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Session : Name of the Session

PRESENTATION TOPIC

Presented By

NAME, DESIGNATION, COMPANY NAME OF THE PRESENTOR

Title: Global Head of Energy Business Unit, LTSCT

Prior to LTSCT, Andres Carvallo was the founder and CEO of **CMG Consulting LLC**, a strategic planning and advisory firm focus on designing, building and managing Smart Grids, Smart Utilities, Smart Cities, and Smart Buildings during which time he helped design the power grids in Dubai, Abu Dabhi, Turkey, Brazil and US. And he was also a Professor, Fellow, and Director at **Texas State University**, where he taught Electrical Engineering classes and built 14 living labs in 800 acres focus on 5G/IoT, Mobility, Utilities, Cities, Infrastructure and Buildings, Energy, Sensors, Networks and BigData/Software. And he is the author of "The Advanced Smart Grid" and has published a total of 48 books in Power Engineering, Telecom/IoT, and Building Technologies. Carvallo has also received 36 industry awards since 2005.

Carvallo is globally known as the "Godfather of the smart grid" for designing and building the very first smart grid in the US at **Austin Energy** where he was the CIO/CTO and led a storied $4 billion deployment of technology transformation in 8 years, via 2,500 projects with a 98% on-time and on-budget. He designed and built solar, wind, biomass, and CHP plants.

Carvallo has held c-suite and senior executive leadership roles such as CIO/CTO at **Austin Energy** (from $700 million to $1.4 billion in 8 years and managed 300 people), Division President at **Philips Electronics** (from zero to $3.5 billion in 4 years and managed 10,000 people**)**, Division President at **Digital Equipment Corp (**now **HPE** went from zero to $2 billion in 2 years and managed 4,000 people**)**, General Manager at **Borland** (from zero to $200 million in 2 years and managed 400 people**)**, and built, ran, and sold six IoT/telecom and Internet startups. Carvallo started his career as a Windows Product Manager at **Microsoft** in Redmond, WA.
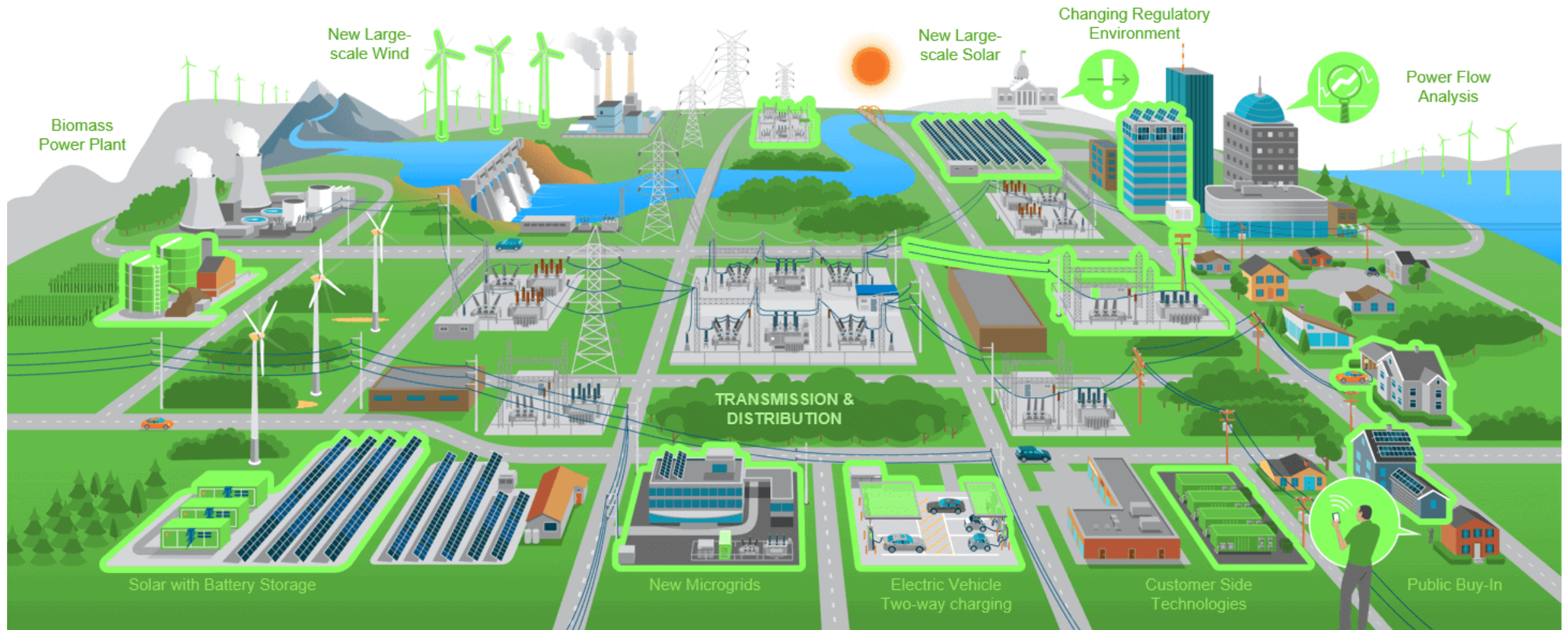
Driving the Future: Why Digitalization is Essential

- Challenges facing modern utilities: aging infrastructure, increasing demand, renewable integration, cybersecurity threats.

- The Grid of The Future needs to be far more resilient, efficient, and sustainable. And it must be 2-way power flow, 2-way data flow.

- **In my book "The Advanced Smart Grid**, I talk about how "edge power" is inevitable and it will create the necessity for real-time data monitoring, control and optimization for grid stability and sustainability.

Charting the Course: Developing a Digitalization Roadmap

- Importance of a phased and strategic approach.
- Key roadmap components: data acquisition, analytics, automation, cybersecurity.
- Integration of IoT, AI, and cloud computing.
- **In my book I talk about the** concept of the "energy internet" as a framework for building an interconnected and intelligent grid.
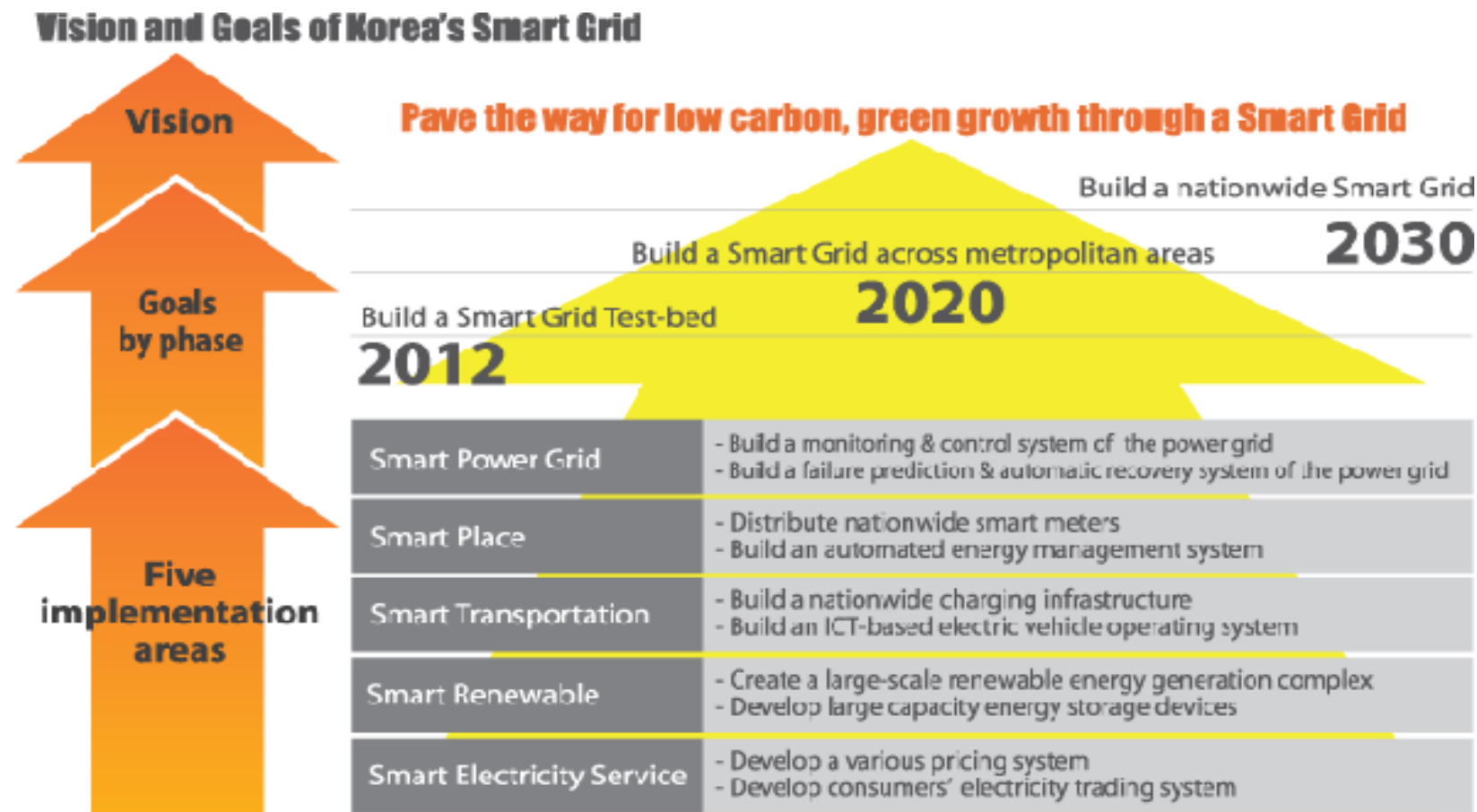

Figure 4.   Vision and goals of KEPCO smart grid

The Power of Digital Twins

Virtual Reality, Real Results: Digital Twins for Utilities

- Easy use cases: grid simulation, asset management, predictive maintenance, optimization.
- Digital twins enable proactive decision-making and risk mitigation.
- **In my book, I relate how** digital twins ease the path toward a self-healing and adaptive grid, where virtual models are used to optimize real-world operations.

Digital Twins are virtual representations of physical assets, processes or systems

They provide a dynamic, real-time mirror of their real-world counterparts, enabling simulations, analysis, and optimization. In the utility sector, digital twins offer a powerful tool for enhancing operations, maintenance, and planning.

Building the Digital Foundation: Essential Technologies
- Key technologies: advanced metering infrastructure (AMI), Advanced Distribution Management System (ADMS) and distribution automation (DA), energy storage, Distribution Energy Management System (DERMS), cybersecurity solutions.
- And need to add Data Analytics and AI to enable predictive Grid Intelligence.
- **In my book, I help connect the dots on how** edge computing, microgrids, and distributed energy resources (DERs) are the crucial components of the advanced smart grid.

Digital twins are transforming various aspects of the utility sector, including

- **Grid Management:**
  - Simulating grid behavior under different load conditions, weather events, or renewable energy integration scenarios.
  - Optimizing power flow and voltage control.
  - Identifying and mitigating potential grid vulnerabilities.
- **Asset Management:**
  - Creating digital replicas of substations, transformers, power lines, and other critical assets.
  - Monitoring asset health and predicting failures.
  - Optimizing maintenance schedules and reducing downtime.
- **Renewable Energy Integration:**
  - Simulating the impact of distributed energy resources (DERs) on the grid.
  - Optimizing the integration of solar, wind, and energy storage systems.
  - Forecasting renewable energy generation.

Digital twins are transforming various aspects of the utility sector, including:

- **Distribution Automation:**
  - Creating digital twins of distribution networks to optimize feeder reconfiguration and fault location.
  - Improving the reliability and resilience of distribution systems.
- **Water and Wastewater Management:**
  - Simulating water flow and pressure in distribution networks.
  - Optimizing pump operations and reducing energy consumption.
  - Predicting and preventing leaks and pipe failures.
- **Training and Simulation:**
  - Creating virtual environments for training utility personnel on complex tasks and procedures.
  - Simulating emergency scenarios to improve response times and decision-making.
- **Planning and Development:**
  - Simulating the impact of new infrastructure projects on the grid.
  - Optimizing the design and placement of new assets.
  - Testing new technologies in a virtual environment.

Digital Twin Benefits for Utilities

- **Improved Reliability:** Predictive maintenance and fault detection.

- **Reduced Costs:** Optimized operations and maintenance.

- **Enhanced SAIDI, SAIFI and Energy Efficiency:** Optimized power flow and resource utilization.

- **Increased Safety:** Simulation of hazardous scenarios.

- **Faster Innovation:** Testing and validating new technologies in a virtual environment.

- **Better Planning:** Simulation of future scenarios.

In essence, digital twins are a powerful tool for utilities to gain deeper insights into their operations, improve efficiency, and build a more resilient and sustainable energy future.

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THANK YOU

For discussions/suggestions/queries email: isuw@isuw.in

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Links/References (If any)