THE ENVIRONMENT AND ITS IMPACT ON GAS PENETRATION IN THE ENERGY MARKET

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1 Introduction

One of the main arguments proposed in favour of gas is that it is environmentally friendly. In a world increasingly concerned about the ill effects of pollution one would expect the penetration of gas in energy markets to be very dramatic. The share of gas in world primary consumption increased from 18 per cent in 1975 to 23 per cent in 1993. Although this means that the rate of growth of gas consumption in the past two decades was higher on average than the rate of growth of the consumption of all other fuels taken together, and that the penetration was significant, it cannot be said that gas has dramatically displaced dirtier fuels. Take coal, for example. Its share in world energy consumption declined from 30.7 per cent in 1975 to 27.4 per cent in 1993. This is not negligible but one can hardly say that coal is on the way to being eliminated from world energy consumption.

The thesis of this paper is that gas, although not free from pollution problems is nevertheless more benign than generally appreciated. The obstacles to gas penetration are flawed environmental legislation, political factors and, in some areas, a cost disadvantage relative to other fuels which turn out to be higher than the environmental premium which society is prepared to pay.

2 Natural Gas: clean or dirty?

Is gas an environmental ogre or an environmental saviour? This is a little like the old riddle: is the bottle half full or half empty? And, just as with the riddle, the answer depends on where you are coming from.
Let us first admit that natural gas, like all forms of energy, has environmental drawbacks. Natural gas is by its nature an explosive substance. The laying of pipelines can be a threat to natural habitats. Once in place if these pipelines leak they send methane into the atmosphere, a dominant greenhouse gas. The unknown levels of leakage from the Soviet gas system continue to be a matter of concern; whereas the earthquake in Japan raises safety issues regarding plans for constructing a national pipeline system in that country. Pipelines may also be a target for terrorist attack. The alternative mode for long-distance transport are LNG tankers. Expanded use of these giant vessels through narrow shipping lanes such as the Suez Canal can over time only lead to safety and environmental worries. The LNG trade generally, because of its first-rate safety standards, has not yet been subjected to the glare of public scrutiny which ritually follows all large-scale industrial accidents.

I should nevertheless like to argue that natural gas is an environmentally favoured fuel - indeed more than is often recognized within the gas industry itself. It is true that like the other fossil fuels - coal and petroleum products - combustion of natural gas leads to emissions of pollutants such as sulphur dioxide, particulate matter and nitrogen oxides. However, emissions of sulphur dioxide are a small fraction of emissions from the other fossil fuels and emissions of particulate are, to all intents and purposes, negligible.

Only nitrogen oxides are emitted in volumes which can give rise to concern, although gas still retains a significant advantage over coal and oil. Furthermore a large percentage of nitrogen oxides are normally accounted for by the transport sector - the sector where use of natural gas (or other technologies) on a large scale
is least feasible.

Of course nuclear power and other renewables make great play of the fact they produce absolutely no emissions and are therefore inherently different to fossil fuels. Here we see the common theme that gas is thrown into the fossil fuel camp and tarred with the same brush. Yet in absolute terms (which is what matters) the very low levels of emissions from gas place it nearer the zero emissions of nuclear and renewables than the high emissions of coal and oil. The difference between very, very little and nothing is very, very little.

Few better examples exist of the ability of gas to reduce air pollution than the experience of Ankara in Turkey. Ankara is located in a bowl-shaped structure surrounded by mountains. It suffers from temperature inversions which place a cap on the city and prevent local pollutants from escaping. There is no natural air conditioning stream since the winds are moderate and no river runs through the city. During the harsh winters low quality lignite was burnt to heat buildings and the resulting pollution became legendary. A switch to cleaner imported hard coal eased the problem without solving it. The importation of natural gas from Russia and its substitution for much of the city's heating systems has slashed sulphur dioxide and particulate concentrations. Natural gas has not only made a palpable difference to air quality in Ankara; it has also improved the quality of life. There are many other highly polluted cities in the developing world which may follow the path taken by the Ankara authorities.

Besides air pollution, combustion of natural gas also leads inevitably to carbon dioxide emissions, the alleged chief culprit of global warming. Compared on a unit basis, gas is said to produce around 40 percent less CO₂ than coal, and
25 percent less CO$_2$ than oil.

Yet these bare facts understate the virtues of gas. Firstly, gas is thermally more efficient so that one unit not only emits less CO$_2$ but also covers a greater energy requirement. Secondly gas is controllable: the heat can be turned on and off instantly. Thus it is not only more thermally efficient at producing a fixed amount of energy, but it also produces much closer to the amount of energy (or heat) actually desired. There is no need for example to let a boiler smoulder over night, as may be the case with coal, producing unwanted heat. Thirdly, gas quality standards can be easily monitored and maintained. The system requires gas of a given quality. Where oil or coal are used, it is difficult to prevent burning of sub-standard fuels - perhaps cheap local lignite, wood or peat. Use of these unofficial fuels is almost always overlooked by emissions calculations. These fuels may be used in boilers which are not properly maintained and do not conform to official standards and where boilermen may be ill-trained. The fuels are therefore less efficient than is assumed by standard emission factors. All these traits are especially important in developing countries. Finally, gas delivery is automatic and invisible. It dispenses with the need for delivery trucks which slow down principal highways and add to urban congestion - not to mention exhaust fumes. Once again, these externalities are usually left out of pollution calculations.

Nevertheless, with regards to CO$_2$ and global warming it is correct to lump gas with the other fossil fuels, since it is clearly inferior to nuclear and renewable technology to a significant degree. For these reasons an unholy alliance between the more extreme environmentalists and the nuclear industry casts natural gas as a "villain".
A major climate and energy study conducted by the Stockholm Environment Institute for Greenpeace International in 1992/3 produced a "Fossil Free Energy Scenario" in which the complete phasing out of coal, oil and gas (and indeed nuclear) was proposed over the course of the coming century. This was not meant as a forecast, but a demonstration of what could be achieved given a fundamental change in institutional priorities and thinking. Although most people in this audience will dismiss this as idealistic nonsense, it signifies that natural gas was seen by the study and is often seen by the public in the West as being in the anti-environment camp. Greenpeace is after all a populist organization. The fact that it is usually oil companies and oil states which control natural gas sustains this popular prejudice and presents the marketing of natural gas with a considerable credibility problem.

In fact, even this most extreme environmental scenario ultimately fell back on expanded use of natural gas. The scenario presented saw an early decline in nuclear, oil and coal. In the longer term after 2020, the hope was that energy efficiency and new renewable technologies would fill the gap left by these fuels. Up to 2020, however, it was accepted that it was impossible even under the political assumptions made for renewables and efficiency to take on the vacated role. In the model, gas consumption fills the role and actually increases for some twenty years before itself declining. In other words, contrary to prejudice the model concluded that natural gas had a key role in the medium-term in furthering environmental objectives.
I wish now to go on to consider the motivations behind environmentalism. Environmental preoccupations are not new. There is, however, a major difference between the environmental debate of the 1970s and that of the mid-90s. The germ to environmental concern in the 1960s and 1970s was the belief that finite natural resources were running out and would become progressively more expensive because of their scarcity. This led to concerted action for conservation of energy, investment in alternative technologies and energy efficiency. This philosophy was necessarily an attack upon gas, as well as the other traditional fuels. Its most renowned consequence on the gas business was the idea that gas penetration should be restrained and precious gas should be kept for its "premium uses". This led to the EC Directive banning the use of natural gas for generating electricity. How odd it seems today that banning gas-fired power stations was justified on environmental grounds!

Today the West still pays lip-service to the concept of energy efficiency - clearly, nobody is in favour of energy inefficiency - but for good or for bad the force behind this drive has gone. In an age of cheap and plentiful energy resources, energy efficiency makes sense only where cost savings are clear, or where it is a cost-effective means of reducing pollution and greenhouse gas emissions. And this is the key point. The core concept of environmentalism today is that the price of fuels should reflect not only their marginal cost of production but also the cost of environmental damage - "internalising the externalities" as the jargon goes. It is now recognized that there is no virtue per se in energy efficiency - the virtue lies in mitigating any ill effects of energy use.
Now it should be clear in the light of what was said above, that any legislation or fiscal regime based on this logic will greatly favour gas. For example a sulphur dioxide tax which reflects accurately fuel contributions to SO$_2$ emissions should impose only a tiny surcharge on gas, scarcely impairing its competitive position vis-a-vis renewables. The same tax on oil and coal would be many times greater placing them at a huge disadvantage. Even a tax to reflect carbon dioxide emissions should not impact too heavily on gas if all the externalities mentioned above are considered. Gas would have the option either to increase significantly its market share, or could continue to price itself netbacked from taxed fuel equivalents, giving itself a greater rent.

4 Beware the Legislator

I have tried to illustrate why I believe that the intellectual argument over environmental control has shifted greatly in favour of gas in recent years. In short energy conservation is a threat; pollution abatement is not. But once the politicians and legislators seize on these ideas, there is no guarantee that the resulting initiatives will be so favourable. Indeed experience so far suggests that for all the green credentials of gas, green legislation remains a threat.

A telling example is the imposition of value added tax on domestic fuel in the UK. The official reason was the encouragement of energy efficiency (which becomes relatively more cost effective) in order to meet the UK's Rio commitments, while the real reason was that the tax also raised revenue at a much needed time. The point that concerns us is that it is a uniform tax. Coal, oil, electricity and gas bills are all taxed at 8 per cent at the point of the end-consumer. No distinction
between the fuels is made, nor any incentive given to use one kind of generating plant (eg gas) rather than another (coal) for electricity production. Consumption of all fuels will be dented somewhat by the higher cost, but the cleaner fuels have no prospect of compensating fuel-switching gains.

The EC carbon tax provides a second example. This proposal appears dead but it is still a useful demonstration of how the effects of legislation can fail miserably to coincide with environmental objectives - for political reasons. The EC proposals were for a hybrid form of taxation, based half on the carbon content of fuels, half on the energy component. It is as if a government, anxious to discourage drunkenness, were to impose an alcohol tax which was based half on alcoholic proof and half on liquid content and was therefore levied not only on beer and wine but also on tea and coca cola. The reasons for this illogicality were political and social. A pure carbon tax would have skewed the burden of tax across community countries, favouring countries like France with large (zero tax) nuclear capacity and hitting large users of coal. The hybrid proposal could be interpreted as a way of partially protecting indigenous coal industries. Indeed Sheikh Hisham Nazer, the Minister of Petroleum and Mineral Resources of Saudi Arabia, made exactly this allegation.\footnote{H Nazer, Middle East Economic Survey, 15 February 1993} The combined tax reduced the potential taxation of coal as compared to a pure carbon tax by 10 per cent while increasing it on gas by 15 per cent.\footnote{JY Mitchell (1992), "Preserving Oil’s Competitiveness in the Face of Environmental Regulations", Papers of OPEC Seminar on the Environment, OPEC Vienna}

The Carbon tax and its trans-Atlantic ugly sister, the Btu tax, were riddled
with such anomalies. Most of the anomalies of the carbon tax arose because it was imposed upon the pre-existing tax regime. This meant that there was no link between the incremental carbon tax levels and the new post-tax levels of relative prices. The post-tax price increase of gas was estimated at 14 per cent, and the increase of light fuel oil at 16 per cent. The scope for fuel-switching in the key German market, where light fuel oil continues to provide a major part of domestic heating, would have been minimal. The percentage price increases of gasoline and diesel were even less than for gas because of the pre-existing tax layer. Thus this legislation would have actually made it more difficult - not less - for natural gas vehicles to penetrate the market.

It is, I hope, clear that environmental legislation is unlikely ever to reflect accurately the environmental merits of competing energy forms. Nevertheless, it need not always be that gas is the victim of inappropriate legislation. Perhaps it was the nuclear industry that could feel most aggrieved by the energy component of the EC carbon tax. Oil was the victim in the case of President Clinton’s Btu tax since the tax was to be levied at a higher rate than for coal and gas which were to be levied at the same rate per Btu.

Four examples of environmental legislation have been touched upon - the EC ban on gas-fired power generation, the imposition of VAT on fuel in the UK, the EC carbon tax and President Clinton’s Btu tax. Besides their failure to give proper signals for environmental protection, they all share a second common trait: they have all been rejected. The Carbon and Btu taxes never gained sufficient political support to come into force. This was not because of their anomalies and shortcomings, but because environmental issues became submerged by worries
over energy prices and the effects on competitiveness. The ban on gas-fired power held up (outside Holland) so long as nobody wanted to use gas for power; when the economics changed, the lifting of the Directive soon followed. The Dutch had always been exempt from its restrictions in any case. As for UK VAT, the first tranche at 8 per cent was successfully pushed through a recalcitrant Parliament at a time when the State's finances desperately needed the revenues. The second tranche raising the tax level to 17.5 per cent however was thrown out. This outcome suggests that the political constituency does not put the environmental objective above all its other objectives and that it is only prepared to pay small amounts in taxes for protecting future generations from the ill-effects of global warming.

The lesson to be learnt is that a host of other economic and political factors continue to take precedence over the environment even in today's supposedly ecologically-minded world.

5 The Limitations of Environmental Drivers

Many of the most dramatic advances in environmental initiatives are where environmental objectives concur fortuitously with political or economic priorities. The classic example is the so-called "dash for gas" in the UK. If we could argue that the headlong rush towards gas-fired power was the result of environmental priorities, we might well conclude that environmentalism can have an enormous positive impact on gas market penetration. There is no doubt that gas-fired power is the single most important factor which will help the UK to meet its Rio commitments on CO₂ and also (along with a limited programme of flue gas
desulphurisation on existing coal plant) reduces the UK's role in causing acid rain across North West Europe. These benefits have frequently been pointed out by advocates to justify the "dash for gas". But we should not be misled into thinking that the environmental gains were a primary, or even a secondary, motive. The private companies which invested in gas stations made their decisions on traditional commercial strategy grounds. These calculations did not involve damage cost externalities. The strategic reason for the mushrooming of gas-fired power stations in the UK was that the newly privatised regional electricity companies were fearful of paying high prices for electricity to the generators, National Power and Powergen, who were given duopoly market power under the privatised electricity business. Rather than be reliant on the generators, the regional electricity companies opted to invest in their own generating capacity. For new capacity, they naturally chose gas-fired stations with low unit capital costs.

We only have to look over towards Germany to see that with different political priorities and a different economic cost base, the policy is reversed. Gas-fired power generation shows only limited growth and the Government continues to support the indigenous coal industry. It is difficult to see Germany meeting its CO₂ reduction targets. Yet this a country supposedly with far stronger green credentials than the UK! The difference between the two countries is that Germany embarked on a major programme of fitting flue-gas desulphurisation on its coal stations some years ago. With the sunk cost made, pre-existing coal stations become competitive with new gas capacity. The lesson here inter alia is that you can combine environmental concerns with support for preferred fuel sources - even when it is coal!
What about cases where the level of pollution is so severe that environmental issues are foremost? An example is the intolerable levels of air pollution which were experienced in the mid-1980s in Ankara, as alluded to earlier. Pollution was the key motivation behind a decision to extend the Russian gas import pipeline beyond Istanbul to Ankara. Even in this extreme case, however, the financing of the project appears to have been made and authorised on traditional commercial calculations. That is to say, the project was judged to be commercial without factoring in the environmental savings.

The Oxford Institute for Energy Studies has been working with the World Bank to develop ways in which environmental considerations may be incorporated into traditional project evaluation calculations. A study by the Institute, expected to be published by the World Bank shortly, considers these issues with particular reference to the use of natural gas. The problem is two-fold. First, the theoretically correct solution would be to use a cost-benefit analysis of environmental gains. Unfortunately, cost-benefit analysis appears to be of little value practically when we are dealing with air pollution. The estimates of damage costs for different fuels are so wide and arbitrary that they scarcely help policymakers. In some studies the results of the cost benefit analysis have led to conclusions which are so at variance with experience that they are simply not credible. The second problem, although a resolvable one, is that the wave towards privatisation, and the view that money should only be invested in projects which stand up on their own commercial logic, makes it still harder to incorporate the environmental externalities.

All that has been said applies equally well to developing countries as to
developed ones. In fact, developing countries look even less likely to let environmental considerations hold sway over economic or political forces. With one important proviso - the role of lending organizations. These organizations can influence energy patterns considerably by applying conditions to their loans. The support given by the World Bank to hydro-electric power in the 1970s and early 80s resulted in a significant growth of this energy form. Since the promotion of hydro has now been discredited on environmental grounds, the World Bank appears to be opting for gas-fired power as a favoured alternative. This may hold out significant opportunities for gas market growth within developing countries. Looking at it from the point of view of a major potential exporter such as Qatar, the main obstacle is that gas prices will have to reflect the large costs of major gas export projects. Developing countries are unlikely to be able to meet these costs, and banks are unlikely to underwrite the projects, if energy prices remain subsidised at the point of the end-consumer. Nevertheless, sponsorship of gas projects by international lending organizations for environmental reasons is one of the few instances where gas could make material progress from its environmental advantages.

6 Conclusion

Let us take stock. There are four steps in the argument which has been presented.

- First, gas is an environmentally benign energy source, even more so than is commonly realized.

- Second, drives towards conservation and energy efficiency will
normally impact negatively on gas: drives to mitigate pollution should greatly favour gas. The latter theory is now in the ascendant.

- Third, environmental legislation is a threat to gas penetration because of its failure to incorporate environmental concerns appropriately.

- Fourthly, environmental concerns remain very much a secondary force and will rarely take precedence over political and economic considerations.

To put it more succinctly: in theory gas should gain from environmental initiatives, in practice this may not always happen and paradoxically there is a danger in certain cases that it will be affected detrimentally.

While the environmental advantages of gas should be stressed over and over again, it would be wise not to overestimate the likelihood of far-reaching environmental legislation. I recently came across the following quotation from a Shell Briefing Service note and I quote: "the increasing concern with environmental questions in many parts of the world is a powerful factor favouring the future of natural gas". Some will be inclined to agree with this articulation of the common wisdom, but unfortunately this was written in a briefing note dated February 1973. The story of gas is too often of paradise postponed.

Shell Briefing Service, "Growth in Natural Gas", February 1973