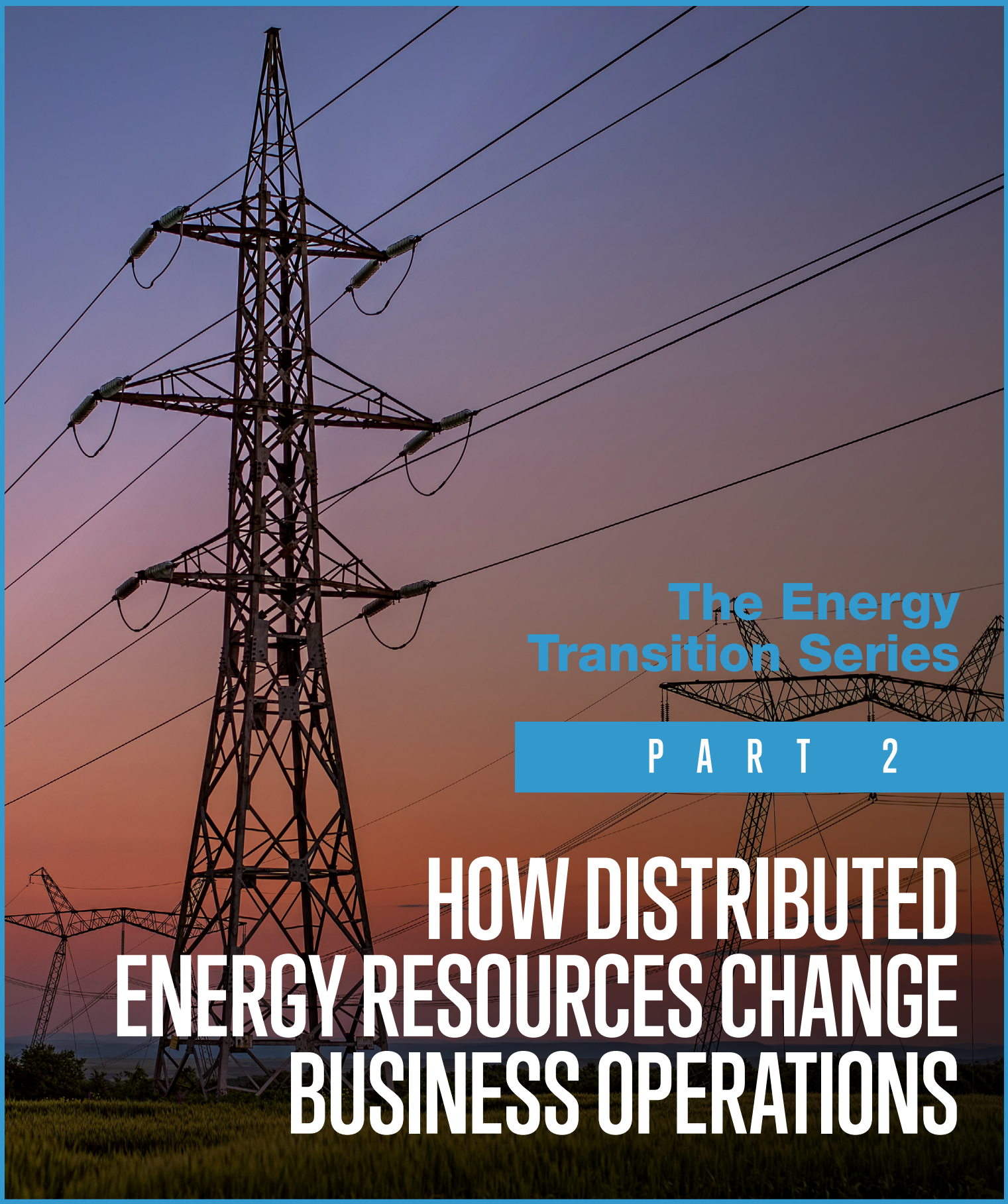

The Energy Transition Series

PART 2

HOW DISTRIBUTED ENERGY RESOURCES CHANGE BUSINESS OPERATIONS

A Hansen POV Paper

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ENERGY TRANSITION: RIDING THE NEW WAVE

The increased focus on renewables and local production fundamentally changes how we produce, trade, store and use electricity. All of us are experiencing this right now and we call it the Energy Transition.

As we highlighted throughout Part 1, a key defining feature of the Energy Transition – and core focus for Hansen – is the shift from a system characterised by large, centralised resources with one-way flows of energy and information, to an advanced grid market with distributed, decentralised, decarbonised resources with two-way flows of energy and information.

The Energy Transition manifests itself as a combination of technological evolution, decentralisation of energy management and customer empowerment. Combined, these elements challenge how consumers (residential and industrial) purchase energy and how traditional energy businesses sell and deliver energy. As a result, new business models are emerging.

These new business models include micro markets and new energy sources in the shape of solar panels, electric vehicles (EVs) and batteries – and the rising demand from individual customers to be in control of their energy sources through advanced technology. Moving towards real-time and larger market areas means that the requirements for automation in data management and analytics increase as a result of the additional complexity and volume of available data.

In this second part of our report, we are going to examine how distributed energy resources (DER) are influencing the energy industry of today – and of tomorrow. And the fundamental changes in business operations that energy companies are experiencing in this constantly developing market environment.

DER: THE UNDERLYING PROCESS OF THE ENERGY TRANSITION

At Hansen, we define the ongoing Energy Transition as the evolution from a state of large, centralised resources with one-way flows of energy and information to an advanced grid market with distributed, decentralised, decarbonised, democratised resources with two-way flows of energy and information.

As we've shown, we categorise the changes into the "5 Ds":

D1: Deregulation
D2: Decarbonisation
D3: Distributed Energy Resources
D4: Digitalisation
D5: Democratisation

And it's the third "D" that we're really interested in focusing on here. The increase in Distributed Energy Resources (DER) is the result of the rapid shift from a system characterised by large, centralised resources with one-way flows of energy and information, to an advanced grid market with distributed, decentralised, decarbonised resources with two-way flows of energy and information. Digital technologies have been supporting and enabling energy systems for decades, but today we are finding a greater pace of adoption.

Millions of EVs, solar panels and other DERs will equate to millions of batteries that will be integrated into the grid system. Inevitably, building and upgrading the grid will continue to be a solution, given the need to replace ageing assets and further electrification of heat and transport. It's useful to remember that we are still at the early stages of what can be done with data and analytics. The smart grid will never be fully in place but will continue to get smarter as the market and technology evolves.

The best part of $1 trillion was expected to be invested in DER capacity in the 10 years to 2030, as the energy sector continues to transition to a more decarbonised and flexible system, according to a report from Frost & Sullivan REF[1]. Distributed generation was forecast to account for 10% of the world's global installed power generation capacity by 2030. Even with the pandemic reducing investment levels in the short term, the market was expected to recover. Throughout the decade, a forecast $846 billion will be invested in DER, supported by a further $285 billion that will be invested in battery storage.

This investment will be driven by favourable regulations, declining project and technology costs, high electricity demand, availability of funding, and new financing models – such as green Power Purchase Agreements [PPAs] – that offset initial investment barriers.

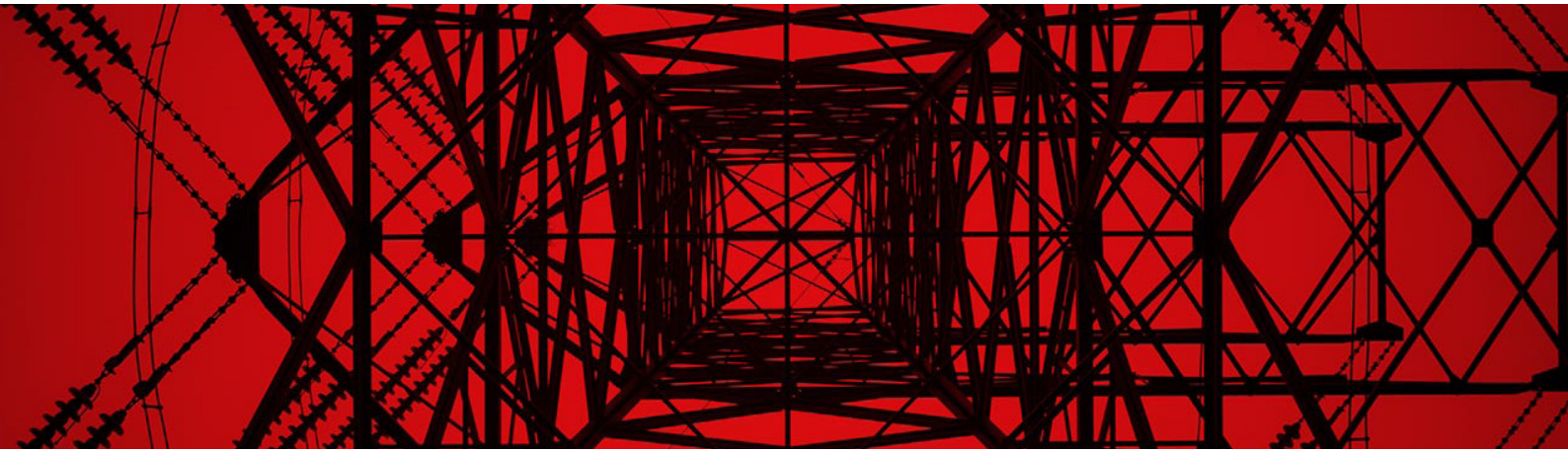
The significance and potential of DER for the energy industry is huge and growing. However, there are a number of barriers to DER achieving a truly influential position. We'll explore those next.

DER: WHAT'S TAKING SO LONG?

When Hansen first produced this series of reports on The Energy Transition and how distributed energy resources change business operations, we led this section by asking why, if DER was so powerful a trend in the industry, full-scale adoption was taking so long. And we summed up that lack of investment was key, specifically technology investments on the edge of the grid being out of step with the emergence of DER.

Since that report there have been, it's gratifying to say, a number of positive developments in demand-response strategies and mechanisms to manage electricity demand and help balance and stabilise the grid, including regulation and implementation. As the International Energy Agency noted in its report at the end of 2021 on Demand Response REF[2], more countries removed barriers preventing demand-response from providing more services to the grid, and some also increased the amount of capacity awarded in electricity markets.

Nevertheless, as the Paris-based agency also said, even faster progress is needed: 500 GW of demand response should be brought onto the market by 2030 to meet the pace of expansion required in its Net Zero Emissions by 2050 Scenario (NZE), a tenfold increase on deployment levels in 2020. But, the IEA added: "Demand response can be unlocked through actions taken in this decade to open markets to demand-side participation, encourage new business models and establish controllability standards for equipment and appliances."



We would also say progress has been made, but as the IEA report mentions, a tenfold increase from 2020 levels in the deployment of demand response will only be achieved with great strides made in this decade to encourage new business models; as we covered in the trends section of report one, demand side management will need to evolve to manage the variety of electricity requirements to meet special parameters such as direct current, low voltage, or high quality. Energy-efficiency platforms that focus on enabling renewable/DER adoption from core to grid edge will require new systems to measure and control energy consumption.

Hansen believes that there are three main reasons why DER is still a work in progress.

1. THE GRID IS NOT READY

The grid must be upgraded to handle rapidly increasing DER demands, all the way from the core to the edge.

Policy and regulation are moving in the right direction but as long as incidents like overvoltage events and power failures still occur, customers will not have the incentive to fully take on the role as "modern DER customers". There is still some ground to cover before the risk of issues like grid capacity stop deterring them from becoming the kind of customers innovative utilities would like them to be.
As we noted in Part 1 of this report, for example, the US power grid urgently needed modernisation, as highlighted as recently as CERA Week in March 2022. It was still "stuck in the 1940s", said industry experts, and creating queues of stacked renewable projects waiting to come online REF[3].

A modern grid is more efficient, making better use of renewable sources of energy and harnessing many of the same digital tools we use in the communications sector.

	Outdated Grid	Modern Grid
FLOW OF ENERGY	One way, with energy flowing from power plants to homes and businesses.	Multiple ways, allowing people to make, move and sell their own energy.
Customer Control	Next to none, other than manually turning lights and appliances on and off.	People can preset – and control via smartphones or tablets – how and when their homes or businesses use energy. Or they can consult a third party to do so for them.
Automation	Utility employees physically check meters monthly to measure usage. Utilities may only know of an outage if a customer reports it.	Sensors continuously track usage and can detect and resolve problems quickly.

REF[4]

2. THE RIGHT DATA IS HARD TO FIND

Energy companies do not currently employ the right tools to extract meaningful information from their big data.

The energy market is moving from daily settlement to 60-minute settlement, further on to 15 minutes and even 5 minutes in some regions and countries. Not so long ago, energy customers submitted manual meter readings. With a metering value being recorded automatically much more often, the amount of data grows very quickly. And as low voltage, micro production of electricity comes onto the market, by prosumers and more community renewable projects - a bi-directional market enabled with grid edge technologies, some of which we highlighted in the trends section of report one, creates a tsunami of data and all its complexity will need to be managed. We have officially entered the era of Big Data.

Real-time data on the energy system and energy use will become a high-value commodity, that will dictate the direction of travel for the future

3. UTILITIES ARE NOT CUSTOMER-CENTRIC (ENOUGH)

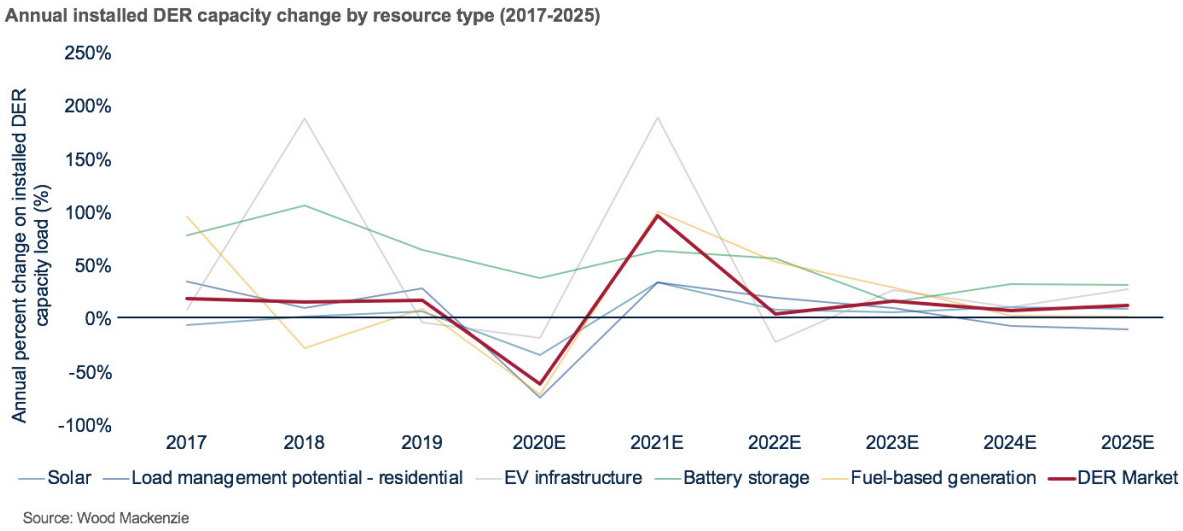
Utilities must redefine themselves, adapting to their new roles as “Energy as a Service (EaaS) Providers”.

DER is not yet generating commercial opportunities on a large scale, as the market is still in a very early phase. This is akin to the experience of the mobile phone market in its infancy, with different players testing the waters, so to speak. The industry standards are evolving but not in place to create a mass market.

There are exceptions and examples of players starting to dig into the opportunities offered by DER. In Norway, Tibber REF[5] is targeting specific DER niches by offering the consumer increased control over their electricity usage. Through an app, the user can connect and monitor heating, vehicle charging and various electrical equipment. The company aims to provide the cheapest possible electricity to their clients, by constantly scanning all available retailers and automatically switching to the best deal. Although the factors holding back and delaying DER and the Energy Transition are not insignificant, the process is most definitely underway. Demand is present and steadily growing, and technology development will progressively accelerate events.

Other very positive developments we can also note is the emergence of community solar and wind projects, delivering affordable green energy. We will be covering that further in the next part of this report.

THERE'S NO STOPPING THE INEVITABLE



Source: Wood Mackenzie

The 2020s look set for massive distributed energy resource growth. In the US, the combined capacity of DERs like distributed solar, batteries, flexible loads and electric vehicles will reach 387 GW by 2025, according to a Wood Mackenzie Power & Renewables outlook report REF[6] driven by more than $110 billion in cumulative investment. While their mid-2020 outlook did factor in the impact of Covid that year, it expected the US market to experience a recovery in 2021 and overtake its pre-outbreak high by 2024.

But the key systems business and operational systems of utilities will need to absorb and manage the impact of the change. From Hansen's experience of working with hundreds of energy and utilities providers worldwide, Hansen we see five imperatives related to business and operational systems that must be addressed to prepare for the full impact DER within the context of the Energy Transition.

1. PREPARE TO HANDLE VARIETY

Big data is usually defined by "4 Vs" – Volume, Velocity, Veracity and Variety. It's relatively easy to grasp that the volume and velocity will be "big", and that it will be challenging to verify it all.

However, in the context of DER, the variety of the data will be most significant. Variety is what makes Big Data really big. DER will entail data capture from a great variety of sources and come in a variety of types – structured, semi-structured and unstructured. Different data types require different processing capabilities.

Input from technical components like solar panels, electric vehicle chargers, various batteries and other sources will require a whole new breed of backend solutions. The best way to handle variety is to utilise systems that use open architectures in order to collect, store, process, present and analyse all customer-related data and other types of information.

An open architecture establishes and enables present and future integration points for advanced network planning models and DER service evaluation methods.

GreenTech Media, "5 Major Trends Driving the $110B US Distributed Energy Resources Market Through 2025", https://www.greentechmedia.com/articles/read/5-takeaways- on-the-future-of-the-u.s-distributed-energy-resources-market, accessed October 2020

2. DEVELOP SERVICE ADAPTABILITY

To unlock the potential of a customer-centric and data-driven business, companies must build an IT platform for the future. The solution architecture must cater for a high degree of service adaptability and product innovation to be able to reach the overarching goal of providing a great customer experience. Business-minded companies will need to build digital information channels for customers and suppliers, and to develop digitised platforms for streamlined customer enquiries, connections, and installations. Smart grid solutions will enable data visualisation, dispatch simulation and long-term asset optimisation. At the same time, companies will need to expand the deployment of sensors across the network to monitor DER at all voltage levels, including remote monitoring, controls and automation of data exchanges.

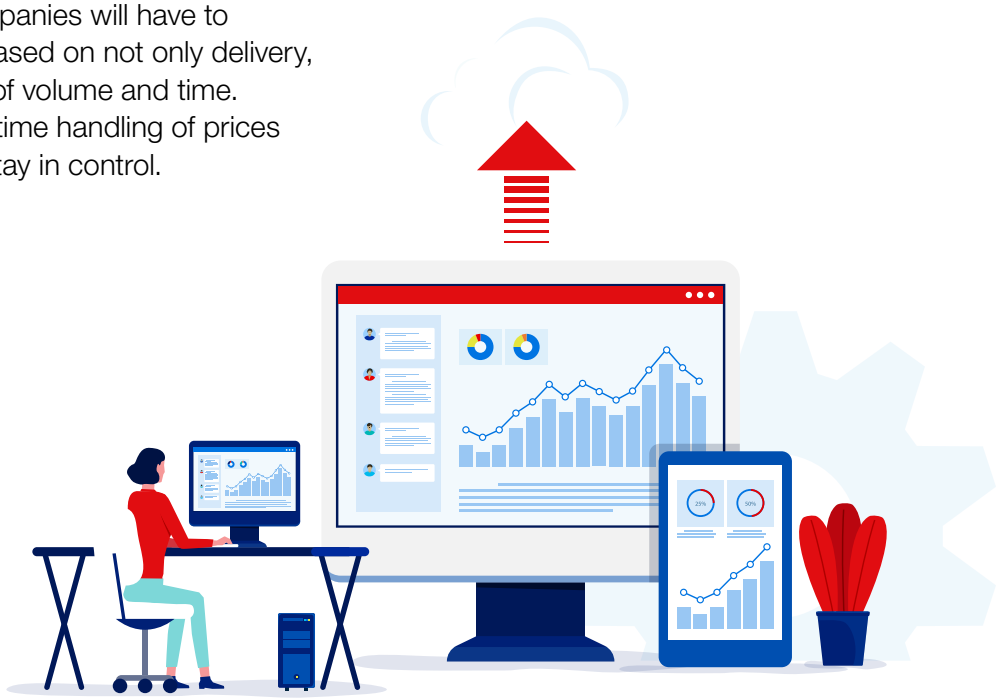
The business rationale is to increase the flexibility and scalability of the IT infrastructure and to leverage new technologies where there is a rising need for scalability and real time processes. This relates to the entire value chain – from wholesale and trading to customer engagement.

3. MORE DYNAMISM FOR BILLING AND RECONCILIATION

The traditional CIS is built around the principle of directional flow of energy and invoices. In the age of DER, it will be all about real-time management and the ability to set up advanced products and services in order to capitalise on new innovations. Robust billing will be important for all entities responsible for distributing and managing energy and not just retailers.

In a report on retail, billing, and CIS for a competitive edge REF[7], Quindi Research highlighted the need for retailers to look for flexible applications to automate campaigns, run engagement initiatives and efficiency programs, and effectively cross-sell new products. All this while maintaining a unified, up-to-the-minute vision of customers and prospects and being able to perform analytics along the customer journey.

The full impact of DER means that companies will have to conceptualise products and services based on not only delivery, which in itself carries the uncertainties of volume and time. They will now also be dealing with real-time handling of prices and need a dynamic billing system to stay in control.



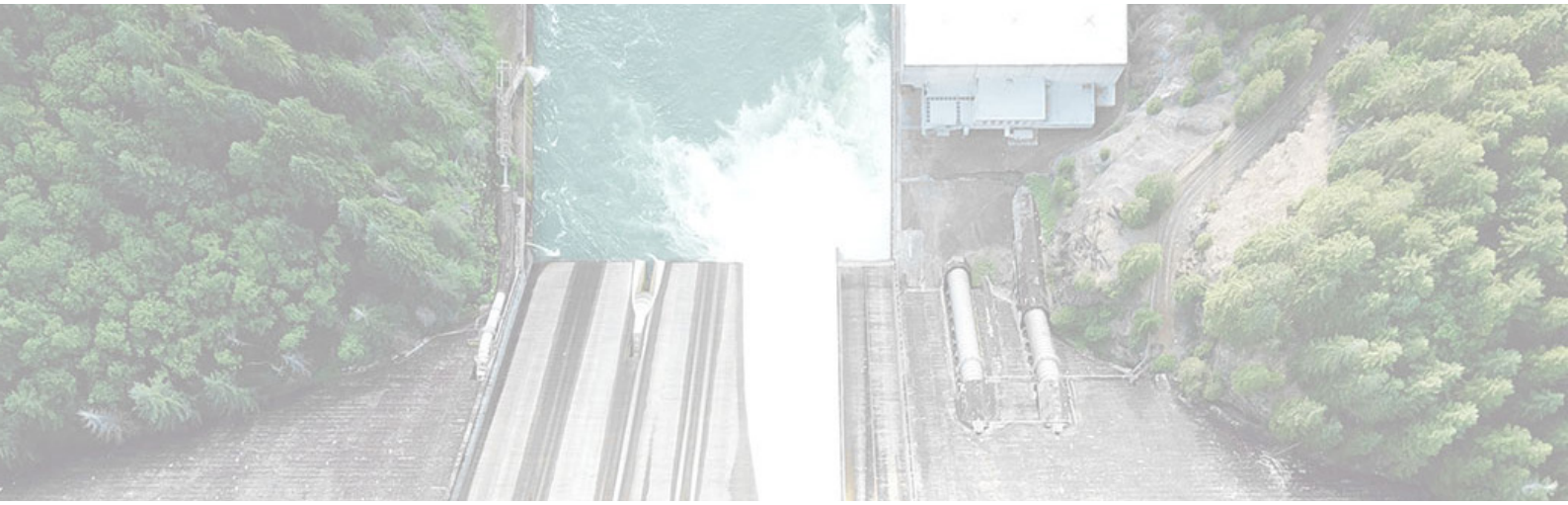
4. FOCUS ON YOUR PEOPLE: RE-ORGANISE, RE-TRAIN AND RECRUIT TO BUILD PROACTIVE, MORE AUTOMATED CUSTOMER SERVICE.

The evolvement of DER will entail a full re-thinking of the energy company business model and how individuals working directly with customers think about their work.

For energy retailers, the move from "electricity only" to "energy as a service" will necessitate a new approach to enable service offerings in tune with consumer expectations. Staff will have to adapt to becoming more of a consultant to the customer. Customers will be expecting advice on how to minimise their electricity bill as well as how to get the most out of their new energy resources and gadgets.

Automation of customer service processes will be necessitated by DER but must be carefully implemented along with people processes to fulfil the intended purpose. Automation will enable staff to focus on more proactive customer service as there will be far less need for manual tasks. The frontrunners and early adopters have grasped that automation is necessary to be able to handle the dawning age of the prosumer.

These providers understand to focus on their people as they automate.



5. GET HELP FROM EXPERIENCED PLAYERS

There is another caveat. A phenomenon like the energy transition with DER as a central component can capture the attention of a wide range of enterprises in the business of providing IT services and perhaps an impressive array of other tech and support systems. But the generic offering can fall short for energy companies – and for a number of reasons.

Simply, a broad-based IT company may not fully grasp the energy market in which it is trying to operate. And discovering that it has a weak understanding of the industry and the regulations and trends that so heavily influence the market can be a long and painful process.

When DER truly breaks through, it's vital to make sure that your service and IT partners understand the market conditions, locally and regionally; have the tried and tested solutions and market knowledge to support you in creating, selling, and delivering new products and services; and possess the needed market knowledge and working systems that support specific requirements.

ENERGY TRANSITION DRIVE IMPORTANT CHOICES

The energy transition is well underway – that much is clear. Different markets worldwide are rolling out new waves of systems and devices, or implementing datahubs to create a faster-moving and more open energy market. Each in their own fashion will impact market dynamics, competition, and business development. While we're not likely to see a global, harmonised model in the near future, we can look forward to e.g., power connectors across borders and harmonisation of business processes, and other shared objectives and projects.

The energy market is highly regulated with few international standards, mostly governed by local and regional legislation. We expect to see faster regulatory changes to adapt to the new era.

Without a doubt, business model redesign is accelerating with the increasing speed of energy technology advancement. Energy companies are wondering and looking into how they need to change and adapt. There will be key questions like: How do we prioritise? What areas should we look into changing first? In any case, What's certain is, important choices will need to be made.

In the next part of this Energy Transition series, Hansen will provide our view on the priorities for change and how that is realised in our Energy & Utilities Suite. And we will review case studies of energy providers that are in the midst of adapting to the Energy Transition.

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