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How green is your software?

Taking control of sustainability goals with
OpenText DevOps Cloud

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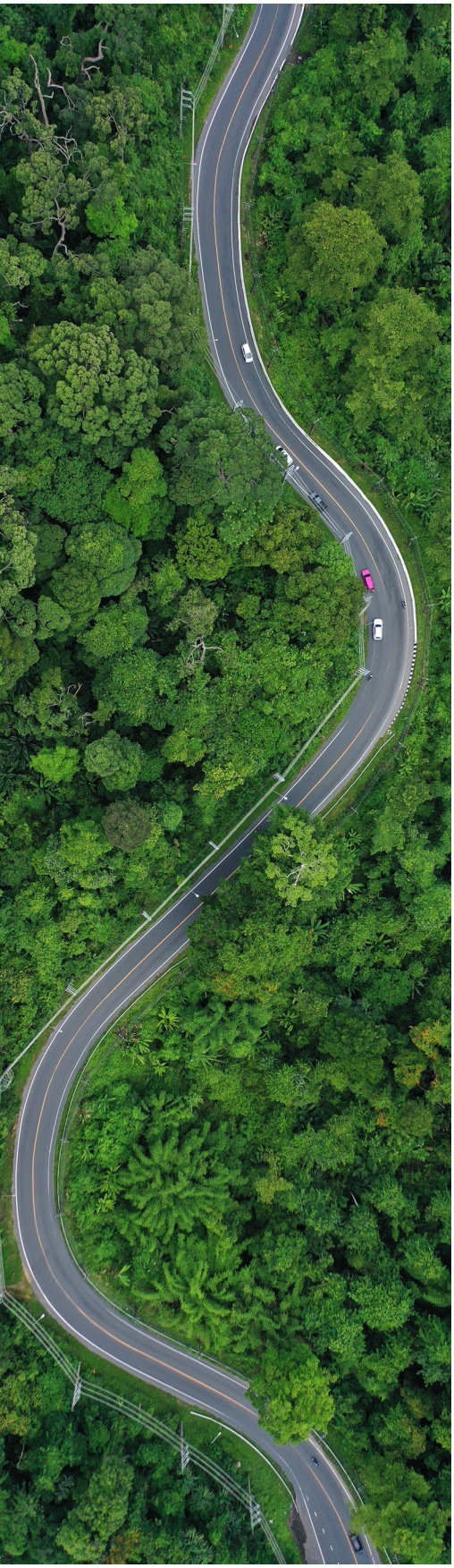


Executive summary

More and more customers expect brands to have sustainable business practices. They also want improved IT services. Modernize your application delivery so you can provide strategic business solutions while reducing greenhouse gas emissions and saving resources.

A typical digital value stream often includes significant amounts of waste—including both time and energy resources. Every employee that engages with the digital value stream uses significant amounts of energy. Data centers, which provide the underlying infrastructure of application delivery, are also energy intensive, even if this is hidden from the end user.

Reducing energy use and GHG (greenhouse gas) emissions in application development and delivery provides several benefits, including meeting government regulations, fostering customer loyalty, achieving organizational net zero goals, saving costs, and attracting and retaining top talent. Five key areas of the digital value stream where organizations can reduce waste are planning, code, build, test, and release.[1]

Information management has a critical role to play in reducing waste in the digital value stream. Value stream management (VSM) tools enable organizations to gain visibility across the software development lifecycle. This exposes information that can be used to improve workflows, eliminate waste, increase automation, and ensure compliance. A modern, end-to-end VSM platform enables organizations to reach net zero targets, reduce energy consumption, and contribute to a more sustainable future.

1 Significant savings can also be found in the efficient management of operational systems, but as those savings are outside of the scope of most application delivery teams, they are excluded from this paper.

Environmental, social, governance—growing priorities in application delivery

The IT landscape has become increasingly service-centric, with customer demand for improved services at an all-time high. Consumers have become accustomed to continuous change and improvement in the apps they use.

Customers are also increasingly demanding that the organizations they do business with have environmentally sustainable and socially responsible business practices. Research commissioned by OpenText indicates that nine in ten global consumers want to buy products sourced in a responsible and sustainable way—and 83 percent would pay more for goods that are ethically produced.

Success in application development now requires that organizations optimize costs and meet their environmental, social, and governance (ESG) targets while quickly and effectively delivering services and solutions.

Reducing energy consumption and the production of greenhouse gas (GHG) emissions in application delivery is a complex endeavor. According to Harvard Business Review, software doesn't consume energy or emit any harmful discharge on its own.[2] However, the way software is developed for use, and the way it is used, can present significant ESG challenges. Specifically, "software runs on hardware, and as the former continues to grow, so does reliance on the machines to make it run."[3]

In other words, software is not itself a GHG emitter. However, development, testing, and use across the software development lifecycle (SDLC) requires the development, delivery, and use of increasingly energy-intensive hardware. From high-performing computational systems, laptops, and desktops to the servers or data centers that make up the underlying infrastructure, modern application delivery produces harmful discharge and consumes vast amounts of energy.

Enterprise leaders must find a balance in delivering more value to their customers while attempting to reduce GHG emissions and the carbon footprint of their business value streams. By reducing waste across all segments, organizations can deliver business value more readily and reduce the impact of application delivery. This, in turn, reduces an organization's carbon footprint and ecological burden and can help organizations advance towards a net neutral or carbon positive outcome.

This paper discusses how companies can accelerate safe delivery of strategic business solutions while saving resources and minimizing climate impact as they look for ways to innovate faster and keep pace with more agile competitors. It will provide tips for reducing GHG emissions while continuing to meet customers' evolving needs, as well as an overview of the software solutions that can help.

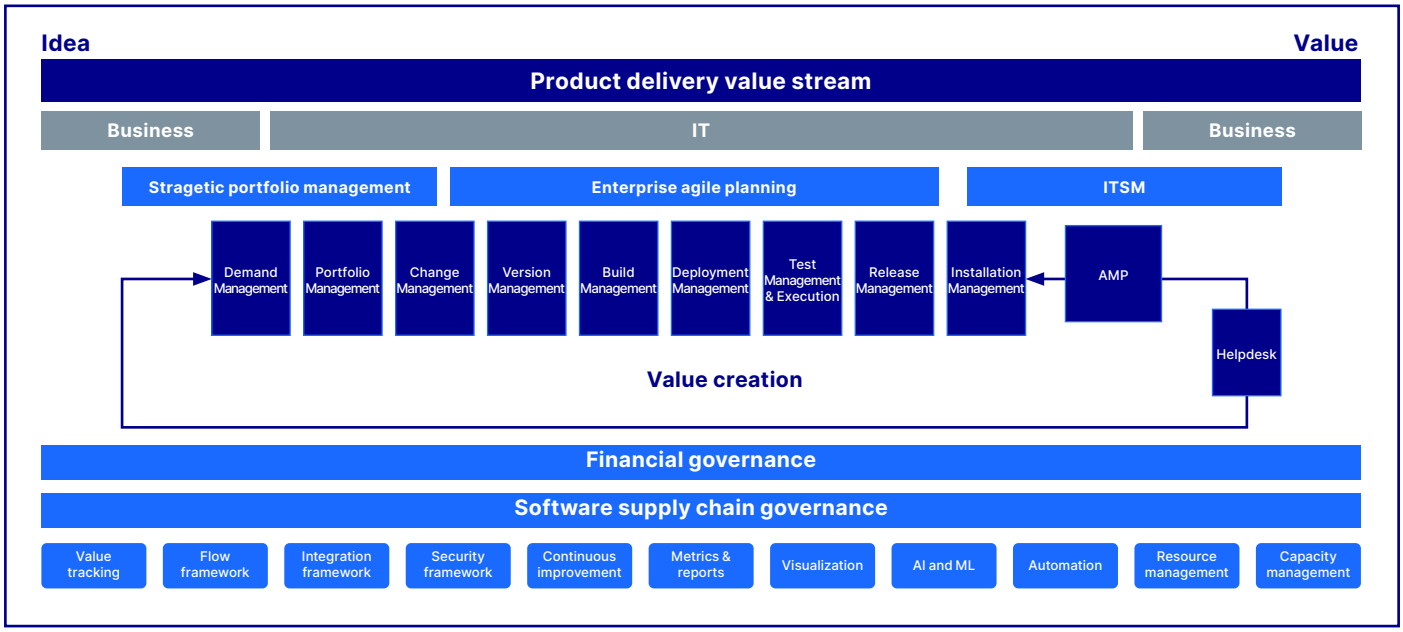
ESG challenges in modern application delivery

To understand potential waste reduction in modern application delivery, let's look at a typical application delivery or digital value stream flow. In a simplified value stream (shown below), business ideas are captured, passed into business portfolios, and then sent to the digital value stream delivery process.

2 Harvard Business Review, How Green Is Your Software?, 2020

3 Ibid.

Extended DevSecOps Landscape



Throughout the process, both time and energy resources can be wasted, through idling, overproduction, and reworking. Each instance of waste influences time to market, time to value, and the ecological impact.

Device-driven waste

Every developer, tester, operations team member, or project lead participating in product delivery relies on high-performing computational systems, laptops, or desktops with high energy use potential. As a side effect, these tools generate high levels of residual heat, often requiring additional cooling to ensure users' ongoing comfort.

Infrastructure-driven waste

SDLC processes also introduce changes into existing information systems. As these systems undergo development, testing, deployment, and delivery to production, the infrastructure involved in running the system starts consuming increasing levels of energy.

Data centers and server machines present significant ESG challenges for modern application delivery. When an application is built, tested, and deployed onto target systems or servers, the underlying infrastructure is usually located in a data center (with substantial associated running costs), or a cloud environment (which are, in turn, powered through data centers).

According to Data Centre Magazine, data centers are estimated to be responsible for up to three percent of global electricity consumption today—and that number is expected to increase to four percent by 2030.[4] With the advent of artificial intelligence (AI) models, which require increasing amounts of energy, some forecasts predict data centers could draw up to 21 percent of the world's electricity supply by 2030.[5]

4 Data Centre Magazine, Energy efficiency predictions for data centres in 2023, 2022

5 Nature, How to stop data centres from gobbling up the world's electricity, 2018

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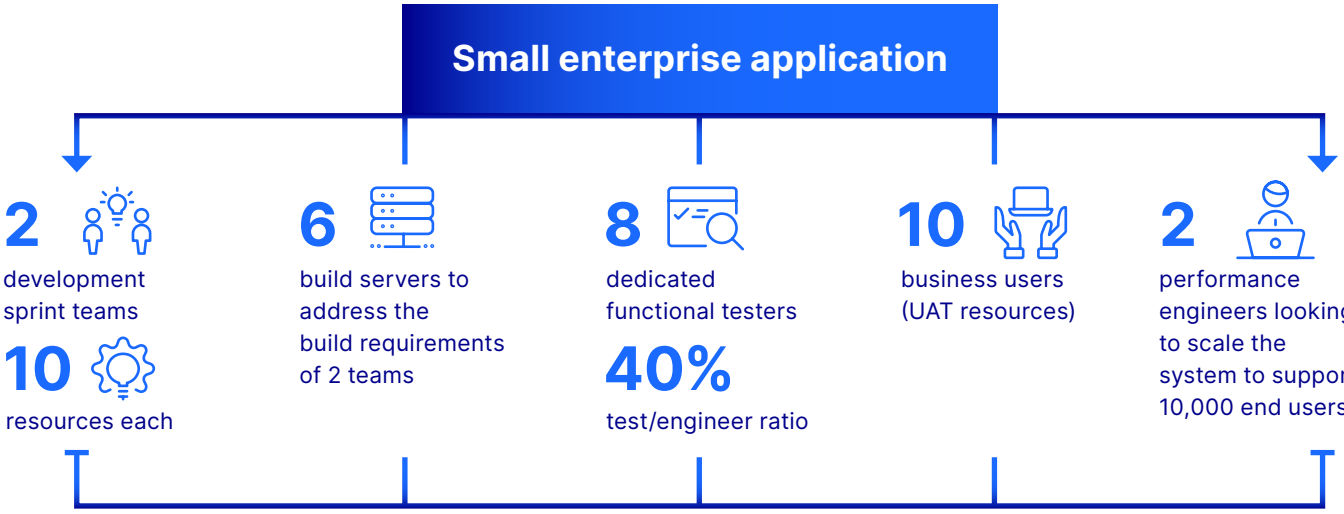
Running the numbers

Maintaining even a small application can result in significant levels of energy use and associated GHG emissions. It's estimated that a small team of 10 developers, working five days a week on local desktops, will generate 5,115 lbs (2,320 kgs) of greenhouse emissions (CO_2 alone) per year. When scaled to the level of the digital value stream, following an SDLC from development through to production, these numbers significantly increase. Let's work through the math we used to get those numbers.

It's estimated that a desktop computer uses an average of 200 W/hour or 600kWh per year,[6] and a data center uses 126,111kWh per year.[7] Based on EIA estimates,[8] this equates to emissions of 513lbs (232 kgs) of CO_2 per desktop per year and 248,653 lbs (112,787 kgs) of CO_2 per high end rack server per year.

Based on this data, a single, three tier application with a small development team would use 4.44 kWh in energy per year and produce 3,795,207 lbs (1,721,477 kgs) of CO_2 per year—roughly the same amount as produced by 258 American citizens each year.[9]



As these calculations demonstrate, the energy consumed in the SDLC is substantial—and there is a stark need for organizations to reduce their energy consumption and GHG emissions.

Four benefits of environmental sustainability in application delivery

Reducing energy use and GHG emissions are necessary components of combating climate change and becoming a climate innovator, but these efforts also provide four additional benefits.

6 Energuide.be, How much power does a computer use? And how much CO_2 does that represent?

7 NIyte Software, How Much Does it Cost to Power One Rack in a Data Center?, 2021

8 Us Energy Information Administration, How much carbon dioxide is produced per kilowatthour of U.S. electricity generation?, 2023

9 The World Bank, CO_2 emissions (metric tons per capita) – United States, 2023

Meet government regulations

Businesses of all sizes must abide by governmental mandates and regulations. Agencies such as the US Environmental Protection Agency and Climate Change Canada are mandated with enforcing environmental regulations and overseeing industries that have set climate targets to meet.

Many public sector agencies are also requiring government contractors to demonstrate they are a low-emissions vendor as part of their procurement policies. By reducing energy consumption and GHG emissions, organizations can better comply with governmental regulations and position themselves as sustainable vendors.

Foster customer loyalty

We are at the beginning of a global sustainability revolution with serious implications for organizations. Customers increasingly expect the brands they work with to have ethical and sustainable business practices. Whether it's an ethical supply chain, fair trade goods, or sustainability programs, consumers are more aware than ever of companies' practices.

The good news is that implementing ethical and sustainable practices benefits both the environment and your brand. Recent research conducted by OpenText demonstrates that brand loyalty is becoming increasingly tied to sustainability. In fact, 86 percent of respondents in Canada and 82 percent in the US and UK indicated they would pledge their brand loyalty to companies with a clear commitment to responsible sourcing.

Achieve organizational net zero goals and cost savings

Reducing your environmental impact has a direct impact on the costs associated not only with the SDLC, but more generally with running a successful business.

Lowering energy consumption saves money on an organization's energy bill and operating costs. Reducing waste from delivery cycles also frees up infrastructure and saves on both energy use and time to market. This can help organizations deliver additional capabilities and can even divert extra resources to the creation of other green agenda-centric functionality, such as product sleep modes or quiet-time processing.

Organizations can also reduce the costs associated with running data centers, along with their footprint, by consolidating, adopting energy-efficient servers, outsourcing certain IT services, or moving to the cloud.

Attract and retain top talent

Just as consumer demands for ethical practices are rising, employees are increasingly looking to work for companies with strong sustainability policies. In fact, reports indicate that more than 70 percent of workers are drawn to environmentally sustainable employers.[10]

The talent market is competitive and the costs to recruit and train new employees are high—some reports indicate companies don't break even on a new employee for up to six months.[11] Having strong sustainability practices can attract and retain employees which, in turn, can help organizations save on the recruitment process.

10 TechTarget, Why sustainability improves recruitment, retention, 2023

11 Investopedia, The Cost of Hiring a New Employee, 2022

Areas of emphasis for reducing waste in the digital value stream

Eight core domains

From a software or application engineering and deployment perspective, there are eight core domains in a digital value stream where waste reduction can occur:

Plan: Strategic portfolio planning and strategy setting.

Code: Removing waste from code development and review, static code analysis, continuous integration tools.

Build: Eliminating hardware use from version control tools, code merging, build status.

Test: Continuous testing, test automation, practical uses of performance engineering, and predicting test results to determine successful outcomes and reduce energy use and load.

Package: Establishing an artifact repository, application pre-deployment staging, artifact reuse, and governance to reduce rework.

Release: Change management, release approvals, release automation, as well as provisioning to improve efficiency of delivery and reduce machine run costs.

Configure: Infrastructure configuration and management, infrastructure as code tools to remove unnecessary machine load and reduce energy levels.

Monitor: Monitoring applications performance, end user experience, and system performance to minimize redundant machines and reduce overall system run costs.

Five key areas for efficiency

Within these core domains, five represent the biggest opportunities to reduce energy use and GHG emissions.[12]

Plan

Application delivery is complex and time-consuming. Strategic planning can improve resource efficiency, reduce the waste of work or rework for activities not aligned with business goals or strategy, and ensure compliance. Well-planned strategic objectives that are allocated to teams in a timely manner can reduce the waste of waiting.

Code

Improved communication and review processes allow teams to focus efforts on successful code commits. Local builds can validate all included components before push into the mainline or CI server build system, and security scans and unit tests can run locally to ensure that “shift left” approaches to minimize rework are in place. Although this will not cause significant server savings per developer, the reductions in requests following unsuccessful builds and rework due to failed security, functional, or performance testing is significant.

12 This position paper explores the reduction of energy consumption in planning, code, build, test, and release. The second paper in this series will outline reduction of energy consumption in package, configuration, and monitoring. The second paper will also address the generation of GHG and energy used in the creation of third-party software that is embedded into products delivered through a digital value stream.

Build

Dynamically provisioning build infrastructure and using build job scheduling or allocation based upon server load and job priority can have a significant impact on energy consumption. With efficient build configuration and the dynamic creation and allocation of build infrastructure (based upon build type and resource requirements), build systems and server requirements can be reduced by 40 percent or more. Queuing low priority jobs and using predicative build outcomes to identify potential build failures prior to submission to server allows significant resource reductions to be made.[13]

Test

This is an area of huge potential saving, because AI functional testing and test automation can dramatically reduce the amount of time required. Using computer vision and natural language processing to understand analogous words can remove the risk of test failures due to application change. With test scenarios being run with more confidence, the requirements for dual testing environments are removed. The old model where an organization runs a test server and a back-up test server is no longer required.

Another area of significant cost reduction is cloud-based load testing servers. The use of just-in-time, dynamically provisioned load environments using load generators to validate demand that auto-scale can significantly reduce the number of idle servers.

Release

Effectively using servers and environments is key to long-term energy efficiency and reduced allocation. Adopting accurate release processes and environment allocation timelines successfully can reduce capacity needs for test, UAT, and pre-production environments.

For example, well planned, scheduled, and delivered releases, can reduce time allocated to UAT environments. Common business frustrations during UAT are ongoing environment updates and unavailability of resources or stable product versions to perform UAT against. With accurate release scheduling, including environment allocation, the demands on UAT server infrastructure can be reduced by about 40 percent.

Impact on energy consumption and GHG emissions

Applying the above-mentioned improvements to a single, three-tier application could save 2,396,536 kWh per year (4,438,840 minus 2,042,304) or 2,049,038 lbs (929,428 kg) of CO_2 equivalent.

	Desktops	Servers	Load servers	Energy use (Pa) kWh
Develop	20	-	-	12,000
CI	-	4		504,576
Test	8	3		383,232
UAT	10	1		132,144
Performance	2		8	1,010,352
				2,042,304

13 Build scheduling to make use of lower cost and demand "off peak" energy will be discussed in the second position paper in the series.

Adopting additional waste reduction mechanisms, such as VSM-based processes, can bring additional cost and energy savings to the average simple application delivery (digital) value stream.

Reduce your carbon footprint with digital value streams

Information management has a critical role to play in reducing waste in the digital value stream.

At OpenText, our purpose is to empower our customers to organize, integrate, and protect data and content as it flows through business processes inside and outside their organization. With modern information management solutions, we enable our customers to work smarter by spending less time on manual, menial tasks and instead focusing on adding value and making better decisions.

OpenText believes in protecting people, the environment, and society. It's this belief that drives us to collaborate with customers and other partners to shape the future with technology that positively impacts the world. For example, OpenText developed an online environmental impact calculator for our customers in partnership with the Environmental Paper Network. Customers can input the number of supply chain transactions, faxes sent and received, documents printed for signatures, and/or customer bills mailed to produce an output of the estimated environmental impact (such as trees saved) of digitization.

Customers of OpenText™ Trading Grid™ digitize more than 33 billion transactions per year. This paper reduction saves the equivalent of 6.5 million trees and greenhouse gas emissions of more than 922,000 tons of CO_2e according to the calculator.

OpentText customers digitize more than 33 billion paper transactions

equating to 299,374 metric tons of paper

or 7.9 million trees

Paper reduction saves GHG emissions of 2.69M MT of CO_2e

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Resource link

OpenText DevOps Cloud

VSM focuses on the value of delivery initiatives across an organization's SDLC. Using VSM tools, organizations can gain wide-angle visibility across the software development lifecycle, from ideation to software delivery. This enables software development and IT teams to better analyze each touchpoint throughout the value stream to improve workflows, eliminate waste, increase automation, and remain compliant.

A modern, end-to-end VSM platform doesn't just provide real-time insights. It also facilitates the ability to act where and when necessary. VSM platforms are flexible systems that can integrate with existing toolchains and provide extended functionality and capabilities, including predictive AI, smart automation, and continuous quality.

Value Stream Management is a proven approach to improve the value, flow, and quality of software delivered by IT to business. OpenText™ ValueEdge™ is a cloud based VSM and DevOps platform. ValueEdge is a modular software delivery platform designed for quick and incremental adoption across a digital value stream. With ValueEdge, organizations can tap into AI-powered insights and connect to existing tools to work smarter, enhance continuous quality, foster collaboration, and increase the flow of value to customers. Through its flexible modular architecture, AI-powered insights, and emphasis on collaboration and quality, ValueEdge enables organizations to achieve digital value streams of the future.

Through innovative approaches to application delivery, real-time infrastructure instantiation and optimization, and a reduction in server waste, future digital value streams can align with organizational goals of achieving net zero, reducing energy consumption, and contributing to a sustainable future.

Learn how to automate DevOps, make the most of VSM, accelerate activities across your digital value stream, and increase your sustainable business practices with OpenText DevOps Cloud.

About OpenText

OpenText, The Information Company, enables organizations to gain insight through market leading information management solutions, on premises or in the cloud. For more information about OpenText (NASDAQ: OTEX, TSX: OTEX) visit: opentext.com.

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