We are *not on track* to meet the Paris Agreement's objectives. What should we do?

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06

The *need* for a demand side Energy Transition

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Missing piece in the energy transition puzzle: how the demand side will reshape the energy landscape

1. Debates around the energy transition focus too much on the supply side and the amount of investment needed to meet future electricity needs
2. In the pursuit of a sustainable energy future, the demand-side transition, encompassing energy efficiency, demand-side management, and demand response, remains a pivotal yet often underappreciated component
3. We need to refocus the conversation and put consumers back at the center

Introduction

The International Energy Agency (IEA) identifies energy efficiency as crucial for maintaining the 1.5 °C climate target, yet global investment falls short. The current 2% annual improvement rate needs to double by 2030, requiring a tripling of investment within five years. Despite challenges in the building and industry sectors, 2023 saw resilient global energy efficiency and electrification investments, boosted by strong EV sales.

The U.S. Energy Information Administration (EIA) shows that energy efficiency has kept USA energy consumption stable since 2000, even with economic growth. The recent rise in electricity demand for AI data centers highlights the ongoing need for demand-side focus.

The Australian Energy Market Operator (AEMO) projects that enhanced demand-side management could cut peak demand by 10% by 2030, reducing the need for new infrastructure.

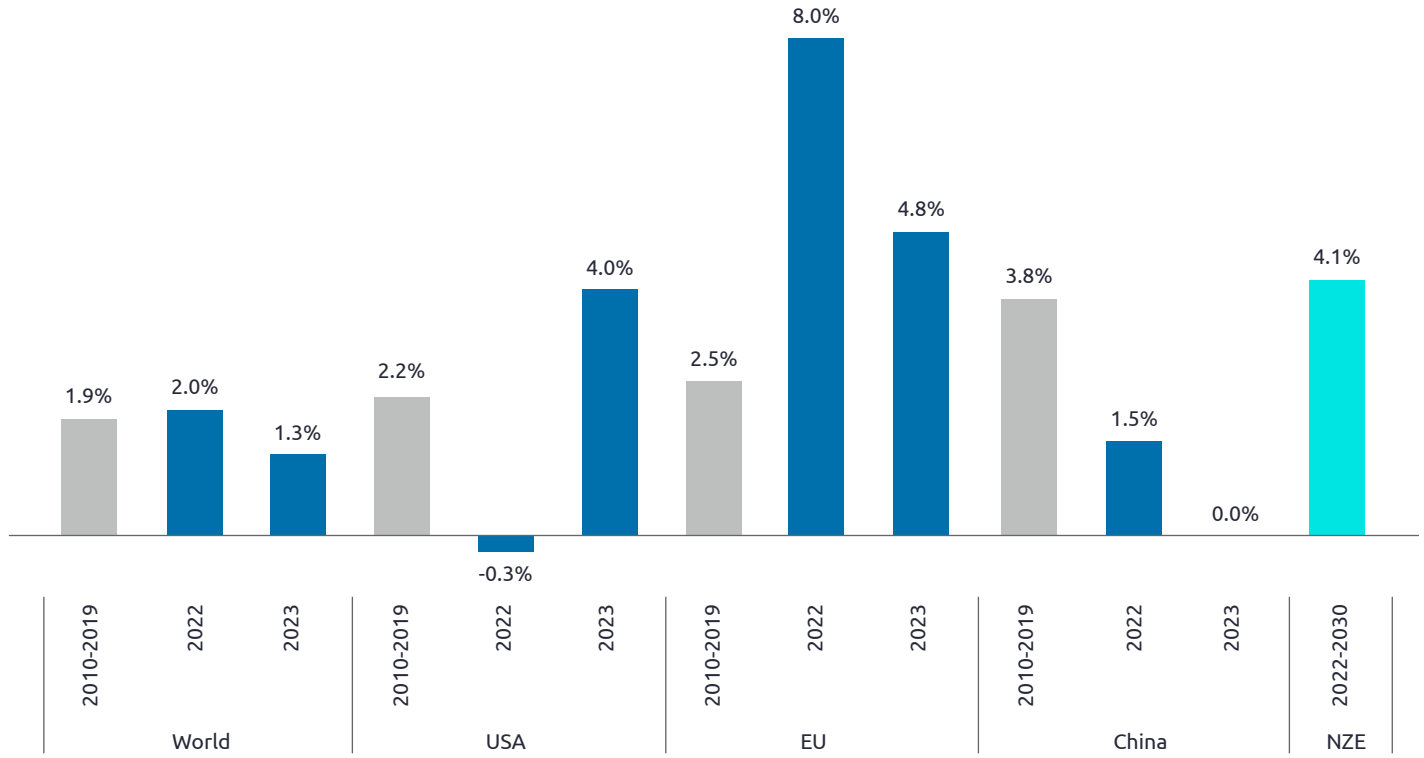
Engaging consumers and leveraging technology is essential for an effective and fair energy transition.

What we are seeing

- Customers becoming from prosumers to omnisumers, individually or collectively (energy communities)
- Technology Advancements that empowers customers
- Interesting Cross Industry Collaborations
- New Markets, New Opportunities, and New Entrants

FIGURE 1

Slower global intensity improvement in 2023 masks significant progress at the country and regional levels (USA – 4%, European Union – 4.8%)



Customer engagement matters

Customer Choices Add Complexity

The energy transition is transforming traditional power systems. Electricity demand is rising as customers adopt electric vehicles (EVs), electric heating, and other electric devices. Data center consumption further contributes to a significant increase in electricity demand. Simultaneously, customers are enhancing energy efficiency in their homes and businesses and investing in distributed energy resources (DERs) like rooftop solar and battery storage to reduce bills and improve resilience. This shift creates a more intricate system with greater load flexibility and more pronounced peaks. To manage this increasingly complex system, electricity providers must rethink their planning and operations. New tools are required to balance supply and demand in real-time, with flexible resources and non-wires alternatives (NWAs) complementing traditional infrastructure solutions.

Consumers Hold the Key to Unlocking Grid Value

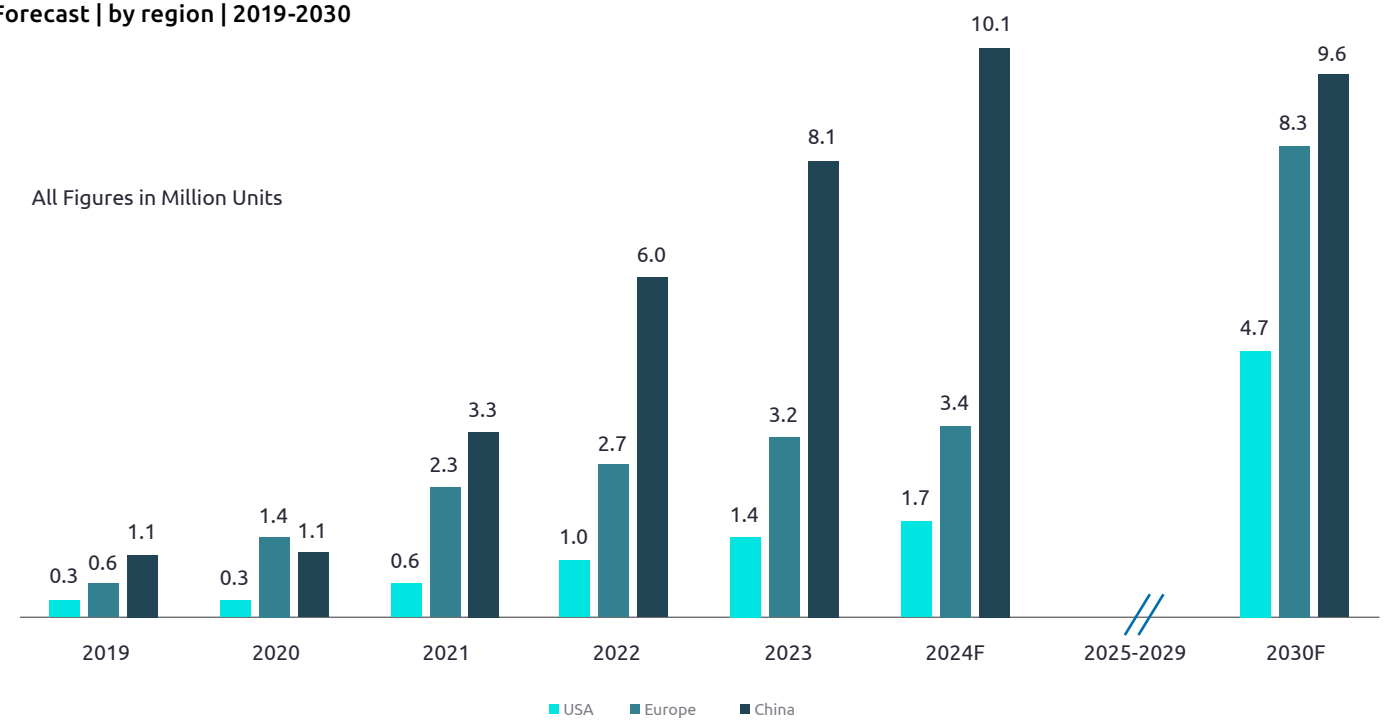
Customers across all segments are increasingly investing in smart devices that monitor and control energy usage, such as smart thermostats, battery storage systems, and programmable EV chargers. These devices offer significant grid benefits when energy providers actively engage customers and incentivize participation in demand response programs. By leveraging customer-owned controllable devices, utilities can reduce peak demand and build flexible resources, like virtual power plants (VPPs), which help defer or avoid capital investments.

However, customers commonly invest in smart energy devices or energy efficiency for their own benefits—to lower their energy bills, increase the comfort of their homes, or reduce their carbon footprint—rather than benefits for the grid.

To unlock the grid value of these customer investments, electricity providers need to find new ways of engaging customers that make it easy and attractive for them to participate. At the same time, utilities must trust customers as active participants or "prosumers" for these benefits to materialize and to keep customer costs low. It's essential to empower everyone, regardless of economic means, to participate in a fair and just energy transition.

FIGURE 2

EV Sales Forecast | by region | 2019-2030



Source: IEA, EVAdoption, USB

Client Story

Giselle DeGrandis

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Giselle is part of the Customer Strategy & Energy Transition team and leads Hydro One's residential demand response (DR) program, called myEnergy Rewards.

How we see this market / issue

- Tapping into customer demand flexibility offers Hydro One a new and cost-effective way (a non-wires alternative) to meet emerging system needs and help alleviate some upward pressure on rates.
- Hydro One is ideally positioned to engage DER-owning customers, reward them for their investments, and aggregate the value of their participation in the operation of a clean and reliable grid by creating a Virtual Power Plant (VPP).

What we are doing

- Hydro One is collaborating with the IEA in a study to test and evaluate customer engagement methods that result in desired energy behavior change.
- Hydro One is aggregating customer smart devices into a geographically segmented, all-season, multi-DER VPP by incentivizing customer participation.
- The OEB provides funding to income qualifying customers for base-board smart thermostats.
- Planning and Operations teams are assessing how this helps them meet local distribution needs and quantify the deferral value of planned system investments.

Demand Response and Time-Variable Pricing in USA Utilities

Most USA utilities offer DR options to their commercial and industrial customers. Additionally, the country's seven independent system operators/regional transmission organizations (ISO/RTOs) sponsor DR programs, allowing demand response capabilities to bid into markets for energy, capacity, or other grid-support services. These capabilities often include reducing consumption or using behind-the-meter generators.

Time-variable pricing (TVP), where electricity prices vary by time of day and season, is widespread. Common TVP options include time-of-use (TOU) rates, real-time pricing (RTP), day-ahead hourly pricing, and block-and-index pricing. TOU rates typically feature higher prices during afternoon peaks, lower overnight rates, and intermediate "shoulder" periods.

DR programs and TVP arrangements reflect the dynamic nature of electricity production costs, which can vary significantly. These programs incentivize consumers to manage their loads, providing substantial benefits for those who can adjust their usage in response to market signals, thereby helping to stabilize the grid and reduce costs.

The more these flexibility are automated, the more efficient DR programs and price signals are.

Energy Command center (ECC)

Schneider Electric

Schneider Electric's leading connected products, edge control, and advisory applications help organizations efficiently manage their energy supply across multiple assets, such as factories, offices or other infrastructure, while also reducing energy consumption across their operations in one integrated platform.

How we see this market / issue

- Designed to help organizations accelerate their journey towards smarter and greener facility management, energy efficiency and demand side transition, the Energy Command Center leverages a unique end-to-end combination of digital solutions and cutting-edge technologies, to both simplify energy management and optimize its consumption.

What we are doing

- An innovative energy management platform that will enable organizations to monitor and manage the performance of energy assets across their operations
- Capgemini brings its expertise in data integration and processing, AI and machine learning, and the integration of all products and software in a central decision-making platform.
- Leveraging next-generation technology to significantly increase energy efficiency and improve asset utilization.

Technology advancements empowering customers

Introduction

Tackling the energy and climate crises is paramount, and energy efficiency and demand side transition plays a key role in mitigating these challenges. Decarbonization through electrification and digitization is a necessity for a sustainable future.

Technological advancements are fundamentally transforming the demand side of the energy equation, empowering consumers to play an active role in the energy transition. Through smart grids, Headend Management systems, DERs, demand response programs, EVs, blockchain, AI, and IoT, consumers can optimize their energy usage, reduce costs, and contribute to a more sustainable and resilient energy future.

Key data

>25%

Energy efficiency increase / saved cost

>20%

Reduction in maintenance costs

>30%

Asset utilization improvement

ECC – An integrated and Centralised Platform

The Energy Command Center solution, developed by Capgemini and powered by Schneider Electric, is an integrated and centralized platform to monitor, control and optimize all building assets consuming energy including data centres or critical environment rooms. Using real-time energy consumption and carbon emission data combined with modular and interoperable building management software and systems, the Energy Command Center helps to lower energy consumption and spend to help achieve organizational goals while accelerating towards a net-zero future. The platform combines advanced artificial intelligence (AI), machine learning logics and algorithms, and the Internet of Things (IoT) technologies to measure and predict various metrics like energy intensity, health of critical assets, critical operations, renewable energy generation, and the overall performance across all energy assets

Cross industry collaborations

Energy reduction has been an increasing part of our domestic and industrial mindset for some time – the clearest manifestation of this arguably being the 2021 forced rescale of the European energy labels because of the rapid evolution of more energy efficient products. The efficiency classes above A (A+, A++ etc.) were saturated with, for example, over 90% of refrigerators sold being class A or above.

Whilst clearer labelling and better understanding helps reduce usage, reductions have been partly countered with an increase in the number of devices – from home technology to EVs. This 'stagnation' is driving an increasing interest and demand in cross-industry collaboration, not only to reduce consumption at source, but also to reduce demand through the energy networks and generators.

As an example, the UK has successfully trialed demand-reduction techniques, using retailer incentives (loyalty points) to drive down consumption when supply is constrained. This brings together the Electricity System Operator (ESO) with the retailer(s) and consumers, but the key players are all in the energy industry. The more interesting area, though, is the growing recognition that demand can be managed more effectively locally to reduce overall draw through substations. Being beyond-the-substation, this is, by definition, local and what we are seeing is that the time of the intelligent self-balancing energy communities is here

Energy Sharing Communities Europe

The European Commission first set up the rules for energy sharing communities in 2019. Initial progress was disappointingly slow, but there is now a building momentum in these groups which bring together DSO, house builders, storage companies (including mobility) and technology companies. We are approaching a tipping point driven by constrained capital investment budgets, demand increase through house building and public pressure for secure supply.

These are more than peer-to-peer energy saving arrangements. These are evolving to be intelligent networks, optimising local production and consumption, import and export, based on predictive analytics in the home, neighborhood, district, environment and on the networks. The home builders are incentivised to invest in the opportunity of being part of the long-term energy community operating company, as well as gaining extra revenues from building houses with storage and generation capacity. There is a further benefit for the builder and the DNO in that the substation demand is lower – shortening supply cycles and lowering the capital costs.

Portugal seems to be leading the way, already having rolled out enabling legislation, but other nations are rapidly gaining momentum. As an example, The Cleanwatts Living Lab aims to bring together capabilities including peer-to-peer energy trading, using EVs and battery storage to help balance local and national grids, thus driving grid flexibility. The Cleanwatts approach has, importantly, engaged the consumer (with an app) and brought together technology providers, the grid operator, regulator and the retailers. All this is bundled into a replicable solution.

Many other examples exist – for example, in the Netherlands, 110,000 properties are part of local energy communities – nearly 1.5% of the entire residential estate. In the UK, the new government has announced plans to drive thousands of local energy projects through its Great British Energy corporate vehicle.

Energy communities also encompass the rapidly-evolving heat networks programmes where lower-temperature systems are driving greater efficiencies.

In all these cases, momentum is being driven by accessibility of the technologies to the consumers, enabled normally by smart metering and the digitisation of the grid. Volatile energy prices, low cost solar and the growth in EVs in particular is providing an impetus for consumers to engage and invest, whilst looking for realising the benefits of having generation and storage assets in the home or community. Large energy and mobility enterprises are on the cusp of working out how to make money from community schemes and this will further spur on the market.

EV-Grid-Integration Group in the USA

The formation of the EV-Grid-Integration Group in the USA marks a significant milestone in the collaborative efforts between the automotive and utility industries. This group, which includes major auto players such as GM, Ford, and Utilities such as PG&E, and Consolidated Edison, exemplifies how industries can come together to address the challenges and opportunities presented by the rapid growth of electric vehicles (EVs).

Given the surge in EV adoption, as highlighted by recent data showing a substantial increase in USA electricity demand due to EVs, this collaboration is timely and essential. By working together, these industries can pave the way for a more integrated and efficient energy ecosystem. The formation of this group is not just a response to current demands but a proactive step towards a sustainable future, where the synergy between automotive and utility sectors can drive innovation and progress in the energy transition.

If successful then the outcomes will be seen in exploiting the storage assets that are EVs whilst allowing optimisation of capital spend on networks.

New markets, new opportunities, and new entrants

This is only the start of the transformation, though, and the rapidly-evolving smart energy world is delivering data opportunities which are attracting new approaches and hence new entrants. Most importantly, enabling the energy transition will require a new energy ecosystem, where new players, such as aggregators and market operators, play critical roles in leveraging all available energy resources.

As reported in prior editions of WEMO, the legacy world of energy retail is starting to be disrupted by new entrants from other sectors. This threat to the revenue and profit streams has been seen before in the finance and telco worlds.

The signs are clear – customers are taking control, buying energy assets to reduce demand and become prosumers. They are also, perhaps unwittingly, buying huge storage devices in the form of EVs and largely (currently) failing to exploit the full value of all the assets they own.

Held back by slow processes, a lack of expertise in the asset domain and brand/investment issues, the market is open for new entrants to thrive....but which ones are coming into the market?

A few examples of market disruptors

Coming in from a mobility and storage angle we have the headline-grabbers such as Tesla (with its VPP offerings in UK, Spain, USA) and the potential expansion into a broad energy services company which includes the transactional energy retail elements.

From home services we have Ikea and its recently-launched Energy Insights feature enabling consumers to monitor their energy consumption. How long before AI is applied to automatically optimize your home energy use, production and export?

Be it a mobility/storage entrant, a home services entrant, or another (telco examples exist, spilling over to energy based on brand/customer experience), the disintermediation of the traditional retailer from its customer is starting to happen.

This is the start, though. Once the full suite of smart solutions are implemented, the power of the data can be fully leveraged – offering new opportunities to optimize home energy services at a household, community or national level. The winners in the future will the firms that can capitalize on this data in near-real time – blending an individuals predicted demand (home and car) with the market pricing and storage options every 30 minutes of every day.

Our Convictions

- Consumers are the New Power Brokers: The future of energy is decentralized and consumer-driven. Consumers must be empowered with the tools and information to make informed energy choices.
- Cross-Industry Collaboration is Non-Negotiable: The convergence of the automotive, utility, and technology sectors is essential.
- Data is the New Currency: Data from smart meters, connected devices, and energy management systems is invaluable. AI and machine learning will play a pivotal role in optimizing energy use, predicting demand patterns, and integrating renewable energy.
- Equity and Inclusion in Energy Transition: The benefits of the energy transition must be accessible to all, regardless of income or location. Policies should ensure that low-income households have access to energy efficiency programs and renewable energy solutions.
- Regulation Must Evolve: Regulators need to create frameworks that encourage innovation, support new business models, and ensure that utilities can recover the costs of investments in smart grid technologies and energy efficiency programs.
- Behavior Change is Critical: Technological solutions alone are not enough. Behavioral science must be leveraged to encourage energy-saving behaviors among consumers. Programs that provide feedback, set goals, and use social norms to promote energy conservation can be highly effective

About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

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