http://seekingalpha.com/article/3975647-utah-oil-sands-best-left-un-mined?page=2

Summary

Utah has an estimated 12-19 billion barrels of bitumen underground in the desert. Even strip mining would be expensive and prohibitive.

US Oil Sands, Inc. is a Canadian public company that's all set to start operation at PR Spring, producing 2,000 BPD of Bitumen. Not really.

USO claims a novel solvent bitumen-recovery technology, reducing capex over 75%, using virtually zero water, a good fit for the Utah desert. Again, not really.

At first blush, one may believe that US Oil Sands, Inc. (OTC:UERLF) is a fresh E&P company, with an exciting new technology, about to start a modest 2,000 BPD open-pit bitumen production in Utah's PR Spring. And that it's a Canadian public company, traded on the TSX Ventures as USO. Also, that USO's disruptive solvent technology can radically reduce capex, as well as use far less water (than in Athabasca, Canada) for open pit mining. A perfect fit for the Utah desert, and its unique brand of water-free oil sands. But looks are misleading. None of the above is true.

The focus of this writing is indeed US Oil Sands, Inc. (which I'll abbreviate here as "USO"). Also, we are using induction to infer the inherent dangers from an estimated 12 to 19 billion barrels of bitumen buried in the Utah desert. The current low petroleum market prohibits oil sands' expensive recovery, even by strip mining. But

there may be a day in the future, when crude oil costs rise sufficiently to make this resource attractive.
I strongly believe that by then, we will have a severe water shortage to rival our fuel shortage. Using make-up 4.5 barrels of water per barrel of bitumen produced (and discharging the same, to some unlined settling ponds), makes extraction prohibitive. Normally, we learn by failure. In this instance, we cannot afford it. Worse than in water-rich Athabasca, the massive loss of the environment would be irreversible. The game is not worth the candle.

The rest of this article contains obscenely tedious calculations and numerical data. It relies only on published information, which is used in reverse-engineering mode to divine performance, capacities, and costs. If it were not such a life and death situation out there in the Utah desert, I would strongly advise readers to spend, instead, more time with their families.

1. Is It an E&P or E&E Company?

USO is actually an Exploration and Evaluation (E&E) company, masquerading as Exploration and Production, E&P. So what? The differences are significant, just like between the egg and the bacon at breakfast: the chicken contributed, but the pig was committed. An E&E will look for a swift exit, at a speculative high value of the resources in-place; this would be relatively low compared to an E&P exit on the same site, which demonstrated the final step to production and marketing. An E&P will have the production facility and its cash flow as significant boosters to its asset value. In our case of oil sands, the difference is immense, as capex is a huge barrier.

To appear as an E&P without investing $0.4 billion in production facilities, USO, with its novel Ophus solvent technology, yet unproven on an industrial scale, has to resemble good quality margarine, namely, feel like butter, and include some percentage of butter.
First, the butter. The Milestones below are collected from USO's website. They show an excellent 10-year track record, in terms of patenting, pilot testing, obtaining relevant permits for further mining operation, and a third party estimate of reserves.

Earth Energy Res.,Inc., and US Oil Sands, Inc. Milestones	
Date	
Apr. 2004	Completed 6 hr solvent test on 25 T Athabasca oil sand
Nov. 2005	Completed pilot test at PR Spring
Feb. 2007	Completed 24 BPD Automated, Instrumented Shop Demo test unit
Sept. 2007	Submitted Large Mine Application to Utah State Div. OGM
Oct. 2007	Submitted international PCT patent application
Mar. 2008	Received ground water discharge permit from Utah St. Div. OGM
Oct. 2008	Engaged Independent EPC for 2,000 BPD at PR Spring
Sep. 2009	Received Large Mine Permit from Utah St. Div. OGM
Apr. 2011	Earth Energy Res. Becomes US Oil Sands, Inc Public listed TSXV
Apr. 2012	Indep. Resource Assessment: 184.3 million barrels in place
Jun. 2014	US Patent (Ophus) granted. Assignee is USO.

Funding to date? Check. Obtained from six Private Placements, which continued even after the company converted to public status and listed on TSX Ventures, in April 2011, totaling C$113 million. Again, the ability to access this size private equity funding is quite remarkable, for a new technology. In USO's 2014 Annual Report, it is disclosed that 56% of the company is owned by insiders.

Potential Reserves in Place? Check. The acquisition of all of the PR Spring leases were completed as shown in the following Table, to a total of 32,055 acres.

Land Lease Acquisitions in Utah				
Date	Amount	Location	cumulative	
	Acres		Acres	Total, PRS
Jun. 2005	2,562	PR Spring	2,562	
Jun. 2005	50	?	2,612	
Apr. 2006	1,808	PR Spring	4,420	
Feb. 2008	1,905	Northwest	6,325	
Feb. 2010	1,560	PR Spring	7,885	5,930
Jun. 2011	24,170	Cedar Camp	32,055	

The initial (Phase-I) PR Spring project area, per USO's 2015 Resource Report, contains 3 permitted sites for open pit mining, apparently covering 235 acres; USO has calculated 12.5 million barrels of bitumen, as minable volume for these 3 pits. This volume is part of the total assessed "Discovered Resources" on USO's PR Spring property, which come to 184.3 million barrels of bitumen.

The Right Corporate Governance? Check. USO Chairman, Verne G. Johnson, is a black belt sensei in this shadow art form. Case in point: Elan Energy's (Canada, where Mr. Johnson was president and CEO) 1997 buy-out by Ranger Oil, Ltd., for US$407.4 million, plus debt assumption of US$111 million. The Elan buy-out followed Elan's acquisition from Amoco of its 190 heavy-oil properties at Elk Point, Alberta, including 43 million barrels of bitumen reserves, and some 7,500 BPD production, all for US$89 million. Nice differential.

So on, with recent sale of leases in Albania, by Petromanas Energy, Inc. (Verne is Chairman), for about $45 million, (following impairment of about US$25 million since 2015), and alongside a write-off to its entire Australian assets. As to Gran Tierra Energy, Inc., a

Calgary based E&P company also traded on TSX:GTE, the opposite. Focused on Colombia, GTE originally was registered as Goldstrike, Inc., in Nevada, 2005, with Mr. Johnson a founder and director. Alas, as GTE switched deeper into creating value through production, a different governance skill set was needed, and Vern retired, Aug. 2014. As Clint Eastwood's Harry used to say, a man has "got to know his limitations."

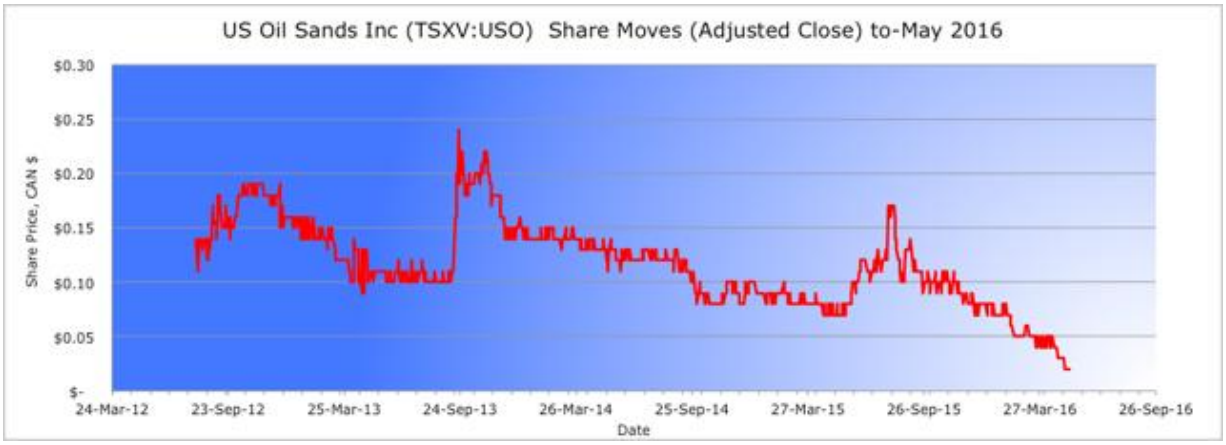
As to Frank Giustra's Blue Pacific Investments Group, Ltd., from Colombia, (2 board seats) one need not say anything. The man is a Canadian legend, a grand master in mining commodities. Do look this amazing person up. He recently sold all of US uranium sites he was holding, along with the 3 main Kazakhstani uranium mines he recently acquired cheaply, to none other than Rosatom (read, Vladimir Putin), for $3.2 billion. Frank turned down a seat on USO's board, but his spirit prevails.

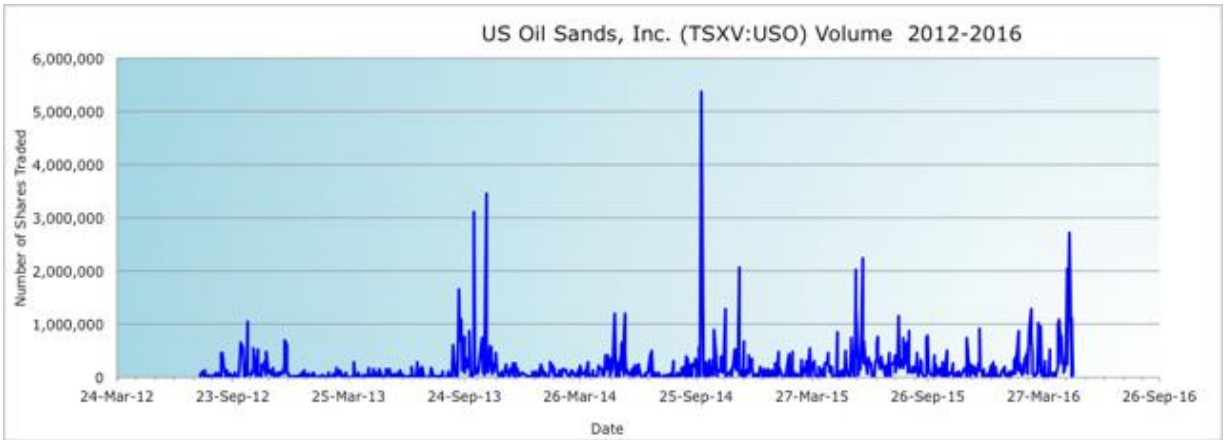
So USO is in good hands, as long as it is looking for a swift (relatively speaking) profitable exit, with minimal possible investment in production. We will return, in detail, to discuss their fascinating mechanism to appear productive. It is intended to serve a small number, perhaps just three or four, USO insiders. Other shareholders, the environment, and the state of Utah, are, to borrow a phrase from mining, being shafted as we speak. The breathtaking view below is from USO's 2015 Annual Report.

PR Spring Opening Mine Pit – September 2015

2. Is USO a Public Company?

Publicly Listed? Check. Ostensibly, a publicly listed company on Canada's TSX Ventures, USO in practice is acting as a private entity.





The figures above are a snapshot of the insiders' playbook.

Consider, for example, raising capital by repeated Private Placements, namely, special discounted private share offerings (so-called PIPE, private investment in public equity) turning to its insiders to raise capital. Ostensibly, a Canadian company, its insiders hold more than 56% of its equity. Its largest shareholder is ACMO s.a.r.l., at 26% (end of 2015), an offshore entity fronted by Anchorage Capital Group, LLC in NYC (one BOD member, a second pending). ACMO seems to also hold interest in McCarthy & Stone in the UK, a retired-homebuilder. Other major shareholders are, a Colombian firm called Blue Pacific Investments Group, Ltd., which is a Frank Giustra company, (2 BOD positions) and Spitfire Ventures, LLC, one (of many) Rodney Ray Lewis entities (one BOD member).

Spitfire is the proud owner of a Dehavilland DH89A Dragon Rapide biplane (1944), its only other listed property. Guess which guys buy their shares at a significant discount, get options or warrants for further exercise at each special offer, and stand to profit the most for their equity holdings when the company is

finally sold at a large multiplier to book value? You guessed right, the insiders, regardless of how low the share price falls. All of which may be legal.

No Debt? Check. USO has virtually zero debt, to date. This is an important buyout attraction factor, but a deterrent to serious production. Its recent attempt to get $10 million financing secured by production, in September 2015, has fallen through. USO has gone through at least 3 special private offerings since its switch to being publicly listed on the TSXV: (1) Within 30 days of its public listing in April 2011, for C$12.6 million, (2) in May 2012, another Private Placement for C$11.0 million, and (3) in October 2013, yet another, for C$81.0 million.

These were for field operations, lease acquisitions, project expenses. The last and largest one, to fund a "Phase-I" 2,000 BPD bitumen production at PR Spring, currently (April 2016) 90% complete. But wait, you get one more: (4) this April 2016, in effect as of this writing, a fresh Private Placement for C$12.6 million, to complete the PR Spring plant; what cost for the insiders? C$0.015/ share, while the concurrent TSXV share price stood at C $0.03. So, 50% off, not too bad?

We note that this way, the deep-pocket insiders do not get significantly diluted, because in the Private Placements, they will purchase shares in rough proportion to current holdings, at a generous discount. Those shareholders who do not ante up, get diluted significantly. For instance, the October 2013 "Strategic Financing" of C$81 million has increased the number of outstanding shares from 313 million to 853 million, while

the price per share remained unchanged at C$0.20/share from Sept. 30, 2013, to Oct. 31, 2013. Thus, the benefit to non-insiders in that sizable capital infusion was mostly spiritual.

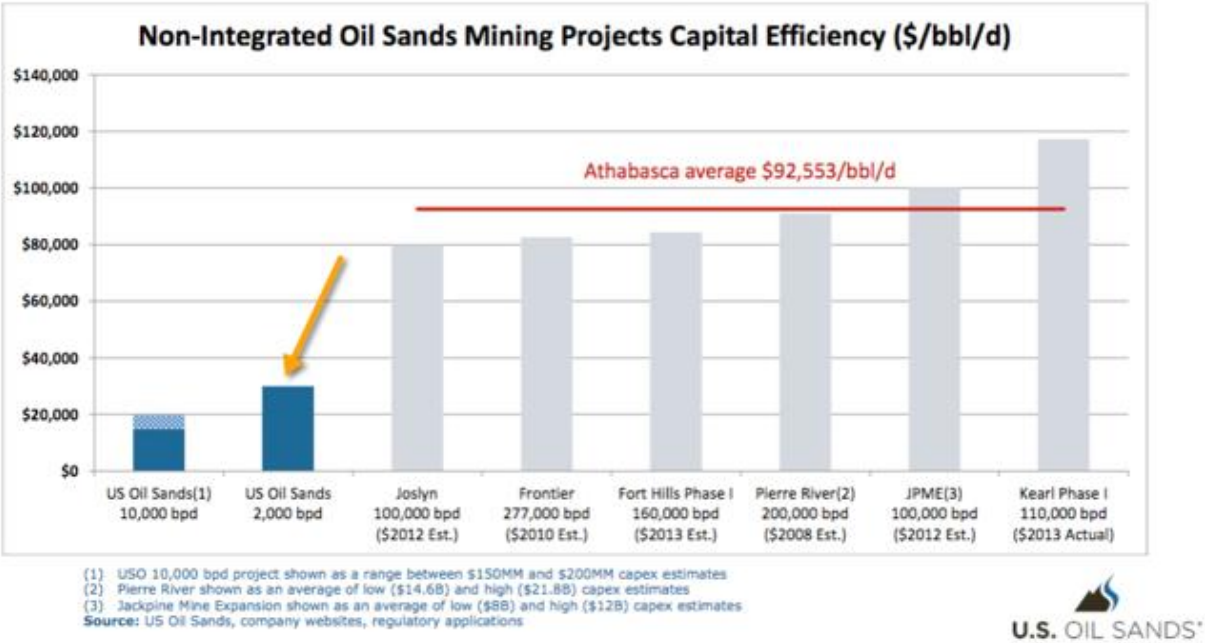
The current No.4 private placement would double the number of shares, to 1.9 billion. This feels a bit klutzy for a company that has zero sales for 6 years straight. To remedy, the BOD proposes (a) to change the name to something more globally appealing, and (b) to convert 100:1 the existing shares.

In summary, it appears that USO is listed as a public company only cosmetically, to attract a buyout. Yet its major financial transactions are private, inward-directed. By, and on behalf of, its insiders. Essentially, one can purchase a majority holding in USO by acquiring only the insider's shares, through a small number of simple transfers. This profit-taking would leave out the small shareholders, as the effect on stock price on TSXV would be minimal, or zero.

3. How Real is that Low-Low Capex?

The following diagram is reproduced from USO's 2014 Annual Presentation.

Lowest capital intensity of any recent mining oil sands project – even at small scale



Ultra-low capex is declared for its modest 2,000 BPD initial production. USO's Corporate Presentation of Sep. 2014 declares that it's technology can reduce capex by over 75%. This exuberance warrants a close look.

3.1 A Look at the Technology

USO is the assignee of the 2014 Kevin Ophus patent, US 8,758,601, "Removal of Hydrocarbons from Particulate Solids." What is it? A watery d-Limonene emulsion, added at relatively high dosage to the saturated oil sand, forming a bitumen+Limonene solution, which separates from the sand particles, and floats up. Since bitumen density is very close to water's 1 g/CC, and Limonene is 0.8411 g/CC, the emulsion tends to float to the top, whereas the sand drops to the bottom. For best performance, water emulsion of d-Limonene at 10% by volume were used, recovering some 98% of the bitumen-

in the lab. Temperature above 40 deg.C seems to have little effect on efficacy. This avoids the necessary air-bubbling and froth flotation practice, as well as recovery from middlings (as in Athabasca) but it obviously requires additional process equipment, such as Limonene distillation for reuse, heat recovery, Limonene/water solvent mixing, and solvent storage. Not to mention bitumen onsite coking, to make the exported Utah bitumen flowable.

USO tested this technology in a small, 24 BPD "shop demo pilot," possibly in batch process sessions, totaling several hundreds of hours. This was to test the effectiveness of product separation, with Utah oil sands as feedstock. There is no evidence of actual 1,000 hours continuous operation in process demonstration mode. A full process demonstration should be continuous, and include the ultimate bitumen/Limonene separation from water, the Limonene recovery, the water recycling, and the sand and clay separation from the water slurry, the steam raising distillation product heat exchanger, and a coking unit. If USO's effective water/sand plus clay separation relies upon the Robert Schutte patent, (US 3,869,384, Mar. 1975), one still needs a good sized settling pond, and there will remain recycled-water polishing issues.

Another issue in solvent recovery from the primary product by distillation is the Limonene boiling temperature of 178 deg.C. The diesel component distillation range is 150 - 370 deg.C, which will start during the bitumen solution heat-up. Therefore, one needs to separate and recover the lighter diesel components as well, complicating the separation.

Indeed Utah oil sands are different from Athabasca oil sands in several major parameters, as in the study by Oblad et al., 1975 using PR Spring samples:

From Oblad et al. (1975)	weight percent	
Components	Athabasca	PR Spring
Sand (44 micron)	75.3	90.5
Fines or Clays (44 micron)	8.4	1.5
Bitumen	12	7.5
Water	4.3	0.5
Bitumen Properties:		
Molecular weight,g/mol	568	820
Specific Gravity, g/CC	0.989	0.994
Viscosity, centipoise at 20 C	638,000	32,500,000

The Athabasca tar sands are termed "water-wetted" (bitumen encasing sand surrounded by clay and water layer), while Utah's tar sands are termed "oil-wetted," without intermediate clay/water layer. The differences in processing would be profound. We note the lower PR Spring clay and water; yet clay is not at zero concentration in Utah. We also note the ultra-high viscosity, which would require possibly some onsite coking to make a flowable bitumen; this would definitely mean further energy input and residues, especially solid. Finally, we see a significantly lower recoverable bitumen in the saturated sand: 37.5% lower than Athabasca. All of these would affect capex, and impact OPEX.

In summary, the information in the public domain regarding the USO d-Limonene process, shows at best a

development stage. The process seems un-demonstrated as far as its application on industrial scale, such as the USO "Phase-I" 2,000 BPD. The claim of near-total solvent recyclability is of particular concern. Indeed Utah oil sands contain far less clay (and water) than the Athabasca type. However, unless the clay concentration is zero in the saturated oil sand substrate, Limonene solvent distillation from bitumen could be problematic (as experienced in the failed solvent demo at Asphalt Ridge, 1997), and waste water clarification for reuse remains a serious and expensive undertaking.

To quote from the USO website, explaining the difference between the Ophus process and the classical Karl Clark hot-water (1929) process: "All of the capital cost and operating expense associated with creating bitumen froth, froth treatment, middlings treatment and tailings pond management and reclamation is eliminated. The result is a highly capital efficient and operationally simple extraction process."
Indeed, the above avoidance amounts to a significant reduction in capex, but less than 50%. What is omitted is the considerable extra elements, introduced by the Ophus solvent process, which will add to complexity, and capex, quite a lot.

The point we are making here is, that the USO process overall, applied to the Utah oil sands, is quite similar to the conventional Clark hot water process in complexity. The USO/Ophus process additionally requires (1) a solvent mixing stage (quite long in batch mode, to get a proper d-Limonene solution in water); (2) a rather elaborate distillation stage to recover the d-Limonene from the bitumen/limonene solution at a temperature of

178 deg.C, while co-distilling the light diesel fraction; (3) steam raising by heat recovery, (cooling the products from the solvent extraction); (4) also, must address a raw bitumen 50 times more viscous than the Athabasca variety, so a coking stage might be necessary for export product mobilization. All of these are unique to the PR Spring project, do not appear in Athabasca, and have significant capex impact.

Thus, in the balance, the USO process may credit the Ophus innovation for less than 40% reduction of the total capex needed relative to the Clark Hot Water technology used in Athabasca (and in Asphalt Ridge Utah)-if any reduction at all.

3.2 Calculation of the Implied Capex

Comparison with the Athabasca plants is both relevant and illuminating. Athabasca in Alberta, Canada, is the only region in Canada where open-pit tar sands mining is performed. So we would be comparing apples to apples. From Nat. Post, 2015:

ECONOMICS OF MAJOR NEW OILSANDS PROJECTS

	Company	Incremental production (thousands of barrels per day)	WTI breakeven (US$ per barrel)	Capex ($/flowing per barrel)
Mining Projects				
Kearl with Debottleneck	Imperial Oil Ltd.	235	$85	$56,915
Horizon Expanion	Canadian Natural Resources Ltd.	127	$90	$91,200
Kearl Expansion	Imperial Oil Ltd.	110	$95	$81,818
Fort Hills	Suncor Energy Inc. – Total SA	164	$96	$82,317
In-Situ Projects				
Christina Lake (F & G)	Cenovus Energy Inc.	122	$68	$32,000
Foster Creek (F, G & H)	Cenovus Energy Inc.	120	$73	$38,000
Jackfish Phase 3	Devon Energy Corp.	35	$76	$37,142
Surmont Phase 2	ConocoPhillips Co. – Total E&P Canada	125	$76	$44,037
Nabiye	Imperial Oil Ltd.	40	$70	$55,000
Kirby North	Canadian Natural Resources Ltd.	40	$80	$40,000
Sunrise	Husky Energy Ltd.	60	$82	$53,333

SOURCE: CITI RESEARCH

ANDREW BARR / NATIONAL POST

We ignore the In-Situ projects. If we use the Horizon Expansion, Kearl Expansion, and Fort Hills projects' at 60% of capex respectively, and scale down from each to the USO 2,000 BPD project at PR Spring, we will get a USO capex of C$400 million to C$468 million (2015 dollars). These calculated values are not just larger than the USO-projected US$60 million. They are an order of magnitude higher.

Conversely, what bitumen capacity could capex of, say, C $80 million afford? With the 3 parameter groups above, using the same 60% assumption of Athabasca capex, we get a scaled PR Spring project capacity of 85 - 110 BPD. The prevailing USO budget is therefore quite reasonable for a technology demo, but NOT for an actual industrial operation at 2,000 BPD.

An ad hoc conclusion: USO did not seriously intend to

enter industrial production, because it is too expensive, and risky, especially at a small scale such as 2,000 - 10,000 BPD.

USO admits (2015) that the Ophus technology is a development. By definition, therefore, it is not ready for industrial scale application. It would be far too risky (and therefore, expensive) to finance a US$400 million PR Spring 2,000 BPD experiment, only to have it fail. It is crystal clear that the USO management team, a group of seasoned professionals headed by Cameron Todd, CEO, knew all about the data quoted above, as well as the complications of the Ophus process as discussed here, and know as well as I do, how to scale up or down similar chemical plants. This information must also have been shared with the BOD, chaired by the astute, aforementioned Verne G. Johnson, and hence, shared with all of the insiders mentioned earlier. There should be no doubt, therefore, that the misleading statements in the 2015 annual presentation, explicitly connecting the low production capex with "2,000 BPD," are part of a USO strategy.

As stated in the USO 2015 Annual Report:

US Oil Sands expects to complete its first commercial development at PR Spring, Utah for a cost of US$60 million. It is a modest sized project of 2,000 barrels per day, with an estimated cost of US$30,000 per barrel of capacity, a small fraction compared with recent Canadian megaprojects. The project is expected to be completed in under two years, thereby exposing investors to a much shorter cycle time, and if successful would be economic at lower oil prices than previously possible. The project is well-suited for expansion and the Company will target to repeat development once the technology has been commercially demonstrated.

Suppose you are a hypothetical buyer, checking out potential value. If USO invested US$60 million, and produced only 110 BPD of bitumen sold at *net*US$10/barrel (say, 2017 and on; today, the gross might be US $8.00/barrel) your 15-year IRR = -21%; this should be somewhat of concern. If, on the other hand, the

same capex is promised (by Miracle) to produce 2,000 BPD, you, the potential buyer, calculate 15-year IRR = +7%, not too bad. The freezing of PR Spring project construction "at 90% completion" in April 2016 is therefore a wonderful position for USO to be in, when considering a potential buyout. Why so wonderful? Because the evidence of actual production is avoided.

4. A Recent Precautionary Tale of Utah Oil Sands

The information regarding the availability, stratigraphy, composition, and bitumen characterization at PR Spring was in US reports, published about 1975, soon after the famous 1973 Saudi oil embargo.

In 1997, a company called Crown Energy Corp., in accordance with its 10-K filing, intended to build a bitumen production plant at Asphalt Ridge near Vernal. The plant was to mine 3,000 s-ton/day of oil sand, and produce 1,700 BPD of bitumen. It declared a partnership with MCN Energy Group, Inc. to provide 75% of the financing, sold $5 million of its preferred stock to Enron Corp. to raise capital, and obtained rights to US Patent 4,968,412 (1990) by E. Park Guymon, for solvent method to remove bitumen from tar sands contaminated with clay. The solvent: condensate from natural gas wells.

Crown's declared capex: $19 million (1997 US dollars). With a CPI inflation factor of 1.48, this is $28.1 million in 2015 dollars. Let us digest this a bit. The Crown declared metric ore rate is 2,724 Tonne/day. With the US Bureau of Mines (1975) data, we can expect 1,149 BPD of bitumen, not 1,700 BPD as advertised. Further, using our

40% discount over hot-water processing, the capex (2015) calculated should be, at best, US$278 million for the declared 1,700 BPD capacity. This is a factor of 10 over the Crown estimate. As we know, it did not take a long time to fail - likely long before a full sized plant was built. It is unclear whether this was a naïve attempt, or something stronger.

Interestingly, despite the dire predictions of the Oblad study (1975) mentioned above, the Clark process is *not* ineffective in Utah. It was called in to salvage the failed solvent project, and demonstrated with expert help from CANMET, 1999-2000 building and operating a 240 BPD pilot, at Asphalt Ridge. The Coleman group inherited some of the old equipment. This information, further discussed below, is totally omitted from the USO propaganda, for obvious reasons.

The 240 BPD continuous-flow demo operated intermittently for about 1 full year, culminating with a 288-hour uninterrupted performance. It was using the Clark hot water process, with caustic soda (NaOH). Froth was the means of bitumen separation, and the process produced dry tailings. Reported by Coleman et al, 2004: "... *operation of the (solvent) facility yielded poor economical results,*" mainly due to clay interference with its solvent recovery (distillation). Also see: History of Asphalt Ridge tar sands development.

There is no indication whatsoever, that the Ophus process can avoid the problematic small percentage of clay in the mined oil sand, which can potentially disrupt solvent separation, as it did in Crown's Guyman process.

5. Recalculation of PR Spring Mining Resource Parameters

USO has reported (Resources Report, 2015) some useful parameters for assessment of the quality of their resource for Phase-I, as well as its ease of mining, reproduced below.

Disclosure of Contingent and Discovered Resources

Table 1.0 In-Place (Mineable) Barrels and Contingent Resources in Phase I Mine Pits

Pit No.	Ore Grade (Wt. %)	Mineable Volume (bbls)[1]	TV/BIP Ratio	Strip Ratio
1	8.9	740,629	8.2	0.66
2	8.8	6,212,732	11.4 - 16.6	1.16 - 2.24
3	9.3	5,579,288	9.0	0.76

Total = 12,532,649 bbls

Best Estimate Un-risked Contingent Resources (incl. recovery factors[2]) = **10,715,415 bbls**[4, 5]

Total Discovered Resource on property = **184.3 MM bbls**[3, 4]

Following the doubt raised regarding USO's capex and the 2,000 BPD capacity, It is of interest to make an independent calculation of the "Table 1.0" parameters, based on the data published by the US Bureau of Mines (1975):

ABSTRACT

This Bureau of Mines report presents the analysis of three cores from the Asphalt Wash area of the P.R. Spring tar sand deposit of northeastern Utah. Two tar sand zones are indicated in the Asphalt Wash Area. Total net thickness of the tar sand ranges from 23 to 39 ft, with occurrences between 56 and 263 ft in depth. The sand has average porosity of 24.7 pct of bulk volume, average permeability before and after extraction of 87.5 and 596 md, respectively, and average oil saturation of 58.1 pct of pore volume. Oil gravity averages 10.9° API.

Taking the best scenario, we use the thinnest overburden with the thickest saturated oil sand layer, namely, OB= 17.1 m (56 ft), TS= 11.89 m (39 ft). Thus, the calculated Strip Ratio, SR= OB/TS = 1.436, which is inside the USO range shown for Pit #2. High SR is more difficult to mine. Again, using the parameters from USBM above, we can calculate the volume fraction, Xb, of bitumen in the saturated sand's total volume:
Xb = Vbit/Vts = (Vpores/Vts) * (Vbit/Vpores) = 0.247 * 0.581 = 0.1435

The ratio of densities of the bitumen (0.9936 g/CC = 10.9 deg.API) to that of the bulk density of the saturated tar sand, (2.139 g/CC, given elsewhere in the USBM Report), allow calculation of the Ore Grade, which is the mass fraction of bitumen in the saturated tar sand:
OG = [DENS(bitumen)/DENS(oil sand)] * (Vb/Vts) = [0.9936 / 2.139] * 0.1435 = 0.0667

Namely, in percentage, the calculated "Best" OG = 6.67%, which is considerably lower than all 3 values in USO's "Table 1.0." Of course, the higher the OG, the better. Now we calculate TV:BIP, the ratio of total volume mined to the volume of bitumen in place. We use the volumes per unit area:
TV:BIP = Vtotal/Vb = (OB+TS)/[Xb * TS] = (17.07m + 11.89m)/[0.1435 * 11.89m] = 16.97

The smaller the TV:BIP the better. The "Best" value calculated above is larger than the upper limit in USO's "Table 1.0." Finally, how about the total volume of bitumen in place? If the total permitted area were 235 acres, and an acre = 4,047 m 2, we can calculate
Vb(barrels) = Xb *TS *A = 0.1435 *11.89 *(235* 4,047)

* 6.2898 B/m 3 = 10.2 million barrels.

This value is close to the "un-risked" value given by USO (10.7 million barrels).
In summary of this brief detour, it can be said that the overall "Best" picture is dimmer than USO's data indicate. The overburden is thicker, the total mined volume needs to be larger, the ore grade lower-about 25% lower than the USO declared value, and the estimated volume of bitumen in place is smaller, by about 20%. It is indeed expected that more meticulous core sampling (as USO has done) of the specific pit area, will yield higher fidelity data regarding the underlying ore. So long as these data are unavailable, the systematic shift from the USBM (1975) "Best" parameters, as shown above, is cause for concern.

6. Rough Estimate of USO's PR Spring Production Capacity

The enclosed panoramic photo is from the USO 2015 Annual Report, showing their processing plant at near completion. It includes several common features such as people and cars, so dimensions may be estimated by proportion. For instance, the left guy in the short yellow jacket, in the pair standing in the center below the small hydro-cyclone, is 6 ft. tall. It would be interesting to calculate the actual plant production capacity implied by the dimensions read from this photo. This is of course but a crude calculation, with no further information than is given in USO's publications.

PR Spring Winter Construction – November 2015

6.1 Overall Plant Capacity

The 4 olive drab vertical cylinders shown right of center have h=10 m, d=6 m each, and combined capacity of 1,000 m 3 of liquid, and are *likely* d-Limonene/water solvent storage tanks. The 2 coupled conical reactors in the foreground center are *likely* hydro-cyclone emulsion/ water/sand separators. The cyclone dimensions are for the primary (left), d=7 meters by h=7m, and for the smaller secondary, d=5 m by h=6 m or so.

The horizontal cylindrical white shape left of center, is a rotary drum mixer, *likely* for incoming ore at left, and mixed discharge of product, water and sand facing right, to be lifted into the first cyclone. The rotary drum mixes the crushed saturated oil sand with steam and solvent (likely a 10% emulsion of d-Limonene in water). Its external dimensions are L=9.5 m and d=3.5 m. Allowing for insulated walls, the internal volume of this rotary drum mixer is about 65 m 3. This type of mixer must normally be operated at low RPM, with no more than 15%-20% of the cross section filled by solid and liquid. In other words, the volume occupied by liquid solvent

plus saturated ore should not exceed about 13 m 3 at any time.

From the foregoing calculation of "Best" case for PR Spring, the volume of saturated oil sand mined per barrel of bitumen, is 1.1 m 3/barrel. Production of 2,000 BPD must therefore process 1.1 * 2,000/24 = 92 m 3/hour of saturated ore.

To allow 98% bitumen recovery by mass, the Ophus patent teaches that a primary product solution of bitumen and d-Limonene is to be formed, with a mean density of 0.9007 - 0.9039 g/CC. This will float on water. A simple calculation shows that the d-Limonene solvent therefore must be 60% by volume of this primary product. Hence, to produce 1 barrel of bitumen, one must provide 0.60/0.40 = 1.50 barrels of pure d-Limonene. According to the patent, the d-Limonene is applied as a 10% (by volume) water slurry. In other words, the active solvent requires 13.5 barrels of water, mixed with 1.5 barrels of d-Limonene, to produce 1 barrel of bitumen.

The foregoing calculations shows, that for a production of 2,000 BPD of bitumen, one needs 1.5 * 2,000/24 = 125 barrels/hour = 20 m 3/hour of pure d-Limonene, as well as clean water, 13.5 * 2,000/24= 1,125 barrels/hour = 179 m 3/hour-just for the primary-product emulsion forming.

The addition of saturated steam to raise the temperature of the above mixture to about 60 deg.C in condensing mode, at 80% efficiency, would require about 21 Tonnes/ hour of low steam (about 13 MegaWatt thermal), which adds 21 m 3/h to the slurry upon condensation.

Now the total volume to be processed in the rotary drum mixer becomes clear. It comprises of the volume of ore, plus the volume of solvent-emulsion and steam as described above: a total volumetric flow rate of 92 + 20 + 179 + 21 = 312 m 3/hour.

For 2,000 BPD, the aforesaid rotating drum dimensions imply a processing time of 13 /312 = 0.0417 hours = 2.5 minutes. This seems shorter by an order of magnitude than the expected reaction time in forming the primary bitumen product. For 100 BPD production, the implied gross volumetric flow rate would be about 16.6 m3/hour, and the calculated drum residence time, 13/16.6 = 0.783 hours = 47 minutes, which may be sufficient to complete the primary product emulsification.

In the same vein, assuming the 4 vertical tanks are solvent slurry holding tanks, with capacity of 1,000 m 3 as estimated above, these will allow operation of 1,000/(179+20) = 5 hours total. Allowing for the times for separation of the primary product in the hydro-cyclones, plus distillation time to recover the solvent from the primary product, and adding the long mixing time of d-Limonene in water (as described in the Ophus patent, one batch mixing may last up to 24 hours)--the tankage should hold more like 70 hours or 3 days worth of ready solvent. Again we see a lower order of magnitude applied to solvent tankage volume-strong indication of lower capacity: At 100 BPD production, 1,000 m 3 solvent storage capacity is 100 hours worth, quite acceptable.

6.2 The Cost of d-Limonene

Bulk cost of this solvent is $894.60 per 42-gal barrel. Supposing that fully 97.5% was recycled by distillation of the primary product (This must be the most successful solvent recovery on the planet). Then the daily attrition (at a production rate of 2,000 BPD) comes to 2.5% * 1.5 * 2,000 = 75 barrels/day or $67,100/day. The annual cost is quite prohibitive, at $22.4 million-even if discounted by 50%. It must be stressed that the presence of small amounts of clay can severely complicate the Limonene distillation process, as was the experience at Asphalt Ridge (with their NG Condensate solvent), in 1997-1999. Thus actual solvent recovery may be considerably lower than 90%. As we know, the 1997 solvent demo ("1,700 BPD") by Crown Energy Corp. at Asphalt Ridge, was a failure, with a far cheaper solvent.

6.3 Water Usage

A brief word about water usage at a production scale of 2,000 BPD. Just the combination of steam and solvent dilution calculated above, requires 21+179 = 200 m 3/ hour of clean water (especially for steam). Suppose that, realistically, 70% of the water can be effectively cleaned for reuse. This is quite optimistic. The makeup fresh water is therefore 60 m 3/hour, or, per barrel of bitumen produced, 60 * 24 /2,000 / 0.159 = 4.5 barrels-water per barrel of bitumen. This is the same as the consumption on average at Athabasca's oil sand operations. The difference between Utah desert and Athabasca, is the Athabasca river, is already severely impacted. In Utah's desert, the demand would be for 127 million gallons/year. Where from? Also, we should be looking for a discharge of waste water at roughly the

same volume. Where to?

Ah, forget about this project's energy consumption.

This may be continued ad nauseam with the hydro-cyclones deployed for primary product (bitumen/d-Limonene), and the sand separation unit, but one should, by now, get the picture.
In the panoramic picture above, therefore, we are not looking at a 2,000 BPD facility, but rather a 100 BPD facility at 90% completion, a factor of 20 lower than advertised.
Why not tell the truth up-front? Because the magic of low-low capex will be gone. And once it is gone, there is not much to look for in terms of a quick killing in Utah's oil sands: It is very expensive, still risky, and for the foreseeable future, with low crude prices, unprofitable.

7. Conclusions

The cynical investor may see no harm in this game of equity hide and seek, and would consider upping the production capacity by a factor of 20 but slight, creative exuberance. After all, the buyer should go through due diligence, and all seller's annual reports are full of legal forward-looking caveats, and vague warnings of "development." And, after all, the seller has provided 100% of the C$113 million invested to-date, has all the right milestone parameters checked, and has zero debt.
Oh, the off-shore thing and private/public dance? We have seen so much off-shore (and, grand scale, on-shore) mischief since 2008, that it has transformed into just another way of doing business, quasi-legal.

But for one or two things, near harmless.

7.1 The Great Desert Hold-Up

First, a desert is a national treasure of wild life, fresh air, pristine landscape, clean water, flowers and trees. It is a live thing in our common custody, to be kept alive not just for us, but also for the next generations. Second, ostensibly there are some 12-19 billion barrels of bitumen "in place" underneath. If this is a potential energy bonanza, it, too, should belong to the people of the state.

Even the state of Nigeria would take an onshore royalty position of 20% - so why not Utah? The state government of Utah has chosen to lease 32,000 acres of untouched desert for C$12 million or so, with annual lease payments of about $300,000 or less - until 2021. A pittance. The money is long spoken for, gone. Which leased acres will, with all the promised "remediation" and "95% water recycling," look and feel just like Athabasca, Alberta. Take a good look at success. Alberta's bitumen output before the recent fire: 2.3 million BPD.

Namely, the future of those leased acres: A desolate, scarred, contaminated, dangerous wasteland. For an ongoing operation, consuming hundreds of millions of gallons of water per year, from water resources already under severe pressure. Because USO is looking for a swift exit, it does not give a fig about remediation or ground water. Someone else will assume the liabilities. USO's allotted "Remediation" budget of 2015, about US$1 million, will be insufficient even to clean up its demo facility. The scar left by the started Pit No.1? it will remain bare for 200 years, and ground erosion will ruin everything on the slope downhill from it. Look again at Fig.1, and weep.
But wait, what I describe above, already happened at Asphalt Ridge, Vernal, and should serve as a warning.

Luckily, there was but minimal strip mining done prior to the "1,700 BPD" plant failure, mentioned earlier. This was followed, until 2012, by small-scale asphalt mining on site. Currently (May 2016), there is an unfolding environmental lawsuit against the bankrupted Crown Asphalt Ridge, which has abandoned its site full of broken concrete, rusting steel and a failed remediation, virtually on the streets of Vernal. See satellite picture below, on the left.

And yet, unbelievably, some new company, Tar Sands Holdings II, bought out the bankrupt carcass of Crown, and wants to continue the open pit mining on the same site, per the Salt Lake Tribune article. Per SL Tribune report, They want to process some 663,000 Tonnes/year of tar sands, for 11 years. The SL Tribune article provides a ground level picture of their dream, see below.

The point: The USO facility at PR spring first and foremost is a daylight robbery performed on the people of the state of Utah, and the rest of us, U.S. taxpayers. Done by the masters of USO, and facilitated by the government of Utah. We, the people, are not supposed to see any benefit of this grand transaction, but suffer the destruction it makes, the water shortage it creates, and eventually pay billions to remedy its damages. Those cheap mining rights, which may have made sense several hundred years ago, are sadly still in effect, to serve the very few on account of the taxpayers. The hope for jobs, development, taxes, are all powerful drivers for permitting cheaply. Water shortages are played down, and environmental devastation, long a trademark of

mining in the U.S., is taken as an obvious given right. Sadly, as illustrated by the Asphalt Ridge story followed by the PR Spring story, just 20 years apart, this will happen again.

No, there will be very few new jobs, virtually zero development, and not a red cent for the rightful owners of the desert resource, the people of Utah. There will be no USO paid taxes, as deferrals, and possibly millions of dollars in incentive credits, take precedence. And, of course, unlike Nigeria (20% royalty onshore), no royalty payments. But there is an assured bonus: Billions of dollars in remediation costs, once it is found out what is leaching into the ground from those unlined cesspools shown above, foreground.

7.2 What about USO?

If a brainless buyer happened by, USO will ask something like $500 million for its assets. My fair guess. But since the continuous downward spiral of oil prices, and the USO share price at some $0.02, they may consider letting it go for $100 million, tomorrow afternoon, cash on the barrel, at Calgary. The majority of which money goes, you guessed, offshore.

If, on the other hand, USO manages to complete its production operation, the day of reckoning low-production, high-capex, and expensive Limonene, is nigh. It is left to us to find out, which is worse.

7.3 What to do?

We learned from Athabasca, Alberta that capex is very high, and oil prices can go quite low. And we can see

their toxic moonscapes. The best outcome should be to leave all of the oil sands in place in Utah, untouched. There is no money to be made there, only grief.

Disclosure: I/we have no positions in any stocks mentioned, and no plans to initiate any positions within the next 72 hours.

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