cng services ltd

The Clerk,
Energy and Climate Change Committee,
7 Millbank,
London,
SW1P 3JA

13th January, 2011

Dear Sirs,

Shale Gas Enquiry

CNG Services Ltd (CSL) appreciates the opportunity to comment on this enquiry. We will leave it to others to address the environmental issues in relation to shale and the level of resource that can be produced. Our submission is in relation to the specific question:

What are the implications of large discoveries of shale gas around the world for UK energy and climate change policy?

The attached short paper provides supporting details but our key points are:

- If there is a significant shale gas resource then natural gas prices can be expected to remain low
- The use of natural gas (stored on vehicles in compressed or liquid form) in dual fuel (with diesel) engines for commercial vehicles will reduce the level of imported oil by 2020 which is good for security of supply and diversity
- Whilst the gas will be imported its cost on an energy basis is around 50% of that of oil
- The use of '80% natural gas – 20% diesel' dual fuel truck emits around 25 – 30%% less CO2 than a diesel vehicle on a well to wheel basis

The paper shows that whilst UK has leading technology providers in relation to dual fuel trucks we have a negligible market in natural gas vehicles. We believe that now is an appropriate time for the Government to review the benefits of dual fuel trucks to see if jobs, investment, reduced oil imports, better air quality and 30% CO2 reduction really can be delivered as we suggest.

A large shale resource would allow UK to diversify away from 100% diesel in the haulage sector which has many advantages. Much of the world is introducing natural gas vehicles, we believe the UK truck sector should also follow this path and request that this option is reviewed by Government

Yours sincerely

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Shale Gas Enquiry

What are the implications of large discoveries of shale gas around the world for UK energy and climate change policy?

1. The UK economy was converted to natural gas in the 1970's on the back of North Sea reserves. The use of oil in British industry was dramatically reduced in the period 1970 – 1990 as industry converted to gas and as a result oil is now predominately used for transport.

2. Around 85% of domestic consumers have gas for heating with appliance efficiencies of around 90%.

3. British Gas were generally reluctant to promote the use of natural gas as a fuel for power generation because a combined cycle gas turbine (CCGT) generation plant will only operate at around 50% efficient.

4. However, in the period 1993 – 2010 there has been dramatic growth in CCGTs and now around 50% of UK electricity is generated by gas, with a large build programme now underway as a number of coal plants are being closed down. Reference 1 gives details of CCGT generation in the National Grid 2010 Ten Year Statement

5. British Gas were world leaders in the development of natural gas vehicles in the early 1990's. However, the NGV programme in the UK failed for a number of reasons. First, the compressed natural gas (CNG) filling stations were located on gas-holder sites were British gas had lots of vans. This was a major mistake in that the gas was generally 'wet' which damaged engines.

6. In addition, the vehicles were conversions of petrol vehicles. They were not reliable, had no standby fuel and the CNG storage tanks took up significant space and reduced payload. They were also poor to drive, with low acceleration. Reference 2 gives an indication of British Gas NGV activity in the 1990's.

7. The privatized British Gas has spawned 3 world class companies, Centrica, BG Group and National Grid. In the UK it has helped to develop a highly advanced gas grid (connecting around 95% of population centres) which has broader coverage then any other major economy.

8. Overseas BG Group is making investment in relation to NGVs (Brazil, Argentina, India, Kazakhstan) as the world sees huge growth in NGVs. When British Gas worked on it in 1992 there were around 10,000 vehicles in the world running on natural gas. By 2002 this had grown towards 1 million. But by 2012 there is forecast to be 15 million, this is significant growth.

9. In the US, National Grid are also involved in the growing NGV market there. This is partly driven by the political drive to reduce reliance on oil but the key driver is the low price of natural gas caused by shale gas production. Reference 3 shows National Grid NGV activity in the US.

10. The German Government fixed CNG fuel duty in 2001 at the CEU minimum level (6 p/kg) for 20 years on the basis that the gas industry would build CNG filling stations and the car industry will develop CNG cars (note - in the same period duty in the UK has risen from 9 p/kg to 28 p/kg today). Reference 4 shows EU and Worldwide NGV Statistics.

11. This strategy has been successful in that in Germany there are now 900 CNG filling stations and around 100,000 cars and vans running on CNG from the grid.

12. The new cars and vans have been designed to run on CNG and have none of the drawbacks that the British Gas developed vehicles had 20 years ago. The VW Passat Ecofuel has a 1.4 litre engine with twin supercharger and turbocharger. It can go 0 – 60 mph in 9.5 seconds but has CO2/km of less than 120 g/km. It can also run on petrol and has a combined range on CNG and then petrol of around 700 miles. The Mercedes Benz Sprinter NGT is similarly excellent in terms of range (1,100 km) and performance as is the VW Caddy. Reference 5 shows that the Passat Ecofuel has been voted the Greenest Car in the world.

13. By designing from first principles cars and vans to run on CNG there is excellent performance and utility and low CO2

14. But what of the UK? In 2002 there were around 20 CNG filling stations operational in the UK but now there are no grid connected public access stations that are capable of 'fast filling' a vehicle.

15. In terms of vehicles there are estimated to be around 50 vehicles running on CNG and 200 running on natural gas stored on board as LNG, with fuel mostly provided at a small number of depot-based filling stations.

16. There is no case for large scale investment in installing CNG at petrol stations. Diesel and petrol hybrid cars are very good in terms of CO2/km and whilst CNG emissions are lower than a normal petrol they are comparable to many diesel and hybrids. There is not believed to be any investors looking at the UK car market for natural gas and, with the development of electric vehicles, this situation is unlikely to change. We can reasonably assume that CNG will not be made available at petrol stations in the UK. Home refueling with CNG is possible and attractive but will be a niche market.

17. The sector of interest for natural gas is the commercial vehicle sector. There are around 700,000 vans, rigid trucks and tractors operating in the UK and a large proportion of these operate from depots. As such, they are well suited to running on natural gas as the gas grid is invariably close by. The most significant technological development is in relation to the engine and fuel combination. Reference 6 shows that 18% of transport emissions come from trucks.

18. If air quality is the driver (nitrous oxides and particulates) then having an engine that runs on 100% natural gas gives exceptional performance. This is why most Los Angeles buses run on CNG (9,000) and all 670 refuse trucks in Madrid run on CNG. There are now no longer any diesel buses operating in LA City nor any diesel refuse trucks in Madrid. CNG is the fuel of choice where air quality is a major issue. Whilst air quality is an issue in the UK, the driver for change is now reduction in CO2. Reference 7 shows LA buses and Reference 8 shows the benefits of the CNG refuse trucks in Madrid.

19. Diesel is a mix of hydrocarbons, typically in the C9H20 to C12H26 range. Compared to a molecule of CH4 (methane, which is >90% of natural gas), burning diesel gives rise to greater CO2. However, the buses in Los Angeles and refuse trucks in Madrid and 99.9% of the 13 million NGVs on the road today use a 'spark ignition' engine. This is similar to a petrol engine and not as efficient as a diesel engine. It can be said that the price for improved air quality and longer life

is achieved by a reduction in efficiency of conversion of hydrocarbons to vehicle movement.

20. The development of dual-fuel diesel-natural gas engines in transformational. The vehicle starts on 100% diesel, but after 30 seconds it becomes 80% natural gas, 20% diesel. This gives the advantage of lower CO2 from burning methane instead of C12, but maintains the advantage of the diesel cycle. The engine thinks it is still a diesel engine and if the gas runs out it is still a diesel engine. No range anxiety there then. Reference 9 shows Volvo dual fuel trucks.

21. There are also reductions in emissions of Nox and particulates by the displacement of 80% of the diesel.

22. Volvo and Mercedes Benz are both selling diesel-natural gas trucks and they say that the reduction in CO2 is around 20% compared to 100% diesel. This is highly significant when it is compared with the reduction possible from biofuels. Even if 10% of diesel is replaced with biodiesel this will not give a 10% reduction in CO2 because of the energy cost of making biodiesel, then there are the food versus fuel issues.

23. There is a further good news element. There are 3 companies in the world that lead in relation to dual fuel truck technology. One is Canadian (Westport), the others are based in Leyland (Clean Air Power, CAP) and Nottingham (Hardstaff).

24. My grandfather worked at Leyland Motors in the inter-war years and it is encouraging for UK manufacturing industry that CAP are now providing their dual fuel technology to the likes of Volvo Trucks (as an aside, the name Leyland lives on in the truck industry but not in the UK - Ashok Leyland make trucks and buses in India including CNG versions). Reference 10 shows CAP technology.

25. Hardstaff are also very successful with their technology which is being sold in Mercedes Benz trucks. Hardstaff also hold the patents for a system that allows CNG storage to be on the trailer with an umbilical connection to the tractor unit – this means that as much CNG storage as required can be on the vehicle. A leading UK logistics company Tenens Environment are using this system. Reference 11 shows Hardstaff Dual Fuel technology, Reference 12 shows Hardstaff Umbilical technology and Reference 13 shows Tenens Environment and CNG.

26. What other vehicle technology is there with 2/3rds of the world's best technology in the UK?

27. So, we have the vehicles, we have the technology, we have the truck manufacturers, we have the CO2 saving, what about the fuel?

28. When there have been 'Well to Wheel' studies that have looked at natural gas they have used data from the 1990's gas industry. The assumption has been that the gas is taken out of the low pressure grid (same as around gasholders).

29. First, it requires 30% more electricity to drive a compressor using gas at 0.5 bar than if the gas was at 4 bar. Going forward, CNG should be taken out of the grid at pressures from 4 – 50 bar, giving up to a 75% reduction in electricity consumption.

30. Second, a substantial part of the gas pipeline grid was developed in the period 1890 – 1930 when towns gas (made from coal) was the fuel. These pipelines were made from cast iron and have leaking joints, around 0.5% of the gas leaks out of the low pressure tiers. Even though around £1 billion a year is invested replacing these pipelines it will take until 2030 until the grid is substantially leakage free. Hence, if gas it taken for CNG at these low pressures, it was assumed that around 0.5% of it would have leaked out. With the global warming effect of methane around 20 times worse than CO2, this 0.5% translates to around 10% CO2. By taking gas out of high pressure grids (4 bar and above) there is negligible leakage and hence there is a further 10% benefit.

31. There is also a new advantage of CNG that is aligned with wind generation. It makes sense to run compressors at times when renewable electricity is in surplus. In this way, the CNG will further reduce its carbon footprint. The alternatives of compressing air or pumping water up-hill to use 'surplus' electricity are both highly wasteful of energy, because something is being done that no-one wants to be done Compressing gas however, is a required activity, why not do it at night? Overseas it is already seen as a complement to wind generation.

32. There are also positive developments in relation to the energy footprint of bringing natural gas to the UK. At the Isle of Grain, National Grid uses waste heat from an EON CCGT to warm the LNG and make it into natural gas for injection into the gas grid. This is estimated to give around a 5% CO2 benefit which is also significant. Reference 14 shows the benefits from the efficient scheme at Isle of Grain.

33. Paragraphs 28 – 32 have considered CNG made from gas within the grid. There is also liquefied natural gas, LNG. The Hardstaff and CAP technology uses gas in gaseous form at low pressure. Whether the gas is stored on the truck in compressed form (CNG) or liquid form (LNG) is neither here nor there. So, let us look at the LNG supply chain.

34. There is a major prize possible in relation to 'Well to Wheel' CO2. The UK now has major LNG importation facilities at Isle of Grain and Milford Haven. It is low cost and technically straightforward to load 20 tonne road tankers with LNG at these facilities by installing an LNG road tanker loading bay (cost around £3 Million). Fluxys has done this in Zeebrugge and already LNG is imported by ferry and road to UK from Zeebrugge to serve the new dual fuel trucks that are coming to market.

35. We do not know if the owners of the LNG importation terminals at Isle of Grain and Milford Haven are considering LNG road tanker loading but we hope they are. Importing LNG in containers by ferry and road is not a great idea when we have Isle of Grain and Milford Haven and there should be jobs in UK not in Belgium for this activity. Reference 15 shows the Fluxys LNG Road Tanker Loading system.

36. If LNG is made in Qatar (for example), transported by ship to UK, loaded into an LNG road tanker, transported to a depot LNG storage tank, then decanted into the LNG storage on board a truck, there are very low CO2 emissions in that supply chain. The LNG stored on board uses waste engine heat to become gas again. We estimate that there is around 10% saving in CO2 from this.

37. So, LNG in dual fuel may be able to deliver a 30% reduction in CO2, with CNG a similar saving.

38. In terms of climate change, the reduction from dual fuel trucks is material within that sector and material overall and is worthy of independent analysis. It would be very helpful if The Committee on Climate Change reviewed the data and gave an opinion.

39. Separately, the reason British Industry switched from oil to gas was because gas cost around half price in energy terms. It is around half price again today and so the logic of switching haulage from diesel to (part) gas is a sound one, We estimate that UK balance of payments would take a hit of around £40 billion a year compared to 2010 as a result of importing oil. If we can reduce oil imports by 15% as a result of dual fuel then we would save £6 billion of oil at a cost of £3 billion gas.

40. Security of Supply is going to be an oil issue by 2020 and anything to reduce reliance on Middle East oil imports by then has to be considered attractive.

41. For a 44 tonne truck to run on electricity, it has been estimated that around 50 tonnes of batteries would be required. So there is clearly not going to be a material electricity option for trucks.

42. If the shale gas reserves are as big as the promoters say, and if they can be developed economically, then the logical response for UK plc is to start to switch haulage to natural gas-diesel dual fuel.

43. The final point, if the shale gas is real, what can the Government do. It could ask the owners of Milford Haven and Isle of Grain to install LNG road tanker loading buys. It could ask the Technology Strategy Board to support Hardstaff and CAP in developing their dual fuel natural gas – diesel technologies. The Government can also support cities like Sheffield that are taking significant steps to move along the LA and Madrid paths by introducing natural gas for refuse trucks and other commercial vehicles as the best way to improve air quality. Reference 16 shows Sheffield/Veolia and CNG.

44. Crucially, however, the Government can also support investment in infrastructure and vehicle development by giving a longer period of confidence on natural gas fuel duty (at present only fixed relative to diesel for 3 years). The regimes to promote investment in offshore wind or ground source heat pumps or anaerobic digesters rely on a long term guarantee of income support. An equivalent level of confidence in duty level is required if we are to capture the CO2 reduction prize offered by dual fuel. This will also offer a duty reduction to hauliers who are prepared to invest in the natural gas refueling infrastructure and vehicles.

45. Once the depot based filling stations are built and depreciated, the Government can look forward to increasing duty on natural gas without it killing the market, but this is 15 years away.

46. The Energy Networks Association commissioned a report by Redpoint published in November 2010 (“Gas Future Scenarios Project – Final”) which makes the case that natural gas for commercial vehicles is an attractive option. See Reference 17.

47. One final point, the Government is preparing to announce the level of the Renewable Heat Incentive which includes the renewable premium paid to biomethane (renewable natural gas made from organic material). If set at an

appropriate level this will encourage waste to be converted into biomethane, injected into the gas grid and taken out at existing truck depots. In this way, the duel fuel CNG-diesel development is aligned with the move towards a fossil free economy. National Grid forecast in January 2009, that biomethane could supply around 50% of the gas used by domestic gas consumers. The same resource would supply much more than the 80% of gas required to move haulage to dual fuel. Reference 18.

References

1. CCGT Generation
   http://www.nationalgrid.com/uk/Gas/TYS/current/TYS2009.htm

2. British Gas NGV Paper from the 1990's
   http://87.224.35.44/tech_papers/17th_congress/2_3_24.asp

3. National Grid NGV
   http://www.nationalgridus.com/rigas/business/programs/3_gasvehicles.asp

4. NGV Statistics – NGVA Europe
   http://www.ngvaeurope.eu/statistical-information-on-the-european-and-worldwide-ngv-status

5. Passat Ecofuel
   http://green.autoblog.com/2010/01/06/volkswagen-passat-ecofuel-squeaks-past-prius-as-greenest-car-in/

6. Transport Emissions from Trucks
   http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsgb/latest/tsgb2010energy.pdf

7. Los Angeles buses – no more diesel
   http://www.latimes.com/news/local/la-me-buses-20110112,0,6536088.story?

8. Madrid refuse trucks on CNG
   http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V1T-4TRR90K-1&_user=10&_coverDate=05/31/2009&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1608663932&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=c05d7ea61a74d7992e0faa83bdb6da8c&searchtype=a

9. Volvo Dual Fuel Trucks
   http://www.volvotrucks.com/SiteCollectionDocuments/VTC/Corporate/About%20us/Environment/Volvo%20gas%20truck.pdf

10. Clean Air Power Dual Fuel Trucks
    http://www.cleanairpower.com/dualfuel.php

11. Hardstaff Dual Fuel Trucks
    http://www.hardstaffgroup.co.uk/site/hardstaff-dual-fuel-technologies/available-vehicles

12. Hardstaff Umbilical Trailer Connection
    http://www.hardstaffgroup.co.uk/site/hardstaff-dual-fuel-t echnologies/umbilical-trailer

13. Tenens Evironment and CNG
    http://www.tenens.com/environment/transport.html

14. National Grid Isle of Grain (see page 2)
    http://www.nationalgrid.com/NR/rdonlyres/E60C7955-5495-4A8A-8E80-BB4002F602F/44779/TenYearStatement2010.pdf

15. Fluxys LNG Road Tanker Loading
    http://www.fluxys.com/en/NewsAndPress/2010/101119_TruckLoading.aspx

16. Para 43Veolia CNG Refuse Trucks in Sheffield
    http://www.veoliaenvironmentalservices.co.uk/Sheffield/Waste-and-Recycling/Cleaner-greener-vehicles/

17. Redpoint Report on Gas Future Scenarios
http://www.redpointenergy.co.uk/images/uploads/ENA_gas_future_scenarios_report_v1.1_FINAL.PDF

18. National Grid Biomethane Report
http://www.nationalgrid.com/corporate/About+Us/climate/press/020209.htm