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From the writer's desk

Kate Macri, Deputy Editor

Government Turns to Tech to Meet Sustainability Goals

The Biden administration's 2021 executive order set the tone for how federal agencies should think about climate change: it is a national security priority. Defense, health and civilian agencies responded by developing climate strategies to cut greenhouse gas emissions, optimize energy consumption and build sustainable solutions for doing business.

In more ways than one, IT elevates government sustainability efforts. Digital twin technology for reducing the environmental impact of construction — which relies upon AI, data synthesis, cloud computing, Internet of Things and software applications — shows tremendous promise.

More broadly, IT allows government to track and visualize climate change and adjust decision-making accordingly. Building a more sustainable, environmentally friendly future starts with IT. ❀

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How Tech Guides Defense Climate Strategy, Sustainability Efforts

Digital twin technology, data and software tools play a leading role in helping the Defense Department meet its 2030 and 2050 climate strategy benchmarks.

BY KATE MACRI AND ANASTASIA OBIS

Around the globe, climate-related extreme weather events disrupt the Defense Department's day-to-day operations, affect military infrastructure and influence the department's future planning abilities.

In the past, wildfires caused damage to several military bases in California, Hurricane Laura impacted Fort Polk and Barksdale Air Force bases' operations in Louisiana, and Hurricane Michael resulted in significant destruction to Tyndall Air Force Base in Florida.

In 2021, the White House issued an executive order on tackling the climate crisis at home and abroad, making climate change considerations a central part of the U.S. national security and foreign policy.

"Climate change is, in fact, changing the complexity of the sort of geostrategic environment that we find ourselves operating in today. … It just makes the complex things more complex," said Acting Assistant Secretary of the Air Force for Energy, Installations, and Environment Edwin Oshiba in an interview with GovCIO Media & Research. "We have to understand sort of the impact that those kinds of events have on our ability to get our mission done, whether it's here in the continental United States, whether it's how we project power overseas, how it impacts our ability to operate in a distributed environment."

The Navy is also honing in on the potential threats from climate warming

Photo Credit: Dustin Gautney, U.S. Army Corps of Engineers/DVIDS

and what that means for its infrastructure, technology and personnel training.

"I think climate change presents itself to navies in two vectors," said Navy Adm. Sam Paparo at the AFCEA West conference hosted by AFCEA International and the U.S. Naval Institute in San Diego in February. "I think the first and our most important vector is really its effect on our ports and on our airfields. … And then the second threat vector is its threat to populations."

To mitigate the impact of climate change at the Air Force, the service developed a comprehensive climate action plan outlining the strategy necessary to operate in changing climate conditions.

The Air Force climate action plan includes three priorities: maintaining air and space dominance in the face of climate risks, making climate-informed decisions and optimizing energy use while pursuing alternative energy sources.

"One of the driving factors that was really motivating us to get after this problem set and get out and publish a climate action plan is in the recognition of just how complex this environment has become," Oshiba said.

Digital Twins for Eco-Friendlier Construction

Innovators across DOD are turning to new IT solutions, such as digital twin technology, to further sustainability goals around improving energy efficiency, reducing the department's carbon footprint and limiting the department's environmental impact.

Digital twin technology guides ongoing repairs of Tyndall Air Force Base to improve energy efficiency and limit waste of resources, setting a new standard for how DOD components use IT to modernize installations.

At the Army Corps of Engineers, Senior Scientific Technical Manager Lance Marrano served as the primary advisor for repairing Tyndall after Hurricane Michael destroyed most of the base in 2018 and caused more than $5 billion in damages. Given the enormity of the task, Marrano realized the repair teams

needed more data and information at their fingertips to rebuild the base as quickly as possible while maintaining cost efficiency.

"Because of this immense reconstruction program, ... the digital twin initiative was a way for us to catapult and have a catalyst to say, 'How do we receive all of this new infrastructure data and use it to look at how we transform, how we make decisions about how to manage and operate the installation?'" Marrano said in an interview with GovCIO Media & Research.

A digital twin is essentially a virtual model of a physical construction, which allows engineers to tweak and optimize plans before commencing new construction. Digital twins rely on cloud computing and software services, and sometimes incorporate artificial intelligence (AI) and machine learning (ML) for predictive analytics.

Relying on a digital replica also helps planners limit waste of funds and opens up opportunities for environmentally friendly improvements in pursuit of sustainability goals.

Tyndall's digital twin, for example, can help reduce carbon emissions at the base by simulating traffic peaks during construction to optimize traffic flow.

"At the peak of construction, we're going to have a significantly large increase in the number of people that are going to be on the base," Marrano said. "From an environmental perspective, you can think about how much time people wasted sitting in cars in queues to get through the gates. And so by being able to have the traffic simulation, we can look at what those sort of rush hour surges look like and use that to inform the base of how they can increase the number of gates that they open, increase the number of lanes that they have open, even inform leadership about some differences in telework schedule for the folks that are normally there every day that could work for that date in a telework status to optimize that flow of traffic across the base onto the base."

Oshiba said rebuilding Tyndall allows DOD to design the base to be more fuel-efficient but also more resilient to future natural disasters.

"We have an opportunity now to kind of take a fresh look at what should the base of this feature or installation of the future look like?" he said during

Ken Pathak

Division Chief, Software Engineering & Informatics, U.S. Army Corps of Engineers

an interview with GovCIO Media & Research. "How can we design resiliency, for example, into our installation, into our facilities, so that if we know it's going to be subjected to extreme weather events like hurricanes because of where it is, what can we do up front to design facilities to be more resilient in the face of those kinds of extreme weather events?"

Marrano's applied expertise comes from years of research and development at the Army Corps of Engineers around what impact digital twin technology can have on the environment. Army Corps of Engineers Division Chief for Software Engineering and Informatics Ken Pathak said digital twin technology enables government to improve planning and resource allocation for building projects while addressing potential environmental concerns.

"Everybody has data, large quantities of data, but the problem is it's so massive and unmanageable that the decision-makers are not able to make well-informed decisions because there's no way a human being can take terabytes of data process in their brain and make a decision," Pathak told GovCIO Media & Research in an interview. "Digital twins manipulate the data, pre-digest it in a certain way and focus and hone in on the questions we want to answer. It's a human-machine interactive decision. We do take AI and ML and are able to predict some stuff based on historic data, then take real-time observations and merge them together. We can plan on it, line up funding for it, so we don't have a problem."

Digital twin technology also allows for "Tradespace" analytics, which can be described as cost versus urgency.

"You can do large-scale modeling with a system of digital twins for a structure or a lock and for the habitat, people and the community," Pathak said. "When you build out a system of digital twins and couple digital twins together, the output from one can be the input for another one. You can do a large-scale study with digital twins to say, if I fix this [dam or lock] here, how will this affect salmon down the road?"   (ctd.)

> **"Environmental modeling could be part of the system of digital twins when doing a project to gauge the environmental impact. Maybe you want to stretch out construction time or use different means. It has a very big impact."**
>
> **— Ken Pathak, Division Chief, Software Engineering & Informatics, U.S. Army Corps of Engineers**

Pathak said the use cases for digital twins are unlimited, especially regarding sustainability and caring for the environment.

"Every time you construct, you can simulate emissions damage, which can be caused by construction, manufacturing, transportation," he said. "We can do post-disaster simulations of the environment. You save environmental damage by not making a physical prototype in many cases. It's really valuable to run these what-if scenarios [via digital twin]. Environmental modeling could be part of the system of digital twins when doing a project to gauge the environmental impact. Maybe you want to stretch out construction time or use different means. It has a very big impact."

Data, Software Underpin Sustainability Efforts

As digital twin use cases continue to expand, data and software tools underpin a variety of DOD sustainability efforts.

Last year, the Army released its climate strategy implementation plan, and the Navy and Marine Corps launched Climate Action 2030, pledging to achieve net-zero greenhouse gas emissions by 2050.

The Air Force uses multiple tools to help predict extreme weather events and mitigate their impacts. The Defense Climate Assessment Tool (DCAT), a software tool DOD developed and one that all service branches use, helps the Air Force assess vulnerabilities that military installations are subjected to due to climate change.

"If, for example, we are trying to do an operational plan that requires us to maybe be a tenant or use an installation that belongs to the Army or to the Navy or the Marine Corps, being able to see what kind of climate risks we may be exposed to is helpful from a planning process," Oshiba said.

DCAT data comes from authoritative government sources and is intended to provide information on a variety of weather-related events, such as hurricanes and tropical storms, droughts, wildfires and flooding.　　(ctd.)

"It is a great way to look at sort of exposure events or assess exposure at the local individual installation level as well as maybe, broadly speaking, at a regional level that we in the Department of the Air Force may not have the data for," Oshiba said.

To support military operations, Oshiba said the team leverages the 14th Weather Squadron's expertise to provide a cognitive data analysis and turn weather data into climate assessments for the Air Force. The 14th Weather Squadron, located in Asheville, North Carolina, is the Air Force's only climate operations unit that collects and analyzes data gathered from various authoritative sources to support military operations around the globe.

In addition, the 14th Weather Squadron provides specialized weather support to agencies outside of DOD, including the National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA).

The Air Force also uses the DOD regional sea-level database, managed by the Naval Oceanographic Office, to help the Air Force plan ahead and provide up-to-date information on sea level or other ocean conditions.

"It kind of helps us look at potential projected future sea level rise assessments, say maybe in the South Pacific [where] we may want to be operating in the future," Oshiba said.

The Climate Explorer tool, an analysis tool developed by NOAA, provides the Air Force with historical and projected climate data to help the Air Force plan for different climate variables such as sea level rise or precipitation levels in a specific region.

"There are certain aircraft operations that are very temperature sensitive, in terms of maybe limiting the amount of cargo you can carry if you're operating in a really high-temperature environment. Certainly, the precipitation matters if you're looking at potential flooding events, and so understanding how that works together might help," Oshiba said.
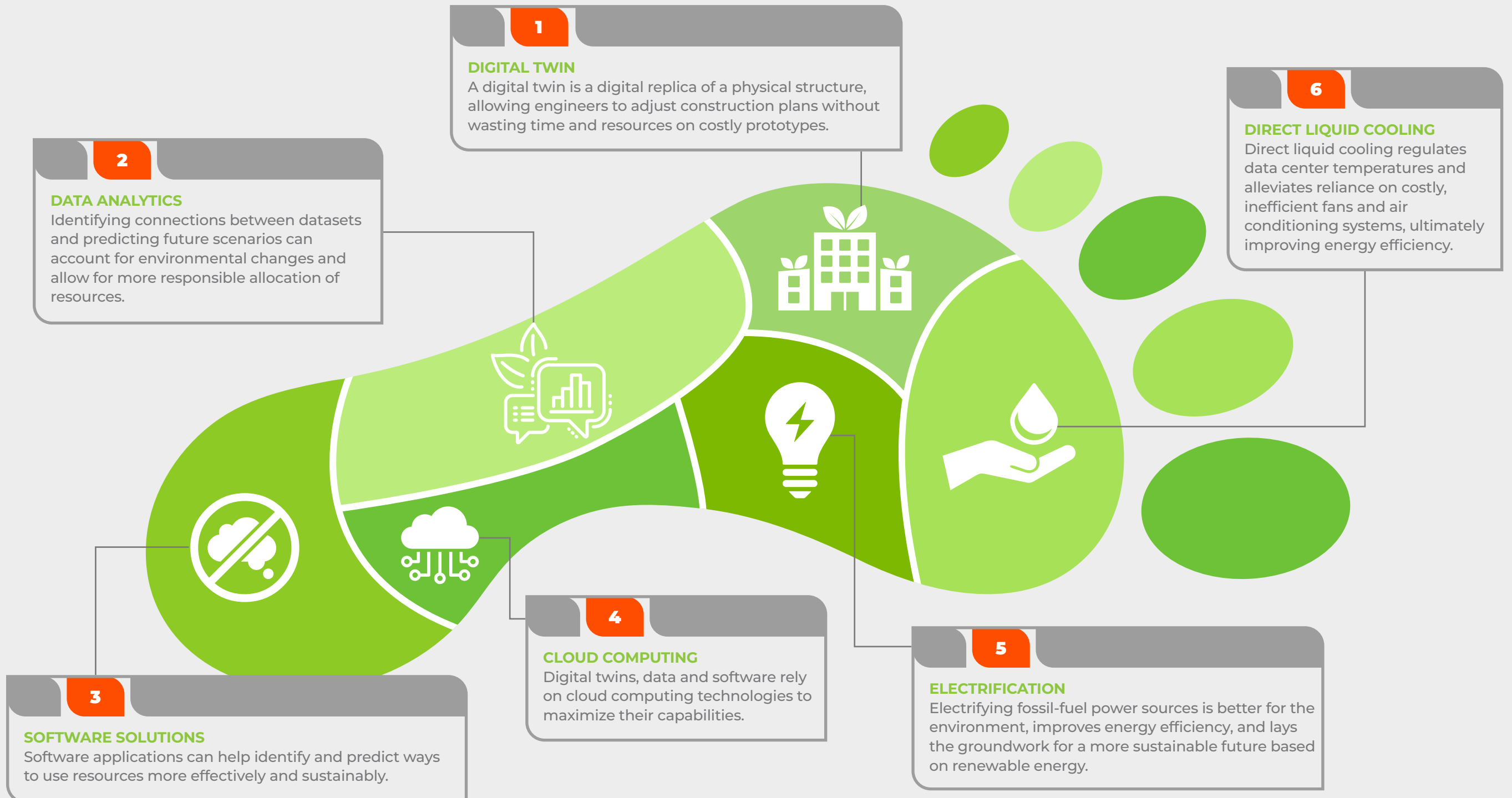
As all of DOD aggressively pursues sustainability goals to meet 2030 and 2050 benchmarks, IT will play a leading role in those efforts.

"Technology plays a big part in how we can design our installations to be fuel-efficient, and maybe in some ways less contributing to the greenhouse gas emissions problem if you build it upfront," Oshiba said. "My theory is that we have all the data we need to make good decisions. Our problem is to gather that data, integrate it, make it accessible in a way that helps us make better informed decisions. Working with DOD, we've set out some surveys to get an idea of what sort of knowledge or awareness people have on climate change so we know where to place our efforts going on to the future. This year is all about really kind of getting our baseline set." ✳

Shrinking Our Carbon Footprint

Data analytics and software solutions can identify new ways for federal agencies and their vendors to operate more sustainably.

1

DIGITAL TWIN
A digital twin is a digital replica of a physical structure, allowing engineers to adjust construction plans without wasting time and resources on costly prototypes.

2

DATA ANALYTICS
Identifying connections between datasets and predicting future scenarios can account for environmental changes and allow for more responsible allocation of resources.

6

DIRECT LIQUID COOLING
Direct liquid cooling regulates data center temperatures and alleviates reliance on costly, inefficient fans and air conditioning systems, ultimately improving energy efficiency.

4

CLOUD COMPUTING
Digital twins, data and software rely on cloud computing technologies to maximize their capabilities.

3

SOFTWARE SOLUTIONS
Software applications can help identify and predict ways to use resources more effectively and sustainably.

5

ELECTRIFICATION
Electrifying fossil-fuel power sources is better for the environment, improves energy efficiency, and lays the groundwork for a more sustainable future based on renewable energy.

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PARTNER INTERVIEW

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Cloud Modernization, Data Visibility Help Government Build a More Sustainable Future

While IT can be a significant source of environmental strain, federal agencies can leverage IT and emerging technologies to better understand and limit their environmental impact.

Given recent policy initiatives around reducing greenhouse gas emissions, how can partnerships help to develop innovative tech solutions to meet these policy goals?

Landry Addressing recent policy initiatives aimed at reducing greenhouse gas emissions will require industry and government to work together to develop innovative technology solutions to meet these policy goals. Doing so can help government agencies address this threat to our planet and climate through public-private collaboration centered around innovation.

That said, it is important to keep in mind that government budgets are far from endless. We need to look closely at the types of technology and innovation that will yield the highest rate of return for emission reduction initiatives. Industry has a key role to play in supporting government agencies by helping them

Sonny Landry
Senior Director, Energy and Critical Infrastructure, Maximus

> **"IT efforts that help government agencies track energy use and environmental risks provide key data to help these organizations better understand their environmental impact over time — and that knowledge is power."**
>
> **— Sonny Landry, Senior Director, Energy and Critical Infrastructure, Maximus**

clearly define the desired end state and then effectively prioritize activities and associated technologies that can help achieve that end state.

At Maximus, we support many clients in their migration to the cloud — a push that can effectively help reduce greenhouse gas emissions associated with IT. Our support includes meaningful analysis to drive long-term cost savings while also achieving zero trust framework objectives to improve cybersecurity posture. Because we understand that government agencies have multiple priorities to address, we aim to help them maximize every dollar while achieving both long-term objectives and the requirements of new initiatives.

How can technology and especially IT help drive more environmentally sustainable business practices in the public sector?

Landry   Technology and IT play important roles in helping both industry and government adopt and promote more environmentally sustainable business practices. Technology integrators are true partners in this journey — and businesses and government agencies alike should lean into integrators' expertise to make sustainability a focal point of technology decisions.

Specifically, integrators can help organizations closely examine how to make environmental sustainability part of the overall return on investment calculus when laying out roadmaps for IT initiatives. This is a value-add both for the bottom line and the planet. Plus, it can also help ensure intelligent innovation investments over the long term. This allows each IT project to move the needle, bit by bit, across multiple strategic goals and ensure that short-term investments pay off in addressing long-term priorities.

At Maximus, we support transitions to cloud environments to help limit the impact of on-premises digital footprints, reduce physical and paper waste, and realize benefits associated with greenhouse gas emission reductions. And more broadly, our use of modern DevSecOps and cloud-native approaches — among

other tools — help to address these sustainability goals while also driving long-term efficiency and scalability and improving cybersecurity posture.

✻ How can IT, such as efforts around data collection and data visualization tools, help track energy use and environmental risks to help organizations become more conscious of environmental impacts?

Landry IT efforts that help government agencies track energy use and environmental risks provide key data to help these organizations better understand their environmental impact over time. This knowledge is power. It helps teams make better decisions to limit environmental impact and implement more sustainable practices for the long term. These, of course, are important components of overall efforts by government agencies to reduce greenhouse gas emissions and other factors.

For instance, at Maximus, we support the National Energy Technology Laboratory (NETL), whose research aims to advance carbon capture, utilization and storage technologies for widespread commercial deployment by 2035. The lab uses data and visualization as a force multiplier, and creates an environment where data preservation is encouraged and facilitated through technology. This, in turn, gives researchers access to curated data sets and knowledge products to increase the pace of innovation and improve sustainability.

(ctd.)
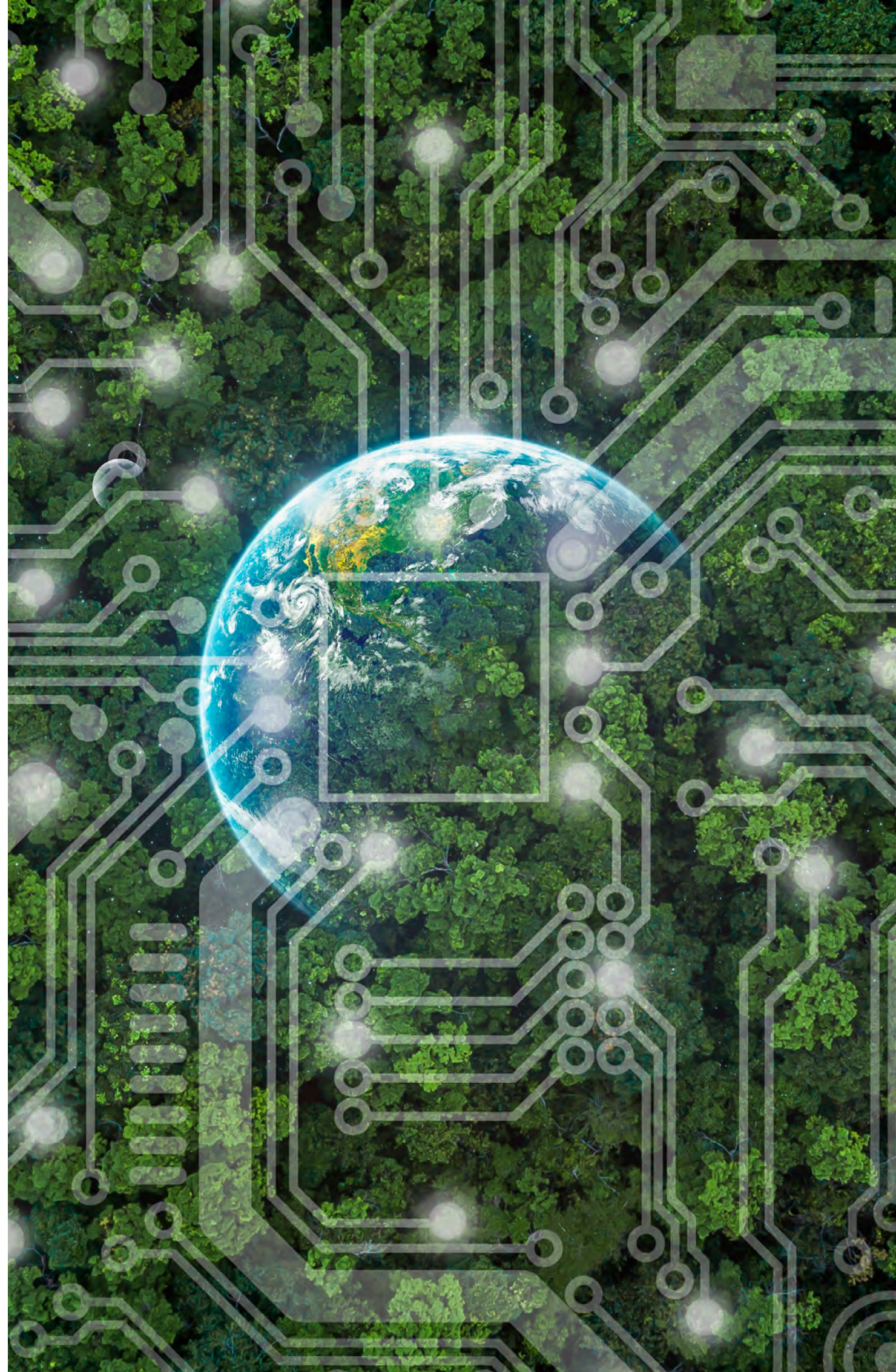
✳ IT and IT supply chains are often a source of significant environmental harm, and some research suggests the IT supply chain carbon footprint will only increase with time. How can organizations "clean up" the IT supply chain and become more energy efficient?

Landry This is a legitimate concern because many government agencies simply do not have enough visibility into their digital supply chains, including software and hardware bills of materials. When organizations make decisions about sizable IT investments for large-scale rollouts, those new software applications or systems could have upstream vulnerabilities. Without visibility into digital components, decision-makers have no insight into the full picture of third-party contributors, potential vulnerabilities or impacts to the IT environment, and especially not the physical environment, for that matter. Those impacts could be environmental, but they could also be cybersecurity vulnerabilities, or both. All of these impact the ability to execute the mission or address strategic priorities.

At Maximus, we're helping agencies address this gap by keeping sustainability and cybersecurity imperatives at the core of our delivery — ensuring everything we do is mission-focused and requirements driven to achieve desired outcomes related to sustainability, cybersecurity and digital modernization in tandem. Agencies should never have to choose one priority over another, and it starts with ensuring they have full visibility.

With better visibility into the digital supply chain, we can then empower government agencies to make the best vendor choices and IT investment decisions that help improve sustainability and security posture over the long term while also addressing digital modernization goals. ✳

Tech Drives Federal Plans to Reduce Carbon Footprint at DOE

Electrification, cutting-edge research labs and cooling technologies are helping agencies reduce carbon footprint.

BY NIKKI HENDERSON

Technology plays a major role in the Department of Energy's plan in 2023 to achieve sustainability goals and reduce greenhouse gas emissions, tackle supply chain issues and meet other directives from the White House.

The new initiatives come on the heels of President Biden's 2021 executive order to establish the U.S. as a leader in sustainability goals, like achieving 100% carbon pollution-free electricity by 2030 and net-zero emissions from federal procurement.

Electrification could significantly reduce greenhouse gas emissions, according to DOE Team Lead for Sustainability Cate Berard. The Office of Energy Efficiency and Renewable Energy is currently using funding to spur innovation and help communities transition from older technologies to newer technologies reliant on electricity as their primary source of energy.

"There's a really big push within the federal government and across the country for electrification. It's converting things that we use everyday like water

heating and cooking from using gas and fossil fuels to electricity," Berard told GovCIO Media & Research. "We're also working on greening the grid. Then when these two things come together we will be more sustainable, climate-friendly and resilient."

IT plays a big role in helping DOE boost its supply chain resilience, sustainability and security. Berard said DOE's cutting-edge research labs enhance the agency's research into climate modeling, which is helping Energy leaders make decisions about resilience.

"In DOE's climate action and resilience plan, we ask all of our sites to do a vulnerability assessment. They had to assess their vulnerabilities and then look at what technologies would address those vulnerabilities and come up with a long-term plan for implementing those — what can we afford and what makes the most sense?" Berard said. "All of our sites also have a personalized look at how climate is effecting them now and up to 50 years in the future so what can we do to mitigate that and also be resilient for things we can't avoid like

Cate Berard

Team Lead for Sustainability, Department of Energy

wildfires and hurricanes."

Implementation instructions from The White House Council on Environmental Quality (CEQ) outlined different components, such as electronic stewardship, agencies should cover in sustainability plans to meet the requirements of Executive Order 14057.

"One great thing CEQ did, even though electronic stewardship wasn't specifically called out in any of the executive orders, is in the implementation instructions for EO 14057," Berard said. "There's an entire chapter that says these are the sustainable actions that we expect you to take with regards to electronics, and it will help you meet your climate goals, your greenhouse gas emission goals and your sustainable acquisition goals."

The instructions include specific metrics, strategies and details about how agencies should think about these various components to sustainability. Other components include factors like waste management and environment justice.

Sustainability Investment Yields Long-Term Payoff

General Services Administration (GSA) Administrator Robin Carnahan said investing in the sustainability of goods and products has never been more important. Combining these investments with President Biden's executive orders on sustainable acquisition, will drive all of government to begin buying green, she added.

"We care more about sustainability in the materials we buy, the vehicles we buy, in the supply chain from the start, than ever before," Carnahan said during an Imagine Nation ELC panel last year. "It is not just GSA, it is government-wide. So the more you can support and help your partners think through emissions and climate-related costs through the supply chain, the more you'll be helping them because this is going to increasingly be a factor as government makes purchasing decisions going forward."   (ctd.)

For Carnahan, buying green makes practical business sense from multiple perspectives.

"To me, this makes sense because it is a triple win," Carnahan said. "Not only is it good for the environment and the health of our planet and our kids, it's great for creating jobs in America, and it's great for saving tax money on lower energy costs."

Berard also pointed to efforts to reduce greenhouse gas emissions from physical data centers. According to DOE, data centers are among the most energy-intensive building types compared to commercial office buildings, for instance. DOE is leveraging things like direct liquid cooling technologies over traditional air cooling for data centers, which store and manage the growing amount of data federal agencies are increasingly relying on in today's digital

and technological landscape.

"We're trying to put the least amount of energy into cooling compared to the amount of energy we're using to run the equipment at our data centers," Berard said. "We want to run our data centers and what we need to do in them, but we don't want to spend twice as much on energy cooling, so a lot of effort has been put into identifying what those best practices are and helping agencies implement those."

Looking ahead, DOE CIO Ann Dunkin hopes industry will step up to partner in supply chain analysis for reducing emissions.

"There are companies out there that do supply chain analysis," Dunkin said. "You can tell us where something's manufactured. You can tell us where the components came from. You can tell us who invested in those companies. Well, you can also tell us the greenhouse gas emissions. That's where I look back at industry and say, 'You've got 95% of the answer, give us the rest of it.'"

Information-Sharing Advances Sustainability

Efforts are underway to better share data and put information into the hands of the decision-makers that are innovating across many of these sustainability efforts.

Last year, DOE's Argonne National Laboratory released a new digital portal that shares actionable climate data throughout the country. This Climate Risk and Resilience (ClimRR) portal, which was built on sophisticated methodologies, was the result of a collaboration between DOE, the Federal Emergency Management Agency (FEMA) and AT&T. ClimRR distributes data about future climate risks to state, local, tribal and territorial governments.

The tool gives "communities across the country free and open access to actionable climate data," said Argonne Director Paul Kearns. "Harnessing the power of our supercomputers, we are making cutting-edge climate data available to the public sector and local planning officials to help them better

"IT is one place where we can have a significant impact both in how we procure it and use it and dispose of it but also in what we're using it for, like for climate modeling. This is an exciting area to be in, there's always been an opportunity to look at the next way that we can use technology or how we can make computers more sustainable."

— Cate Berard, Team Lead for Sustainability, Department of Energy

understand local climate-change risks and take the needed actions to become more climate-resilient."

Berard said DOE's Sustainability Performance Division, which reports sustainability metrics, is in the final stages of developing a resource hub where employees and contractors can find information on climate change and sustainability.

"One of our staffers has been assisting with the development of that hub," Berard said. "The idea is to make sure that everyone has a base level understanding of what climate is, what our climate challenges are and what we're doing. Then how does it connect to your job and what can you do to be sustainable in the work that you do."

Berard said it's encouraging to see recognition from federal agencies working toward their sustainability and emissions reduction goals.

"We need to give them the training and information they need if we want to meet these very ambitious goals because it's not always clear like how climate change and resilience relate to your contract or what you're doing for your mission, so the requirement that we educate our workforce on what that is and how they can do it is really important and is a great feature of the executive order," she added.

Finally, Berard said the implementation instructions for EO 14057 highlight the benefits of IT, which is her personal passion. Tech touches everything, she said, which is especially pertinent for federal agencies seeking to reduce their carbon footprints.

"IT is one place where we can have a significant impact both in how we procure it and use it and dispose of it, but also in what we're using it for — like for climate modeling," Berard said. "This is an exciting area to be in. There's always been an opportunity to look at the next way that we can use technology or how we can make computers more sustainable." ✺