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# Development of Utah Oil Shale and Tar Sands Resources

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### ***I. Executive Summary***

This paper discusses the key issues facing development of the oil shale and tar sands resources in the State of Utah and makes recommendations to encourage development of these needed energy resources. Oil shale and tar sands represent alternative energy resources that should be considered as part of the comprehensive domestic energy portfolio to provide safe and secure energy at home and increased global energy market stability.

An overview of the Canadian tar sands commercial development is provided as insight into issues and solutions applicable to the potential oil shale/tar sands development in the United States and Utah in particular. The review of the Canadian tar sands experience highlights differences on matters of both concern and opportunity,

***With energy prices reaching record highs, especially costs for liquid fuels, there has never been a more important time to advance policies that allow for utilization of our vast alternative energy resources for purposes of realizing enhanced energy and economic security for the United States.***

Utah's oil shale and tar sands resources can be economically developed in a sustainable manner in accordance with sound environmental principles. However, obstacles to commercialization of these resources must be overcome. The following recommendations for federal, state and industry activities are presented as solutions for overcoming impediments to the development in Utah of this essential oil shale/tar sands alternative energy industry:

## ***A. Federal Actions***

- Establish a level of proven reserves for resources as identified in the Federal Unconventional Fuels Task Force report regarding “recoverable resource.”
- Provide tax incentives for independent research and development projects analogous to funding provided for other alternative energy resources.
- Establish consistent leasing programs for exploration and mining of resources analogous to programs for other mineable resources on federal lands.
- Identify key corridors for accessing, transporting and refining resources and associated production outputs.
- Allocate overall regulatory responsibility to the state Department of Oil, Gas and Mining to promote and ensure consistent regulatory requirements across the state and more effective implementation strategies.
- Remove the Payment Law clause from PILT legislation, thereby allowing current mineral lease funds to flow directly to the local impact communities.
- Allow local impact communities to keep 100% of mineral lease bonus payments as was done in the prototype programs of the 1970’s.
- Allow industry to pay production royalties directly for community impact needs.
- Fund major infrastructure needs, such as highways or water projects from the federal portion of the Mineral Lease account, with the expectation those funds would be restored in the later years of the project.
- Formalize the Canadian alliance to establish the North American Energy corridor for protection of resource development zones.

## ***B. State and Local Actions***

Considerations for oil shale and tar sands will differ by state and region but some general themes can be identified, especially those regarding market access, impacts on local communities, and enhanced refining capacity. Recommendations for state and local actions are based on these general concepts with a focus on Utah’s needs and prospects:

- Expand small mine leasing programs to allow for reasonably sized intermediate projects.
- Coordinate the permitting process across regulatory agencies to enhance regulatory certainty.
- Identify and fund private-public partnerships that support needed infrastructure and expanded refining capacity in the state.
- Update transportation corridors and priorities to improve access to resource areas.
- Define and fund educational programs to support local employment opportunities and growth in the labor force.
- Support cost-match options for federal grants to advance development technologies, including carbon-capture and sequestration efforts.

## ***C. Industry Commitment***

With proactive federal and state policies, industry is poised to deliver on technological innovations to develop oil shale and tar sands resources through utilization of the best available technologies for protection of core social and environmental values. It is the industry’s commitment to adhere to the following principles:

- Active communication with federal, state and community governments to assure appropriate consideration in long-term planning for sustainable development.
- Deployment of best available technologies for protection of environmental values.
- Provide cost-match strategies for development of infrastructure needs, including roads, refining capacity and education.
- Undertake appropriate planning to address socio-economic impacts.

## ***D. Education***

Stakeholders are encouraged to read the accompanying CCEI publication titled “Canada’s Oil Sands”, as an effective starting point in becoming familiar with industry terms and the key related issues in Canada. By gaining an understanding of the constraints faced by first generation oil shale and tar sand producers in Utah, it will become readily apparent to the industry’s proponents and detractors alike, that policy decisions cannot simply be based on comparisons to the Canadian tar sands operations.

Proposed oil shale/tar sands ventures must be considered on their respective merits, through evaluation relative to an energy policy framework and on their ability to address defined regional priorities. Pioneering operations are faced with numerous challenges: technical, environmental, financial, political and socio-economic, that can be overcome in large part by effective dissemination of information about the industry and the benefits it will bring to the region and the country.

## ***II. Introduction***

The intent of this paper is twofold: (1) provide stakeholders with a summary of the key issues facing development of the oil shale and tar sands resources of the State of Utah; and (2) make recommendations to promote development of these essential alternative energy resources.

The United States now imports two-thirds of its oil – up from 20% in the 1970’s – at a cost of \$300 billion a year, which accounts for 40 percent of the nation’s record trade deficit. Every \$10 increase in a barrel of crude oil costs an American household \$700 a year, according to the Rand Corporation. Oil prices have risen 63 percent since 2004, and higher fuel costs have slowed economic growth in the United States to the lowest in four years. Developing our abundant oil shale/tar sands resources is critical to domestic energy security.

Development of the U.S. oil shale/tar sands resources also provides an opportunity for unparalleled economic benefit to the Nation. While oil shale/tar sands development in the U.S. will differ from tar sands development in Canada, the economic experience realized there provides confidence that significant monetary value is held within these resources. Economic benefits will accrue in the form of direct state, local and federal taxes with indirect benefits; and growth realized in secondary markets for labor, resources, and the multitude of complimentary and supportive industries. Socio-economic gains will realized as resource development provides long-term stable economics and employment within rural communities, contributes to infrastructure enhancements, and defines best practices for environmental safeguards.

With the vast deposits of oil shale and tar sands resources and its commitment to energy development and sustainability, Utah is in a unique position to advance greater national energy and economic security through development of these resources. Moreover, well defined regulatory parameters will allow economic contributions to be successfully realized in the context of sound

environmental practices. Assessment of the Canadian tar sands development experience provides insight regarding economic possibilities and planning, as well as impact mitigation.

It should be noted, however, that the oil shale and tar sands resources of Utah are distinctly different, both in nature and extraction methodologies, from the Canadian Athabasca tar sands. Assessing the political, social and environmental issues associated with the Canadian tar sands development is relevant as the magnitude of the oil shale resource in Utah and Colorado is comparable in size to Athabasca. A clear understanding of the differences between the resources of Utah and Athabasca will help legislators and policy-makers arrive at decisions that will strike the best balance between the energy needs of the country, environmental safeguards, and sustainability.<sup>1</sup>

While the specifics of oil shale and tar sands development in Canada and potentially in Utah are notably different due to fundamental physical characteristics – such as composition, geologic setting and extraction techniques -- there are numerous common aspects and issues. These include: access to the federal (BLM) land base, regulatory permitting requirements, supporting infrastructure needs, and socio-economic and environmental issues. Clear and concise policies governing oil shale and tar sands development are needed immediately to allow first generation oil shale/tar sands production companies to develop and refine economic extraction technologies and implement environmental safeguards tailored to Utah. To date, the industry has struggled with unclear or moving regulatory goal posts with the resulting inability to adequately capitalize pioneering technologies and begin commercial production.

The following sections of this paper describe the nature of the respective oil shale/tar sands resources, historical and current developments, government involvement and community/environmental issues faced by these two widely differing regions of North America. The industry's commitment to development of Utah's oil shale/tar sands resources in a sustainable and environmentally responsible manner is clearly stated. Critical infrastructure requirements for establishment of a viable Utah oil shale/tar sands industry are also discussed.

### ***III. Utah's Tar Sands And Oil Shale Resources***

#### ***A. Definitions***

The terms "tar sands" and "oil sands" can be used synonymously, with "tar sands" being most used in the United States. The oil contained within tar sands, known as bitumen, is a heavy tar-like hydrocarbon that requires up-grading by removal of excess carbon atoms or addition of hydrogen atoms prior to refining into petroleum products.

Oil shale differs from tar sands in that it is a sedimentary rock, typically a carbonate or marlstone, that contains high concentrations of immature oil called "kerogen." Kerogen must also undergo a form of up-grading (e.g. retorting) wherein this solid form of elemental hydrocarbon is heated to approximately 700°F to remove excess nitrogen and complete its conversion to a liquid hydrocarbon. Retorted kerogen from oil shale is suitable for refining into numerous high value products including diesel fuel, jet fuel and gasoline.

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<sup>1</sup> An exhaustive study of the Canadian tar sands industry is not presented in this paper but the reader is encouraged to visit the Canadian Centre for Energy Information (CCEI) website [www.centreforenergy.com](http://www.centreforenergy.com) for background information related to any aspect of the tar sand/heavy oil industry or energy production in Canada. CCEI is a non-profit organization jointly funded by government and the oil sand industry. The CCEI publication titled "Canada's Oil sands" was produced with input and review from the leading industry players, government and regulatory organizations, as well as community and environmental stakeholder groups. It is a comprehensive, informative description of the resource, the industry and the key related issues. Additional valuable information can be obtained by visiting the website of the Canadian Association of Petroleum Producers [www.capp.ca](http://www.capp.ca).

## ***B. Nature and Scale of Utah's Tar Sands Resources***

In discussing Utah tar sands development comparisons are often made between the state's bituminous sandstone deposits to the much larger and well known tar sands deposits in the Athabasca Region of Northern Alberta, Canada. The Athabasca resource has been estimated to contain over 1.7 trillion oil equivalent barrels, rivaling the size of conventional light oil deposits of Saudi Arabia. The smaller tar sands resources of Utah have been estimated at 25-32 billion oil equivalent barrels and constitute approximately 55% of the known tar sands resources of the United States. Although only 2% of Canada's Athabasca tar sands resources, Utah's tar sands are a substantial resource that will make significant contributions to regional, state and U.S. economies when brought into commercial production.

The majority of Utah's tar sands resources are concentrated in six separate deposits that differ significantly in both their geological setting and in their commercial development potential. The diverse nature and physical orientation of the tar sands deposits will necessitate differing extraction methods, ranging from surface mining to site-specific in-situ technologies. A commercially viable Utah tar sands industry is certainly possible, as well as quite likely, given recent spikes in the world oil price and growing U.S. demand for domestic energy security. Development of the state's tar sands resources, however, will never attain the magnitude or pace witnessed in Athabasca, Canada, for the reasons of scale. Additionally, a number of other existing constraints are discussed in this paper that must be resolved in order for Utah's smaller, yet significant, tar sands resources to be fully developed.

## ***C. Nature and Scale of Utah's Oil Shale Resources***

The United States has the largest, richest, and most concentrated deposits of oil shale in the world. These resources have been extensively characterized by the U.S. Geological Survey, state surveys, and private industry. Oil shale deposits in Colorado, Utah, and Wyoming in the Green River Formation contain the richest resources with the greatest potential for near-term development. Approximately 1.2 to 2.0 trillion oil equivalent barrels are contained in deposits that occur beneath 25,000 square miles (16 million acres) in these three states. Estimates are that about 321 billion oil equivalent barrels of oil shale are located in Utah.

Oil Shale deposits with oil yields greater than 25 gallons per ton are viewed as the most economically attractive for development. Some of the thickest and richest deposits in Utah and Colorado could yield between 100,000 to 1 million oil equivalent barrels per acre. As much as 800 billion oil equivalent barrels could be recovered from U.S. oil shale deposits with current and emerging technologies. If developed, production from these oil shale resources could yield direct federal and state economic benefits in excess of \$500 billion over a 25 year period.<sup>2</sup>

America's recoverable oil shale resources are:

- Nearly three times as large as Saudi Arabia's proved oil reserves (267 billion barrels)
- Approximately 35 times current U.S. oil reserves (22 billion barrels)
- More than 100 years of projected U.S. oil imports (12 million barrels/day).

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<sup>2</sup> US DOE Office of Petroleum Reserves - Fact Sheet – U.S. Oil Shale– 2007. Available online at [http://www.unconventionalfuels.org/publications/factsheets/Oil\\_Shale\\_Economics\\_Fact\\_Sheet.pdf](http://www.unconventionalfuels.org/publications/factsheets/Oil_Shale_Economics_Fact_Sheet.pdf)

More than 70 percent of the U.S. oil shale resources in Colorado, Utah and Wyoming are on Federal lands managed by the Department of the Interior's Bureau of Land Management (BLM). The rest is found on private, state, or tribal lands and can be commercially developed within the framework of existing state environmental and mineral development policies and regulations.

## ***IV. Tar Sands Development in Athabasca, Canada***

### ***A. History***

The earliest known history of the Canadian tar sands dates back almost 300 years ago. The local Aboriginal people used the bitumen from the tar sands to waterproof their canoes. In 1875, John Macoun led the first government-sponsored expedition of the area, and observed water naturally washing oil out of the tar sands, which is the essence of today's technology for extracting bitumen from Canadian tar sands.

Over the years, many people tried to commercially develop the Athabasca tar sands. In 1906, Alfred von Hammerstein was the first person to drill for oil near Fort McMurray, but he discovered salt deposits and natural gas instead. A few years later, Sidney Ells, began working with a new method for extracting the bitumen from the tar sands using hot water. Dr. Karl A. Clark and his associate Sidney M. Blair, also worked on separating the oil from the tar sands, and in 1928 the two were granted a patent for their hot water process. Over the years, many other people worked to separate various elements from the Athabasca tar sands for roofing materials, road asphalt and diesel oil.

After many failed commercial ventures, the 1950's brought renewed hope for development of the Canadian tar sands resources. In 1964, approval was granted to Great Canadian Oil Sands Company, now Suncor Energy Inc., for the first tar sands project which officially began production in 1967. A few years later, Syncrude Canada Ltd., a joint public-private venture was formed, and construction began on a much larger site which came online in 1978.

Since the mid-1990's, development of the Canadian tar sands has exploded. An example is the area's population growth in the community of Fort McMurray, which grew from a small town of 300 in 1900, to a thriving city with a population of 65,000 people today. Industry investment in tar sands development now totals \$30 billion, with \$15 billion worth of projects under construction. Projects totaling \$100 billion have been announced for completion by 2020, raising the combined production of bitumen and upgraded products -- known as synbit -- to a forecasted 3 million barrels/day.

Crude oil exports derived from the Athabasca tar sands to the United States are now the largest single source of U.S. petroleum supply, exceeding 1 million barrels/day. Total oil exports from Canada to the U.S., of both conventional and un-conventional oil, now exceed 1.5 million barrels/day which constitutes 7.5% of daily U.S. oil consumption.

Some recent political statements in the United States have branded the production from Canada's tar sands as "dirty oil" in relation to the environmental impacts and the energy required to produce a barrel of unconventional bitumen-derived oil versus lighter conventional production, principally sourced from the Middle East. However, full cycle comparisons of these energy sources show that when product transportation factors are considered, the margin between the two is in the order of 5 percent. The Canadian tar sands industry is working hard to change this negative image, in parallel with efforts to increase production, as it responds to additional growing export demands from developing countries in Asia and the Pacific Rim.

## ***B. Government Support -- The “Alberta” Model – Accelerated Canadian Tar Sands Development***

From its discovery in the 1870's, development of the Canadian tar sands has benefited significantly from government involvement. Funding of early fact-finding expeditions and provincial support of extraction research through the Alberta Research Council have helped the Canadian tar sands industry gain a technical foothold. In addition, the provincial government of Alberta was one of the initial major shareholders in the Syncrude partnership, eventually divesting its publicly-owned share in 1986.

Tax incentives for pioneering operations, including pre-payout royalty holidays and grandfathering of reduced royalty structures, have provided the economic foundation for Canada's tar sands commercial success. The recent price increases of crude oil have masked the impact of these crucial incentives, as well as the tremendous technical strides the major Canadian tar sands producers have made in reducing production costs. In times of sharply rising fuel and labor costs, process improvements have kept tar sands production costs relatively flat since the 1980's.

In addition to more direct forms of government financial incentives, the Canadian tar sands industry has benefited from publicly funded infrastructure construction in the Athabasca region. Construction of a major highway, including several large bridges, facilitated the rapid growth experienced in the past decade. Crown (provincial) land was also made available for the construction of road and rail links to the major plants. A second major highway access to the region is now under construction to ease the pressure on the existing two-lane highway.

## ***C. Socio-economic Impacts of Canadian Tar Sands Development***

Despite increases in royalty revenues, the province of Alberta has been hard pressed to keep up with the rapidly growing demand for all forms of public infrastructure, including hospitals/clinics, schools, recreation facilities and municipal services. Canadian government funding for existing airport expansion and new regional airports has been insufficient to meet demand, and has forced the major tar sands companies to construct their own airstrips. Transportation constraints and regional labor shortages have been overcome in part by flying in workers from southern Alberta and distant regions of Canada on a 2-3 week rotational basis.

More than 20,000 construction and operations personnel are housed in large, deluxe, semi-permanent, hotel-style camp complexes, constructed in close proximity to the tar sands operations. These “home away from home” camps are complete with the latest amenities and recreational facilities. This camp-based population -- approximately 20% of the total population of the regional municipality -- is locally referred to as the “shadow population,” and is regarded with mixed feelings by permanent residents and the aboriginal community. Both the municipality and province are undertaking efforts to attract a larger percentage of “permanent” residents to the region, as opposed to encouraging even greater numbers of transient workers whom disproportionately overburden municipal services and infrastructure.

A related consideration is housing affordability. With growing populations and increased demand for houses, residential real estate prices have soared. Options for affordable housing must be part of any viable mix of property development.

## ***D. Environmental Issues Associated With the Athabasca Tar Sands Development***

Environmental issues associated with the mining, extraction, and upgrading the Athabasca tar sands resources on a large commercial scale have garnered heightened public awareness. New projects and existing mine/plant expansions currently in the regulatory application approval stages are now facing opposition from environmental and other special interest groups.<sup>3</sup>

Actions on the part of the Canadian government to resolve environmental challenges offer lessons for up-front planning and mitigation as the oil shale/tar sands industry develops in the United States. In particular, Utah has worked to ensure its energy goals and environmental and socio-economic impacts are properly addressed by any new development. By way of example, Utah has developed off-site mitigation strategies for other energy development programs in the state to allow development with minimal incursion on wildlife habitat and realization of net-environmental gains. Forward thinking programs such as these will be adopted and implemented in the context of oil shale and tar sands development in Utah.

## ***V. Tar Sands: Development Challenges in Utah***

### ***A. Background***

Geologic exploration and cataloging of the tar sands resources in Utah began in earnest in the 1960's with the mapping, coring and analysis efforts of Covington, Ritzma, Cashion and others. However, development of the Utah tar sands resources have never advanced beyond the demonstration stage, due to the numerous challenges posed by the physical characteristics of the resource and substantial water requirements of the older extraction processes.

### ***B. Extraction Challenges and Water Requirements***

The tar sand ores of Utah are classified as "oil wet", meaning the bitumen trapped within the pore spaces of the host sandstone adheres directly to the sand grains, without the presence of an intervening film of water (known as connate water). Canadian tar sands are classified as "water wet", having water contents typically in the 3-5% range. Variants of the conventional water-based processes used in Canada -- e.g. the Clark process -- have been tried in Utah. However, with ores devoid of connate water, on which the Clark process relies, all have met with failure or limited success at best on Utah's tar sands. Also, alternative solvent-based extraction methods have been tried in Utah in the past, without commercial success.

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<sup>3</sup> Environmental issues concerning the Canadian tar sands development that have been problematic and are now being addressed include: water withdrawal/consumption from the Athabasca River; groundwater diversion associated with mine dewatering and in-situ operations; transmission of leachates from tailings ponds to the Athabasca River and its tributaries; alleged health-related issues of downstream aboriginal communities associated with airborne and waterborne contaminants; greenhouse gas emissions from mining equipment, in-situ plant steam generation, extraction plants and up-graders; potential impacts on fisheries and forest habitats; impact of tailings ponds on migratory birds, and reclamation issues. While all of the above issues are significant, the industry's substantial greenhouse gas emissions rank as the number one issue from the global perspective. This concern has prompted the Alberta government to recently announce a \$2 billion research fund to accelerate implementation of effective carbon dioxide capture and sequestration technologies in the tar sands industry. Locally, water consumption from the Athabasca River is the environmental challenge that could curtail the pace of development, unless more water efficient extraction technologies are implemented in the near future.



### ***C. Mining***

Tar sands production operations in Utah are faced with additional challenges in mining and conditioning the highly consolidated and abrasive sands prior to extraction processing. Utah tar sands (typically quartz sandstones) exhibit compressive strengths 3 to 4 times that of Athabasca ores and consequently cannot be mined by truck and shovel methods. Tar sands from highly consolidated beds must be mined using hard rock techniques and equipment prior to processing in extraction plants, adding a significant premium to the overall costs of production. These tar sands mining operations would be similar to techniques required prior to retorting of surface-mineable oil shales.

### ***D. Current Status***

Driven by increasing domestic demand and unprecedented crude oil prices, new and more environmentally responsible tar sands extraction technologies are currently in the regulatory permitting stage, and are expected to move into commercial production within the next two years. Proposed pilot plant operations, in connection with these new tar sands technologies, will require the endorsement and support of state and federal governments and pro-active involvement of regulatory agencies.

## ***VI. Oil Shale: Development Challenges in Utah***

### ***A. Mining***

Oil shale resources in Utah can be mined using technologies consistent with traditional underground or surface hard rock mining. While mining processes are not particularly unique, development activities will require access to water, energy, infrastructure, and to the resource itself.

### ***B. Water***

Limited amounts of water are necessary for producing oil shale. The amount and quality required varies with the extraction technology being used. Typical secondary water uses include process cooling, reclamation, dust control and the municipal needs resulting from any population increase from the industry workforce and supporting businesses. A reasonable planning estimate is that 1-3 barrels of water will be required per barrel of oil equivalent produced from oil shale. Process improvement over time is expected to reduce water needs. This water requirement is not outside the bounds of water conditions for conventional oil production, but does necessitate an allocation of sufficient water and planning to adequately support the industry.

Many of the oil shale and tar sands deposits in Utah are located near existing oil and gas activities where produced water is generally trucked from the site or replaced through injection wells. With injection well siting providing its own set of challenges and water removal transport requiring additional roadway activity, the environmental benefits of utilizing local produced water extend beyond minimization of fresh water requirements. Solutions such as recycling of produced water from conventional oil and gas production could be utilized to help offset water requirements for oil shale production.

## ***C. Energy***

Energy requirements for oil shale development also vary across technologies. However, production of kerogen from oil shale is associated with high net energy yields – about 7 Btus are produced for each Btu consumed. This ratio is similar to Alberta tar sands.<sup>4</sup> Oil shale has the potential to be completely energy self-sufficient, with no demands on external energy sources.

Energy efficiency in extraction is expected to increase with the development of oil shale and other unconventional resources. This can be verified through examination of the Alberta experience. According to the Unconventional Fuels Task force report, “the average efficiency of oil sands development has improved to about 82% from the low 70’s in first generation operations”.

Expansions of Utah’s electricity grid will be required to meet the energy demands of oil shale development. Some processes may be self sufficient in energy, but growing communities and enhanced economic development in historically remote, and/or low load centers, will necessitate additional electric generation and transmission capacity.

## ***D. Current Status***

Significant technological advancements have occurred in the last 25 years to economically and sustainably deliver fuel feedstocks from oil shale. Commercialization of both new and existing technologies can be realized, but will require that RD&D efforts be allowed to move forward, whether located on private, state or federal lands. Utah is currently home to one of the six RD&D leases granted under the federal program administered by BLM and designed to demonstrate commercial, technological and environmental sustainability. In addition, projects are moving forward on non-federal properties. There is significant benefit to Utah in allowing a full slate of RD&D efforts to develop. Benefits include refinement of technologies, demonstration of best practices, and continued technological innovation to continually improve both economics and environmental safeguards.

# ***VII. Oil Shale/Tar Sands Development Challenges in Utah***

## ***A. Access to Federal Lands***

At present, it is exceedingly difficult for start-up oil shale and tar sands companies to assemble contiguous parcels of state/federal lands that are of sufficient size and resource potential for major industry investment. Access to federal (BLM) lands for unconventional resource development is non-existent due to the absence of a regulatory framework for commercial leasing. Recent announcements by the President and Utah Congressional leaders have heightened public awareness of this issue. However, meaningful and effective federal land policies have yet to be implemented to allow Utah’s oil shale/tar sands industry to become established.

## ***B. Infrastructure***

Lack of developed road/rail transportation infrastructure is a key issue for development of Utah’s oil shale and tar sands resources. Existing road access in the oil shale/tar sands areas is poor and often non-existent after heavy rainfalls or major winter storms. For construction projects and plant

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<sup>4</sup> US DOE Office of Petroleum Reserves - Fact Sheet – Energy Efficiency of Strategic Unconventional Resources – 2007. Available online at [http://www.unconventionalfuels.org/publications/factsheets/Energy\\_Efficiency\\_Fact\\_Sheet.pdf](http://www.unconventionalfuels.org/publications/factsheets/Energy_Efficiency_Fact_Sheet.pdf)

operations road infrastructure for movement of workers and transport of construction materials, process chemicals and hydrocarbon products is essential. Poor road conditions pose a significant commercial, safety and environmental risk.

Product transportation costs as a result of inadequate roads, rail and pipeline infrastructure represent approximately 25% of total production costs and are the largest commercial risk to first generation oil shale/tar sands operations. The state has been considering a highway connector (Hwy 40 to I-70) through the region since the early 1990's. However, lack of funding for this has limited progress to feasibility studies only. Both state and federal funding is urgently required to jump start work on this critical component of needed infrastructure.

Socio-economic considerations will also have to be addressed. Growing communities will be required in the way of schools, housing, roads, utilities, and other essential services to meet the needs of new workers required for Utah's oil shale/tar sands industry. Expanded municipal tax bases and local commerce will in part offset the initial costs of the additionally needed infrastructure.

### ***C. State and Federal Royalty Structures***

With respect to government incentives for first-generation oil shale/tar sands operations, the State of Utah has implemented a permanent sales tax exemption on capital costs related to mining equipment; as well as a severance tax holiday until 2016. Furthermore, Utah's state royalty deductions are structured around conventional oil and gas production. As a result, mining costs -- which constitute approximately 50% of total oil shale/tar sands production costs -- are not deductible from state (SITLA) royalty calculations. Inclusion of a mining cost deduction in the royalty determination for Utah oil shale and tar sands operations would help first-generation producers to establish a solid commercial foothold. Royalty rates at both the state and federal levels must remain reasonable for industry to remain healthy, competitive and able to attract needed investment.

Corresponding reasonable royalty rates for operations on BLM federal lands will have to be established to ensure oil shale/tar sands operations remain economically viable while generating significant revenues for both federal and state coffers.

Equally important would be state and/or federal incentive programs to attract and support necessary industrial infrastructure, such as additional electricity availability, transmission pipelines, upgraders and/or refineries.

### ***D. Regulatory Issues and Public Education***

The regulatory framework under which mining/extraction operations must be permitted is complicated by the overlap between state and federal agencies. Regulatory jurisdictional disputes have led to stagnation of the permitting process and moving goal posts with respect to design and operational permit criteria. Resulting delays in the issuance of regulatory approvals unduly hinder oil shale/tar sands operators attempting to construct small scale pilot plant operations and commercialize processes. Delayed start-ups and associated cost impacts further erode investor confidence in a sector with a history of failed ventures and weak capitalization.

The oil shale and tar sand industry are new and unfamiliar to both state and federal regulatory agencies, and as a result, administrators and permit approval staff are treading very cautiously. Numerous perceptions and perhaps misperceptions exist with respect to the negative trappings of mineable hydrocarbon resource extraction, largely founded on the image created by the tar sands operations in Athabasca, Canada. For Utah's oil shale/tar sands industry to gain a foothold and grow to the point where it is self-sustaining, first impressions made to regulators, legislators and

the general public must be positive, based on fact and criteria truly applicable to operations in Utah.

The fundamental differences between operations proposed in Utah and those in Canada, must be emphasized through education of legislators, regulators and the public. In parallel with perception clarification and informed advocacy, proposed mining and extraction operations must be carefully tailored to operate within the numerous environmental challenges in Utah (scarce water resources, soil and water quantity/quality sensitivities, carbon dioxide generation, wildlife impacts, reclamation, etc.). Members of industry organizations such as the Utah Mining Association will communicate these priorities back to their respective members and ensure they are included as design and operational priorities.

If an increased level of domestic energy security is ever to be attained in the United States, federal regulatory agencies -- such as the BLM and EPA -- must work in a cooperative fashion with responsible pro-active industry participants. It is to all stakeholders' benefit that permitting procedures and policies be streamlined as much as possible and published information is accurate and applicable. Expansive documents -- such as the BLM's recently issued Programmatic Environmental Impact Study (PEIS) for oil shale/tar sands development on federal public lands -- is an example of where comparisons of heavy oil production operations in Bakersfield, California to oil shale/tar sands mining operations in Utah are not directly applicable and serve to confuse the understanding of the public.

### ***VIII. Moving Forward with Oil Shale/Tar Sands Development in Utah***

Proponents of first generation oil shale and tar sands operations in Utah are enthusiastic about the prospects for establishing a growth industry, an industry that can help the nation attain its goal of domestic energy security, in an environmentally responsible fashion. For this goal to be attainable however, concerted and coordinated participation is required by industry, the public, regulators and all levels of government. To demonstrate what is possible with the active support and participation of the public sector, a description of the Alberta model for the Athabasca tar sands development has been included in this paper.

Rapid growth, as occurred in Canada during its tar sands development, lead to a number of unanticipated socio-economic and environmental impacts. Those negative experiences in Alberta will have to be specifically identified and addressed as development occurs in Utah. Therefore, fundamental differences between Canada and Utah: the smaller nature of the oil shale/tar sands resources, their geography, location, and other differences will serve to moderate the pace of development in Utah to a rate that is sustainable. Understanding of these constraints is paramount to establishment of effective overall energy development policy for Utah. Development of the oil shale and tar sands resources in Utah can occur in an environmentally responsible fashion, however, policies originating at the federal level must be based on facts and current applicable data. Industry organizations such as the Utah Mining Association will educate legislators, policy-makers and the public.

Oil shale and tar sands development involves advanced mining activities rather than traditional oil extraction techniques. Consequently, oil shale and tar sands development on either Federal, state or private lands will be regulated as a mining activity and subject to all applicable environmental, wildlife, safety, and health laws regarding mining. These laws have been in place in the United States over the past 50 years and have been continually updated to ensure workers, the public, wildlife, and the environment are all fully protected.

If an increased level of domestic energy security is to be attained in the United States, Federal regulatory and state agencies must work in a cooperative fashion with responsible pro-active

industry participants. It is to each stakeholder's benefit that permitting procedures and policies are streamlined as much as possible among all Federal and state regulatory agencies.

Areas where Utah's oil shale and tar sands resources are located contain similar landscapes and ecosystems that will allow for concurrent reclamation practices. Similar examples can be found in the Powder River Basin of Wyoming and in Colorado, where lands formerly disturbed by large open pit coal mines have been concurrently reclaimed to conditions that exceed their original capabilities to support wildlife and wetland habitats.

Concurrent reclamation is not only possible but an established and engrained operating practice of responsible resource extraction companies. Proponents of oil shale and tar sands operations in Utah are committed to conducting their operations in a likewise sustainable manner.

The emerging Utah oil shale and tar sands industry is committed to developing the unconventional petroleum resources of the state and of the Nation in an environmentally responsible manner using best available technologies to include:

- Protection of air quality and water resources.
- Limiting greenhouse gas emissions and maximized waste heat recovery methods.
- Incorporation of renewable energy sources in extraction operations where feasible.
- Establishing concurrent reclamation as a required operating practice.
- Accommodating special wildlife protection areas within development plans.

## ***IX. Conclusions and Recommendations***

Utah's oil shale and tar sands resources can be economically developed in a sustainable manner in accordance with sound environmental principles. However, obstacles to commercialization of these resources must be overcome. The following recommendations for federal, state and industry activities are presented as solutions for overcoming impediments to the development in Utah of this essential oil shale/tar sands alternative energy industry:

### ***A. Federal Actions***

- Establish a level of proven reserves for resources as identified in the Federal Unconventional Fuels Task Force report regarding "recoverable resource."
- Provide tax incentives for independent research and development projects analogous to funding provided for other alternative energy resources.
- Establish consistent leasing programs for exploration and mining of resources analogous to programs for other mineable resources on federal lands.
- Identify key corridors for accessing, transporting and refining resources and associated production outputs.
- Allocate overall regulatory responsibility to the state Department of Oil, Gas and Mining to promote and ensure consistent regulatory requirements across the state and more effective implementation strategies.
- Remove the Payment Law clause from PILT legislation, thereby allowing current mineral lease funds to flow directly to the local impact communities.
- Allow local impact communities to keep 100% of mineral lease bonus payments as was done in the prototype programs of the 1970's.
- Allow industry to pay production royalties directly for community impact needs.
- Fund major infrastructure needs, such as highways or water projects from the federal portion of the Mineral Lease account, with the expectation those funds would be restored in the later years of the project.
- Formalize the Canadian alliance to establish the North American Energy corridor for protection of resource development zones.

## ***B. State and Local Actions***

Considerations for oil shale and tar sands will differ by state and region but some general themes can be identified, especially those regarding market access, impacts on local communities, and enhanced refining capacity. Recommendations for state and local actions are based on these general concepts with a focus on Utah's needs and prospects:

- Expand small mine leasing programs to allow for reasonably sized intermediate projects.
- Coordinate the permitting process across regulatory agencies to enhance regulatory certainty.
- Identify and fund private-public partnerships that support needed infrastructure and expanded refining capacity in the state.
- Update transportation corridors and priorities to improve access to resource areas.
- Define and fund educational programs to support local employment opportunities and growth in the labor force.
- Support cost-match options for federal grants to advance development technologies, including carbon-capture and sequestration efforts.

## ***C. Industry Commitment:***

With proactive federal and state policies, industry is poised to deliver on technological innovations to develop oil shale and tar sands resources through utilization of the best available technologies for protection of core social and environmental values. It is the industry's commitment to adhere to the following principles:

- Active communication with federal, state and community governments to assure appropriate consideration in long-term planning for sustainable development.
- Deployment of best available technologies for protection of environmental values.
- Provide cost-match strategies for development of infrastructure needs, including roads, refining capacity and education.
- Undertake appropriate planning to address socio-economic impacts.

## ***D. Education***

Stakeholders are encouraged to read the accompanying CCEI publication titled "Canada's Oil Sands", as an effective starting point in becoming familiar with industry terms and the key related issues in Canada. By gaining an understanding of the constraints faced by first generation oil shale and tar sand producers in Utah, it will become readily apparent to the industry's proponents and detractors alike, that policy decisions cannot simply be based on comparisons to the Canadian tar sands operations.

Proposed oil shale/tar sands ventures must be considered on their respective merits, through evaluation relative to an energy policy framework and on their ability to address defined regional priorities. Pioneering operations are faced with numerous challenges: technical, environmental, financial, political and socio-economic, that can be overcome in large part by effective dissemination of information about the industry and the benefits it will bring to the region and the country.

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