World Economic Forum
Digital Transformation Initiative:
In collaboration with Accenture

WORLD ECONOMIC FORUM

The electricity industry: uncovering value through digital transformation

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Digital transformation could unlock $1.3 trillion of value for the electricity sector – if it embraces digitalization

The electricity sector is ripe for realizing value from rapid digital transformation. By leveraging the building blocks of digitalization, such as service platforms, smart devices, the 'cloud' and advanced analytics, companies in the industry have the opportunity to increase the asset life cycle of infrastructure, optimize electricity network flows and innovate with customer-centric products.

Yet the maturity of digital initiatives in the industry is varied – from projects using advanced analytics to optimize assets and the widespread implementation of smart meters, to early moves by some utilities to manage and integrate distributed generation resources.

As the sector continues to adapt to the various transformations taking place, digitalization must be a key priority, and, indeed, can support the development of new business models to respond to these industry shifts.

45% The percentage of electricity industry profits that are at stake from digital transformation (through value addition and migration) over the next decade.

Source: World Economic Forum / Accenture research

The Digital Transformation Initiative

The Digital Transformation Initiative (DTI) is a project launched by the World Economic Forum in 2015 as part of the Future of the Internet Global Challenge Initiative. It is an ongoing initiative that serves as the focal point for new opportunities and themes arising from latest developments and trends from the digitalization of business and society. It supports the Forum's broader activity around the theme of the Fourth Industrial Revolution.

We assess four digital themes with great potential to unlock value – both for the industry and wider society – and to transform the electricity sector:

1. Asset lifecycle management

2. Grid optimization and aggregation

3. Integrated customer services

4. Beyond the electron

1. WORLD ECONOMIC FORUM In collaboration with Accenture

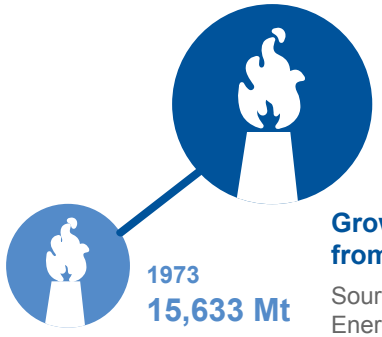
To find out more about the DTI project, visit digital.weforum.org

Digital trends in the electricity industry

Utilities are under pressure to decarbonize and decentralize. How can digital technologies help the energy industry respond to these shifts?

Decarbonization

The energy industry is under pressure to decarbonize. More than 75% of global energy supply currently depends on nonrenewable sources, contributing significantly to carbon dioxide (CO2) emissions.



2012
31,734 Mt
99.5% of these emissions accounted for **coal, oil and natural gas.**

1973
15,633 Mt

Growth in global CO_2 emissions from energy (1973-2012, Mt)

Source: International Energy Agency (IEA), Energy and Climate Change, 2015.

Decentralization

At the same time, rapid technological development is making decentralization possible through distributed generation and storage solutions, including renewable and battery technologies.

3.3% **Average annual growth rate of global electricity demand to 2020.**

40% **Rate at which decentralized energy will grow faster than global electricity demand to 2020.**

Source: GE, The Rise of Distributed Power, 2014

Technology trends

Cloud, social technology, big data and analytics are driving a number of technology trends that have immense potential to improve the efficiency of the electricity system and accelerate decarbonization and decentralization.

Three technology trends are especially relevant to tomorrow's electricity provider:

Intelligent enterprise

Machines are becoming smarter, and software intelligence is being embedded into every aspect of a business, helping drive new levels of operational efficiency and innovation. This trend turns big data into smart data, enabling significant cost and process efficiencies. As machine-to-machine communication becomes more prevalent, the interaction of people, data and intelligent machines will have a far-reaching impact on productivity and operations.

Platforms

Leading companies are bringing together digital initiatives onto the same platform to create next-generation products and services. While factories were the platforms driving the Industrial Revolution, computer and communications platforms have driven the information and connectivity disruptions of the past 30 years. Now, digital platforms are the next wave of change. The platform revolution will offer an opportunity to develop an entire system for electricity and beyond, spanning the digital and physical worlds.

Mass Personalization

The 'Internet of Me' is the personalization of applications, products and services. It is changing the way people and enterprises interact through technology, placing the end user at the centre of every digital experience. An environment in which every intelligent device provides a channel for engagement with a customer is approaching quickly, creating an opportunity for electricity companies that can move fastest.

Future horizons: digital themes and initiatives

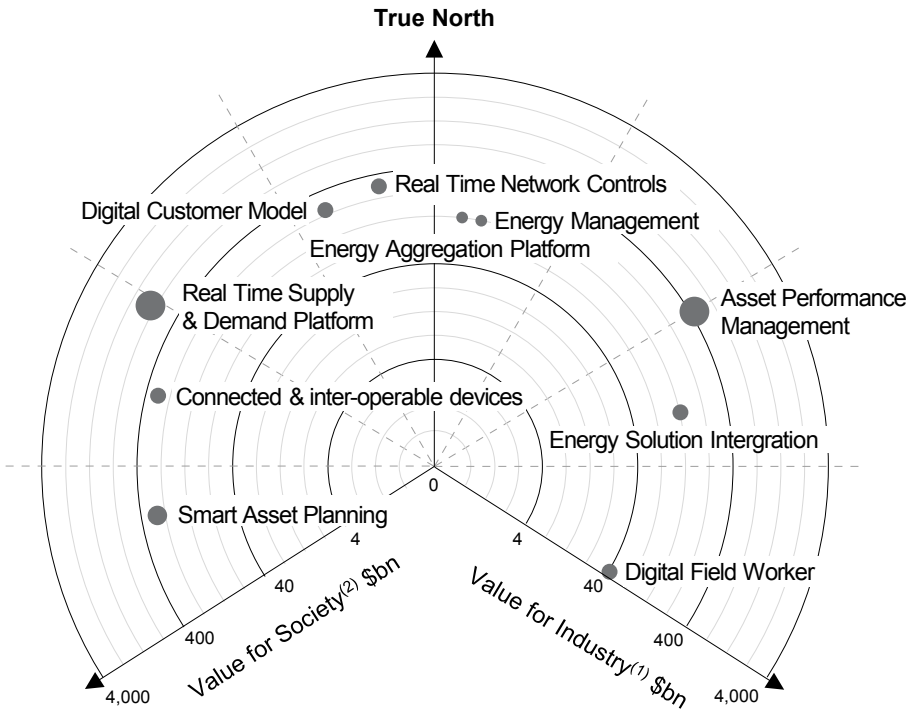
Calculating the value of digital transformation in the electricity industry

Drawing on these industry and technology trends, we have identified four digital themes that we believe will be central to the digital transformation of the electricity industry over the next decade.

Within each theme, we have identified digital initiatives that can be pursued by electricity players, highlighting case studies that illustrate the relevance of these initiatives to the industry.

These digital themes and initiatives provide a framework for us to calculate the potential value that digital transformation in the electricity industry could deliver over the next decade – both for the industry itself and wider society.

Delivering value from digital transformation for the electricity industry and society



Note: (1) We have followed a logarithmic scale for the value for Industry and Society, with industry value represented by cumulative operating profit from 2016-25; (2) Total Societal Value at Stake includes impact on the consumers, society and environment; (3) Bubble Size indicates the combined business and societal annual impact on 2025; Energy Storage Integration has not been represented; Sources: World Economic Forum, Accenture Analysis

How we calculated the value of digital transformation

Our value-at-stake methodology aims to assess the impact of digital transformation initiatives on industry, customers, society and the environment. It provides likely value estimates of global industry operating profits that are at stake from 2016 to 2025, and the contribution that digital transformation can make to customers, society and environment in that time frame.

Value at stake for industry comprises two elements. First, the potential impact on an industry's operating profits that will be generated from digital initiatives (value addition). Secondly, operating profits that will shift between different industry players (value migration). Value at stake for society measures the value impact of digital transformation for customers, society and the environment.

For a full explanation of our value-at-stake methodology, visit digital.weforum.org.

To find out more about the DTI project, visit digital.weforum.org

1. Asset lifecycle management

Optimizing asset life cycles: from generation to distribution

Asset life cycle management has the potential to extend the life cycle or improve the operating efficiency of assets. Some utilities have projects underway and are deploying technologies such as smart sensors on generation and distribution assets. However, many assets still lack the capacity to collect and transmit data and are not connected to a central platform.

A marginal improvement in the operating efficiency of generation, transformers or power lines will have an exponential effect once scaled across the industry.

The percentage of breakdowns that energy companies have eliminated through implementing predictive maintenance.

Source: US Department of Energy

Asset lifecycle management digital initiatives

• Asset performance management.

Condition monitoring, predictive forecasting and reliability-centered maintenance, all enabled by analytics and robotics.
Utility firms are likely to enjoy margin expansion from lower repair and maintenance costs, lower downtime of assets and fewer critical breakdowns.

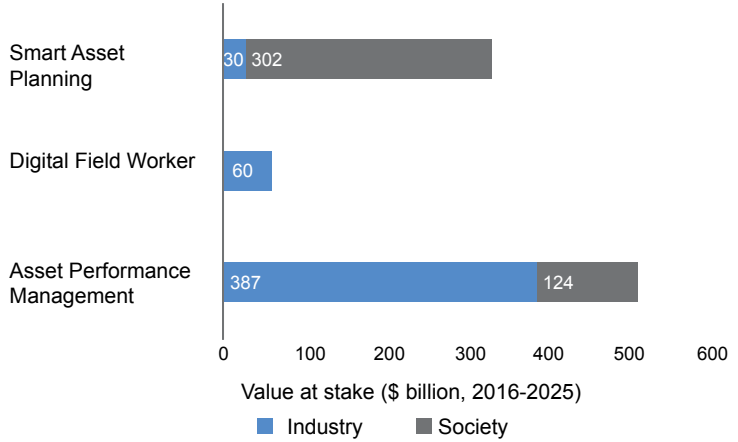
• Digital field worker

Digital technology to improve field workers' performance by empowering them with data and tools to drive operational efficiencies.
Electronic work packages can transform the end-to-end work cycle, from the planners and schedulers to those responsible for data entry and reporting.

• Smart asset planning

Predictive analytics, machine learning and robotics to improve capital project execution, installation and decommissioning.
Smart asset planning offers the potential to commission assets more effectively, including through better site and asset selection, thus optimizing capital expenditures.

Unlocking value from asset lifecycle management



Source: World Economic Forum / Accenture analysis

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Case study: Iberdrola (asset performance management)

In 2003, Iberdrola deployed a technology to monitor and operate renewable generation facilities from a single dispatch centre called CORE, located in Toledo, Spain. CORE centralizes the operation and control, in real time, of 7,000 megawatts (MW) of installed power from 220 wind farms, 70 mini hydro power plants and more than 6,000 wind turbines, spread across nine countries.

Information from sensors is fed to the central control centre, which monitors in the region of 2 million operational signals. With improved insights into areas such as fault detection and both reactive and active power regulation, the quality of renewable energy and the management of the grid is improved. By taking preventive measures remotely, both operational risk and maintenance expenses are significantly reduced.

Source:
DTI electricity industry working group

2. Grid optimization and aggregation

How can digital help build a more flexible and resilient electricity grid?

Grid optimization and aggregation is made possible through real-time load balancing and network controls, enabled by connected devices and advanced monitoring capability. Utilities will be able to receive the latest usage information from customers, while customers will receive up-to-the-minute pricing signals and tariffs.

The impact of grid optimization and aggregation is transformational: the system can start to dispatch the most economic, reliable and sustainable sources to meet demand, delivering higher efficiency.

Grid optimization and aggregation digital initiatives

• Energy aggregation platforms

Bringing small-scale distributed energy sources onto a single platform, enabling a cluster of generators to act as one large power plant.

These platforms (which often harness renewable sources such as solar or wind) can both deliver electricity when it is required and store any surplus power, thereby balancing the grid.

• Real-time supply and demand platform

Monitoring and communicating current load supply and demand, paired with a discriminatory pricing framework.

This initiative enables a fundamental change in behavior through tariffs, localized pricing signals and interconnectivity.

• Real-time network controls

Enabling real-time adjustments to changing loads.

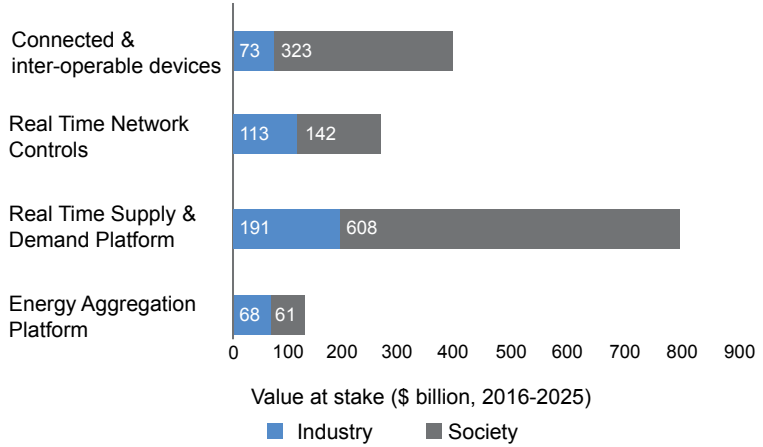
These adjustments can be made to generation and failure conditions of the distribution system, allowing two-way communication and operational signals with the market.

• Connected and interoperable devices

Device-to-device connectivity, and the collection and display of energy consumption points for a utility.

Through this initiative, devices can then be linked seamlessly to the distribution network.

Unlocking value from grid optimization and aggregation



Source: World Economic Forum / Accenture analysis

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Case study: Alliander (real-time supply and demand platform)

Alliander, a major energy distributor in the Netherlands, is currently piloting projects that match supply and demand at the local level in real time and has launched a Realtime Energy eXchange (REX). An example at the municipal level includes smart controls for switching street lamps on and off at optimal times, leading to energy savings. At a household level, REX enables nonessential appliances to be run at times when supply is abundant and power prices are low – for example, overnight. By acting as an aggregator, the exchange allows surplus energy to be traded on the energy trade market.

Source:

CGI.com, “Alliander and CGI win Nederland ICT Environment Award for open smart grid platform”.

3. Integrated customer services

Reinventing customer service through digital innovation

As electricity companies adopt integrated customer services, they will move from being ‘energy-centric’ to ‘customer-centric’, using increasing volumes of customer data to better understand consumer behavior. A tremendous opportunity exists to develop innovative digitally enabled products and services, bundled to provide an integrated customer service.

Energy companies will start to play a bigger role in how consumers optimize the home, choose tariffs, manage consumption and payments, and embed self-generation. Add-on services present a new revenue stream that will help overcome the risk of a low-profit, low-growth market.

Integrated customer services digital initiatives

• Energy storage integration

Technology solutions that enable integrating energy storage devices into the grid, including those in a domestic setting.
Energy storage integration is significant because of the value at risk from migration to new entrants, and the potential for pass-through margins from the sale of storage units to existing customers.

• Energy solution integration

New services from branded solution integrators that help customers optimize energy production and use.
Energy solution integration has the potential to capture significant value through developing plays in integrating renewable resources, while customers could also save money through these solutions.

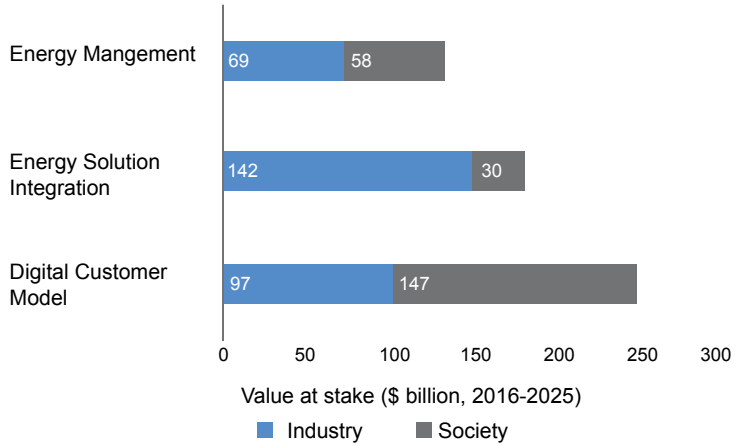
• Energy management

Energy information displays and controls they need to allow prosumers to manage generation, storage and flow.
Utilities must act now if delivering on-site energy management is to be an attractive business model. Customers can benefit from lower costs and re-selling excess energy back to the grid.

• Digital customer model

Multiple channels – including web, mobile and social – for customers to interact with their electricity provider.
The customer interaction model will be transformed through embedded customer analytics within services that accelerate digital migration and improve customer engagement.

Unlocking value from integrated customer services



Source: World Economic Forum / Accenture analysis

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Case study: PowerShop (energy solution integration)

PowerShop is an integrated energy solution provider, offering consumers the ability to view, monitor and purchase electricity online, on mobile and via social media. Launched in 2009, the disrupter offers a differentiated, modern service by providing convenient, cost-effective and personalized access to energy packages at a range of price points. From their smartphones, customers can monitor home energy consumption and choose the source of their electricity, such as from alternative energy projects including wind, solar or landfill generation.

Source:

Accenture, The New Energy Consumer, 2015

4. Beyond the electron

Through hyper-personalized, connected services, electricity supply can be transformed from a commodity into an experience.

Customers are now starting to develop 'liquid expectations', with the belief that a high-quality service in one industry should be connected and translated to the next. Technology is propelling this expectation, through sensor-rich objects, smarter devices, the decreasing cost of cloud computing and the increasingly seamless nature of connectivity.

As the provision of electricity moves from being a commodity to becoming an experience, it will be managed not by a single utility but by cross-industry partners. Developing an ecosystem of partnerships will be a critical success factor for electricity companies in 'beyond the electron' initiatives.

Beyond the electron digital initiatives

- **Living services**

Cross-industry digital services for consumers.
A new layer of integrated consumer experience can be delivered by combining sensors, the cloud, connected smart devices and real-time analytics. The connected home is a key location for the provision of living services.

- **Industrial services**

A suite of engineering services for business customers.
These services cover areas such as manufacturing and industrial processes, energy, power, data security, lighting and safety. All operate from a single platform and continually evolve using insights from data analytics.

- **Municipal services**

Fully integrated services for citizens, such as transportation, emergencies, food, sanitation, waste management and electricity.
Citizens will experience real-time interactions with service providers and receive tailored, individualized service. Services that move beyond the electron, particularly when scaled to the city, will have a meaningful impact on consumers' quality of life.

Case study: Singapore (municipal services)

Singapore is a smart city, with the government planning to install thousands of sensors across the city to monitor metrics such as water levels, traffic congestion, crowds and air quality. Across Singapore, connected heating, ventilation and air conditioning, and an abundance of sensors, allow for monitoring consumer movement and behavior in real time.

Most government services are also available on a single online platform. Launched in 2003, SingPass is a gateway to hundreds of e-services that provides convenience and a more individualized service. Singapore continually ranks highly as one of the world's safest, healthiest and digitally secure cities according to The Economist Intelligence Unit's Safe Cities Index 2015. Ultimately, improved data will lead to safer and more efficient living spaces and transport options in the city, boosting economic growth and improving its citizens' living standards.

Source:
Singapore Personal Access (SingPass), "About Us", 2015

How electricity companies can become digital champions

We have identified several digital priorities for the electricity industry – both tactical 'no regrets' moves and longer-term 'bold plays' to revolutionize a company's strategy.

'No regrets' capabilities

Develop a digital strategy and roadmap

Digital should be fully integrated into the core business, with digital strategy supporting the overall corporate strategy.

Capture, understand and leverage data

Use data not just to create operational efficiencies but to create new customer experiences or sources of revenue.

Build and maintain a high-quotient digital team

To escape orthodox thinking, create an open channel for ideas or use technology to crowdsource ideas from more junior employees.

Build a digital talent strategy

Companies should have a clear plan to address any skill shortages, for example in data analysis, creative marketing or programming.

Launch and communicate a change programme

To kick-start a shift towards innovative digital initiatives, change management, supported by internal communications, is vital.

Bold plays

Accelerate the pace of digital innovation

Leaders should experiment more – innovation should not be a function but a mindset that runs through the business.

Design a delightful customer experience

Customer expectations now transcend industry borders. Every digital initiative must have the end-customer experience at its heart.

Partner and invest in the electricity ecosystem

Partnering with peers and competitors will become core business activities for energy companies in the new electricity ecosystem.

Engage regulators around market redesign

Establish a positive dialogue with regulators to ensure that the industry and market are redesigned to work for all participants.

Form an industry consortium to address concerns around interoperability, data privacy and cybersecurity

Collaborate to address risks and barriers to transforming the industry.

For our full recommendations, please read our in-depth report on digital transformation in the electricity industry, available at digital.weforum.org.

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- Carlos Javaroni, Schneider Electric
- Avi Sahi, Vice President, Innovation, JCI
- Kazi Mamun, Global Strategic Business Development Manager, Eaton Corporation
- Kiva Allgood, Vice President, Global Market Development and Smart Cities, Qualcomm
- Abhishek Bahl, Senior Director, Product Management, and European Lead, AutoGrid
- Gerard Reid, Founder and Partner, Alexa Capital

Digital Transformation Initiative project team contributors
World Economic Forum

- Mark Spelman, Head of Future of the Internet
- Bruce Weinelt, Head of Digital Transformation
- Ramya Krishnaswamy, Head of Energy Utilities
- Bosco Astarloa, Head of Energy Technologies

Accenture

- Stuart Solomon, Accenture Strategy Utilities
- Greg Bolino, Accenture Strategy Utilities
- Anand Shah, Digital Transformation Engagement Lead
- Gemma Baker, Accenture Strategy and World Economic Forum Secondee
- Anubhav Jha, Accenture Strategy
- Ankur Niyogi, Accenture Strategy
- Narry Singh, Europe Digital Strategy
- Matthew Robinson, Accenture Institute for High Performance
- Mark Curtis, Fjord Chief Client Officer

References

For a full list of sources and references, please refer to our in-depth report on the electricity industry, available at digital.weforum.org.