Conclusion paper

6th Stakeholder & Innovation Council

Landscaping the future grids & customers. How to define innovation, regulation, and expectations?

E.DSO - European Distribution System Operators
Association Internationale Sans But Lucratif – AISBL

Registered Office/Siege social:
Rue de la Loi 82, 1040, Brussels, Belgium
Registration no/N° d'enregistrement: 825.054.581
Banque Carrefour des Entreprises

Setting the Stage

The 6th Stakeholder & Innovation Council, the E.DSO's flagship event, marked an important return to its roots in the European capital, Brussels. Breaking away from the trend of online and hybrid events, the 2023 edition reintroduced a closed-door format with limited attendance, catering a restricted audience.

Incumbent Secretary General and a key figure behind the Council's success, Roberto Zangrandi, set an ambitious tone for the event: aiming at **Landscaping the future grids and customer expectations**.

While the European Commission's focus on sustainable, and carbon-free energy generation has been constant, 2023 emerged as the 'year of the grids"[1]. This perspective amplified the central role of electricity infrastructure in achieving the EU's Net-Zero emissions by 2050 and puts grids among the top priorities of the European Commission.

In the context of unprecedented challenges that hit Europe and the world, the Stakeholder & Innovation Council (hereinafter: the Council) turned its attention to questions addressing future regulation that establishes a relation to customers, and at the same time, sustains innovation.

David Peters, E.DSO Vice-President, and Chief Transition Officer (CTO) at Stedin, stressed the urgency of addressing the current congestion challenges faced by the Netherlands. He further pointed out the necessity for quick actions, emphasising that ensuring a resilient network infrastructure is a must to succeed with the desired transition. The future energy ecosystem heavily, reliant on renewable energies and active customers, demands improved coordination and alignment with customers' expectations.

In particular, the need for adequate flexibility services makes a proper regulatory framework indispensable. This encompasses anticipatory investments but also a radical change of the historical set-up of our existing energy systems.

Nicolás González Casares, Member of the European Parliament, and Rapporteur of the Electricity Market Design (EMD) reform delivered a video message keynote in which he stressed the delicate balance required between network reinforcement and the efficient use of available capacity. He underlined the significance of promoting anticipatory investments as a key strategy within the reform. This aims to proactively address future challenges and demands in the electricity sector, ensuring a resilient and responsive energy infrastructure.

This year's edition showcased the pressing need for proactive thinking and anticipatory regulations in the face of the evolving energy landscape.

[1] High Level Grid Forum https://energy.ec.europa.eu/news/commissioner-simson-participates-first-high-level-electricity-grids-forum-2023-09-05_en

KEY FINDINGS

- The role of electricity grids and Distribution System Operators (DSOs) is gaining importance in the energy transition, with grid modernisation and expansion taking centre stage.
- Legislative initiatives like the reform of the Electricity Market Design (EMD) are promoting a more grid-centric approach, recognizing the changing role of DSOs.
- The Clean Energy Package (CEP) had limited impact on grid-related issues, but there is a shift towards more proactive and anticipatory investments in the energy sector.
- Flexibility, particularly in managing grid resources and integrating renewable energy, is essential for future grid development.
- Regulatory challenges, such as the slow adoption of dynamic tariff models, hinder innovation and customer involvement.
- Policymakers are making progressive moves, like the European Green Deal and Fit for 55 package, to support the energy transition.
- Smart meters play a critical role in empowering customers and enabling efficient energy management.
- Energy sharing and energy communities have potential but require careful consideration for network stability and supply security.
- Customer-centric technologies, including digital twins and blockchain, are advancing renewable energy integration and customer engagement.
- Collaboration, transparency, and open communication among market participants are essential for a successful energy transition and customer participation.

I. Ambitious Agenda: Understanding the energy landscape

1.1. Regulating grids for the future and their interplay with customer expectation

Recent media coverage[2] and newspaper headlines[3] are pointing to a growing awareness about the role of electricity grids and Distribution System Operators (hereinafter: DSOs) when it comes to a successful energy transition[4]. While previous years saw a predominant focus on the need for rapid expansion in

[2] Bill Gates, The surprising key to a clean energy future https://www.gatesnotes.com/Transmission
[3] Hug pylons, not trees: The case for an environmentalism that builds. Available at: https://www.economist.com/leaders/2023/04/05/the-case-for-an-environmentalism-that-builds
[4] IEA Report on Electricity Grids and Secure Energy Transitions https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions/executive-summary

renewable generation (mostly solar and wind), grid modernisation and grid expansion, have now taken over the spotlight. Against this background, current legislative initiatives like the reform of the Electricity Marked Design (EMD[5]), are a positive trajectory toward a more grid-centric approach.

Reflecting on past initiatives such as the Clean Energy Package (CEP), the grid dimension was largely disregarded. Apart from this, the impact of the CEP has been rather limited, although it is considered as an innovative step towards defining necessary local energy management products - such as flexibility- through DSOs. Since then, it appears that progress has been slow, and the implementation of the CEP yet incomplete.

The transfer of responsibilities to DSOs in the context of the Electricity Market Design (hereinafter: EMD) revision, such as flexibility assessments formerly done by National Regulatory Authorities (NRAs), can be considered important steps towards the appropriate recognition of the new role of DSOs in the future energy landscape. Another notable development is connected to the introduction of the concept of "anticipatory investments", which has widely been appreciated by various stakeholders, including DSOs.

The emphasis on "anticipatory investments" represents a major shift in the Commission's perspective[6], demonstrating a proactive stance in addressing future challenges within the energy sector. This departure from reactive approaches calls for the need for strategic planning and lays the foundation for a more resilient and forward-thinking energy infrastructure.

In simpler terms, it is extremely important to prevent stagnation by understanding the perspectives of everyone involved in a particular field and considering this understanding when planning for the future. This thinking approach has contributed to our current situation, and if we don't grasp and address it correctly, it could impede the necessary changes in our energy sector in the years ahead.

1.2. Beyond legislation: reorganising energy structures and roles

The future energy system requires a fundamental reorganisation of its existing structures. This reorganisation should not only involve forward-looking investments and flexibility but also a systemic change that brings Europe closer to its desired net-zero reality.

Regulations alone cannot accomplish this task alone; instead, the decision-making processes need to be adapted practically. This goes beyond the EMD reform or any new legislative initiatives.

Furthermore, roles in the industry are constantly evolving, and what is considered "normal" today may look different in a few years. This underscores the importance of building strong and long-term relationships among the various actors involved. Introducing forecasting practices, which can help mitigate risks and distribute tasks more effectively among all market players, could be a way to monitor the evolving

[5] Reform of electricity market design: Council and Parliament reach deal https://www.consilium.europa.eu/en/press/press-releases/2023/12/14/reform-of-electricity-market-design-council-and-parliament-reach-deal/

[6] Joint Statement On EU Grid Action Plan https://edsoforsmartgrids.eu/edso-publications/joint-statement-on-eu-grid-action-plan

landscape of role restructuring and raise awareness within the industry. This, in turn, would provide investors with the confidence to continue investing where it is most needed.

Collaboration is essential to ensure a smooth and efficient transition to the new energy landscape. A key aspect of this collaboration involves sharing technical knowledge with government officials who make decisions about future regulations.

Flexibility has the potential to bridge between the grids' expansion capacity and customers' needs, ultimately reducing the substantial investments required to modernize and expand the aging grid infrastructure by 2050[7]. The Netherlands serves as a notable example in this context. There is growing pressure to connect customers to the network in the Netherlands[8], where capacities are insufficient to meet both demand and supply. Connection requests are on the rise, and unfortunately, the current rate of network expansion and modernisation is insufficient to keep up.

Figure 1: The Dutch case

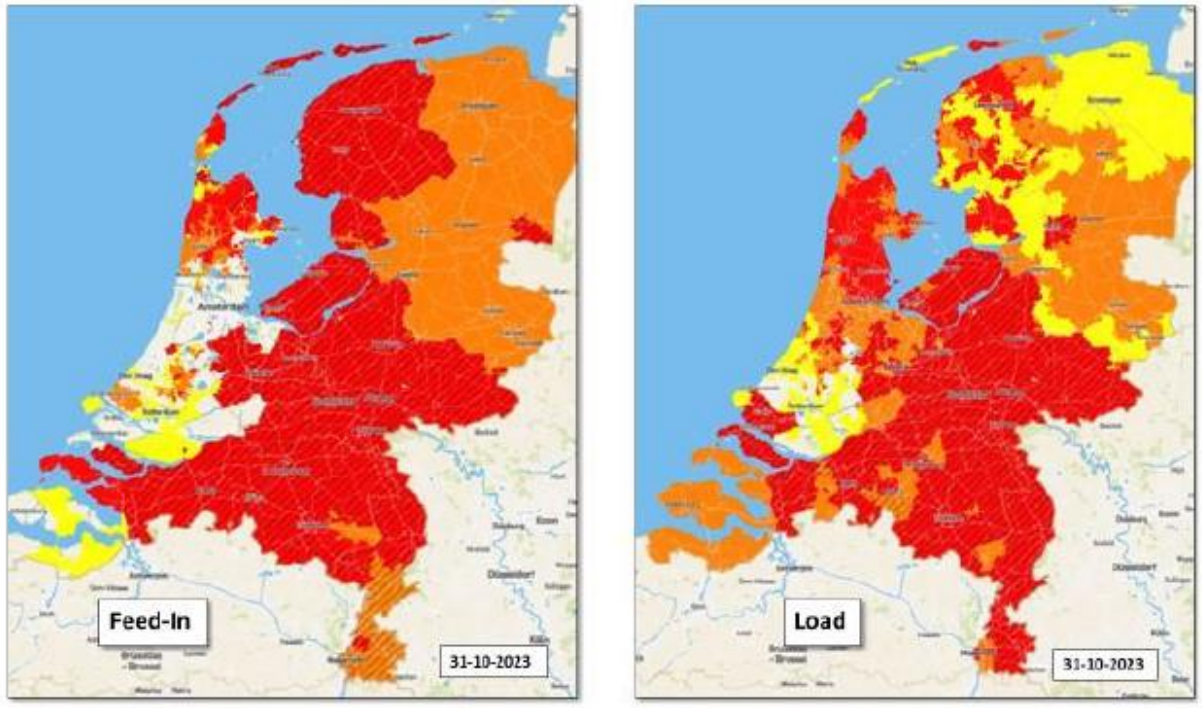

Figure 1: Dutch grid capacity challenges

However, Dutch DSOs are facing significant challenges, including a lack of sufficient financial resources, a shortage of technical staff (estimated at around 18,000 personnel), and time constraints to meet the Dutch

[7] Gridlock: Why Europe's electricity infrastructure is holding back the green transition https://ecfr.eu/article/gridlock-why-europes-electricity-infrastructure-is-holding-back-the-green-transition/

[8] Gridlock: how the Netherlands hit capacity https://www.enlit.world/smart-grids/grid-management-monitoring/gridlock-how-the-netherlands-hit-capacity/

2030 climate objectives for a 55% reduction in CO2 emissions. These challenges highlight the need for not only additional energy infrastructure but also a smart digital infrastructure that seamlessly interacts with markets and customers.

Unexpected advancements in technologies, such as the rapid increase in electric vehicles, greater subsidies for solar energy, and increased use of electrolysers, are the primary drivers behind this challenge.

Regulatory incentives should further encourage the use of "hidden flexibility"[9] and enhance the way customers are integrated and motivated to participate in the journey most efficiently and transparently possible.

Revamping tariff designs has surfaced as a promising strategy to actively involve customers. Nevertheless, the persistence of regulatory preferences for traditional tariff models is obstructing the advancement and acceptance of these innovative approaches within the market. The benefits of dynamic tariffs are especially noticeable in scenarios involving electric vehicles, the integration of renewable energy, and battery systems. The gradual introduction of hybrid tariff models into the market is contingent upon the successful implementation of the smart meter rollout.

II. Industry Collaboration for Grid Transformation. Future-Proofing Grid Infrastructure & Investments.

2.1. Industry collaboration as a driver of an accelerated energy transition

Effectively harnessing flexibility resources, whether in the form of EVs or heat pumps, represents a valuable solution to reinforce the widespread adoption of renewable energies. When reflecting on the evolution of flexibility trends, past forecasts concerning the use of smart meters have proven to be remarkably inaccurate[10]. Many countries underestimated the benefits of these devices, a miscalculation that is now negatively impacting European economies. In this context, DSOs bear a significant responsibility, making it imperative for them to adapt to a changing landscape of small-scale applications.

While there have been notable improvements in performance and the DSOs' quality of service in recent years, there are still several challenges and gaps to address. Key indicators of concern include the duration of power interruptions per customer and the frequency of these interruptions.

The share of electricity generated from renewable energy sources (RES) has risen from 30.2% in 2016 to a record high of 40.7% in 2022 in the EU[11]. However, the fact that 70% of renewable capacity is connected to the distribution grid presents significant challenges for grid networks[12]. These challenges encompass not only responding to new connection demands but also proactively anticipating future developments.

[9] The complementarity resources (hidden flexibility) among power networks that are not fully utilised.
[10] Smart Meters - Significant Inaccuracies Discovered https://www.iotforall.com/smart-meter-accuracy
[11] European Environment Agency (EEA), Share of energy consumption from renewable sources in Europe available at: https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from
[12] E.DSO, Eurelectric and Deloitte Monitor Study: Connecting the dots: Distribution grid investment to power the energy transition. Available at: https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/energy-resources/deloitte-ch-en-eurelectric-connecting-the-dots-study.pdf

This entails preparing for increased flexibility, improved balancing, congestion management, and enhancing coordination between system operators (TSOs and DSOs).

Cross-border electricity trade is on a steady rise, reflecting progress in implementing the EU internal electricity market. However, the extent of market integration and the use of cross-border capacities vary among regions and bidding zones. These variations are often constrained by network congestion and a lack of harmonisation in market rules and network codes.

In the realm of advancing grid network digitalisation and customer empowerment, it is worth noting that the rollout of smart metering has achieved the EU target of 80% in many EU countries[13]. However, in some other countries, the rollout is still in progress or has just begun.

The effectiveness of smart metering hinges on several factors, including the availability and accessibility of data, the interoperability of devices and services, and the active participation of both customers and prosumers. These elements collectively contribute to realise the full benefits of smart metering systems.

On a more basic level, the practice of recycling of scarce raw materials, such as copper, holds significant value for multiple stakeholders and play a critical role in maintaining the integrity of the electricity grid's network infrastructure.

The transformation of DSOs is underway, and to ensure the development of flexibility services across Europe, novel approaches and synergies are essential. These efforts should not be limited to interactions among DSOs but should encompass the entire energy system. Furthermore, it is crucial to prevent unnecessary investments in grids that can be addressed through the intelligent integration of flexible resources.

2.2. Bridging the gap between regulation and industry cooperation

Innovating in the realm of regulation is undeniably one of the most challenging tasks. It is compounded by factors such as regulatory complexity, inaction, the need to balance risks, and limited technological understanding at a given time. Nevertheless, European policymakers have demonstrated their progressive approach. Significant milestones in this journey include initiatives like the European Green Deal[14] and Fit for 55 (FF55)[15]. The introduction of concrete and ambitious targets to achieve net-zero emissions by 2050 was a pivotal step in setting the course in the right direction.

Further, the upcoming Network Code on Demand Response[16] deserves mention. This code is designed to facilitate the integration of flexibility and renewable energies into the system while allowing active customers to participate.

[13] ACER - CEER Energy Retail and Consumer Protection 2023 Market Monitoring Report, Table 12, page 94-95
[14] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[15] Fit for 55: Delivering on the proposals https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal/fit-55-delivering-proposals_en
[16] https://eudsoentity.eu/blog/closed-consultations-5/public-consultation-on-the-network-code-demand-response-draft-57

One notable example of regulatory innovation, the Net-Zero Industry Act (NZIA)[17], includes provisions for innovation sandboxes that create a regulated environment for fostering innovation. These sandboxes grant Member States and companies the freedom to choose the type of innovation they pursue. This approach incentivizes Member States to explore innovative solutions. The flexibility offered by these sandboxes is crucial as it allows for tailored, individualized solutions in each Member State. It serves as yet another demonstration of the Commission's commitment to designing effective regulations that promote progress in a unified direction while allowing for the freedom to choose appropriate and personalised pathways to achieve goals.

In E.DSO, we have a concrete example of successful industry collaboration with T&D Europe[18]. Within the framework of the NZIA, E.DSO and T&D Europe have established a strong and exemplary partnership. Their goal is to provide the necessary support for essential grid technologies as outlined in the NZIA. The industry faces significant investment challenges, including the modernisation and expansion of the grid, all within a timeframe of approximately 10 years. This collaboration is a testament to the commitment to addressing these challenges effectively.

The regulatory development must keep pace with technological advancements, allowing for a faster integration of these innovations. Without smart meters, owning an electric vehicle and having a technologically advanced, adaptable home are limited in their functionality, as smart metering plays a crucial role in enabling their full use.

While legislative processes may sometimes appear slow and deliberate, it is essential to acknowledge the EU's forward-thinking approach stands out globally. Regulatory initiatives like the Artificial Intelligence (AI) Act[19], upcoming Energy Data Space[20], and the Data Act[21] underline the commitment to foster and complement innovation.

Furthermore, the imperative of modernisation of grid infrastructure should receive full support to enhance grid planning, operation, and management. Inefficient approaches not only lead to financial waste but also contribute negatively to CO2 emissions. Policymakers must advance on the regulatory front, while market players should enhance their collaborative efforts to ensure the efficient management and use of infrastructure.

---

[17] The Net-Zero Industry Act: Accelerating the transition to climate neutrality https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en

[18] Let's Make It Real: Investing In Europe's Electricity Networks And Grid Technology Sector https://edsoforsmartgrids.eu/edso-publications/lets-make-it-real-investing-in-europes-electricity-networks-and-grid-technology-sector

[19] EU AI Act: first regulation on artificial intelligence https://www.europarl.europa.eu/news/en/headlines/society/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

[20] European Energy Data Space https://energy.ec.europa.eu/publications/common-european-energy-data-space_en

[21] Data Act: Proposal for a https://energy.ec.europa.eu/publications/common-european-energy-data-space_en Regulation on harmonised rules on fair access to and use of data https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A68%3AFIN

In conclusion, the path forward requires a concerted effort between regulators, industry players, and stakeholders to ensure the effective deployment of technology, modernisation of grid infrastructure, and the achievement of our collective goals.

III. Design Thinking for Customer-Centric Solutions

3.1. Consumer-centricity at the heart of the future energy landscape

There is a strong emphasis on putting the customers at the forefront of all energy policy discussions, particularly evident in the Commission's EMD reform.

In this context, the deployment of smart meters remains critically important. Smart meters serve as the primary source of the necessary data and information, providing customers with tools to manage their energy consumption effectively and enabling suppliers to enhance the efficiency of their services.

Moreover, the presence of an effective and supportive legal framework is crucial, not only for the development of new and innovative services but also for the production and consumption of energy. Energy exchange, often referred to as energy sharing, holds significant potential, especially in empowering customers through entities like energy communities.

However, there is currently no universally accepted industry-wide definition of energy sharing, which has led to varying visions and interpretations among different stakeholders. While reaching a consensus on a unified definition is a desirable goal for the future, the current lack of agreement should not hinder collaboration among various actors along the energy value chain.

The roles of all participants in the energy market are experiencing significant transformations, a trend that is expected to continue. Citizens, who will play a central role in the future energy system but may have limited knowledge about entities like DSOs, need to be more actively involved. Since all citizens interact with the energy network, it falls upon network operators, including DSOs, to take a proactive approach and raise awareness about these evolving roles.

To facilitate this, suppliers must gain a comprehensive understanding of their customers' profiles, recognising different customer types. The first type comprises informed and well-equipped customers who can benefit from advanced offerings like super-dynamic tariffs, load-shedding measures, and demand response. The second type consists of customers who may have less interest in energy matters, and suppliers can provide them with low-risk products such as fixed-price contracts. Finally, there are vulnerable consumers with distinct needs who require special attention.

To address the needs of these vulnerable customers, suppliers, and other market participants can consider establishing specialized teams that collaborate with government and social services. Regardless of the customer type, suppliers must acknowledge that liberalisation and energy markets must align with commercial objectives.

3.2. Challenges to implement a customer-centric energy system: energy sharing as potential solution

The importance of a consumer-centric energy system cannot be overstated. However, the idea of activating all customers and promoting energy sharing presents a significant challenge. Speed is a critical requirement in this endeavour. Once these initiatives are implemented and operational, their potential for scalability becomes virtually limitless, especially when combined with available technologies. This potential is even more evident when we consider the substantial investment required, which was estimated at €400 billion in 2021[22] but does not account for the updated and more ambitious renewable energy expansion goals, such as those outlined in legislation like the FF55.

Furthermore, it is essential to consider additional factors for the resilience of the energy system, particularly considering new concepts like energy sharing. This involves the need for technologies capable of handling fluctuations resulting from the increased prevalence of energy sharing among various market actors. Building a robust and adaptable energy infrastructure is key to meeting these challenges effectively.

Energy sharing holds appeal for customers within energy communities. It is important to note that the local aspect remains central in the concept of energy communities. Cross-border energy exchanges, at least until now, have typically been limited to exchanges between sister cities. Achieving an optimisation rate of around 80% relies on leveraging complementary resources like wind and solar power, alongside other tools such as peak load reduction and battery usage. This potential decreases significantly if the principle of local energy exchange is not applied. The emergence of different consumer types provides added flexibility in using various energy sources.

However, it is crucial to recognise that large, isolated energy communities can pose a substantial risk to network stability and, consequently, supply security. In some countries, such as Germany, this risk is becoming a reality as energy sharing between northern and southern regions is being planned. The inherent risks associated with transporting such large quantities of energy through the network necessitate a careful evaluation of costs and benefits. Maintaining a level playing field is imperative, ensuring that smaller market participants are not overshadowed. Additionally, administrative efforts become quite complex for such projects, spanning different geographical areas, and potentially traversing multiple DSO regions.

Effective cooperation between energy communities and DSOs is vital for the success of these communities. As all market participants adapt to their new roles, it is crucial to understand how DSOs and energy communities can mutually benefit from a more robust collaboration. The advantages of an energy community extend beyond energy sharing among its members. One significant benefit is the consolidation of smaller customers within a community, which simplifies DSOs' interactions with these new players by allowing them to deal with a single representative of the community. Moreover, these community models have the potential to evolve and become energy suppliers or generators, presenting yet undiscovered opportunities, even for DSOs.

[22] Ibid, Deloitte Monitor study

However, there are challenges associated with energy communities, particularly concerning their competitiveness within the sector[23]. This can create disadvantages for inexperienced, non-profit-driven energy communities when compared to well-established, experienced, and well-equipped market participants. Addressing these challenges is essential to ensure that energy communities can thrive and contribute positively to the energy landscape.

3.3. Technologies and services to meet customer expectations.

Customer-centric technologies have transformed information access, including faster and more convenient methods. Innovative network technologies, like advanced power management, expedite renewable energy integration and significantly reduce solar panel connection times, as has been shown in the UK. Digital Twin technology empowers customers to explore their needs and address climate change risks efficiently by considering weather conditions. Mature technologies like blockchain hold untapped potential, necessitating efficient management.

Furthermore, energy sharing and emerging players like energy communities highlight the essential role of energy customers in achieving Net Zero goals by 2050. However, this potential remains underutilised due to inadequate incentives for customer participation. As customer roles evolve, traditional market participants should support their entry into the market through collaboration and open exchange. Legislation should encourage this without compromising network principles and supply security. Digitalization and innovative technologies are readily available, necessitating efficient deployment.

Customers' flexibility is invaluable, making them central to the energy transition, with DSOs enabling this transition. Open and transparent communication is crucial for efficient cooperation among all market participants. Recent crises have heightened customer interest in active energy market participation.

IV. Conclusions

In this comprehensive exploration of the evolving energy landscape, we have witnessed a significant shift in focus from renewable generation to grid modernisation and expansion. Legislative initiatives, such as the Electricity Market Design (EMD) reform, are paving the way for a grid-centric approach, recognising the vital role of DSOs.

While the Clean Energy Package (CEP) made strides, it fell short in addressing grid-related challenges. The concept of "anticipatory investments" has emerged as a beacon of proactive planning, driving resilience and forward-thinking energy infrastructure.

Yet, transformation goes beyond legislation. It requires adaptable decision-making processes, industry collaboration, and a deep understanding of evolving roles. Flexibility resources are becoming invaluable, and smart meters are pivotal in empowering customers.

Energy sharing and communities offer promise but require careful consideration. We must balance customer-centricity with network stability and supply security.

[23] DSOs As Facilitators Of Energy Communities https://edsoforsmartgrids.eu/edso-publications/dsos-as-facilitators-of-energy-communities

In this journey, technological innovations like digital twins and blockchain play critical roles. Collaboration, transparency, and open communication among stakeholders are paramount.

Regulators, industry players, and customers all have roles to play. European initiatives, including the European Green Deal and Fit for 55, underscore a forward-thinking approach. Regulatory innovation is challenging but essential for progress.

Industry collaboration, such as E.DSO and T&D Europe's partnership, exemplifies commitment to grid modernisation. Smart meters are indispensable for an advanced energy landscape.

In conclusion, our collective effort will shape the energy transition's success. Customers, as central actors, demand attention, and active participation. By embracing innovation, collaboration, and a customer-centric approach, we can navigate the complex energy landscape and work toward a sustainable, resilient, and efficient future.