Session 10: Business Models

Agenda

- ✓ Business Models for Digitalization of the Utilities and Smart Grids
- ✓ “CAPEX Models” vs. “As a Service, OPEX Models” vs. TOTEX
- ✓ Regulatory Sand Box Model
- ✓ Enabling Regulations and Tariff Methodologies
- ✓ Business Models Related to the Technology Implementation
- ✓ Innovative Business Models and Revenue Streams for Utilities
- ✓ Cost Benefit Analysis for Validation of Project Viability and Business Model
- ✓ Key Takeaways related to Business Models

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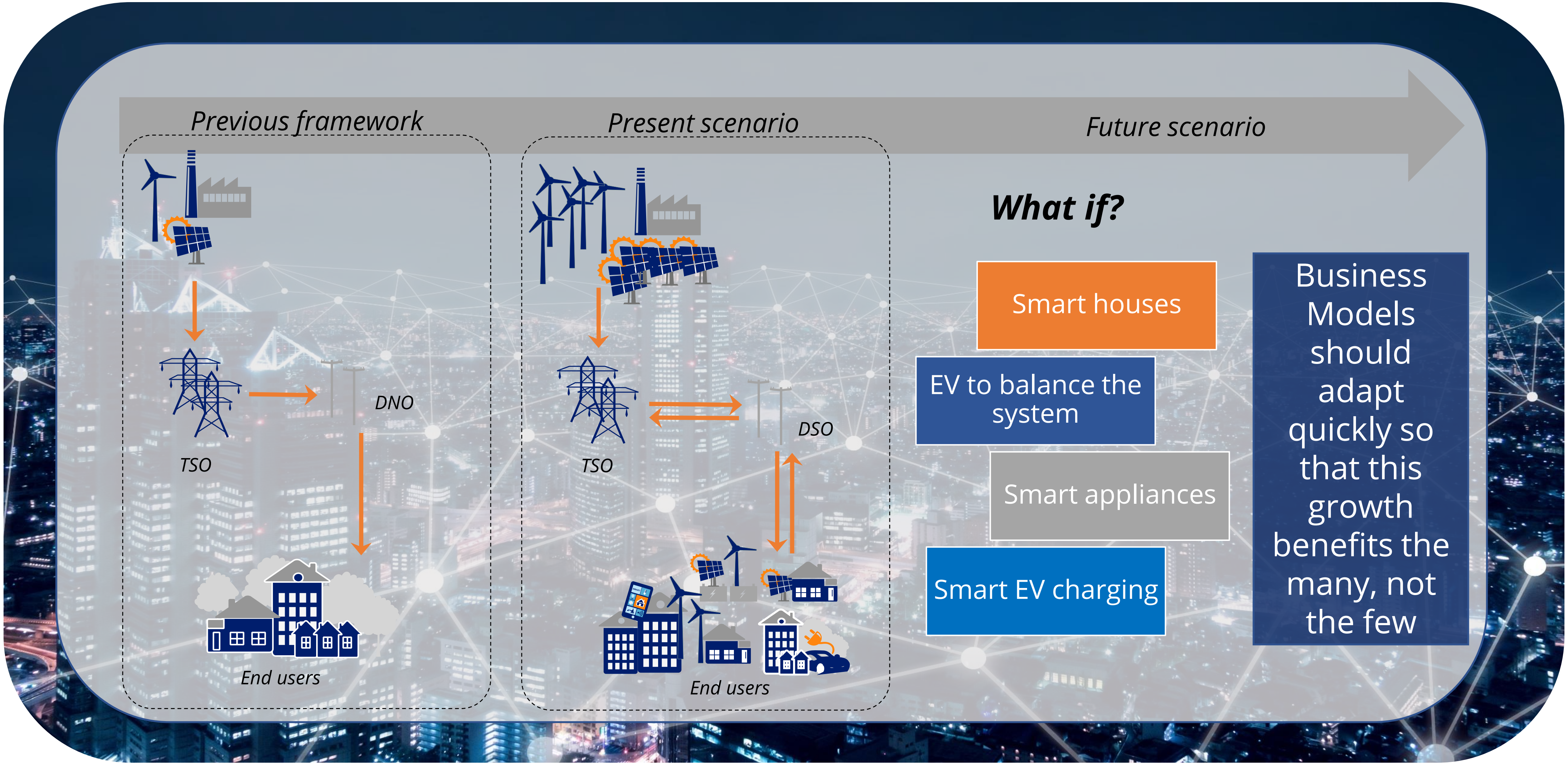
Electricity market changes - a new world for networks



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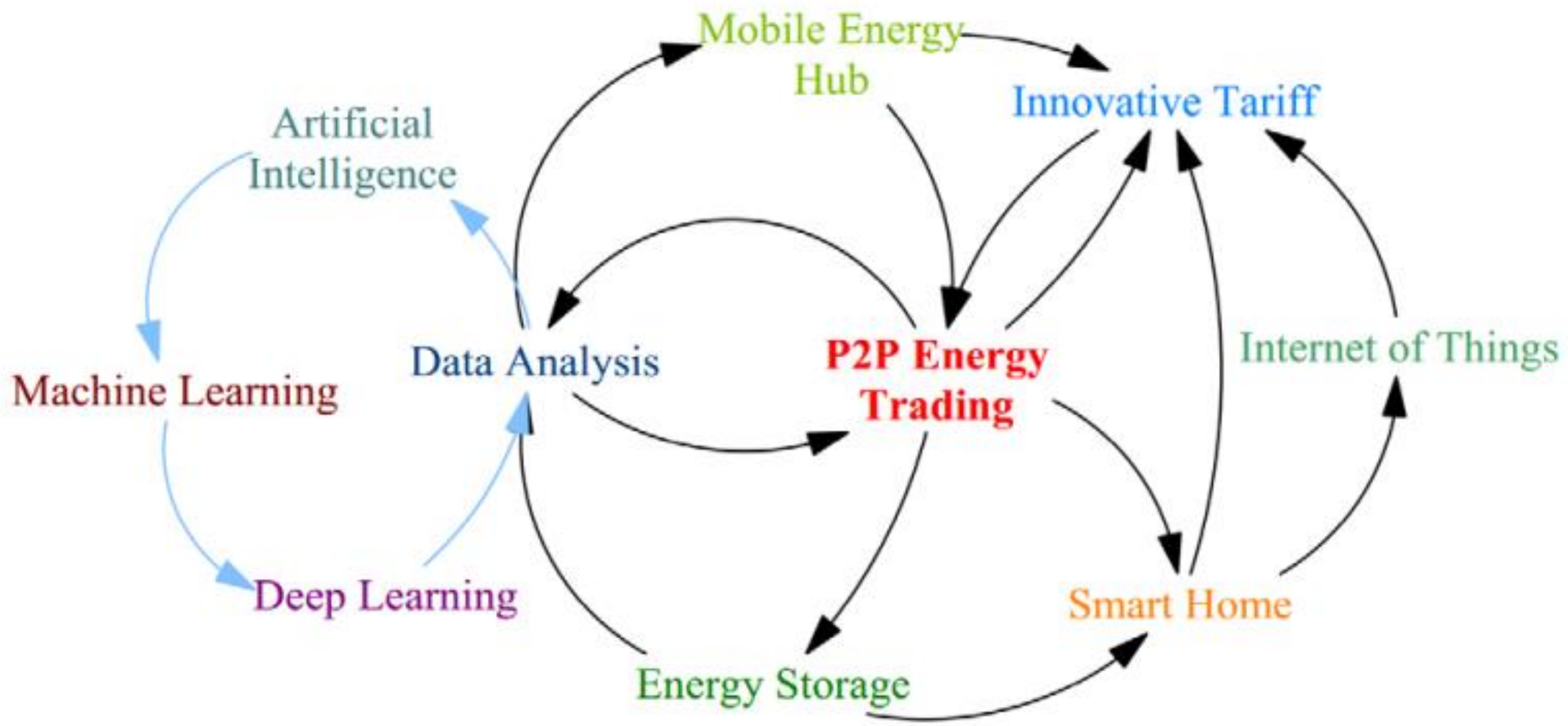

Business Models for Smart Grid Development

Business Models

1. As-a-Service Models

This model allows utilities to use software, platforms, and infrastructure on a subscription basis without owning them outright. It includes Software as a Service (SaaS) for managing grid data analytics, Platform as a Service (PaaS) for application development and deployment, and Infrastructure as a Service (IaaS) for computing and storage resources.

2. Performance-based Contracting

Utilities and service providers enter into agreements where payment is based on achieving certain outcomes, such as reducing energy losses or improving grid reliability. This model shifts the performance risk to the service provider, who is incentivized to meet or exceed the agreed-upon metrics.

3. Public-Private Partnerships (PPP)

These partnerships involve collaboration between public entities and private companies to finance, build, and operate smart grid projects. PPPs can take various forms, including design-build-finance-operate-maintain (DBFOM) contracts and concessions.

Business Models for Smart Grid Development

Business Models

4. Energy Services Company (ESCO) Model

ESCOs design, finance, and implement energy savings projects, often using the savings generated to pay for the project over time. This model is used to upgrade infrastructure with energy-efficient technologies, including smart grid components, without upfront costs to the utility or end-user.

5. Regulatory Incentive Models

Regulatory bodies offer incentives to utilities for investing in smart grid technologies that improve system efficiency, reliability, and customer service. Incentives can include performance-based rates, cost recovery for smart grid investments, and bonus payments for achieving certain benchmarks.

6. Utility Led Programs

Utility-led programs through CAPEX involve traditional investment models where utilities finance the development and implementation of smart grid technologies directly as capital projects. These investments are typically recovered over time through regulated rate structures approved by regulators.

THE WORLD BANK
IBRD • IDA

ESMAP
Energy Sector Management Assistance Program

APUA ASEA

ISGF
India Smart Grid Forum

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CAPEX Model

- CAPEX projects are appraised on the basis of
  - Return on Investment (ROI) v/s Weighted Average Cost of Capital (WACC)
  - Financial Internal Rate of Return (FIRR) – FIRR should higher than the WACC
  - Economic Internal Rate of Return (EIRR) – typically EIRR should be higher than FIRR
- Issues with Development of Business Case for CAPEX Projects
  a. Project Design, Estimation of Bill of Materials and Cost Estimates at the project appraisal and at project completion vary often – in some cases it could double or triple
  b. Time overrun – delay in implementation
  c. Both a & b above lead to cost overrun
- Estimation of Project Benefits
  a. Benefits estimation is complex – often management may not be convinced of the estimated benefits
  b. Benefits measured after project completion may not match with what is estimated at project appraisal
- Maintenance
  - AMC for software: often 22% of the purchase cost per year - difficult to appreciate the value initially! Patches and version updates will be discontinued when AMC payment is stopped
  - Experienced personnel in the organization often get transferred, promoted or retired – huge risk in maintaining the systems
  - Hardware go obsolete in few years

XaaS Models (OPEX)

- The "Everything as a Service" (XaaS) model is reshaping the utilities sector, especially within the realms of digitalization and smart grid technologies. This model transitions utilities from traditional capital expenditure (Capex) models, where assets are purchased and owned outright, to operational expense (Opex) models, which favor subscribing to services. This evolution aligns with the broader digital transformation trends across industries, emphasizing agility, innovation, and the strategic management of resources.
- XaaS offers significant advantages for electric utilities, primarily in **risk mitigation** and **cost reduction**. Utilities can avoid large upfront CAPEX through subscription-based models, adapt to technological advancements without major investments, and enhance operational efficiency. XaaS solutions help mitigate risks related to **technology obsolescence, inefficient capacity planning, cybersecurity threats,** and **data loss**. The shift towards renewable energy sources and the need for advanced grid management underscore the importance of XaaS in enabling utilities to adapt rapidly and efficiently.

1. **IaaS (Infrastructure as a Service)**: Offers physical and virtual servers, storage, and networking.
2. **PaaS (Platform as a Service)**: Provides a cloud-hosted platform for application development and management.
3. **SaaS (Software as a Service)**: Access to cloud-hosted application software for various business needs.
4. **BPaaS (Business Process as a Service)**: Outsourcing of business processes to third-party vendors.
5. **OaaS (Outcome as a Service)**: Focuses on delivering specific business outcomes.
6. **DaaS (Data as a Service)**: Provides data independent of client infrastructure or location.
7. **DaaS (Desktop as a Service)**: Offers virtual desktops with applications.
8. **BDaaS (Big Data as a Service)**: Facilitates advanced analysis of large datasets.
9. **DBaaS (Database as a Service)**: Cloud database system layer for application developers.

XaaS Models (OPEX)

- Success of OPEX model depends on the competence and integrity of the Supplier providing the services
- Total Cost of Ownership (TCO) of an Opex project tend to look higher than the TCO of a Capex project – but if the Capex project is not appraised correctly and implemented meticulously without time and cost overruns, TCO may be much higher than Opex projects
- Definition of SLAs – for Opex projects measurable SLAs should be clearly defined (no ambiguity or subjectivity) and monitoring mechanisms should be in place
- Internal Capacity – competent inhouse teams to manage the out-sourced operations efficiently
- The Cloud Architecture utilising infrastructure, platform and software as service solutions making OPEX projects less riskier now
- Advantages with Cloud
    - Low initial cost – monthly fee could be well with in the power of an IT Manager/HOD
    - Scalability – no need to invest in new hardware or software as the system is scaled up
    - Cyber security better managed by experts and constantly updated

Challenges of XaaS

- **Long-term Costs:**
  - Cumulative subscription fees may exceed Capex model expenses.
  - Evaluating Total Cost of Ownership (TCO) is crucial.
- **Dependency on Service Providers:**
  - Increases reliance on third-party vendors.
  - Risks include service availability, data security, and vendor lock-in.
- **Integration and Customization:**
  - Technical and managerial challenges in integrating diverse services.
  - High degree of customization may be limited by XaaS offerings.
- **Limited Availability of Critical Solutions as XaaS:**
  - Key systems like SCADA and ADMS not widely available as XaaS.
  - Market still evolving, with few mature cloud-based solutions.
- **Maturity of IT and OT Systems for XaaS:**
  - Confidence needed in the reliability, security, and performance.
  - Immature technologies risk operational disruptions and vulnerabilities.
- **Vendor Ecosystem:**
  - Scarcity of vendors offering mature XaaS solutions.
  - Limited vendor choice affects solution suitability and negotiation leverage.

Key Takeaways on XaaS

- In conclusion, while the XaaS model presents an attractive proposition for utilities looking to enhance their **operational flexibility, reduce initial capital outlays**, and **access continuous innovation**, the current limitations in **the maturity and availability of market offering**s for certain critical IT and OT systems represent a notable challenge.
- Utilities must navigate this landscape by carefully assessing the **available XaaS solutions against their specific needs**, considering the long-term implications of service dependencies, and potentially maintaining a combination of in-house managed assets and externally provided services.
- Utilities are advised to **embrace XaaS by collaborating with regulatory bodies** to identify the strategic approach to navigate the challenges and opportunities presented by the adoption of XaaS models (not only Energy Regulator but also ICT related Regulator)
- This strategic approach will enable utilities to effectively balance the benefits of the XaaS model with the realities of the current technology ecosystem, ensuring a smooth transition towards digitalized and smart grid operations.

TOTEX Model

In order to provide a sustainable distribution service, distribution companies must maintain the optimum balance between the **operating expense ceiling** and the **investment ceiling** which are the two main elements of the electricity distribution tariff model. In some countries that apply the revenue cap methodology, this balance is tried to be achieved by using the concept of **TOTEX (OPEX+CAPEX)**, which forces both budgets to be evaluated together.

- **Holistic Budgeting:** TOTEX provides a comprehensive view by integrating CAPEX (investment in assets) and OPEX (costs of operating and maintaining those assets) into a single framework. This approach aligns with strategic planning and resource allocation, focusing on the asset's entire lifecycle.
- **Lifecycle Cost Management:** It encourages organizations to consider the total cost of asset ownership, operation, and disposal, enabling more informed decision-making that can lead to cost savings and efficiency improvements over time.

TOTEX Model

Advantages:

- **Strategic Decision-Making:** By assessing costs through a TOTEX lens, utilities can make more strategic decisions that balance initial investments with long-term operational costs, potentially selecting solutions that offer lower lifecycle costs.
- **Enhanced Sustainability and Efficiency:** TOTEX encourages the adoption of technologies and practices that may have higher upfront costs but lead to significant operational savings, contributing to sustainability goals.
- **Flexibility and Innovation:** A TOTEX approach can drive innovation by removing the traditional budgetary constraints that separate CAPEX and OPEX, fostering a more flexible and holistic approach to project planning and execution.

Challenges:

- **Complexity in Implementation:** Integrating CAPEX and OPEX into a unified TOTEX model requires robust financial and operational frameworks, which can be complex to implement.
- **Cultural and Organizational Shifts:** Moving to a TOTEX model may require significant cultural and organizational changes, as it alters traditional budgeting and performance evaluation metrics.

Smart Metering Program on TOTEX Model in India

- Good example of TOTEX Model is the 250 million smart metering program in India
- Government of India adopted this model with minor modification – TOTEX model – for rollout of 250 million smart meters
- Under the TOTEX model, 15% of the smart metering project cost is given as grant from Govt of India against project delivery; balance 85% is paid as monthly instillments in 8-10 years by respective utility
- The Nodal Agency (REC) empanelled Advanced Metering Infrastructure Services Providers (AMISPs) who could bid for these projects in different utilities
- Initially AMISPs found it difficult to raise debt from financial institutions – later Government of India made utilities to agree for opening Escrow Accounts with first charge for AMISPs to receive payments of their monthly fees
- By end of December 2023, out of 250 million target, tenders for 180 million floated, orders placed for 94.5 million. Rest are under various stages of contract finalization. Tenders for remaining 70 million expected in 2024

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Regulatory Sand Box Model

Understanding

- Regulatory sandboxes are frameworks set up by regulators that allow innovators to conduct live experiments in a controlled environment under a regulator's supervision.
- Aimed at enabling digital innovation in utilities by allowing temporary relaxation of regulations.
- They provide a safe space for testing new technologies, business models, and services without immediately incurring all the normal regulatory consequences.
- Regulatory sandboxes and experimentation frameworks play a pivotal role in aligning with national climate and energy strategies, lowering innovation barriers,

- **Objectives:** To foster innovation, reduce time-to-market for new solutions, and enable regulatory adaptation to technological advancements.
- **Benefits for Utilities:** Insights into customer needs, operational efficiencies, and potential for integrating renewable and sustainable resources.
- **Benefits for Regulators:** Better understanding of new technologies, data to inform policy making, and ensuring consumer protection.

Regulatory Sand Box Model

- Innovators often **face legal and regulatory barriers** that inhibit the progress of trials, especially when experiments challenge existing frameworks and require new regulatory approaches or exemptions.
- Regulatory sandboxes and experimentation clauses must respect **principles of subsidiarity, proportionality, and the precautionary principle**, ensuring high levels of protection for citizens, consumers, and the environment
- Additionally, these frameworks significantly impact the utilities sector's business model evolution. By facilitating the trial of **new tariff models**, organizational structures, and the integration of cutting-edge technologies, they empower utilities to modernize, better satisfy consumer needs, and incorporate sustainable practices, marking a critical step towards adapting to and thriving in the digital era.
- **Adaptive and Supportive Legal Frameworks:** The evolution of regulatory support mechanisms, from pilot projects to regulatory sandboxes, demonstrates the need for adaptive and supportive legal frameworks that encourage innovation while maintaining customer protection and a fair playing field.
- **Iterative Learning and Development:** The development of sandbox services reflects learning from experience and innovator feedback. It emphasizes the need for regulatory frameworks to evolve, providing clearer support for market entry and making the limitations of sandboxes explicit for informed resource and risk management.
- **Policy and Regulatory Evolution:** Insights from sandbox-supported schemes are used to inform policy and regulatory evolution, demonstrating the value of these experiments in driving targeted changes to the energy system.

Regulatory Sand Box Model

01	CONCEPTUALIZATION	Define the sandbox's structure; engaging requisite institutions and regulators, and collaborations with other several actors; verifying team capacity and resources; and establishing eligibility criteria, time frame, tools and enforcement.
02	SANDBOX OPERATION	executed through the submission of applications; the provision of guidance and connections with external and internal advisors; and the proceeding to monitoring and evaluation of projects.
03	EVALUATION OF OUTCOMES	generally include encouraging the gathering and sharing of data; external engagement and collaboration; the provision of support and feedback; internalizing lessons and taking actions; engaging international cooperation; and fostering knowledge sharing and transfer.
04	EXIT	exit of tested concepts, resulting in either their deployment or discontinuation. The deployment may be a full-fledged or tailored authorization of the innovation and necessary changes in regulation.

Regulatory Sand Box Model

Example Practices

- **UK's Ofgem:** Launched an electricity and gas regulatory sandbox allowing trials of innovative products, services, and business models.
- **Australia's Energy Market Commission**: Established a sandbox for energy market innovations to test new business models and technologies.
- **Singapore's SP Group:** Created a sandbox for testing new energy solutions like blockchain for energy trading and smart grids.
- **Netherlands, Dutch Regulatory Sandbox for Energy Innovators:** A regulatory sandbox approach to support the testing of innovative energy projects, including smart grid solutions.
- **Japan: METI's Sandbox for Energy Innovation:** The Ministry of Economy, Trade and Industry (METI) in Japan has established a regulatory sandbox framework to support innovative projects in various sectors, including energy.
- **Austria's "Energie.Frei.Raum" program** focuses on integrating new technologies and market models for renewable energy, emphasizing sector coupling and energy storage.
- **Belgium's regulatory sandbox** for smart grids and flexibility services aims to connect decentralized production to distribution networks, fostering grid stability and integrating renewable energy sources

Example Regulatory Sandbox Projects

- **France's "Flexitanie" project,** which explores the use of blockchain for energy transactions, showcases the potential for new business models in energy trading and distribution.
- **Israel's** integration of battery storage systems to enhance grid reliability and support renewable energy sources, highlighting the shift towards more resilient and sustainable energy systems.
- **The OEB Innovation Sandbox in Ontario, Canada,** offers a platform for testing new ideas in electricity and natural gas sectors, focusing on value to energy consumers.
- **Norway's pilot project** for electric taxi charging, demonstrating the potential for electrification in transport and its integration with the energy system.
- **ISGF’s Blockchain project for Peer-to-Peer (P2P) trading** of rooftop solar energy in Lucknow City, Uttar Pradesh (UP) is a classic example
  - UP Electricity Regulatory Commission (UPERC) issued order to UP Power Corporation Ltd (UPPCL) to allot a P2P pilot project to ISGF which was successfully executed in 2020 – 2021
  - In 2022, UPERC ordered UPPCL to scaleup the project across the state
  - Based on a petition filed by UPPCL, UPERC issued regulations for P2P trading of rooftop solar energy on blockchain platform in April 2023 – one of the first such regulations across the globe!
  - Now, UPPCL is in the process of appointing service providers for the same

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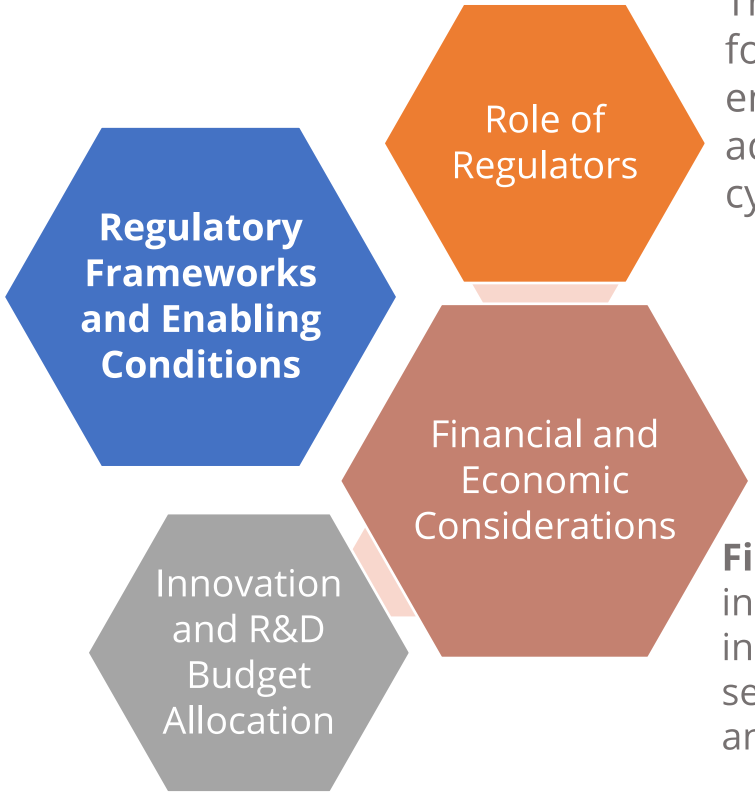
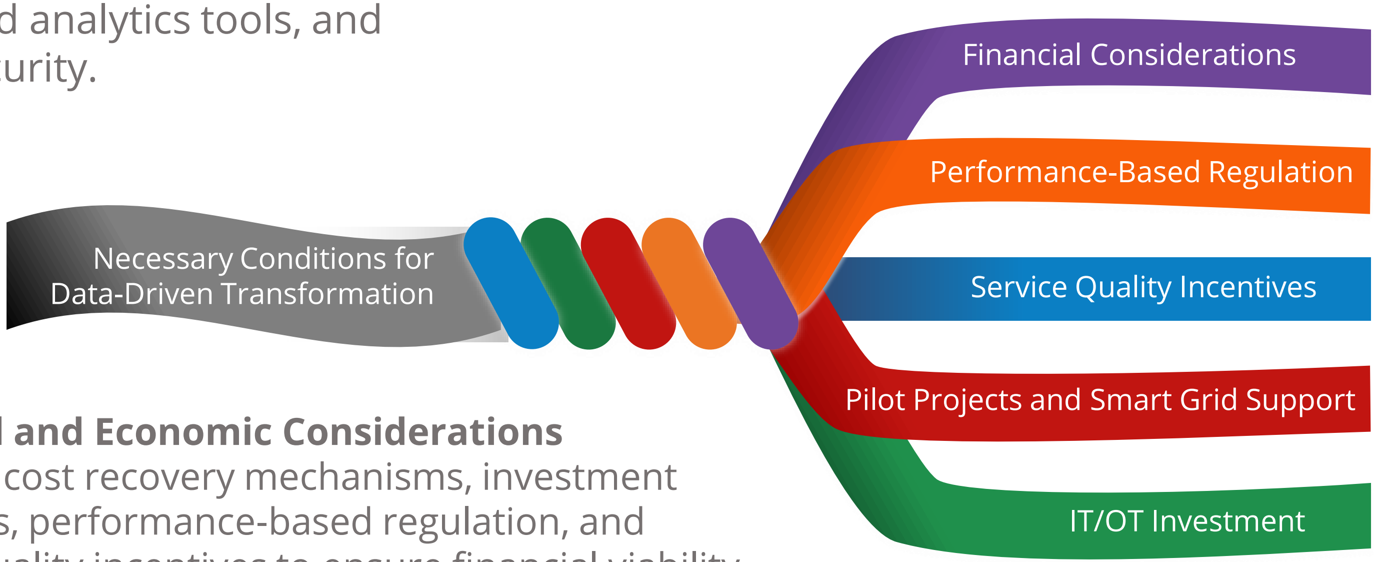
Enabling Regulations



The crucial role of **Regulators** in fostering an investment-friendly environment for data infrastructure, advanced analytics tools, and cybersecurity.



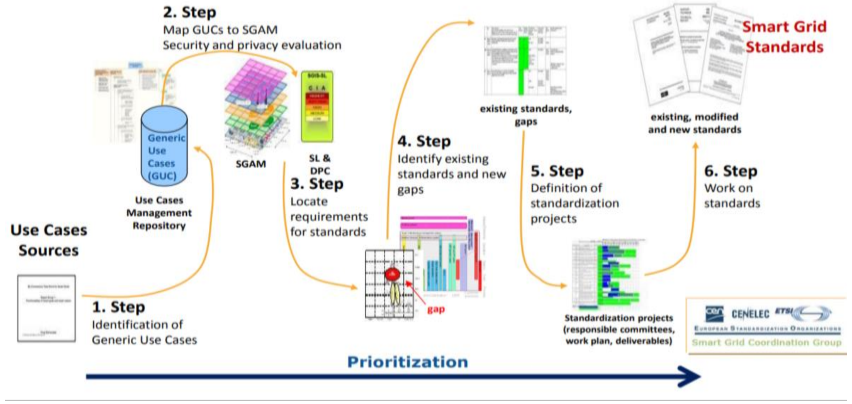
Financial and Economic Considerations including cost recovery mechanisms, investment incentives, performance-based regulation, and service quality incentives to ensure financial viability and encourage utilities to invest in new technologies.

Innovation and R&D Budget Allocation to support data-driven projects and foster a culture of innovation within utilities, emphasizing the importance of regulatory support for smart grid technologies and IT/OT investment budgets.

Regulatory Challenges for Smart Grids Roll-out (1/4)

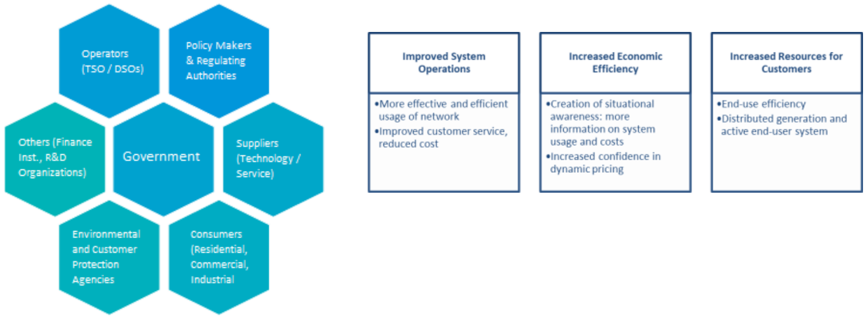
- The main problems with smart grid legislation in many countries include **lack of published and accepted legislation** on this issue, the evaluation of smart grid solutions within **unchanged market mechanisms**, **social pressure on electricity prices** and **limited investment revenues**, uncertainty about how the prepared **national action plans** will be directed, settlement process and payment methodologies, **data protection laws**, **lack of clarity regarding the roles and responsibilities of stakeholders**, **lack of standardization and different implementation practices**.

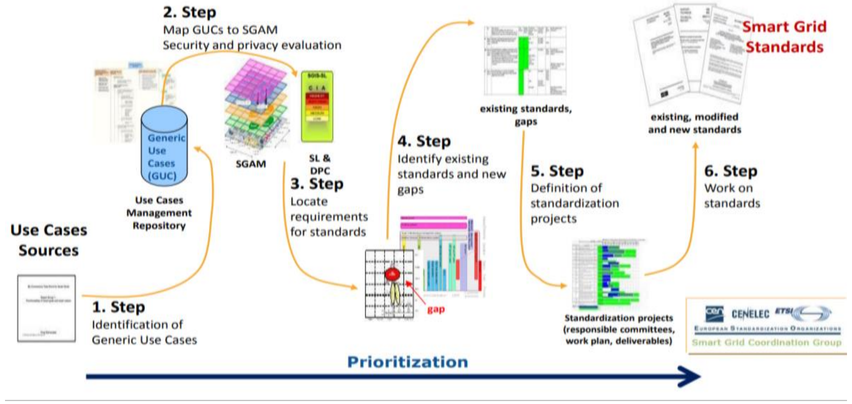
- In developed countries use of **price regulation mechanisms to promote smart grid**, and use of **performance indicators is relatively common**. However, in many countries there is still **lack and need to develop regulatory tools for smart grid development.**



Regulatory Challenges for Smart Grids Roll-out (2/4)

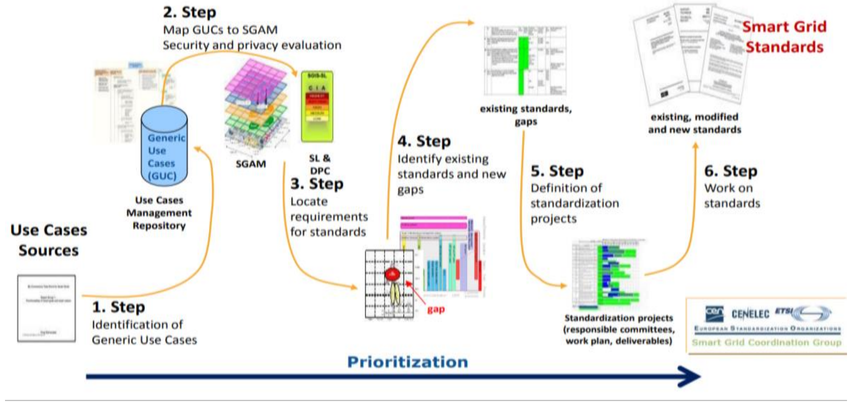
- Incentives to encourage network operators to choose investment solutions that offer the most cost-effective solutions (e.g. In United Kingdom, capital efficiency requires that the DNOs employ the most cost-effective network development strategies.)
- Incentives to encourage network operators to choose innovative solutions/incentives for network operators to encourage efficient use of electricity and renewable electricity production (e.g. In United Kingdom, incentives are provided for the best innovation projects that help all network operators understand the measures needed to provide environmental benefits and security of supply for value for money. In Italy, the index used for selecting demonstration projects considers the benefits of increasing the renewable electricity supply and the reduction of losses.)
- Incentives to encourage network operators to choose investment solutions that offer the most cost-effective solutions (e.g. In United Kingdom, capital efficiency requires that the DNOs employ the most cost-effective network development strategies.)





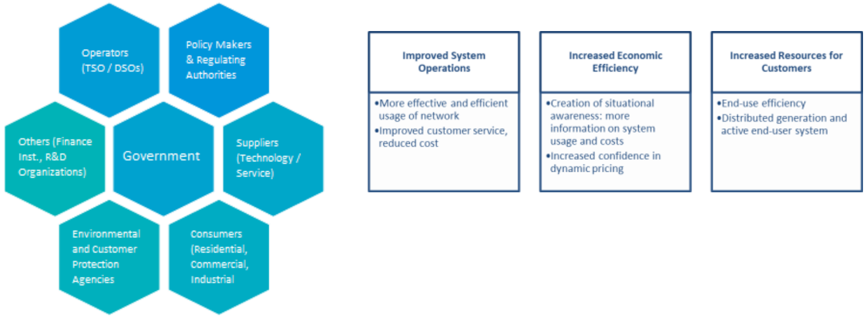
Regulatory Challenges for Smart Grids Roll-out (3/4)

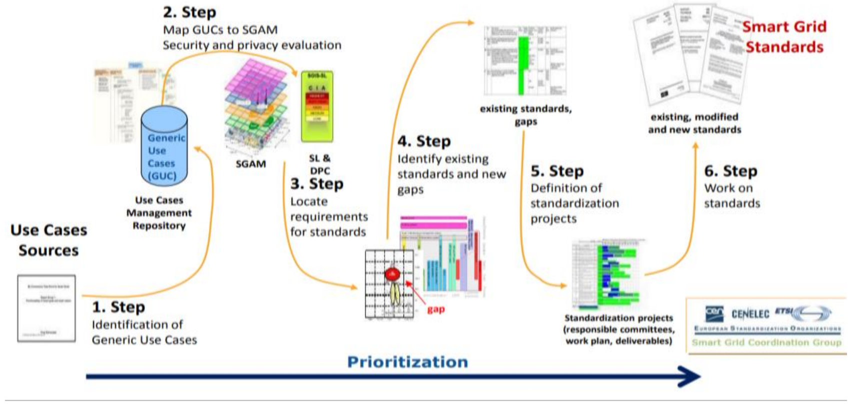
- Active participation in the development of smart grids by stakeholders (e.g. In Spain, manufacturers will need to provide appropriate equipment and so will need to be more actively involved in a smart grid. Similarly, in Portugal, hardware and software developers will need to innovate as new services are offered to customers. In Italy, the level of stakeholder involvement will increase alongside smart grid development.)
- The roles and relationships of relevant stakeholders to encourage the introduction of new services or markets (In Germany, incentives must be created for some roles, for example aggregators and consumers. In United Kingdom, new stakeholder roles and relationships must be defined as new services are introduced in a smart grid.)



Regulatory Challenges for Smart Grids Roll-out (4/4)

- The introduction of new tariffs to incentivise more efficient network use (e.g. In Finland and France, new tariffs are being developed with the advent of smart grids.)
- Unbundling that cause uncertainty about the responsibility regarding the smart grid investments (e.g. In Portugal, unbundling activities introduce new regulatory challenges since potential new services for smart grids will be provided by a combination of DSOs and suppliers.)
- Lack of customer demand and applications (e.g. in Germany, although technology is not a problem, there are not many electric vehicles or smart home applications are not common etc. This goes hand in hand with the fact that business cases are still lacking. In addition, there is lack of awareness and limited understanding, related to smart grids)
- Lack of certain technical standards (e.g. different utilities and technology suppliers might use different communication interoperability)





Tariff Incentives for Smart Grids Innovation (1/3)

Smart grids demonstration and innovation expenses are still treated like any other cost in most of the countries; i.e. there is no specific compensation for the risks involved in testing new technologies and processes. In certain countries, new specific regulatory mechanisms have been introduced to promote R&D and/or pilot projects.

Country	Country regulations
Austria	The regulatory system provides incentives for cost reductions as companies must follow a regulatory efficient path. Additionally, E-Control (the Austrian NRA) applies an **incentive factor to stimulate investments in innovation**. The **investment factor constitutes a cost-based element in the incentive-based regulatory system.**
Denmark	Regulator applies a public service obligation-financed mechanism (ForskEL). The **ForskEL mechanism is dedicated to support R&D and demonstration of environmentally friendly technologies** and provides annual funding of DKK 130 million.
Greece	From 2017 onwards, the approved **budget for R&D and pilot projects** added to the annual allowed revenues in Greece.
Finland	DSOs can cover some of their investment costs through the innovation incentive system. As part of the innovation incentive system, the EMV can approve **R&D related expenditures up to a maximum of 0.5% of a DSO's annual turnover** (NordREG).

Tariff Incentives for Smart Grids Innovation (2/3)

Country	Country regulations
France	A new instrument that includes **a dedicated amount for R&D and pilots** was issued at the end of 2013. If the DSO spends less than the projected allowance, the remaining amount is returned to the customers benefit, while if the company overspends is at its own risk. In the current French regulatory period, **R&D and pilot projects' operating costs are covered by a specific part of the distribution network tariff**. These costs are **excluded from efficiency requirements.**
Ireland	The Commission for Energy Regulation (CER) introduced **an extra-allowance mechanism for incentivizing DSO to carry out research and development and sustainability activities**. The total amount of the projected fund equals €18.2 million and will allow DSOs to explore technological advances **in areas such as smart grids, generation integration, and adaptation of new network devices** to support the integration of renewable generation into the network and improve the reliability of service.
Italy	In Italy, in 2012, NRA introduced a **competition-based procedure providing specific incentives for innovative demonstration projects** related to the active distribution network. To generate interest by DSOs, these pilot programs allowed for a **2% premium over the cost of capital** for a limited time period of 12 years. At present, output-based incentives are used.

Tariff Incentives for Smart Grids Innovation (3/3)

Country	Country regulations
Norway	Since 2013, the Norwegian NRA has been providing **extra income of up to 0.3% (book value * 1.01) on some innovative projects**, that is expenditures for R&D and pilot projects are added to the allowed revenues (max. 0.3% of regulated assed base)
Portugal	The DSO will **receive the minimum between a higher regulatory RoR and 50% of the system benefits.** The extra rate is 0.25% in the first year and rises 0.1% each year, until it reaches 0.75% in the sixth year. Hence, **projects should allow for an OPEX reduction**, which will be accounted as part of the system benefits; otherwise, the DSO may receive a lower incentive
Slovenia	Regulatory framework acknowledges **3% of the book value for smart grid investments**
United Kingdom	Ofgem announced a funding mechanism (Low Carbon Network Funds-LCNF) of £500 million over the period 2010 to 2015 **to support competitive tenders for "large-scale trials of advanced technology including smart grids",** as part of DPCR5. In 2015, with the introduction of RIIO-ED1, the LCNF was replaced **by a new funding scheme, called Network Innovation Competition (NIC)**. DSOs can now **recover money for pilot projects through an innovation stimulus** under the RIIO model and are incentivised to roll out innovative projects through the regulatory framework.

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Business Models Related to the Technology Implementation

In the context of digital transformation in the utilities and smart grids sector, the decision between developing technology in-house or implementing commercial products from suppliers is pivotal. Each approach has distinct advantages and challenges, influencing operational efficiency, innovation pace, cost management, and strategic alignment.

In-house Technology Development

Advantages:

1. **Customization and Control:** Tailoring solutions to precise operational needs and strategic objectives, offering better integration with existing systems and processes.
2. **Intellectual Property:** Retaining ownership of the developed solutions, which can provide competitive advantages and potential revenue streams through licensing.
3. **Adaptability:** Easier adaptation to changing regulatory and business environments, as in-house teams can quickly pivot or update technologies.
4. **Internal Capability Building:** Enhancing the organization's skills and knowledge base, fostering innovation culture, and reducing dependency on external vendors.

Challenges:

1. **Higher Initial Costs:** Significant upfront investment in research and development, talent acquisition, and technology infrastructure.
2. **Time to Market:** Potentially longer development times compared to deploying ready-made solutions, which can delay benefits realization.
3. **Resource Intensity:** Requires continuous investment in talent development, research, and technology maintenance.
4. **Risk of Obsolescence:** Rapid technological advancements can quickly render in-house developments obsolete without ongoing innovation and investment.

Business Models Related to the Technology Implementation

Implementing Commercial Products from Suppliers

Advantages:

1. **Speed of Deployment:** Commercial products are typically ready to implement, allowing utilities to realize operational improvements and cost savings more quickly.
2. **Lower Initial Cost:** Reduces the need for heavy upfront investment in development, relying instead on the supplier's economies of scale.
3. **Access to Advanced Technologies:** Suppliers often offer cutting-edge solutions that benefit from broader industry insights, continuous R&D, and feedback from multiple clients.
4. **Support and Maintenance:** Vendors provide ongoing support and updates, reducing the burden on the utility's internal teams.

Challenges:

1. **Dependency on Vendors:** Risk of becoming locked into specific technologies or platforms, potentially facing high switching costs and limited flexibility.
2. **Customization Limits:** While commercial products might offer configurability, deep customization to fit unique operational needs can be challenging or expensive.
3. **Data Security and Privacy:** Utilizing third-party solutions may raise concerns about data sovereignty, security, and compliance with local regulations.
4. **Cost Over Time:** While initial costs may be lower, licensing fees, subscriptions, and costs associated with upgrades or additional services can accumulate, impacting the total cost of ownership.

Business Models Related to the Technology Implementation

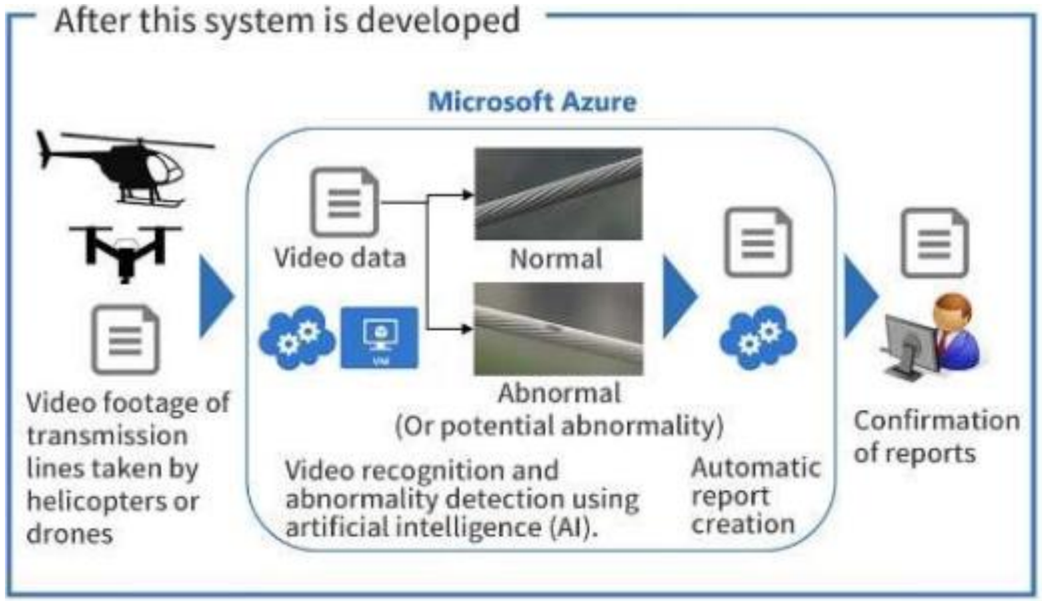
The choice between in-house development and commercial products depends on strategic priorities, capacity for innovation, risk tolerance, and financial considerations.

For many utilities, a hybrid approach, leveraging commercial products for standard functionalities while developing in-house solutions for strategic differentiators, offers a balanced path. This approach enables utilities to stay at the forefront of technology, maintain control over core competencies, and optimize investment in digital transformation.

Let’s continue with examples utilizing different approaches.

Examples to Utility Business Models, Utility- Solution Provider Collaboration

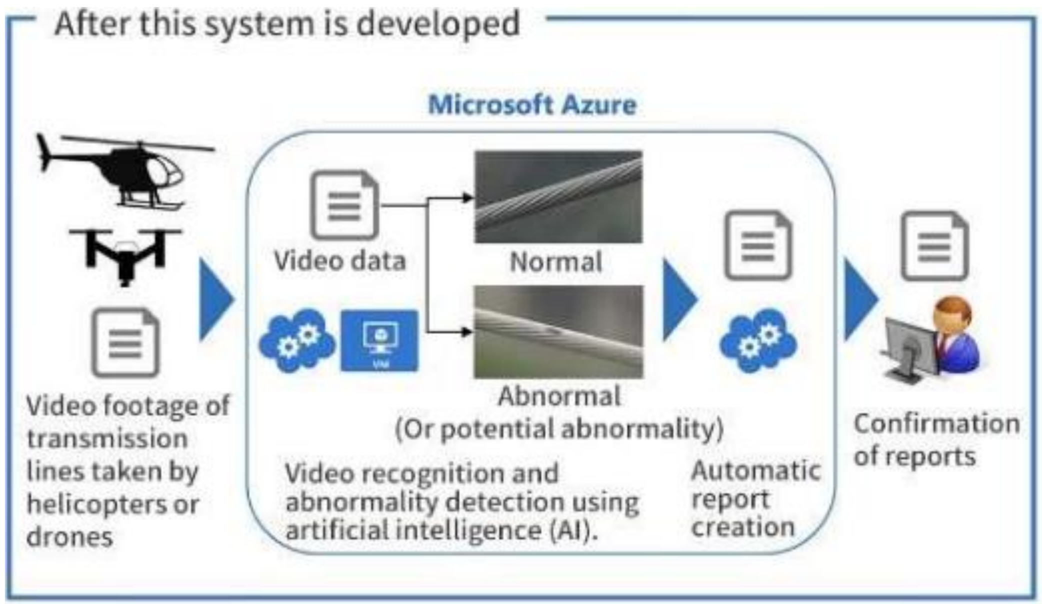
※(TEPCO) Automation of the process to diagnose power transmission lines
In collaboration with Tecnos Data Science Engineering, Inc. (TDSE), TEPCO developed a system that utilizes artificial intelligence (AI) to automatically detect transmission line faults from video footage captured by helicopters flying over transmission lines in mountainous areas that have limited access for maintenance workers. Through the development of this system, it is able to automatically detect faults from video footage taken by drones for transmission line inspection work.



Examples to Utility Business Models, Utility- Solution Provider Collaboration

※(AEP, US) S/W-based asset management system of transformation facility

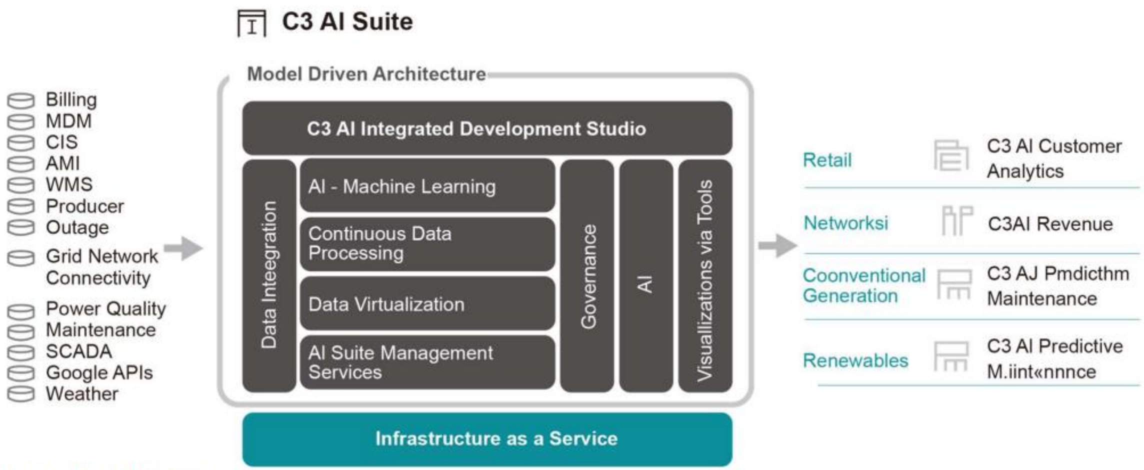
In cooperation with ABB, AEP has developed and applied VENTYX, a transmission facility asset management system, which collects data through various monitoring systems, such as sensors, etc., analyzes such data in Asset Health Center (AHC), and provides the owner or manager (utility) of an asset with information regarding facility maintenance to be used in an operation instruction to field workers.



Examples to Utility Business Models, Utility- Solution Provider Collaboration

※ (ENEL, Italy) C3 AI Fraud detection and power distribution predictive maintenance

In cooperation with C3 AI, ENEL developed the C3 AI Fraud Detection application. It uses advanced AI capabilities to prioritize potential cases of nontechnical loss at service points, based on a blend of the magnitude of energy recovery and likelihood of fraud. The system integrates and correlates 8 trillion rows of data from 83 Enel source systems and 218 data integrations into a unified, federated cloud image in near-real-time, running on Amazon Web Services. Using analytics and more than 300 machine learning models with thousands of machine learning features, it continuously updates probability of fraud for each customer meter.

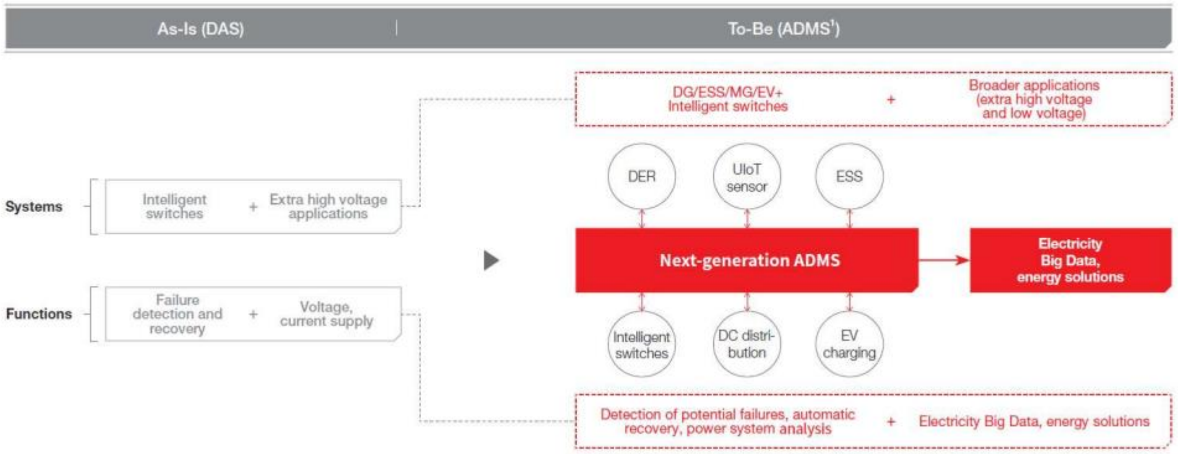


*source: C3 AI website

Examples to Utility Business Models, Development of Utility's Own Solutions

※(KEPCO, Korea) Development of the next-generation distribution automation system

KEPCO implemented a DAS (Distribution Automation System) in 1998, and by 2022, had installed over 130,000 intelligent switches, representing a significant portion of its distribution line switches. Leveraging the DAS, KEPCO optimizes its distribution system by monitoring line data and controlling switches. This allows for swift power restoration within 3 minutes of a line failure, resulting in one of the shortest outage durations per household globally.



Examples to Utility Business Models, Development of Utility's Own Solutions

※Singapore Power - Digital Twin and Grid Management Solutions

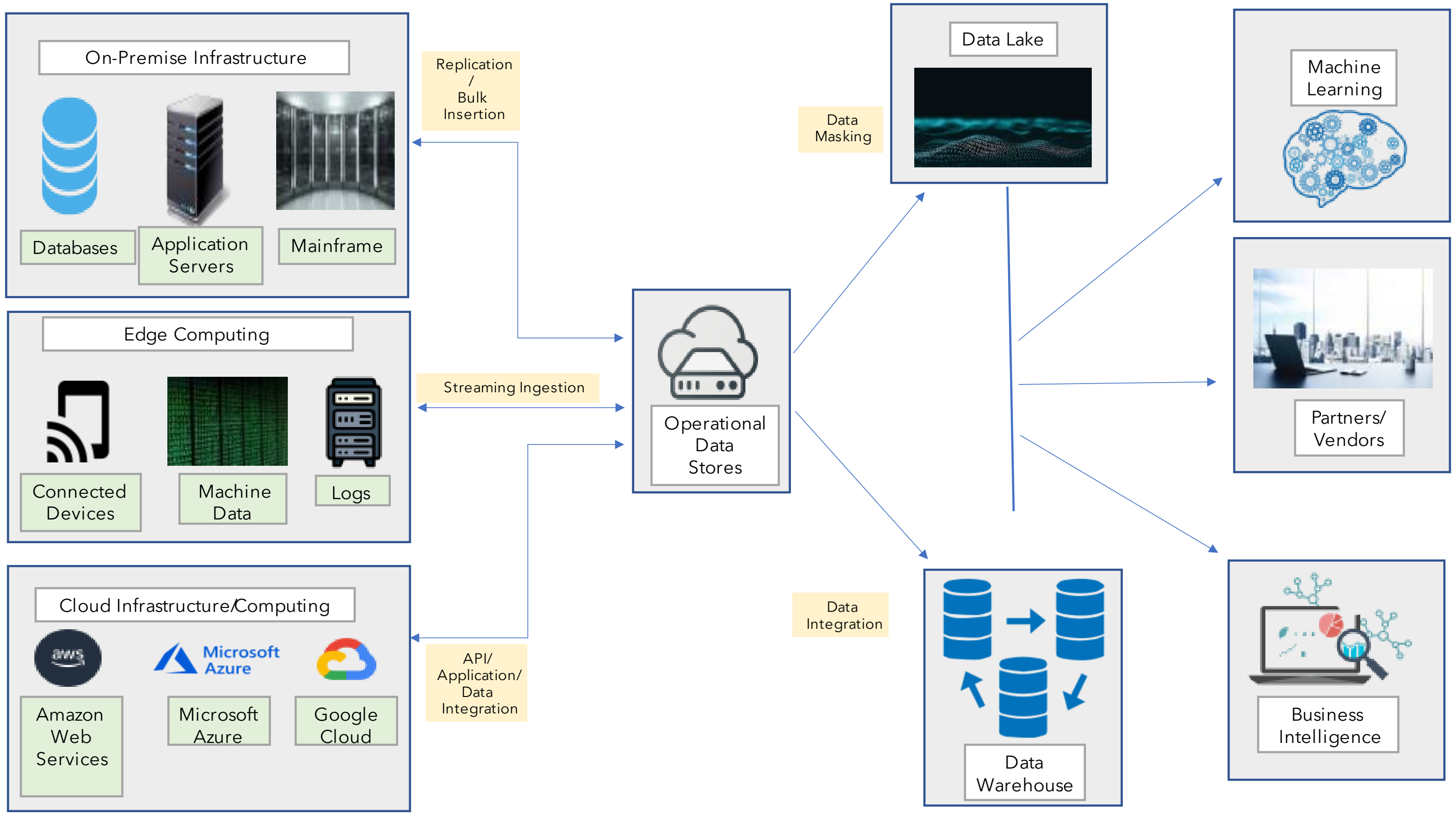
Singapore Power has invested in developing digital twin technology and grid management solutions internally. These in-house developments are part of Singapore Power's strategy to enhance grid reliability, support the integration of renewable energy, and improve the overall efficiency of the energy network.

※Turkey – EnerjiSA, Development of Own Meter Data Management Solution

EnerjiSA, serving as three distribution companies in Turkey, embarked on developing its own Meter Data Management (MDM) solution in-house. This strategic initiative was aimed at enhancing operational efficiency, improving customer service, and supporting the integration of distributed energy resources. By leveraging internal resources for this development, EnerjiSA could create a solution perfectly tailored to the regulatory and operational landscape of Turkey's energy sector

Business Models for System Infrastructure Solutions

- ✓ **Choosing Computing Technologies and Infrastructures**
- ✓ **Software vs. Service Providers**
- ✓ **On-premise Infrastructure**
- ✓ **Cloud Infrastructure**
- ✓ **Hybrid Infrastructure**
- ✓ **Data Preservation and Storage**
- ✓ **Backup and Disaster Recovery (BDR)**



Overall, the choice between on-premise, cloud, and hybrid infrastructures depends on the utility's specific needs, resources, and vision for the future. Each infrastructure type offers unique advantages and challenges, playing a crucial role in the utility's data-driven transformation journey.

Agenda

- ✓ Business Models for Digitalization of the Utilities and Smart Grids
- ✓ "CAPEX Models" vs. "As a Service, OPEX Models" vs. TOTEX
- ✓ Regulatory Sand Box Model
- ✓ Enabling Regulations and Tariff Methodologies
- ✓ Business Models Related to the Technology Implementation
- ✓ **Innovative Business Models and Revenue Streams for Utilities**
- ✓ Cost Benefit Analysis for Validation of Project Viability and Business Model
- ✓ Key Takeaways related to Business Models

Innovative Business Models and Revenue Streams for Utilities

Electric Utilities have several untapped assets that can be unlocked to raise funds for grid modernization and digitalization – few examples are:

- **Unlocking the value of land** – the existing air-insulated substations in urban areas are constrained and have no space for expansion; but if these substations are converted to gas insulated substations (GIS), 60-70% of the land becomes free that can be commercialized – huge funds can be raised; besides ample scope for capacity expansion

- **Street light poles** can be leveraged for a variety of applications – EV Charging Points, Internet Routers, Sensors for Pollution Monitoring, Security Cameras etc.

- **Utilities have rich data (digital in most utilities)** – customer data, asset data (GIS maps that cover entire cities), operations data etc. that can be shared with third parties – additional revenue

- **Billing Systems and Call Centers** can be extended to water distribution, city gas distribution domains and municipal services at marginal cost – combined bill for electricity, water, gas and house tax – one call center for all services - additional income and customer satisfaction.

Innovative Business Models and Revenue Streams for Utilities

Electric Utilities have several untapped assets that can be unlocked to raise funds for grid modernization and digitalization – few examples are:

- **Energy as a Service (EaaS):** Utilities offer a subscription-based model for energy services, where customers pay a fixed monthly fee for energy usage, maintenance, and upgrades. This can include energy efficiency improvements, renewable energy installations, and smart home devices.

  Benefits: Encourages energy efficiency and the adoption of green technologies, provides a steady revenue stream for utilities, and reduces upfront costs for consumer

- **Infrastructure Leasing:** Leasing excess fiber optic cables, conduit space, or other telecommunications infrastructure to internet service providers or telecommunications companies.

  Benefits: Generates steady income from existing assets without significant additional investment. It leverages the utility's extensive infrastructure network, which often has unused capacity.

- **Microgrid as a Service (MaaS):** Developing and operating microgrids for communities, campuses, or industrial sites under a service agreement. Customers benefit from local energy generation and increased reliability without managing the system. This model could be utilized both for "premium electricity" and also "electrification"

  Benefits: Creates new revenue opportunities by offering resilience-as-a-service, especially valuable in areas prone to outages. It also positions the utility as a partner in sustainability and innovation.

Innovative Business Models and Revenue Streams for Utilities

Electric Utilities have several untapped assets that can be unlocked to raise funds for grid modernization and digitalization – few examples are:

- **Installing Distributed RES for Reduction and Compensation of Technical Losses:** This innovative approach involves the strategic installation of distributed renewable energy sources (RES) by the Utility, such as solar panels, across the utility network. The aim is to generate electricity closer to the point of consumption, thereby reducing the distance electricity needs to travel through the grid. This model focuses on placing these RES installations in areas identified with high technical losses due to long transmission distances or where the grid infrastructure is less efficient.
- **Renewable Energy Certificates (RECs) Trading:** Generating and selling renewable energy certificates, which represent proof that electricity was generated from a renewable energy source. These can be sold to businesses or individuals looking to offset their carbon footprint.
- **Virtual Power Plants (VPPs) and Participation in Ancillary Services Market:** Aggregating distributed energy resources (DERs) like solar panels, wind turbines, and battery storage owned by businesses or households to create a virtual power plant. Through advanced software and control systems, these aggregated resources can provide ancillary services to the transmission grid.

Innovative Business Models and Revenue Streams for Utilities

Electric Utilities have several untapped assets that can be unlocked to raise funds for grid modernization and digitalization – few examples are:

- **Customized ESCO Services for I&C Customers:** DSOs utilize AMI and EMS data to offer customized energy efficiency solutions tailored to the specific needs of industrial and commercial (I&C) customers. Through performance contracting agreements, DSOs invest in energy efficiency measures for their customers and share in the financial savings achieved.

- **DSOs as Electric Vehicle Charging Point Operators (CPO) :** With the growth of electric vehicles (EVs), DSOs have the opportunity to operate EV charging points. Leveraging Smart Grid technology, they can manage the additional load from EV charging to ensure grid stability and reliability.

- **DSOs as Battery Storage Operators:** By integrating battery storage systems, DSOs can offer grid services such as frequency regulation and voltage support. Utilizing data analytics and optimization algorithms, these storage systems can be efficiently managed to maximize their utility and generate revenue through market participation. Capacity payment models or ancillary service contracts can be adopted to ensure steady revenue.

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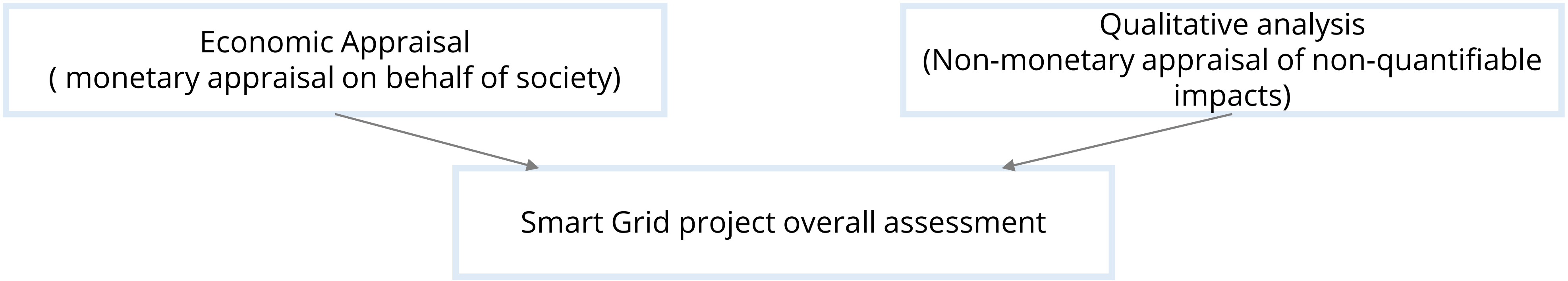
- ✓ Key Takeaways related to Business Models

Cost Benefit Assessment for Digital Projects

- CBA is a tool for evaluating between various projects or deciding the viability of a project (including the business model)
- Considers costs of implementation and benefits
- Can be economic or financial in nature
- Reflects timing of costs and benefits
- Minimum # of potential scenarios is two: 1. Do-nothing or Business-as-usual 2. Introduce the project
- CBA does not avert the need for prior technical analysis
- However, it provides a means to assess project viability
- Key Questions
  - For what investments should a CBA apply?
  - What is the appropriate level of analysis (national/DSO)?
  - Should different business models be evaluated for project specific CBA?

Cost Benefit Assessment for Digital Projects

- **Economic-oriented CBA of Smart Grid projects**
  - Societal perspective, considering the project’s impact on the entire value chain and society at large;
  - Customer-oriented approach;
  - Goes beyond of what can be captured in monetary terms (e.g. returns to investors approach)



  - All reference documents offer a step-by-step analysis to be followed.

Cost Benefit Assessment for Digital Projects

- Steps to Quantify Costs and Benefits 3 Step methodology

Boundary Conditions

- Tailor to local conditions;
- Assumption of specific values (growth, discount rate, WACC, CO_2 price);
- Critical to accuracy and meaningfulness of the result.

CBA Framework

- Conduct CBA incorporating 7 step analysis;
- Characterize the project and its costs;
- Estimate Benefits;
- Compare costs and benefits.

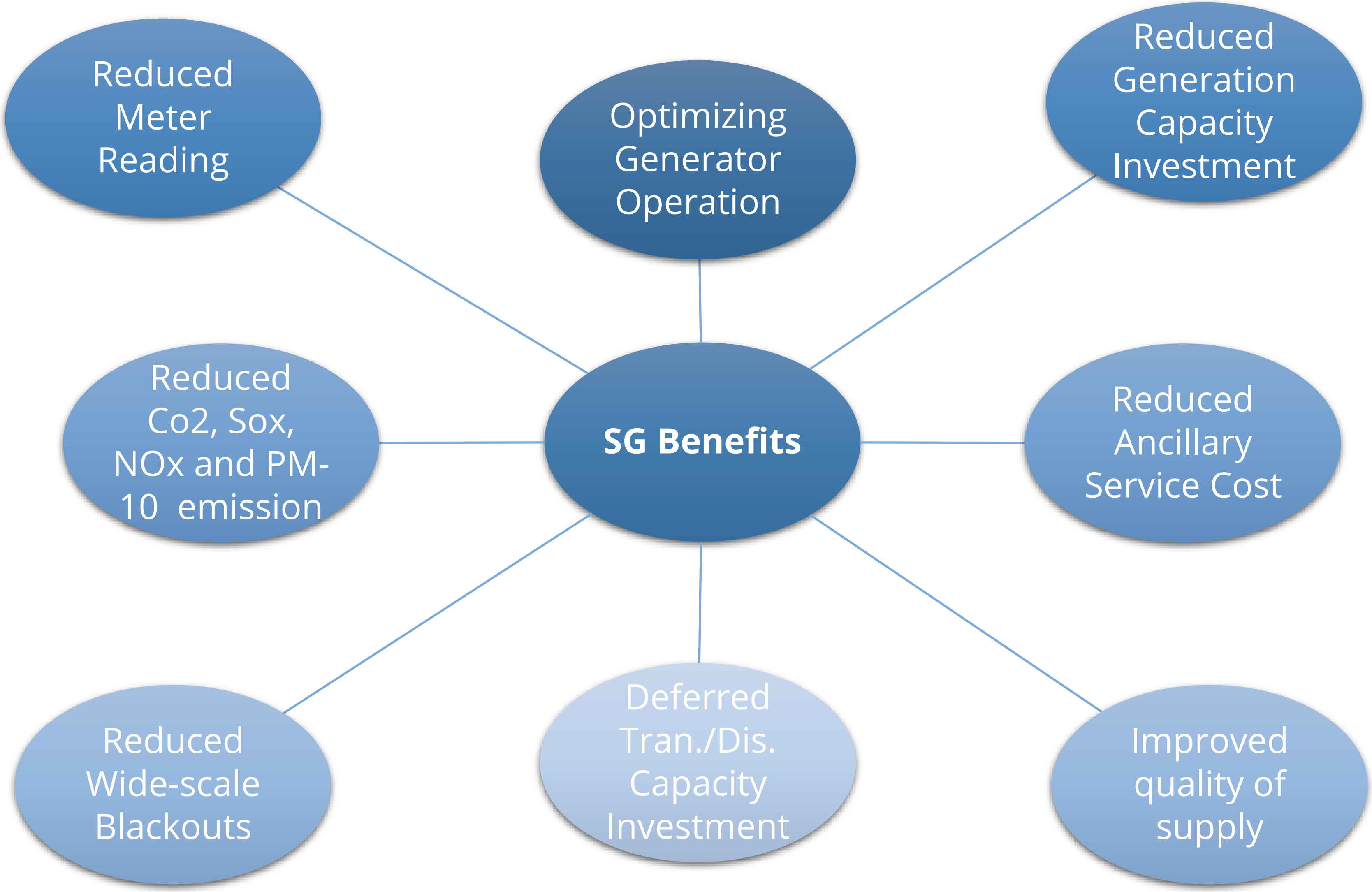
Sensitivity Analysis

- Carry out a sensitivity analysis to show uncertainty/ variations of key variables;

Examples of Smart Grid Costs

General Category	Type of Cost
CAPEX	Investment in metering systems (including home area network)
	Investment in Distribution Transformer Controllers
	Investment IT
	Investment Communications
	Sunk costs of previously installed traditional meters
OPEX	IT maintenance cost
	Network management and front-end costs
	Cost of communications
	Communication/ data transfer costs
	Scenario management costs
	Replacement/failure smart metering system
	Cost of consumer engagement programmes
	Meter reading

Selection of Smart Grid Benefits



Definition of Boundary Conditions

Setting of Parameters I

1. Discount Rate
- Time value of money;
- Risk or uncertainties of future cash flows
- Social Discount Rate or WACC

2. Time Horizon of the CBA
- Fixed according to the lifetime of the Project

3. Schedule of Implementation
- Great difference on different stakeholders depending on the point of time we consider the costs and benefits.

4. Impact of the Regulatory Framework on Assumption
- Potential presence of a risk premium to Smart Grid investment

Definition of Boundary Conditions

Setting of Parameters II

5. Macroeconomic factors	• Inflation rate, carbon costs, etc.
6. Implementation technology	• Design parameters, system architecture and technology, public standards and protocols
7. Peak load transfer	• Share of electricity usage that is shifted from peak periods to off-peak periods
8. Electricity demand	• Combination of factors: population growth, domestic consumption, electricity prices etc.

CBA Steps

Step 1: Review and describe technologies, elements and goals

Step 2: Map assets onto functionalities

Step 3: Map functionalities onto benefits

Step 4: Establish the baseline

Step 5: Monetise benefits and identify beneficiaries

Step 6: Quantify costs

Step 7: Compare costs and benefits

Characterise the Project

Estimate Benefits

Compare Costs and Benefits

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Key Takeaways Related to Business Models and Regulations

Some Actionable Recommendations

Business Models for Digitalization of the Utilities and Smart Grids

- Embrace innovative business models that leverage digital technologies to enhance grid reliability, efficiency, and customer engagement. Focus on integrating renewable energy sources, implementing smart grids, and adopting data analytics to improve operations and decision-making.

"CAPEX Models" vs. "As a Service, OPEX Models" vs. TOTEX

- Evaluate the shift from traditional CAPEX models towards OPEX and TOTEX models to optimize spending and improve financial flexibility. Consider "As a Service" models to reduce upfront costs and facilitate scalability and technological updates.

Regulatory Sandbox Model

- Consider the discussions with sector stakeholders about regulatory sandbox environments to experiment with new business models, technologies, and services in a controlled setting, allowing for innovation with reduced risk and regulatory barriers.

Enabling Regulations and Tariff Methodologies

- Advocate for enabling regulations and adaptive tariff methodologies that support the investment in and adoption of smart grid and digital technologies, ensuring that regulatory frameworks facilitate rather than hinder innovation.

Key Takeaways Related to Business Models and Regulations

Some Actionable Recommendations

Business Models Related to the Technology Implementation

- Choose between in-house technology development and outsourcing to suppliers based on strategic goals, available human resources, financial considerations, and operational needs. A hybrid approach may offer a balance between control, innovation pace, and cost management.

Cost Benefit Analysis for Validation of Project Viability and Business Model

- Perform comprehensive cost-benefit analyses to evaluate the financial viability and societal benefits of smart grid projects. This should include considering economic and customer-oriented impacts, as well as the potential for operational improvements and environmental benefits.

Innovative Business Models and Revenue Streams for Utilities

- Explore new revenue streams through the monetization of underutilized assets, partnerships with technology providers, and service diversification, such as Energy as a Service (EaaS), Infrastructure Leasing, and Microgrid as a Service (MaaS).

Thank You

Any questions?

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