Distributed Energy Resources (DER) on the rise

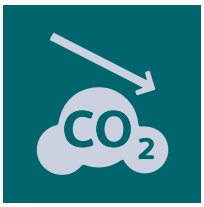
Maximizing the value of local energy generation with data.
siemens.com/deop

SIEMENS

1. DEOP: Sustainability and Flexibility in Energy Markets

Energy Markets differ a great deal from country to country, but they all have three significant concerns in common.

Cost
Generation businesses want to reduce cost of production, customers want to reduce cost of consumption, while distributors want to cut out energy losses and improve their own margins.



Carbon emissions
There have been some dramatic changes in recent years, not just to public opinion but to business practices. Sustainability is rapidly becoming one of the most important of business indicators, and the drive to cut emissions from power generation, distribution and usage is altering the business environment fast.

Stability
Grid operators need balance of supply and demand to provide stable grids, while large consumers need continuity of supply at all times, no matter what happens within the wider grid.

This paper provides a short introduction to the changes now remaking our energy grids, and focuses on how best to adopt one key concept: Distributed Energy Resources (DER) as a potential source of business advantage. In this first section, we introduce key enablers for change and show how these can act as catalysts for new ways to optimize assets, enhance services and grow profitable new business lines.

Sustainability

The climate crisis is driving significant change across the energy market. The most visible sign of this is the growing importance of renewable energy sources, notably photovoltaic and wind-generated power. These now account for a much higher proportion of total energy usage in developed countries than even optimists thought possible a few years back.

Volume growth has been matched by cost reductions, with solar and wind-generated energy now competing successfully on price with fossil fuel alternatives. We expect this trend to continue over the next few years, and even to accelerate, as public pressure, governmental commitments and continued technology advances make sustainable solutions more viable.

From one directional to bi-directional

The growing appetite for local generation and consumption is enabled by energy management systems that make it possible for power to flow both ways through the grid, which is already a completely normal part of business as usual in many countries. This has created the "prosumer" concept, in which individuals and organizations of many kinds can both consume energy from the grid as needed, but also supply energy back to the grid, when their own generating capacity gives them an energy surplus.

National and regional grids are now increasingly engineered to permit two-way traffic of this kind, and commercial contracts are being revised to recognize prosumer status through reduced costs or even potential profit for local generators. Industry observers consider the rise of Distributed Energy Resources, enabled by bi-directional flows, as potentially one of the most disruptive changes ever to impact on to grid structures and operations.

Flexibility and balance

In bi-directional grids, the focus is now increasingly on how to use assets and, in particular, **those able to buffer energy**, to provide extra flexibility within the grid. We see increasingly inventive uses of existing assets to provide balance, for example, or top-up power to areas of need, and other forms of flexibility. Options can be varied and wide-ranging. Schemes exist for enabling energy to be redirected away from residential areas to deal with a surge in demand elsewhere, with individual houses able to opt-out if they wish, while those opting-in are rewarded for their flexibility by lower bills.

This approach can also include any asset that stores energy, from electric vehicles connected to the grid through an EV charging point, to production assets in factories to water heaters, air conditioning and other storage or flexible units. All of these can temporarily deliver some of the energy they store to the grid and, when enough of them are connected to a bi-directional grid, this can have a very positive effect on smoothing out peaks and troughs of demand, without affecting the operational integrity of the assets concerned.

Campus power operations

Locally generated power can be significant as part of a campus microgrid or as a way to balance requirements and generating capacity within an organization, or group of organizations. This is especially the case as new technologies start to become more widely adopted.

For example, the now very rapid move from petrol or diesel to electric vehicles makes it necessary to provide a new infrastructure of charging units. A large commercial campus will also need large-scale batteries to balance production and consumption, mitigating some of the risks related to peaks and troughs of supply and demand.

By consolidating all sources of power availability on-site (within the campus or wider organization), these players can take effective steps to reduce their requirements for grid-delivered power, cutting their costs and also moving faster to meet sustainability targets.

Virtual Power Plants

Businesses operating across geographically separated sites, not just those limited to a single campus, can also explore the option of creating Virtual Power Plants (VPPs), in which DER are networked together and operate as a unified whole. This enables the VPP operator to negotiate better terms for power supply and to market flexibility **as a source of added value** to the grid, while also balancing generation and demand across their own environment more efficiently.

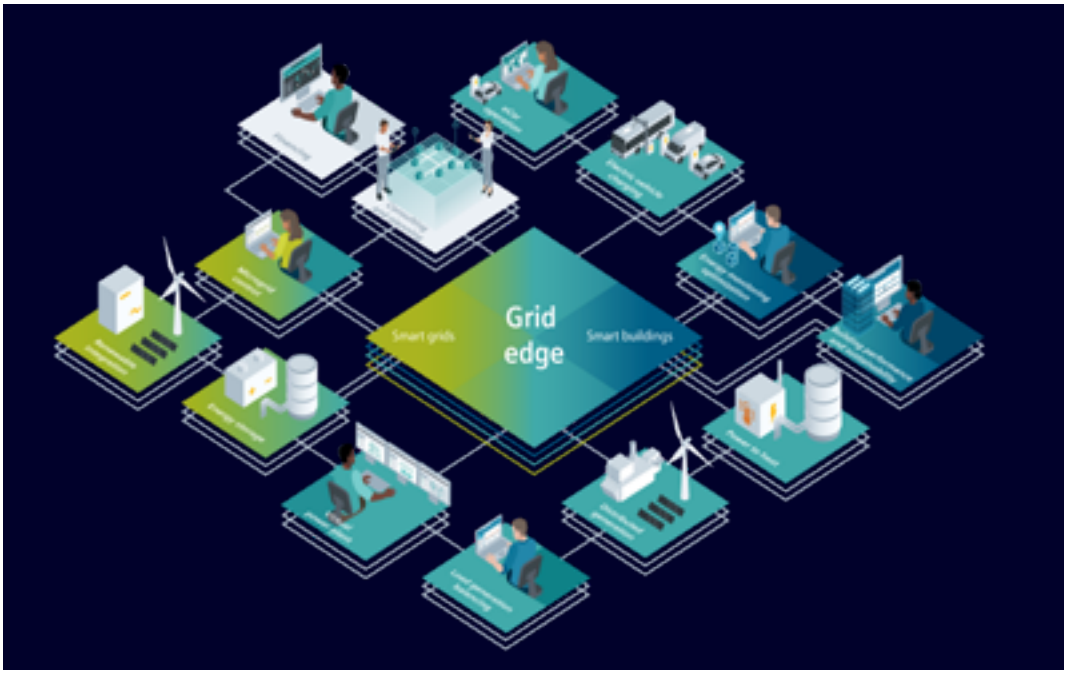
The VPP concept has enabled the rise of "software energy companies", which do not own production capabilities, but aggregate existing generation, flexible loads and energy storage assets to aggregate them or build growing communities of energy providers. This enables them to deliver overspill, balancing and stabilizing input to grids, providing extra flexibility, while opening revenue opportunities to members of these growing communities.

This emerging business model is opening a new line of business to organizations that own production or storage assets of any kind. It is becoming increasingly normal for businesses to monetize their assets through grid sales via VPPs, and it will become unusual to find businesses **that do not use their assets in this way**.

The new Grid Edge era

The rules of the game are changing in power supply and usage due to a combination of all these emerging technologies and systems.

- Power generation can now take place efficiently, not just on a national scale but also at a very local level, using largely (but not entirely) sustainable methods.
- Bi-directional capability in the grid means power can be supplied both to or through the grid as well as from the grid.
- Assets used for local generation and for energy storage (which can even include parked electric vehicles) can be incorporated in DER services to provide extra flexibility to the grid as and when needed.
- Grids are being transformed from highly centralized constructs, based on very large central generators, to much more flexible, multi-directional systems, in which innovation increasingly takes place at the Grid Edge.



We can see that a similar process of evolution is happening in power grids as for very large-scale integrated communication and IT networks. We are moving rapidly away from centralized processing, with data flowing from the edge to the center and commands coming back from the center to the edge.

Instead, advanced components (in power grid terms, this means everything from small solar arrays to sensors to automated/local control systems) operate only at the edge of the grid. These are integrated, not only edge to center/center to edge, but point to multiple points within the environment. Grids are likely to become more decentralized and distributed, more agile, resilient and open to participation by a great many different players, of different sizes, with their own strategic goals.

Sale of energy to the grid remains a low profit activity, but these new techniques make it easier for organizations of many different kinds to achieve economies of scale by aggregating energy generation across multiple sites (through VPPs). They can also balance their usage and production more efficiently to ensure that a higher proportion of their needs are reliably met through their own local resources.

The key requirement for turning opportunity into outstanding performance is a combination of visibility end to end across the entire asset base, with the ability to manage usage dynamically in order to optimize usage. That is the role of DEOP – the Siemens Software for the optimization of distributed energy assets.

2. Growth of Distributed Energy Resources: Challenges and Opportunities

Distributed Energy Resources (or DER) is a term widely applied to both local power generation and energy storage capability that is interconnected via smart networking (normally through bi-directional energy grids). The diagram below gives an overview of expected growth in different forms of DER, as predicted by leading market intelligence firm Guidehouse Insights.

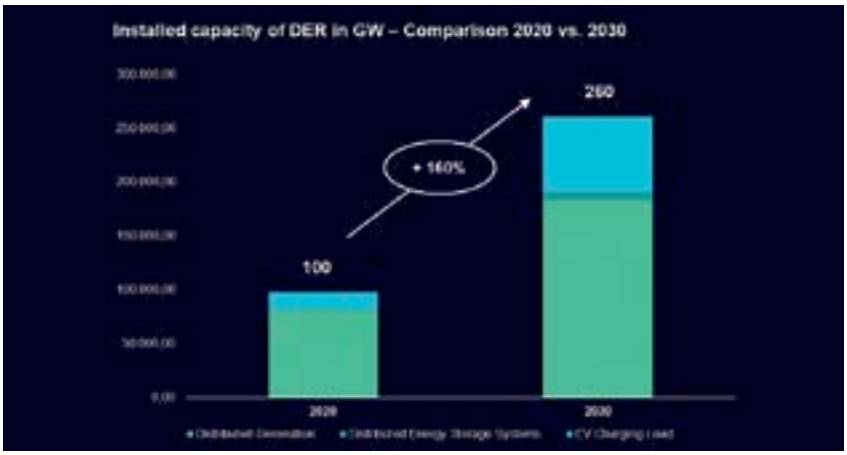


Figure 1: Expected growth in use of DER.

A more than 250% increase in distributed generation is also highly significant, but the most remarkable factor in this prediction is the rise of distributed storage. The figure for storage in 2020 was only 0.7 GW, but the predicted total for 2030 is 7.2 GW, a rise of over 1000%. This gives a clear indication, not only of high growth rates but also of a change in the balance of power in the market.

As we have already shown, access to large, distributed storage capacity is a key factor in providing greater flexibility and stability to the market, while also being central to the growth of such important new concepts as VPPs.

This review covers the current decade, ending in 2030 and it shows an increasingly steep rate of adoption and usage. Globally, annual new installed DER capacity is expected to reach 260 GW by the end of the decade, divided between distributed generation, storage and EV charging points.

As the automotive market makes an historic transformation from fossil fuel driven vehicles to the point where, in most markets, the only new vehicles for sale will be electrically powered, it is not surprising to see such a remarkable rise in EV charging points: a 950% annual increase in capacity*.

* Find more information on the growth of the EV market and software for charging infrastructure in our eMobility Whitepaper.

DER Overview

There is no "typical" DER format or structure, but the campus diagram below helps show how DER contributes to business operations and can offer competitive advantage. We will see later how energy management, through the DEOP concept, applies to this campus and its resources to enable optimization of energy use.

Figure 2:
Campus layout

This campus contains a range of energy resources already in place. Production assets on-site include photovoltaic panels, small wind turbines and also a small-scale Combined Heat and Power (CHP) generation unit, driven by natural gas. A battery unit has been installed, as well as building management systems to help balance power demand and generation through "intermittent" methods (sun and wind).

One of the most eye-catching requirements in the campus is the need for charging points to supply electric vehicles. This illustrates the potential importance of DER to commercial organizations, and also the potential impact of DER on power grids more widely. Businesses running large fleets of electric vehicles can benefit by using locally generated electricity, rather than power taken from the grid at normal rates.

This is an illustration of how energy optimization can be used to improve bottom line profitability, while also challenging current grid operational models. It also illustrates how management of Distributed Energy Resources can deliver significant financial gains, while enhancing corporate agility and flexibility. This is the prize now being targeted through DER. So how can we deliver on this promise?

DER Management

Let's go back to the campus illustration we saw in figure 2 and show the same scene with some additional information.

At the center is the Siemens software DEOP for the optimization of distributed energy resources, which integrates both supply and demand across the organization, its business requirements and its interface to the grid. Using the electric vehicle example already introduced, the DEOP system will prioritize use of locally produced wind and solar power for EV charging where possible. Energy stored in and delivered via the installed battery is the next priority, with local CHP the back-up option.

All assets that store energy and are connected to the network can potentially be used to supply to the campus or to the wider grid, based on clearly defined and constantly monitored business rules. Electric vehicles can also be used for profit-generating energy supply to the grid. Depending on the capacity of the EV charging points, for example, it is possible to charge a fleet of vehicles during the evening, then allow some of the energy stored to flow back into the grid if a high demand event should arise, before recharging in time for use the following morning. The same principle applies to other forms of asset.

DEOP ensures that vehicle operation is not compromised and the net cost of charging is positive for the organization concerned. The grid gains in flexibility and the operator reduces their overall energy costs. It is a win for all concerned.

Figure 3: Campus with key management and monitoring points highlighted

DER aggregation

The net gains made by any individual organization in the example given above will be marginal. Benefits arise when this becomes a regular occurrence, and when many different organizations are aggregated within a single virtual network. Utilities are already seeking ways to aggregate available energy supply (generated or stored locally) to provide effective added value, both in terms of greater flexibility to the grid and in monetary terms to the asset owners or local power generators. Commercial organizations, or groups of organizations, can carry out similar activities by managing their own distributed resources across widely separated locations, effectively becoming Aggregators in their own right.

The principle is the same as for the approach taken by large utilities. DEOP permits the user group (Aggregator) to manage power output and usage within their own defined (but geographically distributed) areas, and deliver "home-generated" power to where (in the group) it is most needed. The bi-directional capabilities of the grid permit DER-generated electricity to be delivered to the grid in one location and then from the grid to another location where it is needed, at significant cost savings to the organization (or group of organizations) concerned.

Again, this is a source of opportunity to commercial organizations that possess significant distributed power generation and/or energy storage capability of their own, but it is a challenge to traditional power generation businesses and potentially to grid operators. Grids may now act as a conduit for aggregator energy in the same way that a telecom network acts as the conduit for other organizations' content.

3. How DEOP works

DEOP provides the management systems, connectivity, monitoring, and control required to ensure that energy produced or stored locally is used in the most effective possible way.

Cloud-based

DEOP is fully digital, and operates from a secure cloud, enabled by the partnership between Siemens and AWS. Within this partnership, AWS provides and secures its own virtual datacenters that provide almost infinitely scalable, low-cost hosting, while complying with all regulations related to data location and privacy.

Siemens establishes and secures its own private cloud locations within the AWS environment, and is responsible for applications, data management and customer connectivity. DEOP customers therefore gain the cost, fast access and scalability advantages of cloud, while also benefitting from Siemens' proven security record and rapid, efficient remote support.

IoT Monitoring

DEOP is based on continuous monitoring and analysis of sensor data, generated by all relevant and connected systems across the specific environment. Siemens' leadership in Grid Edge means that low-latency processes (such as alarms) are managed on-site, without the need to exchange data in real-time across the cloud, while patterns in data flows are analyzed and used for highly granular control by customer management.

DEOP connects all core systems within the customer environment. This even extends to building management systems. The intention is to give end to end, top to bottom visibility and transparency, by providing a single source of the truth regarding energy use.

Automation

Increasing numbers of key processes can be automated, if required, by using DEOP. Fast response to alarms and indicators that demand instant response will be governed by algorithms to sharpen control and enhance performance. Without compromising on customer-defined policies, automation will progressively improve performance and effectively support management to achieve their cost and performance goals.

Grid Edge

DEOPs one of the increasing number of applications and services that Siemens is bringing to market connected to the Grid Edge concept. This strategic development has been covered in the Siemens white paper **The Grid Edge Revolution**, which provides a comprehensive overview of the concept, its applications and likely development path.

All solutions based on Grid Edge thinking and technology aim to decentralize power generation and distribution, reducing the dangers inherent in over-centralized systems, making power provision more resilient and robust, while also driving rapid decarbonization. Driving beneficial change from Grid Edge technologies requires use of rich data flows (from sensors and IoT devices), enabled by automation (increasingly informed by machine learning and, eventually, AI) to balance power services and power supply.

This approach means that KPIs (see below) can be reliably met with the smallest possible energy usage, cutting costs and carbon, while opening up DER opportunities.

KPIs

These will naturally be defined by customers, but we anticipate progressive reduction in CO2 emissions and identification of every opportunity to reduce energy usage as being natural outcomes of successful DEOP implementation. Asset owners remain entirely in control of the way they choose to balance objectives (cost, energy applications, availability vs restricted use, environmental factors...) and DEOP enables them to define and vary at will the priorities they choose to apply.

Support

DEOP as a software is delivered in a Software as a Service (SaaS) model. It is possible to provide DEOP as a Managed Service, in a service "package" for external delivery, or to keep it as a wholly internal process, owned and managed by the relevant customer department. Visibility is provided through customizable, highly intuitive dashboards, while specialized support from Siemens' specialists, is always available.

Summary

DEOP forms part of the growing number of Siemens digital, cloud-based and delivered software applications, incorporating Grid Edge and IoT monitoring to provide the best balance of low-latency responsiveness and low-cost cloud native management.

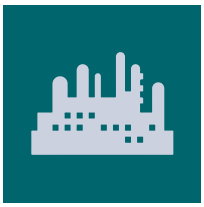
The goal, as with all related Siemens products is to use automation, machine learning and remote support to accelerate optimization, with full control staying in the customers' hands, and expert support from Siemens always rapidly accessible. This formula is delivering measurable benefits in market sectors as diverse as Asset Performance Management, Diagnostic Services, Proactive Maintenance and now Optimization of locally generated power.

This also confirms our view that the Grid Edge is where most innovation is currently happening in this industry, and DEOP is designed to enable full and trouble-free integration with all relevant business, operational and environmental systems already in place. It is based on MQTT, the most widely used IoT Protocol, with gateways for protocols like IEC 60850-5-104, IEC 61850, Modbus TCP and others, together with proven API integrations to the Siemens applications DESIGO CC & E-Car OC.

4. Verticals and Use Cases

4.1 Who Benefits? Existing and Emerging Verticals

DER can potentially provide an added value service to a wide range of different industry sectors. These include a number of emerging service sectors that are enabled in large part by the development both of DER as a concept, and by the arrival of DEOP and other management solutions.



Manufacturers

Both discrete and process are very large users of power. The ability to balance energy produced under their own control on-site with grid-delivered electricity gives these companies a vital tool for reducing overhead costs and staying competitive in often very difficult financial conditions.

At a leading Italian pasta manufacturer, use of DEOP has led to enhanced production efficiency, while reducing carbon emissions and improving management control through a customized optimization algorithm and intuitive dashboards. DEOP has enabled better testing of applications and production methods before go-live and has successfully addressed a key concern of the company: how to boost production and improve output, while at the same time reducing carbon emissions.

Industrial units

Where large numbers of independent manufacturing and other industrial businesses are based on a single geographical location, are natural users of DERs.

At the Diangzhong industrial zone in Yunnan province, China, DEOP has facilitated development of a local cloud platform, accessed by all customers on the site, which enables them to optimize energy use and reduce both costs and emissions. The zone covers 480 square KM and is constantly evolving and expanding. It includes wind and solar energy production, combined heat and power, electricity charging stations and extremely complex energy needs, all of them optimized and enhanced via DEOP. (Read more about this project here)

Real estate
Businesses, such as shopping centers, have been hard hit as a result of the Covid pandemic.

At the Sello shopping mall in Espoo (Finland's 2nd largest shopping center), DEOP helps manage local DERs that include 600 KW of photovoltaic power, 50 electric vehicle charging points and 1.68 MW battery storage. DEOP has optimized energy usage, enabled participation in the Fingrid market through Vibeco, and integrated with building management systems to help reduce consumption, while providing asset transparency. (Read more about this project here)

Educational institutions
such as large universities or specialist research centers, use management and energy use balancing capabilities to ensure maximum efficiency at a time when budgets are under pressure.

At Keele University in the UK, a world-ranked research establishment specializing in sustainability systems, several DER operate on the University campus, including solar, battery and micro-CHPs, together with a "living lab" carrying out research into decentralized energy systems. DEOP integrates micro generation and digital evidence systems, providing detailed management information and playing an active part in driving down carbon footprint by 35% from baseline levels.

We have already seen how utilities, large-scale energy generation companies and grid operators are building new skills in aggregation, VPP and other concepts to balance supply and demand dynamically, cutting wastage and reducing environmental impact, while meeting all availability obligations. (Read more about this project here)

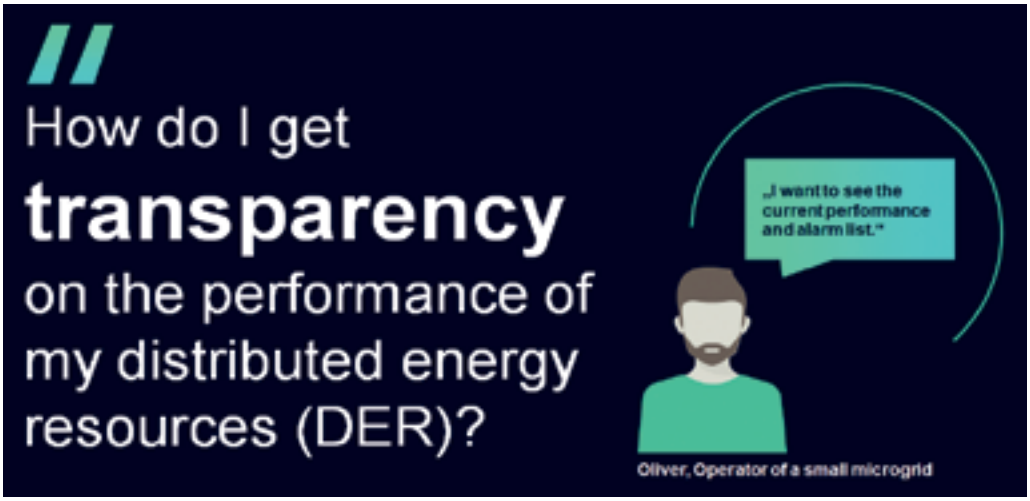
We are also seeing the rise of specialist **Energy Aggregators and Energy Service Companies**. These businesses use energy flows from VPPs as a resource for bidding into grids for supply contracts, without the need to build their own power generation units, and help grids and utilities enhance their own efficiency performance, creating a more effective and reliable market.

One such company is EGO Group in Italy, which is a leading VPP provider, integrating 400 flexible assets (and growing) with production capacity of 150 MW. DEOP helps EGO optimize operations and offer standard packages, while also delivering VPP options to the market. A growing community of businesses is working with EGO to optimize their asset value and monetize key aspects of their normal business operations through energy supply to the grid.

The customizable dashboards provided enable the company to manage the application exactly as they require it, while a market participation gateway and algorithm enhance monetization. Business models of these kinds would not be possible without grid evolution, enabling more flexible, two-way energy flows, and without advanced management software, such as DEOP. This is another example of how digitization is helping to transform the energy landscape.
(Find out more about the collaboration with EGO in this video)

4.2 Main use cases for DEOP

In all cases, users focus on three major use case types:
Monitoring and Transparency; Cost Optimization; and Revenue Generation.



Monitoring and Transparency
DEOP (together with all performance enhancing management solutions) is ultimately based on rich data flows. DEOP collects data from all connected sensors and devices in real time and visualizes this in easy to understand standardized or customized reports (to be used within the organization or by the Managed Service provider), delivering an integrated, complete and always current view of performance. This enables the organization concerned to understand current performance on a minute-by-minute basis, while also permitting fast intervention as needed.

Automation, driven by algorithms and increasingly enhanced by machine learning, enables continuous optimization within defined parameters, while also enabling hands-on intervention as and when needed.

The monitoring capability within DEOP permits recurring or emerging patterns to be identified, with potential enhancements also set out. Reports can be generated at any point to provide detailed, auditable information for review and as input to strategic planning. The growing and evolving role of IoT will enrich the data available to monitoring solutions, providing deeper insights and enabling better decisions.

Cost Optimization

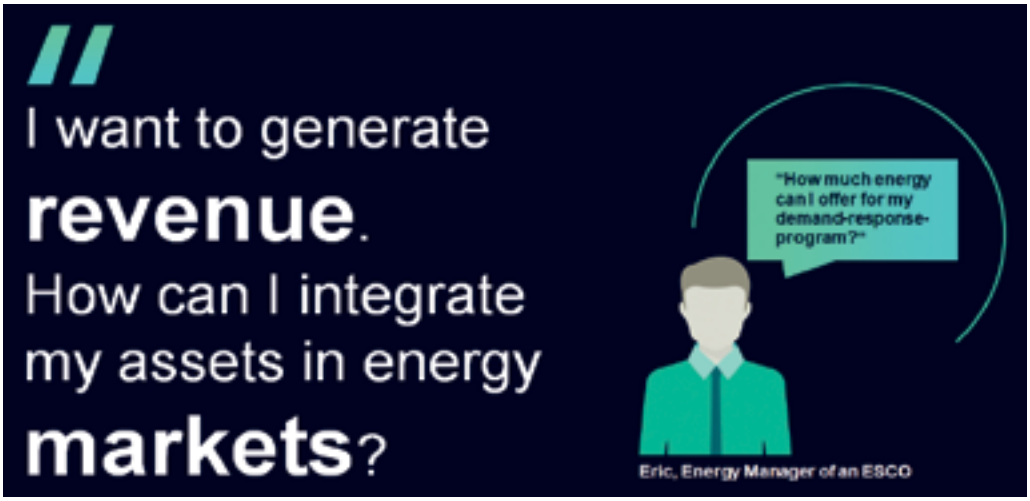
Although cost reduction is not the only reason for using DEOP (or DER, for that matter) yet it is a key factor in driving adoption. We all appreciate the fact that energy supplies are not infinite and come with serious downsides: including constantly rising costs and major environmental concerns.

DEOP makes it possible to **see clearly** the levels of usage in every specific area of a customer's working environment; to **spot trends**, together with root causes; and to **develop strategies** that enable maximum efficiency, leading to cost optimization at every location, process stage and usage type.

DEOP is based on an analytical engine that reviews and presents rapid insights on all aspects of energy consumption, including:

- Who is using energy, when and for what purposes?
- How that energy is being supplied, at what cost and when?
- Where is energy being stored and how much could potentially be available for flexible offering to the grid or to local operations?
- What levels of emissions are being generated as a result of this usage, and how these can be successfully reduced?

The algorithms supplied as part of DEOP rapidly learn the details of the customer environment, and then continue to develop a deeper understanding, day by day, increasingly through machine learning and (in the near future) AI. This enables the solution to identify possible issues and, most important, propose areas for dynamically intervening in both usage and supply patterns to drive down costs.



Revenue Generation

The two previous use cases are both primarily focused on efficiency gains within the organization concerned, but the rise of DER and management solutions such as DEOP also open the possibility of using locally-produced and stored energy or flexibility as an additional line of business in its own right.

Aggregators, in particular, are constantly searching for energy sources to include in their own VPPs for packaging and sale into the grid, ideally at times when prices are attractive. A single campus owned by a manufacturer, large research and educational center or headquarters of a major commercial body, can provide the energy equivalent of several hundred houses fitted with photovoltaic panels.

This improves the Aggregator's offer by making their own energy supply and flexibility sale, and therefore their value proposition more reliable, reducing the cost of sale and raising profitability. The flexible interfaces provided as an integral part of the DEOP solution enables simple participation in this business model.

Summary

The options covered in this section are broadly indicative, rather than being exhaustive.
New opportunities are being developed, in terms of industry verticals and specific options for cost reduction and profit generation. The key factor in DEOP is its extreme flexibility, with industry standard interfaces, continuously kept up to date, ensuring a good fit with the market at all times.

5. Role of Cybersecurity

DEOP is a cloud-based solution that includes multiple points of integration with sensors, business systems and databases. As with all digital systems delivered from the cloud, security is a key element of its design, configuration and management.

Siemens Security Protocols

The solution adheres to Siemens' own design and operational principles for cybersecurity, which are based on a profound understanding that interconnecting OT and IT systems risks exposing operational management solutions by making them accessible online. At every stage in the design and production process, therefore, Siemens protocols aim to remove risk, close loopholes and continuously update in response to emerging threats.

Siemens DEOP development follows OWASP general coding practices, with a quality and security automation pipeline, which includes a wide range of checks at all stages, backed by concepts such as secure zoning, access control, hardening and security logging following security by design principles. All access to the Siemens DEOP platform undergoes a state-of-the-art, strong authentication mechanism. The principles apply to all solution components and defense in depths is used for the security controls.

Hyperscale Partnership

As described earlier, Siemens works with AWS to ensure that all Siemens digital services combine the benefits of true hyperscale cloud (scaling, fast set up, very low costs) with the security characteristics delivered by a meticulously designed and managed private datacenter approach.

The AWS and other cloud platforms are certified to conform with ISO 9001 (quality management), ISO/IEC 27001 (information security), ISO/IEC 27017 (cloud security), ISO/IEC 27018 (cloud privacy), SOC 1 (Audit Controls Report), SOC 2 (Security, Availability, & Confidentiality Report) and SOC 3 (General Controls Report) standards.

Secure data transfer

The secure IoT protocols, such as MQTT or connections secured by VPN are used for managing transfer of data from customer devices or sites to the Siemens locations in the cloud. These are proven solutions that also connect with on-site Edge devices to ensure that low-latency processes are managed locally, while keeping all records up to date.

ments of ISO/IEC 27001, NISTIR 7628 Guidelines for Smart Grid Cybersecurity in order to provide a comprehensive coverage of cybersecurity controls relevant to cloud-based applications and managed service in the cloud.

Compliance

Siemens DEOP complies with all relevant national, EU and North American regulations, and is constantly updated to ensure compliance. This includes EU Directive (EU) 2016/1148, commonly known as the Network and Information Systems Directive (NIS-Directive) and EU Regulation (EU) 2018/151, which focuses on ensuring that digital service providers take appropriate security measures to protect their assets and notify their national authorities about serious cybersecurity incidents.

As a technology provider in North America, Siemens understands NERC CIP standards, which are applicable to operators of bulk electrical systems in order to protect their critical infrastructure against cyber risks. Siemens works to international standards, which also cover the requirements of NERC CIP-005 for Electronic Security Perimeter protection. This includes, too, requirements of ISO/IEC 27001, NISTIR 7628 Guidelines for Smart Grid Cybersecurity in order to provide a comprehensive coverage of cybersecurity controls relevant to cloud-based applications and managed service in the cloud

Summary

Siemens believes that digitalization, with development, delivery and management handled in the cloud, is the best way to provide customers with the most advanced, efficient and high-performing solutions, enabling them to optimize their operations and enhance business success. Security is the non-negotiable key enabler for successful moves to the cloud, and security is built into every aspect of DEOP design and implementation.

This also confirms our view that the Grid Edge is where most innovation is currently happening in this industry, and DEOP is designed to enable full and trouble-free integration with all relevant business, operational and environmental systems already in place. It is based on MQTT, the most widely used IoT Protocol, with gateways for protocols like IEC 60850-5-104, IEC 61850, Modbus TCP and others, together with proven API integrations to the Siemens applications DESIGO CC & E-Car OC.

6. Long-Term Market Impact

By using real-time data flows to monitor in real time, analytical engines to identify trends, opportunities and root causes, and intelligent algorithms to enhance decision-making, organizations will reduce their costs, cut emissions and improve energy efficiency. This makes DEOP an extremely useful tool for achieving a range of mutually supportive and beneficial goals:

- Encourage further systematic investment in renewable energy sources.
- Help grids to become more resilient and cost-efficient.
- Make organizations more energy efficient and therefore both more sustainable and viable for the long term.

The DER concept is now widely accepted as being highly disruptive to the power and utility industry because it is facilitating development of new lines of business that may significantly change business models in the wider utilities landscape. Our main focus right now is on the potential offered by DER to alter the economic realities for energy users within a growing range of organizations, in multiple sectors.

The rise of Grid Edge technology is set to accelerate in the immediate future, as DER becomes more attractive to users in many different sectors, and this brings the same challenges we find in any emerging technology space. Evolution is fast and it is essential to partner for the long-term: a solution that fits today's market will need to develop, potentially out of recognition, and you will need to know that the best available support is always there when you need it.

Siemens is committed to DEOP as its flagship product for the DER market. Our key recommendations for every participating business are these:

- Strategic thinking
  DERs are now a strategic issue. They should be on the C suite agenda from now on, and COOs need to be directly engaged.
- Continuity
  It is essential to have a policy that is achievable and flexible enough to develop as the market changes. That depends to a great extent on the relationships you build with strategic partners today.
- Learning and development
  DERs require a steep learning curve and the sooner a business engages and builds a broad range of competence, the more likely it is to safeguard investments and maximize returns.
- Focus
  There is profit to be made in this market, and we suggest that all potential participants focus on the low-hanging fruit available to them today, while analyzing potential to target larger profit in the future.

The thinking we propose for DERs fits in with the strategic guidance we offer for every market in which we participate. We are seeing a historic shift towards decentralized systems, highly automated and managed at the edge (the grid edge or the network edge). The earlier you invest in the opportunities this strategic change offers, the better it is for competitive position, business security and long-term profitability.

Published by
Siemens AG

Siemens Smart Infrastructure
Digital Grid
Humboldstrasse 59
90459 Nueremberg
Germany

For the U.S. published by
Siemens Industry Inc.

100 Technology Drive
Alpharetta, GA 30005
United States

For more information, please contact
E–mail: deop.si@siemens.com

Article No. SIDG-B10086-00-7600
© Siemens 2021

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

© 2021 by Siemens AG, Berlin and Munich