and pressure. In our CEFCO system, with the collision at supersonic Mach speed, energy is generated by the collision. And you know that if you are playing pool or billiards, and when one ball hits the other ball, they get hot. It's just based on collision. In our situation, when reagents being propelled hit the pollutant, they collide, they have this generation of energy and pressure, and that energy and pressure creates the capture situation.

For instance, in the first reactor chamber, we call that the MRS, or the metals recovery system. It recovers all metals and any solid particulates. In the sense that now the metals, whether they existed in a vapor form or liquid form before at high temperature, now at a low temperature they become solids. For instance, mercury and others that behave like mercury, when they're at a low temperature, and they have been already met with an oxidizing reagent, or a bromine and chlorine reagent, they become a piece of solid and they will fall to the bottom. Our reactor's system has a coalescing device where whatever has been formed as a solid will be encapsulated in a collapsing steam into water droplets. And this water droplet encasing and encapsulating the captured solid will be removed at the bottom of the coalescer into a liquid stream to a liquid tank. But the gas, the gaseous part that's not part of the capture, will move on to the next chamber. So what we have done is taken out all the particulates and the metals in the first chamber.

The second chamber now is loaded with reagent that would go after sulfur … within a split-second the SO2 is removed and within that same split-second — at the tail end of that split-second — it's converted into a potassium sulfate or sulfite fertilizer. And that capture comes down through the coalescer into the bottom and flows out to the capture tank. The rest of the flue gas will move on. In the third chamber, we aim for the NOx or the nitrogen compounds. Again the reagent is put in and the reaction takes place. The NO2 is captured and quickly converted to the potassium nitrite and nitrate fertilizer.



Free-Jet collision scrubbers four module system
Source: CEFCO Global Clean Energy

In the fourth chamber, or fourth reactor … the CO2 is now attacked and put together with a reagent, and it will be captured coming out the bottom in the form of potassium bicarbonate or potassium carbonate. Bicarbonate will become a solid at a lower temperature, and that is now the solid form of actually carbon capture.

So the product of capture of each pollutant group now becomes a commercializable product because they were captured clean and not contaminated by toxic metals. Attempts to capture pollutants and make them into products have been done in the past, but they often have been complicated by the inability to separately capture the metals and the toxics first. So the toxics have been carried over to their product of capture, making it contaminated and not sellable. Our technology takes care of that at the very beginning: removing the toxics and the metals. And that's the big difference between our technology and somebody else's technology.

In the case of a coal-fired plant, at what stage in the power generation process does the CEFCO process fit in?

We describe ourselves first as a post-combustion capture technology. That means any time after the fuel has been burned, we can be installed in the treatment process. Many power plants already have ESPs [electrostatic precipitators] and baghouses, so we can be installed right behind them to help clean up the particulates and metals that they couldn't capture … helping them to comply with the Cross-State Air Pollution Rule [CSAPR], as well as the utility [Maximum Achievable Control Technology] standard and of course the New Source [Performance] standards. For those who already have [selective catalytic reduction systems] to take care of NOx, that's fine, but their equipment at best does about 90%. Very often over, say, an operating year, they're at a much lower standard of capture. So we then come in behind them to help them clean up the rest of the NOx to meet the new codes coming in.

How is the CEFCO process powered?

It's a very low energy user. First, the steam that we use to drive out supersonic nozzles is a slipstream of steam that we borrow from the power plant after the last use of that steam for power generation, therefore we do not rob fresh steam and we do not take away the ability to generate power. We believe that the cost of running our system in totality is so small that a vast majority of power production will be used for sale, and therefore, will have minimum impact on the sale and availability of electricity. Furthermore, the user in our system now actually produces a sellable product at every stage. So there is a potential of recovering all the cost that they have put into this system. And several years down the road when they have recovered cost, then you're talking about future potential profitability for the user.

Do you have any pilot programs in place or pilot agreements with utilities established yet?

We have a pilot program with our manufacturer, Peerless Manufacturing Co., head office in Dallas, [which] is one of the large pollution control equipment manufacturers in the country. In fact they have manufactured and installed over 700 SCRs in the country at various industrial sites and with a long list of users. When they saw our technology they wanted to become our manufacturer. So on that basis they set up their own internal pilot test plant at their own Wichita Falls, Texas, facilities, and we have that running out there. They began installing it in the early months of 2011 and began testing and running them in the last

six months. And on Sept. 13, 2011, they had a webcast to the investors and shareholders of their own company that they have finished running the first two modules and found that to be very successful. And they will devote more time to run the third and fourth module.

But thus far, any utilities or power generation facilities?

We are in discussions with several power companies right now. Of course, they're very busy trying to comply with the Cross-State Air Pollution Rule, and also trying to either postpone or comply with the utility MACT requirement coming up. So we are in discussions to put in a demo plant at one of their facilities that would have the most problem complying with the CSAPR or with the MACT compliance. Our patent was issued Nov. 30, 2010, so we are just under a year in actually being able to tell more details to the outside world. For those who are interested, already very intimate discussions have taken place. They have signed nondisclosure and confidentiality agreements.

There is actually more pressure in the cement industry, and in the oil and gas refining industry, to comply than in the power industry. The power industry is probably the third one to come on where they are properly motivated, not because of the EPA pressure, which they are able to hold off, but because of the profit motive. When they see cement companies and oil refineries and gas treatment centers actually make a profit out of pollution control, then the power companies will jump in and say, "Hey, we can do this, too, and we have a lot more to produce." So we are talking about a true paradigm shift in the concept and expectation of pollution control. We're moving it away from a cost-centered to a profit-centered concept.

Where do you hope to be a year from now?

A year from today I'm hoping that we will have a cement demo plant either being installed or being committed, as well as an oil and gas demo plant to be committed or installed.

Anything to add?

The technology that we have, the capture part, is a true, proven science, and it's already in use. The newness to it is we take it away from a cost worry to becoming a profit consideration for those who are using it. Because we now have the ability to convert the capture to a very useful and valuable end product. And that is the greatest difference between ourselves and all other capture technology.