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Toward a Flexible Energy Future

For further information:
Eric Spiegel, McLean: eric.spiegel@booz.com
Neil McArthur, Amsterdam: neil.mcarthur@booz.com
Tom Stewart, New York: tom.stewart@booz.com
Booz & Company

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Toward a Flexible Energy Future

When the price of fuel reflects *all* the costs, government and industry will know where to invest.

by Lord Andrew Turnbull

In most of the industrialized world, there is a growing consensus that nations must re-examine and restructure their energy portfolios. A number of factors have contributed to this awareness: increasing fuel prices, the insecurity of energy supplies, and the recognition that humanity must reduce its carbon dioxide (CO_2) emissions to address global climate change. Even countries that have enjoyed steady supplies of electricity, transportation fuel, and heating fuel in the past will find it much more difficult to maintain control over those supplies in the future. Any responsible government that is not thinking seriously about its country's energy investments today — from both the public and private sectors — risks being caught cold, powerless, and immobile in the future.

But there is typically a five- to 10-year lag between an energy investment and the time the new capacity comes online. After that, countries are stuck with the facilities they have built for at least several decades. Thus, every major decision made now about energy involves a bet about the future. Because we don't know which mix of fuels will be available or most useful in the coming years, how can investments best be allocated among natural gas, coal, oil, nuclear power, renewables, or improved energy efficiency?

The debate over these choices is contentious. In my own country, the United Kingdom, there are heated arguments over whether nuclear power should be promoted or decommissioned; whether increased use of natural gas is or is not a viable option; and whether wind farms represent an ecological breakthrough or an inefficient blight on the countryside. In any given year, new energy technologies (hybrid cars, hydrogen fuel, biofuels) emerge and add to the contention. The only way that political and business decision makers can appropriately manage these options is through a flexible portfolio: not a choice about a particular mix of fuels but through an effective and resilient marketplace that can take advantage of economic principles to help us settle on the optimal combination of investments at any given time.

In policy circles, this is coming to be known as the "modified mar-

Illustration by Lars Leetaru

ket approach." The government (or perhaps a regional political structure like the European Union) establishes a framework for energy prices. This framework incorporates the prices and costs of energy, as set by supply and demand, but also takes into account the social and ecological benefits and harms of each fuel source. Fuels that exacerbate climate change, for example, are made more expensive; fuels that reduce the danger cost less. An implied surcharge on carbon-based fuels reflects the desired CO_2 reduction target. Once a rationale is agreed on, the government embeds the new framework in permits, surcharges, and regulations, after which the various technologies can effectively compete in the marketplace.

The modified market approach is a relatively recent innovation. Traditionally, governments have handled energy decisions in two ways: "Add it up" and "laissez-faire." Adding it up is a time-honored approach. Government planners assess worldwide energy needs and generation capacity, make projections for the next 20 years, calculate the gap between future demand and supply, and decide which mix of fuels to subsidize, tax, or invest in.

Flexible Portfolios

Even at its best, this approach has many shortcomings. It is static; if energy technologies, supply constraints, or demand patterns change, another plan will be needed. It is also vulnerable to lobbying, with the verdict going to whichever pressure group shouts loudest that "our favorite fuel is better than yours." And if political priorities change, the desired goals cannot be adjusted without a new plan. This makes it extremely difficult to take advantage of lower-cost opportunities, such as new technological developments, that emerge in later years.

Faced with these complexities, many governments take the "laissez-faire" approach: they leave it to the oil and power industries to govern their own investments. But this method, too, has many shortcomings. Market prices do not capture such externalities as the environmental impact of fuels, and they do not recognize the complex interdependencies among different forms of energy, the infrastructure required to maintain them, the security of supply, the needs of customers, and the uncertainties of the future.

To their credit, many governments are gravitating to the flexible portfolios of the modified market approach. In the U.K., for example, the government (controlled by the Labour Party) and the largest opposition party (the Conservative Party) agree on four basic objectives: to reduce CO_2 emissions; keep the economy competitive (by reducing the price of energy); maintain security of supply; and ensure that people on all levels of society, including the poor, have heat and mobility. Both parties have encapsulated these objectives in a rationale that, when it is complete, will allow energy sources to compete and evolve, without regulators and investors having to predict in advance precisely which technologies will be adopted by the market.

For a modified market approach to succeed, there must first be a clear set of targets for the reduction of CO_2 emissions. In setting the formulas that determine a nation's energy portfolio, we should favor not merely the cheapest fuels, but the optimal fuel mix that adjusts

Lord Andrew Turnbull
(turnbull_andrew@bah.com) is a senior advisor to Booz Allen Hamilton based in London. Between 2002 and 2005 he was secretary of the Cabinet and head of the Home Civil Service in the United Kingdom.

over time, operates effectively during scarcities and surpluses, produces energy when the wind blows and when it doesn't, and is independent of the vagaries of international oil politics (it must be viable whether or not a nation is on good terms with Russia, Nigeria, Saudi Arabia, Iran, or Venezuela). To accomplish this, three elements, in particular, must be reflected: the ecological impact of carbon, the variability of fuel supply, and the costs of energy security. If we understand how to factor in those elements, then all available energy sources — oil, gas, coal, alternative fuels, hydrogen, nuclear power, hydropower, and renewables — can compete on an equal footing.

Environmental Shadow Prices

In the coming years, faced with general climate change and more extreme weather patterns, every government will have to make a decision: To what levels must carbon fuel emissions be reduced to affect the rate of global warming, and by what year? No government can ignore this imperative for long. There is a growing body of opinion which (drawing on conclusions from such groups as the International Intergovernmental Panel on Climate Change and the American Association for the Advancement of Science) recognizes that human activities are contributing significantly to the dangers of global warming. Already, serious efforts to mitigate climate change are moving forward, with those political leaders who refuse to participate finding themselves marginalized; for example, a July 2006 greenhouse gas reduction agreement between U.K. Prime Minister Tony Blair and California Governor Arnold Schwarzenegger bypassed Washington completely.

The effective modified market approach must reflect the real environmental costs of different fuels. Having set a CO_2 reduction target — taking into account the estimated effects of global warming on sea levels, crops, and the weather, and the destruction such effects could cause — governments must engineer a "shadow price of carbon" that delivers that target. The new framework would, in effect, modify the price of every fuel and technology, reflecting the increased risks caused by its CO_2 emissions, while exempting fuels and technologies that emit little or no CO_2.

The process for setting a shadow price must be transparent enough to draw open criticism from both environmental and economic experts, and robust enough to meet or incorporate that criticism without losing scientific credibility. It must also be consistent enough to enable suppliers to make informed predictions about costs and to set prices with confidence. Documentation would be required for each estimated cost — and costs would be revisited periodically to take into account changes in technology, practices, and damage assessment techniques. Priorities could no longer be determined by pressure groups demanding, for example, expansions of natural gas lines, bans on nuclear power, or restrictions on windmills.

In its approach to climate change, the E.U. has adopted a modified market system, at least in principle. The Emissions Trading Scheme (ETS), introduced in 2005, is still (as of late 2006) in the first phase of implementation. Each member country proposes a cap on greenhouse gases emitted by power plants and other major industrial sites; the E.U. approves the caps; and then companies are granted permits to operate within those caps. Carbon-profligate companies can buy more emissions rights from carbon-frugal companies, giving everyone more incentives for lowering emissions and building efficiencies.

Every government must decide: Reduce carbon emissions to what level, and by what year?

But the ETS is an imperfect work in progress, in which political horse-trading overrides the best scientific judgment. The caps were so generous in the first year that no countries were forced to reduce total CO_2 emissions — which (as many observers noted) undercut the entire purpose of the initiative. In the end, it is not clear whether the ETS will have the political will to overcome bargaining on the part of special interest groups, but only a tough stand will allow it to deliver a true shadow price for carbon that genuinely leads to the CO_2 reductions required to mitigate climate change.

Because the ETS is still embryonic, most countries in the E.U. are retaining a national carbon or energy tax. This represents a significant structural difference: Trading systems, which fix the level of permitted emissions and allow the price

to vary, tend to be more effective at capping emissions than tax systems, which fix the price and allow the amount of pollution to vary. Tax systems are also more prone to the arbitrariness of top-down control; the U.K.'s Climate Change Levy, for example, is a confused mixture of energy and carbon tax, levying on nuclear power, even though it is a low source of CO_2.

The Price of Volatility

Emissions trading programs represent a valuable first step, but because they don't take the other uncertainties of the sector into account, they alone are not an adequate means of guiding energy investment. Volatility adds cost to any portfolio. Investors know this well; they diversify across a variety of assets, balancing their requirements for growth and security. A good modified market energy portfolio should do the same, taking into account the volatility of the availability and price of different fuels.

Natural gas, as the world has witnessed, can fluctuate enormously. In the U.K., the spot price of natural gas doubled between 2004 and 2006. Even more damaging were two price spikes, in which U.K. gas prices briefly rose about 400 percent. Importing nations, in particular, have little recourse if suppliers raise prices suddenly (as Russia's Gazprom has done) or supplies approach a natural peak (as has been predicted for oil). Other fuels are relatively stable; once reactors are built, the price of nuclear power remains relatively constant. Nuclear power can therefore take the role that bonds play in a pension fund: not necessarily the highest-yielding asset, but one that reduces volatility.

Another source of uncertainty that needs to be addressed arises from the protracted and uncertain nature of planning and licensing regulations. These are particularly damaging to highly capital-intensive options, such as the building of new liquid natural gas (LNG) or nuclear power facilities, or the recovery of heat from waste incineration. The U.K. government is proposing to address this uncertainty by allowing licensing of technologies to run in parallel with the planning process.

Nuclear power can take the role that bonds play in a pension fund: reducing volatility.

Any resumption of nuclear construction should be preceded by agreement on a strategy for disposal of nuclear wastes (though those energy sources emitting CO_2 as a waste are not required to meet an equivalent constraint). We should also insist that enough funds be allocated for waste disposal and decommissioning of plants, lodged outside the producer's balance sheet.

If nuclear power can compete with the benefit of the carbon adjustment while meeting its waste and decommissioning costs in full, then it should find a place in the energy mix. Conversely, if it is still uneconomical, it should not. And the same logic should apply to other technologies, including renewables. There is no reason why established renewable energy technologies such as wind power should receive *both* the preference of the CO_2 adjustment *and* a guaranteed market share (as is currently the case in the U.K.).

Recent analysis conducted by the U.K. government shows that nuclear power would be viable over a wide range of scenarios. It would struggle to compete only if gas prices and the shadow price of carbon were both low. That combination is inherently implausible, however; it would almost certainly lead to a higher shadow price for carbon, bringing nuclear power back into contention.

During my tenure as Cabinet secretary, I saw the shortcomings of addressing the energy supply in piecemeal fashion. Although there were two attempts to write an energy policy paper, at the time no one wanted to challenge prevailing assumptions — for example, the assumption that greater energy efficiency, renewables (such as wind power), and natural gas would provide enough carbon reduction in and of themselves. Such assumptions were undermined when the price of energy shot up, and the Russians and others reminded us of the vulnerabilities of natural gas.

But as I write, a consensus is building in Europe and North America with respect to global climate change and energy security, and it is coupled with a growing sense of urgency. We now have a moment of opportunity to create a framework that enables the essential energy choices to be made — not by dictating them, but by providing open competition and building all the relevant factors into the marketplace where choices are made. +

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