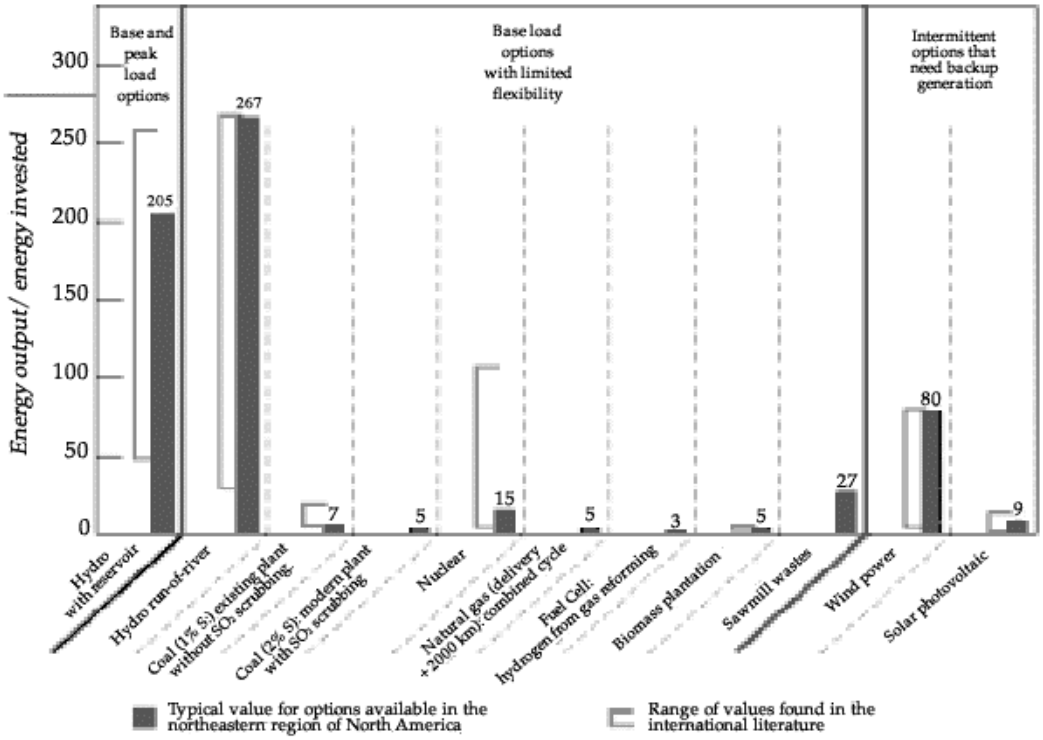
Panel: Why coal and nuclear energy can't fill in for gas and oil



In an energy-scarce world, the financial cost of producing fuel will not matter as much as the energy cost. Indeed, the amount of energy one needs to spend to produce a unit of energy will be all-important. The chart below shows how much energy it takes to produce electricity in various ways. Coal-fired generation comes out of the comparison very badly, producing only around seven times as much energy as it took to produce it. This calculation takes into account the energy required to sink the mine, build a railway to take the coal to the powerstation, and then build the powerstation itself as well as the constant supply of energy is needed to operate the railway and the mine. If the coal has a high sulphur content and has to be scrubbed to prevent sulphur dioxide, the energy gain can fall to as little as 5 times the amount of power that went into producing it. Some authorities have put the figure as low as 2.59 And if the CO2 produced by the burning of the coal was to be sequestrated – that is, pumped into a disused oil well or the cold depths of the sea, the energy gain would be very little at all. Compare this with the eighty-fold energy gain from building a windfarm and there can be no doubt which project would give the better return.
Energy Payback Ratio

That's electricity. If coal was required to fill the other big use of oil – as a transportation fuel – it could be liquefied with the loss of at least 40% of the energy it contains. As more energy would be required to build the processing plant and to operate it, not more than half the energy in the coal would end up in the petrol substitute. A typical US coal mine produces between 15 and 30 times more energy than is needed to build and run it. As a result, the net energy gain from producing petrol from coal could be somewhere between

7 and 15 times. This is far worse than the return that could be had from producing hydrogen using wind-generated electricity and then burning the hydrogen in a fuel cell aboard the vehicle. In short, neither major possible use of coal makes good energy sense except in in parts of the world without a reasonable renewable energy alternative.

Nuclear energy is a more attractive competitor as its energy gain could be as high as from the wind but it has to be rejected on five grounds:

1. The risk factor. The nuclear industry is unable to get commercial insurance cover and governments have had to step in, taking on the burden instead. This is a massive subsidy.

2. The type of society that would be created. Nuclear reactors make wonderful targets for terrorists. Just having them could lead to a police state. There is also the problem of providing the materials for the proliferation of nuclear weapons.

3. The need for the long-term care of the waste. We don't know that our descendants will have the capacity to provide it continuously for the next 10,000 years.

4. Uranium is in very limited supply and the use of fast breeder reactors does not get around the problem very convincingly. They entail considerably higher energy investments but could, theoretically increase the energy available by a factor of 60. But as the UK Atomic Energy Authority wrote in 1989, 'In practice, it is now not clear how [the use of fast breeders] would be achieved on an expanded global scale without encountering basic plutonium shortages, not to mention serious problems with waste disposal, power plant decommissioning and nuclear weapons proliferation."

5. Even if there was the fuel, the number of nuclear stations required is too large to be feasible. 1,700 stations would be required just to make up the decline in oil and gas output between 2015 and 2040 and if we wished to provide the capacity for world economic growth to continue at 2% beyond 2015, that would take another 5,000 stations. So, over the 25 year period up to 2040, between 6,500 and 7,000 stations would have to come on stream – that's five every week. There would be real problems in finding suitable sites outside earthquake zones where the cooling water would not harm the marine environment. And given that most stations take ten years to build, work would have to start almost immediately.