

Energy constraint and impact assessment

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1 Abstract

- Dramatic reductions in global GHG emissions are required within the lifetime of all current policy, programme and project proposals in order to safeguard human well-being. Current concentrations are intolerable.
- Peak oil will increase the price of energy and promote exploitation of unconventional sources of fossil fuel that have high GHG emissions.
- There are no credible alternative sources of energy, so consumption will be constrained and access to goods and services will fall - leading to widespread suffering.
- All impact assessments should have an energy and climate change chapter. There should be full disclosure of GHG implications.
- All mitigation recommendations should be designed to operate under energy constraints.

2 Introduction

The twin issues of climate change and peak oil imply that all policies, programmes and projects (PPP) that are planned today will operate in an energy constrained world. The energy used by all PPP generates greenhouse gases (GHG) and requires the purchase of an increasingly scarce fossil fuel resource. PPP require energy for construction, operation, mitigation, and social investment.

There are currently relatively few joint analyses of climate change and peak oil [1, 2] but relatively larger numbers of reports which consider each alone.

2.1 Climate change

The evidence for anthropogenic climate change is no longer contested [3]. It includes the Dome ice core records, the summer melt of the Arctic sea ice and the recession of glaciers. Global average temperature continues to rise and may be approaching a tipping point where runaway climate change could occur. Current atmospheric concentrations are intolerable and the impact includes some 150,000 deaths being brought forward annually [4]. The incidence of associated disease, famine, war, and psychosocial disorder must rise [5].

The conclusion from climate change studies is that GHG emissions need to fall rapidly by 80% in order to stabilise the climate. The cost of taking action now would be much lower than the cost of taking action later [6]. The reduction can be brought about by using less, developing alternatives, offsetting what is used, and carbon capture and storage.

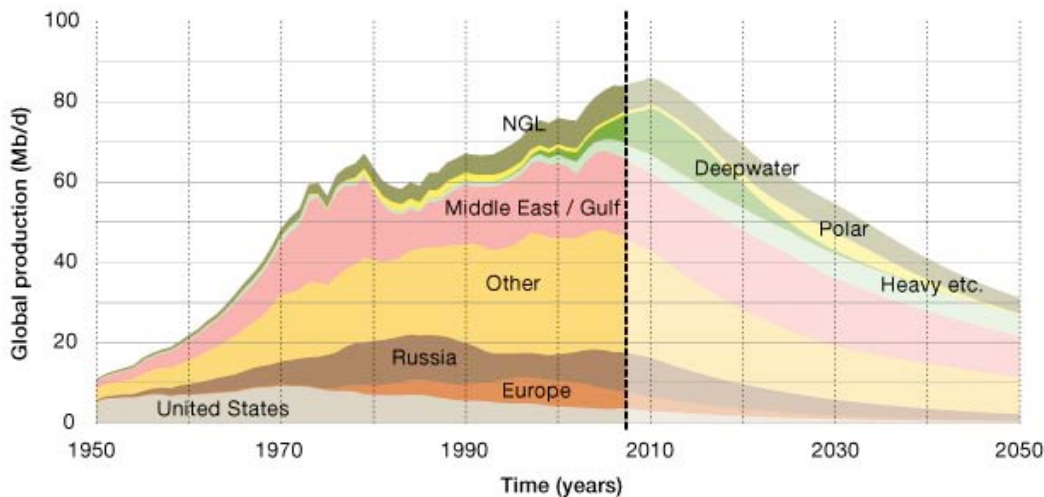
There are few, if any, creditable forms of carbon offsetting. Carbon has been locked up in the ground for geological time periods. Once it is released it remains in circulation for similar periods. Capturing it in a growing tree for one hundred years has limited value. Similarly, paying poor people to emit less GHG so that rich people can emit more GHG is contentious [7]. Carbon offsets that are used to permanently remove carbon credits from circulation may be credible. Very large scale forestation may help to reduce atmospheric carbon dioxide significantly providing that it is maintained, but this is contentious.

Carbon capture and storage, or carbon sequestration, consists of stripping the CO₂ out of fossil fuel and its combustion products. The CO₂ is then compressed, transported, and pumped into deep geological reservoirs, such as old oil fields. The financial and energy cost are substantial and the technology unproven.

2.2 Peak oil

Peak oil occurs when half the global reserve is used and the supply rate can no longer increase even though demand rises [8-11]. Demand dampening occurs through price adjustments. The economic, social, and political costs are unprecedented [12]. The timing of peak oil is hard to predict and can only be known accurately in retrospect. We do know that there is a 30-40 year lag between discovery and exploitation and that global discovery peaked around 1964 [1]. Figure 1 summarises the view that informs this paper.

Figure 1 Global oil production [8]



Some of the salient points in the peak oil argument follow.

- The shape of the production peak is unknown. It may be relatively sharp or it may be an undulating plateau. The plateau could be created by complex processes in the global market and political system.
- Oil production in the lower 48 states of the USA peaked in 1970 at around 10 million barrels per day.
- North Sea oil production peaked in 2000 at around 6 million barrels per day.
- Middle East oil and gas reserves are notoriously hard to estimate. However, the UAE, for example, cannot meet its own summer demands.
- 64 of the 98 oil producing countries in the world have passed their production peak.
- Unconventional oil and gas exploitation will release large quantities of GHG and the Energy Return on Energy Invested (EROEI) is poor.

2.3 Energy return on energy invested

EROEI is an indicator of the amount of energy that must be spent in order to produce and distribute new energy. It has dropped from 100:1 to 10:1. For unconventional sources it is about 2:1. As the EROEI falls, the associated emission of GHG rises rapidly, contributing further to climate change. The EROEI for carbon capture and storage may be 33% of the energy value of the fuel.

2.4 Financial evidence and consequence of peak oil

The price of oil and gas spiked during 2008 to above \$145 per barrel, possibly as the market anticipated peak oil [9]. Since, there has been a sharp price reduction associated with economic recession. Price increases have had devastating effects on poor countries, where more must be spent on fuel than on health or poverty alleviation [13]. The recession is having devastating and destabilising effects in all countries.

2.5 Alternative energy

Renewable sources of energy cannot fully replace fossil fuels [14]. The replacement would have to address both issues of quantity and quality. Key areas of energy quality include density, EROEI, intermittency, and flexibility. Renewables have poor energy quality compared to fossil fuels, except with regard to GHG emissions. For example, the volume of renewables may increase by roughly 45% by 2030 [15]. If it does so, it will still only represent about 10% of projected global demand, assuming business as usual.

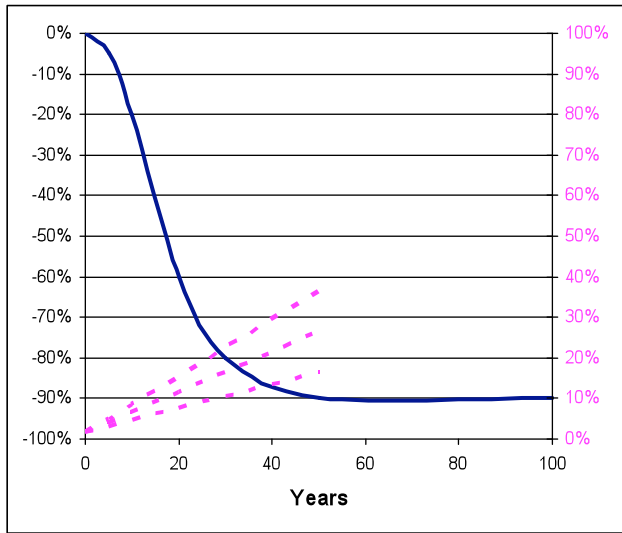
Nuclear power is a contentious alternative because of issues such as: waste storage; cost of insurance; supply, refining and transport of uranium; cost of decommissioning; and the transport and storage of the electricity produced. Like every non-renewable resource, the supply of good quality uranium is limited and a global switch to nuclear power would produce rapid peaking.

First generation biofuels have removed valuable food stocks from a starving world and may cost more energy to produce than is derived from them.

3 The energy transition

There must be a voluntary or involuntary energy transition: per capita energy consumption must fall substantially. Figure 2 is a sketch of the energy transition from a UK perspective. Future reductions in fossil fuel or gains in renewable energy are only indicative. The graph seeks to convey the view that declining fossil fuel use will not be matched by the availability of renewables. A range of rates for renewables is indicated.

Figure 2 The Energy Transition in the UK: target reduction in fossil fuel use compared with present (solid line). Range of expected increase in renewables compared with demand at that time (dotted line).



4 Consequences for impact assessment

The consequence of the energy transition is that the energy requirements of construction, operation, mitigation and social investment should be considered during the impact assessment process. Impact mitigation measure should be fossil fuel independent, as far as possible. See Table 1 for examples.

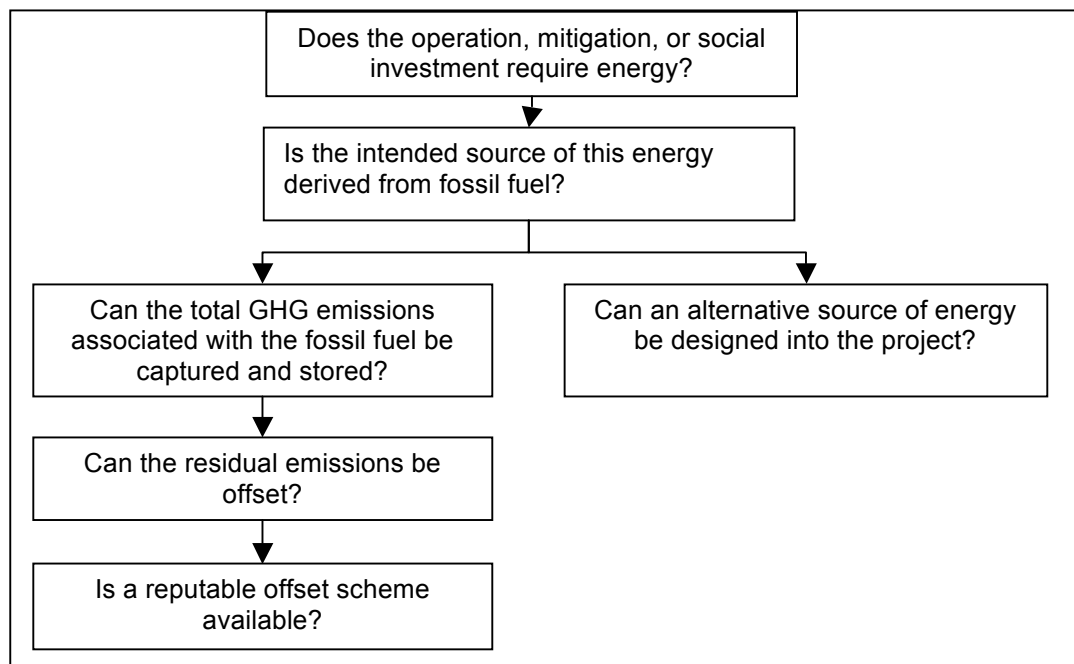
Table 1 Examples of alternate mitigation measures

Fossil-fuel based mitigation measures	Fossil-fuel minimised mitigation measures
Road transport	Rail transport
Electric powered heating/cooling	Passive heating/cooling
Supplies sourced at a distance	Supplies sourced locally
Fossil-fuel powered	Wind, photovoltaic or wave powered
Replace wind powered fishing boats by powered fishing boats	Replace wind powered fishing boats by more efficient wind powered boats
New housing developments are planned round roads and motorways	New housing developments are planned round public transport, cycling, local shops and home-working
Rainfed agriculture replaced by diesel powered irrigation	Rainfed agriculture replaced by wind powered irrigation

4.1 Mitigation flowchart

The mitigation of energy associated impacts of a PPP will depend on answering a series of questions. The following flowchart represents a first attempt to organise these questions into a logical structure. If satisfactory answers cannot be provided to these questions, then the PPP may not meet the minimum requirements for implementation under an energy transition.

Figure 3 Flowchart for energy and mitigation



4.2 Emission reporting in the energy sector

Particular challenges arise in fossil fuel projects themselves because the product is a principal source of GHG. There is no clear policy on carbon disclosure during impact assessment of fossil fuel projects. Emissions occur during construction, operation, decommissioning and use of the product. Shell policy, for example recognises that the scope of impact assessment includes issues in both the host society and international interest and examines how products can impact society or the environment throughout their life cycles [16, 17]. Fulfilment of this policy must include examining and reporting on the GHG emissions associated with both processes and products.

The Carbon Disclosure Project indicates that on average 6-7 times more CO₂ is emitted from the consumption of oil products than from production [18]. However, IPIECA [19] and IFC [20] recommend that only emissions associated with production should be disclosed.

Impact assessment provides an opportunity to present the total GHG figures of a project in a comparable format that meets the needs of society. Fossil fuel producers cannot solve the climate change issue on their own: a more comprehensive dialogue is needed and that must be informed by data. In order to make rational decisions, both the producer and society need to know the total future GHG implications of fossil fuel projects. This requires full disclosure as part of the impact assessment.

5 Conclusion

Societal response to the twin issues of climate change and peak oil require strong international and national policies. Impact assessment can assist by reporting the energy and emissions implications. Every impact assessment should have a climate change and energy scarcity chapter with full disclosure. The recommendations for mitigation measures from an impact assessment should be energy and GHG emissions sensitive.

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