



Displacement of Indonesia Diesel and Thailand LPG and Fuel Oil by LNG Delivered at 4th Unconventional Gas Summit Asia in Bali

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THE LANTAU GROUP
strategy & economic consulting

Displacing Traditional Fuels with Onshore LNG

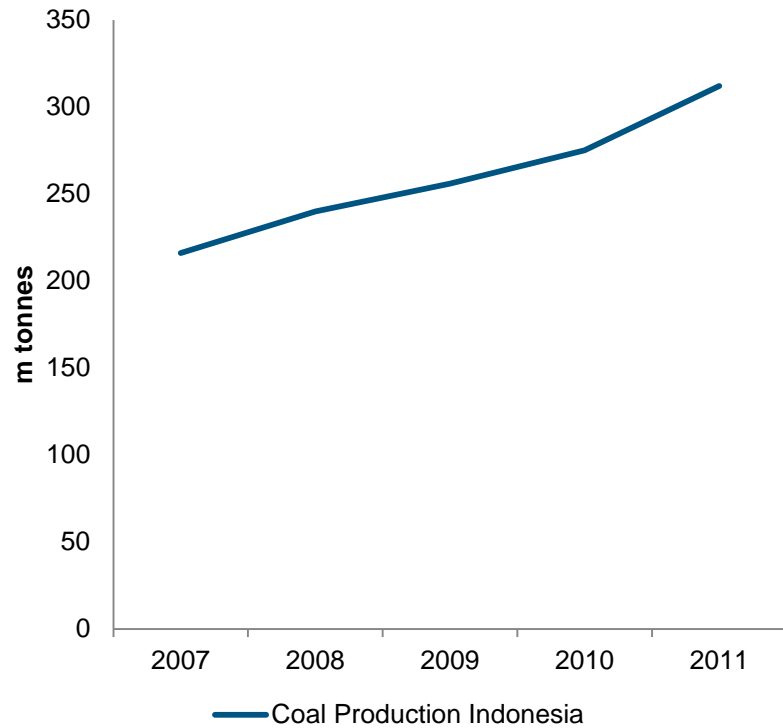
Main Points

- Small scale LNG on a CBM PSC is a quick way to market production from remote fields.
- 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 LNG infrastructure leaves plenty of headroom for attractive upstream ex-PSC gas prices.
- Some parts of small scale LNG equipment are now becoming standardised driving down costs.
- Large potential market in Kalimantan and Sumatra to displace market diesel with LNG in mine trucks.
- Industrial use of LPG and fuel oil might also be targeted.



Indonesia

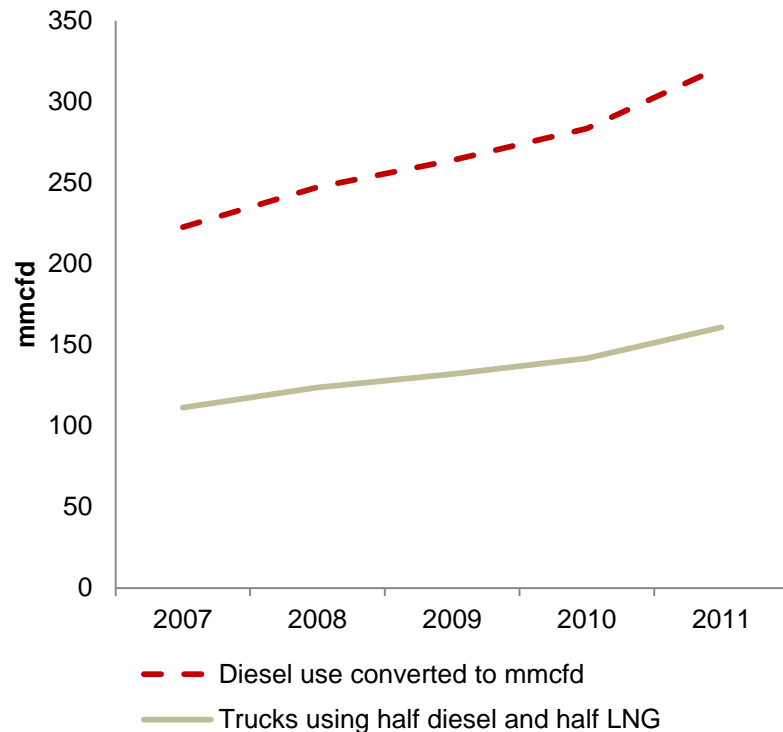
Coal production in Indonesia



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.
- 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.

54 CBM PSCs Soon to be Looking For a Market for Their Gas

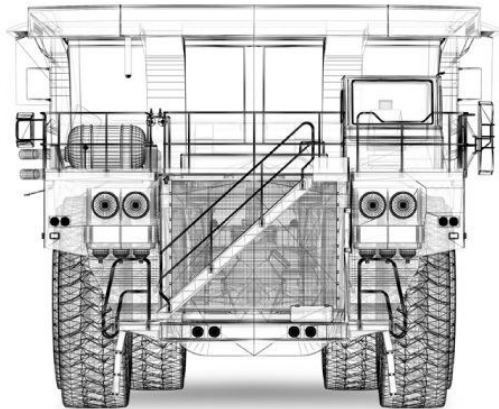
Date awarded	CBM Blocks Awarded	Location	Operator	Participation
1	May-08 Sekayu	South Sumatra	Medco	Medco, Batavia Energy, Ephindo
2	Jun-08 Bentian Besar	East Kalimantan	CBM Asia	Ridlatama Mining Utama (farmed 70% to CBM Asia 2011 Oct?)
3	Jun-08 Indragiri Hulu	Riau, Central Sumatra	Samantaka Mineral 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 Komerling	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 Komerling II	South Sumatra	East Ogan Methane	East Ogan Methane (Santos)
14	Aug-09 Pulang 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, Lasmoo Sanga Sanga, OPIC 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	Senyuir CBM	Senyuir 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	Senyuir 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 li& 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 Komerling	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 Geosinklinal 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 6 to 7 mmbtu.

But it will be several years yet before full commerciality is achieved.

Source: BP MIGAS

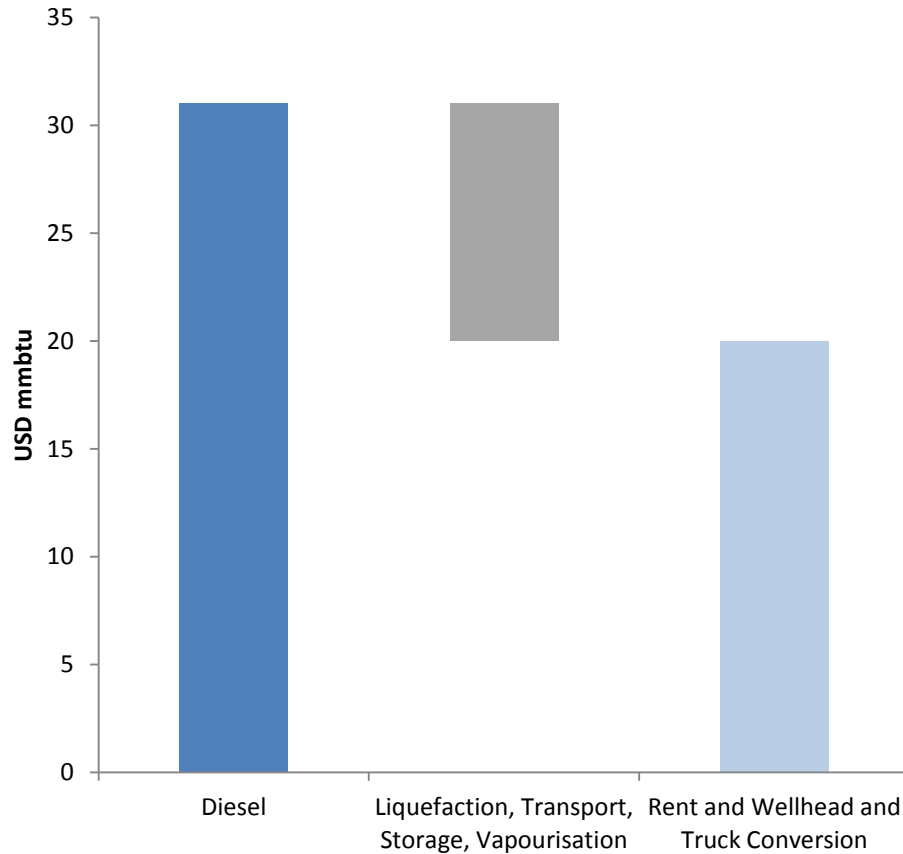
GFS Corp LNG-fueled Mine Truck



Source: GFS Corp

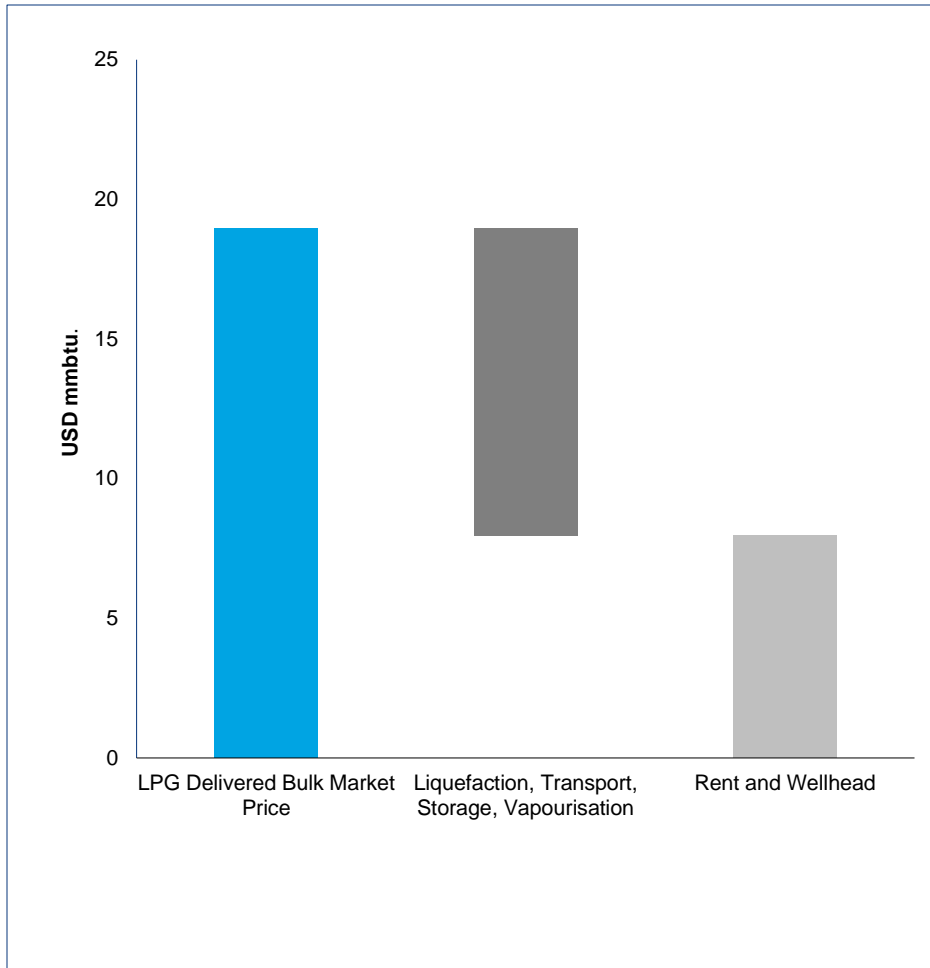
- The EVO-MT™ System for Caterpillar 793 Mine Haul Trucks allows operators to substantially reduce operating costs and improve sustainability by replacing diesel fuel with liquid natural gas (LNG)
- The EVO-MT 7930 System is designed and manufactured by GFS Corp of Weston, Florida and is the world's 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.

Market Price Diesel Less Cost of Small Scale LNG



- We show here the unsubsidized diesel price which 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 under 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.

High-level cost assumptions for small scale onshore LNG

Small Scale LNG Cost Assumptions

- Liquefaction: USD 2000 per tonne per year (USD5.1 mmbtu)
- Opex: 2% of capex (USD 0.75 mmbtu)
- Tractor and trailer capex: USD 500,000 (USD0.70 mmbtu)
- Tractor and trailer opex: USD 0.50/mmbtu
- Storage: USD 1,500 cubic metre and 10 days of capacity plus opex: USD 2.2 mmbtu
- Vaporisation: USD 1.0/mmbtu
- Overheads and marketing: USD0.75 mmbtu
- All in USD 11.0 mmbtu

Small-Scale LNG Market Participants

- Current Projects in China (2.5 mmtpa, 6,800 tpd or 350 mmcf/d capacity, with the same again under construction) some recent additions are:
 - Suchuan Huayou Gas Guangan – 700 tpd, 35 mmcf/d
 - Xinjiang Borli Energy – 250 tpd, 12 mmcf/d
 - Bayanzouer Huayou Gas – 250 tpd, 12 mmcf/d
 - Lanzhou Kunlun Gas – 250 tpd, 12 mmcf/d
- Upstream infrastructure suppliers - Air Products, Black & Veatch/Chemtex, CIMC ENRIC, Chart, Cryostar, Furuise, Kryopak, Linde, Technip.
- Tractors and trailers – Volvo, Daimler, Chart, numerous local suppliers in China.

Small Scale LNG Liquefaction



Source: Linde

LNG Delivery by Truck



Source: Linde

LNG Offloading



Source: GasNor

Storage & Ambient Air Regas



Source: GasNor

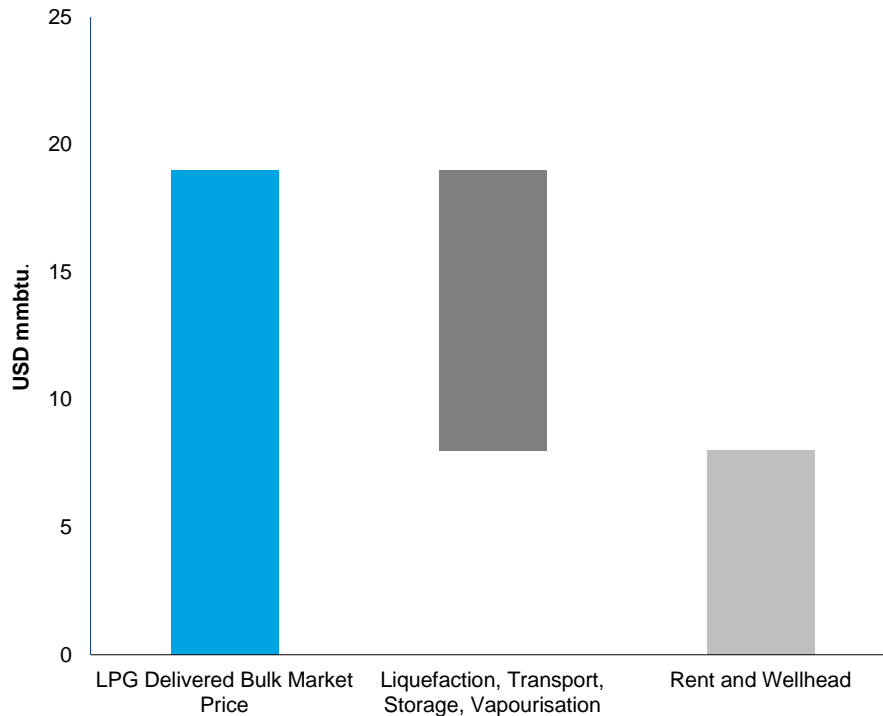
Conventional Road Haulage – Infrastructure and Dual Fuel Diesel Engines

Australia	<p>LNG Refuellers Pte Ltd Tasmania - Designed in 2006 and opened in 2008 with 50 tonnes per day or 2.5 mmcf/d and five refuelling stations. This was designed to support trucks carrying product from Gunn forestry, which has hit financial troubles and demand is below forecast.</p> <p>Wesfarmers EVOL LNG Western Australia – Opened 2009 with 175 tonnes per day or 8.75 mmcf/d supports remote power plant, industry and 130 trucks that can travel 1,200 km on a tank of LNG.</p>
China	<p>At the 200 tonnes per day or 10 mmcf/d level local manufacturers can handle most of EPC work, larger plant needs imported design and components.</p> <p>Between 9 and 14 bcma (900 mmcf/d to 1.4 bcf/d) used in transport sector, and most of this is CNG in local municipalities, which is roughly 10% of total gas consumption in China of 130 bcma.</p> <p>Many local manufacturers of CNG and LNG kits and vehicles and some JVs such as Weichai Westport on LNG heavy duty engine.</p>
UK	<p>CHIVE - Has been in the business for 15 years and has several refuelling stations in central England. Was hit by EURO IV which counted methane in tail pipe emissions. But engines have got better and meet new standards and demand is on the rise.</p>
Cummins-Westport HPDI	<p>Just new on the market. 1% diesel and 99% LNG in compression with no need for sparking. Now available in Volvo trucks in Europe and States. Reported to have same power and torque as engine running on diesel, which is what haulage industry has been waiting for.</p>

Source: Chive Ltd, LNG Refuellers, TLG, Westport

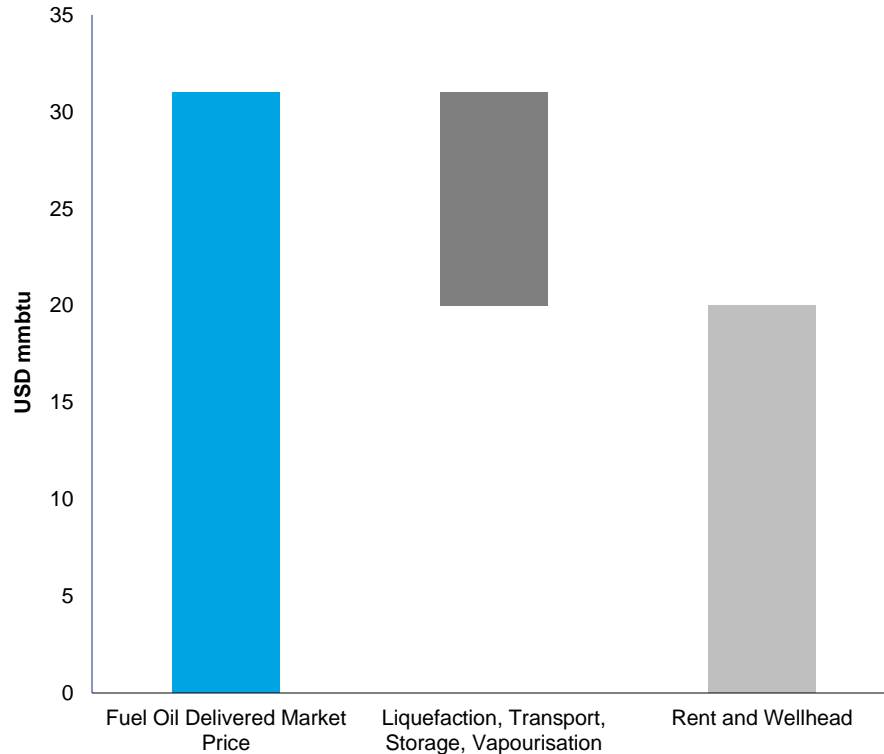
Thailand

LPG to Industry Price Raised to Level That Raises Attractiveness of Switch to Small Scale LNG



- The industrial price of LPG has now been raised to THB 27 per KG which is close to USD 19 mmbtu
- Potential market size in northeast, north and central Thailand of the range 20 to 25 mmcf
- Political pressures have for the moment called a halt and in some cases a slight retreat by the government and its move to market prices for LPG and NGV

Fuel Oil Price is Now Sufficiently High to Merit Switch to Small Scale LNG



- The fuel oil price is less subject to political considerations and is generally linked into the world price plus local excise taxes and duties
- Potential market size in north, northeast and central Thailand of the range 30 to 40 mmcf

Main Industrial LPG and Fuel Oil Upcountry Demand

Up-country Thailand LPG and Fuel Oil Demand Overview

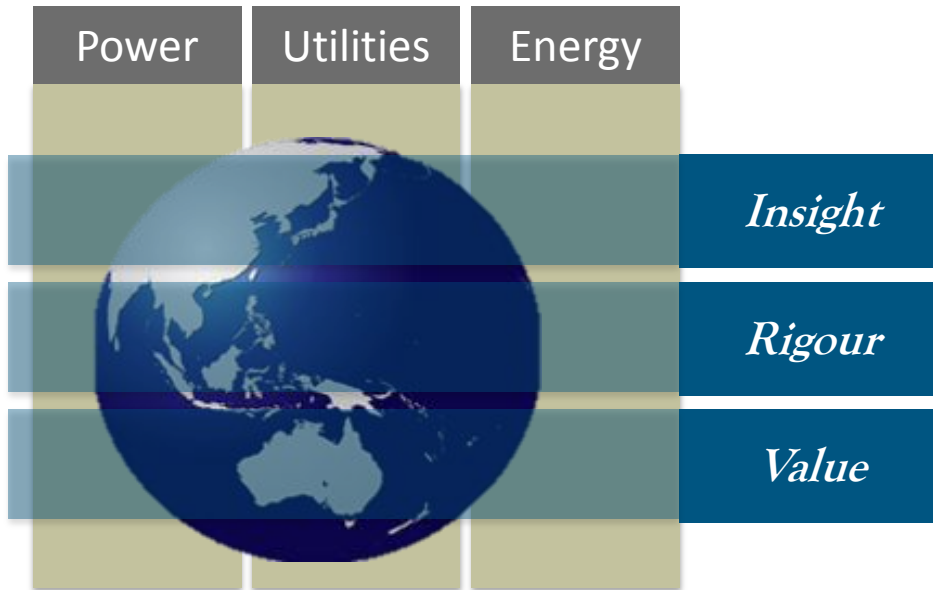
- Current demand
 - Northern region LPG demand centred around Chiang Mai, Lamphun, and Lampang. The ceramic industry is substantial and represents the key LPG consumer in the region.
 - Central region demand is dominated by food and meat processing companies using LPG and fuel oil.
 - Most demand in Northeast centred around the provinces and capital towns Khon Kaen and Korat using mostly fuel oil.
 - Major users include glass manufacturers, breweries, auto-parts, food and beverage producers and a ceramics company



Key Takeaways

- Small scale LNG on a CBM PSC is a quick way to market production from remote fields.
- 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 LNG infrastructure leaves plenty of headroom for attractive upstream ex-PSC gas prices.
- Some parts of small scale LNG equipment are now becoming standardised driving down costs.
- Large potential market in Kalimantan and Sumatra to displace market diesel with LNG in mine trucks.
- Industrial use of LPG and fuel oil might also be targeted.

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