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Sustainability and Profitability Q&A Document

Where are the investment areas and actions, we see industries undertake for decarbonization?

Investments by organizations for decarbonization efforts fall into five major areas:

1. Procurement

Procurement of energy, water, and sustainable raw materials is the first pillar of the sustainability journey, and a low hanging fruit for many organizations. There are many important initiatives and investments possible here including contracts with utility firms, investments into green energy projects, exploring as-a-service models for hardware procurement and others.

2. Operations

Optimizing infrastructure and operations to be sustainable can be complex but also presents the most opportunity among initiatives that organizations undertake. These opportunities will vary significantly with each geography and industry. However, scale plays an important role in the changes and investments organizations make. Data center and IT infrastructure optimization leveraging digital solutions, forms a major part of operational initiatives companies undertake. Technology also plays a critical role in end user (or demand side) electrification efforts.

3. End of lifecycle

An effective circular economy strategy closes the loop on the sustainability journey of an organization by optimizing for energy usage, operations, and recycling. To complete this circle requires more than just attention to recycling and waste management efforts — an organization will need a deliberate strategy throughout the procurement and design phases of your business, infrastructure, and operations.

4. Measurement and assessment

Measurement is often the first step and spans all facets of procurement, operations, and end of lifecycle. With new regulations across the globe, putting into place right measurement parameters and KPIs along with the required processes and tools are all crucial. Many environmental software tools help in data gathering, analytics and dashboards creation, including creating recommendations for carbon footprint reduction.

5. Communication

Communication and reporting are crucial for organizations both internally as well as externally. Internally, employees tend to rate their workplace higher if they see a clear internal sustainability strategy. Externally for being compliant, organizations not only have to report into various reporting frameworks such as the TCFD or GRI, but also into government regulatory authorities. Many vendors also need to adhere to supplier codes of conduct to continue partnerships with suppliers.

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What levels of maturity exist in the market in addressing environmental sustainability?

Different industries are at different levels of maturity in addressing environmental sustainability. Even within the same industry, the focus of each organization varies dramatically.

As organizations proceed higher up on the maturity, they are able to make sustainability sustainable within their organizations, evolve their internal teams to be more focused, and have more influence on policies. We see 5 levels of maturity currently in the industry: Compliance, Commitment and roadmap, Operational Excellence, Disruptive innovation and Future Generation safe.

1. For firms at the compliance level in regulated industries, the strategy is to meet regulatory standards in order to avoid fines and further regulation. In unregulated industries, other drivers determine compliance strategy such as needing to increase stock price, insurance, secure supplier or third-party relationships, or obtain loans at better rates.
2. At the commitment level, firms are making public-facing sustainability commitments with the goal of mitigating environmental impact as well as attracting green customers.
3. Operational excellence sustainability initiatives are varied and can include critical operational processes (e.g., supply chain, plant operations, product manufacturing, facilities management, or resource management) or technology-led innovation processes (e.g., data center efficiencies or technology optimization).
4. At the disruptive innovation level, firms are morphing into sustainable businesses — innovating to enter adjacent markets, changing the game in their industry, and launching entirely new offerings — not just more sustainable products.
5. Finally, few, if any, firms have reached the ultimate maturity level of being Future – generation – safe, eliminating their ecological debt and generating positive externalities for the planet, thus caring for future generations. Today, only born-sustainable startups, along with a very few traditional businesses, belong to such a category of aspirational firms.

How can we accelerate the energy transition with emerging technologies?

Emerging technologies such as blockchain, digital twins, artificial intelligence and machine learning (AI/ML), edge and IoT, augmented reality/virtual reality(AR/VR), and automation have a critical role to play in the energy transition since they enable many efforts needed for the net-zero transition. These technologies will aid in the observability of new data and predictive modeling; increase efficiencies in facilities management and manufacturing; and, in some cases, help reduce carbon emissions directly. A range of sustainability-related services and solutions have emerged, leveraging these technologies in a variety of carbon emission reduction or climate action arenas. For instance, Forrester predicted that in 2022, edge and IoT will drive new solutions for scope 3 emission reduction. High-demand use cases driven by edge and IoT will include environmental monitoring, resource management, and supply chain processes.

For heavy industries and manufacturing, some of the challenges include the measurement and reduction of scope 3 emissions, high temperature heat requirements that necessitate energy storage solutions, waste reduction, sustainable procurement and reduction of manufacturing process related emissions. Emerging technologies play a major role in all of these areas.

Are there risks of the inherent carbon footprint of new emerging technologies?

Many emerging technologies themselves are not always sustainable in all applications. AI/ML and blockchain, among others, are computationally intensive. The International Energy Agency (IEA) reported that bitcoin alone consumes more than 100 TWh (terawatt-hour) per year, which is equivalent to the annual electricity consumption of the Netherlands. As a specific example, edge and IoT devices distribute the carbon footprint of computing to the edges of the network. They also contribute to e-waste generation.

In general, the risks posed by emerging digital technologies include

1. soaring power, water and cooling requirements that increase GHG emissions;
2. expanded manufacturing risks and resource requirements for new chips, devices, and robots;
3. surge in landfill waste, e-waste, and toxic chemicals.

Hence, use cases and scale will dictate the balance of how beneficial or risky these technologies can be.

What are some practical applications of digital technologies in energy transition available today?

Digital technologies including advancements in green software is already playing a major role in the energy transition. From scope 1, 2 and 3 emission reduction to education, the future of sustainability is in many ways, digital. Below is a table of illustrative use cases in 5 areas:

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Technologies	Use Cases
Data and Block Chain	Provided all ecosystem participants supply the required data, blockchain-based systems provide a trustworthy record of end-to-end processes, including the journey from raw materials to finished product. Blockchain-based timestamps and certificates ensure tamper-proof evidence of data and product provenance as long as there's a way of maintaining the link between physical product and its digital representation.
IoT and Energy Use	Connected sensors on individual machines measure and report their energy use, collecting and displaying data in a digital twin. By measuring current energy use, it becomes easier to reduce it. At the simplest level, a digital twin may highlight machines that are consuming energy but not doing anything productive. These can be switched off.
Digital Twins and Asset Optimization	By collecting historical data on the way machines are used, the way they are maintained, and the way they fail, the digital twin supports efforts to make more efficient and sustainable use of these expensive and resource-hungry pieces of industrial equipment. Digital twins play a role in allocating work across a set of machines in the most efficient way and support predictive and prescriptive maintenance use cases that minimize unplanned downtime.
AI and Failure Predictions	AI can be used in the energy and utility sector to conduct predictive maintenance of equipment or entire systems, helping organizations anticipate potential equipment failures and address them before they occur. This results in fewer incidents, more controlled deployment of spare parts, less on – site travel for staff, and optimize spare parts inventory.
Smart building	Smart building management solutions automate monitoring, management, and control of mechanical devices to improve use of building systems and resources including energy, power, lighting, and HVAC systems. Smart building management solutions proactively reduce building energy consumption, reduce building GHG emissions, and keep occupants comfortable in an efficient manner

Automation	Autonomous drone inspections prevent chemical spills. Robots collect microplastics by sifting them out of the sand on beaches. Aerial drones monitor and analyze air samples around potentially hazardous sites.
AR/ VR and remote assistance	AR applications support remote assistance and remote inspection use cases for complex industrial assets, allowing remote experts to minimize travel time and cost by supporting their colleagues in the field with augmented video calls. Simple remote assistance workflows are little more than the 'phone a friend' use case well-understood by field service professionals for decades. More complex applications tie into job scheduling systems, spare parts catalogs, and audit and certification workflows to verifiably assert what was done, when, and by whom. More effective monitoring and maintenance of distributed energy grids, for example, has the benefit of reducing waste.