PERSPECTIVES ON TRANSFORMING UTILITY BUSINESS MODELS

Paper 5 – Business Model Development: Information Inputs for Decision Making

June 2024

INTRODUCTION

Energy utilities are in the early stages of transformation to a decarbonized future. Central to this journey are the art and science of decision making, with information and its timely dissemination playing a pivotal role.

Effective decision making impacts all aspects of a utility's business, both internally and externally. It involves understanding the dependencies and trade-offs across technical, operational, and business behaviors and actions, with success measured by the climate, economic, and social outcomes delivered. Making the best possible decisions is a strategic imperative for the utility, not only for its own success, but for helping to secure a sustainable future.

Good information and good decision making have always been key to a utility's success, but the transformation of the energy system that is happening today is profound, creating many new challenges and opportunities for the decision maker. The level of uncertainty and complexity is high, and the need for pace is unprecedented. Data and information are important resources for building the capability both to respond and mitigate associated risks, some of which are familiar, but many of which are new. These risks arise from a broad spectrum of sources such as changing weather patterns, social media enabled communities of interest, policy and regulatory dynamics, and geopolitical factors amongst many others. Change has altered the roles and perspectives of many stakeholders including citizens, customers, employees, investors, and supply chains, and must be taken into account.

Effective decision making increasingly depends on the flow of the right data and information to the right people at the right time. This aligns with the digitalization of many—if not all—aspects of the economy and society. More data is available, and there is an expectation that processes will be digitally enabled and engagement will be digitally informed. While this abundance of data may allow better decisions to be made, it also can equip others to challenge the correctness or appropriateness of those decisions. Evidence and opinion can become blurred. These effects can be felt in the utility, in the territory and markets in which it operates, and in the wider national context. Geopolitical influences can extend the effects even further to include the need for global awareness.

Data and information flows are critical across the life cycle of utility business models—from strategy and design to implementation and measurement, and ultimately evolution and/or potential replacement. As utilities transform to support Net Zero, they will seek ways to innovate. Business model innovation will be important; technology innovation will be necessary but not sufficient to ensure that utilities will be successful. There are substantial opportunities for those investing in and deploying new business models but only if the choices made are founded on good information and good processes.

The decision-making landscape encompasses many challenges including the number of diverse sources of data and information, the dynamics of information sharing and utilization, and the way that processes are used to help people act on the decisions they make.

The number and variations in the data sources available create a significant challenge: how best to find, select, and use data. Trying to use all the data and information that is available will be overwhelming. Technology supports data acquisition and storage while artificial intelligence (AI) has the potential to help make sense of it. Together these tools help people, using well-structured and implemented processes, to plan and operate networks and systems to deliver the best possible services to customers.

The information sources that could inform business model development come with both uncertainty and the challenge of accounting for those uncertainties to enable usable insights to be extracted. Applying AI and machine learning (ML) techniques may be helpful, but there remains the need to ensure that the right data of sufficient quality is used and that sound judgment is applied. Embracing a hybrid model that harnesses the strengths of both human intuition and technological capabilities means organizations can navigate uncertainties, extract actionable insights, and make informed decisions.

The ambitions that underpin achieving Net Zero require sophisticated decision making, addressing "what" utilities can do and "how" they might approach doing it. In this paper, the treatment of decision making focuses on "how" and considers the challenges and opportunities that arise.

THE ROLE OF GOOD DATA AND INFORMATION IN DECISION MAKING

Decision making happens in an environment where there are dynamic interactions across many actors; good decision making depends on having access to timely and relevant data and information necessary to understand these interactions and to reveal dependencies. Energy utilities, in their pursuit of Net Zero, will have to navigate a large and complex landscape of data and information sources. Each source contributes a unique dimension to the decision-making process, and a holistic approach is required to assimilate and interpret this diverse array of information.

The information derived from the vast landscape of sources is inherently uncertain, introducing a substantial challenge for decision makers. Uncertainties may arise from evolving customer preferences, unpredictable geopolitical events, or the volatile nature of financial markets for example.

The task is not only to recognize these uncertainties but to develop strategies that acknowledge and account for them, ultimately transforming uncertainty into a strategic advantage.

AI and ML present themselves as powerful tools capable of augmenting decision-making processes. By leveraging historical data, analyzing uncertainties, and predicting future potential, these techniques offer a systematic and data-driven approach to support decision making. However, integration of AI and ML must be approached judiciously to unlock their full potential with acceptable risk.

Decisions based on inaccurate or inadequate information, or which are made too early or too late, can have serious consequences for the utility. The impacts may be felt in operations, commercial position, or strategic direction. This is not to suggest that efforts should be devoted to trying to acquire all possible information and delaying decisions in an attempt to achieve certainty. It can be more effective and efficient to take reasonable measures to become informed, make a well-founded decision, and acknowledge that the decision may not be perfect. This course of action in turn suggests the need to have the resources and commitments in place to mitigate risks that might arise.

KEY DATA AND INFORMATION SOURCES

Effective decision making as utilities refresh and transform their business models depends on the availability of timely and relevant information. The spectrum of information sources is vast and varied and includes:

- **Consumer and citizen trends:** Shifting preferences and behaviors, driven by increasing environmental consciousness, concern about costs, and the need for assurance regarding security of energy supply are critical determinants of success in energy system transformation. People are more willing and capable of actively engaging through social media and other methods, providing not only a source of valuable insight, but doing so in an immediate way. Direct engagement through surveys, feedback mechanisms, and social listening tools provides real-time insights into changing expectations.

- **Policy and societal goals:** Legislative changes, government policies, and societal aspirations should reflect citizens' needs and economic priorities and shape the regulatory environment, influencing the trajectory of energy utilities. Monitoring these functions and the reporting on them can help ensure alignment with broader goals and facilitate proactive adaptation to policy, regulatory, and market shifts.
- **Technology development:** Advances in renewable energy, energy storage, and smart grid technologies are examples where technology is impacitng the industry landscape, presenting both opportunities and challenges. Engagement with research and innovation communities, manufacturers, and technology users will provide valuable quantitative and qualitative information on technology availability, performance, quality, and cost, supporting a proactive approach to technological integration.
- **Financial markets:** Access to capital, investment, and financial indicators provides insights into the economic viability of energy system transformation initiatives and helps develop understanding of the possible outcomes of undertaking such initatives. Close monitoring of global financial markets, trade dynamics, and geopolitical shifts allows energy utilities to anticipate and respond to external influences.
- **Competitor activity:** Understanding the strategies, actions, and offerings of competitors is essential for positioning energy utilities in a competitive market, fostering innovation, and achieving a sustainable advantage. Regular analysis will help guide strategic decision making.
- **Regulatory direction:** Compliance with evolving regulations and standards is crucial for maintaining operational resilience and public trust. Information on anticipated changes and compliance requirements, as well as performance against those requirements, will play an important role in shaping future plans.
- **Geopolitical direction:** Global geopolitical shifts can influence energy policies, trade agreements, and access to resources, thereby impacting the strategic decisions of energy utilities. Monitoring relevant direct and indirect influences will help develop timely responses to potential and real impacts.
- **The utility itself:** Data and information regarding the performance of the utility and its operations will be key to ensuring that information from across the landscape can be placed in the right context and applied most effectively. This means the utility should collect data from all key aspects of its business—financial, technical, service provision, and its relationships with internal and external stakeholders—and use that data to generate meaningful insights.

The scale of the challenge of identifying valuable data and information and ensuring that "blind spots" are avoided is substantial. Having access to the right data at the right time plays a critical role in taking the active and iterative approach that is essential to supporting and enabling adaptive change and continuous improvement.

It is important to be systematic in identifying, selecting, and using data sources, and to be sure their relevance and quality are maintained over time. Horizon scanning as explored in other EPRI work[1] could be helpful in this endeavor and may offer confidence that the best possible data and information are being applied.

The importance and prominence of energy system transformation have seen many new sources of data and information emerge adding to an already active landscape of providers to the industry. These sources address technical, environmental, financial, market, policy, regulatory, consumer, and many other data types. Primary sources are mixed and fused to create secondary sources and to generate insights which are also made available. Some data is open, other is available on a commercial basis; some data is available on an ad hoc basis, other by subscription. There is also increased availability of data inside the utility itself as its operations and business activities digitalize. The options that utilities face require them to have a data management and governance approach that aligns with their business strategy.

The diversity of information that utilities can access and use in their decision making is illustrated by reference to just a small sample of sources available such as:

1 *Perspectives on Transforming Utility Business Models Paper 1: Horizon Scanning and Forecasting*, EPRI, Palo Alto, CA: 2024. 3002028820.

- Bloomberg New Energy Finance: A comprehensive data source across the energy sector with a global perspective | BloombergNEF (bnef.com)
- The utilities practices in the major consultancies including Accenture, Boston Consulting Group, EY, KPMG, McKinsey, PwC, PA Consulting, and others | The data-driven enterprise of 2025 | McKinsey
- The smaller specialist consulting and analysis firms that address more localized interests | Technology & Data from LCP Delta
- The government agencies and regulatory bodies | Data Best Practice Guidance (ofgem.gov.uk)
- The trade bodies representing the utilities and their supply chains | Energy Networks Association (ENA) - The voice of the networks
- Academic and other research and innovation organizations | Welcome to the Smart Energy Research Lab - Smart Energy Research Lab (serl.ac.uk) and Open Data - Energy Systems Catapult

THE KINDS OF DECISIONS ENERGY UTILITIES WILL FACE

The journey to Net Zero will generate significant transformation in the business models of energy utilities. Traditional business models in the electricity sector for example, are centered around fossil fuel-based power generation and a one-way flow of electricity to consumers; they do not align with the emerging decentralized, distributed, digitalized system of the future and therefore may not serve well the goals of decarbonization and sustainability. To navigate this transition successfully, utility companies will pursue new business models that prioritize low-carbon energy sources, energy efficiency, flexibility, and customer engagement.

In earlier work undertaken by EPRI,[2] consideration was given to scenarios that describe possible futures for utilities and how these might be reflected in new or refreshed business models. These are shown in Figure 1.

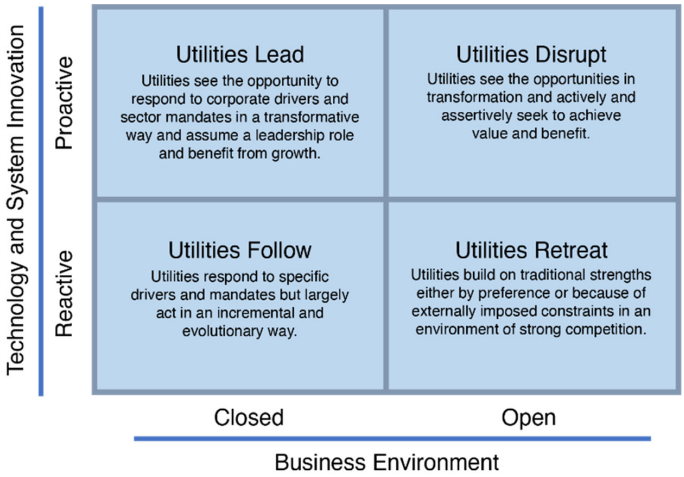

Figure 1. *Energy system transformation scenarios for utilities*

These scenarios show possible relationships between the approach adopted for innovation and the extent to which the policy, regulatory, financial, and commercial environment offers encouragement and support for change. Consequently, the scenarios provide a way to organize and describe the context in which utilities are likely to be required to operate and reveal options for how they might choose to participate. They reveal questions that require well-informed, timely decision making across key strategic areas and provide focus on important considerations such as:

- Possible responses to changes that are happening or could happen in the energy landscape, in commercial and/or innovation environments
- Conditions that must be true in order for a utility to respond in a particular way
- Perspectives of other stakeholders and how they might align or conflict with those of the utility
- The transformation destination being sought
- Possible strategic options for reaching the destination successfully

These questions may be explored at a further level of detail as illustrated in Table 1.

2 *Towards Net Zero: The Evolving Utility Business Model and Possible Future Scenarios*, EPRI, Palo Alto, CA: 2022 3002025745.

Table 1. *Issues utilities may need to address when considering participation in changing business environments*

ASPECT	CONSIDERATIONS FOR HOW UTILITIES MIGHT CHOOSE TO PARTICIPATE
Strategy: Focus on markets and customers where competitive advantage can be sustained in what is an uncertain and unpredictable environment.	• Which markets to pursue? • Where to position on the value chain? • Energy only? • Options that are realistically available? • Positioning against competing demands? • How to play: individual player or with partners? • Measuring success: what success factors will be measured, how, and why? • What mergers, acquisitions, and partnerships could be needed or beneficial? • Restructuring to enable participation in unregulated markets?
Carbon: Commit to delivery of decarbonized energy and to operating decarbonized business.	• Can required decarbonization be provided inside a viable business model and financial constraints? • What offering can be made that aligns? • Desired customer/community perception of the organization?
Resilience: Satisfy economic and social needs for reliable and resilient sources of energy.	• Can required resilience be provided inside a viable business model and financial constraints? • What level of resilience and of what kind do you want to offer (aligned with service offering)?
Reputation: Respond to consumers' and citizens' needs, and act in a way that builds positive, trust-based relationships and respect in the community.	• Which customers? • Where to position in the market (in terms of offering and quality)?
Risk: Identify, evaluate, mitigate, and manage the interdependent technical, operational, and commercial risks that arise with change.	• Risk appetite? • Mitigate or accept?
Financial: Be financially robust and sustainable, following best corporate practice.	• Which business model? • What are the costs of implementation/change? Can this be afforded? • Is the new business model sustainable?
Innovation: Be innovative, drawing on the best that technology has to offer and apply it in the most effective and efficient ways.	• Leverage existing strengths and optimize, or embrace innovation? • Focus and priorities if innovation is to be key? • How to address the risk of stranded assets?
Policy: Operate within the policy structures and engage positively with policymakers.	• How active to be in trying to drive change? • Knowing what you want… which changes and which priorities? • Aligning the business with the desired policies?
Regulation: Maintain constructive relationships with regulatory bodies and comply with the spirit and rule of regulation.	• How active to be in trying to drive change? • Knowing what you want… which changes and which priorities? • Aligning the business with the desired policies?

Decisions will not be conveniently limited to one of these considerations; instead, there will be complex dependencies and trade-offs that must be accommodated. This necessitates good data, good processes, and good culture in order to make the best possible judgments.

The value of data and information in making real-world decisions—supported by the right tools and processes—is illustrated in the three brief case studies which follow.

CASE 1: LINEAR INFRASTRUCTURE PLANNING

The planning and deployment of energy infrastructure is technically, environmentally, and socially complex. Tools and processes enabled by extensive data and AI are increasingly being used to support the required decision making.

One example of such a tool is Optioneer offered by Continuum Industries, which has been applied in various energy scenarios including:

- SSEN Transmission choose final alignment | Continuum Industries
- Fred. Olsen Seawind and Vattenfall JV complete grid connection route | Continuum Industries
- NGN and Arup Use Optioneer for East Coast Hydrogen | Continuum Industries

The use of tools with the benefits of the right data enables design to be undertaken more quickly. This in turn enables the processes of consultation with local stakeholders to begin sooner and to be more effective, given that options can be revealed and discussed. The approach also enables better communication and collaboration internally and with external specialist consultants and contractors.

This approach aligns with the thinking and recommendations of the UK's Linear Infrastructure Planning Panel, which highlighted the complexity of decision making and the need for sophistication in the use of data, information, and engagement.

- Linear Infrastructure Planning

The work of the UK's Electricity Network Commissioner also identified the role of data in addressing the challenge of halving the time it takes to build electricity transmission infrastructure. Specific recommendations are made about the necessity of data sharing to achieve desired outcomes.

- https://assets.publishing.service.gov.uk/media/64c8e85219f5622360f3c0ee/electricity-networks-commissioner-companion-report.pdf (see particularly section 5.13 starting on page 40)

CASE 2: NATIONAL, REGIONAL, AND LOCAL SYSTEM PLANNING

Decarbonization of the energy system will require interventions at national, regional, and local levels. These efforts need to be aligned and mutually supportive if good outcomes are to be delivered at lowest cost and greatest pace. Spatial data is one example of the data that will be needed to support the planning process, with the same data enabling all levels. Additional data needed relates to the energy assets that are available or planned and energy demand, being just two examples.

Data-enabled decision making in response to this requirement is facilitated by various approaches and toolsets. Addressing uncertainty is one aspect of these tools. An example is illustrated by Decisio™, a decision-processing tool offered by Business Modelling Applications, in Figure 2.

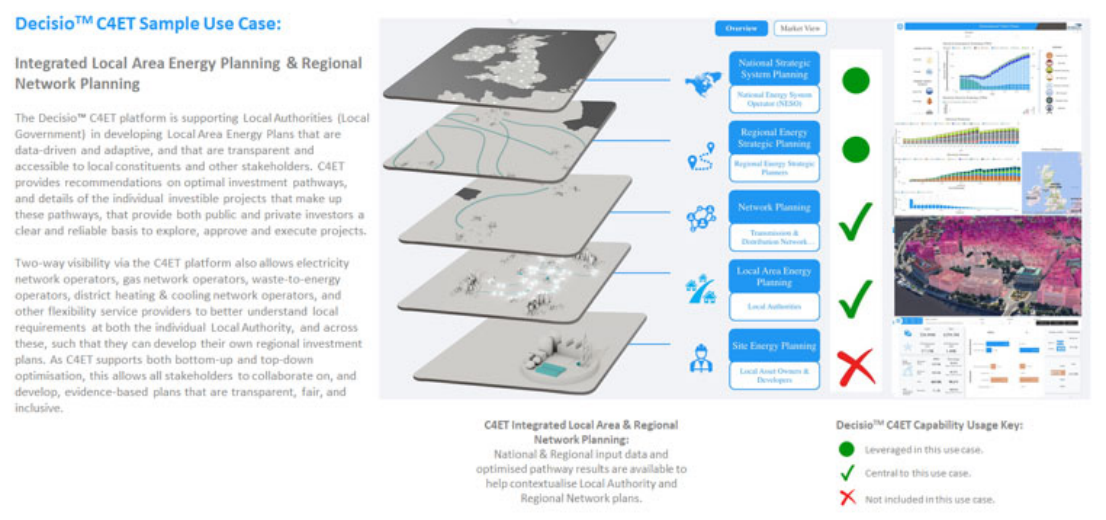

Figure 2. *Spatial data modelling in energy networks using Business Modelling Applications' Decisio environment*

Integration of different data sets—with the same data being shared across various levels of interest—provides scenarios that enable insights into uncertainty.

One of the challenges that this type of planning encounters is the wide variation in data, in terms of availability, quality, and type. The principles of creating the structures for data sharing as proposed by the Electricity Networks Commissioner (as referenced in Case 1) apply in this case specifically and across the sector generally.

CASE 3: USING AI TO SUPPORT DECISION MAKING

Working with a major gas transmission utility and consulting partner, Ockham, a UK knowledge operations business, proved a novel approach to the technical knowledge work of applying a specification to pipeline repurposing compliance decisions. The company's system ''atomized" unstructured technical content from the specification into knowledge blocks. These knowledge blocks enabled transformation of decision workflows through application of digital technologies to support decision makers' efforts to improve pace and quality. The project identified important considerations:

- Preparation of data, information, and knowledge system architecture to position for application of digital technologies is key.
- Target implementation of tools that support core activities across the whole asset lifecycle as a "first step."

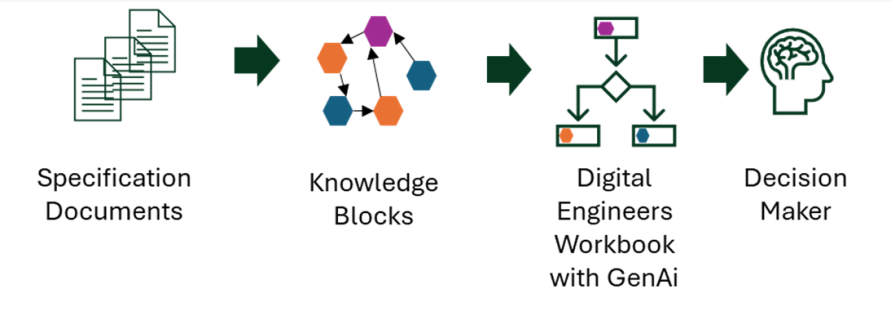

Figure 3. *Ockham's approach using AI to support decision making* https://ockhamhydrogen.com/

USING DATA AND INFORMATION TO ITS FULLEST POTENTIAL

Transformation of the energy system in pursuit of Net Zero is characterized by uncertainty, complexity, and urgency. Effective governance of the system and its transformation depends on stakeholders having timely access to the right data and information to enable them to make good, well-informed decisions. Enabling well-informed decision making requires consideration of several key success factors in using data and information effectively. These factors and the relationships between them can be illustrated as shown in Figure 4.

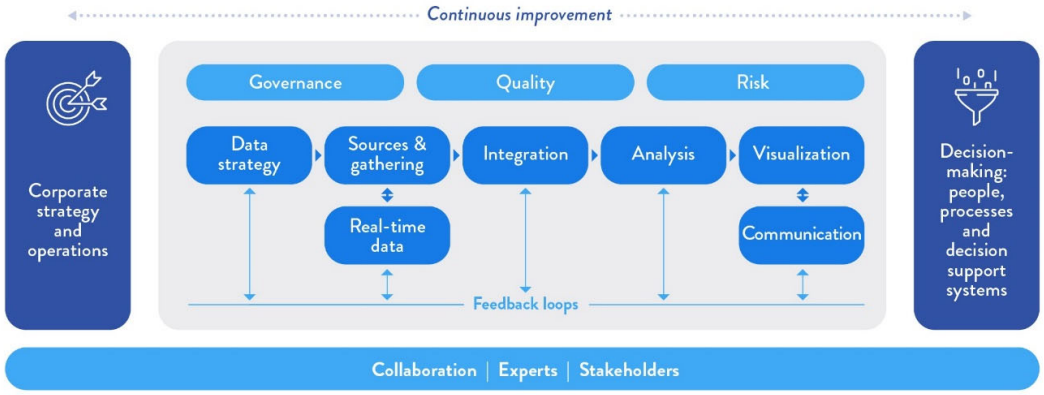

Figure 4. *Data and information for decision making*

The components of this approach comprise:

- **Corporate strategy and operations:** The purpose and direction of the utility as reflected in its strategy and operations will inform what data and information are needed to enable effective decision making.
- **Data strategy:** The utility needs an understanding of the data required to support and enable decision making. Using the most appropriate data will help clarify decisions the business is or will be making This understanding can form the basis of a data strategy that addresses what data is to be acquired, how it is to be acquired, and what priorities apply. This in turn will inform and help shape the overall business and operational strategy.
- **Data gathering and sources:** With the benefit of the data strategy, the next step is to identify and efficiently access a wide range of information sources, including customer data, market research, industry reports, financial data, competitor analyses, and government publications. The approach taken should consider both internal and external sources in order to help gather diverse and relevant data.
- **Real-time information:** Gathering and analyzing real-time information will support adapting quickly to changing conditions and making timely decisions. Doing this well requires appropriate systems and processes to be implemented.
- **Data integration:** Integration of the data from various sources following the strategy and using innovative techniques will create a unified, comprehensive dataset and a view of the business environment.
- **Data analysis and AI/ML:** AI and ML techniques will play an increasingly important role in analyzing historical and real-time data, identifying patterns, and predicting future trends. These techniques will help make sense of large datasets, uncover hidden insights, and model uncertainties.
- **Data visualization:** Data visualization tools are needed to present information in a clear and understandable manner, helping stakeholders to grasp complex data more easily.
- **Transparent communication:** Transparent communication of decisions and the rationale behind them—including the data and information employed—is essential for building trust among stakeholders, including consumers, citizens, employees, and investors.
- **Feedback loops:** The data and information landscape is continuously changing. Feedback mechanisms are

needed to assess the accuracy and relevance of the information being acquired and used, with adjustments being made based on learnings.

- **Data governance:** Implementing robust data governance practices ensures the accuracy, integrity, and security of information.
- **Data quality:** Data quality control processes will be needed to help ensure data accuracy, reliability, and consistency. The credibility and relevance of information sources should be validated.
- **Risk management:** Risk management strategies must include those that mitigate the potential negative impacts of data and information-related issues.
- **Cross-functional collaboration:** Collaboration between different departments and teams within the utility organization should be encouraged. Cross-functional teams can provide diverse perspectives. This will help ensure that insights from different groups and departments contribute to coordinated and coherent decision-making processes.
- **Expert input:** Subject matter experts and key stakeholders are crucial to data and information review, as they have unique understanding that will offer valuable insights, validate data, and help in interpreting complex information.
- **Stakeholder engagement:** External stakeholders, including government bodies, regulators, community representatives, and supply chains, serve as both sources and users of data and information. Effective stakeholder engagement will foster a holistic approach to decision making that considers broader economic and societal goals.
- **Decision support systems:** Decision support systems (DSS), which integrate data analytics and AI to provide decision makers with relevant insights and recommendations, facilitate access to the benefits of extensive data and information. These systems enable people to make informed decisions using strategically consistent processes.
- **Continuous learning:** The pace of change in the energy and digital sectors highlights the need to stay up to date with the latest trends in data analytics, AI, and decision-making methodologies and to encourage a culture of continuous learning and improvement within the utility organization.

… BUT THERE ARE CHALLENGES

There are challenges that using rich sources of data present in decision making processes. Among these are:

- **Data overload:** The temptation to collect "all the data" is strong, but an overabundance of data does not necessarily generate good information and can overwhelm decision makers, leading to paralysis. Obtaining data should be preceded by careful consideration of the data's purpose, what contribution it can make, and what value it will potentially provide as described in the data strategy. Discipline is needed in both the framing of the strategy and its implementation.
- **Technological integration:** AI and ML are seen as solutions to the opportunity presented by data. While there is truth in this—they will help in acquiring, improving, and using data—they are not a panacea. While they offer immense potential, integrating these technologies into existing systems requires strategic planning, investment, and a robust technological infrastructure. Developing a clear strategy for adopting and integrating AI and ML technologies involves assessing organizational needs, investing in the right tools, and providing adequate training.
- **Human-AI collaboration:** Striking the right balance between human intuition and the analytical capabilities of AI is crucial. Decision makers must not become overly reliant on technology, recognizing the irreplaceable value of human judgment.
- **Cultural shift:** Embracing a culture that values data-driven decision making and continuous learning is essential. This cultural shift involves training and upskilling the workforce, fostering innovation, and cultivating a mindset that views change as an opportunity for growth.

LESSONS FROM OTHER SECTORS

Energy utilities can draw valuable lessons from other sectors that may inform or help shape decisions as they consider business model change and the use of data to support this task. Cross-sector learning may reveal how data drove innovative strategies, best practices, or approaches that have been applied elsewhere with success. These include:

- Customer-centric approach from **Retail:** Understanding customer needs and improving customer satisfaction by providing personalized services, transparent communication, and interactive platforms for engagement.

- Agile methodologies from **IT and Software Development:** Using agile frameworks to enable faster adaptation to changing market conditions, technological advancements, and regulatory landscapes, enhancing overall organizational adaptability.
- Innovative financing models from **Finance and Investment Sectors:** Leveraging alternative financing mechanisms to provide necessary capital and risk management approaches to address uncertainties.
- Supply chain optimization from **Manufacturing and Logistics:** Implementing efficient supply chain management to reduce costs, minimize waste, and improve operational resilience.
- Digital transformation from **Tech and Telecom:** Monitoring and controlling assets in real time, optimizing operations, and providing customers with data-driven insights and offerings.
- Sustainability practices from **Automotive and Manufacturing:** Applying sustainable practices to minimize waste, lower carbon footprints, and address circular economy opportunities.
- Collaboration and ecosystem building from the **Pharmaceutical Sector:** Collaborating with diverse stakeholders, including technology providers, research institutions, and others to accelerate innovation and promote shared solutions.
- Regulatory engagement from **Highly Regulated Industries:** Studying regulatory engagement practices from highly regulated industries, such as pharmaceuticals and finance, to effectively navigate and influence regulatory frameworks.
- Cross-industry collaboration from **Open Innovation Models:** Collaborating with organizations outside the energy sector to facilitate the exchange of ideas, accelerate innovation, and provide access to diverse perspectives.
- Adoption of circular economy principles from **Consumer Goods and Manufacturing:** Reducing waste and promoting resource efficiency.

By drawing on these cross-sector learnings, energy utilities can gain the benefits of the experience of others in transformation. This experience may not translate directly to the energy sector, but the successes and failures can help inform and shape the approaches and tools that may be implemented to support decision making as it relates to business models. In particular, it might be helpful to explore the kinds of data that were most useful, how the data was sourced, how it was shared and used, and some of the barriers and risks involved.

THE RISKS OF FAILING TO EVOLVE DECISION MAKING

Energy utilities could face many risks associated with bad decision making in their business models, particularly in the context of the transition to a more sustainable and resilient energy system. These risks can have profound implications for the financial health, reputation, and long-term viability of a utility and may include:

- **Financial instability:** Poorly conceived business models may lead to financial instability for energy utilities. Overinvestment in outdated infrastructure, misjudged market trends, or failure to anticipate regulatory changes can result in financial losses. Financial instability can hinder the ability of utilities to make necessary investments in renewable energy and grid modernization for example.
- **Stranded assets:** Failure to adapt to evolving market conditions and regulatory frameworks may result in stranded assets, where existing investments become obsolete or economically unviable. Stranded assets can lead to significant financial losses and undermine the utility's ability to recover investments, negatively affecting shareholder value and potentially requiring costly decommissioning efforts.
- **Regulatory non-compliance:** Inadequate alignment with evolving regulatory requirements and failure to meet environmental standards can lead to regulatory non-compliance. Regulatory penalties, fines, and legal actions can result, damaging the utility's reputation and financial standing. Strained relationships with regulatory bodies may hinder future projects and approvals.
- **Reputational damage:** Poor decision making in areas such as environmental responsibility, community engagement, and ethical practices can lead to reputational damage. A damaged reputation can erode public trust, provoke public opposition, and lead to increased scrutiny from regulators and policymakers. It may also deter investors and partners, affecting the utility's ability to attract capital and secure partnerships.
- **Technology and innovation lag:** Failing to embrace technological advancements and innovation in the

energy sector can result in a lag behind competitors. A lack of innovation may lead to inefficiencies, reduced competitiveness, and missed cost-savings opportunities. It can also hinder the utility's ability to adapt to changing market dynamics and customer preferences.

- **Failure to address climate risks:** Inadequate planning and mitigation strategies for climate-related risks, such as extreme weather events or shifts in resource availability, can expose utilities to significant vulnerabilities. Increased frequency and severity of climate-related events can disrupt energy infrastructure, lead to service interruptions, and result in financial losses. Failure to address climate risks may also impact the utility's long-term sustainability.
- **Community opposition:** Ignoring or inadequately addressing the concerns and needs of local communities can result in community opposition to utility projects which may lead to project delays, legal challenges, and increased project costs. It can also harm the utility's social license to operate, affecting relationships with key stakeholders.
- **Cybersecurity threats:** Inadequate cybersecurity measures may expose utilities to the risk of cyberattacks, data breaches, and operational disruptions. Cybersecurity threats can compromise the integrity of the energy system, disrupt operations, and lead to the loss of sensitive customer information. The resulting financial and reputational damage can be substantial.
- **Lack of resilience:** Failure to build resilient infrastructure and adapt to changing environmental conditions may leave utilities vulnerable to disruptions. Increased frequency of extreme weather events, natural disasters, or other disruptions can lead to service interruptions, increased maintenance costs, and compromised grid reliability.
- **Inadequate talent management:** Neglecting workforce development and failing to attract and retain skilled talent can hinder a utility's ability to innovate and adapt to changing industry dynamics. Inadequate talent management can result in a lack of expertise in emerging technologies, slow response to market trends, and an inability to implement new business models effectively.
- **Failure to embrace customer-centric approaches:** Overlooking the importance of engaging and meeting customer expectations may result in a disconnect with consumer preferences and needs. Utilities that do not prioritize customer-centric approaches risk losing customers to competitors, facing increased customer complaints, and struggling to adapt to changing consumer demands.
- **Global market challenges:** Ignoring global market trends, geopolitical factors, and international cooperation may leave utilities unprepared for global challenges and opportunities. Global factors such as geopolitical tensions, trade policies, and market dynamics can affect energy prices, supply chains, and regulatory environments, impacting the financial performance of utilities operating in multiple regions.

Energy utilities must carefully consider the potential risks associated with their business models to ensure resilience, adaptability, and long-term sustainability. Proactive decision making that prioritizes innovation, environmental responsibility, and stakeholder engagement is essential to navigating the complexities of the evolving energy landscape and contributing to the global effort to achieve Net Zero. Mitigation of these risks depends on access to the right data and information at the right time and the necessary resources and commitment to address them.

CONCLUSION

Effective information gathering: A foundation for informed decision making

The journey to Net Zero requires energy utilities to assimilate information from numerous and diverse sources. Traditional channels such as financial markets and competitor activities provide essential insights, but to stay ahead in a rapidly evolving landscape, organizations must broaden their field of view. Monitoring emerging areas, including technological advancements and societal goals, is crucial for developing a holistic understanding of the forces that will shape the sector and its businesses. Horizon scanning[3] will be an important activity.

Understanding changing customer trends will continue to be critical and grow in importance. As consumers become increasingly conscious of their carbon footprint, engage in providing energy services, and demand more in terms of sustainable behavior from utilities, gathering and analyzing data on consumer preferences, behavior, and expectations

3 *Perspectives on Transforming Utility Business Models Paper 1: Horizon Scanning and Forecasting*, EPRI, Palo Alto, CA: 2024. 3002028820.

will be essential for tailoring services to meet evolving needs.

Maintaining an understanding of policy and regulatory developments is also critical. Changes in this landscape will affect market dynamics and play a role in shaping the commercial and innovation environments in which the utility operates. Effective information gathering should encompass a global perspective giving the broadest possible base to help decision makers anticipate and respond to geopolitical shifts that may influence the energy sector.

Timely communication: Enabling and accelerating decision making

Timeliness of sharing and exchanging data and information is a necessity as energy utilities transition to Net Zero. The effectiveness of decision making depends on the flow of information between key stakeholders. Delays in communication can result in missed opportunities, ineffective or inefficient action, or erode the support of needed stakeholders. Decision makers must not only be aware of relevant information but also be equipped to act upon it at an appropriate pace.

Collaboration between different departments within the utility is equally vital. Siloed information can lead to disjointed decision making, hindering the development of cohesive strategies. By fostering a culture of open communication, energy utilities can break down internal barriers, ensuring information flows across departments and levels of the organization.

Fostering a culture of continuous learning and adaptability

The journey to Net Zero is a continuous process of adaptation and evolution. Energy utilities must cultivate a culture of continuous learning within their organizations to keep pace with the rapidly changing landscape. Decision makers should be equipped with the latest, appropriate tools and methodologies for information analysis.

Embracing new technologies should not be seen as a one-time initiative but as an ongoing commitment to staying at the forefront of industry advancements. A culture of adaptability enables energy utilities to adapt swiftly in response to emerging trends, regulatory changes, and technological innovations.

Accessing new opportunities

Energy utilities that are committed to effective and strategic use of data and information in their decision-making practices can unlock a range of opportunities that might not otherwise have been obvious or visible. Focused and creative analysis will help in assessing the potential and evaluating associated risks of these opportunities.

Opportunities can be revealed that may contribute to long-term sustainability, competitiveness, and positive societal impact. These may be reflected in customer-centric business models for example. Utilities that prioritize customer satisfaction and address evolving consumer preferences can enhance brand loyalty and attract new customers; clarity in the offering is made possible by understanding where there are gaps or failure to respond to change quickly enough.

Market diversification is another area of new opportunity. Diversifying services and entering new markets, such as electric vehicle charging infrastructure or energy services, can create additional revenue streams. Market diversification helps utilities navigate changes in consumer behavior and market dynamics.

A further perspective on how opportunities can be enabled by data and analysis is that of finance and investment. Risks will be clearer, and confidence in the potential returns and the mechanisms for measuring progress and achievement will be greater.

Data and analysis can also help organizations understand where strategic partnerships and alliances could provide access to complementary resources and expertise. Partnerships may be at a local scale or provide a more ambitious opportunity, offering the potential to expand into other markets, potentially even international markets, thereby opening new avenues for growth.

Accounting for uncertainties: The role of AI and ML in decision making

Uncertainties are inherent in the journey towards Net Zero. Energy utilities face challenges ranging from technological uncertainties to shifts in consumer behavior and regulatory landscapes. Addressing these uncertainties requires a sophisticated approach in which AI and ML technologies emerge as invaluable assets.

These technologies excel in analyzing vast amounts of data, identifying patterns, and predicting future trends. Leveraging historical data, AI and ML can assist in navigating uncertainties and extracting meaningful insights to inform decision making. For instance, predictive analytics can be employed to forecast energy demand, helping utilities optimize their resource allocation and reduce waste.

The hybrid approach, combining human expertise with AI and ML capabilities, is particularly potent in dealing with uncertainties. Human intuition and experience play a crucial role in interpreting complex information and making decisions that AI and ML algorithms may struggle to grasp. Integrating the strengths of both human and machine intelligence allows for a more comprehensive understanding of the complex factors at play.

Moreover, AI and ML technologies can enhance risk management strategies. By identifying potential risks and predicting their impact, decision makers can proactively mitigate challenges and position their organizations for success in the evolving energy landscape.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

EPRI CONTACT

NEIL HUGHES, *International Executive Director*
+44 7979 708360, nhughes@epri.com

For more information, contact:

EPRI Customer Assistance Center
800.313.3774 • askepri@epri.com

3002030494 **June 2024**

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 650.855.2121 • www.epri.com