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Sustainable Energy Management

A Complete Guide to Energy as a Service

End-to-end, Resilient, Reliable and Cost-effective Power for the Commercial and Industrial Sector

Hitachi Global Environment Business Division - North America

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Content

1 Introduction

What is Energy as a Service (EaaS)?

Energy as a Service (EaaS) is an innovative business model in the energy sector where customers are provided with energy solutions based on desired outcomes rather than individual components or commodities. Rather than investing in, owning, and maintaining energy infrastructure themselves, customers can essentially "subscribe to" energy services from providers.

This model offers flexibility and customization, allowing users to access the latest energy technologies, achieve their sustainability goals, and better manage their energy consumption and costs without the need for significant upfront capital expenditures. EaaS represents a shift from traditional energy consumption to a more holistic, service-oriented approach.

The Evolution of the Energy Industry and the Rise of EaaS

The Evolution of the Energy Industry

Traditionally, the energy industry revolved around centralized models where large utilities produced power, often from fossil fuels, and distributed it to energy consumers through extensive grid systems. This model was largely one-directional, with utilities generating and consumers passively receiving electricity.

However, the late 20th and early 21st centuries have seen a significant shift towards **energy decentralization**, driven by technological advancements, environmental concerns, and changing economic dynamics. Renewable energy sources like solar, wind, and hydropower have gained prominence due to lower costs and easier implementation, contributing to this decentralized energy landscape where businesses can now produce, store and use the power they produce when needed, and sell the excess back into the grid.

This democratization of energy generation, known as the **prosumer** (producer-consumer) model, has shifted the dynamics of energy distribution. With this shift, the grid is transforming from a one-way "source-to-consumer" model into a **multidirectional, interactive system**.

As renewable energy technologies become even more affordable and efficient, the demand for flexible, resilient and sustainable energy solutions is continuing to grow.

Enter Energy as a Service (EaaS)

In response to the changing energy landscape and the demand for more flexible energy solutions, the concept of Energy as a Service (EaaS) has emerged. **EaaS is an innovative business model where customers purchase the outcome – energy, efficiency, or operational benefits – rather than the individual system components or commodities.**

This approach provides energy end-users with a customizable energy solution, allowing them to benefit from advanced technologies, achieve their sustainability goals, manage energy costs, and reduce risks - all without upfront capital expenditures.

As industries worldwide continue their march towards digitization, decentralization, and sustainability, EaaS is becoming an integral component of the modern energy ecosystem, signaling a new era of energy consumption and management.

2 A New Energy Landscape.

Decentralizaiton, digitalization and decarbonization

Shift from Traditional Utilities to Distributed Energy
Historically, the energy landscape was dominated by traditional utilities that operated large power plants, typically fueled by coal, oil, or natural gas. These centralized entities produced vast amounts of electricity and delivered it to consumers through extensive grid systems. The relationship was predominantly one-way: utilities produced, and consumers received.

However, recent years have seen a move away from this centralized model towards a more distributed energy system. In this new paradigm, energy is produced closer to the point of consumption, often by smaller, localized power sources, reducing transmission losses and increasing grid resilience.

The Role of Renewable Energy Sources
Renewable energy sources, notably solar, wind, and hydropower, have been pivotal in reshaping the energy sector. Their increasing efficiency, coupled with declining installation costs, has made them more accessible to the average consumer. As a result, households and businesses are now not only consumers but also potential producers of energy.

This “prosumer” model has disrupted traditional energy dynamics. Renewables also offer a cleaner, more sustainable energy option, aligning with global efforts to combat climate change and reduce carbon emissions. Their integration has fostered innovation and driven the need for more adaptable and flexible grid systems.

Energy Decentralization and Digital Transformation
The move towards energy decentralization, where power generation is spread out across numerous small-scale sources, has been complemented by rapid digital transformation. Smart grids equipped with sensors and advanced metering infrastructure allow for real-time data collection and analysis.

This digitization facilitates better grid management, optimizing energy flow, predicting demand, and integrating variable renewable sources seamlessly. Moreover, consumers equipped with digital tools can monitor and manage their energy consumption, participate in demand-response programs, and make informed decisions about energy use, creating opportunities to decarbonize their facilities across their entire footprint. This convergence of decentralization and digital technologies is paving the way for a more resilient, efficient, and sustainable energy future.

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Current Energy Challenges & Drivers

Economic
- Rising energy prices
- New tariff rates
- Federal, state, local incentives
- Reduced production costs
- New revenue opportunities

Operational
- Increased and intermittent energy demands
- Grid instability and dependency - lack of autonomy
- Improved digital integration
- Less operational risk tolerance with tighter supply chains

Environmental
- Sustainability concerns
- GHG awareness & goals

Benefits of Energy as a Service

Cost savings, reliability, resiliency and access to clean energy sources

Cost Savings for the Commercial and Industrial sector
One of the most immediate advantages of EaaS is the financial relief it brings. Instead of making significant upfront investments in energy infrastructure, businesses can access state-of-the-art energy solutions without having to invest in upfront capital expenditures.

By paying for energy services based on a fixed rate, businesses can better predict and manage their energy expenses. Furthermore, the EaaS model often leads to optimized energy use, reducing wastage and thereby decreasing overall energy bills.

Enhanced Energy Reliability and Security
An EaaS model allows businesses to benefit from the latest energy technologies and solutions, ensuring a continuous and stable energy supply. This includes a mix of renewable sources, energy storage solutions, and advanced grid management tools. Such an integrated approach not only reduces the risk of outages but also safeguards against energy price volatility.

Additionally, with real-time monitoring and predictive maintenance, potential issues can be identified and addressed before they escalate, ensuring uninterrupted energy service.

Carbon Footprint Reduction and Sustainability Goals
Adopting EaaS promotes the utilization of cleaner energy sources, such as solar power. This shift away from fossil fuels helps businesses to significantly reduce their carbon footprint. Moreover, EaaS can be a strategic solution for companies looking to reduce their carbon emissions and meet their sustainability targets, demonstrating a commitment to environmental responsibility and enhancing their reputation for sustainability.

Flexibility in Energy Consumption and Production
EaaS offers a dynamic approach to energy management. With the integration of advanced digital tools and technologies, energy consumers can actively monitor, control, and adapt their energy consumption patterns. This level of granularity provides the flexibility to adjust their energy consumption based on their needs, external energy prices, or grid demands. Additionally, for those producing energy (e.g., via solar panels), there is the potential to feed excess energy back into the grid or participate in demand-response programs, creating additional avenues for revenue or savings.

In essence, EaaS encapsulates a forward-thinking approach to energy management, combining economic benefits with environmental responsibility and adaptive flexibility, resulting in energy resiliency while offering the potential for sustainable outcomes.

3 Outcomes & Benefits

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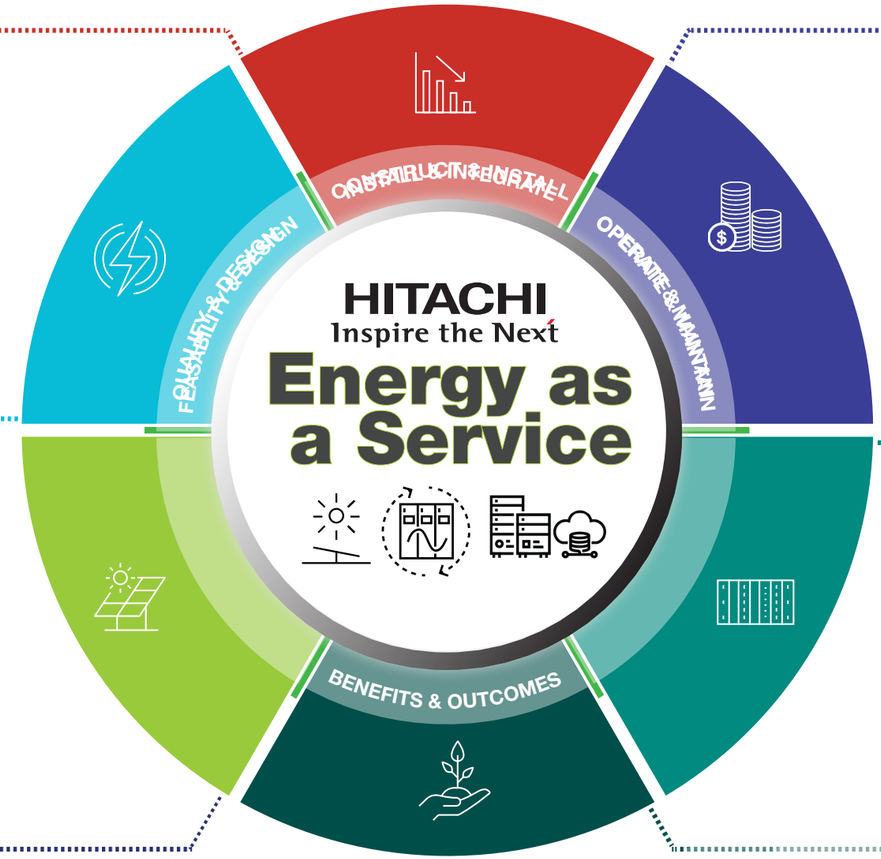
Outcomes

Cost savings
Avoid capital costs, pay for energy used instead of energy infrastructure

Reliability and flexibility
Monitor and control energy consumption with digital energy optimization

Sustainability
Maximize renewable integration by utilizing clean energy technologies



Benefits

Financial benefits
Immediate savings, reduced energy costs, affordable OPEX model, reduced ownership risks

Operational benefits
Improve load management, increase resiliency, reducevoltage fluctuation

Environmental benefits
Address sustainability needs and reduce carbon emissions

4 EaaS Business Models

Products, Solutions and Services

Behind-the-Meter Solutions
Behind-the-meter (BTM) solutions refer to energy systems and technologies **installed on the customer's side of the utility meter.** These solutions are often referred to as microgrids - and can be isolated or "islanded" from the grid when needed. These solutions allow businesses to generate, store, and manage their own energy, often with renewable sources like solar panels or wind turbines.

By adopting BTM solutions, energy consumers can **reduce their reliance on traditional utilities**, achieve substantial savings by lowering peak demand charges, and even sell excess energy back to the grid. Furthermore, BTM technologies like energy storage or demand response systems can **enhance resilience** by providing backup power during outages or grid instability.

Off-Site Energy Services
Off-site energy services refers to energy generation that occurs away from the consumption point. Instead of installing energy infrastructure on-site, businesses can enter into agreements (like power purchase agreements or PPAs) to procure energy from larger, centralized renewable projects, such as wind or solar farms.

This model offers companies a way to leverage the benefits of renewable energy without the need for direct investment or managing on-site infrastructure. Additionally, it's an attractive option for entities with limited on-site renewable potential or those seeking to diversify their energy mix across multiple sources.

Integrated Energy Solutions
Integrated energy solutions are **holistic approaches to energy management** that combine multiple technologies and strategies to optimize energy usage and sustainability. Rather than viewing components like generation, storage, efficiency measures, and demand management in isolation, integrated solutions consider them as interconnected parts of a larger energy ecosystem.

Integrated solutions ensure seamless interaction between different energy assets, enhancing overall system efficiency, resilience, and adaptability. This approach often incorporates a mix of renewables, energy storage systems, advanced analytics, and smart grid technologies.

Managed Energy Services
Managed energy services refer to **comprehensive energy management** where the responsibility for the entire energy portfolio of a business, from procurement and infrastructure management to efficiency improvements and regulatory compliance is managed by the Energy as a Service provider.

By **outsourcing their energy management,** businesses can focus on their core operations while benefiting from the expertise and resources of energy specialists. This not only ensures optimized energy consumption and cost savings but also mitigates risks associated with volatile energy markets, technological obsolescence, or regulatory changes.

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"The heart of our integrated solution is advanced energy management combined with all the advantages of a microgrid and a service model that minimizes upfront costs.

For our customers, this means clean, cost-effective and reliable power delivered seamlessly anytime, anywhere - even when the grid goes down.

Kal Allam
Vice President & General Manager
Hitachi America, Ltd.
Environment Business Division - North America

5 Key Components of Energy as a Service

Battery Storage and Demand Response

Battery storage systems, when paired with renewable installations or grid connections, allow for the capture and storage of excess energy produced during peak generation times.

This stored energy can then be deployed during periods of high demand or when renewable generation is low.

Demand response programs complement storage by encouraging energy consumers to reduce or shift their energy use during peak periods, often in exchange for financial incentives. Together, battery storage and demand response enhance grid stability, reduce energy costs, and ensure a constant power supply, making them vital components in the EaaS ecosystem.

Renewable Energy Installations

At the heart of many EaaS offerings are renewable energy installations such as solar panels, wind turbines, and hydroelectric systems. These installations harness natural resources to generate clean, sustainable power, reducing reliance on fossil fuels and decreasing greenhouse gas emissions.

As part of an EaaS package, renewable energy installations can be tailored to fit the specific needs and conditions of the business, ensuring maximum energy yield. Whether integrated into urban infrastructures or rural landscapes, renewable sources can lower the environmental and carbon footprint as well as stabilize energy costs by mitigating the volatility of traditional energy markets.

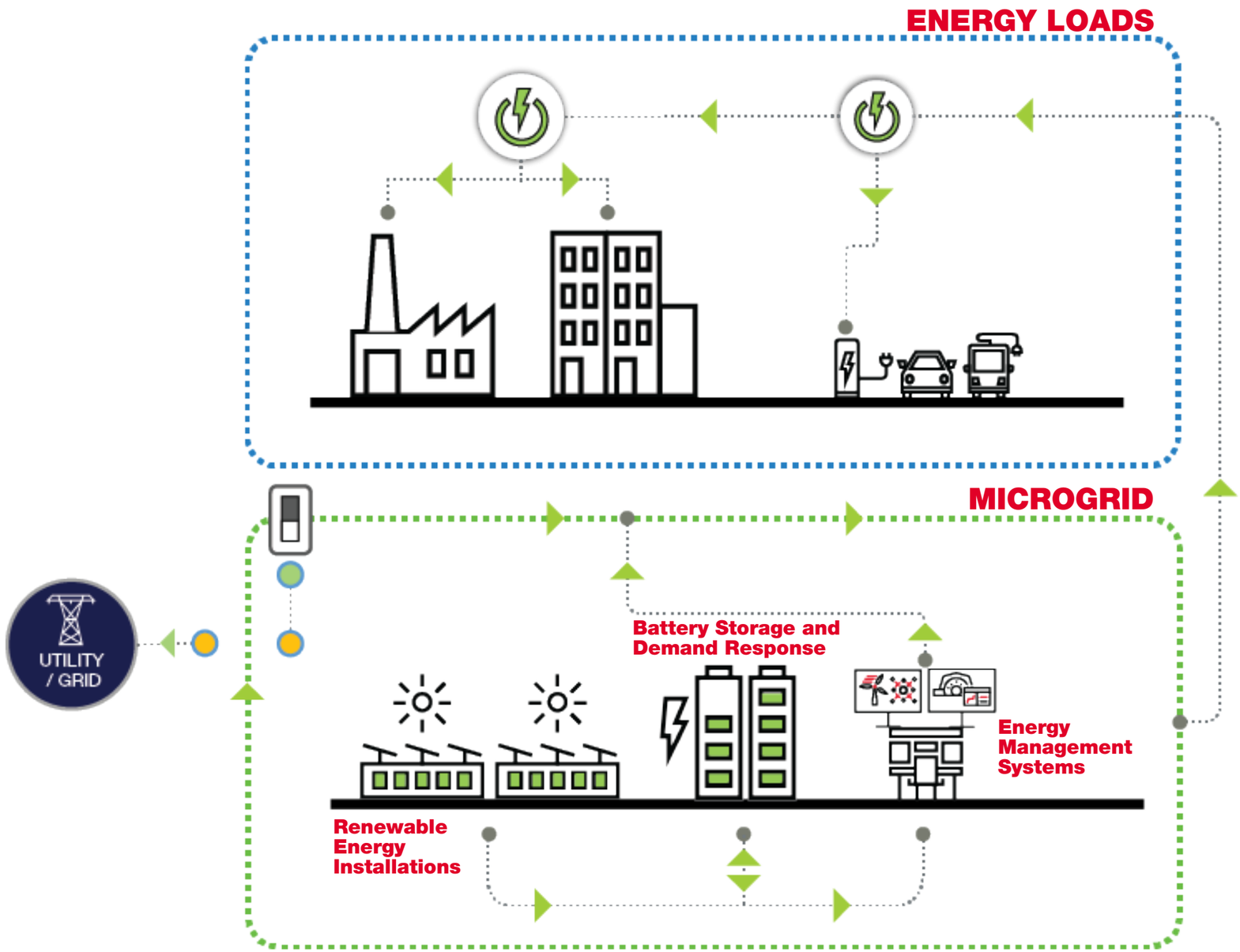
Energy Management Systems

Energy management systems (EMS) are advanced platforms that monitor, control, and optimize energy consumption across a facility or an entire enterprise. These systems collect data from various energy-consuming devices and use analytics to provide insights into usage patterns, inefficiencies, and opportunities for cost savings. With real-time monitoring and predictive capabilities, EMS can automatically adjust energy consumption based on demand, external energy prices, or pre-set criteria, ensuring optimal energy utilization.

As a cornerstone of EaaS, EMS empowers businesses and consumers to have greater control over their energy portfolios, enhancing both sustainability and economic performance.

Hitachi Energy's e-mesh™ portfolio is a scalable, vertically integrated and intelligent digital ecosystem of communications and controls that manage and optimize energy at all levels throughout the microgrid.

5 Key Components of Energy as a Service



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Critical and non-critical energy loads such as office buildings, factories and other facilities, as well as electric vehicle charging stations need cost-effective, resilient and reliable energy, even when the grid goes down.

A microgrid consists of distributed energy resources, for example solar, wind, and generators, plus energy storage systems that can be operated in a controlled, coordinated way, either connected to the main power grid or in islanded mode.

A microgrid can be an effective solution for peak shaving and demand response, as it allows for more efficient management of energy supply and demand at the local level.

6 Case Studies

Case Study 1
Large Retail Chain's Transition to Solar

A global retail chain, with hundreds of stores worldwide, decided to transition to solar power for its operations. Through an EaaS agreement, they installed rooftop solar panels across all their retail locations, with managed installation, maintenance, and energy optimization.

A phased implementation approach allowed for lessons from initial installations to inform subsequent ones. Utilizing EaaS enabled the retailer to avoid large upfront costs while optimizing energy use. The retailer learned the importance of clear communication with stakeholders, ensuring that store operations were minimally disrupted.

Case Study 2
University Campus Microgrid System

A prominent university established a microgrid system for its sprawling campus. The microgrid combined solar arrays, battery storage, and advanced energy management systems, ensuring consistent power even during outages.

The project underscored the importance of stakeholder engagement, particularly with faculty, staff, and students, to ensure understanding and buy-in. The EaaS model allowed for regular system updates, ensuring the university always had access to the latest energy management technologies, while a proactive approach to maintenance, facilitated by real-time monitoring, ensured high system reliability.

Case Study 3
Manufacturing Plant's Efficiency Overhaul

A large manufacturing plant, facing rising energy costs and a mandate to reduce emissions, entered into an EaaS agreement. The provider implemented a range of energy efficiency measures, including LED lighting, optimized HVAC systems, and automated energy management systems, resulting in a 30% reduction in energy costs and a significant drop in carbon emissions.

The manufacturer learned the importance of comprehensive energy audits to identify inefficiencies. By addressing both low-hanging fruit (like lighting) and more complex issues (like machinery optimization), the company maximized its ROI. Regular performance reviews and feedback loops ensured continual improvement and adaptation to the plant's changing needs.

Successful EaaS implementations highlight the importance of project planning, stakeholder engagement, comprehensive energy assessments, and proactive operations and maintenance. EaaS offers flexibility and resiliency, and can lead to significant cost savings, improved energy reliability, and notable sustainability achievements.

7 Other considerations

Market Dynamics and Regional Variations
EaaS operates at the intersection of technology, business, and public policy. Different jurisdictions have varying rules concerning energy generation, distribution, and sales. Some regions embrace decentralized energy models and support renewable integration, while others may have protective measures that favor traditional utility models. Additionally, market dynamics, such as fluctuating energy prices, subsidies, or incentives, can have a significant impact on the feasibility of implementing Energy as a Service.

Integration with Existing Infrastructure
For many businesses and institutions, transitioning to an EaaS model means integrating new technologies and systems with legacy infrastructure. Older buildings or power systems need to be assessed for adaptability to the latest renewable installations or energy management systems. It's essential to find efficient ways to integrate the old with the new, ensuring that the resulting energy system is cohesive and efficient.

Economic and Technological Considerations
While EaaS can lead to long-term cost savings, there may be questions about the stability and predictability of energy prices, which can influence the return on investment. EaaS agreements generally span 5-10 years or more, and ensuring that such contracts are favorable and adaptable to changing economic conditions is crucial. Businesses need to weigh the potential savings and benefits against the costs and economic uncertainties inherent in the energy market.

The energy sector is also undergoing rapid technological advancements. While this brings about many opportunities, it also introduces challenges related to system compatibility and interoperability. Different manufacturers might produce components that adhere to different standards or communication protocols. Ensuring that all these components—from solar panels and battery storage to energy management systems—work harmoniously is critical.

EaaS offers a transformative approach to energy management and can support the key objectives of a business to lower its costs while achieving its sustainability goals - however, its adoption requires thoughtful planning, robust strategies, and adaptive solutions.

8 4 Steps to Implement EaaS for your business

Hitachi designs and delivers tailored energy solutions based on your business needs. Our approach allows your company to remain focused on its core operations while we provide reliable support for your long-term success.

1 Plan: Assessing current energy needs and consumption patterns

We begin with understanding your energy goals and a thorough assessment of your current energy consumption patterns, including analysis of the past 12-18 months of your electricity bills, interval data and existing infrastructure. This helps to identify areas of inefficiency, peak demand periods, and potential opportunities for renewable integration. This assessment also provides a baseline against which EaaS can be measured and informs the scope and specifics of the solution and services required.

2 Design: Selecting partners, site planning and contracts

Selecting the right partners is a critical step that can influence the success of the entire project. Hitachi prioritizes partners with a proven track record and robust technological solutions, and a clear understanding of the business's sector and unique needs. Partners may include solar installers, architects and engineers, and construction firms, as well as finance partners who specialize in EaaS financing models. Site planning, preliminary design and schedule, plus contracts and agreements are important aspects of this phase.

3 Build: Installation, commissioning and training

Once contracts, site design and construction documents are in place, the focus shifts to implementation: awarding of contracts, ordering and procuring hardware, equipment and materials, obtaining permits and site construction, and equipment installation, including renewable energy systems, battery energy storage systems and energy management platforms. Implementation also requires commissioning, training and integrating the energy solution with existing infrastructure which may involve building or efficiency upgrades.

4 Operate: Ongoing monitoring, maintenance and management

Once the project is deemed ready to "go live", ongoing monitoring, maintenance and management is vital. Regular testing, performance reviews, system maintenance, adjustments and upgrades ensure that the energy solution and infrastructure continues to deliver optimal value based on evolving business needs. This is a continuous journey of monitoring, learning, and adapting to your business' needs and energy pricing to maximize benefits.

9 About Hitachi: 4 reasons to work with us.

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1 Reliability

Hitachi is a globally recognized company rooted in a rich history with diverse expertise spanning multiple industries, including energy, industrial manufacturing, transportation and digital services. Our extensive experience in numerous energy projects across the globe is a strong testament to our customers.

2 Advanced technology

Operating in a multitude sectors on a global scale, we offer world-class digital technologies and capabilities, upholding our commitment to efficiency, quality, and sustainability. This translates to shorter lead times, heightened responsiveness, and improved forecasting and best-in-class energy management.

3 Market resilience

With a multifaceted portfolio, global operations, and technological advancements covering a broad range of industries, our market resilience is robust. Leveraging over a century of risk management expertise, you can have confidence in our ability to effectively manage project planning and execution.

4 Global reach

With an extensive portfolio of Hitachi Group companies, our reach is far and wide. We offer access to deep industry expertise, a collaborative innovation ecosystem, resource availability, research and development, economies of scale, risk mitigation, and comprehensive solutions.

9 Reliability, resiliency, and advanced digital solutions.

We offer a comprehensive and integrated approach to energy management to help companies reduce their energy costs, improve operational efficiency, achieve sustainability goals, access advanced technologies, and benefit from energy solutions that are flexible and scalable.

Cost Savings

Access to energy services through Hitachi means our customers save costs by avoiding capital expenditures for energy infrastructure.

Cost Predictability

Ensure energy expenses remain in line with your business goals and financial projects by enabling better budgeting and financial planning.

Energy Efficiency Solutions

Leverage data analytics and technology to identify and implement energy-saving measures meaning reduced energy consumption and lower operational costs.

Access to Advanced Digital Solutions

Deploy state-of-the-art energy technologies within your business operations without diverting resources or attention away from their core operations.

Renewable Energy Integration

Facilitate the integration of renewable energy sources without making a significant, upfront investment in infrastructure.

9

We have the power to empower ...and the track record to prove it.

Hitachi brings extensive expertise and experience to the commercial and industrial sector. We empower our customers to achieve resilient, reliable, and efficient energy.

Our portfolio of flexible and scalable energy solutions including remote monitoring and advanced analytics, renewable energy integration, battery energy storage systems, and energy management that can meet the unique needs of any organization, while contributing to a cleaner, more sustainable future.

1910 — **The beginning of our innovative journey**

250+ — **Global energy installations**

186k — **Global patents**

10th — **Largest tech company in the world by revenue**
Fortune Global 500

TOP **100** — **Global innovator for 10 consecutive years**

OT Operational and Industrial Excellence

Global reach, financial strength, innovative solutions, commitment to society and sustainability, vertical sector expertise, and a comprehensive approach to solution design and implementation.

9

We're committed to creating a sustainable future.

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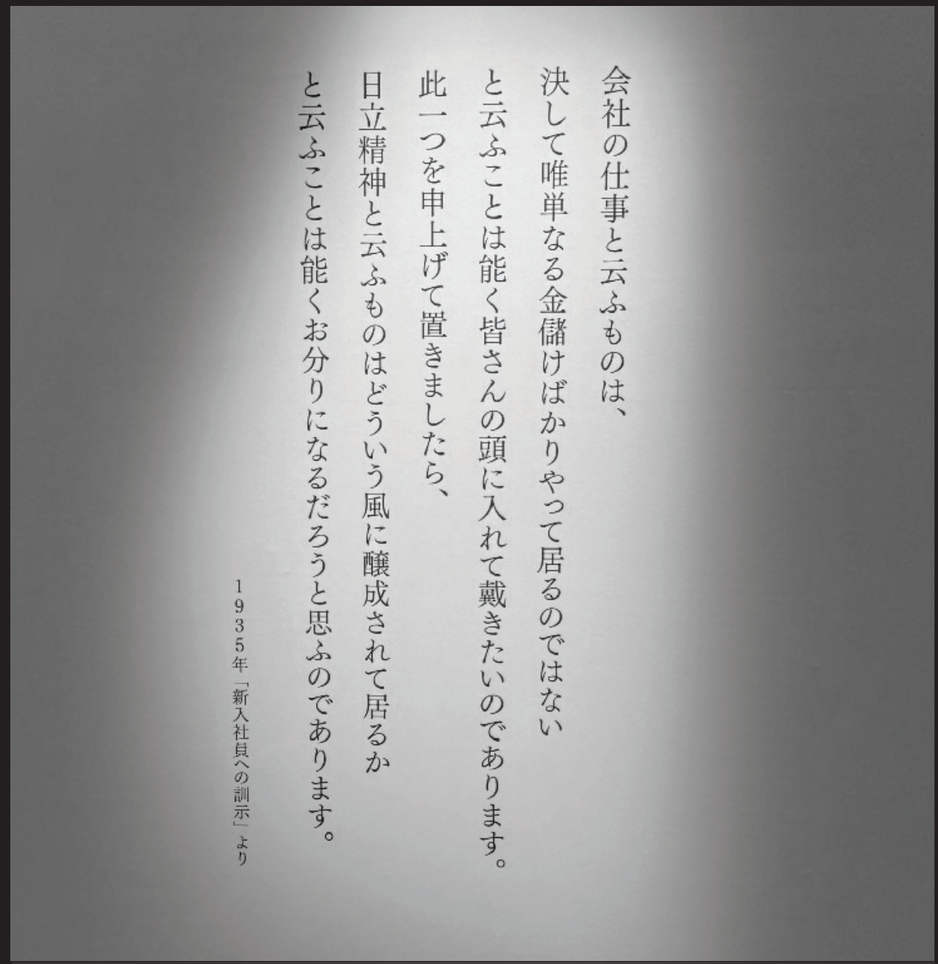
Our portfolio of flexible and scalable energy solutions including remote monitoring and advanced analytics, renewable energy integration, battery energy storage systems, and energy management that can meet the unique needs of any organization, while contributing to a cleaner, more sustainable future.

We believe in more than the pursuit of profits.

Embracing the ethos of environmental responsibility, Hitachi's vision extends far beyond mere corporate interest. We harness the power of cutting-edge technology to forge a harmonious balance between progress and the preservation of our planet.

Our transformative approach integrates advanced digitalization and data-driven insights, paving the way for sustainable urban development and clean energy solutions, while meeting the evolving needs of the modern world without compromising the future.

With our unwavering commitment, cutting-edge technology and global partnerships, we are continuously innovating to help preserve our planet for generations to come.



"I would like all of you to keep in mind that a company does more than just pursue profits. This single message should be enough for you to clearly understand what the Hitachi Spirit is."

Quote from Namihei Odaira, Hitachi's founder, to new employees in 1935

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Energy as a Service: Driving impactful change for real results

Addressing Sustainability Goals
EaaS plays a pivotal role in the pursuit of a sustainable energy future. By facilitating the shift from fossil fuels to renewable energy sources, it directly contributes to the reduction of greenhouse gas emissions. Moreover, EaaS can help lead to reduced energy consumption, further lowering carbon footprints.

As businesses increasingly adopt EaaS models, the cumulative impact can be substantial, making it a vital tool in global efforts to achieve carbon neutrality and attain a sustainable balance between energy consumption and environmental preservation.

Promoting Energy Resiliency
One of the transformative aspects of EaaS is its potential to decentralize energy generation and distribution. By enabling businesses to generate their own renewable energy, it reduces reliance on traditional, centralized energy grids and imports.

This energy independence not only enhances resilience against grid failures or volatile energy prices but also diminishes geopolitical dependencies that come with fossil fuel-based energy sources. As a result, businesses, regions and even nations can have greater control over their energy destinies, fostering stability and self-reliance.

Economic Benefits
EaaS offers commercial and industrial businesses potential cost savings through reduced energy costs, an affordable OpEx financing model, and unlock of new revenue streams. It also aligns value received with payments made over time, and can lead to financial reallocations to other growth-centric initiatives, further boosting economic vitality.

EaaS is a catalyst for positive change at the individual business level, as well as at the local, regional and ultimately globally, helping to address some of the most pressing challenges of our times while laying the foundation for a sustainable, interconnected, and prosperous future.

Energy as a Service Benefits and Outcomes

Economic
- Immediate savings
- Reduced energy costs – ~10%-35%
- No upfront capital costs
- Affordable OPEX ownership model
- Unlocking new revenue streams
- Reduces ownership risks
- Aligns value received with payments made over time

Operational
- Reduced energy consumption
- Improved load management
- Increased reliability and resiliency
- Reduce voltage fluctuation
- Decreased grid dependency
- Eliminate blackouts / brownouts
- Flexible and optimized energy

Environmental
- Address sustainability objectives
- Reduce carbon emissions
- Maximize renewable integration

We are powering good.

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To get started, simply send us the **last 12 months of your electricity bills** from your facility.

Our team will analyze your facility's energy consumption and help design a microgrid solution that is right for you. We'll also contact you to discuss how Energy as Service can benefit your specific situation.

Ready to speak with an energy expert?

Contact us today →

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