

Oil Shale's Triple Threat

Too Much Water | Poor Energy Source | High GHG Emissions

The claim that commercially developing oil shale will lead to energy independence, or otherwise significantly reduce US oil imports, is untrue. But that's not all. Developing these deposits in Colorado, Utah, and Wyoming would come at great expense to communities and the region, and would undermine our nation's commitment to combating climate change.

Among other problems, commercial development of oil shale would:

1. Use too much water in an arid region.
2. Produce a poor energy source (low energy return on investment).
3. Contribute 23-73% more greenhouse gasses than conventional fuel.

These impacts are oil shale's Triple Threat.

Western Resource Advocates

Uses Too Much Water
In a Dry Environment

Water is the lifeline of the West, and is essential to sustaining our communities, economies, rivers, and wildlife. Scientists, however, project that climate change will make the West hotter and drier, with longer and more intense droughts, thereby exacerbating today's challenges. Such changes would further threaten the West's ability to meet the water demands of growing cities, the agricultural sector that is the bedrock of rural communities, and the recreational industry.

According to the U.S. Bureau of Reclamation, since 2003 the 10-year average use of water in the Colorado River Basin has exceeded the 10-year average supply (see Figure 1). Further, recent hydrologic studies of the Upper Colorado River Basin project runoff will decrease 5-20% by 2050, further reducing the water available for farmers, cities, power plants and other uses.

In Utah, where governmental officials and industry are proposing to develop both oil shale and tar sands, the state will likely exceed its Colorado River allocations around 2025 – and that's without using any water for either oil shale or tar sands (see Figure 2).

According to recent estimates, large scale development of oil shale alone would require 378,000 acre feet of water per year. By comparison, the Denver, Colorado metropolitan area, with a population of 1.4 million, uses approximately 225,000 acre feet annually. Developing tar sands would require additional water.

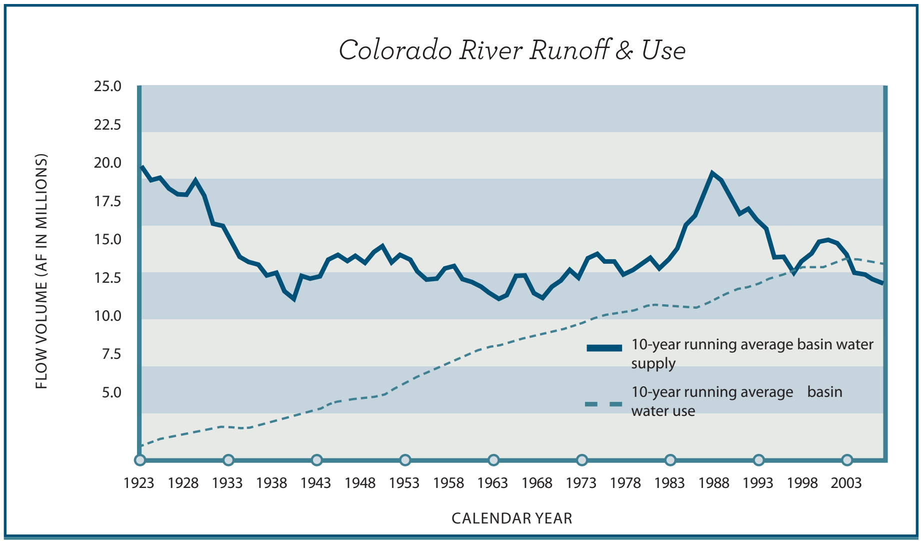

Figure 1. In the Colorado River Basin, consumptive water use already exceeds available supplies. Any reductions in water supplies will result in unmet demands. Source: Colorado River Basin water supply and demand study proposal," U.S. Bureau of Reclamation, 2009.

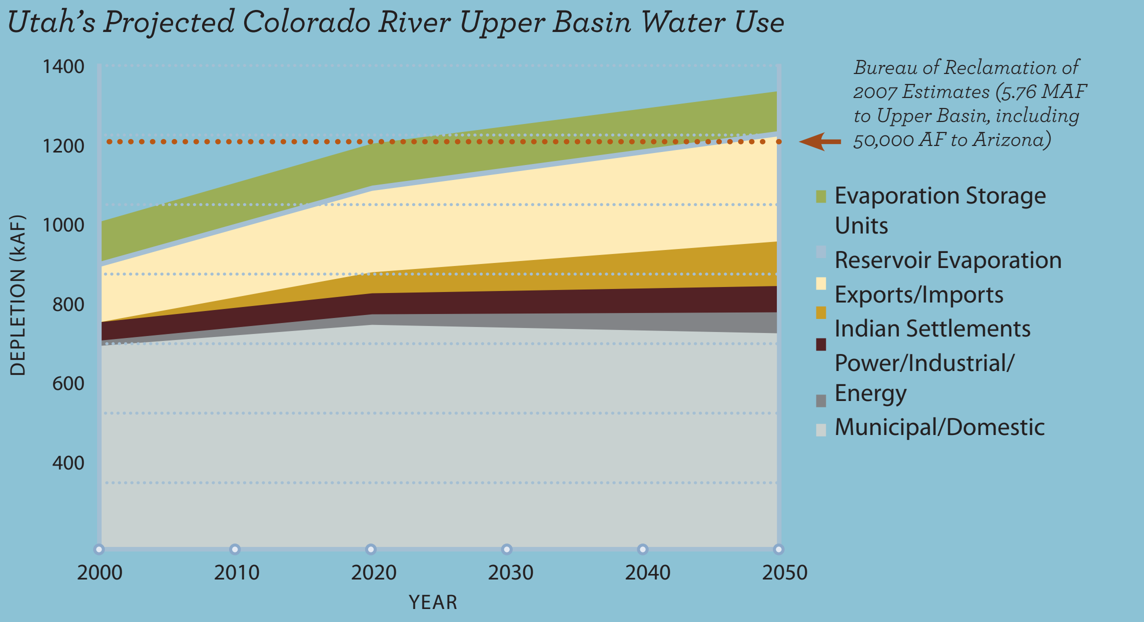

Figure 2. Note: Projections do not include water for tar sands and oil shale development

A Poor Energy Source

Energy Return on Investment

EROI, or energy return on investment, underpins any analysis of the value of energy produced. In simple terms, EROI is a comparison of the amount of energy that goes into a production process versus the amount of energy delivered by the process. An EROI of 1:1 means there is no energy "profit" from the investment of energy.

The EROI for oil shale is considerably less than the EROI of conventional crude oil, both at the wellhead and at the refined fuel stages of processing. Even under marginal conditions, such as smaller and deeper well fields, loss of artesian pressure, etc., conventional crude oil still generates a significantly larger energy surplus than oil shale – approximately 20:1.

Why Does Oil Shale Have a Low EROI?

The kerogen in oil shale is solid organic material that has not been subject to the temperature, pressure, and other geologic conditions required to convert it to liquid form. In effect, humans must supply the additional energy required to "upgrade" the oil shale resource to the functional equivalent of conventional crude oil. This extra effort carries a large energy penalty, producing a much lower EROI for oil shale.

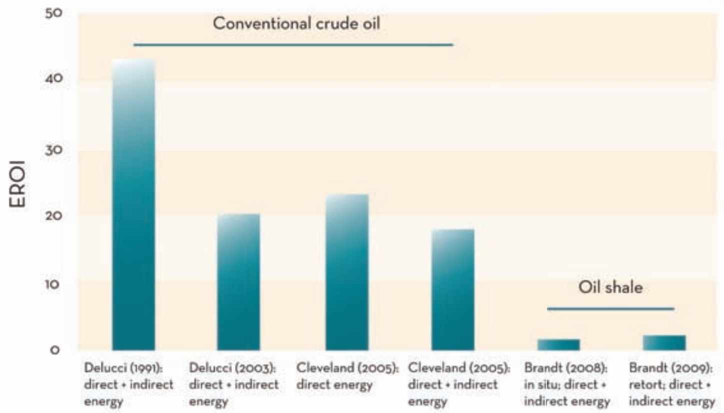

Figure 3. A comparison of estimates of the energy return on investment (EROI) for refined fuel produced from conventional crude oil and from oil shale.

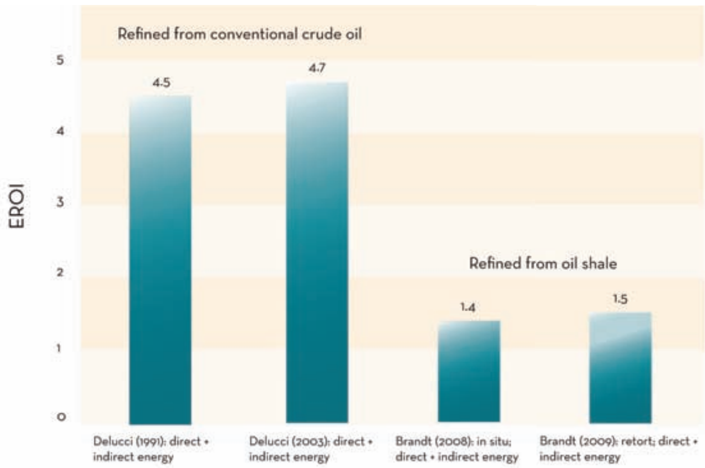

Figure 4. A comparison of estimates of the energy return on investment (EROI) at the wellhead for conventional crude oil, or for crude product prior to refining for oil shale.

Greenhouse Gases and EROI

A Double Whammy for Oil Shale

Dr. Adam Brandt with Stanford University has determined that oil shale's low EROI is closely connected to a significant release of greenhouse gases. The large quantities of energy needed to process oil shale, combined with the thermochemistry of the retorting process, produce disproportionally high levels of carbon dioxide and other greenhouse gas emissions. As shown in Figure 6, depending on the process used, oil shale emits 23% to 73% more greenhouse gases than conventional liquid fuels from crude oil feedstocks. The high GHG and low EROI are costs to society.

Source	Type	Range	Extraction & Upgrading	Well-to-Tank	Tank-to-Wheel	Well-to-Wheel
U.S. 2005 Avg. (EPA)	Ultra Low Sulfur Diesel			17	75	92
Brandt	Shell IPC in-situ	Low	30	38	75	113
		High	48	62	75	137
Brandt	ATP ex-situ	Low	52	61	75	135
		High	73	84	75	159

Figure 6. Emissions associated with production of diesel from oil shale. Units in gCO2e/MJ. ICP is Shell's experimental underground (or in-situ) processing technology. ATP is the Alberta Taciuk Processor, an above-ground retort processor. Source: GHG Emission Factors for High Carbon Intensity Crude Oils," Natural Resources Defense Council, September 2010. http://docs.nrdc.org/energy/files/ene_10070101a.pdf.

Resources

"Protecting the Lifeline of the West: How Climate and Clean Energy Policies Can Safeguard Water," Western Resource Advocates and Environmental Defense Fund, 2010. http://www.westernresourceadvocates.org/water/lifeline/lifeline.pdf

"Fossil Foolishness: Utah's Pursuit of Tar Sands and Oil Shale," Western Resource Advocates, 2010 http://www.westernresourceadvocates.org/land/utosts/utreport.php

"Water on the Rocks: Oil Shale Water Rights in Colorado," Western Resource Advocates, 2009 http://www.westernresourceadvocates.org/land/wotrreport/index.php

"GHG Emission Factors for High Carbon Intensity Crude Oils," Natural Resources Defense Council, September 2010. http://docs.nrdc.org/energy/files/ene_10070101a.pdf

"Colorado River Basin water supply and demand study proposal," U.S. Bureau of Reclamation, 2009. http://www.usbr.gov/lc/region/programs/crbstudy/CRBasinStudy.pdf

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