

FOSSIL FUELS IV

Tar Sand and Oil Shale



[Audio Link](#)

Tar (oil) Sand

- Tar sands are simply sands that contains a hydro carbon product called bitumen.
- Bitumen is a viscous oil that must be rigorously treated in order to convert it into an upgraded crude oil before it can be used in refineries to produce gasoline and other fuels.
- Bitumen is about 10-12 % of the actual oil sands found in Alberta.

- Oil Sand occurs in more than 70 countries.
- The two largest deposits are Canada and Venezuela, with the bulk being found in four different regions of Alberta.
- Alberta's reserves that are deemed to be technologically retrievable today is estimated at 280-300Gb (billion barrels).



(a)



(b)

FIGURE 5.55. (a) The distribution of major tar-sand deposits in the world. (b) The location and size of the heavy oil deposits in Alberta, Canada. (From P. H. Phizackerley and L. O. Scott and from F. K. Spragins, respectively, in G. V. Chilingarian and T. F. Yen, *Bitumens, Asphalts and Tar Sands*. Amsterdam: Elsevier, 1978 p. 57 and p. 94. Used with permission.)

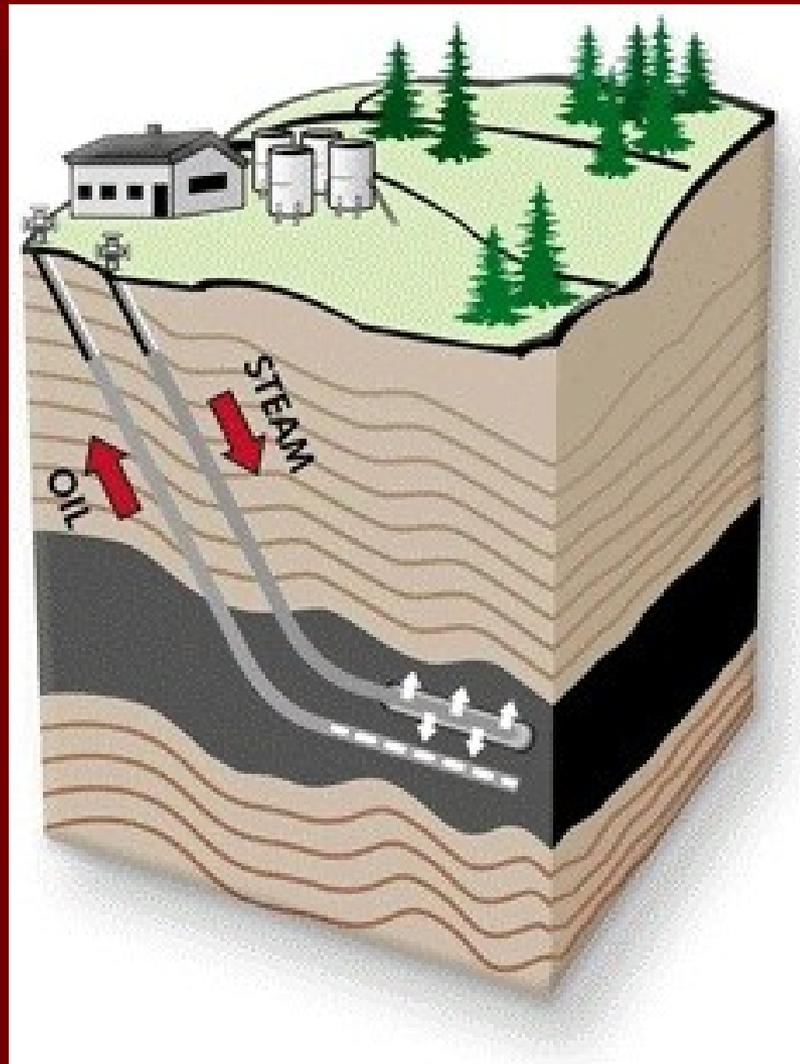
Take a look at the following set about tar sands.
<http://ostseis.anl.gov/guide/tarsands/>

Surface Tar Sand Deposit

Can you find online videos supporting or opposing mining tar sand deposits?



Deep Tar Sand Extraction

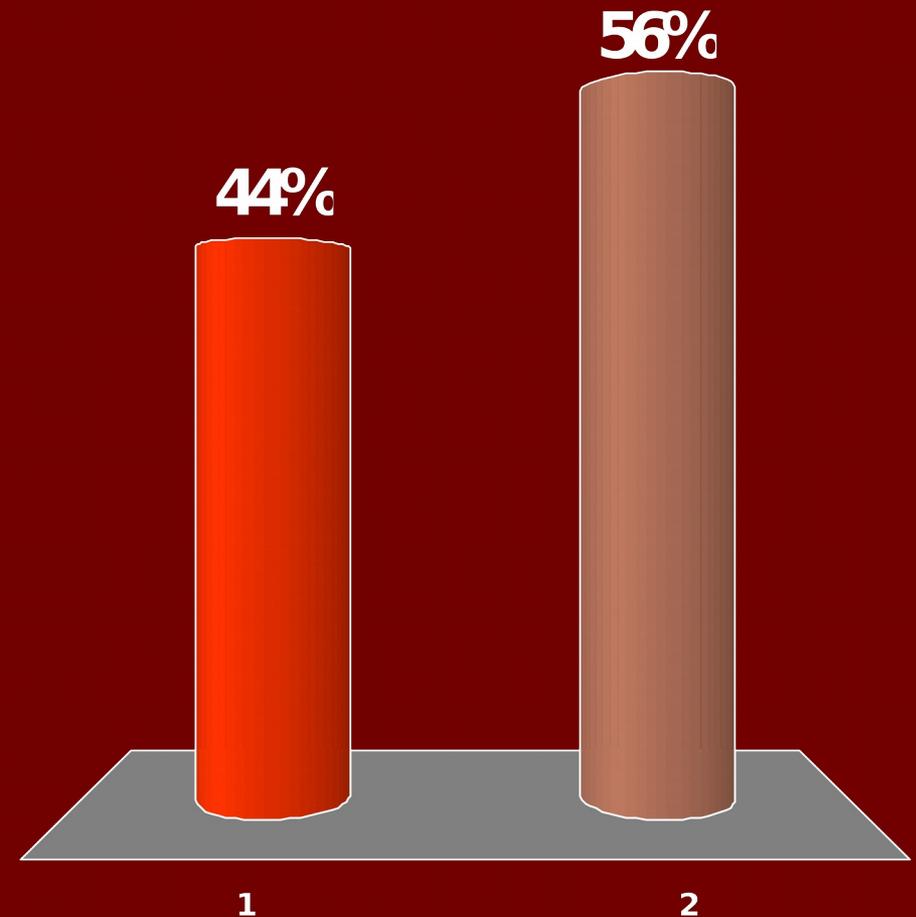


Potential (Actual) Problems

- The first step of tar sand extraction is estimated to result in gasoline that carries a burden of "at least five times more carbon dioxide" than would conventional "sweet crude" oil production. Difficult under Kyoto protocol.
- Large amounts of land need to be reclaimed after production ends.
- Large amount of water used/lost

Should the US continue to increase oil sand imports from Canada?

1. Yes
2. No



Oil Shale

- Oil shale is a combination of the rock shale (very fine grained) and the solid petroleum product *kerogen*
- When kerogen is heated to 800°F it breaks down into a liquid similar to crude oil.
- Total world resources of oil shale are conservatively estimated at 4.7 trillion barrels. (unproven reserves)

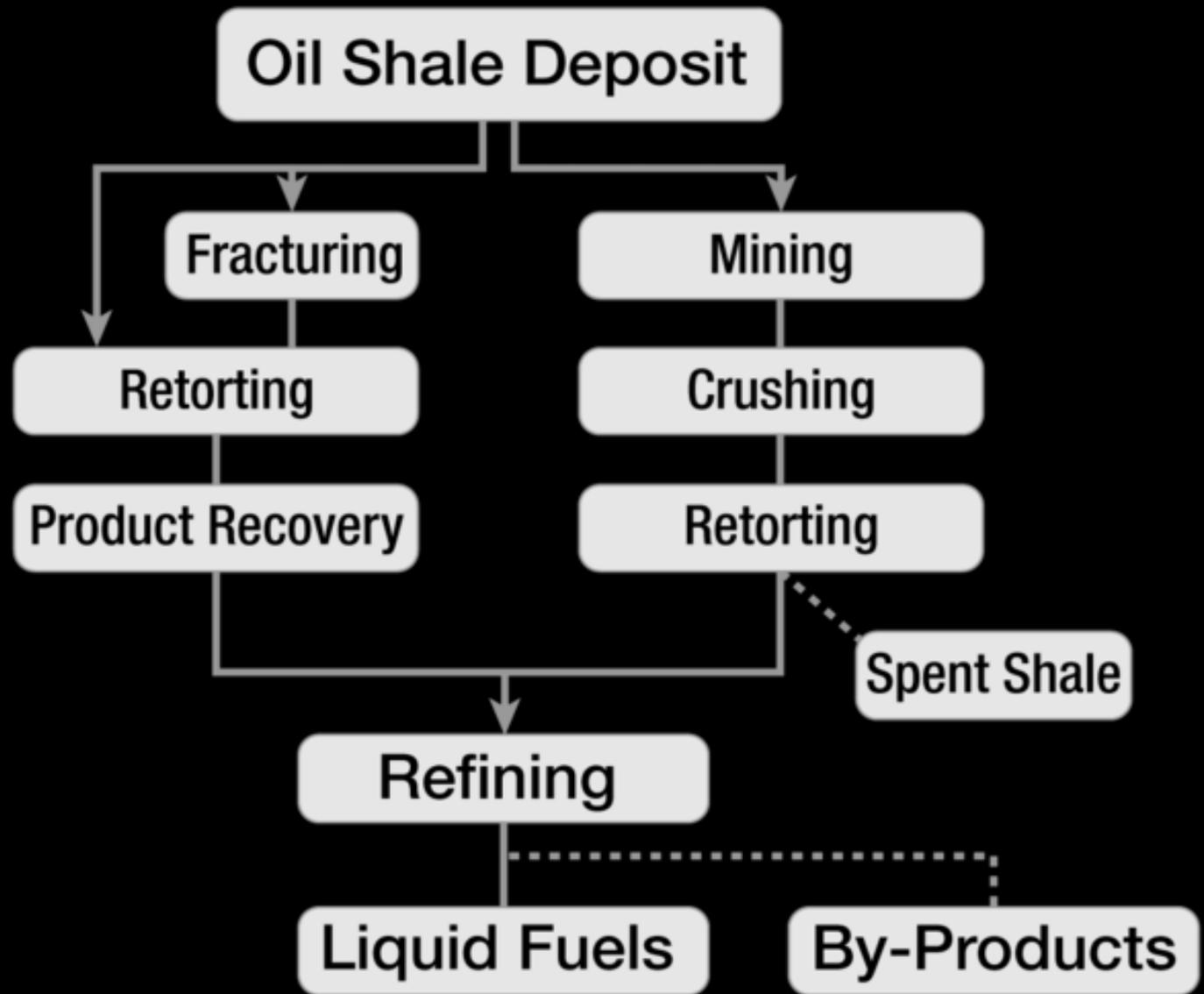
- At least 1 trillion barrel are recoverable worldwide
- $\frac{3}{4}$ is in the U. S.
- Good shale produces 25-35 gallons (0.6 barrels) of shale oil per ton of rock processed.
- Even modest production requires processing a lot of rock.
- Estimates of 500-1,000 billion barrels in US alone. (Way more than Saudi Arabia).

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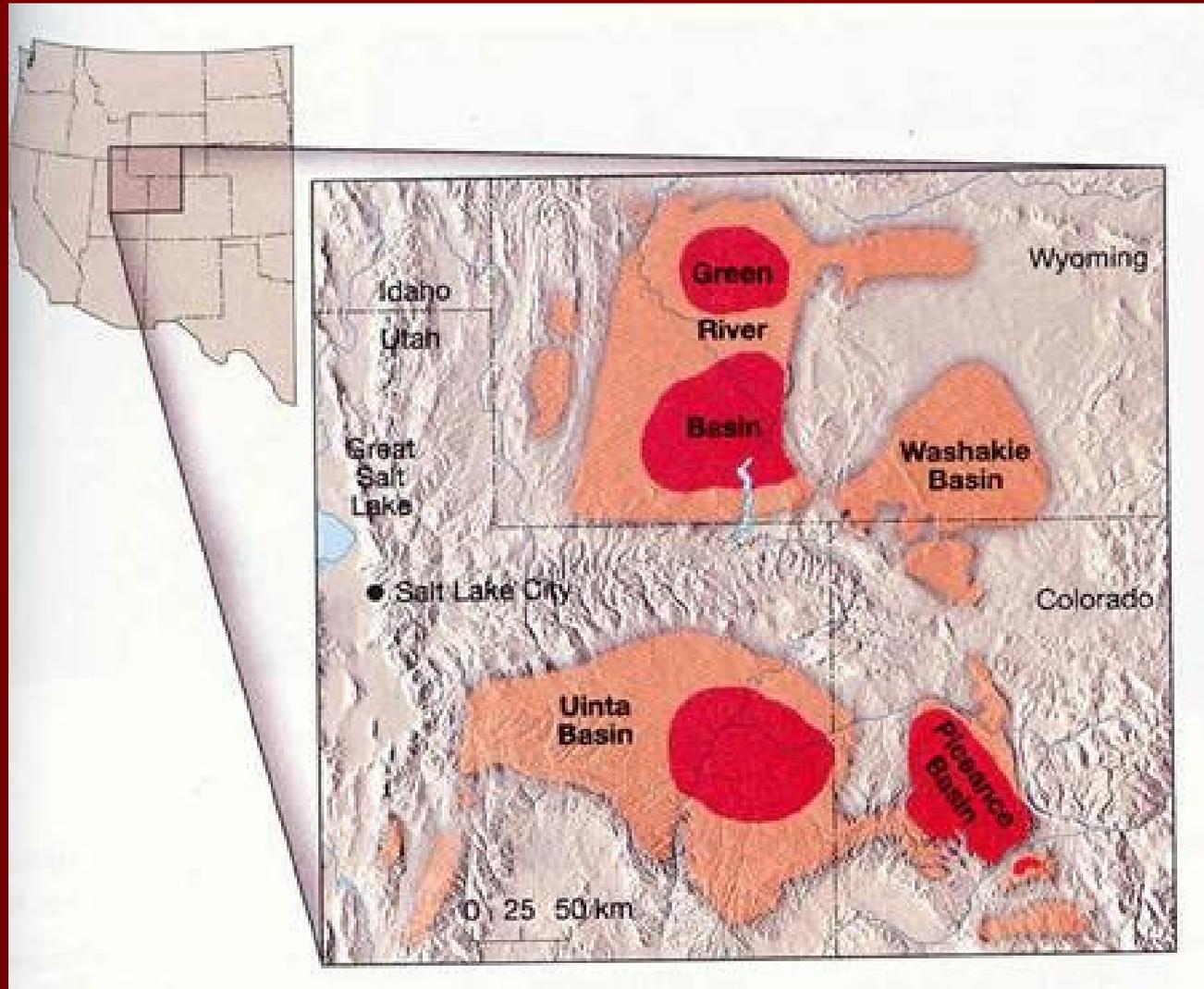
<http://ostseis.anl.gov/guide/oilshale/>

https://en.wikipedia.org/wiki/Oil_shale_reserves

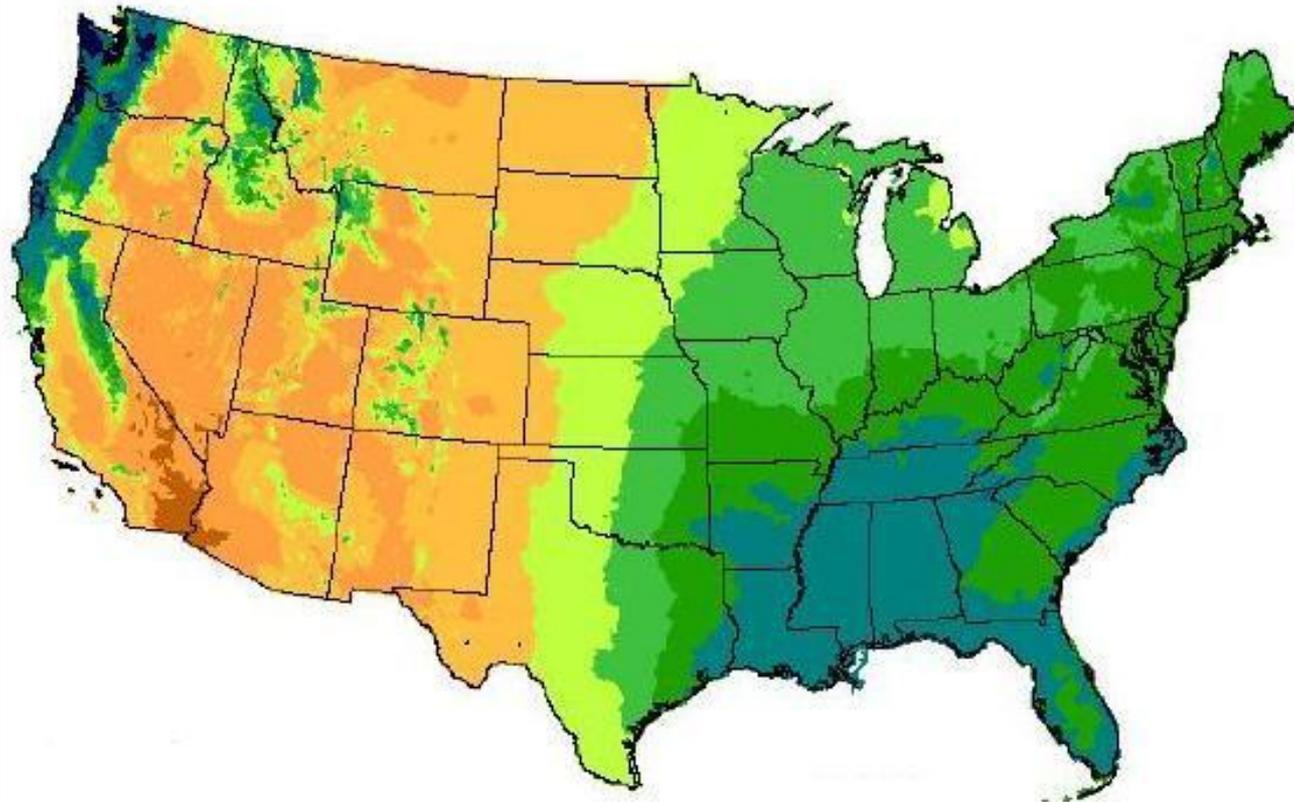
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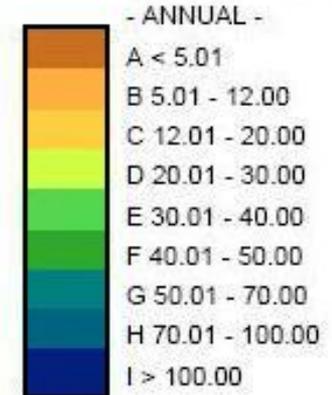
Oil Shale Reserves in US



US Average Rainfall



MEAN TOTAL PRECIP (INCHES)



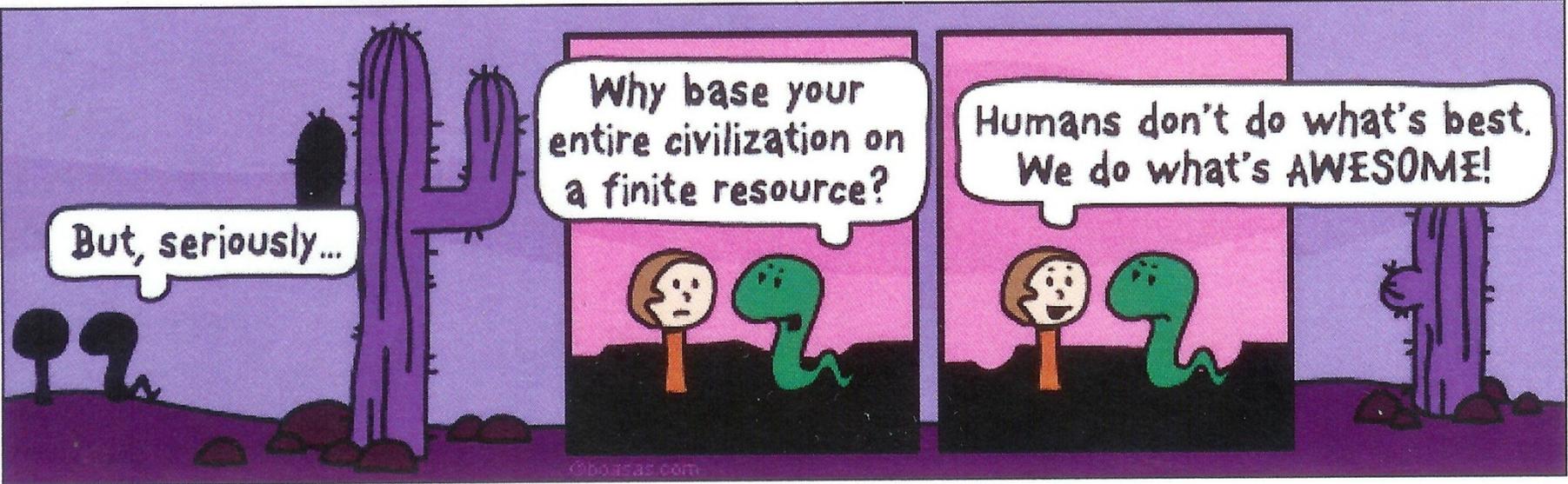
U.S. map showing annual precipitation in inches - Internet Accuracy Project

- Production requires a lot of people and water. Both are rare in the regions of the deposits.
- What do you do with the left over rocks?
- Can you find online videos supporting and opposing the development of oil shale resources?

Should we develop the oil shale deposits in the US?

1. Yes
2. No





But, seriously...

Why base your
entire civilization on
a finite resource?

Humans don't do what's best.
We do what's **AWESOME!**