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SERVICE FEATURE / **EMERGING ENERGY RESOURCES**

Emerging energy advisory services help energy industry decarbonize processes

The pressure to decarbonize energy production and reduce overall carbon emissions is rapidly intensifying. Combining environmental, social and governance (ESG) pressures with the increasing cost of maintaining and enhancing asset profitability poses a daunting task. Meeting these challenges requires a strategy road map focused on investments that enable the most profitable and sustainable path forward.

Techno-economic evaluations can deliver needed market insights.

From petroleum refining and petrochemical manufacturing to interstate pipelines and distribution utilities, all energy sectors are under relentless pressure to develop strategies that identify and mitigate carbon emissions. These imperatives bump up against the need to maintain and enhance profitability.

A knowledgeable partner with a deep bench of experience can help you navigate through these new realities with emerging energy advisory services tailored to each company's unique market realities.

New operational realities include:

- Commoditization of services and products
- Global workforce
- Increasing demands for performance and reliability
- Market-responsive business models
- Evolving technology
- Ever-increasing data creation and utilization

Scope of services

A techno-economic approach delivers the market insight needed for a business case tailored to your specific market factors. Emerging energy advisory services provide a suite of techno-economic solutions designed for customized strategy implementation. Key areas of focus include:

- Business case development
- Asset configuration services
- Financial analysis
- Competitiveness analysis
- Strategy advisory

Case studies

Green hydrogen benchmarking facility
A Middle Eastern national oil company requested a detailed study on a benchmark green hydrogen production facility. It could become a resource to test and resolve the many technical and economic challenges associated with development of hydrogen as an emissions-free energy source.

The study recommended a facility that would utilize wind and solar power along with desalinated seawater to produce an average of 50 million standard cubic feet of hydrogen per day (MMSCFD). The plant would rely on electrolyzers to split water molecules into hydrogen and oxygen. Under the plan, part of the hydrogen produced would be utilized for fueling of passenger and commercial vehicles and the remainder transported via pipeline to a major population center.

Because intermittent renewable power would cause hydrogen production to ramp up and down each day, hydrogen storage would be required to level out ongoing production. Cost-effective and technically feasible storage has proven to be one of the most challenging problems facing the industry. It takes significant amounts of energy to compress or liquefy hydrogen for transport or cost-effective storage. For this benchmark facility, storage in medium-pressure tanks was considered the most feasible option, as the existing electrolysis process can produce the pressures needed with minimal additional energy required.

As hydrogen research progresses on new technologies and processes, especially related to storage, new breakthroughs will be monitored and incorporated into the facility plan.

CO_2 mineralization

A major Middle East petrochemical company is exploring options to reduce carbon emissions from a steam methane reforming (SMR) plant that is currently used to produce hydrogen for refinery hydrotreating operations. The scope of the assignment involved evaluating mineralization of CO_2 emissions — converting the gas into sodium bicarbonate solids to be deposited in a landfill for proper containment.

The process selected is a unique, patented means of removing CO_2 from the SMR flue gas stream and then converting it to sodium bicarbonate, a mineralized carbon byproduct. The process removes over 90% of the CO_2 from the flue gas by capturing it from the pressure-swing absorber (PSA) inlet gas at the SMR hydrogen plant. Sodium hydroxide in solution reacts with CO_2 from the PSA inlet gas, forming a sodium bicarbonate-rich salt solution. This solution is subsequently dried, and the sodium bicarbonate is then transported to a landfill.

The expectation for this pathway was that prevailing market conditions would yield negative financial metrics using traditional methods such as internal rate of return (IRR) and net present value (NPV). Instead, a break-even cost of carbon was calculated by applying a price of carbon per ton of CO_2 captured and consumed in the process, producing a $0 net present value at a target discount rate.

Other projects

Other examples of the 1898 & Co. techno-economic approach:

- Modeling of various operational scenarios for Argonne National Laboratory, focused on renewable fuels co-processing.
- A configuration analysis for zero-emission processing of light crude for a U.S. Gulf Coast refinery.
- Analysis of multiple refinery assets for a potential conversion from conventional crude refining to renewable diesel production.
- A techno-economic analysis of viable pathways from green ammonia process to power production.
- Development of a market entry strategy for production of biodiesel, renewable diesel and cellulosic ethanol.
- Review of carbon capture technology to remediate refinery stack emissions.

About 1898 & Co.

1898 & Co. is a business, technology and cybersecurity consulting firm serving the industries that keep our world in motion. As part of Burns & McDonnell, our consultants leverage global experience in critical infrastructure assets to innovate practical solutions grounded in your operational realities.

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