Meandering Through the Oil Industry: Part 4

This technical article is in a series characterizing the process that the oil industry follows to bring us one of our favorite commodities, the gasoline that powers our Classics. Fourth in the series is an ode to the refinery engineers.

Mixology

By Brian Rohrback

In an earlier meandering, I outlined the basics of the refining process, breaking crude oil down into a bunch of components, mixing, matching, heating, messing with structures, and ending up with six (more or less) com-ponent streams available for blending. Today, we look more at the blending operation where highly experienced engineers are charged with making optimal use of changing ingredients to deliver the identical driving experience to grateful consumers. Grateful?

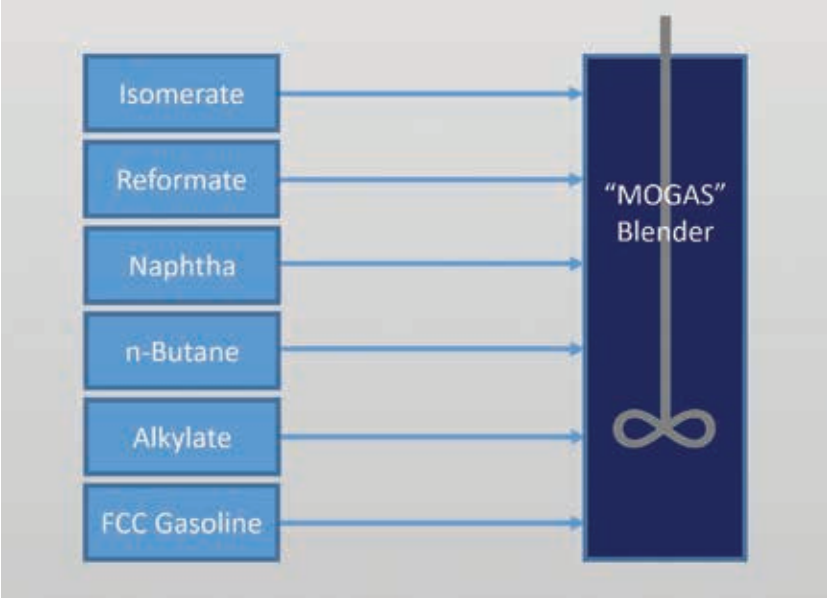
Remember, we need to do this blending without generating any waste (and we need to make money). There was a time when, if we had excess of any of the components, we simply poured it out on the ground. Interest-ingly, this is what we used to do with the gasoline fraction. Back before the Classic Era, the focus was on producing kerosene used for household heating, cooking, and light. Gasoline was the unwanted by-product and was disposed of in a manner consistent with reckless abandon. Now, with a better understanding of environmental impact and a slate of local, state, federal, and world-wide laws, we waste-not and profit by doing so; everybody wins.

So, let's consider the challenge of blending complexity in a non-stop process.

As was discussed in a previous article which provided an overview of a refinery and identified the pathways for making the six main ingredients of gasoline. 'Nuff said

Well, no; there is more complexity to come.

The Blending Unit in Action!



You can think of the Naphtha plus the FCC Gasoline as the low-octane base stock. To that, we blend in the "ates", Alkylate, Isomerate, and Reformate, to boost the octane. Of course, each has other properties that need to be considered as the final blend must match a series of perfor-mance targets – not just octane rating. Straight-chain butane is added mostly to improve cold-start characteristics (although a lot of what is added in the refinery is lost along the way to the pump, but that is an advanced topic).

Enter the amazing person known as the Blend Engineer. We have at least six input valves that this person will set to achieve the characteristics of the gasoline that are desired. There are a few other considerations:

1. *The industry must adhere to a whole raft of gasoline properties (see sidebar).*
2. *We need to account for product demand - Can I sell it profitably? Do I have a slot in the pipeline/ship/vehicle to take it away?*
3. *The ingredient tanks must be monitored for level and have new material flow-ing into them at all times (and not necessarily with the same composition).*
4. *Specifications change as dictated by the altitude and average temperature where the current batch will be sold and most refineries service several regional markets.*

So, a recipe is set at the start of a blending campaign, but the properties of the gasoline are closely monitored and this blend is often (make that usually) tweaked either as the properties drift toward unacceptable values or the ingredient tanks start to drain or their composition varies. Sometimes it reminds one of Lucille Ball trying to maintain production volume in a truffle factory. And in the refinery this is a 24/7/365 job.

The Blending Console

Being a good blender requires a combination of art and science and is one of the most demanding jobs in the refinery.

Community Outreach

On June 2, 2017, intrepid Classic Car promoter and incorrigible lecturer Brian Rohrback spent a pair of hours at a branch of Bellevue College talking about "Classic Cars and Grand Marques". This activity was solicited by Telos, an extension program aimed at the community in general.

Brian spent just over an hour introducing the Full Classics® and placing them in context with Veteran, Brass Era, Antique, etc., providing the history and some lesser-known stories about the origin of the automobile. Most of the Classics in the slides were of cars from the Pacific Northwest Region. About 40 people showed up for the free coffee and agreed to stay to hear all about our favorite mode of transportation. At the end of the PowerPoint blast, we quit the classroom, headed to the garage, and spent another 45 minutes going over the 1939 Bentley All Weather also in attendance. Attendees were amazed at some of the features such as the bijur system of lubrication, the hydraulic ride control, servo brake assist, fuel pumps, the venting front windshield, the quiet sound of the Silent Sportscar, and the not-so-quiet sound of the country horn.

The Properties of Gasoline

Octane is only one of a series of properties that are checked to insure that our fuel enables the proper function of our Full Classics® and our modern iron. Below is what we monitor and in most cases control as gasoline is produced:

1. RON – Research Octane Number is a 600 RPM measure of suitability for engines operating at a certain compression ratio.
2. MON – Motor Octane Number is a 900 RPM measure of suitability for engines operating at a certain compression ratio.
3. Olefins – These are hydrocarbons with at least one double bond and their reactivity makes them the building blocks of many chemicals such as plastic. Unfortunately, in gasoline, these compounds are responsible for gummy buildup in engines and injectors.
4. Aromatics – These compounds help set the combustion properties of the gasoline, but there are balancing environmental concerns as they do not combust completely into CO2 and water.
5. Benzene – Because we want to control the concentration of this specific compound.
6. API Gravity – Density of the fuel on a very strange scale courtesy of the American Petroleum Institute.
7. Sulfur content – Sulfur comes with the crude oil, but we really don't want it in the gasoline as it fouls catalytic converters, is oxidized and turns to acid in the environment.
8. RVP – Reid Vapor Pressure measures the volatility of gasoline and is of particular importance in carbureted vehicles.
9. TV/L – This is the tendency of a fuel to vaporize in an engine; more specifically, but maybe not more helpful, it is the temperature at which a sample of gasoline generates a threshold pressure.
10. Distillation properties – Insuring that not only are we in the correct C4 to C10 range, but the relative distribution within the boiling range is acceptable for Winter, Summer, or Transitional driving.