10/9/09 OVERVIEW: COOK INLET REGIONAL INC. NEW ENERGY...

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COOK INLET REGION INC.

An **Alaska Native** corporation

Energy Briefing

October 9, 2009

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About CIRI

CIRI (Cook Inlet Region Inc.) is an Alaska Native corporation

Key Facts:

- One of 12 Alaska-based regional corporations established by the Alaska Native Claims Settlement Act of 1971 to benefit Alaska Natives who had ties to the Cook Inlet region
- Owned by more than 7,500 Alaska Native shareholders of Athabascan and Southeast Indian, Inupiat and Yup'ik Eskimo, Alutiiq and Aleut descent
- Based in Anchorage and has interests across Alaska, the United States and abroad
- Overall portfolio: tourism, real estate, wireless communications, traditional and alternative energy
- Substantial ownership of surface and subsurface land around cook Inlet and Southcentral Alaska

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Need for new energy

- Southcentral Alaska faces imminent shortages of local natural gas for heat and electricity
- CIRI is developing diverse, environmentally-responsible energy solutions
- Underground coal gasification (UCG) is a timely and local energy solution

CIRI's project

CIRI's UCG project

- Underground coal gasification (UCG) project sized to fuel a new 100-MW combined-cycle power plant
- Located on CIRI lands on the west side of Cook Inlet
- Create syngas (also know as a synthesis gas), which can be used to generate electricity or upgraded to synthetic natural gas or clean liquid fuels
- Committed to carbon capture and sequestration by way of enhanced oil recovery
- Integrated carbon capture and sequestration (UCG + CCS is a world-first project)

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CIRI project area

- CIRI has substantial land holdings on the west side of Cook Inlet, in Alaska
- CIRI is evaluating UCG development sites near Beluga area natural gas fields and infrastructure
- Area is remote and largely unpopulated near existing infrastructure and development

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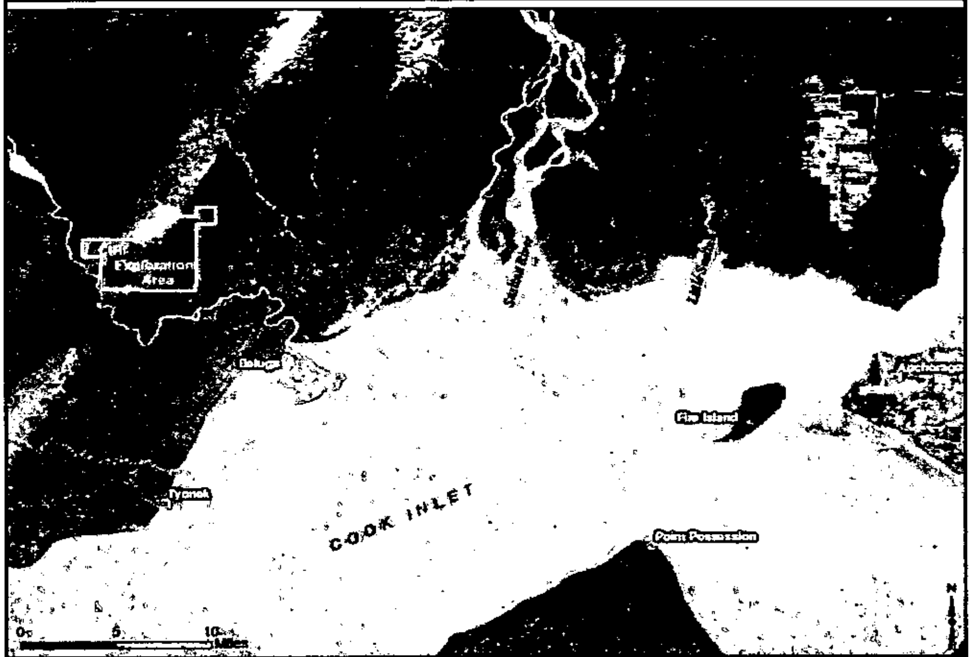

Underground Coal Gasification

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What is Underground Coal Gasification (UCG)?

UCG is a proven technological process that harnesses the energy potential of coal in the ground without mining

- Coal + H_20 + O_2 + heat = H_2 + CO + CO_2 + methane gases
- Product is "syngas," also known as a synthesis gas
- Process occurs deep underground without mining

Syngas

UCG produces 'syngas' (or synthesis gas)

This energy-rich gas product can be:

- Handled and used like natural gas
- Used to fuel a turbine to generate electricity
- Upgraded or converted to make synthetic natural gas or liquid fuels

As clean as natural gas

UCG-produced syngas using pre-combustion carbon capture:

•Can result in lower CO_2 emissions than a combined-cycle natural gas power plant

•Has emissions of other tracked compounds (SO_x, NO_x, etc.) comparable to natural gas

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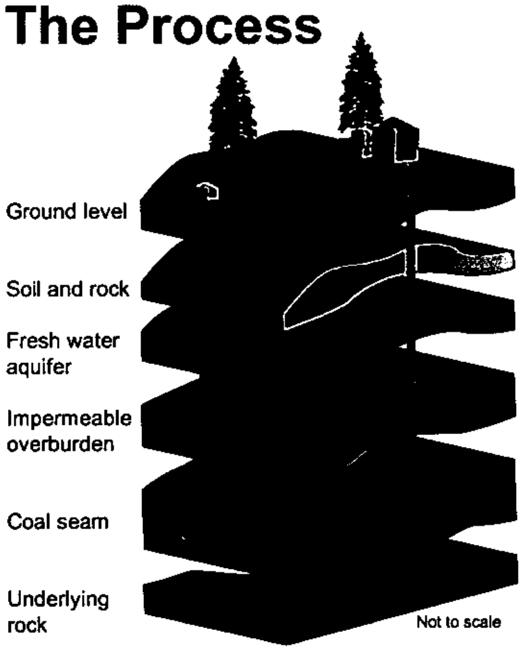
The Process



- Drill two wells and create a connection between the wells
- At one well, inject an oxidant such as air
- Start a combustion reaction
- Heat and pressure gasify the coal
- Second well produces gas to surface

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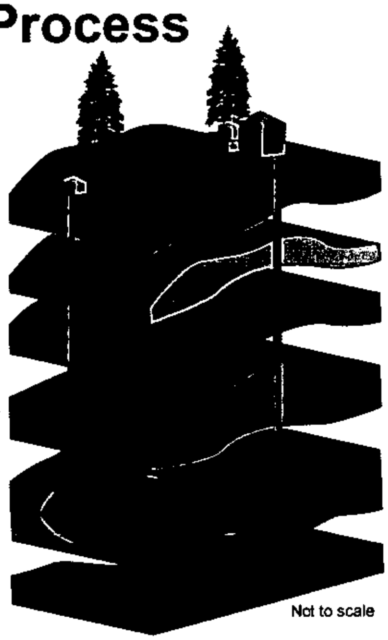
The Process



- Ash and other byproducts remain underground
- Processing and clean-up at the surface prepares gas for near-site use or transport
- Carbon capture and sequestration

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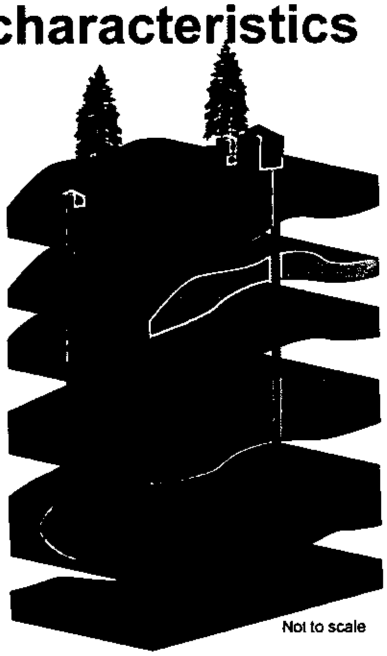
Site characteristics



- More than 650 feet deep
- Below and isolated from the fresh water aquifer
- Strong and impermeable overlying rock layers
- Ongoing study, testing and monitoring throughout process

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Mitigating Hazards

•Manage surface subsidence and groundwater contamination with careful site selection, site characterization, project design and operation, and subsequent monitoring

•Process pressure is carefully managed to contain contaminates in the process cavity

•Operators control or halt the process by managing oxygen supply

•Natural water influx quenches the reaction, eliminating the possibility of unwanted coal-seam fires

•Technology provider has a proven track record

•Lawrence Livermore National Laboratory is CIRI's independent technology consultant

Why UCG?

Practical, reliable energy

- Proven energy technology to access an abundant local resource
- Produces syngas (synthesis gas) that can generate electricity or be converted to other products such as synthetic natural gas
- Provides a secure domestic energy supply and a bridge fuel for the future
- Very efficient process

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Safe and proven

•The reaction is controlled and can be stopped at any time

•Risks are mitigated by careful site selection and characterization, project design and operation, and ongoing monitoring

• More than 50 test and commercial projects completed worldwide

•A "here-now" technology that responsibly harnesses an abundant energy resource

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Environmental Benefits

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Low-impact energy production

- Requires minimal surface infrastructure
- Eliminates environmental risks/problems associated with coal mining, handling, transport and waste
- Leaves most coal byproducts safely contained deep underground
- Enables carbon capture and sequestration (CCS)
- Highly efficient at producing energy content of coal resource

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Enables CCS

- UCG process produces syngas at temperatures and pressures that allow relatively easy, low-cost carbon removal at the surface, prior to burning
- UCG with carbon capture and sequestration leaves a carbon footprint that is far smaller than coal and similar to natural gas
- CO_2 is easily separated from syngas using existing scrubbing technologies for underground sequestration
- Commercial-scale carbon capture has successfully removed CO_2 at surface coal gasification plants

Enhanced Oil Recovery (EOR)

- Proven method of carbon sequestration
- Economically-preferred method of sequestration
- Extends productive life of existing oil fields

Environmental benefits of EOR

- Maximizes use of existing oilfield infrastructure
- Environmental impact of development already realized by legacy oil development
- Reduces pressure to explore and develop additional areas

UCG is not coal mining

•No open pits, mountaintop removal or tailing piles

•No surface water pollution or impact

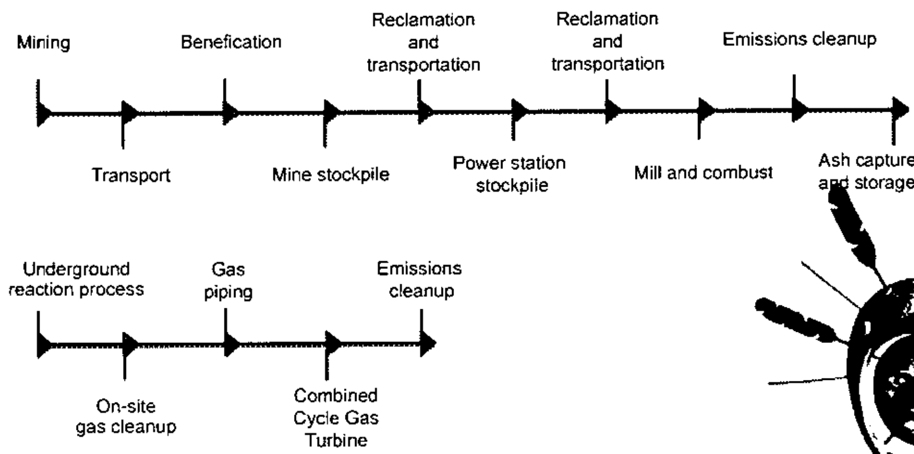
•Reduces or eliminates pollutants that accompany coal mining

•No surface ash and slag waste handling

•Project site is small and easily restored upon project completion

•Not coal bed methane extraction

UCG is not coal mining



CIRI's commitment

CIRI will only begin building a UCG facility after a deliberate, thoughtful process

- Performing all necessary due diligence, Environmental Impact Statement (EIS) and securing all necessary permits
- Reaching agreements with world-class technology partners
- Evaluating input from local and national stakeholders

Timeline

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Preliminary timeline

Dec. 2009: Resource Assessment drilling begins

Feb. 2010: Preliminary Resource Assessment results; Preliminary site selection

Mar. 2010: Pre-feasibility drilling begins

Aug. 2010: Site characterization drilling begins

Nov. 2010: Project permit application preparation begins

Nov. 2012: Project permits received

Jan. 2013: Above-ground project construction begins

Jan. 2014: Commercial operations begin

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What is Underground Coal Gasification?

Underground Coal Gasification (UCG) is a technology that harnesses the energy potential of coal in the ground without mining. The gasification process takes place deep underground within the coal seam. Air is injected into the coal through one well. The coal is then synthesized into a product called syngas, also known as synthesis gas, and produced from a second well. UCG uses reactions between the coal, oxygen from the injected air and water that is in the coal seam to produce hydrogen, carbon monoxide and methane. The syngas can be handled and used much like natural gas. It can, for example, be piped, stored and used to fuel a turbine to generate electricity. Syngas can also be upgraded with methanation into synthetic natural gas.

The gasification process occurs underground ("in-situ"), foregoing most of the dangerous, dirty and destructive effects of coal mining. UCG requires minimal infrastructure and involves very little physical disruption to the natural area above the coal seam. There are wells, pipelines, compressors and some gas processing equipment at the production site.

UCG represents a dramatic shift in the method of accessing and unlocking the energy potential of an abundant domestic natural resource. When combined with carbon capture and sequestration, the UCG process of producing, transporting and using coal energy leaves about the same carbon footprint as traditional natural gas.

UCG: How it works

Responsible UCG projects require careful site selection and evaluation to identify deep coal seams that are typically at least 650 feet below the surface, below the water table and contained by strong, impermeable layers of rock.

After appropriate site selection and evaluation, the process typically begins by drilling two well holes into the coal seam a few hundred feet apart. Operators inject air (for the oxygen) into one of the wells and then start a carefully-controlled combustion reaction. The heat and pressure created by the reaction converts the coal into syngas. The gas moves through a permeable path that has been created in the coal where the second well vents it to the surface. Only syngas is removed, leaving ash and most other byproducts deep underground. Following some surface processing, the gas is ready for near-site use or transport. The operation can be expanded by drilling additional process wells. Some of the coal is left in place to prevent subsidence (unintentional settling).

The UCG process is controlled from the surface by managing the injection of the oxygen. Operators can quickly halt the process at any time by cutting the oxygen supply or flooding the well with water. Natural water influx will quench the reactions, eliminating any potential for unwanted coal-seam fires.

Why consider UCG?

Commercial-scale UCG projects have been used to gasify coal for more than 50 years. There have been more than 50 test and commercial UCG projects worldwide, including in the United States. Numerous commercial operations are currently in various stages of design, development, scale-up or operation. Recent investment and scientific study have led to a better scientific understanding of the UCG process.

Commercial-scale carbon capture technologies are mature and have been successfully used for years to remove carbon dioxide from syngas produced at surface coal-gasification plants. UCG lends itself easily to carbon capture and sequestration. The UCG process also produces syngas at temperatures, pressures and CO_2 concentrations that enable relatively simple, low-cost carbon removal, prior to use. The syngas is then burned to create clean energy with a carbon emission footprint similar to that of natural gas and far below that of coal mining and combustion.

UCG with CCS eliminates most of the environmental and safety issues associated with coal mining and energy generation, including mine safety, surface disfiguration, coal dust, surface water contamination and other pollutants including carbon dioxide, nitrogen oxide, sulfur dioxide, ash, mercury, arsenic, sulfur and tar. UCG's biggest environmental concerns involve subsidence and underground residues that can be managed with careful project site selection and evaluation, design and operation.

UCG with carbon capture is clean, economical and safe. It has a small carbon and environmental footprint. UCG with CCS can become a bridge technology that will help our nation move toward domestically produced, sustainable energy resources and away from its dependence on imported oil.

Key Facts

- UCG harnesses the energy potential of coal underneath the ground—without conventional mining
- UCG produces syngas, which can be burned directly for heat or electricity, or converted to other products such as synthetic natural gas, hydrogen, methanol or hydrocarbon liquids
- UCG works well in conjunction with carbon capture and sequestration (CCS)
- UCG with CCS can provide clean, reliable and competitively-priced power to meet today's energy needs
- UCG uses coal that is otherwise not economically recoverable
- UCG is a safe technology that has been used commercially for more than 50 years
- Careful site selection and process operation assure minimal environmental impacts
- UCG with carbon capture is a bridge technology that can help Alaska and the United States move toward energy independence

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Environmental Benefits of UCG

Underground coal gasification (UCG) is a proven technology that harnesses the energy potential of coal in the ground while avoiding the environmental risks and hazards of coal mining. It represents a promising opportunity to meet our energy needs using coal, one of our most abundant natural resources, in a responsible manner. UCG offers many environmental benefits over conventional coal mining and natural gas extraction, including a lower carbon footprint and options for carbon capture and sequestration (CCS). UCG combined with carbon capture could become an important bridge technology that can help the United States transition from its unsustainable high-carbon economy based on imported oil to a more sustainable economy that relies on domestic energy resources, and ultimately to a clean renewable energy future.

Underground coal gasification represents a drastic shift away from conventional coal mining.

With UCG, coal is gasified through a controlled process that requires a series of wells drilled several hundred feet apart. Site operators inject air into one set of the wells and start a carefully- controlled combustion reaction that converts into syngas that is produced through a second set of wells. The above-ground landscape remains largely untouched. There are no open pits, mountaintop removal or tailing piles because there is no conventional mining and the environmental and health hazards associated with mining are virtually eliminated. Because little above-ground infrastructure is needed, the natural landscape is easily restored upon project completion.

UCG has a smaller carbon footprint.

With UCG, syngas is synthesized from the coal and can be used for power generation or piped to nearby locations, reducing the carbon and other emissions from handling, transportation and waste management associated with coal mining beyond extraction and burning. UCG eliminates the need for miles of conveyor belts pulling coal to rail or shipping lines. There are no clouds of coal dust polluting the environment. UCG produces clean, local, reliable energy.

The UCG process leaves most pollutants underground where they belong.

According to the Lawrence Livermore National Laboratory, UCG results in no production of criteria pollutants including SO_X and NO_X. Many other pollutants, including mercury, particulates and sulfur species, are greatly reduced and easier to handle. Likewise, UCG leaves the coal ash and other process wastes deep underground, eliminating the cost and risk of handling and disposing of dirty surface ash.

UCG syngas burns more cleanly than coal and even natural gas.

Burning UCG-produced syngas with pre-combustion carbon capture can result in lower CO_2 emissions than a combined-cycle natural gas power plant, the cleanest of all fossil fuel plants. UCG-produced syngas also significantly reduces or eliminates SO_X, NO_X, mercury, particulates, coal ash and other pollutants.

UCG lends itself easily to carbon capture and sequestration.

The UCG process also produces syngas at temperatures, pressures and CO_2 concentrations that enable relatively simple, low-cost carbon removal, prior to use.

There are well-established scientific methods for dealing with the remaining environmental risks of UCG syngas production.

The two main environmental risks associated with UCG–surface subsidence and groundwater contamination-are easily managed by careful site selection, project design and project monitoring. Subsidence is a downward shift in the earth's surface into the cavity created in the reactor zone. UCG operations cause less subsidence than underground mining, and this subsidence can be minimized or even eliminated with proper site selection, reactor zone pressure and temperature management. Likewise, the risk of groundwater contamination can be virtually eliminated by selecting a site well below the fresh-water aquifer and with the proper type of impermeable overburden strata. The process chamber pressure is carefully managed to keep it below the hydrostatic pressure in the coal seam to keep water in flux and pollutants in the process cavity.

CIRI

Frequently Asked Questions

Why is CIRI looking at Underground Coal Gasification (UCG)?
CIRI is investing in innovation, technology and a diverse portfolio of clean, dependable and economical energy sources that are critical to the future of Alaska. In addition to our interest in UCG, CIRI's energy projects and investments involve wind, biofuels, and traditional oil and gas operations. Energy is a critical part of CIRI's business and we take seriously the responsibility of providing diversified energy solutions while respecting Alaska's natural environment and cultural traditions.

What is UCG?
UCG is a technological process that harnesses the power of abundant and previously untapped underground coal resources to create cleaner energy without the environmental hazards of coal mining. Read What is UCG? for more detailed information.

Is UCG a proven technology?
Yes. Lawrence Livermore National Laboratories, a research institute funded by the U.S. Department of Energy and home to some of the nation's best minds on energy technology and security, developed UCG best practices based on factual and reliable scientific evidence. Commercial-scale UCG projects have been used to gasify coal for more than 50 years. There have been more than 50 test and commercial UCG projects worldwide, including in the United States. Numerous commercial operations are currently in various stages of design, development, scale-up or operation. Recent investment and scientific studies have led to numerous refinements that make the UCG process safer and cleaner. Several projects have demonstrated that UCG works well with carbon capture and sequestration (CCS) technologies.

How does UCG work?
UCG facilities involve wells drilled into carefully selected deep coal seams that are well below the fresh-water aquifer and contained by overlying, strong impermeable layers of rock. Site operators inject air into one set of wells and start a carefully controlled combustion reaction to convert the coal into syngas that is produced through a second set of wells. The process is designed so that operators can effectively control the oxygen supply and, thereby, combustion from the surface. The process can be stopped at any time for any reason. Read What is UCG? for more detailed information.

How is UCG different from conventional coal mining?
The environmental footprint of UCG is much smaller than both underground and surface coal mining. UCG is conducted completely underground and UCG-produced syngas extracted from the coal can be utilized near-site for power production or efficiently shipped by pipeline to other destinations. The aboveground landscape remains largely untouched. There are no open pits, mountaintop removal or tailing piles. Minimal infrastructure is needed aboveground, and the surface landscape is easily restored upon project completion. Read our Environmental Benefits for more information.

What is syngas?
Synthesis gas, or syngas, is an energy-rich product created by gasifying the carbon found in coal, petroleum-based materials or other sources that would be rejected as waste. Once created, it can be piped, stored or used to fuel a turbine to generate electricity; handled and used like natural gas; or upgraded or converted to make synthetic natural gas or other liquid fuels.

How much energy can UCG produce?

According to Lawrence Livermore National Laboratory, UCG provides the potential for an increase of 300-400 percent in recoverable coal reserves in the United States alone. These coal reserves represent an outstanding opportunity to harness the power of coal without the hazards of coal mining. For CIRI to proceed with a UCG project, we would need a project that is environmentally and economically viable from site selection to syngas production. An initial project that provides enough syngas to power a 100-megawatt combined-cycle power plant may be an economically viable option.

How does UCG compare to other energy sources?

UCG syngas burns more cleanly than coal and is comparable to natural gas. Burning UCG-produced syngas using carbon capture results in even lower emissions than a combined-cycle natural gas power plant, the cleanest of all fossil fuel plants. UCG-produced syngas also significantly reduces or eliminates pollutants including nitrogen (NO_X) and sulfur oxides (SO_X), mercury, particulates and coal ash.

How will UCG benefit Alaska?

Developing UCG facilities in Alaska will not require large public subsidies and will be faster and more economical than building a bullet line to ship natural gas from the North Slope to Southcentral Alaska. UCG with carbon capture can be a bridge technology that can help reduce our reliance on diminishing oil and to cleaner, domestic energy resources that can help Alaska regain its position as a world-class energy provider and innovator. The result is a much-needed reliable and homegrown source of clean energy for Alaska.

When will CIRI begin production?

CIRI would only begin building a UCG facility for syngas production after completing an Environmental Impact Statement, securing all necessary permits, reaching agreements with world-class technology partners and evaluating input from local and national stakeholders.

Where will CIRI's facility be located?

CIRI is evaluating its privately-owned land on the west side of Cook Inlet to identify a site with the right characteristics for a UCG development. The site will have a large and productive deeply-buried coal seam overlain by a strong and impermeable layer of rock. The site will be selected for geology and hydrogeology that would minimize any risk of environmental contamination. The site will be near existing power and natural gas infrastructure but away from any populated communities.

*Science*Insider
Breaking news and analysis from the world of science policy

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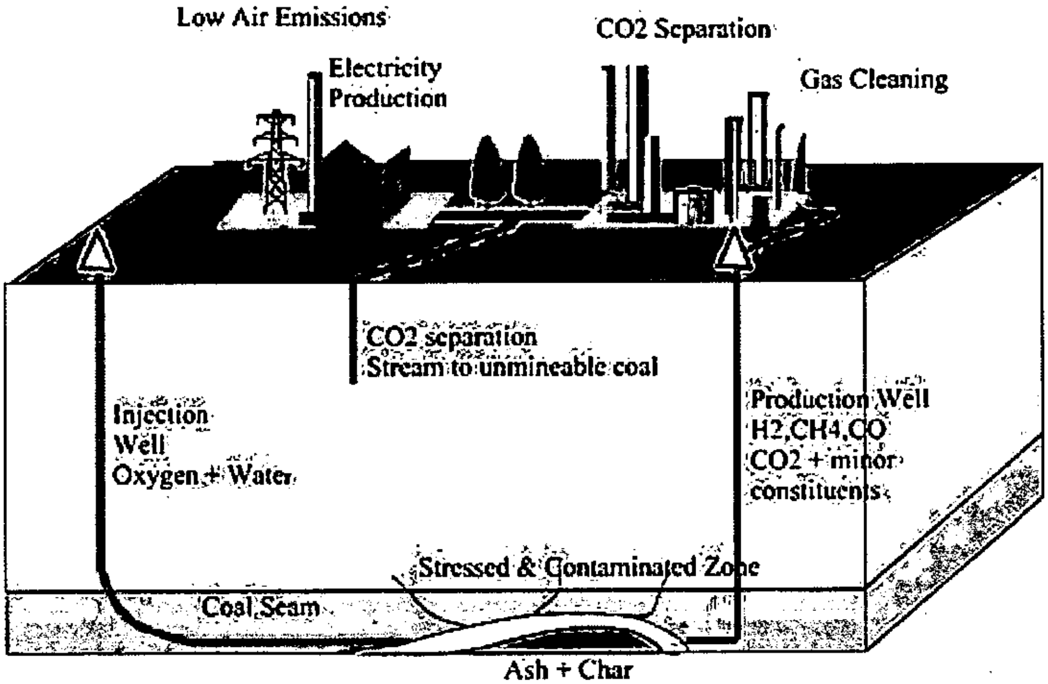

Should the U.S. Build Its Next Coal Plants Underground?

By: Eli Kintisch

Might burning coal thousands of feet below the surface be the secret to making coal climate friendly?

That's what fans of underground coal gasification will be saying this week at several sessions and in the keynote speech at the International Pittsburgh Coal Conference, which goes through Wednesday. Momentum is growing worldwide to look closely at the idea, a 150-year-old technique of igniting seams of coal deep under the ground to produce electrical power or chemicals. It's a proven technology: Joseph Stalin launched the first national research program into the idea in 1928 and the Soviets used it for 40 years to produce power. Since then, cheap natural gas and shallow, easy-to-mine coal burned in traditional power plants have prevented the technique from taking off. (graphic courtesy Lawrence Livermore National Laboratory)

But gasifying coal underground is now a hot topic among power companies and scientists, with at least 10 pilot projects around the world planned or underway. The cost benefits and climate advantages are among the reasons that five countries run national research programs on the technique; is the United States falling behind on the next big fossil fuel technology?

Yes, says the nonprofit Clean Air Task Force, a well-respected public health and environment advocacy group, in a report issued last week.

Recent studies suggest that energy obtained using the technique would be cheaper than more popular methods of getting low emissions coal power, like so-called Integrated Gasification Combined Cycle (IGCC), which involves gasifying coal above ground in facilities like the FutureGen project, which the Bush Administration proposed and then killed. The idea would also eliminate the need for strip mining, which is environmentally harmful, or carbon intensive shipping of mined coal.

"The enormous potential of underground coal gasification to meet rising energy demand in a CO_2-constrained world warrants a high priority effort by the United States government to speed commercialization," the Task Force study said.

The technology works by drilling two holes on either side of an underground layer of coal. If the layer is not porous, engineers drill horizontally to connect them, allowing gas to flow between the pipes. Then air or oxygen is added to one pipe and the coal ignited underground. There, the coal is partially oxidized; the gas which escapes from the second pipe is a mixture of syngas (carbon monoxide and hydrogen) and carbon dioxide and a little methane. On the surface, the hydrogen is cleanly burned in a turbine to produce electricity and the carbon dioxide, as well as processed carbon monoxide, is liquefied for underground storage.

The advantages of the techniques are myriad, says the Task Force, starting with the fact that it's a cleaner version of "clean coal" than other techniques:

> *[D]uring gasification, roughly half of the sulfur, mercury, arsenic, tar, ash, and particulates from the used coal remain in the subsurface, and any sulfur or metals that reach the surface arrive in a chemically reduced state, making them relatively simple to remove.*

The carbon dioxide that comes out of the ground is at high pressure, saving energy that in IGCC would be required to compress it for underground storage. The coal doesn't have to be mined; the facilities on the ground are much smaller than traditional coal plants with boilers or IGCC plants. The trick is to use the ground itself as a gasifier instead of having to gassify the coal in a vessel—which can cost billions.

The Task Force thinks that the technology could compete economically a natural gas plan that sequesters its carbon. That's a claim most advocates of other coal technologies cannot make. And a study that the task force cited suggested that underground gasification with the carbon capture for storage would cost a quarter as much as IGCC.

Traditionally, the coal industry looks for thick layers of coal near the surface so it can mine them relatively easily. With underground gasification, geologists would scope out thinner but broader layers of coal found much deeper. The idea would be to produce power right above those seams. So, the report argues, underground gasification makes sense for new power plants in coal rich states, say in the U.S. midwest. A report by Purdue University scientists in March, in fact, found five promising sites state in Indiana where facilities could be built.

So if underground coal gasification is so great, why are commercial projects exploiting the method so few and far in between? Up till now, the reason is the availability of cheap energy using other means, author Julio Friedmann of the Lawrence Livermore National Laboratory in California tells *Science*Insider. During the late '70s energy crisis, the technology got several demonstrations in the United States, but the coal industry stuck with the methods it liked, especially because they owned rights for coal close to the surface. Plentiful and cheap natural gas was a further disincentive.

Now though, with natural gas prices rising and climate a central concern, Australia, Canada, China, New Zealand, and South Africa all have government-funded R&D projects in this area. "China has minted 100 Ph.D.'s in this area," says John Thompson, director of the Task Force's project on coal transformation. "We are losing."

The United States, he says, has little expertise comparatively, and the clean coal programs funded by the U.S. Department of Energy all but ignore the underground gasification technique. (One earmarked research effort in Utah is examining it.) "It's just not on our radar screen," says DOE Technology Development Manager Gary Stiegel, who says that funding limitations are the main reason that the government has not looked into the technology. He says the cost advantages to the technique might one day prove accurate, but in the meantime, "Nobody's built any so how do you know?"

For its part, the report suggests DOE spend more than $100 million over the next 4 years on science, development, and demonstration efforts to try to catch up.

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