



# Digital technology for the energy future

Bank of America 2020 Digital Energy Forum

Uwem Ukpung  
EVP of Regions, Alliances & Enterprise Sales

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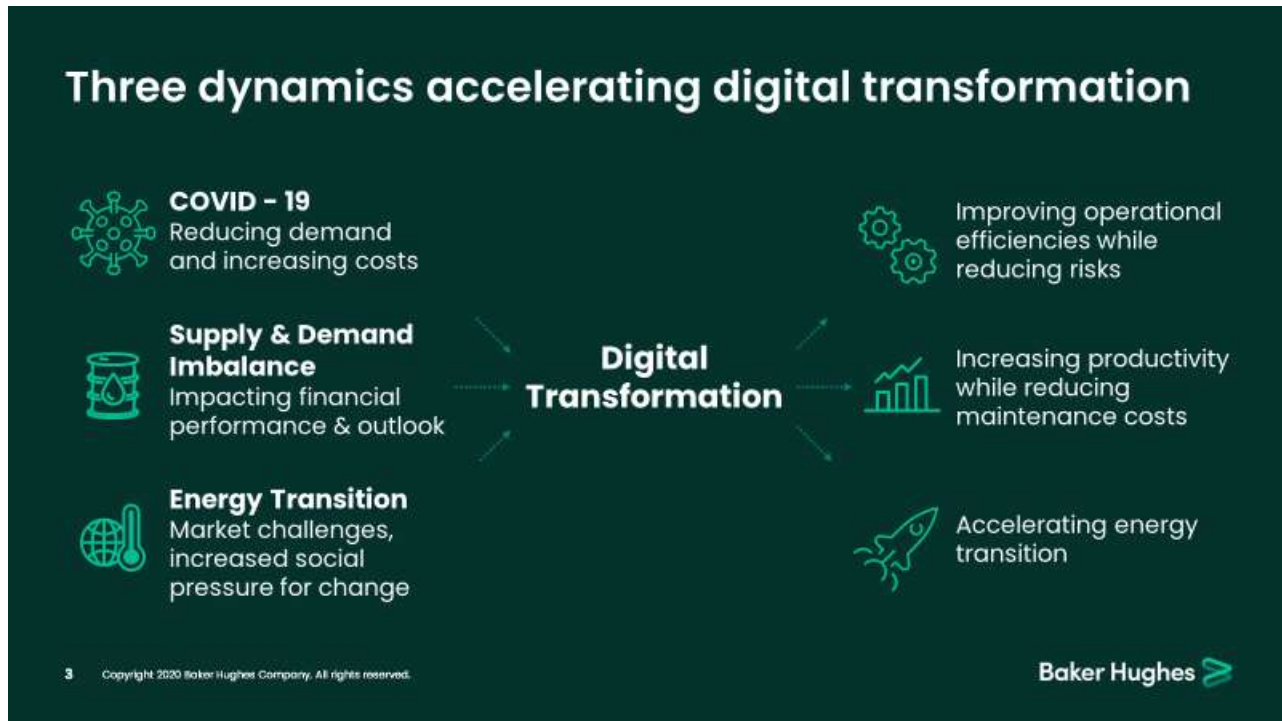
Good morning. Thank you to Chase Mulvehill and the Bank of America team for inviting me to speak today, and for all of you who are joining this session remotely.

This presentation (and oral statements made regarding the subjects of this release) may contain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended, (each a "forward-looking statement"). The words "anticipate," "believe," "ensure," "expect," "if," "intend," "estimate," "project," "foresee," "forecasts," "predict," "outlook," "aim," "will," "could," "should," "potential," "would," "may," "probable," "likely," and similar expressions, and the negative thereof, are intended to identify forward-looking statements. There are many risks and uncertainties that could cause actual results to differ materially from our forward-looking statements. These forward-looking statements are also affected by the risk factors described in the Company's annual report on Form 10-K for the period ended December 31, 2019 and quarterly reports on Form 10-Q for the period ended March 31, 2020 and June 30, 2020 and those set forth from time to time in other filings with the Securities and Exchange Commission ("SEC"). The documents are available through the Company's website at: [www.investors.bakerhughes.com](http://www.investors.bakerhughes.com) or through the SEC's Electronic Data Gathering and Analysis Retrieval ("EDGAR") system at: [www.sec.gov](http://www.sec.gov). We undertake no obligation to publicly update or revise any forward-looking statement.

The Company presents its financial results in accordance with GAAP; however, management believes that using additional non-GAAP measures will enhance the evaluation of the profitability of the Company and its ongoing operations. See the Appendix of this presentation for a reconciliation of GAAP to non-GAAP financial measures.

Before I begin, please note the disclosure around forward-looking statements that I may make today. As always, you can refer to our latest SEC filings for further details.

Today, I am going to address how Baker Hughes is working to deliver digital capabilities to our customers and the industry as an energy technology company.



I have worked in the energy industry for more than 20 years and have spent the last decade working with software for the oil and gas industry. I believe that today's realities are placing unforeseen pressure on the energy industry and all sectors of the oil and gas industry.

There are three dynamics in the marketplace today that are helping accelerate the digital transformation: COVID-19, the supply-demand imbalance in global oil markets, and energy transition.

We expect the COVID-19 pandemic to impact economic growth for the foreseeable future, potentially drive long-term behavioral changes in terms of travel and commuting patterns, and continue to push our customers to change the way they operate in the field.

In the oil markets, excess capacity remains a material overhang as the OPEC+ countries maintain their highest level of excess capacity in the last 20 years.

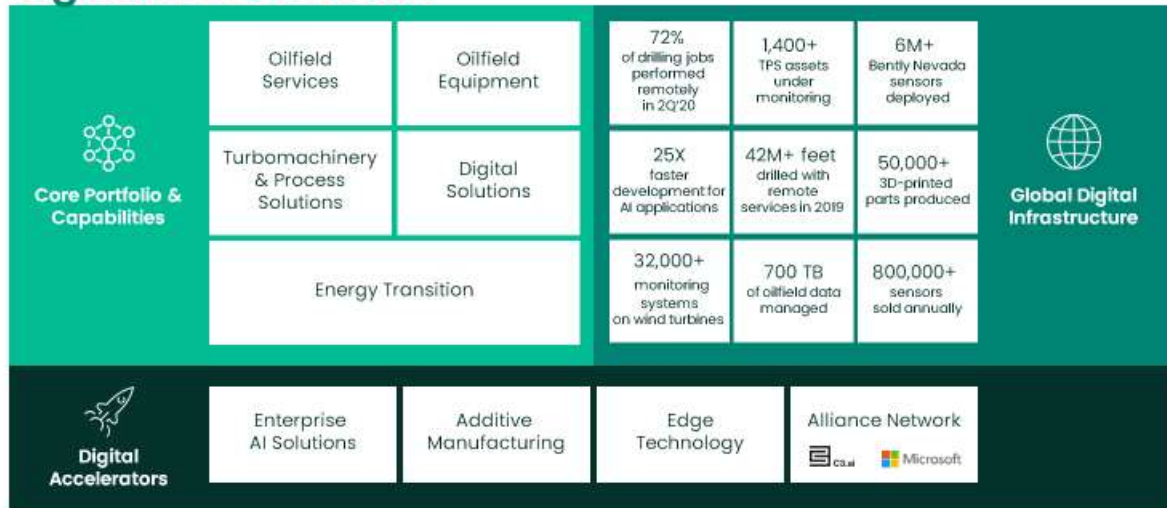
And looking beyond the current supply-demand imbalance, energy transition is becoming the bigger story in the energy markets as there is a broader shift unfolding in energy investment and consumption patterns that holds longer-term implications.

Due to a combination of factors that include greater energy efficiency, slower economic growth, and higher demand for cleaner energy sources, the growth in capital investment for hydrocarbons has downshifted significantly from prior decades while growth in renewable sources of energy is accelerating.

More importantly, we believe these trends are still in the relatively early stages and they are poised to widen further as demand for lower carbon solutions helps the energy transition gain momentum. Around the world, a growing percentage of the population, as well as governments and policymakers, are committing to a reduction in future carbon emissions.

These three dynamics will likely accelerate adoption of critical digital technologies that deliver productivity and safety, improve the economics of brownfield assets, and help our customers manage carbon emissions.

## Baker Hughes uniquely positioned to drive digital acceleration



Baker Hughes is uniquely positioned as an energy technology company to drive digital acceleration across the industry.

We operate in more than 120 countries around the world today, with 70% of total company revenues in 2019 coming from outside North America. Our core portfolio consists of four product companies, from oilfield services and equipment to turbomachinery and processing solutions. We also offer industrial measurement and controls capabilities through our digital solutions product company.

Our goal is to combine these strengths to deliver on the energy transition. This will entail helping to decarbonize existing oil and gas operations as well as expanding into new areas like carbon capture, hydrogen, energy storage and methane detection and management.

Digital accelerators are applied to these core capabilities; technologies that we have incubated, built, and partnered to deliver to customers.

This includes our BakerHughesC3.ai portfolio and our Microsoft alliance as well as our deep network of industrial sensors. Our technology centers are working with customers to develop applications that deploy at the edge for critical operations like compressor monitoring and drilling. Our additive manufacturing facilities are delivering spare parts and components for customer use, as well as for PPE to help first responders in the continued fight against COVID-19.

We believe our domain expertise and core capabilities in data science and R&D combined with leading technology providers C3.ai and Microsoft give us an unmatched ability to deliver digital.

## BakerHughesC3.ai is an AI leader in energy

June 2019	Sep. 2019	Nov. 2019	Feb. 2020
Launched BakerHughesC3.ai	1 <sup>st</sup> Joint AI Application Available	Microsoft Alliance Announced	2 <sup>nd</sup> Joint AI Application Available
			

### Accelerate Digital Transformation of the Energy Industry

Baker Hughes Internal Uses		Energy Customers		
Project	Value to Baker Hughes	Customer	Project	BHC3 AI Solution
<ul style="list-style-type: none"> <li>Inventory Optimization</li> <li>Demand Planning</li> <li>Drilling Hazards Prevention</li> </ul>	<ul style="list-style-type: none"> <li>Targeted reduction in inventory on hand</li> <li>Improve materials management and demand forecasting</li> <li>Optimize drilling plans to reduce NPT</li> </ul>	<ul style="list-style-type: none"> <li>Major Oil Company</li> <li>Canadian Oil Company</li> <li>Multi-national Chemical Company</li> </ul>	<ul style="list-style-type: none"> <li>Rapid deployment of AI, predictive analytics &amp; ML for energy applications</li> <li>Improve well production through ML, real-time alerts, and well targeting</li> <li>Improve ethylene plant efficiency through AI &amp; anomaly detection</li> </ul>	<ul style="list-style-type: none"> <li>BHC3 AI Suite</li> <li>BHC3 Production Optimization</li> <li>BHC3 Reliability</li> </ul>



It has now been just over a year since we announced our investment in C3.ai and launched the BakerHughesC3.ai alliance. This partnership is a testament to our commitment to bring a differentiated approach to supporting our customers’ digital transformation agendas and help meet the growing demand for AI solutions in our markets.

BHC3 enables us to address the use cases most highly in demand today – remote operations, asset health, and energy transition – and is a critical component of our deployment of AI to the industry.

Since launching BHC3 in June 2019, our alliance has met a number of milestones in the development and commercialization of a portfolio of AI-based applications. During this time, Baker Hughes has also become a customer of C3.ai, adopting C3.ai technology to accelerate our own digital transformation.

We have been focused on deploying solutions that help us run the company more efficiently and further innovate around our core products and services. An area we continue to make progress is in inventory optimization. Using the BHC3 Inventory Optimization application, our teams will analyze and recommend optimized safety stock levels for parts. We expect to see up to 10% reduction in inventory while maintaining on-time delivery.

We also recently launched an AI-based Demand Planning application for materials management in our OFS business that could further reduce inventory by 3-5% and reduce forecast error rates up to 50%.

We are also working on several projects to combine our domain expertise in oil and gas operations with AI to improve in areas such as drilling operations, inventory management and remote monitoring for rotating equipment. I will spend some time on these areas in a moment.

We have also utilized the strength of significant technology partners such as Microsoft, the leading cloud provider for the oil and gas industry. By integrating and optimizing BHC3 applications, we are able to simplify the adoption of AI for our customers.

For example, in the second quarter, we announced the first customer of our BHC3 Production Optimization application in Canada. This customer is deploying an AI-based approach to better visualize and optimize their SAGD operations. The contract marked the first customer commitment for BHC3 Production Optimization since the technology was announced. We have also entered into a number of additional commercial agreements with several large customers and are focused on deploying the BHC3 technology to support their digital transformation agendas.

# Key use cases & strategic priorities of energy industry

## Remote Operations

Manage data and decision-making over distance, reduce costs and improve performance.



## Asset Health & Reliability

Minimize asset failures, understand optimal maintenance programs and reduce operation costs across energy value chain.



## Energy Transition & Low Carbon

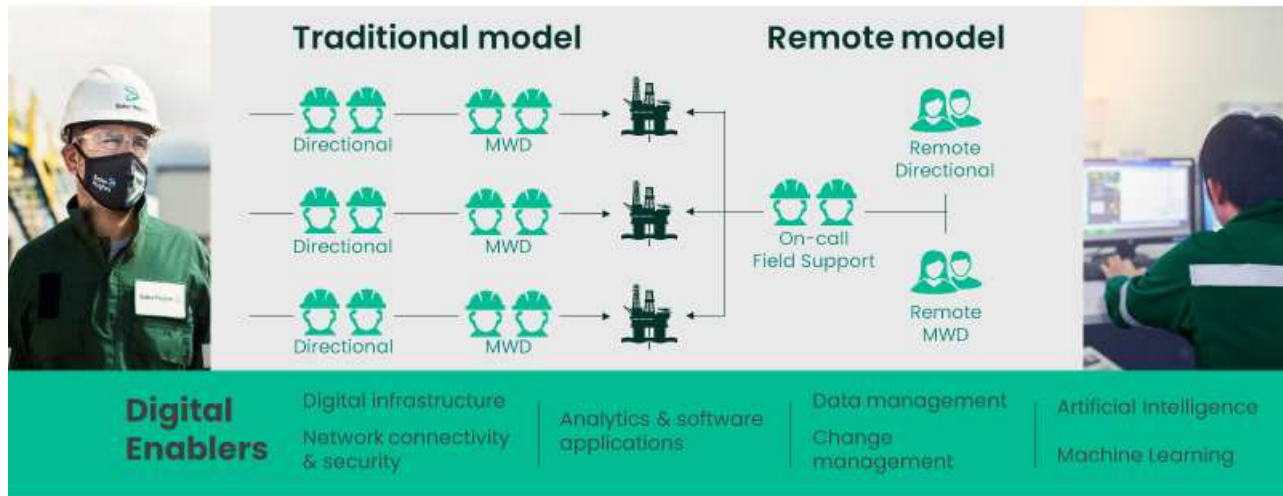
Reduce emissions, conserve energy and operate more efficiently.



Given the state of the industry today, I wanted to highlight three very important use cases where we see increased demand for digital and AI applications.

Drawing on digital accelerators, we are able to deliver on the priorities that customers are asking for today. These include remote operations, asset health and reliability, and help in navigating the energy transition and to deliver energy with a lower carbon footprint.

## Enabling remote operations through digital



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Historically, most of the upstream industry has been functioning with the following traditional model in drilling operations: field engineers who have to travel to a site, stay for several weeks, wait to perform a specialized service, then travel to the next site.

Today we see the possibility to rethink how work takes place at the rig site through digital enablement, automation, and a fresh approach to a multi-skilled workforce, potentially allowing for a more than 60% reduction in personnel at the rig site.

We are in the early stages of capitalizing on this digital potential with the remote operations capabilities in our OFS business, which represents an ecosystem that helps reduce HSE risks, enhances performance quality, improves efficiency, and delivers greater results for our customers. Building upon our early success in remote operations will require multiple skillsets as well as the aggregation and management of significant amounts of data.

To give you an idea of what I am talking about, Baker Hughes’s physical infrastructure expertise allows for the enablement of digital and remote operations deployment, through the embedding and alignment of digital capabilities with the tools and assets in the field. This process produces continuous streams of operational data, the management of which is critical.

Today we manage over 700 terabytes of oilfield data at any given time. However, this data is not delivered ready for analysis; it requires ingestion, aggregation and a certain level of clean-up. Capitalizing on the use of this data and extending the capabilities of remote operations will require proficiency in AI, an area where the BakerHughesC3.ai alliance uniquely positions Baker Hughes.

In fact, we are already utilizing data and our AI partners to improve drilling results. Working with our experts in OFS, our BakerHughesC3.ai team of data scientists and domain experts are using offset well data and applying AI to identify hole stability and quality-related hazards before they occur.

For example, we are working with a large offshore operator to use AI to mitigate instances of stuck pipe and wellbore instability, which were leading to 2,400 hours of nonproductive time and tens of millions of dollars lost in one field. This is about application of true artificial intelligence, not just better drilling or moving E&P software to the cloud.

While most of today’s remote operations are focused on the drilling side, we see a number of applications across the oilfield services value chain. For instance, in most production businesses, reservoir engineers, production engineers, E&P maintenance staff, and operations centers collaborate but work on separate data sets that are not connected into a single, aggregated view.

Bringing data from multiple systems into a single review requires aggregation, integration, and persistence capabilities that the BHC3 AI Suite offers. Beyond a single view of the data, the BHC3 Production Optimization application applies machine learning to data from individual and multiple wells to the pipeline, distribution, and point-of-sale for anomaly detection, production forecasting, and prescriptive actions that improve production performance. This application is currently being deployed with the Canadian-based oil company that I mentioned earlier.

In both of these examples, AI is required to analyze the sheer volumes of data that are being produced. AI ingests greater amounts of data in faster timeframes, automates reactions to non-critical alerts, and predicts and prescribes actions. This is the future of remote operations.



**Digital infrastructure to support asset health & reliability**

**Digital Enablers**

- Digital infrastructure
- Advanced analytics
- Sensors & edge computing
- Additive manufacturing

**iCenter**  
Asset monitoring & diagnostics for critical assets across 1,400 install base

**Bently Nevada**  
Edge connectivity and condition monitoring for rotating equipment

**BHC3™ Reliability**  
System-of-systems approach to deliver Balance of Plant reliability

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**Baker Hughes**

In our TPS business, our iCenters in Florence, Houston and Kuala Lumpur remotely monitor more than 1,400 machines, tracking deviations from expected behavior, detecting symptoms of failure modes, and proactively identifying opportunities for operational improvements.

Our iCenters are supported by a digital infrastructure to enable continuous data streaming, with a data processing and analysis layer for quality and cleansing. We have accumulated more than 39 million hours of equipment data from our installed base of over 5,000 gas turbines and 8,000 compressors globally.

The early warning capabilities of our iCenter are possible because access to this data combined with a 20-year monitoring and diagnostics heritage of turning big data into deep insights that improve performance and reduce emissions, gives us the ability to better understand operational issues. We have 210,000 active analytics consuming data around the clock, and engineering services expertise to fix problems as they occur.

BakerHughesC3.ai released the AI-based BHC3 Reliability application in September 2019. This application augments the physics-based approach to monitoring critical equipment and analyzes data from entire systems.

In many cases, poor system reliability is caused by non-critical equipment. BHC3 Reliability can aggregate data from plant-wide sensor networks, enterprise systems, maintenance notes and instrumentation schematics to detect and alert anomalies that may lead to potential equipment or system failures.

We are able to scale these offerings to any number of assets and processes across offshore and onshore platforms, pipeline compressor stations, LNG trains, refineries and petrochemical plants, reducing downtime and increasing productivity.

The future of asset health and reliability will bridge our capabilities with existing footprint at the edge together with the BHC3 AI technology.

At the edge, Bently Nevada Condition Monitoring maintains a strong presence in the upstream, downstream, renewables and chemical sectors. Bently Nevada has over 60 years of condition monitoring experience, with more than 6 million sensors installed on mission-critical machinery worldwide.

Take an LNG plant. The iCenter monitors critical driver and driven equipment. Our Bently Nevada sensors and System 1 condition monitoring software protects other high-speed critical rotating equipment in the plant. BHC3 Reliability will then supplement these capabilities, taking a system-wide view of operational data and delivering asset health for balance of the plant.

**Detecting, reducing and preventing emissions with data**

**Measurement & mitigation**    **Low to zero emissions solutions**    **Alternative energy services**    **Energy transition & low carbon consulting**

**Digital Enablers**

- AI / machine learning
- Drones & robotics
- Sensors & edge computing

Baker Hughes

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Baker Hughes also sees a range of opportunities for our technology to help the industry address energy transition and meet the increasing demands of energy with a lower carbon footprint.

Monitoring and analyzing data to directly address emissions as well as improve reliability and efficiency requires digital capabilities.

We offer solutions to detect, reduce and prevent emissions.

In detection and reduction, our Avitas business offers the Lumen Sky and Terrain solutions for ground and drone-based methane monitoring solutions to help monitor, detect, and reduce fugitive emissions. As announced earlier this month, we are delivering this technology with Shell for a program covering methane-leak detection and repairs in the Permian.

Avitas can also utilize customer data to detect and predict corrosion risk. For example, a customer with insulated pipe was able to provide 30 years of data from operations information, inspections, and environmental conditions. Using this data, Avitas was able to project corrosion risk 10 years into the future, increasing corrosion findings over 10-fold without increasing the risk profile of the assets.

Our Flare.IQ offering is a digital flare monitoring and control platform that can reduce methane and VOC emissions by up to 50%, while helping downstream operators to remain compliant with regulations and to save operating costs by cutting back steam consumption by as much as 90%.

AI is also critical to energy management. BakerHughesC3.ai delivers the BHC3 Energy Management application, which helps energy, sustainability and facility managers, and C-suite leaders reduce energy consumption levels.

The application offers forecasting energy loads to reduce peak demand, automatically detecting anomalous behaviors and billing errors, regulatory reporting, facility monitoring, and optimizing portfolios of capital.

As we extend this application further into the oil and gas industry, we are focused on developing applications for Refinery Energy Balance Optimization, Hydrocarbon Loss Detection, and Production and Emissions Balancing.

## Continuing digital innovation

<p><b>Transforming the Intelligent Edge</b></p> 	<p><b>Extending Additive Manufacturing</b></p> 	<p><b>Accelerating Enterprise-Scale AI in Energy</b></p> 
<ul style="list-style-type: none"> <li>• I.Q.uity edge platform (hardware, software, service)</li> <li>• Avitas automation, environmental and analytics capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Non-metallics materials through 50/50 Saudi Aramco JV</li> <li>• Generative design capability through global additive centers and technology partnerships</li> </ul>	<ul style="list-style-type: none"> <li>• BakerHughesC3.ai alliance leveraging the strength of our core energy businesses</li> <li>• Extending and simplifying enterprise AI through technology partners</li> </ul>
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I would like to spend a few moments on innovation and technologies that we are focused on for future digital innovation and development.

Adding intelligence to the edge augments our cloud-based software and AI offerings.

I.Q.uity gives our customers the power to bring advanced algorithms and machine learning to existing hardware assets and control systems, combining hardware, software and services from subject matter experts. The technology helps our customers ingest and analyze data and connect to controls systems for action at the edge – where data is collected. Gas Lift Optimization is one example. I.Q.uity can improve gas lift by up to 5 percent by connecting analytics to existing control systems.

Avitas is another example of where we continue to innovate. Avitas draws on advanced analytics and robotics, from crawlers to drones, to create automation techniques. That means gathering data directly from customers, from a drone flyover, or from sensors in the field to monitor and predict issues like corrosion, methane leaks, and wellsite maintenance.

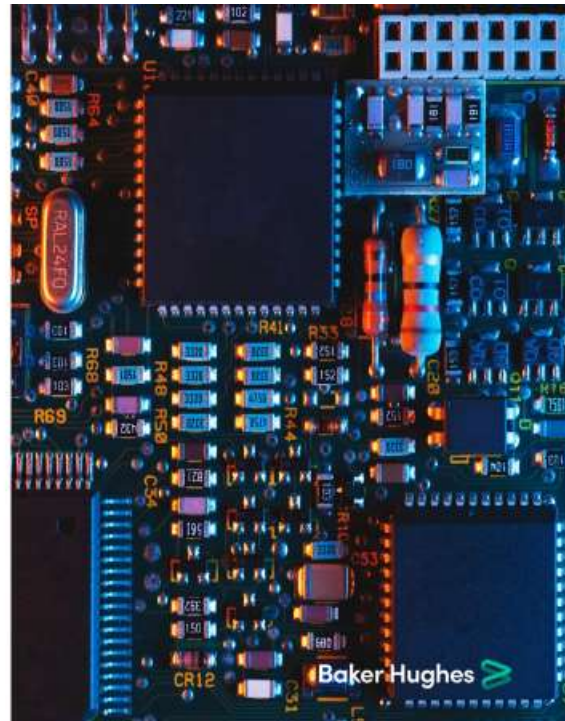
In additive manufacturing, to-date we have printed more than 50,000 parts across our 4 global additive manufacturing sites. We see significant opportunity in the non-metallics industry through our joint venture in Saudi Arabia.

Lastly, our innovation with enterprise-scale AI will be a multiplier for all of these investments and will focus on addressing complex, industry-specific problems that require deep domain expertise in our core businesses. We will also continue expanding these technologies through our alliance network, with BHC3 alliance partners such as Microsoft.

## Digital technology for the energy future

- Combining core strengths with digital accelerators
- Delivering high demand use cases – remote operations, asset health, energy transition – with digital foundations
- Leveraging the BakerHughesC3.ai alliance to complement capabilities across all sectors
- Innovating for the future in edge intelligence, additive manufacturing and AI / Machine Learning

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In summary, digital technologies are transforming the way that the energy industry works. Digital is enabling remote operations, improving asset health and productivity, and supporting low carbon solutions.

We are committed to delivering these capabilities today while innovating for the future. Artificial intelligence, machine learning, and the intelligent edge will complement existing solutions, allowing us to move faster with more data, more connected controls, and predictive insights to solve persistent problems across all sectors.

Thank you for the time and thanks again to Chase and the BofA team for inviting me to speak today. I look forward to answering some of your questions.

