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TOP STORIES

ULSD Corrosion: Questions & Answers from Hart Energy Webinar

An October 15 webinar titled, “Corrosion in Systems Storing and Dispensing ULSD,” cosponsored by Hart Energy’s *Diesel Fuel News* and the International Fuel Quality Center, provided insights into how contamination of ultra-low sulfur diesel (ULSD) with ethanol apparently is causing rapid and severe corrosion in some retail diesel-fuel storage-tank and piping systems in the United States.

The webinar featured results of an investigation by the Battelle Memorial Institute – commissioned by the Clean Diesel Fuel Alliance (CDFA) – which found that ethanol contamination of diesel fuel apparently is boosting the production of acetic acid by a certain type of bacteria. In turn, the acetic acid is causing accelerated corrosion of the metallic portions of ULSD storage-tank fuel systems.

Below is the transcript of the question-and-answer section of the webinar, featuring Anne Marie Gregg, a research



scientist at Battelle, and Prentiss Searles, fuels marketing issues manager at the American Petroleum Institute. Moderating the session was Jack Peckham, executive editor of Hart’s *Diesel Fuel News*.

Q&A Session

Jack Peckham: *What’s different today with this corrosion phenomenon that we didn’t see 10 years ago? Certainly one of the main differences would be that sulfur levels in diesel fuel in the U.S. are much different today than they were 10*

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years ago, and probably a lot more ethanol in gasoline today than 10 years ago on average. Is it possible that the higher level of sulfur 10 years ago might have been an inhibitor to this rapid corrosion phenomenon that is appearing today?

Anne Marie Gregg: Basically, yes. The higher sulfur acted as a biocide in the older formulation of diesel fuel and removing it gave the opportunity for these environmental bacteria to survive. Clearly it's a very specific environment, even still. We weren't able to definitively decide that. We were looking in the literature for aerobic biocide ability, but a lot of that research is focused on anaerobic ability of sulfur to be a biocide. So we do believe that is definitely a component and the simultaneous introduction of ethanol into the system, with the slight contamination or issues with that. So, if you decrease the biocide and then increase the oxygen and increase the ethanol, then there's the possibility of this microbe community surviving and threatening.

Q: Were the samples analyzed for biodiesel content?

Gregg: Yes, they were. One of the samples was at 3.5% and one of the samples was just barely over the detection limit and the other samples were under the detection limit of the method in February. We didn't expect to find much biodiesel content.

Q: So biodiesel content was not considered to be a crucial factor in your study of rapid corrosion phenomena?

Gregg: It wasn't ruled out as a factor, but it wasn't something that showed to be a strong relationship.

Q: What were the NACE ratings (corrosion ratings on the metallurgy)?

Gregg: Three of them were below the B+ and three of them were above. That is in one of the tables in the report – table 9, the main chemical analyses for the fuel, the water and the vapor.

Q: Another way of putting the question is, were the NACE ratings acceptable, meeting standards or requirements?

Gregg: That's really something done further up the distribution stream, there isn't a pass or fail at the retail site. According to the actual test, three of them were below what you would expect to see in corrosion inhibition. Three of them did pass.

Q: Do the acetobacteria live at the hydrocarbon-water interface?

Gregg: Yes, and in the water. They do have the ability to produce a biofilm, so that can be some of the cellulose clogging the filters that we're seeing.

Q: Was the majority of the corrosion product iron, iron acetate or iron oxide?

Gregg: I would say the majority of it was iron acetate, but everything is made up of all different kinds of components, so they do corrode a little differently.

Q: How might the acetic acid be produced at the other three sites without the acetobacteria?

Gregg: The North Carolina site had just gone through a biocide treatment in December, two months out, and we didn't get much biological activity there. But that doesn't mean that the acetic acid wasn't still there. Just because it wasn't continually being produced any more, if the acetic acid wasn't removed or washed off, then it would still be there. There was another site that had a biocide, but that was much earlier in the year. I saw a pattern where the ethanol was higher in the water where there was less bacteria. And where there was very little ethanol in the water, there was a lot more bacteria, so I think that's just the cycle of the ethanol being the energy source for the bacteria.

Q: Would the fugitive corrosion findings affect heavy-duty to severe-duty diesel engines if the engines are converted to run on a dual-fuel like a diesel or diesel/natural gas engine. Would this have any impact on those engines, this corrosion?

Prentiss Searles: Right now we don't see anything that would indicate that there's a problem with the engines themselves. The CRC would be looking at that if that were the case, but that's not one of the concerns for this issue right now.

Q: Given all the conditions mentioned, but excluding the impact of ethanol, would you expect corrosion to be prevented?

Searles: At this time, we have a hypothesis for what we believe could be the cause. So, at this point, we would not make a recommendation that we change the distribution system to modify the way that diesel fuel is delivered. More research is needed and we've got a list of things that we might want to look at, and so the corrosion task force and the CDFA are going to meet again to discuss the next steps, what is the next research that we need to do, that we need to undertake, so we can really understand what the issues are.

If it's not ethanol – all things now would be that it is, as Anne pointed out, due to switch-loading or to cross-venting of the diesel tank and the gasoline tank. But right now, I think it answers the question of, if you could remove ethanol, would it resolve the problem completely? I don't think that we know that today.

Q: If acetic acid from ethanol is the cause, would there also be a similar corrosion issue in tanks holding ethanol or gasoline-ethanol blends?

> **Searles:** I can say that we haven't seen any indication in the gasoline/10% blend ethanol tank – we haven't seen this type of corrosion.

Q: Was dissolved oxygen measured in the water layer? The water layer would be below the diesel fuel layer and likely would be depleted of oxygen. Anaerobic bacteria could certainly produce the volatile fatty acids mentioned.

Gregg: There was oxygen measured, yes, and it was shown that in an aerobic environment, there could be pockets of anaerobic activity, but there was just a small component of anaerobic bacteria identified. There is a table in the report that breaks down the aerobic, anaerobic and facultative bacteria that were found.

> *Q: Is a direct chemical oxidation of ethanol by oxygen to acetic acid ruled out?*

Gregg: No, it's not ruled out. As Prentiss said, we were trying to pull together a hypothesis that pulled together the data that we had as a way to move forward and try to figure out the problem. With fixed sites, it's difficult to figure out, although the factors that would influence the development of the corrosion.

Q: Since hypotheses are infinite, is there a plan to focus on certain hypotheses or certain areas of investigation to try to get a better handle on this issue?

Searles: Anne, I think it would be good to walk through the initial hypotheses that we had, just very high-level the approach that we took.

Gregg: A lot of the hypotheses that we received were from the people involved and from their networks of people. They looked at whether it was an additive issue, or whether it was a refinery processing problem upstream. Maybe there was a grounding issue, basically a lowering of sulfur was one of them. There was a variety of things that people came up with, and I think that ultimately, what we came up with was a combination of multiple hypotheses, and I'm not saying that we might not go into a different hypothesis once we go into this next phase, but at least we have a good starting point that's supported with some data, and as we move forward and gather some more data, we will have a very comprehensive data set that we can go back to that would have some information that maybe we weren't able to use in this first go-around.

Searles: What are our next steps? Some of the things that we might do for new research is to see if we can replicate the issues that we saw in the field, in the lab, and then figure out: is there a place at which you end up without having enough ethanol to create this issue? Are there other things that might be happening? Are there fungi that are creating the ethanol and then that's being broken down into acetic acid. We'll also compare the chemical and DNA

tests from terminals, tank trucks and retail stations to determine if there are differences there.

We attempted in this original study to identify a clean site and use that as the benchmark to compare against the other sites. Unfortunately, the sites that we thought were clean ended up having corrosion and so the next time that we would do the research we would look at doing some additional research and finding a site that is indeed clean to be able to compare it. So, those are just a couple of the things that we are looking at as the next step.

> *Q: Were the tanks in this study manifolded?*

Searles: They were not.

Q: Could methanol be the source of contaminating levels in biodiesel? And also, does the bacteria metabolize methanol, the most common alcohol used in biodiesel transesterification?

Gregg: The biodiesel wasn't much of a component in these samples. It certainly is a possibility and there is a metabolic pathway, and as far as I know, whatever they prefer to use as an energy source is ethanol. They would be opportunistic when they found methanol, if that was something that they could metabolize, then yes, that would be a potential pathway. I think that looking at bio-diesel, and the components and the role of biodiesel in this process is definitely something that would be of interest to many people. But we weren't able to discern much of that since we only had one sample with biodiesel.

Q: One of the New York sites was considered clean, yet both of the New York sites showed bacterial growth. Do you have theories or ideas on why one of these sites had more severe corrosion than the other site?

Gregg: They interpreted it as clean, but we weren't able to get a clean site for our sampling, so I consider that site to have the problem. It had more diversification in the microbe component and some differences in the way that some of the symptoms were presenting, like it wasn't as far down in the establishment of the bacterial community, so there were differences in the analyses, but I think that it had the problem, just like the other ones. So even though our intentions were for it to be a clean site, I did put "clean" in quotation marks because it wasn't actually clean.

Q: But one of them was more severely corroded than the other?

Gregg: Yes. The New York 1 site was actually the oldest site so it had a lot more wear and tear anyway, and as the corrosion took over, it was in pretty bad shape.

Q: Any problems with steel tank materials or tank material in fiberglass tanks? The second part of that question is yes, because all tanks are fiber-glass tanks. Would you expect similar problems with steel tanks?

Gregg: We hope to find that out in the next phase.

>Q: For the piping system, etc., does the metallurgy matter for this type of corrosion?

Gregg: The different metals were attacked in different ways. You'll notice that the aluminum components, like the aluminum drop tubes, they themselves weren't really corroded, but corrosion was depositing on them from other components. Given the correct environmental factors, if the pH were to go much lower than 3, that's when the aluminum pieces would be a lot more susceptible.

All the different components have different thresholds for when they would start corroding, but they are all definitely corroding to some extent. Not all of them, I should say, but the majority of these components that are showing a lot of corrosion present in a similar fashion.

Q: I guess another way of putting that question would be, is there a metallurgical solution? In other words, if you were to change all of the types of metallurgies now used in underground storage tanks to some other metallurgy, would this problem disappear?

>Gregg: I've heard of people replacing the majority of pieces at a site with stainless steel, and that has subsided a lot of the issues. I don't know if that is a very realistic solution to the problem, considering how many different metals are used in all the different components and it's not necessarily just metal. There are O-rings and seals and other issues that are going on that are being affected, but we're focusing on the metallic components right now.

Q: How much dissolved oxygen is necessary for aerobic activity?

Gregg: I can't tell you the specific number, but oxygen was not an issue. Diesel tanks are vented to the atmosphere, so every time fuel is dispensed, every time fuel is dropped into the tank, basically there's more oxygen being introduced to the system. So it can either be dissolved into the fuel when it was dropped or it can just be coming in through the vapor space and mixing in.

Q: So another way of putting that is, you're always going to have plenty of dissolved oxygen. There's really no way to avoid that.

Gregg: Right.

Q: Three out of four sites failed NACE. If NACE was an "A," would you expect that to be beneficial?

>Gregg: I think it's a gauge for the corrosivity of the fuel. It wouldn't get rid of the possibility that the fuel is a good environment for the bacterium to survive. There's a difference between being a good place for bacteria to survive to produce something caustic, as opposed to some kind of chemical species that's contributing to the corrosivity of the fuel itself.

Q: It wouldn't be the quick and easy solution just to have everything meet NACE standards?

Gregg: It could be helpful to know that the fuel has a lower corrosivity site, since it's not something that's generally used as a gauge, since it's not being transported, it's just being stored.

Q: One of your slides mentions additives. Are you sharing any of your findings regarding additives. Or, what impact, if any, did additives have on this corrosion phenomenon?

Gregg: We basically ruled out this hypothesis. One, it was very difficult to get a lot of information on additives – most of it is very proprietary – and it was hard to know what exactly was in the samples that we received. But basically, since they were geographically separate and there were differences in the suppliers and differences in the owners and how they maintained their tanks, since there were so many similarities as far as the chemical issues and the biological factors and those were very similar, that additives really didn't play a role.

Q: Did Tank NCI have worse corrosion with a relatively high ethanol content in the water?

Gregg: We didn't really rate the level of corrosion. It was similar to the other four sites that were considered severely corroded. I didn't see a difference with that. Like I said, that site did have a biocide treatment two months before and so the microbial component was much less abundant than a lot of the other sites. So if ethanol is contaminating the fuel every time that it's dropped, that ethanol will migrate from the fuel into the water and basically collect in the water until the microbial bacteria come back into the system and eat up the ethanol.

Q: Perhaps another way of putting that is, if a tank had double or triple the amount of ethanol of some other tank, would that affect the rate of corrosion?

>Gregg: Well, it would affect the rate of acetic acid production, and what we're emphasizing is that the acetic acid itself, once it gets on the components, there's really nowhere else for it to go and so it just stays there and keeps the reaction going and basically it gets dosed over and over again every time a fuel drop comes.

Searles: The other thing I would add to that is that if you have too much ethanol, you actually get into a flammability issue and you get out of spec with the ASTM diesel spec. So, there's a point where you hit dropability issues and performance issues with the fuel if you get too much ethanol in it. So, you may not see the higher blends of ethanol, if you will, or higher contaminations of ethanol, because it would cause issues that would take you out of spec and consequently you'd have to pump out your tank

and clean that up a different way. You wouldn't expect it to sit in there and be eaten by your microbes.

Q: *All six of these sites had microbial activity. Would you rate the activity as heavy, moderate or slight, and is there a correlation between the heavy, moderate and slight microbial activity and the amount of activity and the amount of corrosion?*

Gregg: Well, we tried to look at some of those patterns but it was difficult because we didn't really come up with a metric to figure out the severity of the corrosion in the sites. They were either severely corroded sites or the one that we expected to be clean that wasn't. I think that could be of interest to look at in the future, but no, we did not.

Q: *Did you actually characterize the microbial activity in each tank using a classification like, this has heavy microbial activity or that has moderate or slight activity?*

Gregg: With bacterial components, we did the diversity assessment. On one slide that we looked at, there were only a few bacteria that dominated the entire community, which, as far as what we could see as relative amount. We saw how much DNA was able to be extracted from the samples, but then we also were only able to see relative amounts – 50% with one bacterium and another 20% was its close cousin – that there was not a lot of diversity. So as far as actual numbers, we weren't able to actually quantify.

Q: *Was sodium present and if so, was it at a level to identify the source was sodium chloride, or were there other cations involved as a source of chloride?*

>Gregg: Yes, there were sodiums and we had lengthy discussions about whether this was a salt issue. A lot of the chlorides in the sodiums contributed to high conductivity of the water bottoms. I have a feeling that water bottoms sit there for quite a while. None of the ATGs registered a measurement of water, so we were able to gather some water off of the bottom even though it was not easy, but there was no reason for them to go in and take the water out, so over time this water collected a lot more conductivity and chlorides and sodium and there was a component of the sodium chloride and calcium chloride that are used on either side of the country for road salt.

So that's a question that's been raised: Is it the road salt or is it some sort of refinery process that didn't get enough of the salts out, or could it be something entirely different?

Q: *During an internal API 653 tank inspection, an inspector reported seeing a milky white residue inside the tank where the floor experienced aggressive contamination. Have you seen or heard of this before?*

Searles: No, we have not. Be interested in having them e-mail me that information, though.

Q: *Does the bacteria just eat ethanol? Or would it eat ULSD if ethanol wasn't present?*

Gregg: It would be opportunistic and eat what it would prefer, first. Whether it would specifically eat ULSD, I'm not a microbiologist, but I doubt it. I think that it would go to the methanol before it would go to hydrocarbons.

Q: *Isopropyl alcohol is sometimes used in trace amounts to mop up small amounts of water. Can this lead to the same corrosion problems as ethanol?*

Gregg: That's a good question. I don't know. I was going to use isopropyl alcohol as a decontaminant ... for the next phase, but that's definitely something to look into.

Q: *Was any attempt made to sample bacteria on interfaces, that is, water-fuel interface or tank wall interface?*

Gregg: No. Basically, we filtered the water and we filtered the fuel. In getting the water sample, what we had to do was deploy the sampler multiple times, at least a dozen times, to get 100 ml of water. So what we did was try and decant it, the actual interface between the fuel and the water was disturbed but it also was actually captured over and over. So, we didn't specifically go after a sample that was mixed, but we ultimately ended up with a water sample that had some fuel there on it.

Q: *What are the types of bacteria found in these locations?*

Gregg: It's not very diverse. The majority of bacteria were from the same family of acetobacteriaceae, that are aerobic, that prefer ethanol environments, that like low pHs, that need oxygen that need water. They are pretty much ubiquitous in the environment. They are environmental bacteria that you're going to get if they like the environment.

Q: *If we eliminate the water, does that eliminate the problem?*

>Gregg: Following this hypothesis, probably not. If acetic acid is already coating the equipment, it will continue to corrode.

Q: *If tanks weren't manifolded in this study, then the ethanol source has to be switch-loading or produced by microbes or fungi. Correct?*

Gregg: Or something that we have not identified yet.

Q: *How frequently is a diesel tank cleaned out and the water removed? Is there some kind of standard in the industry?*

Gregg: I think that's on an as-needed basis, usually. There are periodic inspections, but if it's not necessary, I don't think people are going to shut their tanks down and do that without a need for it.

>Q: *Since ethanol is only 10% in the U.S. gasoline, what concentration of hydrocarbon did you find in the samples?*

Gregg: We didn't find much out of the ordinary for diesel. Table 10 gives a breakdown of the hydrocarbons, but they were just general diesel hydrocarbons.

For Oil and Gas Industry, Obama's Victory Presents 'Incredible Regulatory Hurdles'

It's fairly safe to say the oil and natural-gas industry is less than thrilled by U.S. President Barack Obama's re-election on November 6.

While industry leaders and analysts put different spins on the results – some were glum; others seemingly confident they could work with Obama – it's clear most of the industry backed Republican presidential contender, Mitt Romney, and his party.

Some leaders congratulated Obama, while others predicted trouble on the horizon.

Julia Bell, a spokesperson for the Independent Petroleum Association of America, said the election represents an important moment for the U.S. oil and natural gas industry.

"We face incredible regulatory hurdles from the administration, but the great news is that, so far, producers have been able to overcome them to grow oil and natural-gas production to record levels in this country," Bell said.

"The fact is the economy will not be able to get back on track with a crippled energy industry," she noted. "If the president wants job creation, he is going to have to rely on America's oil and natural-gas industry."

Tax issues will likely resurface in Congress, Bell said, "so we just need to keep educating legislators and the American people how critical the deductions of intangible drilling costs and percentage depletion are to sustained production levels."

Crowe Horwath LLP, among the largest public-accounting and consulting firms in the nation, on November 7 noted that current Internal Revenue Service code contains targeted deductions for taxpayers in specific industries.

Obama's proposed changes would eliminate many targeted provisions available to fossil-fuel industries – oil, gas and coal – while renewable-energy incentives might be extended or increased, the firm said.

According to a recent *Reuters* report, energy companies likely will face more regulations in Obama's second term – and less access to federal lands and water even as the administration promotes energy independence. Tighter rules are expected for oil and gas drilling, and it's possible there could be stronger emission rules for petrochemical producers.

While Obama said he would cut oil imports in half by 2020, he also said he would roll back subsidies for oil companies and reduce the nation's reliance on oil by mandating the production of more fuel-efficient vehicles.

"You are going to have less access to federal lands and tougher government agencies," Dan Pickering, chief investment officer at TPH Asset Management in Houston, told *Reuters*.

In a statement released November 7, Jack Gerard, president and CEO of the American Petroleum Institute (API) congratulated Obama on his re-election, adding that he looks forward to continuing API's work with the administration to expand domestic oil and natural gas as major pathways for job creation and economic growth.

Gerard hopes to help the president "fulfill his campaign promise to increase domestic-oil and natural-gas production that will create American jobs and strengthen our economy."

The API head noted that both candidates supported more development of oil and natural-gas resources. "Energy is a big winner in this election," he said.

Gerard also encouraged the president to approve TransCanada Corp.'s Keystone XL pipeline and "put thousands of Americans to work."

"By following through on his own executive order to eliminate overly burdensome regulations, he can rein in EPA [Environmental Protection Agency] plans to impose regulatory burdens that could cost businesses hundreds of billions of dollars and chill economic growth," he added.

Further, Gerard urged the president to acknowledge that states already are effective in oil and natural-gas regulation and avoid the temptation to impose unnecessary, redundant regulations on hydraulic fracturing.

"The domestic energy-from-shale boom is just beginning," he said. "We have an unprecedented opportunity to work together to create millions of new jobs, generate hundreds of billions of dollars for our government and strengthen our energy and national security. With the right public policies, this could be a game-changer for America."

Still, the antipathy between the oil and gas industries and Obama was no secret during the president's first term. Energy policy on Obama's re-election campaign website was framed by the question, "Why is Big Oil Attacking President Obama?"

Obama has said he supports tapping the country's 100-year supply of natural gas and expanding domestic-oil production by offering millions of acres of land for development. However, he attacked Romney's energy plan, saying it was "written by Big Oil for Big Oil" and that it wouldn't move U.S. energy security forward.

Offering further contrast, Obama said Romney would "continue giving government handouts to oil and gas companies – US\$4 billion a year."

As for natural gas, Obama claimed Romney wouldn't make the U.S. more secure and would open up "sensitive lands and coasts to drilling," without the proper safety and environmental safeguards in place.

The industry let money do its talking.

Since the 1990 election cycle, 75% of oil and gas contributions have gone to Republicans, according to

opensecrets.org, a website run by the Center for Responsive Politics.

During the 2008 election campaign, Obama received \$884,000 from the oil and gas industry – more than any other lawmaker except then-Republican presidential candidate, Sen. John McCain, according to the website.

This year, Romney received nearly \$4.8 million through oil and gas contributions. With roughly \$705,000 in donations, Obama wasn't even second. That position was taken by Texas Gov. Rick Perry (R), who received \$967,000 in campaign contributions.

Overall, oil and gas contributions totaled \$4.2 million for the Democrats in 2012. A full 90% of contributions went to Republicans – \$39.4 million.

In Texas, shale oil and gas is flourishing, and the state leads the nation in oil and gas production. Ed Longanecker, president of the Texas Independent Producers & Royalty Owners Association said moving forward responsibly – without hampering the industry – is vital.

According to Longanecker, the oil and gas industry employs more than 345,000 Texans and millions more in states throughout the country.

The industry also pays billions of dollars in taxes, including nearly \$9.25 billion in taxes and royalties in Texas, alone, during fiscal-year 2011. Economic growth is tied to the industry, as is tax revenues at a time when they are needed most, Longanecker said.

In South Texas, the Eagle Ford has produced oil, gas and liquid condensate at record levels in recent years – far exceeding original expectations and significantly contributing to a rapidly evolving business climate in the region, Longanecker noted.

From January through August this year, 297,000 barrels of oil per day, on average, were produced in the Eagle Ford – versus 11,900 per day in all of 2010, he noted.

“With the election now behind us, all of our newly elected officials, state regulators, the general public and the oil and gas industry must work together to formulate policy that supports domestic-energy development and provides sustained economic growth while protecting the environment, so as to ensure a bright future for the State of Texas and the U.S.,” Longanecker said.

– Darren Barbee, Hart Energy

U.S. President Obama's Re-election to Bolster EVs, Emission/Fuel Standards

U.S. President Barack Obama's re-election on November 6 likely means continuing U.S. government support for “green” electric vehicles (EVs) and likely clears the way for finalization of proposed “Tier-3” lower-sulfur gasoline and lower-emissions vehicle standards.

As noted in a November 7 report from *Automotive News*, “the [U.S.] auto industry figured heavily in Obama's re-election effort, which included as a centerpiece the US\$85-billion auto bailout and the resurgence of General Motors and Chrysler” following bankruptcies by both automakers.

“Car companies may not agree with all of Obama's policies, but they can accept the predictability of the White House-brokered corporate average fuel-economy deal with automakers and the State of California,” according to *Automotive News*.

“The rules, which set annual targets that ramp up to the equivalent of 54.5 miles per gallon by the 2025 model year, should now go into effect without major changes through the end of Obama's second term in 2016.”

Meanwhile, the U.S. Environmental Protection Agency (EPA) is now seen likely to plunge ahead with final “Tier-3” rules requiring refiners to slash maximum sulfur content in gasoline to 10 parts per million (ppm).

That would make U.S. gasoline effectively match Euro-5 gasoline-sulfur limits, while helping automakers meet tougher tailpipe-emissions standards. Obama reportedly had ordered the EPA to hold-off publishing the Tier-3 rules until after the election because of Republican claims that the rules would trigger higher gasoline prices.

Current U.S. gasoline is limited to 30-ppm sulfur (average) and 80-ppm sulfur (maximum). Refiner-sponsored studies found that slashing sulfur in gasoline could cost more than US\$0.20 per gallon (/gal), but other studies sponsored by air regulators and automakers found that the refiner-cost impact would be trivial – less than US\$0.01/gal.

EV Support

Obama's goal to have one million EVs on U.S. highways by 2015 is likely to fall short, according to several recent industry studies. But the president nevertheless will continue government subsidies for EV expansion, according to the *Automotive News* analysis.

“Obama proposed in February [2012] to increase a \$7,500 tax credit for electric cars to as much as \$10,000, a clear sign he'll resist efforts to cut that subsidy during the tax talks that will grip Washington over the next few months,” according to the report.

Under recently finalized EPA and U.S. National Highway Traffic Safety Administration fuel-economy and carbon-dioxide (CO₂) rules for cars sold between 2017 and 2025, EVs get big CO₂ credits that effectively will allow automakers to offset the higher CO₂ of their more profitable sport-utility vehicles (SUVs) and pickup trucks with the lower CO₂ of EVs.

As a result, automakers can take profits from their relatively robust SUV sales to subsidize the higher cost of relatively lower-volume EV sales.

Saudi Aramco Selects Contractors for 'Jazan' Refinery/IGCC Project

Saudi Aramco [announced](#) October 21 that it picked seven contractors for its 400,000 barrels/day "Jazan" refinery and integrated gasification combined cycle (IGCC) project in the southwest part of the Kingdom.

"After completion of front-end engineering design (FEED) work in April 2012, competitive bidding for the EPC contracts took place, and it has concluded with the selection of Saudi Arabian and international contractors to implement the mega-project," according to Aramco.

The winning contractors include Petrofac Saudi Arabia Ltd. (Saudi Arabia), Hyundai Arabia Co. Ltd. (Saudi Arabia), Hanwha Engineering and Construction Corp. (Korea), SK Engineering & Construction Co. Ltd. (Korea), Tecnicas Reunidas (Spain), JGC Corp. (Japan) and Hitachi Plant Technologies Ltd. (Japan).

"Scheduled for completion in late 2016, Saudi Aramco's Jazan Refinery and Terminal mega-project is expected to play a significant role in the supply of feedstock and fuels to support the growth of major industries in Jazan Economic City," according to Aramco.

"The refinery will process Arabian Heavy and Arabian Medium crude oils, and produce gasoline, ultra-low sulfur diesel, benzene and paraxylene.

"The Jazan Refinery will be synergized with a world-scale integrated gasification combined-cycle plant that is currently at the FEED stage.

"The marine terminal will have the capacity to handle very large crude carriers (VLCCs) for the supply of crude oil to the refinery and berths to support refined product exports from the refinery," according to Aramco.

Q&A With Plains All American Chief Greg Armstrong

Greg Armstrong, the chief executive of Plains All American Pipeline, a master limited partnership (MLP), recently answered questions about issues that have a direct link to unconventional oil and gas technology in the U.S. – particularly in South Texas.

"The Eagle Ford is one of three of the largest resource plays in the United States. Rig count in the Eagle Ford, Permian and Bakken account for about 50% of the rig count in the U.S.," Armstrong said. "The Eagle Ford and the Permian, for us, are the most resilient because of well cost, well depth and their proximity to market.

"We've gone from a nominal level of pipeline capacity coming out of the Eagle Ford to the current projects that are under construction or existing pipelines that are about 1.8 or 1.9 million barrels."

Plains All American is the fourth-largest MLP behind Enterprise Products Partners, Kinder Morgan and Williams. Plains has four product platforms: crude oil, natural gas liquids, refined products and natural-gas storage, the largest of which is crude oil. The company has an asset base throughout the United States and Canada.

At Hart Energy's recent DUG Eagle Ford conference in San Antonio, Armstrong answered questions about a business model for pipelines, transportation issues and possible bottlenecks in the pipeline system.

Hart Energy: *MLPs have become the predominant business model for pipelines. If there anything that would cause that to change?*

Armstrong: It has been a very good run, and we're seeing a lot of non-traditional assets being placed into the MLP market, and some of the non-traditionals are somewhat subject to cycles. As an MLP, our focus is on distributing cash flow at least at the current distribution level and obviously raising it over time.

We're focused on making sure people understand that some of the newer aspects that have come into the market have some cyclicity.

Hart Energy: *You mentioned that rail and barges are a partial solution to the transportation issue. Can you elaborate on that?*

Armstrong: Rail and barge will be the immediate transportation solution. To move product from the Bakken all the way to the East Coast can range, depending on whether you're doing manifest trains, which are under 104-car trains, or unit trains, which are 104 cars, can probably run in the neighborhood of US\$13-plus per barrel. As long as you're moving barrels from the Bakken, for example, to the East Coast against an \$18 Brent differential, then you actually have enough profit margin to make it worth your while.

We recently bought a shut-down refinery on the East Coast. We're basically disassembling the refinery part of it in Yorktown, Virginia, and converting it to a terminal that allows us to bring in Bakken crude and put it on a barge. So we can actually take Bakken crude up and down the East Coast.

You might ask why don't you go ahead and build a pipeline? It's very difficult to build pipelines through these highly populated areas, but the railroads already exist there. We can do the same thing (using rail) on the West Coast. For some of the product in the Gulf Coast, we can actually

put in on ocean-going barges and move it around Florida and up into the East Coast. That's going to be the near-term solution.

Longer term what they should let us do – but is not politically popular right now – is export light crude to markets that want light crude and continue to bring in sour crude, but it's difficult in the U.S. today to export crude without presidential permission.

The other solution that would make more sense would be to put it on barge or vessels and move it from a U.S. port to a U.S. port. But there we've got the protectionism of the *Jones Act* that doesn't allow you to go port to port in the U.S. unless it's on a U.S.-built and U.S.-flagged crude vessel. Quite candidly, we don't have any of those anymore other than ocean-going barges.

Hart Energy: *If we look at the pipeline system, particularly with NGLs, it seems like we'll have the capacity to transport it. But the next bottleneck appears to be the ability to process it. Are you seeing something along those lines, and if that's the case what type of window do we have before transportation, processing and production are all backed in to a balance?*

Armstrong: It's going to be several years, I think, because the rate of growth in the Eagle Ford has surprised all of us. It's been growing by huge amounts each month. We went from a standing start in 2008, and shifted over to crude oil focus in 2010 and 2011.

We've seen some months where the average rate of production over the prior month is about 60,000 barrels a day higher. None of us had that kind of clairvoyance, so we're playing catch-up.

– Mike Madere, Hart Energy

TransCanada to Build US\$1-Billion Natural Gas Pipeline in Mexico

TransCanada Corp. announced November 1 that its Mexican subsidiary, Transportadora de Gas Natural del Noroeste, won a US\$1-billion contract from Mexico's federal power company to build a 329-mile (530-kilometer) natural-gas pipeline.

The Calgary, Alberta-based pipeline company said the deal includes a 25-year natural-gas transportation service contract with Mexico's Comisión Federal de Electricidad (CFE).

According to TransCanada's announcement, the El Encino-to-Topolobampo pipeline will have contracted capacity of 670 million cubic feet per day and is expected to be in service by the third quarter of 2016.

"Mexico's government is engaged in a comprehensive plan to expand the nation's electrical grid and generating capacity, and much of that generation will be natural gas-fired," TransCanada president and CEO Russ Girling was quoted as saying.

The Topolobampo pipeline will begin in El Encino, in the state of Chihuahua, and terminate in Topolobampo, in the state of Sinaloa – interconnecting with other pipelines that are expected to be built as a result of separate bid processes by the CFE, according to TransCanada.

"This project is a response to a CFE invitation to bid. As Mexico makes the transition from fuel oil to cleaner-burning natural gas, there will be additional opportunities for TransCanada," Girling added.

TransCanada already has built and is operating the Guadalajara and Tamazunchale pipelines and will soon break ground on a Tamazunchale pipeline extension, the announcement also noted.

Gunvor Raises US\$625 Million for Belgian-Refinery Credit Facility

Switzerland-based Gunvor announced October 31 that it closed an oversubscribed borrowing-base credit facility to support operations at its "Independent Belgian Refinery" (IBR) in Belgium.

The facility launched at US\$500 million and closed oversubscribed at US\$625 million, according to Gunvor.

"Confidence in Gunvor's business plan for its refining operations is very strong, with about 45% of IBR's facility consisting of new funding beyond standing allocations from our banking partners," Gunvor Group chief financial officer Jerome Schurink said. "Gunvor's move to diversify its operations to become a truly integrated trading house has clear support."

ING and Rabobank were the two mandated lead arrangers of the facility, of which 25% of the participation came from non-European markets.

The credit facility will be used to finance the purchase of crude oil and feedstocks for the refinery, as well as carrying of receivables, according to the company.

U.S. LNG Exports to the Rescue?

In the last half decade, the United States – once a net importer of natural gas – is now on the threshold of becoming a major exporter of liquefied natural gas (LNG).

In the early part of the 21st century, companies began building LNG import terminals in advance of an expected decline in natural-gas production.

What was once seen as a strong investment began to sour as unconventional natural-gas producers started to unlock the vast amounts of shale gas reserves in North America.

While the first of these shale plays to reach production in the U.S., the Barnett shale in the Fort Worth basin, was considered to be a source of incremental volumes of the country's gas supplies, it was anticipated that the majority would be coming from LNG imports.

However, in the years since the advent of the Barnett shale, the need for LNG imports has dissipated as shale production has exploded from the likes of the Bakken, Eagle Ford, Fayetteville, Haynesville and Marcellus.

Production from these plays was brought on so quickly – with reserve levels so high – they have not only been able to meet domestic demand but, in fact, have overwhelmed this demand to the point where natural-gas prices have fallen more than 75% since 2008.

Meanwhile, LNG prices have much higher values than domestic gas prices, especially in the wake of the 2011 Fukushima disaster in Japan. As Japan shuts its nuclear power program, its demand for LNG will continue to rise.

The price discrepancy has potentially given new life to the expensive LNG terminals that have been constructed in recent years and gone largely unused as the owners of these facilities have been seeking permission to export LNG volumes from the U.S. to more lucrative foreign markets.

Thus far, only Cheniere Energy's Sabine Pass terminal has received permission from the Federal Energy Regulatory Commission (FERC) and the U.S. Department of Energy (DOE) to export up to 803 billion cubic feet per year – 2.2 Bcf per day (Bcf/d) – of domestically produced LNG volumes to countries both with and without Free Trade Agreements (FTA) with the U.S. The company stated it could be ready to export these volumes as early as 2015.

Fourteen other terminals have received DOE approval to export LNG to FTA countries. The majority of these applications are also seeking to export volumes to non-FTA countries.

Projects include:

- Freeport (Texas) LNG, which received approval for two applications in February 2011 and February 2012 to export 511 Bcf/d to FTA countries. This project is expected to take three to four years to complete and could be brought online in early 2017;
- Southern Union's Trunkline LNG in Lake Charles, La., was approved in July 2011 to export 2 Bcf/d of LNG to FTA countries. The company said that construction could start in 2014 with the terminal being functional for exporting by 2018;
- Carib Energy received approval in June 2011 to export 300 million cubic feet per day (MMcf/d) of LNG from Florida and the Gulf Coast via ISO containers to FTA countries;

- Dominion's Cove Point LNG terminal on the Chesapeake Bay in Maryland received authorization in October 2011 to export 1 Bcf/d;
- Jordan Cove Energy Project seeks to build a terminal in Coos County, Ore., that will export 1.2 Bcf/d of LNG. It received DOE approval to export LNG to FTA countries in December 2011;
- Sempra's Cameron LNG received permission from the DOE in January 2012 to export 1.7 Bcf/d from Hackberry, La., to FTA countries. The company stated that it intends to start construction on the project in late 2013 and begin operations in late 2016;
- Gulf Coast LNG Export announced plans to build an export terminal in Brownsville, Texas, that will be capable of exporting up to 2.8 Bcf/d. The company is owned by Freeport LNG's chief executive Michael Smith and is pending approval to export to both FTA and non-FTA countries;
- Gulf LNG Liquefaction Co. received permission from the DOE in June 2012 to export 1.5 Bcf/d of LNG from its terminal in Pascagoula, Miss.;
- Oregon LNG anticipates completing work on its terminal in Warrenton, Ore., in 2017. It received DOE approval to export 1.25 Bcf/d to FTA countries;
- SB Power Solutions received DOE permission in June 2012 to transport 700 MMcf/d of LNG from the Atlantic Coast to the Gulf Coast and on to FTA countries;
- Southern LNG Company received DOE approval in June 2012 to export 500 MMcf/d of LNG from its terminal on Elba Island in Georgia, to FTA countries;
- Excelerate Liquefaction Solutions I was granted a permit in August 2012 to export 1.38 Bcf/d of LNG from a terminal it is planning to build in Calhoun County, Texas, to FTA countries; and
- Golden Pass LNG terminal owned by ExxonMobil and Qatar Petroleum International received DOE approval in September 2012 to export 2.6 Bcf/d of LNG to FTA countries.

– Frank Nieto, Hart Energy's Midstream Monitor,
MidstreamBusiness.com

Neste Inaugurates Microbial-Oil Pilot Plant for 'NExBTL' Diesel Feedstock

Neste Oil announced October 26 that it has opened Europe's first pilot plant for producing microbial oil from waste and residues at Porvoo, Finland.

"Microbial oil produced from industrial and agricultural residues, such as straw represents one of the most promising future raw materials for 'NExBTL' renewable diesel," according to Neste.

Neste senior vice president Lars Peter Lindfors added that "the start-up of the new microbial oil pilot plant represents a significant step towards achieving this goal, as the plant will test how various agricultural and forest industry residues can be converted into oil with the help of microbes.

"Agriculture in Finland and elsewhere, for example, produces large quantities of straw, but little of this straw is put to effective use. Thanks to the technology that we have developed, it will be possible to process straw into a feedstock for premium-quality renewable diesel in the future. Our microbial technology is also capable of handling many other raw materials as well," Lindfors said.

The microbial oil research program also involves Aalto University School of Chemical Technology.

Neste Oil announced in December 2011 that it was going to invest €8 million [US\$10.3 million] in building a microbial oil pilot plant alongside its Technology Center at Porvoo.

"The first phase of the plant was completed in August this year and has already successfully produced microbial-rich biomass," according to Neste. "Microbial oil is expected to enter commercial production in 2015 at the earliest."

MARKET REPORT

U.S. NGL Prices Plummet, Undercut Gas Fracking; Diesel More Profitable

Prices for U.S. natural gas liquids (NGLs) have plummeted this year, "weakening the profitability of a key driver of the U.S. shale [gas-fracking] development," according to a new study by energy industry consultants Ernst & Young.

"Extracting NGLs, such as ethane, propane and butane, is still more attractive than producing dry natural gas, but it's not as robust as it was nine months ago," according to Ernst & Young.

"NGL production has surged over the last few years as oil and gas producers dramatically changed their drilling focus from dry to liquids-rich gas in a bid to boost profits. But supply has outpaced demand, primarily from chemical plants that use NGLs as feedstock for plastics. The result has been lower prices," according to the consultants.

"Companies still have plenty of incentive to produce NGLs. Prices remain significantly higher than natural gas. But we're seeing a marked shift in demand," said Marcela Donadio, oil and gas analyst at Ernst & Young. "The market for liquids seems to be leveling out," Donadio said.

"Further pressuring the 'frac spread' has been the recent increase in [U.S. spot] natural gas prices, which have been driven upward by improving fundamentals – a slow-down in production growth, increasing demand (particularly in the power sector, where year-to-date gas consumption is up 30%), and a reduction in the massive storage overhang that had persisted over most of the past year," according to the analysts.

"Spot natural gas prices have climbed over US\$3.25 per million Btus (British thermal units). While this is about 50% higher than the second quarter, it is still low by historical standards.

"After a long time of being significantly above normal levels, natural-gas storage levels in the U.S. are approaching a more average range. This is encouraging for natural gas producers as prices would be strengthened by a cold, early winter and lower storage levels."

Meanwhile, "U.S. oil production continues to grow amid increased shale drilling, but infrastructure bottlenecks remain a serious issue. Defying the historical trend, moving crude by rail has become a crucial piece of the U.S. energy infrastructure and the solution continues to gain ground," according to the analysts.

Diesel/Gasoil Margins Still Strong

Simultaneously, "profit margins for the global refining business strengthened [in third-quarter 2012] compared to the second quarter as product prices stayed relatively high," according to the analysts.

"Much of the recent strength in the global downstream segment has come from improved margins from distillates, such as heating oil, gasoil and diesel fuel. Global distillate demand growth has remained relatively strong, while gasoline demand worldwide has been fairly weak," according to the analysts.

"Looking ahead, the future for the downstream sector continues to present challenges. A lot of new refining capacity is expected to come online in the next three to five years, which would erode refining margins across the board and could force less-profitable plants in the U.S. and Europe to close."

Idling Engines on Biodiesel Worse on Emissions than ULSD - Study

Idling diesel engines that run on a blend of 20% fatty acid methyl ester (FAME) biodiesel (B20) blend produce worse "toxic" tailpipe emissions than idling the same engine on

pure hydrocarbon ultra-low sulfur diesel (ULSD) fuel, according to a new [study](#) by researchers at the University of Michigan and University of Minnesota.

The study investigated regulated and unregulated emissions from both light-duty passenger car (1.7-liter) and medium-duty (6.4-liter) diesel engines at idle and load.

Exhaust aftertreatment devices on the vehicles included a diesel-oxidation catalyst (DOC) and a diesel particle filter (DPF).

“For the 1.7-liter engine under load without a DOC, B20 reduced brake-specific emissions of particulate matter (PM), elemental carbon (EC), nonmethane hydrocarbons (NMHCs), and most volatile organic compounds (VOCs) compared to ULSD,” according to the study. “However, formaldehyde brake-specific emissions increased.

“With a DOC and high load, B20 increased brake-specific emissions of NMHC, nitrogen oxides (NO_x), formaldehyde, naphthalene and several other VOCs.

“For the 6.4-liter engine under load, B20 reduced brake-specific emissions of PM_{2.5}, EC, formaldehyde, and most VOCs; however, NO_x brake-specific emissions increased.

“When idling, the effects of fuel type were different: B20 increased NMHC, PM_{2.5}, EC, formaldehyde, benzene, and other VOC emission rates from both engines, and changes were sometimes large, e.g., PM_{2.5} increased by 60% for the 6.4-liter, 2004-calibration engine, and benzene by 40% for the 1.7-liter engine with the DOC, possibly reflecting incomplete combustion and unburned fuel.

“Diesel-exhaust emissions depended on the fuel type and engine load (idle versus loaded). The higher emissions found when using B20 are especially important given the recent attention to exposures from idling vehicles and the health significance of PM_{2.5}.

“The emission profiles demonstrate the effects of fuel type, engine calibration and emission-control system, and they can be used as source profiles for apportionment, inventory and exposure purposes,” according to the researchers.

U.S. Focus on Shale Gas Affecting Domestic Butadiene Production - Study

The relatively recent and intense exploitation of U.S. natural-gas reserves is resulting in an increased dependence on butadiene imports, according to a report released October 30 from business intelligence group GBI Research.

The business intelligence company’s latest study predicts that the disparity between butadiene production and demand will climb in the near future as the U.S. moves away from crude oil and naphtha to the increasingly cheap natural gas.

The percentage of C₄ hydrocarbons required for the production of butadiene is very low in natural gas compared to crude oil or naphtha. As a result, growing demand will necessarily require a boost in imports.

U.S. butadiene demand last year stood at 1.9 million tons – comparable with the 1.6 million tons the country produced.

Still, GBI Research predicts demand will hit 2.4 million tons by 2020, while butadiene yield will climb at a slower rate – reaching 1.9 million tons by the end of the decade.

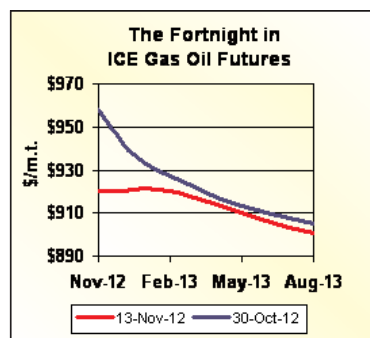
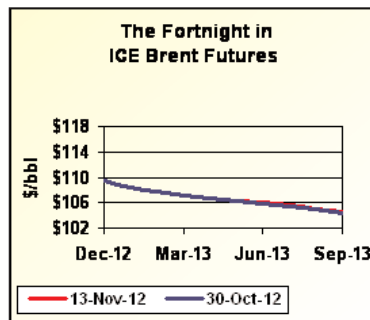
The next four years, in particular, are expected to be relatively bleak in terms of butadiene production growth. Beyond that period, a number of on-purpose technologies are currently in development, possibly boosting overall production.

However, it will take some time for these to emerge as a viable alternative supply option, the research firm said.

In 2011, the U.S. imported 329,118 tons of butadiene, with Canada, South Korea, Netherlands, China, the U.K. and Germany the leading suppliers. GBI Research expects that figure to rise to 524,916 tons by 2020.

Fortnight Market Snapshot: ICE Brent Futures and ICE Gasoil Futures

These charts show biweekly activity of the ICE Brent Futures and ICE Gasoil Futures from October 30 to November 13.



Report: Asia-Pacific to Lead Oil Refinery Additions Until 2017

With a total of 24 planned oil refineries, the Asia-Pacific region is expected to contribute 40% of global capacity

additions over the next five years, according to the latest report from energy research firm GlobalData.

According to the report, China alone is expected to install nine new refineries by the end of 2017, with 2,211,000 barrels per day (b/d) in total crude distillation unit (CDU) capacity additions during the 2012-2017 period – the most of any country in the world and nearly double that of the second greatest contributor, Saudi Arabia, with a total of 1,201,000 b/d in additions during the same timeframe.

China's national oil companies PetroChina and Sinopec will be responsible for most of the country's additions in the near future. Sinopec plans to build two new refineries in China, one in the coastal city of Lianyungang with an initial capacity target of 240,000 b/d and the other in Zhanjiang with expected crude processing capacity of 300,000 b/d, according to the announcement.

PetroChina aims to install five new-build refineries between 2012 and 2017 across locations such as Sichuan and Yunnan.

GlobalData forecasts that India will place a distant second in the region's CDU capacity additions, with 803,000 b/d over the next five years, while Indonesia is forecast third with a total of 319,000 b/d.

By region, GlobalData's report predicts the Middle East and Africa will follow Asia-Pacific closely with 37% of the global additions for 2012-2017, leaving Europe and the America's combined total at just 23%.

Diesels Now Seen Much Worse on Aerosol Pollutants - UC-Berkeley Study

Air-pollution researchers and regulators have long believed that "secondary organic aerosol" (SOA) vehicle pollutant emissions were mostly a gasoline problem rather than a diesel problem, largely because evaporative emissions from gasoline are much worse than from diesel.

But a new study by University of California-Berkeley (UC-Berkeley) researchers discovered that prior studies greatly underestimated diesel SOA emissions – and regulations allowing alternative compliance with California Air Resources Board (CARB) ultra-low sulfur diesel (ULSD) limits on aromatic content aggravate the problem.

The new study has just been published in the prestigious *Proceedings of the National Academy of Sciences*. The U.S. Environmental Protection Agency (EPA), the U.S. Department of Energy, the U.S. National Oceanic and Atmospheric Administration (NOAA) and the California Air Resources Board (CARB) jointly funded the study.

Asked to explain the new findings, UC-Berkeley study co-author Drew Gentner on October 23 told *Diesel Fuel News* the following:

Diesel Fuel News: *Why did all the previous studies fail to notice this? Were they looking for the wrong indicators?*

Gentner: Previous work on this topic has noted the potential importance of both gasoline and diesel sources for SOA formation. Previous studies have not failed to notice the importance of motor vehicles for this pollution, but we collected new data with advanced techniques to allow us to provide one of the first quantitative estimates of gasoline versus diesel contributions to this pollutant.

Diesel Fuel News: *It's well-known that gasoline vehicles (and refueling stations) have higher evaporative emissions than diesel vehicles/refueling sites (as gasoline is more volatile). Is it possible that the Berkeley study is underestimating the higher amounts of evaporative gasoline emissions that later could convert to SOAs in the atmosphere, in addition to tailpipe SOAs?*

Gentner: Gasoline vehicles do have considerable evaporative emissions. We address these non-tailpipe emissions from gasoline, but while these emissions are important for ozone formation they do not have the right chemical characteristics to form SOA.

Diesel Fuel News: *How were the emissions measured? Tailpipe sampling? Ambient air sampling? Tunnel measurements?*

Gentner: We assess the chemical composition and magnitude of gasoline and diesel emissions through multiple methods: sampling and analyzing liquid fuels, ambient air measurements in downtown Bakersfield, California, and measurements of tailpipe emissions in a tunnel.

Diesel Fuel News: *What about the impact of post-2010 diesels, which are equipped with ultra-low-emissions control devices (particle filters, oxidation catalysts, nitrogen oxides catalysts)? Isn't it likely that the post-2010 diesels will have much lower emissions (including SOAs) and hence as the old diesels are scrapped and replaced with new diesels that the emissions will decline? In other words, isn't California (and the U.S.) moving in the right direction on diesel (and gasoline) emissions reductions?*

Gentner: You are correct. New diesel vehicles hitting the road are much cleaner (as are new gasoline vehicles). The policies in place in California are improving air quality overall and will reduce emissions of the compounds that form SOA.

Diesel Fuel News: *Why is the San Joaquin Valley especially significant in this study? Is that because there are a lot of old, obsolete diesel engines used on farms or other non-road sectors? Or some other reasons?*

Gentner: The San Joaquin study is just a case study in the paper. This is because they have serious air quality problems and we were part of a larger air quality study there. It is an interesting location for this paper given that more diesel is used in that region than other locations such as Los Angeles, where there have been many air quality studies.

Diesel SOA Exceeds Gasoline SOA

In their investigation in two California regions, the study authors discovered that diesel exhaust is responsible for 65% to 90% of a region's vehicular-derived SOA, depending upon the relative amounts of gasoline and diesel used in the area.

"We can now say that, while both motor vehicle sources are important for these 'secondary' particles, diesel is responsible for a larger portion, especially in regions such as the San Joaquin Valley with a lot of diesel use," according to principal investigator Allen Goldstein.

The researchers analyzed a total of 40 gasoline and 12 diesel fuel samples from California, employing several gas-chromatography methods, which yielded a "comprehensive speciation of the 'unresolved complex mixture' in diesel fuel," according to their paper.

"Gasoline hydrocarbons fall mostly within the VOC [volatile organic compound] range, with some aromatics extending into the IVOC [intermediate VOC] range, whereas only 30% of diesel fuel hydrocarbons are in the VOC range," according to the study.

"Diesel fuel is widely distributed across molecules containing 8 to 25 carbon atoms with a peak around 10 to 13 carbon atoms. This peak is a result of aromatics and cycloalkanes, as straight and branched alkanes are evenly distributed between 10 and 20 carbon atoms. Aromatic and aliphatic hydrocarbons make up 23% and 68% of diesel fuel, respectively.

"By comparison, gasoline contains ~30% aromatics, with the remainder of the non-ethanol fraction dominated by straight and branched alkanes with less than 10 carbon atoms," the study noted.

As a result, "for the same mass of unburned fuel emissions reacted, diesel exhaust forms 6.7 times (plus or minus 2.9 times) more SOA than gasoline exhaust. Considering differences in emission factors, diesel exhaust is expected to form 15 times more SOA than gasoline per liter of fuel burned.

"For populated regions with 10% to 30% diesel fuel use, this implies that diesel exhaust is responsible for two to seven times more SOA than gasoline exhaust.

"Non-tailpipe gasoline emissions were 39% to 77% lower than gasoline exhaust emissions and produce negligible SOA as a result of a substantially lower yield," they found.

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CARB Diesel-Regulation Factor

“In 1993, with the goal of mitigating emissions of particulates and nitrogen oxides, California regulated diesel fuel to have less than 10% single-ring aromatics and 1.4% polycyclic aromatic hydrocarbons, but concerns about engine performance and the cost of fuel production led the state to allow higher aromatic levels in diesel fuel,” the study notes.

“It is evident from our data that the vast majority of diesel fuels sold in California are certified alternative formulations that contain nearly double the aromatic content than initial regulations intended.

“Although the fuel regulations were designed to help control primary particulate emissions (i.e., black carbon), this enhancement of aromatic content in diesel fuel increases the SOA potential of diesel emissions, especially for hydrocarbons with 9 to 17 carbon atoms.

“Significant progress is being made to improve heavy-duty diesel engine performance with post-combustion control technology, which may affect emissions of gas-phase organic carbon, but it is clear that attention to gasoline and diesel fuel composition and emissions of reactive organic gases is necessary to control SOA precursor contributions from all vehicle classes [including older engines lacking 2010 and later emissions controls].

“Furthermore, this work has focused on organic carbon emissions originating from fuels, but emissions of unburned motor oil from both gasoline and diesel vehicles represent an additional source of organic carbon.

“Although total consumption of oil is minor relative to fuel, oil contributes gas and particle-phase compounds with lower volatilities than diesel fuel and should continue to be monitored in field, laboratory, and modeling studies,” according to the study.

Diesel Technology Forum Response

In reaction to the UC-Berkeley study, the Diesel Technology Forum (DTF) on October 25 issued a [statement](#) questioning some of the findings.

“While this UC-Berkeley study concluded that diesel emissions were worse for smog formation than gasoline, a March 2012 study by the National Oceanographic and Atmospheric Administration (NOAA) and Cooperative Institute for Research in Environmental Science (CIRES) found that ‘gasoline emissions were the predominant contributor to the secondary organic aerosol mass,’” DTF executive director Allen Schaeffer said.

“Atmospheric chemistry is a complex science and it is clear from this and other studies that the science is still evolving and is without a consensus. We intend to continue

working with the scientific community to evaluate the science and better understand its implications.

“EPA notes that the formation of PM_{2.5} [fine particulate] from NO_x [nitrogen oxides] and VOC [volatile organic compound] gases from on-road mobile sources is not a constant value or conversion factor. Many environmental factors are responsible for the conditions that make it favorable or unfavorable for formation of PM_{2.5} from these compounds.

“While the scientific debate will continue on atmospheric chemistry, there is no debate about the impact of clean diesel technology in terms of air quality and emissions of fine particles.

“No other sector has done more to improve California’s air quality in the last decade than diesel.

“According to the California Air Resources Board [CARB], particulate emissions from heavy-duty diesel trucks have declined from 7.5% of the overall state inventory in 1990 to 3.8% in 2008, and by 2020 it will be just 1.6%. The CARB also projects that from 2008 to 2020, while emissions of all sources of PM are expected to increase by 3.2%, PM from all diesels will decline by 58%.”

– Jack Peckham

EU Study: ‘Surplus’ Land for Biofuels May be Overstated

A new [study](#) by a team of 11 scientists from Europe and the United States suggests that the indirect land-use change (ILUC) phenomenon tied to the growth of biofuel croplands could be underestimated because of faulty calculations on supposedly “surplus” lands for crop expansion.

“We still have limited understanding of how much land is truly surplus and suitable for energy crop production,” said Jens Dauber, study lead author at Germany-based Helmholtz Centre for Environmental Research (UFZ).

One key reason for uncertainty is because of “constraints arising from environmental and socio-economic implications of bioenergy development in those areas [which] are often not accounted for in assessments of land availability,” Dauber said.

As a result, the researchers propose a “thorough reassessment of land availability for bioenergy production by clarifying the terminology of surplus land and taking both constraints and options for efficient and sustainable bioenergy-land use into account.”

“Factoring in the constraints, combined with creativity in utilizing the options provided by the novel cropping systems, would lead to a more sustainable and efficient development of the bioenergy sector,” according to Dauber.

EU ILUC Guidance

On a related front, the European Commission published a guidance [memo](#) October 17 to Member States on calculating ILUC for a newly revised EU 2020 biofuels directive.

According to the memo, “the new rules will make biofuels used in the EU more sustainable and will help us to reduce further greenhouse gas emissions and encourage greater market penetration of advanced biofuels.

“This will be achieved in particular by:

- “Increasing the minimum greenhouse gas saving requirements for new installations to 60%, compared to fossil fuels, in order to improve the efficiency of biofuel production processes as well as discouraging further investments in installations with low greenhouse-gas performance [GHG];
- “Including ILUC factors in the reporting by fuel suppliers and Member States of GHG savings of biofuels and bioliquids;
- “Limiting the amount of food crop-based biofuels and bioliquids that can be counted toward the EU’s 10% target for renewable energy in the transport sector by 2020, to the current consumption level – 5% up to 2020, while keeping the overall renewable-energy and carbon-intensity reduction targets; this means that the remainder will have to come mainly from second-generation biofuels; and
- “Providing incentives for biofuels with no or low indirect land use change emissions, and in particular the second- and third-generation biofuels produced from feedstock that do not create an additional demand for land, including algae, straw and various types of waste, as they will contribute more towards the 10% renewable energy in transport target of the Renewable Energy Directive,” according to the Commission.

– Jack Peckham

NEWS FROM AMERICAS

Alon USA to Suspend California Refining Operations

Alon USA Energy, Inc. is shutting its California refining system for at least one year because of a weak asphalt market and soaring West Coast crude costs, according to a November 7 earnings release citing chief executive Paul Eisman.

The Dallas-based refiner-marketer expects to restart operations in the fourth quarter of 2013 – at the earliest – if

a reconfiguration of its Bakersfield, Calif., plant goes as planned, according to the announcement.

“California remains challenging from an asphalt-refining perspective, as low demand and value for produced asphalt in a high-cost West Coast crude environment led to disappointing financial results,” Eisman was quoted as saying. “We have submitted permit applications to ship via rail lighter, [U.S.] Mid-Continent crudes to replace the heavier West Coast crudes currently used in the California system.”

Alon’s California system includes three facilities in Bakersfield, Paramount and Long Beach that operate as a single, 94,000 barrel-per-day system. The Paramount and Long Beach facilities reportedly were shut last month.

During the Bakersfield shutdown – coinciding with the end of the asphalt season – Alon expects to receive the permits, complete required infrastructure build-out and enter into the required supply arrangements, the announcement also noted.

Strong Revenue, Profit Growth

During the third quarter of (3Q) 2012, revenue rose 16% to US\$2.36 billion – from \$2 billion during the comparable period in 2011, Alon announced November 7.

“During the third quarter, we increased throughput at each of our refineries versus the second quarter, and also realized increased sales in both asphalt marketing and Alon brands,” Eisman said. “We generated very favorable operating margins of \$28.19 per barrel [bbl] at our Big Spring [Texas] refinery and \$11.28 per barrel at our Krotz Springs [Louisiana] refinery. In Krotz Springs, we processed, on average, a record of over 23,000 barrels per day of WTI [West Texas Intermediate crude].

Net income for 3Q 2012 was \$43.2 million, or \$0.76 per share, versus net income of \$28.6 million, or \$0.51 per share, for the same period last year, according to the earnings statement. Excluding special items, Alon recorded net income of \$47.6 million, or \$0.84 per share, for 3Q 2012, compared with net income of \$39.0 million, or \$0.70 per share, for the same period in 2011.

Alon USA Launches IPO

Alon USA Partners announced November 9 the launch of its initial public (IPO) offering on the New York Stock Exchange of 10 million stock shares representing limited partner interests in Alon Partners.

The underwriters will be granted a 30-day option to purchase up to an additional 1.5 million common units.

“Alon Partners was formed by Alon USA Energy to own, operate and grow its strategically located crude oil refinery in Big Spring, Texas, with total throughput capacity of approximately 70,000 barrels per day, and the

related petroleum products marketing business,” according to the company.

The common units being offered represent a 16% limited partner interest in Alon Partners, or an 18.4% limited partner interest if the underwriters exercise their option to purchase additional common units in full.

Weak Ethanol Margins Impact Murphy Oil's 3Q 2012 Earnings

El Dorado, Ark.-based Murphy Oil Corp. announced October 31 that its U.S. downstream segment (now an independent entity), which includes a retail marketing business, two ethanol-production facilities and wholesale marketing and trading operations, generated a profit of US\$17.3 million for third-quarter (3Q) 2012, versus a gain of \$88 million for same quarter in 2011.

“The earnings decline for this business in 2012 was principally a result of weaker margins for both retail marketing and ethanol production operations compared to the prior year,” the company said in its earnings statement.

“U.S. retail marketing margins averaged 10.3¢ per gal (/gal) in the 2012 quarter compared to 20¢/gal in the 2011 quarter. Wholesale gasoline prices rose significantly in the third quarter 2012 and the retail marketing operation was unable to fully pass on this cost increase to its retail customers.

“The operating results at the two U.S. ethanol production facilities in 2012 were significantly weaker than the prior year due to crush spreads that were squeezed by high corn prices in the just-completed quarter,” according to the earnings statement.

BIOX Suspends Biodiesel Production at Canadian Facility

Toronto, Ontario, Canada-based BIOX Corp. announced October 25 that it temporarily suspended biodiesel production at its 17.7 million-gallon-per-year (mgpy) facility in Hamilton, Ontario based on the “existing conditions within the U.S. biodiesel market.”

“The company will monitor biodiesel market conditions, including biodiesel production volumes, as well as trading liquidity and pricing, to determine the appropriate time to resume production,” the company noted in a statement.

Concurrent with the suspension of biodiesel production, BIOX said that it reduced its operations group by 17 positions “on a temporary basis.” During the temporary suspension of biodiesel production, BIOX said it will continue to operate a recently commissioned stand-alone glycerin-refinement system to upgrade crude glycerin in inventory to technical-grade glycerin.

“Our proprietary technology is one of the lowest cost biodiesel production platforms in the industry, however based on the EPA [U.S. Environmental Protection Agency] reported production volumes that have resulted in depressed prices and the volatility within the RIN [Renewable Identification Numbers] market, we believe that temporarily suspending biodiesel production at our Hamilton facility is the responsible decision,” BIOX chief executive Kevin Norton said in the announcement.

“Given our balance sheet, we are in a strong position to manage through this short-term setback. We remain confident in the long-term fundamentals of the broader biodiesel market, specifically given the 28% increase in the mandated minimum volume of biomass-based diesel for 2013, and we expect to resume production in due course,” Norton added.

Earlier this month, the EPA published U.S. biomass-based diesel (biodiesel) production through September 30, which determined that U.S. biomass-based diesel RIN generation exceeded 90% for the first nine months of the year – or 1.356 billion RINs of the minimum volume of 1.5 billion RINs mandated under the federal Renewable Fuel Standard (RFS-2) for 2012.

“As a relatively nascent industry, the production volumes reflect that producers have been slow to respond to the temporary supply/demand imbalances,” BIOX noted in its statement.

“BIOX expects these imbalances to be resolved in the near term, particularly in light of the increase in the minimum volume requirement of biomass-based diesel to 1.28 billion U.S. gallons, or 1.92 billion RINs in 2013, which was recently confirmed by the EPA,” the company said.

A steep drop in RIN prices in recent months also has impacted its business strategy going forward, BIOX said. RIN prices have fallen from US\$1.50 per gallon (/gal) in January to as low as 40¢/gal in October. As of October 24, biodiesel RINs were trading around 51¢/gal.

According to BIOX, current market conditions have impacted the construction timeline of its second facility – a 26.4-mgpy plant in New York Harbor – and the firm “has deferred procurement of certain long-lead time, capital-intensive components and reduced its project planning team related to the construction of the New York Harbor facility.”

“BIOX will update the market with an estimated commission date of the second facility in a timely manner,” according to the announcement.

'World's Largest' Hydrogen-Pipeline Network in Full Operation

Air Products announced October 25 that its recently completed “Gulf Coast Connection Pipeline” (GCCP) –

described as the “world’s largest hydrogen plant and pipeline-supply network” – is now in full operation.

The pipeline stretches from the Houston Ship Channel in Texas to New Orleans. In August 2012, it began supplying more than 1.2 billion cubic feet per day of hydrogen to refinery and petrochemical customers.

“Air Products had operated two hydrogen-pipeline systems in Texas and Louisiana before joining them with a new, 180-mile segment. The 600-mile pipeline span is fed by over 20 Air Products hydrogen-production facilities,” according to the company.

Another source of hydrogen for GCCP will be coming from Leucadia’s “Lake Charles Clean Energy” petcoke-gasification plant, scheduled for construction start-up next year (see related story, this issue).

“The benefits of the [hydrogen] pipeline for customers are already evident,” Air Products vice president Jeff Byrne said. “The most recent hurricane showed we can deliver hydrogen from Texas to meet customer demand in Louisiana. We’ve also signed new business for increased product supply that allows hydrogen in the pipeline to be directed to multiple customer locations in the both states.”

Fluor Wins Five-Year Downstream-Engineering Deal with Shell

Texas-based Fluor Corp. announced November 2 that it won a five-year downstream-engineering and project-management services contract from Royal Dutch Shell plc.

The deal potentially could expand to include Shell’s upstream, onshore projects in Europe, Africa and the Middle East (EAME).

“Under terms of this agreement, Fluor will provide design, project and construction management, home-office and site-based engineering services,” according to Fluor.

The agreement includes an option to be extended for another five years and opportunities to include Shell’s upstream projects and other geographic regions.

Fluor is currently working on Shell projects in Malaysia, the Philippines and Canada. Fluor also provides operations and maintenance services at Shell sites in Australia, Qatar, Russia and the Netherlands.

U.S. EPA Releases Draft QAP Measures Toward Combating RIN Fraud

The U.S. Environmental Protection Agency (EPA) on October 31 released a draft plan to enforce quality-assurance measures among generators and reports of renewable identification numbers (RINs) for compliance with federal Renewable Fuel Standard (RFS) volume obligations.

The released draft will allow members of the biofuel and petroleum industries time to provide input before the EPA

begins formulating a Notice of Proposed Rulemaking (NPRM), which the agency anticipates should be finalized by the end of the year.

“EPA expects that this will promote greater liquidity in the transfer and use of RINs, helping to make the RFS program more efficient and effective,” according to an EPA statement.

The agency’s proposal “would provide a recognized means for independent third parties to audit the production of renewable fuel and the generation of RINs.

“The basis for these audits would be quality-assurance plans (QAPs), which would be developed and implemented by independent third parties, based on the requirements for a QAP in the regulations,” the EPA also noted.

Elements of the proposed QAP include: feedstock-related components, production process-related components, renewable fuel-related components and RIN generation and separation-related components.

While the QAP requirements in the EPA’s draft plan represent “current thinking,” some elements “could change in the NPRM as we continue to gather information and develop other aspects of the proposed program requirements,” according to the statement.

NBB Reaction

The National Biodiesel Board, the trade association that represents biodiesel producers on Capitol Hill – and the industry that’s been hit hardest by RIN-fraud incidents – said the plan “isn’t perfect,” but “it is a significant step in the right direction,” Anne Steckel, NBB vice president of federal affairs, said in a prepared statement.

“We applaud EPA for moving their initial guidelines for the quality assurance plan into the private sector and we anticipate this will move the regulatory process forward in a constructive and efficient manner,” Steckel added.

“Once EPA approves Quality-Assurance Providers, and many providers have already completed real-world assessments at nearly every biodiesel facility, then all sectors of the biofuels market will have greater confidence in day-to-day RIN transactions,” she further noted.

The EPA’s QAP draft plan can be viewed in its entirety [here](#).

– Bryan Sims

TransCanada, Phoenix Energy Plan Cdn\$3-Billion Alberta Pipeline

TransCanada Corp. and Phoenix Energy Holdings Ltd. will develop a US\$3-billion (US\$3.01-billion) pipeline project in northern Alberta.

According to an October 29 TransCanada announcement, the two firms will each own 50% of the proposed Grand Rapids pipeline system. The project will include both a

crude oil and a diluent line to transport volumes about 500 kilometers (km) between the producing area northwest of Fort McMurray and the Edmonton/Heartland region.

Pending regulatory approvals, the Grand Rapids pipeline system is expected to be in-service by early 2017, the announcement noted. The system will have the capacity to move up to 900,000 barrels per day (b/d) of crude and 330,000 b/d of diluent.

TransCanada said it will operate the Grand Rapids system, and Phoenix has entered a long-term commitment to ship crude oil and diluent on it.

“As Alberta crude-oil production continues to grow, it’s critical to have the infrastructure in place to move oil to market from emerging developments west of the Athabasca River,” TransCanada president and CEO Russ Girling was quoted as saying. “This is the first major pipeline project to meet the needs of this fast-growing area.”

The final Grand Rapids pipeline route and design will be determined with aboriginal and stakeholder input, as well as consideration for environmental, archaeological and cultural values, land-use compatibility, safety, constructability and economics, according to TransCanada.

TransCanada recently announced the Northern Courier pipeline project – a 90-kilometer pipeline system to transport bitumen and diluent between the Fort Hills mine site and the Voyageur Upgrader located north of Fort McMurray, Alberta.

Phoenix Energy president and CEO Zhiming Li commented: “Phoenix is committed to developing its Dover and MacKay River oil-sands assets through multiple phases.

“Given that transportation in the Athabasca region has become a bottleneck, working with TransCanada to build a pipeline system in a timely fashion is crucial to implement our development strategy,” he said in the announcement. “This transportation solution will be important to Phoenix and other potential producers in this area to monetize their huge resources.”

The Grand Rapids pipeline system will be built, owned and operated by the Grand Rapids Pipeline Ltd. Partnership – jointly owned by Phoenix and a wholly owned unit of TransCanada.

Canada’s largest pipeline company, TransCanada currently operates 24,200 kilometers of natural-gas pipelines across Alberta and 3,500 km of crude pipelines via the Keystone pipeline, which has moved more than 300 million barrels of oil from Alberta to markets in the U.S.

Cat Posts Record Earnings in 3Q 2012, but Weaker 1H 2013 Seen

Caterpillar announced October 22 that it posted all-time record third-quarter (3Q) earnings in 2012, but warned that

first-half (1H) 2013 earnings would be “weaker” in the face of slowing global economic growth.

According to Cat, 3Q 2012 profits rose 49% year-on-year, to US\$1.7 billion, compared to \$1.14 billion in 3Q 2011, while revenues also rose 5% year-on-year, to \$16.4 billion.

Despite “economic and geopolitical headwinds facing the world,” Cat is “focused on finishing 2012 as the best year for sales and profit in our history,” Cat CEO Doug Oberhelman said.

According to the company, “we now expect 2012 sales and revenues to be about \$66 billion and profit in a range of \$9.00 to \$9.25 per share. The previous outlook for sales and revenues was a range of \$68 to \$70 billion with profit of about \$9.60 per share at the middle of the sales and revenues outlook range.

“The decline in the sales and revenues outlook reflects global economic conditions that are weaker than we had previously expected. In addition, Cat dealers have lowered order rates well below end-user demand to reduce their inventories.

“Production across much of the company has been lowered, resulting in temporary shutdowns and layoffs. Lower production will continue until inventories and dealer order rates move back in line with dealer deliveries to end users.

“The reduction in the profit outlook is in line with the lower sales and revenues outlook, partially offset by the gain on the sale of a majority interest in our third party logistics business,” according to Cat.

2013 Outlook

“From an economic standpoint, we are expecting slightly better world growth in 2013 with modest improvement in the United States, China and most of the developing world, but continuing difficulty in Europe. Based on our economic forecast, our preliminary outlook for 2013 is for sales and revenues to be about the same as 2012 in a range of up 5% to down 5%.

“We are taking a pragmatic view of 2013 – we’re not expecting rapid growth, and we’re not predicting a global recession. At this point, we expect 2013 sales will be similar overall to 2012, but with a slightly weaker first half and a slightly better second half.

“While machine deliveries to end users have continued to hold up, our sales will probably remain relatively weak early in 2013 as dealers are likely to continue reducing inventories.

“When expected dealer inventory reductions level off, and easing actions by central banks and governments around the world begin to improve economic growth, we expect our business will begin to improve. While there’s reason for optimism, and we’re not expecting a global recession in 2013, we are prepared and stand ready to take action no matter what happens to the global economy,” Oberhelman added

Dresser-Rand Takes Aim at Diesel Markets with 'Small-Scale' LNG

Houston-based Dresser-Rand announced October 25 that it signed a deal with New York-based Expansion Energy for a worldwide exclusive license for a "small-scale" technology capable of making up to 100,000 gallons per day of liquefied natural gas (LNG).

The technology, called "VX Cycle," aims to bring more LNG supplies to diesel vehicle fleet operators and oil and gas driller, according to Dresser-Rand.

According to Brad Dickson, Dresser-Rand chief marketing officer, "in our on-going evaluation of technologies to complete the value chain for the burgeoning shale markets, as well as solutions for addressing global natural gas flaring and the rapidly expanding markets for LNG vehicle fueling, Expansion Energy's LNG production process met all of the requirements we identified and embodies technology that we can bring to the market quickly.

"We already have several clients anxious to take multiple units to fuel their fleet operations. We presently believe that the market for this technology will be in the range of \$100 million to \$200 million within just the next two to three years, and will continue to grow robustly beyond that."

Dresser-Rand believes that the technology would provide "a cost-effective small-scale LNG production process with capacities as low as 1,500 gallons per day – far smaller than any other LNG production system commercially available today," according to the company.

"The mobile, skid mounted equipment configuration for this process technology opens up a wide variety of applications in markets currently underserved or not served at all," according to Dresser-Rand.

"Upstream applications would include LNG conversation at production sites where associated gas is being flared, according to the company. The scheme also would enable conversion of drilling rigs to run on LNG rather than diesel.

"Downstream" applications would include the production of "vehicle-grade LNG, allowing LNG to compete effectively with diesel fuel on a cost-per-energy-content (British-thermal-unit [Btu]) basis," according to Dresser-Rand.

"The use of LNG fuel is increasing rapidly for long-haul trucks; delivery fleets; buses; ships, barges and ferries; railroad locomotives; and construction and mining equipment.

"As a first for the industry, the 'VX Cycle' enables the distributed production of LNG with small-scale plants, as the technology can utilize natural gas from virtually any

high- or low-pressure pipeline or distribution line, or from stranded wells.

"As such, the 'VX Cycle' eliminates the need for the costly trucking of LNG long distances from large, centralized plants to LNG fueling depots, as is the practice today.

"Instead, the 'VX Cycle' produces LNG right at the fueling station or at the wellhead. The 'VX Cycle' technology can also be used to upgrade existing CNG [compressed natural gas] stations to produce LNG and/or a colder, denser CNG product with a higher-Btu density versus standard CNG," according to Dresser-Rand.

Under the agreement, Dresser-Rand will "design, package and sell equipment embodying the 'VX Cycle' production technology including Dresser-Rand reciprocating compressors and 'Guascor' engine-generator sets, and associated control systems," according to the company.

Petrobras 3Q 2012 Net Income Falls 12%

Brazilian state-run Petróleo Brasileiro S.A. (Petrobras) posted a third-quarter 2012 net profit of R\$5.57 billion (US\$2.74 billion), up 36% from the previous quarter but down 12% versus the comparable period last year.

According to an October 26 Petrobras announcement, the results reflected the full impact of gasoline price hikes – 7.83% in June – and diesel price increases of 3.94% in June and 6% in July. The earnings also reflected reduced expenses from the write-off of dry or sub-commercial wells and a stable period exchange rate, the multinational energy firm said.

Refinery capacity utilization in Brazil reached 98% with the maximization of diesel output. Processed crude moved up by 2%, reaching a new record of 2,101,000 barrels per day (b/d) on August 12, according to the announcement.

Net income for the first nine months of 2012 totaled R\$13.44 billion (US\$6.62 billion), the company also noted, down 52% for the same period in 2011. Petrobras cited the depreciation of the real, higher operating expenses (particularly from the write-off of dry and economically unviable wells in the second quarter of 2012) and an increased share of imported oil products in sales volume as reasons for the reduction.

Year-to-date earnings before interest, taxes, depreciation and amortization (EBITDA) totaled R\$41.5 billion (US\$20.4 billion) – down 14% on the first nine months of 2011.

Total oil and natural gas production in Brazil and abroad remained flat over 2011, but domestic oil output fell by 2%, chiefly due to operational stoppages, according to Petrobras.

The FPSO (floating production storage and offloading) Cidade de Anchieta began operating in September, initiating production in the Baleia Azul field, in the pre-salt

area of the Campos Basin, the announcement also noted. Current output is about 42,000 b/d.

NEWS FROM EUROPE / AFRICA

Africa Evolving as a Prominent Natural-Gas Player

Africa could emerge as a powerhouse in natural-gas production as attention on the continent known for oil production takes aim at natural gas to help fulfill global demand and stimulate local economies.

If various regions of Africa are able to overcome obstacles, which vary depending on the region, the rewards could be great – considering the abundance of untapped resources.

Making up about 7.5% of the world's gas reserves, Africa has proved reserves of about 494 trillion cubic feet (Tcf), with technically recoverable natural-gas reserves estimated at nearly 2,612 Tcf, according to figures in Ernst & Young's (EY) newly released report, *Natural Gas in Africa: The Frontiers of the Golden Age*.

“Natural-gas development holds tremendous opportunity for Africa, and it can be a strong prime mover for broader economic and social development,” the report notes. “But those opportunities come with risks and challenges – some that are beyond the control of local/regional industry and government.

“Others, while daunting, can be managed but will need resolute and dedicated attention,” the analysis states. “Most importantly; however, the opportunities for Africa presented by the *Golden Age of Gas* are enormous, and the challenges and risks can be addressed and mitigated, if not fully overcome.”

Currently, gas production in Algeria, Egypt and Nigeria are taking the lead, making up 88% of the 7.2 Tcf produced in 2011, according to the report. But drilling activity continent-wide continues to increase not only onshore, where companies primarily focus on oil and also for gas, but offshore as well, which reportedly witnessed resurgence in 2010.

Now, the West African countries of Nigeria and Angola are joining North Africa's Egypt and Nigeria for heightened drilling activity, while work offshore East Africa's Mozambique and Tanzania steps up.

And the finds – by large and small independents alike – are turning heads.

In October, Tullow Oil's “Twiga South-1” exploration onshore Kenya struck oil. The well is part of a multi-well drilling campaign in Kenya and Ethiopia. Kuwait Energy made a new oil discovery at the “Ahmad-2” well in the Gulf of Suez, Egypt. In another announcement, oil and gas

deposits reportedly were discovered in the Bida basin in Nigeria's Niger State.

The EY report also noted large discoveries offshore Mozambique and Tanzania. However, it predicted that in the future, African gas exploration is expected to shift to the east. Unconventional-gas resources in North Africa and South Africa could add to the new supplies.

East Africa

Dubbed “the new promised land” or the “next epicenter,” East Africa has shed its reputation of being a “non-story” with complex geology, poor seismic data and political factors that hindered coastal exploration, the report said.

With companies making finds in the area – such as Anadarko's frontier-opening “Windjammer” discovery offshore Mozambique in the Rovuma basin and additional discoveries by the company along with Eni – recoverable reserve estimates for the country jumped to 196 Tcf. Success in the basin continued in Tanzania with major gas finds by BG Group, Ophir Energy, and Statoil and partner ExxonMobil. With limited gas demand from the region, the report pointed out that most of gas from the discoveries is destined for Asia.

The region has more potential if limited gas activity in other East African areas such as Sudan, Ethiopia and Uganda takes a positive turn from infrastructure woes and political issues.

Other challenges include a moratorium on hydraulic fracturing in South Africa, where water concerns, land ownership and infrastructure also have posed problems.

The technique has proven a success in boosting gas production in the U.S., but the process uses hefty amounts of water. Nonetheless, the report says South Africa has substantial shale-gas resources in the Karoo basin. “Risky gas in place has been estimated at more than 51 Tcf, with recoverable gas estimated at almost 494 Tcf.”

North Africa

Home to three of the continent's four top gas-reserve holders – Algeria, Egypt, and Libya – EY cites a number of challenges that face gas development in the region.

“In the wake of last year's overthrow of the Mubarak government, natural gas has become an intensely politicized issue in Egypt. Egypt has long been Africa's biggest consumer of natural gas and the focus of the gas industry in Egypt was originally to provide cheap domestic energy,” the report explains. “But in recent years, exploration and development success has led to growing export temptations and to subsequent over-commitments of export supply, with resulting domestic shortages and high prices.

“Domestic fuel subsidies have long been an issue, and the new government will likely be very sensitive to public opinion. As a result, the new government is expected to

scale back gas-export ventures, via pipeline and LNG [liquefied natural gas].”

But that may not be the case for other areas in the region. For example, Algeria – the second-largest gas supplier into Europe – is working to expand its gas reserves and export infrastructure, the EY report notes. The country is opening offshore blocks – a first – and making special fiscal concessions for shale gas development, the report noted.

Meanwhile, Libya is still in somewhat of a recovery mode following last year’s revolution. But the lifting of U.S. sanctions and the government’s offering of production-sharing agreements could help facilitate restoration.

West Africa

Known for its oil, the West African region has limited domestic markets for gas with most of the gas being flared, according to the report. But a global gas-flaring reduction initiative by the World Bank is working to change that.

“While Nigeria dominates the sub-region in terms of reserves and production of oil and gas, the country and its national oil company (NOC), Nigerian National Petroleum Co. (NNPC), has struggled to translate its vast resources into consistent, efficient revenue generation,” the report explained. “Tribal and ethnic violence has frequently curtailed production and threatened foreign investment, while the development of a consistent government energy policy has often been seemingly compromised by corruption and mismanagement.”

Work is under way to transform the NNPC into a competitive international company as the government revamps policy to up local participation and upstream investment returns, the report continued.

Angola, South Africa

On the other hand, Angola has been the area’s and the continent’s bright spot recently.

“Angola has delivered Africa’s strongest increases in oil production over the last decade and has seen its associated-gas production rise dramatically as well. And like much of the sub-region, until recently most of that gas was flared,” the report said.

Flaring reductions and gas capture have been a focus in Cameroon, Gabon, Ghana, and Equatorial Guinea, the report further notes. “Notably, with the opening of Marathon’s big gas-monetization project, “EG LNG,” in 2007, oil’s dominance [in these countries] has given way to gas. Ghana’s massive “Jubilee” development, while primarily oil-focused, also is generating lots of associated gas.”

Numerous areas stand to greatly benefit from production in Africa. Some NOCs from these areas have realized the

potential and have chosen to invest in African assets, according to the report. Among them: China National Petroleum Corp.(CNPC), China National Offshore Oil Corp. (CNOOC) and China Petroleum & Chemical Corp. (Sinopec); India’s Oil and Natural Gas Corp. Ltd.(ONGC); South Korea’s Korea National Oil Corp. (KNOC); Malaysia’s Petroliaam Nasional Berhad (Petronas); Russia’s Gazprom; and Thailand’s PTT Public Co. Ltd.

Natural-gas production could jump to 1.4 Tcf by 2035, according to the International Energy Agency, while regional-gas consumption could reach 6 Tcf. Net exports from the continent could double to more than 8.1 Tcf by 2035.

“African governments and local/regional NGOs [non-governmental organizations] will of course have critical roles to play,” the report states. “Their first and foremost role will be developing meaningful and practical master gas-development plans – ones that address the upstream tax and licensing models. Secondly will be the necessary infrastructure issues and investments, and local training and job-creation issues. Collaboration and partnerships with the IOCs [independent oil companies] – big and small – will also be critical.”

– Velda Addison, Hart Energy

MAN Launches Super-Long Truck Trial; Aims to Cut CO₂

MAN announced October 18 the launch of super-long-truck trials in Germany, aimed at finding out how much carbon dioxide (CO₂) could be reduced compared to conventional truck freight shipping.

However, several “green” groups in Europe have been lobbying against any relaxation in truck lengths, arguing that super-long trucks will grab more freight volume from “lower-CO₂” railroad and marine freight carriers.

“Since the beginning of October, a 25.25-meters-long MAN road train has been shuttling between the MAN Logistics Centers Dachau and Salzgitter, transporting spare parts for trucks and buses,” according to the company.

“MAN is deploying a long truck on this nearly 600 kilometer stretch in order to study the traffic, commercial and environmental impact of longer vehicle combinations in the transport of goods by road.

“The loading volume offered by the long truck is approximately 40% more than that of a conventional road train, and this without increasing the permitted gross weight of 40 tonnes. Because two long trucks can transport as much as three conventional road trains, fuel can be saved and CO₂ emission reduced.

“Moreover, the long truck also reduces the amount of traffic and helps to take some of the strain off the road

infrastructure thanks to a more favorable distribution of the vehicle's weight over a greater number of axles," according to the company.

"MAN's long truck comprises a three-axle truck chassis with a swap body, a dolly (i.e. a trailer with a fifth-wheel coupling) and a conventional semi-trailer. The 440-horsepower MAN TGX is equipped with all the safety systems currently available: in addition to ABS and electronic-stability program (ESP), adaptive cruise control, the LaneGuard and continuous-damping control systems (CDC) are all on board.

"This long truck provided by MAN is being operated by hauliers Grosse-Vehne, headquartered in Marsberg (North Rhine-Westphalia). The driver was specially trained for the job beforehand by instructors from MAN ProfiDrive."

BASF to Build 150-Million Emissions-Catalyst Plant in Poland

BASF plans to build a mobile emissions-catalysts production facility in Sroda Slaska, a Special Economic Zone near Wroclaw, Poland, the company announced November 6.

Construction of the new 40,000 square-meter facility – BASF's largest in Europe – will begin before the end of 2012, company officials said. The plant is expected to start production in the first quarter of 2014.

Ludwigshafen-based BASF expects to invest about €90 million (US\$115 million) initially, according to the announcement. Additional expansion will follow, raising the total investment volume for the project to approximately €150 million (US\$192 million).

Once all 10 planned light-duty and heavy-duty production lines are operating at full capacity by 2016, BASF said it expects to employ more than 400 people at the new site.

"The planned implementation of Euro-6 light-duty and Euro-VI heavy-duty emissions regulations in Europe will drive an increased demand for advanced emissions-control systems," Rui Goerck, senior vice president for mobile-emissions catalysts at BASF, was quoted as saying. "BASF is more than doubling its production capacity in Europe to keep pace with this demand and to continue to meet our customers' needs."

Among the advanced technologies that will be produced in Poland are selective catalytic-reduction (SCR) systems and cutting-edge SCR on filter solutions, according to the announcement.

In addition, the plant will house a regional sample laboratory and a production line for BASF's "Premair)-

branded ozone-destruction catalysts for automotive applications.

Dr. Joachim Meyer, head of BASF's central Europe business center, added: "Due to its central position in Europe and its positive economic development, Poland is an attractive location for BASF to invest. The new facility strengthens our position in the Polish market as a supplier of innovative solutions."

In parallel with the new production plant, BASF said it is also modernizing and expanding its emissions-catalyst production operation in Nienburg, Germany.

"The new plant in Poland will provide geographic diversity for our manufacturing operations and a strong complement to our existing production hub in Nienburg," Xavier Susterac, vice president for BASF's European mobile emissions-catalysts business, also noted in the announcement.

"The combination of the two facilities in Europe will allow us to effectively manage our growth, optimize our production model, and meet the needs of the market in the most efficient way possible," Susterac said.

Germany's Oxea Mulls Downstream Plant Upgrades in Texas

Germany-based oxo-chemicals producer Oxea announced November 5 that it's nearly completed a feasibility study on additional downstream plant-expansion projects at its site in Bay City, Texas.

The announcement follows a recent project in which Bay City syngas production was successfully raised by 10%, the company said.

The feasibility project is examining various scenarios to boost the plant's capacities, as well as the further optimization of Oxea's product portfolio, according to the announcement.

The study is expected to be completed by the end of the year.

Oxea's Bay City plant is a large world-scale facility for oxo chemicals such as oxo-alcohols, carboxylic acids and acetate esters, the company said.

"There is a continuously growing demand for oxo chemicals from an increasing number of industries," Miguel Mantas, Oxea executive board member for marketing and sales, was quoted as saying.

"Oxea's oxo-alcohols and carboxylic acids for example, are building blocks for among others phthalate free plasticizers or energy-efficient lubricants for the manufacturing of environment-friendly cooling systems, and are therefore in high demand," Mantas added.

Oxea was established in March 2007 as a buyout of assets and a joint venture from Celanese and Evonik. Based

in Oberhausen, Oxea is a global manufacturer of oxo-intermediates and oxo-derivatives, such as alcohols, polyols, carboxylic acids, specialty esters and amines.

The products are used for the production of high-quality coatings, lubricants, cosmetics and pharmaceutical products, flavorings and fragrances, printing inks and plastics.

In 2011, Oxea generated about €1.5 billion (US\$1.9 billion) in revenue and employed some 1,365 employees in the Americas, Asia and Europe, according to the announcement.

Neste Oil Expands 'NExBTL' to Include Renewable Naphtha

Neste Oil announced October 29 that it has expanded its "NExBTL" biomass-derived hydrotreating technology to include renewable naphtha.

"'NExBTL' renewable naphtha can be used as a feedstock for producing bioplastics, for example, and as a biocomponent for gasoline," according to Neste.

"Neste Oil is one of the world's first companies to supply bionaphtha on a commercial scale. 'NExBTL' naphtha is produced as part of the 'NExBTL' renewable-diesel refining process at Neste Oil's sites in Finland, the Netherlands and Singapore.

"Bioplastics produced from NExBTL naphtha can be used in numerous industries that prioritize the use of renewable- and sustainable-raw materials, such as companies producing plastic parts for the automotive industry and packaging for consumer products.

"The mechanical and physical properties of bioplastics produced from NExBTL renewable naphtha are fully comparable with those of plastics produced from fossil naphtha; and the carbon footprint of these plastics is smaller than that of conventional fossil-based plastics.

"Bioplastic products produced from NExBTL renewable naphtha can be recycled with conventional fossil-based plastic products, and can be used as a fuel in energy generation following recycling.

"In addition to renewable naphtha, the NExBTL renewable-diesel refining process also produces renewable propane, which can be used as a traffic fuel, for cooking and heating in the home, and in food packaging. Neste Oil recently started a study on the feasibility of commercializing NExBTL propane.

"All the products produced as part of NExBTL renewable-diesel refining comply with the strict sustainability criteria established by the EU's *Renewable Energy Directive* across the entire supply chain. They have been verified as being sustainably produced, the inputs used can be fully traced back to their origin, and they contribute a significant reduction in life-cycle greenhouse-gas emissions compared to comparable fossil-based products."

Neste Oil 3Q 2012 Income Rebounds

Neste Oil announced October 25 that its third-quarter (3Q) 2012 operating profits rose to €156 million (US\$202 million), up from €68 million (US\$88 million) in 3Q 2011.

The improvement was "driven by strong refining margins and improved performance at Renewable Fuels" division, the latter of which produces an all-hydrocarbon, renewable-diesel ("NExBTL") fuel, according to Neste.

Commenting on the results, Neste CEO Matti Lievonon said: "Oil Products had a solid third quarter, thanks to high refining margins, which continued to be very strong and were particularly high in September. This was mainly driven by high diesel and gasoline margins resulting from low inventories and refinery outages in Europe and North America. Our refineries also operated smoothly.

"Overall, we are pleased with Oil Products' third-quarter comparable operating profit of €54 million. "Renewable Fuels' performance improved by €38 million [US\$49 million] from the corresponding period last year, but the business still recorded a loss due to low margins, particularly during the first part of the quarter. This resulted in a comparable operating loss of €19 million [US\$24.6 million] for the business.

"The price spread between different vegetable oils and biodiesel producers' margins improved towards the end of the quarter.

"Cash flow was strong in the third quarter and improved our leverage. Uncertainties in the global economy have been reflected in the oil market and will continue to pose a risk for our business.

"However, we expect the Group's full-year comparable operating profit to improve significantly compared to 2011. During the remainder of 2012, we will continue to focus on cash flow, refinery productivity, and profitability at Renewable Fuels," Lievonon added.

Rest of 2012 Favors Diesel

As for the remainder of this year, "the market expects that margins for advanced refiners, such as Neste Oil, will be higher during the fourth quarter of 2012 compared to last year," according to Neste.

"Diesel is projected to be the strongest part of the barrel going forward, and gasoline margins are expected to remain higher than in 2011. Approximately 30% of Oil Products' volume in 2012 is hedged at a US\$4.70 per barrel [bbl] reference margin level, assuming an Urals-Brent differential of [minus] US\$1.0/bbl.

"Oil Products' full-year comparable operating profit is expected to improve significantly compared to 2011, assuming good productivity during the remaining part of the year.

“Renewable Fuels’ comparable operating profit during the fourth quarter is expected to improve compared to the third quarter. We expect the fourth quarter result to be close to breakeven. Approximately 60% of the fourth quarter [renewable diesel] margins were hedged during the summer, which limits our short-term capability to capture the full value of palm-oil price decline. The result is sensitive to market development, which has been very volatile in 2012,” according to Neste.

Gazprom’s Omsk Refinery to Launch Euro-5 ULSD Production

Gazprom announced October 24 that it has started up a new hydrocracker at its Omsk refinery in Russia, which eventually will enable production of 3 million tonnes per

year (mtpy) of Euro-5 (10 parts-per-million sulfur) ultra-low sulfur diesel (ULSD).

An earlier “phase-one” hydrotreating plant came online at the 20-mtpy refinery in May 2012, enabling low-sulfur gasoline production.


The “phase-two” project now underway will be completed in 2013, enabling Euro-4 and Euro-5 gasoline as well as Euro-5 ULSD, according to Gazprom.

“Total investment in the construction of the two plants was R15.9 billion [US\$507 million],” according to Gazprom.

The company brags that the Omsk refinery “remains one of the best and most modern refineries of the country. Commissioning of the new processing facility will allow Gazprom to more effectively address the challenge of strategic Russian [supply of] high-quality fuel.”

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