Power electronic event 2015

’s Hertogenbosch 23 juni

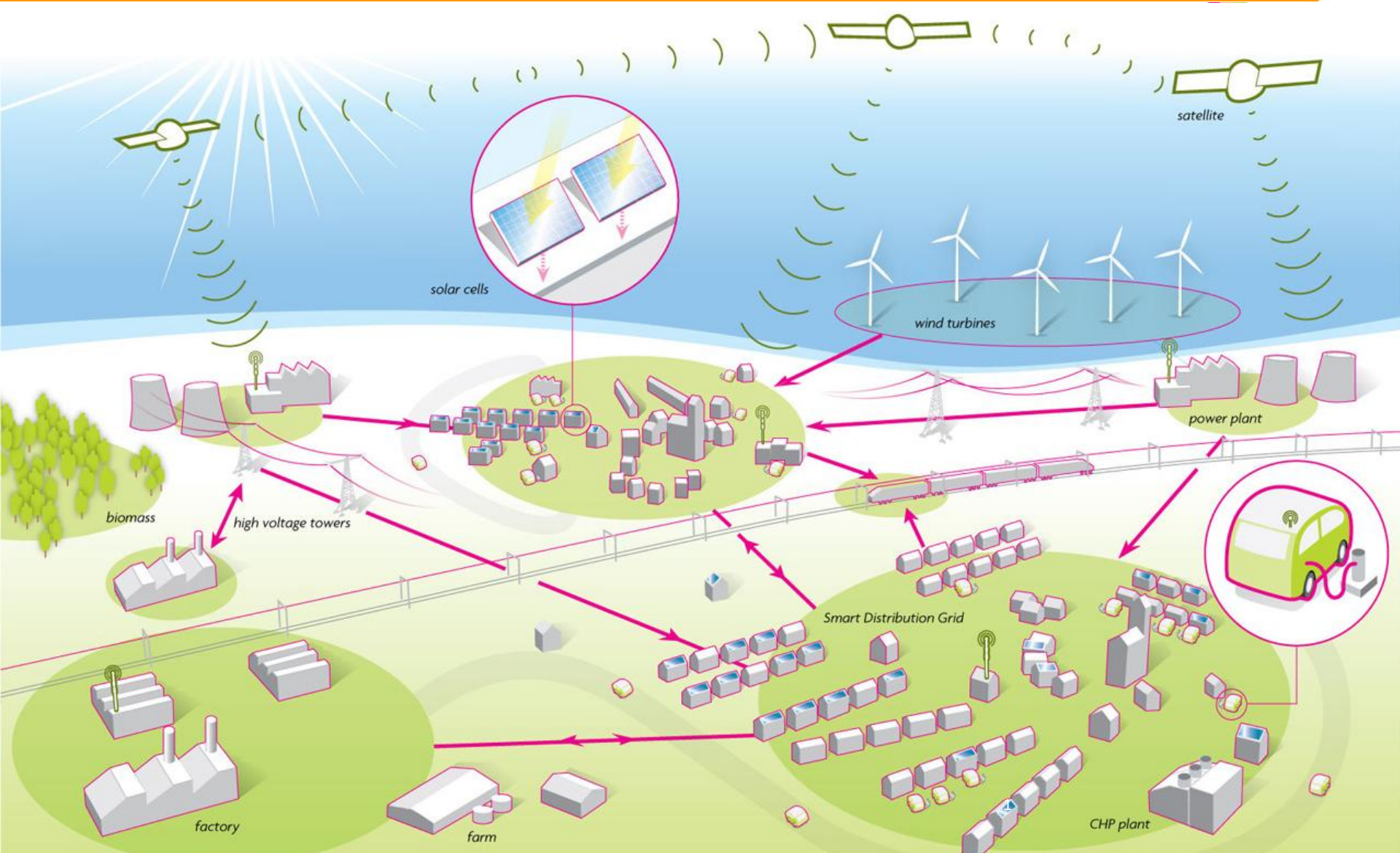
Prof. dr. ir. J.F.G. Cobben

It is all about Smart!

TU/e Technische Universiteit Eindhoven University of Technology

Where innovation starts

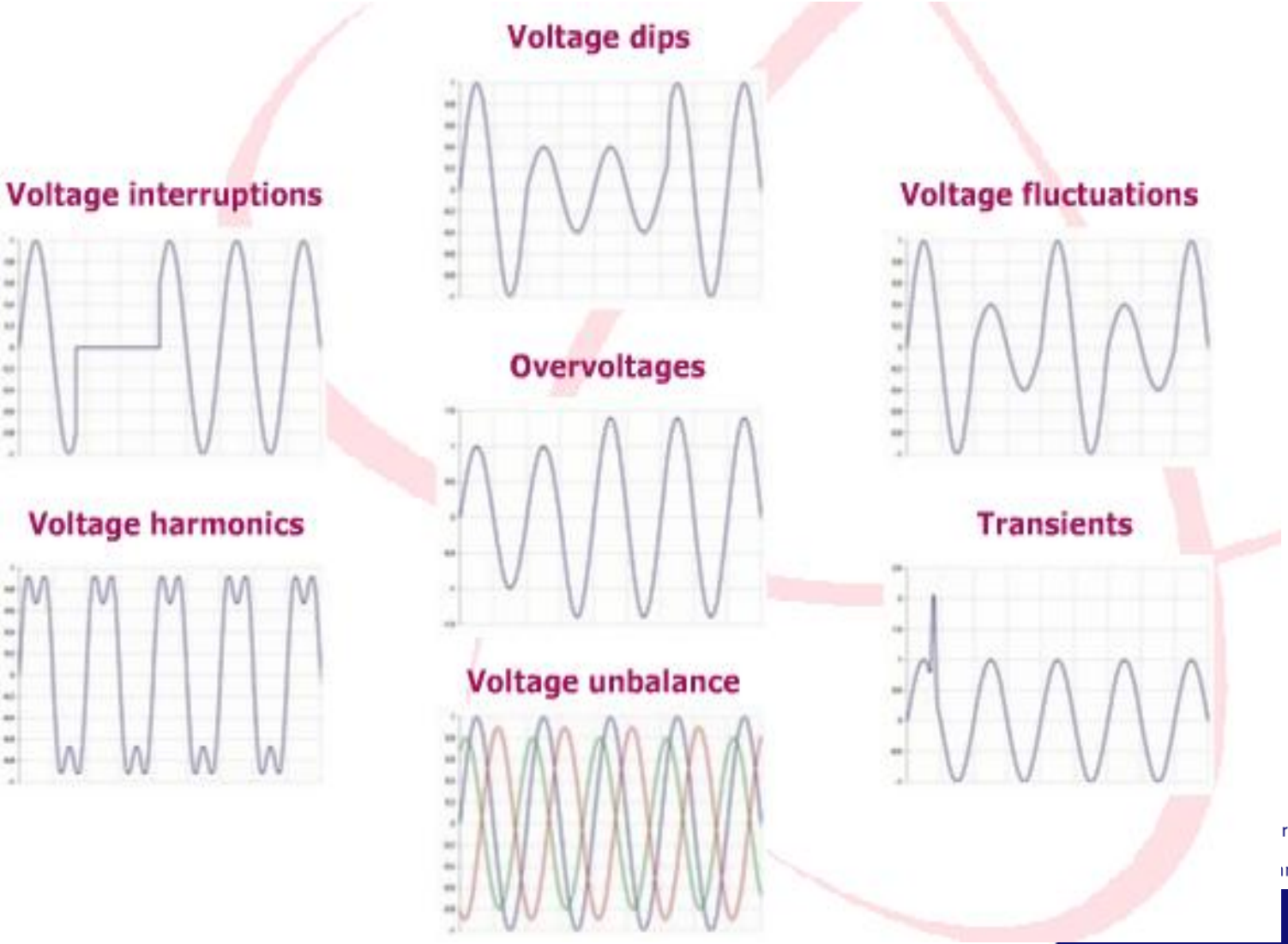
The future electricity network!



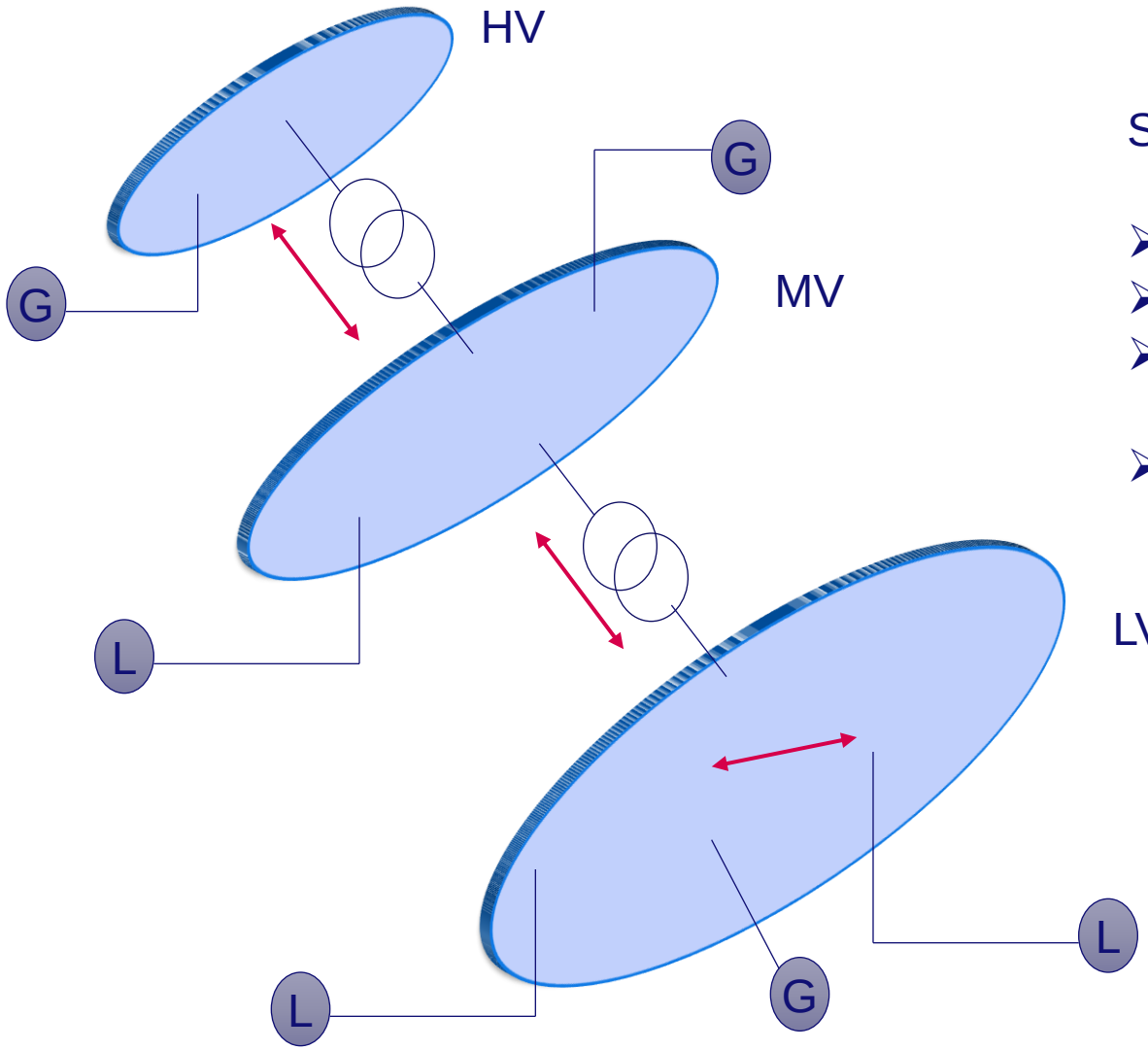
From consumers to producers

Not only generation but also additional load

Even more important in a “smart grid”



PQ and “smart grids”

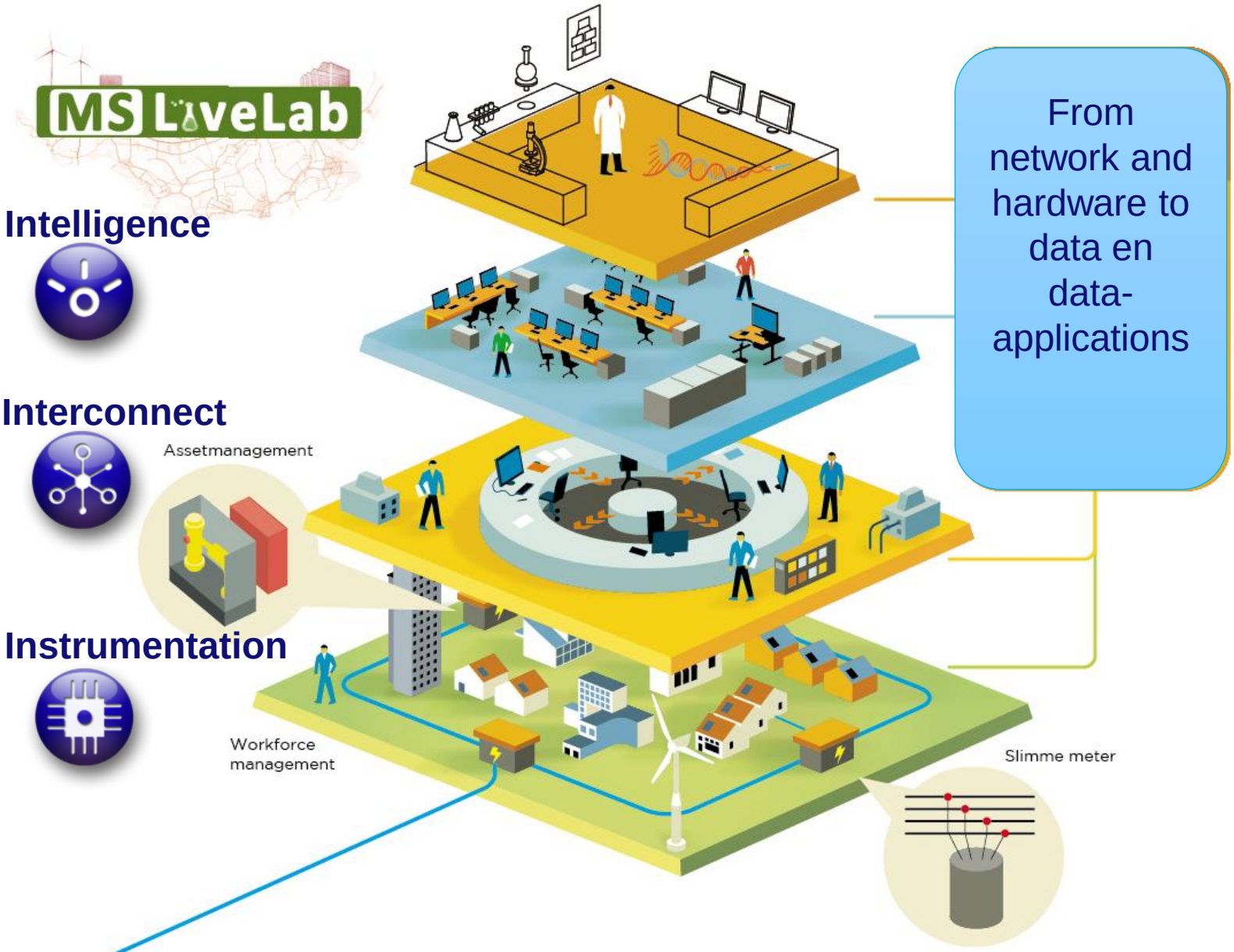


Smart grids:

- More information needed
- More control needed
- Propagation PQ

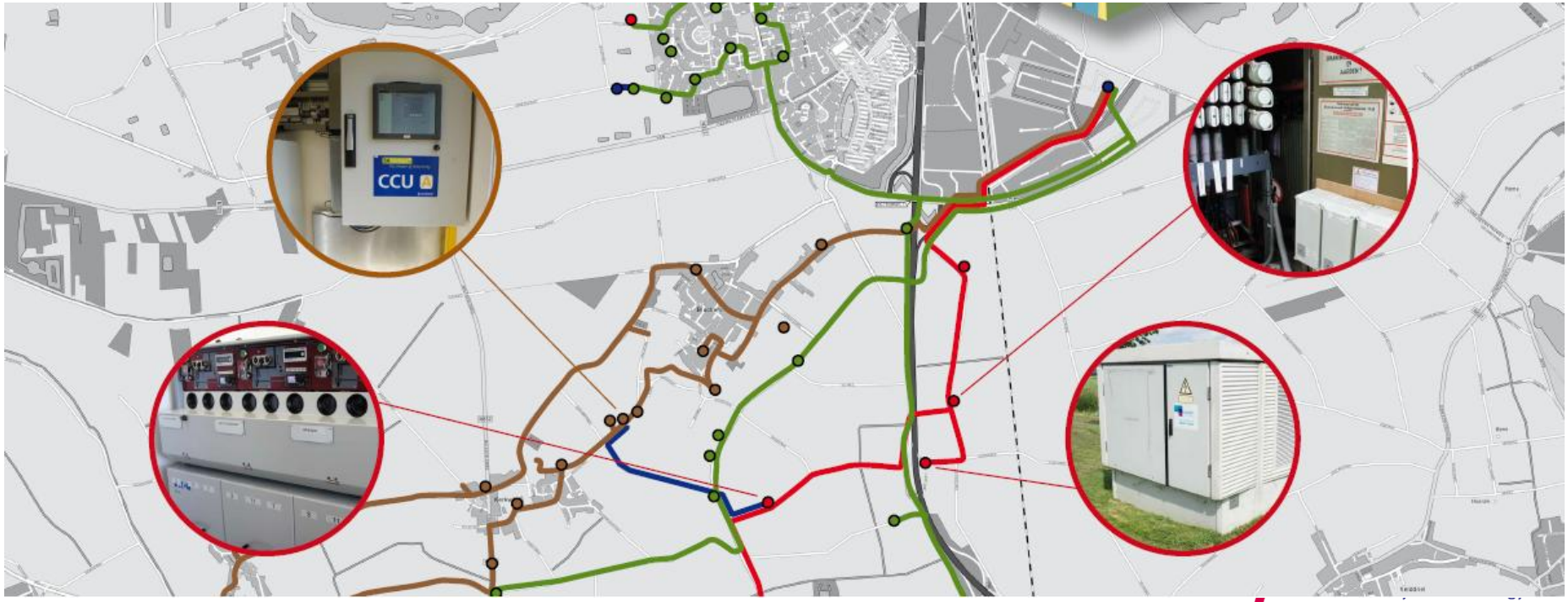
- “Predict and prevent”

MS-LiveLab Alliander



Sensors placed in the network

- **Part of the MV-network**
- **Parts of LV-networks**



Substation MV/LV

Substation MV/LV

Substation MV/LV

Functionalities Live lab

Optimalisation Network performance

Investments

Losses

Fault prediction

Power Quality trend

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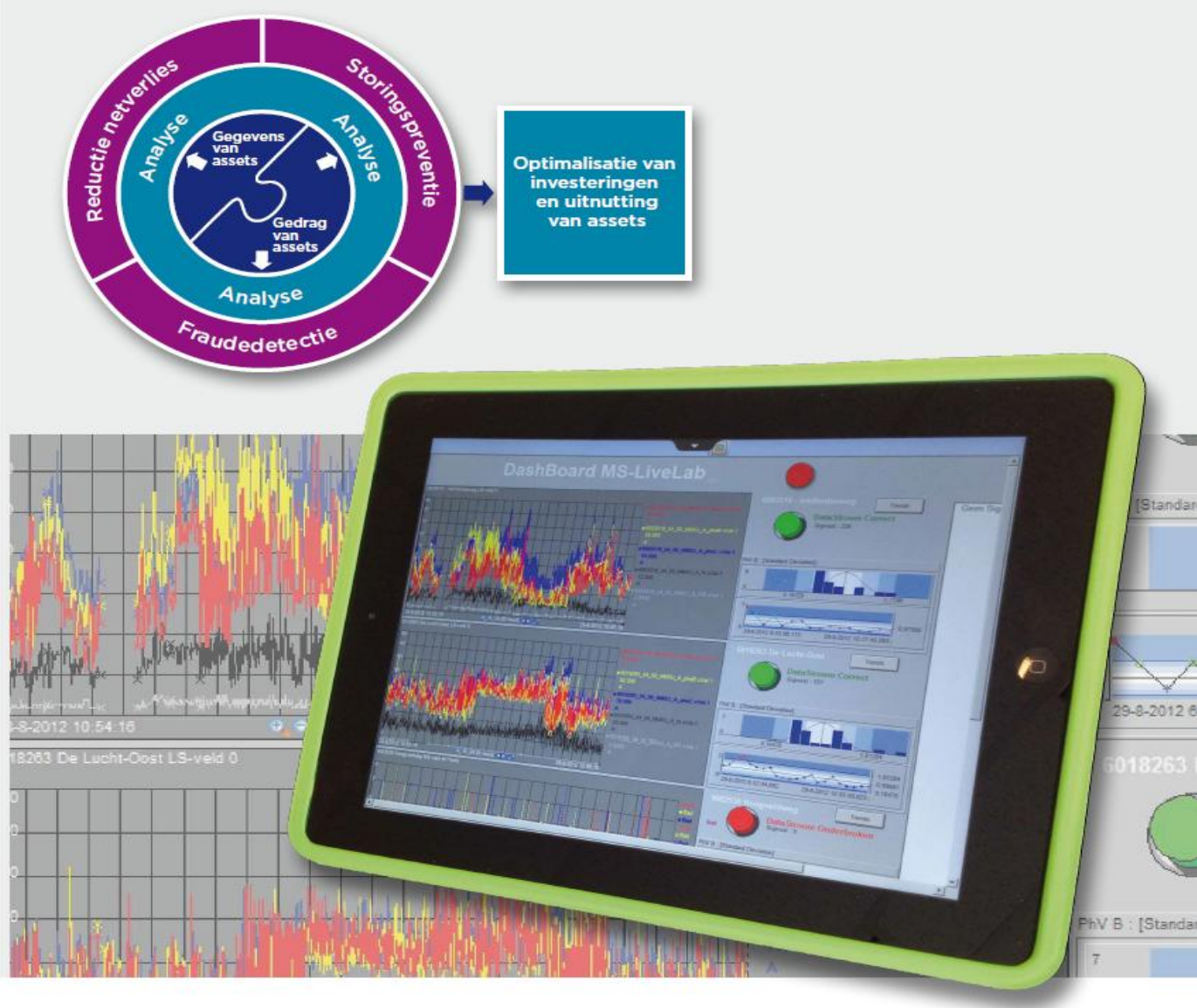


Measurement in LV-network

Is my smart meter spying on me?

by Nikki Whiteman, Social Media Manager | Energy & Home | 9 March 2011 | 6 - 1

We have to rely on the government to look after our personal data. But would we trust companies with it too? With the roll-out of smart meters we could be giving our utility companies some extremely sensitive data.

We may have mixed views on what we want to tell the government, but in general our views on private companies holding personal data are pretty clear: we don't like it.

And yet with the installation of millions of smart meters across the UK, we could be letting utility companies collect sensitive personal data on a half-hourly basis.

It is all about to make the system “smart”

From “blind and happy”

How to measure power of distorted waveforms precisely?
The next generation photovoltaic inverter
Flexible LV grid interface for controllable PV production and EV charging
Electric vehicle charging by PV
A DC socket outlet in your house?
Towards a DC distribution system – opportunities and challenges

Without electricity the world stops turning
The importancy of optimal quality of voltage and current

To “state estimation and alert”

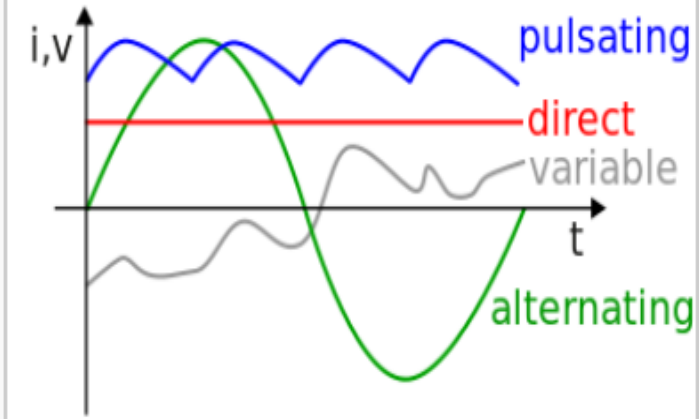
DC – An interesting topic

From Wikipedia, the free encyclopedia

"LVDC" redirects here. For the computer, see Saturn Launch Vehicle Digital Computer.

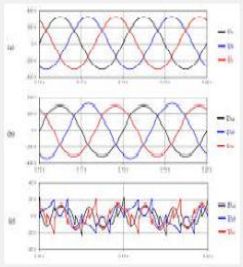
This article **needs additional citations for verification**. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. *(June 2009)*

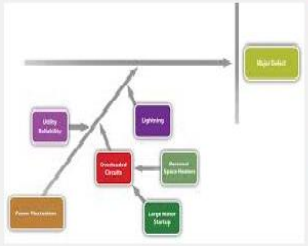
Direct current (**DC**) is the unidirectional flow of electric charge. Direct current is produced by sources such as batteries, thermocouples, solar cells, and commutator-type electric machines of the dynamo type. Direct current may flow in a conductor such as a wire, but can also flow through semiconductors, insulators, or even through a vacuum as in electron or ion beams. The electric current flows in a constant direction, distinguishing it from alternating current (AC). A term formerly used for this type of current was **galvanic current**.[1]



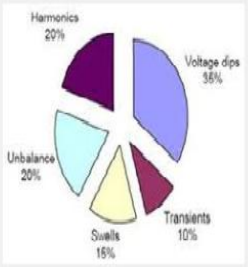
Direct Current (red curve). The horizontal axis measures time; the vertical, current or voltage.

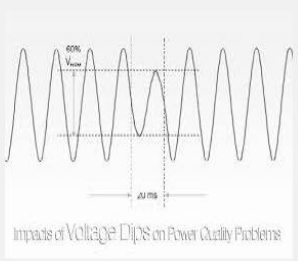
Power Quality problems

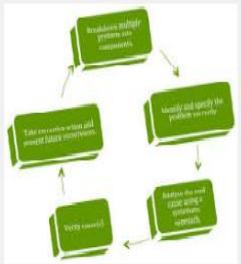


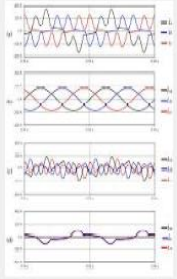


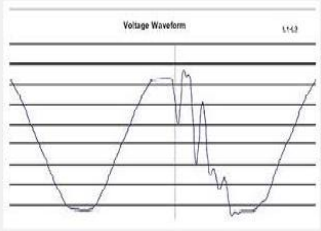
Typical Tolerance Standards	
Parameter	Tolerance
Steady-state voltage	+/- 10% of nominal voltage
Line voltage swell	RMS amplitude of 120% of nominal voltage of up to 0.5 seconds
Low-frequency decaying ring wave	Sliding scale from 140% at 200 Hz to 200% at 2,000 Hz
High-frequency impulse and ring wave	500 minimum transient immunity
Voltage sag	80% of nominal voltage for 10 seconds; 70% of normal for 0.5 seconds
Dropout	Complete loss of voltage for up to 20 msec (1.25 cycles at 60 Hz)

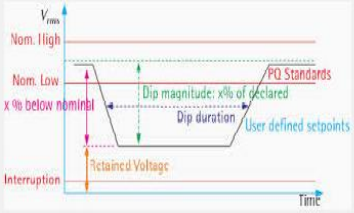


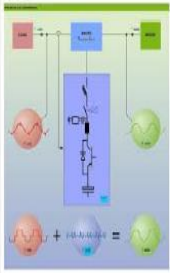


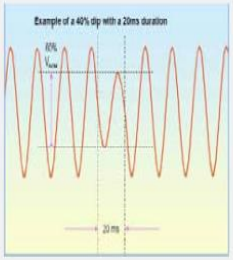


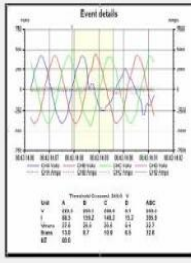


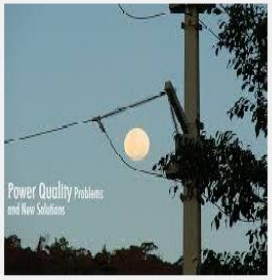


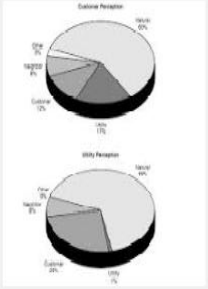


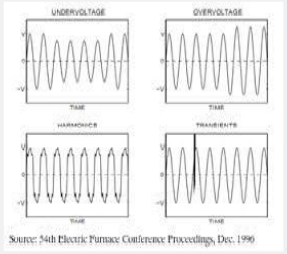


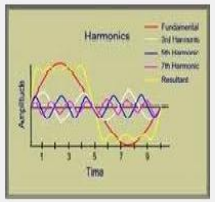


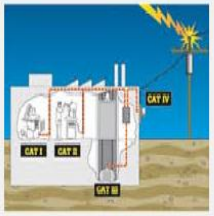


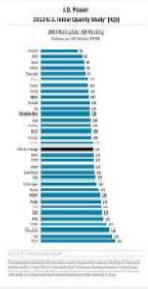






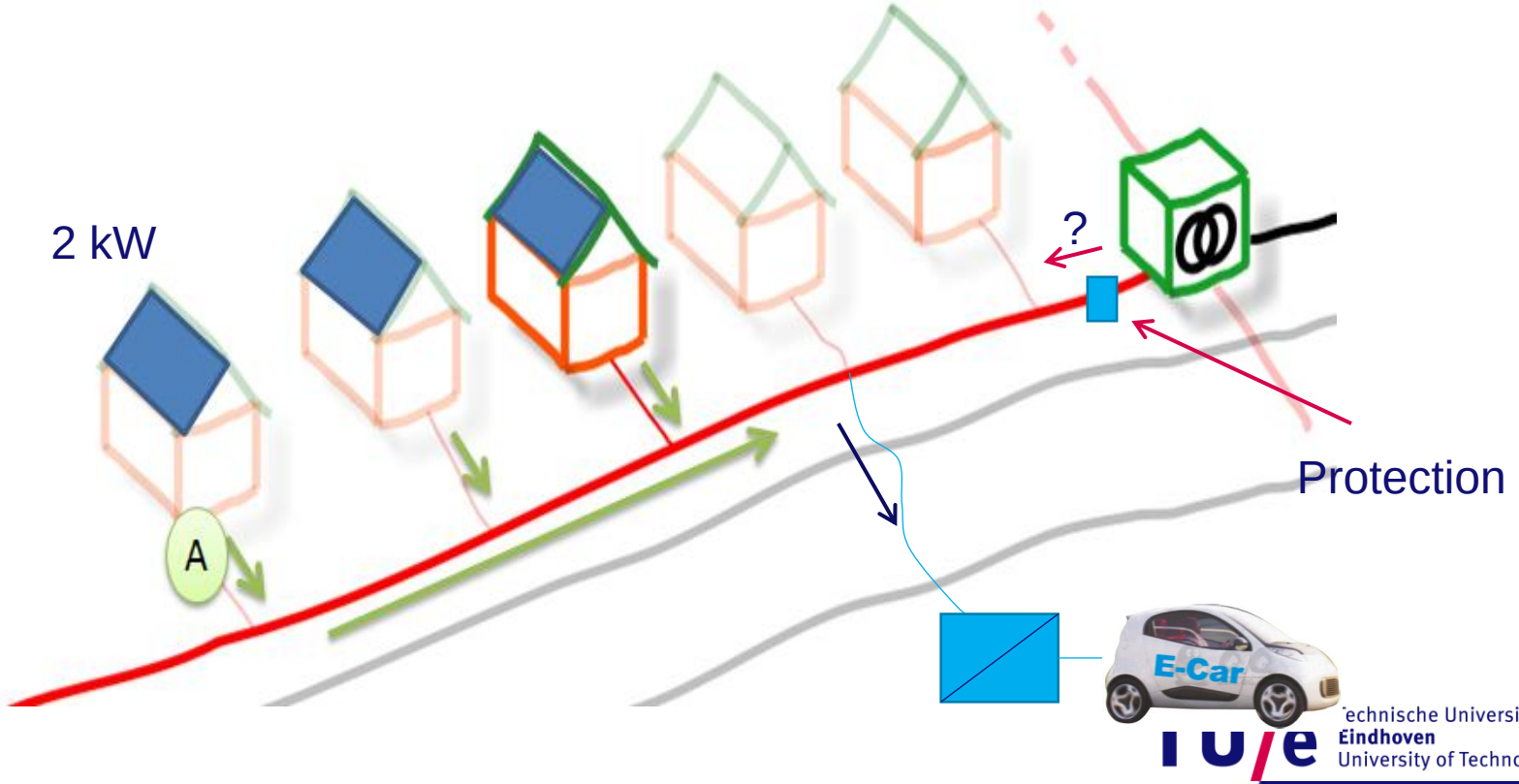




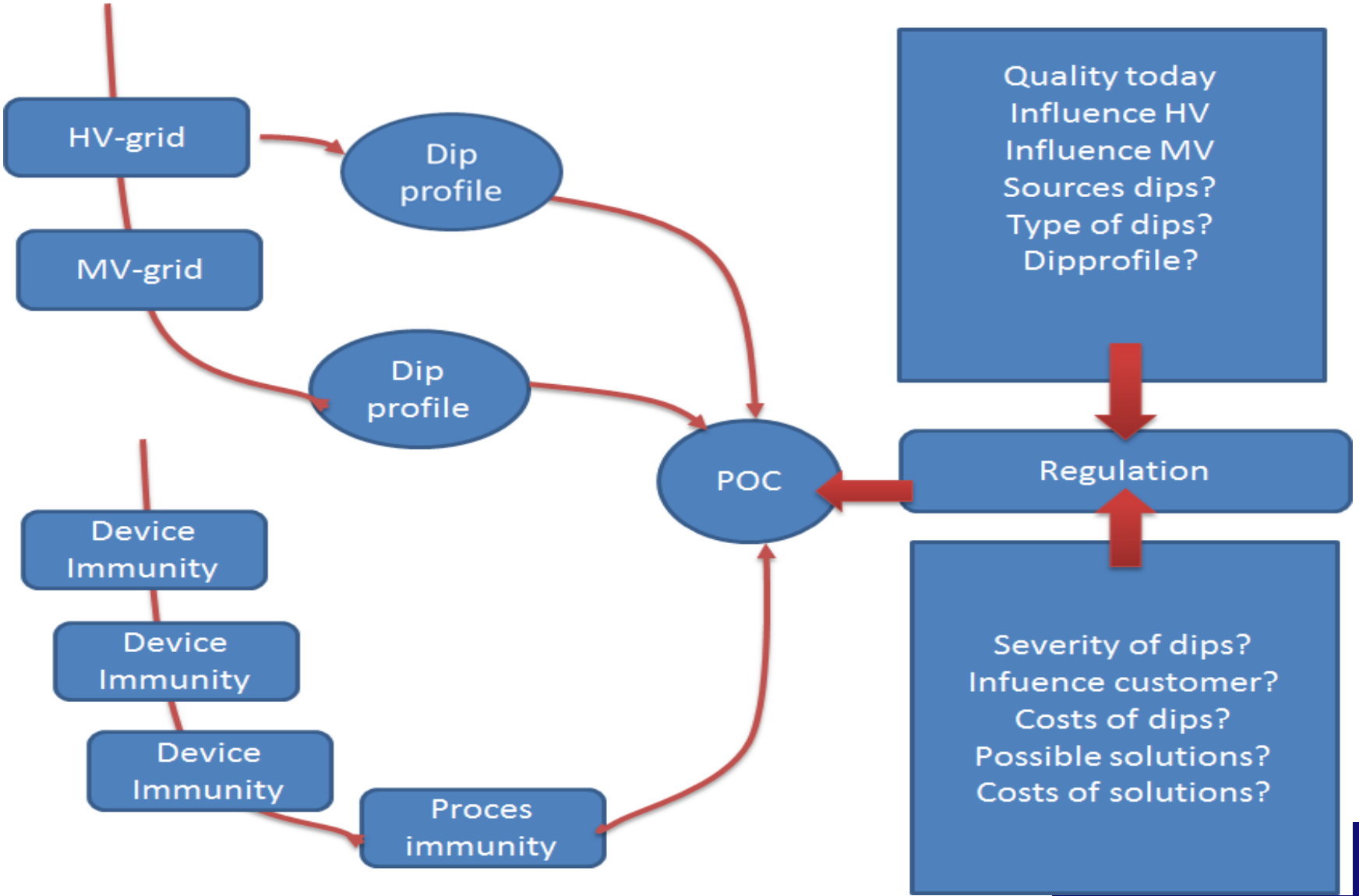


Problems related to PV-systems

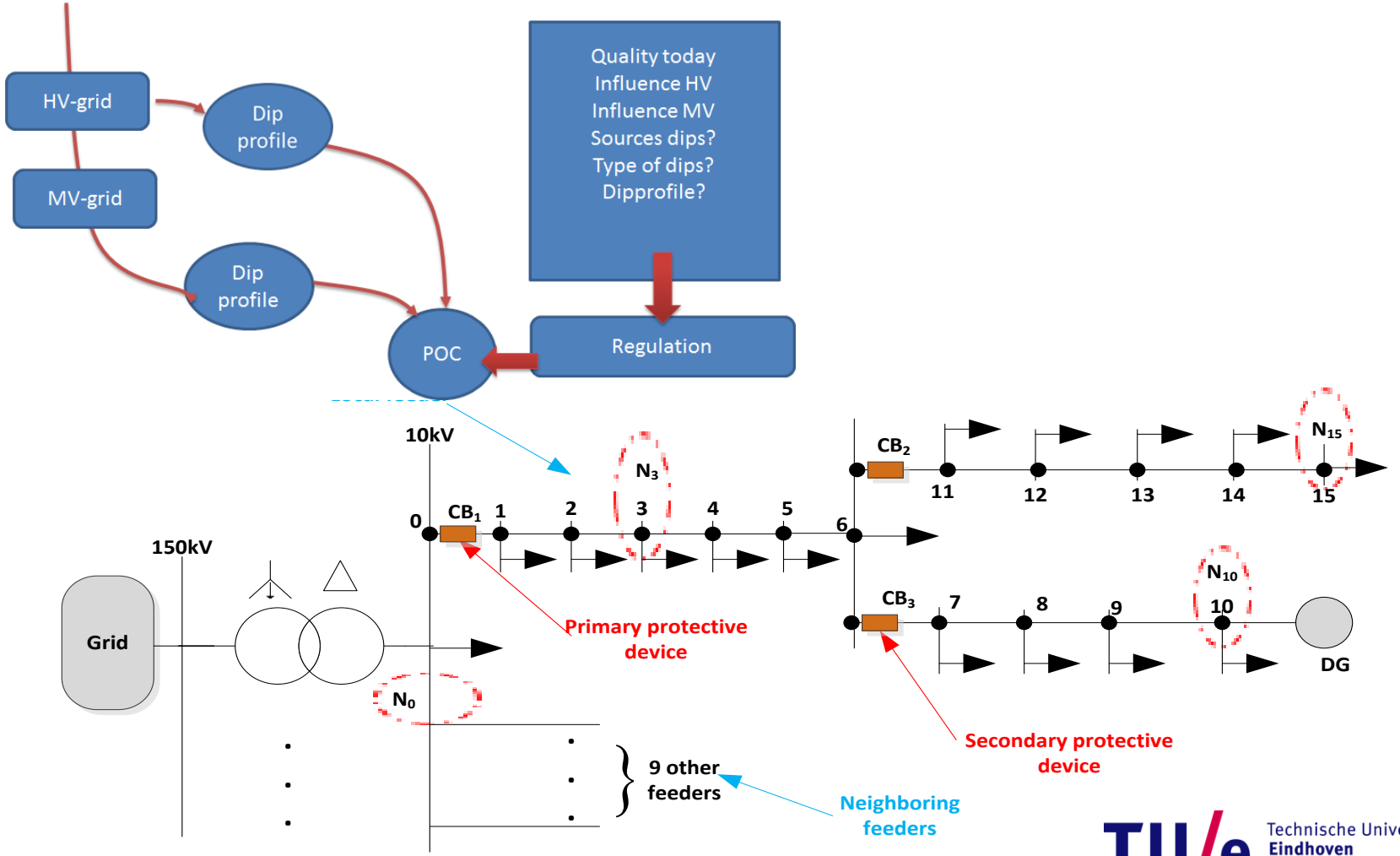
- **Overloading of transformer and overvoltages!**



Voltage dip


HV-grid
Dip profile
MV-grid
Dip profile
Device Immunity
Device Immunity
Device Immunity
Proces immunity
POC
Quality today
Influence HV
Influence MV
Sources dips?
Type of dips?
Dipprofile?
Regulation
Severity of dips?
Infuence customer?
Costs of dips?
Possible solutions?
Costs of solutions?

Research related to voltage dips



Research related to voltage dips

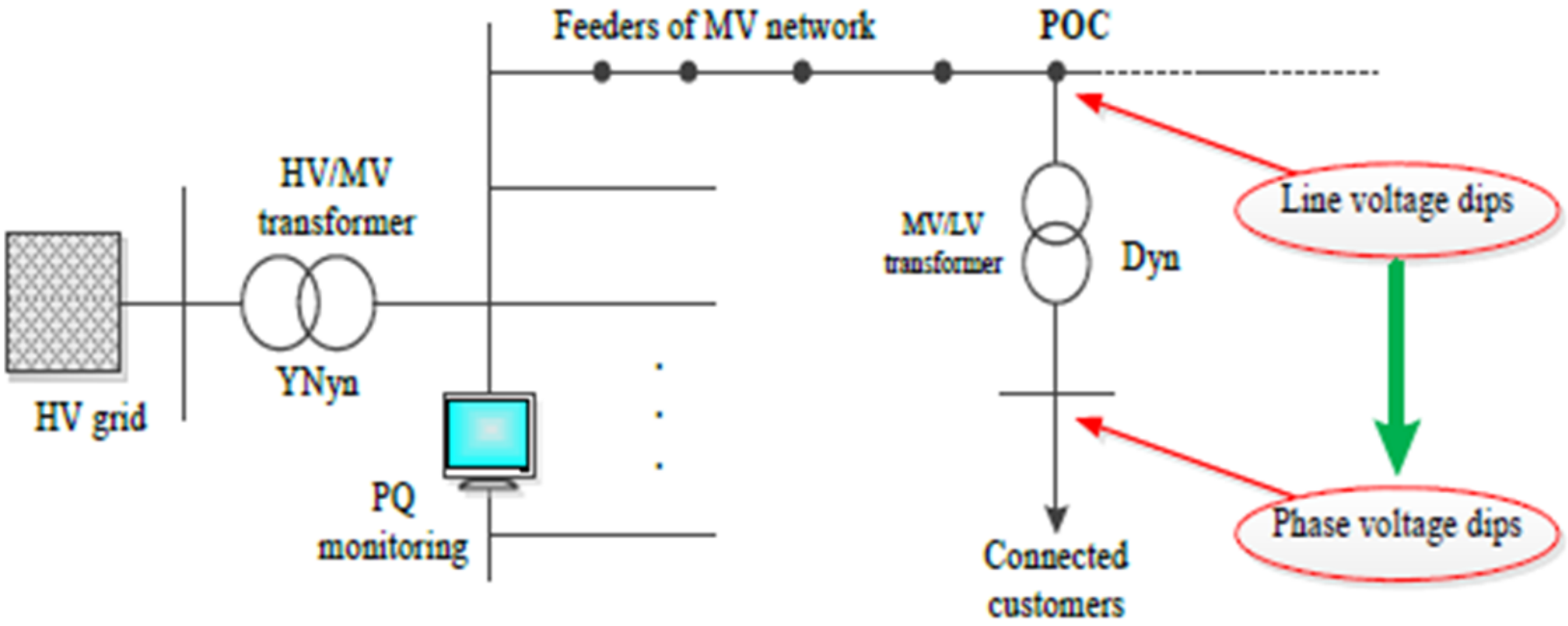
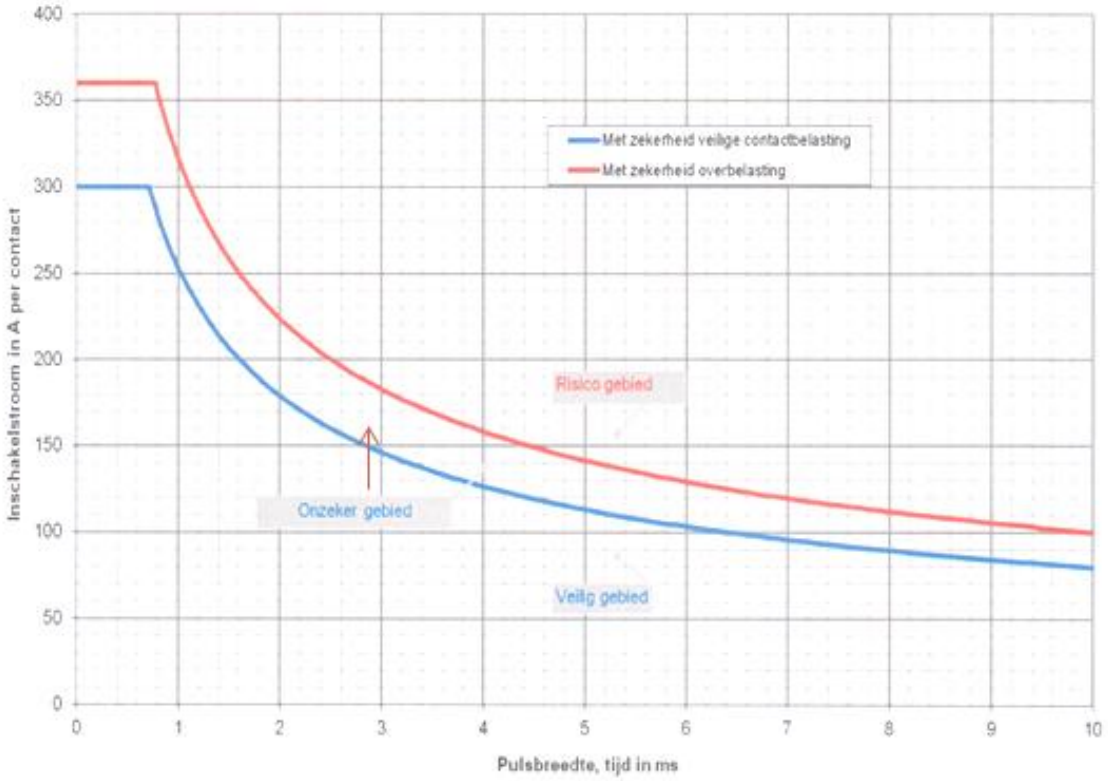
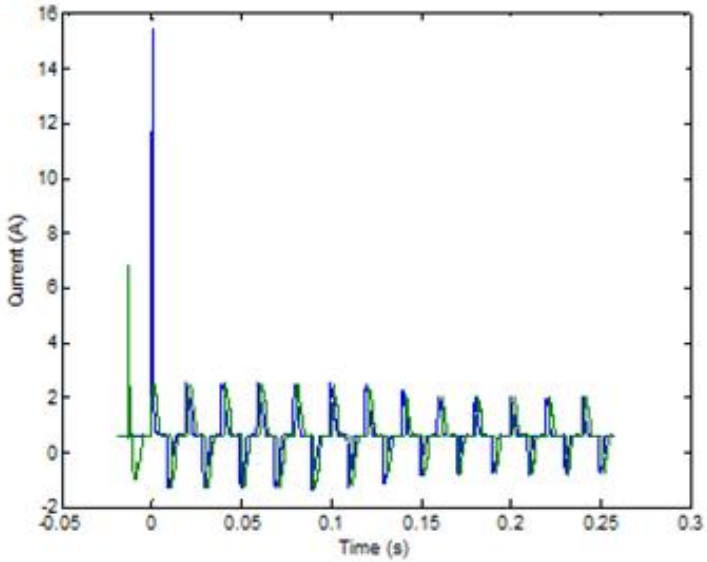


Figure 2: Simplified schematic for a10kV (Nijkerk) network

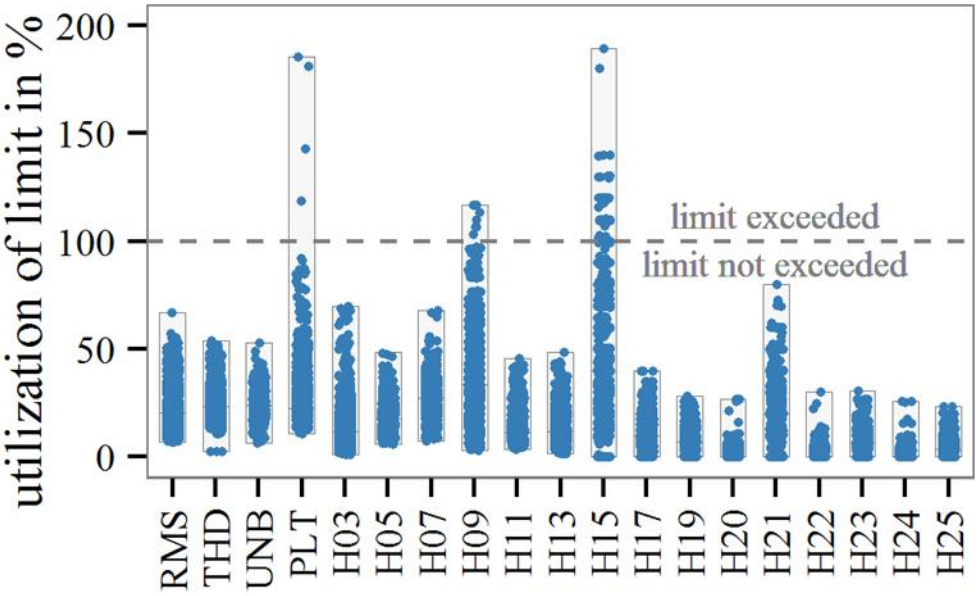
Inrushcurrents (contactors/circuit breakers)





The capacitor has the capacity to create problems in the network

Harmonics and monitoring



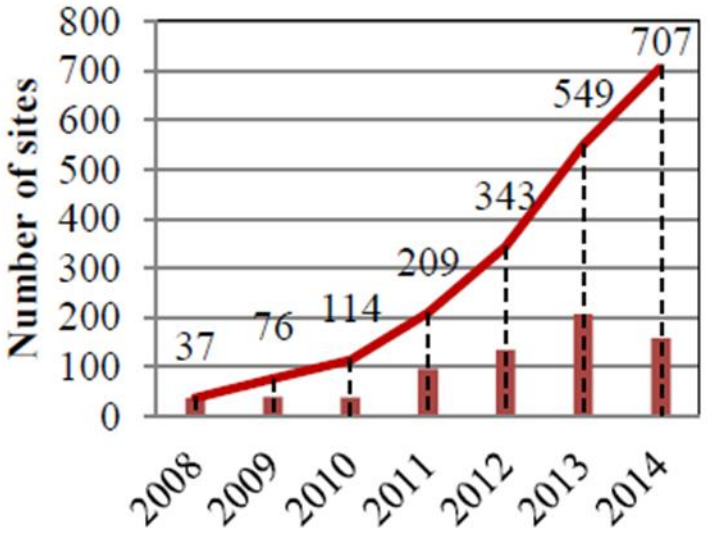
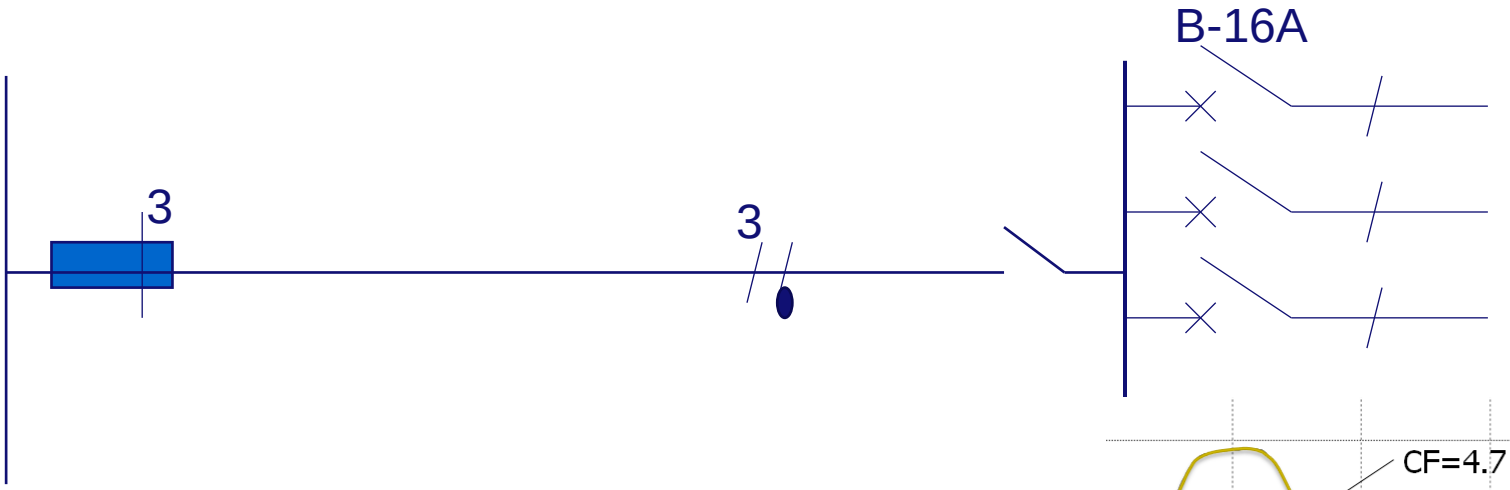


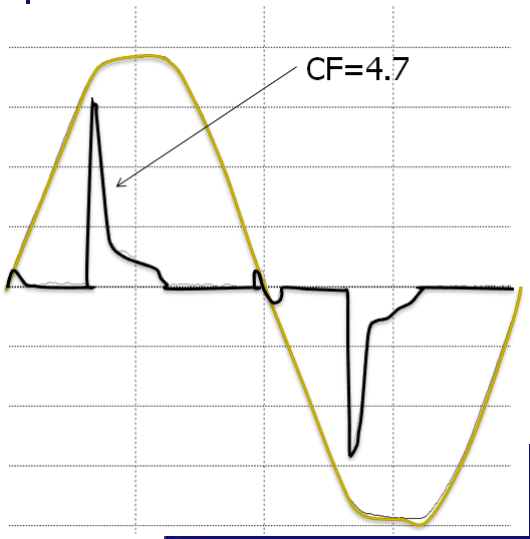
Figure 4 Annual growth of measured sites

15th harmonic voltage problem has to be solved!

Cable cross section

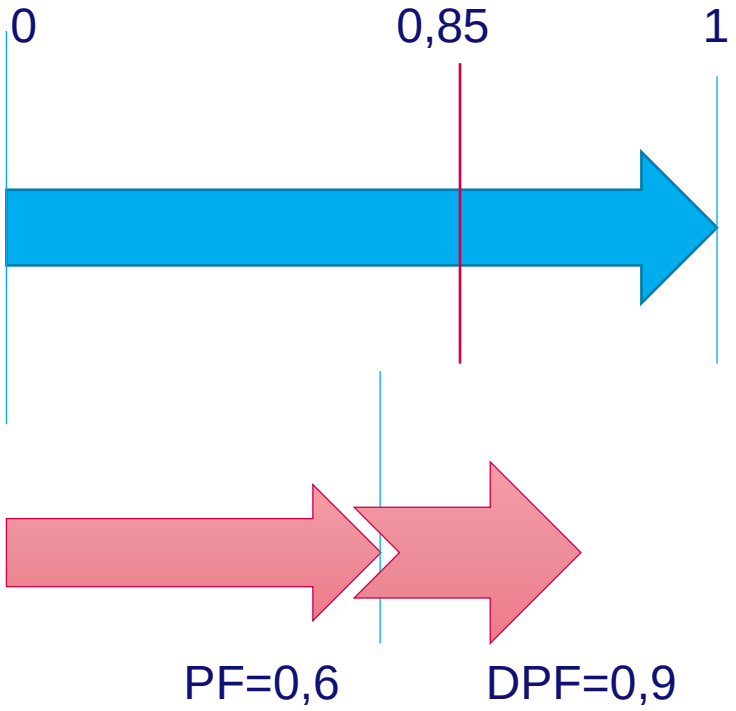
- **With high harmonic distortion**

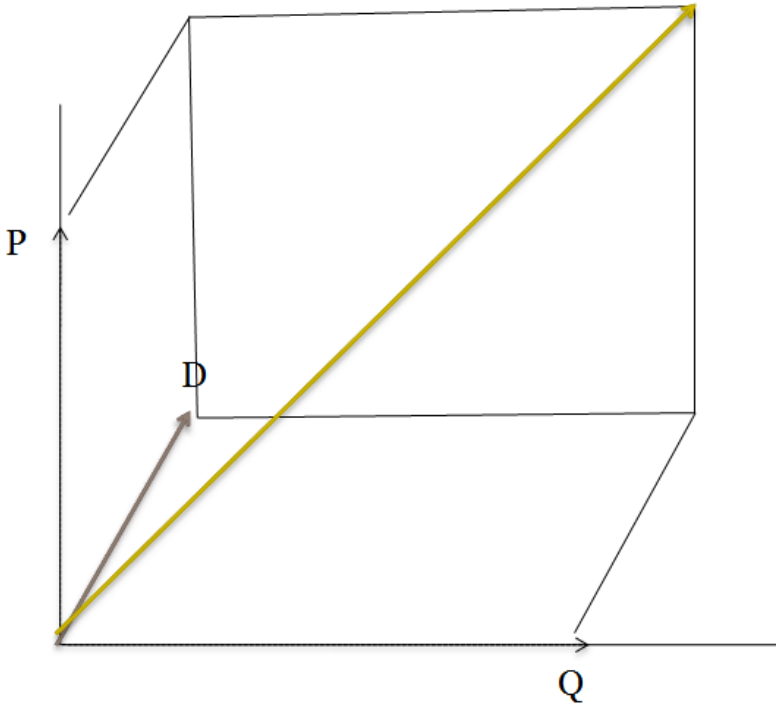




- Without harmonics: 16 mm2
- With 3rd harmonic: 25 mm2
- With all harmonics: 35 mm2

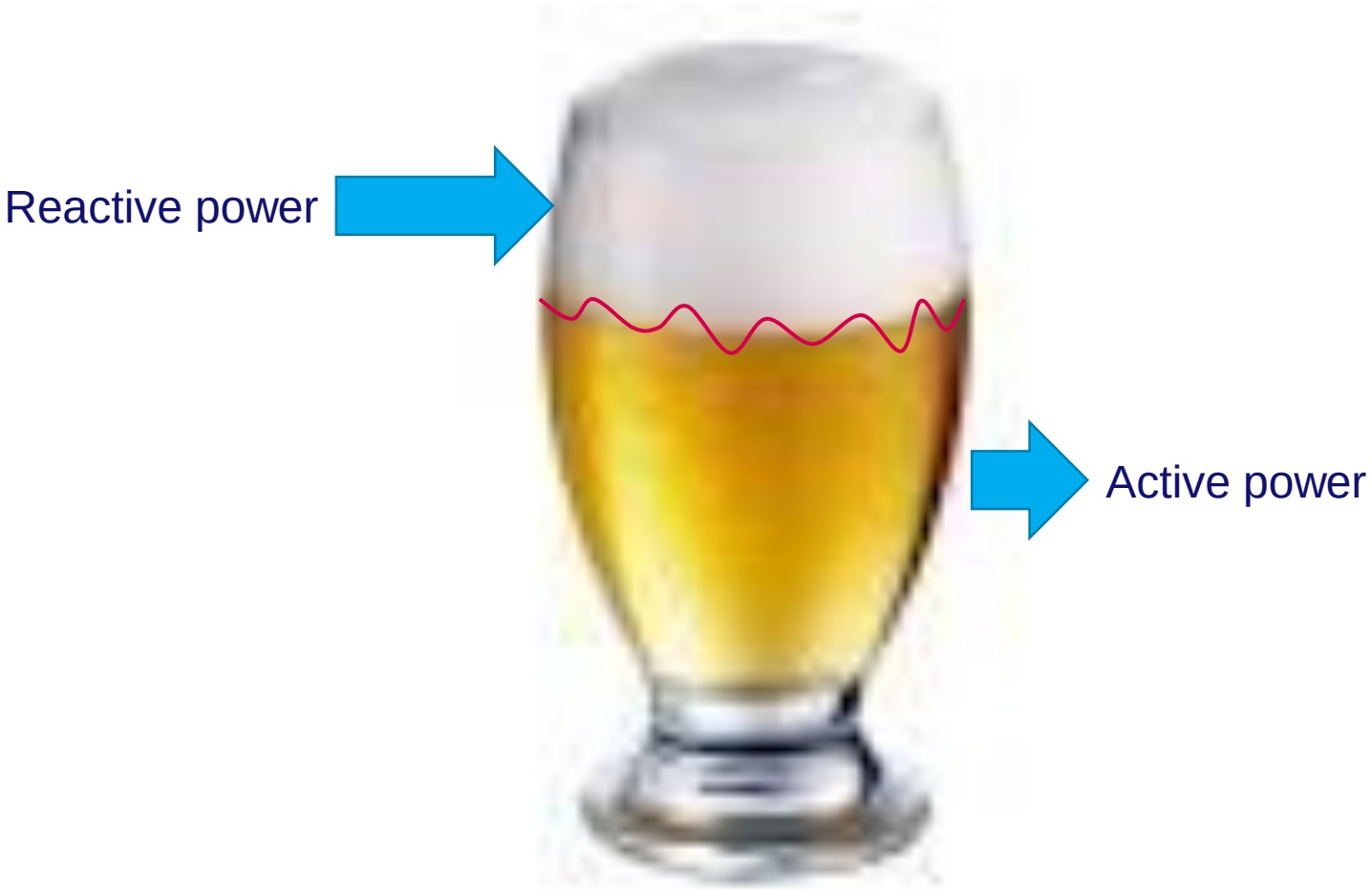
PF and the need for compensation





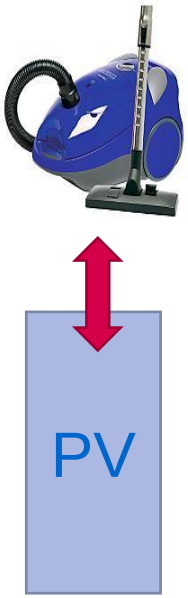
$$S = \sqrt{P^2 + Q^2 + D^2}$$

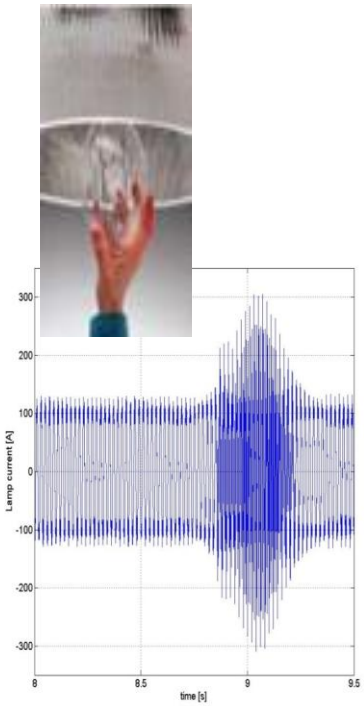
How to define the content of the glass?

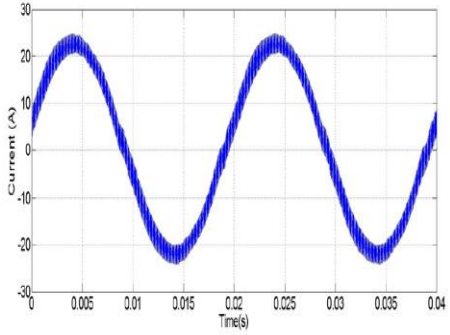


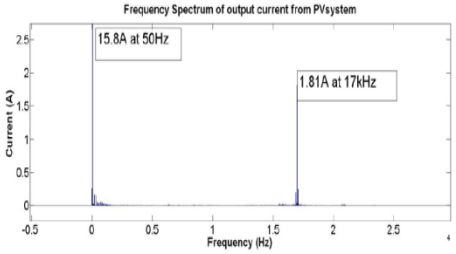
Harmonic distortion makes it
difficult to define the quality of the beer!

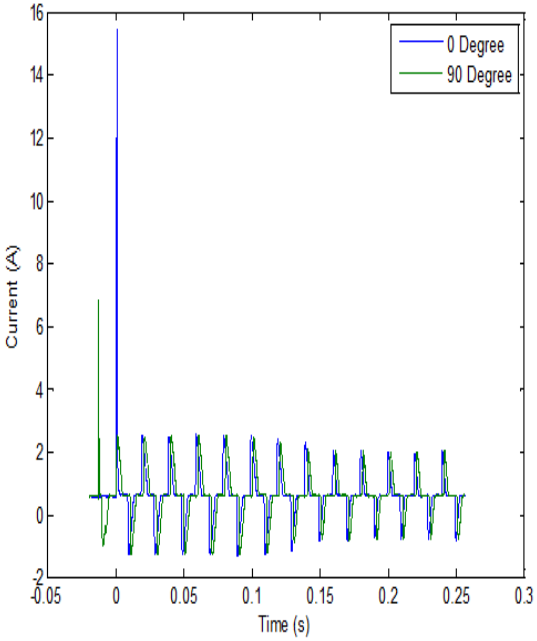
Examples of non-compatibility











Knowledge and education: Key to smart!