



**Are you DSO, ready for the future, or even for tomorrow?  
Take advantage of lessons learned.**

*Mark Ossel*

- board member OSGP Alliance
- member European CIE Coordination Group Smart Electricity Grid (CG-SEG)
- Sr Vice President Networked Energy Services (NES Corporation)
- Member IEC TC13/TC57, ETSI, CEN/CENELEC, ESMIG





Networked  
Energy  
Services

- ▶ Networked Energy Services Corporation (NES) is a global smart energy leader in the worldwide transformation of the electricity grid into an energy control network.  
Projects: Enel, Vattenfall, EON, Caruna, Tauron
- ▶ Provide smart metering Systems and technology to collect daily 99.8% up data from over 40 Million meters as foundation for e.g. Grid Navigator, Grid Flow.
- ▶ Support the energy transition by using smart electricity meters as sensors and provide a secure, reliable neighborhood control and information network



**OSGP**  
ALLIANCE



- ▶ Industry/Usergroup. NGO, developing and promoting Open Smart Grid Protocol, a standard to support the energy transition in the **LV** distribution network. (ETSI, CENELEC, IEC)
- ▶ Over 60 Utilities using OSGP
- ▶ Best performance, extended functionality
- ▶ Future proof architecture

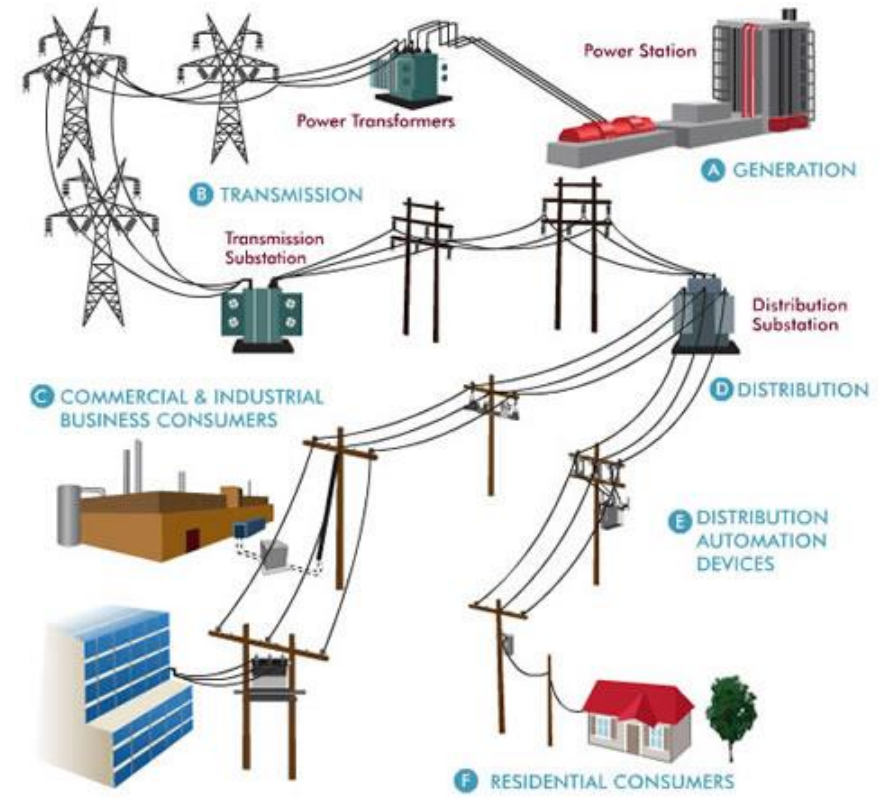


**OSGP**  
Open Smart Grid Protocol

# The Energy Transition & CEP

Losses... SLA... outages  
Consumer empowerment  
Grid stability... voltages..  
Storage... Solar... PV..EV..  
Secure...Digital grid ...  
Smart Grid .. PLC... RF

The secret of change is to focus all of your energy,  
not on fighting the old, but on building the new.  
*Socrates*



19XX

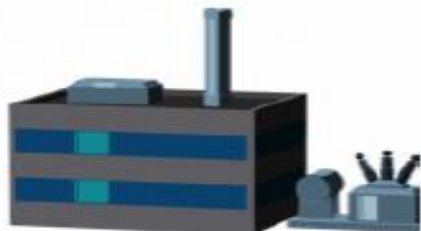


# A Fundamental Shift is Underway.. Are you ready???

Utility/Electricity ...40-50 year cycles..... The third one has started

## YESTERDAY:

- Single source, local
- Steady-state
- Captive consumer
- Ubiquitous, cheap
- Single business model



## TODAY:

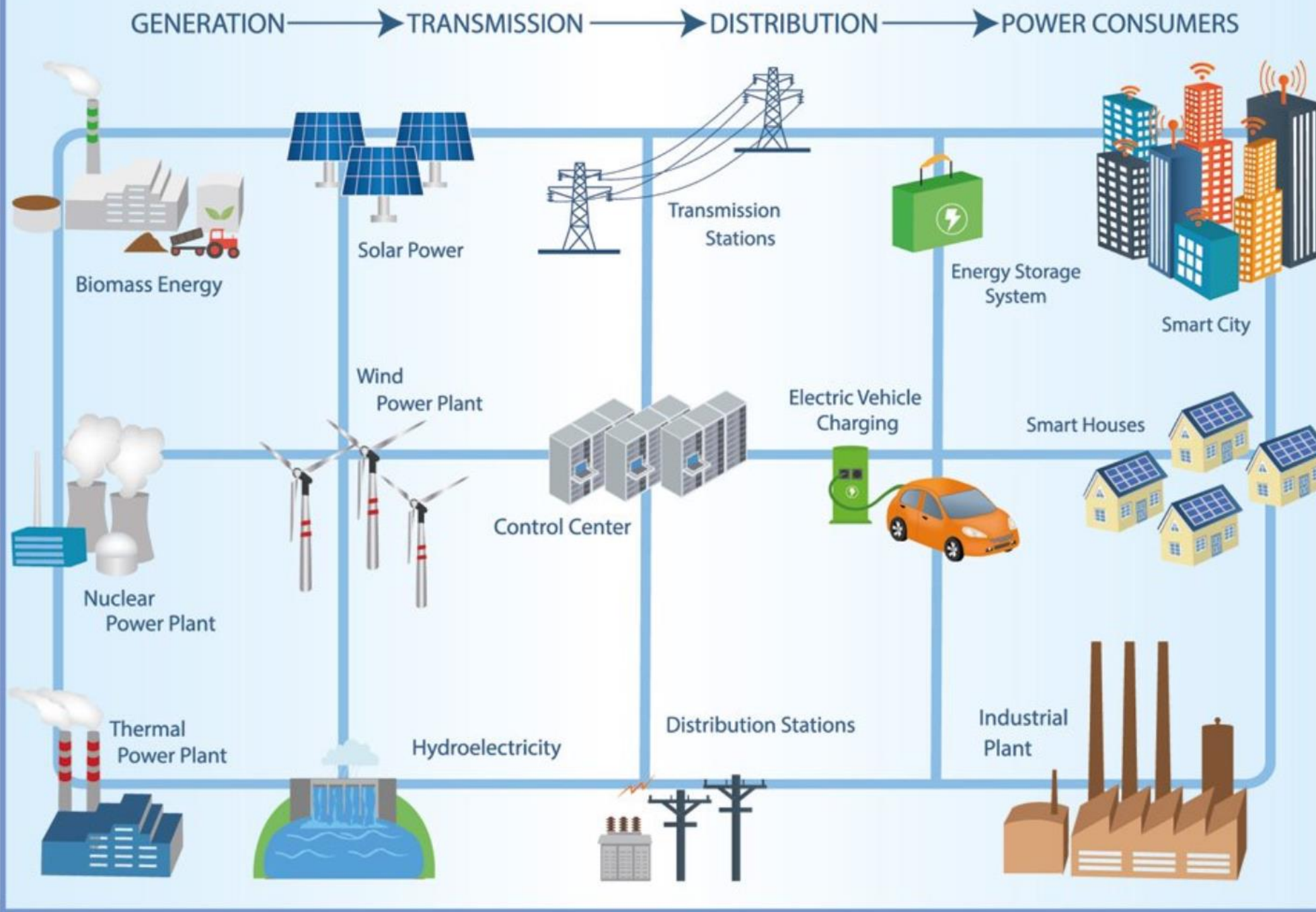
- Distributed energy sources, global
- Erratic demand
- Consumer choice and participation
- Key GDP component, price pressure
- New business models



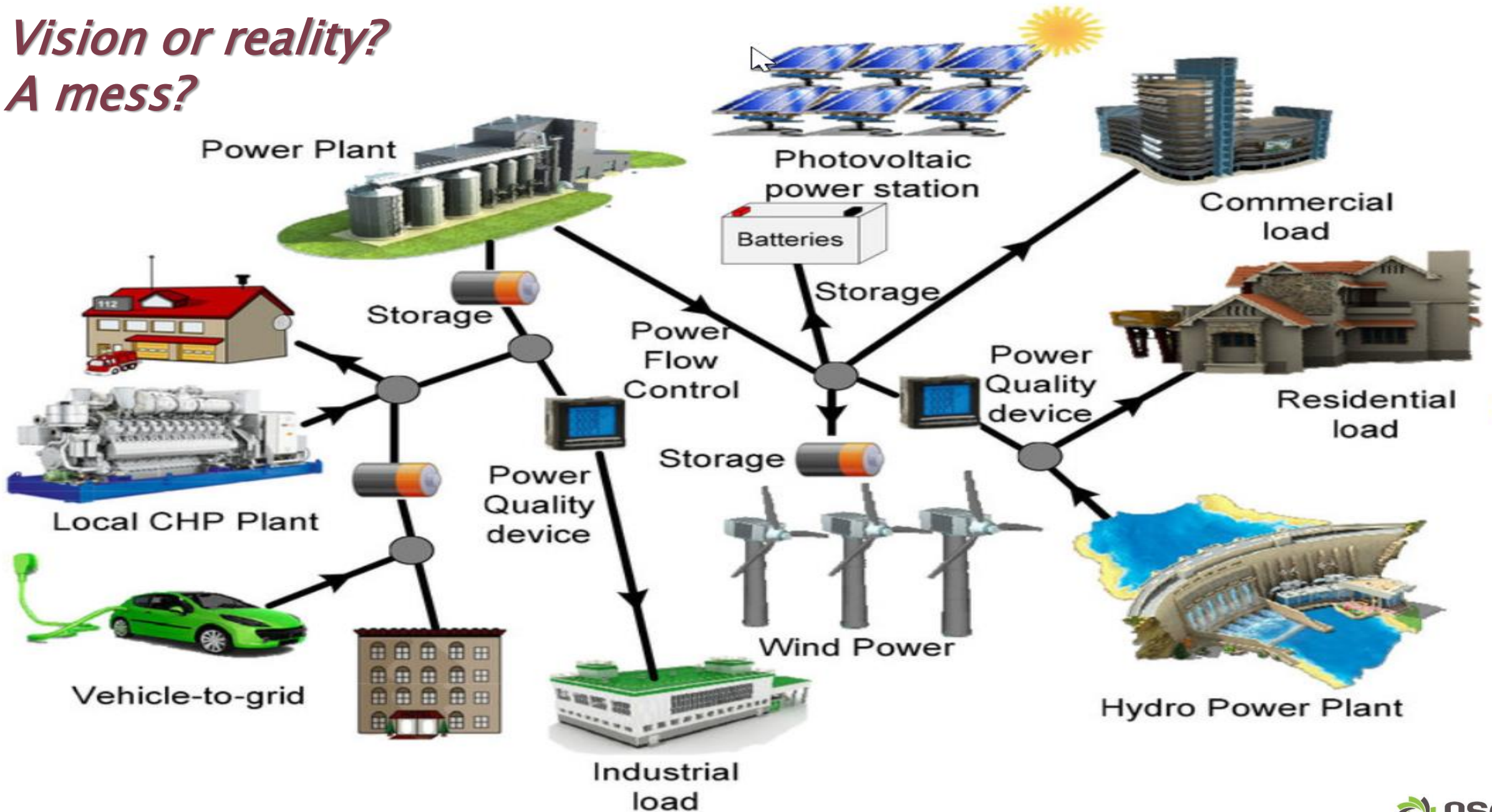
*The grid will change forever and as never before*

The traditional Model updated..

but drawn as the old world



# Vision or reality? A mess?

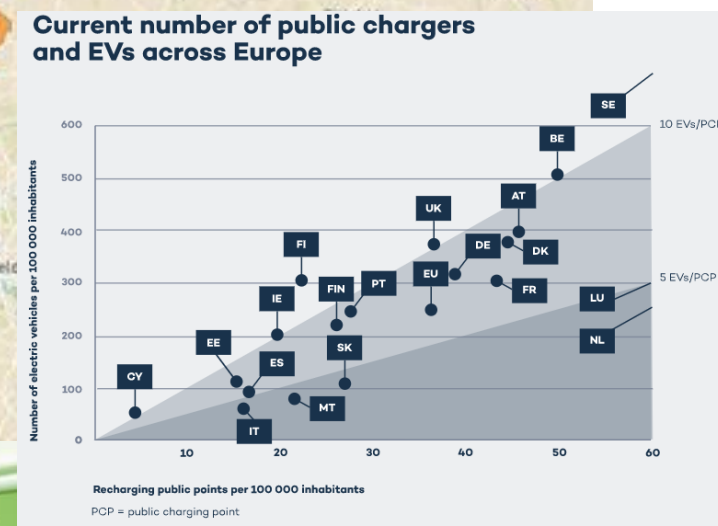
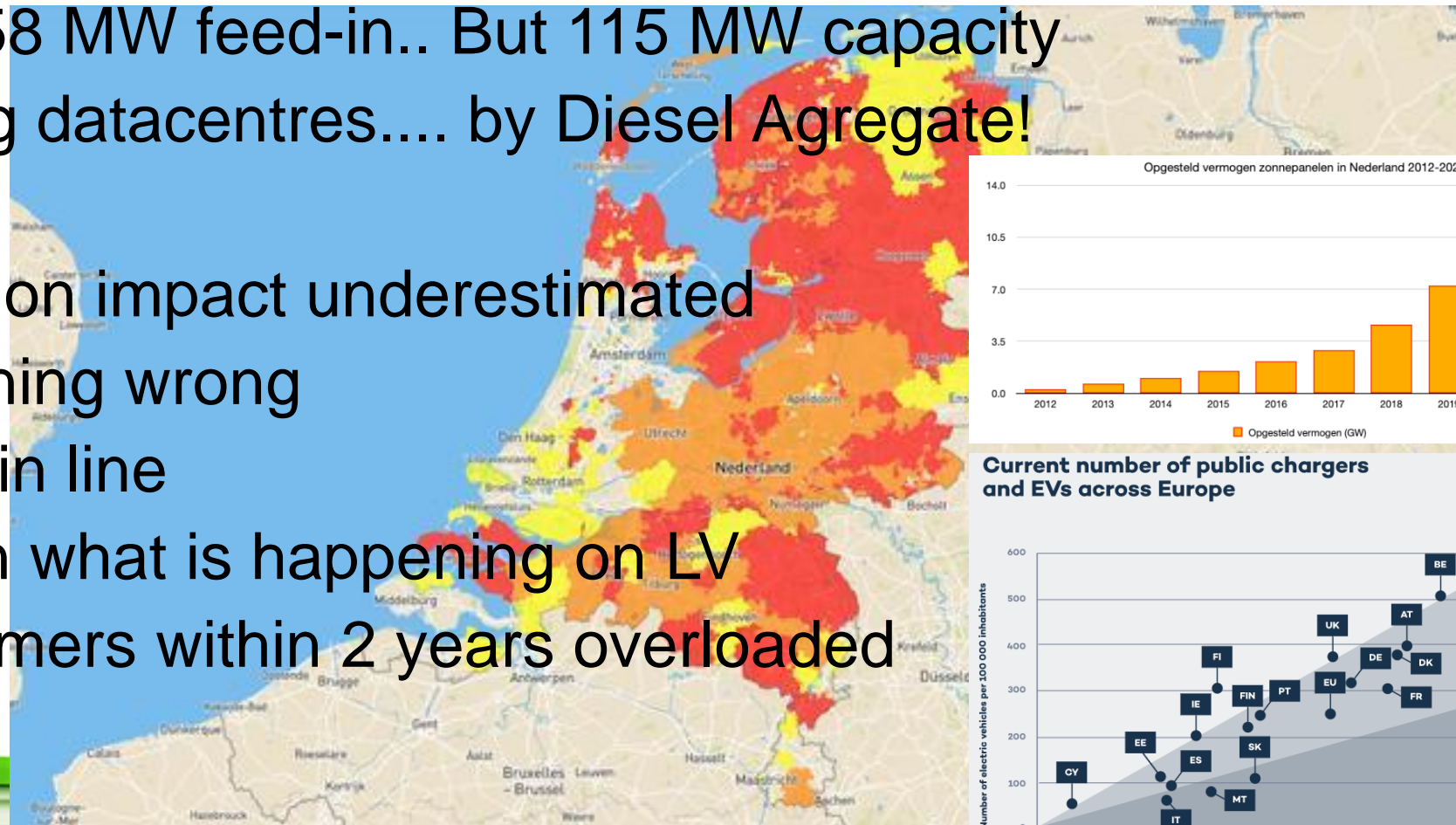


# Congestion on the net... This is not Africa... But Holland!

## ***Feed-in and Demand issues today! No connection!***

- ▶ In one area, 758 MW feed-in.. But 115 MW capacity
- ▶ Demand for eg datacentres.... by Diesel Agregate!

- ▶ Energy transition impact underestimated
- ▶ Capacity planning wrong
- ▶ Financing not in line
- ▶ No information what is happening on LV
- ▶ 4% of transformers within 2 years overloaded



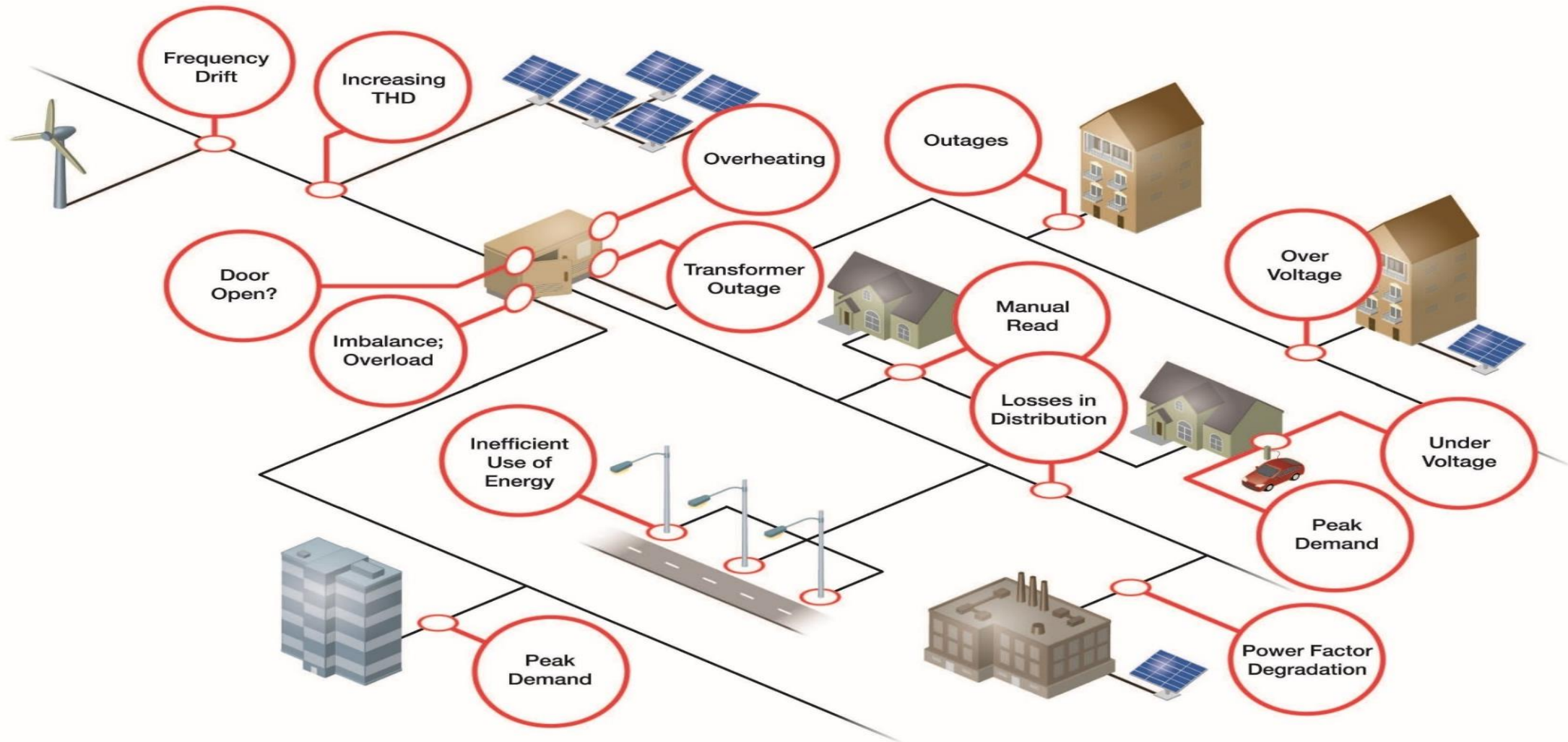
# Life has changed... faster than expected. What is your vision? Do you invest in the future?

- ❖ Grid stability is an issue already *Today*
- ❖ Feed in of energy, from everywhere  
Unplanned current draw
- ❖ No measurement and control on Low Voltage grid
- ❖ No proper topology information
- ❖ No information on loads on secondary transformer
- ❖ No information on capacity left for EV charging
- ❖ No information on PV feed-in by transformer
- ❖ Planning capacity of cables, transformers without real information and not for the future
- ❖ Organizational silo's...

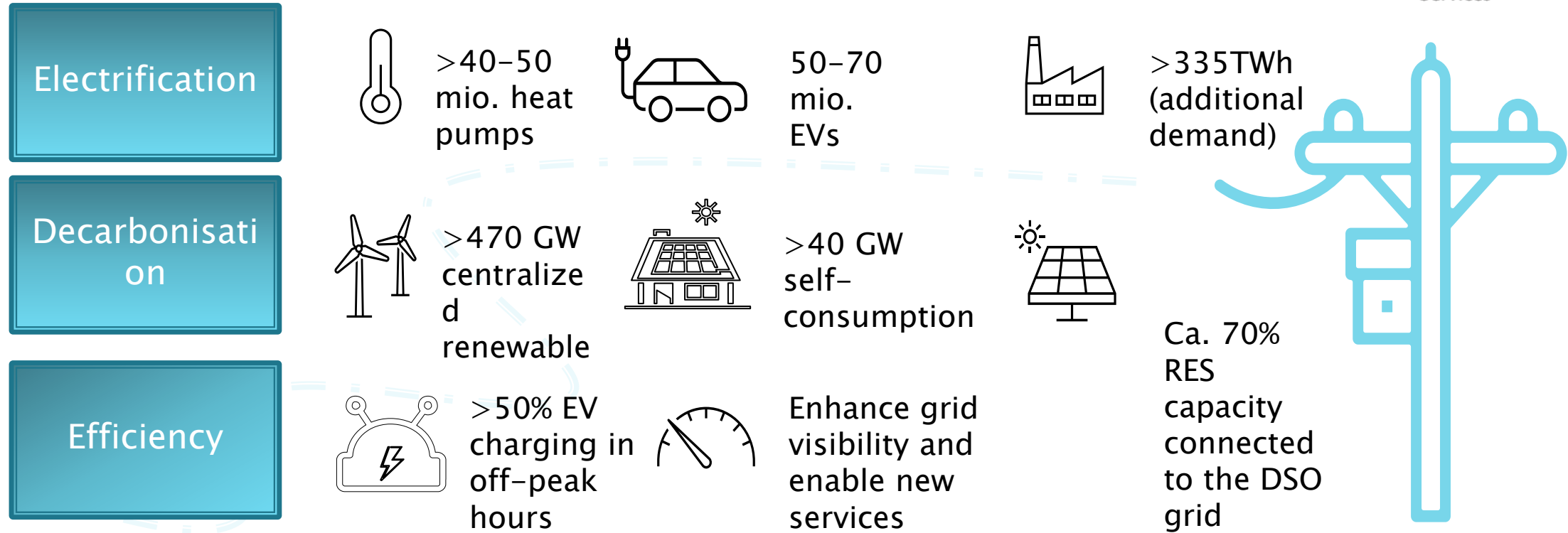


The secret of change is to focus all of your energy,  
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# Applications Beyond Smart Metering Grid Stress Points



# Energy transition: A network's perspective... vision or fact?



EU27+UK energy transition levers by 2030  
 Scenario aligned with the EU decarbonization goals

Source: Deloitte, E.DSO, eurelectric: Connecting the dots: Distribution grid investment to power the energy transition

# DRIVERS FOR SMART METERING... IN LINE WITH CAPABILITIES

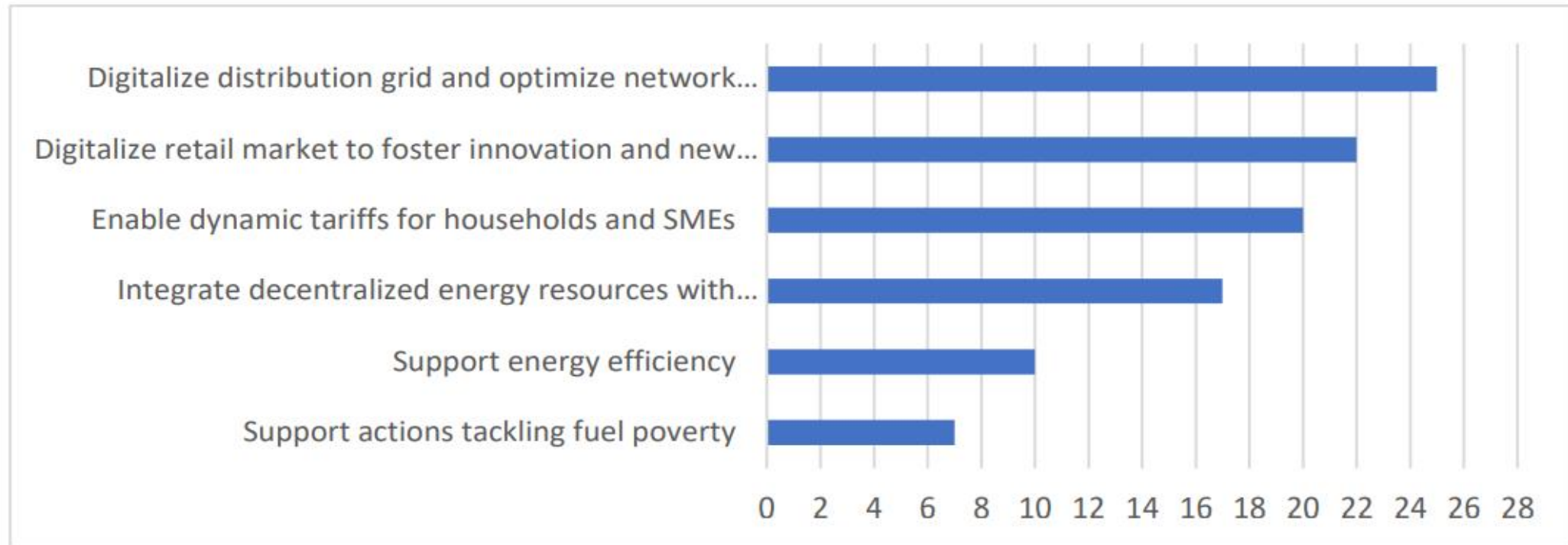
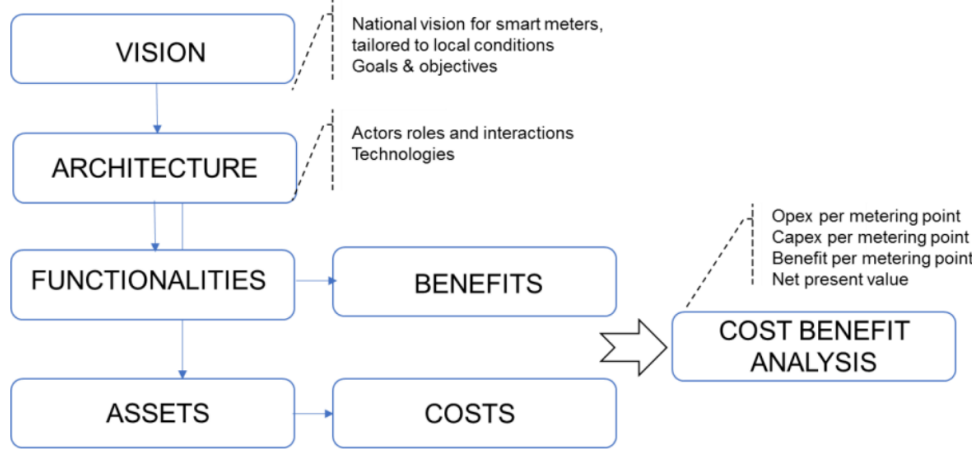


Figure 17: Primary market drivers for smart meter rollout in the case of electricity vs. number of member States

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# CBA PER COUNTRY, KEY FOR THE RIGHT FUNCTIONALITY AND COST



- ▶ Lack of knowledge at regulators
- ▶ Different cost and benefits taken into account
- ▶ CAPEX and OPEX in other area's
- ▶ Reports will be provided

Benchmarking smart metering deployment in the EU-28

	Efficiency due to energy efficiency	Reduction due to dynamic pricing	Provision of rapid flexibility services	Increased competition in retail market	Easier access to photovoltaic production	Access to smart services	Operational & maintenance of assets	Reduction capacity demand	Transmission capacity demand	Generation capacity demand	Technical losses reduction	Non-technical (intermittent, long lead times, etc.)	Change management (based on market value of lost load)	Change management (based on reduced customer intervention)	CO <sub>2</sub>	Ap production (per metering point)	Other
AT																	
BE (BR)																	
BE (FL)																	
BE (WA)																	
BG																	
HR																	
CY																	
CZ																	
DK																	
EE																	
FI																	
FR																	
DE																	
EL																	
HU																	
IE																	
IT																	
LV																	
LT																	
LU																	
MT																	
NL																	
PL																	
PT																	
RO																	
SK																	
SI																	
ES																	
SE																	
UK																	

Table 10: Considered benefits in the CBA for each Member State (Legend: green = considered, blank = not considered, grey = data not available).

**Cost & Benefits attributes different by country - Knowledge - !**

Benchmarking smart metering deployment in the EU-28

	CAPEX - Investment in smart meter	CAPEX - Investment in IT	CAPEX - Investment in Telecom	CAPEX - Investment in In-home display	CAPEX - Sunk cost of conventional meters	OPEX - IT maintenance	OPEX - Network management and front end	OPEX - Telecom	OPEX - Change management	OPEX - Unplanned renewal and failures of smart meter	OPEX - Revenue reduction	OPEX - Meter reading	OPEX - Call center and customer service	OPEX - Consumer engagement programme	Other
AT															
BE (BR)															
BE (FL)															
BE (WA)															
BG															
HR															
CY															
CZ															
DK															
EE															
FI															
FR															
DE															
EL															
HU															
IE															
IT															
LV															
LT															
LU															
MT															
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PL															
PT															
RO															
SK															
SI															
ES															
SE															
UK															

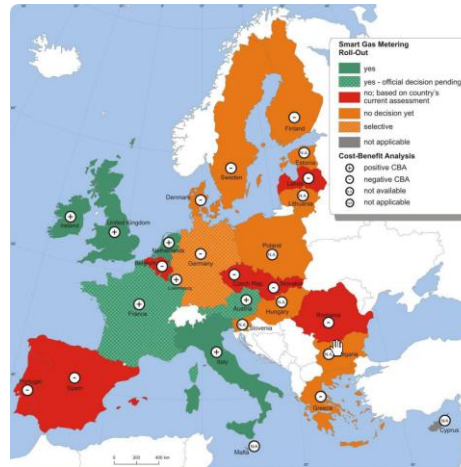
Table 9: Considered CAPEX and OPEX costs in the CBA for each Member State (Legend: green = included, blank = not included, grey = data not available).

- CAPEX - Investment in smart meter
- CAPEX - Investment in IT
- CAPEX - Investment in Telecom
- CAPEX - Investment in In-home display
- CAPEX - Sunk cost of conventional meters
- OPEX - IT maintenance
- OPEX - Network management and front end
- OPEX - Telecom
- OPEX - Change management
- OPEX - Unplanned renewal and failures of smart meter
- OPEX - Revenue reduction
- OPEX - Meter reading
- OPEX - Call center and customer service
- OPEX - Consumer engagement programme
- Other

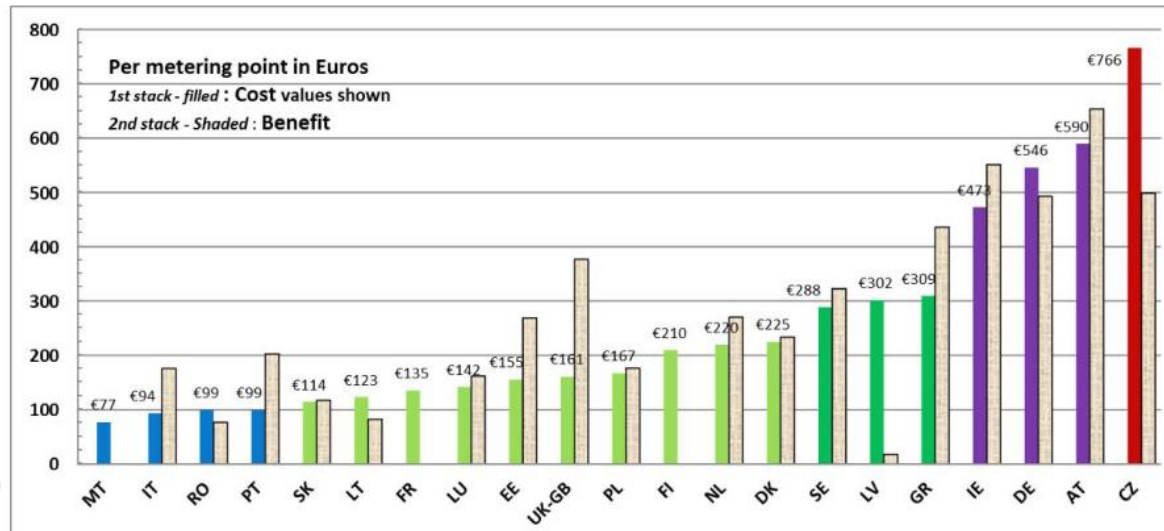
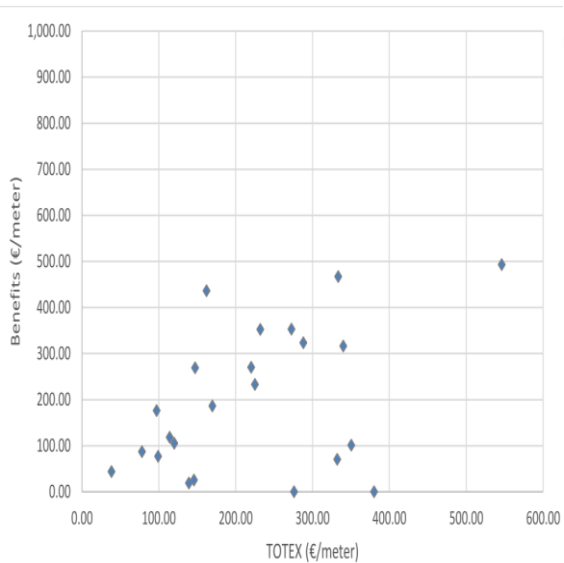
# Cost per meterpoint EU

Or.. Demonstrate "The lack of understanding"

- ▶ Cost 77,- tot 546,-
- ▶ Benefits 19,- tot 969,-
- ▶ 2013- 2018: same or up or down....?



	TOTEX (€/meter) 2018	TOTEX (€/meter) 2013	Benefit (€/meter) 2018	Benefit (€/meter) 2013
Austria	332.00 €	590.00 €	70.00 €	654.00 €
Belgium	340.00 €	340.00 €	316	316
Bulgaria				
Croatia	272.40 €		353.1	
Cyprus	275.80 €		969.00 €	
Czech Republic	350.33 €	766.00 €	100.82 €	499.00 €
Denmark	225.00 €	225.00 €	233.00 €	233.00 €
Estonia	147.10 €	155.00 €	269.00 €	269.00 €
Finland	209.70 €	210.00 €		-
France	135.00 €	135.00 €		-
Germany	546.00 €	546.00 €	493.00 €	493.00 €
Greece	162.00 €	309.00 €	436.00 €	436.00 €
Hungary				
Ireland	380	473	448	551
Italy	97.00 €	94	176.00 €	176
Latvia	38.18 €	302	43.64 €	18
Lithuania	169.60 €	123.00 €	185.90 €	82.00 €
Luxembourg	139.00 €	142.00 €	19.00 €	162.00 €
Malta	77.00 €	77.00 €		-
Netherlands	220	220	270	270
Poland	78.00 €	167.00 €	87.00 €	177.00 €
Portugal	333.30 €	99.00 €	466.70 €	202.00 €
Romania	99.00 €	99.00 €	77.00 €	77.00 €
Slovakia	114.00 €	114.00 €	118.00 €	118.00 €
Slovenia	145.50 €		25.50 €	
Spain	120.00 €	-	105.00 €	-
Sweden	288.00 €	288.00 €	323.00 €	323.00 €
United				



# COST VS BENEFITS

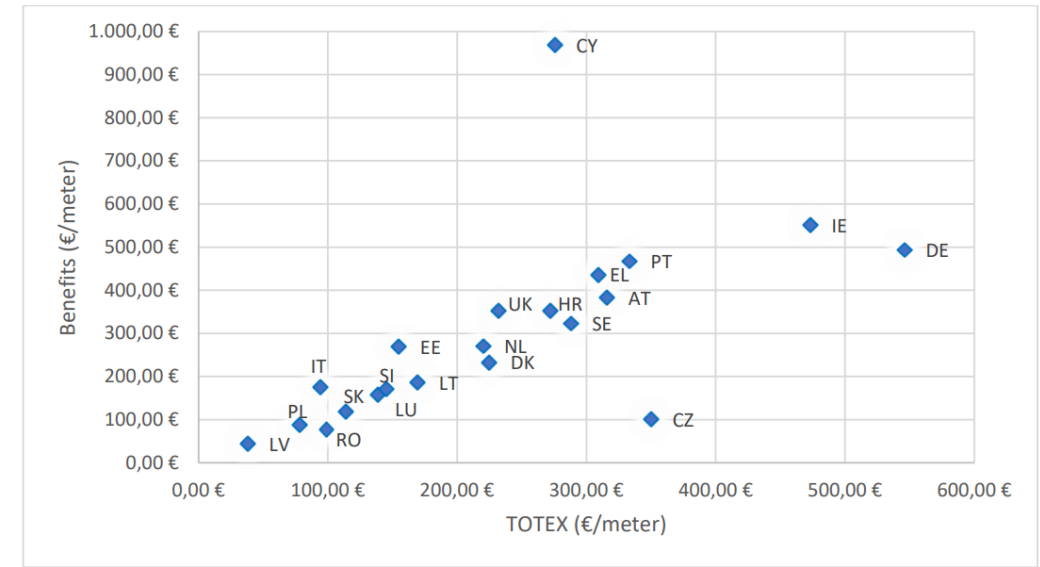
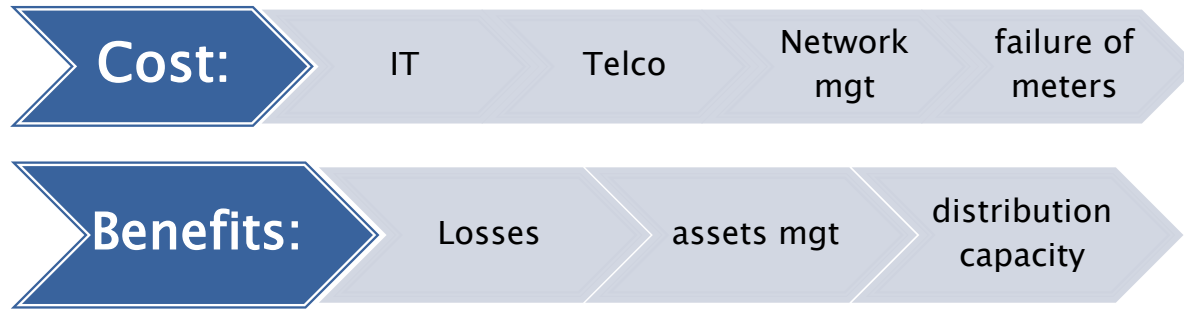


Figure 15: Normalised costs vs. benefits per metering point (most recent figures for each MS), for the case of electricity.

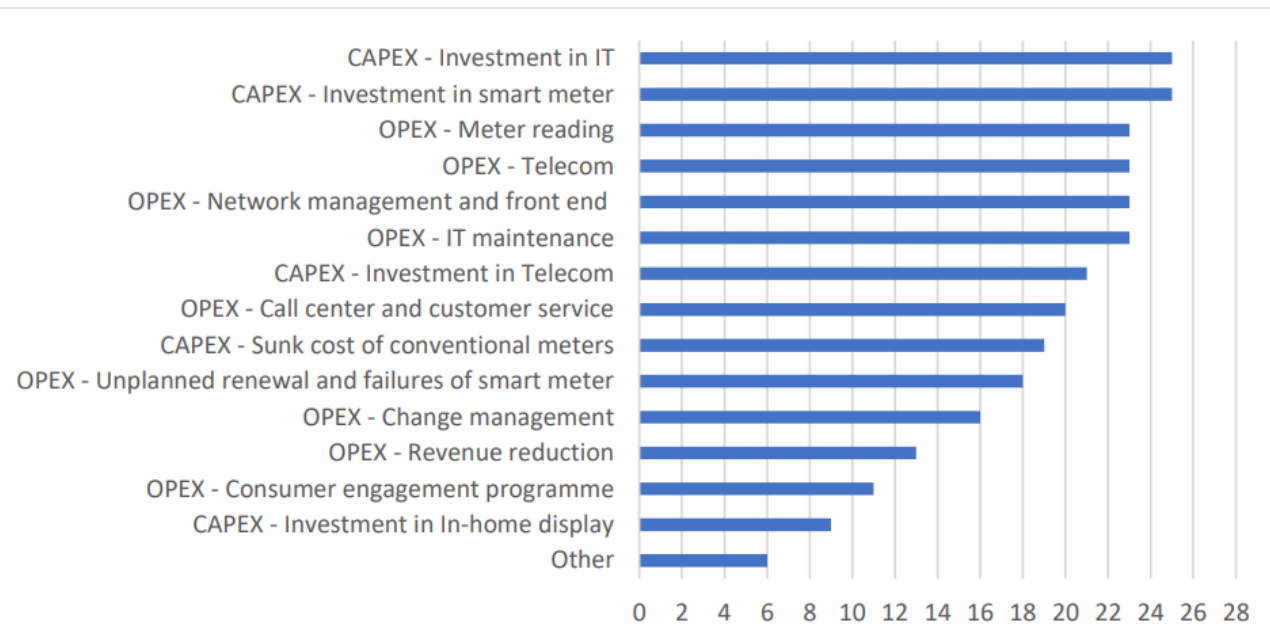


Figure 10: Ranking of the considered CAPEX and OPEX costs in the electricity CBAs vs. number of Member States.

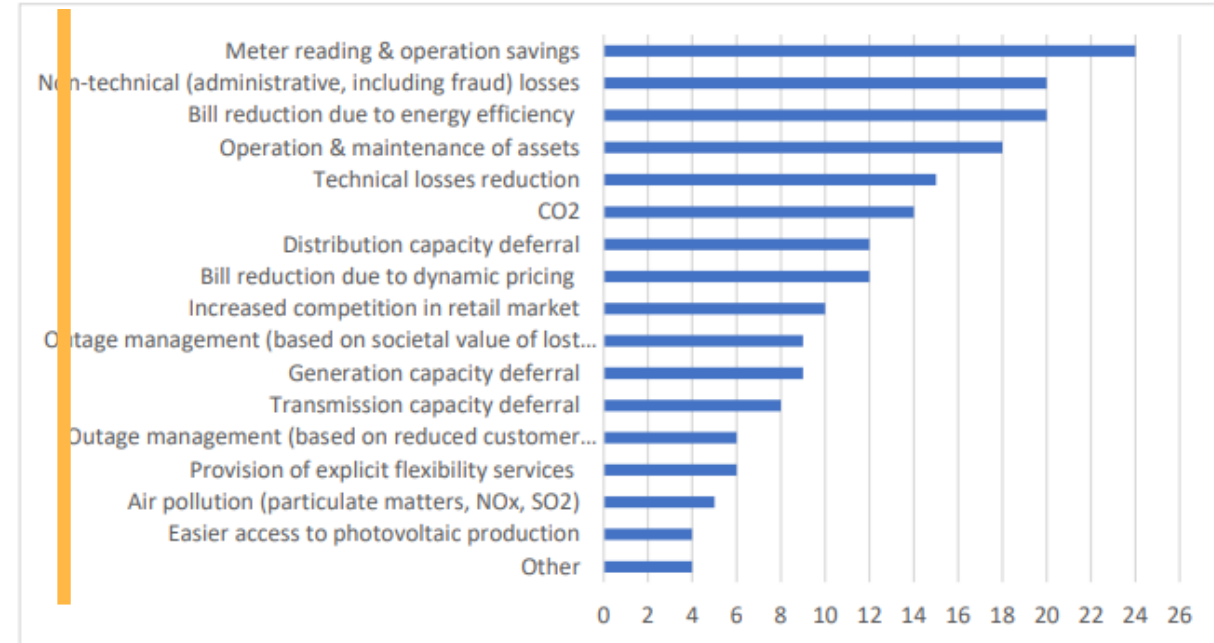


Figure 11: Ranking of the considered benefits in the electricity CBA vs. number of member States

# The European directives in the field of energy efficiency have strong impact on smart metering systems, rights of consumer .. Role of DSO

## Directive 2003/54 / EC and Directive 2006/32 / EC

the first initiatives aimed at improvement energy measurement activity

## Directive 2009/72 / EC

it concerns the «Common rules for the internal electricity market» which have given impetus to the development of smart systems metering

## Recommendation 2012/148 / EU

concerns the preparations for the introduction of intelligent measurement systems

## Directive 2012/27 / EU (efficiency energy)

reiterated the importance of intelligent metering systems capable of measuring the consumption of energy and to transmit and receive data by electronic communication

## Benchmarking Report 356/2014

reports the implementation status of the smart metering of which the characteristics, costs, benefits and timing of implementation of smart metering systems are analyzed in different European countries

## Directive 2015/13 / EU

concerns the conditions for placing on the market and marketing of instruments of measure

***European Commission does enforce change: Clean Energy Package (CEP) implementation mandatory.***

## Resolution 229/2017 / R / eel

defines the default configuration of second generation LV electricity meters for their commissioning and communication obligations to end users

## Resolution 248/2017 / R / eel

defines the measurement data management interventions attributable to the 2G smart metering systems within the Integrated Information System (SII), for the subsequent optimization of business and system processes

## Resolution 289/2017 / R / eel

it concerns the procedure for evaluating any future evolutions of the functional characteristics of low electricity meters 2G voltage

## Resolution 306/2019 / R / eel

updated the guidelines for recognition the costs of second generation smart metering systems for measuring low voltage electricity for the three-year period 2020-2022

## Resolution 105/2021 / R / eel

defines the minimum requirements to be adopted by distribution companies regarding information to end customers and businesses of sales as part of the marketing plans service



## Electricity Regulation (defining rules and principles of the internal electricity market)

Objective: Remove distortions in the internal market for electricity

- ▶ Principles: **customer empowerment**, market-based incentives for RES and flexibility, energy efficiency & investment, cross-border, equal access to market

### Chap VI. Distribution System Operation

- ▶ Art 51. **EU DSO will have among its tasks to contribute the deployment of smart grids and smart meters**, and to participate in the elaboration of network codes relevant to the distribution network.

## Electricity Directive (defining role and responsibilities of market participants)

Objective: Adapt the market to changing electricity system + Establish the central role of customers in the electricity market

- Principles on **customer rights, market participation of aggregators and citizen energy communities**, rules on data exchange and interoperability, Distribution system operators (DSOs), Transmission system operators (TSOs) and National energy regulators tasks

## Chap. III Consumer empowerment

- ▶ Customers have the right to freely choose a supplier or aggregator. They are entitled to **request a dynamic-price contract and to engage in demand response, self-production, self-consumption, storage and sale of electricity**
- ▶ **Citizen energy communities have the right to engage in local energy generation, distribution, aggregation, storage and energy efficiency services. They can own, establish, purchase or lease a distribution network.** Can also manage a distribution network, with the agreement of DSO and TSO connected to this network.
- ▶ Demand Response through aggregation: Member states should allow foster aggregators participation in the market in a non-discriminatory manner.
- ▶ Art 19, 20,21 Smart metering, functionalities and entitlement to smart meters.  
Art 19.3 recognises the need to develop smart grids for enabling smart meters
- ▶ Art 24 gives the mission to Member States to facilitate data interoperability of energy services within the EU, and announces the establishment of an implementing act to determine data interoperability requirements.

# Smart Grid & Smart City : Metering and control essential

## Key Features of Your Smart Grid

### Requirements of the Smart City

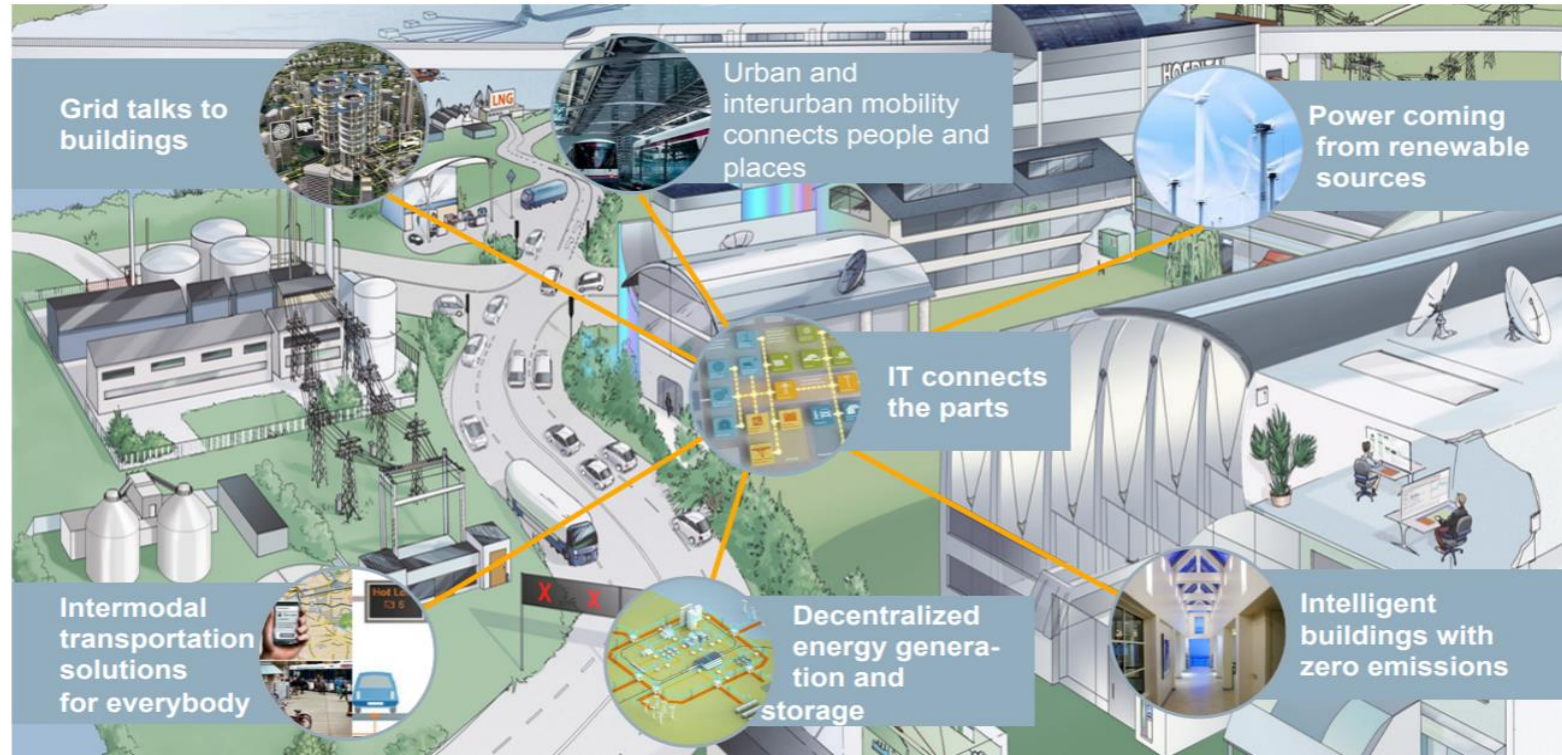
Protection of Information & Service (SLA/CEP)

Energy Efficiency: Manage the grid

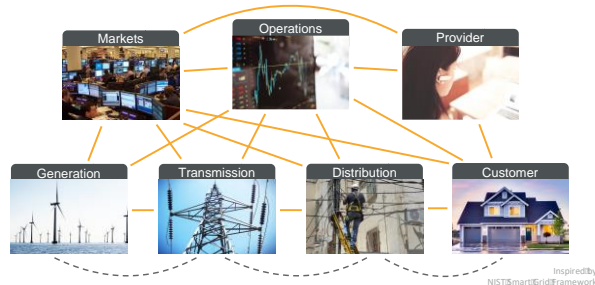
Decentralized Energy Consumption, Storage & Generation

Infrastructure Optimisation Demand & Resource mgt: Asset Management

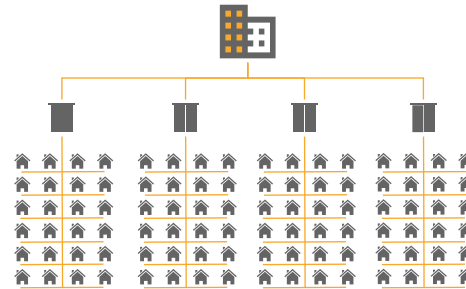
Security	Communications	Analytics	Infrastructure Monitoring
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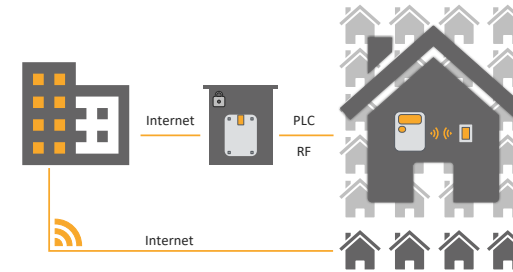
# I New players, new solutions, new risk



Smart Grids are highly interconnected and depend on authentic data



Large attack surface – millions of potential access points



Mix of technologies with drastically different characteristics than normal IT

*Security is getting is big thing!*

*Tip: read “black-out”*

# I Require LV Grid Insight Apps... need for LV power quality data!

**LV grid mapping,** Topology information by transformer/feeder/phase: improving service level and ROI.

**Efficiency and theft monitoring.** Identify losses due to technical and non-technical sources. Identify location of loss.

**Power Quality, FDIR/Outage identification,** resolution guidance, restoration reporting and duration reporting

**Voltage and load heat maps** for capacity, calculation, identification of hot spots, optimal use of DER, asset protection and failure prediction mapped on the LV grid map

**Transformer protection,** load monitoring, efficiency based on load, voltage and temperature, integrated with understanding of loop configuration or re-configuration recommendations. Manage transformer load lifetime.

**Failure Prediction,** monitor loss to identify equipment degradation before failure.

**Grid Watch:** Security, the next level.. intrusion detection... if one tries!



# | Business Value For Utilities: Support Future Business Needs

- **State-of-the-art Meter2Cash process**
  - Automated meter reading operation
  - Eliminate estimates, re-reads and reader fraud
  - Pre-payment
- **Improved customer service**
  - Immediate, 24/7 move-in/move-out processing (on the phone)
  - Reduction/elimination of billing errors
  - Immediate online investigation of power quality issues
- **Reduction in technical losses**
  - Automated transformer balancing
  - Right-sizing distribution transformers
- **Reduction in non-technical losses**
  - Magnetic, power tamper reporting
  - Immunity to severe magnetic tamper
  - Neutral metering and disconnection
  - Load-side bypass checking
- **Increase service offerings**
  - Flexible multi-tariff/TOU billing
  - Integration of water, gas
  - Security, life-safety value-added services
  - Distributed PV, storage, wind integration
- **Transformer protection and demand-side management**
  - Rapid load reduction, voltage mgt
  - Unique mapping of loads to transformers ensure correct load-reduction decisions are made
- **Enhanced reliability/quality of supply.**
  - Unique wire analysis by PLC enables prediction of transformer, cable
  - Topology insight and management
  - Outage pinpointing through rapid restoration reporting solution
  - Grid management
- **Increase security level continuously**

# METERS ARE SENSORS IN THE NETWORK, COLLECTING PQ INFORMATION



## POWER QUALITY MEASUREMENT:

- SAG (under voltage) – including storage of voltage and date/time and the total number of occurrences.
- Swell (over voltage) – including storage of the voltage and date/time and the total number of occurrences.
- Over current – including storage of the current and date/time and the total number of occurrences.
- Outage – including total number of short power outages, total number of long power outages, and duration and time of the last 10 long power outages.
- Frequency – maximum and minimum frequency.
- THD – total harmonic distortion event information up to the 10th harmonic.
- **Report SAIDI, SAIFI, CAIFI, MAIFI**

## POWER CHARACTERISTICS MEASUREMENT:

- ✓ Active power (kW): forward, reverse.
- ✓ Maximum forward active power over a specified interval.
- ✓ Average forward active power over a specified interval.
- ✓ Maximum reverse active power over a specified interval.
- ✓ Average reverse active power over a specified interval.
- ✓ Active energy (kWh): forward, reverse, forward + reverse, forward – reverse.
- ✓ Reactive power (kVAr): import, export.
- ✓ Maximum forward active power over a specified interval.
- ✓ Average forward active power over a specified interval.
- ✓ Reactive energy (kVArh): import, export.
- ✓ Apparent Power (VA).
- ✓ RMS voltage.
- ✓ Max Demand in a period.
- ✓ Minimum voltage over a specified interval.
- ✓ Maximum voltage over a specified interval.
- ✓ Average voltage over a specified interval.
- ✓ RMS current.
- ✓ Power factor.
- ✓ Phase Angle.

# | Take Aways:

Think years ahead.... What is needed in the future, you install now



## SMART METERING TO SUPPORT SMART GRID and SMART COMMUNITIES.

- **Insight in LV grid, transformer centric;** energy flows, PQ, SLA
- Security : **“Protect, detect, respond”** should be a guiding design principle



## INTEGRATED NETWORK... DOES NOT STOP AT MV: LV CENTRIC

- Connect... staff & systems upto the last mile and device
- New view on standards... high level, open for innovation, future proof
- Asset management; LV transformer and feeder monitor through smart meters



## THE FUTURE HAS STARTED:

- **Any investment should be based on how the world (and energy system) will look in 10+ years**
- Key is to build upon an architecture to support evolution, innovation and expansion of technology.
- Ability to adopt new technologies without disruption
- Source today what provides best performance and supports evolution

Thank you....



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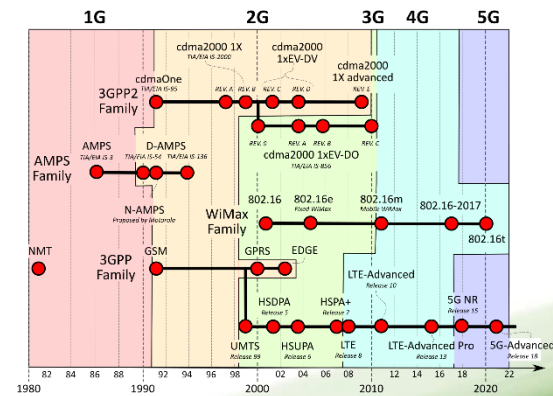
## Tips for tenders

- ▶ Agree internally to go for a investment in the future: for 2030 and beyond. Decentralized micro-grids, LV centric.
- ▶ Start with the IT architecture: multiple head-end and no lock-in
- ▶ Be open for any coms technology, as long it is an open standard
- ▶ Define performance goals (99% up daily reads) and penalties
- ▶ Functionality to support the energy transition: insight in the grid
- ▶ Cost-Benefit: focus on asset management and ability to manage the grid. (peak mgt, heat maps,
- ▶ Security: Encryption, Intrusion detection, AI rule based action
- ▶ Ability to integrate with all: EV, PV, Storage, Wind, smart buildings, etc

# OSGP – Open Smart Grid Protocol suite of standards



- ETSI TS 104 001 Open Smart Grid Protocol; (Application Layer 7)
- ETSI TS 103 908 Power Line Telecommunications (PLT) BPSK Narrow Band Power Line Channel for Smart Metering Applications. (Layer 1)
- IEC/ISO 14908 Control network layer (Layers 2-6)
- CEN/CENELEC CLC/TS 50586 Open Smart Grid Protocol
- IEC 62056-8-8, DLMS/COSEM Suite - Communication Profile for ISO/IEC 14908 series networks
- ITU-T G.9903 
- LTE-M / NB -IOT 



# TRACK OF SUCCESSFUL DEPLOYMENTS



Networked Energy Services



France  
9k smart devices

Italy  
Powers 30 million meters

Poland  
411K smart devices

Sweden  
685K smart devices

Sweden  
400K smart devices

Austria  
242K smart devices

Netherlands  
75K smart devices

Albania  
4k smart devices

Denmark  
410K smart devices

USA  
680K smart devices

Finland  
746K smart devices

Denmark  
245K smart devices

Sweden  
44K smart devices

Denmark  
248K smart devices

Denmark  
18K smart devices

Puerto Rico  
56K smart devices

Russia  
410K smart devices

South Africa  
15K smart devices

Romania  
85K smart devices

South Africa  
100K smart devices

Switzerland  
75K smart devices

Germany  
24K smart devices

# Evolution of Smart Grid drives Evolution of the DSO

Smart Grid enables a Mix of **DSO** and **Retail** benefits New services are enabled by the DSO for the retailer The DSO will become a service provider as well

<b>PHASE 1</b> <b>THE SMART GRID FOUNDATION:</b>	<b>PHASE 2</b> <b>GRID AWARENESS:</b>	<b>PHASE 3</b> <b>THE BUSINESS AND CUSTOMER PERSPECTIVES:</b>	<b>PHASE 4</b> <b>SUPPORT THE ENERGY TRANSITION BY A SMART GRID INFRASTRUCTURE AND SYSTEM:</b>
<ul style="list-style-type: none"> <li>• Support Meter to Cash</li> <li>• Meter operations field-force efficiencies</li> <li>• Long-term infrastructure deployment</li> <li>• Backwards compatibility, expansion growth</li> <li>• Exceptional resilience of communications</li> <li>• Highest level Security and Privacy (customer data protection)</li> </ul> <p><b>DSO: Prepare for the future</b> Comply with EU/local regulation for smart metering Infrastructure to support energy transition</p>	<ul style="list-style-type: none"> <li>• Asset and Process Optimisation (op-ex, cap-ex)</li> <li>• Loss reduction and revenue protection</li> <li>• Regulatory compliance (down-time and availability)</li> <li>• Utilities convergence (electricity, gas, water, heat)</li> <li>• Meter controlled supply actions</li> <li>• Peak shaving, special tariffs</li> <li>• Consumer awareness</li> </ul> <p><b>DSO Progress:</b> Understand the dynamics and trends in the grid</p>	<ul style="list-style-type: none"> <li>• Convergence of offerings; DSO and retailer</li> <li>• Visibility to the customer and customer experience</li> <li>• Customer service availability</li> <li>• Detailed monitoring into the LV grid, LV SCADA</li> <li>• Customer and operational data monetisation</li> <li>• Business aligned operations decision making</li> <li>• Demand response automation</li> </ul> <p><b>DSO on the Move:</b> Optimize the Service level, at lowest cost, take decisions based on business assessment and develop new lines of opportunity</p>	<ul style="list-style-type: none"> <li>• DSO as Service provider for community</li> <li>• Energy brokering</li> <li>• Smart Home (including supply automation and control) and End user empowerment</li> <li>• Grid and IT convergence</li> <li>• Operational transformations</li> <li>• Smart City</li> <li>• Monetisation of information for retailers or 3rd parties</li> </ul> <p><b>The new DSO:</b> Provide a agile, software defined local grid as a service including settlement information to third parties</p>

The successful DSOs will replace static, physical grids designed to distribute power with agile, software defined Smart Grids designed to broker the local generation and consumption of energy

**MAKING THE SMART GRID MAKE BUSINESS SENSE:**

- Each phase must be self-funding
- Incremental steps reduce time-to-revenue for any initiative and remove major jumps or changes
- Selection of steps specific to a DSO, there are multiple paths to transition to a new DSO

**KEEPING THE LIGHTS ON WHILST TRANSITIONING:**

- Gradual operational and administrative changes to organisation aligned with smart grid technology evolution
- Transition from physical/static grid paradigm to active, software defined, agile energy broker paradigm
- Transition from engineering operational processes to ICT operational processes as grid start to contain software defined IT

