June 15, 2023

Department of the Interior
Bureau of Land Management

Re: Notice of Intent To Prepare an Environmental Impact Statement To Analyze the Potential Environmental Effects from Maintaining Secretary Jewell's Coal Leasing Moratorium

Dear Bureau of Land Management, Interior:

The Wyoming Energy Authority's mission is to advance Wyoming's "All-the-Above" energy strategy by driving data, technology, and infrastructure investments. WEA's vision is to support and promote Wyoming's energy sector by implementing the state's energy strategy; delivering positive economic impact and jobs for Wyoming; fostering an environment for the sustainability and growth of Wyoming's economy; and ensuring Wyoming continues to power the nation.

A moratorium on coal leasing would cause significant and unnecessary harm both to Wyoming and to the Nation due to several important factors:

1. **Reducing the amount of federal coal leased and ultimately produced would result in the reduction of hundreds of millions of dollars of revenue for Wyoming and the Nation.**

Wyoming is unique in that a large portion of its land and minerals are owned and administered by the federal government. Of all the coal that is owned and leased by the federal government, over 80% of the Federally owned coal is produced in the Powder River Basin (PRB) annually. "*The BLM manages approximately 18.4 million acres of public lands and 42.9 million acres of federal mineral estate for multiple use in Wyoming. BLM-managed lands in Wyoming contain world-class energy and mineral resources that are crucial to the nation."*[1] *(BLM 2023).* Due to the nature the federal ownership it would make it nearly impossible for any operator to continue operations in the future if new PRB leasing did not continue.

The revenue generated through coal is vital to Wyoming and is necessary to support K-12 education and many other critical needs. Mineral severance tax to all accounts from coal for 2023 is projected to be more than $162M, which accounts for more than 18% of all mineral severance taxes paid to the state of Wyoming. In addition, for every 5% reduction in coal production, state coffers are negatively impacted by approximately $24.9M. Wyoming coal is estimated to provide the federal government over $110M this year in Federal Mineral Royalties and in 2022, coal produced in Wyoming helped power a quarter of our nation's homes.

[1] BLM 2023 - https://www.blm.gov/about/what-we-manage/wyoming#:~:text=The%20BLM%20manages%20approximately%2018.4,are%20crucial%20to%20the%20nation

2. **<u>A moratorium on federal coal leasing is unnecessary due to both technological innovation and other Federal efforts.</u>**

The EPA's proposed 111b regulation eliminates the need for a moratorium on coal leasing in the PRB. Advances in carbon capture and storage technologies make PRB even more environmentally beneficial. The proposed 111b regulations and existing 111d regulations assert that CCS is a commercially available technology for the mitigation of carbon dioxide emissions from coal-fired power plants and could capture 90% of the CO_2 from these facilities while reducing other criteria pollutants. Continuing the leasing and use of PRB coal for electricity generation with CCS under the current and proposed regulations will mitigate the potential for impacts on the climate and the environment.

The State of Wyoming is a leader in advancing CCS and is moving forward to do so commercially. Wyoming is one of the only states that have enacted legislation related to CCUS projects – e.g., state law defines who owns the pore space, a critical aspect of such projects. Wyoming is also one of the only states with existing CCUS-related infrastructure, such as carbon dioxide (CO_2) pipelines and extensive expertise based on hosting the largest operating CCS project in the world –Exxon's Shute Creek facility.

- Wyoming is the only state in the Nation to enact a law that creates a low-carbon/CCUS-based standard for coal-fired power plants that are regulated as public utilities. The law – H.B. 200 – is related to prior legislative enactments related to Wyoming's coal fleet (e.g., S.F. 159).
- Now only the second state in the Nation to be granted primacy from the U.S. Environmental Protection Agency (EPA) for implementation of the CO_2 injection regulations under the Class VI of the Safe Drinking Water Act's Underground Injection Control program. EPA announced this decision just last week.
- An international leader in many aspects of CCUS technology. Researchers at the University of Wyoming, for example, are currently funded by the U.S. Department of Energy (DOE) to advance a potential large-scale integrated CO_2 storage project near Gillette, Wyoming, in the Wyoming CarbonSAFE project.[2] Several years ago, comparable geologic assessments were conducted at another site in the state, and the University of Wyoming is in negotiations with the Department of Energy on another award focused on designing and partially constructing a CO_2 storage hub in southwest Wyoming.[3]
- Home to the Wyoming Integrated Test Center, where researchers test the utilization and management of CO_2 that is sourced from a coal-fired power plant.[4]

Wyoming is moving forward with deployment of CCS, and it is the best approach to drastically reduce emissions from federal coal, not a leasing moratorium.

3. **<u>To ensure electric grid reliability, coal is necessary for the foreseeable future.</u>**

The DOE EIA Annual Energy Outlook 2023 predicts that even with the shift toward deployment of large amounts of renewable energy, coal will still play a significant role in the electricity sector providing over

[2] https://www.uwyo.edu/cegr/research-projects/carbonsafe-p2-dryfork.html.
[3] https://www.uwyo.edu/cegr/research-projects/project-wy-cusp.html.
[4] https://www.wyomingitc.org/about/.

110 GW in 2030 and over 70 GW of electricity in 2050.[5] A moratorium on leasing coal from federal mineral leases in the PRB will put the system of coal-fired power plants in jeopardy of producing reliable electricity necessary to support a grid that will be bringing on a significant amount of intermittent renewable energy.

As the North American Electric Reliability Corporation (NERC) concluded in its '2023 Summer Reliability Assessment', a majority of the United States is under elevated risk for "potential for insufficient operating reserves in above-normal conditions". A federal leasing moratorium for coal would only increase this risk assessment in the future and put millions of Americans in jeopardy of not having adequate electricity.

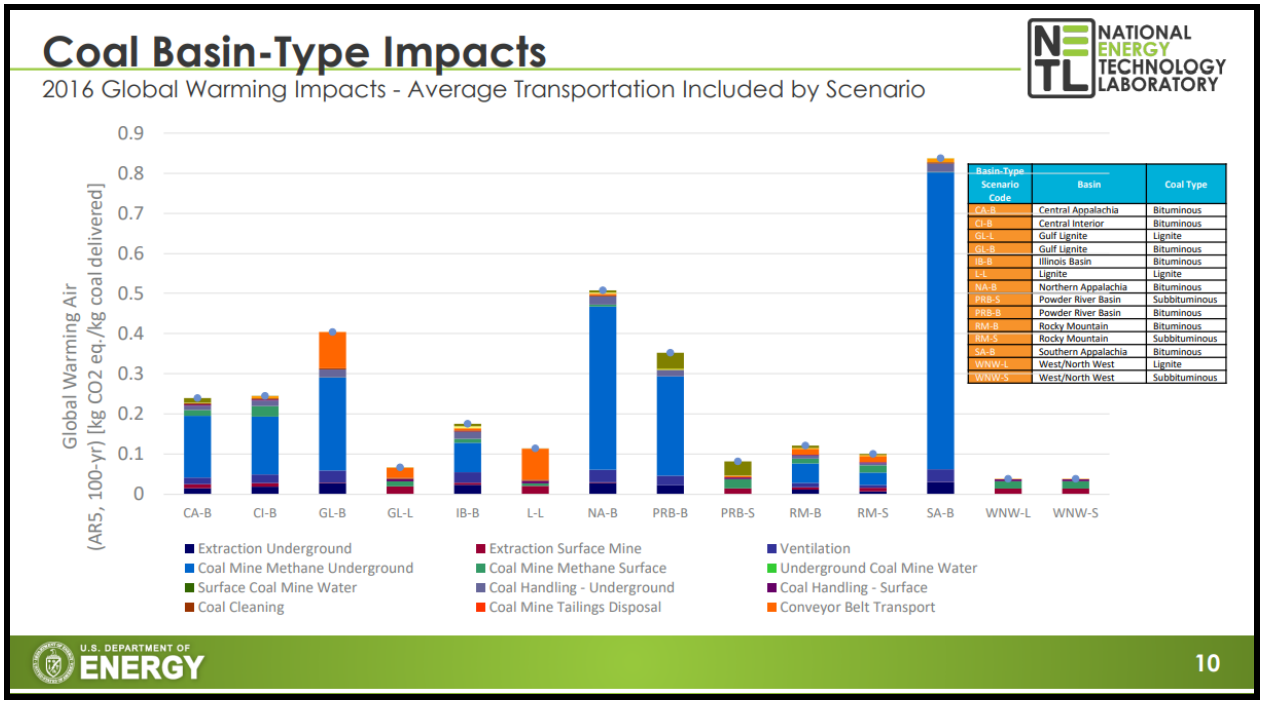
4. **<u>Federal coal from Wyoming offers a lower environmental footprint compared to most non-federal coal fuel sources.</u>**

Limiting mining for PRB coal will force the increased use of other coals with higher sulfur content and GHG footprint, which will have a negative impact on the environment when federal coal consumption is replaced with non-federal coal consumption. In addition, Wyoming federal coal is considered a low-sulfur coal.

Department of Energy researchers at the National Energy Technology Laboratory assessed various types of coal in the United States. Subbituminous Powder River Basin coal, largely produced in Wyoming, is among the lowest in terms of global warming impacts.[6] Therefore, any EIS should consider that any displacement of Wyoming coal due to a federal leasing moratorium could have adverse impacts on the greenhouse gas life cycle footprint. See the figure below for more information (noting that Wyoming federal coal is largely represented by the data label 'PRB-S').

[5] DOE EIA – Annual Coal Report - Release Date: October 18, 2022 - https://www.eia.gov/coal/annual/#:~:text=Highlights%20for%202021,2020%20level%20to%2039%2C518%20employees.

[6] Carlson, Derrick R., Krynock, Michelle, Roman-White, Selina, Cooney, Greg, and Skone, Timothy J.. Modeling the Life Cycle Impacts of U.S. Coal Mining at a Regional Level - ISSST2018. United States: N. p., 2023. https://netl.doe.gov/energy-analysis/details?id=4b951273-6650-4832-9a2b-c20be195340a



5. **<u>The federal government and Wyoming have invested in non-combustion uses of Wyoming coal and coal byproducts that will sustain economic development, jobs and revenue in Wyoming, improve national security and reduce environmental footprint compared to market incumbents.</u>**

    a. Rare Earth Elements and Critical Minerals

A federal coal moratorium would cripple the United States' efforts to transition to a clean economy and the production of low-carbon fuels, critical minerals, and building products. Federal PRB coal is an excellent feedstock to produce many of these low-carbon energy technologies, such as the rare earth elements and critical minerals needed for energy technologies, such as wind turbines.

Coal and coal byproducts have potential as unconventional feedstocks for critical minerals, including rare earth elements. Infrastructure and skilled workforce exist in coal regions that could potentially be transitioned to other energy-related industries centered around the critical minerals and carbon-based products supply chains. These complex supply chains offer the opportunity for jobs related to extraction, processing, and manufacturing.

The Department of Energy is investing in identifying rare earth elements and critical minerals associated with Wyoming federal coal in two projects in the CORE-CM program (Carbon Ore, Rare Earths and Critical Minerals). A federal coal moratorium would result in the stranding of potential CORE-CM assets at a time when the United States needs access to the widest variety of geologic materials required to meet the goal of a complete domestic supply chain related to carbon ore and critical minerals. Additionally, the closure of certain coal assets that possess ideal raw materials for modern industry, located adjacent to

developing advanced technology industries such as battery production, solar panel production, and aerospace technologies (among other advanced manufacturing sectors), would hinder the economics of these budding domestic industries. Therefore, it is worth considering the allowance of the DOE-led

CORE-CM projects to complete their course and not stop these important efforts through a federal coal leasing moratorium.

b. Carbon Engineering

Since its inception in July 2016, the Carbon Engineering Initiative at the University of Wyoming, School of Energy Resources has focused on identifying the feasibility and proving pathways to manufacture value-added high carbon content products from Wyoming Powder River Basin (PRB) coal. The state of Wyoming has spent more than $30 million investing in this program since its inception with the goal of creating high paying manufacturing jobs in the Nation's largest coal community: Campbell County, Wyoming.

In the past seven years, the researchers working in this area have developed a two-step upstream process: Solvent Extraction and Fast Pyrolysis that produce coal extract materials and coal char. Using the feedstocks generated by these processes, downstream products are being made into products that are superior to current market products and are economically attractive. The current focus of the initiative is to identify and produce coal-derived products that consume large quantities of Wyoming coal.

There are numerous products under development, including components for asphalt for roads and roofing materials, building materials (bricks, foam, drywall, pavers, aggregate for roads and other products), graphene oxide, soil amendment, reclamation, and polymer products (decking material) and carbon membranes for water reuse.

The life cycle of these products, especially the CO_2 footprint, is being considered throughout this initiative. For example, coal-derived asphalt products have a lower carbon footprint than their petroleum-based market incumbents. Petroleum-derived asphalt products produce 376 kg CO_{2e}/ton of asphalt whereas coal-derived asphalt products produce 73kg CO_{2e}/ton of coal-derived asphalt. Similarly, coal char bricks are chemically cured, resulting in energy savings during production compared to traditional bricks. These coal char bricks are less expensive to produce and are half the weight of a clay brick, which helps with transportation costs and potentially transportation fuel consumption.

These are just some of the advantages of the products generated from the Carbon Engineering Initiative. This program and the overall goal of supporting the largest coal-producing community in the Nation would be in peril if a federal coal-leasing moratorium were to be put in place.

c. Hydrogen

The Hydrogen Strategic Plan and Roadmap release in June 2023 predicts that an additional 10 million metric tonnes (MMT) of clean hydrogen will be produced annually by 2030, 20 MMT annually by 2040,

and 50 MMT annually by 2050.[7] Only 1% of the current U.S. hydrogen production is produced by electrolysis due to the lack of electrolyzer production capacity and renewable energy to dedicate to electrolysis. Meeting the goals for clean hydrogen production using only electrolysis and curtailed renewable energy is not feasible in the proposed time frames. Gasification of PRB coal with CCS offers a low-cost pathway to meeting the demand for low-carbon hydrogen from the industrial, power, and transportation sectors as the electrolysis and renewable energy sectors mature. This is a well demonstrated option for hydrogen production, as coal gasification presently provides around 18% of the

[7] DOE 2023 Hydrogen Strategy and Roadmap - https://www.hydrogen.energy.gov/pdfs/us-national-clean-hydrogen-strategy-roadmap.pdf

total hydrogen in the world and is the second-largest and most cost-effective way of producing hydrogen.[8]

Coal gasification appears to be a significant option for cleaner and more cost-effective generation of energy and other chemical products,[9] where the following advantages come to the forefront compared to the traditional coal combustion processes:

- Coal gasification converts more efficiently the high moisture and ash content of coal into useful outputs[10]
- Coal gasification provides synthesis gas production with high calorific value[11]
- As a result of coal gasification, carbon emissions are considerably decreased[12,13]

Gasification is the only commercial, large-scale option for converting solids into gases,[14] and the cleanest conversion technology for solid fuels. Hydrogen produced from coal-based gasification has recently been shown to be competitive with production from natural gas, provided the cost of natural gas remains above US$4/106 Btu and the reliability of gasification-based processes can be demonstrated to be high.[15]

The cost of producing hydrogen from coal could be reduced by 25–50%, even with the capture and sequestration of CO_2.[16]

The costs of hydrogen production for natural gas and coal/biomass are much lower than for electrolysis (which presently has only a 4% market share) due to the production volume (which is much higher for hydrogen from fossil fuels) and the mature state of the technology. A comparison of efficiencies and costs for various hydrogen production methods[17] shows steam reforming of natural gas to be the most beneficial, with high efficiencies (65 to 75% based on LHV) and low production costs (5 to 8 US$/GJ). Gasification of biomass and coal has an overall efficiency of 42 to 47% (LHV) with an average production cost at 9 to 13 US$/GJ, while water electrolysis has the lowest efficiency (35 to 42% HHV) and highest production cost (on average 20 US$/GJ) see Figure 1.

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[8] Adnan Midilli, Haydar Kucuk, Muhammed Emin Topal, Ugur Akbulut, Ibrahim Dincer, A comprehensive review on hydrogen production from coal gasification: Challenges and Opportunities, International Journal of Hydrogen Energy, Volume 46, Issue 50, 2021, Pages 25385-25412, ISSN 0360-3199, https://doi.org/10.1016/j.ijhydene.2021.05.088.

[9] Y. Wu, Impinging streams: fundamentals, properties and applications (1st ed.), Elsevier Science (2007) https://doi: 10.1016/B978-0-444-53037-0.X5026-5

[10] M. Gräbner Industrial coal gasification technologies covering baseline and high-ash coal (1st ed.), Wiley-VCH, Weinheim (2014), 10.1002/9783527336913

[11] J.C. Solarte-Toro, Y. Chacón-Pérez, C.A. Cardona-Alzate Evaluation of biogas and syngas as energy vectors for heat and power generation using lignocellulosic biomass as raw material Electron J Biotechnol, 33 (2018), pp. 52-62, 10.1016/j.ejbt.2018.03.005

[12] X. Lu, L. Cao, H. Wang, W. Peng, J. Xing, S. Wang, S. Cai, B. Shen, Q. Yang, C.P. Nielsen, M.B. McElroy, Gasification of coal and biomass as a net carbon-negative power source for environment-friendly electricity generation in China, Proc Natl Acad Sci Unit States Am, 116 (17) (2019), pp. 8206-8213, 10.1073/pnas.1812239116

[13] A.B. Rao, P.C. Phadke, CO2 capture and storage in coal gasification projects, IOP Conf Ser Earth Environ Sci, 76 (2017), Article 012011, 10.1088/1755-1315/76/1/012011

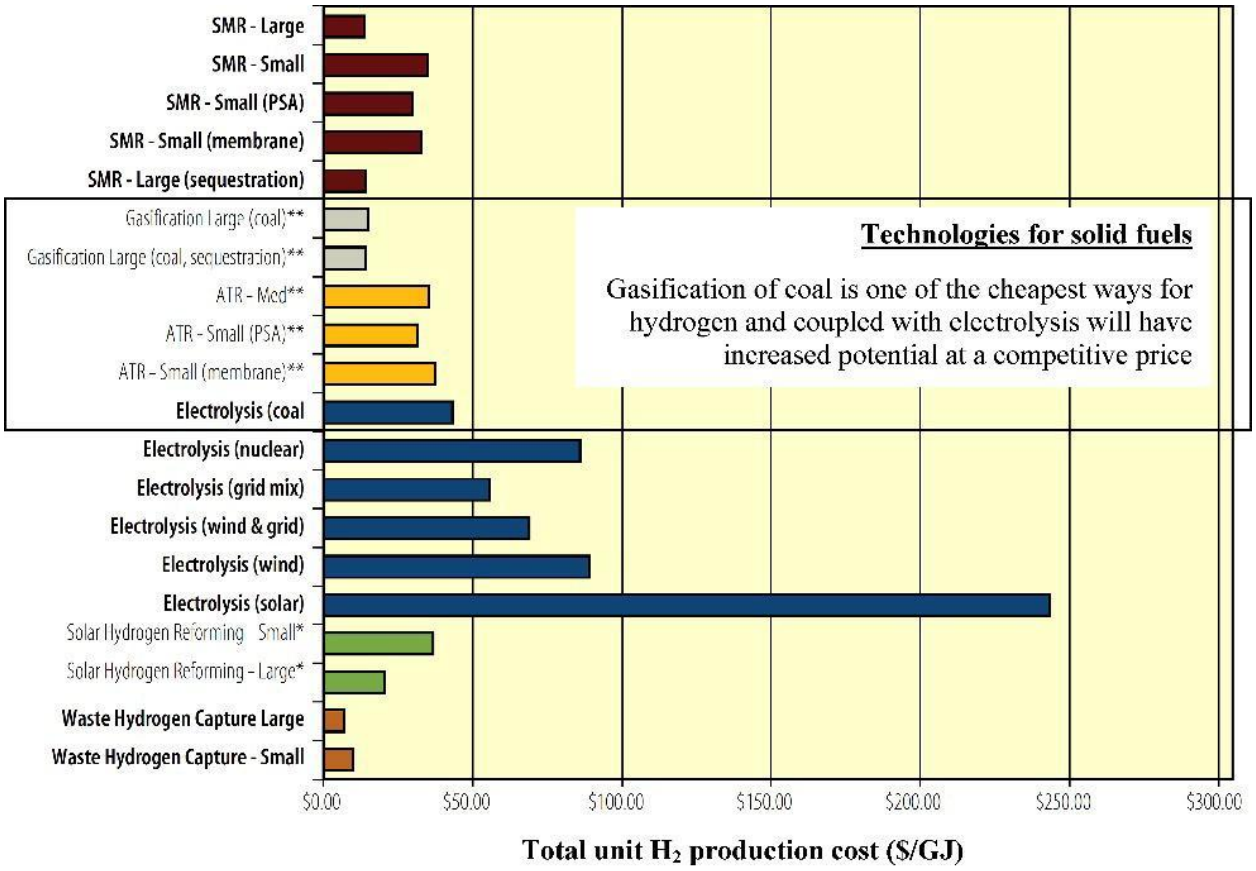
[14] N.V. Gnanapragasam &M.A. Rosen, A review of hydrogen production using coal, biomass, and other solid fuels, Pages 725-745 | Received 08 Oct 2015, Accepted 08 Feb 2017, Published online: 28 Mar 2017, https://doi.org/10.1080/17597269.2017.1302662

[15] G.J. Stiegel, M. Ramezan, Hydrogen from coal gasification: an economical pathway to a sustainable energy future, Int J Coal Geol, 65 (3–4) (2006), pp. 173-190, 10.1016/j.coal.2005.05.002

[16] N.V. Gnanapragasam &M.A. Rosen, A review of hydrogen production using coal, biomass, and other solid fuels, Pages 725-745 | Received 08 Oct 2015, Accepted 08 Feb 2017, Published online: 28 Mar 2017, https://doi.org/10.1080/17597269.2017.1302662

[17] Shoko E, McLellan B, da Costa D. Hydrogen from coal: Production and utilization technologies. Int J Coal Geol. 2006;65:213–222

The costs of hydrogen produced by SMR are dominated by fuel and feed costs, which makes coal gasification more favorable, especially if energy prices rise increasingly. Hydrogen production costs for SMR are estimated at 9.5 €/GJ, and an optimally designed coal gasification plant with electricity export may reach 7 €/GJ. CO_2 avoidance costs compared to identical plants without CO_2 capture are 23 and 5 €/t of CO_2 for SMR and coal gasification, respectively. The penalty for CO_2 capture is compared in Figure 2 with other hydrogen production technologies based on data compiled by Sustainable Development Technology Canada, 2006.[18]



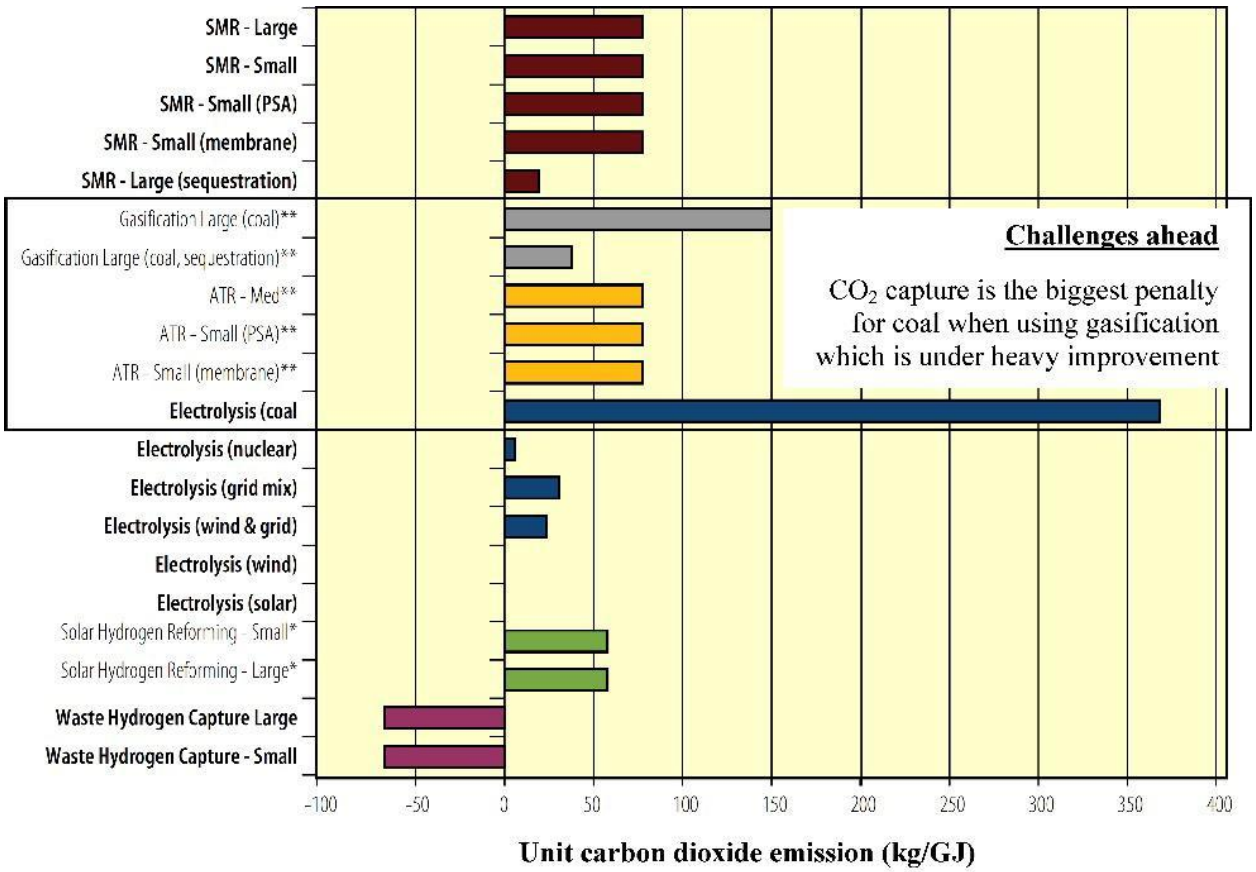
* Assumes CH_4 as source.

** Technology/process is under development.

Figure 1. Total costs of hydrogen production (in US$ per GJ hydrogen) with CO_2 valued at US$15/tonne for various production processes. Costs for solid fuel technologies are highlighted. SMR: Steam-Methane Reforming; PSA: Pressure Swing Adsorption; ATR: Auto-Thermal Reforming[19]

[18] SDTC. Renewable fuel – hydrogen. SD Business Case, Version 1, Sustainable Development Technology Canada, November. 2006. Available from: http://sdtc.ca/en/knowledge/RenewableFuel-Hydrogen.pdf

[19] SDTC. Renewable fuel – hydrogen. SD Business Case, Version 1, Sustainable Development Technology Canada, November. 2006. Available from: http://sdtc.ca/en/knowledge/RenewableFuel-Hydrogen.pdf



* Assumes CH_4 as source.

** Technology/process is under development.

Figure 2. Figure 8. Unit CO_2 emissions (in kg per GJ hydrogen), for various hydrogen production processes. Emissions for solid fuel technologies and their challenges are highlighted. SMR: Steam-Methane Reforming; PSA: Pressure Swing Adsorption; ATR: Auto-Thermal Reforming[20]

Federal coal in Wyoming is an integral part of the Nation's energy and supply chain, now and into the future. It is absolutely imperative to avoid a federal leasing moratorium for coal. This fuel can and must be a part of the Nation's future energy portfolio.

For your consideration,

Rob Creager

Executive Director

[20] SDTC. Renewable fuel – hydrogen. SD Business Case, Version 1, Sustainable Development Technology Canada, November. 2006. Available from: http://sdtc.ca/en/knowledge/RenewableFuel-Hydrogen.pdf