Renewable Solution

ISOBUTANOL—A RENEWABLE SOLUTION FOR THE TRANSPORTATION FUELS VALUE CHAIN

Executive Summary

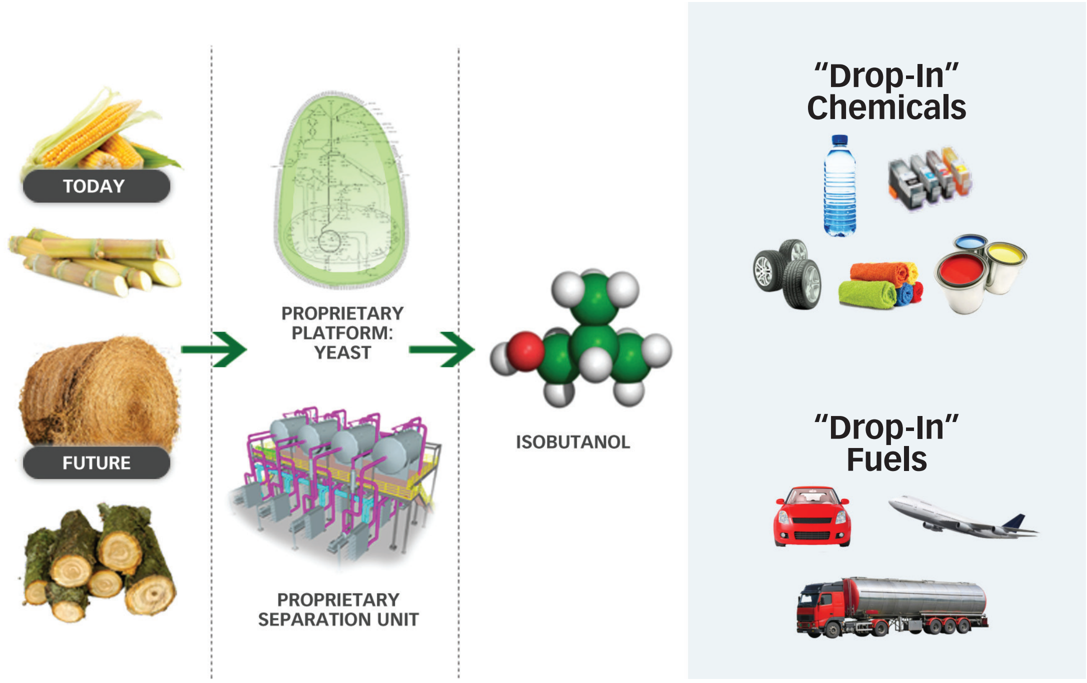
The demand for a clean, renewable biofuel increases as new benchmarks are legislated and increased pressure is placed on the petroleum industry to reduce America's dependence on imported fossil fuels for energy consumption.

Gevo®—a leader in next-generation biofuels—has developed and patented a cost-effective process, Gevo Integrated Fermentation Technology® (GIFT®), which converts fermentable sugars from sustainable feedstocks into isobutanol, a biobutanol product that provides solutions to many of the value chain issues highlighted by first-generation biofuels.

In this paper, you'll learn how isobutanol provides a renewable solution to improve the transportation fuels value chain.

What You Will Learn:

» Isobutanol is a dynamic platform molecule.
» Isobutanol ships in pipeline systems.
» Isobutanol can address future regulatory issues now.
» Isobutanol mitigates end-user challenges.



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As the demand for renewable sources of fuels intensifies, it is imperative that the transportation fuels industry has the necessary solutions to optimize the value chain. Gevo's renewable isobutanol can potentially be applied across the entire transportation fuels industry and shipped through the pipeline, while complying with government regulations and mitigating end user issues.

To find out how isobutanol is the next-generation biofuel, contact us at:

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***Notice Regarding Forward-Looking Statements**
Certain statements in this document, including, without limitation, Gevo's ability to produce cellulosic isobutanol once biomass conversion technology is commercially available, may constitute "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. These forward-looking statements are made on the basis of the current beliefs, expectations and assumptions of the management of Gevo and are subject to significant risks and uncertainty. Investors are cautioned not to place undue reliance on any such forward-looking statements. All such forward-looking statements speak only as of the date they are made, and the Company undertakes no obligation to update or revise these statements, whether as a result of new information, future events or otherwise. For a further discussion of risks and uncertainties that could cause actual results to differ from those expressed in these forward-looking statements, as well as risks relating to the business of Gevo in general, see the risk disclosures under the section captioned "Risk Factors" in Gevo's final prospectus related to its initial public offering filed pursuant to Rule 424(b) under the Securities Act of 1933, as amended on February 9, 2011.

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Butanol Evolves

BACKGROUND ON BUTANOL

The use of butanols in gasoline goes back to the 1970s–'80s and has been approved under Section 211(f) of the Clean Air Act through the "Arconol," "DuPont" and "Octamix" waivers. At that time, tert-butyl-alcohol (TBA), a man-made material, was the prime butanol used, although research suggests that isobutanol was also being evaluated. These butanols were produced from petroleum processes: Both n-butanol and isobutanol were produced using the oxo process, and TBA was a by-product of the PO process.

Gevo has developed a proprietary biochemical pathway to produce renewable isobutanol, a four-carbon alcohol with many attributes that may aid the transportation fuels industry across its value chain. It is now being evaluated as a next-generation biofuel.

Isobutanol should not be confused with the other isomers in the butanol family (n-butanol, sec-butanol, tert-butyl-alcohol [TBA]). It is a naturally occurring material with a musky odor found in many essential oils, foods and beverages (brandy, cider, gin, coffee, cherries, raspberries, blackberries, grapes, apples, hop oil, bread and Cheddar cheese).

Today, Gevo has developed a renewable method to produce a 98+ percent–purity product using sugars from any available source. The initial plan is to convert existing U.S. cornstarch ethanol plants into isobutanol plants for a fraction of the cost to build new facilities. Gevo also plans to upgrade some of these facilities to produce an isobutanol that will be classified as an advanced biofuel as defined by EPA under the U.S. Energy Independence and Security Act (EISA), to allow cellulosic sugars to be used as a feedstock as they become cost competitive, and to allow multiple products to be generated.

ISOBUTANOL IS A NEXT-GENERATION RENEWABLE FUEL AND A "BUILDING BLOCK" TO THE FUTURE FUELS VALUE CHAIN

To become a next-generation renewable fuel, it is paramount that the manufacture of a renewable product leverages existing infrastructure and extends the current fuels value chain. With the U.S. oil-and-gas downstream industry (inbound distribution, refining, outbound distribution and marketing) conservatively valued at over $500 billion, it would be inefficient to build an entirely new supply chain infrastructure to accommodate a renewable product industry valued at less than 10 percent of the downstream industry.

The optimal value chain for a transportation fuel, including renewables, might look like this [Figure 1]:

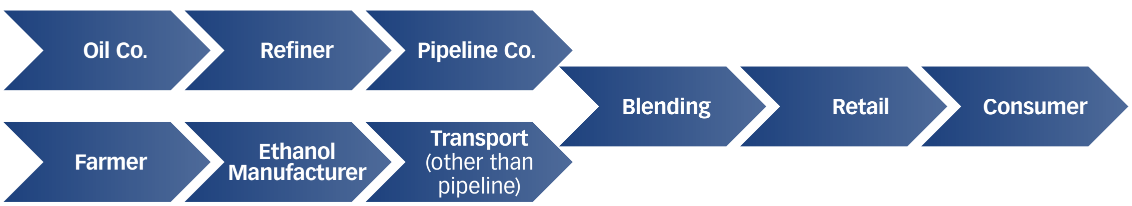
Figure 1

Feedstocks are shipped to a producer (refiner, blender or bio-refiner), where they are converted to a finished product, which is then cost-effectively shipped to market, and sold to the end user based on a specification that meets regulatory needs. Over time, as regulations have been introduced, the optimal value chain has remained intact.

With the advent of the Renewable Fuel Standard (RFS) and EISA, the value chain, using first-generation renewable products, has been changed; for example, ethanol enters the value chain at the terminal [Figure 1a], where it is either blended with a sub-octane gasoline product to produce the finished gasoline, or is added to a finished gasoline to produce a higher-octane product.

Figure 1a

Existing Gasoline Value Chain

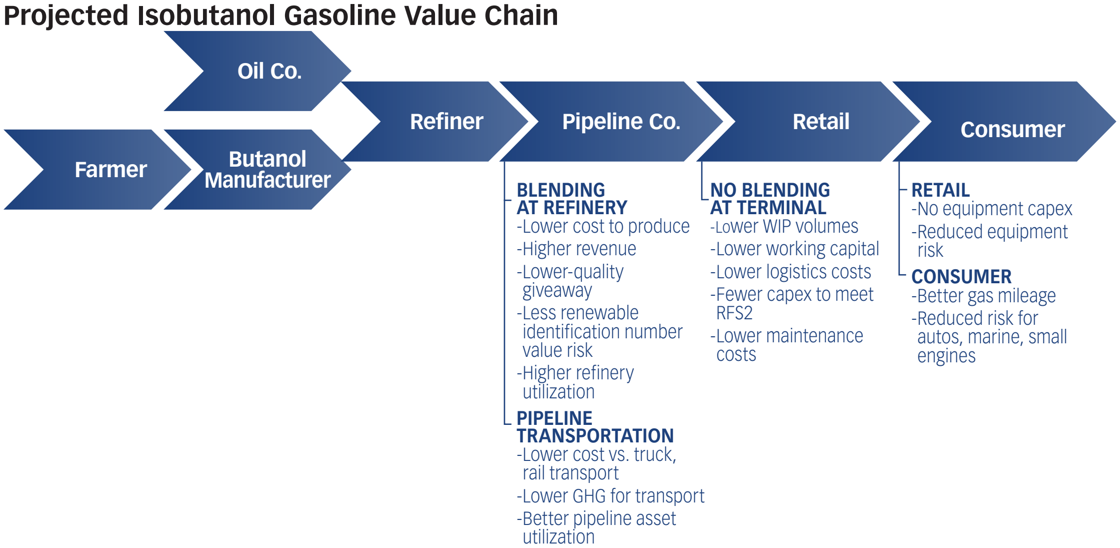


This inefficiency primarily stems from the inability of first-generation biofuels to be shipped in a pipeline, adding system cost(s) as additional capital is required at the terminals for blending these products. Additionally, giveaway costs increase as refiners no longer ship finished products but are held legally accountable for the finished-product specification. If the trend toward using first-generation biofuels grows, pipeline throughput volumes may decrease, giving rise to potential tariff increases on the remaining shippable products.

By analogy, isobutanol is today's "smartphone" to first-generation biofuels' "cell phone;" it can re-optimize the value chain with its ability to be shipped in pipelines, both inbound to and outbound from a refining/blending facility, as shown in Figure 1b. The versatility of isobutanol's properties as a blendstock for gasoline and its ability to be converted to other valuable products give the downstream industry great flexibility.

Figure 1b

Projected Isobutanol Gasoline Value Chain



Dynamic Molecule

ISOBUTANOL IS A DYNAMIC PLATFORM MOLECULE

Isobutanol is an ideal platform molecule, a more flexible and versatile renewable alternative to current biofuels. It can be used as a "drop in" gasoline blendstock; it converts readily to isobutylene, a precursor to a variety of transportation fuel products such as iso-octene (gasoline blendstock), iso-octane (alkylate—high-quality gasoline blendstock and/or avgas blendstock), iso-paraffinic kerosene (IPK, or renewable jet) and diesel. Isobutanol is not constrained to just the gasoline pool; hence, its value to a producer and/or purchaser is its flexibility.

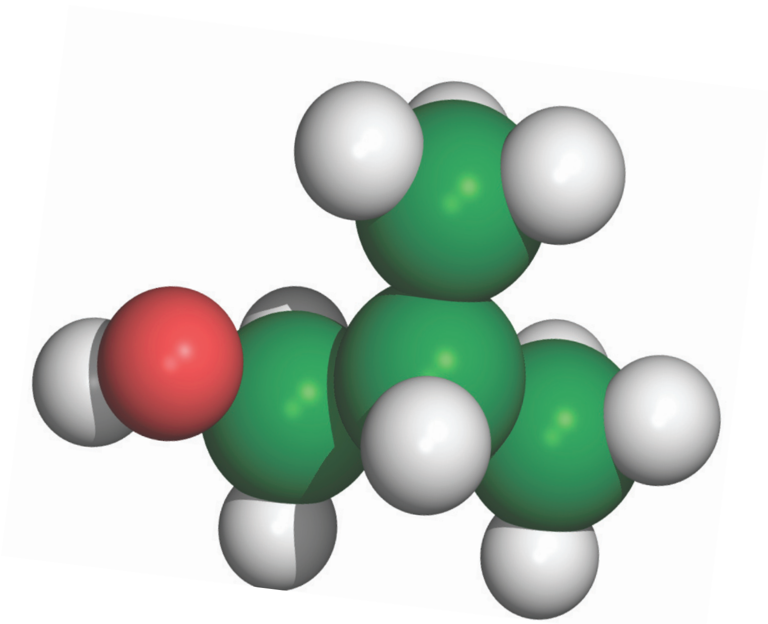
Gasoline and Renewables

The oil embargoes of the 1970s drove the introduction of alternative, renewable feedstocks for the oil-and-gas industry. At the time, the EPA granted various waivers allowing methanol, ethanol, butanols and other materials into gasoline. By the 1990s, the Clean Air Act required gasoline to have an oxygenate added to improve urban air quality. Until 2005, there were two primary options: MTBE (produced by the refinery and optimally blended into the finished product) and ethanol (produced locally and blended into gasoline, not always optimally, at various distribution terminals).

With the creation of the Renewable Fuel Standard (RFS) and the elimination of MTBE as a viable blendstock in 2004, ethanol became the prime renewable material. Production increased dramatically. As more ethanol entered the market, its price decreased relative to gasoline and its usage increased. The 2007 Energy Independence and Security Act (EISA), which requires different categories of renewable fuels (based on greenhouse gas emission reductions), has also increased the volume obligation of a refiner or blender to use renewable products. In addition, as sulfur and benzene concentrations in gasoline have been addressed, it is anticipated that there will be continued efforts to lower ozone levels, with gasoline volatility being a key driver.

The first-generation renewable products have provided a good start to improving air quality and increasing energy independence, but may not provide an optimal economic solution across the value chain. Isobutanol, as the next-generation product, builds on the foundation and provides additional solutions to various challenges not met by first-generation products. Some of these include:

» Blend properties in gasoline
» Volatility
» Phase separation
» Energy content
» Blend wall



Blend Properties in Gasoline

Isobutanol has several blend property advantages: low Reid Vapor Pressure (RVP), above-average octane, good energy content, low water solubility and low oxygen content [Figure 2].

Figure 2

	ETHANOL	ISOBUTANOL
Blend RVP	18–22 psi	4.5–5.5 psi
Blend Octane	112	102
Energy Content (% of gasoline)	65%	82%
Water Solubility	Fully Miscible (100%)	Limited Miscibility (8.5%)
Oxygen Content	35%	22%

Volatility

As sulfur and benzene content in gasoline is limited by legislation, it is likely that efforts to control ozone, which have already increased, will continue to increase in the future.

A key tool used by state regulatory agencies for reducing ozone precursors in the air is through reduced volatility of gasoline as measured by RVP. As ethanol's RVP blend value is high (~18 psi for E10 blends), the base blendstock for oxygenated blending (BOB) must be low to accommodate this high-RVP material. This problem will be exacerbated as any ethanol blends less than 9 percent or greater than 10 percent currently do not qualify for a 1-psi waiver.

Isobutanol's low-blend value RVP (~5.0 psi for 12.5 percent–volume blends) [Figure 3] allows refiners to decrease costs by optimally blending additional lower-cost blendstocks (butane, pentane, NGLs, naphtha) and/or reducing the purchases of more costly low-RVP alkylate. For example, by using Baker and O'Brien's proprietary PRISM™ model [Figure 4] , a refinery serving a low-RVP gasoline market was able to eliminate alkylate purchases and significantly increase butane purchases by using isobutanol instead of ethanol.

Figure 3

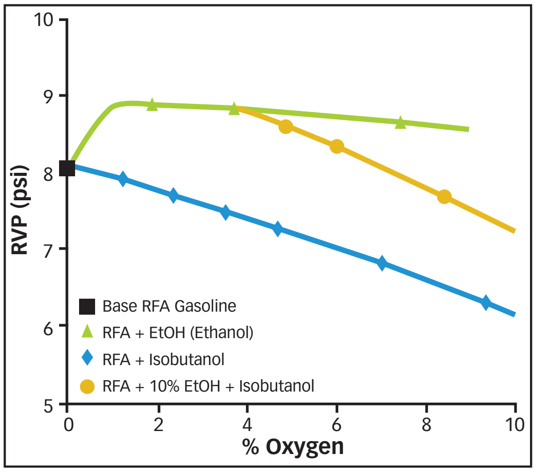
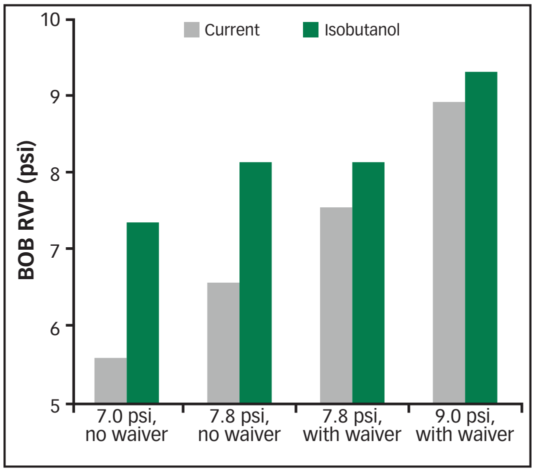


Figure 4



Phase Separation

Because gasoline may come in contact with water, it is important that the blendstocks remain in the hydrocarbon phase and not migrate into the water. Ethanol, a highly polar material, will separate from the gasoline phase into the water phase, degrading the gasoline's octane. Isobutanol is less polar than ethanol, and tends to act like a hydrocarbon with very limited amounts moving from the gasoline phase to the water phase [Figure 5]. As a result, there is no dilution of the gasoline's octane value, and operational issues related to water content are reduced or eliminated.

Figure 5

Energy Content

Isobutanol has approximately 82 percent of the energy value of gasoline. Although every engine is different, higher energy content typically translates into greater fuel economy. In addition, per EISA, as isobutanol has 30 percent more energy than ethanol, its equivalence value (EV) is 1.3 [Figure 6], which translates into significantly more renewable identification numbers (RINs) being generated than ethanol.

Figure 6

BIOFUEL	EQUIVALENCE VALUE (EV)
Ethanol	1.0
Isobutanol	1.3
Biodiesel (FAME)	1.5
Renewable Jet (Biojet, IPK)	1.6*
Renewable Diesel	1.7

*Estimate based on EISA formula.

Blend Wall

Engine manufacturers are concerned about exceeding 3.5 percent–by-weight oxygen levels, and obligated parties need to generate even greater RINs. Isobutanol provides a solution to these needs. If isobutanol were used at E10 oxygen content levels (3.5 percent–by-weight oxygen), it would generate more than twice the RINs. Even at transitional "substantially similar" oxygen levels (2.7 percent– by-weight oxygen), isobutanol generates more RINs than either E10 or E15 [Figure 7].

Figure 7

	OXYGEN CONTENT (%)	EV	RINS GENERATED PER 100 GALLONS FINISHED PRODUCT
12.5% Isobutanol	2.7	1.3	16.25
10% Ethanol	3.5	1.0	10.00
16.1% Isobutanol	3.5	1.3	20.93
15% Ethanol	5.2	1.0	15.00

Converting to Jet Fuel

ISOBUTANOL CAN ALSO BE CONVERTED TO PRODUCE A RENEWABLE JET

According to the International Civil Aviation Organization (ICAO), environmental efficiency gains from technological and operational measures may not offset the overall emissions that are forecast to be generated by the expected growth in air traffic. As a result, the airline industry is evaluating sustainable alternative fuels to reduce its greenhouse gas (GHG) emissions profile, while improving local air quality. It is the ICAO's view that the development and use of sustainable alternative fuels may play an active role in improving the overall resource allocation and security of aviation fuels supply, perhaps by stabilizing fuel prices. A global framework has been established for sharing information on best practices and/or initiatives to allow sustainable alternative aviation fuels to be developed and brought to market.

IPK/KEROSENE

Isobutanol is an ideal platform molecule to produce renewable iso-paraffinic kerosene (IPK), a blendstock for jet fuel. Through known technology, isobutanol can be readily converted to a mix of predominantly C12/C16 hydrocarbons [Figure 8].

Figure 8

Bio-based IPK Jet

Gevo's IPK offers several benefits:

» Blend Rate—may be blended at up to a 1:1 ratio with petroleum jet.

» Properties—very low freeze point (–80°C), high thermal oxidation stability, and meets ASTM distillation curve requirements.

» Regulatory—using EISA's formula, the projected EV is approximately 1.6, which, at a blend rate of 50 percent, would generate 80 RINs per 100 gallons of finished product.

» Tax Credit—it qualifies for a $1.00/gallon tax credit under IRS Title 26, Subtitle A, Chapter 1, Subchapter A, Part IV, Subpart D, Article 40A.f.3.

» GHG—using renewable energy and/or improved feedstocks in the production process, it has the potential to significantly reduce GHG emissions.

Distribution Versatility

ISOBUTANOL CAN USE THE EXISTING PIPELINE DISTRIBUTION INFRASTRUCTURE

A key advantage for isobutanol to be adopted into the transportation fuels industry is its ability to be shipped in pipelines without negatively affecting the integrity, quality or operations of the pipeline system [Figure 9, below].

Pipelines are a key part of the value chain, and using the existing infrastructure to move product may provide significant advantages:

» There is value in blending at the refinery instead of at the terminal. According to a Solomon Associates presentation* finished fuel from a refinery appears to avoid giveaway costs estimated at $0.01 to $0.03 per gallon of finished gasoline.

» As ethanol volumes have grown, pipeline throughputs have fallen; with lower throughputs, tariffs on the remaining products may increase.

» Shipping material by pipeline is the most cost-effective manner to move liquid products compared to rail, barge and/or truck.

Isobutanol has the potential to be used in the existing pipeline system, both inbound and outbound, providing potential cost savings, flexibility and efficient access to end-user markets.

Figure 9

	ETHANOL		ISOBUTANOL	
Integrity				
Stress Corrosion Cracking	Yes		No	
Elastomeric Compatibility	Manageable		Highly Compatible	
Quality				
Oxygen Content in Gasoline	E10	3.5%	I12.5	2.7%
	E15	5.2%	I16.1	3.5%
Ship Neat Product	Qualified No		Qualified Yes	
Operations				
Blend Location	Terminal		Refinery/Terminal	
Segregated Storage	Yes		No	

**Use of Ethanol in Conventional Gasoline Blending—A Look at U.S. Refiner Trends* by John Popielarczyk, October 2009, NPRA Q&A meeting.

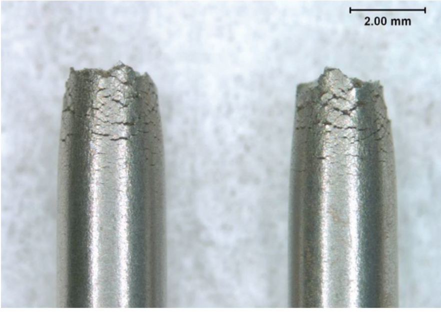
Integrity

There are two key measures of integrity:

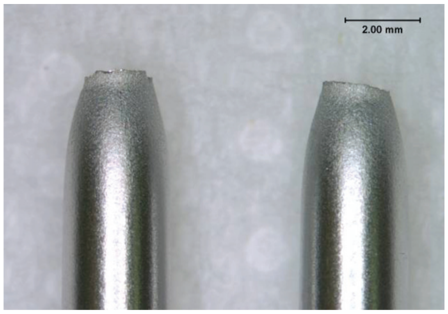
» Stress corrosion cracking (SCC)

» Elastomeric compatibility issues

Det Norske Veritas (DNV), a leading corrosion consultantcy that has done significant work on the distribution of ethanol-blended gasoline, has also evaluated isobutanol. Based on DNV's conclusions, carbon steel is susceptible to stress corrosion cracking (SCC) in fuel-grade ethanol; however, no SCC was noted in isobutanol-containing gasoline at concentrations of 12.5 percent and 50 percent, nor was any SCC found with neat isobutanol, as shown at right. In addition, several elastomeric materials were evaluated with respect to their compatibility with isobutanol and gasoline; the tested materials showed better performance in isobutanol than in gasoline.



Evidence of stress corrosion cracking



No stress corrosion cracking at 12.5% isobutanol

Quality

Today, regulatory pathways exist for isobutanol to be used in gasoline at two volume levels, 12.5 percent under the EPA "substantially similar" ruling (2.7 percent by-weight oxygen content) and 16.1 percent under previous EPA waivers (DuPont, Octamix waivers allowing 3.5 percent by-weight oxygen content). Discussions with pipeline distribution companies have revolved around the shipping, handling and storage of three possible products: 12.5 percent and 16.1 percent by-volume isobutanol-containing gasoline and 100 percent neat isobutanol.

Operations

In recent years, many terminals have increased capital spending to handle blending of ethanol. At the same time, the volume throughput of pipelines has been reduced by the amount of ethanol blended at the terminal. Isobutanol, shipped to a refinery, optimally blended to reduce giveaway cost(s), and then shipped as a finished product to end-user markets, would use the existing assets more cost-effectively.

Regulations and RIN

ISOBUTANOL CAN ADDRESS FUTURE REGULATORY ISSUES NOW

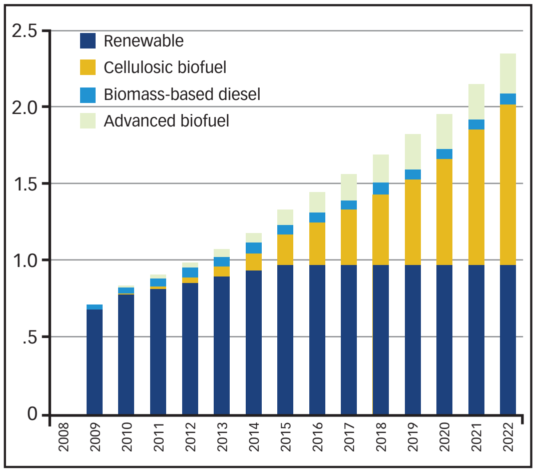
A key driver for isobutanol that will influence its adoption into the transportation fuels industry is the impact that existing and potential regulations may have on guiding which renewable fuels become prominent. Key issues include total RIN volume needed, RIN generation, type of RIN generated, 1 psi waiver and ozone control.

RIN Volume/Generation

EISA (or RFS2) set new volume targets for the industry; specifically, by 2022, 36 billion gallons per year (or about 2.4 million barrels per day) of renewable products are to be used [Figure 10]. To account for this volume, a renewable identification number (RIN) was established; using the concept of equivalence value (EV) [Figure 6, p. 5], which allows a multiplier based on energy content to be used, it is conceivable that the physical volume used by the transportation fuels industry is less than the EISA target volumes. For example, in Figure 11 (below), if 10 gallons of ethanol with an EV of 1.0 are used, 10 RINs are generated per 100 gallons of finished product. With isobutanol, if 12.5 gallons are used with an EV of 1.3, 16.25 RINs are generated per 100 gallons of finished product. The RINs generated are a function of the physical volume used multiplied by the EV of the renewable product.

Figure 10

TARGET VOLUME
(mmbl/day)

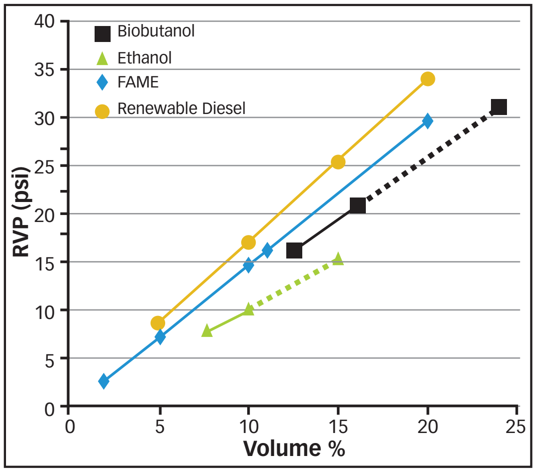


"Advanced" RIN Capable

A key component of the EISA legislation was the introduction of RIN types: renewable and advanced. The advanced category, with a minimum hurdle of reducing GHG emissions by 50 percent, has the subsets of cellulosic, biomass-based diesel and "advanced other." The ultimate volume requirement for the renewable type was set at 15 billion gallons per year (BGY), and for the advanced type at 21 BGY. Although target volumes were set for the cellulosic and biomass-based diesel categories, EPA has the authority to adjust these totals annually, based on availability, but it cannot reduce the total advanced requirement. As such, there may be a growing need [Figures 12, 13, p. 10] for products that meet the "advanced other" category, or products that have 50 percent lower greenhouse gas emissions compared to gasoline.

Figure 11

RINS GENERATED
(per 100 gallons of Finished Product)



One psi Waiver

Another key driver of isobutanol adoption is a consistent standard with regard to volatility; for E10 blends, ethanol was granted a 1 psi waiver when the finished-product RVP was considered. If a state implementation plan (SIP) required a 9.0 psi RVP for conventionl gasoline, this specification would become 10 psi when using ethanol blends.

At present, only gasoline blends containing 9 percent to 10 percent ethanol are granted a 1 psi waiver. Hence, finished product with a 9.0 psi must have a base blendstock RVP substantially lower than 9.0 in order to accept higher ethanol blends, i.e., E15+.

With isobutanol, obligated parties have considerably greater formulation flexibility and might be able to go as high as 9.6 psi in their blendstock and still meet their Clean Air Act requirements without a waiver.

Figure 12

PROJECTED RIN (Gallons)
VERSUS EISA NEEDS (mmbl/day)

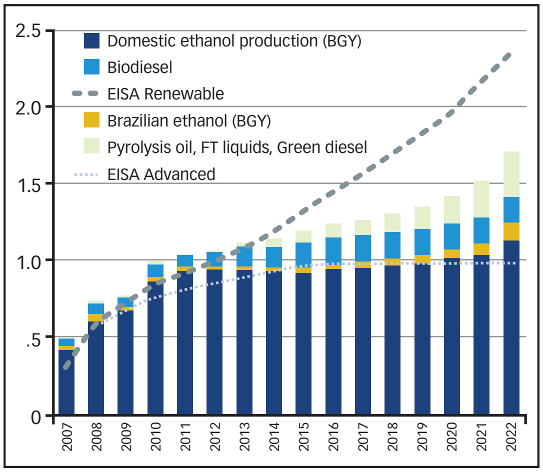
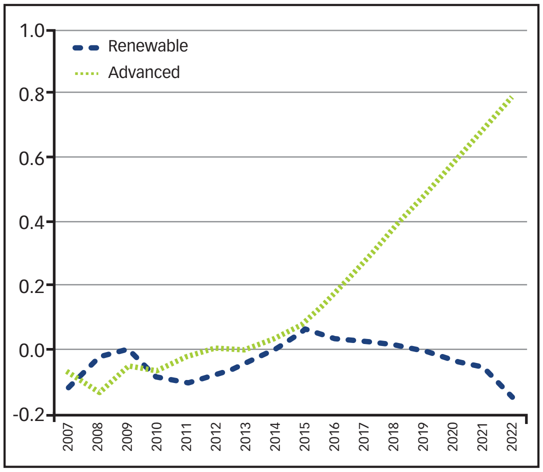


Figure 13

PROJECTED UNDER-SUPPLY
(mmbl/day)



NOTE: Per EISA, corn starch–derived ethanol plants are excluded from achieving an "advanced other" level. However, starch-derived isobutanol plants have the ability to achieve the advanced status. As the only currently available advanced products are FAME biodiesel (limited volumes) and Brazilian ethanol imports, isobutanol provides a secure alternative to meet this need.

Ozone Control

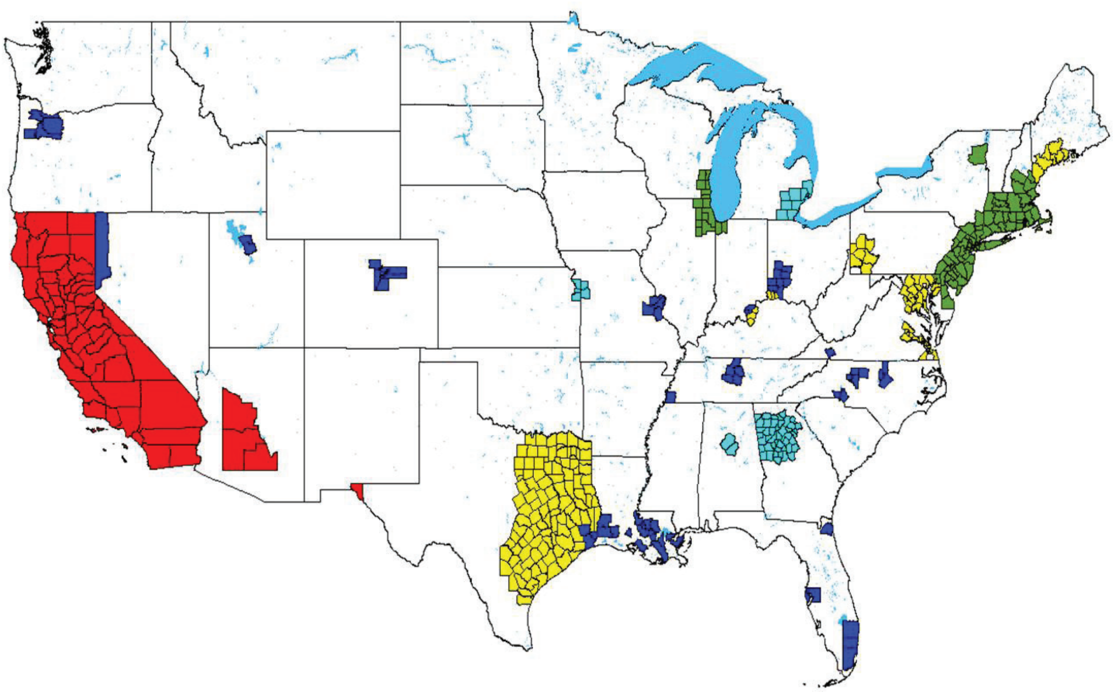
Ground-level ozone is harmful to breathe and damages crops, trees and other vegetation. Gasoline volatility is the key lever used by the states to control ozone precursors. There are already many markets requiring special RVP specifications [Figure 14]. If the EPA target for ozone is set at 75 ppb, it is estimated that over 300 counties nationwide will fall out of compliance. In addition, a U.S. EPA Scientific Advisory Board (SAB) has recommended that the ozone target be lowered (perhaps to 60–70 ppb), which would have a dramatic impact on most of the U.S. gasoline market. Isobutanol, with its low-blend volatility, provides obligated parties greater flexibility to meet both lower volatility (RVP) and renewable fuel obligations.

Figure 14

Market RVP Specification	Gasoline Market Size	Isobutanol Market Opportunity
PSI	BGPY	BGPY
7.0 no waiver[1]	18	2.2
7.8 no waiver	16	1.9
9.0 no waiver	18	2.2
7.0 waiver	6	0.7
7.8 waiver	11	1.3
9.0 waiver	72	8.6

Increasing value

[1] Waiver = 1 psi RVP waiver given to ethanol in many markets.



Overcoming Concerns

ISOBUTANOL MITIGATES END-USER ISSUES

The concept of energy independence was established with the introduction of first-generation renewable fuels. However, in trying to increase the use of these products, several significant constraints must be addressed relative to the various end users: certification of storage tank/dispensing equipment, equipment operational concerns, product liability issues for convenience store operators, fuel mileage/maintenance issues and American pride/innovation. Isobutanol can address these concerns as the next step in the evolution of American-produced biofuels.

Fuel Dispenser Certification Concerns

Underwriters Laboratories (UL) establishes the safety requirements and testing procedures for automotive fuel dispenser systems (UL 87) and certifies new products to ensure they meet material compatibility, adhere to fire safety codes, and are consistent with related products. Although UL has certified certain dispensers for ethanol volumes greater than 10 percent, most existing dispensers used by convenience store operators were only tested and approved for 10 percent blends. The cost of replacing the dispensers is uneconomical for the operator. Isobutanol's initial use would be at EPA gasoline "substantially similar" levels eliminating the need to replace or certify fuel dispensers.

Consumer Labeling/Product Liability Concerns

EPA has given qualified approval for the sale of E15 blends for use in car model years 2001 and newer, and discussions are under way to determine an appropriate label to be displayed on the dispenser to ensure that the consumer uses the appropriate fuel for their car. Unfortunately, per EISA and its current legal framework, the liability to ensure that the consumer uses the right fuel is placed on the convenience store operator. Many operators find this risk to be too high to consider selling ethanol blends above 10 percent. Again, as isobutanol's initial use would be at EPA "substantially similar" levels, it would be considered the same as a conventional petroleum product.

Operational Concerns

The use of ethanol in gasoline has been encumbered by operational issues. In addition to its phase separation issues, it is a fairly strong solvent that tends to dislodge dirt/sludge from the dispensing equipment, causing dispenser filter problems and gasket leaking. Isobutanol is not as potent a solvent as ethanol, and based on preliminary discussions with dispenser equipment suppliers, is not expected to have the same issues as ethanol.

Price and Energy Content Concerns

Consumers tell us that although price remains a key driver of fuel purchase decisions, product performance as a reason for choosing a gasoline brand is increasing. Consumers are keeping their vehicles longer and taking better care of them; rethinking what goes in the tank is becoming more important. Any product that reduces fuel mileage and/or may increase maintenance costs will be avoided if there is a better alternative. Isobutanol has higher energy density than ethanol, and tests are being conducted to quantify this potential benefit to fleet operators and the general motoring public. Qualitatively, gasoline marketers are looking for ways to differentiate themselves, and having a fuel that is renewable but not ethanol is of high interest.

Marine and Small-Engine Concerns

For specialized uses, such as small-engine and/or marine fleet engines, it is paramount to have a fuel that does not cause operational safety issues and can meet EPA emission targets. As the amount of oxygen content in a fuel increases, the operating temperature of that engine increases, potentially causing undue wear and increased emissions. This is an issue with engines that do not have sophisticated instrumentation. In addition, safety issues have been highlighted, relative to higher idle speeds and unintentional clutch engagement.

The National Marine Manufacturers Association (NMMA), the Outdoor Power Equipment Institute (OPEI) and many of their member companies are evaluating isobutanol as a possible alternative to ethanol to help reduce emissions and eliminate phase separation issues. For example, BRP US Inc. recently conducted a study that found butanol-containing gasoline produced less greenhouse gas emissions and had less engine enleanment than ethanol-blended gasoline.

Summary

The petroleum industry needs to focus on innovation to meet future environmental regulations, achieve energy independence and mitigate end-user issues. Isobutanol is an ideal platform molecule to address these issues while benefiting the transportation fuels industry value chain.

Isobutanol may provide environmentally favorable options for the transportation fuels industry to position its products facilities and manufacturing processes to meet increasingly stringent regulatory policies and industry standards.

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Dr. Christopher Ryan is the executive vice president of business development at Gevo. He started his tenure at Gevo in 2009 with more than 15 years of strategic leadership, business development, and research and product development in bio-based materials. Most recently, Dr. Ryan was chief operating officer and chief technology officer for NatureWorks, LLC, which he cofounded in 1997. While at NatureWorks, Dr. Ryan was involved in the development and commercialization of the company's new bio-based polymer from lab-scale production through the introduction and growth of PLA through its $300 million world-scale production facility. He also spent four years working in corporate R&D for HB Fuller, a specialty chemicals company.

Dr. Ryan completed the management of technology program at the University of Minnesota, Carlson School of Management, and holds a Ph.D. in organic chemistry from the University of Minnesota and a B.S. in chemistry from Gustavus Adolphus College.

Dave Munz, MBA
Business Development Manager, Transportation Fuels

Dave Munz joined Gevo in early 2008 and has been focused on placing isobutanol and/or its derivatives in the transportation fuels industry. His background includes business development, pricing, and/or sales and marketing positions with DuPont (U.S. and UK), Conoco (upstream and downstream, U.S. and UK) and CountryMark. Over the past several years, Mr. Munz's focus has been on renewable fuels and their efficient integration across the value chain within the oil-and-gas industry.

Mr. Munz has a BS degree in chemical engineering from the University of Wisconsin—Madison and an MBA from Warwick University in England.

Gary Bevers
Downstream Petroleum Consultant

Gary Bevers has 28 years' experience in product and market development for innovative eSupply Chain Management solutions designed to increase downstream petroleum distribution efficiencies. His firm focuses on systems and logistics support projects that help companies drive sales and operations more efficiently, especially online. He developed Internet-based e-business solutions for TETRA Technologies for oil and gas and handled product marketing for Exxon Chemical, where he received its "PRIME" Marketing Award of Excellence in 1996. He also published *NPN Magazine* and *Fuel Oil News*, covering every sector of the downstream wholesale, commercial, transportation and retail markets.

Mr. Bevers is a member of and actively participates on numerous industry organizations and committees: API/PIDX, SIGMA, NACS/PCATS, PMAA, ILTA, NPECA and MPGA.