AES Eletropaulo

Developing a Smart Grid Strategy and Roadmap

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Smart Grid: *key motivations for a AES Eletropaulo*

MARKET	• Serves an extremely dense market, • Operate under critical loads and • High demand for quality of service
PRODUCTIVITY	• The strategic and operational challenges require: • constant pursuit of productivity gains, • innovations and • best practices for business sustainability
EFFECTIVENESS	• The current isolated projects resulting in: • inefficiency, • demand for a systemic vision
OPPORTUNITY	• to create • an environment of continuous innovation • systematic evaluation of new concepts and solutions, • implementation in business

AES Eletropaulo Smart Grid: *key objectives*

Create a ***Living Lab*:***

+ to allow the execution of tests and evaluations technological and functional systemic form,

+ obtain the solutions defined in the program

+ provide references for large-scale deployment

Create ***Methodology (Metrics) evaluation***

+assessment of solutions obtained in reduced environment

+ provide framework for the future roll out.

"ROADMAP"

+ for solutions in smart grids,

+for systemic features and specific market

❖ **The Living Lab is a research concept, customer-centric, and in the idea of collaborative innovation, usually operating in a territorial context**

Background

(Is AES Eletropaulo ready to implement Smart Grid?)

Existing infrastructure in AES Eletropaulo.

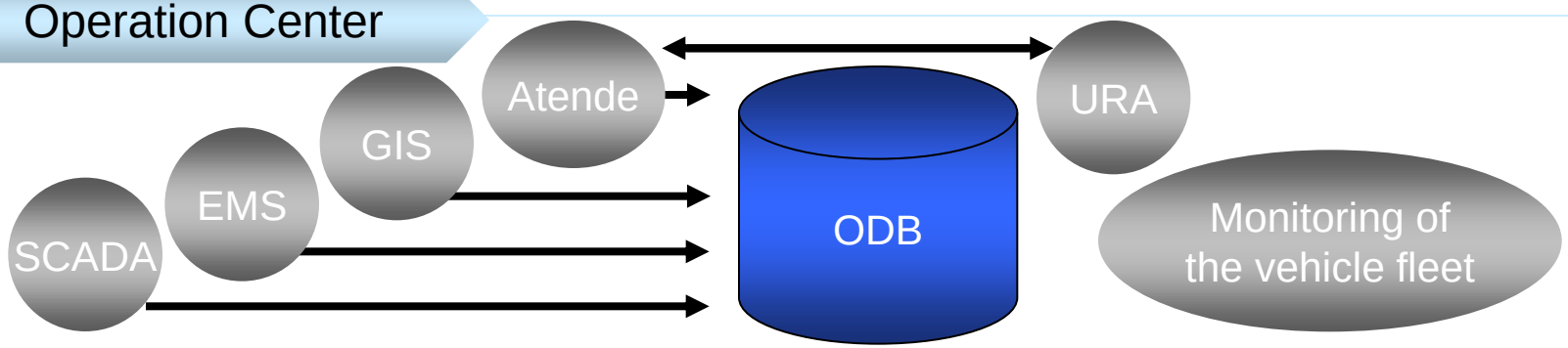
Electric Grid Automation

- Remote command and supervision in 100% of the Substations
- Digital Communication in 100% of the Substations
- Remote command in 100% of the sub transmission line switches
- Operative metering in 100% of output of the Medium Voltage feeders
- Digitalization of 100% of the substations

Telemetry

- 100% of the boundary meters
- 100% of the A2 and Free Clients
- 100% of the transformer secondary of the substations
- 74.000 Low Voltage Clients

Operation Center



“Smart Grid” Initiatives to Date

Engineering

- Automatic Recompostion of Loads: *12 Reclosers*
- Introduction of Automatic Reclosers : *3.000*
- Automation of Underground Cameras : *1.200*

Smart Grid Projects

- R&D Smart Grid Ipiranga Project: *1.200 meters*
- R&D Fiscal Measurement Project: *840 meters*
- R&D Telecom Infrastructure Project: *Obtaining a radio patent*
- Exteriorized Metering: *1.430 meters*
- Telemetry Group A: *100% of Consumers*

Operation Center

- System Upgrade: DMS, OMS and MWM
- Failure Management (OMS) through smart meters (AMI)

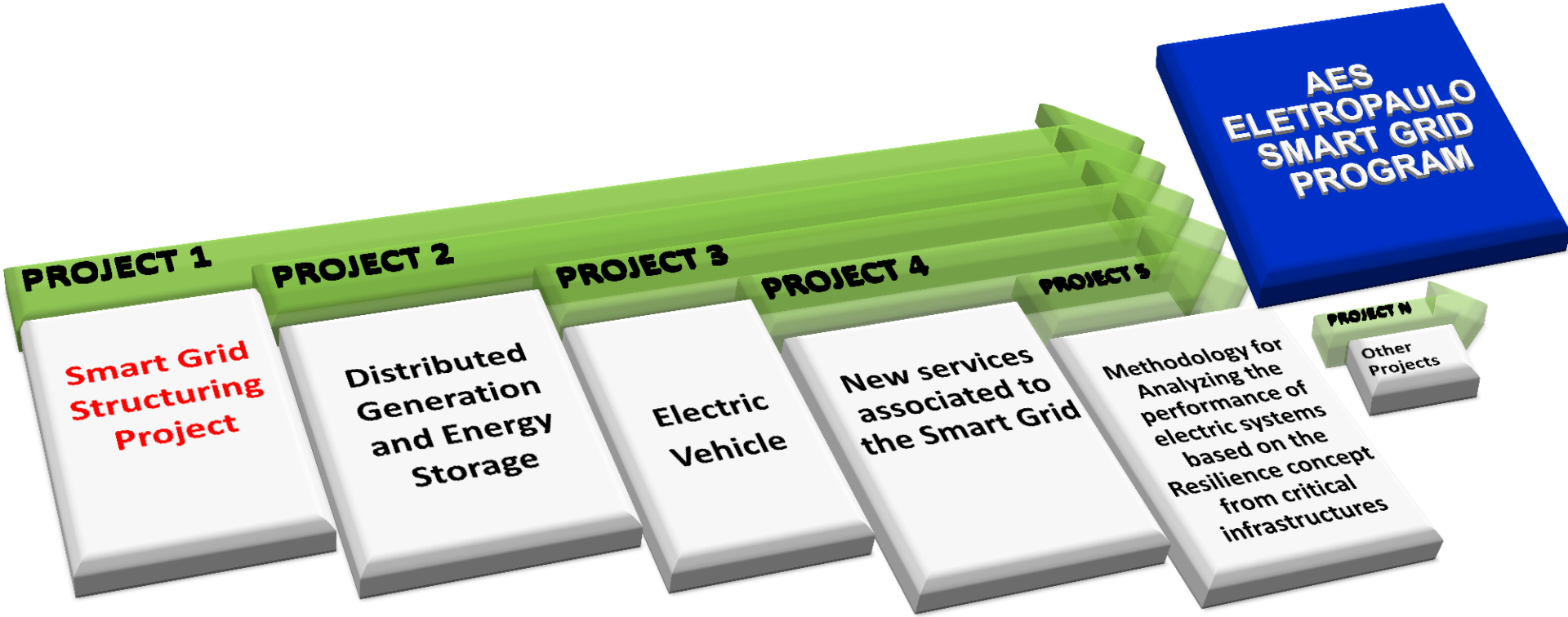
AES Eletropaulo Strategic Plan

1. Creating a Smart Grid Program: ***vision, strategy, organization, objectives, roadmap, costs and benefits;***
2. Overcome prospecting phase, ***only transformation projects for roll out;***
3. Interact with the Regulator in a structured and systematic manner for the Smart Grid Topics;
4. Address the technological gap***: redefine the technological architecture, governance standards and integration;***
5. Invest in initiatives with a higher potential for contributing to the objectives of the Corporate Strategic Plan: ***quality improvement, client satisfaction, revenue protection, cost optimization and use of the assets***.

Actions plans

1. Detail the Smart Grid corporate strategy;
2. Structure and Prioritize the Smart Grid Projects Roadmap;
3. Build the Governance Model for the Program;
4. Define the Future Communication Architecture;
5. Define the System Integration Architecture;
6. Design Business Cases for launching the initial projects.

Smart Grid Program



Project 1
Smart Grid Structuring Project

Eletropaulo Digital

Objectives

1) To create a deployment model replicable throughout the concession area,
2) To prepare appropriate Technology and Strategic Road Map.

Features of the project

Period***: 2013 – 2015***
Budget***: R$71,2 milhões***

Metering / Commercial losses

- Smart meters in 100% of the clients;
- Remote cut-off and reconnection in 100% of the clients;
- Energy Balance in 100% of the MV transformers;
- Exteriorized Metering for illegal connection, in 2.500 clients;
- To protect secondary overhead for illegal connection;
- Pre-payment for pilot evaluation.

Grid Advanced Automation

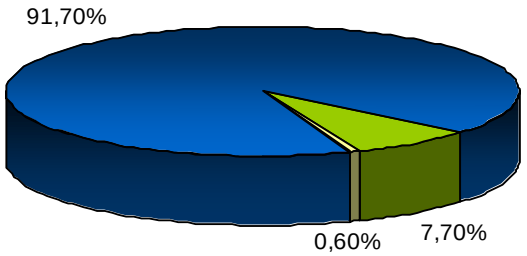
- Detection / Fault location;
- Self Healing;
- Volt / Var Control;
- Automatic dispatch.

IT and Telecom infrastructure

Sites for the field test

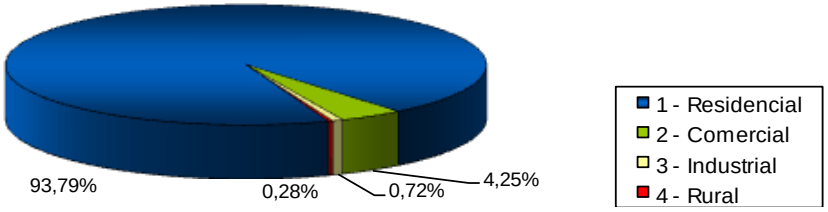
Barueri

- 51.490 Clients
- Annual consumption – 1.2 millions MWh
- 304 Km of MV overhead power grid



Vargem Grande + Caucaia do Alto

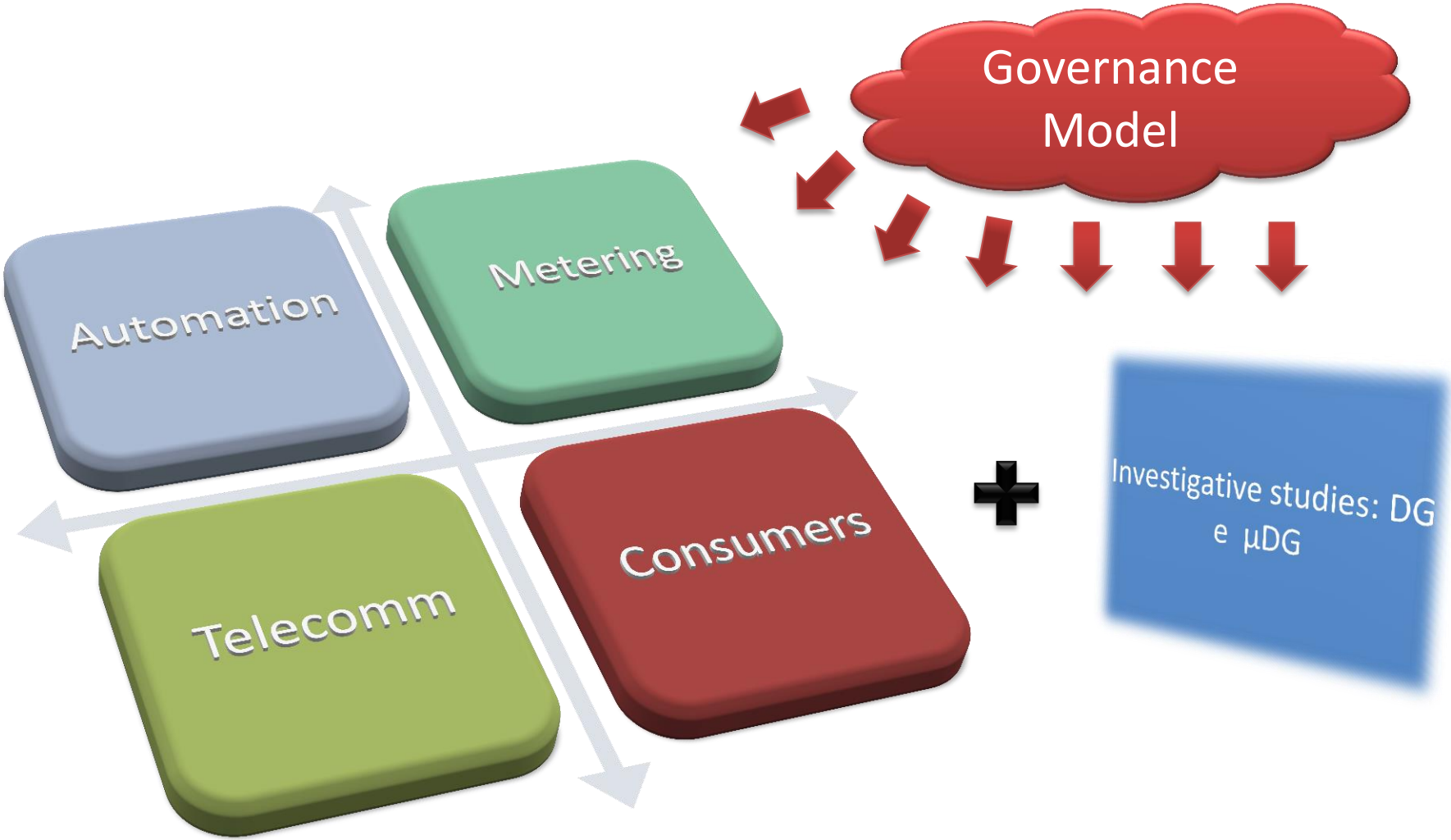
- 32.289 Clients
- Annual consumption – 178.000 MWh
- 374 Km of MV overhead power grid



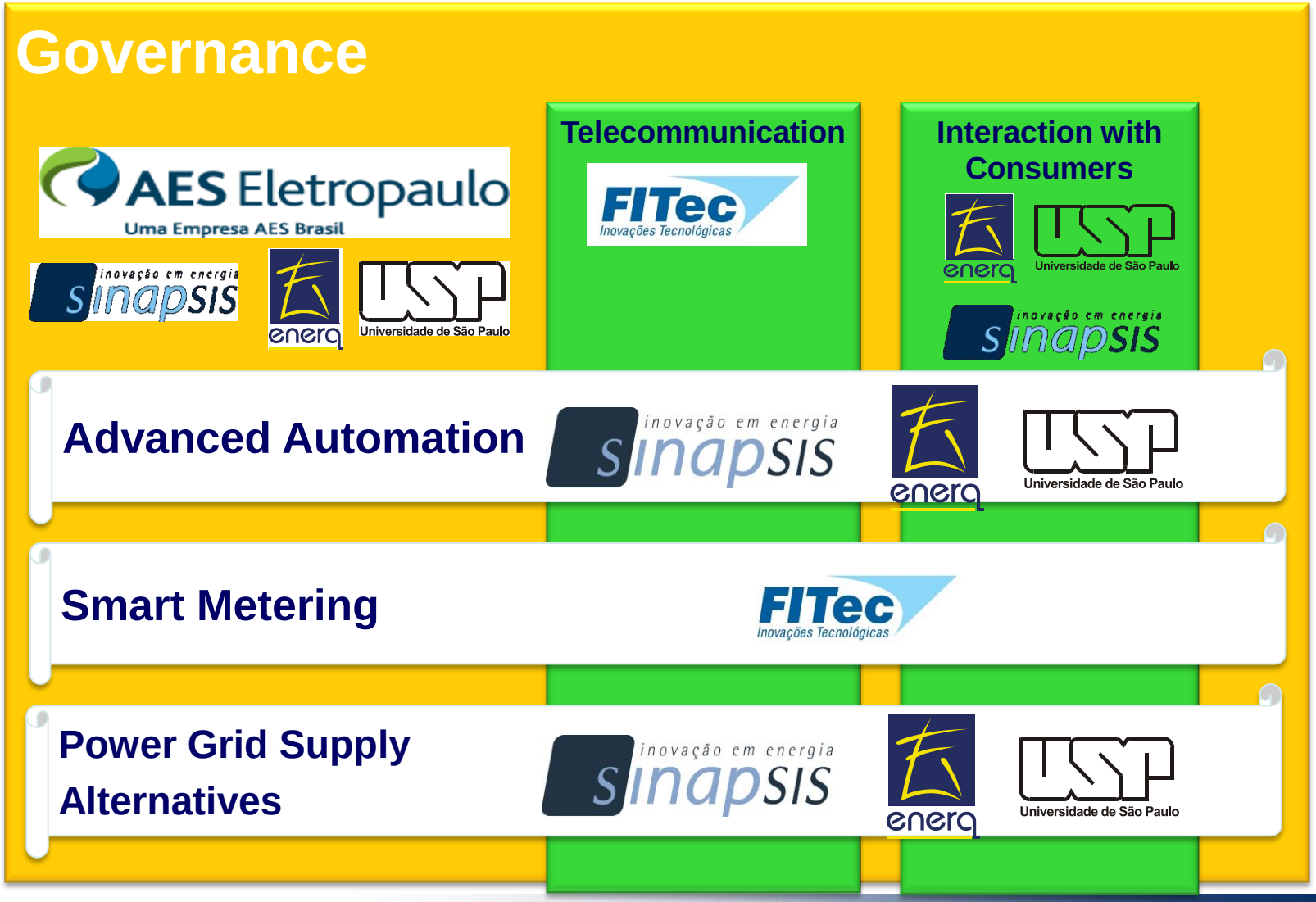
Reasons for selecting field test areas

Barueri	Vargem Grande + Caucaia do Alto
AES Eletropaulo representative model: - Metropolitan area (high density) - Similar client profile - High consumption - Power grid (short feeders and mesh) - Similar performance indicators	AES Eletropaulo different characteristics: - Rural area - Environment Protect Area - Long circuit = 100 km + - Isolated feeders = 23 kV - Nonstandard performance indicators

Systemic integration vision



2.1.4.1.4 - Technical Advisors (Operational and Tactical Levels)



Reference Architecture

Eletropaulo Digital Project Challenges

Metering Center

MDM

Energy balance

Pre-payment

AMI

Existing Infrastructure

GE

DMS

OMS

MWM

ALSTOM

EMS / SCADA

WiMax + Frequency Radio

FR / OF / Etc...

Smart Meter

Telecom last mile

Metering Concentrator

Energy Balance

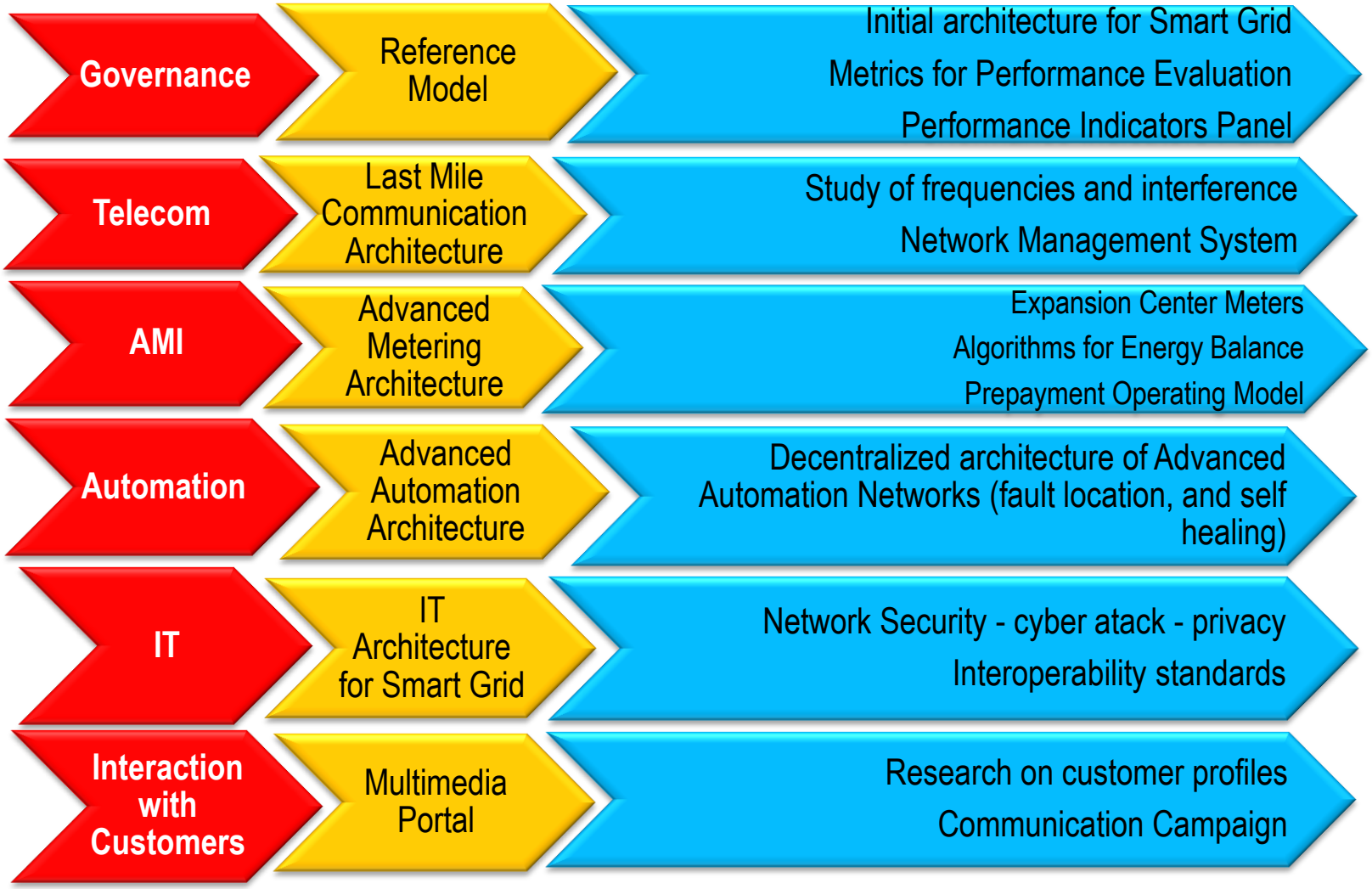
Fault Detectors

Aut. Reclosers

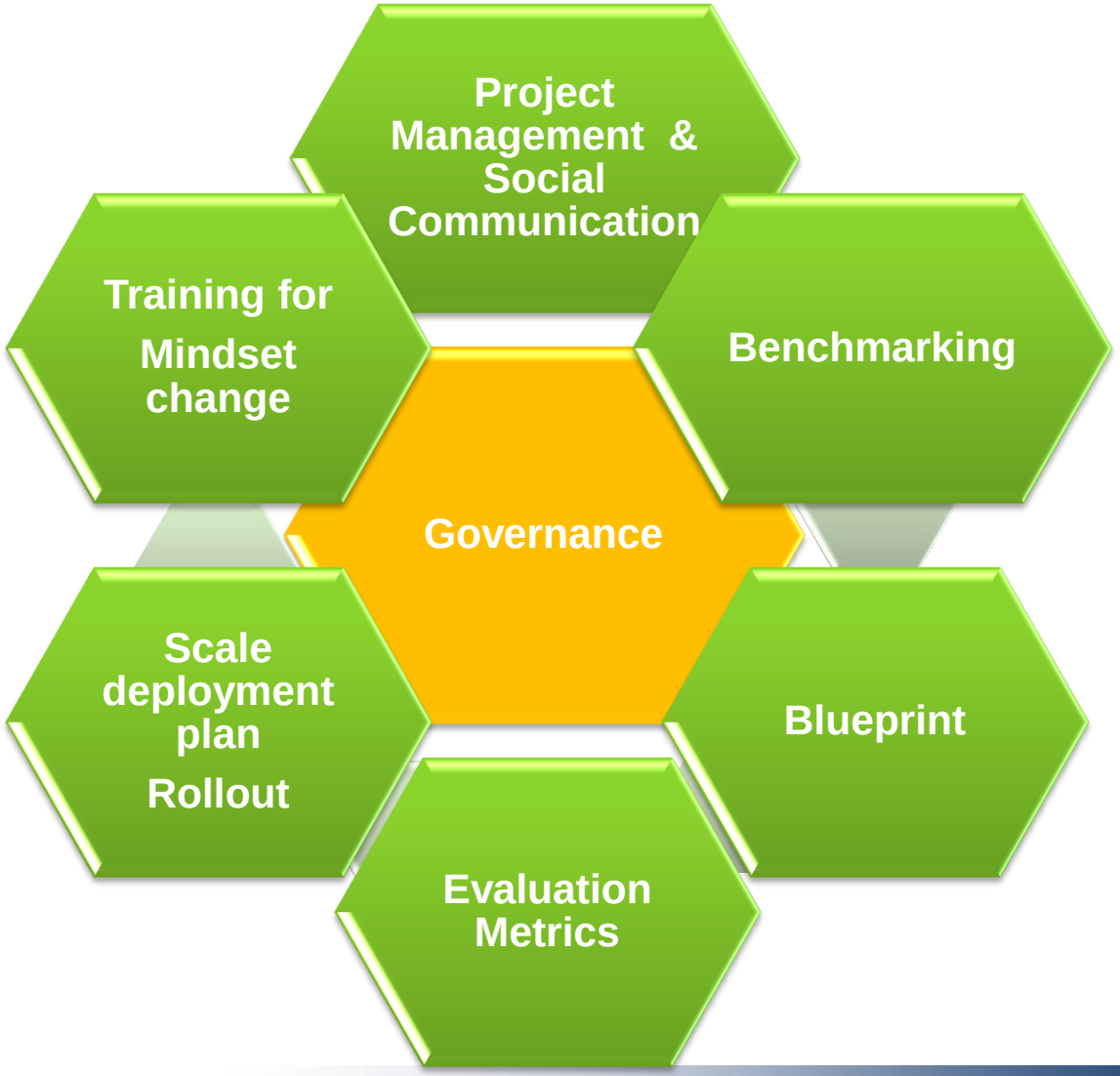
Digital Substations

Eletropaulo Digital Project

Resources and Development projects



Governance – Extra Functions

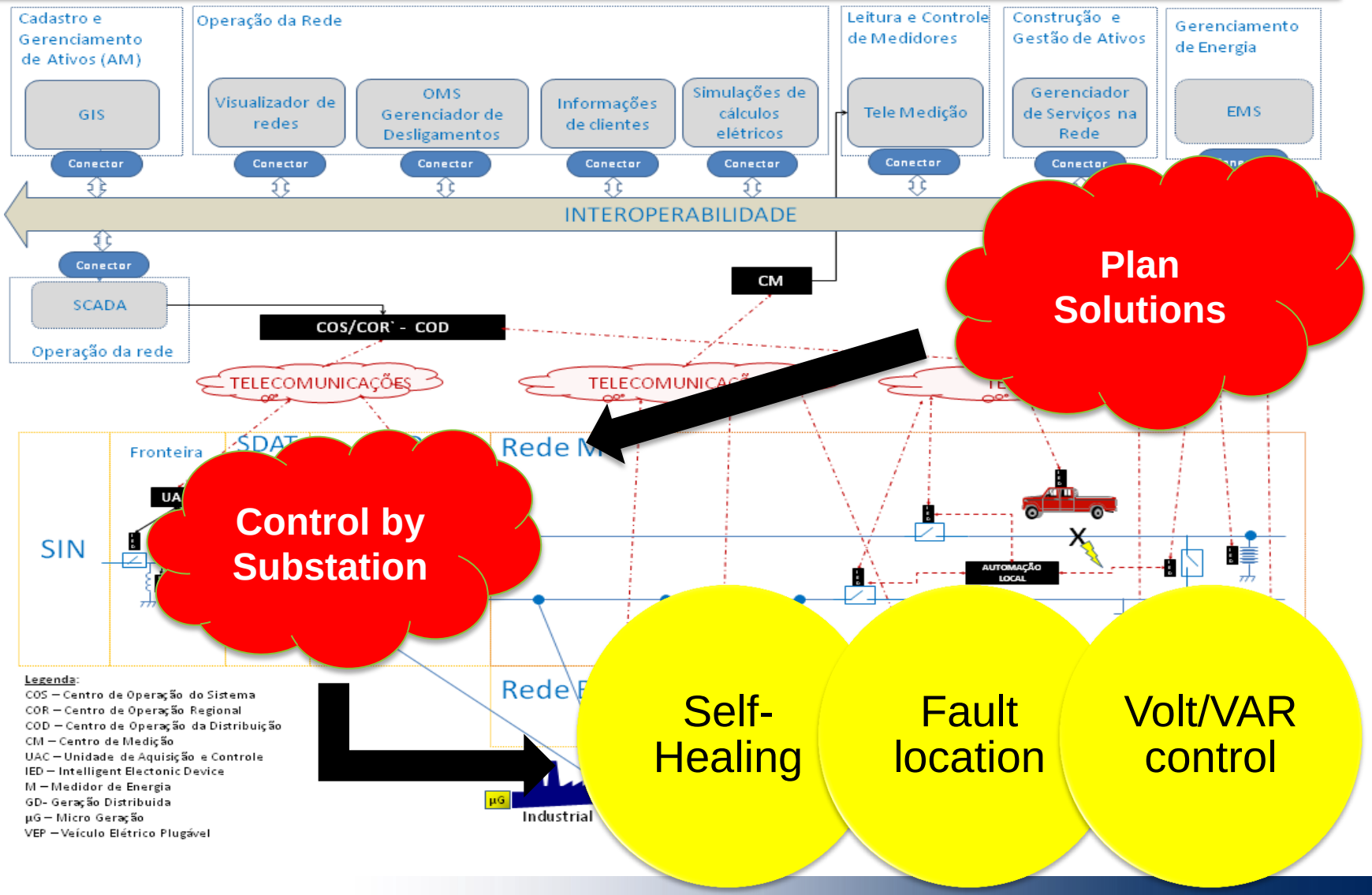


- The Governance Model

Overall system benefits

- **Overall system benefits by reducing:**
  - *Interruptions in the feeders*
  - *Time location of faults in the electrical network*
  - *Time for restoration of power supply*
- **Reduction of Commercial Losses**
- **Reduction of Operational Costs**
  - *Reduction of time to fault localization*
  - *Reduction of call center cost*
  - *Reduction of costs with the revenue management*
- **Asset Regulated Return**
  - *Remuneration of investment assuming regulatory WACC*
- **Avoidance of fines**
  - *Reduction of penalties for non-compliance with reliability targets (SAIDI/SAIFI)*
- **End user benefits**
  - *Savings from energy efficiency*
  - *Improved quality of service*
  - *Value added services*

2.1.4.2 - Grid Advanced Automation - Functionalities



2.1.4.3 - Interaction with Consumers - Functionalities

Smart Home

Communication (medias)

Smart Grid technologies and new services Acceptance

Metropolitan Clients

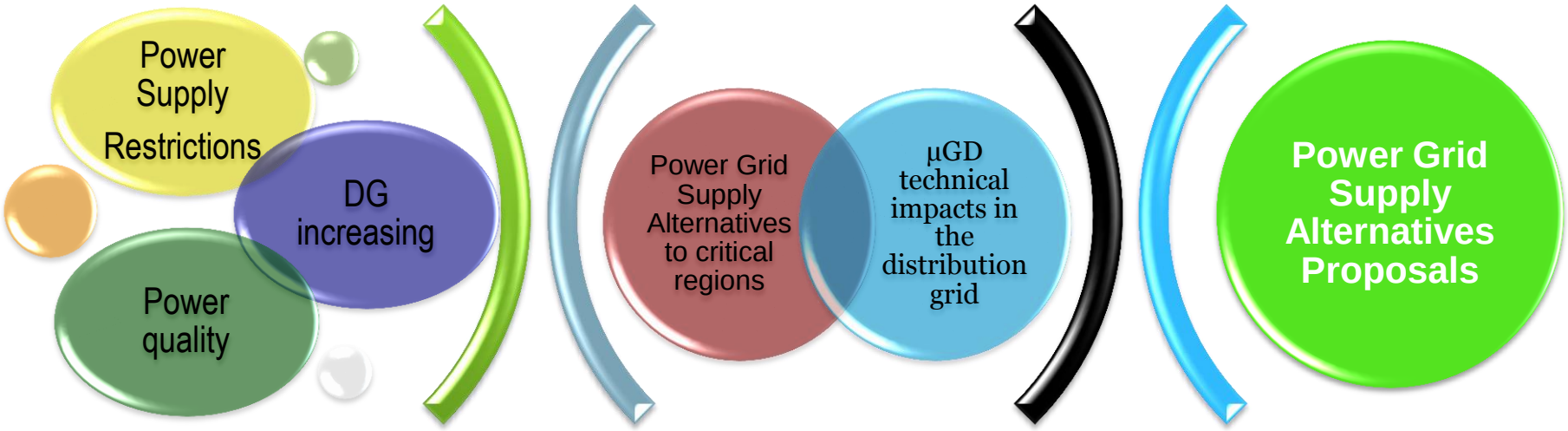
(typological diversity)

Show-room development

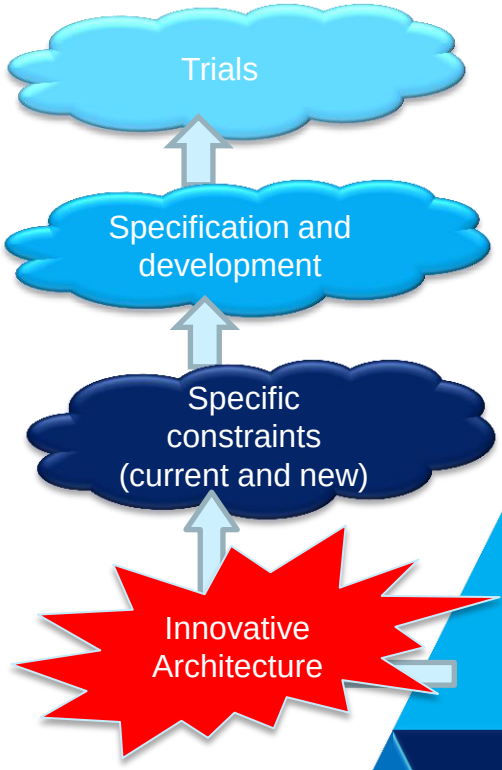
Consumer research and development of tools for interacting with customers (WEB portal)

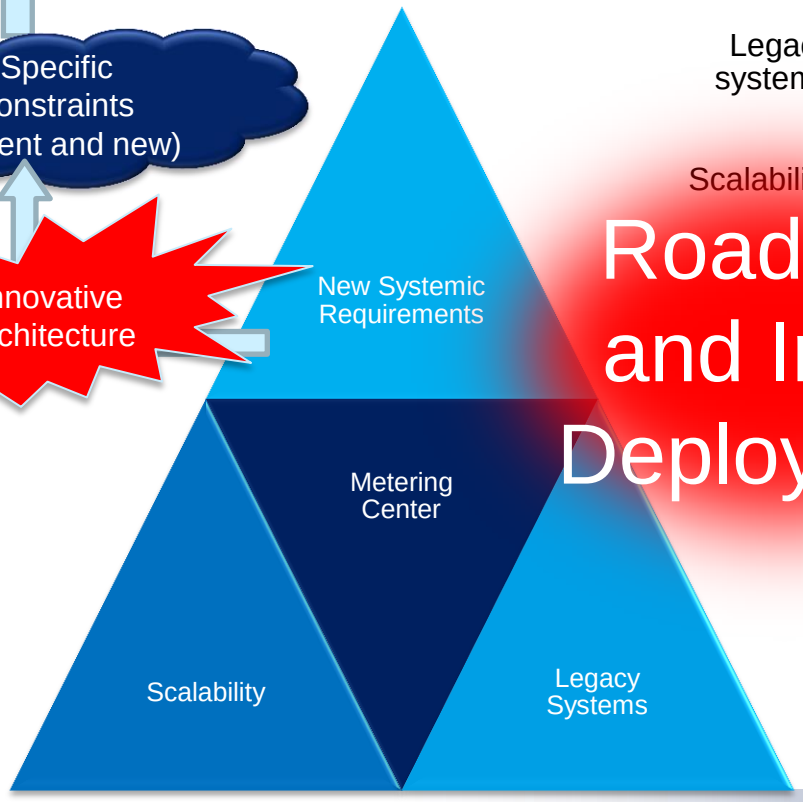
Consumer research, prospecting for new services and specific regulatory analysis

2.1.4.4 -Power Grid Supply Alternatives - functionalities



2.1.4.5 - Smart Metering – Metering Center - functionalities





New Requirements	• Advanced features automation of measurement (prepay, energy balance, cut / reconnects etc.).
Legacy systems	• Systems Integrations
Scalability	• AES Eletropaulo concession area(~7mi consumers)

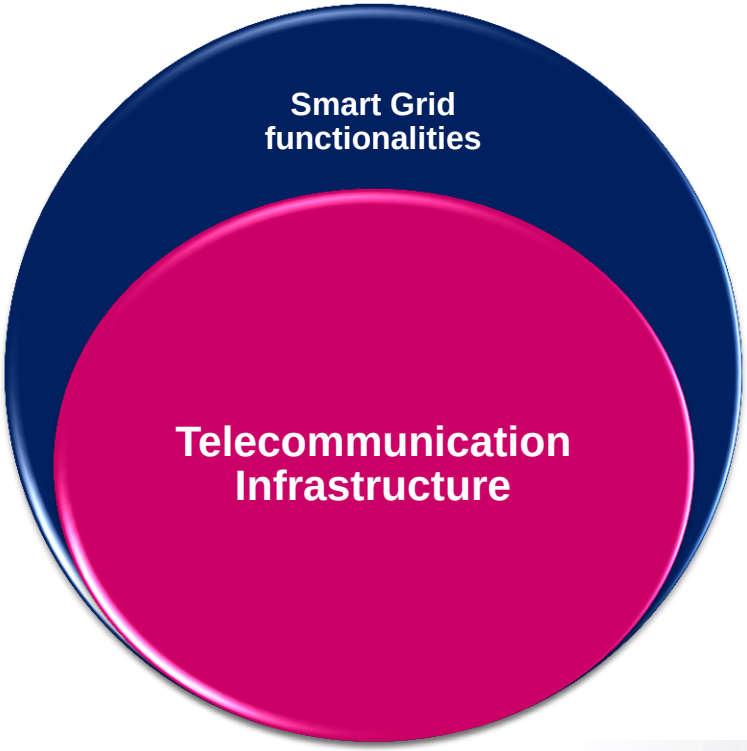
RoadMap and Initial Deployment

Technology Solutions Challenges

Advanced Metering Center for 7 Millions of clients	Redundant Communication way	Meters adequate ANEEL e AES requirements

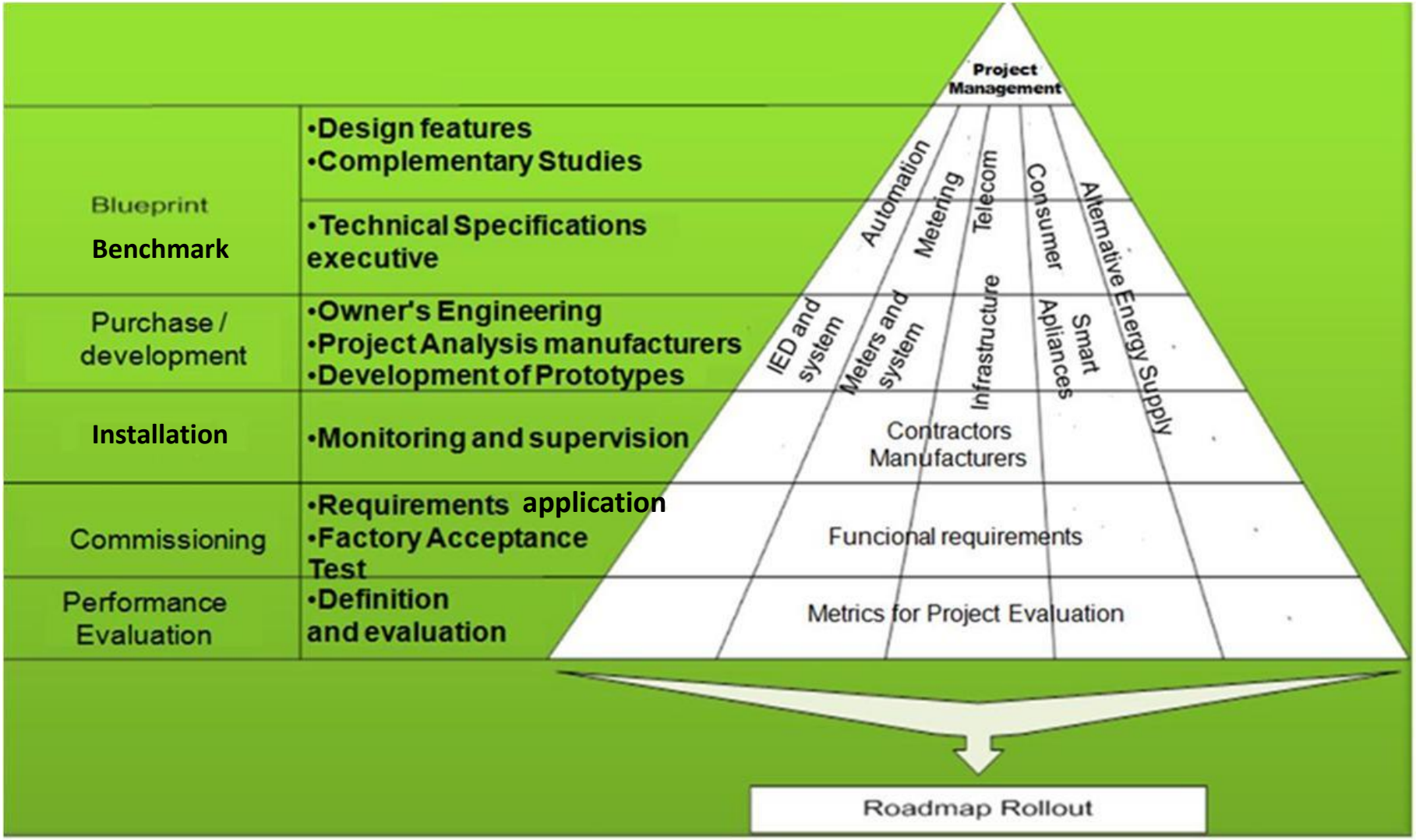
2.1.4.6 - Telecommunication - functionalities

Study and mapping variables and requirements for telecommunications distribution system, identification of technological gap's and developing new telecommunications architecture for Smart Grid integrated functionalities



What to address?	• New requirements systemic
How to address it?	• Architecture definition and Gaps identification
How to install it?	• Definition of standards for field installation
How to manage it?	• System monitoring and fault correlation

2.1.5 Project Execution Plan



Electric Vehicle Project

Zero Emission Pilot Program

Electric Vehicle Project

Technical Cooperation Agreement and Operational Participants

- *Sao Paulo Municipal Government*
- *Nissan do Brasil Automóveis Ltda*
- *SINETAXI – Sao Paulo Taxi Companies Union*
- *AES Eletropaulo*

Objective

- Implementation of a pilot program to evaluate the operational performance of ten (10) electric-drive vehicles for providing public transport, in the taxi mode, for the city of São Paulo.

Positive participation aspects

- Disclosure of the company's image representing concern with the environment and sustainability;
- Monitoring this new business and its impact on the power grid.

Zero Emission Pilot Program launch

- Official launching: June/05/2012

Electric Taxi

Power	Autonomy	Residential Tariffs	Cost for 100% charge	Operational Cost / km
24 kWh	160 km	US$ 0,15/ kwh	USD$ 3,5	US$ 0,02

AES Eletropaulo

Thank you.