Solutions for a smarter grid

Introduction to the workshop

Marc Lees

15 Feb 2012

Ubifrance Electricity Forum

Bangkok, Thailand

Schneider Electric

The energy dilemma is here to stay

The facts

×2

Energy demand

By 2050

Electricity by 2030

Source: IEA 2007

VS

The need

÷2

CO_2 emissions to avoid dramatic climate changes by 2050

Source: IPCC 2007, figure (vs. 1990 level)

Frequent power outages

Rising energy prices

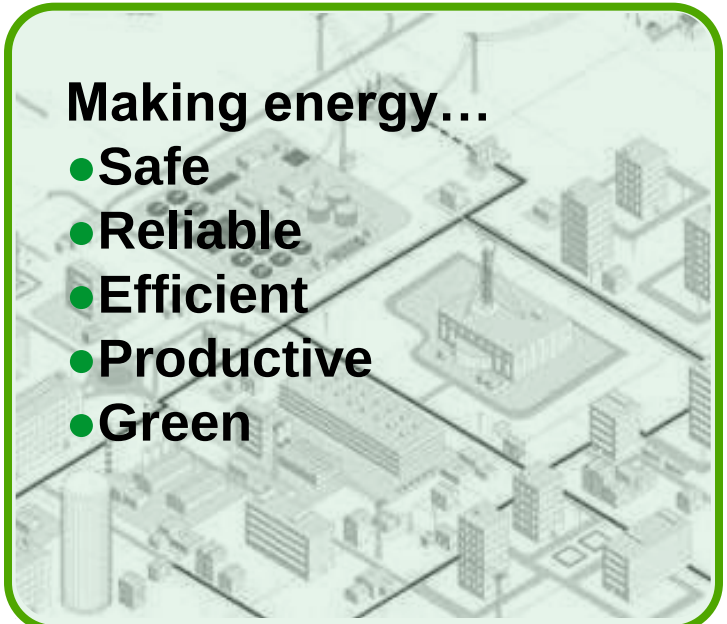
Climate change

Conflicts for resource access & control

The Global Specialist

in Energy Management

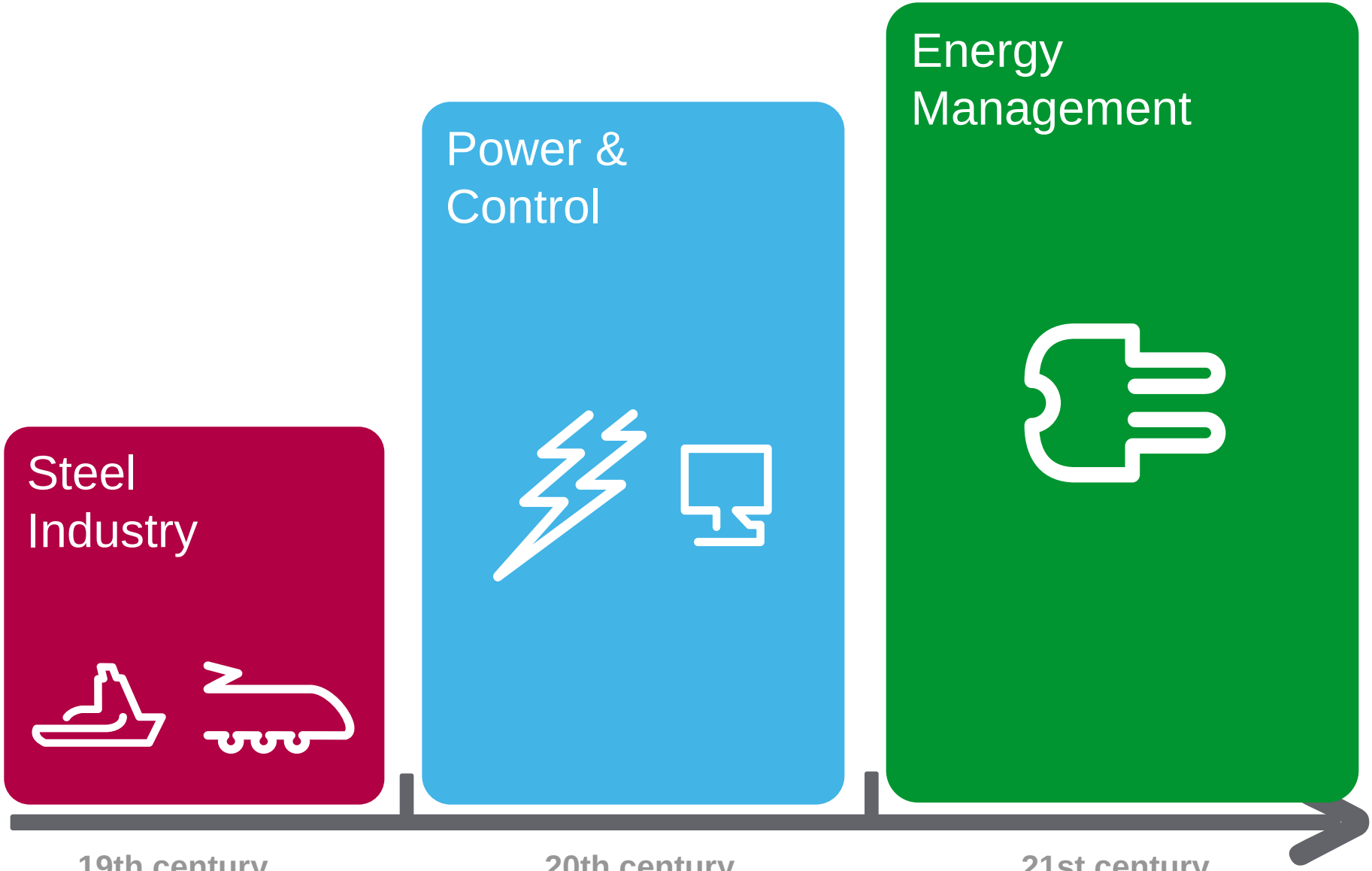
Energy production & transmission	**Energy Management**	Energy Usage
●Wind energy	**Making energy…**	●Appliances
●Solar energy	●Safe	●Climate control
●Hydro	●Reliable	●Security
●Biofuels	●Efficient	●Lighting
●Hydrocarbons	●Productive	●Machines
●Nuclear	●Green	●IT servers

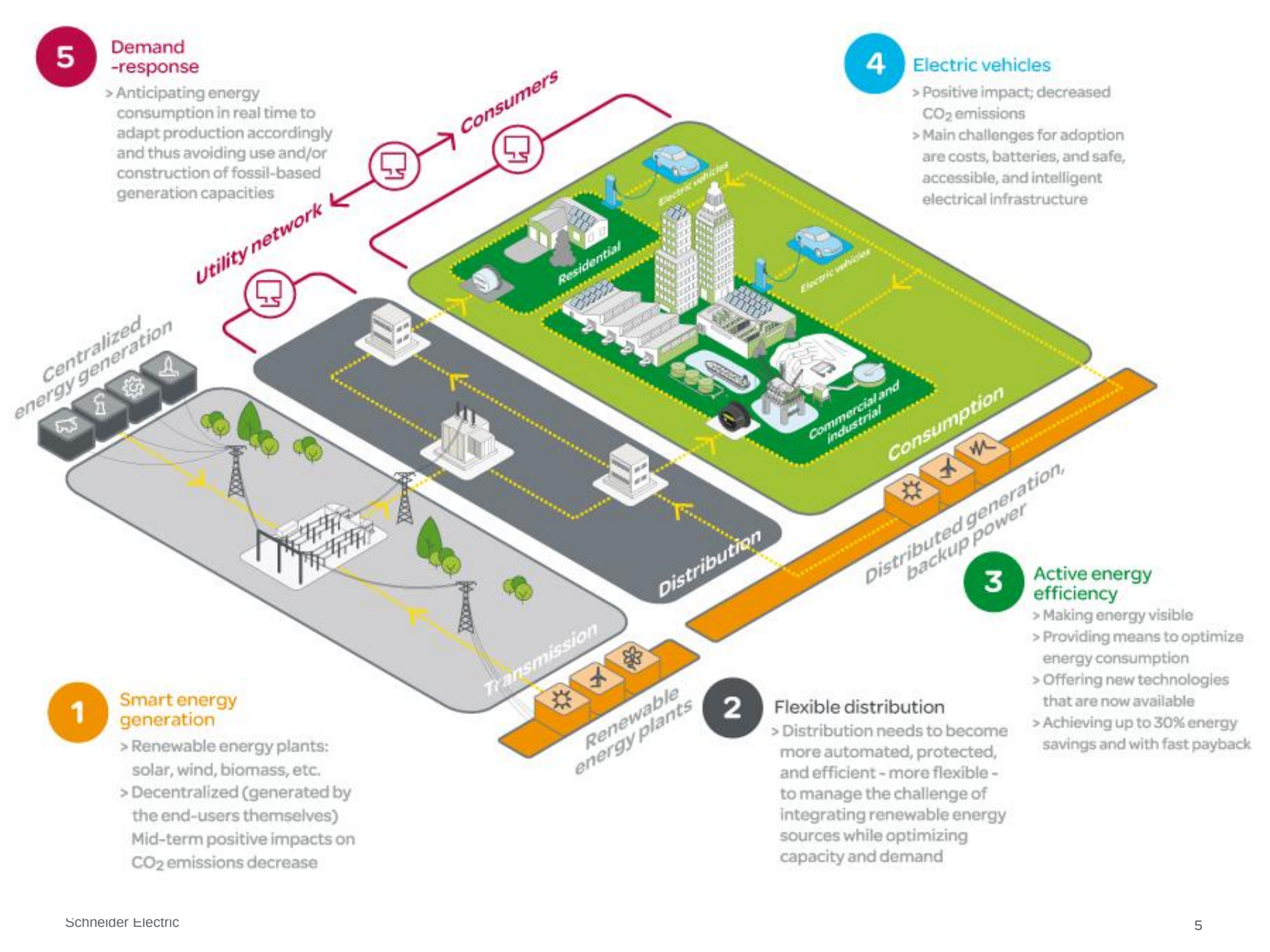


…with 30-70% savings everywhere

up to 30% energy saving

More than 175 years of history

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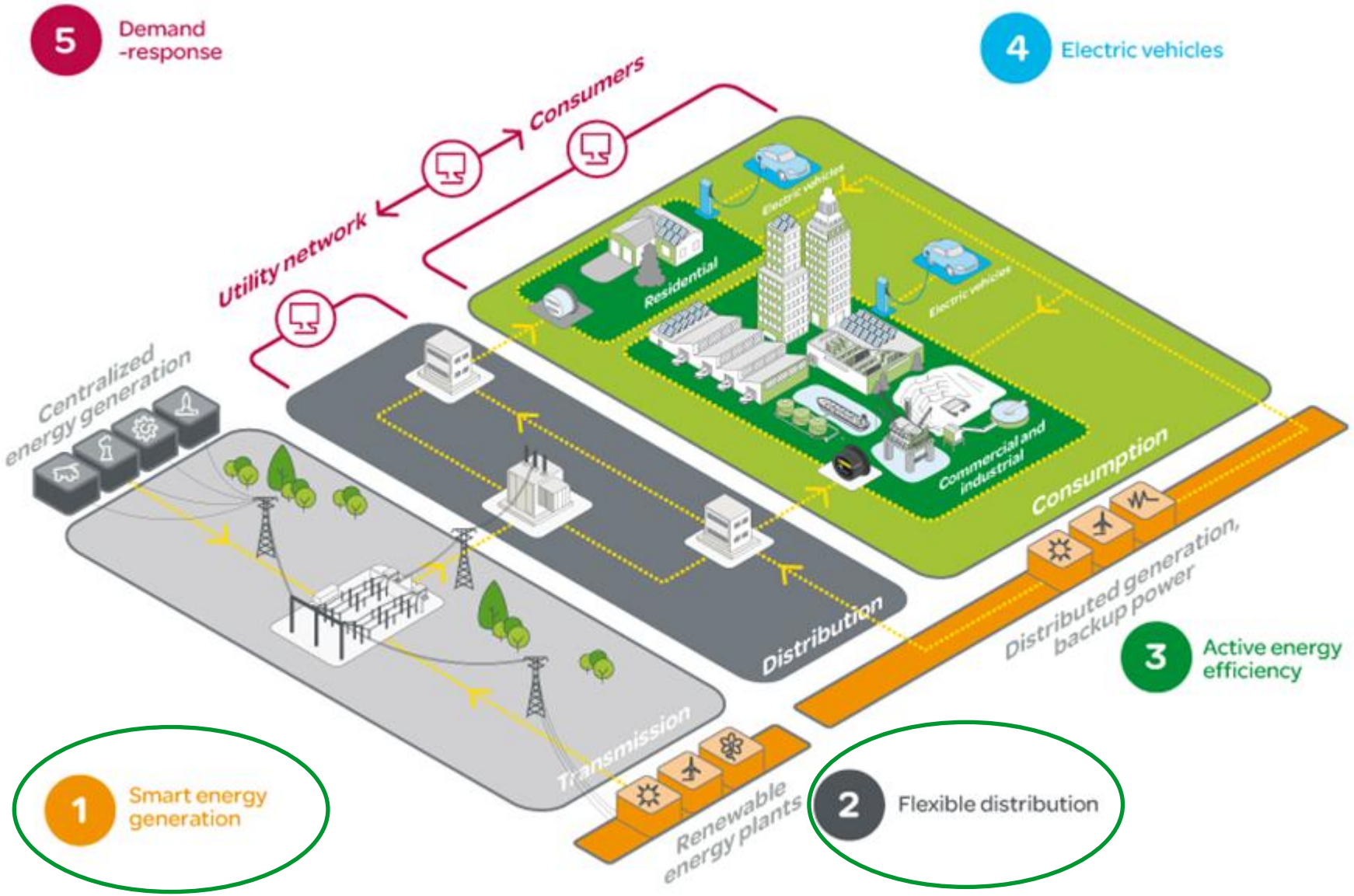
Demand -response
> Anticipating energy consumption in real time to adapt production accordingly and thus avoiding use and/or construction of fossil-based generation capacities
Consumers
Utility network
4
Electric vehicles
> Positive impact; decreased CO_2 emissions
> Main challenges for adoption are costs, batteries, and safe, accessible, and intelligent electrical infrastructure
Electric vehicles
Residential
Electric vehicles
Commercial and industrial
Consumption
Centralized energy generation
Distribution
Transmission
Distributed generation, backup power
Renewable energy plants
1
Smart energy generation
> Renewable energy plants: solar, wind, biomass, etc.
> Decentralized (generated by the end-users themselves)
Mid-term positive impacts on CO_2 emissions decrease
2
Flexible distribution
> Distribution needs to become more automated, protected, and efficient - more flexible - to manage the challenge of integrating renewable energy sources while optimizing capacity and demand
3
Active energy efficiency
> Making energy visible
> Providing means to optimize energy consumption
> Offering new technologies that are now available
> Achieving up to 30% energy savings and with fast payback



-> Grid-interactive features (Volt/Var Control) of power electronics in solar farms
-> Dynamic Line Rating for better integration of renewable energies into the grid

-> Introduction to Telvent DMS Software

Solutions for a smarter grid

A focus on smart generation and smart distribution

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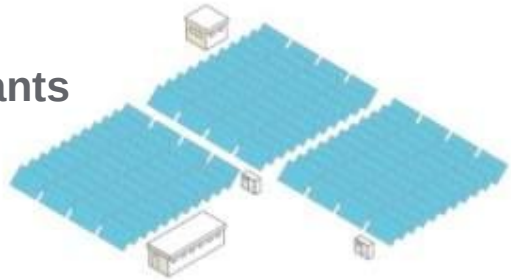
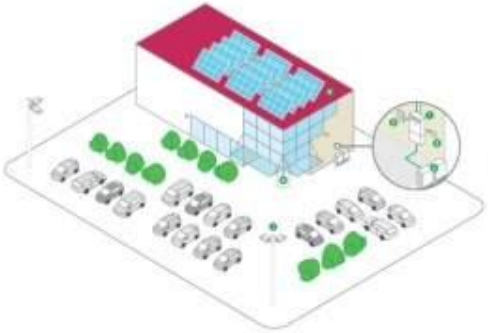
Renewable energies such as wind and solar and developing at a fast pace

Wind power plants

Residential

PV power plants





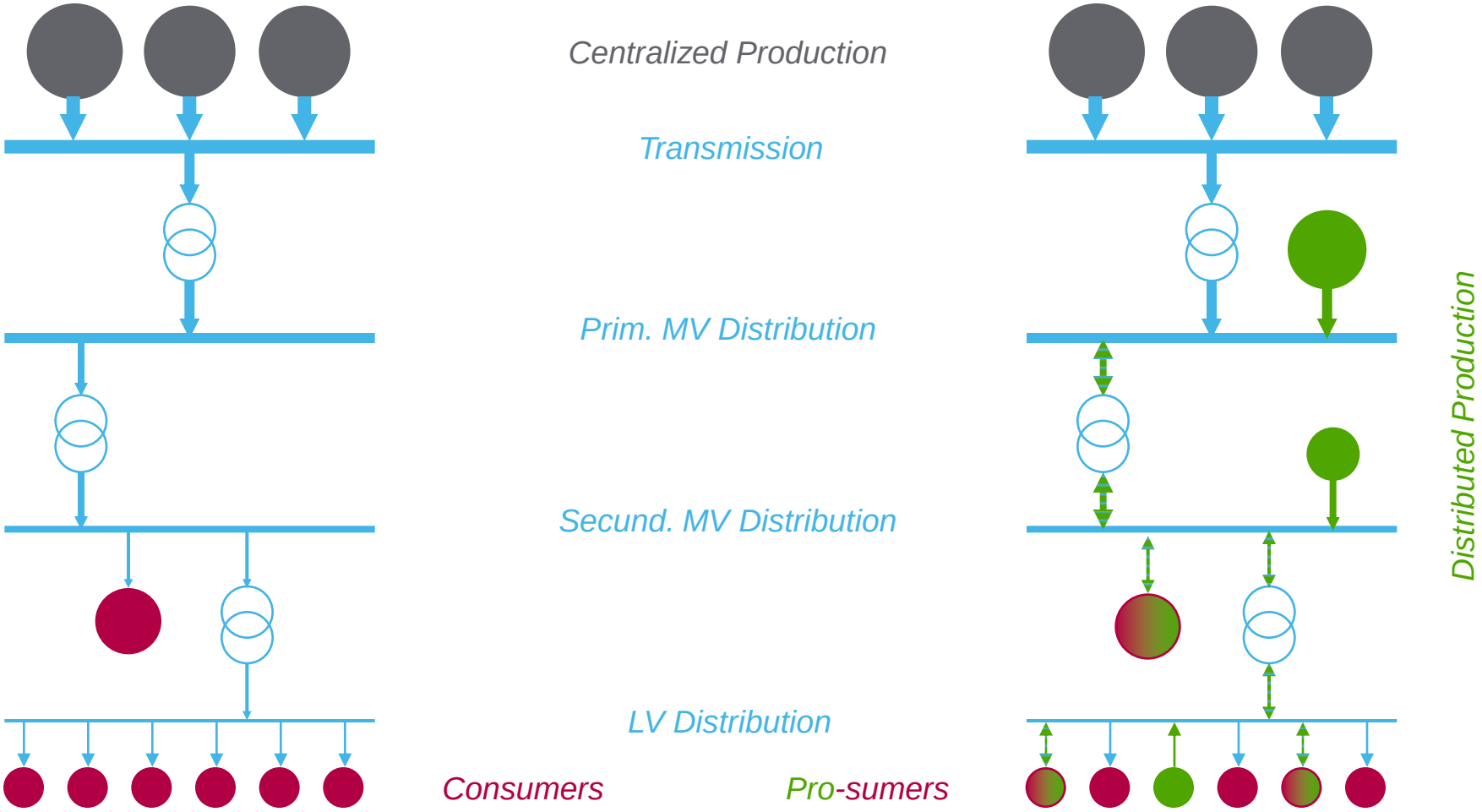
Buildings

Off-grid & back-up

Renewables bring new challenges to grid managers

- Numerous distributed sources of very different sizes
  - Located where the resource is
  - From small kW (residential solar) to some 100th of MW (large wind farms, hydro)
- Intermittent production
  - Seasonal variability
  - Day / night cycles (solar)
  - Intra-day variability that is difficult to forecast
  - Need backup ‘dirty’ generation that negates carbon savings
- New type of machines connected to the grid
  - Power electronic converters
  - Operate differently from traditional electromechanical generators

With Renewables, the grid turns from a top-down scheme to a true network …



… With some potential impacts

- Production – consumption balance more difficult to keep
  - Key issue for grid stability and frequency
- Grid operation and safety becomes more difficult
  - Selectivity of protections
  - Mastering of losses
  - Risk of islanding
  - Voltage stability
- Impact on the grid electrical infrastructure
  - Resizing / creation of lines and transformers ➔ CAPEX
- Quality of Energy
  - Respect of DNO’s commitment to provide calibrated voltage / frequency
  - Power electronics ➔ Harmonics, flicker, DC current

Renewables stimulate new technical opportunities…

- Distributed sources may allow grids to better withstand the loss of a centralized production unit or a local grid incident
  - Islanding can become a degraded mode of operation if it is controlled
- Power electronic converters bring the flexibility of software controlled machines, plus the ability to communicate
  - Ability to operate in different modes
  - Exchange of information with the grid management
  - One component in the Smart Grid

Power electronics in solar PV inverters to control reactive power and AC voltage

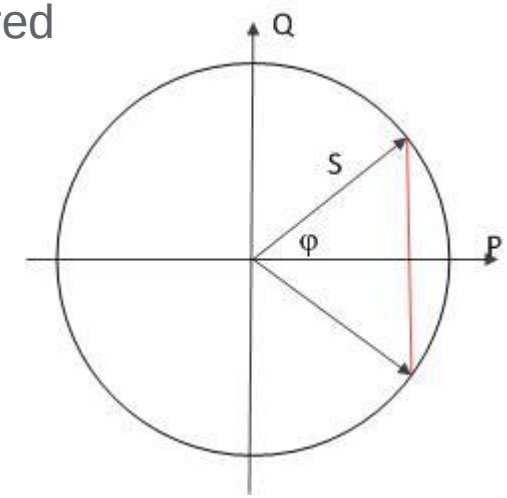
- Grid interactive features such as Volt/Var control and Low Voltage Ride Through have been a key direction of our research & development

	XC540	XC630	XC680
KVA Rating	540	630	680
KW Rating (French Decree)	500	585	630
Max DC Voltage	1000	1000	1000
Nominal MPPT Range	440-800	510-800	550-800
Nominal Input Current	1280	1280	1280
Nominal AC Voltage	300	350	380
Nominal AC Current	1040	1040	1040
Power Factor Range	+/- 0.8	+/-0.8	+/-0.8

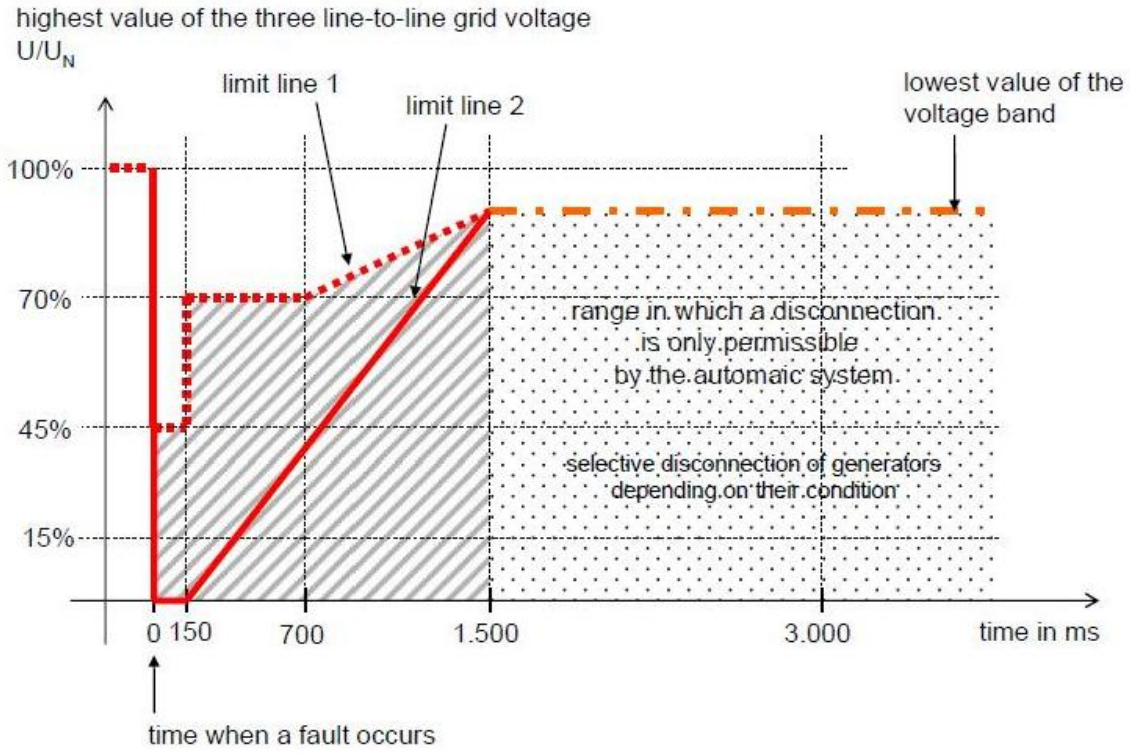
XC series

Grid interactive features

- VAR Control
  - Power factor range from +/-0.8
  - VDC min dynamically adjusts depending on Q delivered



- Low Voltage Ride Through



Dynamic Line Rating with Interconnection Protection Relays

- The MiCOM P341 and P922G Interconnection Protection Relays offer the protection requirements necessary for operating machines in parallel with the main power supply network.

- Dynamic Line Rating (DLR):
  - Protection to optimize transmission line capacity.
  - Enabling more Distributed Generation (DG) such as windfarms to be connected to the grid by taking into account the real time weather conditions

Micom P341

…And make the grid smarter

- Prediction of aggregated production of intermittent sources
- Real Time monitoring of production, demand and flows across the grid
- Demand side management, including Demand Response
- Flexible operating modes, from full reselling to full self-consumption
- Grid support and mitigation of grid failure effects by distributed sources.
- Logical selectivity
- Control of grid parameters (voltage, frequency) by the production of reactive power on demand
- Storage at different levels of the grid

More information
More communication
=
Smart Grids

Smart Information for a Sustainable World

TELVENT

TELVENT is part of Schneider Electric

A Smarter Grid, A Brighter Future

SCADA and RTU provide open, secure operational control for critical grid elements

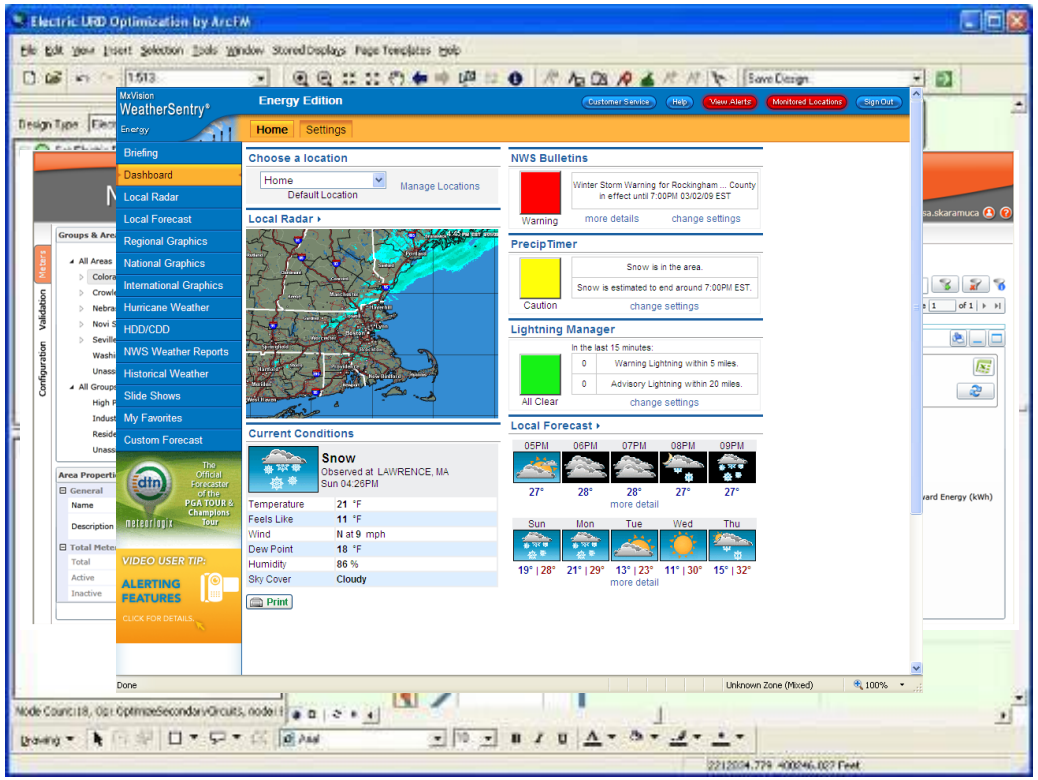
GIS optimizes asset management, saving money and resources. Generate & Maintain Network Model

DMS analyzes, optimizes and automates the grid

OMS improves system reliability and reduces the 'real cost' of service

AMI and MDM enable utilities and customers to work together to save energy

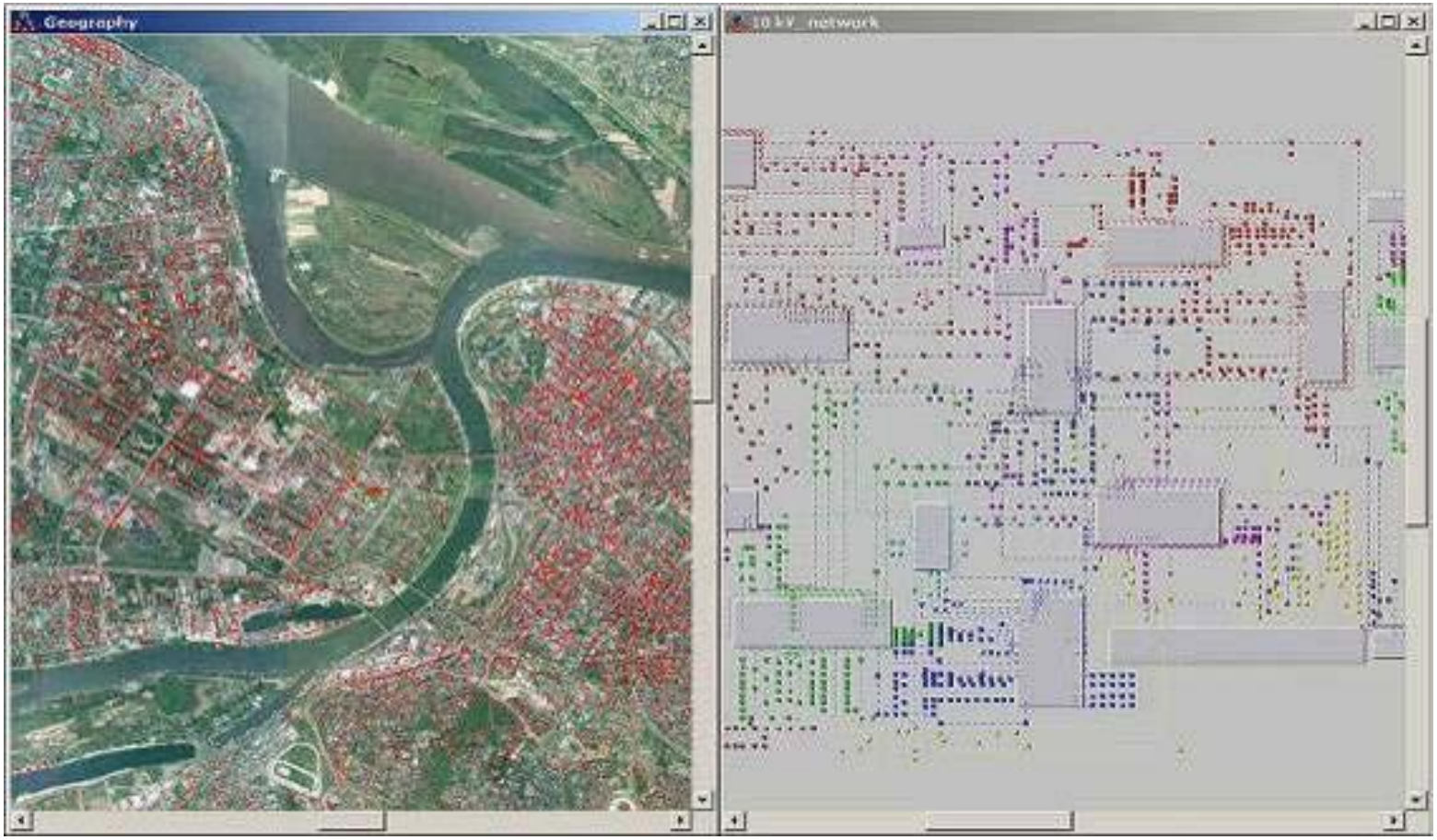
Weather provides situational awareness and drives operational planning and analysis



The Power of the Integration: the best way to success harnessing the information generated and turning it into real-time business intelligence

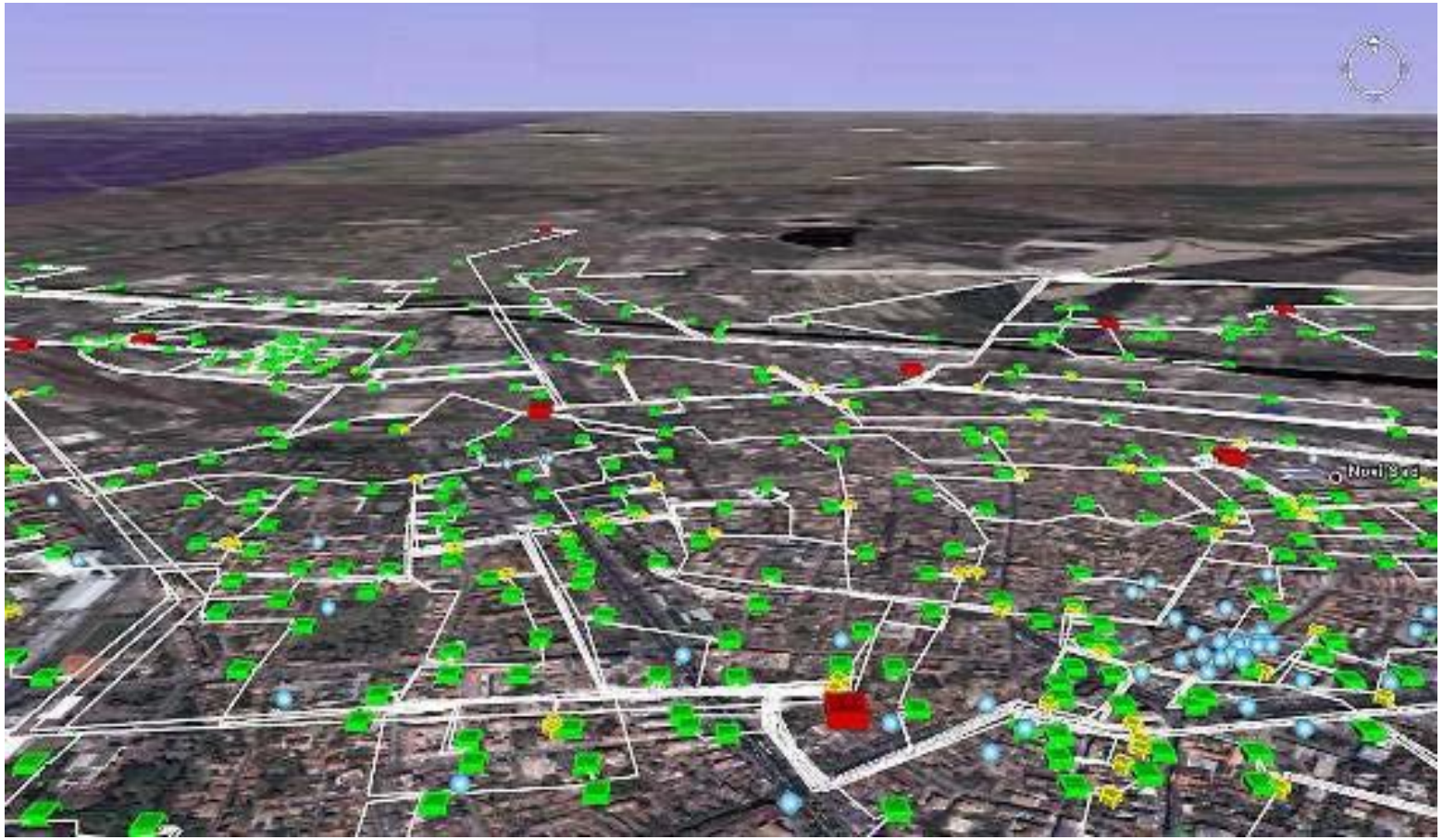
Some views and examples of DMS Software

- DMD multi-view (schematic and geographic diagrams)



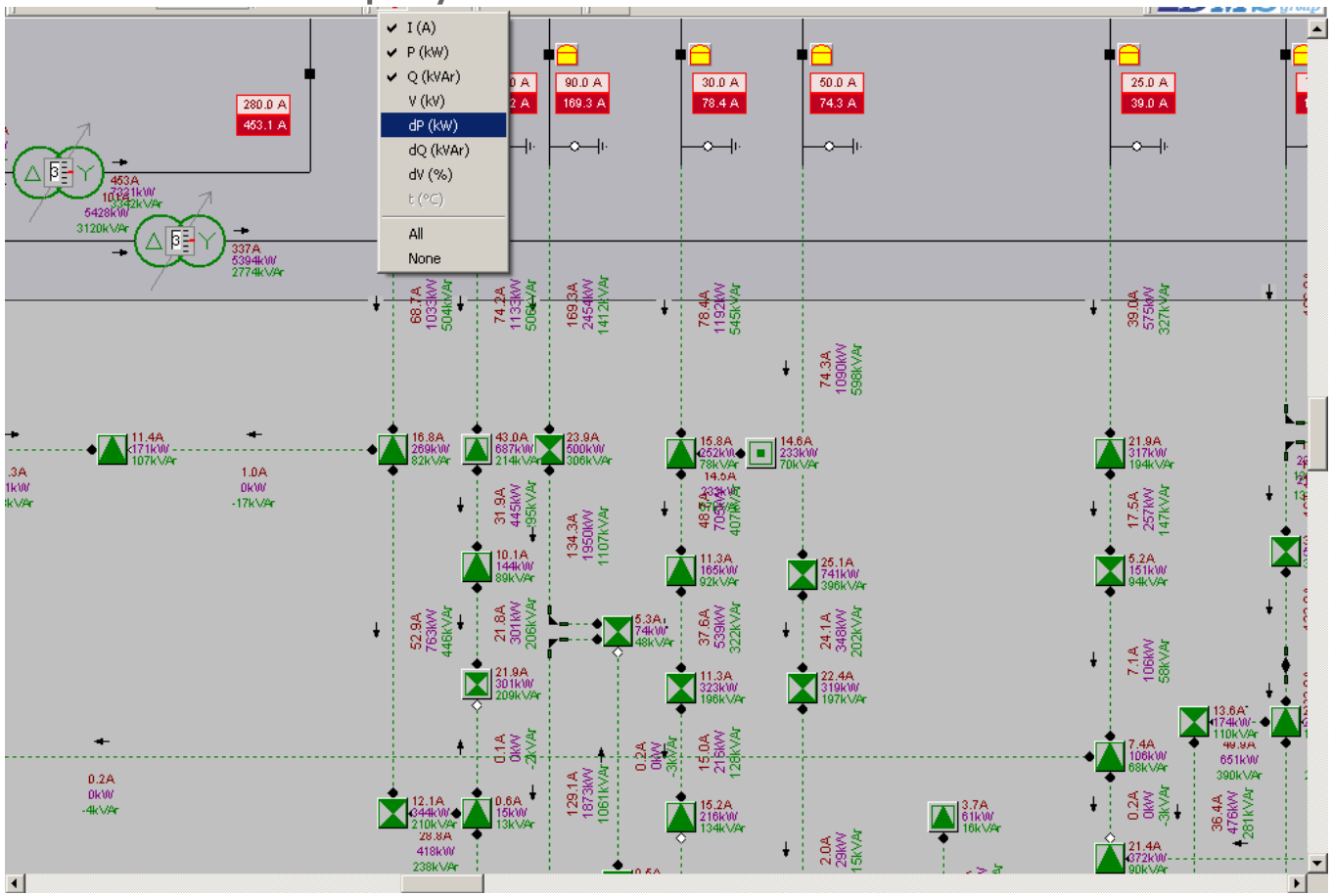
Some views and examples of DMS Software

- DMD 3D view in integration with Google Earth



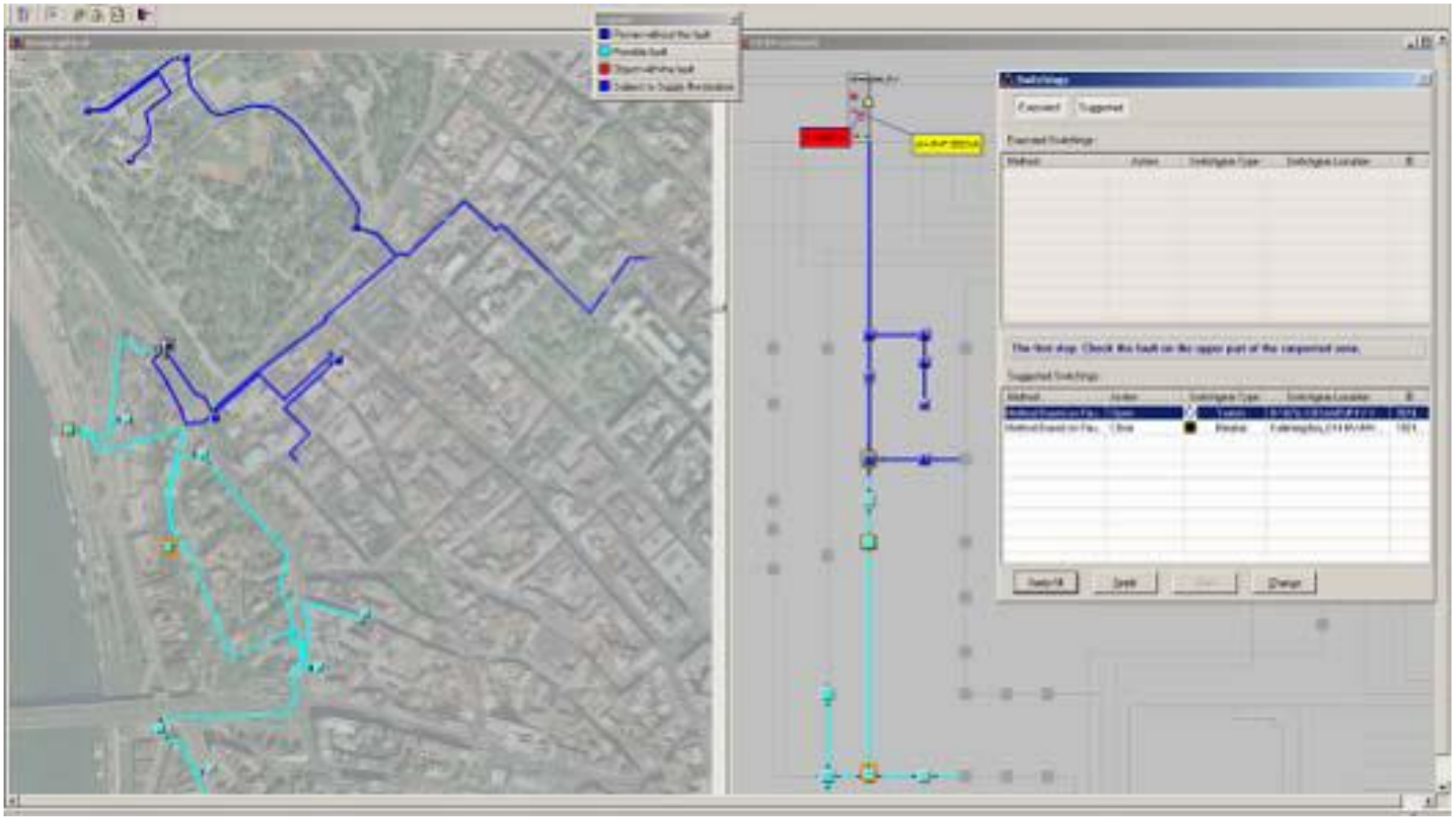
Some views and examples of DMS Software

- Segment of DMD display with Load Flow results and popup menu for selection of displayed values



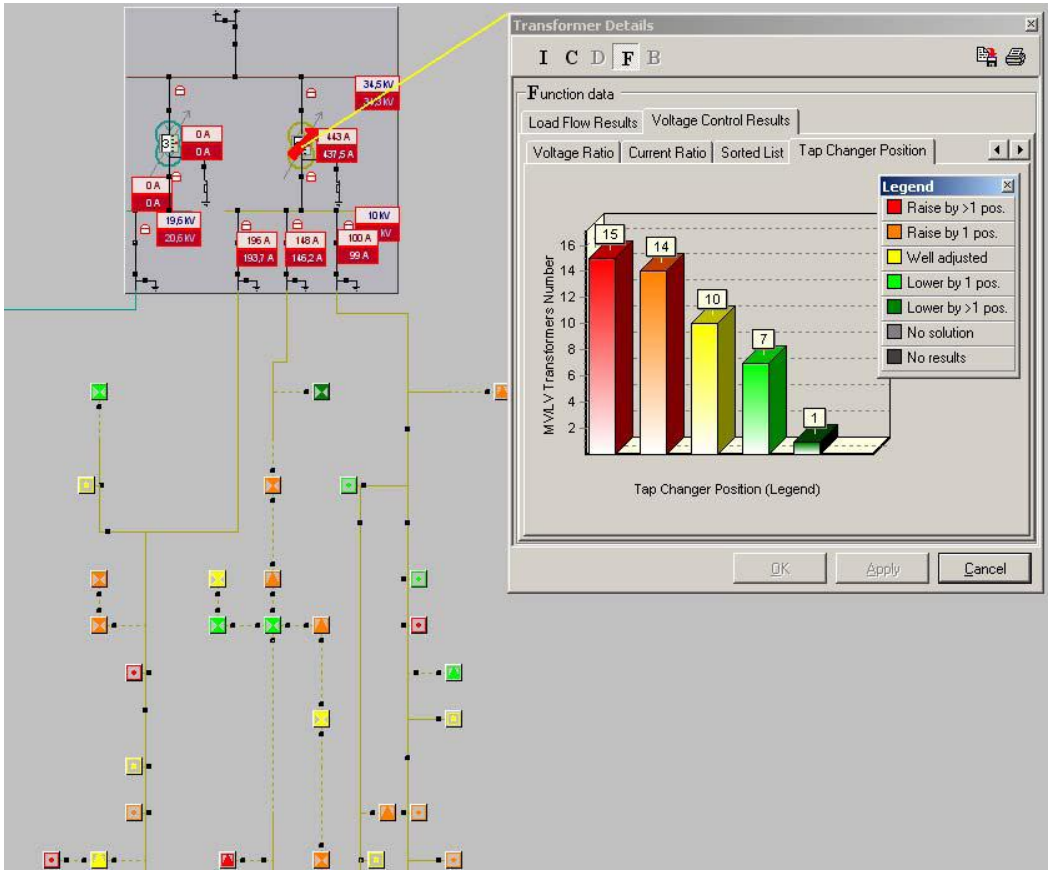
Some views and examples of DMS Software

- Fault Isolation - Recommendation for switching

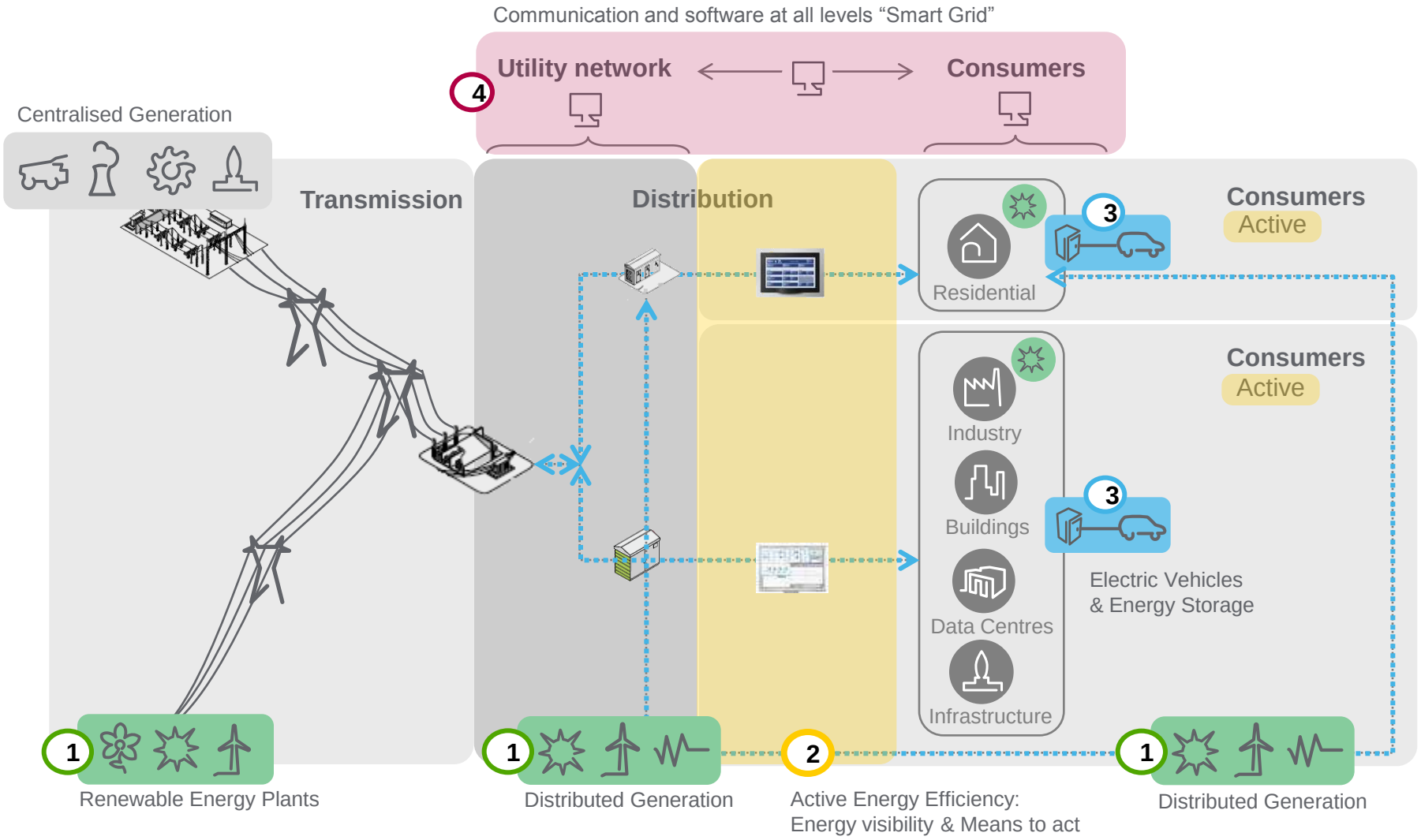


Some views and examples of DMS Software

- Voltage control - optimal positions of OVTCTs tap changers



From one-way energy-only grid to two-way energy+data Smart Grid



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