

**eandis**

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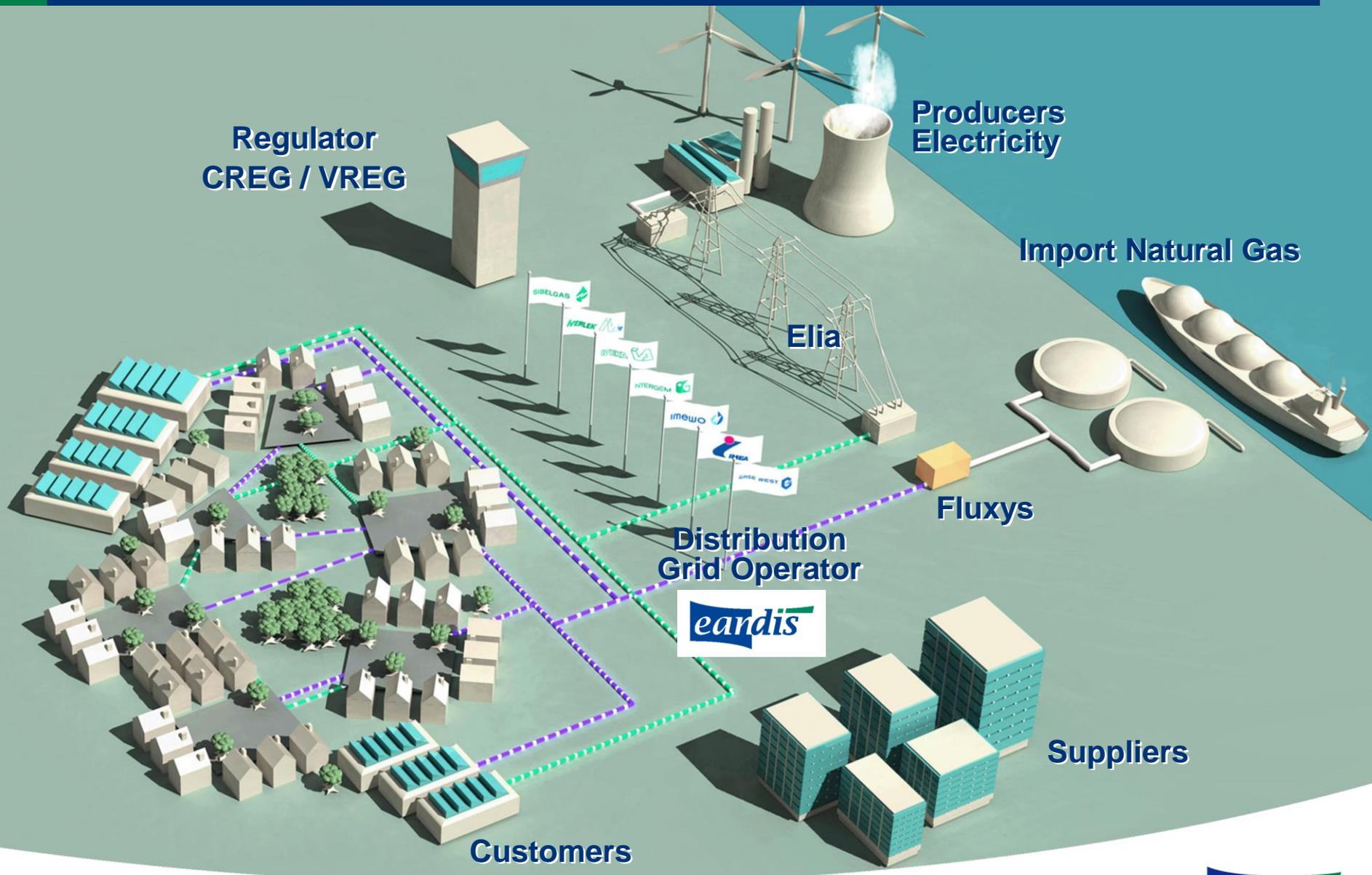


# Eandis IEC61850

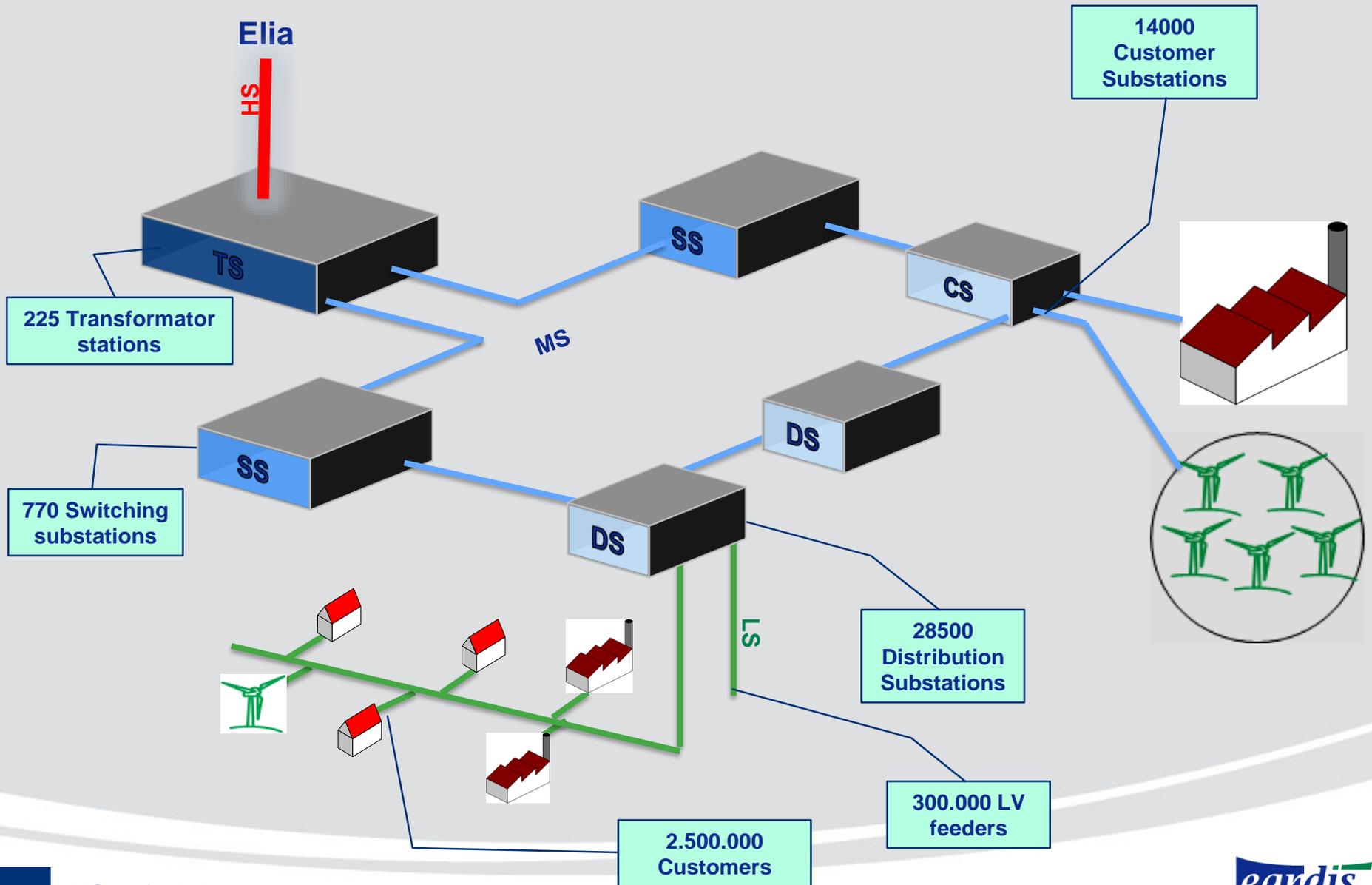
## Next steps

*27 September 2017*

# Eandis in the Energy market

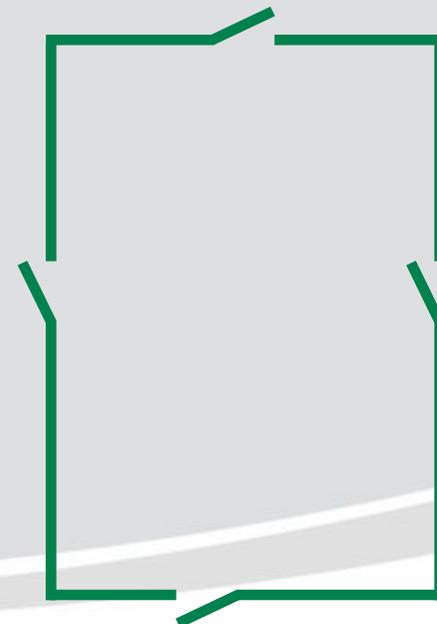
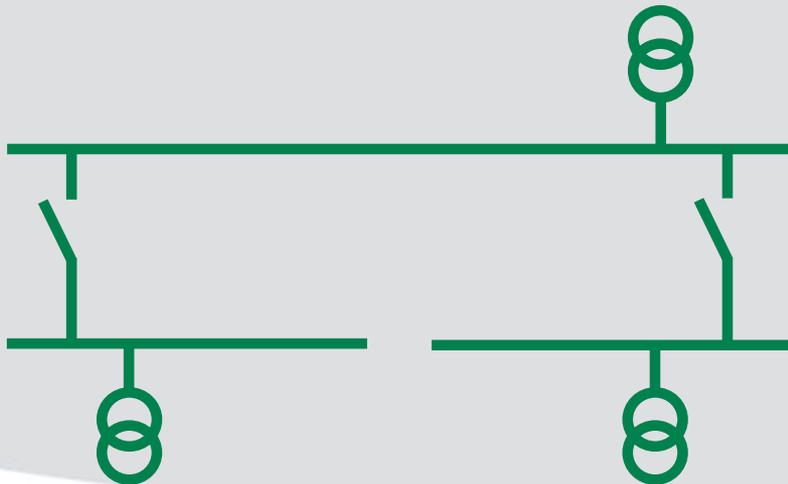


# Eandis Network: TS -> SS -> DS



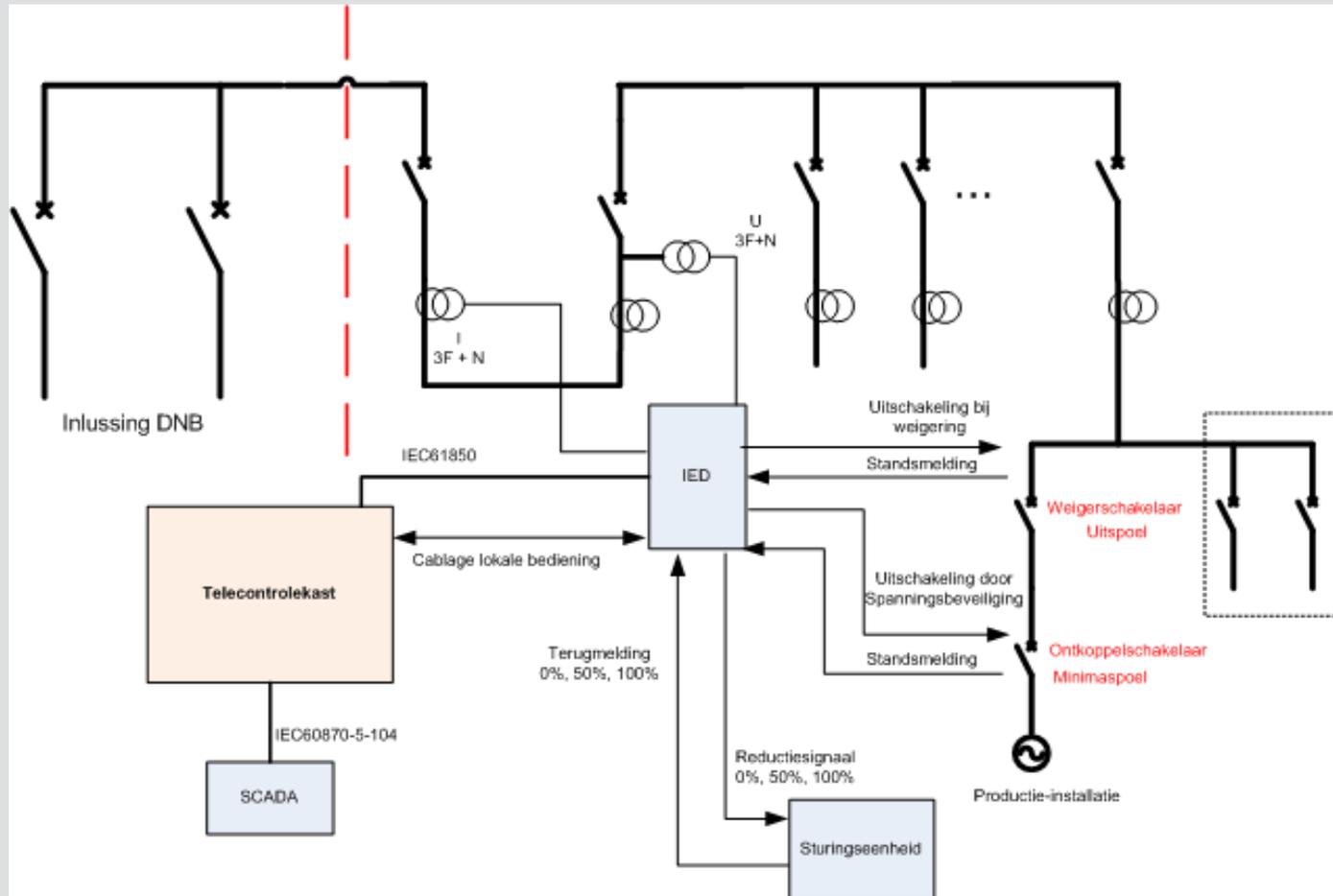
# Introduction Eandis and substation concept

HV/MV primary substation - TS	MV secondary substation - SS
Double busbar cubicle	Single busbar cubicle
2 or 3 busbar linear sections	2 to 4 busbar sections in O-shape
Always involving ELIA Possibly involving other DNO('s)	Rarely involving other DNO('s)
All position indications, measurements, alarms and control signals implemented using classical wiring (no experience with substation protocols, eg 103)	

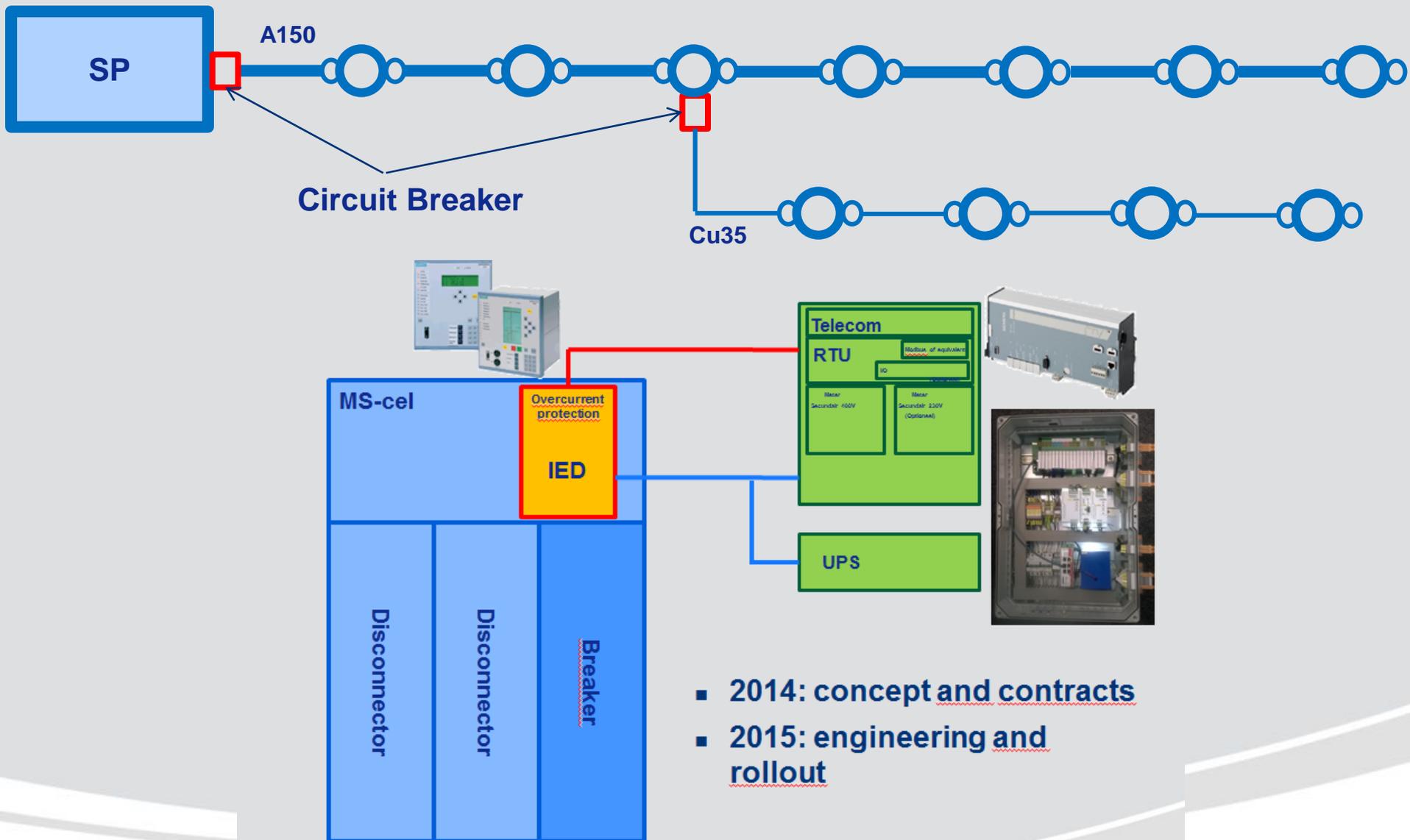


# Decentralised production systems

> 1 MVA or when N-1 situation is not guaranteed



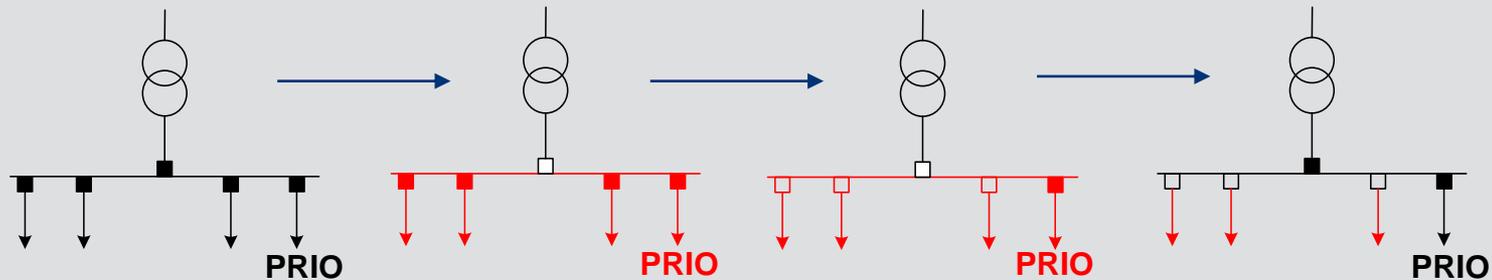
# Protection IED in Distribution substations



# Implementation of UFLS using IEC61850

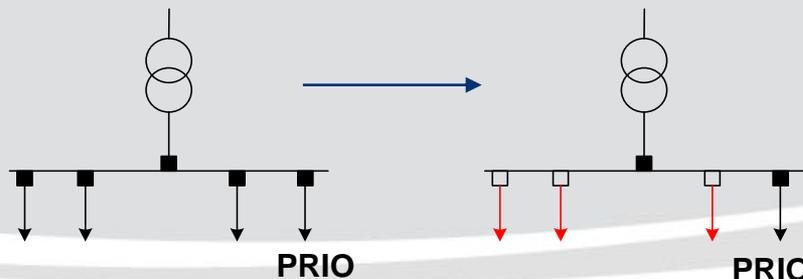
## ▪ Legacy Transformer Substations: no IEC61850

- Trip transformer CBR in case of frequency drop
- Partial clearing of feeders before reclosing transformer CBR



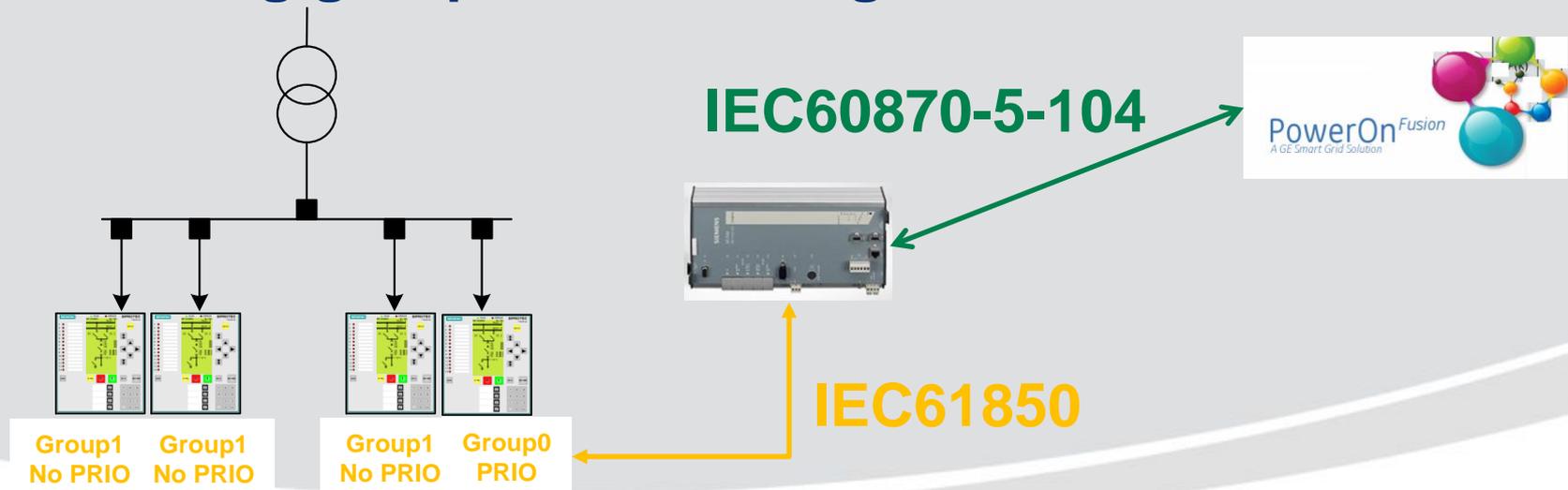
## ▪ Under Frequency Load Shedding with IEC61850

- Partial clearing of feeders
- Priority feeders → no zero pass through

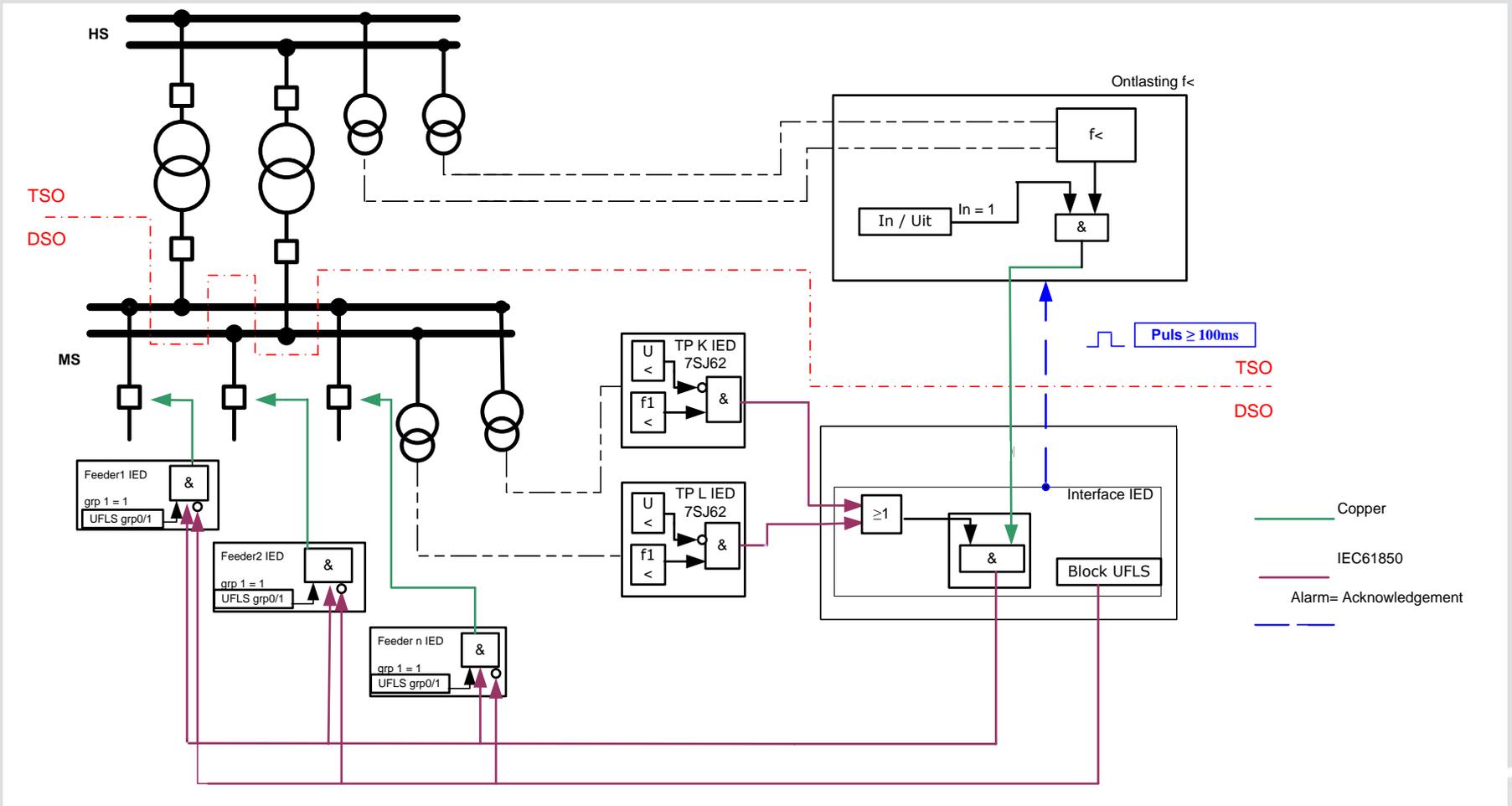


# Implementation of UFLS using IEC61850

- **Automated script** determining the group setting for every feeder in the transformer substation
  - **GROUP 1**: non-priority feeders (passif feeders)
  - **GROUP 0**: priority feeders (e.g. hospital)
- Script runs **periodically** (every month)
- UFLS setting group is send using the **IEC60870-5-104**



# Implementation of UFLS using IEC61850



## ■ Commissioning & maintenance aspects

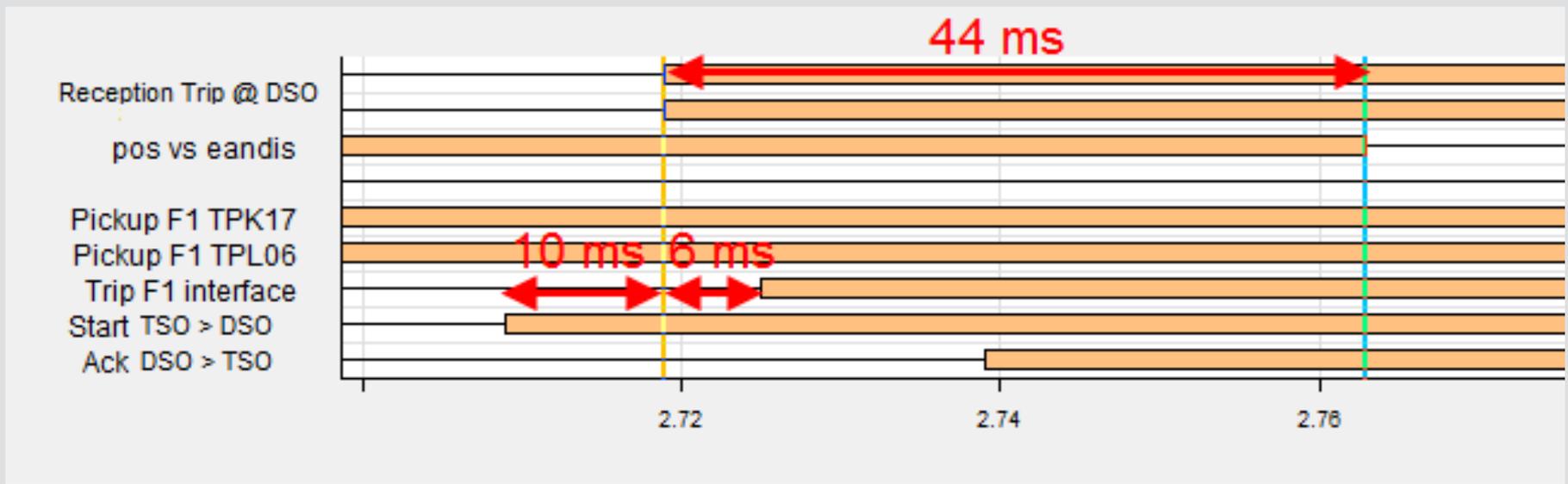
### ➤ Reducing the risk of unwanted Trips

- Arming principle of DSO function
- VT – IED' s have under frequency criteria
- Send pick up through GOOSE
- Interface IED is armed on pick up

### ➤ Possibility to test UFLS in live substation

- Implementation of generic BLOCK UFLS GOOSE signal
- Function key on interface IED sets BLOCK signal high
- “Live” feeder IED' s will ignore the Trip signal
- Using key on Feeder IED you are able to test UFLS TRIP

# Implementation of UFLS using IEC61850



- DSO pick up @ 49,8 Hz
- TSO pick up @ 49 Hz
  - TSO → DSO: 10 ms (*high speed relay*)
- Processing time IED: 6 ms
- DSO- SAS reaction time: 44 ms (*incl. CBR' s*)

# Added value UFLS using IEC61850

- **Flexible and selective solution**
  - Priority of feeders can change in time
  - no zero pass through Prio Feeders
- **Reaction time E2E: 44 ms (incl. CBR trip)**
  - Total time Trip TSO → Trip DSO: 54 ms
- **Need to implement GGIO GOOSE message(s)**
  - For commissioning and maintenance purposes
  - Should be integrated in test mode

# Transition to IEC61850: take the plunge

- **2011: POC (multi vendor)**
  - Multivendor works
  - Many different toolings: too complex on DSO scale
- **2012: European Tender**
  - Single sourcing (IED, RTU, Switch)
- **2013 – 2017: IEC61850**
  - 75 x MV secondary substations
  - 12 x HV/MV primary substations
  - 145 x Dec. production units
  - 35 x Distr. Substations with OC
- **What' s next?**



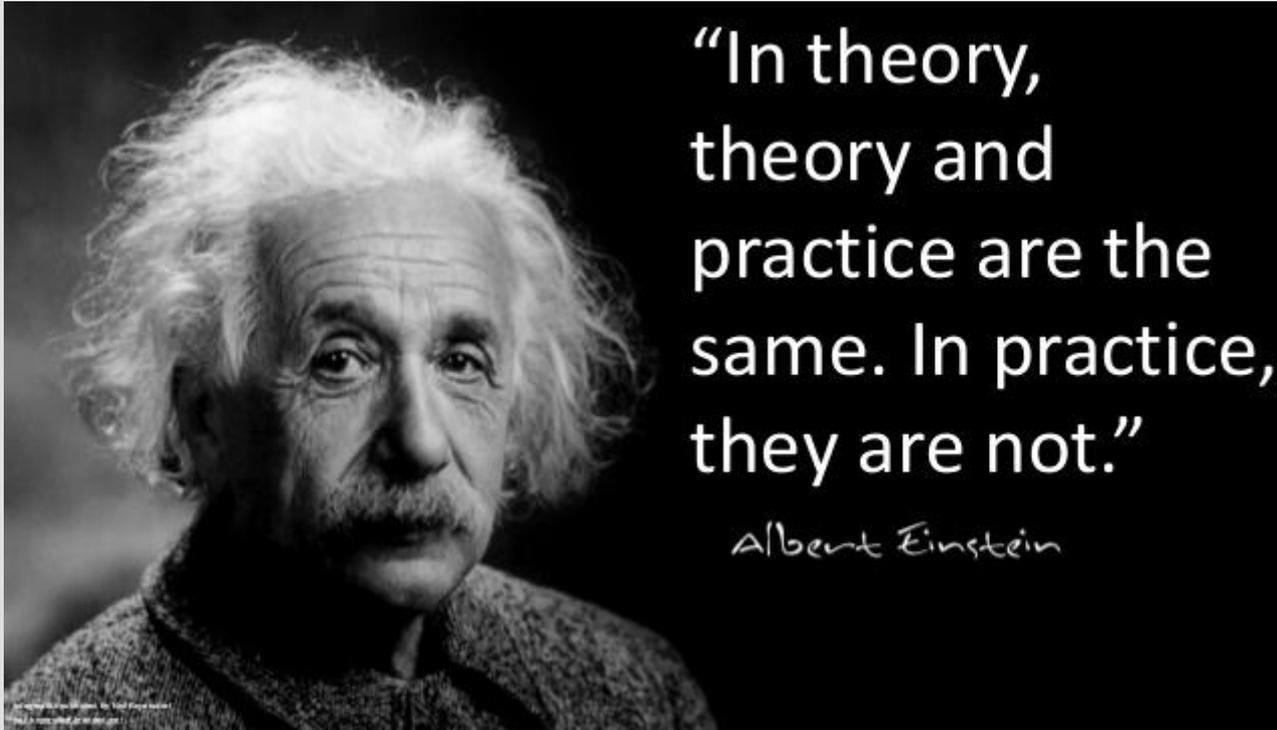
# Existing substations Eandis

- **Single** vendor (IED and RTU)
- IEC61850 **Ed. 1**
- Client server implemented for reporting
- **Dynamic datasets possible**
- **Engineering process**
  - Only 2 configuration tools required (RTU / IED)
  - No .scd transfer between tools necessary
- **GOOSE** implemented for interlocking and protection schemes
- **Conventional VT and CT**

# IEC61850: research topics for Eandis

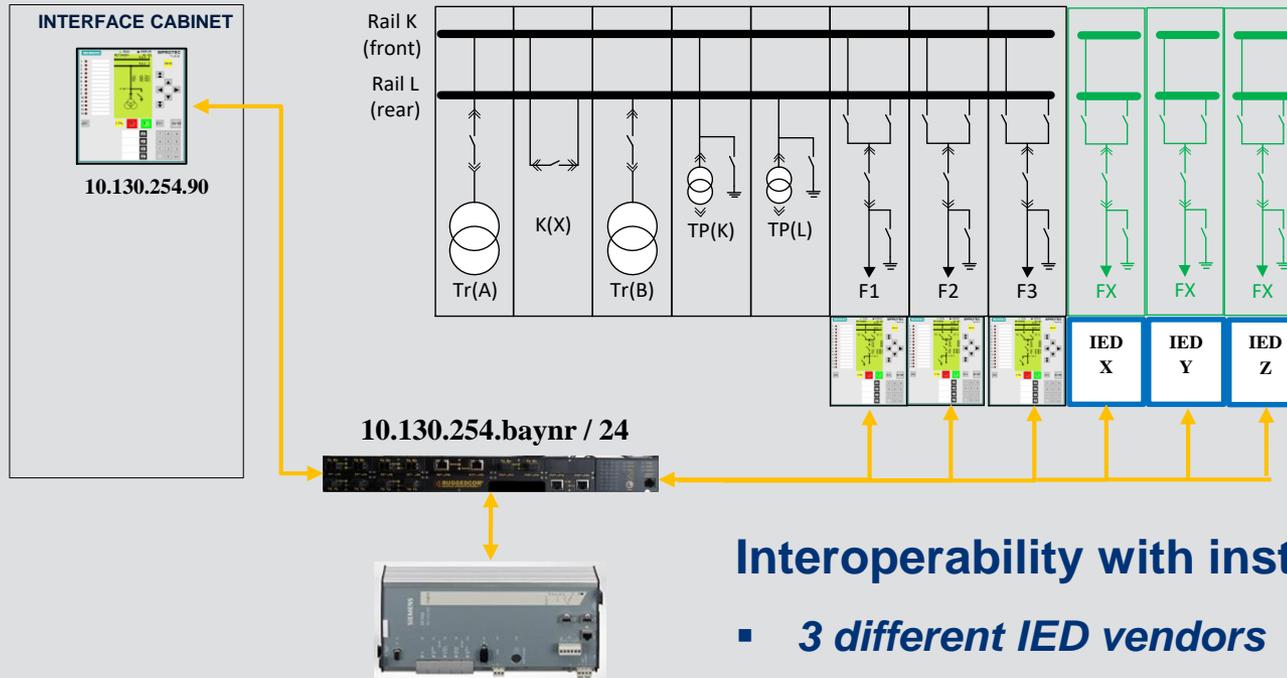
- Interoperability with installed base
- IEC61850 Ed. 1 vs Ed. 2
- Engineering process
- Dynamic vs Static datasets
- Single vs Multi vendor
- Inter-substation
- Sampled values
- Non- conventional sensors





# Expanding existing substation

## ■ Case 1: Integrating new IED's in existing substation

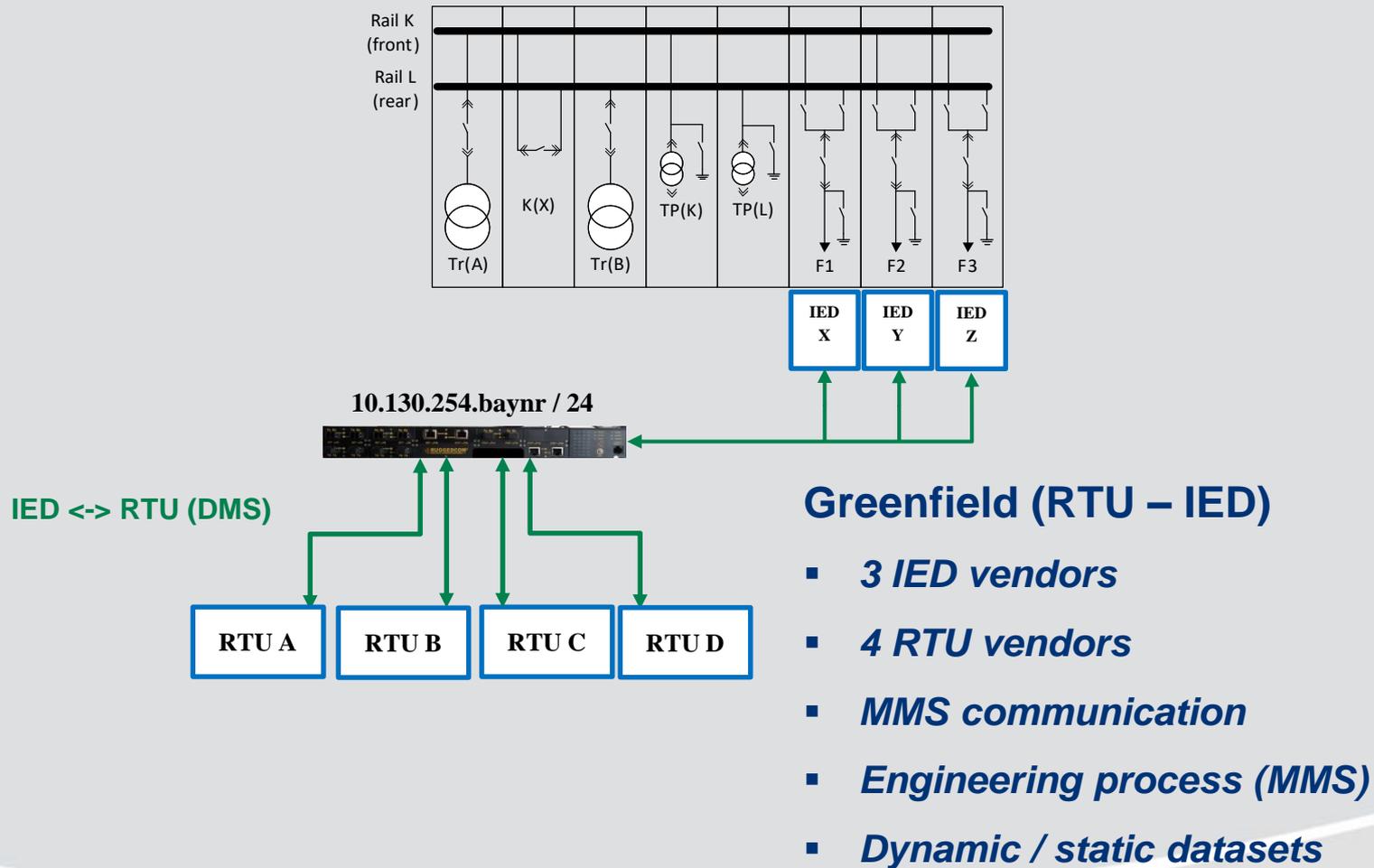


### Interoperability with installed base

- *3 different IED vendors*
- *Interlocking using GOOSE*
- *Engineering process (GOOSE)*
- *Ed1 vs Ed 2*
- *Dynamic / static datasets*

# Greenfield conditions

## ■ Case 2: New IED on new RTU



# Challenges for Eandis & industry

- **Dynamic datasets**

- Nice feature for future data needs
- However not widespread on market
- Issues with association process
  - need for flexible RTU (/IED) vendor
  - Conformance testing

- **Datamodel specification**

- How to impose Top down datamodel on vendors
  - Every vendor has own **LD/LN hierarchy**
  - **Readability:** user-specific “*Prefix*” to LN name

- **Engineering process**

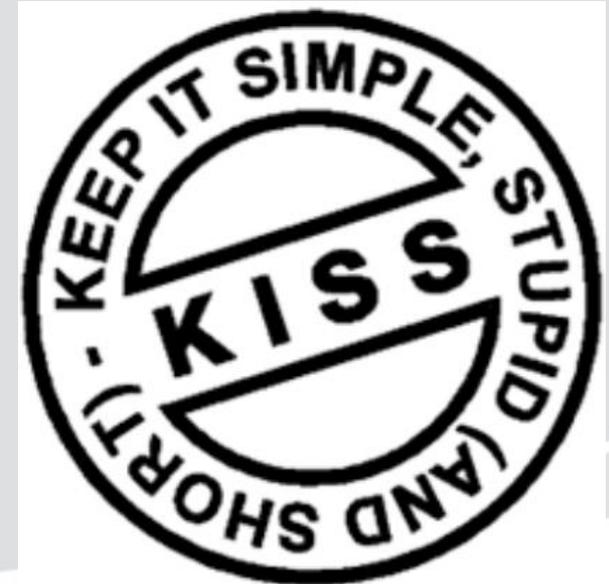
- Trying to avoid need for SCT tool for every project

# Challenges for Eandis & industry

- **Combination of generations of equipment**
  - **Single** sourcing → **multi** source environment
- **Implementing ed. 2 not possible installed substation**
  - IED' s have to be multi – edition
- **Put specific functions of IED in ‘test mode’:**
  - Not possible now: so specific GGIO GOOSE messages!
  - Industry has to implement more advanced test modes
- **“Semi Automated” Asset management:**
  - E.g. firm versions
  - Protection thresholds
- **future use cases @ DSO?**
  - Inter substation GOOSE
  - Sampled values
  - Control room to substation IEC61850

# Conclusion: Integrating IEC61850 @ Eandis

- Key success factors @ Eandis:
  - **Standardisation** (Prim. & Sec. equipment)
  - Time & resources to gain expertise
  - In house **engineering**
  - Involvement from **decision** makers to **adopters**
  - Good, **easy to use** software tools
  - Firmware **freeze**
  - **KISS**: Keep It Simple Stupid





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