



AI-based
Digital Twin



31
Technical Institutes

25
Years of Experience

6000+
Research Scholars

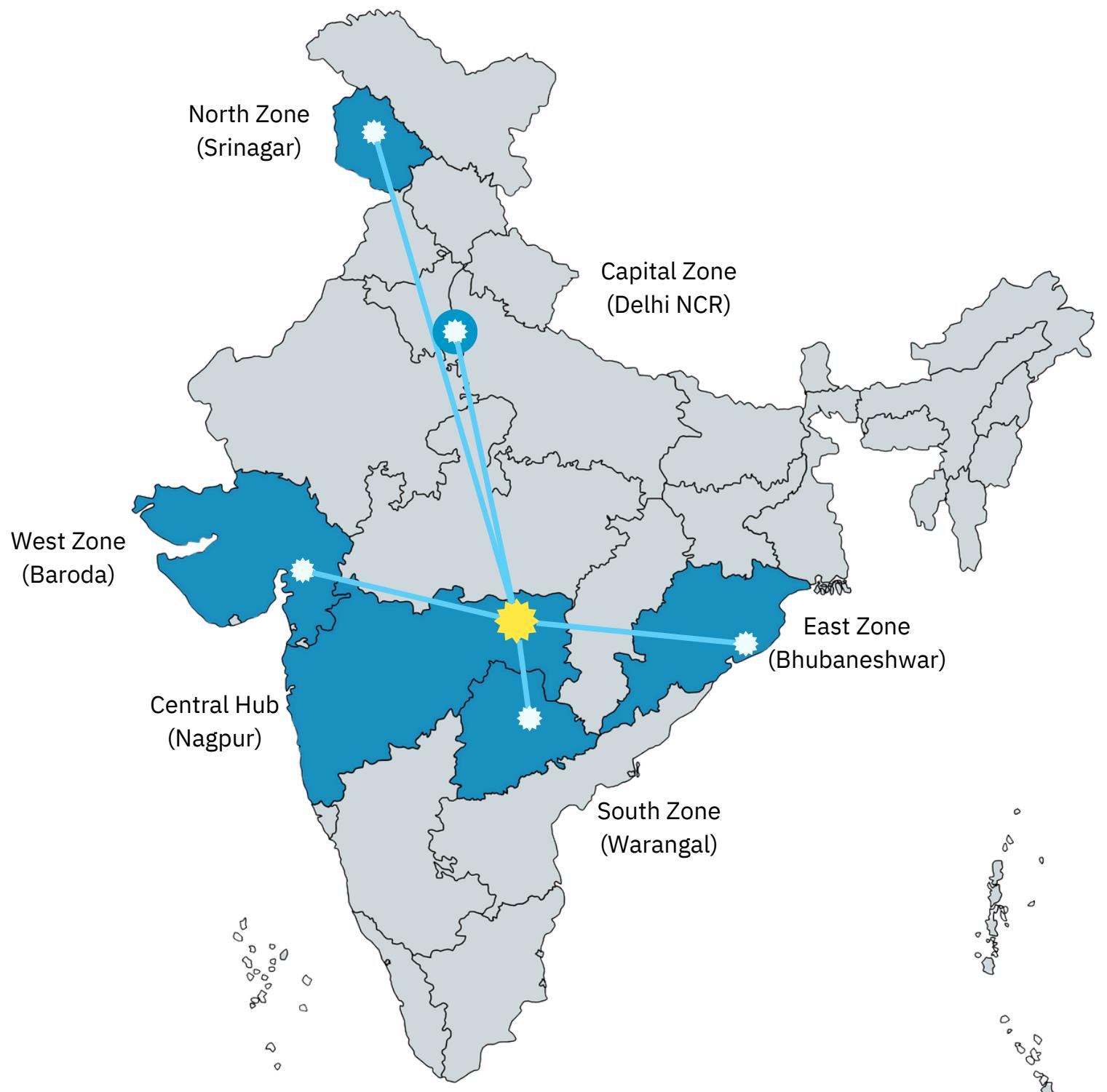
KIGG's Energy Transition Lab

In order to help organizations

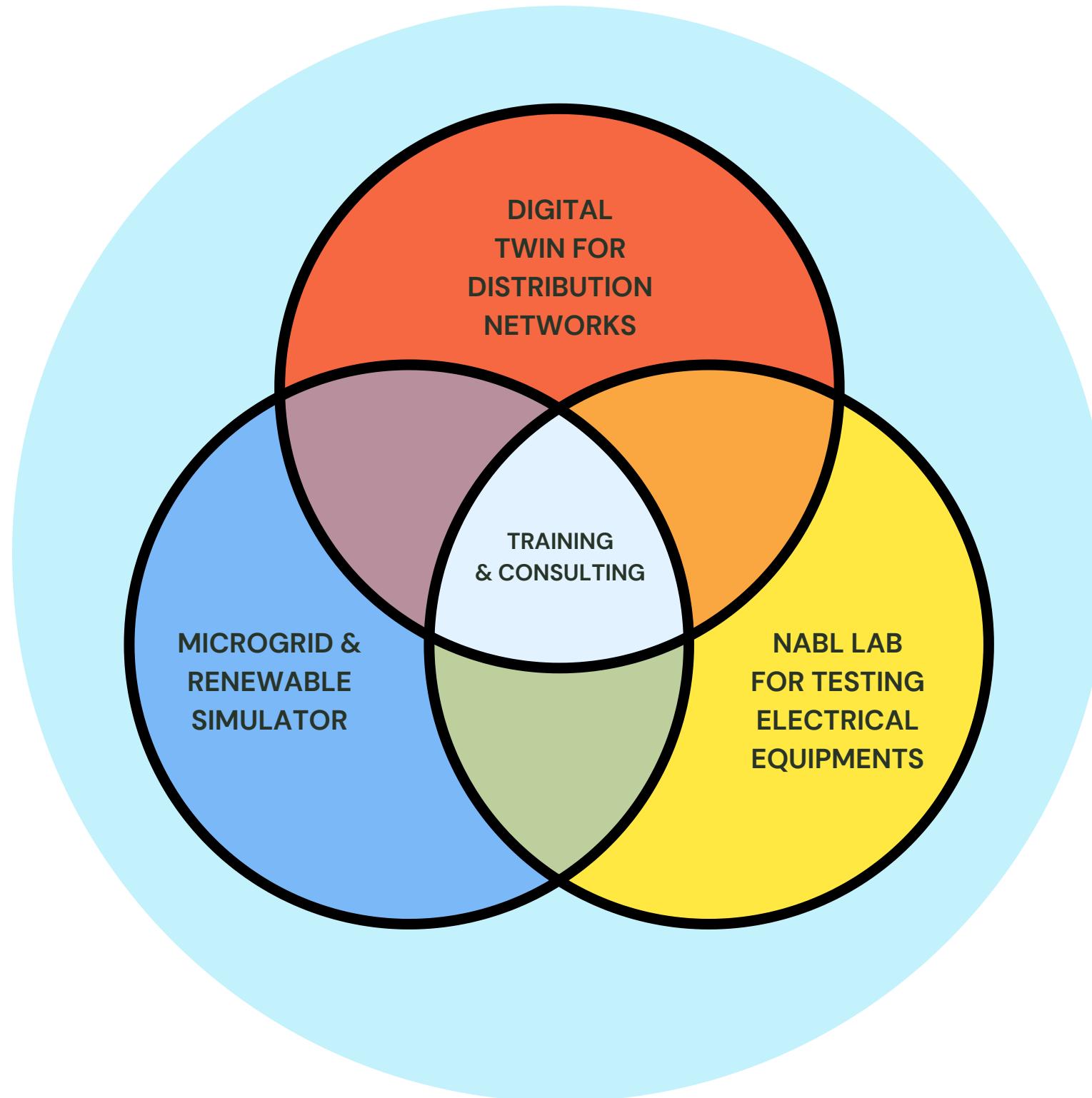
- 1 *Transition from conventional to renewable energy sources smoothly*
- 2 *Improve their energy efficiency in a strategic and calculated manner*
- 3 *Organize training programs to upskill their present manpower*

There exists a need for an Energy Transition Lab/Center of Excellence which will act as a hub providing multiple tools/facilities/services to help companies target these problems in an organized way.

KIGG Plans to open one hub (main lab) at Nagpur and 5 other spokes (associated labs) at Baroda, Bhubaneshwar, Warangal and Srinagar and Delhi NCR.



Services Portfolio of the Energy Transition Lab



Digital Twin



Renewable and Green Simulators



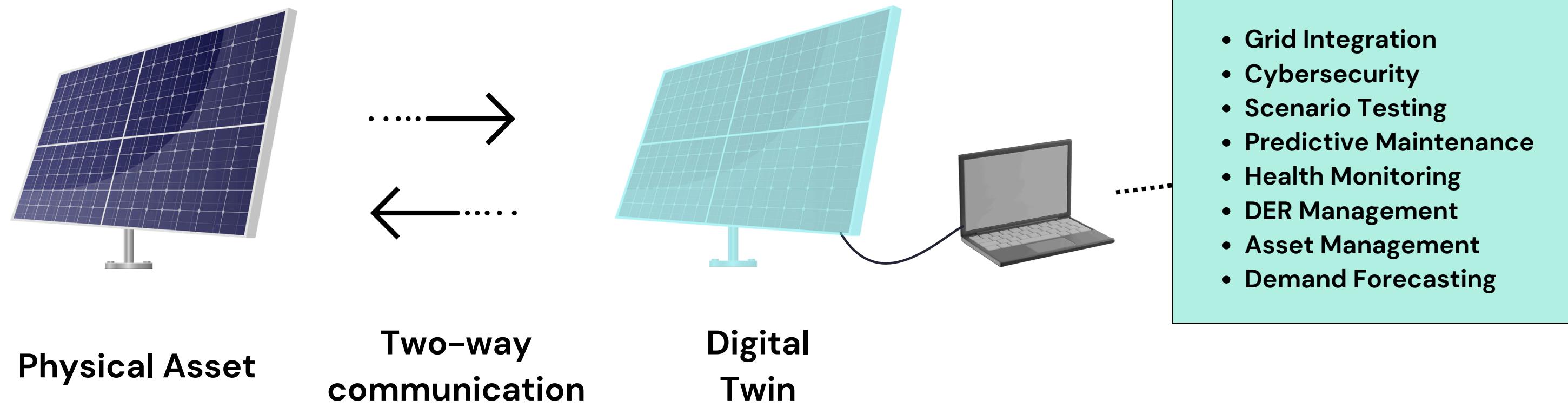
Accredited NABL Lab



Training and Consulting

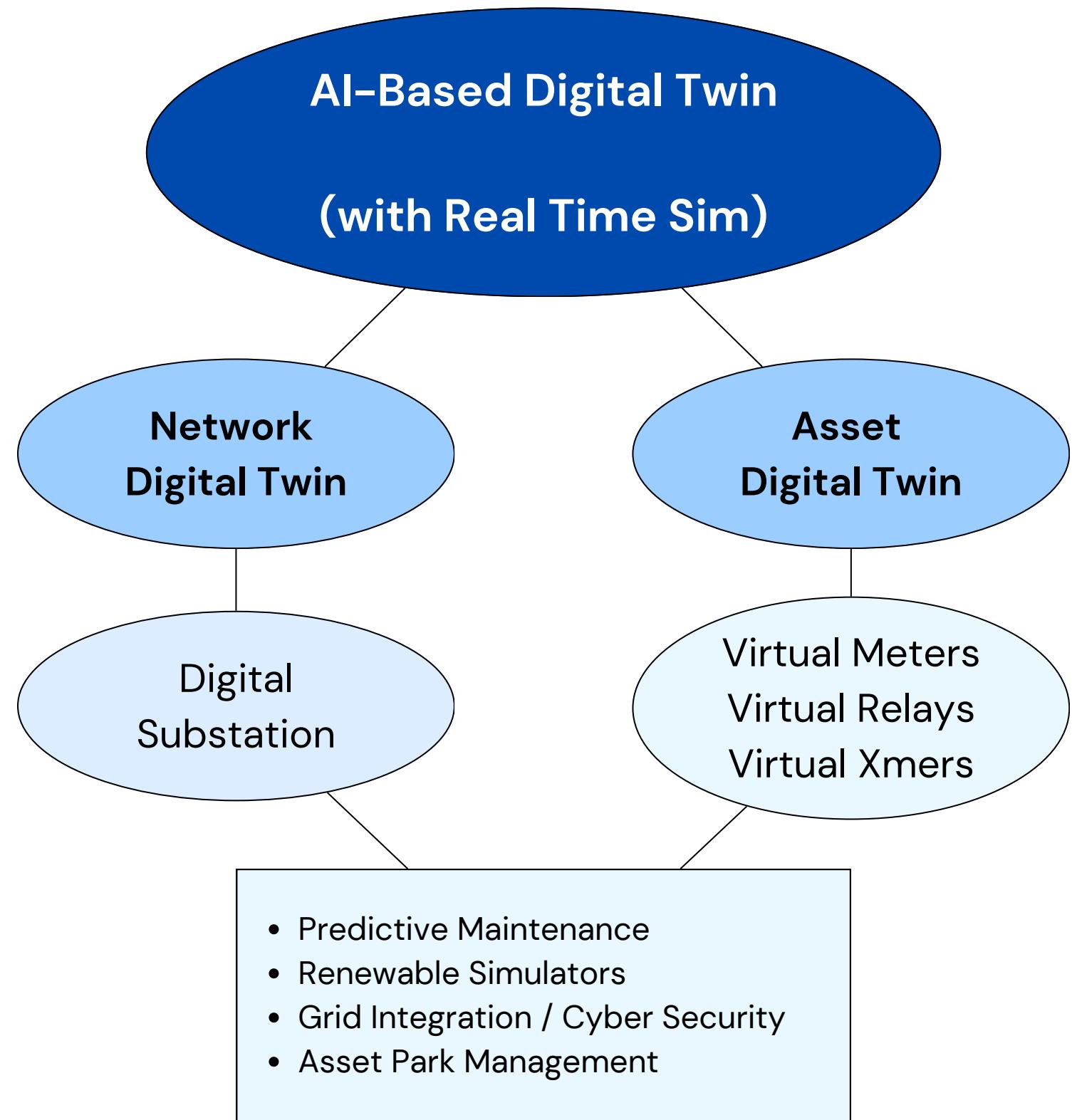
What is a Digital Twin?

Definition: A Digital Twin is a virtual representation of a physical asset, process, or system that allows for real-time monitoring, analysis, and optimization.



A tool that will allow your organization to meet its goal of reaching its targets in a much more organized manner

Heart of the ETL: Digital Twin



23%

Overall Cost
Reduction

15 mins

Before Asset
Failure Alert Time

98.1%

Fault-Diagnosis
Accuracy in an asset
using Digital Twin

44%

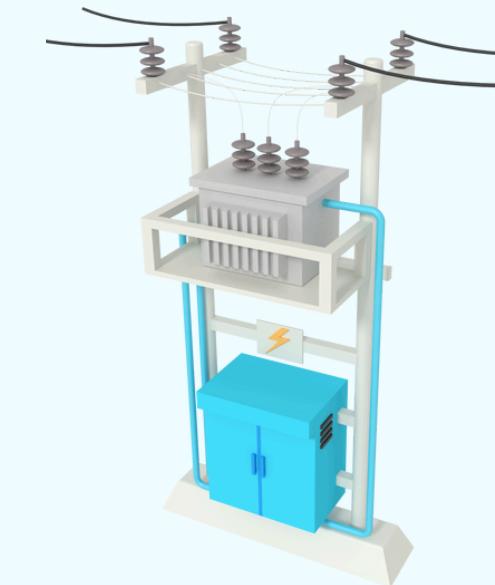
Reduction in plant startup
and shutdown time
because of simulation

Two Approaches for creation of the Digital Twin

Substation are the pillars upon which our entire electrical network is built

We can create the Digital Twin of substations in two ways

1



With Digital Substation

2



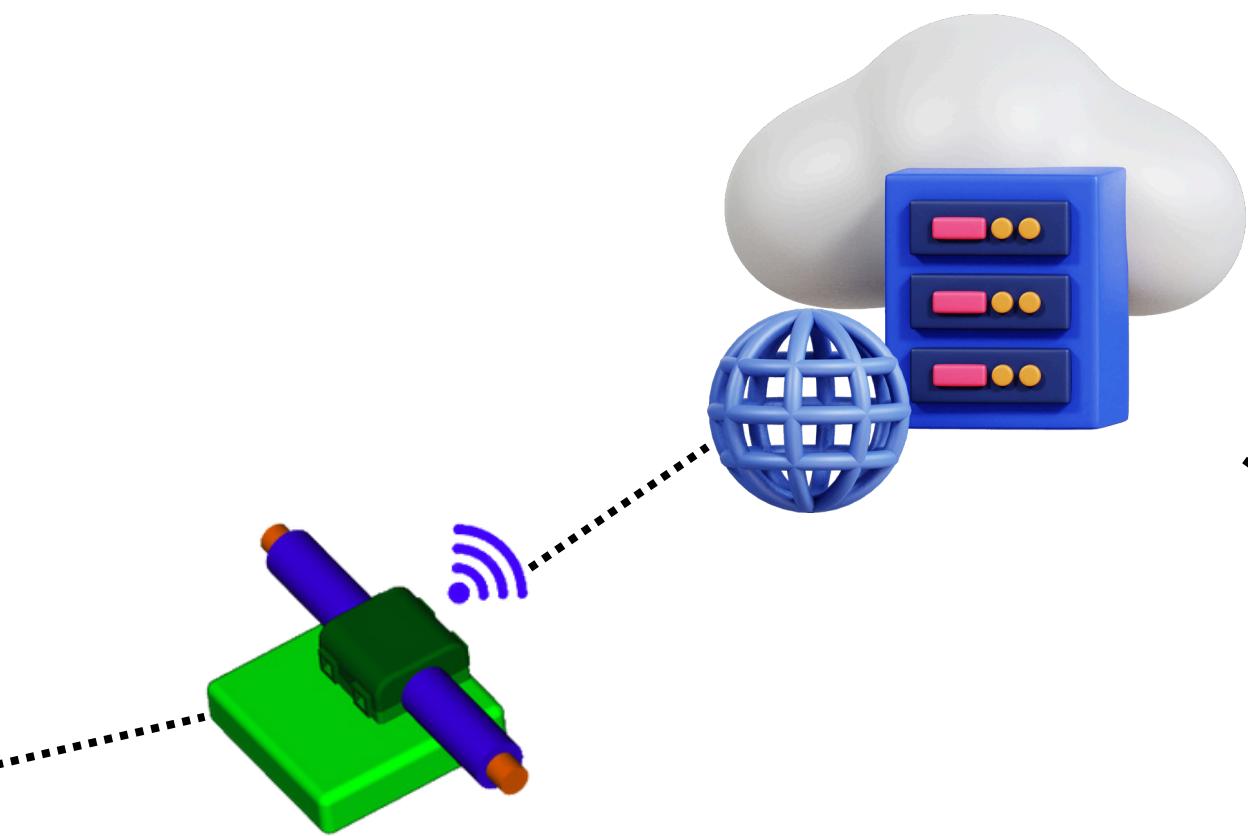
**Directly through
Real-Time Simulator**

Digital Twin through Real-Time Simulator



1

Physical Asset at a Substation



2

IOT Device
attached to it, capable
of communicating data



3

Real-Time Simulator Rack
with cloud storage which
will receive, store and
process the data



4

Dashboard that can be
used to see, analyze
and perform
simulations on the data

Defining the DT goals of your organization

DS.AI Data Acquisition & Ingestion	DS.SG Synthetic Data Generation	IR.ET Enterprise System Integration	IC.SR Search	IC.PR Prediction		UX.BV Basic Visualization	UX.DB Dashboards
DS.ST Data Streaming	DS.ON Ontology Management	IR.EG Eng. System Integration	IC.CC Command & Control	IC.AI Artificial Intelligence		UX.AV Advanced Visualization	UX.CI Continuous Intelligence
DS.TR Data Transformation	DS.RP Digital Twin (DT) Model Repository	IR.IO OT/IoT System Integration	IC.OS Orchestration	IC.PS Prescriptive Recommendations		UX.RM Real-time Monitoring	UX.BI Business Intelligence
DS.CX Data Contextualization	DS.IR DT Instance Repository	IR.DT Digital Twin Integration	IC.AL Alerts & Notifications	IC.FL Federated Learning	IC.BR Business Rules	UX.ER Entity Relationship Visualization	UX.BP BPM & Workflow
DS.BP Batch Processing	DS.DS Domain Specific Data Management	IR.CL Collab Platform Integration	IC.RP Reporting	IC.SM Simulation	IC_DL Distributed Ledger & Smart Contracts	UX.XR Extended Reality (AV/VR/MR)	UX.GE Gaming Engine Visualization
DS.RT Real-time Processing	DS.SA Data Storage & Archive Services	IR.AS API Services	IC.AA Data Analysis & Analytics	IC.MA Mathematical Analytics	IC.CS Composition	UX.GM Gamification	UX.3R 3D Rendering
DS.AS Asynchronous Integration	DS.SR Simulation Model Repository	MG.DM Device Management	MG.EL Event Logging	TW.EC Data Encryption	TW.SC Security	TW.SF Safety	TW.RP Responsibility
DS.AG Data Aggregation	DS.AR AI Model Repository	MG.SM System Monitoring	MG.DG Data Governance	TW.DS Device Security	TW.PR Privacy	TW.RL Reliability	TW.RS Resilience

Digital Twin Periodic Table

There exists a need of a solution specific to the client's requirement

Requirements of each utility types

Aspect	GENCOs	TRANSCOs	DISCOMs
Primary Focus	Asset Performance Efficiency, Predictive Maintenance	Grid stability, load balancing, real-time monitoring	Decentralized asset management, customer integration, outage management
Key Modeling Requirements	Complex process simulation (thermal dynamics, combustion, turbine, boilers)	Geospatial accuracy, power flow simulation, voltage stability analysis	Detailed low-voltage circuit modeling, distributed energy resource (DER) integration
Real-time Data Integration	SCADA, DCS, IoT sensors for real-time operational insights	SCADA, PMUs, weather data, and GIS for grid monitoring	Smart meters, IoT sensors, customer consumption patterns
Simulation Needs	What-if scenarios for operational optimization, maintenance planning	Contingency planning, fault condition simulation, emergency response	Load forecasting, outage prediction, voltage regulation
Challenges	Data integration from multiple sensor systems, complex process modeling	High-latency communication, large-scale data management, cybersecurity	Managing vast, decentralized data sources, DER impact modeling
Main Benefits of Digital Twin	Increased plant efficiency, optimized maintenance scheduling, extended asset life	Improved grid resilience, reduced transmission losses, optimized load dispatch	Better outage response, enhanced customer service, optimized energy distribution
Key Stakeholders	Plant operators, maintenance teams, regulatory bodies	Grid operators, emergency response teams, policymakers	Utilities, local government, energy consumers

Takeaways

New projects

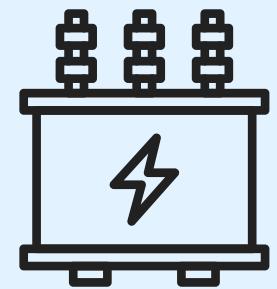
- Planning
- Simulating “what-if” situation

Existing operation

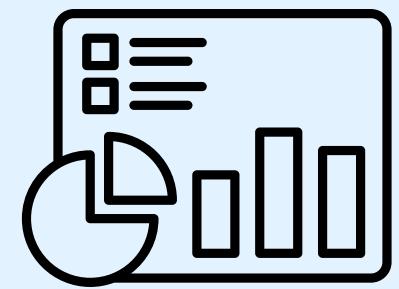
- Asset Management
- Maintenance

- 1) Digital Twin is more than simple, using AI/ML or GenAI
- 2) Domain Expertise Matter most packages available are modeled around mathematics-based. However, in order to be effective you need a physics-based model
- 3) Digital Twin gives real-time closed loop solution so its much more than just an analytical tool
- 4) Training is very crucial
- 5) We need to move this tech from educational institutes into the hands of practicing engineers

Our AI Applications



Health and
Performance
Monitoring



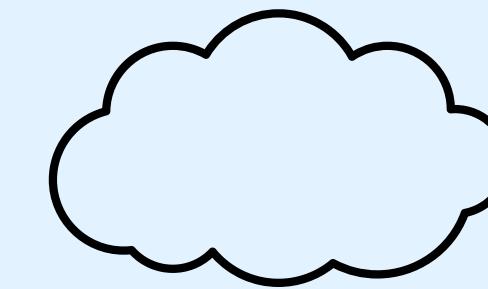
Comprehensive
Dashboard for
CXOs



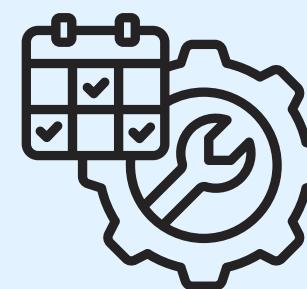
Cost
Reduction
for Utilities



Visual Analytics
from real-time
data



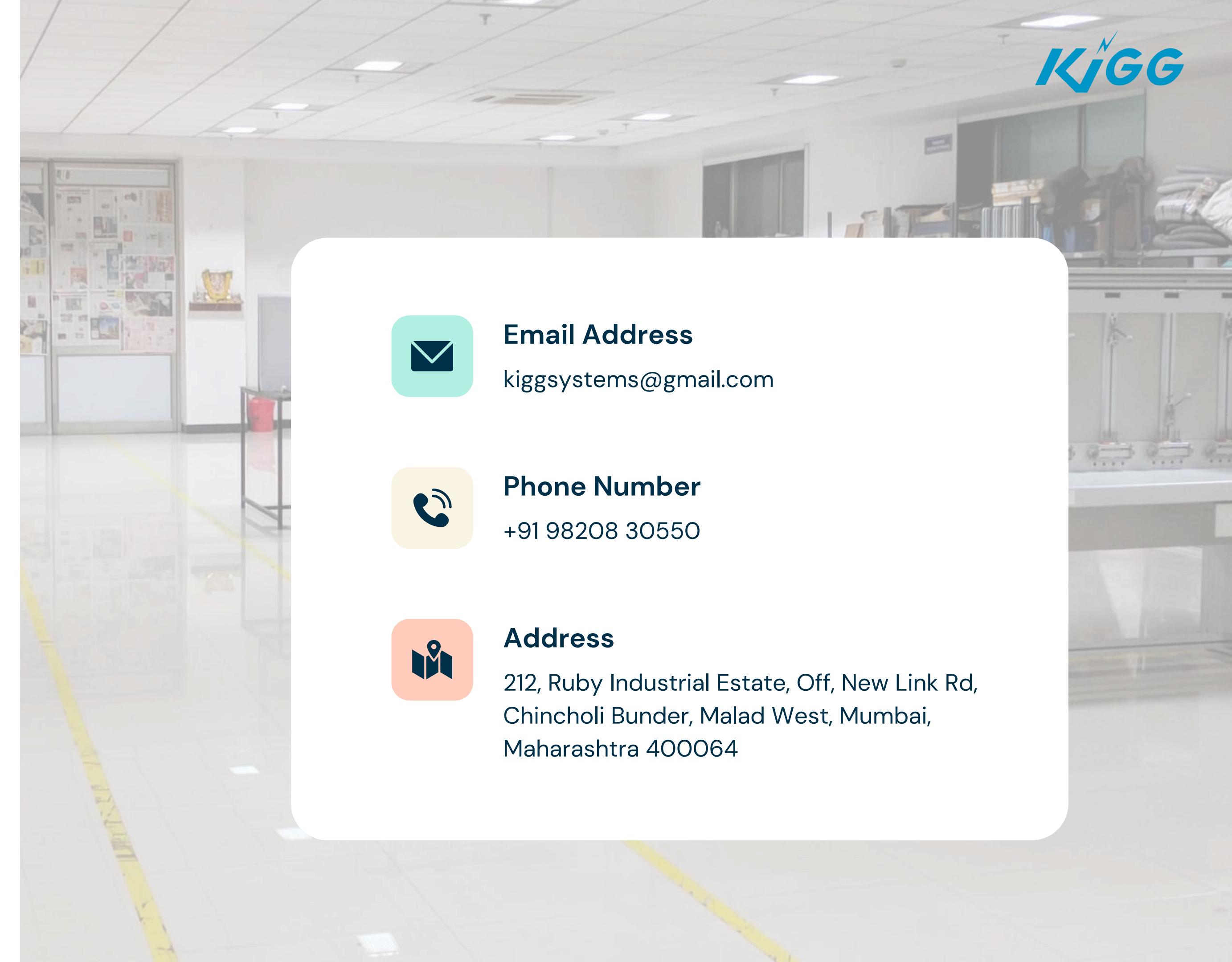
Cloud
Agnostic
deployment



Predictive
Maintenance

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