Current Energy Requirements in Indonesia

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PLN is currently requesting the establishment of 10,000 MW of LNG fired electrical power, financed, built, owned and operated by IPP (Independent Power Plant) operators. It seems PLN may not be aware of the huge difficulties this would entail. *[Note: authorities are now promoting the power of 35,000 MW (August 2016)]*

1. PLN PLAN TO USE LNG IN THE NEW POWER PLANTS

A power of 10,000 MW, at the average load of 14 hours a day, as is common in the region, means the production of 140,000 MWh of electricity per day, which would consume 1,400 MMSCFD (million standard cubic feet per day) of high energy natural gas, or over 10 million metric tons per annum. That's 3 times the production of Bayu-Undan or 4 times that of Greater Sunrise. *[Note: at the 35,000 MW level demand would be 4,900 MMSCFD, or over 35 million metric tons per annum]*

It seems that PLN intends to use LNG as the source of its natural gas, and procure it from Bontang in East Kalimantan, and Tangguh (Bintuni) in West Papua.

Actual production capacity at these plants is:

- Bontang: 2,845 MMSCFD, most of which is already committed to Japanese clients
- Tangguh: 500 MMSCFD exactly, with a future extension to 1,000 MMSCFD. The extension plan is currently on hold.

The LNG requirement for 10,000 MW of electrical power would represent 49% of Bontang's production, or 280% of Tangguh's, and 140% of Tangguh's potential future capacity, which is clearly not feasible.

Moreover, it is important to keep in mind that the LNG plants are partly owned by the buyers of the LNG and that deliveries are firmly committed to them for the duration of the plants' expected lifetime.

With regard to total Indonesian natural gas figures, including Bontang and Tangghu, production, consumption and exports are as follows:

- Production: 6,811 MMSCFD
- Consumption: 3,718 MMSCFD
- Net Exports: 3,024 MMSCF

Exports are diminishing because of increased domestic consumption, while Indonesia signed a few months ago two contracts with Cheniere Energy to import for 20 years the

equivalent of 210 MMSCFD of LNG from the U.S. at a price thought to exceed $12 per 1,000 cubic feet (MCF).

It appears PLN intends to use 20% of total national production for its own use, which would reduce exports by 47%, a political decision that could not be easily taken and would quite certainly not be for PLN to make. *[Note: if the 35,000 MW plan were to be implemented, those figures would rise to 70% of total national production and 160% of current exports].*

With regard to prices, Indonesia currently exports LNG at prices between $14 and $16 per MSCF (thousand standard cubic feet) and imports LNG at $12 [***April 2015***]. This means that the quantities required by Indonesian power plants would need to either come out of exported production ($14 to $16), or would need to be imported ($12). Assuming the imported value of $12, LNG at the production plant would cost $480 per metric ton of diesel or heavy fuel equivalent. Assuming the export values, that cost could rise to $640. Just for reference, liquid fuel prices at Singapore in mid-April 2015 were $543 for diesel and $336 for IFO380 (heavy fuel). Incidentally, if oil prices rise, LNG will follow suit.

Additionally, whenever a unit of gas that could have been exported for $16 is used for local consumption, its real cost is in fact $16. If the unit of gas is imported at a cost of $12, the real value is still $16, as this unit of gas could have been re-exported for $16.

When using this LNG for power generation, to these costs will need to be added loading, transportation, offloading and re-gasification costs, which will amount to at least $5 to $7per MSCF, for a total delivered price of between $21 and $23. Distances from Bontang or Bintuni to Kupang, in West Timor, to give an example, are 800 nautical miles. Compared to liquid fuel, these prices would be at least 15% higher than diesel in the best case and up to 90% higher than heavy fuel oil.

To summarize, the idea of burning LNG in a power plant in a country that exports LNG at high prices is just plainly uneconomical, and the option would today be more expensive than diesel or heavy fuel. LNG is an option in countries that have no alternative, but not where it can be exported to Japan and Korea at such high prices.

Additionally, it is unavoidable that all the different IPP's competing for scarce resources of LNG will drive prices up, to the probable satisfaction of the gas producers.

Note: LNG in itself has absolutely no use whatsoever (except to liquefy more gas). LNG liquefaction is only used for the conditioning of large quantities of gas for transportation over long distances. Wherever a gas field is close to destination, this conditioning becomes not only useless, it needs to be avoided as too expensive and cumbersome. In addition, whereas compressed gas can be conserved in tanks for unlimited periods of time, LNG either evaporates or needs to be re-liquefied, which needs more gas and therefore results in a constant loss over time.

2. COMPETITIVE COST CONSIDERATIONS

A price relationship can be established between the value of the Brent barrel of oil and the price of liquid fuels for bunkers in an efficient market such as Singapore.

- At $100 a barrel of Brent oil, diesel is $852 per metric ton ($21.30 per MMBTU) and heavy fuel oil IFO380 is $565 ($14.10 per MMBTU)

- At $40 a barrel of oil, diesel is $430 ($10.75 per MMBTU) and IFO380 is $245 ($6.15 per MMBTU)

As per paragraph 1, the cost of LNG delivered to a power plant in Eastern Indonesia would be in the vicinity of $20 per MSCF, based on the real value of LNG being that of forfeited exports. By comparison, the cost of CNG from some Australian fields to Kupang would be about $10.

The fuels available for power generation (excluding in this analysis nuclear, geothermal, hydro-electric, wind and solar) are: coal, heavy fuel oil, diesel, CNG and LNG.

Markets vary from one region to another but let's consider first the U.S., where prices for electrical generation fuels are currently as follow, including transportation and handling, **landed** at the power plant, per MMBTU:

- Coal: $3
- Natural gas: $4
- Diesel: $17
- Heavy oil:: $14

In **Indonesia,** from actual market data, we find similar landed prices, with variations due to the closeness or remoteness of locations, but natural gas prices will be higher, for market and export reasons:

1. **Assuming a $40 Brent barrel of oil**
    - Coal: $3
    - Natural gas CNG: $10
    - Natural gas LNG: $20
    - Diesel: $15
    - Heavy fuel oil:: $13

2. **Assuming a $100 Brent barrel of oil**
    - Coal: $3
    - Natural gas CNG: $10
    - Natural gas LNG: $24
    - Diesel: $25
    - Heavy fuel oil:: $20

Coal: apart from environmental considerations not discussed here, the fuel of choice from a purely economic standpoint seems to be coal, and it definitely is in certain conditions: coal

can deliver good consistent cheap base-load but it must be supplemented by other more flexible fuels such as diesel or natural gas to accommodate the steep power variations encountered in smaller, non-industrialized markets. Although coal is cheap, it is not flexible, and it is difficult to handle and manage in small plants. For relatively small and non-industrialized markets, typically under 300 MW, coal is not the solution of choice. Coal also presents the problem of disposal of ashes and solid waste.

Heavy fuel oil: although it is cheaper than diesel to buy at the refinery, it is more expensive to handle, transport, and store, because of its viscosity which requires high temperatures to handle, typically 60 to 80 C. For relatively small quantities, these requirements make heavy fuel oil quite cumbersome. It also has the disadvantage of not being very flexible and must be supplemented by diesel generation to accommodate steep variations in small non-industrialized markets. Heavy fuel oil also comes with some environmental issues, not discussed here.

Diesel: diesel is an excellent versatile and flexible liquid fuel, easy to transport and to store, and for these reasons it is in high demand and therefore is expensive. In addition, diesel is also used for a variety of other applications, which also contributes to the high demand. The more remotely located power plants in Indonesia run on diesel.

LNG: in Indonesia LNG will prove to be of the same order of price as diesel (see above), if the barrel of Brent crude oil is at the US$100 level. If the barrel of Brent is under US$90, LNG becomes more expensive than diesel, let alone heavy fuel oil, which will discourage the switch from diesel to LNG, especially considering the large investments required not only for transportation and storage, but also for replacing generators.

CNG: CNG is the most appropriate alternate fuel for relatively small power plants (up to 250 MW) requiring very high flexibility, but the supply of cheap CNG entails the availability of stranded gas fields within a relatively short distance. These fields are considered stranded because they are too small for LNG production, which makes them available for local consumption. Additionally, in certain cases, CNG will be a good option for supplementing large distant coal fired power plants at peak load. However, wherever CNG is obtained only by re-gasification of LNG, it will prove uneconomical. Again, CNG requires the availability of natural gas from nearby stranded fields.

To summarize:

- To be competitive with diesel LNG would require the Brent barrel of oil to stay above $90.

- In some particular markets where CNG can be produced from stranded fields, it would compete with a barrel of oil as low as $15. With a $90 barrel, CNG is 60% cheaper than diesel. The almost constant price of stranded field produced CNG will not be affected by fluctuating commodity and oil prices, as other fuels are.