

ConvertCoal, Inc.

Low-rank Coal as Syncrude Oil Resource

1. **LRC Energy Resource** - At present U.S. LRC is an important energy resource as fuel for domestic power generation providing approximately 730-million ton per year as fuel for more than 160,000-MW electric capacity. The availability of LRC exceeds 250 years supply at current rate of mining.

LRC also represents an important potential syncrude oil resource without notably impacting its availability as power generating plant fuel. The CCI process converts the energy available in LRC to 65 - 70% clean coal fuel and 25 - 30% syncrude. In this process the incremental conversion efficiency of coal to oil is approximately 75% when the entire energy loss is allocated to the oil product. In comparison the energy conversion efficiency of CTL processes based on coal gasification and Fischer-Tropsch synthesis only is 55 - 60%, and such projects cannot produce clean coal fuel.

2. **CCI Process Application** - The CCI process is applicable to existing and new PC power generating projects and IGCC projects based on bituminous, sub-bituminous and lignite coals. The CCI syncrude oil product supports the cost of upgrading LRC to higher efficiency clean coal fuel. Current domestic U.S. LRC capacity and coal power plants provide a prospective market for 250 nominal CCI 10,000-t/d projects 2-million-barrels per day syncrude oil and exceeding \$125-billion capital investment. The conversion of the domestic LRC resource into a domestic clean coal and syncrude oil resource therefore can contribute significantly to the domestic oil supply for years to come.
3. **LRC Perspective** - The application of CCI processing of LRC will require an expansion of the LRC supply by 25 - 30% as the conversion to syncrude requires energy for the oil product and conversion process. Prospectively the production of 2-million barrels per day of syncrude would require the expansion of the current capacity from 730-million tons per year to 1-billion t/y. In economic terms this would create a domestic energy industry that would save \$45-billion per year in oil imports, expand the domestic coal industry and the local economy, and provide added-value long-term jobs.
4. **Syncrude Oilfield Perspective** - ConvertCoal, Inc., has recently completed the design and patent applications for a modular mild-temperature pyrolysis plant for processing 10,000-t/d Wyoming PRB coal to produce 1150-t/d coal-tar-oil and 5000-t/d low-emission coal-char fuel matching a 500-MW power plant. Catalytic hydrogenation of the coal-tar-oil yields 8000-bbl/d syncrude with suitable properties for petroleum oil refining. A new "virtual oilfield resource" producing 200,000-bbl/d with predictable oil quality and defined recovery profile therefore would result from having in operation two dozen such projects based on 12,000-MW generating capacity and 85-million-t/y LRC, which is less than 12% of current annual LRC mining capacity. The capital intensiveness of the project is similar to oilfield and power projects on a barrel-per-day of oil or ton-per-day of coal basis. Current engineering studies indicate that the process can be economically attractive at current energy price levels, and it therefore could become the basis for converting the large U.S. LRC resources into equivalent oil reserves.

5. **CCI Oil Resource Risk and Equivalence** - Based on the CCI process, the equivalent oil resource corresponding to the existing identified U.S. domestic low rank coal [LRC] resources would be 140-trillion barrels of recoverable-oil-in-place [ROIP]. This oil would in principle be completely recoverable. This is unlike crude oil reserves where the production declines over time and only 25 – 45% of OIP usually can be recovered directly and/or by enhanced oil recovery. Another important consideration is the much lower CCI oil project risk index resulting from on-shore project location, domestic project control, elimination of currency and country risk, and predictability of the “equivalent CCI oil well productivity”.

CCI AND OILFIELD PROJECT COMPARATIVE RISK FACTORS		
EVALUATION OF PROJECT RISK FACTOR FOR OILFIELD E&P PROJECTS		
PROJECT:	OFF-SHORE OILFIELD	CCI PROJECT
RISK FACTOR	RISK ASSESSMENT	RISK ASSESSMENT
Crude oil market pricing	Major uncertainty	Major uncertainty
ROIP* uncertainty	Medium to high	Low or none
Geology uncertainty	Medium	Low or none
Recovered oil quality	Medium	Low or none
Exploration cost	Uncertain	Low and defined
Project capital cost	Uncertain	Defined
Project technology risk	Defined or definable	Definable **
Project operating risk	Low	Low or none**
Production rate	Definable but uncertain	Defined
Production cost	Definable but uncertain	Defined
Transportation cost	Uncertain	Defined
Incident weather risk	Uncertain	Low or none
Political stability	Definable risk	Low or none
Contractual stability risk	Definable risk	Low or none
Currency exchange rate risk	Uncertain	None
Coal supply cost	Minor or none	Minor or none

6. **LRC RESOURCE BENEFITS FROM CCI** - CCI projects will benefit low-rank coal (LRC) producers and producing states in several ways.
- 6.1. **COAL DEMAND INCREASE** - The demand for LRC will increase by approximately 20% for each ton of coal going to a CCI project. This is because the coal conversion process uses approximately that amount of the feed-coal energy to produce clean-coal fuel and syncrude oil.
- 6.2. **IMPROVED COMPETITIVENESS** - After processing by CCI, LRC is as efficient and competitive as high-rank coal. LRC currently is less efficient in PC-power plants and IGCC projects due to the amount of moisture carried in the coal. This is especially significant for new IGCC projects that use high sulfur Eastern coals because these projects can be located adjacent to Eastern coal mines and compete directly with Western LRC. The increased production of low-sulfur Western LRC from 17% in 1985 to 75% in 2006 therefore may be reversed in the future without CCI projects.
- 6.3. **DOMESTIC VIRTUAL OILFIELD DEVELOPMENT** - CCI provides a virtual oilfield of 8000-bbl/d for each 500-MW PC-generating plant using LRC. This is equivalent to a thirty-year oil resource of 84-million-bbl ROIP (recoverable oil in place) valued at \$4.2-billion based on \$50/bbl without escalation.
- 6.4. **INCREASED WATER SUPPLY** - The CCI project recovers the moisture contained in the LRC which amounts to 30 – 45w%. A 10,000-t/d coal CCI project therefore will produce 500 – 750-gpm water that can be cleaned for use for power generation or irrigation.

- 6.5. **LOCAL POWER PLANT EFFICIENCY GAIN** - The CCI project supplying an adjacent PC-generating plant with clean-coal fuel will provide a 5 – 8% efficiency gain and effectively reduce the GHG emissions by the same amount.
- 6.6. **INCREASED LABOR DEMAND AND TAX BASE** - The construction and operation of a CCI project increases the demand for labor and provides the local community with an added franchise tax basis.
- 6.7. **DOMESTIC INDUSTRY DEVELOPMENT** - CCI provides a unique domestic industrialization opportunity because it is dependent on a local, domestic coal resource and represents a domestic source of syncrude for domestic refining and consumption. Unlike manufacturing, this industry cannot be exported to low labor cost countries.
- 6.8. **EMISSIONS MITIGATION** - The CCI technology provides a low-emission clean coal to the power generation plant that therefore can save capital and operating costs, increasing the competitiveness of the utility cost and local economy.