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Q3 2007

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The Energy Monitor gives you the information you need for forecasting, marketing, and making decisions on product features in the flow, temperature, pressure, and valves industries.



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Table of Contents

Issues & Perspectives . . . 9

A look at oil consumption.....9

Chart: World Petroleum Consumption by Geographical Region in 2006....11

Table: World Petroleum Consumption.....11

Table: Top 15 Oil Consuming Countries in 2006.....12

Chart: Top 15 Oil Consuming Countries in 2006.....13

Table: International Petroleum Consumption14

West Texas Intermediate15

Brent North Sea Crude15

NYMEX futures16

OPEC basket price ...16

Dubai Mercantile Exchange reports record open interest for benchmark Oman
crude oil future contract ...17

Peak Oil or Oil Plateau?.....18

Global Spotlight: Africa . . . 19

Tier 1: Nigeria, Algeria, Libya, Angola, Egypt ...19

Tier 2: Equatorial Guinea, Sudan, Congo(Brazzaville), Gabon, South Africa.....19

Tier 3: Chad, Cote d'Ivoire, Cameroon, Tunisia, Mauritania, Congo, Ghana, Morocco, Zambia,
Madagascar, Ethiopia, and Sierra Leone.....19

Non-producing countries.....19

Map: Tier 1.....20

Table: Petroleum Production.....21

(Continued on page 6)

Table of Contents, continued

(Continued from page 5)

Table: Proven Crude Oil Reserves.....	21
Table: Natural Gas Production.....	22
Table: Proven Natural Gas Reserves.....	22
Map: Tier 2.....	23
Table: Petroleum Production.....	24
Table: Proven Crude Oil Reserves.....	24
Table: Natural Gas Production.....	25
Table: Proven Natural Gas Reserves.....	26
Table: African Oil Production.....	27

Oil & Gas, and Refining . . . 28

In the News . . . 29

Statoil and Hydro Merge	29
StatoilHydro chair steps down....	29
Statoil and Petrobras sign strategic agreement	29
Schlumberger buys Geosystem for EM and seismic imaging.....	30
NATCO announces Saudi Arabian joint venture agreement.....	30
Shell and PetroChina in long term supply deal for Gorgon LNG.....	30
Chevron announces global ‘Human Energy’ ad campaign.....	31
Japan and China try to settle East China Sea dispute.....	31
LUKOIL and Saratov government sign cooperation agreement.....	31

Industry Pulse . . . 32

Growth in gasoline demand slows for October	32
EIA sees ongoing price volatility	32

New Projects . . . 33

Indonesia to sign \$10 billion in oil and gas contracts	33
Production begins at the Marimba North field off the Angolan coast	33
KOC plans new and upgraded facilities with US\$ 300m contract	33
ExxonMobil to build 2nd worldscale steam-cracking complex	34
Gazprom partners with StatoilHydro in Shtokman project	34
Cairn India gets government approval for Rajasthan Pipeline	35
New oil find in Sleipner area	35
Petrobras announces the construction of Platform P-56	35
Petrobras will build two new oil drilling rigs in Bahia.....	35
New light oil discovery in the Santos Basin of Brazil.....	36
New exploration license in Qatar.....	36

(Continued on page 7)

Table of Contents, continued

(Continued from page 6)

Company Korner: PetroChina . . . 37

Power & Renewables . . . 39

In the News . . . 40

- Mubarak says Egypt to build nuclear power stations40
- Shell and Codexis expand biofuel collaboration for super enzymes40
- Petrobras acquires thermoelectric plant in Northeastern Brazil41
- Auction for geothermal leases nets US\$ 20 million in bids

Industry Pulse...42

- WEC says renewables to supply 70% of world energy by 210042
- US green power increases 10.6% according to DOE43

New Projects...44

- Petrobras invests \$3.4B in ethanol44
- GE invests in Texas wind project45
- Scotland proceeds with renewable energy/hydrogen facility45
- \$1.6B coal-fired power project in Alberta for EPCOR and TransAlta46
- Five new coal-powered plants planned in Indonesia46
- US utility to buy solar power46

Company Korner: Suntech Power Holding Co., Ltd. . . . 47

Table of Contents, continued



The **Energy Monitor** is part of the Worldflow Monitoring Service. Other publications in this service include the **Market Barometer** and **Flash Reports**. The **Living Database** provides more in-depth information and analysis about the instrumentation business.

Here is the **Worldflow** publication schedule for the rest of 2007 and early 2008:

Q3 2007

Market Barometer—November 2007

Energy Monitor—November 2007

Q4 2007

Market Barometer—December 2007

Energy Monitor—January 2008

Q1 2008

Market Barometer—February 2007

Energy Monitor—March 2008

Issues and Perspectives

A look at oil consumption

A Worldflow Special Report

By Jesse Yoder

In the last issue of the Energy Monitor (Q2 2007), we looked at crude oil supply, including a look at which countries are the leading producers of crude oil. The top five oil producing countries are as follows (*with numbers for 2006, including lease condensate*):

- Russia (9.25 million barrels per day (bpd))
- Saudi Arabia (9.15 million bpd)
- United States (5.14 million bpd)
- Iran (4.03 million bpd)
- China (3.69 million bpd)

While there are multiple causes of the high price of oil, which now stands near \$100 per barrel, we believe that the high price of oil is fundamentally a result of supply and demand. In particular, oil supply is flat, while oil consumption is increasing.

In this issue of the Energy Monitor, we look at oil consumption. In particular, we look at which countries are the leading consumers of crude oil, and how much they are consuming.

The table and chart on page 11 shows oil consumption by geographic region. North America is the leading consumer of crude oil, consuming almost 25 million bpd in 2006. The second leading region is Asia and Oceania, which consumed about 24.2 million bpd in 2006. A look at the chart on page 12 shows quickly why North America is the leading region in terms of oil consumption. The United States consumes far more crude oil than any other country in the world. The following are the top five oil-consuming countries in 2006:

- United States (20.59 million bpd)
- China (7.27 million bpd)
- Japan (5.22 million bpd)
- Russia (3.10 million bpd)
- Germany (2.63 million bpd)

The pie chart on page 13 shows the top 15 oil consuming countries, and what percentage of the world total each represents. The United States consumes almost 25 percent of the world's oil, while China consumes 8.6 percent of the total.

Based on these numbers, it is easy to see why oil analysts cite increasing demand from China

(Continued on page 10)

Issues and Perspectives

A look at oil consumption

(Continued from page 9)

and India as two reasons why oil demand will continue growing. India, which consumed an average of 2.53 million bpd in 2006, is sixth on the list of oil consuming countries. Both China and India are rapidly growing countries with expanding economies that will need more oil as a source of energy. China's gross domestic product (GDP) is increasing in the range of 9-10 percent annually.

One specific reason for China's expanded need for oil is that the number of privately owned automobiles is increasing each year. At the end of 2006, there were close to 22 million privately owned cars on the road in China. There are currently 30 cars for every 1000 people in China, which is far below the world's average of 120 cars per thousand people. Some reports say that China's car population is growing in the range of 20 percent per year.

While the US economy is not growing anywhere near as fast as China's, the US already consumes more than three times as much oil annually as China. With the Bush administration in power for the past seven years, the US has done little to promote energy conservation, or even to improve the average miles per gallon of cars sold by Detroit. It is safe to say that the only thing that will prompt conservation efforts in the United States is extremely high oil prices, accompanied by high gasoline prices. With the price of crude oil near \$100 per barrel, and gasoline selling for more than \$3.00 per gallon, those high prices are here. So far, however, even these high prices have done little to curb the demand for oil in the United States.

Page 14 has EIA projections for oil consumption by the major oil consuming countries through the end of 2008. Projections are for oil consumption worldwide to increase to almost 88.5 million barrels per day by the fourth quarter of 2008. Worldwide supply is forecast to be just under this amount, at 88.37 million barrels per day. Regardless of how accurate these predictions are, it is clear that supply and demand are likely to remain very close for the foreseeable future. Given this relationship, it is easy to see why potential "orifice plate" restrictions in supply, as explained in the discussion of oil supply in the last issue of the Energy Monitor, cause increases in the price of oil.

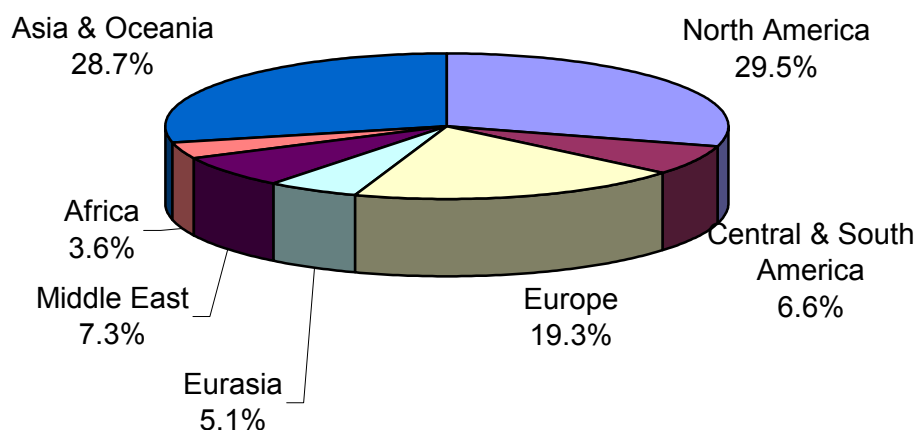
Are oil prices really too high? There is a psychological reason why they seem so high. We are used to measuring oil by the barrel. A barrel is just one thing, so \$95 dollars seems expensive for a barrel of oil. Yet a barrel holds 42 gallons. So even at \$100, the price of oil would be \$2.38 per gallon. This is less than we are currently paying for gasoline on a per gallon basis.

At \$60 per barrel, the price of oil is \$1.43 per gallon. This sounds like a bargain, considering how much work goes into bringing oil to the surface, especially for offshore drilling. And if oil is selling at \$40 per barrel, the price is only \$0.95 cents per gallon.

The tradition of measuring oil by the barrel is not likely to change, but it is important to realize that a barrel holds a lot of oil. When looked at in "per gallon" terms, the price seems a little more reasonable.

Issues and Perspectives

World Petroleum Consumption by Geographic Region in 2006



World Petroleum Consumption (Thousand Barrels per Day)					
	2002	2003	2004	P2005	P2006
North America	23,797.4	24,198.6	25,035.4	25,153.0	24,936.1
Central & South America	5,237.9	5,195.7	5,349.1	5,464.9	5,599.4
Europe	16,030.7	16,161.9	16,224.7	16,372.2	16,3340.0
Eurasia	3,828.5	3,910.2	4,040.8	4,072.9	4,328.2
Middle East	5,107.3	5,286.2	5,539.4	5,853.0	6,165.5
Africa	2,667.7	2,715.1	2,819.5	2,912.3	3,017.9
Asia & Oceania	21,368.2	22,146.0	23,323.3	23,826.3	24,274.0
Total OECD	47,891.9	48,605.4	49,359.6	49,664.0	49,244.9
Total World	78,037.6	79,612.7	82,332.7	83,654.6	84,661.0

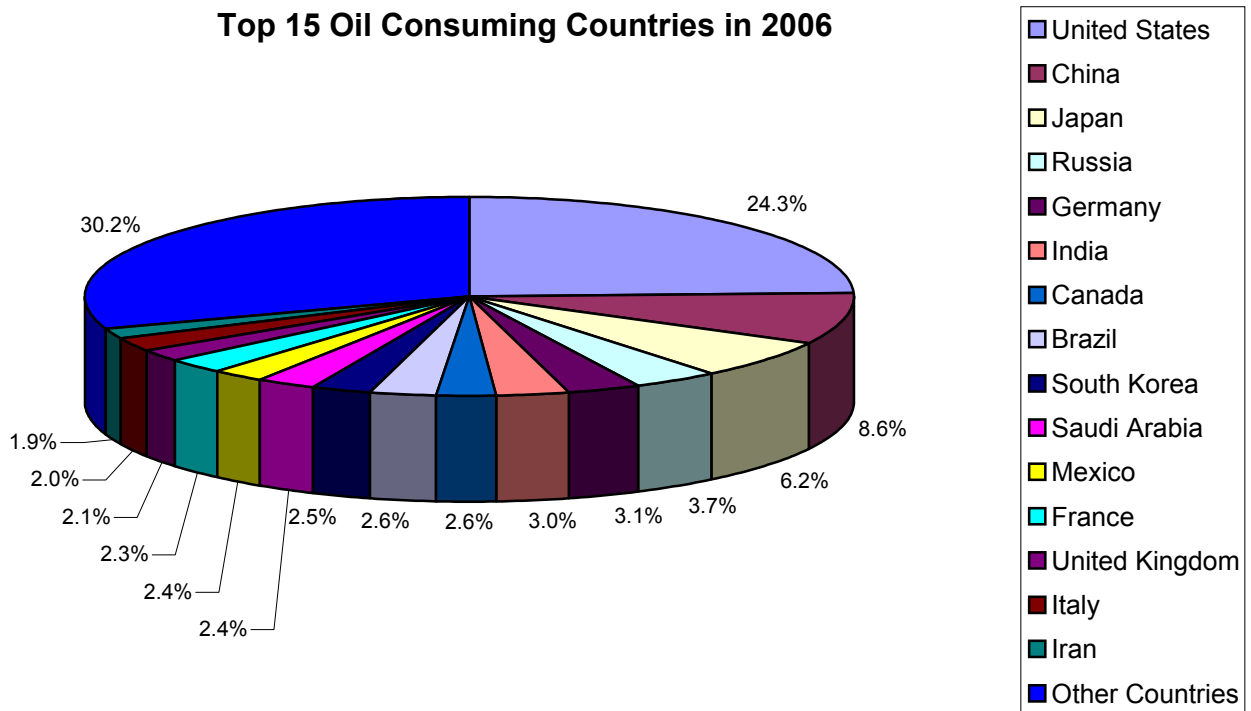
P = Preliminary Data; OECD = Organization of Economic Cooperation and Development

Issues and Perspectives

Top 15 Oil Consuming Countries in 2006 (Thousands of barrels per day)			
Rank	Country	Consumption in 2006	% of Total
1	United States	20,588	24.3%
2	China	7,274	8.6%
3	Japan	5,222	6.2%
4	Russia	3,103	3.7%
5	Germany	2,630	3.1%
6	India	2,534	3.0%
7	Canada	2,218	2.6%
8	Brazil	2,183	2.6%
9	South Korea	2,157	2.5%
10	Saudi Arabia	2,068	2.4%
11	Mexico	2,030	2.4%
12	France	1,972	2.3%
13	United Kingdom	1,816	2.1%
14	Italy	1,709	2.0%
15	Iran	1,627	1.9%
	All Other Countries	25,530	30.2%
	Total	84,661	100.0%

Issues and Perspectives

A look at oil consumption



(Continued from page 10)

The EIA gives the following “supply and demand factors” behind the high price of oil:

1. Strong world economic growth driving growth in oil use
2. Moderate non-Organization of the Petroleum Exporting Countries (OPEC) supply growth
3. OPEC members’ production decisions
4. Low OPEC spare production capacity
5. Organization for Economic Cooperation and Development (OECD) inventory tightness
6. Worldwide refining bottlenecks
7. Ongoing geopolitical risks and concerns about supply availability

<http://www.eia.doe.gov/emeu/steo/pub/special/2007-oil-prices.pdf>

(Continued on page 15)

Issues and Perspectives

A look at oil consumption

International Petroleum Consumption (EIA) (Millions of barrels per day)					
	Q4 2007	Q1 2008	Q2 2008	Q3 2008	Q4 2008
United States (50 states)	20.92	20.96	20.85	21.12	21.05
U.S. Territories	.36	.36	.35	.34	.36
Canada	2.28	2.23	2.15	2.22	2.26
Europe (OECD)	15.72	15.42	15.00	15.41	15.65
Japan	5.62	5.95	4.84	4.81	5.32
Other Non-OECD	5.42	5.37	5.08	5.03	5.38
Former Soviet Union	4.60	4.69	4.59	4.60	4.81
Europe (non-OECD)	.79	.86	.80	.75	.81
China	7.97	7.93	8.05	8.17	8.44
Other Asia	8.82	8.74	8.81	8.60	8.90
Other non-OECD	14.96	15.20	15.49	15.81	15.51
Total World Consumption	87.45	87.69	86.01	86.85	88.48
Total OECD Consumption	50.32	50.27	48.28	48.92	50.01
Total non-OECD Consumption	37.14	37.42	37.73	37.93	38.47
Total World Supply	85.88	86.36	86.85	87.79	88.37

Source: Forecast by the Energy Information Administration (EIA)

Issues and Perspectives

A look at oil consumption

(Continued from page 13)

How is the price of oil determined? Actually, there are many different types of oil, selling for different prices in different locations. However, two oils have become generally recognized benchmarks for “the price of oil.” The two oils are as follows:

- West Texas Intermediate (WTI)
- Brent Blend

The EIA explains as follows:

According to *The International Crude Oil Market Handbook, 2004*,¹ published by the Energy Intelligence Group, there are about 161 different internationally traded crude oils. They vary in terms of characteristics, quality, and market penetration. Two crude oils which are either traded themselves or whose prices are reflected in other types of crude oil include West Texas Intermediate and Brent. Comparing these two crude oils with EIA's Imported Refiner Acquisition Cost (IRAC), the OPEC Basket, and NYMEX futures is important to understand the differences among the various types of crude oil that are often referred to in the press and by analysts. Generally, differences in the prices of these various crude oils are related to quality differences, but other factors can also influence the price relationships between each other.

West Texas Intermediate

West Texas Intermediate (WTI) crude oil is of very high quality and is excellent for refining a larger portion of gasoline. Its API gravity is 39.6 degrees (making it a “light” crude oil), and it contains only about 0.24 percent of sulfur (making a “sweet” crude oil). This combination of characteristics, combined with its location, makes it an ideal crude oil to be refined in the United States, the largest gasoline consuming country in the world. Most WTI crude oil gets refined in the Midwest region of the country, with some more refined within the Gulf Coast region. Although the production of WTI crude oil is on the decline, it still is the major benchmark of crude oil in the Americas. WTI is generally priced at about a \$5 to \$6 per-barrel premium to the OPEC Basket price and about \$1 to \$2 per-barrel premium to Brent, although on a daily basis the pricing relationships between these can vary greatly.

Brent North Sea Crude

Brent North Sea Crude is actually a combination of crude oil from 15 different oil fields in the Brent and Ninian systems located in the North Sea. Its API gravity is 38.3 degrees (making it a “light” crude oil, but not quite as “light” as WTI), while it contains about 0.37 percent of sulfur (making it a “sweet” crude oil, but again slightly less “sweet” than WTI). Brent is ideal for making gasoline and middle distillates, both of which are consumed in large quantities in Northwest Europe, where Brent crude oil is typically refined. However, if the arbitrage between Brent and other crude oils, including WTI, is favorable for export, Brent has been known to be refined in the United States (typically the East Coast or the Gulf

(Continued on page 16)

Issues and Perspectives

A look at oil consumption

(Continued from page 15)

Coast) or the Mediterranean region. Brent, like WTI, production is also on the decline, but it remains the major benchmark for other crude oils in Europe or Africa. For example, prices for other crude oils in these two continents are often priced as a differential to Brent, i.e., Brent minus \$0.50. Brent is generally priced at about a \$4 per-barrel premium to the OPEC Basket price or about a \$1 to \$2 per-barrel discount to WTI, although on a daily basis the pricing relationships can vary greatly.

NYMEX futures

The NYMEX futures price for crude oil, which is reported in almost every major newspaper in the United States, represents (on a per-barrel basis) the market-determined value of a futures contract to either buy or sell 1,000 barrels of WTI or some other light, sweet crude oil at a specified time. Relatively few NYMEX crude oil contracts are actually executed for physical delivery. The NYMEX market, however, provides important price information to buyers and sellers of crude oil in the United States (and around the world), making WTI the benchmark for many different crude oils, especially in the Americas. Typically, the NYMEX futures prices tracks within pennies of the WTI spot price described above, although since the NYMEX futures contract for a given month expires 3 days before WTI spot trading for the same month ceases, there may be a few days in which the difference between the NYMEX futures price and the WTI spot price widens noticeably.

OPEC basket price

For a discussion of crude oil pricing in general, and of the OPEC Basket price in particular, see EIA's OPEC Fact Sheet. OPEC collects pricing data on a "basket" of seven crude oils, including: Algeria's Saharan Blend, Indonesia's Minas, Nigeria's Bonny Light, Saudi Arabia's Arab Light, Dubai's Fateh, Venezuela's Tia Juana Light, and Mexico's Isthmus (a non-OPEC crude oil). OPEC uses the price of this basket to monitor world oil market conditions. As mentioned above, because WTI crude oil is a very light, sweet (low sulfur content) crude, it is generally more expensive than the OPEC basket, which is an average of light sweet crude oils such as Algeria's Saharan Blend and heavier sour crude oils (with high sulfur content) such as Dubai's Fateh. Brent is also lighter, sweeter, and more expensive than the OPEC basket, although less so than WTI.

Both WTI and Brent are light sweet crude oils. This distinguishes them from the OPEC basket of seven crude oils, which include some sour crude oils. In fact, much of the oil from the

¹Energy Intelligence Group, *The International Crude Oil Market Handbook, 2004*, pp. E1, E287 and E313.

(Continued on page 17)

Issues and Perspectives

A look at oil consumption

(Continued from page 16)

Middle East is sour crude, with a significantly higher sulfur content. For this reason, the Dubai Mercantile Exchange (DME) is seeking to have its crude oil be accepted as a worldwide standard for the price of oil, alongside WTI and Brent. This oil is called Oman Crude Oil. The following press release explains this.

Dubai Mercantile Exchange reports record open interest for benchmark Oman crude oil future contract

Dubai (October 24, 2007)—The Dubai Mercantile Exchange Limited (DME) today announced that it has achieved its highest level of open interest for its benchmark Oman Crude Oil Futures Contract, since the commencement of trading on the Exchange on June 1, 2007.

As of October 24, open interest on the DME stood at 7,199 contracts, an increase of 732 since the previous high of 6,467 recorded on 29 June 2007. A rise in open interest on the Exchange is a leading indicator that customers are becoming more confident with the Oman Crude Oil Futures contract as the pricing mechanism for Middle East sour crude oil.

This rise in open interest also corresponds with a steady increase in trading volumes. During the month of September and month-to-date in October, average daily trading volumes were 1,865 and 1,953, respectively as the DME continues to attract new market participants and further expand its global customer base. In recent weeks, the DME has also seen active trading of the Oman Crude Oil Futures Contract as far out as December 2008.

Commenting on the announcement, Gary King, Chief Executive Officer of the DME, said: "We are pleased to continue to report enhanced levels of open interest and trading activity on the Exchange. This development is further underscored by the consistent growth in trading activity as additional members are being inducted and new participants enter the market. We are particularly gratified to see strong volume growth out of Asia, where confidence in our benchmark Oman Crude Oil Futures Contract has increased significantly following the successful physical delivery of the DME futures contracts traded during our first two months of operation. We are extremely positive about this enhanced level of activity and confident that we will continue to build on this progress and attract even greater industry participation in the weeks and months ahead."

Enhanced levels of liquidity and open interest on the Exchange provide greater visibility and transparency for the trading and pricing of Middle East sour crude oil and further reinforce fast growing recognition of the Oman Crude Oil Futures Contract as the global benchmark for the pricing of Middle East sour crude oil.

Issues and Perspectives: Peak Oil or Oil Plateau?

Today the world is producing about 85 million barrels of crude oil per day, and supply and demand are very close. Yet demand for oil is expected to increase indefinitely, especially from fast-growing countries such as India and China. Will supply always keep up with demand, or is there a practical limit to how much crude oil can be pumped from the ground?

According to an article in the Wall Street Journal on November 19, 2007, a number of industry analysts now favor a view that there is a practical limit to the number of barrels of crude oil that can be produced on a daily basis. Some analysts put this limit at about 100 million barrels per day, and they say that this limit could be reached as early as 2012.

This idea is similar to another idea that has been discussed in relation to worldwide oil production. That idea is the idea of “Peak Oil,” and it was first proposed in 1956 by a Shell geologist named Dr. Marion King Hubbert. Dr. Hubbert predicted that production in the United States would peak in 1970, and world production in 1995. After reaching its peak, he projected that oil production would decline.

Events have proven Dr. Hubbert’s prediction wrong, at least in terms of when the peaks would occur. World oil production has continued to increase, although production in the United States has leveled off. And even today, the idea of Peak Oil is not widely adhered to. Enhanced recovery methods and new technologies have been the basis for continued growth in world oil production.

The theory described in the Wall Street Journal articles is better described as “Plateau Oil” rather than Peak Oil. The idea is that due to a number of factors, sometime in the future the world’s oil supply will reach a practical plateau, and be unable to grow significantly beyond that point.

According to BP PLC, worldwide oil production has increased by an average of 2.3 percent per year since 1965. What would create a production plateau? Here are several factors:

1. Many people believe that the world’s largest oil fields have already been discovered. By 1970, explorers had found ten oil fields capable of producing more than 600,000 barrels per day. Between 1970 and 1990, exploration yielded only two such fields. Since 1990, the industry has found only one field able to produce over 500,000 barrels per day – the Kashagan fields in the Caspian Sea.
2. The output from some fields, such as those in Iraq, is limited by security factors and the lack of outside investment.
3. Production is declining at many of the world’s largest oil fields, such as the Cantarell Field in Mexico.
4. The search for new oil has led companies to explore offshore areas more intensively – but production in offshore and deep water oil fields is by its very nature more expensive and difficult than onshore and shallow water fields.
5. Labor and construction bottlenecks are making production from proven fields more difficult.
6. The costs of production, including the higher price of oil rigs, are making recovery of oil in existing fields, less cost-effective. As a result, companies are falling behind in the investment needed to get maximum production from existing fields.

Of course, no one knows now if or when oil production will plateau. But if it does, it will further hasten the day when the world is forced to turn to alternative energy solutions.