CIRED KONFERENZ 2017 IN GLASGOW -
ZUSAMMENFASSUNG VON TECHNISCHEN HÖHEPUNKTEN

15. CIGRE/CIRED-Informationsveranstaltung 2017
Aschaffenburg, den 24. Oktober 2017

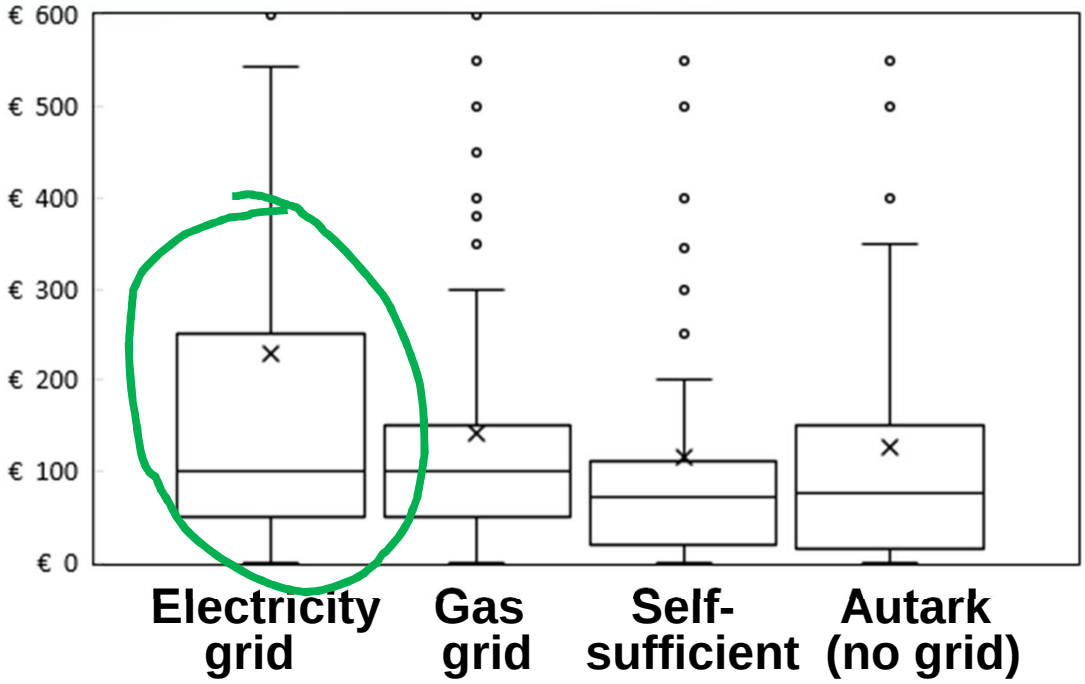
Bastian Bauhaus, SWKiel Netz GmbH
Markus Zdrallek, Bergische Universität Wuppertal

CIRED

GRID VALUE

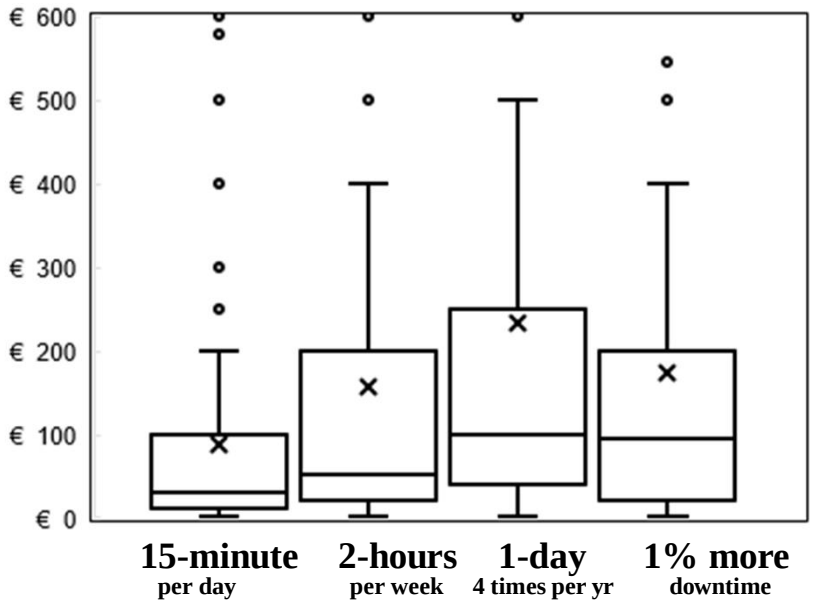
...FROM A DEMAND PERSPECTIVE

WILLINGNESS TO SPEND LARGER THAN CURRENT GRID COSTS



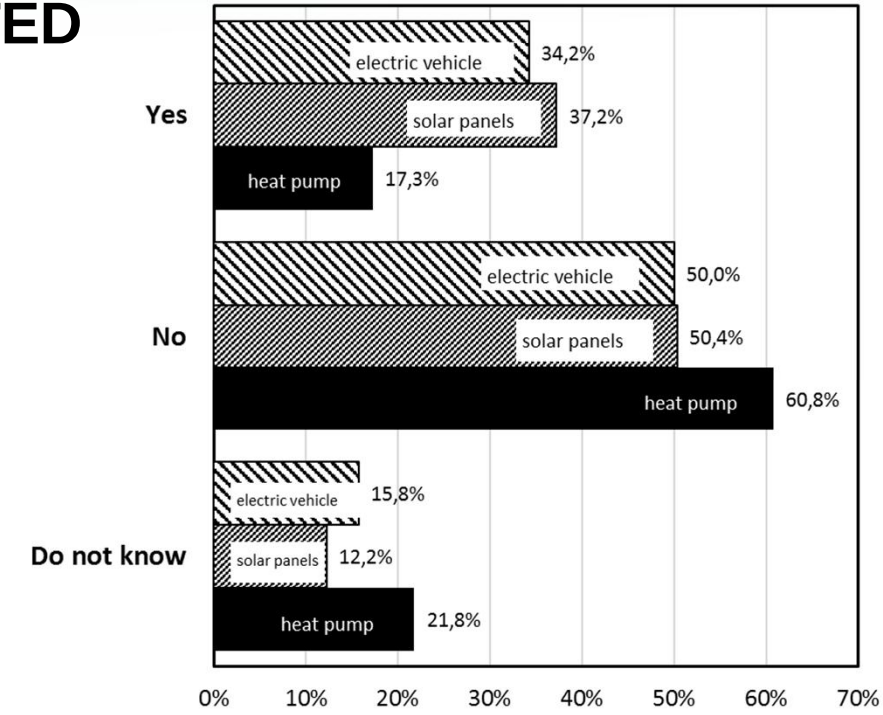
Grid valued at 5% - 7.5% of modal income

GRID RELIABILITY VALUE PERCEIVED 88 EUR/MONTH FOR 1% RELIABILITY DECREASE



Note: current grid reliability stands at 99,99% in 2015.

ADOPTATION OF ELECTRIC VEHICLE AND SOLAR PV FASTER THAN EXPECTED



Solar-PV
6 GW_{el} solar-PV in residential area within ~10 years

Factor two faster than current energy planning

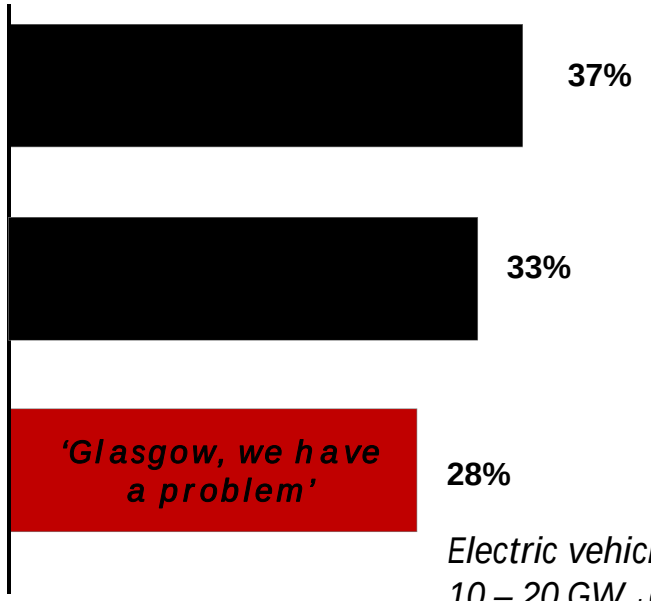
‘How would you charge your electrical vehicle?’

1/3 OF ELECTRICAL CAR CHARGING NON-FLEXIBLE

Flexible and my home can use the electricity from the battery if I save costs

Charging is flexible, provided the battery is full enough for my next trip

Charging starts when I come home and I would like the battery to be almost full (as soon as possible)

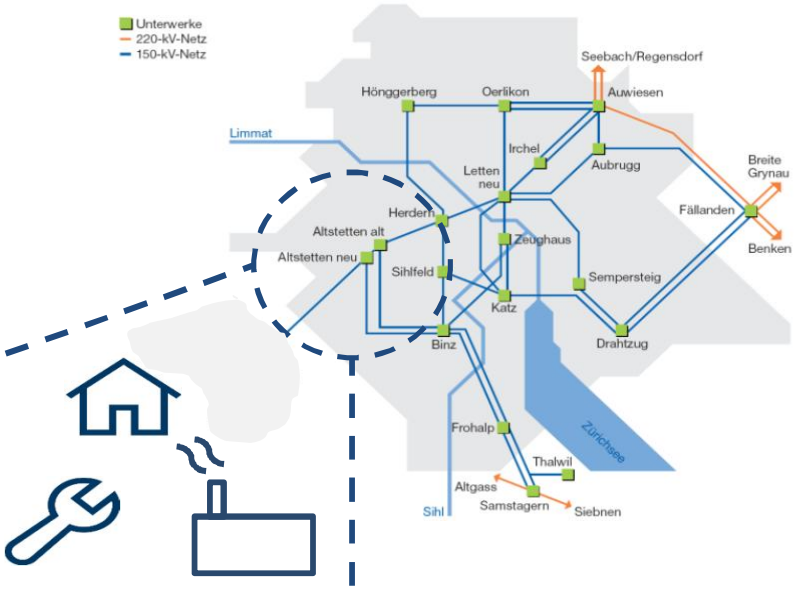


Electric vehicles 10 – 20 GW_{el} demand that is non-flexible in worst-case

URBAN GRID PLANNING

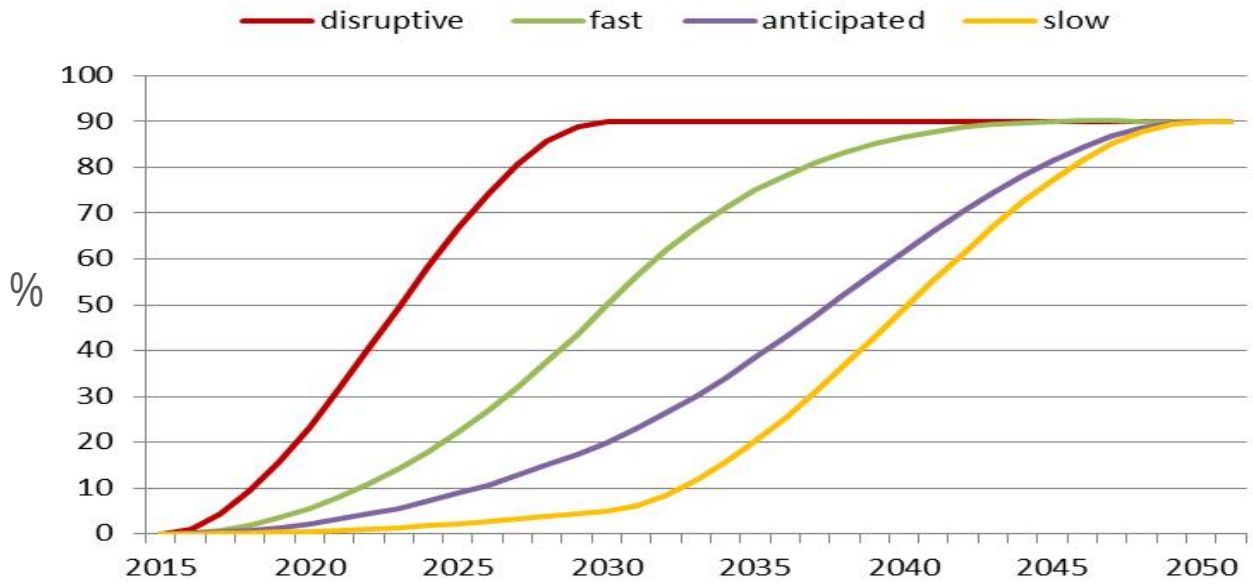
...CONSIDERING E-MOBILITY

Subgrid



- 35’000 customers
- 65 MW maximal load
- 37 photovoltaic units
- 1600 kWp installed

Electromobility Scenarios



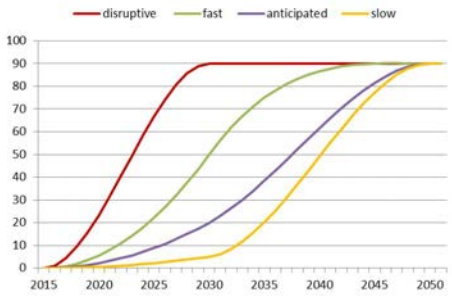
Evdokia Kaffe – Switzerland – S5 – 0954

Measures

- Grid expansion

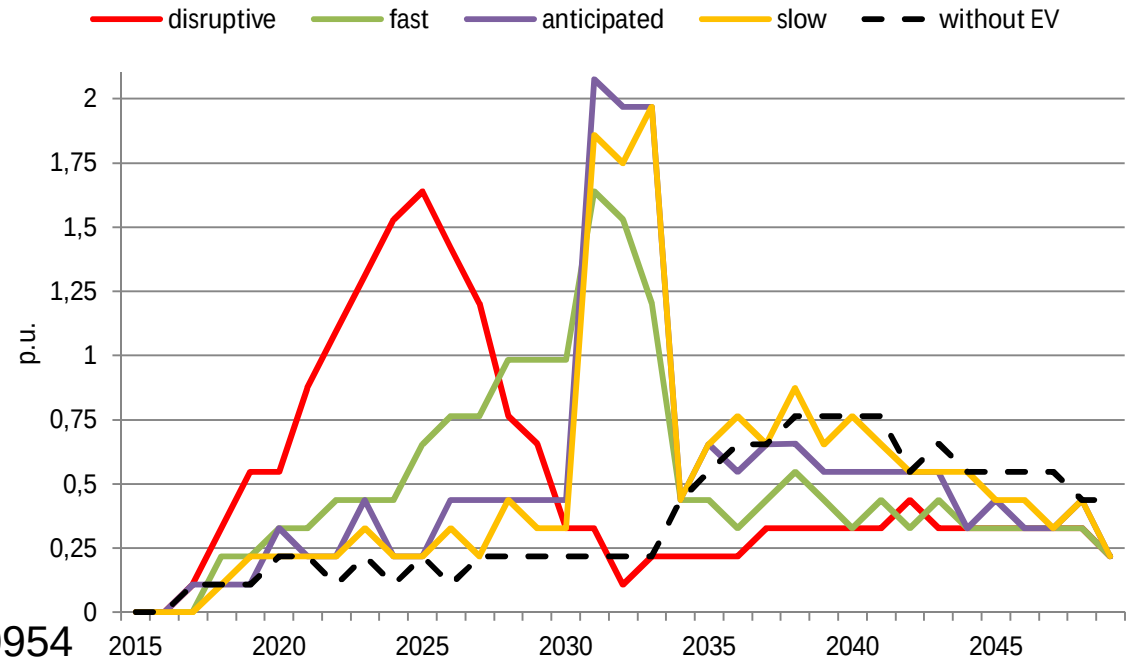
- Intelligent charging

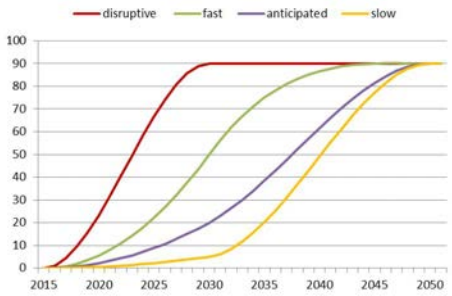
…for EVs in car parks to avoid simultaneous charging in order to shave peaks.



Results

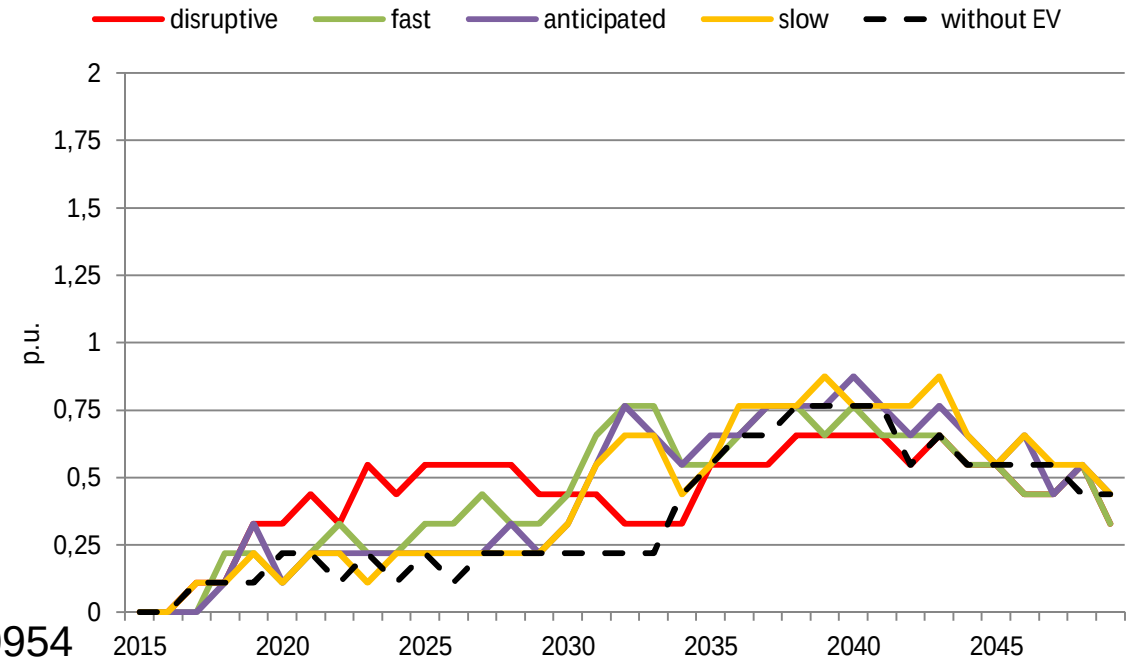
Yearly grid expansion costs due to load and electromobility growth **without intelligent EV charging**.





Results

Yearly grid expansion costs due to load and electromobility growth **assuming intelligent charging**.

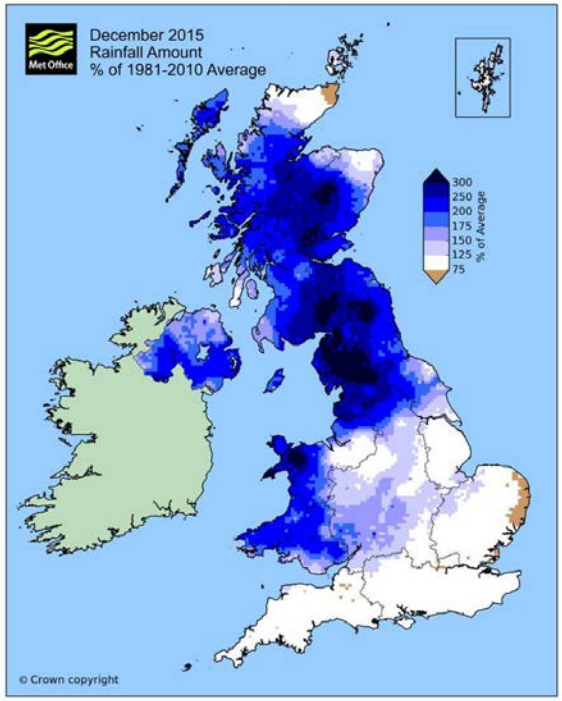


CRISIS MANAGEMENT

…BEING PREPARED

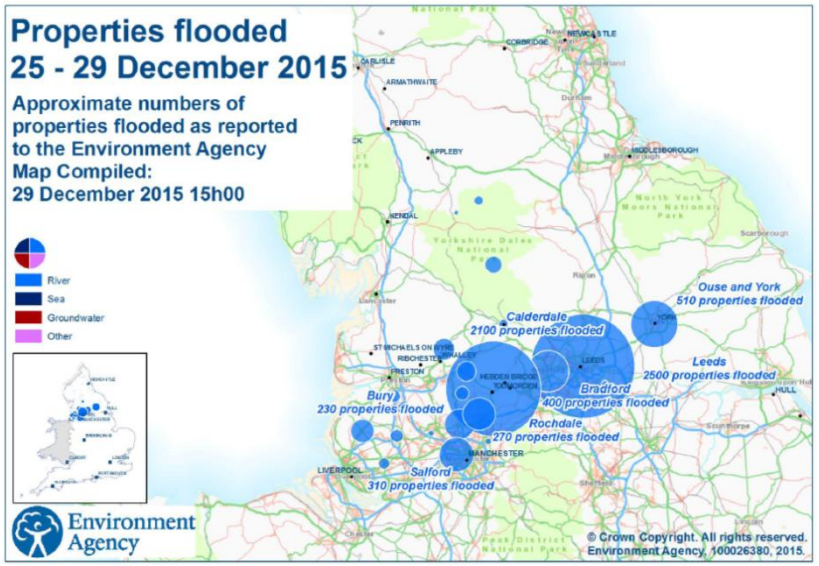
STORM DESMOND AND EVA: DECEMBER 2015

- Storm Desmond hit the UK in the first week of December 2015. The rainfall levels exceeded previous 24 and 48 hour national records, with more than 300mm falling in some locations.
- As the rain was falling on already saturated ground, it caused rivers to ‘flash’ with river levels spiking beyond previously recorded levels.
- Storm Eva followed on Saturday 26 December 2015, again causing extensive flooding over a different geographical area.



THE IMPACT

- Over 6,000 properties flooded
- Significant damage to major substation infrastructure in Lancaster and Leeds
- Electricity supplies to 90,000 customers lost



THE CIRCUMSTANCES AROUND THE EVENT PROVIDED INSIGHT INTO HOW WE MIGHT RESPOND IN FUTURE

- Substations flooded where most customers are not flooded
- Substations flooded where significant customers are also flooded
- Substations flooded where supplies to customers are not affected
- Substations flooded causing significant supply interruptions
- Damage to other types of assets (bridges, pylons, telecoms)

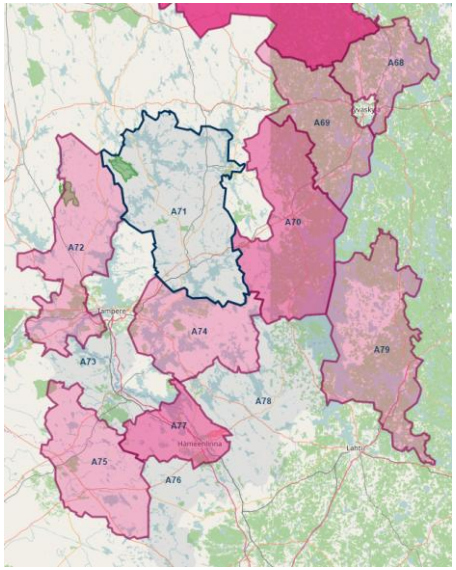
PLANNING FOR THE LONGER TERM

- Valuing the impact of floods: - *societal as well as damage to infrastructure*
- Locally Significant Infrastructure: - *isolation of local communities not just CNI*
- Planning Standards: - *impact of climate change predictions, surface water flooding and high-customer numbers (over 10,000)*
- Interdependencies: - *vital role in supporting other utilities e.g. telecoms*

Direct Benefits
Customer disruption
Environmental impacts
Economic impacts
Wellbeing, societal impacts

SITUATION AWARENESS TOOL

- In practice real-time data from the DMS
- Centralized system for coordination
- Designed to serve the key coordination areas
- Visual approach – easy to use



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GLASGOW, SCOTLAND | 12-15 JUNE 2017

AUGMENTED REALITY

TO SUPPORT GRID OPERATION

Virtual Reality to renew training approach

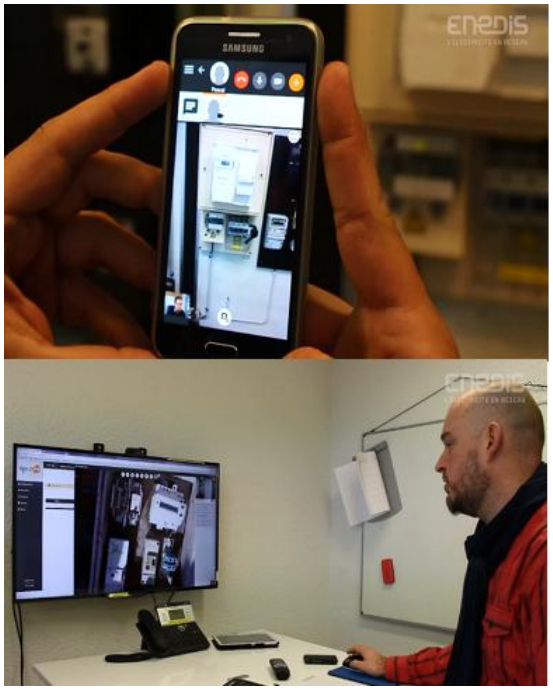
- ✓ Goal : widen the training methods for technicians
- ✓ Expectation :
  - More effective and more attractive training,
  - Reduced deployment time: Intuitive use of the tool,
  - Reduced cost compared to traditional training methods.
- ✓ Solution tested : VR to immerse the trainee in the environment of a primary substation and give support to learn and carry out an MV lockout procedure
- ✓ Results : the training solution is available and feedback from the users is very positive

Interaction between field technician and expert

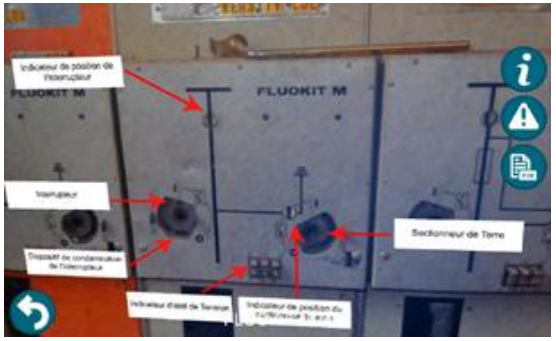
- ✓ Goal : increase efficiency and safety of field operation, trough improved access to expertise
  - in the event of unforeseen circumstances
  - for new recruits
- ✓ Solution tested : real-time interactive video with AR

  Typical application : reliable shared diagnostics with AR indication from the expert directly on the image displayed to the field operator.

- ✓ A very positive feedback from the technicians involved in the experiment



Augmented Reality to support operation



- ✓ Goal : support the efficiency and safety of operation and maintenance trough artificial intelligence + AR technologies
- ✓ Solution tested : a tablet based tool with the main following capabilities
  - automated recognition of MV switchgear and LV switchboard,
  - access to dedicated safety, maintenance and operation instruction,
  - remote access to asset database
  - … to be extended
- ✓ Results : proven value as a support tool for infrastructure operation maintenance

Augmented Reality for cable fault location

- ✓ Goal : simplify cable route tracking during fault location
- ✓ Solution tested : cable routing displayed with smartglasses
  - no need to use the maps to achieve fault location
  - increased efficiency : easier location
  - increased safety : better awareness of the environment (road traffic…)

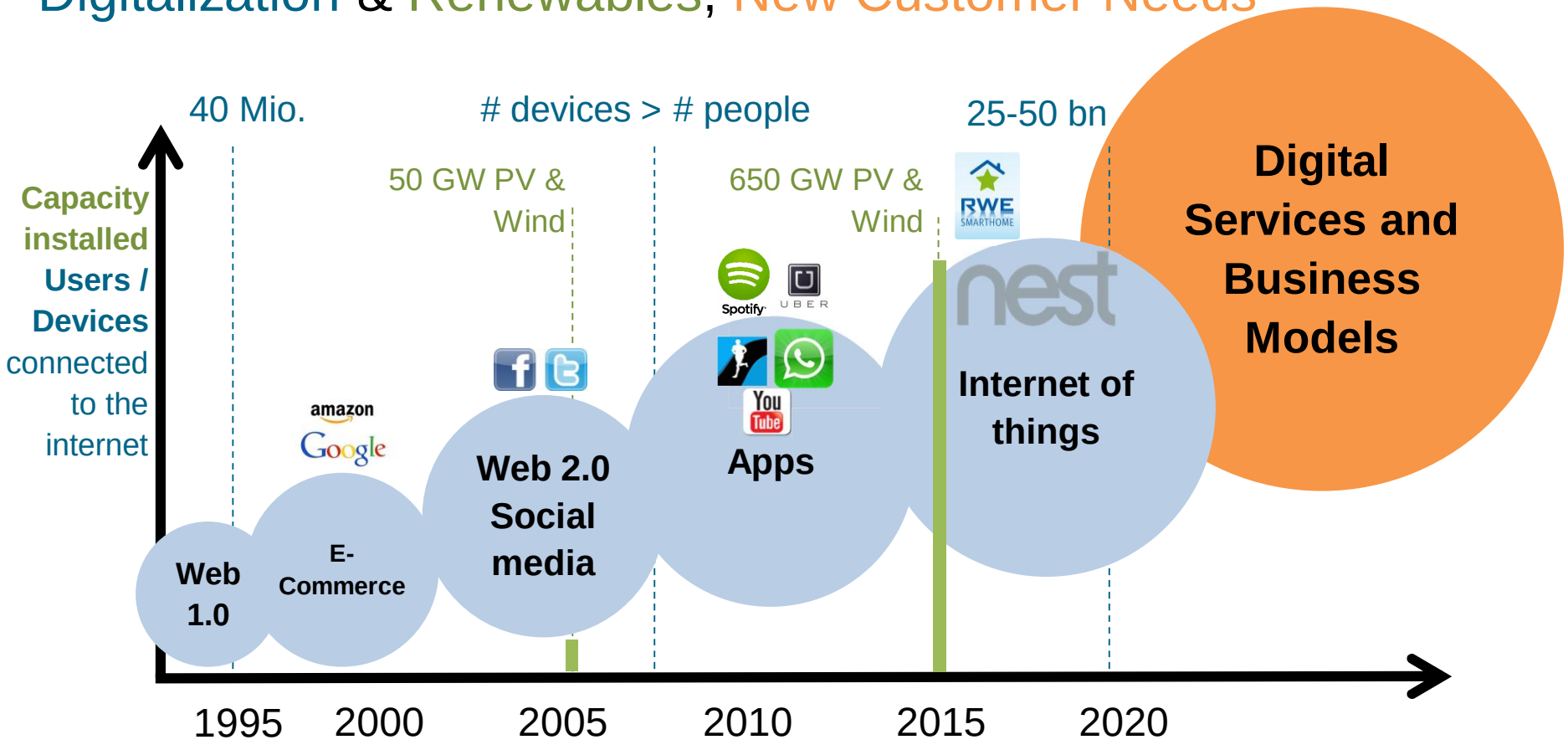
- ✓ A promising use case, but further technological improvements are needed to reach operational benefits !

DATA SCIENCE

DSO WILL BECOME DATA MANAGERS [… AND ENTER THE WORLD OF BIG DATA]

Philippe Monloubou, CEO at Enedis,
« Power distribution at the heart of the energy transition »,
CIRED 2015, 15th of June 2015, Lyon

Digitalization & Renewables, New Customer Needs



Sources: REN21, Cisco, Gartner, The World Bank

The expanding digital transformation of utilities demands a comprehensive approach

Devices (*IIoT*) 10^2 10^3 10^6

HV MV LV

Smart Digital Grid

=

move2future program

Devices + ICT + Processes + Organization

Automation | **Distributed Sensors** | **Smart Meters**

Optical fiber | **ADMS** | Wireless | **Analytics** | PLC | **AMI**

MV/LV Outage Management | **Optimized Asset Management** | **Data Management**

Culture | **People** | **Skills**

Data Analytics Applications Everywhere

Asset Management
- Condition Based Maintenance
- Asset Planning
- Asset Performance

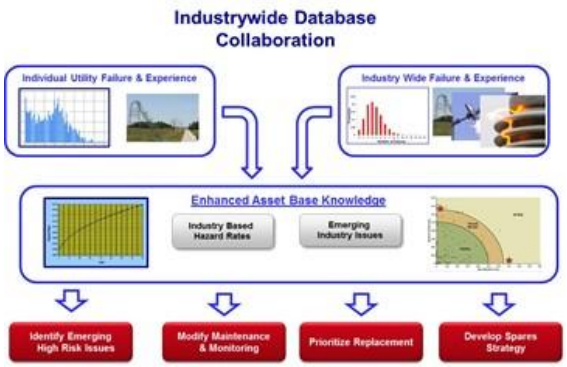
Work Management
- Work planning optimization
- Fleet optimization
- Materials, supplies, procurement

Operations
- Storm Damage Prediction and Assessment
- Storm Response
- Vegetation Management
- Voltage Management
- Loss Reduction
- Forecasting

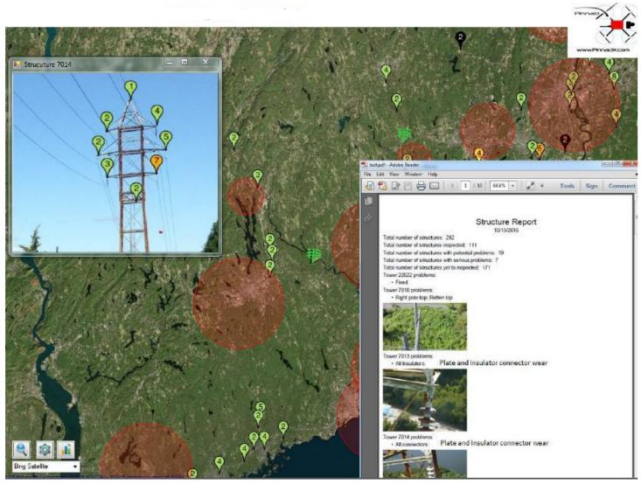
Distributed Resources
- PV Characteristics/Forecasting
- Energy Storage
- Electric Vehicle Charging
- Demand Response
- Microgrids
- DMS/DERMS/ADMS

Customer Operations
- Service Complaints
- Theft of Power
- Customer Segmentation
- Personalization
- Customer Services/Marketing
- Rates and Pricing
- Energy Efficiency
- Demand Response
- Call Center Optimization
- Collection Analytics

New Technologies integrated with data analytics



Asset Management Analytics

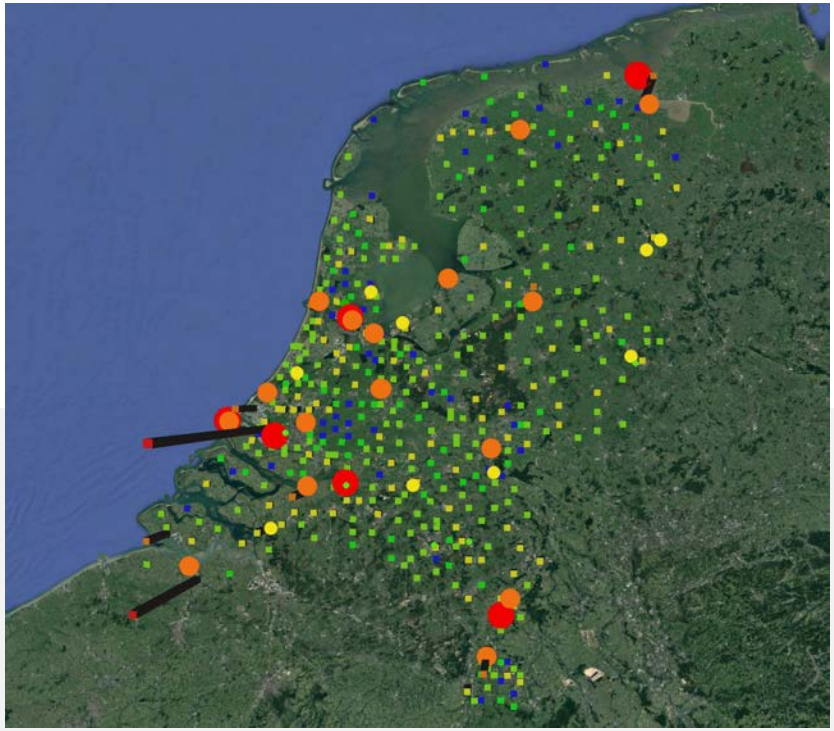


Inspection and
GIS Management Support

Augmented Reality
Applications

MCGRANAGHAN – USA – RT7

Is network planning possible with Artificial Intelligence?



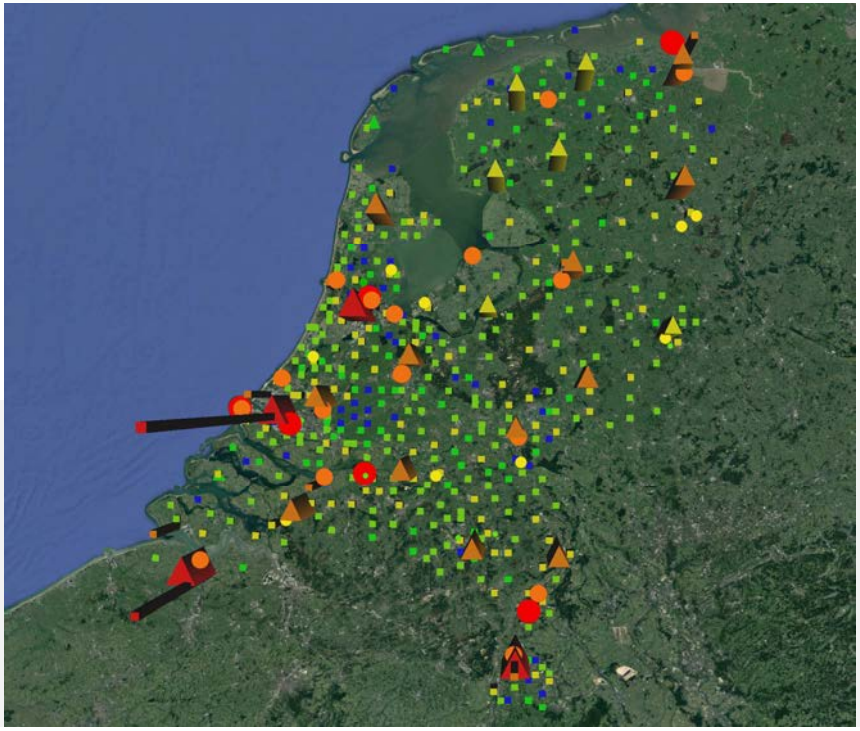
Legend real-life

ELECTRICITY USAGE 2016

- very small use
- small use
- medium use
- large use
- very large user

- small producer
- medium producer
- large producer
- very large producer

Is network planning possible with Artificial Intelligence?



Legend real-life

ELECTRICITY USAGE 2016

- very small use
- small use
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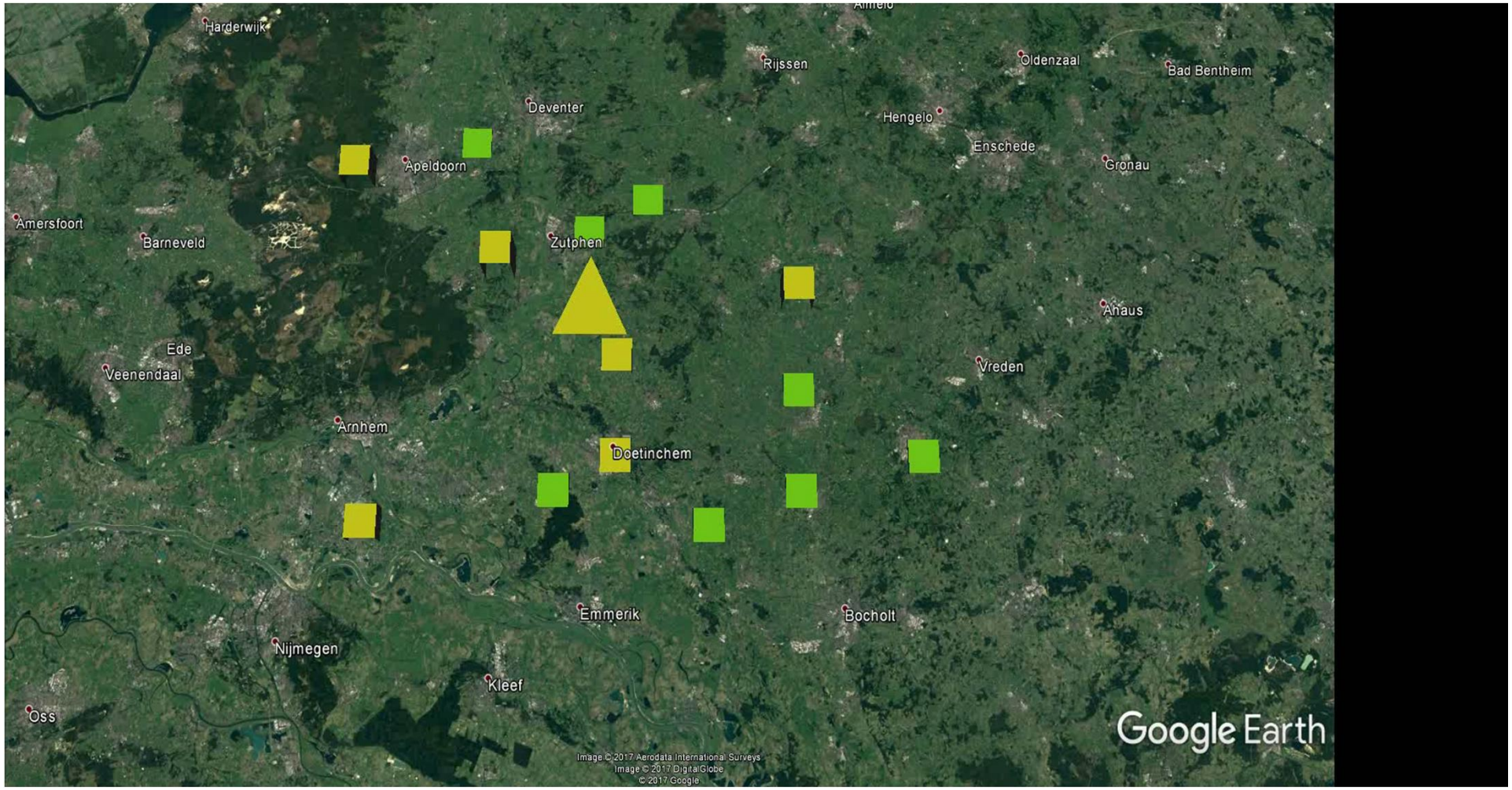
- large use
- very large user

Legend AI

- small producer
- small producer
- small producer
- small producer

- small producer
- medium producer
- large producer
- very large producer

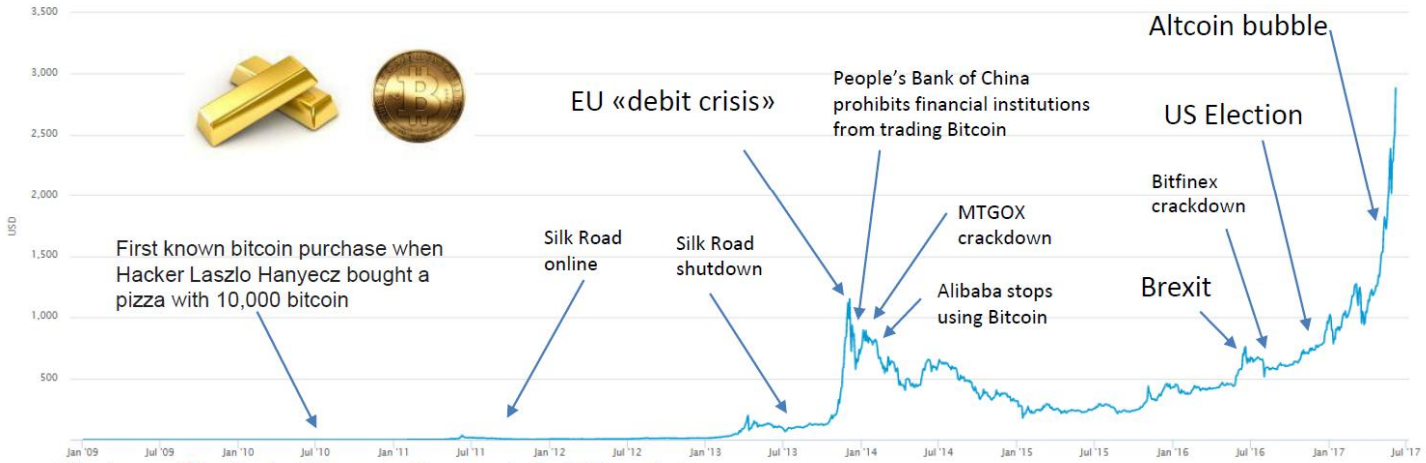


A.J. Van der Mei & J.P. Doomernik – The Netherlands – RIF Session 5 – paper ID 1031

BLOCKCHAIN

WHICH USE CASES IN THE ENERGY INDUSTRY

A growing phenomenon which is exploding right now



- Bitcoin could be traded like any other assets in OTC markets.
- Can be seen as «digital gold» due to the fact that it is a digital scarce and not replicable resource (first time in digital realm), moreover it is expensive to "extract".

Bitcoin Mining Pilot @ VERBUND Hydro Plant

Direct base load delivery from the plant

5 x  

Electricity was procured directly on site:
Due to the location at the plant and the small scale of the pilot, **no grid charges nor taxes were due.** Our pilot was therefore competitive (global) next to low energy cost locations like Island.

1. **VERBUND Bitcoin mining was very profitable**
   - Break-even In a very short time lapse (4 months)
   - IRR exceeded 100% after resale of the ASICS.
   - Electricity cost > 50 % of total life cycle cost
   - Further optimisation potential (Demand Response)
2. **Scaling of mining remains controversial**
   - Bitcoin mining farms need electricity 300-1000 MW
   - But: 80-90 % of bitcoin transactions are done by speculative players – difficult planning environment.
   - However: energy and ASIC-mining-hardware are key for Bitcoin's high IT-security

Key Learnings:

- **Blockchain** technology in the future => **electricity demand** will remain high
- **Cryptocurrencies** are the necessary **fuel** to crowdfund **secure infrastructure** => no blockchain without bitcoin & co
- **Public** Blockchains like Bitcoins will be stronger linked to **Private** Chains / cloud databases

Blockchain enables the 4th industrial revolution by connecting IoT + physical delivery

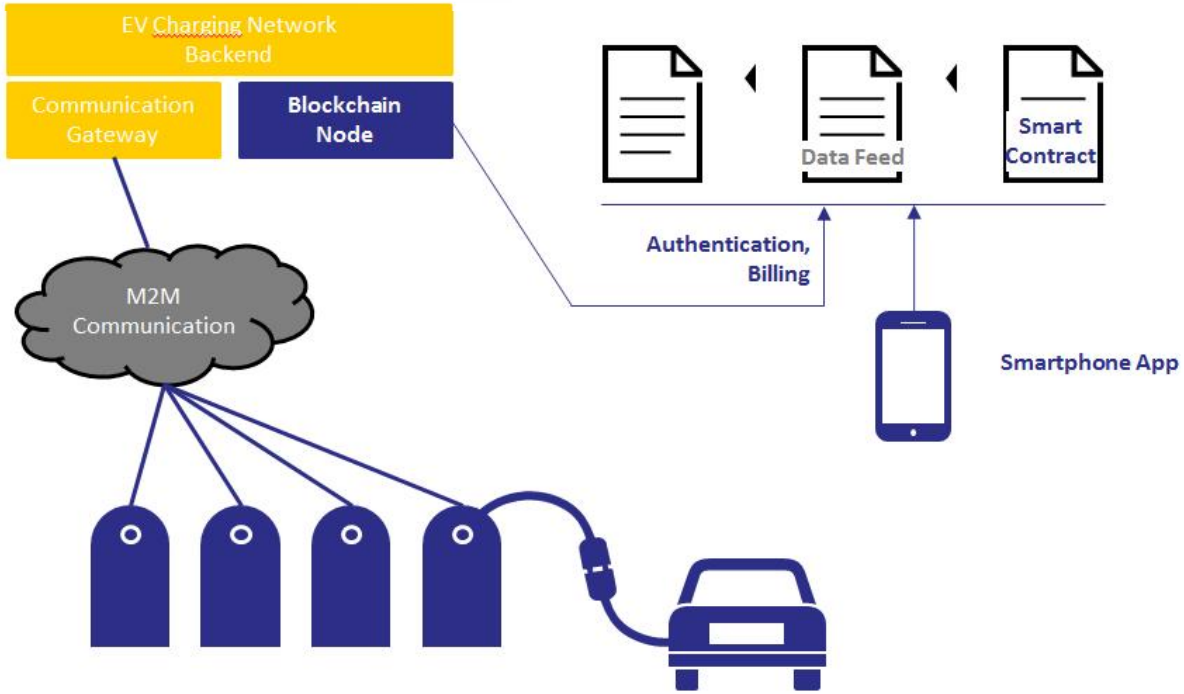
Internet of Things (IoT) + P2P Networks/ Blockchain + Physical Delivery

P2P Networks = Blockchain + P2P Data Storage + P2P Communication + Modern Cryptography + Off-chain Computing

IoT: Internet of Things

Source: innogy SE

Now: "BlockChainifying Systems": Backend Integration



Source: innogy SE

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