

Cameron Todd would like to mine bitumen for oil. His company, US Oil Sands, holds leases on 32,000 acres of Utah state trust land. The state has granted the necessary permits, first at a 213-acre site near PR Spring, then on 5700 adjacent acres atop the Book Cliffs. PR Spring mine sits atop the 50-million-year-old Green River Formation that underlies much of the Uinta Basin.

We have leased 32,000 acres of land. Only a small fraction of our 32,000 is likely to ever be developed. I can't speak to exploratory lands that we haven't explored yet. I think they're likely not as prospective as what we've already got, but of the 5,900-acre lease that we've got at P.R. Spring, I would guess that our total area of development is less than a quarter of that.

The Green River Formation is a complex geologic strata comprised of many different facies which can quickly change from sandstone to shale to mudstone then back to sandstone—with some facies more likely to bear hydrocarbons than others.

Quite common to find multiple layers. Typically they might be twenty or thirty, forty feet thick individually; and in combined pay overall it's not uncommon to find sixty to over a hundred feet of combined oil-saturated members. The deepest that we've drilled is 500 feet, and the deepest that we've encountered oil is probably a little over 200 feet.

If it's too deep, you have to mine too much solids. If it's too lean, then you don't get enough out of it. 14% is a very good ore, and we've found some as high as 14% but it's not the average.

Todd and US Oil Sands are based in Calgary. He previously worked for larger companies in bitumen-rich Alberta, where projects commonly start with production levels of a hundred-thousand barrels a day. Todd knew that his new small company couldn't compete with giants like Shell, Suncor, and ConocoPhillips. The sheer scale of the province's brawling economics forced Todd to find fresh ground to demonstrate that a new extraction process which he says will more efficiently separate bitumen from sandstone. PR Spring would be the first place in the United State where bitumen will be mined for oil.

Economically you want to minimize how much solids you move, and you want to minimize how many times you handle it, because that's what costs you money. So what the best is, if you handle it once. So a truck bearing oil sand ore comes to the processing facility, dumps its load into the processor. That same truck goes around the back of the mine, picks up a load of clean sand, and runs it back to the mine and deposits it in the mine, and takes another load, on a closed cycle. Same truck, same day.

Our technology is better than other technologies in getting leaner ore. So economically and technically we can recover lower-grade ores.

What we get out of our process is about 96% recovery, up to 98%. There's no oil process on earth that gets that high a recovery. It's the most efficient process that we're aware of in the world.

Bitumen forms when hydrocarbons migrate from a source rock and lose volatile components in transit. The remaining material, hard as a hockey puck, tightly adheres to sand grains of the

Green River Formation where it's now found. In Alberta, hot water and steam are used to separate the bitumen. But in Utah, water's in short supply. US Oil Sands will use an orange peel extract called D-limonene to extract this bitumen, a process that requires far less water than is used in Alberta.

It dissolves oil, it works to unbind the oil from the sand grain. And it does the same thing on removing a grease stain off your shirt, or to get oil off of a mechanic's hands.

D-Limonene is a readily available product that is used by many, many people. You can find it in your health food store as a supplement to eat in pill form. It's fit for human consumption, it's a food additive for flavoring. It's nontoxic. It's used in perfumes and in cosmetics and in food products.

D-Limonene degrades naturally very rapidly, and it's left in the atmosphere. So as you would expect, it's a citrus product, and if you take an orange and leave it in the field, a couple of years from now there won't be anything left, it biodegrades. The solvent is very volatile, it vaporizes quickly. And it degrades with sunlight. And so between oxygen and sunlight and evaporation, it biodegrades pretty quickly. There isn't any liquid to move back and forth in the sand, and there's no liquid oil in the sand. The stuff that's left over is basically a solid, sort of an asphaltene that's left behind.

The reason we don't get 100% recycle is you can't get the water off the sand grains. So the amount that's left on it, that is not free water but bound to the sand grain is what's left. So when you deposit back in the mine, the sand is slightly damp. It's a very arid environment, and so all of our work to date has shown that the water concentration goes down pretty quickly, within minutes. What really happens is that every sand grain is gonna have water, an irreducible amount of water that's left on it.

Bitumen mining at PR Spring will proceed or stall because of the presence or absence of water. On one hand, US Oil Sands needed water for its operations, so it drilled 2000 feet to find an aquifer. The company is permitted to withdraw 360 acre-feet per year from its five deep wells, water that eventually would have made its way to the center of the Uinta Basin beneath the Green River. But on the other hand, from 2010 through 2012, the company also drilled 240 shallow wells. Cores from these holes were analyzed to produce a three-dimensional map of the Green River Formation beneath the PR Spring mine site. Drillers found bitumen, but they didn't find shallow water.

We drilled 240 wells in there, plus five water exploration wells, and we didn't find a drop of water in between the surface and at least a thousand feet. We drilled where we thought we were gonna find bitumen. But we drilled a sizeable amount of that 5,900-acre lease, and we were lookin' for water. I mean we had the right to the water if we found it near surface, and we want to put water into our people's facilities. If I'd have found good potable water there, we'd be drinking it. And we didn't find a drop.

If shallow water had been found, the company would have faced tighter regulations to prevent potential groundwater contamination from its operations. Despite protests, Utah courts have

upheld this absence of groundwater. USOS will still monitor water that is shed from its tailings, but now it's also turning its attention to reclaiming ground that will be disturbed during mining operations.

Our reclamation isn't something that's done at the end with some money that comes from someplace else. Ours is something that gets the sands, the overburden, and the topsoil is something that is an ongoing part of the operation. And it's not a capital cost later that comes from someplace else. It's an operating cost that goes against project revenues as you develop it.

I don't think we'll be above one or two hundred acres of nonreclaimed land at any given time, through the whole life of this project. It might be a little bigger than that, but the fact is that we reclaim our lands as we go, and it's an enormous change from the way strip mining works in most places in the world, and it's certainly an enormous change from the way mining works in Athabasca, in Canada.

What does it mean that the shares are ten cents a share? Means that you're a junior resource company. It means that I don't have a very liquid stock, and that most of my shareholders that have bought and held, and didn't buy and didn't sell. It's not uncommon for a company that's pre-production, pre-cash flow to not have a strong-performing stock.

Finding water has proven relatively easy compared to finding money for this junior company. Investors have been shy. US Oil Sands stock hovered at or below twenty cents a share for most of its existence. But in late October 2013, the company received a fresh infusion of investor cash and confidence, and is ready to move ahead with its facility—and mining—at PR Spring.

If Cameron Todd can successfully use D-limonene to extract bitumen—and ultimately oil—from oil sands, he knows there are bigger fish to fry than the discontinuous sands of the Green River Formation. Extraction of oil sands that are mined in Alberta requires vast tailings ponds fraught with environmental challenges. If his new process could improve operations there it would be worth billions upon billions of dollars.

Even if the big numbers of Utah are borne out—you know, 20 or 30 billion barrels of oil, it's still only one percent of the oil sands of Alberta.

The ten years of piloting that we've done, and the analysis of all of the tails and ore and water and oil that we get is enormous. We've done significant review of what it is that we make, and it's better than anybody's ever done before. I hope to be allowed to do more of it. I hope to show people in Canada that you can do it a better way, and hope to be allowed to go do it in Canada.

There'll be lot of people that will want to put this into their processes. But you have to build the first one before somebody's gonna want to do it.

Cameron Todd just wants to mine bitumen. His mine might initially produce 2000 barrels of oil a day. But even if production swelled to the company's 50,000 barrel-a-day goal, he doesn't

pretend that it would free the United States from dependency on energy from unstable sources in the Middle East.

[7:42a] You're not going to add a million barrels a day and change the equation of energy security in America. That's not gonna happen.....

[1009] But he thinks that his mine could provide employment for people of Utah.

[7:42b] Added together with other energy developments, it'll matter. It'll matter locally and it'll matter to the state, and it'll be relatively small in the context of the United States.

[1010] Cameron Todd writes, "I am an environmentalist because I want to leave the world a better place than I found it." It galls him when some would disagree:

[2:16:24] "When I go up in front of a judge in Utah and have my integrity impugned, or I have people put my name on wanted posters saying that this is Enemy Number 1 and he's killing five million people on the planet, I kind of take that personally."

[1011] Todd was a few minutes late when I visited him in Calgary. He arrived helmet in hand, having bicycled to the office. We talked about the environmental consequences of oil sands and energy development.

[1:55:55] I would love to get into a room with ten people from different walks of life and say, "How can we solve the greenhouse gas problem? What can we do about climate change?" What you need is a new technology that doesn't exist today in energy. We don't have a hope for it in wind—there's not enough. We do have a hope for it in solar, but the technology curve is enormous, and we need to get up that curve, and it's gonna take us thirty years. And we need a transformative energy approach in between now and then so we don't screw up the planet too bad between now and then.

[1013] If bitumen is to be a bridge to the future, what can we hope that future will look like?