Smarter than Smart

The DATA CONNECTION in Smart Grids

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alliander

Setting the Scene

Energy Transition:
Multi-level revolution

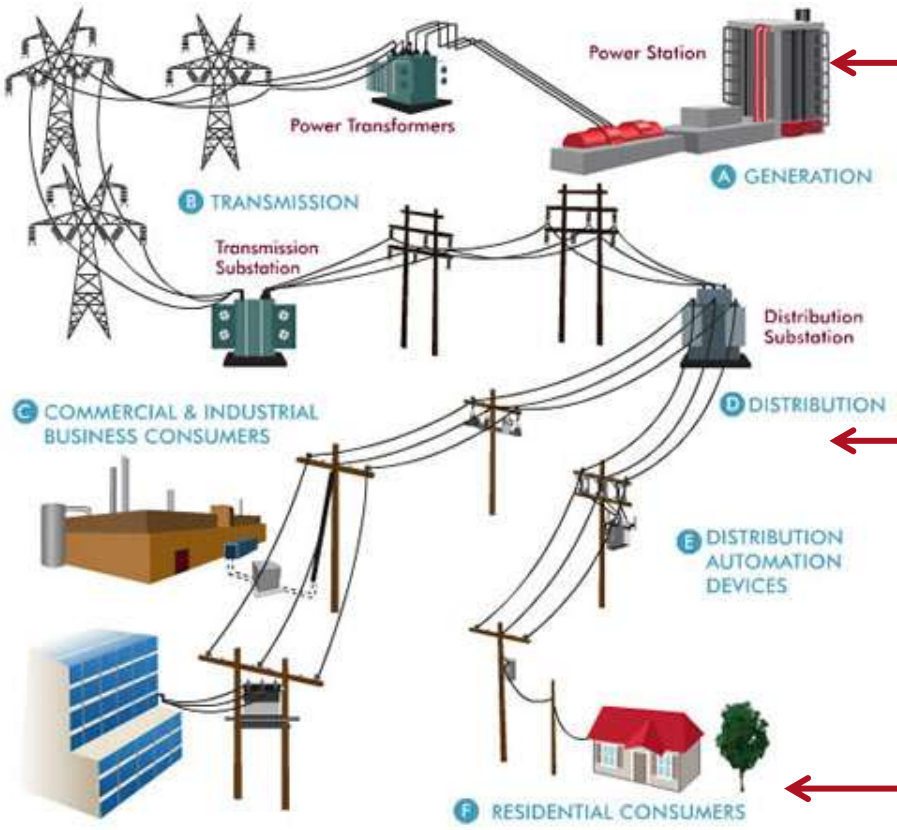
Customer Centric Interactive
Grid Management

Hurdles to Overcome

The Data Connection

Conclusions

Our Current Energy Business Model is based on Planned Scarcity



Scarcity on Purpose and by Planning

Customer = Connection

Customers are Cost Factor and Base Load

This Model is NOT Sustainable

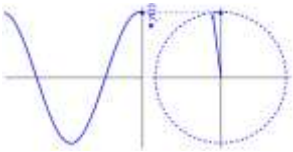
Bleeding at the Speed of Light

Energy losses in Powering a Light Bulb

POWER PLANT
LOSSES
62 Units

38 Units enter
Transmission Lines

TRANSMISSION LINE
LOSSES
2 Units



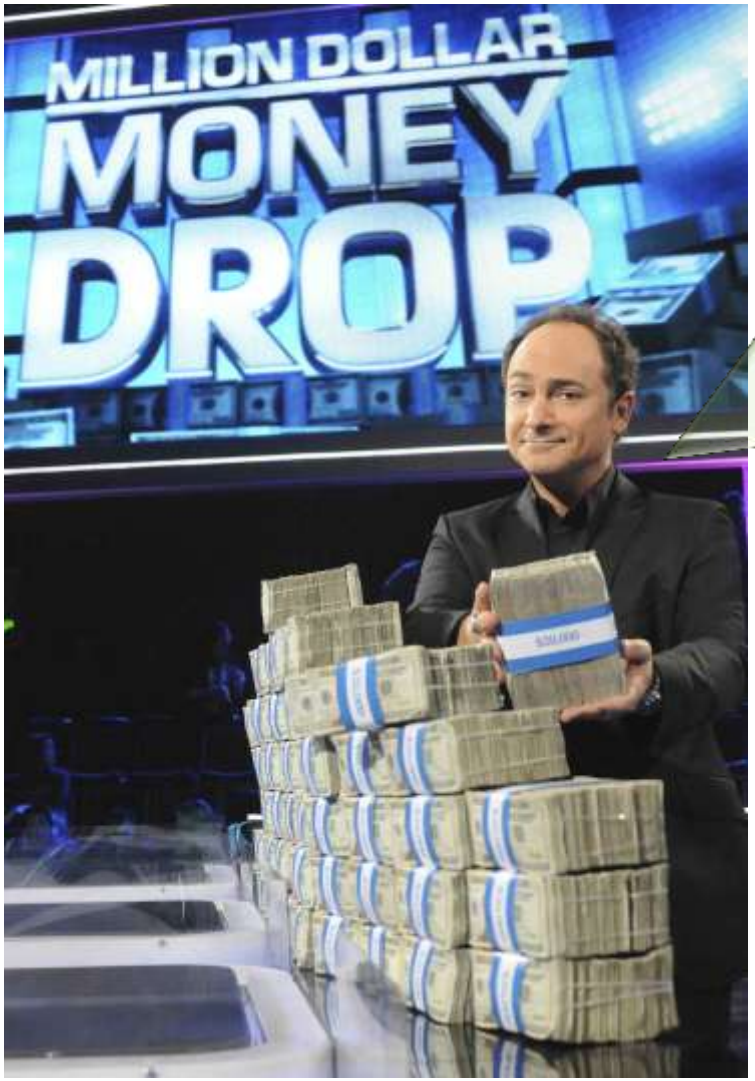
ENERGY CONTENT
100 Units Coal

34 Units
of Heat

ENERGY USED TO
POWER LIGHT BULB
34 Units

2 Units of Energy
in the Light

Basic Macro Question



It is not a question IF the Energy Transition will take place

Nor is it a question WHEN the Energy Transition will take place

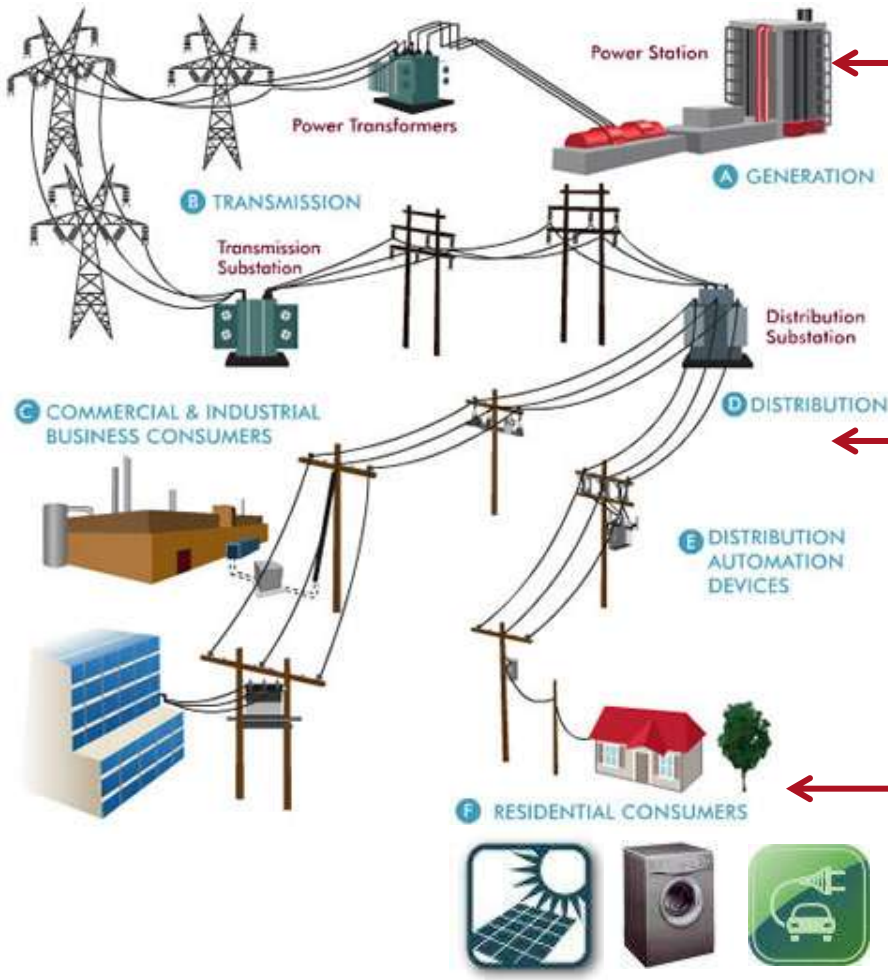
The question is HOW we can make it happen,

and how WE can THRIVE (on) it

The road is clear…

… towards TIDES in Energy

The NEW energy business model is based on Sustainable Balance



Fuel mix dependent on Economics & Politics

Consumers become Active Participants

Customers are Producers, Consumers and "Balancers"

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We have a dream…

VIRTUAL UTILITY

based on

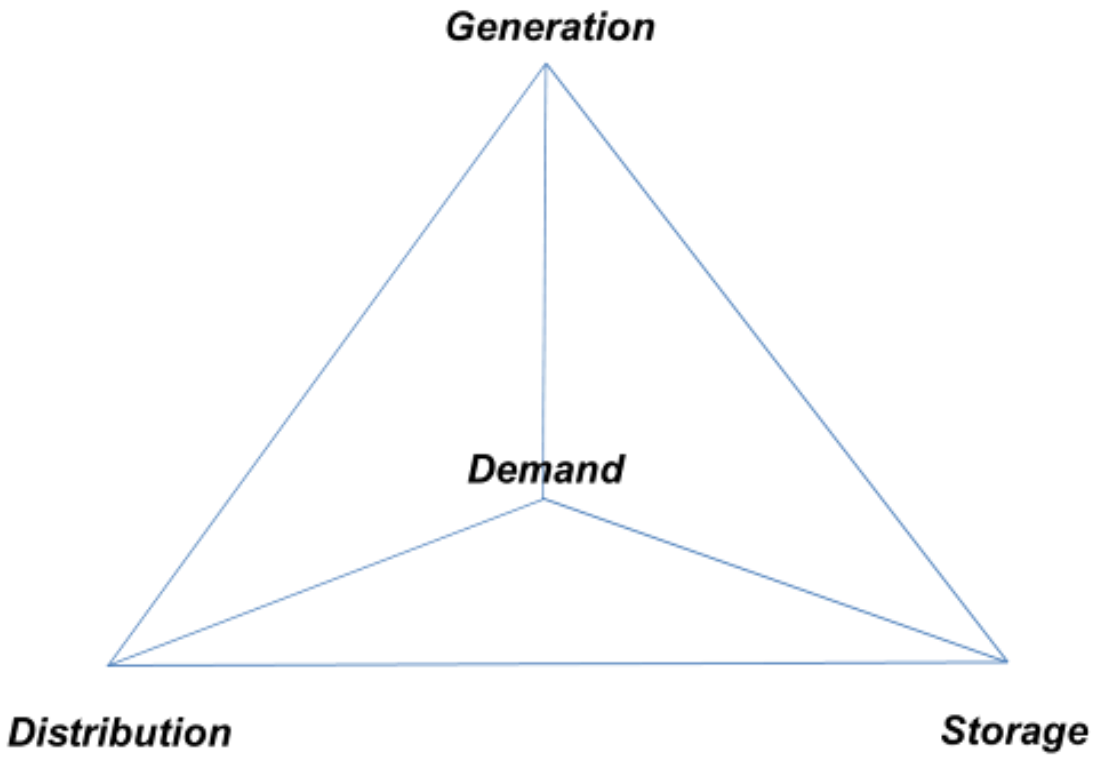
SMART GRIDS

thriving on

Advanced Metering Infrastructures

Not Smart Meters

“Smart Energy Ecosystem” Paradigm



The ‘Right’ Energy at the ‘Right’ Time at the ‘Right’ User
=
Real Time Balancing of Production, Storage and Distribution Capacity and Consumption of Energy

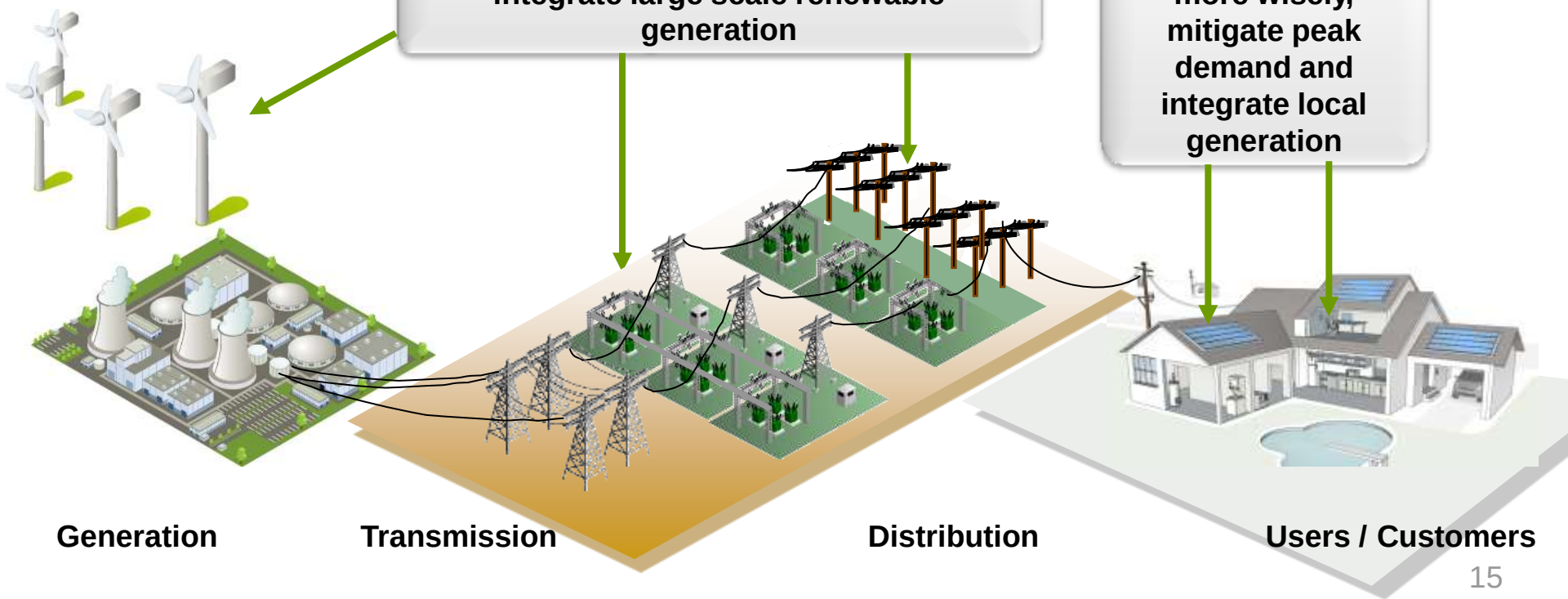
Vision to connect Customers (*Prosumers*) to Energy via Information-intensive Network

The DSO's new grid world

1. Electricity
2. Gas
3. *Data*

New sensors / distributed computing on Transmission and Distribution Lines alarm operators, resolve problems, integrate large scale renewable generation

Smart Meters and **HAN** help users to deploy energy more wisely, mitigate peak demand and integrate local generation



Generation | Transmission | Distribution | Users / Customers

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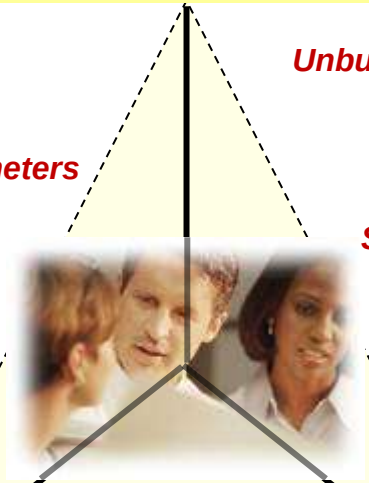
Turmoil: our Environment

Towards a Smart(er) Future



REGULATORY

Unbundling

Market model Harmonization

Smart meters

Deregulation

Smart Energy Ecosystems

Advanced Metering Infrastructures

Regulatory Benchmarks

Economic Climate

Billing model

Web 2.0

Emission Trade

Time-of-Use contracts

Gas & Oil prices

TECHNOLOGY

Demand response

ECONOMY

M & A's

Storage

Distributed Generation

New entrances

LNG/CNG

Home Automation

Price erosion / competition

CO_2 Capturing

CUSTOMER PULL

instead of

TECHNOLOGY PUSH

Red = Influencable

Black = non influencable

Barriers (non-exhaustive)

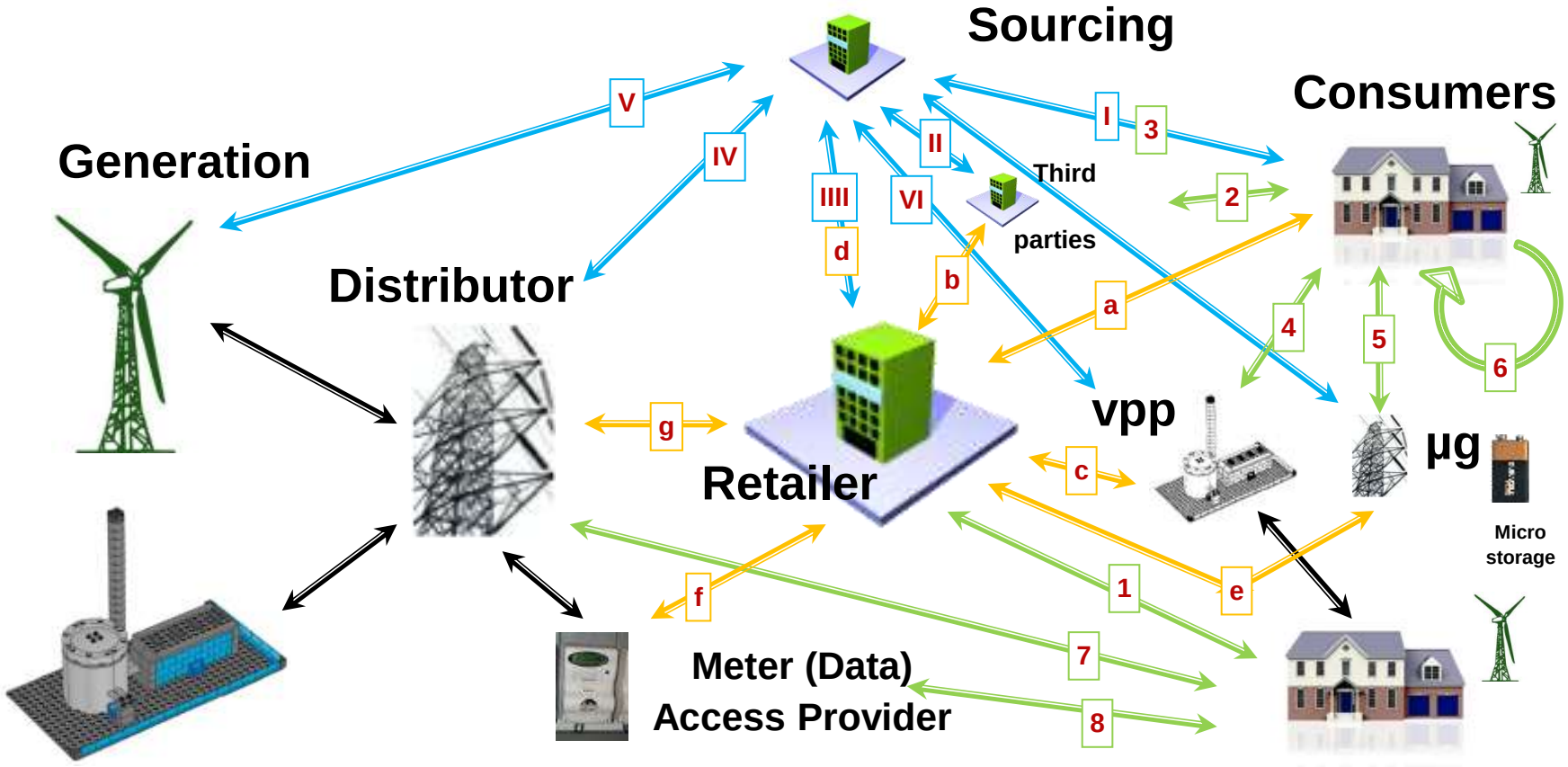
Business Model
Power Matching
Customer Centricity

Technology Advancement
Technology Adoption
Standardization

Market Model Stress
Tax Stress
Mind shift Need

Forest and Trees

Smart Energy Ecosystem Stakeholders



Source: SAP ACCU WORKGROUP AMI & SMART GRIDS

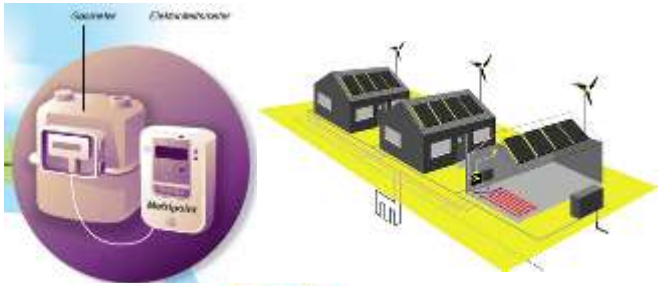
Challenges for grid company

Need to consume less energy

Monitor and steer complex energy flows

Need for energy storage

Enhanced security of supply



From large scale centralized to micro generation

Intermittent and unpredictable production: back up needed

Local balancing demand and supply of energy

Billing two way value stream

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Why are Pilots being paid so much salary?

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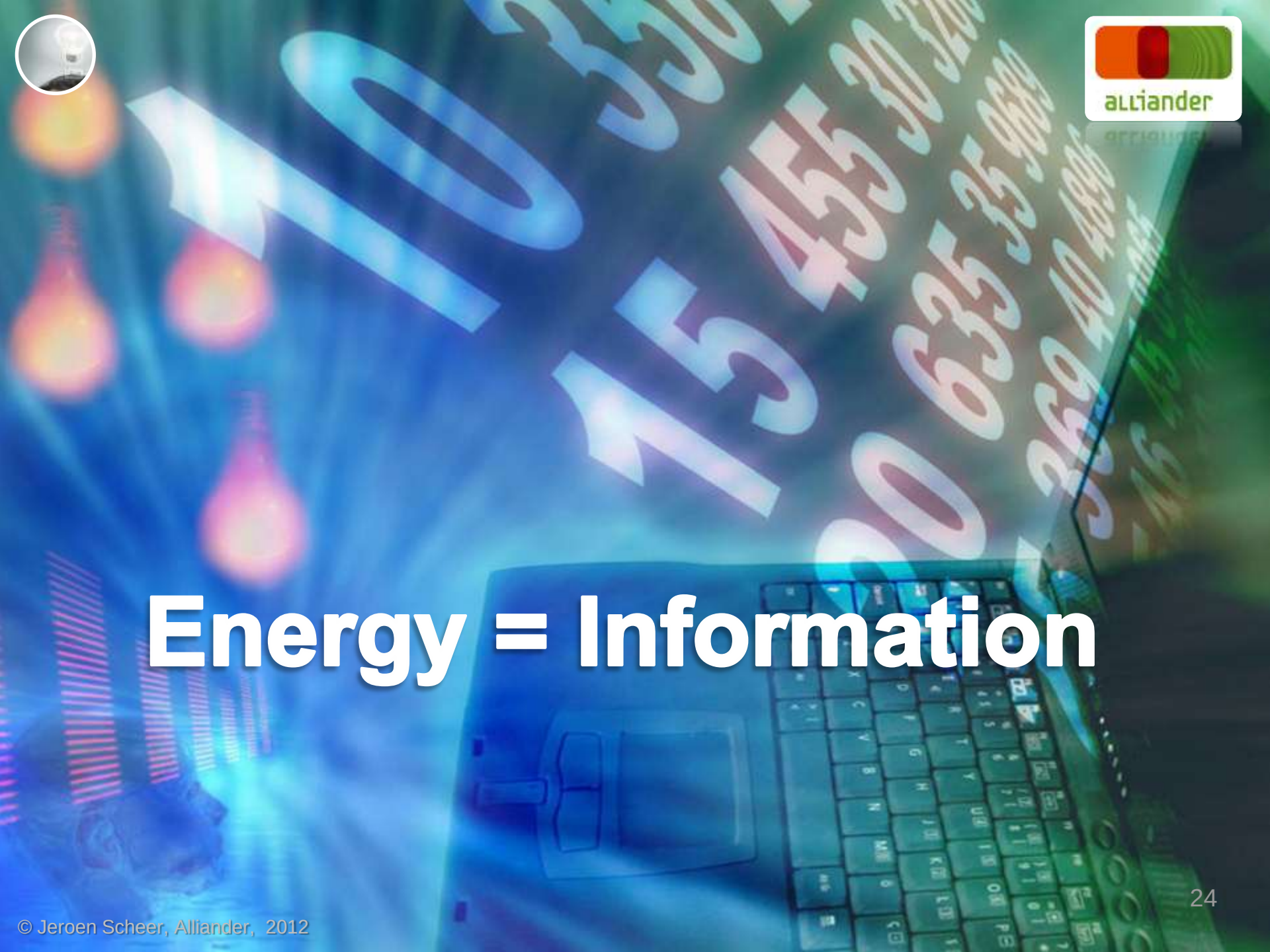
Electric Vehicles

Smarter Buildings

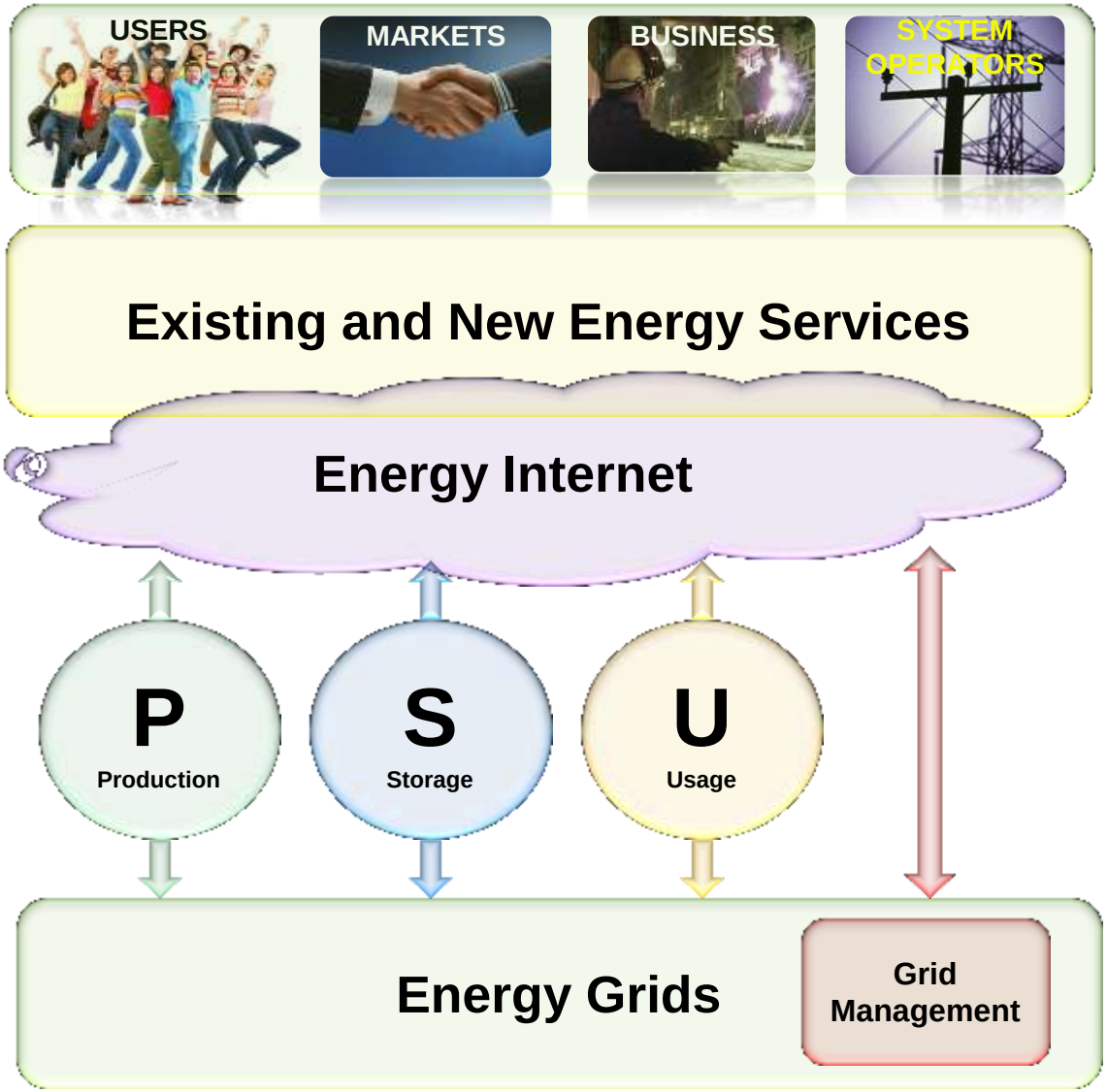
Local Demand/ Supply Management

Dynamic Asset Management



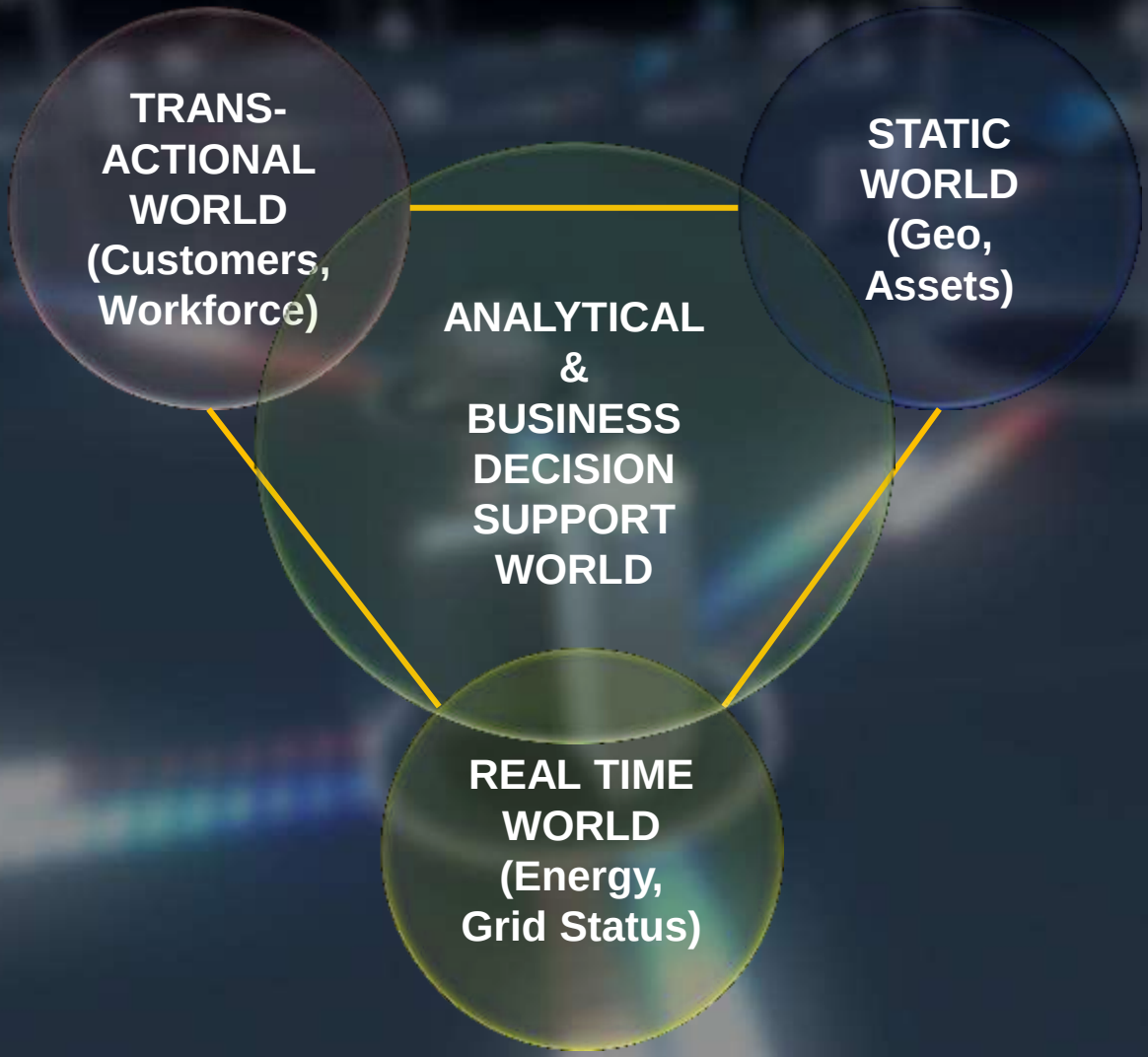
Energy = Information

This leads to Smart Energy Ecosystem



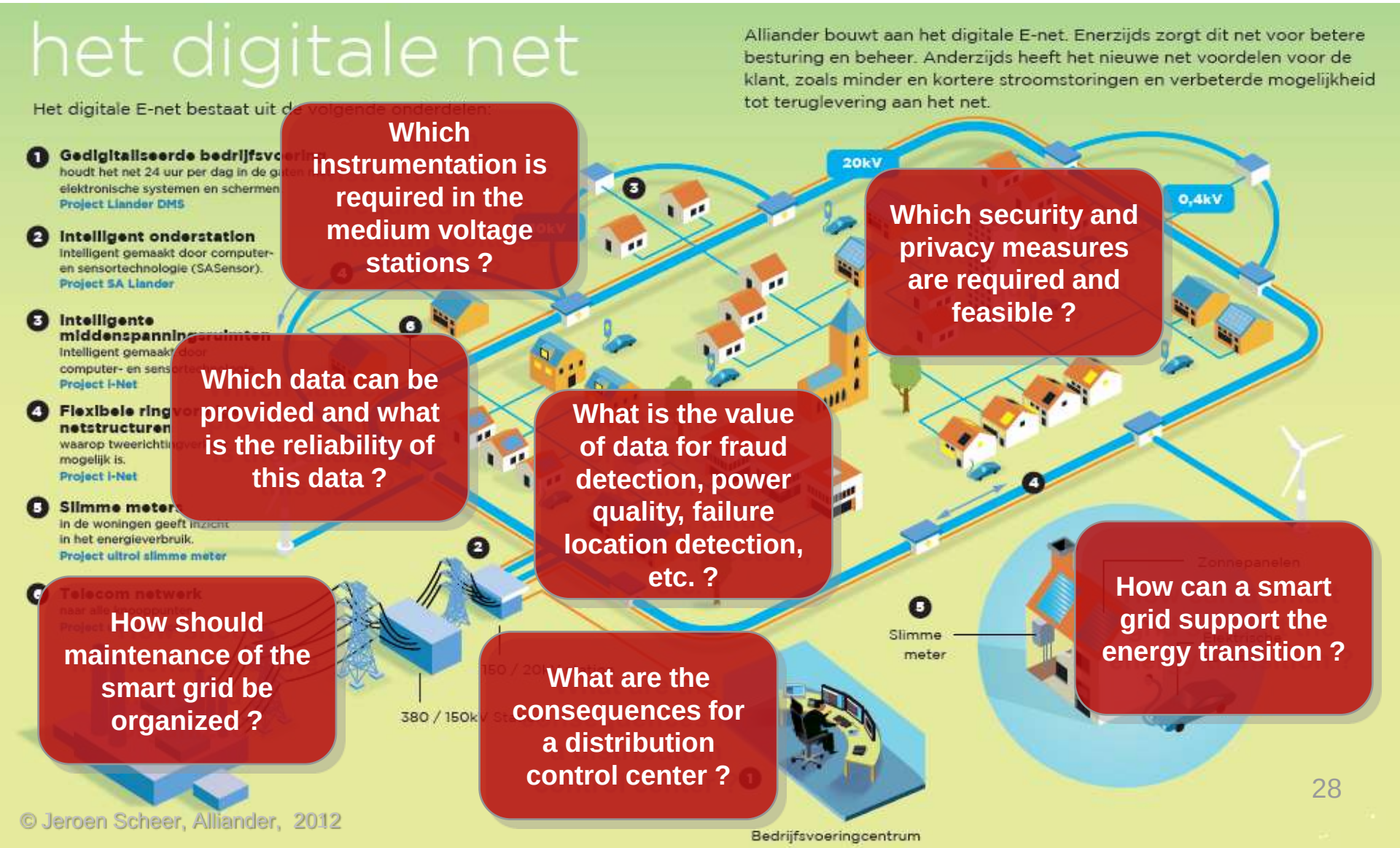
IOT Strategy

Combining several Worlds into One



So, let's get to the Real World

Many questions on the deployment and potential advantages of a smart grid



Which instrumentation is required in the medium voltage stations ?

Which security and privacy measures are required and feasible ?

Which data can be provided and what is the reliability of this data ?

What is the value of data for fraud detection, power quality, failure location detection, etc. ?

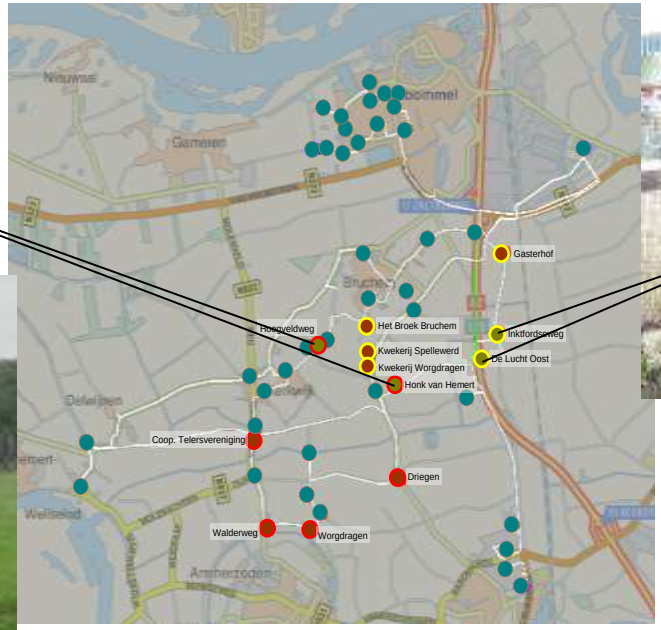
How should maintenance of the smart grid be organized ?

What are the consequences for a distribution control center ?

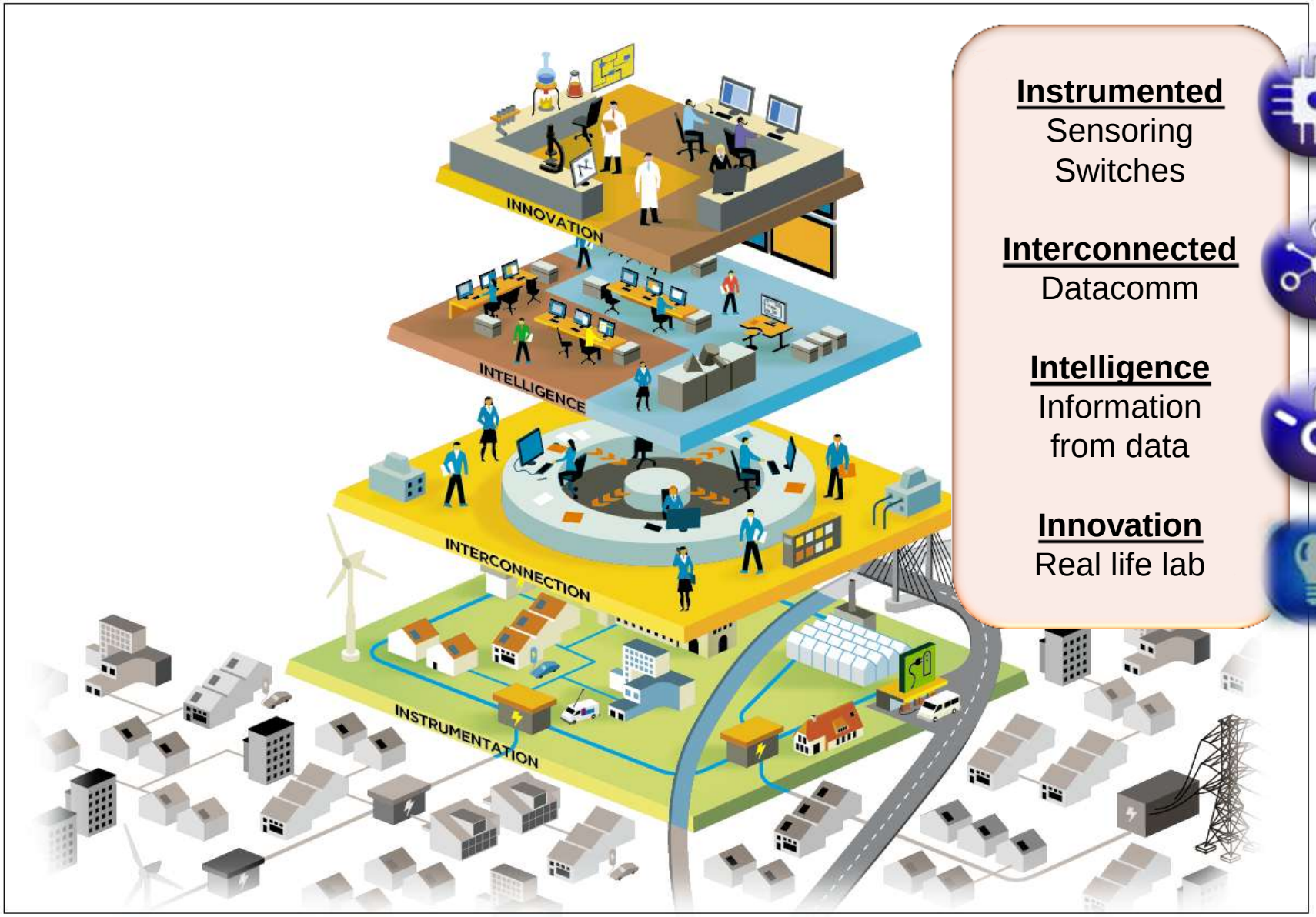
How can a smart grid support the energy transition ?

Large variety of MV stations

Resulting in a lot of (practical) challenges



So, we want to Combine 4 i's…



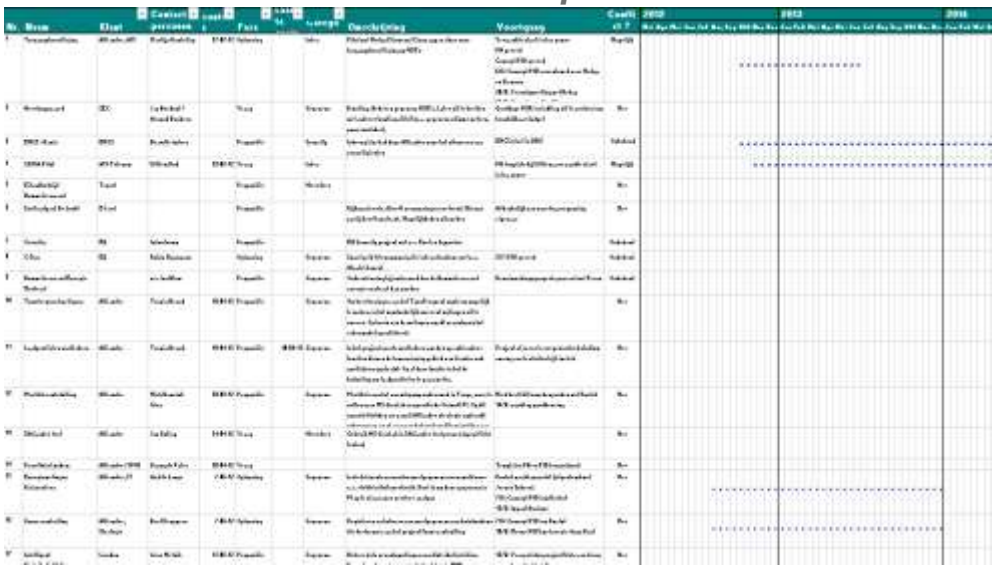
Instrumented
Sensoring
Switches

Interconnected
Datacomm

Intelligence
Information
from data

Innovation
Real life lab

Roadmap

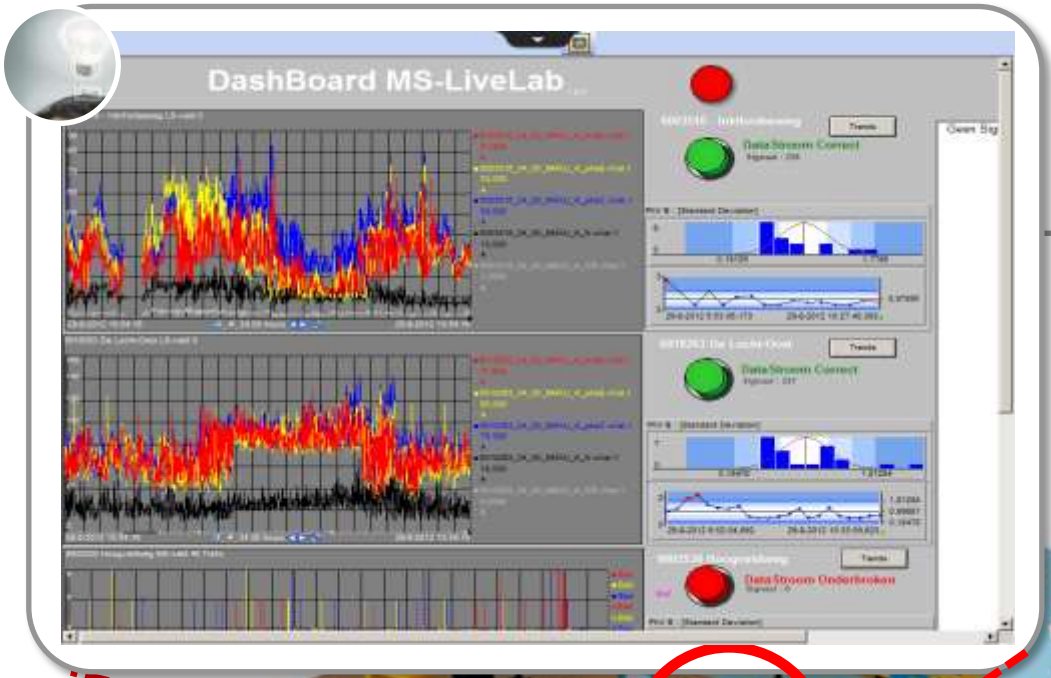


Innovation is the Key driver

We want to gain knowledge on:

- grid behaviour
- customer behaviour, interaction between components
- asset life cycle analysis
- costs
- benefits

1 **INNOVATION**



Insights in field data is important function

- Attributes
- Measurements
- Algorithms
- SG Analytics
- Component failures
- Predictions

2 **Analytics**

Learning how to communicate with all components in field, to collect, store, validate and distribute data

Status grid:

- Real time
- Near Real time
- Offline

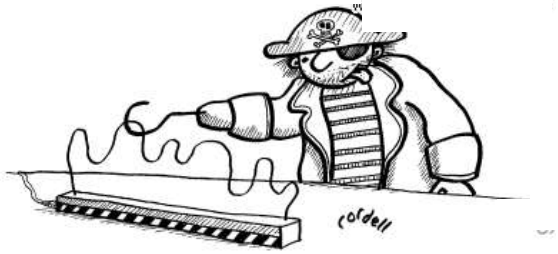
3 **Interconnection**

Placing sensors in field from many suppliers for comparison reasons. Basically starting in Zaltbommel, but easily extended to other regions

Result: our LiveLab

- End2End chain MV-LV
- In Real Life grid with:
  - Electrical Vehicles
  - Decentral Generation
    - Homes
    - SME (Greenhouse industry)
  - Entire residential area

Our Livelab



SASensor

HV stations

HV - MV

LIVELAB: digitalizing (existing) MV grids

MV stations

MV - LV

Infostroom: Smart Meters

LV connections

SM

SM

SM

SM

LV - Home

(nano) (milli) seconds

seconds minutes

minutes 15’

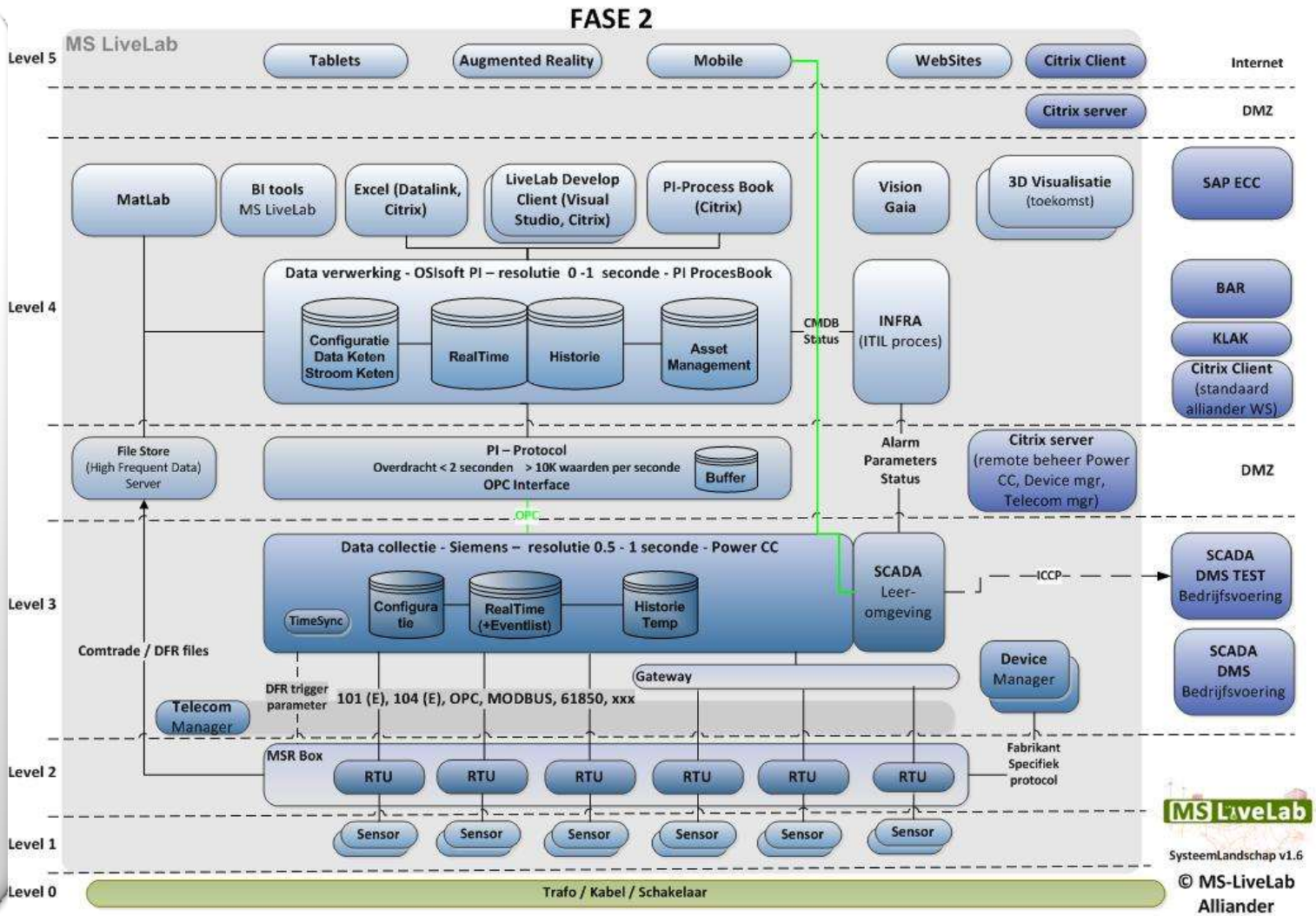
Architecture

Layered approach with STANDARDS

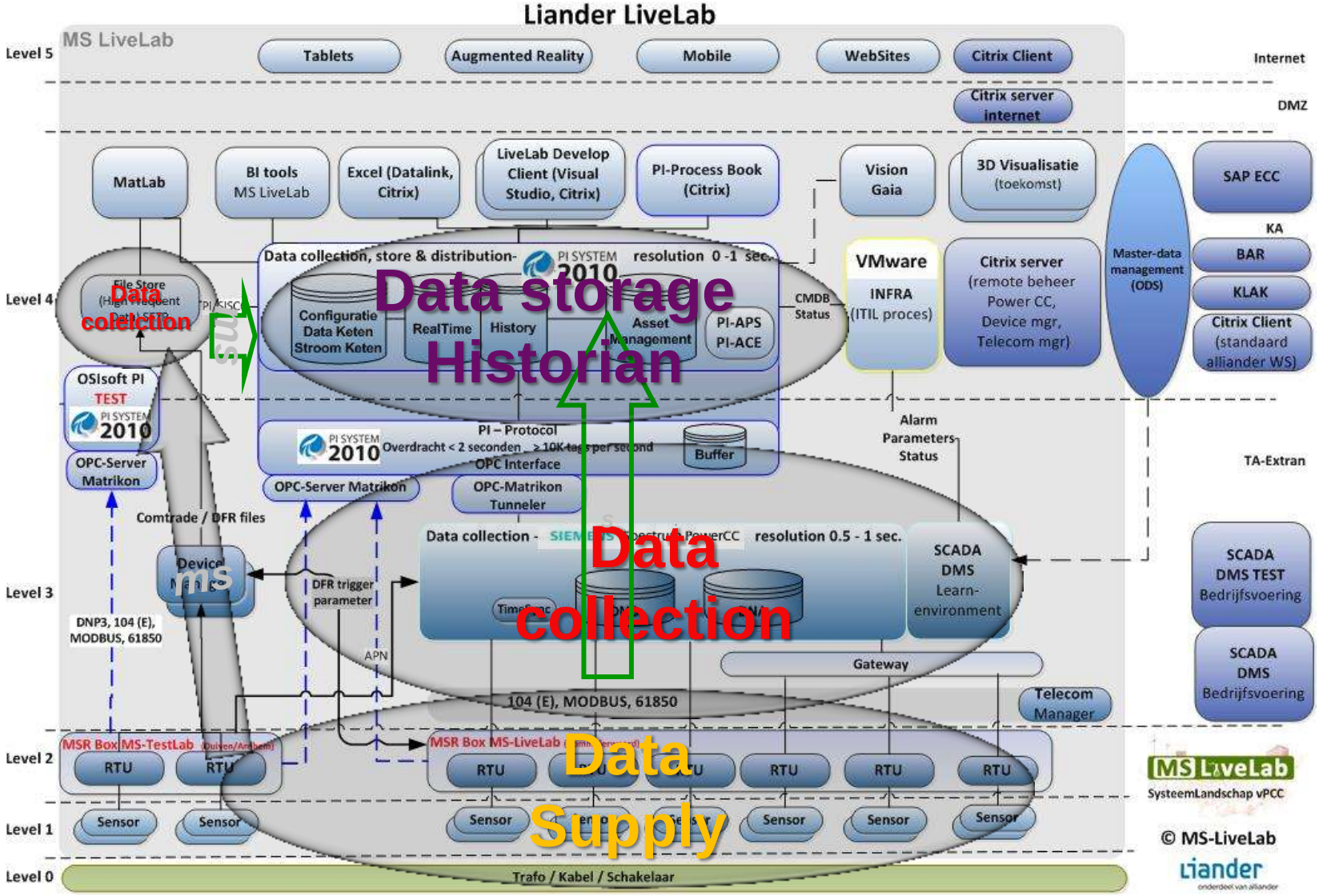
SECURITY ZONES

DISTINGUISH
- REAL TIME
- NEAR RT
- OFFLINE

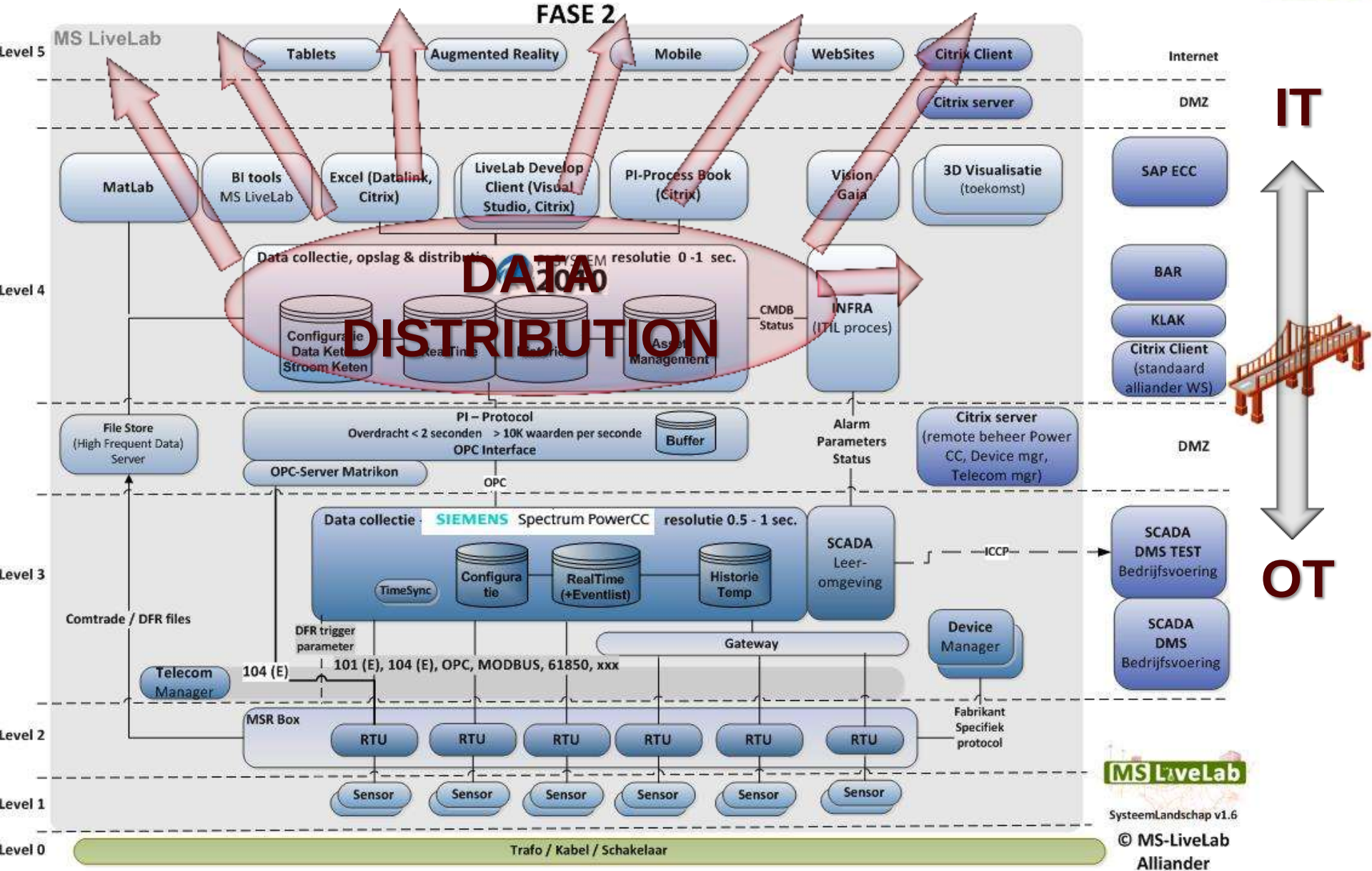
INTEGRAL
- IT
- OT
- Sensors



Getting the Basics Right

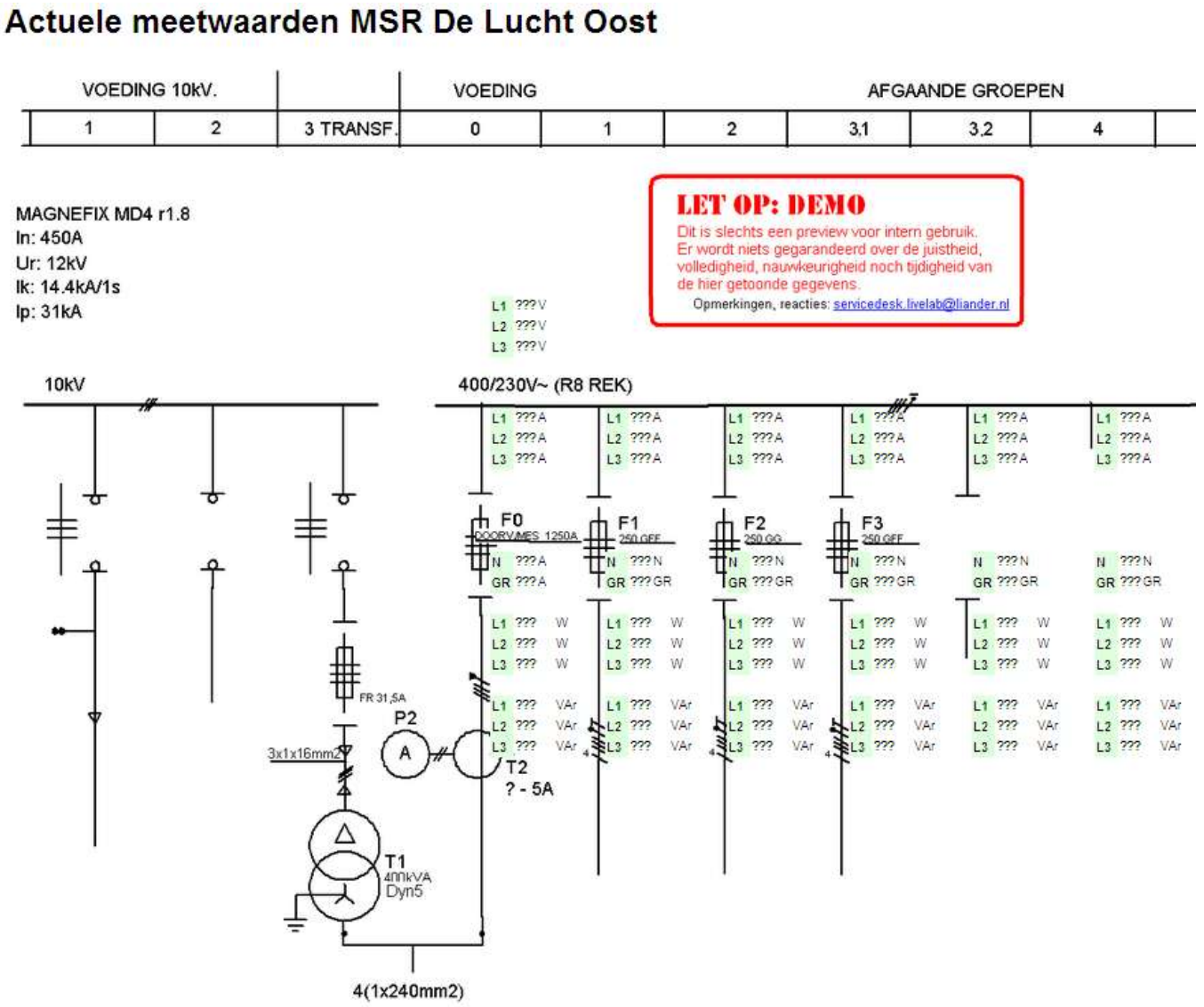


Getting it to Work



Example of real time data usage

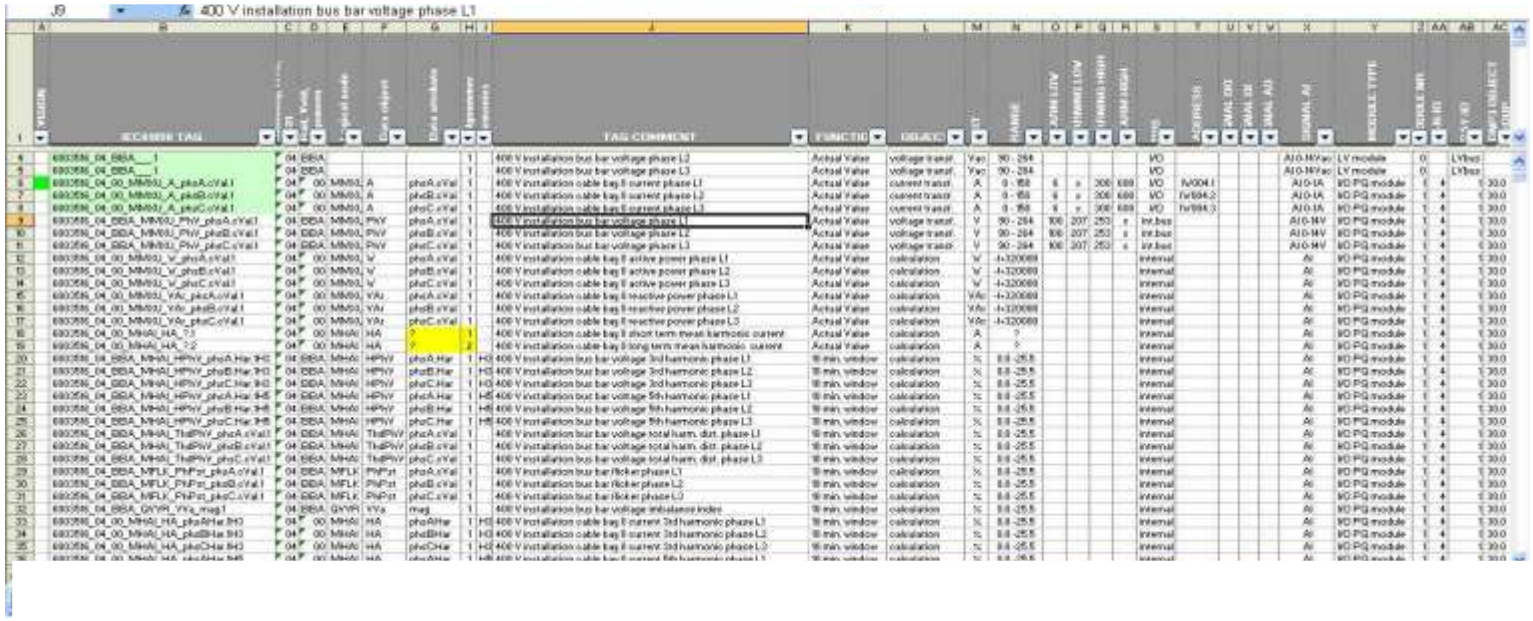
(delay of some seconds)



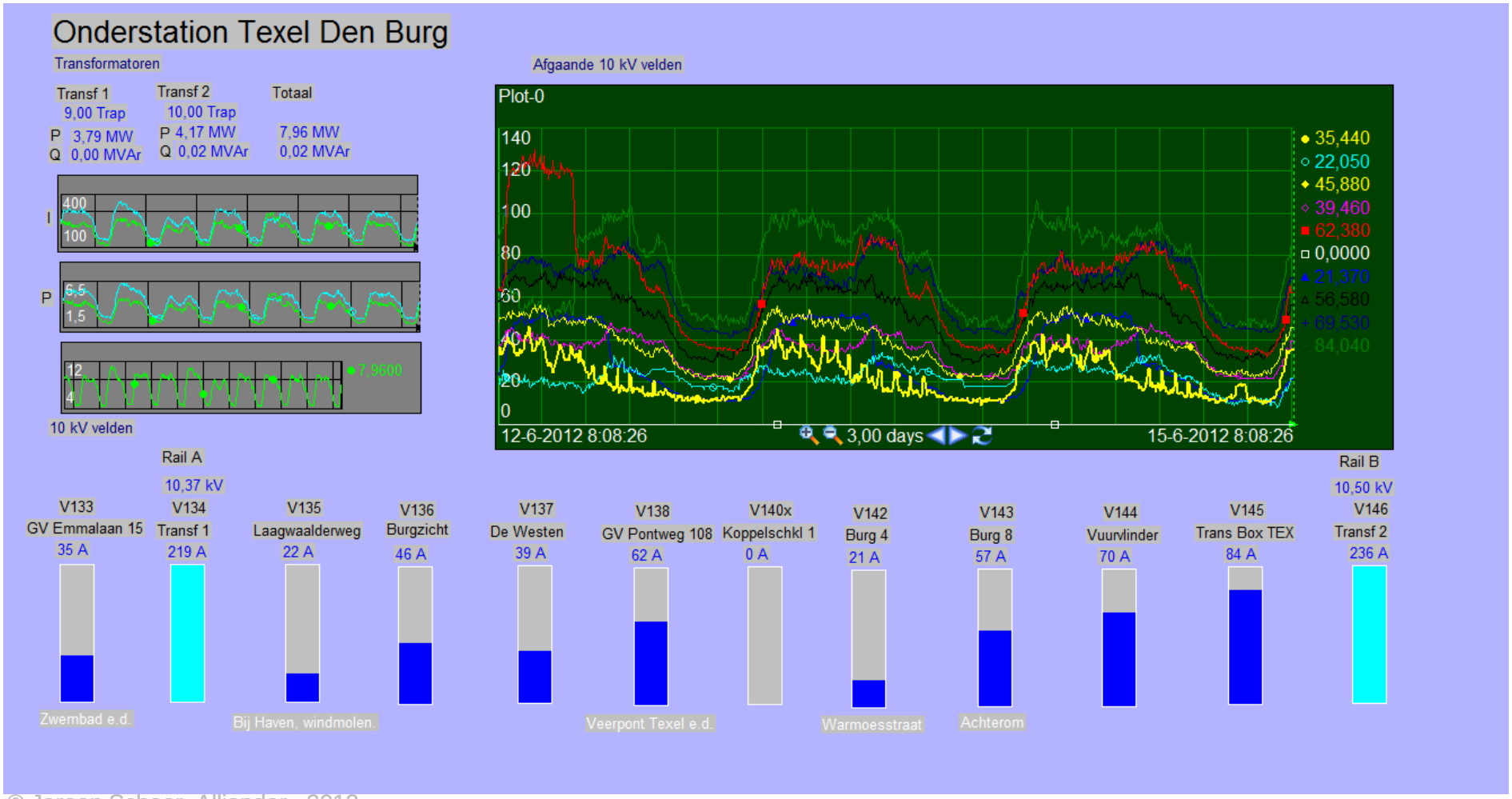
Our Signal list

Per MV Substation 450 signals, 40,000 MV Stations

- Originally in Oracle RDBMS
- More than **13,000,000,000 values**, representing nearly 15 years of history
- From hours of query to seconds

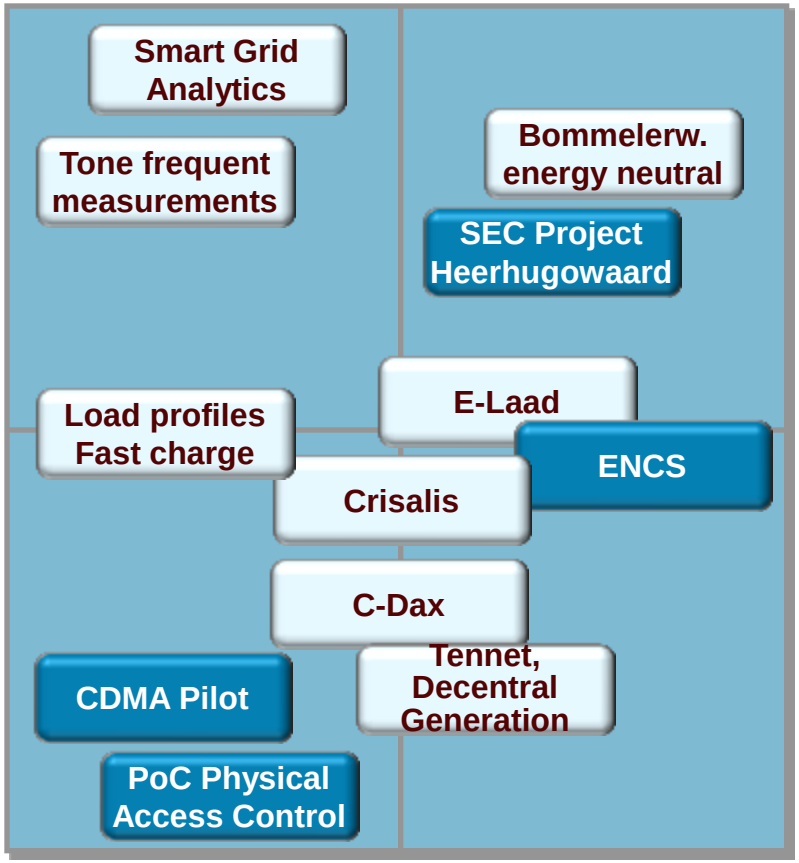


PI Processbook



Livelab is in Full Use

Selection of Livelab Projects



ENCS:
Cooperation with the European Network of Cyber Security. LiveLab will be used for security testing.

Heerhugowaard:
Cooperation with SEC project Heerhugowaard (measurements in a PV neighborhood). LiveLab will be used for data collection and data analysis.

CDMA Pilot:
Test of CDMA in a smart grid environment.

PoC Physical Access Control:
Test of physical access control and video monitoring for MSR's

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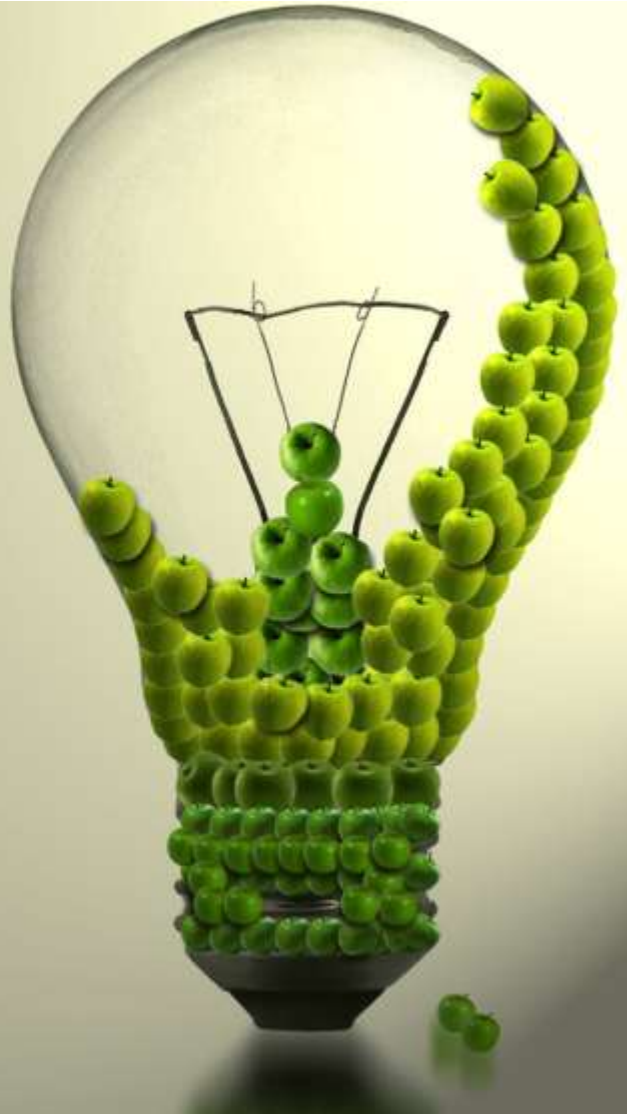
Energy Transition means

SUFFICIENT SUSTAINABLE ENERGY

which means that Energy will still be a

COMMODITY

and not a High Interest Product…



… and that

changes

EVERYTHING

in our Industry

The Future is NOW

Our Delivery Strategy

CUSTOMER **CENTRIC FULFILLMENT**

REGULATORY ***PARTNERSHIP***

SECURITY OF ***BALANCE***

GEOSPATIAL AND ***INTELLIGENT*** **GRID**

MAXIMALLY ***FACILITATED FLUID*** **MARKET**

Energy companies become IT, besides E and G

Bridging IT and OT

Centralize Data from many sources and Distribute multiple

A MINDSET SHIFT IS REQUIRED

Energy markets must
INTEGRATE CONSUMERS
as Active Partners

IT = OT = IOT

Innovation as CATALYST
THINK THE IMPOSSIBLE

Everything Thrives on DATA

Combining all IOT worlds
into One world

IT IS US THAT NEED TO CHANGE AND ACT

THEN WE CAN OVERCOME BARRIERS

AND ENSURE

PERFECT ENERGY

THANK YOU