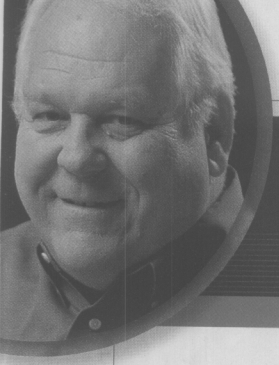

Tech Tidbits

BY DENNIS SIMANAITIS >> ENGINEERING EDITOR

Some Crude Remarks

	Barrels*	Percent of Imports	Percent of Total
CANADA	1.619	15.7	9.5
MEXICO	1.536	15.0	9.0
SAUDI ARABIA	1.438	14.0	8.4
VENEZUELA	1.235	12.0	7.2
NIGERIA	1.049	10.2	6.1

* Millions/day.

TIM BARKER

So where do we get our crude oil? This politically charged question has a remarkably simple answer: from lots of places. What's more, the Energy Information Administration of the U.S. Department of Energy gives a well-defined answer at http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/company_level_imports/current/import.html. (The hardest part is carefully entering all this.)

A nearby graphic shows the top five countries, year-to-date through November 2005 (the latest summary available to me in early February 2006), in millions of barrels/day. Perhaps you find countries 1 and 2 as surprises.

These top five, Canada, Mexico, Saudi Arabia, Venezuela and Nigeria, accounted for 67 percent of our crude oil imports. Among the top 10 countries, accounting for about 87 percent of our imports, no other countries come close to these five, the next being Iraq and Angola, each at less than a half-million barrels/day.

Our total crude imports averaged around 10.27 million bbls/day. Thus, another column of the chart recasts our top five countries and their contribution to that imported total. I draw your attention to Canada and Mexico, at 15.7 and 15.0 percent, respectively.

That is, more than 30 percent of our imported oil comes from our closest neighbors, Canada and Mexico. More than 42 percent comes from the Western Hemisphere.

Indeed, considering the top 15 countries, the Western Hemisphere contributes 48 percent of our import total. The Middle East contributes about 21 percent.

Thus far, we've been talking imports. Let's close with an overall picture: Imports currently account for about 60 percent of our total crude. (This figure could be brought down, but for several good reasons we choose to maintain domestic reserves.) The last column of our chart shows the top five countries and their contribution to our total consumption.

Including the Saudi Arabia figure shown here, the Middle East's contribution to our total works out to about 12.6 percent.

FUEL ASSESSMENTS

"The present rate of gasoline consumption by motor vehicles in the United States is equivalent to all the solar radiation available in 100 sq. miles of the most cloudless desert.

"If we consider the alternative of alcohol as a substitute for gasoline, aside from engineering difficulties of its application, there is not enough arable land in the United States to raise the crops necessary to manufacture the annual supply required. A simple calculation shows that the entire grain crop of nearly the entire grain belt in this country would be involved in this agricultural project alone.

"I must add that no sensible progress has been made in these vital problems, but within 50 years they must be solved."

The source of these pronouncements? Dr. Edison Pettit, of the Carnegie Institution's Mount Wilson Observatory, as cited in *Modern Mechanix,* April 1937.

Plus ça change, plus c'est la meme chose.

SWEET NIGERIA

There are crudes, and then there are crudes. The choice of source depends on a lot more than geography. In particular, some crudes are very sweet (low in sulfur) whereas others are sour (high in this problematic element). This becomes all the more relevant as requirements for low-sulfur fuels phase in during the year. As noted in this column in January 2005, Venezuelan crude is particularly sour (2.9 percent sulfur), Arabian Light is in the middle, sort of (1.9 percent), and Nigerian the sweetest (0.1–0.3 percent).

ARE YOU READY FOR GPC?

As noted elsewhere in this issue (see "Technology Insight: Your Mileage May Differ"), there's controversy concerning the Environmental Protection Agency's current City and Hwy ratings, and the EPA has proposed changes. However, the basic flaw isn't in the testing, but rather in our measuring stick, mpg.

In a very real sense, mpg is the reciprocal—the inverted version—of what we would actually like to measure. That is, we buy *gallons,* not miles. Reporting things in "miles per gallon" makes for topsy-turvy calculations and some very bizarre analyses.

For instance, which is more laudable: jumping from 40 to 50 mpg? From 19 to 21 mpg? Or from 13 to 14 mpg?

Actually, each of these scenarios is worth about the same. Over an average 15,000-mile year, each one saves around 75 gallons.

Said another way, the non-linearity of mpg can confound improvements or shortfalls in fuel use. Ironically enough, it works against high-mpg cars and in favor of gas-guzzlers.

Alas, fuel economy—as opposed to fuel *consumption*—is ingrained in our thinking (and in our regulations). The European idea of liters/100 km avoids this reciprocal tangle. We'd be much better off with something like gpc, gallons per 100 miles. (I'd have suggested gph, but to many it already stands for gallons per hour.)

A POSITIVE VIEW

Dr. Pettit's analysis offered earlier was no doubt based on corn as the primary agricultural input, and matters haven't changed. The only people touting corn-to-fuel economics are subsidized megafarmers and their lobbyists. However, more efficient technologies are evolving that would make biofuels rather more economically feasible to the rest of us. These would not involve feedstock-grade material but grasses, stalks, twigs and the like.

AHOY, THERE! COUGH, COUGH

Awhile back, I came upon a tidbit that ships generate some 30 percent of the world's nitrogen-oxide pollution. In fact, in one hour a single ship entering port generates the air pollution of 350,000 cars.

More recently, a study by our California Air Resources Board found that these diesel emissions drift inland to a greater extent than previously thought. Based on CARB measurements, the area of pollution affects some 2 million people living within a 15-mile radius of the ports of Los Angeles and Long Beach.

As you may recall, NO_X is one of our three regulated automobile emissions, along with HC (hydrocarbons; i.e., fuel that's less than fully combusted) and CO (carbon monoxide, a lamentable by-product of combusting any carbon-based fuel). What's more, in the presence of sunlight, HC and NO_X team up to produce smog.

SMART IDLING STOP

As we've seen in hybrids, turning off an engine when it's not needed has good payoff. But, of course, it has to restart on demand, and this has required an electric starter, indeed, a hefty one to make the whole operation as seamless as possible.

Mazda Research and Development has another approach, though, in its Smart Idling Stop System. Upon shutdown, the system monitors piston position precisely and injects just a tad of fuel. Then, to fire up again, the system ignites the fuel in the appropriate cylinder. Mazda claims this achieves quieter restarting with greater reliability than with the electric-starter approach.

It reminds me of how huge diesel ship engines are urged into action. When the engine is shut down, certain cylinders come to a halt at Top Dead Center, others at Bottom Dead Center. For startup, compressed air is forced into the TDC cylinders, thus pushing their pistons downward. Then the air is switched to the previously BDC cylinders. This continues until a critical starting rpm is reached, at which time diesel fuel gets injected.