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Japan's Liquid Fuels Crisis

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The following guest post is from Jonathan Callahan, a PhD chemist currently working as a data management / information access consultant. Jonathan writes on energy issues and data management at Mazamascience.com

There are so many issues that the Japanese must deal with in the immediate aftermath of their huge quake and tsunami — humanitarian relief, damaged nuclear reactors, and general disruptions and shortages of all kinds. While the ongoing troubles at the Fukushima reactors generate global attention, several recent articles have touched on shortages of liquid fuels that are very worrying. Japan is, after all, the #3 consumer of oil in the world after the US and China.[1] This post will quickly review some recent trends in Japanese consumption and refinery output of the most important liquid fuels — gasoline, kerosene and diesel.

Recent Articles

After Japan's quake and tsunami, freezing weather threatens relief efforts (Guardian, Mar 16, 2011)

> "What we urgently need now is fuel, heavy and light oil, water and food. More than anything else, we need fuel because we can't do anything without it. We can't stay warm or work the water pumps," said Masao Hara, the mayor of Koriyama city, in Fukushima prefecture.

Power, fuel shortages worsen as wintry weather plagues quake-hit Japan (Xinhua, Mar 18, 2011)

> But delivery of relief goods contributed from around the nation to evacuees and survivors still remains difficult due to shortages of fuel and transport vehicles.
>
> The Japanese government ordered Thursday night that 300 fuel tanks will be dispatched to deliver 2 million liters of gasoline and light oil to the northeast region every day to ease fuel crisis. Kerosene will also be sent to the evacuation centers for the use of keeping the people warm.

The Japanese fuel crisis (The Oil Drum, Mar 21, 2011)

> Fuel needs are not just gasoline and diesel for vehicles. With the bitter cold that remains over much of the north of Japan, and no electric power, kerosene is also needed for

> heating. For domestic heating many homes rely on kerosene stoves to heat individual rooms in use, rather than using central heating. Stocks had been falling before the earthquake, due to the severe winter this year. And with stocks being sent to help refugees, there are now shortages in other parts of Japan.
>
> While there are some indications that the nuclear problems may be being brought under control, the problems of fuel shortage and the cascading problem of food, fuel, and other resource distribution that it brings with it are likely to remain in Japan for several weeks as the crisis continues.

TABLE – Japan refinery operations status after quake (Reuters, Mar 22, 2011)

> Japan, the world's third-biggest oil consumer, has 28 refineries with total refining capacity of 4.52 million bpd.
>
> Six refineries operated by four firms with total capacity of 1.40 million barrels per day, or 31 percent of Japan's total, had halted operations after the quake, the survey shows.
>
> So far, three companies have restarted their affected refineries. JX Nippon Oil & Energy restarted its 270,000 barrels per day (bpd) Negishi refinery on Mar. 21. TonenGeneral Sekiyu restarted its 335,000 bpd Kawsaki refinery on Mar. 17, while Kyokuto Petroleum Industries (KPI) restarted its 175,000 bpd Chiba refinery on Mar. 16.

Fuel squeeze hits survivors in Japan's tsunami-ravaged towns (Reuters, Mar 24, 2011)

> A Trade Ministry official said shipments of petrol from elsewhere in Japan were being stepped up to the northeast and the government was reducing the mandatory reserve requirements that oil suppliers must maintain.
>
> But for now, the shortages are exacerbating the chaos of finding and cremating dead bodies, clearing debris and restoring a semblance of normality in the disaster zone.

Nuclear crisis forces Japan to rethink energy needs (Los Angeles Times, Mar 28, 2011)

> Tokyo's iconic electronic billboards have been switched off. Trash is piling up in many northern cities because garbage trucks don't have gasoline. Public buildings go unheated. Factories are closed, in large part because of rolling blackouts and because employees can't drive to work with empty tanks.

All of these articles serve to highlight Japan's dependence on liquid fuels to accomplish everything from transportation to home heating. To understand how this liquid fuels crisis may play out in Japan and world markets it is useful to look at recent trends of consumption, refinery output, imports and available stocks for different liquid fuels.

(All charts below come from the prototype JODI databrowser using the March 19, 2011 release of

the Joint Oil Data Initiative database containing data up through December, 2010.)

Recent Trends for Gasoline

As seen in figure 1), Japanese consumption of gasoline has been fairly steady in recent years, even through the financial crisis and economic downturn of 2008-2009. Refinery output has been very closely matched to consumption with very little in the way of imports or exports. The typical 16 day supply held in stock is undoubtedly being drawn down very quickly at the moment.

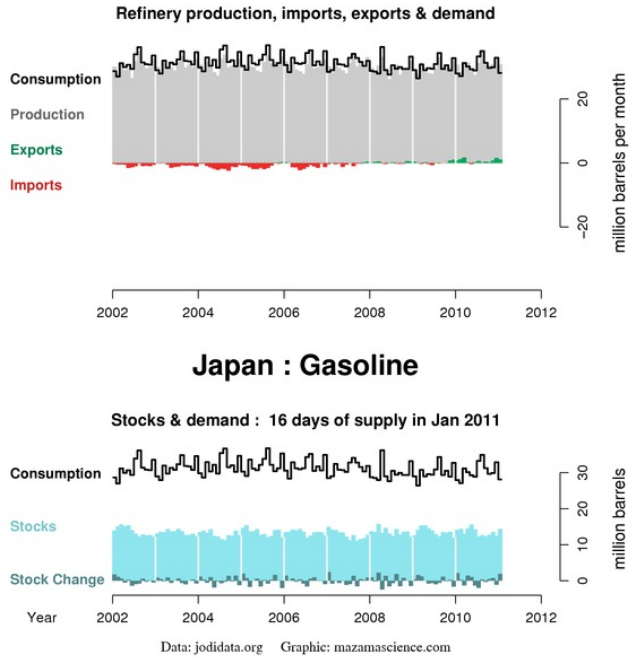

Figure 1) *Refinery production, consumption and stocks of gasoline.*

Recent Trends for Kerosene

Japan, along with Korea, uses lots of kerosene for wintertime home heating. In the upper half of figure 2) we can see that refinery output of kerosene has been fairly steady while wintertime consumption has dropped in recent years due to warmer winters. This has allowed Japan to move from net imports to net exports of kerosene in recent years. Stocks of kerosene were already falling before the recent disaster. The cold weather immediately following the quake and tsunami has greatly exacerbated the current shortage of kerosene in affected parts of Japan. We should expect Japan to quickly run through any remaining stocks (bottom half) in this cold La Nina winter and be looking to import as much during the current cold spell as their port infrastructure can handle.

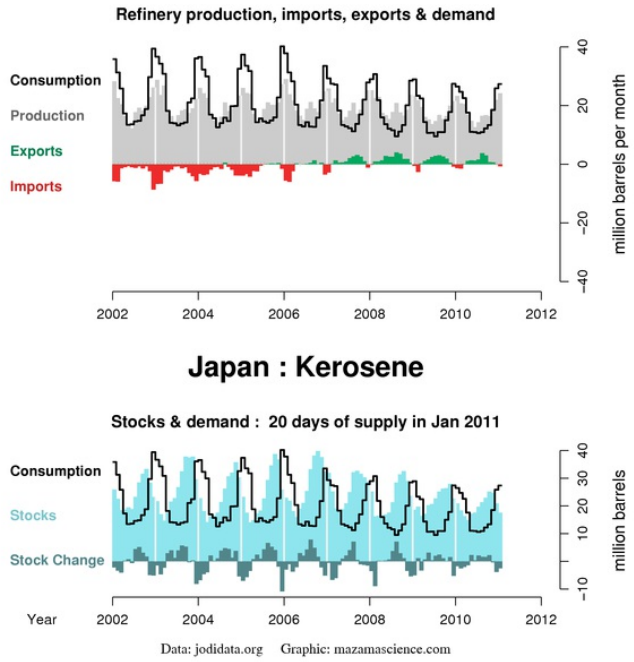

Figure 2) *Refinery output, consumption and stocks of kerosene*

Recent Trends for Diesel

The other petroleum-derived fuel that will be key in the short term is diesel. Figure 3) shows that Japan has seen a large decline in diesel consumption since 2002 according to the JODI data. This has been accompanied by a smaller decline in refinery output and has allowed Japan to become a net exporter of diesel. (Note that units are barrels *per month* rather than *per day*.) In the coming months, Japan will need huge amounts of diesel for reconstruction and to run diesel generators to make up for lost nuclear generation.

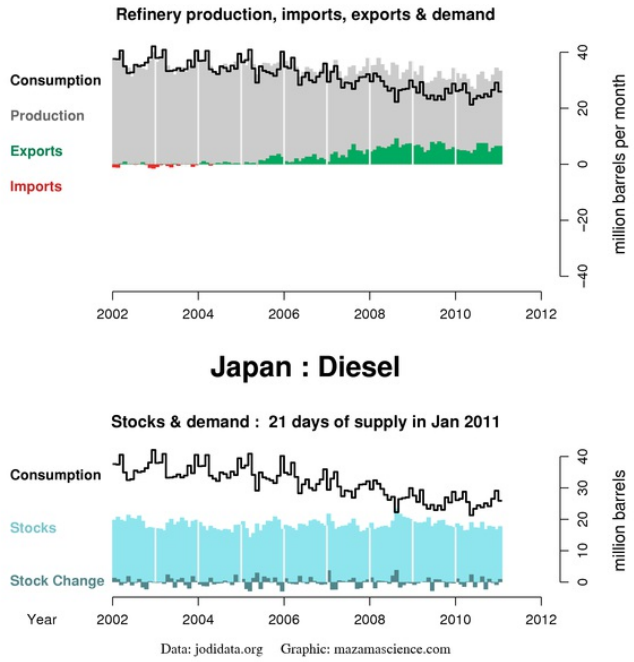

Figure 3) *Refinery output, consumption and stocks of diesel*

Assessment

It seems clear that this liquid fuels crisis will be an ongoing one for Japan and may soon affect global markets for refined products. Several interdependent issues are important in understanding how this will play out:

1. How much has consumption of liquid fuels dropped in Japan?
2. How quickly can the more severely damaged refineries be brought on line?
3. How quickly can Japanese import infrastructure be restored?

Right now it is clear that many Japanese will suffer through the current cold weather due to a lack of kerosene. Gasoline shortages are problematic but probably manageable unless a more serious nuclear meltdown requires a mass exodus from populated areas. This could be next to impossible given current supplies of gasoline. It is less clear from recent articles how important diesel is in the immediate aftermath of the destruction. Clearly, though, a lot of diesel will be needed in coming months for construction and rebuilding.

Best Hopes for Japan and the Japanese.

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1. Energy Information Administration [↩]
