

# OPEN SOURCE TRANSFORMS THE ENERGY INDUSTRY

New Solutions for Modern Energy Challenges

## THE CHALLENGE

In the face of shifting markets, downward price pressure, decentralization, digitization, and climate imperatives, the energy sector must respond with greater agility, flexibility, and efficiency to thrive in the coming decades. The technologies that energy companies rely on are a particular area of challenge, with legacy applications and an infrastructure that commonly creates inefficient, siloed, manual processes that drive up costs and slow the pace of change. To overcome these problems, the industry is in an ongoing state of digital transformation. Spending in the smart energy market — primarily smart grids and digital oilfields — is projected to grow at a CAGR of 9.6% from 2020 to 2027, reaching \$253M.<sup>1</sup>


Technology decision-makers face a varied list of potential initiatives vying for their attention and resources. IoT technologies can instrument, monitor, and control a massive range of endpoints across smart grids, turbines, wellheads, and more, improving efficiency and return on investment. 5G networking offers low-latency, high-throughput wireless connectivity, so that analytics based on machine learning can be performed at the network edge to derive value from that data. Transitioning operations to cloud-native software based on microservices deployed in containers creates further cost and flexibility benefits.

These approaches set the stage for elastic cloud infrastructure and continuous integration/continuous delivery software approaches based on DevOps. Faced with those opportunities, organizations find themselves in a fast-paced period of change, making sound solution design based on proven building blocks essential.

Within that framework of opportunities and challenges, the energy sector also faces grave new threats to its security from malicious attackers, with particular danger from sophisticated nation-state actors. Recent years have seen dramatic cyberattacks on energy infrastructure, from repeated successful attacks on Ukraine's power grid starting in 2015 to the 2021 Colonial Pipeline ransomware case in the southeastern U.S. The industry is also particularly vulnerable to more generalized attacks, such as the SolarWinds hack of 2020. The potential for catastrophic impacts is real and growing, both for the energy industry itself and to the broader society it serves. Cybersecurity must be a primary design consideration for all systems associated with energy production and distribution, informing broader goals for digital transformation.

## WIND RIVER SOLUTIONS

- **Wind River Linux:** The industry-leading open source operating system for connecting, securing, and running embedded systems and applications, Wind River Linux is an open operating system ready to provide a cost-effective foundation, enabling use of containerization for flexible and agile application installations.
- **Wind River Titanium Linux:** Part of the Wind River Titanium Security Suite offering, Titanium Linux provides the most robust Linux system-hardening and security capabilities available on the market today for operationally deployed Linux systems.
- **Wind River Studio:** Studio is the first cloud-native platform for the development, deployment, operations, and servicing of mission-critical intelligent edge systems that require security, safety, and reliability. It is architected to deliver digital scale across the full lifecycle through a single pane of glass to accelerate transformative business outcomes.



**32.5%**

The revised European Union Energy Efficiency Directive seeks to reduce primary energy consumption within the EU by 32.5% by 2030.<sup>2</sup>

<sup>1</sup> Allied Market Research, "Smart Energy Market Analysis – 2027," January 2021

<sup>2</sup> Federal Ministry for Economic Affairs and Energy, "European Energy Policy," 2021

“It’s up to both government and industry to prevent possible harms — that’s why we’re working together to take these decisive measures so Americans can rely on a resilient, secure, and clean energy system.”

— Jennifer Granholm, U.S. Secretary of Energy<sup>3</sup>

The future of the energy industry depends on the development of mission-critical intelligent systems that can cost-effectively and flexibly meet the growing needs of the energy sector. Innovating on a proven foundation of systems technologies is essential to realizing future potential with the needed levels of real-time performance, security, safety, and reliability.

## THE APPROACH

The industry is increasingly defined by the adoption of a more distributed and varied array of energy sources, including wind, solar, and hydroelectric. Newer assets, such as turbines, tend to incorporate sensors, actuators, and other data elements into their core designs; older systems, such as refinery equipment, can have such capabilities added. These trends are ushering in unprecedented data connectivity and enabling novel capabilities, like dynamic pricing based on supply and demand and automated management of resources. For example, increasing connectivity and intelligence in the grid can facilitate generating electricity from low-cost sources and transporting it to high-demand areas, driving up efficiency and profitability.

The interoperability required by this vision is enabled in large part by open standards and open source software. In an era when so much new infrastructure is being built, providers are wisely avoiding siloed, proprietary tools and architectures. This approach also helps ensure that the evolution of shared capabilities can proceed faster than any company would be able to manage on its own. Contributions from across the industry and beyond — including general-interest projects such as Linux — make open source the preferred foundation for transformation.

The Linux Foundation sponsors the LF Energy project, which fosters software collaboration and innovation for the energy industry. With members across commercial, academic, and nonprofit organizations, LF Energy enables the digitalization of the world’s power infrastructure using flexible, secure open source software. Its efforts include technology frameworks and reference implementations that reduce the effort needed by individual companies to transform. At the same time, the project enables integration and optimizes interoperation among systems globally, enhancing

solution quality. As part of its charter, the LF Energy project champions the following set of architectural principles:

- **Interoperability by default:** Encouraging solution design and engineering with a focus on ease of integration helps the technology as a whole advance rapidly.
- **Resilience by design:** To better accommodate the unpredictability of supply from renewable sources, solutions focus on real-time situational awareness to support continuous availability.
- **Simplicity by design:** By maintaining simple, easily adaptable solution architectures, designs can more easily be put in place in different environments and evolve to meet future needs.
- **Security and safety by design:** Integrating security and safety into architectures from the earliest design stages is vital to protecting critical infrastructure and data.

Software-defined energy systems are a major focus of transformation in the energy grid. The distribution of wind power provides a useful example of this approach in practice. The supply from a particular wind farm fluctuates in real time, and distribution must occur immediately, or the capacity is unused and revenue is lost. In such a dynamic system, supply and demand must be continually balanced, with constant adjustment of pricing and direction of energy to a utility or system operator chosen in real time. Done properly, renewable energy becomes an affordable way for operators to balance the grid, but it requires intelligent responsiveness to conditions. Likewise, commercial and industrial customers can be empowered to source energy according to changing requirements and information from sources such as weather forecasts.

Smarter, more flexible electric grids can cut energy losses during distribution. They are critical to enable renewables, which are more variable than conventional electricity generation.

—Project Drawdown<sup>4</sup>

Wind River® is helping to bring about these changes in the energy landscape through the development of transformative technologies for digitization. As part of its continuing embrace of open source, Wind River has committed resources to the advancement of the LF Energy project. Core Wind River offerings that include Wind River Linux, Titanium Linux from the Wind River Titanium Security Suite, and Wind River Studio provide the foundations for use cases as diverse as grid modernization, automated monitoring and control of power substations and production sites, and infrastructure inspection and maintenance.

<sup>3</sup> United States Department of Energy, “Biden Administration Takes Bold Action to Protect Electricity Operations from Increasing Cyber Threats,” April 20, 2021

<sup>4</sup> Project Drawdown, “Grid Flexibility”

## Wind River Linux

Pairing open source innovation with enterprise-class hardening and support, Wind River Linux is the OS of choice across diverse workloads for the energy industry. This POSIX®-compliant foundation is built to accelerate cloud-native development using modern methodologies such as DevOps and continuous integration/continuous delivery. Wind River Linux also facilitates deployments that span multiple architectures, with rich support for bare metal deployments, hypervisor-based virtualization, and popular container platforms such as Kubernetes and Docker. Its benefits include:

- **Lower risk:** Every release of Wind River Linux is thoroughly validated, documented, and supported for mission-critical intelligent systems, providing an added layer of quality assurance.
- **Optimized results:** Wind River Linux supports the energy industry with tuning for deterministic high performance, reliability, and low latency in a small footprint.
- **Secure operation:** Long-term support and maintenance include ongoing threat mitigation for emerging vulnerabilities, expertly relieving that burden from internal teams for safety assurance with improved efficiency.

## Wind River Titanium Linux

Designed by Wind River subsidiary Star Lab (acquired in 2020), Titanium Linux works with Wind River Linux and other leading OSes to harden and protect Linux-based deployments. The offering applies a threat model that assumes root access by attackers while maintaining the integrity and confidentiality of mission-critical systems, applications, and data. Titanium Linux also helps streamline security operations by addressing a broad range of cyber requirements with a single, proven product designed specifically to integrate with Linux systems. It provides:

- **Reduced attack surface:** By removing unused functionality from the OS kernel, Titanium Linux eliminates pathways that attackers may use to alter execution or bypass security.
- **Enhanced protection measures:** Titanium Linux stores crypto keys out of band — beyond the reach of attackers — and verifies the integrity of configuration files before they can be accessed by protected applications.
- **Limited system access:** Even root-level users are denied access by default from protected applications, libraries, scripts, and data files, while Titanium Linux also streamlines secure software updates.

## Wind River Studio

Cloud-native development of code for mission-critical systems requires more than repurposing existing tools and techniques. Studio is designed specifically for creating applications and services with the portability, efficiency, and flexibility that cloud models require. Well appointed for modern cloud-native development practices, the suite provides an integrated and expandable set of tools to streamline the creation of software that meets mission-critical demands for security, safety, and reliability with highly efficient workflows. Studio supports:

- **Unified lifecycles:** Providing a single environment for development, deployment, and operations, Studio enables cross-organizational approaches such as DevOps and DevSecOps.
- **Cloud capabilities:** Delivered as a cloud service, Studio is always up to date and built specifically to support cloud-centric development architectures, such as microservices and containers.
- **Transformative efficiency:** Studio enhances cross-team abilities to automate and accelerate building, testing, and deploying software from a single pane of glass.
- **Reengineered development workflows:** Studio enables solution sets to reduce development costs and accelerate capabilities for building, testing, and deploying on the edge.

## THE RESULT

The energy industry is responding to the challenge and opportunity of cloud-native computing models with a growing open source commitment that pools the forces of innovation for shared advantage. To maximize the benefit of open source, Wind River offers enterprise-level security, stability, and safety through products that include Wind River Linux, Titanium Linux, and Studio.

Replacing legacy technologies, siloed environments, and manual processes with modern, open, automated architecture is critical to increasing efficiency and profitability, even as new and unforeseen challenges arise. Energy companies are also making great strides forward with the adoption of new elements to their technology stacks, such as IoT, 5G, AI, and many others. Partner with Wind River for your transformed future.

To learn more about Wind River tools and technologies for the energy sector, visit [www.windriver.com/solutions/industrial](http://www.windriver.com/solutions/industrial) or contact [salesinquiry@windriver.com](mailto:salesinquiry@windriver.com).

WINDRIVER