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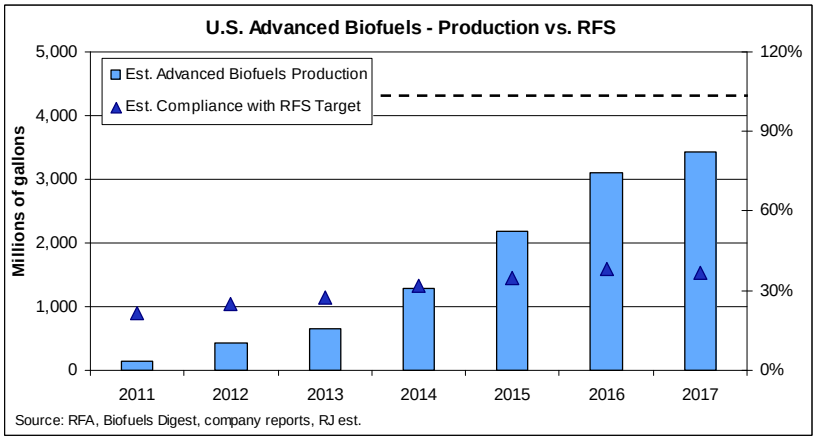
Energy: Stat of the Week

Is the Renewable Fuels Standard Withering on a Vine?

In addition to declining U.S. oil demand and surging liquids production from onshore shale plays, there is a third component to our thesis that the nation is moving towards oil independence by 2020. We project that expansion of biofuels will cut U.S. oil imports by 6% from 2010 to 2020. More specifically, we are referring to next-generation (Gen2) biofuels; corn ethanol's current debacle amid record corn prices shows that it clearly won't be a future growth driver. Whereas there is inherent uncertainty in forecasts for the rig count and well productivity, Gen2 biofuel production – at least in theory – should be set in stone. This is because of the Renewable Fuels Standard (RFS), passed in 2007 and extending through 2022. However, as we detail today, the RFS has become virtually irrelevant when it comes to providing visibility on scale-up of Gen2 biofuels, particularly cellulosic biofuels. Due to a combination of financing constraints and (to a lesser extent) technical hurdles, the industry is far behind on meeting its targets – and getting further behind by the year. The good news is that there are signs of progress as a wide variety of Gen2 biofuels approach commercialization, and companies start to "graduate" from the pre-revenue stage to commercial operations. Still, it is difficult to avoid the conclusion that the RFS has failed in stimulating the market forces required to bring online the envisioned Gen2 volumes over the next decade.

Gen2 RFS targets won't be met until 2018 – under the best-case scenario.
When Congress enacted the Renewable Fuels Standard's Gen2 provisions in 2007, the expectation was that cellulosic biofuels would materialize in commercial volumes by 2010 – at 100 million gallons, to be exact. Well, here we are in 2012, and the actual figure is… practically zero. For 2012, the target is 500 million, but the EPA has essentially waived it – for the **third year in a row** – cutting it to a measly 9 million (less than 0.001% of the fuel mix). For 2013, 50 million gallons (vs. a one billion gallon mandate) is at the upper end of what is plausible. (As a side note, our definition of "Gen2 biofuels" – which varies slightly from the formal EPA definition of "advanced biofuels" – covers just about everything other than conventional ethanol, derived from sugarcane or corn, and conventional biodiesel, derived from soybean oil or other plant oils. Cellulosic biofuels are a subset of Gen2 biofuels.)

So how long will the market have to wait? For this analysis, we used the latest company-level data from the *Biofuels Digest*, released last Friday. Based on the U.S. capacity expansion timelines of Gen2 biofuel producers, there will be less than one billion gallons until 2014, reaching around 3.5 billion in 2017. For some perspective, corn ethanol capacity is currently 14.7 billion gallons. It has been essentially static for over a year and is set to remain that way, but it will exceed Gen2 probably into the next decade. Bottom line: the **earliest** Gen2 production could reach the RFS target would be 2018 – a whopping **five years later** than what we were predicting in 2010 – and we look at that as the absolute best-case scenario. For one thing, this analysis assumes that every pending Gen2 plant is built on time – which simply does not happen in the real world.



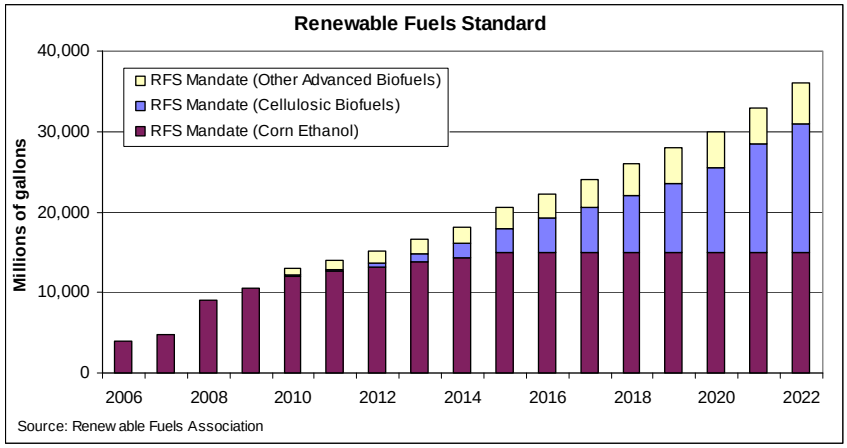
To be clear, the numbers shown above only take into account Gen2 capacity located in the U.S. Including Brazilian and other projects, total global capacity should reach 1.6 billion gallons by the end of 2013, and the 2017 figure would be nearly 6 billion gallons (equating to nearly 400 Mbpd). That said, it's unlikely that large volumes from abroad would make their way into the U.S. market. Furthermore, a meaningful portion of Gen2 volumes will be sold into the chemicals market – where pricing and margins tend to be higher – so volumes available for use as fuel will inherently be less than what is shown in the adjacent chart.

Please read domestic and foreign disclosure/risk information beginning on page 13 and Analyst Certification on page 13.

Why have Gen2 biofuels been so slow to scale up?
The Gen2 space encompasses a wide variety of products. As a very brief primer, here is a look at the main categories.

- **Cellulosic ethanol:** An oxygenate that is blended into gasoline. Produced from non-food feedstocks, such as wood chips.
- **Biobutanol:** A drop-in fuel that can be blended into gasoline (in conjunction with, or as a substitute for, ethanol) and can be used as an input for diesel or jet fuel. Produced from food and non-food feedstocks.
- **Renewable diesel:** A drop-in fuel that has several advantages over conventional biodiesel, for example the ability to be used in cold climates. Produced from food and non-food feedstocks.
- **Renewable jet fuel (biojet):** A drop-in fuel that can be blended into jet fuel. Produced from food and non-food feedstocks.
- **Biocrude:** A drop-in fuel that can be processed (using standard refinery infrastructure) into gasoline, diesel or jet fuel. Produced from food and non-food feedstocks.

There are two primary reasons behind the delays in Gen2 scale-up. First, commercialization entails significant execution risks. This is true both for companies using a biochemical production process (fermentation), which involves a large element of biotech R&D, as well as for those using a thermochemical process. For example, biochemical production of cellulosic biofuels typically requires enzymes for breaking down biomass. While such enzymes exist in carefully calibrated lab settings, applying them in 20+ million gallon plants is not trivial. On a related point, because local supply of biomass can be constrained, there is a growing need for energy crops. Algae technology – a platform to make renewable diesel, among other products – carries its own challenges, such as optimizing nutrient solutions. Thermochemical biofuel production, such as gasification, is by no means immune to operational risks.



Technical factors, while important, do not fully explain why it will take until 2018 – as the best-case scenario – to meet the RFS targets shown in the adjacent chart. What we view as the dominant factor behind the slow scale-up is **constrained availability of capital.** Gen2 commercialization is a highly capital-intensive undertaking – much more so than the prior decade's buildout of corn ethanol plants. As a rule of thumb, plants with lower cash production costs (e.g., able to use cheap feedstock) tend to require higher upfront capital. For example, KiOR, which is developing cellulosic biocrude, estimates the cost of its first commercial plant at ~$222 million (~$170 million not including a hydrotreater). Based on the expected initial yield, annual production would be ~13 million gallons, equating to a capital cost of ~$17/gal (~$13/gal ex-hydrotreater). Companies developing cellulosic ethanol plants are typically guiding to similar unit costs – i.e., $10/gal and up – for the initial projects. To put this in context, modern corn ethanol plants have been built for around $2/gal.

As a thought experiment, let's assume that the average capital cost of the cellulosic biofuel capacity that must be built by 2022 to comply with the RFS – 16 billion gallons – will come down to $5/gal, less than half of the initial plants' price tag. Even with that relatively generous assumption, the implied capital requirement would be **$80 billion over the next decade**, or $8 billion per year. Let's further assume that equity will comprise one-third of this ($2.7 billion per year) and debt the rest ($5.3 billion per year). For some perspective, all the public capital (debt plus equity) raised by all U.S.-listed biofuel companies (Gen1 plus Gen2) since 2005 has totaled only around $4 billion, with more than half of that coming in 2006-07. Of course, the public markets are not the sole source of capital, but their importance for supporting technology commercialization should not be underestimated.

When Congress passed the RFS in 2007 – before the financial meltdown, of course – legislators clearly did not envision that capital availability would be a problem. The expectation was that the RFS would create a guaranteed floor for demand, and capital would pour in to build the plants. The reality is that, in the context of overall risk aversion across the financial sector, both commercial lenders and the capital markets have been taking a rather skeptical view of early-stage biofuel technologies. Keep in mind, venture funding can get companies to the proof-of-concept stage but is almost never enough to pay for major scale-up. Quite simply, the real world turned out to be different from what politicians had expected. As one example of this: out of the six Gen2 biofuel IPOs in the U.S. over the past two years – Codexis, Amyris, Gevo, Solazyme, KiOR, and Ceres – all except Solazyme ended up raising less capital than they had targeted. The most recent attempt at a U.S. IPO in the space, Enerkem, ended up withdrawing its registration

in April. And in July, Coskata, which had filed for an IPO last December, stated that it is shifting focus from cellulosic biomass to natural gas, and concurrently raising a $100 million private placement rather than going the IPO route.

What will turn this around?

There is no escaping the fact that Gen2 expansion on anything close to the scale envisioned by the RFS (21 billion gallons of advanced biofuels by 2022, including 15 billion gallons of cellulosic biofuels) will require a massive increase in capital availability in the years to come. So, what are the factors that could bring that about?

First, an **improvement in the overall mood of capital markets** would boost the ability of biofuel (and other early-stage clean tech) companies to raise public capital, in particular by reopening the "IPO window." Investor risk appetite moves in cycles, and while at present it's in a depressed state, we certainly don't think this will last forever. In large part, it's a matter of resolving some of the macroeconomic concerns – Europe's debt mess, China's slowdown, and to a lesser extent, the U.S. "fiscal cliff" – that have caused such intense volatility. Of course, an oil price rebound would also improve investor sentiment surrounding early-stage oil substitutes (though our current 2013 oil price forecast implies further downside from current levels).

Second, **successful milestones** being achieved by the higher-profile companies in the space – especially, but not exclusively, the public ones – provide tangible examples of validation and should, over time, reduce the market's perception of commercialization risk. For example, whereas Amyris ran into serious scale-up problems and had to withdraw guidance in February, both Gevo and KiOR completed their first commercial-scale plants on schedule and are in the process of ramping up output. Meanwhile, the world's first commercial-scale production facility for cellulosic ethanol, Ineos Bio's plant in Florida, is set to come online within weeks. Other planned start-ups over the next 12-18 months include Abengoa (Kansas), Chemtex (Italy), Enerkem (Alberta), POET (Iowa), and Solazyme (Brazil). Execution in the space has certainly been a mixed bag, but there are plenty of encouraging data points.

Third, **strategic partners** have been stepping up – as we detail in this Stat's appendix. These "big brother" partnerships, which can include direct equity stakes, provide financial support for R&D, production scale-up and/or distribution. While some partnerships involve leading oil and gas companies and aim at traditional fuel markets (with a view to compliance with the RFS and analogous policies abroad), others focus on chemicals or other more specialized applications. Most partnerships are on the downstream end of the value chain (i.e., focused on end users), but plenty of others are on upstream (i.e., with feedstock suppliers). In the context of our below-consensus oil price outlook for the foreseeable future, it's important to note that major oil and gas companies don't base investment decisions on short-term market gyrations, though their interest in oil substitutes could diminish if the period of low oil prices lasts longer than we expect. The other caveat is that, with a few exceptions (such as Valero's Kinross Cellulosic Ethanol joint venture with Mascoma, or BP's in-house cellulosic project in Florida), actual capital commitments have been modest thus far.

Finally, **Washington could revamp its approach** to Gen2 biofuels – though this is the least realistic scenario, in our view. To be clear, subsidies in the traditional sense – tax credits, etc. – are not the issue. Gen2 companies that are using traditional feedstocks (sugarcane, corn, plant oils) tend to focus on high-value markets such as specialty chemicals – which are never subsidized – while those that are using cellulosic biomass and other low-value feedstocks can compete with petroleum directly on cost. Where Congress could do more is from the standpoint of capital availability. For example, federal loan guarantees have been helpful for a number of companies, but the Department of Energy's loan program has long expired and the Department of Agriculture's one has very limited funds to hand out, making competition highly intense. A major increase in funding for loan guarantees would help – especially if the equity requirement were to be reduced – though given the current political climate in Washington, we wouldn't hold our breath. Similarly, the Pentagon's biofuel initiatives have garnered industry praise, though, again, they have not been without political controversy. Ultimately, we think the solution to the industry's capital needs will need to come almost entirely from the private sector.

Conclusion

The next-generation (Gen2) biofuel arena is a young industry that is just starting to gain commercial traction. A key differentiator of this industry compared to many other areas of clean tech is that economics of Gen2 biofuels do **not** depend on government subsidies. Insofar as Washington has been offering policy support, it has mainly been via the Renewable Fuels Standard (RFS), which provides a guaranteed demand floor through 2022. That said, the industry's much slower-than-expected scale-up – a function of financing constraints, and to a lesser extent, technology hurdles – means that the RFS's Gen2 targets will not be fulfilled until 2018 at the earliest. This is particularly true of cellulosic biofuels. A major increase in capital availability – reaching what we estimate needs to be $8 billion per year over the next decade, just for cellulosics – is a must for the RFS to become relevant again. This could come from (1) improved risk appetite for early-stage stories in the capital markets, (2) completion of successful milestones by biofuel developers, and (3) financial support by oil companies and other strategic partners. The least likely scenario, in our view, is the prospect of expanded loan guarantees from Washington. As companies move along their commercialization roadmaps, there will be increasing opportunities for equity investors, though, of course, with substantial risks inherent in an early-stage industry.

Appendix: Investments in Biofuels by Oil and Gas Companies

Below we provide an updated compilation of current biofuel investments among oil and gas companies in the U.S., Canada, Europe, and Brazil. (Most of these are Gen2, though with some conventional production, as well). The list includes both in-house projects as well as investments in other companies, but we do not include stand-alone offtake agreements. As a caveat, because most biofuel companies are privately held, financial details and status updates on the investments are rarely disclosed publicly.

BP plc

- In May 2007, BP entered into a collaboration agreement with Mendel Biotechnology, a developer of energy crops.
- In June 2007, BP made an equity investment in Synthetic Genomics, a developer of algae-based biofuels and renewable chemicals, as part of a collaboration focused on biological conversion processes for subsurface hydrocarbons.
- In June 2007, BP, DuPont and AB Sugar established Vivergo Fuels, an ethanol JV that has since built Britain's largest ethanol plant (using wheat as feedstock).
- In June 2007, BP formed a 50/50 joint venture with British-based D1 Oils, D1-BP Fuel Crops, to develop and grow jatropha as a biofuel feedstock. (In July 2009, D1 Oils bought out BP's 50% stake, becoming the venture's sole owner.)
- In April 2008, BP purchased a 50% stake in Brazilian sugarcane ethanol producer Tropical BioEnergia (JV with Santelisa Vale and Maeda Group).
- In August 2008, BP made an equity investment in Vercipia Biofuels (JV with Verenium, a provider of biocatalysts) to commercialize cellulosic ethanol.
- In November 2008, BP made an equity investment in Qteros, a developer of cellulosic ethanol technology for licensing to third-parties.
- In July 2009, BP established Butamax Advanced Biofuels, a biobutanol JV with DuPont (follow-on phase of a partnership dating back to 2006).
- In August 2009, BP entered into an agreement with Martek Biosciences to develop large-scale microbial biodiesel production through fermentation of sugars. (Martek was acquired by Royal DSM, a Dutch-based life science and materials company, in December 2010.)
- In July 2010, as part of its acquisition of Verenium's cellulosic biofuels business, BP bought out Verenium's 50% stake in Vercipia Biofuels for $98 million, becoming the venture's sole owner.
- In February 2011, BP and several partners (including Brazilian-based Brasil Ecodiesel) entered into an agreement to build a bio-kerosene jet fuel plant in Brazil (follow-on phase of a partnership dating back to 2009).
- In March 2011, BP purchased an 83% stake in Brazilian sugarcane ethanol producer Companhia Nacional de Açúcar e Álcool for $680 million, becoming the operator of two ethanol plants and one under development (completed since then).
- In May 2011, BP made an equity investment in Verdezyne, a developer of advanced biofuels and renewable chemicals.
- In September 2011, BP increased its stake in Companhia Nacional de Açúcar e Álcool to 100% for an additional $25 million.
- In September 2011, BP bought out its partners' 50% stake in Tropical BioEnergia for $71 million, becoming the venture's sole owner.
- In October 2011, BP made an equity investment in Chromatin, a developer of energy crops (focusing on sorghum) for biofuel feedstocks.
- In December 2011, BP made an equity investment in Cool Planet Energy Systems, a developer of biofuels using modular production plants.
- In March 2012, BP entered into an agreement to conduct a field trial of Mendel Biotechnology's miscanthus and evaluate its performance as feedstock at a BP Biofuels demonstration plant.

Chesapeake Energy

- In July 2011, Chesapeake made a $155 million investment (for a 50% stake) in Sundrop Fuels, a developer of biogasoline using cellulosic biomass and natural gas.

Chevron Corp.

- In August 2006, Chevron made an equity investment in Codexis, a provider of biocatalysts.
- In 2007, Chevron entered into a joint development agreement with Solazyme, a developer of algae-based oils for biofuels and renewable chemicals.
- In February 2008, Chevron formed a JV with Weyerhaeuser, Catchlight Energy, to develop biofuels from forest-based cellulosic biomass.
- In 2009, Chevron entered into an additional joint development agreement with Solazyme.
- In September 2009, Chevron made an equity investment in LS9, a developer of advanced biofuels and renewable chemicals, as part of an R&D collaboration.
- In 2010, Chevron made an equity investment in Canadian-based Ensyn Corp., a developer of cellulosic biofuels and renewable chemicals, as part of a biofuels partnership.
- In August 2010, Chevron made an additional equity investment in Solazyme.
- In July 2011, Chevron initiated the second phase of its R&D collaboration with LS9.
- In February 2012, GS Caltex, a Korean refiner that is 50% owned by Chevron, entered into an agreement with SucreSource, a unit of BlueFire Renewables, to build a cellulosic sugar plant in Korea.

ConocoPhillips

- In January 2011, ConocoPhillips, as part of the Energy Technology Ventures consortium, made an equity investment in Cool Planet Energy Systems, a developer of biofuels using modular production plants.
- In December 2011, ConocoPhillips made an additional equity investment in Cool Planet Energy Systems.

Exxon Mobil Corp.

- In July 2009, Exxon entered into a joint R&D agreement with Synthetic Genomics, a developer of algae-based biofuels and renewable chemicals.

HollyFrontier Corp.

- In May 2011, HollyFrontier formed a JV with Endicott Biofuels, Sabine Biofuels, to build a biodiesel production plant using inedible fats and oils in Port Arthur, Texas.

Marathon Petroleum

- Since February 2008, as part of a joint venture with The Andersons, a diversified agribusiness, Marathon has had interests in two corn ethanol plants: Clymers, Indiana (35%) and Greenville, Ohio (50%).
- In May 2008, Marathon made an equity investment in Mascoma, a developer of cellulosic ethanol.
- In August 2010, Marathon made an additional equity investment in Mascoma.

Murphy Oil

- In October 2009, Murphy acquired a corn ethanol plant in Hankinson, North Dakota.
- In September 2010, Murphy acquired an unfinished corn ethanol plant in Hereford, Texas. The plant started up in March 2011.

Petróleo Brasileiro S.A.

- In 2009, Petrobras purchased a 40% equity stake in Total Agroindustria Canavieira, which owns a sugarcane ethanol plant in Brazil.
- In 2010, Petrobras and Grupo São Martinho, a large sugarcane processor, formed Nova Fronteira Bioenergia, a JV that is 49%-owned by Petrobras.
- In April 2010, Petrobras entered into a partnership with Tereos International, including the purchase of a 46% equity stake in Guarani S.A., a large sugarcane processor.
- In August 2010, Petrobras entered into an agreement with KL Energy to develop cellulosic ethanol from sugarcane bagasse.
- In October 2010, Petrobras entered into an agreement with Novozymes to develop enzymes for cellulosic ethanol from sugarcane bagasse.
- As of December 2011, Petrobras owned five biodiesel plants in Brazil: three commercial-scale facilities and two experimental facilities used for developing proprietary technology.
- In December 2011, Petrobras entered into an agreement with Tereos International and Petromoc (Mozambique's national oil company) to study the viability of ethanol production in Mozambique.
- In April 2012, Petrobras, in collaboration with Universidade Federal do Rio Grande do Norte, opened a pilot plant to produce algae-based biodiesel.
- In June 2012, Petrobras extended the scope of its joint development agreement with KL Energy.

Phillips 66

- In December 2006, Phillips began production of renewable diesel using soybean and other vegetable oils at its Whitegate Refinery in Cork, Ireland. (Production ended in 2009.)
- In March 2008, Phillips began a research alliance with the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and Iowa State University to develop conversion technologies targeting cellulosic biofuels production.
- In July 2008, Phillips entered into a research agreement with the Colorado Center for Biorefining and Biofuels (C2B2) to develop new ways to convert biomass into fuels.

Royal Dutch Shell plc

- In November 2006, Shell entered into a collaboration agreement with Codexis, a provider of biocatalysts.
- In 2007, Shell formed a JV with HR BioPetroleum, Cellana, to develop algae-based biofuels. (In January 2011, Shell relinquished its stake in the JV, and HR BioPetroleum subsequently changed its name to Cellana.)
- In November 2007, Shell made an equity investment in Codexis.
- In July 2008, Shell extended a partnership with Canadian-based Iogen Corp. to develop cellulosic ethanol.
- In March 2008, Shell entered into a joint development agreement with Virent Energy Systems, a developer of biogasoline, other advanced biofuels and renewable chemicals.
- In March 2009, Shell expanded its agreement with Codexis to develop biocatalysts for cellulosic biofuels.

- In May 2010, Shell made an equity investment in Virent Energy Systems. (The company was renamed Virent, Inc. in 2012.)
- In June 2011, building on agreements entered into in 2010, Shell and Cosan, Brazil's largest sugarcane processor, finalized the formation of Raizen, an ethanol and transportation fuels JV. Shell contributed its equity stake in Codexis into the JV.
- In February 2012, Shell opened a pilot plant producing drop-in biofuels at its technology center in Houston, based on catalytic process technology licensed from Virent.

Statoil ASA

- In 2007, Statoil purchased a 42.5% equity stake in Lithuanian-based Mestilla, a biodiesel producer, subsequently raising its stake to 49%.
- In 2009, Statoil made an equity investment in Norwegian-based Weyland, a developer of technology for converting biomass into sugars.
- In October 2009, Statoil invested in a project led by two Virginia academic institutions to convert algae into biodiesel.
- In September 2010, Statoil entered into a partnership with Bio Architecture Lab, a developer of algae-based ethanol and renewable chemicals.

Suncor Energy

- In June 2006, Suncor opened a corn ethanol plant in Mooretown, Ontario.
- In 2010, Suncor completed an expansion of the Mooretown plant, doubling its capacity. The plant is currently Canada's largest ethanol production facility.

Tesoro Corp.

- In August 2011, Tesoro and a group of partners began construction of a demonstration-scale cellulosic biofuels plant adjacent to the company's refinery in Kapolei, Hawaii. The project uses technology from Honeywell's UOP subsidiary and Ensyn Corp., a developer of cellulosic biofuels and renewable chemicals.
- In November 2011, Tesoro entered into an agreement with Fulcrum BioEnergy, a cellulosic ethanol developer, to jointly develop plants co-located at Tesoro's refineries.

Total S.A.

- In 2008, Total began participation in BioDME, a European consortium (including, among others, Swedish-based Chemrec) developing dimethyl ether (DME) biofuel from gasification of black liquor.
- In September 2008, Total began participation in Futurol, a French-based cellulosic ethanol development project. The project's pilot plant opened in October 2011.
- In April 2009, Total made an equity investment in Gevo, a developer of biobutanol.
- In March 2010, Total and several partners launched BioTfueL, a project aimed at using the Fischer-Tropsch process to convert wood biomass into biofuels.
- In April 2010, Total made an equity investment in Coskata, a developer of ethanol and chemicals using natural gas and cellulosic biomass.
- In May 2010, Total made an additional equity investment in Gevo.
- In June 2010, Total purchased a 22% equity stake in Amyris for $133 million as part of a biofuels and chemicals partnership.

- In December 2010, Total made an equity investment in Elevance Renewable Sciences, a developer of renewable chemicals.
- In December 2010, Total entered into a joint development agreement with Coskata to collaborate on renewable chemicals.
- In August 2011, Total made an additional equity investment in Coskata.
- In November 2011, Total formed a 50/50 joint venture with Amyris to commercialize renewable diesel and jet fuel, along with some renewable chemicals.
- In January 2012, Total entered into a joint development agreement with Cellectis, a French-based genome engineering company, to develop algae-based biofuels and renewable chemicals.
- In February 2012, Total made an additional equity investment in Amyris.
- In July 2012, Total made an additional equity investment in Elevance Renewable Sciences.

Valero Energy

- In November 2008, Valero made an equity investment in Solix Biofuels, a provider of equipment for algae production. (The company was renamed Solix BioSystems in 2011.)
- In January 2009, Valero made an equity investment in ZeaChem, a developer of cellulosic ethanol.
- In March 2009, Valero acquired eight corn ethanol plants from bankrupt VeraSun Energy. Also, as part of the same acquisition, Valero became an equity investor in Qteros, a developer of cellulosic ethanol technology for licensing to third-parties.
- In April 2009, Valero made an equity investment in Terrabon, a developer of biocrude using landfill waste and other biomass.
- In September 2009, Valero and Darling International formed Diamond Green Diesel, a JV to build a renewable diesel plant near the St. Charles refinery in Louisiana.
- In December 2009, Valero acquired three corn ethanol plants.
- In May 2010, Valero entered into a joint development agreement with Algenol Biofuels, a developer of algae-based ethanol.
- In January 2011, Valero made an equity investment in Mascoma, a developer of cellulosic ethanol, and entered into a letter of intent to collaborate on a commercial plant in Michigan.
- In June 2011, Valero made an equity investment in Enerkem, a Canadian-based developer of cellulosic ethanol using waste feedstock.
- In December 2011, Valero finalized a JV with Mascoma, Kinross Cellulosic Ethanol, to develop and operate a cellulosic ethanol plant in Michigan.

Company Citations

Company Name	Ticker	Exchange	Currency	Closing Price	RJ Rating	RJ Entity
Amyris, Inc.	AMRS	NASDAQ	$	3.40	3	RJ & Associates
BP plc	BP	NYSE	$	41.55	2	RJ & Associates
Ceres, Inc.	CERE	NASDAQ	$	8.87	2	RJ & Associates
Chesapeake Energy Corp.	CHK	NYSE	$	18.46	3	RJ & Associates
Chevron Corp.	CVX	NYSE	$	109.26	2	RJ & Associates
Codexis, Inc.	CDXS	NASDAQ	$	3.23	3	RJ & Associates
ConocoPhillips	COP	NYSE	$	54.97	4	RJ & Associates
Exxon Mobil Corp.	XOM	NYSE	$	87.45	2	RJ & Associates
Gevo, Inc.	GEVO	NASDAQ	$	4.25	2	RJ & Associates
HollyFrontier Corp.	HFC	NYSE	$	36.43	2	RJ & Associates
KiOR, Inc.	KIOR	NASDAQ	$	8.06	2	RJ & Associates
Marathon Petroleum Corp.	MPC	NYSE	$	47.04	2	RJ & Associates
Murphy Oil Corp.	MUR	NYSE	$	54.30	3	RJ & Associates
Petróleo Brasileiro S.A.	PBR	NYSE	US$	19.55	2	RJ Latin America
Phillips 66	PSX	NYSE	$	36.52	3	RJ & Associates
Solazyme, Inc.	SZYM	NASDAQ	$	14.01	3	RJ & Associates
Suncor Energy Inc	SU	TSX	C$	31.86	2	RJ LTD.
Tesoro Corp.	TSO	NYSE	$	27.90	3	RJ & Associates
Valero Energy Corp.	VLO	NYSE	$	26.10	1	RJ & Associates

Notes: Prices are as of the most recent close on the indicated exchange and may not be in US$. See Disclosure section for rating definitions. Stocks that do not trade on a U.S. national exchange may not be approved for sale in all U.S. states. NC=not covered.

U.S. Rig Count Breakdown

	7/27/2012	7/20/2012	W/W Δ	YTD Δ	YTD % Δ	Y/Y Δ	Y/Y % Δ
Total Count							
U.S. Rig Count	1924	1935	(11)	(83)	-4%	16	1%
By Basin*							
Permian	496	497	(1)	41	9%	62	14%
Eagle Ford	264	264	0	28	12%	63	31%
Bakken	210	217	(7)	18	9%	44	27%
Marcellus	97	97	0	-41	-30%	-32	-25%
Granite Wash	71	68	3	0	0%	-8	-10%
Mississippi Lime	66	64	2	18	38%	34	106%
Cana Woodford	50	55	(5)	-8	-14%	-7	-12%
Haynesville	42	45	(3)	-72	-63%	-92	-69%
DJ Basin	40	40	0	-2	-5%	6	18%
Barnett	40	40	0	-19	-32%	-26	-39%
San Joaquin Basin	36	35	1	4	13%	7	35%
Uinta	35	36	(1)	5	17%	9	24%
Powder River Basin	25	23	2	4	19%	13	108%
Pinedale	22	21	1	-7	-24%	-5	-19%
Utica	18	18	0	2	13%	7	64%
Fayetteville	15	15	0	-11	-42%	-11	-57%
Piceance Basin	13	13	0	-14	-52%	-17	-42%
Arkoma Woodford	8	8	0	-12	-60%	-9	-53%
Other	376	379	(3)	-17	-4%	-22	-6%
Drill For							
Oil	1416	1414	2	223	19%	391	38%
Dry Gas	169	171	(2)	(167)	-50%	(192)	-53%
Wet Gas	336	347	(11)	(137)	-29%	(180)	-35%
Thermal	3	3	0	(2)	-40%	(3)	-50%
Trajectory							
Horizontal Oil	802	805	(3)	174	28%	342	74%
Horizontal Gas	349	359	(10)	(190)	-35%	(271)	-44%
Horizontal	1151	1164	(13)	(16)	-1%	71	7%
% Horizontal	60%	60%	0%	2%		3%	

Source: Baker Hughes, Inc, Raymond James research

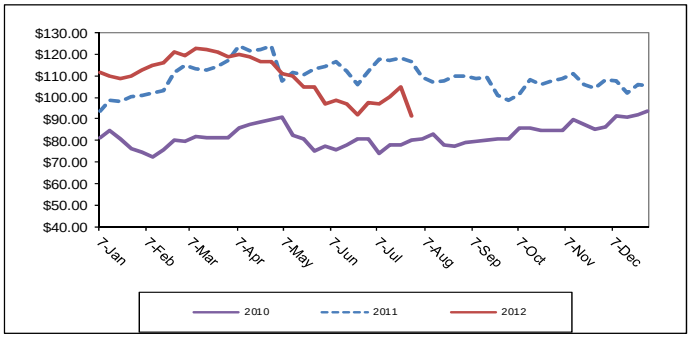
Includes all trajectories

Raymond James Weekly Oilfield Review

For Week Ending: 7/27/2012

12 Month Oil Calendar Strip

Brent

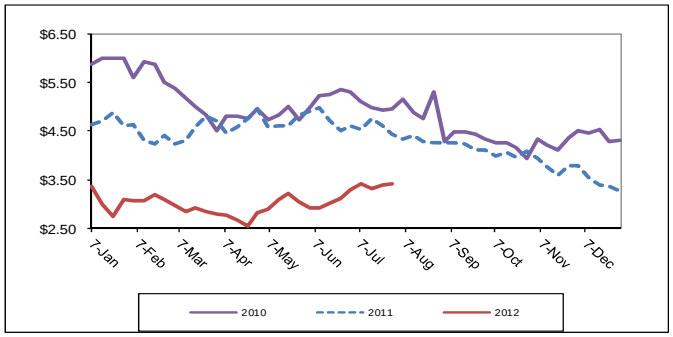


	This Week	Last Week	Beginning of Year	Last Year
Price	$91.57	$104.72	$111.60	$116.30
Percent Change		-12.6%	-17.9%	-21.3%

Source: Bloomberg

12 Month Gas Calendar Strip

Henry Hub



	This Week	Last Week	Beginning of Year	Last Year
Price	$3.42	$3.40	$3.38	$4.45
Percent Change		0.6%	1.4%	-23.1%

Source: Bloomberg

	27-Jul-12 This Week	20-Jul-12 Last Week	29-Jul-11 Last Year	Change From: Last Week	Change From: Last Year
1. U.S.Rig Activity					
U.S. Oil	1,416	1,414	1,025	0.1%	38.1%
U.S. Gas	505	518	877	-2.5%	-42.4%
U.S. Miscellaneous	3	3	6		
U.S. Total	**1,924**	**1,935**	**1,908**	**-0.6%**	**0.8%**
U.S. Horizontal	1,151	1,164	1,080	-1.1%	6.6%
U.S. Directional	240	230	246	4.3%	-2.4%
U.S. Offshore	51	51	37	0.0%	37.8%
U.S. Offshore Gulf of Mexico					
Fleet Size	114	114	121	0.0%	-5.8%
# Contracted	76	77	65	-1.3%	16.9%
Utilization	66.7%	66.7%	53.7%	0.0%	24.2%
U.S. Weekly Rig Permits *	1,342	1,316	1,354	2.0%	-0.9%
2. Canadian Activity					
Rig Count	338	328	395	3.0%	-14.4%
3. Stock Prices (7/27/12)					
OSX	225.1	216.4	273.6	4.0%	-17.7%
S&P 500	1,386.0	1,362.7	1,292.3	1.7%	7.2%
DJIA	13,075.7	12,822.6	12,143.2	2.0%	7.7%
S&P 1500 E&P Index	318.9	530.6	661.9	-39.9%	-51.8%
Alerian MLP Index	393.4	400.1	362.0	-1.7%	8.7%
4. Inventories					
U.S. Gas Storage (Bcf)	3,189	2,693	2,714	18.4%	17.5%
Canadian Gas Storage (Bcf)	612	608	448	0.6%	36.5%
Total Petroleum Inventories ('000 bbls)	870,351	861,758	887,219	1.0%	-1.9%
5. Spot Prices (US$)					
Oil (W.T.I. Cushing)	$90.13	$91.44	$95.70	-1.4%	-5.8%
Oil (Brent)	$106.54	$106.83	$116.74	-0.3%	-8.7%
NGL Composite	$0.00	$37.97	$60.30	-100.0%	-100.0%
Gas (Henry Hub)	$3.01	$3.08	$4.26	-2.3%	-29.4%
Residual Fuel Oil (New York)	$15.21	$15.14	$16.61	0.5%	-8.4%
Gas (AECO)	$2.39	$2.30	$3.66	3.9%	-34.7%
UK Gas (ICE)	$8.66	$8.86	$8.96	-2.3%	-3.4%

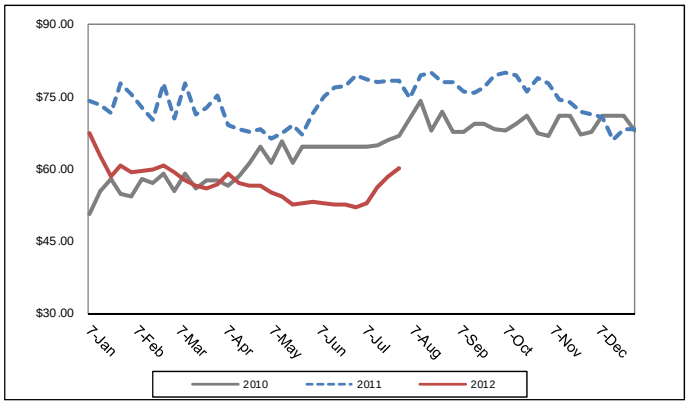
Sources: Baker Hughes, ODS-Petrodata, API, EIA, Oil Week, Bloomberg

** Note: Weekly rig permits reflect a 1 week lag*

Raymond James Weekly Coal Review

For Week Ending: 7/27/2012

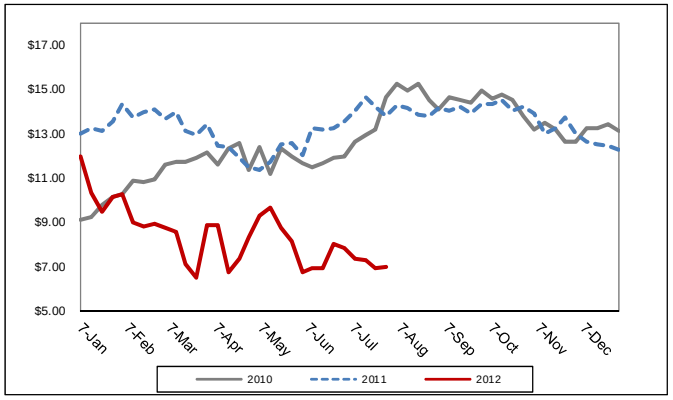
12 Month Big Sandy Barge Prices



	This Week	Last Week	Beginning of Year	Last Year
Price	$60.20	$58.50	$67.50	$67.25
Percent Change		2.9%	-10.8%	-10.5%

Source: Bloomberg

12 Month Powder River Basin 8800 Prices



	This Week	Last Week	Beginning of Year	Last Year
Price	$7.00	$6.95	$12.00	$12.60
Percent Change		0.7%	-41.7%	-44.4%

Source: Bloomberg

	27-Jul-12 This Week	21-Jul-12 Last Week	30-Jul-11 Last Year	Change From: Last Week	Change From: Last Year
1. Coal Prices					
Eastern U.S.					
CSX 1%	$60.20	$58.50	$67.25	2.9%	-10.5%
Western U.S.					
Powder River 8800	$7.00	$6.95	$12.60	0.7%	-44.4%
2. Production	**14-Jul-12**	**7-Jul-12**	**17-Jul-11**		
Eastern U.S.	8,260	8,153	9,042	1.3%	-8.6%
Western U.S.	9,603	10,645	11,885	-9.8%	-19.2%
Total	17,863	18,798	20,927	-5.0%	-14.6%

Source: Bloomberg

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Market Perform (Hold)	39%	33%	55%	31%	8%	24%	0%	0%
Underperform (Sell)	7%	2%	9%	16%	0%	40%	0%	0%

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