NORTHERN PLAINS
RESOURCE COUNCIL

Montana's Energy Future

And why a proposed "Fischer-Tropsch" coal-to-diesel plant in southeastern Montana should not be part of it

We all rely on energy to power our vehicles and our homes and businesses. For decades, Montana has been one of the nation's leading energy producers. Montana can continue to play a leading role in energy production by advancing innovative, clean energy solutions that both reduce U.S. dependence on foreign oil and bring true prosperity to our rural communities.

With home heating bills projected to increase as much as 48% this winter, and gasoline prices hovering around $3 a gallon, we face a tough winter. Record energy prices underscore the instabilities we will face with increased global competition for energy supplies. This has prompted wide-spread calls for energy development schemes that would be harmful to our water, air, and health. Rather than look to energy of the past, Montana can chart a new course. A forward-thinking energy policy should emphasize conservation and efficiency while drawing on clean energy supplies that are readily available in Montana:

- **Conservation and Efficiency:** We need to improve efficiency and conserve energy. From installing compact fluorescent light bulbs to weatherizing homes, we can all do simple things to lower heating costs this winter.
- **Biofuel**: Biodiesel burns cleaner than gasoline, it's good for Montana's economy, and it reduces our dependence on foreign oil. By encouraging biodiesel and making it accessible at the gas pump, we can bring prosperity to rural communities by increasing demand for crops grown in Montana. And, we can take pride in creating a truly clean-burning fuel.
- **Wind and Solar**: Montana has the fifth best wind supply in the nation. Electricity from the Judith Gap wind project is contracted to sell for less than NorthWestern customers currently pay for electricity. Meanwhile, small businesses and residents are installing solar panels to reduce power bills. Wind and solar energy can be employed rapidly and will power our future for years to come.

We have a choice: We can continue to put resources into the energy of the past. Or, we can back solutions that put our state on the road toward broad prosperity. Instead of investing $7 billion in one synfuel plant in southeastern Montana, we should promote local biofuel plants and small-scale wind and solar projects in our rural communities. Doing so will help us begin the transition to the energy of the future. Enclosed is an analysis of the Fischer-Tropsch "synfuel" process as it has been employed around the world. This information is intended to be a resource for decision-makers and Montana citizens as we contemplate options to power our energy future.

BACKGROUND

Montana Governor Brian Schweitzer is promoting development of coal on Southeastern Montana's Otter Creek for use as a feedstock in a synthetic fuels plant that would turn the coal into synthetic diesel. The proposal is part of Governor Schweitzer's plan to develop Montana coal on a massive scale to provide an alternative to imported oil.

Governor Schweitzer proposes to mine state-owned coal under 11 square miles of land in Otter Creek, which is intermingled with private coal. The coal would be converted to diesel in a synthetic fuels plant using "Fischer-Tropsch" technology, developed in Germany in the 1920s.[1] Governor Schweitzer envisions construction of a facility with a production capacity of 150,000 barrels per day (bpd). Governor Schweitzer estimates that a coal refinery of that size would cost $7.2 billion; he has proposed building the facility in 22,000 bpd "modules" at $1.2 billion apiece. Associated infrastructure would include one or more surface coal mines and a pipeline for the fuel, a railroad, or both. The Schweitzer Administration has not proposed a water source for the project.

The Schweitzer Administration has not said how long it believes it would take to construct one or more plants. The Governor's website claims that "America could have a strong synfuel industry by the next decade."[2] The engineering, design, financing, permitting, and construction of even one 22,000 bpd plant would likely require several years.

COAL-TO-DIESEL HISTORY

The only commercial-scale coal-to-liquids plants in the world are operated by Sasol, a South African corporation with its roots in the apartheid era. Sasol's coal-to-liquids plants emit huge quantities of a long list of airborne, liquid, and solid wastes. Sasol is converting its operations to produce liquid fuels *from natural gas rather than coal* to reduce environmental impacts. At a cost of $1.2 billion, Sasol constructed a pipeline to bring natural gas from Mozambique to its synfuels plants. In 2004, it switched the feedstock for its flagship Fischer-Tropsch plant in Sasolburg (Sasol I), which produced diesel fuel from coal.[3] Now the plant uses only natural gas as a feedstock. (It still uses about 1.7 million tons of coal per year for power to run the plant).

Sasol is also using some natural gas as a feedstock at Sasol II and Sasol III plants in Secunda, South Africa (where the company uses the Fischer-Tropsch process to produce 150,000 barrels per day of gasoline, diesel, and other petrochemicals). Sasol may completely replace coal with natural gas as the feedstock at Secunda as well.[4]

Sasol units II and III in Secuda, South Africa.

"[T]he changeover puts the group in line with the international move towards cleaner energy," according to South Africa's *Business Day*.[5] Sasol officials outlined the *environmental benefits of switching from coal to natural gas* at Sasolburg:

- Elimination of hydrogen sulfide emissions.
- Sulfur dioxide emissions lowered by 15,000 tons per year.
- Nitrogen oxide emissions lowered by 10,000 tons per year.
- Carbon dioxide emissions lowered by 47%, or five million tons per year.
- Particulates lowered by 25%.
- Fine ash reduced 73%.
- Solid waste reduction of 50%.
- Water consumption reduced 27% - 30%.
- Dramatic reduction in wastewater pollution, including sodium, boron, fluoride, ammonia, total dissolved solids, and other pollutants.[6]

"'THERE ARE NO SMOKE STACKS,'
SCHWEITZER SAID."

— *Billings Gazette*, August 2, 2005

Pollution* from Fischer-Tropsch Coal-to-Diesel Facilities[7]			
	22,000 bpd	**150,000 bpd**	**One Million bpd**
Sulfur Dioxide (SO_2)	3,800 to 15,000 tons/year (Billings estimated total annual SO_2 emissions = 13,221 tons/year[8])	22,800 to 90,000 tons/year	152,000 to 600,000 tons/year (1% - 4% total U.S. emissions)
Carbon Dioxide (CO_2)	5 million tons/year	30 million tons/year	200 million tons/year
Nitrogen Oxides (NO_x)	3,100 to 10,000 tons/year (Billings industries emit 5,350 tons/year[9])	18,600 to 60,000 tons/year	124,000 to 400,000 tons/year
Hyrodgen Sulfide (H_1S)	10,000 tons/year	60,000 tons/year	400,000 tons/year
Volatile Organic Compounds	80,000 tons/year	240,000 tons/year	3.2 million tons/year
Wastewater	2.5 billion cubic feet/year (20 billion gallons)	30 billion cubit feet/year (120 billion gallons)	100 billion cubit feet/year (800 billion gallons)
Hazardous Solid Waste	60,000 tons/year	360,000 tons/year	2.4 billion tons/year
Non-Hazardous Solid Waste	300,000 tons/year	1.8 billion tons/year	12 billion tons/year

**Sulfur dioxide is irritating to the lungs and reacts with water and oxygen to form sulfuric acid, i.e. acid rain. Carbon dioxide and nitrogen oxides are both powerful greenhouse gases and contribute to global climate change. Hydrogen sulfide is considered a broad-spectrum poison, meaning it can poison several different systems in the body, in particular the nervous system. Volatile organic compounds (VOC) contaminate soil and groundwater and contribute to air pollution. VOCs are associated with cancer and can contribute to respiratory problems.*

COAL, WATER, POWER, AND MONEY

Governor Schweitzer advocates that Montana should build an industry big enough to offset U.S. oil imports (currently 12 million barrels per day). The table below estimates input requirements of a 22,000 bpd synthetic fuels plant, a 150,000 bpd complex, or a one million bpd industry producing liquids from coal.

Inputs Required for a Fischer-Tropsch Coal-to-Diesel Plant			
	22,000 bpd	**150,000 bpd**	**One Million bpd**
Coal	6 million tons/year[10] (1/6 of Montana's current annual production)	36 million tons/year, or 100% of Montana's current annual production	240 million tons/year, or 6.5 times Montana's current annual production
Water	6,000 acre feet/year[11], or 17 times Otter Creek flow	36,000 acre feet/year, or 101 times Otter Creek flow	240,000 acre feet/year. Average annual flow of Tongue River is 300,000 acre feet.
Power	180 megawatts[12] (mw), capacity of Corrette Power Plant in Billings	1,080 mw, equals 1/2 combined capacity of Colstrip Units 1,2,3, and 4	7,020 mw. Total existing nameplate capacity of Montana powerplants = 5,192 mw[13]
Capital Investment[14]	$1.2 - $4 billion	$7.2 - $24 billion	$48 - 160 billion

POTENTIAL TO REDUCE DEPENDENCE ON FOREIGN OIL, ENERGY PRICES

A 22,000 bpd facility would produce approximately 0.1% of total U.S. oil demand, or about 0.2% of our current oil imports. If the U.S. produced one million bpd of synthetic fuels from coal, it would supply 5% of our current level of demand. However, the Department of Energy projects U.S. oil consumption to increase by 1.6% annually. If we could build synfuels plants with a capacity of one million bpd by the year 2020, we could offset about 20% of the increase in U.S. consumption.

Production of even one million bpd would not increase supply enough to prevent world oil prices from increasing, let alone bring them down.

The Schweitzer Administration and other proponents of synthetic fuels estimate the breakeven cost for a coal-to-diesel plant at $30 - $40 dollars per barrel and conclude that at current world oil prices, such a plant would be profitable. The source for these estimates is unknown. The up-front investment cost and annual interest on a capital-intensive facility such as a coal-to-diesel plant will make up a large part of the cost of a barrel of its output. If construction costs end up closer to the costs of the Dakota Gasification Plant at Beulah, N.D., the cost of a barrel of synthetic diesel will be significantly higher than $35 dollars per barrel.

CONCLUSION

Engineering, design, permitting, and construction of a huge coal-to-diesel facility would take many years, if not a decade, increasing the uncertainty of final contruction costs. This would also increase uncertaintly about oil's demand and price should a plant come on line. The $2.1 billion Dakota Gasification Plant, the only commercial-scale synfuels plant ever constructed in the United States, was built with federal loan and price guarantees. The plant went bankrupt shortly after it went on line. The Department of Energy operated it at a loss for a few years, and then sold it for pennies on the dollar ($85 million) to Basin Electric. Even at today's high natural gas prices, the Dakota Gasification Plant is profitable primarily because U.S. taxpayers paid virtually all the construction costs.

The Fischer-Tropsch coal-to-diesel process has only been used on a commercial scale in South Africa, with dubious results. While Montana Governor Brian Schweitzer has repeatedly emphasized that the technology is clean, the South African experience tells a different story. Pollution from Sasol's coal-to-diesel plants has been so significant that the company is shifting its feedstock from coal to natural gas, which, though more expensive, overwhelmingly reduces pollution.

- **Coal-based synthetic fuels technology is far too capital intensive** to be a practical solution to Montana's economic development needs or the nation's energy problems.
- The Sasol facilities, the only plants using the Fischer-Tropsch process commercially, were developed by South Africa, which had no alternative source of fuel at any price. Based on the performance of the Sasol facilities, emissions of sulfur dioxide, hydrogen sulfide, nitrogen oxides, and volatile organic compounds **would be very high**, absent technological breakthroughs. Production of diesel from coal would produce **extremely large volumes of slag, other solid wastes, and hazardous wastes**. Absent huge additional construction and operating costs, **carbon dioxide emissions from a coal-to-diesel plant would contribute more to global warming** than production and use of the diesel it would replace.
- **There is not enough available water in southeastern Montana**, let alone in Otter Creek, to build the facilities proposed by Governor Schweitzer.

Instead of backing the investment of $7 billion and the state's political goodwill in one synfuel plant in southeastern Montana, Governor Schweitzer should promote local biofuel plants and small-scale wind and solar projects in rural communities. Doing so will help Montana lead the way to the energy of the future while bringing broad prosperity to rural communities.

NORTHERN PLAINS
RESOURCE COUNCIL

Northern Plains Resource Council is a grassroots conservation and family agriculture group that organizes citizens to protect water quality, family farms and ranches, and Montana's unique quality of life. Research for this paper was provided by the Western Organization of Resource Councils. For more information, contact:

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ENDNOTES

[1] Gransbery, Jim. "Schweitzer wants to convert Otter Creek coal into liquid fuel," *Billings Gazette*, Aug. 2, 2005.

[2] Frequently asked questions about synthetic fuel, http://governor.mt.gov/hottopics/faqsynthetic.asp.

[3] In the mid-1990s, Sasol shifted production of diesel to its Sasol II and III plants in Secunda and a conventional oil refinery in Sasolburg. The Sasol I plant now produces assorted petrochemicals instead of diesel.

[4] African Development Bank Group Project Brief 2003, Sasol Natural Gas, http://www.afdb.org/pls/portal/docs/PAGE/ADB_ADMIN_PG/DOCUMENTS/PRIVATE_SECTOR_OPERATIONS/PROJECT%20BRIEF%202003.PDF; "Sasol banks on gas to liquids for growth," *Business Report*, June 15, 2005.

[5] Lourens, Carli, "Sasol Brings its First Natural Gas to SA", *Business Day*, February 24, 2004.

[6] "Low emissions, less water use in new natural gas era," *Engineering News*, May 23, 2003, http://www.engineering-news.co.za/eng/features/sasol/?show=35377.

[7] Estimated emissions of sulfur dioxide, carbon dioxide, and nitrgen oxide based on description of emissions improvements projected by Sasol for its conversion from coal to natural gas feedstock at Sasol I. The Sasolburg facility converts roughly the amount of coal as would be used by a 22,000 bpd coal-to-diesel plant, Sasol reports its emissions in its annual report for its total operations, and does not break them down by plant. For other pollutants, we conservatively estimated that one-fifth of Sasol's emissions were from Sasol I, which accounts for approximately 25% of Sasol's synthetic fuels production capacity. Information is not yet available comparing the quality of coal in southeastern Montana to that in South Africa. Governor Schweitzer has claimed that the Fischer-Tropsch process would have zero or near-zero emissions, but he has yet to describe what pollution controls would be used on an Otter Creek plant to achieve that result. Since there are no existing plants using the Fischer-Tropsch process that are close to zero emissions, it is impossible to evaluate the Schweitzer Administration's repeated claims.

[8] http://www.nps.gov/yell/publications/pdfs/airquality/GYA_AirQuality_April_2005.pdf.

[9] *Ibid*.

[10] Assumes one ton of coal produces 1.5 barrels of fuel, per Gransbery, *op cit*.

[11] Sasol uses five barrels of water per barrel of synthetic fuel produced. (Source: http://web.idrc.ca/openebooks/759-0/, *BUILDING A NEW SOUTH AFRICA, Volume 4 Environment, Reconstruction, and Development*, the International Mission on Environmental Policy of Canada's International Development Research Centre.) A 25,000 bpd facility would use 125,000 bpd of water. The mean flow of Otter Creek at Ashland is 356 acre feet per year - well below the water needs of a 22,000 bpd plant.

[12] A coal synfuels plant would need to buy or produce its own electricity for process operations. Figures here are based on estimated power consumption of the Dakota Gasficiation Plant.

[13] http://leg.state.mt.us/content/publications/lepo/deq_energy_report/electricitytable1.pdf.

[14] Lower estimates are based on Governor Schweitzer's estimate of $7.2 billion for a 150,000 bpd plant. Rep. Dennis Rehberg's estimate of $5 billion for an 80,000 bpd plant translates to $1.5 billion for a 22,000 bpd plant. The higher estimates are based on the cost of the Dakota Gasification Plant in North Dakota, which is roughly the size of a 22,000 bpd coal-to-diesel plant. That plant was completed in 1984 at a cost of $2.1 billion, or about $4 billion in current dollars. Estimates of the additional cost of carbon recapture equipment for plants using coal gasification to generate electricity range from 25-33%. It is impossible to estimate the costs of pipelines and other equipment needed to sequester CO_2 underground without knowing where or how the CO_2 would be sequestered. It is not clear if any infrastructure costs (railroads, coal mine, power plant, pipelines) or pollution controls are included in Governor Schweitzer's costs estimates. The cost of a zero-emissions facility touted by Governor Schweitzer is impossible to estimate; there is no commercial scale facility or pilot plant that can be used for comparison.