

Smart or wise or digital grid?

General concept, basic technologies and key benefits.
Products and opportunities.

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Deputy CEO - TAVRIDA ELECTRIC



What is Smart Grid?

American Recovery and Reinvestment and Reinvestment Act of 2009

American Recovery and Reinvestment Act of 2009



Long title An act making supplemental appropriations for job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, State, and local fiscal stabilization, for the fiscal year ending September 30, 2009, and for other purposes.

Colloquial acronym(s) ARRA

Nickname(s) The Recovery Act, Stimulus, The Stimulus Package

Enacted by the 111th United States Congress

Effective February 17, 2009

Citations

Public Law 111-5

[Legislative history](#)

- Introduced in the House as H.R. 1 by Dave Obey (D-WI) on January 26, 2009
- Committee consideration by: [Appropriations and Budget](#)
- Passed the House on January 28, 2009 (244—188)
- Passed the Senate on February 10, 2009 (61—37)
- Reported by the joint conference committee on February 12, 2009; agreed to by the House on February 13, 2009 (246—183) and by the Senate on February 13, 2009 (60—38)
- Signed into law by President [Barack Obama](#) on February 17, 2009

V · T · E

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Total US-state investment > \$800 b.usd.

Smart Grid investments — \$11 млрд.



Energynet
Национальная технологическая инициатива

What are «subjective» reasons?



1 megaflops



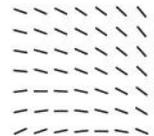
1 gigaflops



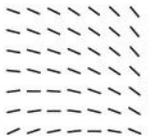
50 CO cycles



20 000 CO cycles



What really happened?



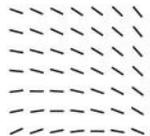
And now we have a new era of Digitalization.

- Tremendous speed of changes
- No standards or new rules every day
- It changes traditional ways of life
- It influences all spheres of life
- No borders at all

How we should apply new technologies?

Problem + Effects + Digital = Digital

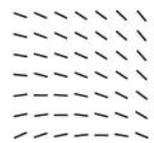
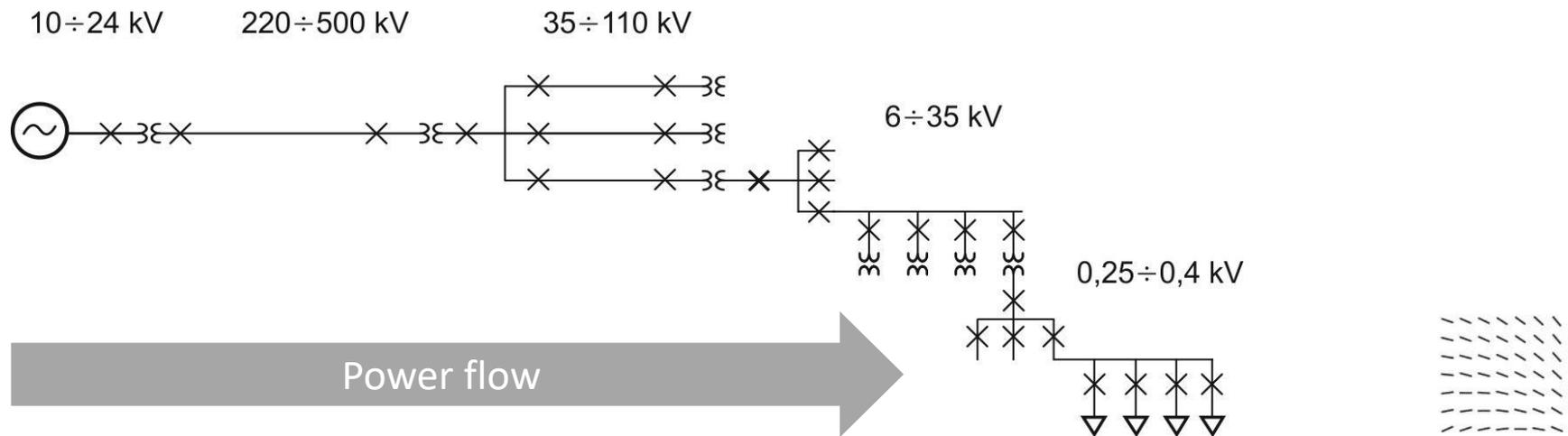
How does it often realized on practice?



What are objective reasons in electrical industry?

- Distributed generation potential appearance.
- Increasement of requirements for reliability and quality of power supply .
- Waiting to reduce the cost of network ownership.
- Simplify the procedure for connecting consumers to the network.
- Growth of energy consumption and changes in its structure.

In the center of it there is a GRID:



What are the problems in the grid?

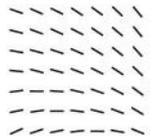
- Depreciation of fixed assets
- Minimal observability
- Knowledge of the regime is minimum
- Outage management system – hand made
- Low reliability and quality

>30%

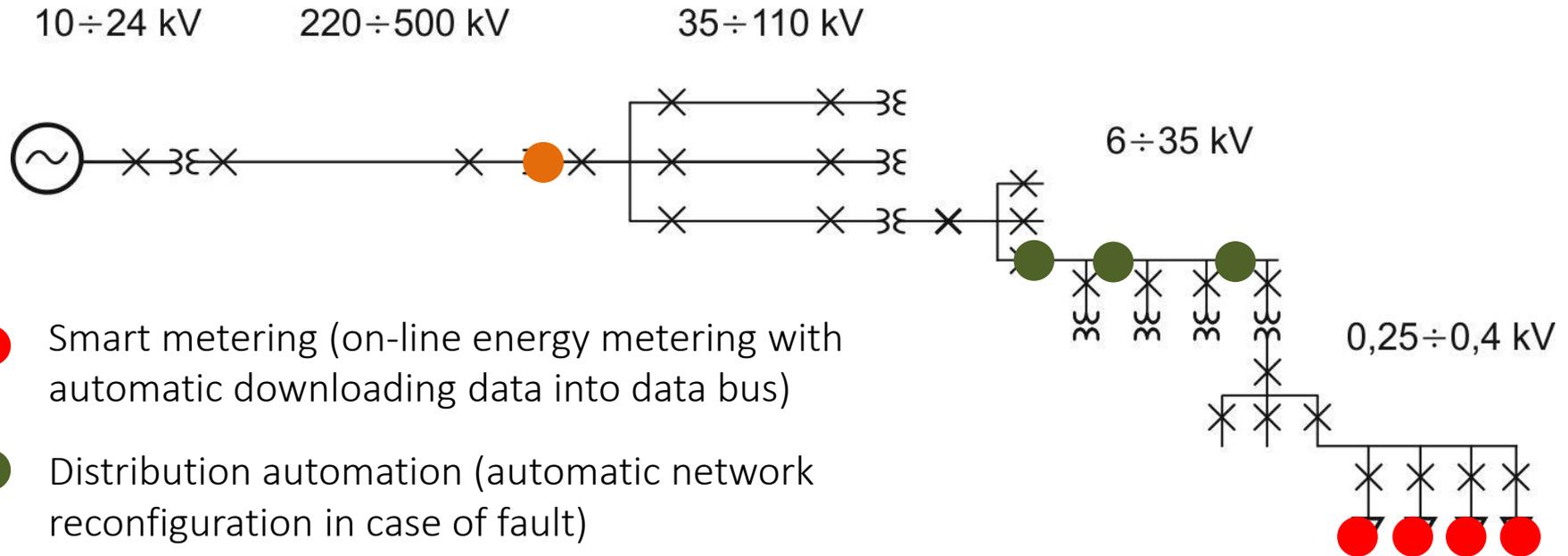
OPEX reserves

>50%

SAIDI reserves



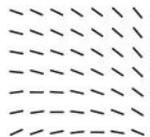
Usual approach?



- Smart metering (on-line energy metering with automatic downloading data into data bus)
- Distribution automation (automatic network reconfiguration in case of fault)
- Digital substations with IEC61850 protocol

The advantages for Smart grid compared with the traditional distribution network:

- Substantial improvement of reliability of supply
- Reduction of power losses
- Reduction of OPEX



And results.



Mexico

Urban overhead lines automation using reclosers

Implementers: CFE, SEL, TEL

Amount: ~ 1500 reclosers

Results:

- SAIDI reduce ~ 50%



San-Paolo

Urban overhead lines automation using reclosers

Implementers : AES, ECIL, TEL

Amount : ~ 2200 reclosers

Results :

- SAIDI reduce ~ 16%
- SAIFI reduce ~ 30%



Chattanooga

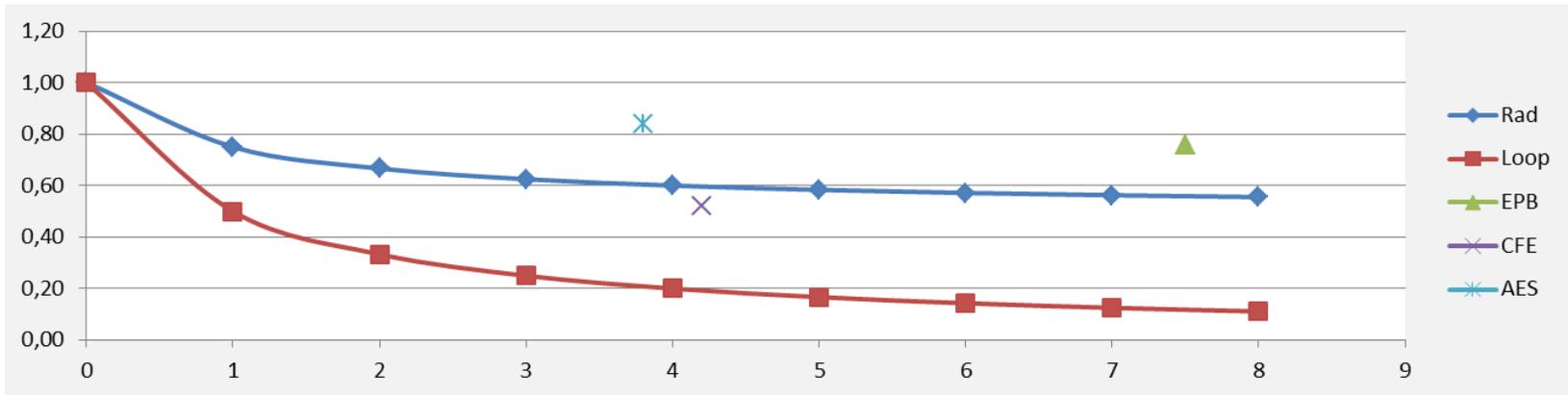
Urban overhead lines automation using reclosers

Implementers : EPB, S&C

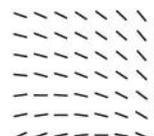
Amount : ~ 1200 reclosers

Results:

- SAIDI reduce ~ 24%



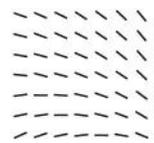
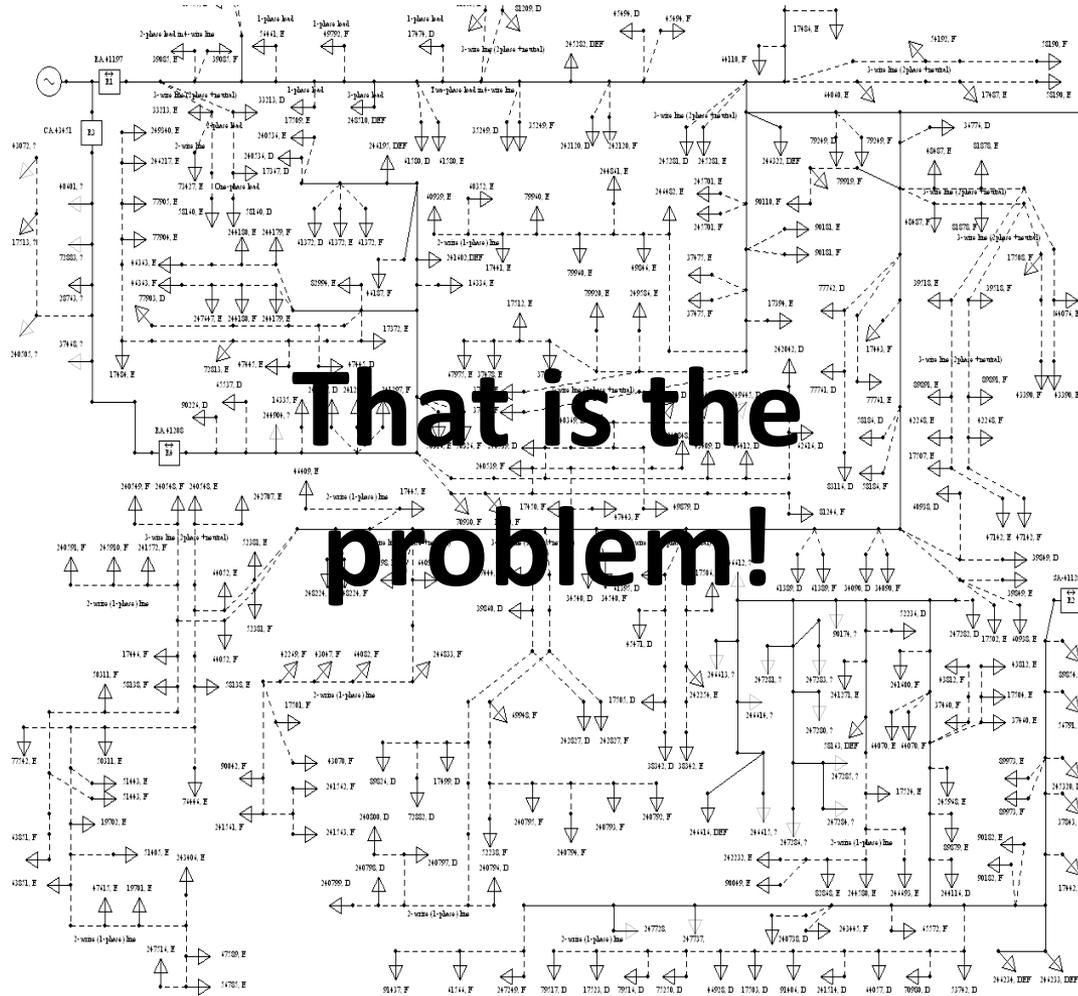
- Reasons for the lack of projects efficiency:
- **Lack of theory understanding (what mainly affects reliability of supply)**
 - **Lack of adequate tools (software, firmware, devices) for solution of this task**



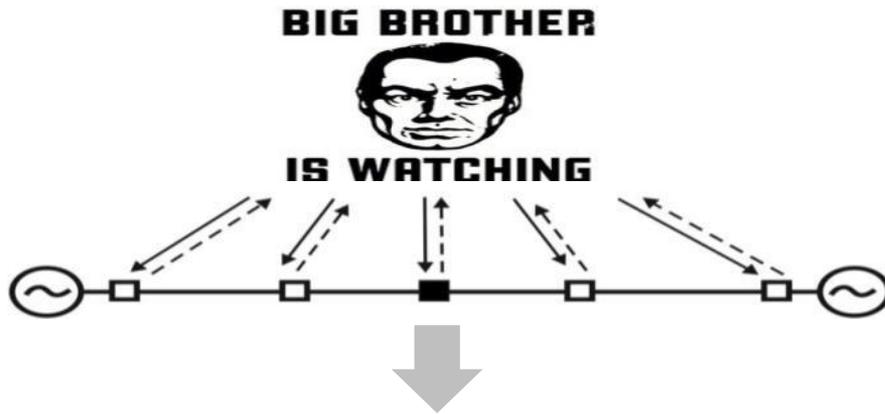
Why? Why? Why?

«We would like to have no settings at all for all of our smart devices!».

Chief of automation department?
AES Utility, Brazil



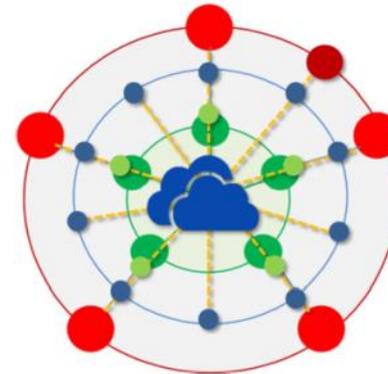
We reinvented Digital grid!



Formal Energynet task for the grid:

The business model of a network utility company of a new technological order providing reliability, quality, availability and level of losses at the best world level with a minimum cost of ownership (target - 75% of the current cost price).

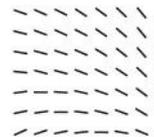
RES (power grid region) – elementary scalable unit of the grid company, necessary and sufficient for changing of the whole thing (private or state utility of any size).



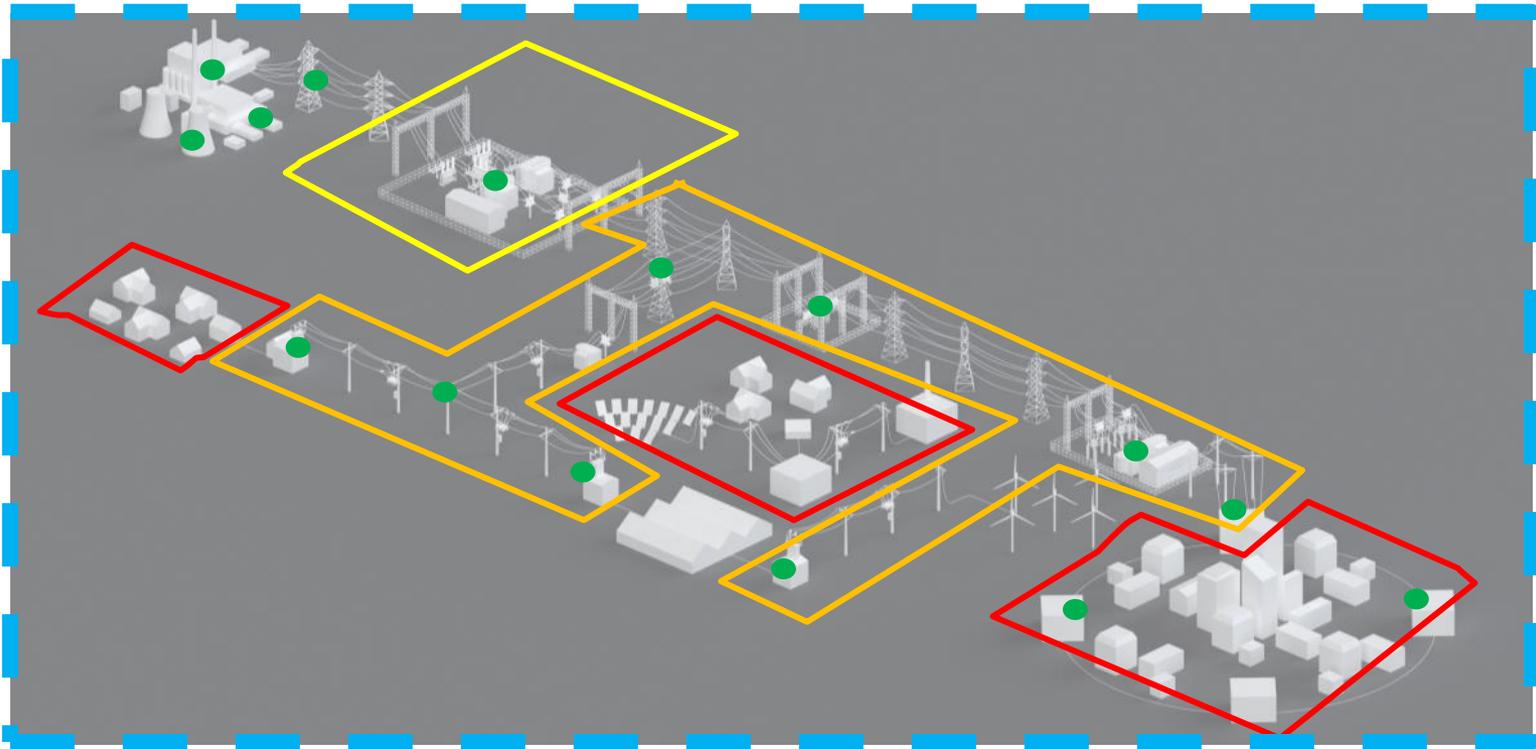
- Power supply centers 110 kV
- Consumer's compact substations 10/0,4 kV
- 110 kV network
- 10-35 kV network
- 0,4 kV network



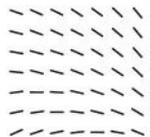
The organs of the circulatory system	The organs of the electrical system
Blood, vessels	Line impedance
Neurons and muscles	Smart devices (reclosers)
Brain	SCADA



Basic technologies.



-  Digital substation
-  Digital grid area with energy loss analysis
-  Blockchain technology for the billing
-  Digital monitoring and assets management
-  Digital solution support system



Kaliningrad Energynet pilot project.

CREATION OF PILOT CLUSTER FOR TESTING BASIC SMART GRID TECHNOLOGIES, AIMED AT THE ACHIEVEMENT OF TARGET INDICATORS OF POWER GRID:

- power supply reliability
- optimisation of operating costs
- minimisation of energy losses



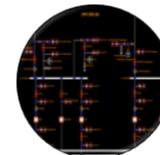
2016

STAGE #1:
Distributed automation of grids and substations (DA)



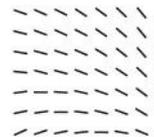
2017

STAGE #2:
Intelligent energy audit and management (AMS)



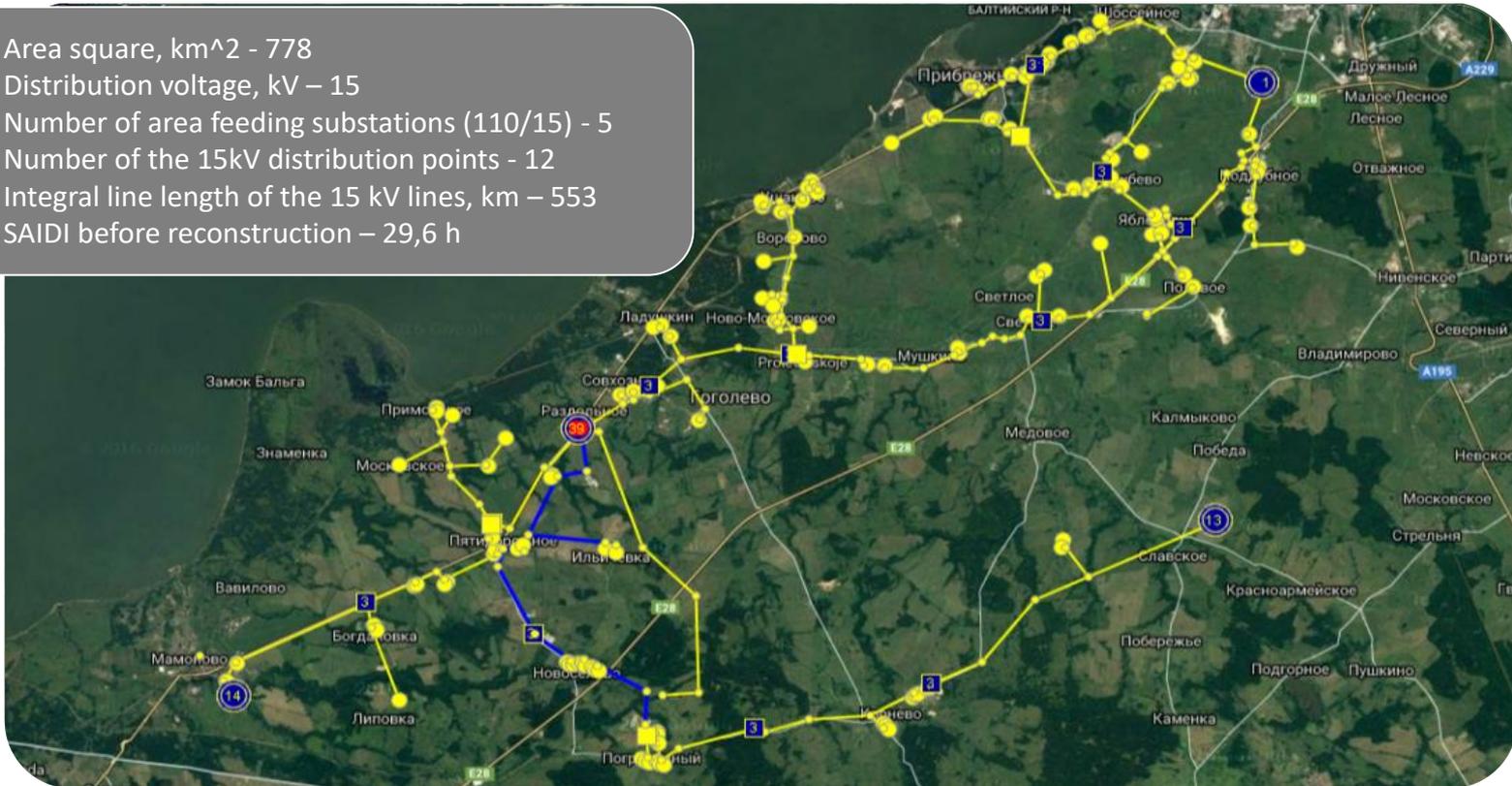
2018

STAGE #3:
Operation process and situational control of grids (DMS/OMS)



Kaliningrad Energynet pilot project.

- Area square, km² - 778
- Distribution voltage, kV – 15
- Number of area feeding substations (110/15) - 5
- Number of the 15kV distribution points - 12
- Integral line length of the 15 kV lines, km – 553
- SAIDI before reconstruction – 29,6 h



Kaliningrad Energynet pilot project.

STAGE #1: Distributed automation of grids and substations (DA)



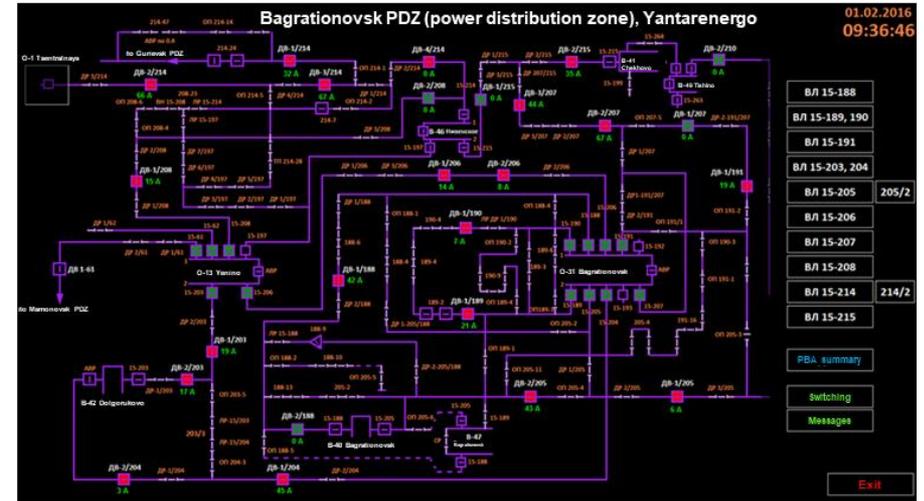
Smart retrofit of main substations

Modernisation of existing main substations in terms of replacement of outdated switching devices and power system protection by digital bay controllers, digital current and voltage sensors and up-to-date vacuum switches.



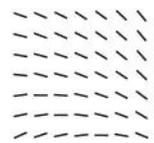
Intelligent reclosers

Integration of intelligent switching devices in grid aimed at automatic identification and localization of faults in distribution grid.



SCADA-power distribution zone system

Engineering of full-scale SCADA-power distribution zone system with integration of 100% automatic and non-automatic switching devices. Allow for operational management of the entire zone grid as well as of individual 15 kV feeders to control emergency and repair modes in grid.



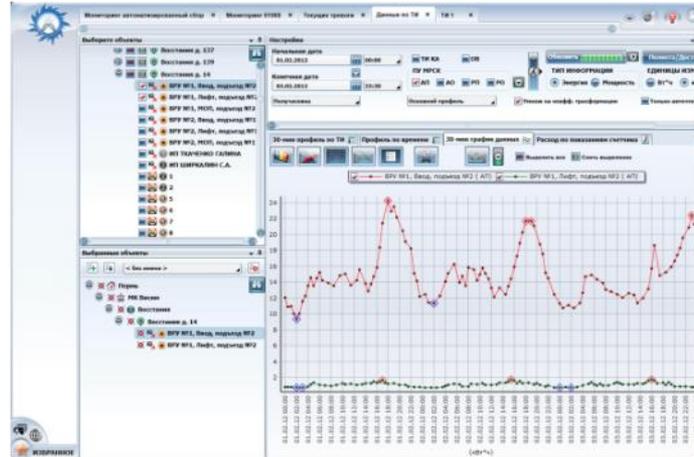
Kaliningrad Energynet pilot project.

STAGE #2: Intelligent energy audit and management (AMS)



Intelligent energy meters

Integration of digital meters equipped with the data transmission device in the grid at a level of end users and tie stations for updating of the grid analyser and energy consumption management.



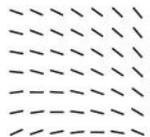
Energy consumption management system

Implementation of software enabling to collect, process and store information on energy accounting, computerise calculation of balance, energy losses for the detection of causes and extents of losses as well as for optimisation of costs for taking readings from metering devices.



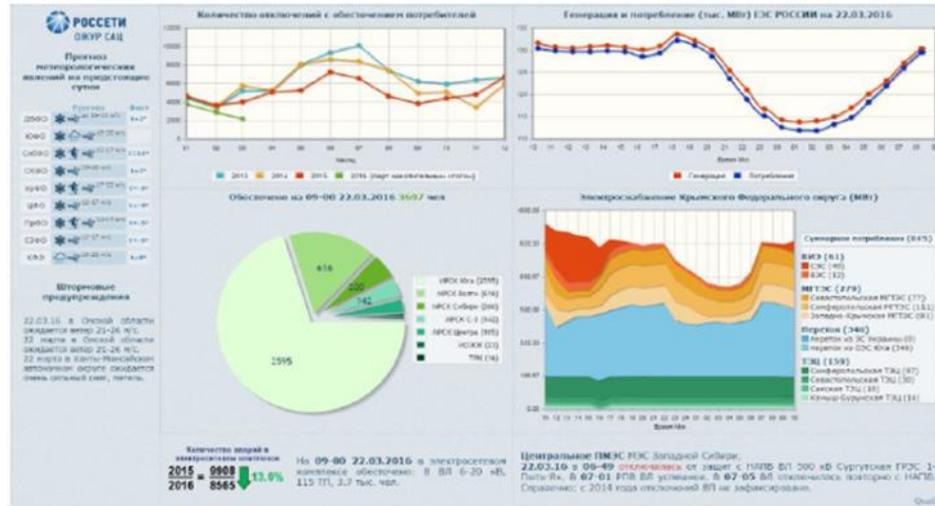
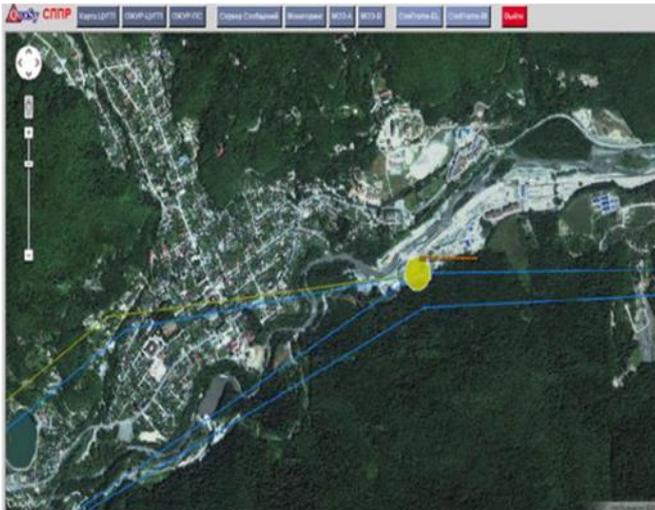
Consumer's desktop

- 24-hour access via Internet
- consumption data remote review
- energy costs optimisation
- energy company feedback



Kaliningrad Energynet pilot project.

STAGE #3: Operation process and situational control of grids (DMS/OMS)

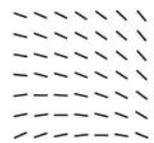


Integrated DMS/OMS-system

Shared IT system for operation process and situational control providing the creation of integrated model of network based on requirements of CIM IEC61970/IEC61968 standard, automated collection of all operational information at all levels of operation process and situational control, improve substantiation and timeliness of the managerial decision-making procedure.

ОЖУР situational control system

Integrated system providing support in making managerial decisions at a level of situational and analytical centre of grid company. The system allows for the creation of ontology-based model of the grid company activities, collect and process big packages of unstructured data about grid events as well as leave behind paperwork when dealing with operation process and situational control. ОЖУР enables to minimise time and human resources during the preparation of consolidated analytical information to control normal and emergency operating modes.



Efficiency of the project.

Before

11,9

25,2

15

RELIABILITY

Number of outages per customer a year (SAIFI), %

▼ 73,4%

ENERGY LOSSES*

Losses of the electrical energy, %

▼ 14,6%

OBSERVABILITY

Value of remote control objects in the system, %

▲ 85%

TOTEX*

Total operating costs per pilot zone area, %

▼ 25%

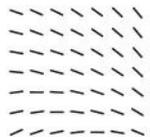
After

3,15

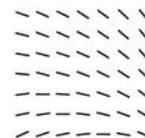
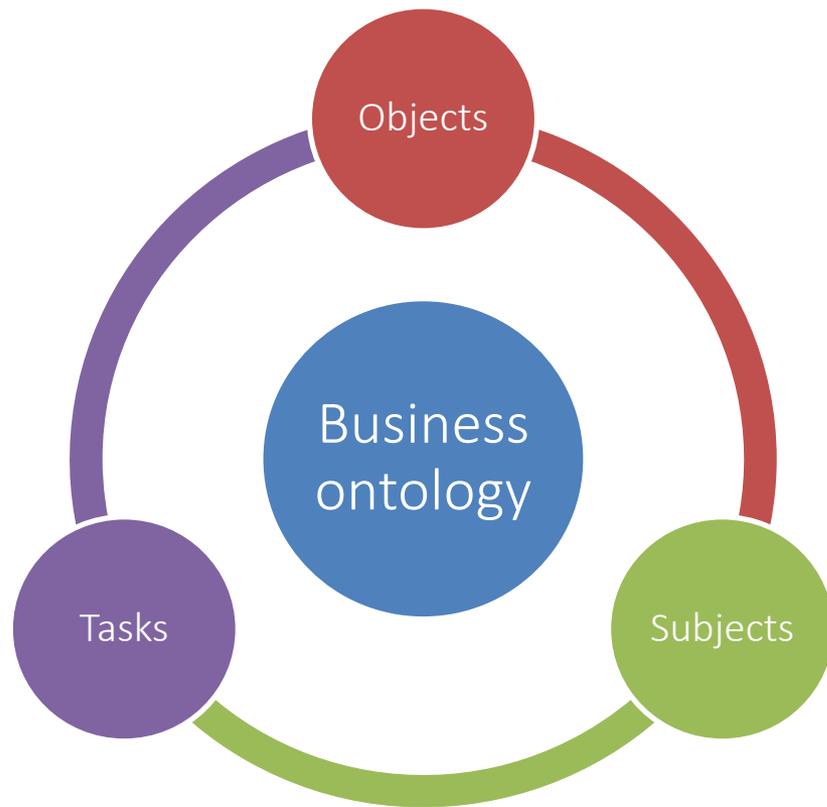
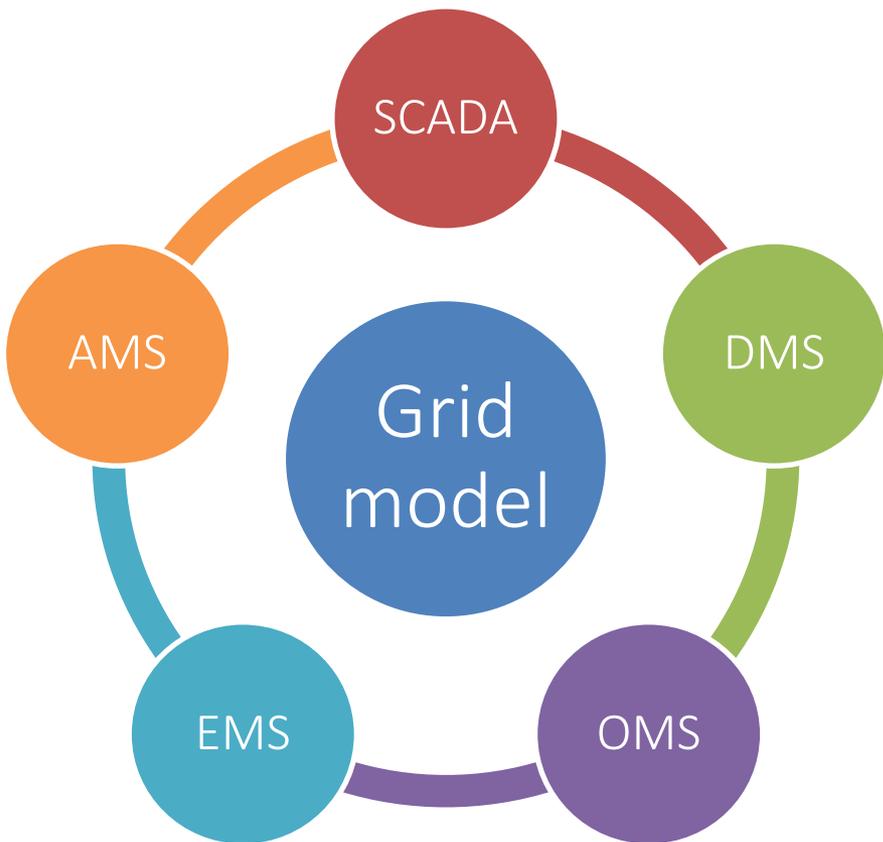
10,6

100

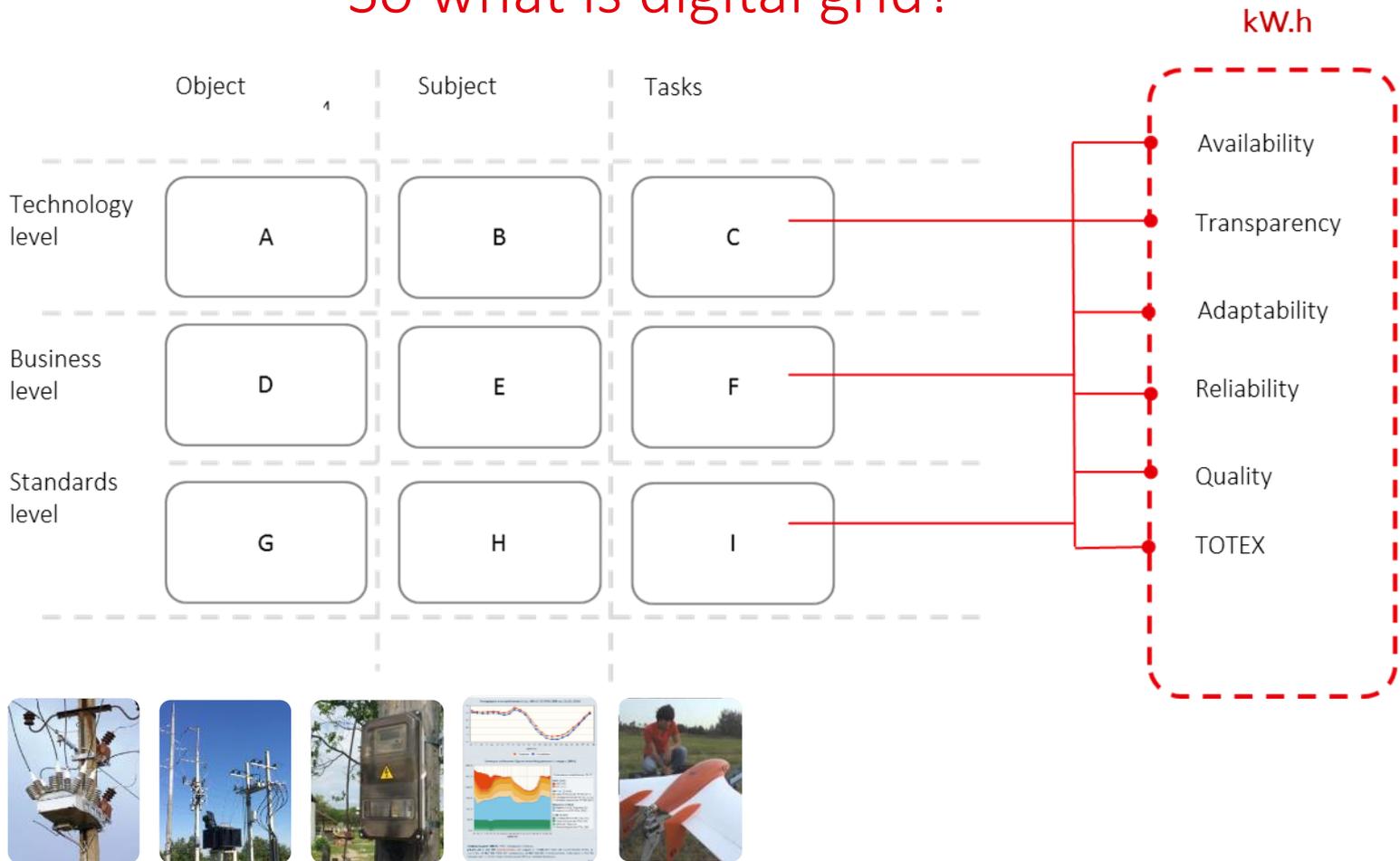
Total investments 4,7 m.USD
Payback period < 5 years*



Fundamental basics.



So what is digital grid?



New business model supported by new digital technologies focused on the key parameters of the key product – kWh



From products to solutions.



Oman,
Mazoon Electricity Company
(MZEC)



UAE,
Al Ain, one of the biggest
residential complexes



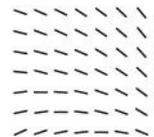
Saudi Arabia,
Retrofit for Saline Water
Convention Corporation (SWCC)



UAE,
Distribution automation for the
Federal Electricity Authority



UAE,
Equipment for the biggest shopping
center in AJMAN



Energygrid
Национальная
технологическая
инициатива

Wide range of solutions and companies.



Thank you for your attention!

