



Small Scale LNG a Way to Market for Stranded Coal Bed Methane in Indonesia

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Asia Pacific Energy Experts

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Testimony

Market Analysis

Asset Valuation

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Market and System Operators

Government Ministries



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Independent Power Producers

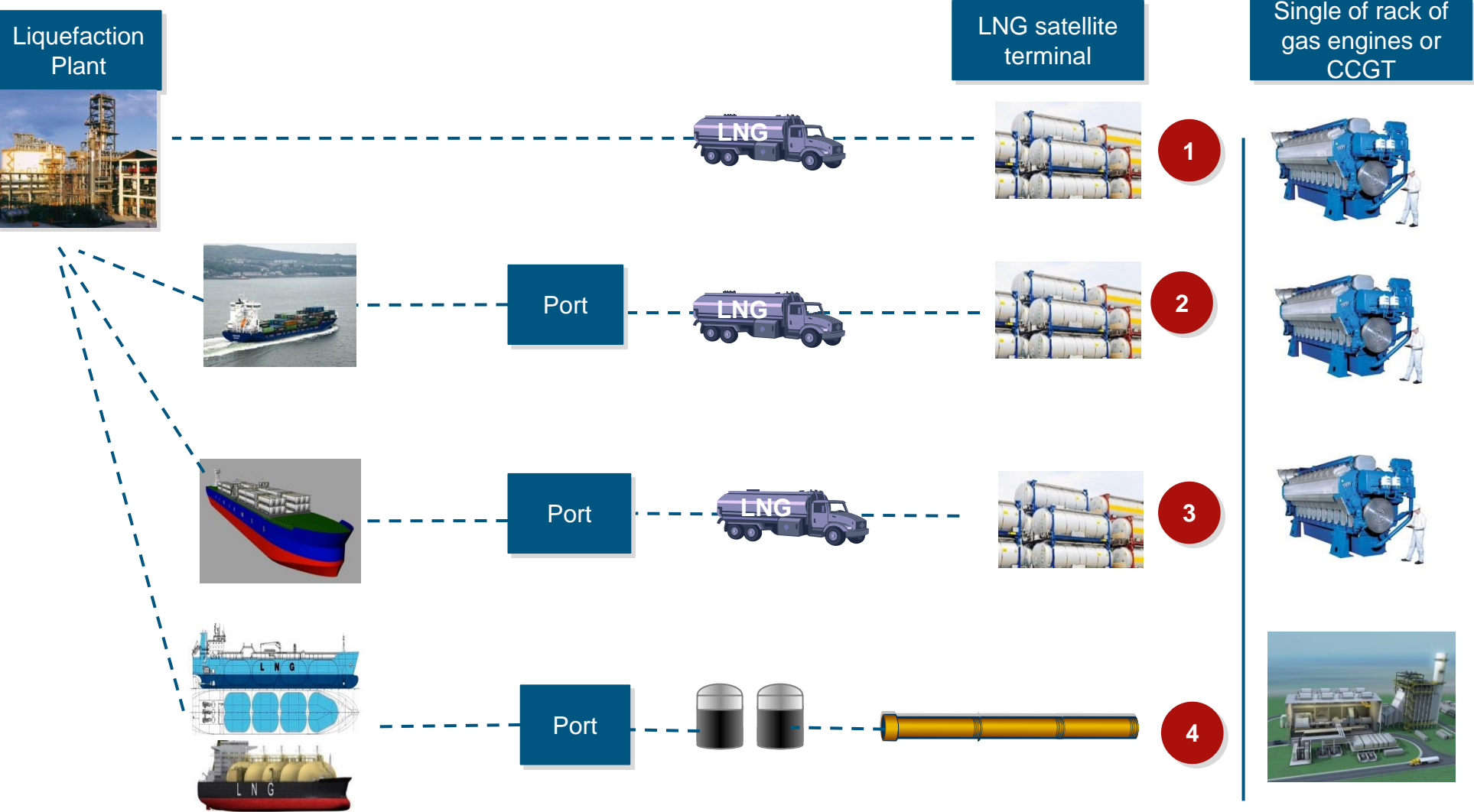


Displacing traditional fuels with onshore small scale LNG

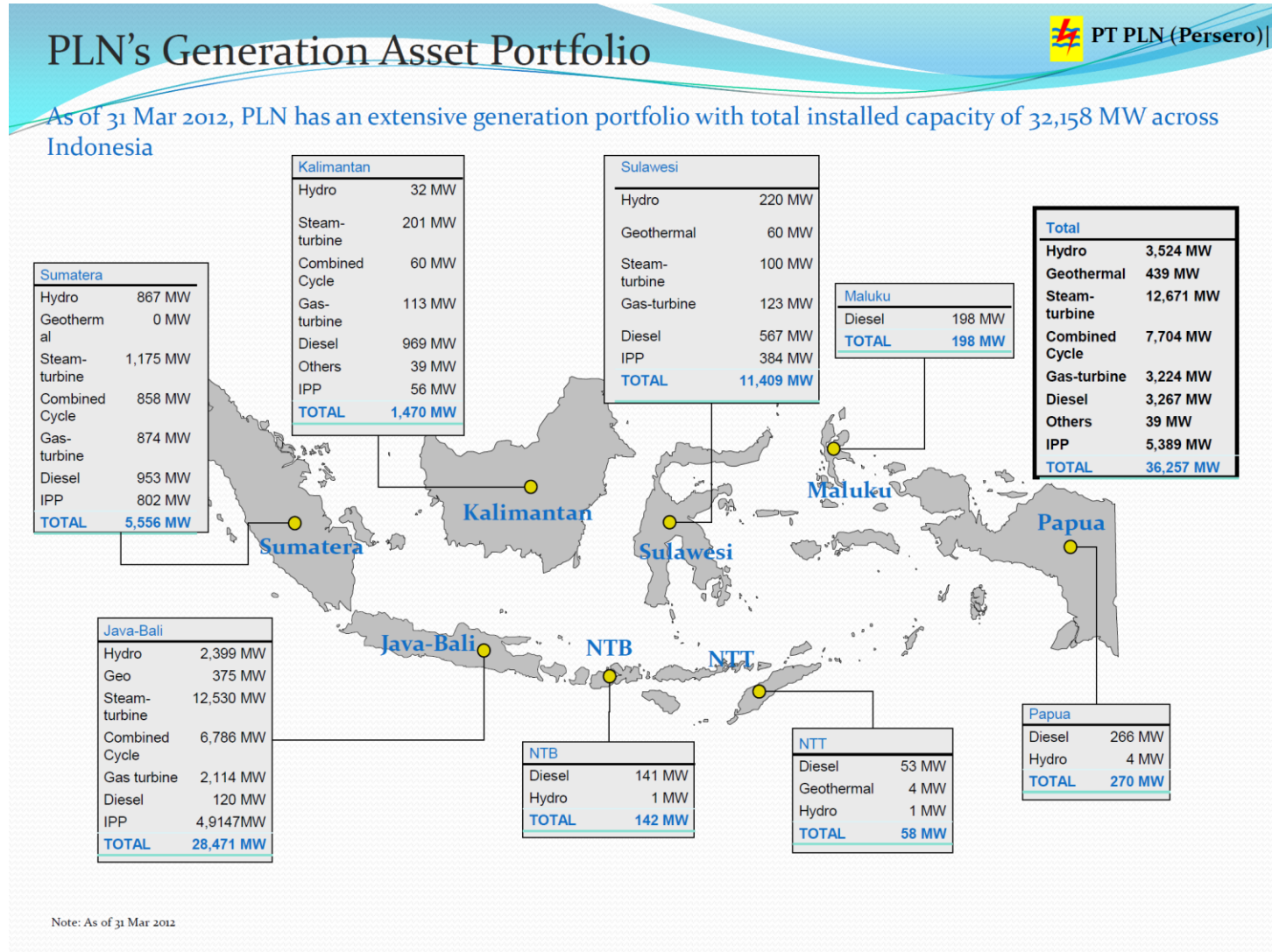
Main Points

- Small scale LNG on a remote onshore gas field is a quick way to market production.
- No need to wait to prove up huge reserves to justify a pipeline.
- No need to then wait for the pipeline to be built.
- Cost of Small Scale LNG infrastructure leaves plenty of headroom for reasonable upstream gas prices.
- Some parts of Small Scale LNG equipment are now becoming standardised driving down costs.
- Remote small diesel-fired generation sets might also be able to get LNG in pressurised container tanks
- Large potential market in Kalimantan and Sumatra to displace diesel with LNG in mine trucks.
- Displacement of industrial use of LPG and fuel oil might also be targeted.

Small scale LNG distribution



PLN's power plants by type and region



PLN Data on 2011 diesel gensets and diesel usage

Macro scale

- PLN 2011 Yearbook says there are 4,786 diesel-fired power plants outside the island of Java.
- With installed capacity of 2,467 MW and rated capacity of 1,490 MW.
- These are mostly gen-sets and consume some 4.6bn litres of diesel a year, or the energy equivalent of about 4.7 bcma, or 450 mmcfd.

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- Small scale onshore LNG to mini loads

Over 50 CBM PSCs soon to be looking for a market for their gas

Date awarded	CBM Blocks Awarded	Location	Operator	Participation
1	May-08 Sekayu	South Sumatra	Medco	Medco, Batavia Energy, Ephindo
2	Jun-08 Bentian Besar	East Kalimantan	CBM Asia	Ridlatama Mining Utama (farmed 70% to CBM Asia 2011 Oct?)
3	Jun-08 Indragiri Hulu	Riau, Central Sumatra	Samantaka Mineral Prima	Samantaka Mineral Prima
4	Nov-08 Barito Banjar I	South Kalimantan	Indobararambai Gas Methan	Consortium of local KP holders, XOM
5	Nov-08 Barito Banjar II	South Kalimantan	Barito Basin Gas	Consortium of local KP holders, XOM
6	Nov-08 Kutai West	East Kalimantan	Kutai West CBM	CBM Asia, Newton Energy Capital
7	Nov-08 Sangatta I	East Kalimantan	Pertamina-Sangatta West CBM	Ephindo, Pertamina, Arrow
8	May-09 Ogan Komering	South Sumatra	Ogan Interior Gas	Ogan Interior Gas (Santos)
9	May-09 Sangatta II	East Kalimantan	Pertamina Hulu Energi Metana Kalimantan - Visi Multiartha	Pertamina Hulu, Visi Multiartha (EMP)
10	May-09 Tabulako	Kalimantan	Artha Widya Persada	EMP, Bumi Resources
11	Aug-09 Barito Tapin	South Kalimantan	Trisakti Gas Methane	Trisakti Gas Methane, XOM
12	Aug-09 Kotabu	South Kalimantan	Satui Basin Gas	Satui Basin Gas
13	Aug-09 Ogan Komering II	South Sumatra	East Ogan Methane	East Ogan Methane (Santos)
14	Aug-09 Pulau Pisau	Central Kalimantan	Uangel Sigma Energi	Sigma Energy Bumi, Blue Tiger
15	Aug-09 Tanjung Enim	South Sumatra	Pertamina Hulu Energi Mitra Enim	Pertamina Hulu Energi Mitra Enim, Bukit Asam Metana Mitra Enim, Dart Energy
16	Nov-09 Barito	South Kalimantan	Trans Asia Resource - Jindal SS Indonesia	Trans Asia Resource, Jindal Stainless Indonesia
17	Nov-09 Rengat	Central Sumatra	Indon CBM	Sigma Energy Bumi, Blue Tiger
18	Nov-09 Sanga Sanga	East Kalimantan	Vico Indonesia	Vico Indonesia, BP East Kalimantan, Lasmo Sanga Sanga, OPIIC Oil Houston, Virginia Inter Co, Universe Gas & Oil
19	Nov-09 Batang Asin	Central Sumatra	Bumi Perdana Energy - Glory Wealth Pacific	Bumi Perdana Energy, Glory Wealth Pacific
20	Nov-09 Muara Enim	South Sumatra	Trisula CBM Energy	Pertamina Hulu Energi Metana Sumatra 2, Trisula CBM Energy (part of ASX listed Nu Energy)
21	Dec-10 Muralim	South Sumatra	Dart Energy (Muralim) E. Ltd	Dart, Medco Energi
22	Mar-11 Kutai East	East Kalimantan	Senyur CBM	Senyur CBM Consortium Inc. - Total E & P East Kutai
23	Apr-11 Kapuas I	Central Sumatra	Transasia CBM	PT Transasia CBM consortium - BP Kapuas I Limited
24	Apr-11 Kapuas II	Central Sumatra	Kapuas CBM Indonesia	Indonesia PT Kapuas CBM consortium - BP Kapuas II Limited
25	Apr-11 Kapuas III	Central Sumatra	Gas Methan Utama	Methane Gas consortium PT Main - BP Kapuas III Limited
26	Apr-11 Kutai West	East Kalimantan	Gas Methan	Gas Methan Abadi
27	Apr-11 Muara Enim I	South Sumatra	Pertamina Hulu Energi Metana Sumatera I	Konsorsium Pertamina Hulu Energi Metana Sumatera I & Indo Gas Methan
28	Apr-11 Muara Enim II	South Sumatra	Pertamina Hulu Energi Metana Sumatera 5	Konsorsium PT Pertamina Hulu Energi Metana Sumatera 5 - PT Metana Enim Energi - PT Indo CBM Sumbagsel 2 Pte. Ltd.
29	Apr-11 Muara Enim III	South Sumatra	Pertamina Hulu Energi Metana 4	Konsorsium PT Pertamina Hulu Energi Metana Sumatera 4 - PT Baturaja Metana Indonesia.
30	Apr-11 Sijunjung	West Sumatra	Global Lion and Tamarin Hill	Senyur CBM Consortium Inc. - Total E & P East Kutai
31	Jul-11 Belida	South Sumatra	Sele Raya	Konsorsium Sele Raya Resource & Andalas Metana Energi
32	Jul-11 Kutai II, East Kalimantan	East Kalimantan	Ephindo	Konsorsium Ephindo Kutai North Inc. & Resources Alam Energi
33	Jul-11 Lematang	South Sumatra	Medco	Konsorsium . Medco Cbm Lematang; Methanindo Energi Resources; & . Saka Energi Indonesia
34	Jul-11 Melak Mendung I	East Kalimantan	Ephindo	Ephindo Mega Methana Inc
35	Jul-11 Melak Mendung III	East Kalimantan	Deep Industries	Konsorsium Deep Industries Limited & Monnetispat & Energy Limited
36	Jul-11 Suban II	South Sumatra	Pertamina Hulu Energi	Consortium PT Pertamina Hulu Energi Metana Suban II - PT. Suban Methan Gas
37	Aug-11 Suban I	South Sumatra	Pertamina Hulu Energi	Konsorsium PT Pertamina Hulu Energi Metana Subani & Pt. Suban Methan
38	Aug-11 Suban II	South Sumatra	Pertamina Hulu Energi	Pertamina Hulu Energi Suban II & Pt Suban Methan Gas
39	Oct-11 Hulu	Central Sumatra	CBM Asia	CBM Asia
40	Dec-11 Bangkanai I	Central Kalimantan	Bangkanai CBM Energi	Sugico Graha
41	Dec-11 Bangkanai II	Central Kalimantan	Borneo Metana Energi	Sugico Graha
42	Dec-11 Bangkanai III	Central Kalimantan	Bangkanai Energi Resources	Sugico Graha
43	Dec-11 Bangkanai IV	Central Kalimantan	Bangkanai Jaya Perkasa	Sugico Graha
44	Dec-11 Tanah Laut	South Kalimantan	Asam-Asan Methan Gas	Asam-Asan Methan Gas, Sumber Daya Energi
45	Dec-11 Tanjung II	Kalimantan	Pertamina Hulu Energi	Pertamina Hulu Energi
46	Apr-12 Air Komering	Sumatera Selatan	Baturaja Energi	Konsorsium PT. Baturaja Energi - PT. Anugrah Persada Energi
47	Apr-12 Air Benakat I	Sumatera Selatan	Pertamina Hulu Energi Metana Sumatera 3	Konsorsium PT Pertamina Hulu Energi Metana Sumatera 3 - PT. Petrobara Sentosa
48	Apr-12 Air Benakat II	Sumatera Selatan	Pertamina Hulu Energi Metana Sumatera 6	Konsorsium PT Pertamina Hulu Energi Metana Sumatera 6 - PT. Prima Gas Sejahtera
49	Apr-12 Air Benakat III	Sumatera Selatan	Pertamina Hulu Energi Metana Sumatera 7	Konsorsium PT Pertamina Hulu Energi Metana Sumatera 7 - PT. Unigas Geosinkinal Makmur
50	Dec-11 West Sanga Sanga	East Kalimantan	Sugico Graha	Sanga Sanga Prima Energi
51	Sep-12 Benlagon	East Kalimantan	Dart CBM	Dart CBM
52	Sep-12 Belawa	South Sulawesi	Bumi Parahyangan Energi	Bumi Parahyangan Energi
53	Sep-12 Sekayu	South Sumatra	Ephindo and Star Energy	Ephindo and Star Energy
54	Sep-12 Kuala Kapuas I	Central Kalimantan	CBM Asia	CBM Asia and Tranaco Utama

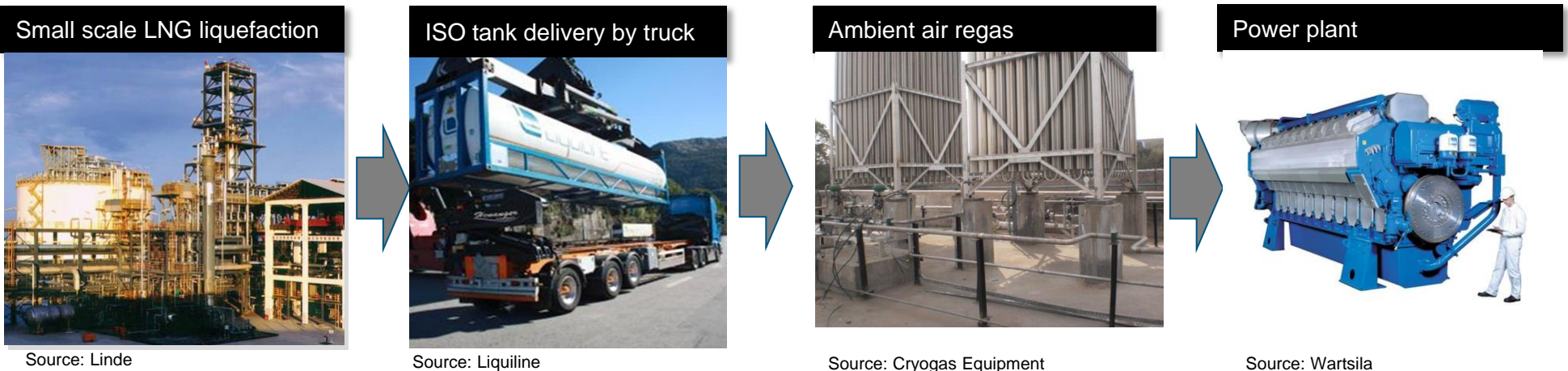
- Wellhead breakeven is estimated in the range of USD 7 mmbtu.
- But it will be several years yet before full commerciality is achieved.

Source: BP MIGAS

Key components of onshore small scale onshore LNG

Description of onshore small scale LNG delivery and use

- Liquefaction and storage
 - Can be anywhere from 25 to 50 tonnes per day or 1.25 to 2.5 mmcf/d (skid mounted) to 700 to 1,000 tpd or 35 to 50 mmcf/d modular design.
- Delivery and Storage
 - ISO tank on back of low loader truck serves as deliver and storage device – just like delivering milk.
- Regasification
 - Tropical environment could use ambient air vapourisation but foot print can be large.
- Power plant
 - Might be worth making them dual fuel if not too old but for those older ones of nearing major overhaul best probably to buy a gas engine (9 MW to 18 MW).



LNG usage at small remote mini power plant

Consumption

- We take a plant with capacity of 10 MW and average capacity factor of 67%
- This level of demand is very unlikely to support conventional LNG delivery chain.
- But would fit with delivery by LNG offloaded into ISO tanks on load loaders.
- In our example there would be the need for the delivery per week of about ten 40 foot ISO tanks with 16 tonnes of LNG for a total of close to 160 tonnes per week.
- Storage on site of ten ISO tanks would give a weeks stand by supply.

At the plant level

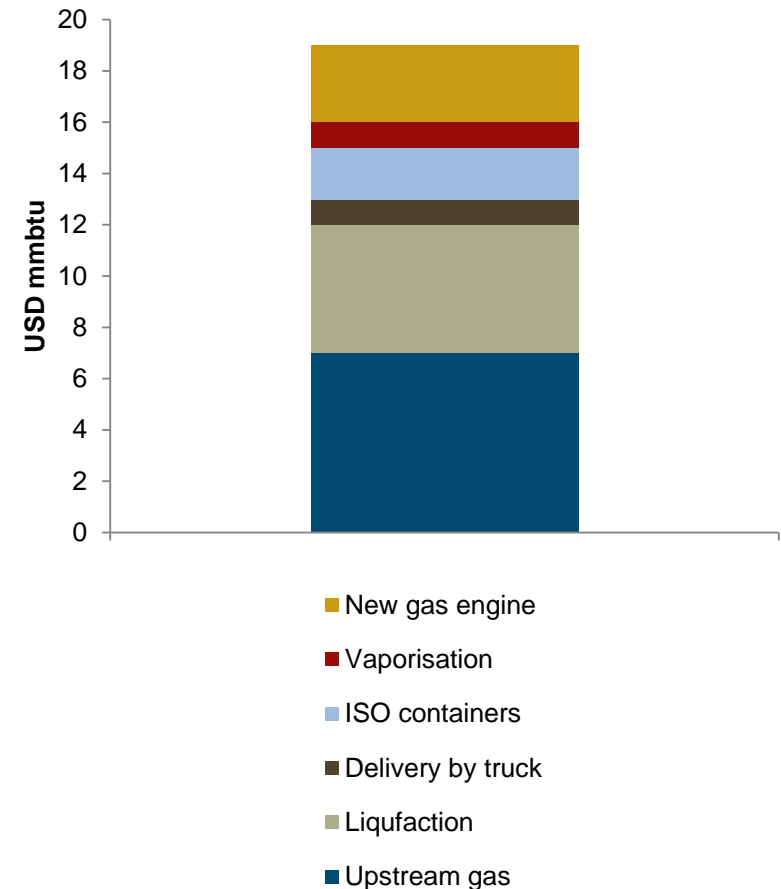
Power plant	MW	10
Hours	per Day	16
HHV	mmbtu MWh	7
mmbtu	per Day	1,150
LNG	mmbtu per tonne	50
LNG	Tonnes per day	23
LNG	Tonnes per week	160

High-level cost assumptions for small scale onshore LNG to mini power

Small Scale LNG Cost Assumptions

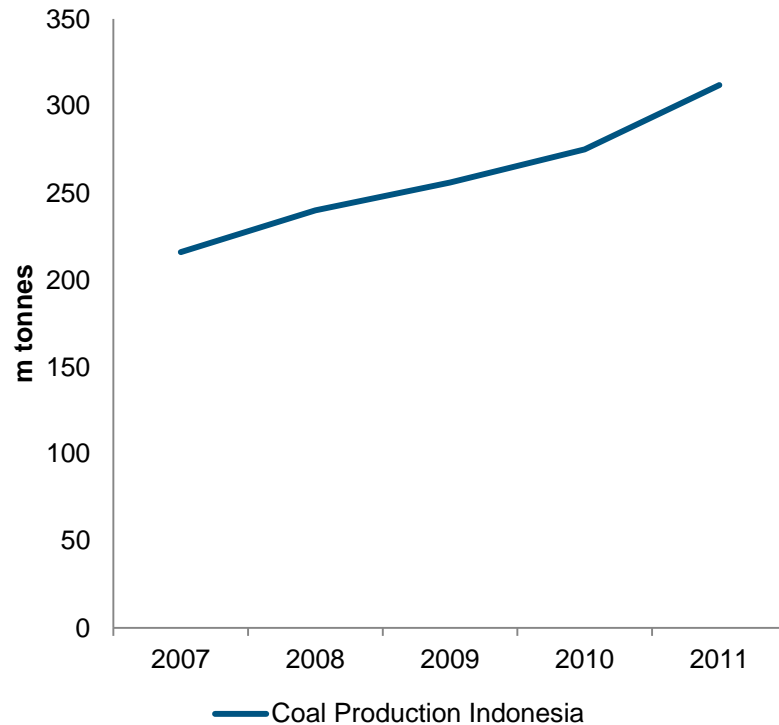
- Upstream well head price.
 - Close to USD 7 mmbtu from stranded CBM gas.
- Small scale onshore LNG plant
 - USD 5 mmbtu
- 40 TEU container frame which contains and ISO tank with 16 tonnes of LNG and is delivered on a back of a low loader directly by road, pulled by a truck, using diesel or LNG, to a power plant.
 - USD 1 mmbtu in round numbers for tractor, fuel and opex.
- The tank can contain the LNG for between 10 to 15 days before some blow off is needed to release pressure. So these tanks as well as being heat insulated are also built to take quite a bit of pressure (15 to 25 bar or 220 to 360 psi). We assume seven days of storage.
 - This works out at a levelised capex number of near USD 2 per mmbtu.
- Vaporization could be by ambient air technology given relatively warm climate.
 - This works out at a levelised capex of under USD 1 mmbtu.
- Gensets would need modified to use a mixture of mostly regasified LNG and some diesel for ignition, or else buy new gas engines that only use gas.
 - Levelised cost of new plant USD 22 MWh at 67 capacity factor. Assuming a heat rate 7 mmbtu per MWh, implies cost of new plant, expressed in fuel terms, in the region of USD 3 mmbtu.
- Sums to USD 19 mmbtu so still plenty of headroom when compared to diesel price of about USD 30 per mmbtu.

Cost stack



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- Small scale onshore LNG to industry

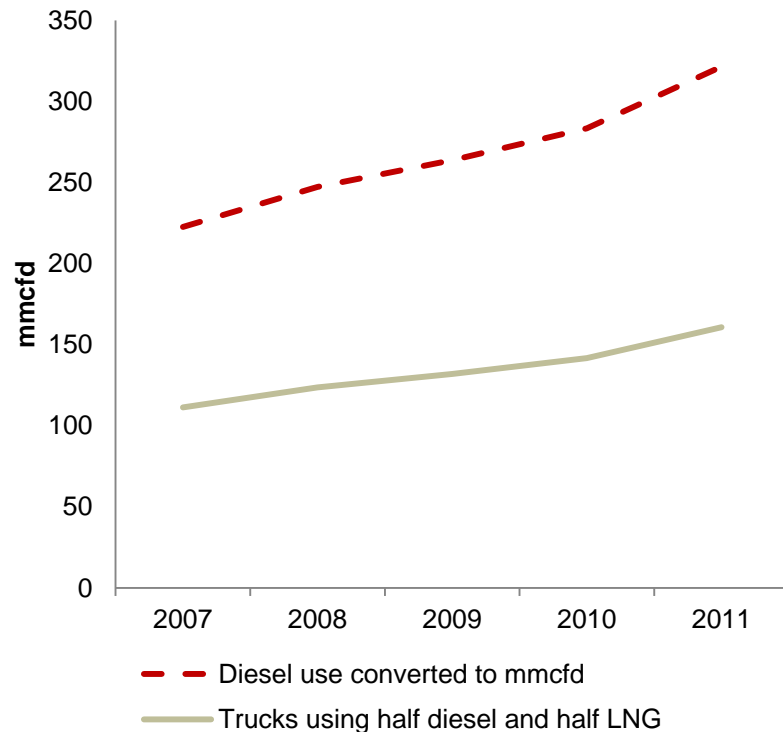
Coal production in Indonesia



Source: Ministry of Energy and Mineral Resources

- Coal production on the rise
- For the whole of Indonesia
- Kalimantan and Sumatra dominate
- Both are near CBM gas fields that are looking to sell gas

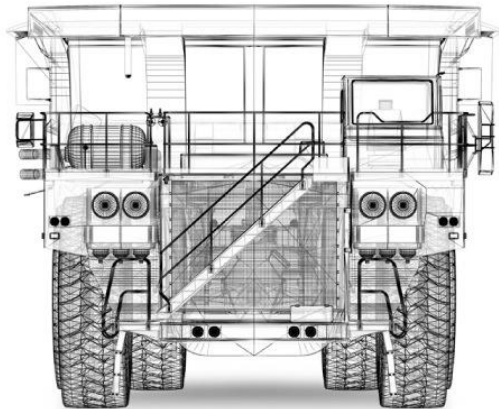
Diesel displacement by LNG in mine trucks



Source: The Lantau Group

- This is for the whole of Indonesia which means in practice Kalimantan and Sumatra
- Assumes 11.4 litres of diesel used per tonne of coal produced.
- GFS technology displaces about half of the diesel consumption.
- LNG demand of about 1.1 mmtpa or 3,000 tonnes per day or 150 mmcf/d.
- Would need a mini-aggregator to collect LNG from various gas fields.
- This would also provide a level of security of supply to the buyers.

GFS Corp LNG-fueled mine truck retro-fit

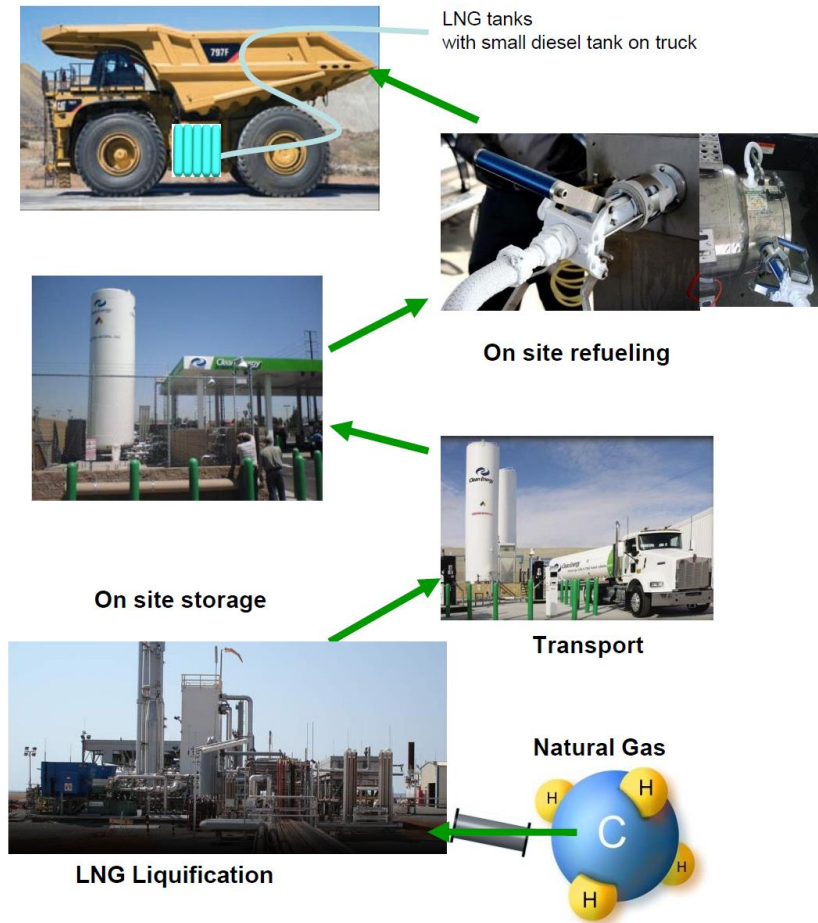


Source: GFS Corp

- The EVO-MT™ System for Caterpillar 793 Mine Haul Trucks allows operators to substantially reduce operating costs and improve sustainability by replacing diesel fuel with liquid natural gas (LNG)
- The EVO-MT 7930 System is designed and manufactured by GFS Corp of Weston, Florida and is the world's first commercial technology that allows large mine haul trucks to operate on natural gas.
- Has to use between 30 to 50% diesel to get ignition.
- These trucks with 3,000 horse power are in a separate class from road haulage which have a tenth of that power.
- Tests with four truck in Wyoming have been running for nine months and appear successful.
- Demonstration in Kalimantan have not started yet.

Caterpillar LNG-fueled mine truck

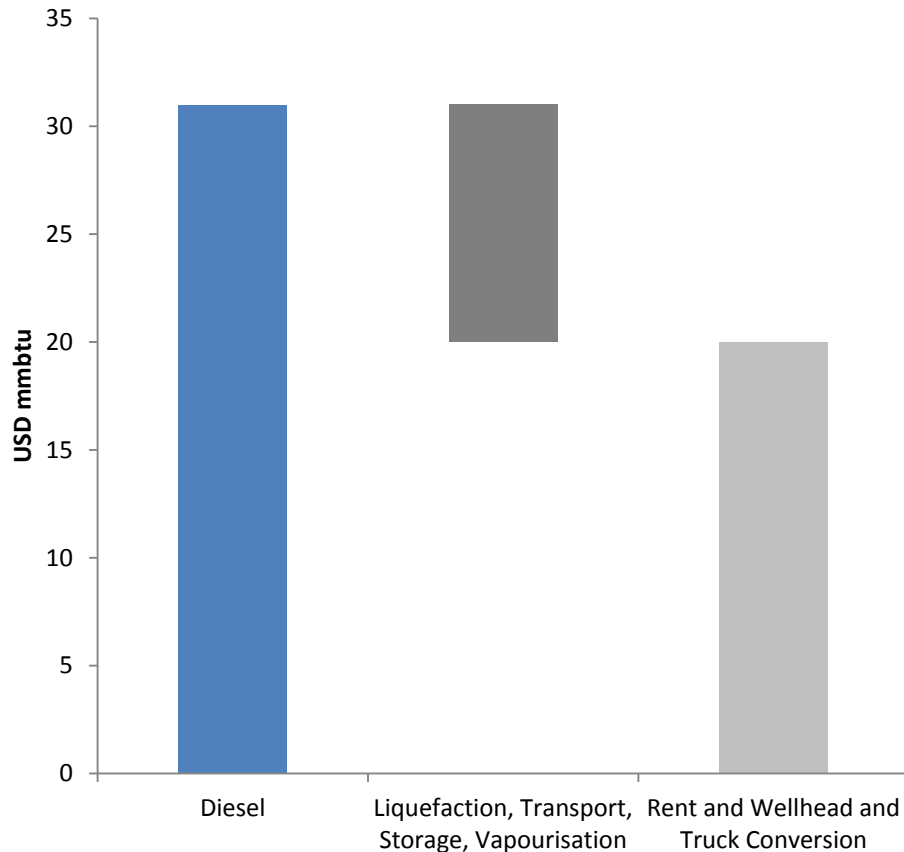
Future LNG Fueling Model



Source: Caterpillar

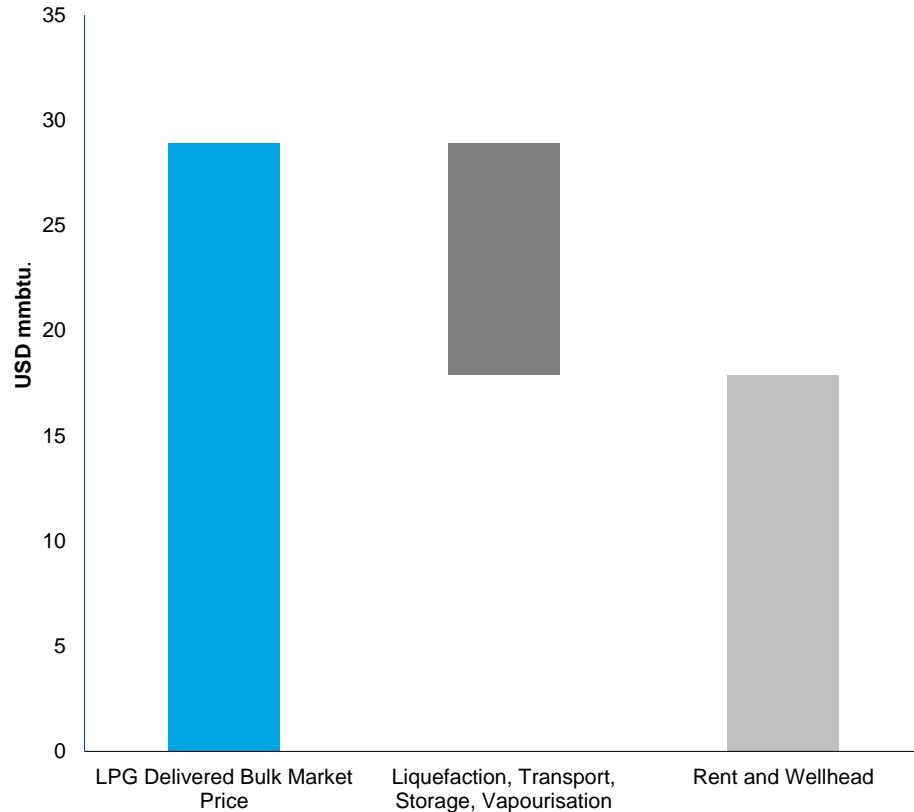
- Caterpillar has said “natural gas is a clean burning, economical fuel that is readily available to the majority of our mining customers worldwide.”
- The company’s first LNG-powered products are expected to include three large mining trucks—the Cat 793, 795 and 797. The large trucks are in the early stages of development with commercial launch expected within five years.
- To accelerate the product development process, Caterpillar is partnering with Westport Innovations, Inc., a global leader in natural gas engines. The company brings its Westport™ high pressure direct injection (HDPI) technology, proven in on-highway applications, to the relationship, complementing Caterpillar’s strengths in engine and off-road equipment development.
- In addition to offering new LNG products, Caterpillar is developing retrofit solutions for those who opt to convert existing mining trucks to natural gas.

Market price diesel less cost of small scale LNG



- We show here the unsubsidized diesel price which the mining industry is supposed to pay.
- Truck conversion cost estimate wrapped up in netback bar.
- If delivered LNG cost is USD20 mmbtu then savings per day could approximate to USD 625 per truck per day based on 3,800 litre per day use of diesel, or payback in a year.

Non subsidised LPG less cost of small scale LNG



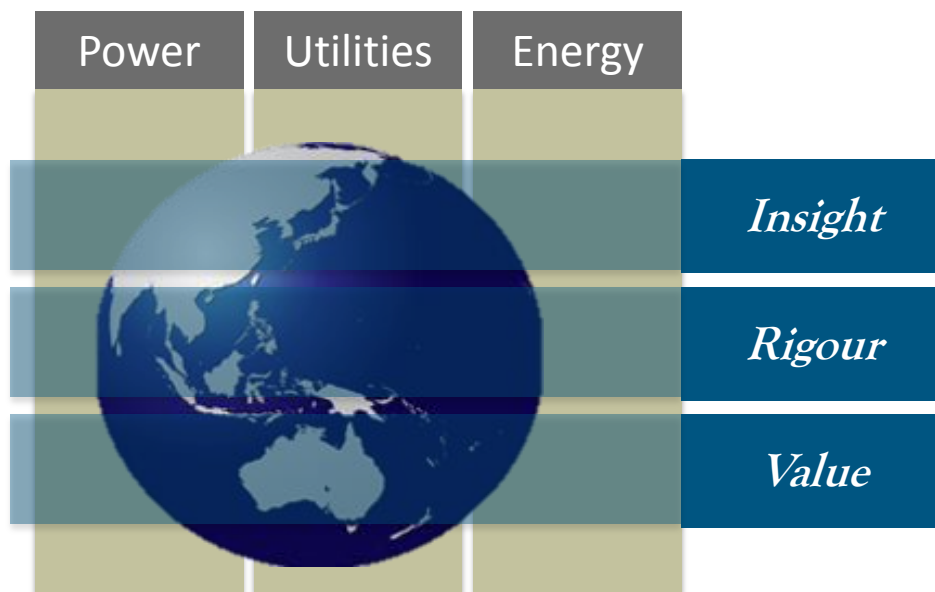
- Here we show the price that large industrial users pay for bulk LPG in 50 kg containers.
- Subtracted is the LNG liquefaction, storage, transport, storage and vapourisation cost.
- This gives the potential price that upstream CBM PSCs could sell their gas for ex-PSC.

Displacing traditional fuels with onshore LNG

Main Points

- Small scale LNG on a remote onshore gas field is a quick way to market production.
- No need to wait to prove up huge reserves to justify a pipeline.
- No need to then wait for the pipeline to be built.
- Cost of Small Scale LNG infrastructure leaves plenty of headroom for reasonable upstream gas prices.
- Some parts of small scale LNG equipment are now becoming standardised driving down costs.
- Remote small diesel-fired generation sets might also be able to get LNG in pressurised container tanks
- Large potential market in Kalimantan and Sumatra to displace market diesel with LNG in mine trucks.
- Displacement of industrial use of LPG and fuel oil might also be targeted.

Thank you



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