intertrust

White Paper

Platform

The digital utility: Ensuring success in a multi-stakeholder environment

Contents

Introduction

"Digital transformation" is an oft-used term describing the effects of digital technologies on all aspects of industries and businesses. While each industry is at a different place on its digital transformation path, it's safe to say that the power utility industry has lagged behind. For example, according to a 2020 Capgemini survey,[1] at a scant 2%, utilities had the lowest rate of production implementation of AI (artificial intelligence) among 12 different industries.

This is understandable since the basic configuration for utilities—centralized power generation distributed by a series of wires—goes back to the late 1800s. In the 2020s, the ever increasing number of distributed energy resources (DERs) such as solar panels and storage assets (EVs and batteries) are beginning to transform the grid into a decentralized system.

Digital technologies and the data that feed them are core to ensuring a decentralized grid's stability. To survive and prosper in today's market, power utilities have begun to switch gears to become data-hungry digital utilities. The digital utility also needs to recognize that it is just one actor in an entire energy ecosystem. To ensure the continuing flow of data throughout the system, not only do digital utilities have to control their own data, they must also adopt trusted platforms that allow data to be securely exchanged with numerous partners.

Data-driven technologies and the modern utility

The digital utility is necessary for the clean energy transformation, but it can be so much more. With an increased reliance on machine learning and AI, utilities are becoming more forward-looking, which translates into better planning, significant cost savings, and wiser investments. A number of utility use cases are based on AI, including predictive maintenance, weather/vegetation growth prediction, volt/VAR (volt-ampere reactive) optimization, and estimating times to restoration of service. One advantage of AI is that it can produce interesting insights that would be difficult to gain through other means.

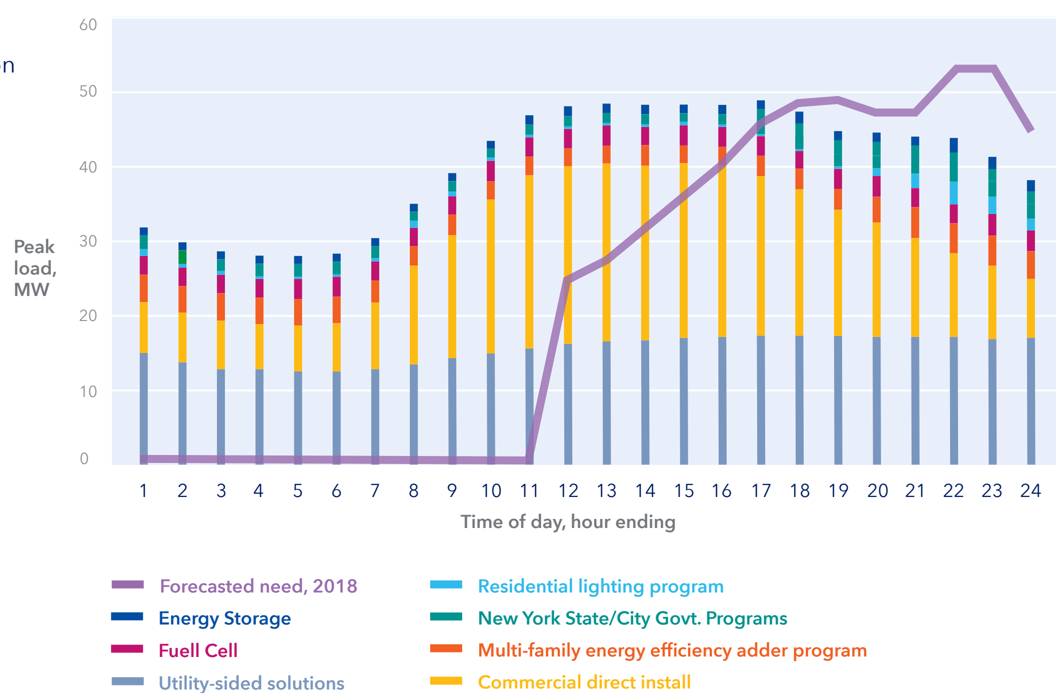
A Georgia Institute of Technology study used AI technology to parse user reviews of EV charging stations to predict charging station availability.[2] This sort of information could be useful for a utility trying to plan charging station maintenance and installation.

While AI captures a large share of press attention, there are a number of other digital technologies that show promise. The Internet of Things (IoT), AR (augmented reality)/VR (virtual reality), digital twins[3], apps, and other digital technologies will allow utilities to do even more, from improved operational efficiency and higher ROI, to better customer support.

One area where data-driven digital technologies are already showing promise is in "non-wires alternatives." This is the ability to avoid additional infrastructure costs where possible, typically by the installation of DERs, demand response (DR)[4] programs, etc. While non-wires alternatives are still nascent in the U.S., these programs have shown clear-cut results. For example, with a budget of $200 million and using a mixture of DERs, DR, and other techniques, the New York utility Con Edison was able to avoid the construction of a substation estimated to have cost $1.2 billion[5] (Figure 1). Many of the techniques used by non-wires alternative programs rely on digital technologies.

Figure 1.
Breakdown of power load reduction by hour/resource type.

Source: Con Edison in Non-Wires Alternatives: Cast Studies from Leading US Projects, SEPA



Digital technologies are essential for another aspect of utility operations: customer engagement. Modern customers expect to easily digitally engage with companies—anytime, anywhere, on any device. Providing the proper digital tools for this engagement is a minimum for any modern organization, but can also be translated into new business models. For example, consumers are already engaged with DR programs that work with their smart thermostats. If utilities can offer even more easy-to-use, secure, energy management services, they have a chance at getting in on the smart home energy management market that is expected to grow to $14.1 billion in 2025[6] (Figure 2).

Another important aspect of digitalization for utilities is the ability to develop new business models and/or avoid being shut out by digital-native competitors. Utilities' long trusted relationships with their customers puts them in a place to offer new products.

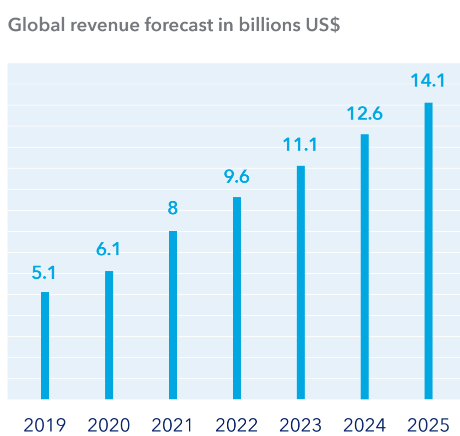
Data is the heart of any digitalization activity. To be successful in any digitalization effort, utilities must make sure they have access to, and control over, the data needed to feed their digital initiatives.

As the managers of complicated electron delivery systems, utilities have access to proprietary data as well as useful customer interaction data that can be leveraged. In a paper detailing future utility business models, from providers of generation services to operators of virtual utilities, the professional services firm PwC noted, "ownership of grid and customer information can provide a knowledge platform that enhances the value proposition."[7]

To recognize full value, utilities first must analyze what data they have and then make it useful to partners. Since it is unlikely they will have all the data they need, utilities should identify the data they are missing and partners who can provide it. Developing data platforms that can securely handle this data will also be crucial to any digitalization effort.

This is not something utilities can be complacent about. The ubiquity of digital connections gives many other actors access to energy ecosystem related data. Large digital native IT companies are especially well positioned to take advantage of their vast data holdings to enter the electrical energy market. Their high profit margins combined with the ever decreasing costs of DER assets give them the opportunity to add energy services to their ever increasing portfolio of products. If utilities fail to move quickly on data and digital efforts, they stand a real chance of being even further disrupted in their core energy businesses.

Figure 2.
Smart Home energy management market forecast (Statista)



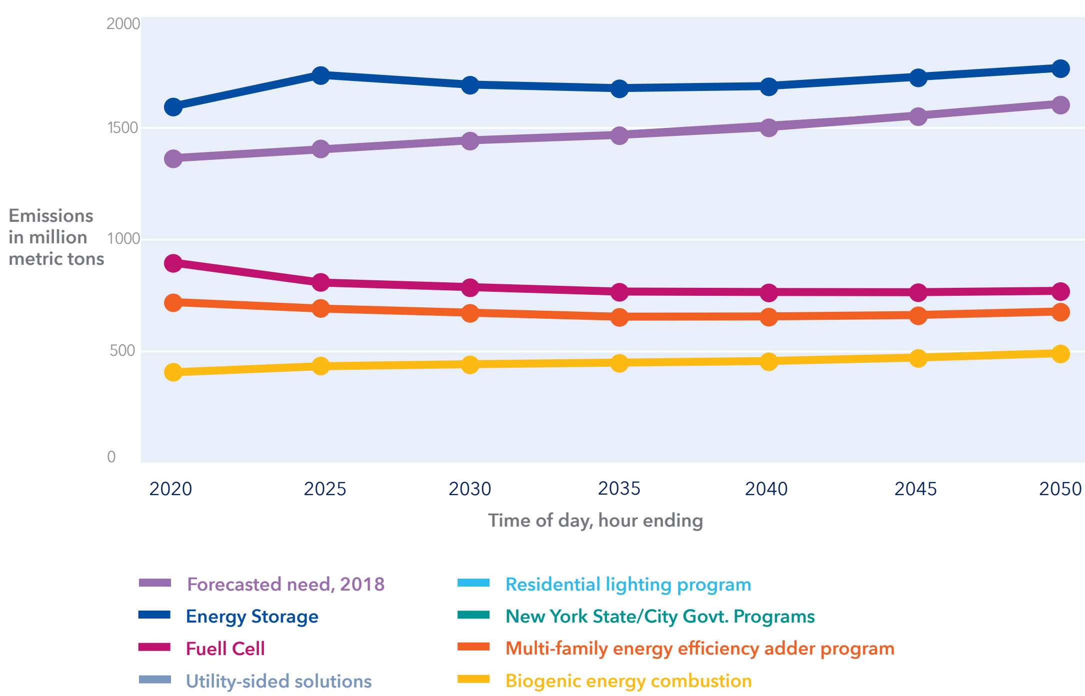
Clean energy, decentralization, and utility digitalization

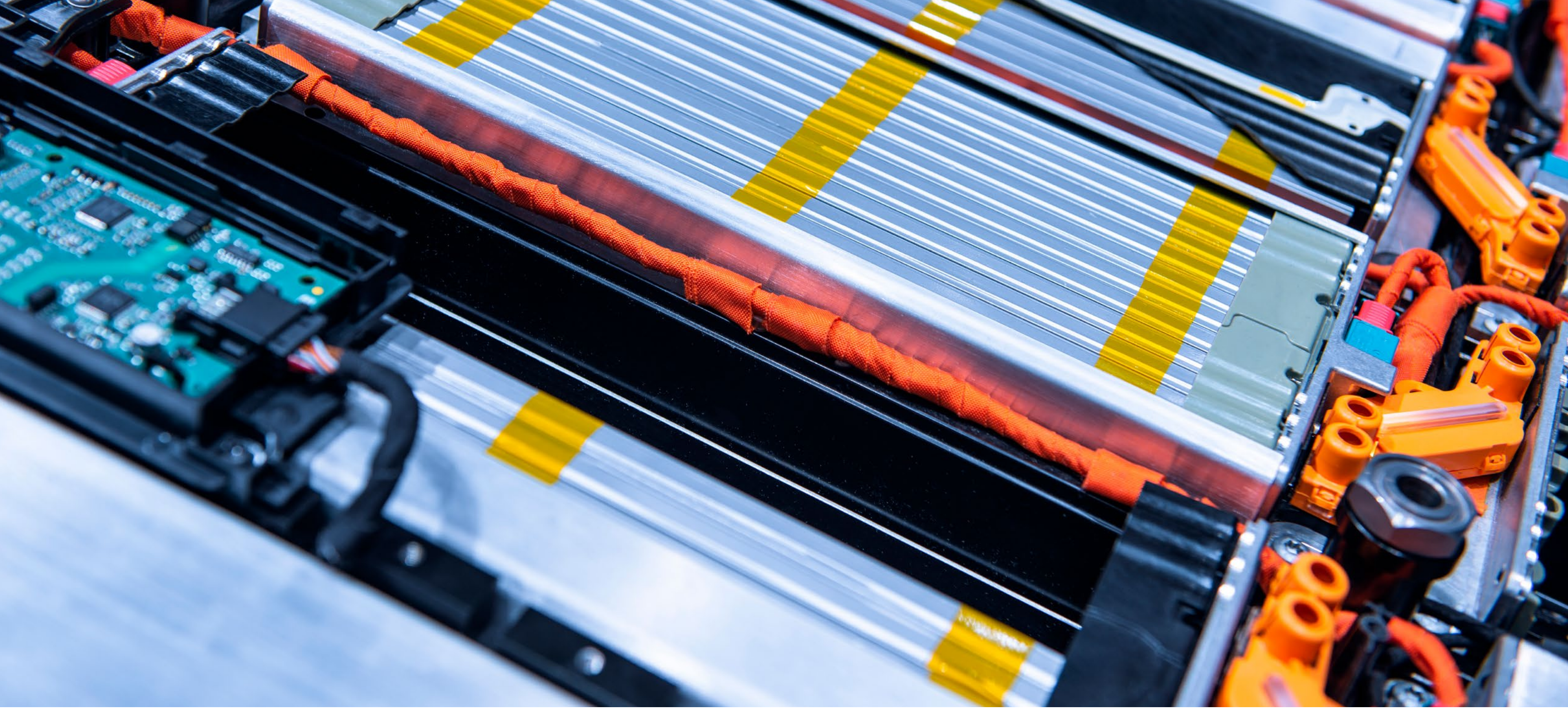
The climate change crisis is forcing the electrical power industry to transform into clean energy providers. Unfortunately, a traditional centralized utility architecture can't support the clean energy transformation.

The clean grid of the future will need to be a decentralized and democratized grid to take advantage of DERs, intelligent buildings, energy efficiency services, microgrids, community solar, and other emerging services and technologies. Many parts of the grid will be under the control of customers, partners, and possibly even competitors.

The point of the clean energy transformation goes beyond reducing the CO_2 emissions of electrical generation. This transformation is also an essential element of the "electrification of everything," i.e., using clean electricity to run transportation, housing, manufacturing, and other industries. The impact of this can't be understated. In the U.S., the EIA[8] projects that the transportation sector will continue to be the highest emitter of CO_2 through 2050, followed by the industrial sector[9] (Figure 3).

Figure 3.
Projected U.S. energy-related carbon dioxide emissions, 2020-2050 (Statista)





Powering the transportation sector with clean energy is the most immediate challenge facing the utility industry. Countries including France, the UK, Japan, India, and Sweden, and U.S. states such as California have set timeframes to ban the sales of fossil fuel sales. In January, 2021, the Biden Administration declared that it would move to electrify the more than 650,000 vehicles in the Federal Government fleet,[10] potentially greatly increasing the market demand for EVs in the U.S.

Regulatory pressures as well as advances in battery and other EV technologies have galvanized a massive shift in the automotive industry to EVs. The market is recognizing this and Tesla's preeminent position in the EV industry has driven a massive increase in its stock price. It must also be kept in mind that Tesla has a DER business based on solar and grid storage batteries as well, making them a potential competitor to utilities.

Major automotive OEMs are also moving to greatly increase their EV production. In November 2020, Volkswagen announced plans to increase their investment in EVs and autonomous cars to $86 billion.[11] U.S.-based OEMs are also aggressively moving into the market. In January 2021, GM announced that sales of light duty fossil fuel vehicles would cease in 2035.[12] This was quickly followed by Ford declaring they would spend $25 billion on EVs and autonomous driving by 2025.[13] In 2020, the IEA[14] estimated that worldwide plug-in light vehicle sales totaled 2.3 million. This number is forecast to grow more than 10 times to 25 million by 2030.

Another driver of digitalization is actually the fuel cost of renewable energy. Since this cost is zero, the laws of economics mean that the price that utilities can charge for commodity electrons will be under pressure. This is particularly true since the cost of solar panels and other types of renewable energy generation is likely to continue to drop, meaning utilities will increasingly be competing with their customers as purveyors of electrons. With pricing pressure on their main business lines, utilities are now looking for new business models. Given their access to valuable proprietary data, utilities are exploring possible business models that could leverage that data for new revenue streams.

The data challenges of digitalization

The prospect of capturing a significant portion of the massive transportation fuel industry certainly has the attention of the utility industry as a way of potentially driving huge revenue growth. It also introduces massive challenges. EV charging doesn't follow traditional demand patterns that have driven utility infrastructure spending for generations.

On top of this, distributed generation sources such as solar panels and wind turbines plus energy storage devices are also expected to undergo rapid growth. For the most part, EVs and other DERs will not be under the control of the utility but under the control of various stakeholders ranging from consumers to major corporations.

Meeting the electricity generation, distribution, and storage requirements of new applications such as EV charging, ingesting energy from distributed power sources, and balancing the needs of microgrids—while maintaining grid stability—will be a massive undertaking. It can only be done through the use of digital technologies and the coordination and exchange of data on a massive scale.

To top this off, if utilities wish to pivot to using their data as a product, they will of course have to share it with their customers. This will require building up the expertise of a data company, something that utilities haven't had to face until recently. They will have to gather data, normalize it, and make sure their data platforms have the capabilities to securely exchange data with partners while following relevant data privacy and other government regulations.

Getting data under control

Data is the lifeblood of any digital utility. To ensure the success of any digitalization effort, utilities need to take a number of steps to get their data under control and actionable.

First, all the data the utility holds needs to be identified and unified so it can be easily accessed. This could be difficult and tedious. Not only are utilities typically siloed, there hasn't been much need for internal exchange of data in the past. As one example, within an utility organization, the generation division generally has data located in a different format and location than their energy trading department. These two data sources are not connected or interoperable. When the exchange of data between the two departments is required, usually it can only be done through a highly manual and cumbersome process. This is further complicated by the sensitive aspects of the data and the need to follow security and data privacy procedures.

Data architectures need to be implemented that take into account multiple data formats (variety), locations, velocities (static, intermittent, and real-time) and handling of an ever increasing amount (volume) of data, including real-time data. A large utility typically controls various data repositories that it collects from their own own or customer operations or purchases from external sources. One data source is real-time smart meter data that needs to be stored in a time-series database. Another data repository would contain their customers' billing and contact information, and a third would hold rates, tariffs, and sensitive demographic information. All of these are held in different databases, data formats, and even different locations which can be in the cloud, on-premises, or in a private data center. The utility needs secure and controlled access, a unified view, and the ability to combine and analyze all these and other datasets to get a 360-degree view of their customers and operations.

Data platforms that are adopted must allow for seamless two-way exchanges of data with trusted partners. The digitized grid will need to communicate with multitudes of partners and partner-held assets such as smart buildings, EV charging stations and their network providers, cogeneration facilities, etc.
In Germany, a distribution service operator (DSO) is already receiving aggregated plug-in vehicle data from a large automotive OEM, including movement patterns, location, and battery state of charge information. This data is combined with grid and infrastructure data to forecast EV charging needs and plan for charging infrastructure buildout.

Utilities hold sensitive data which will increasingly include partner data as well. Electrical grids are a national security asset and grid data must be secured accordingly. Looking at the EV data example above, even in aggregated form, this data raises both data privacy and automotive OEM proprietary information concerns. To maintain the trust of both the OEM and its customers, ensuring data security is paramount.

Data is subject to an ever increasing number of regulations, including data privacy regulations. Consumer energy usage data can reveal a wide variety of personal information including electrical appliance usage information. In Europe, worker data is considered personal data and has to be handled according to the EU's GDPR (General Data Protection Regulation). As governments around the world increasingly adopt new privacy regulations, any selected data platforms and architectures need to be able to comply with these and flexible enough to be updated as necessary.

The Intertrust Platform™ solution

Utilities can try and cobble together their own solutions to handle their data needs. However, the limitations of home-grown solutions will become increasingly apparent, especially when considering the greatly expanding volume, types, and speed of data (and data exchange partners) that the transformation to the digital utility will demand.

In addition, utilities will need to keep up to date with the continually changing security threats and privacy regulations. To maintain an effective home-grown solution will require utilities to attract and keep an ever-increasing number of IT specialists with all the overhead this represents. Working with technology partners to adopt best-of-breed data platform solutions is a much more scalable and manageable approach.

The Intertrust Platform[15] is a data platform developed by Intertrust Technologies[16], a technology company with over 30 years of history in securely distributing valuable data to large numbers of devices and customers. It has a number of features that are being used by utilities to create secure data management platforms supporting applications that require data exchanges between multiple parties. The Intertrust Platform is currently in use by E.ON[17], a major European utility, as well as other utilities worldwide for a number of applications, including:

- Sharing distribution grid information.
- The ingestion and analysis of multiple datasets, including data from third parties, to support the grid integration of DERs including EV charging stations and solar panels. Exchange of data streams such as EV usage and EV charging patterns between the utility and EV OEMs,
- Maintaining customer permission status across multiple digital product offerings, including products offered by third parties through the utility.
- EV charging load balancing.

The Intertrust Platform ties together a number of capabilities important to utilities. Utility data can reside in data stores controlled by either the utility directly or managed by Intertrust. Data stores can be queried using data virtualization techniques that don't require the movement of data from existing locations and work across multiple clouds. Algorithms on queried data can be executed in secure execution environments (Figure 4). The analytical results from the algorithmic discovery can be shared with trusted partners without exposing the raw data. The Intertrust Platform includes identity and access management (IAM) capabilities to govern both internal and external access to data.

The Intertrust Platform includes the following key features and functionalities that can greatly help with the digital utility's data needs:

- **Data Virtualization**
  Data virtualization is an increasingly popular technology that allows access to data in multiple data formats and physical locations, without requiring mass data ingestion or data transfers. Data is held by utilities or their partners in its current location, whether on-premises or in public/private clouds. Data virtualization can also help avoid the high costs and security risks associated with large scale data transfers.

- **Secure Execution Environments**
  This is a technology that governs cloud-based software within containers and ensures that such software only accesses the data it is supposed to access. In many cases, utilities are unlikely to create their own analytics software and will rely on third parties. Secure execution environments provide a trusted environment for this analytics software and prevent any inadvertent or malicious exposure of proprietary data. Only the results of the analytics are shared with the utility's partners, not potentially sensitive raw data.

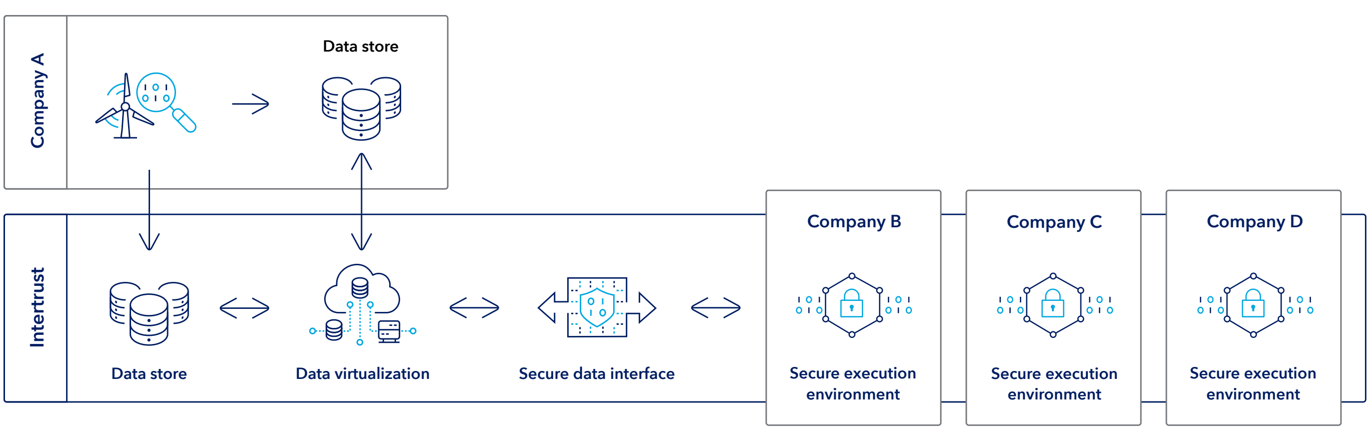
- **Identity and Access Management**
  The Intertrust Platform implementation of IAM is cloud-native and focused on access to data. It provides for fine-grained control of data access permissions to both internal and external stakeholders, simplifying data sharing as well as compliance with privacy and other regulations governing data. This is an important feature for utilities to strictly govern both internal and external access to data and analytics results.

- **Time Series Database**
  Intertrust Time Series Database is an option for utilities that require low-cost data storage. This option is particularly suited for real-time data such as smart meter and other IoT data.

- Auditing capabilities to support security and regulatory compliance auditing. Utilities operate in highly regulated environments. These auditing capabilities will help utilities demonstrate compliance with data-related regulatory requirements, including data privacy regulations.

- Partnerships that provide access to additional tools for handling data according to local regulations.

Figure 4.
An example of how the Intertrust Platform can be implemented.



Conclusion

Utilities need to transform themselves into digital utilities to continue to survive and thrive in the 21st century. This transformation requires utilities to not only consider the management of electrons as their core competency, but also the management of data.

The many issues associated with huge volumes of disparate data, interacting with an ever-expanding list of partners, maintaining data security, and complying with data-related regulations will be daunting for any utility to solve on their own. Working with a trusted data platform provider is a viable strategy for utilities to manage both their current and future data flows.

Sources

1 Published by Statista

2 Topic classification of electric vehicle consumer experiences with transformer-based deep learning

3 Digital twins are digital representations of physical objects, usually machines, and can be digitally manipulated for predictive maintenance and other purposes.

4 Demand response (DR) is a utility practice of modulating customer power demand to meet available power generation at a given time. Digital technologies such as smart thermostats are increasingly being used for DR purposes.

5 Non-Wires Alternatives: Cast Studies from Leading US Projects, E4TheFuture, PLMA, SEPA

6 Smart Home Report 2020 - Energy Management, Statista

7 Looking ahead: future market and business models, PwC

8 U.S. Energy Information Administration

9 The industrial sector also includes the power utility industry.

10 Biden vows to replace U.S. government fleet with electric vehicles, Reuters

11 VW boosts investment in electric and autonomous car technology to $86 billion, Reuters

12 GM Plans to Sell Only Zero-Emission Models by 2035, Bloomberg

13 Ford Makes $29 Billion Commitment to Electric and Self-Driving Cars, Car and Driver

14 International Energy Agency

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17 https://www.eon.com/en.html

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Learn more at: intertrust.com/platform
Contact us at: +1 408 616 1600 | dataplatform@intertrust.com

Intertrust Technologies Corporation
400 N McCarthy Blvd, Suite 220, Milpitas, CA 95035