Non-traditional fossil fuels

Carbon sequestration
Tar sands 175 billion barrels proven recoverable reserves.

(US used about 6.3 billion barrels in 2008)

Significant environmental impacts?

Tar sands and ‘heavy oil. Petroleum that has lost lower molecular weight compounds.
Environmental concerns include:

- water use
- local ecosystem impacts
- carbon dioxide emissions
500 billion barrels of recoverable reserves in the western U.S.

(US used about 6.3 billion barrels of crude oil in 2008)
Oil shale:

water use in an arid climate
waste rock from retorting
ecosystem disruption – surface mining
carbon dioxide emissions
Coal bed methane

US has ~ 20 TCF of proven reserves

US used ~23 TCF in 2008
CBM

water extraction in near-surface aquifer systems

treatment fluids from horizontal drilling and hydrofracturing
Methane clathrate

potential for significant, uncontrolled methane emission
Underground (in situ) coal gasification

Injection of oxygen and water. Ignition, production of ‘syngas’.

runaway underground fires
technical feasibility
Geological Carbon Sequestration

Geological Storage Options for CO₂
1. Depleted oil and gas reservoirs
2. CO₂-driven enhanced oil recovery
3. Deep saline formations
4. Deep unmineable coal seams
5. CO₂-driven enhanced coal bed methane recovery
6. Deep saline filled basalts formations and other formations
Subsea Carbon Sequestration

Carbon dioxide is removed from the surface oceans naturally by photosynthesis; some amount of the fixed carbon is preserved as sediment – perhaps to become part of the intermediate carbon cycle.

Can this amount be increased by ocean surface fertilization using iron, etc?

Can carbon dioxide liquid be released into the deep ocean by direct injection?