

How digitalization and industrial AI are **accelerating sustainability**

The 2015 Paris Agreement and other international climate change accords have helped raise global awareness of the need for countries to take urgent action to combat climate change. How urgent? In a recent ARC Strategies survey of global chemical and energy companies 90% of respondents have sustainability initiatives in place.¹ And as companies continue to focus on sustainability, a common theme is taking shape around the role of digitalization as a key enabler.

In that same survey, 75% of respondents rated digital transformation as highly important for achieving sustainability goals.¹ In addition, the International Energy Agency (IEA) has found that digital solutions can help boost energy efficiency as much as 30% for industrial operations.² In Europe, the Technology Platform for Sustainable Chemistry has highlighted digitalization as a key tool to meet sustainability objectives in the chemicals sector.³

To remain competitive and relevant in the marketplace of tomorrow, companies must work to grow the “triple bottom line,” balancing the impact of company operations on people, planet and profits.

With this pressure on ESG and sustainability reporting, most chemical companies are integrating sustainability metrics into their business goals, looking beyond the typical financial indicators to include the impact of global value chains on communities and natural resources. Chemical producers are exploring and investing in alternative energy sources and preparing to meet the unique demands of the circular economy, where economic activity is decoupled from the consumption of finite resources and waste is re-integrated into processes. This is leading to a fundamental restructuring of current business models.

Digital Solutions: A Key Enabler for Sustainability Goals

Digital tools have targeted corporate sustainability objectives for decades, mainly focusing on energy efficiency, environmental compliance and value chain optimization. Cost savings drove much of these efficiency

efforts. With organizations moving toward more specific process metrics that proactively consider emissions and waste reduction, they are finding that profitability and sustainability are two sides of the same coin (e.g., if there is less waste in production that is good both for margins and the environment). These companies are also seeing firsthand the impact that digital solutions can have on efficiency while identifying new energy sources with lower carbon footprints.

ARC Strategies report: Three quarters of global chemical and energy companies surveyed rated digital transformation as highly important for achieving sustainability goals.

Digitalization is an essential enabler for chemical companies looking to meet business and sustainability objectives. These solutions provide the visibility, analysis, insight and process optimization needed to address the challenges inherent in sustainability goals. Success begins by harnessing the voluminous available data and then

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empowering operators to make the decisions that will achieve their multi-pronged objectives of customer satisfaction, long-term sustainability and business profit.

Additionally, digital solutions make it possible to chart progress on sustainability goals which is critical for any business initiative. For example, today's process simulation technology tracks and optimizes CO₂ and other pollutant emissions. Combined with other technologies such as planning solutions and enterprise visualization dashboards, these solutions may

provide the basis for emissions reporting for chemical and polymer plants and related energy assets.

Using AI to Power Sustainable Operations

Artificial Intelligence (AI) is becoming an invaluable technology for:

- Meeting sustainability goals
- Enabling businesses to extract greater insight from data from across the enterprise to drive higher efficiency
- Avoiding potentially dangerous situations onsite
- Decreasing greenhouse gas emissions associated with process breakdowns as well as unplanned shutdowns and startups

Industrial AI combines domain expertise and first principles-based models with artificial intelligence and analytics algorithms to deliver fit-for-purpose, domain-specific solutions. The AI capabilities act as the “enablers” for more autonomous, intelligent processes, and the embedded engineering fundamentals act as the “infrastructure” for safe and efficient operations.

Embedding AI in process models helps companies develop more efficient production options that use less energy and resources, enabling easy comparison of process options. Deep-learning advanced process control (APC) helps companies apply the optimizing power of APC to more processes, expanding production efficiencies while also boosting throughput. And, in-context guidance, provided by AI-enabled insight from previous operations, supports less-experienced users as they expand digital applications to drive further improvements.

ARC Advisory Group Research Supports Strong Ties

In its **sustainability survey** of global industry leaders earlier this year, ARC considered the priorities and challenges of meeting sustainability targets. The goal was to learn how digitalization and other technologies were aiding chemical and energy companies in these efforts. ARC Energy and Chemicals Analyst Peter Reynolds emphasizes this point: Companies exhibiting operational

excellence are distinguished by two characteristics:

- 1.) They manage their businesses and operational processes systematically.
- 2.) They invest in developing the right culture.

Respondents ranked the top digital capabilities that are enabling success in sustainability initiatives and reflect AspenTech's own experience with chemical industry customers. Five key solution areas were identified:

1. Supply chain optimization to coordinate, manage and improve transparency of connected processes. Many AspenTech customers use supply chain planning tools to improve demand planning, gain visibility into existing processes and reduce emissions and waste.

- Japanese packaging company FP Corporation redesigned its food distribution network to provide a more stable and responsive network. With a digitally enabled plan, the company optimized its distribution to better utilize return trucks and integrate used containers, cutting its annual CO₂ emissions by 135,000MT and reducing waste sent to landfills by 374,096MT in FY2018.

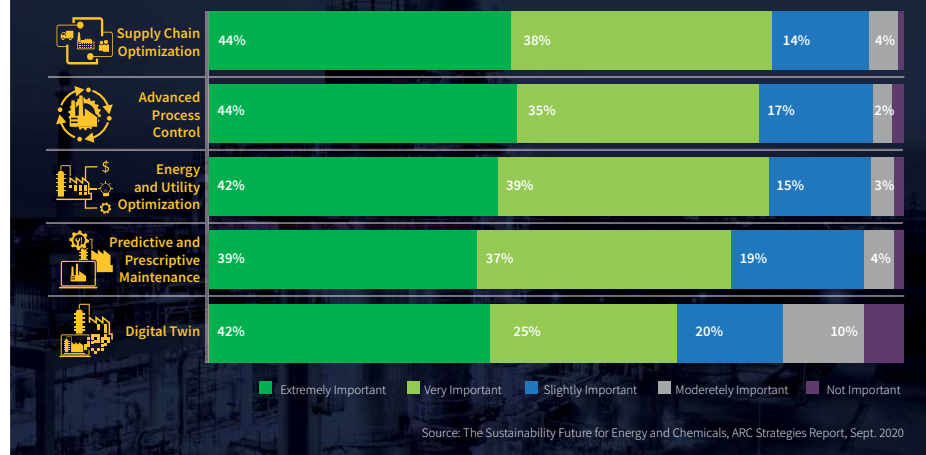
2. Advanced process control to reduce process variability and energy consumption, and support autonomous operations. Adaptive process control enables further optimization by using plant data to update process models and predict process responses to changing plant conditions.

- Global petrochemical company Braskem implemented APC technologies to reduce variations in quality and energy usage for cold end units at one of its ethylene sites. The company lowered energy usage by 20 percent, while increasing production rates and reducing process variability.

3. Energy and utility optimization by using process modeling and simulation technologies. Operators can identify opportunities for heat integration across assets and consider alternative lower-carbon energy sources.

- Korean petrochemicals and polymers producer YNCC used modeling solutions to identify energy and emissions savings across their operations. Improved operations yielded savings of \$19.2M USD per year with a 12% reduction in energy use and carbon emissions, and the opportunity to achieve another 15%

How Valuable Are These Digital Capabilities for Improving Sustainability?



reduction in energy use in the future.

4. Predictive and prescriptive maintenance using machine learning to identify precise failure patterns to predict equipment degradation weeks or even months in advance so action can be taken to avoid unplanned downtime and associated safety and environmental risks. The AI-based technology learns from existing design and operations data and then integrates process knowledge to deliver prescriptive maintenance solutions.

- A European polymer producer used an operational integrity model to prepare for outages in its production. By employing this model, the company gained 27 days advance warning of failure of the hyper compressor in a low-density polyethylene (LDPE) unit. Operators could build necessary inventory, then take down the unit before failure, thus avoiding a potential

Industrial AI combines domain expertise and first principles-based models with artificial intelligence.

safety hazard and possible environmental release while reducing the duration of the downtime.

- A US-based energy company improved its safety and environmental performance while also achieving 30% savings in maintenance costs and estimated production losses of \$30M with early failure predictions of its hydrogen network.

5. Digital Twin technology uses real-time data to provide an evolving digital profile of the historical, current and future behavior of an asset or process. The connected worker can gain insight, optimize operations, predict performance of the asset and get a holistic view of how to achieve the best possible performance while reducing energy consumption.

- Brazilian company Oxiteno used a digital twin to improve production performance for a specialty product. The company applied a plant-wide digital twin model to increase efficiencies across the site, integrating disparate models of reactors, columns, strippers and absorbers to find collective improvement. By employing this broad approach, the company was able to cut steam consumption by 15% while also increasing production capacity.

The integration of sustainability targets with business goals will be transformational for energy and chemical companies. We are already seeing progress today. Global efforts to move toward new energy sources and the circular economy are driving a strategic shift in business metrics and the practices that enable environmentally sound, profitable operations. The digitalization of these operations is becoming critical at the highest levels of an organization as it represents the path to new levels of safety, sustainability and bottom-line success.

¹ The Sustainability Future for Energy and Chemicals, ARC Strategies, September 2020

² Energy Efficiency 2019, International Energy Agency, October 2019

³ Strategic Research and Innovation Agenda, SusChem, November 2019