BlendTiger
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Bio-ETBE, a better alternative to Ethanol

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Background

Since US Congress mandated the Renewable Fuels Standard (RFS), the refining industry and renewable fuel producers, mainly US Ethanol, have been fighting each other. Refiners resented paying billions for RINs to meet their Renewable Volume Obligations (RVO), Ethanol producers have been clamoring to increase the gasoline Ethanol content to 15 vol% or more, while consumers have been impacted by the enormous subsidies for renewables at the pump.

Since the World is moving towards bio-based blend components, why not invest more in bio blend components such as bio-ETBE (Ethyl Tertiary Butyl Ether)?

Bio-ETBE is made mostly of bio-ethanol (around 47% vol) and isobutylene and it shows excellent gasoline properties, high Octane Number, but the most important aspect is that it is less harmful compared with pure ethanol.

The Whole World is going toward bio-ETBE, except the US

Bio-ETBE, widely used in Europe, Latin America, and Japan in concentrations of up to 22vol% (about 10 vol% Ethanol equivalent). ETBE is an ether made with bio-Ethanol, containing about 47vol % Ethanol.

Bio-ETBE has advantages for all, when compared with Ethanol:

- It can be blended directly at the refineries
- It can be shipped via pipelines (why? Low corrosion factor compared with pure ethanol)
- has highly desirable blending properties, like ~110+ Octane and low 4psi RVP
- Low RVP Reduces VOC emissions
- High octane and low RVP promote reduction of Aromatics (carcinogenic precursors)
- it is 99% less water-soluble than Ethanol, thus reduces risk of contamination from leaky filling station tanks
- Proven excellent user of 10 vol% Ethanol-equivalent in gasoline without harmful effects
- Higher mileage because higher energy density
- it is recognized by EPA and qualifies as renewable fuel and RIN credit to meet RVO
- contains about 47% of Ethanol and the rest is isobutylene, so it has a RIN equivalence of 0.47 RIN's.
- ETBE is manufactured economically either by converting existing/mothballed MTBE plants, or building new units. Typical cost is about $30 million for a new 20,000 BPD capacity, and about $18 million for converting an existing MTBE unit.

Then Why Not Use It?

After the California-promoted hysteria against using MTBE, potential users got scared away by potential lawsuits, even though bio-ETBE is radically different in terms of health hazard. All the World is taking advantage of this excellent blend component, except US because it's chained by California or New York regulations, while on the other hand we cannot use MTBE in USA, but we're exporting to others…ironic or non-sense?!

Blending Gasoline with bio-ETBE

In addition to the advantages mentioned above, bio-ETBE uses cheap Naphtha which is abundant thanks to shale crude production, in addition to using also cheap butane.

We propose different scenarios to show the improved blend profit capability of this blend component:

Case-1 we are making CBOB A4 grade from scratch with 20% vol of bio-ETBE;

	RECIPE		INVENTORY [BBL]			PRICE
COMPONENT	VOL%	BBL	INITIAL	FINAL	REMAINING	$/bbl
n-Butane	11.47	11472.23	0.00	100,000.00	88,527.77	50.51
Natural Gaso	0.00	0.00	0.00	100,000.00	100,000.00	76.38
Lt Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	75.12
Med Naphtha	45.98	45977.03	0.00	100,000.00	54,022.97	75.78
Hvy Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	76.44
Alky	22.55	22550.71	0.00	100,000.00	77,449.29	96.75
Hvy Reform	0.00	0.00	0.00	100,000.00	100,000.00	113.05
Isom	0.00	0.00	0.00	100,000.00	100,000.00	80.74
MTBE	0.00	0.00	0.00	0.00	0.00	97.00
ETBE	20.00	19999.98	0.00	100,000.00	80,000.02	107.00
CG87Reg	0.00	0.00	0.00	0.00	0.00	87.03
CG93	0.00	0.00	0.00	0.00	0.00	92.15

Figure-1: Case-1 recipe with profit of $0.44/bbl

The figure-1 shows the recipe to make 100k bbls of CBOB A4. We are using butane, Naphtha, Alkylate and bio-ETBE. All the specs are met and the profit is 44 cst/bbl.

Case-2 we are making always CBOB A4 grade by blending a semi-finished product, CG87 (conventional gasoline) with butane, naphtha and bio-ETBE.

	RECIPE		INVENTORY [BBL]			PRICE
COMPONENT	VOL%	BBL	INITIAL	FINAL	REMAINING	$/bbl
n-Butane	6.45	6452.20	0.00	100,000.00	93,547.80	50.51
Natural Gaso	0.00	0.00	0.00	100,000.00	100,000.00	76.38
Lt Naphtha	0.00	0.01	0.00	100,000.00	99,999.99	75.12
Med Naphtha	33.43	33425.78	0.00	100,000.00	66,574.22	75.78
Hvy Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	76.44
Alky	0.00	0.00	0.00	100,000.00	100,000.00	96.75
Hvy Reform	0.00	0.00	0.00	100,000.00	100,000.00	113.05
Isom	0.00	0.00	0.00	100,000.00	100,000.00	80.74
MTBE	0.00	0.00	0.00	0.00	0.00	97.00
ETBE	13.09	13090.03	0.00	100,000.00	86,909.97	107.00
CG87Reg	47.03	47031.99	0.00	100,000.00	52,968.01	87.03
CG93	0.00	0.00	0.00	0.00	0.00	92.15

Figure-2: Case-2 recipe with profit of $0.77/bbl

The figure-2 shows the recipe to make 100k bbls of CBOB A4. We are using butane, Naphtha, CG87 and bio-ETBE. All the specs are met and the profit is 77 cst/bbl.

Case-3 we are making CBOB A4 from scratch but without using ETBE.

	RECIPE		INVENTORY [BBL]			PRICE
COMPONENT	VOL%	BBL	INITIAL	FINAL	REMAINING	$/bbl
n-Butane	7.62	7618.26	0.00	100,000.00	92,381.74	50.51
Natural Gaso	0.00	0.00	0.00	100,000.00	100,000.00	76.38
Lt Naphtha	34.26	34264.20	0.00	100,000.00	65,735.80	75.12
Med Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	75.78
Hvy Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	76.44
Alky	20.00	20000.00	0.00	100,000.00	80,000.00	96.75
Hvy Reform	18.12	18117.54	0.00	100,000.00	81,882.46	113.05
Isom	20.00	20000.00	0.00	100,000.00	80,000.00	80.74
MTBE	0.00	0.00	0.00	100,000.00	100,000.00	97.00
ETBE	0.00	0.00	0.00	100,000.00	100,000.00	107.00
CG87Reg	0.00	0.00	0.00	100,000.00	100,000.00	87.03
CG93	0.00	0.00	0.00	100,000.00	100,000.00	92.15

Figure-3: Case-3 recipe with a non-profitable situation. The recipe is losing of $1.27/bbl

The figure-3 shows the recipe to make 100k bbls of CBOB A4. We are using butane, Light Naphtha, Alkylate, Reformate and Isomerate. We are meeting all the specs, but this recipe does not show any profit. Indeed, the recipe is losing $1.27/bbl.

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Case-4 we are making CBOB A4 by blending a semi-finished product, CG87, with light naphtha and butane, without bio-ETBE

	RECIPE		INVENTORY [BBL]			PRICE
COMPONENT	VOL%	BBL	INITIAL	FINAL	REMAINING	$/bbl
n-Butane	0.46	462.30	0.00	100,000.00	99,537.70	50.51
Natural Gaso	0.00	0.00	0.00	100,000.00	100,000.00	76.38
Lt Naphtha	22.38	22380.44	0.00	100,000.00	77,619.56	75.12
Med Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	75.78
Hvy Naphtha	0.00	0.00	0.00	100,000.00	100,000.00	76.44
Alky	0.00	0.00	0.00	100,000.00	100,000.00	96.75
Hvy Reform	0.00	0.00	0.00	100,000.00	100,000.00	113.05
Isom	0.00	0.00	0.00	100,000.00	100,000.00	80.74
MTBE	0.00	0.00	0.00	0.00	0.00	97.00
ETBE	0.00	0.00	0.00	0.00	0.00	107.00
CG87Reg	77.16	77157.26	0.00	100,000.00	22,842.74	87.03
CG93	0.00	0.00	0.00	0.00	0.00	92.15

Figure-4: Case-4 recipe with a profit of $0.10/bbl.

The figure-4 shows the recipe to make 100k bbls of CBOB A4. We are using butane, Naphtha and CG87. We are meeting all the specs, and we are having a profit of 10 cst/bbl.

What's Next?

As we can see from the above cases, when we are blending bio-ETBE, either to make a gasoline from scratch or blending on top of a finished product, we are having better profits than not using bio-ETBE. Besides the economics advantage, with bio-ETBE we have better RIN credits and the overall gasoline will be less harmful for the environment.

The next step all the refineries and terminals should take is to push the Government and educate about how bio-ETBE is actually a good solution to improve the gasoline "health".

RAI has been working with several Companies around the World where ETBE is widely used. From Brazil, Mexico, Singapore, UAE, EU and more. If you need help or want to learn more, please reach out to us at: lee@rafautom.com