Case study session 3

Strategic Approaches on Data Driven Transformation of Utilities and Selected Case Studies

Agenda

- ✓ Components of Data Driven Transformation in Utilities
- ✓ Benefits and Challenges of Data-Driven Transformation
- ✓ Ways that Digitalization helps Utilities Tackle with Real Life Business and Operation Challenges
- ✓ Selected Utility Case Study - Turkish DSO Case
- ✓ Selected Utility Case Study - Balkans DSO Case
- ✓ Selected Utility Case Study – Central Asia Case

Speaker:

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THE WORLD BANK IBRD • IDA | ESMAP Energy Sector Management Assistance Program | APUA ASEA | ISGF India Smart Grid Forum

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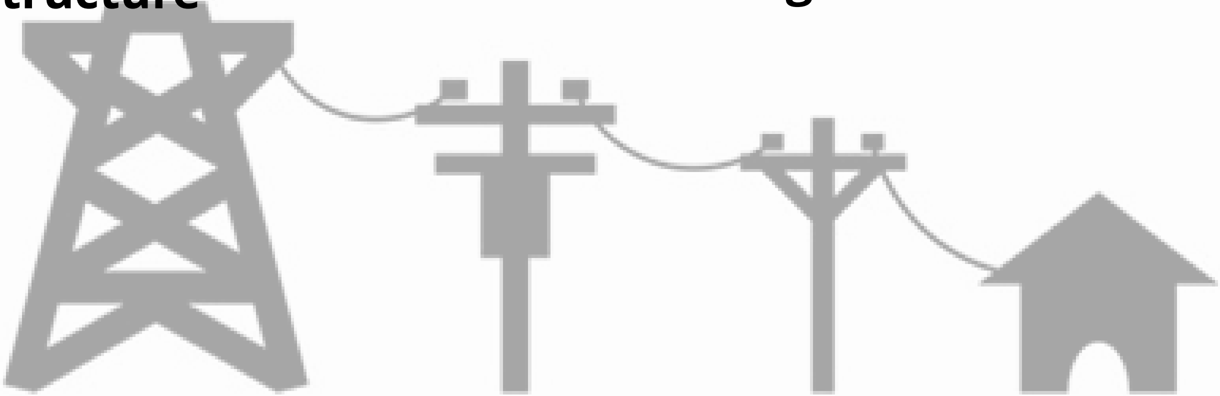
Typical Challenges of Utilities

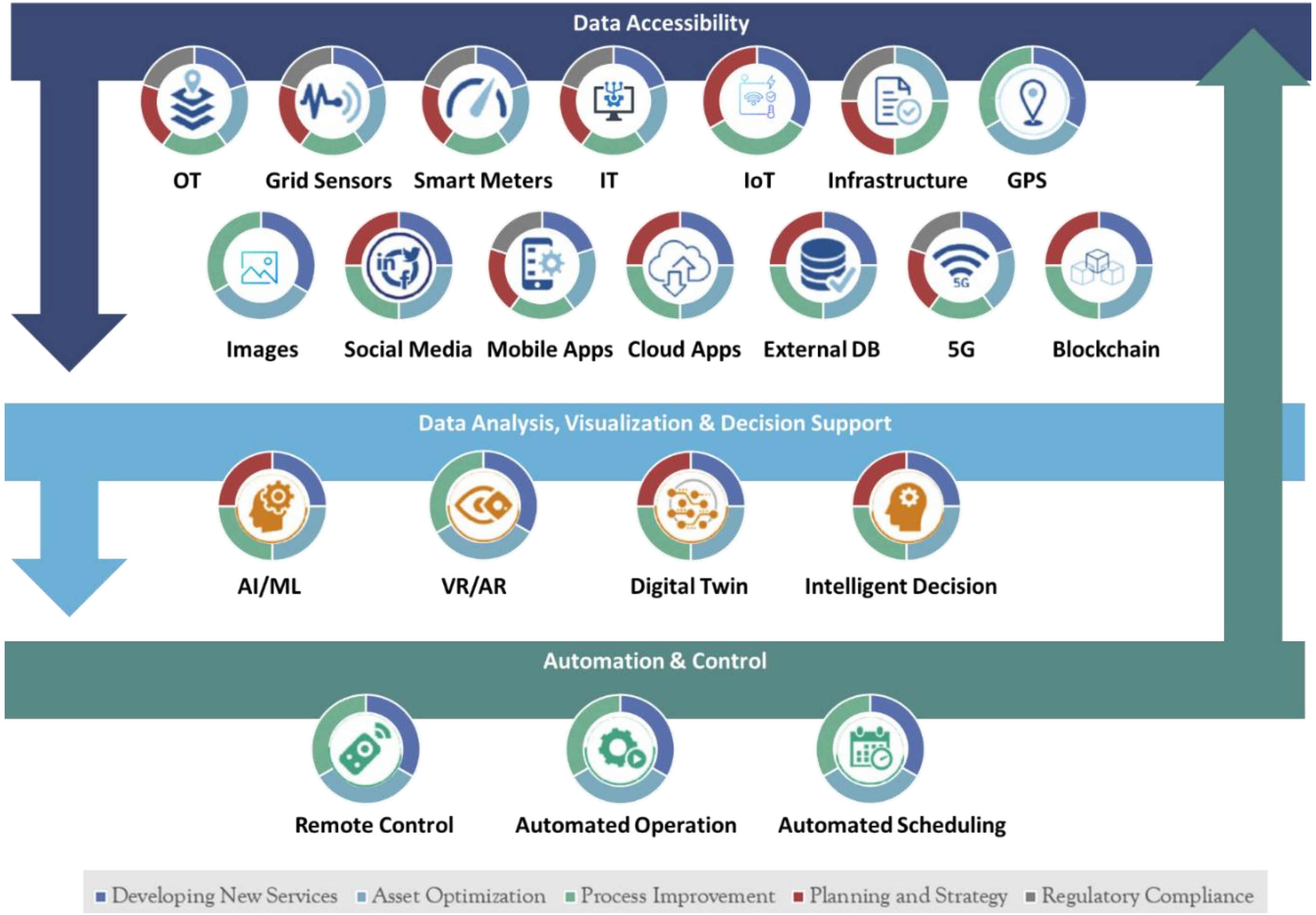
- Electricity utilities in developing countries face significant challenges in achieving operational excellence and sustainability. Typical challenges of utilities -that could also be addressed via data driven transformation- include:

  - ✓ **Low Electrification Rates**
  - ✓ **Electricity Theft**
  - ✓ **Technical Losses**
  - ✓ **Aging and Inadequate Infrastructure**
  - ✓ **Complex Grid Planning**
  - ✓ **Financial Challenges**
  - ✓ **Outdated Metering and Billing Systems**
  - ✓ **Workforce Challenges**



Components of Data Driven Transformation in Utilities

The Data-Driven Transformation of electric utilities marks a significant shift in their operational approach, leveraging extensive ***internal*** and ***external data*** to enhance efficacy and adaptability. This transformation is crucial for the development of ***smart grids***, as defined by the International Energy Agency, which use digital and advanced technologies to efficiently manage electricity transport from all sources to meet varying demands.



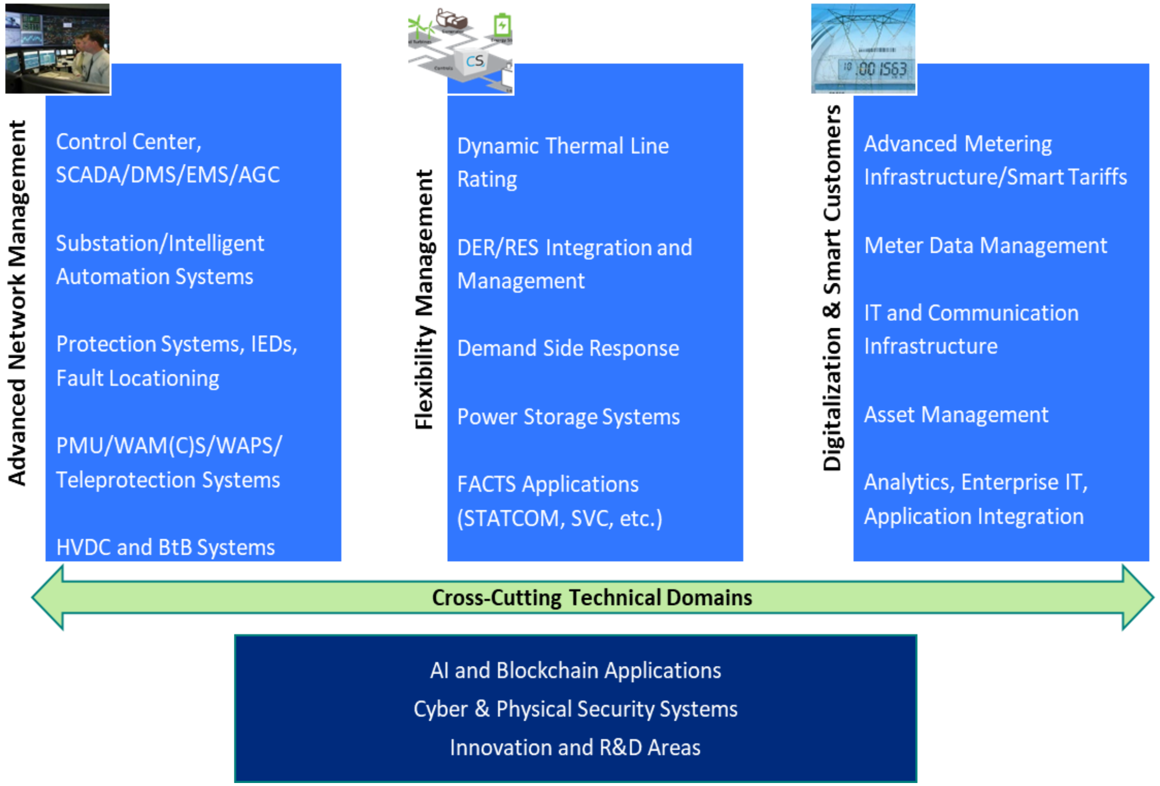
Components of Data Driven Transformation in Utilities

Main components of "Data Driven Transformation" include:

- Data Accessibility
- Advanced Analytics and AI
- Automation and Control
- Data Governance and Quality
- Infrastructure and Technology
- Organizational Change Management
- Customer Engagement
- Cybersecurity and Privacy
- Sustainability and Efficiency
- Innovation and Future-Proofing

The transformation leads to ***new services***, ***optimized assets***, ***process enhancements***, ***strategic planning***, and ***regulatory compliance***. Impact of these changes, with potential cost savings for utilities in especially developing countries is quite crucial. This comprehensive adoption signifies not just modernization but a leap toward operational excellence, cost-efficiency, and a future-ready utility landscape.

Digital technologies pivotal to the data-driven transformation



1. Advanced Network Monitoring, Control, and Management Systems
2. SCADA (Supervisory Control and Data Acquisition)
3. ADMS (Advanced Distribution Management Systems
4. WAMS (Wide Area Monitoring Systems
5. OMS (Outage Management Systems)
6. Asset Management and GIS (Geographical Information Systems)
7. Advanced Metering Infrastructure (AMI)
8. Enterprise Information Technology
9. EAI (Enterprise Application Integration) and APIs
10. DERMS/DRMS/VPP Management:
11. Other Modern Technologies

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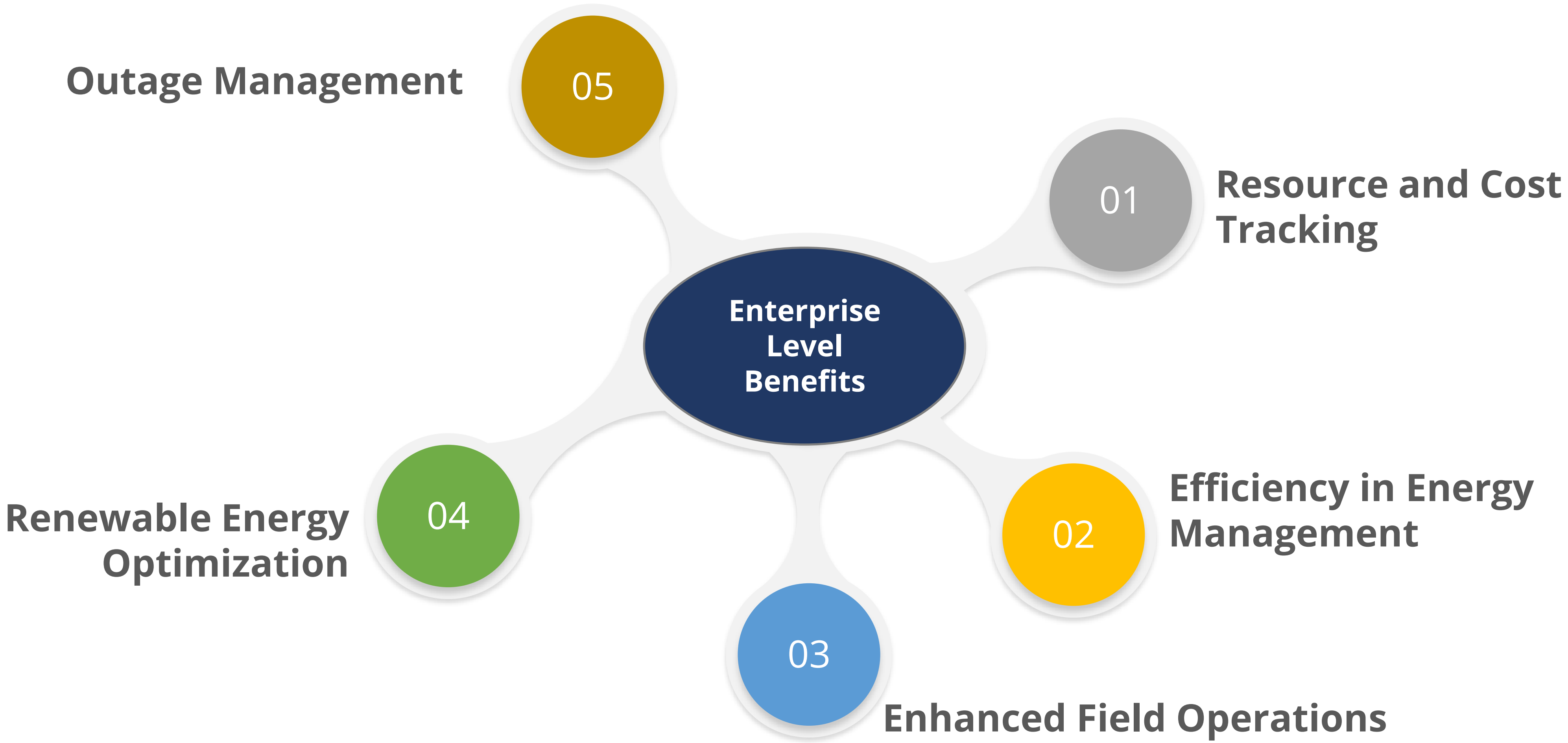
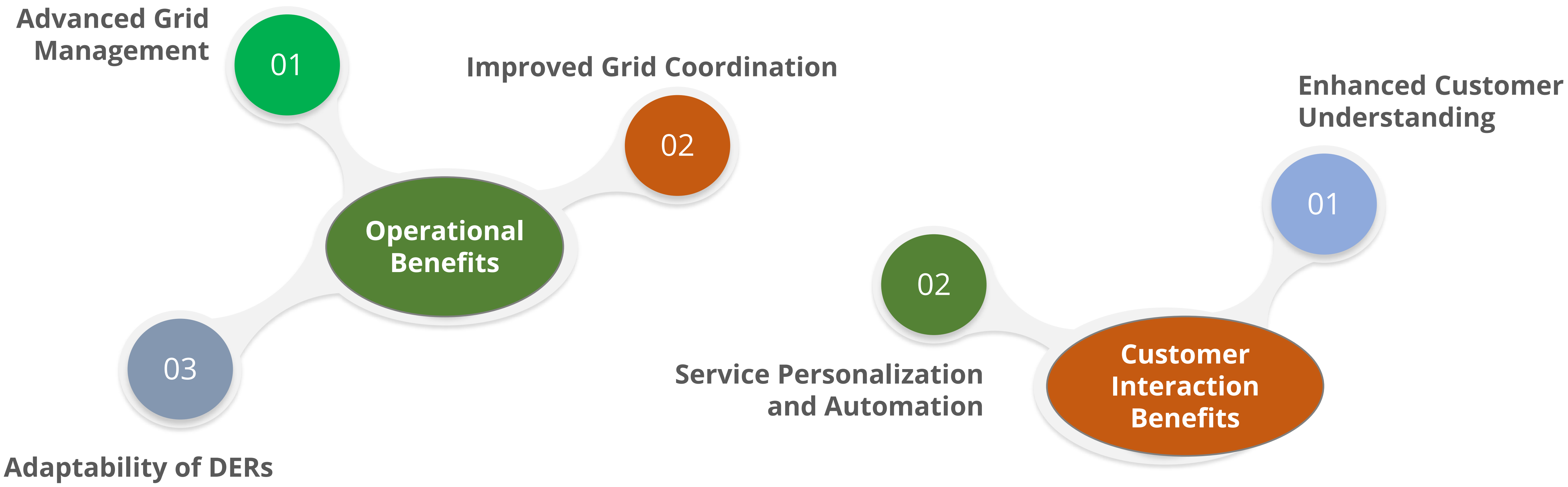
Benefits of Data-Driven Transformation (1/2)



Benefits of Data-Driven Transformation (2/2)



Challenges towards Data-Driven Transformation

Enterprise Challenges

- Lack of Transformation Roadmap
- Cultural Resistance to Change
- Data Governance Issues
- Security and Regulatory Compliance

Operational Challenges

- Infrastructure Investment
- Talent Gap
- Revenue Implications

Customer-Facing Challenges

- Customer Resistance
- Ensuring Transparency and Value

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Empowering Electrification and Demand Surge (1/2)

Analytical Grid Planning

- Analytical methods are key in designing micro-grids for off-grid applications, optimizing cost, efficiency, and reliability.
- Geospatial assessment using GIS tools helps define project coverage, analyze terrain, and distribute potential customers.
- System sizing and technology selection are aided by analytical models and tools to balance capacity with community needs.
- Economic and operational optimization ensures micro-grids' financial viability and efficient performance.
- Distribution system design and end-user integration are crucial.

GIS/Spatial Analysis for Grid Expansion

- GIS systems integrate location data for mapping and analysis, identifying optimal areas for grid expansion.
- Important in planning mini-grid or off-grid solutions, especially in remote areas, by identifying demand hotspots.

Power System Analysis for Planning

- Load flow and dynamic domain analysis, using tools like DIgSILENT PowerFactory, CYME, etc. model electricity flow and guides grid improvements.
- This analysis informs decisions related to grid maintenance and improvements.

Empowering Electrification and Demand Surge (2/2)

Demand Forecasting/Spatial Load Forecasting

- Demand forecasting predicts future electricity consumption, aiding in resource allocation and investment decisions.
- Spatial Load Forecasting adds a geographic dimension, identifying specific demand areas for tailored infrastructure planning.

New Grid Operation Philosophies including DER and Off-Grid Solutions

- Electrification via micro/mini-grids
- Mini-grid optimization involves data-driven sizing and optimization for reliable, cost-effective community electricity supply.
- Grid decentralization enhances resilience and localized decision-making.
- Active Load/Loading Management and other strategies improve grid efficiency and stability.

Enhancing Reliability and Resilience (1/4)

Real-time Monitoring and Remote Control of the Power Grid

- Modern energy landscapes require integration of real-time monitoring and remote-control systems in power grids for reliability and resilience.
- Data processed includes grid sensor, IED data, and meteorological conditions.
- Systems like SCADA, ADMS, and WAMS convert raw data into actionable insights.
- Benefits include early anomaly detection, improved situational awareness, and proactive grid management.
- Real-time data helps manage grid resources efficiently during adverse events and maintain uninterrupted power supply.
- Condition-based monitoring aids in optimized asset management, cost reductions, and extended asset lifespan.

Outage Management Practices

- Outage management is crucial for consistent and reliable power supply, integrating OMS with SCADA/EMS/DMS for effective detection, analysis, and restoration.
- Automated systems with real-time data from smart meters and sensors enable immediate outage detection.
- Integration with AMI offers detailed data from end-users, enhancing the accuracy of outage analysis.
- OMS optimizes resource allocation and supports the entire outage lifecycle, improving restoration efficiency.
- Performance monitoring and reporting by OMS ensure compliance with regulatory standards and quality of service indices.

Enhancing Reliability and Resilience (2/4)

Advanced Metering Infrastructure for Enhancing Situational Awareness

- AMI is crucial in improving grid stability, reliability, and operational efficiency, featuring smart meters, communication networks, and data management systems.
- AMI allows for detailed real-time grid performance monitoring, aiding in identifying non-technical losses and facilitating rapid response to grid disruptions.
- The system's extensive reach across the grid ensures granular visibility for thorough performance analysis and strategic improvements.
- AMI supports demand response programs, enabling effective demand-side management and grid reliability.
- Real-time outage detection capabilities minimize downtime and improve customer satisfaction.
- Continuous voltage level monitoring at various network points detects anomalies, aiding in maintaining grid stability.

Automated Fault Identification and Grid Reconfiguration

- Automated Fault Identification and Grid Reconfiguration technologies are crucial for modern electric power systems, with self-healing networks enhancing resilience and efficiency.
- SCADA systems provide centralized monitoring and immediate fault detection.
- ADMS optimizes grid operations with advanced algorithms for load flow analysis and fault localization.
- PMUs and WAMS offer precise grid stability analysis, improving decision-making and grid recovery capabilities.
- Self-healing power networks automatically detect, isolate, and resolve faults, reducing downtime and enhancing service reliability.

Enhancing Reliability and Resilience (3/4)

Root-Cause Analysis of Faults

- Root-cause analysis of faults is essential for enhancing grid reliability through advanced analytical functions.
- Time-series analysis of historical fault data and PMU data utilization provide trend analysis and anomaly detection.
- Integration with asset management systems correlates faults with specific equipment, aiding in comprehensive fault analysis.
- Machine learning algorithms recognize fault patterns, enhancing predictive capabilities.
- GIS-based visualization aids in identifying geographical fault hotspots.
- Network topology and load flow analysis assess grid impact during faults, informing reconfiguration strategies.

Disaster Preparedness and Grid Resilience

- Data-driven transformation is vital for power system resilience, especially in disaster scenarios.
- Advanced analytics predict extreme weather events, enabling proactive grid management.
- Real-time monitoring, anomaly detection, and automated response maintain grid stability during critical conditions.
- Data-driven disaster response optimizes resource allocation and speeds up recovery.

Enhancing Reliability and Resilience (4/4)

Predictive Asset Management

- Predictive maintenance ensures critical infrastructure readiness for adverse conditions.
- Predictive maintenance uses insights from operating conditions for efficient equipment maintenance.
- Data analytics generate precise predictions about asset and potential failures.
- This approach balances maintenance needs, improving reliability and reducing costs.
- Analysis of customer and consumption patterns aids in prioritizing high-impact assets for maintenance.

Cyber Resilience

- Cyber resilience is critical due to increasing cyber-attacks on power systems.
- The convergence of IT and OT systems in power grids expands the horizon of cyber threats.
- Data analytics applications address cybersecurity issues, detecting and preventing fraud and threats.
- AI-driven tools analyze network traffic and user behavior, enhancing cybersecurity measures.

Unveiling Efficient Network and Operations (1/2)

Improvement of Technical Losses

- Advanced analytics for network performance optimization
- Minimizing losses through network reconfiguration, capacitor placement, and Volt/VAR optimization
- Key tools: Load flow analysis, quasi-dynamic analysis, harmonic analysis
- ADMS for network topology optimization and predictive maintenance

Active Network Management and Grid Services from DERs

- Active Network Management (ANM) for efficient electricity distribution with DERs
- DERs providing grid services like voltage/frequency regulation and peak load reduction
- Predictive analytics and machine learning for proactive grid management
- TSO-DSO coordination for effective DER integration and utilization

Unveiling Efficient Network and Operations (2/2)

Efficiency in Customer and Grid Operations

- Utilizing data analytics for workforce management and route optimization
- Reducing operational expenditures through Robotic Process Automation (RPA) and IT integration
- Advanced analytics for automated and personalized customer service

Improvement of Voltage Profiles and Reactive Power Flow

- Operating schemes for voltage and reactive control using various mechanisms
- Tools: Distribution capacitor/reactor banks, battery storage systems, distributed generation inverters, tap changing transformers, Volt-VAR control

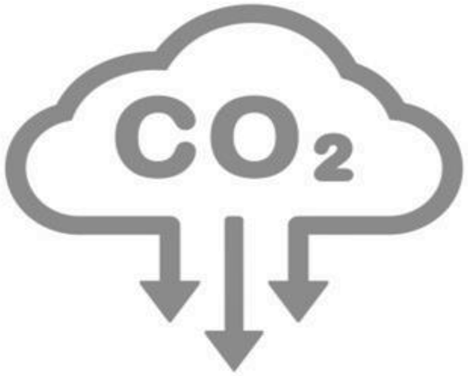
Coping with Non-Technical Losses

- Addressing losses due to theft and meter tampering
- Role of Advanced Metering Infrastructure (AMI) in detection and analysis
- Techniques: Real-time monitoring, anomaly detection, geospatial analysis, machine learning

Catalyzing Decarbonization

Integration of Low Carbon Technologies and Distributed Renewable Energy

- Big data for weather prediction and energy generation analysis (wind, solar)
- Predictive models based on historical data for balancing generation and demand
- Data analytics for effective management of microgrids and distributed energy resources
- Optimizing energy generation, distribution, battery management, and demand forecasting in mini-grids



Demand Side Management

Consumer Engagement for Energy Efficiency

- Smart meters and data analytics engage consumers in optimizing energy use
- Insights into consumption, savings opportunities, personalized recommendations

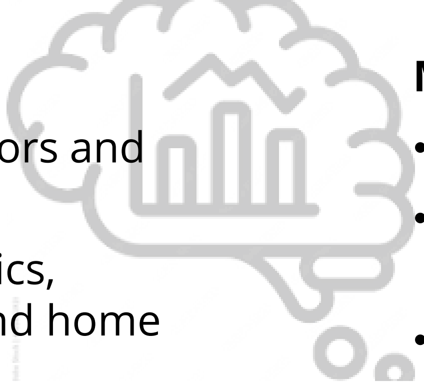
Flexible Load Management and DR Programs

- Incentivizing off-peak energy use for grid stability
- Real-time consumption data from smart meters
- Predictive analytics for peak demand forecasting
- Remote load management and incentives for demand response

Smart Charging of EVs

- Data-driven EV charging infrastructure development
- Load forecasting for EV charging demand
- Demand response programs and dynamic pricing for off-peak charging

Creating New Opportunities



Understanding the Market/Customers

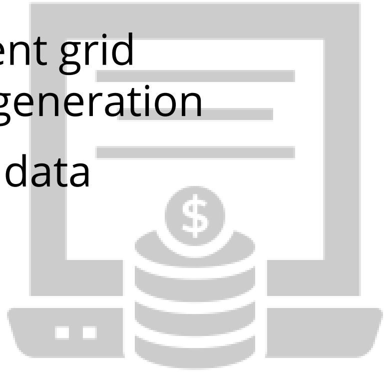
- Analytics to understand customer behaviors and propensities
- Segmentation by geography, demographics, technology adoption, economic status, and home ownership
- Examination of customer behavior in different industries and sizes
- Tailored commercial strategies and effective demand-side management based on customer insights

Sector Coupling and Market Design

- Data-driven insights for dynamic electricity market modeling
- Integration of data from various utility sectors for comprehensive understanding
- Advantages in resource management, grid planning, and customer service

Monetization of Data

- Direct utilization of utility data (UDaaS)
- Anonymizing and aggregating data for B2B partnerships
- Potential applications in energy consumption, grid performance, renewable energy
- Creating APIs for external access to utility data
- Specialized analytical services like load forecasting and grid optimization
- Data partnerships for efficient grid management and revenue generation
- Projected market growth in data monetization



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Selected Utility Case Study - Turkish Case

One of the biggest Turkish Electricity Distribution Utility serves ***3 distribution regions*** (out of 21) in Turkey and around ***12 million customers*** in those regions.

After privatization process, they got operational rights of their first region which contains the capital of Turkey, and their ***digital transformation journey began in 2009.***

The electricity sector traditionally lags behind in data analytics compared to sectors like banking or finance.

Firstly, they had ***legacy systems*** which;

- was state-owned,
- stored just metering and payment data ***with no track record*** of previous subscriptions of the customers,
- stored ***no asset data***,
- has ***limited monitoring capability***.

Therefore, the need for tracking customer payment behavior and historical consumptions emerged, as well as locating theft usage to generate revenue.

Hence, ***new IT systems were commissioned*** like Customer Information and Billing Systems, and Customer Relationship Management, and data were migrated to the new systems.

Initial focus on compliance reporting, demand forecasting, and loss detection. Together with some regulatory incentives, the following actions began to be needed;

- ***Reduction of outage duration and frequency***,
- ***Increase quality of service*** to increase customer satisfaction and to comply regulatory requirements.

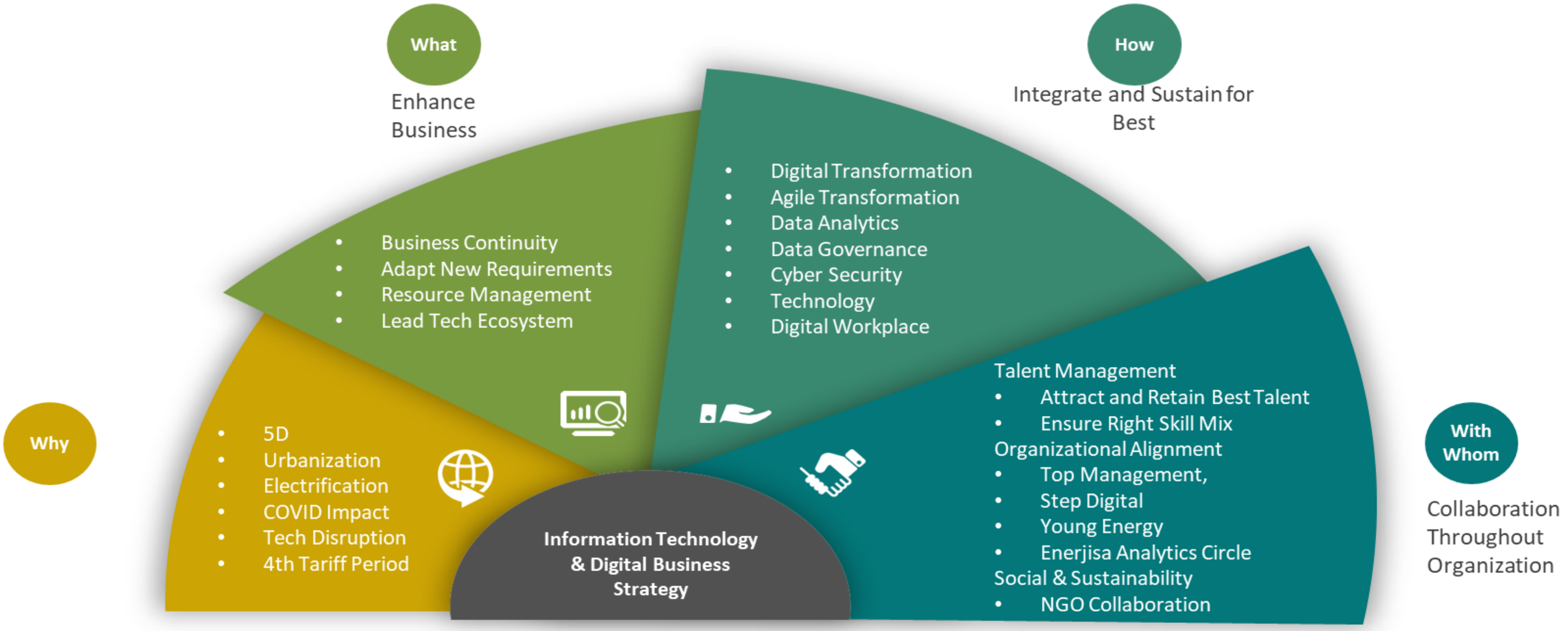
which affected the need of performance tracking.

Then, ***OT systems were commissioned***, like SCADA, OMS, GIS.

In 2021, they designed Digital Transformation model (E-TERNAL) as the first digital transformation model that received a patent protection in the field of energy in the world.

During this journey they have made various investments worth over 1.5 billion TL and aim to make even more for the future.

Selected Utility Case Study - Turkish Case



Selected Utility Case Study - Turkish Case

NOVEMBER 2020

1st Digital Maturity Assesment

Digital Maturity survey with more than 200 employees paticipation

MARCH 2021

E-TERNAL Launch

Digital transformation model has been implemented

JUNE-SEPT. 2021

1st Program and Process Card Meetings

Alignment meetings that encompass all BUs, where demands about the projects have been reviewed

DECEMBER 2021

Learning Outcome and Impact Studies

1st Financial Impact Meetings

OCTOBER 2022

Deloitte-Enerjisa Digital Maturity Project

Project Start: Digital Maturity Index Model for Energy Distribution Sector

DECEMBER 2022

2nd Digital Maturity Assesment

Revision of Digital Maturity Scores

JULY 2023

E-TERNAL Video

Story of Eternal 2020-2022

E-TERNAL PROGRAM TARGETS

Programs are designed to enhance key areas

Supply Security – Reduce Outages, SAIDI & SAIFI

Asset Management – Digitize Asset Planning and Operation

Maintenance Management – Regulatory and Operational Performance

Next to Customer – Increase Customer Satisfaction

Employee Focus – Increase Employee Satisfaction

Enriched Sales – Enhance Speed and Efficiency of Sales

Customized Solutions – E-Mobility, Distributed Generation, Efficiency,..

Digital Finance – Financial Compliance and Performance

Energy Market – Success in Energy Market

M2C Journey – Enhance Customer Processes

Essentials – DISCO IT Establishment and Integration

Data oriented Operation – Use of Analytics and Data in Operations

Technological Infrastructure – Implementation of New Techs

Selected Utility Case Study - Turkish Case

The projects involved in the E-TERNAL process were reviewed and classified according to the areas where they created value, parallel to the sustainability impact domains. Two-tier sustainability impact domain selection was made possible for all projects defined in Jira.

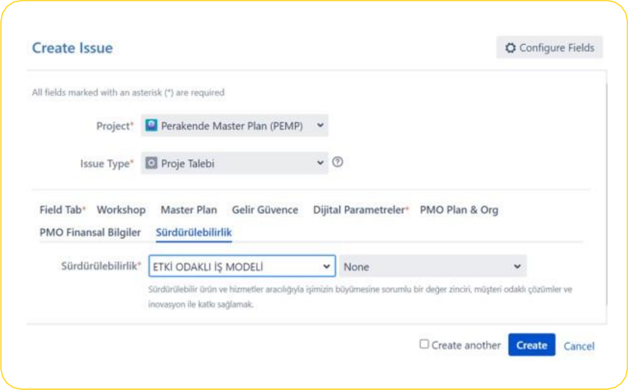
To contribute to the growth of our business through responsible value chain and innovation by means of sustainable products and services.

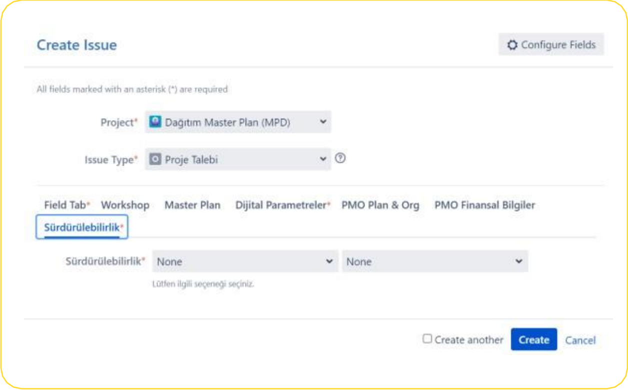
To reduce the environmental impacts of our operations by achieving net zero carbon and zero waste transformations.

To place human and culture, along with digital transformation, at the core of our business in order to create value in our impact domains.

To take responsibility in empowering people for an inclusive society, promoting a diverse and talented workforce in a safe working environment and creating a broader positive impact in the community.

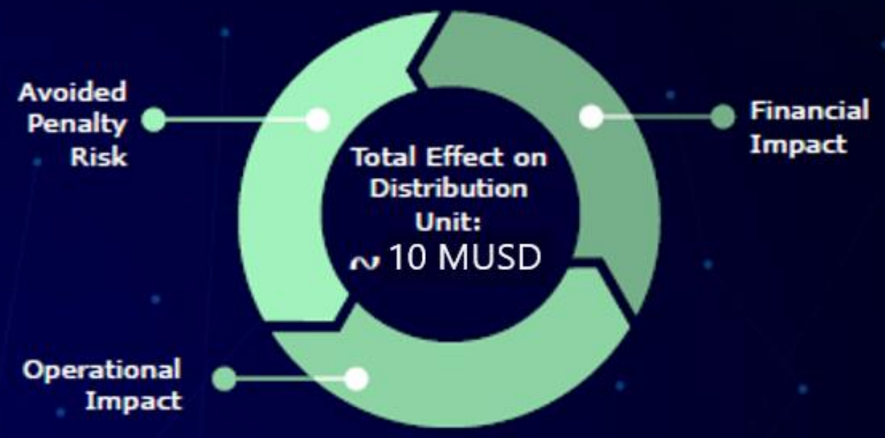
To enhance our performance through strong corporate governance, compliance management, integrated risk management, internal control mechanisms and an approach of effective stakeholder engagement, in order to communicate our impact and performance to our stakeholders.





Selected Utility Case Study - Turkish Case

	2010		2021		2023		FUTURE
Customer Operations	1,1	›	2,8	›	3,1	›	3,8
Network	0,8	›	1,9	›	2,3	›	3,5
Investment Planning	1	›	1,4	›	2,1	›	2,5
Construction Works	1	›	1,3	›	1,3	›	2,3
Compliance and Law	1	›	1,7	›	2	›	2,5
HSE	1	›	1,6	›	1,9	›	2,2
GIS	1	›	2,4	›	2,6	›	3,8
Distribution	1,0	›	1,9	›	2,2	›	2,9



Selected Utility Case Study - Turkish Case

Network Coverage Area	2022	2025
Interruption Data	72%	85%
Customer Notice Data	35%	85%

HV – Distribution Center

MV – Distribution Substation Transformer, MV Communication Lines

LV – Meter, Terminal Box, MV Communication Lines

2022	2025	PROJECT	AIM
6,9 K RTU	7,5 K RTU	High Voltage SCADA	Using RTU to control, monitor and coordinate data collecton process
3,0 K	3,0 K	High Voltage Data Collection	Orta gerilim düzeyindeki kesintileri izlemek.
2,7 K	5,0 K	IOT	Collect data from the low voltage side of transfromers
37 K	73 K	Customer AMR	Remotly collecting load profiles, indices, voltages, currents and interruptions data of major customers.
48 K	95 K	Lighting AMR	Collecting load profiles, indices, voltages, currents and interruptions data of customers.

- **Data Analytics Projects:** Prediction of Theft-Loss, Energy Management and Interruption, Network Statistics, Faulty Meter Readings, Maintanance and Repair Inspections, GIS Developments
- **Projects' Goals:** Increasing customer satisfaction, decreasing SAIDI/SAIFI values, Effective Outage Management and Maintanace Process, Regulatory Compliance, HSE

Selected Utility Case Study - Turkish Case

Theft and Loss Detection: ***Data-driven theft detection model***

- By analyzing ***historical consumption data*** from customers—sourced ***from*** both ***conventional and advanced meters***—this model employed ***fraud detection algorithms*** in conjunction with time series models to forecast theft occurrences.
- The efficacy of theft and loss identification surged, with ***hit rates leaping from 20-25% (through manual inspection) to 40-45%*** with the aid of analytical applications.
- Additionally, by optimizing field operations rooted in these accurate predictions, the utility was able to ***diminish arbitrary searches***, leading to both cost savings and heightened operational efficiency.

Predictive maintenance: ***Image processing techniques***

- By applying advanced analytics and machine learning algorithms to ***equipment data*** derived from OT systems like SCADA, AMI, and OMS, the utility proactively ***identified maintenance*** needs, ***reducing downtime and minimizing reactive repair costs by 20%***.

Demand Forecasting: ***predict short-term electricity consumption***

- By leveraging ***tools*** such as SAS, SAP Hana, and Jupyter (Python), and using ***historical production*** and ***consumption*** data, ***weather data***, and ***calendar variables***, the company developed a regression model and XGBoost for predicting consumption ***two days in advance***, when they ***have to decide*** whether to operate in ***balancing market*** or ***day-ahead market***.
- This predictive model helped in ***balancing the demand and supply of electricity***, ***resulting in a decrease in regulatory penalties around 6 MUSD***.

Selected Utility Case Study - Turkish Case

RPA & AUTOMATION

Projects

- RPA - Accrual Automation
- RPA - Supplier Additional Charge Notification
- RPA Automatic Cancellation Process
- Incident Detection Process Automation

Aim

✔ Time and workforce savings, standardization of processes, increase in quality, reduction in man-made errors

In 5 different Theft Types 30,000-40,000 Accrual

482 Installation %70 ⇨ %90

DIGITAL INTERACTION WITH THE CUSTOMER

Projects

- New Connection Digitalization Project (New Connection Portal)
- Producer Portal
- Field Communication Project

Aim

✔ Being more accessible, sharing and processing accurate data quickly, reducing manual processes

~ 103 Trees

9000 email ⇨ 4000 email

DATA ANALYTICS

Projects

- Advanced Data Analytics and Theft Analysis
- Transformer-Based Theft-Loss Calculation
- Day-Ahead Market Electricity Demand Forecast
- Prosa Project
- Acquisition of Detailed Data from Meters via Optical Port

Aim

✔ Utilizing valuable information from Big Data through data analysis, interpreting the obtained data, making prediction models with machine learning and gaining efficiency in workforce.

245 TRA. ⇨ 750 TRA.

Prosa	2022	2025
Successfull fault detection rate	53,19%	80%

DIGITALIZATION OF THE FIELD

Projects

- Granting Energy Permission with GIS
- Laboratory Test System (LTS) Project
- Mobile Application Project(İş Cepte)

Aim

✔ Accelerating field applications, obtaining accurate data, reducing data loss and decreasing man-made errors in field operations.

%60-70 GIS Usage ⇨ %90 GIS Usage

Laboratory Test Systems		
Pre-Project	Post-Project	After E-Signature (Prediction)
15 days	8 days	6 days

Key Takeaways from Turkish Utility Case Study

Overview of Data and Analytics Strategy

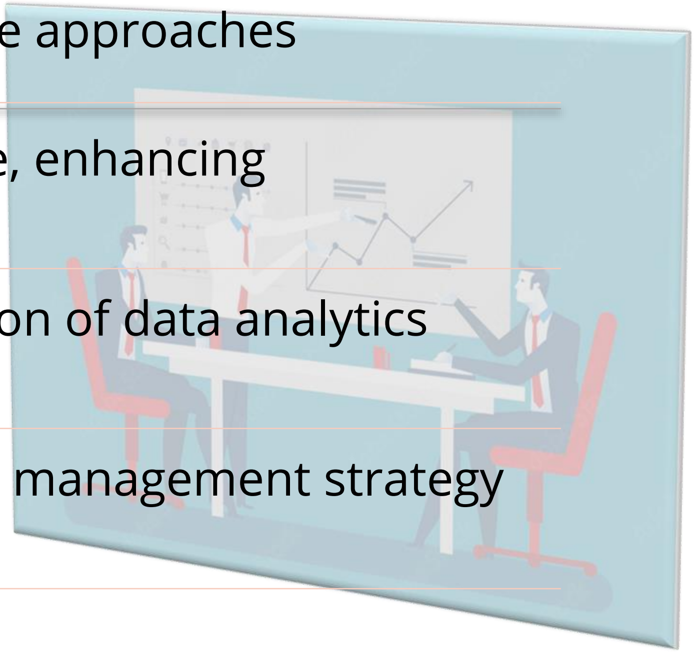
- The electricity sector traditionally lags behind in data analytics compared to sectors like banking or finance.
- The Utility recognizes the need for data and analytics to optimize operations and meet regulatory standards.
- Initial trigger is from the Regulatory Authority, on compliance reporting, demand forecasting, and loss detection.
- Legacy systems lacked historical data, leading to a focus on improving data quality

Real World Applications and Results

- Various use cases in theft and loss detection, predictive maintenance, and demand forecasting.
- Significant improvements in operational efficiency and customer satisfaction.
- Challenges in data integration and quality, requiring continuous adaptation and investment.

Key Takeaways from Turkish Utility Case Study

Lessons and Advices for Utilities in Developing Countries	Importance of data governance and management.
	Need for fostering a data-driven culture & securing management buy-in.
	Balance between in-house teams and external expertise.
	Start with pilot models and adopt agile approaches
Future Challenges and Plans	Developing cloud-ready infrastructure, enhancing cybersecurity, and exploring AI.
	Continuous expansion and optimization of data analytics initiatives.
	Implementation of an enterprise data management strategy and analytics roadmap.



Key Takeaways from Turkish Utility Case Study

Pilot Models	Begin with easily achievable pilot models before attempting comprehensive projects.
Proven Solutions	Adopt proven solutions from other utilities or globally recognized applications to save on development costs and time.
Agile Integration	Use an agile, iterative approach for data analytics projects to ensure flexibility and continuous improvement.
Cloud-Based Applications	Utilize cloud services for their cost-efficiency and scalability, especially for high-demand CPU/GPU resources.
Open AI Models	Implement OpenAI's advanced learning and decision-making models for various applications like predictive maintenance and demand forecasting.
Vendor Engagement	Collaborate with third-party vendors for specialized expertise and advanced technology.
Operational Focus	Target key operational challenges with accessible analytics solutions that offer clear benefits.
Data Security	Maintain a strong focus on data security, governance, and regulatory compliance throughout the transformation.
External Support	Seek funding, technical support, and capacity building from government and international bodies, and share best practices with peers.

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Company Profile

KEDS operates an electrical network, providing distribution, maintenance, and repair services to around 600,000 customers across Kosovo.

KEDS commenced its operations in 2013, With nearly 2000 employees, KEDS is dedicated to leading the energy sector in Kosovo, managing electricity delivery and maintaining its infrastructure, including power lines and substations.

KEDS does the distribution of electricity up to last customer, manages and maintains assets in terrain. Within the KEDS are included lines of medium voltage 35 kV, 20kV,10 kV, 10 kV with possibility of transfer to 20 kV, 6 kV and 3 kV together with respective substations, substations 35/10 kV, 10(20)/0.4 kV, 10/0.4 kV, 6/0.4 kV, lines of low voltage 0.4 kV,

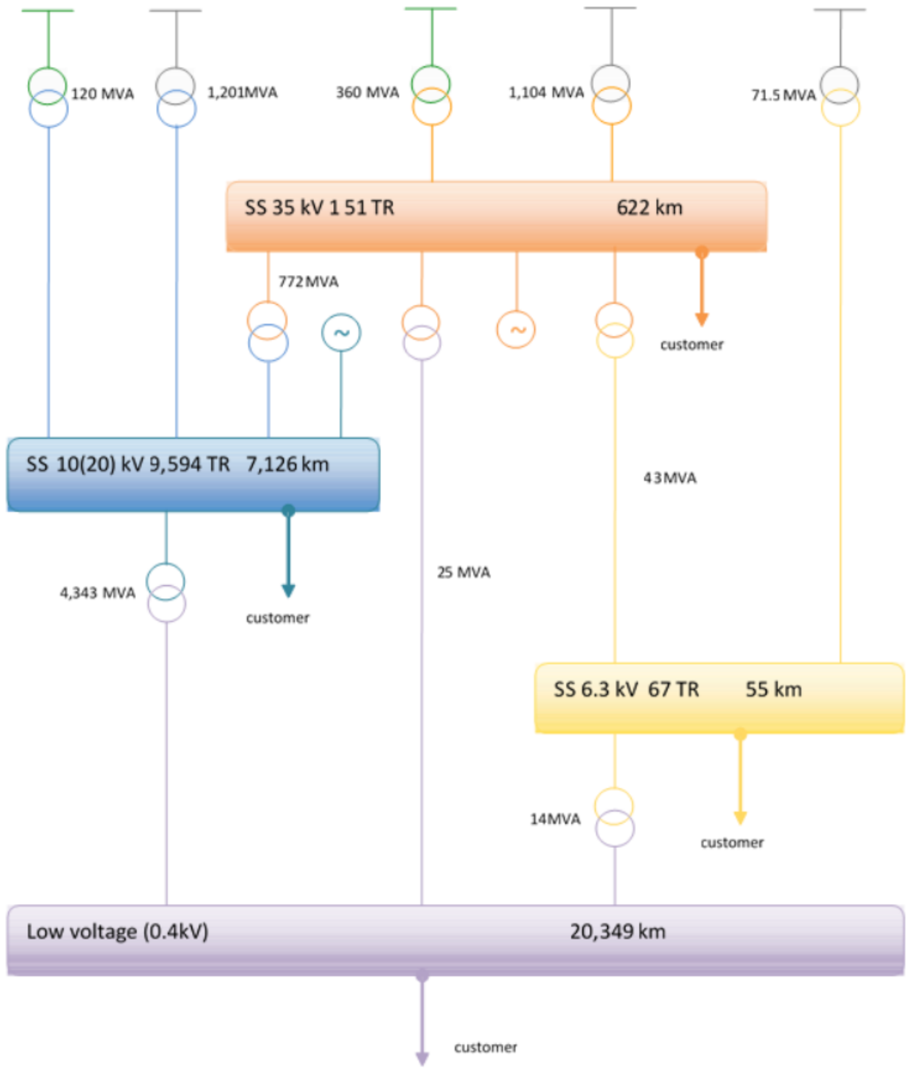
In terms of technology, KEDS is a company oriented to digitalization. The company operates in parallel in two digital fields:

- SCADA - Network Operation Program, already installed throughout Kosovo, through which the network is commanded by the centralized system, respectively from a single room in the central building of KEDS, and;
- KOSOVANET - A program for monitoring and managing the entire infrastructure of the distribution network and the workforce, where every movement in the electricity network is seen in a real-time digital monitor.

Some Grid Data

Transformers per voltage level

Transformation (kV/kV)	Owner	No. of SS	No. of TR	Installed power (MVA)
35/10	KEDS	44	94	662
35/10	Private	11	15	68
35/20	KEDS	2	5	41
35/6 kV	Private	5	12	43
35/0.4kV	Private	17	25	22
10(20)/0.4	KEDS	2 532	2 627	1 338
10(20)/0.4	Private	2 805	2 820	1 391
10/20	KEDS	1	1	109
10/0.4	KEDS	2 893	2 893	899
10/0.4	Private	1 247	1 253	606
6(3)/0.4	KEDS	66	66	13
6/0.4	Private	1	1	1
Total		9 624	9 812	5 194



Basic Technology and Combining Field Discipline

KEDS initiated in 2014, a pivotal project aimed at the monitoring and metering of medium voltage/low voltage (MV/LV) transformers. This endeavor represents a strategic approach to harnessing advanced metering infrastructure to enhance the efficiency of electricity distribution.

Objectives:

- **Enhanced Monitoring:** Implement state-of-the-art monitoring technology for MV/LV transformers to obtain real-time data on electricity flow.
- **Data-Driven Decisions:** Utilize the collected data to make informed decisions aimed at optimizing the distribution network's performance and reliability.

Methodology:

- **Transformer AMR :** The project integrates advanced metering technologies to gather comprehensive data on transformer performance and customer electricity usage.
- **Data Integration:** By combining metering data with customer-network connectivity information, KEDS can analyze patterns that indicate potential commercial losses.

Basic Technology and Combining Field Discipline

Technological Implementation:

- **Smart Metering:** Limited deployment of smart meters in MV/LV transformers and large customers to accurately track consumption patterns.
- **Data Analytics:** Utilization of sophisticated data analytics tools to process and analyze the collected data, enabling the identification of discrepancies indicative of electricity theft or inefficiencies.

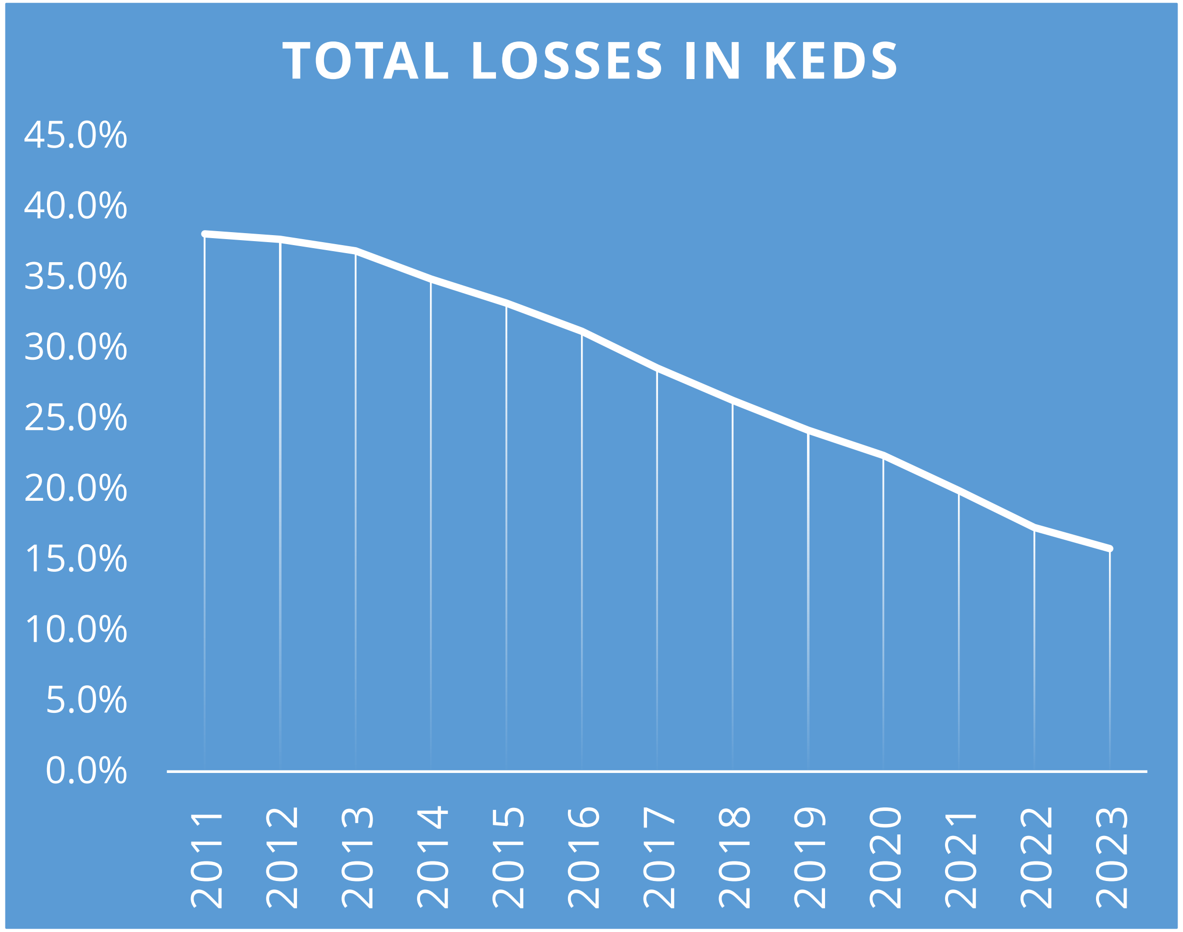
Impact on Theft Reduction:

- **Operational Efficiency:** The project significantly bolstered the efficiency of theft coping teams by providing them with accurate data to target investigations.
- **Improved Hit Rate:** Leveraging data analytics led to a notable increase in the success rate of identifying and mitigating illegal electricity connections and theft.

Basic Technology and Combining Field Discipline

Results and Achievements:

- **Loss Reduction:** Over the course of eight years, KEDS successfully reduced total electricity losses from an initial 33% to an impressive 15%.
- **Operational Excellence:** The project underscores KEDS's commitment to operational excellence and its pioneering role in adopting technological solutions to enhance utility management.
- **Sustainable Impact:** By significantly reducing losses, KEDS not only improves its operational efficiency but also contributes to the sustainable management of energy resources.



Agenda

- ✓ Components of Data Driven Transformation in Utilities
- ✓ Benefits and Challenges of Data-Driven Transformation
- ✓ Ways that Digitalization helps Utilities Tackle with Real Life Business and Operation Challenges
- ✓ Selected Utility Case Study - Turkish DSO Case
- ✓ Selected Utility Case Study - Balkans DSO Case
- ✓ **Selected Utility Case Study – Central Asia Case**

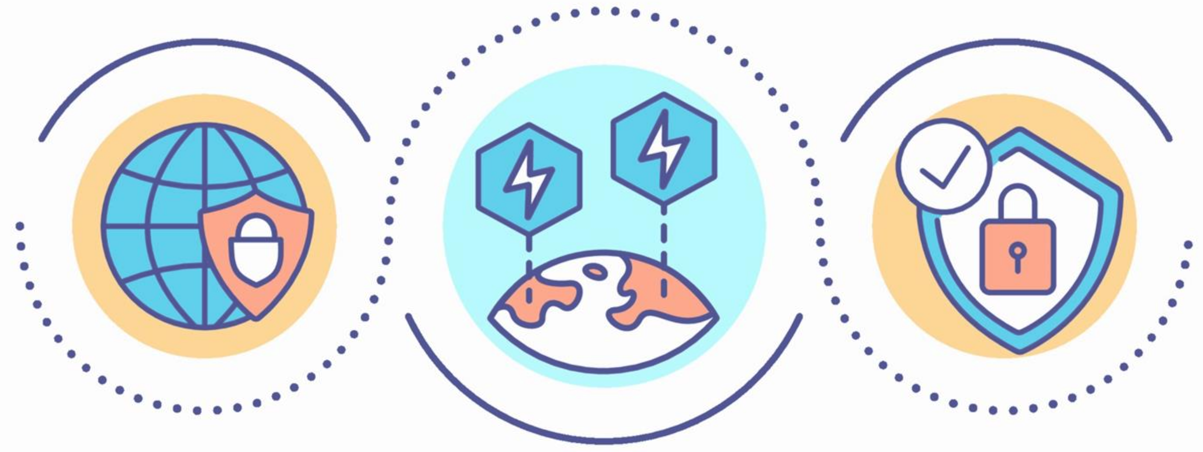
100% AMI Roll-out

One of the key **digitalization efforts** in the energy sector of **Uzbekistan** is the adoption of **advanced metering infrastructure (AMI)** for electricity, including the use of smart meters that provide real-time data on energy consumption.

The adoption of AMI has been supporting to improve billing accuracy and reducing operating costs by eliminating the need for manual meter readings

The adoption of smart grid technologies, AMI, and other digitalization efforts are expected to bring significant benefits such as:

- Improved efficiency
- Reduced costs
- Increased sustainability
- Enhanced energy security



100% AMI Roll-out

- Distribution infrastructure results in **system losses officially reported at 15-20%,** with actual losses **potentially reaching 25%-35%** due to technical and commercial issues, including **theft** and **inaccurate meter reading**.
- AMI has supported to overhaul the manual and self-reporting systems with smart meters to enhance accuracy, efficiency, and theft prevention.

The AMI program, structured in four phases with international financial support, realized the installation of smart meters across Uzbekistan to reduce losses and improve system reliability.

1. **Phase 1:** Funded by ADB, covers Samarkand, Bukhara, and Jizzakh for 1.06 million metering points.
2. **Phase 2:** Supported by IBRR, targets Tashkent City and regions, for 1.26 million metering points.
3. **Phase 3:** Financed by IsDB, aims at Karakalpakstan, Khorezm, and Navoi for 0.8 million metering points.
4. **Phase 4:** A collective funding effort by ADB, IDB, FAR, URDF for Andijan, Fergana, Kashkadarya, Namangan, Surkhandarya regions for 2.6 million metering points.
5. **Phase 5:** Completion of remaining customers to get integrated to AMI system.

Benefits so far via Full Scale AMI Implementation

- 99% of all public have been equipped with pre-paid smart meters in Uzbekistan, and a data center has been installed to process the information from the smart meters was built in the capital city Tashkent (total around 9 million smart meters).

- With the support of AMI, JSC REN has started to accurately measure power usage and provide real-time information to the consumers.

- AMI and automated billing system supported JSC REN to increase the received payments by 40 percent, and accounts receivables have declined by 20 percent.

- The use of smart meters significantly reduced the JSC REN's commercial losses and improved its financial position, helping it invest in further reducing transmission and distribution losses.

Hududiy Elektr Tarmoqlari

Benefits so far via Full Scale AMI Implementation

- JSC REN also employs the AMI to address distribution network congestion and overloading as well, enhancing the management and optimization of electricity distribution amid high demand and technical constraints.

- The company has implemented remote connect/disconnect capabilities through AMI, allowing for the enforcement of consumption limits as per customers' connection contracts.

- By integrating these technologies, JSC REN effectively copes with challenges associated with electricity distribution, ensuring a reliable and efficient supply system, and promoting sustainable energy consumption practices among its customers.

This feature enables JSC REN to control power supply remotely, ensuring users do not exceed predetermined limits, thus maintaining network stability and reliability

Plans to Maximize the Utilization of AMI System/Data

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Meter Management

- **Meter Fault Prediction** — Use predictive analytics to identify potential meter malfunctions before they occur, reducing downtime and maintenance costs.
- **EV Optimization** — Manage electric vehicle (EV) charging demand to ensure grid stability and promote efficient energy use.
- **Load Profiling** — Create detailed profiles of consumer energy usage to tailor services and improve efficiency.
- **Demand Forecasting** — Analyze consumption patterns to forecast future demand, aiding in strategic planning and infrastructure investment.
- **Outage Management** — Quickly identify and respond to outages with near real-time data, minimizing downtime and improving customer satisfaction.
- **Correction of Connectivity Model Errors** — Use data analytics to correct inaccuracies in the network connectivity model, enhancing grid management.

Plans to Maximize the Utilization of AMI System/Data

Hududiy Elektr Tarmoqlari

Loss Management

- **Time Series Clustering of Commercial Losses** — Identify patterns indicative of energy theft by clustering customer consumption data over time.
- **Net Balancing of Customer and Grid Meters** — Compare aggregated customer usage against grid input to identify discrepancies suggestive of theft. Perform detailed energy balance calculations at the transformer level to pinpoint areas of high loss.
- **Identification of High-Risk Customers** — Use time series analysis to pinpoint customers with unusual consumption patterns that may indicate illegal usage.
- **Cost-Benefit Analysis of Loss Reduction Actions** — Evaluate the financial impact of strategies aimed at reducing energy theft and optimizing resource allocation.
- **Optimum Scheduling for On-Site Inspections** — Determine the most effective timing for inspections to catch illegal consumption, based on analytics.
- **Analysis of Illegal Consumption Correlations** — Investigate the relationship between illegal consumption and various socio-demographic, economic, and market factors to inform targeted interventions.

Thank You

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