



THE ISSUE

Decarbonizing Heavy Industry

KEY TAKEAWAY

Heavy industry requires deep decarbonization. This is possible with emerging technologies – but digital technologies are necessary to understand and manage the technical and operational risks

The current situation

Heavy industry requires deep decarbonization, but the businesses in question are, for the most part, in hard-to-abate sectors such as power generation, oil and gas production, metals and mining, and chemicals. To operate, they need masses of energy which means non-carbon solutions like solar and batteries won't work, as they don't provide anything like the energy density required.

The good news is that new technologies and fuel sources such as carbon capture, sequestration, and even green hydrogen are emerging that can help this tough sector to decarbonize. And these projects are already well underway: at GE, we're working on over 100 carbon capture and sequestration projects, and over 300 hydrogen projects.

But, even though we're seeing the emergence of this asset class globally, they're currently still in their earliest stage and aren't yet broadly scalable or cost effective.

What lies below these technologies are a series of risks that the owners and technology companies related to these assets need to manage and mitigate to drive financiability, constructability and, ultimately, long term operations.

Primarily, those risks relate to how you capture, transport and store the carbon effectively for long-term sequestration, and then have long-term reporting, monitoring and verification of that activity. Likewise, with green hydrogen, the major challenge is being able to produce, transport and then burn it effectively in the most efficient manner with the least amount of risk.

The key challenges

The challenges in this area fall into three main categories

Understanding and managing operations

Introducing these emerging technologies into your operations adds an extra layer of complexity to an already complex system. Businesses need to understand how these assets fit into their operations and how they affect the performance of the plant, as well as understanding the different assets that are resident in that technology.

Monetizing carbon projects

Businesses undertaking these decarbonization projects will create a new core revenue stream related to the carbon they avoid and take out of their processes which can then be traded on carbon markets. But to get the best returns in such markets, they need to understand their whole supply chain, understand their plant operations, and understand how the end product is delivered to customers in order to get a picture of the carbon intensity of the whole process and, therefore, get an accurate picture of how much is being removed.

Long-term optimization

Understanding your plant performance and your carbon intensity is a good start – but the real ROI will come from optimizing those activities at scale. Businesses need to understand how they optimize the operations, performance and decision making associated with that plant, both upstream in terms of the feedstocks and supplier relationships, as well as downstream in terms of the monetization of carbon offset.

The digital solution

Digital technologies are critical for heavy industrial businesses undertaking decarbonization projects to help them understand, manage, and mitigate the risks associated with those activities, and getting to the point where they can be optimized.

In carbon capture and sequestration projects, there are technological risks and uncertainties with respect to the amount of carbon being captured, the processes used to capture that carbon, and the transportation and burial of that carbon. Digital technologies can greatly assist with that. For instance, sensors

and measurement devices can be used to record the amount of carbon that's been sequestered to ensure there's no leakage and to verify that the carbon is securely sequestered over a long duration.

Similarly, digital technologies can measure and mitigate the risks of the transport of hydrogen. Hydrogen, from a molecular standpoint, is very different from natural gas. It's a much finer molecule, and so you have to work harder to ensure the integrity of the assets. Just as in a pipeline, digital tools can be used to make sure hydrogen isn't leaking into the atmosphere and causing operational inefficiencies.

Finally, digital technologies are the most efficient and effective means to monetize carbon offset. It is possible to participate in carbon markets without digital tools, but it's suboptimal for two reasons. First, the process of recording that data is highly manual meaning there are far longer lead times in having usable data. Second, the quality of that data is far lower meaning it's less valuable within the markets themselves. (To find out more about decarbonization more broadly, [see this issue brief](#).)

Want to find out more?

For a more in-depth look at the current situation around decarbonization and how digital technologies will help enterprises achieve their goals, read our latest whitepaper: [Sustainability & Profitability: How Digital Solutions Can Help Power Generators and Oil & Gas Producers to Find the Balance in the Energy Transition](#).

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Dig deeper into the Energy Transition with resources focused on:

Why energy operators should focus on [Accelerating Decarbonization](#)

How to leverage digital solutions to [Decarbonize Heavy Industry](#)

Unlocking value with [Intelligent Asset and Fleet Optimization](#)



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John has 14 years experience in technology product management and engineering at GE working in the Energy and Oil and Gas sectors. He has served in roles spanning reliability engineering, outage and turnaround engineering, technology strategy development/execution and technology product management in areas of asset management, operations management and reliability management.

John also has 10 years experience in operations in the United States Air Force where he served as an instructor pilot and a fighter pilot. He holds a MS and BS degree in engineering.

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