
PaaS
SAKURA-IIoT
INNOVINNPROM
Operational Excellence
Maintenance & Repair
Asset Performance Management
SaaS “SAKURA-APM”
innovinnprom.com
INDUSTRY 4.0

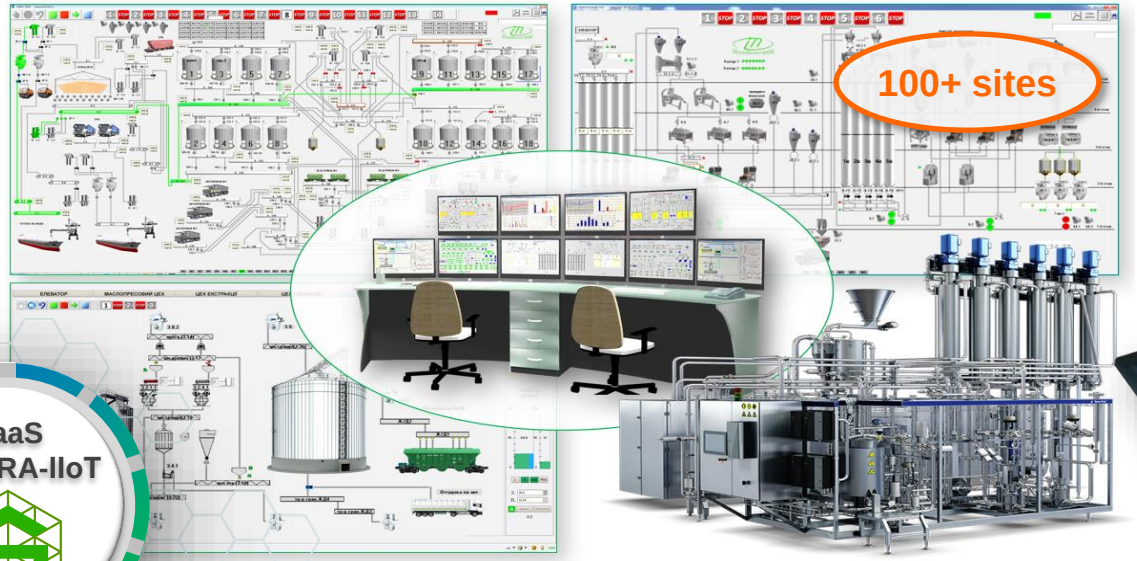
INNOVINNPROM: Products & Solutions

APM/MES/ERP/PLM

8 sites

PaaS SAKURA-IIoT

Automated Design System “Route” / SCADA



100+ sites

Crystal Growing Systems

3 lines

Car Sampling Systems

45 sites

Hopper Railway Car Robotic Sampling Systems

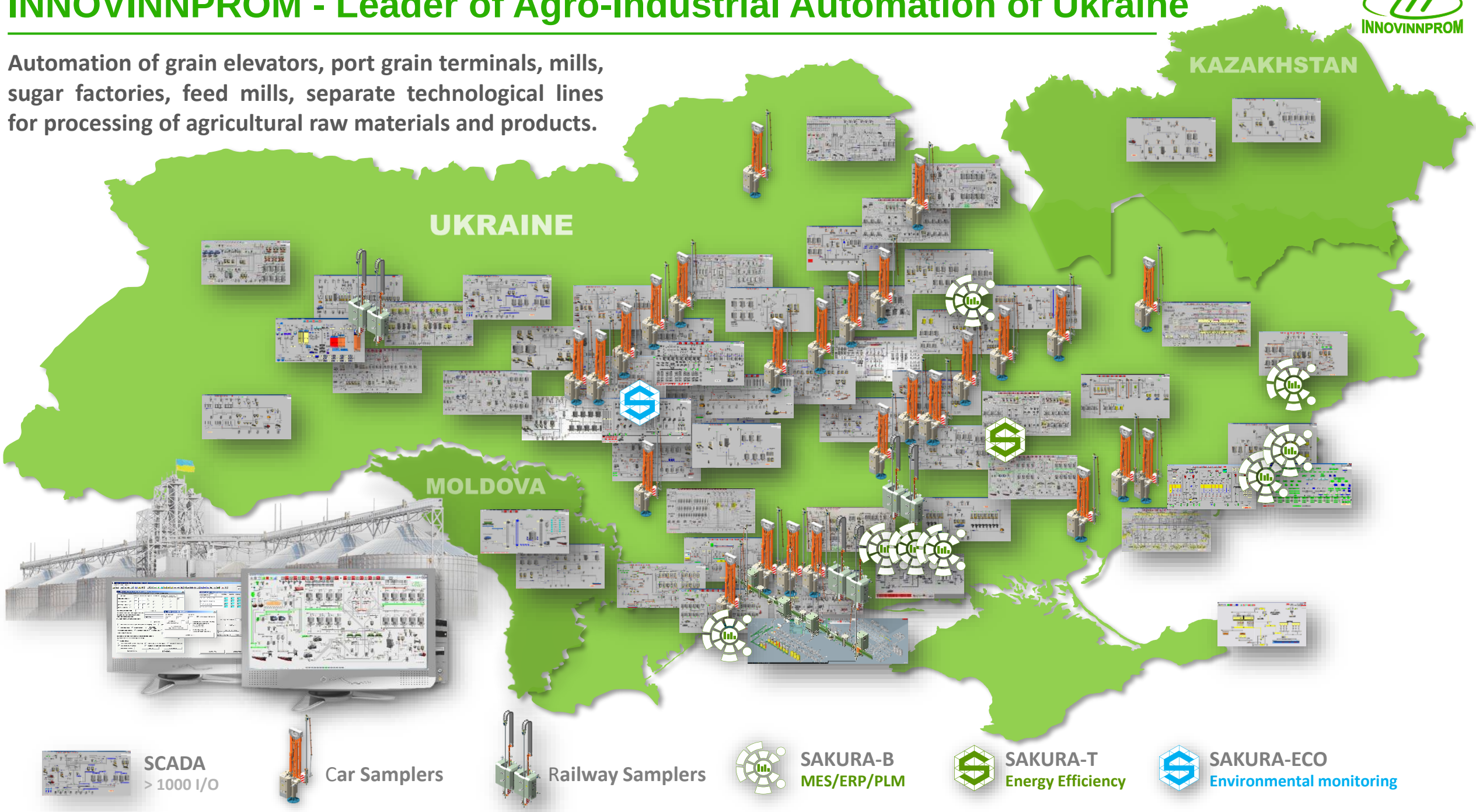
4 sites

Monitoring Systems

50+ sites

INNOVINNPROM - Leader of Agro-Industrial Automation of Ukraine

Automation of grain elevators, port grain terminals, mills, sugar factories, feed mills, separate technological lines for processing of agricultural raw materials and products.



SCADA
> 1000 I/O

Car Samplers

Railway Samplers

SAKURA-B
MES/ERP/PLM

SAKURA-T
Energy Efficiency

SAKURA-ECO
Environmental monitoring

INNOVINNPROM: Company Landscape

Vendors

SIEMENS
Schneider Electric
RITTAL
WAGO
CISCO
ZEMIC
CAMOZZI
ifm
PF ПРОМФАКТОР
ОДЕСКАБЕЛЬ
LAUMAS
FESTO
TELTONIKA
Klemsan
HYDRAULIC LINE ГИДРАВЛИКА ИЗ ПЕРВЫХ РУК
ОВЕН
electro cable GROUP
OMRON
MOXA
ETI
Weidmüller
PHOENIX CONTACT INSPIRING INNOVATIONS
УКРАЇНСЬКА ЕЛЕКТРОТЕХНІЧНА КОРПОРАЦІЯ АСКОУКРЕМ
DKC
EATON
IOT Solutions
LAPP GROUP
VIPA A YASKAWA COMPANY
MOELLER
DEGSON
OBO BETTERMANN
ABB
БКЗ БЕРДЯНСКИЙ КАБЕЛЬНЫЙ ЗАВОД
Develiot

Suppliers

СВ АЛЬТЕРА
galantpol
ALT UKRAINE

Designers

ПОЛТАВАГРОПРОЕКТ

IT

Google Cloud
Microsoft Azure
amazon web services
Grafana Labs
kubernetes
HAULMONT
spring
IntelliJ IDEA
Java
influxdb
chronograf
HAPROXY
PostgreSQL
MESH
PATRONI
APACHE HTTP SERVER PROJECT
Apache Guacamole
UltraVNC
HETZNER ONLINE
docker

Main Clients

МХП АГРОІНДУСТРІАЛЬНИЙ ХОЛДИНГ
UkrLandFarming Public Limited Company
RIOLA CONSTRUCTION GROUP
KERNEL GROUP OF COMPANIES
АгроСпец Сервис
КОРОЛІВСЬКИЙ СМАК
АСТАРТА-КИЇВ агропромхолдинг
ДЕРЖАВНА ПРОДОВОЛЬЧО-ЗЕРНОВА КОРПОРАЦІЯ УКРАЇНИ
НОВІ ПРОДУКТИ
cygnet AGROCOMPANY
НІБУЛОН
агро прайм ХОЛДИНГ
НТТ Новотех-термінал
agrotrade

DIH

АППАУ Асоціація «підприємств промислової автоматизації України»

Vinnytsia cluster of instrument making and automation:

ПРОМАВТОМАТИКА Our synergy is your energy
Liana Company
ТЕРМІЯ
vtnled.com
Viasoft
ПОГ "Вінницьке УВП УТОС"
MAITEK
VINAERO
НВП "ГРЕМПІС" автоматизація обліку енергоносіїв
TIRAS

Universities

ВНТУ ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ
ДонНУ

Innovations

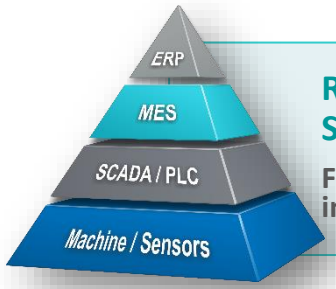
Operational Excellence

Reduction of air emissions

Energy efficiency

Digital product passport

PaaS SAKURA-IIoT INNOVINNPROM



Reasonable Simplification

Four systems into one

SaaS

SACURA-APM

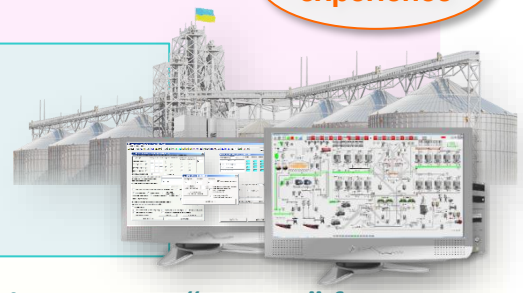
Asset Performance Management

ROUTE-ADC

Agro-Industrial Enterprises SCADA

Improving the system

Adding new features and capabilities



Industrial Internet of Things · · Autonomous Factories

Big Data & Data Sharing · · Digital Twins

Cloud Computing · · AI & ML

Environmental impact analysis

Round-the-clock control

SaaS

SACURA-ECO

Environmental control

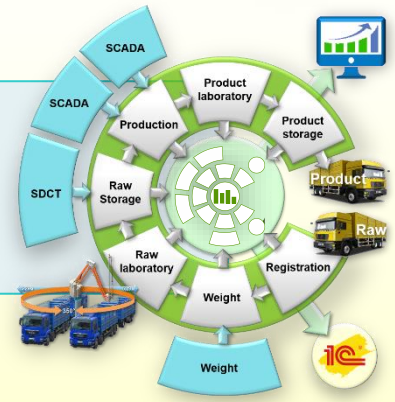
SaaS

SACURA-Business

ERP/PLM/MES

Transfer to cloud services

Provision of services as SaaS



Shared databases

Open Source

Support for all OT and IT protocols

Application of modern IT technologies

Ability to integrate cheaper IoT devices and sensors

Cooperation with DIH and universities

Customer Intimacy

Innovations in better adaptation

30 years of experience

Automated Design System “ROUTE” for SCADA

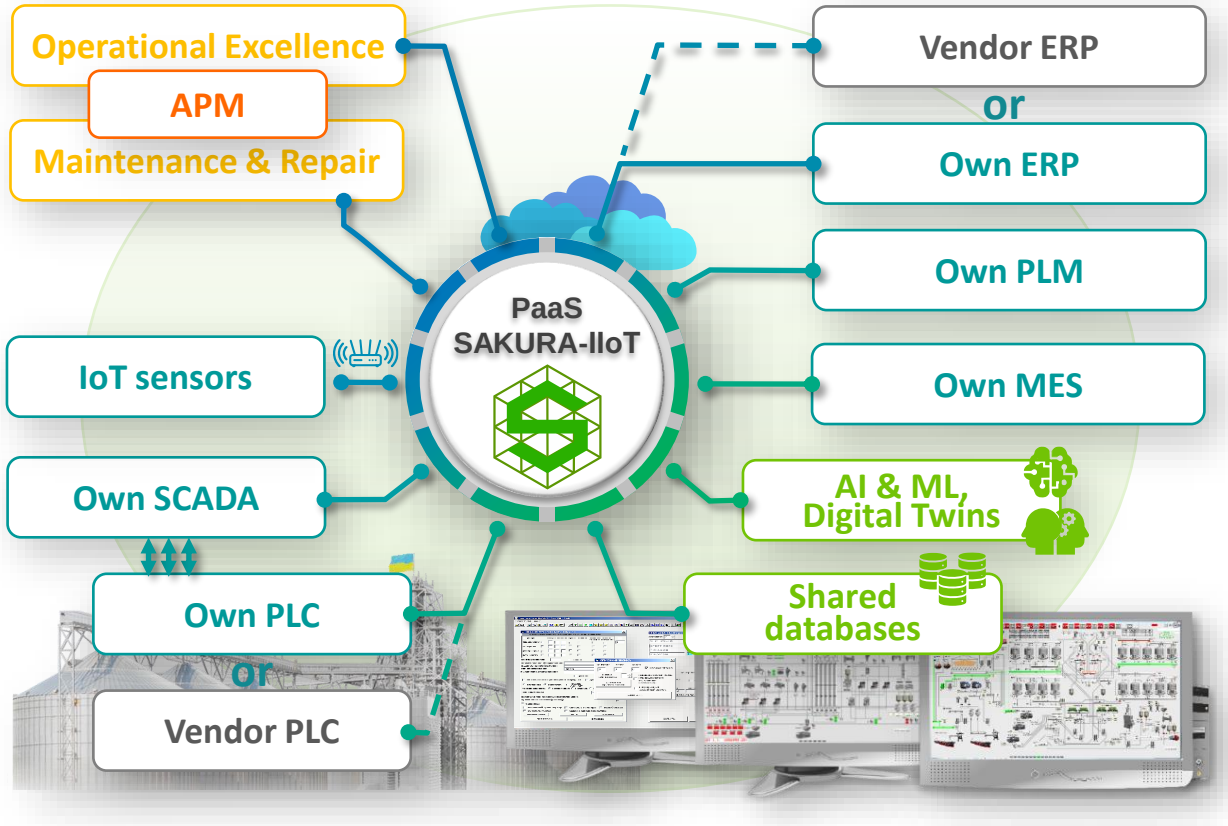
Quantitative and qualitative accounting system

The Best Industry Solutions

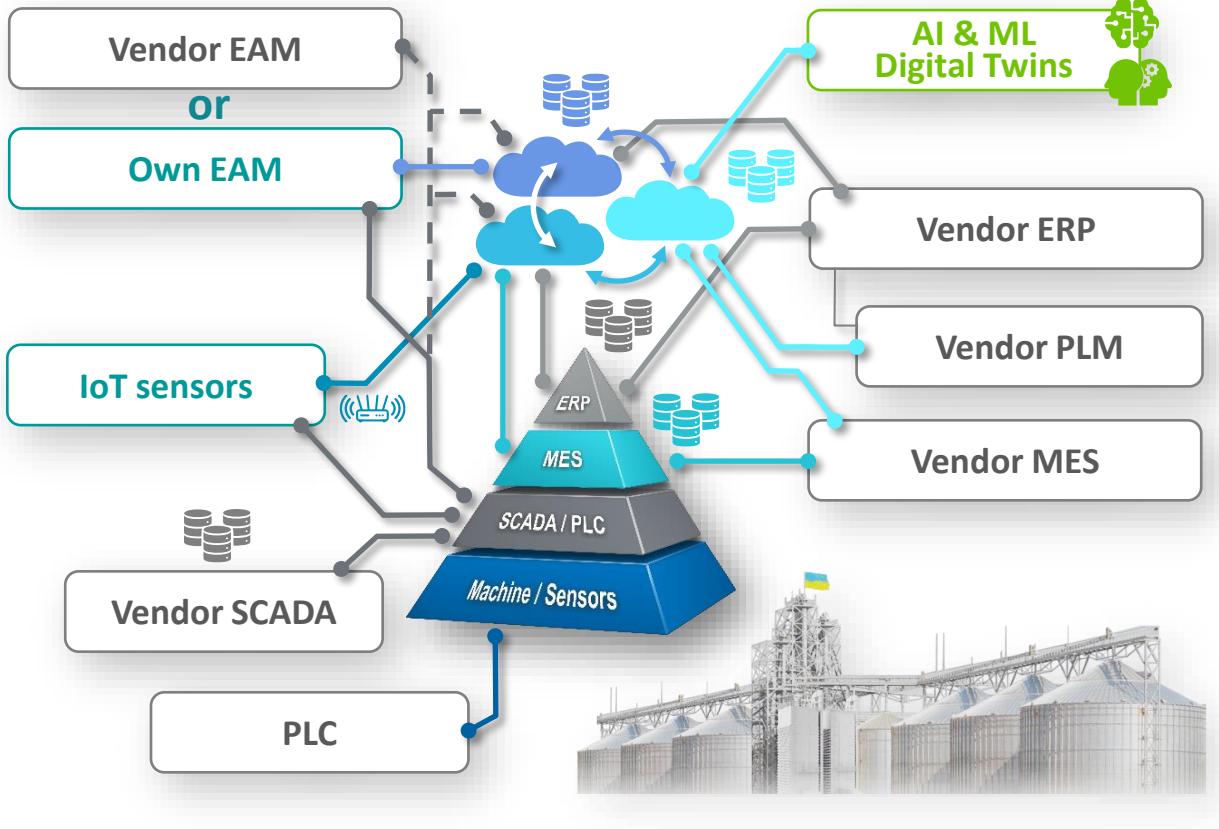
of INNOVINNPROM are adapted to the conditions of the region

Competitive Advantage

INNOVINNPROM – quality leap

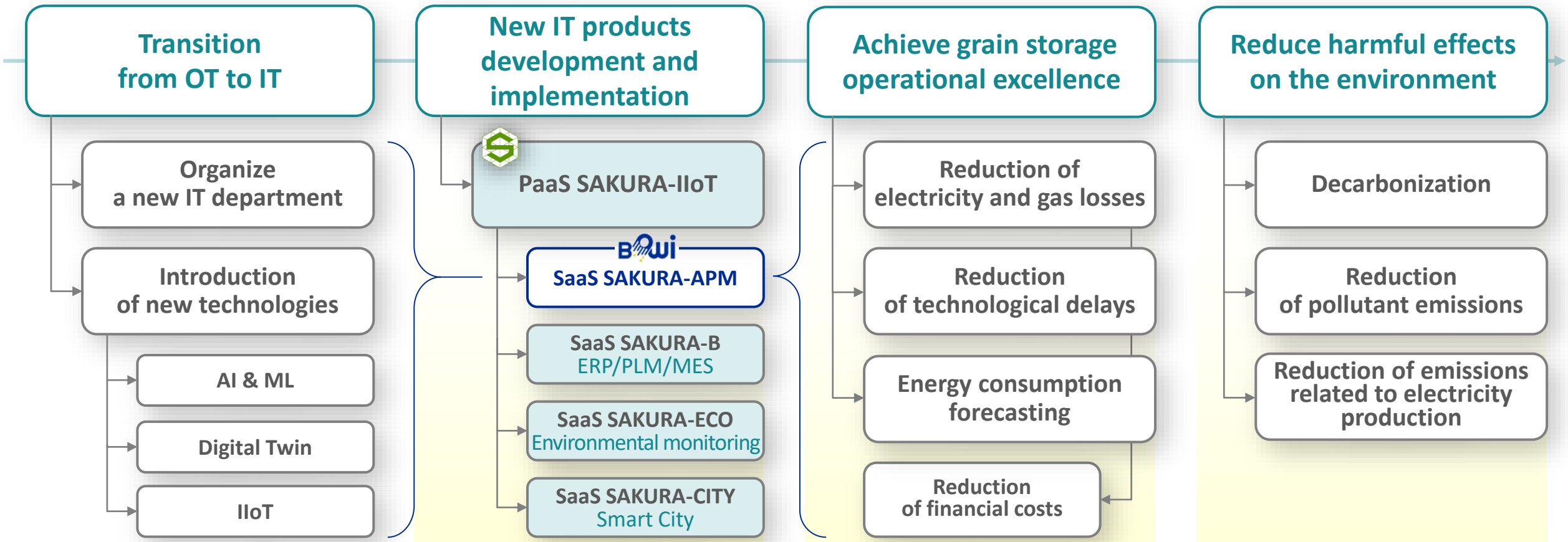


Competitors – increased complexity



	INNOVINNPROM	Competitors
Architecture	Simplified: SCADA + Own Platform on a Cloud	Classic: SCADA + eclectically added ERP / PLM / AEM / MES
Industrial Internet of Things	As a component of the PaaS	Added solution
Data Sharing	Consolidated Enterprise Database	Disparate databases and systems
AI & ML, Digital Twins	As a component of the PaaS	Added solution
Technology ownership	Specialized PaaS, ADC SCADA, APM	Adaptation of vendor systems to customer requirements
Software implementation	SaaS	Hosted Software and applications

Project Roadmap



Projected market volume – 1000 enterprises

Estimated profit from installation at one enterprise –

€50,000

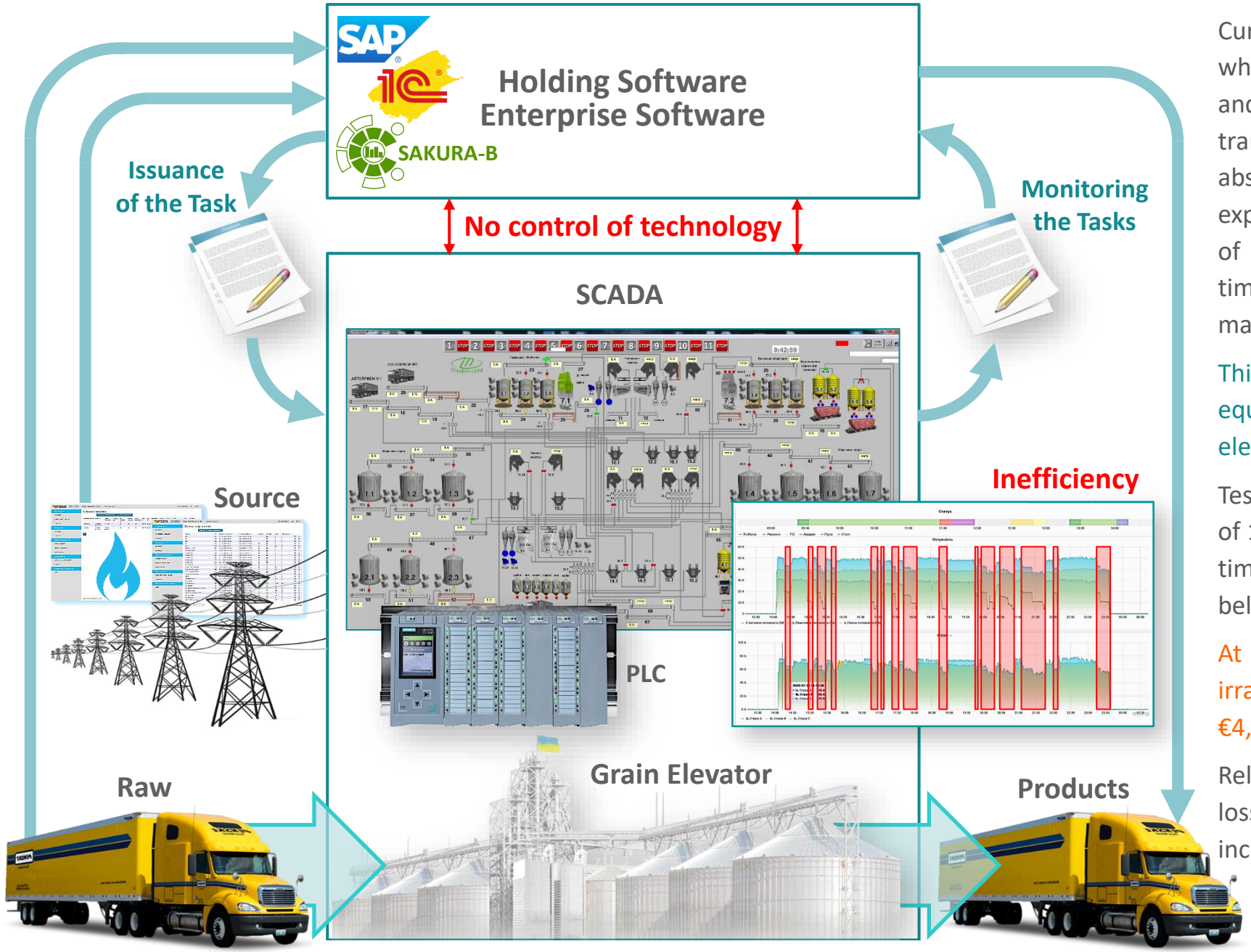
Projected savings of one enterprise per year –

€50,000

Reduction of pollutant emissions per year –

10,000 kg

Problem Description



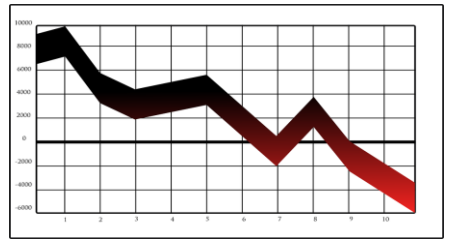
Currently, most elevators in Ukraine have SKADA, which are disconnected from production management and resource control systems. As a rule, automated transfer of tasks and control of their execution are absent. The SKADA operator, guided by its own experience, chooses a technological route from dozens of possible alternatives. Adjustment of technological timings depending on the quality and quantity of raw materials is not applied.

This leads to suboptimal use of mostly powerful equipment and to significant overconsumption of electricity and natural gas.

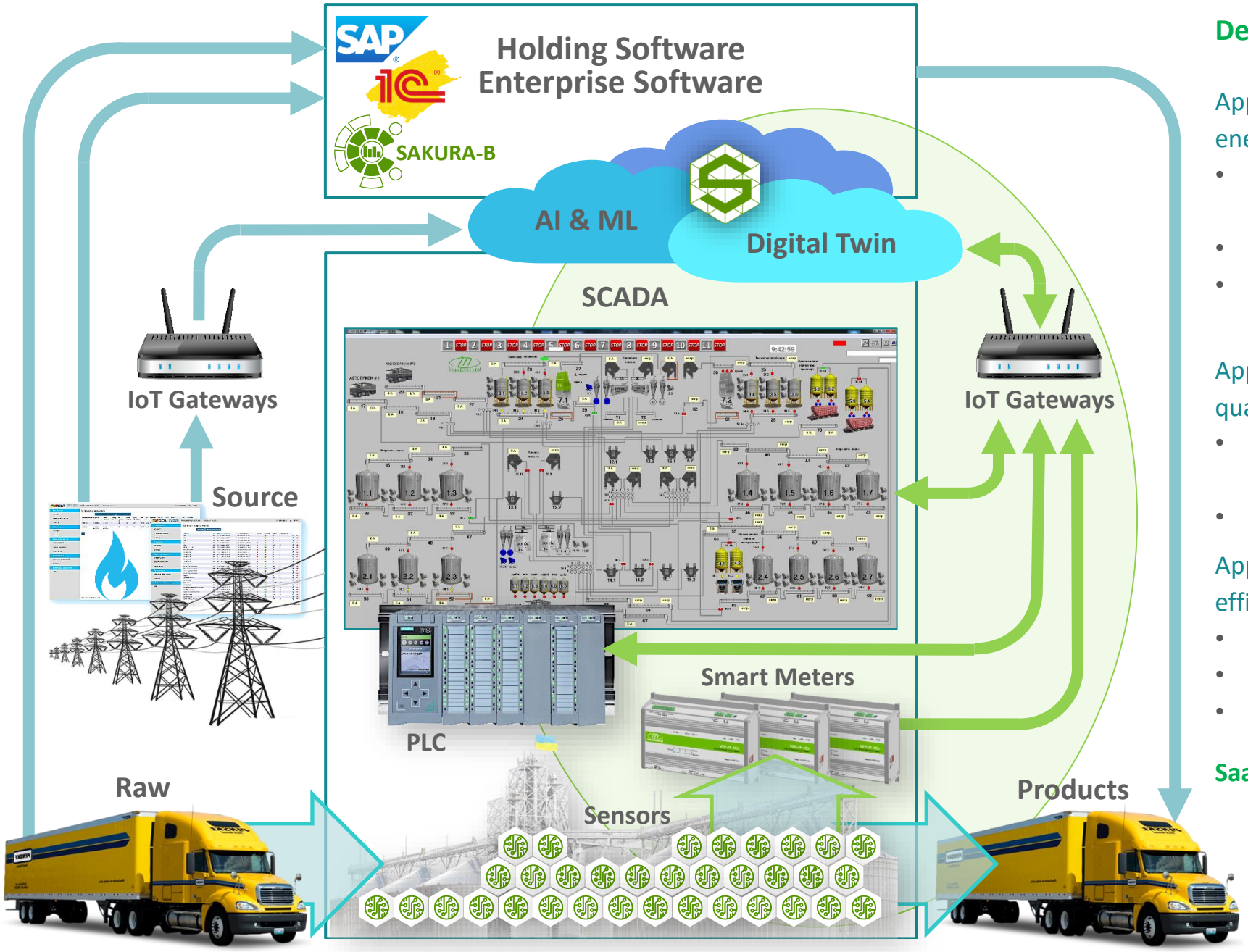
Tests of a pilot project on an elevator with a capacity of 100,000 tons of grain showed that about 17% of the time elevator equipment works with an efficiency below 40%.

At current electricity prices, financial losses due to irrational use of electricity alone amount to about €4,500 per month.

Related production losses significantly increase financial losses.



Problem Solving



Deployment of SAKURA-APM:

Application of IIoT technologies for data collection on energy consumption by each equipment:

- Installation of additional sensors, smart meters, IoT gateways;
- Reading of additional data from PLC and SKADA;
- Deployment of cloud services based on the PaaS SAKURA-IIoT.

Application of Digital Twin technologies for product quality control at all stages of production:

- Adjustment of technological lines depending on product quality;
- Product life cycle control.

Application of AI & ML technologies to increase energy efficiency of technological processes:

- Optimization of technological delays;
- Forecasting the cost of energy resources;
- Correction of staff errors.

SaaS SAKURA-APM is based on the PaaS SAKURA-IIoT

SAKURA-APM Workspace

Full Control and Analytics at All Levels - Holding / Enterprise / Production Line / Equipment

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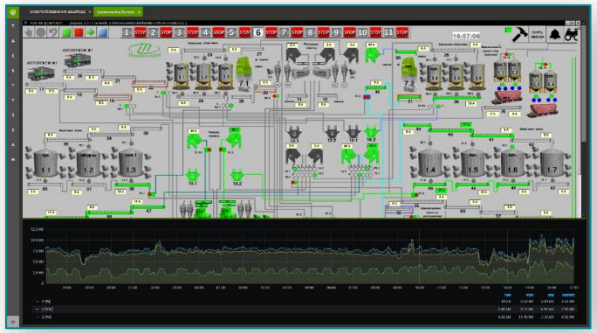
- Internet of Things
- Artificial Intelligence
- Machine Learning
- Edge Computing
- Big Data
- Cyber Security
- Digital Twin

SAKURA-APM Modules

The Enterprise module

visualizes consolidated, comparative, detailed and analytical information coming from holding companies. This information is focused on quantity and quality of products, energy consumption and energy efficiency of technological operations of a holding's enterprises.



The Operational Excellence module

provides similar metrics as The Enterprise module, but for a particular enterprise.

The Maintenance and repair module (M&R)

provides planning and control of maintenance and repairs at the holding companies.
The main types of information are information on the operation of equipment, energy consumption, use of spare parts and materials during maintenance and repairs.

The Energy Efficiency module

provides low level metrics and analytical information on the consumption of the main types of energy by each unit of equipment, technological group and enterprise as a whole. Based on the obtained data, the calculation of energy efficiency of equipment and technological operations is performed.

SAKURA-IIoT Architecture in a Typical Manufacturing Scenario

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Sensors / Devices

- Sensors
- Smart Meters
- IoT Devices
- Asset OEM Devices
- Enterprise Data

Protocol Interface

Edge

Edge Manager

- Device Connectivity
- Device Protocol Drivers
- Data Streaming Services
- Real Time Analytics & Rules Engine
- ML Run Time
- Cloud Integrations

- Edge Gateway Orchestrator
- Data Integrator
- Application Integration
- Cloud Integration

Cloud

Google Cloud

Microsoft Azure

amazon web services

HETZNER ONLINE

- IoT Gateway Hub
- Device Management
- Digital Twins

- Streaming Services (On Stream Data Processing)
- Event Triggered Functions (Insights On the Stream)
- Storage
- ML Engine (Features, AI, Algo)

Security

Consumer

User Dashboards

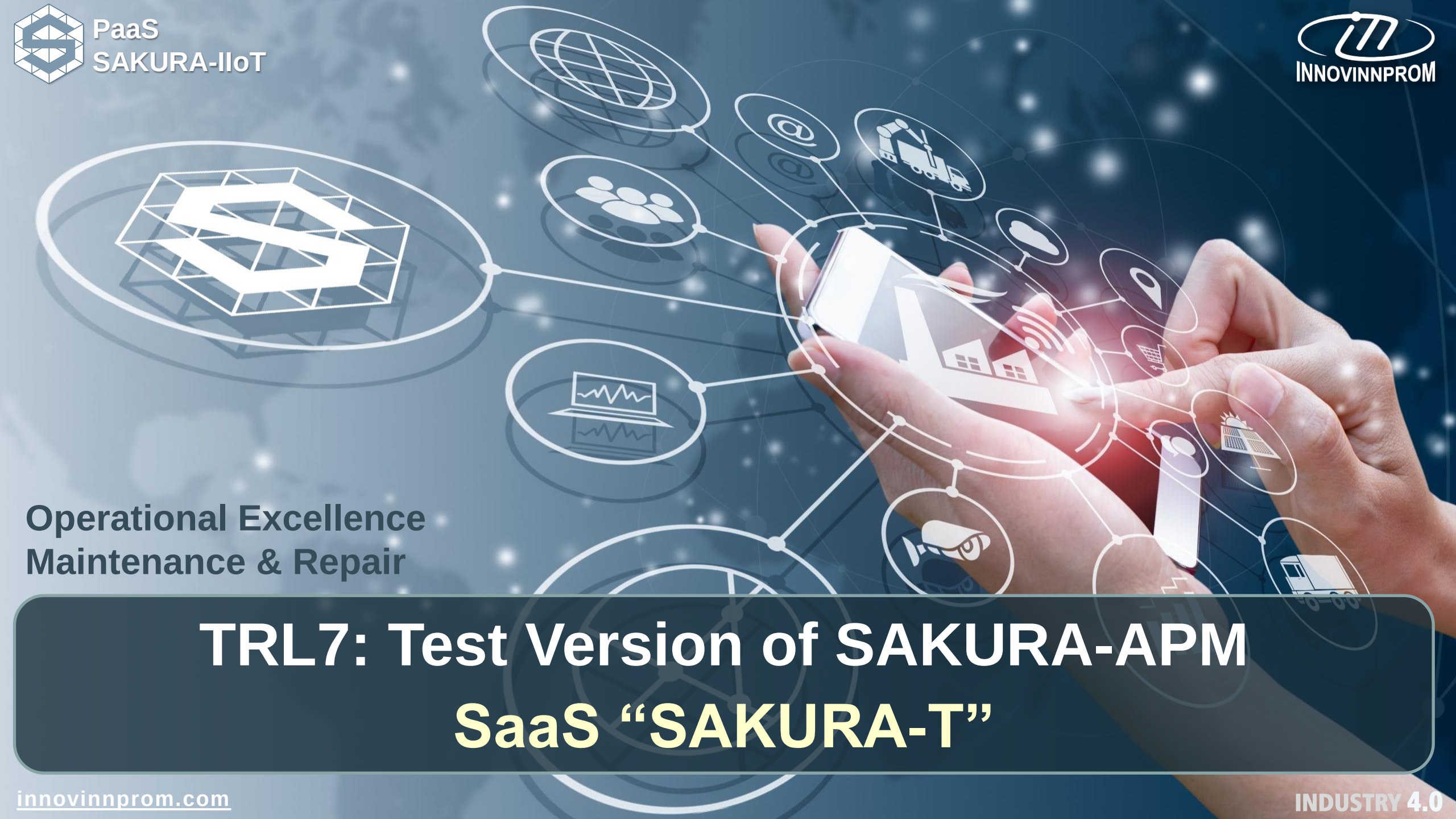
User Alerts

User Insights

INDUSTRY 4.0

PaaS
SAKURA-IIoT

INNOVINNPROM



Operational Excellence
Maintenance & Repair

TRL7: Test Version of SAKURA-APM
SaaS “SAKURA-T”

innovinnprom.com

INDUSTRY 4.0

Object of Project Implementation

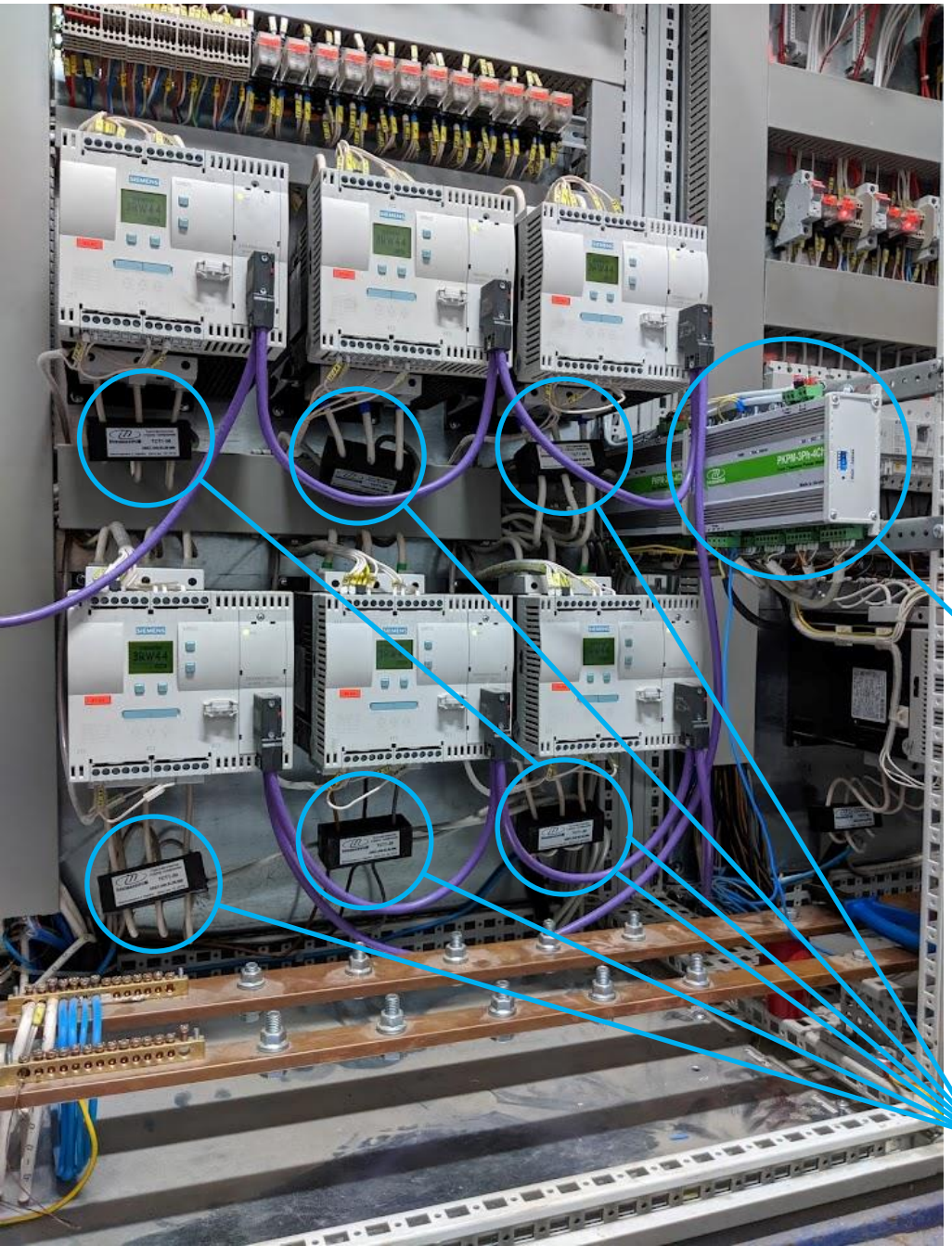
The volume of fully loaded grain storage is 100,000 tons

SCADA - Automated design system “Route” INNOVINNPROM

PLC – Siemens S7-1500, 1500 DI/DO/AI/AO

INDUSTRY 4.0

Installation of Equipment Without Reassembly



Installed:

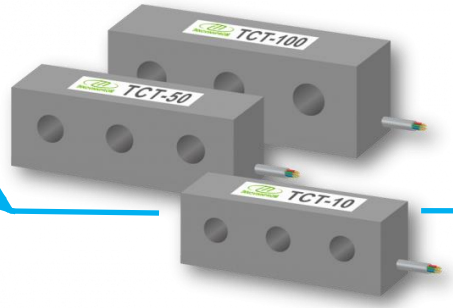
Power Meters 17 units
Transformers 65 units
IoT Gateways 2 units

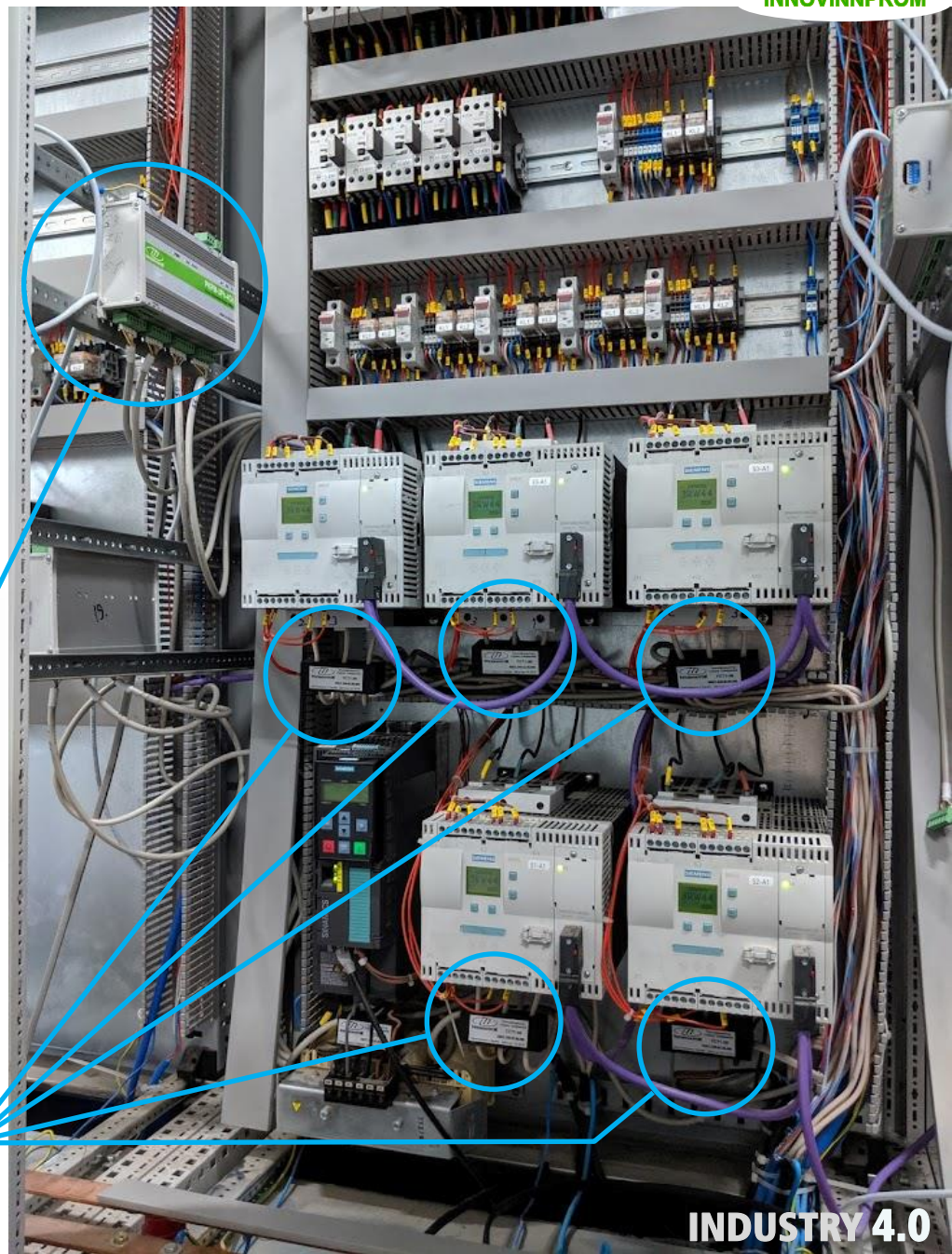
Total:

65 units controlled equipment
3,000 control channels per second

4 Channel Smart Power Meters
INNOVINNPROM

Innovative 3 Phase Transformers
INNOVINNPROM





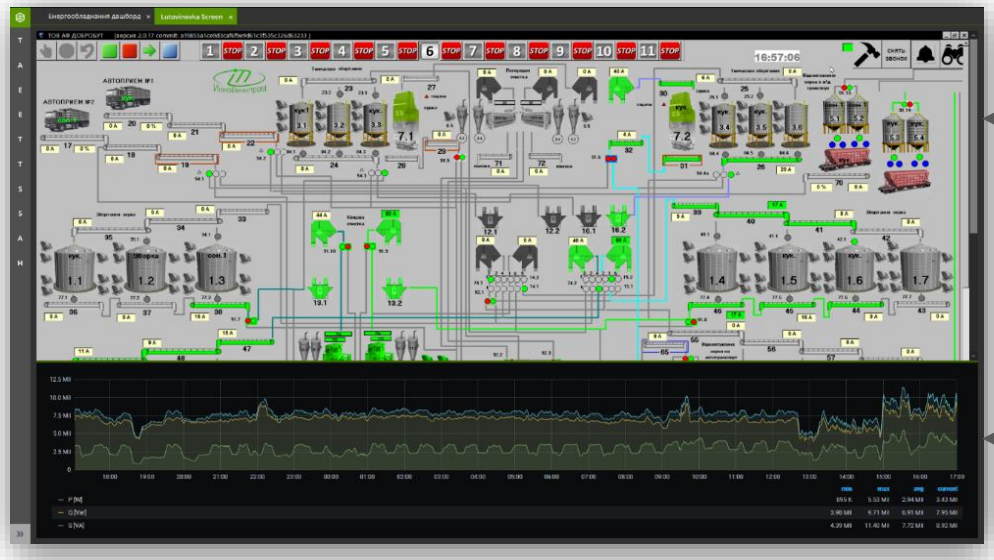
INDUSTRY 4.0

Test Version of SAKURA-APM – SaaS SAKURA-T

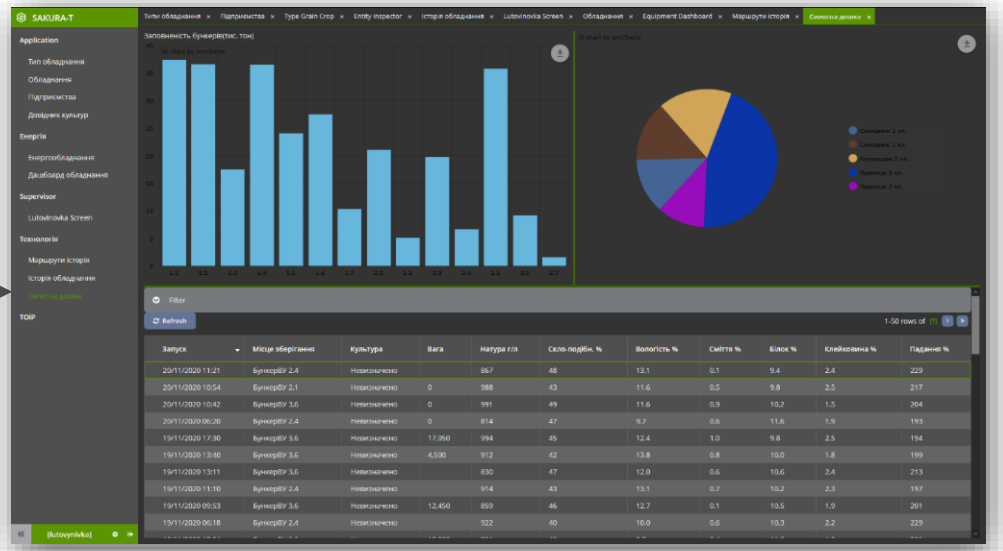
Installed:

1. PaaS SAKURA-IIoT
2. SaaS SAKURA-T – Control of energy efficiency

https://cloud.innovinnprom.com/app/#login



Technology control



Energy efficiency analysis

KPI calculation

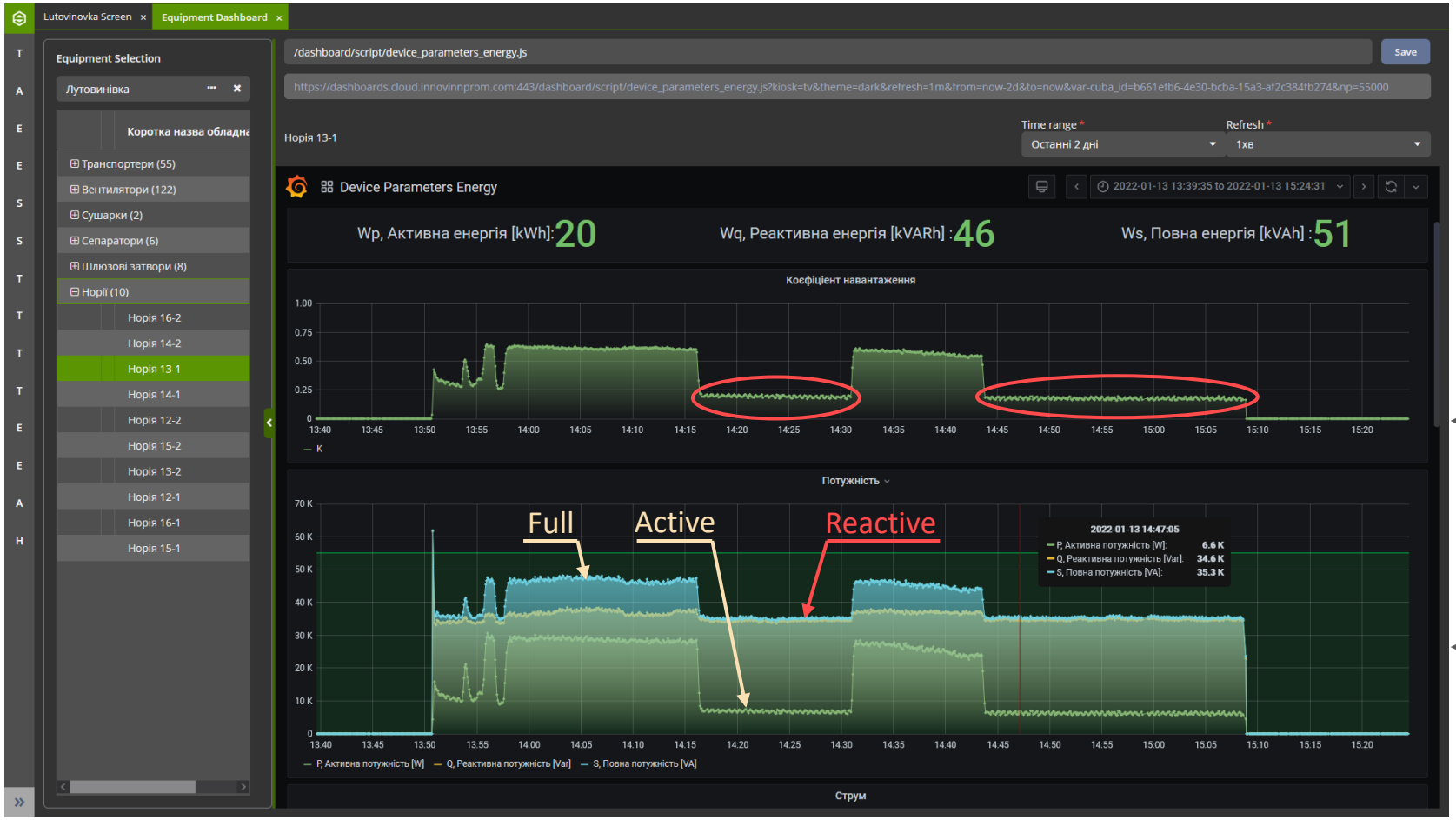
Total energy consumption

Analysis of technical processes

Control of equipment operation

Problem Discovery and Diagnostics

Example of using one unit of equipment out of 65:



Test operation showed that more than 17% of the company's equipment was used inefficiently. Moreover, if electric motors were idling without load, the energy consumed by them dropped insignificantly. The reason is the high reactive component of energy consumption.
As a result, energy is released into the air, contributing to cable lines over-heating. This is the main reason for excessive energy consumption by the company and excessive wear of equipment.

Equipment efficiency - 25%

during 50% of the technological process

Electricity losses 37 kVA/h

prevalence of the reactive component
direct electricity losses

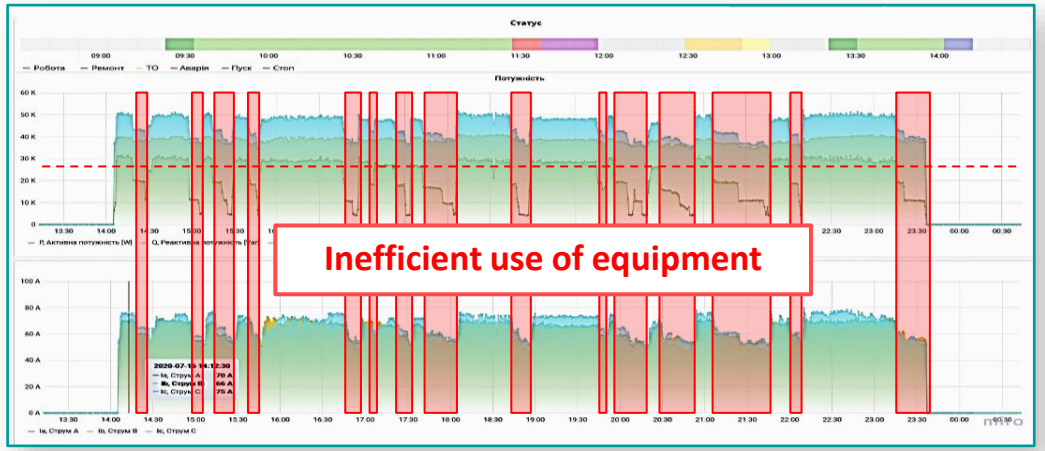
Result:
More than 25 kVAh was lost during the technological process lasting 1 hour 20 minutes

The task of the SaaS SAKURA-T:
Using AI & ML, automatically detect cases of suboptimal use of equipment and provide appropriate correction commands to SKADA

The Results of Proof of Concept

The period of test operation - from July 2020 to January 2022, only 16 months

	Wp, Active energy [kWh]	Wq, Reactive energy [kVARh]	Ws, Full energy [kVAh]
Consumed during the trial operation	388 238	772 376	934 885
On average, daily	808,83	1 609,17	1 947,68
Inefficient operation at load <40%	66 000,46	131 303,92	158 930,45
Losses, Euros			31 786,09



The table takes into account only electricity losses, excluding:

- operation of ventilation, aspiration and lighting systems;
- gas costs for drying products;
- related operating losses.

Altogether, total losses can be 3 ... 5 times higher.

The task of AI & ML:

- Optimization of technological delays
- Product life cycle control
- Adjustment of technological parameters depending on product quality
- Forecasting the cost of energy resources
- Recognition and correction of human errors

The result of the implementation of SAKURA-T in addition to financial costs will reduce emissions of pollutants.

Technological Readiness Level

INNOVINNPROM

Sensors / Devices	Edge	Cloud	Consumer

Grain storage Lutovynivka

- Sensors 65 x 3 pcs
- Smart Meters 17 x 4 pcs
- IoT Devices 2 pcs
- Enterprise Data from SCADA

Edge Manager
3000 parameters every second

HETZNER ONLINE

Protocol Interface

- Device Connectivity
- Device Protocol Drivers
- Data Streaming Services
- Real Time Analytics & Rules Engine
- ML Run Time
- Cloud Integrations

- Edge Gateway Orchestrator
- Data Integrator
- Application Integration
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- IoT Gateway Hub
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- Storage
- ML Engine (Features, AI, Algo)
- Security

Consumer

- User Dashboards
- User Alerts
- User Insights

BOWI Resources for implementation

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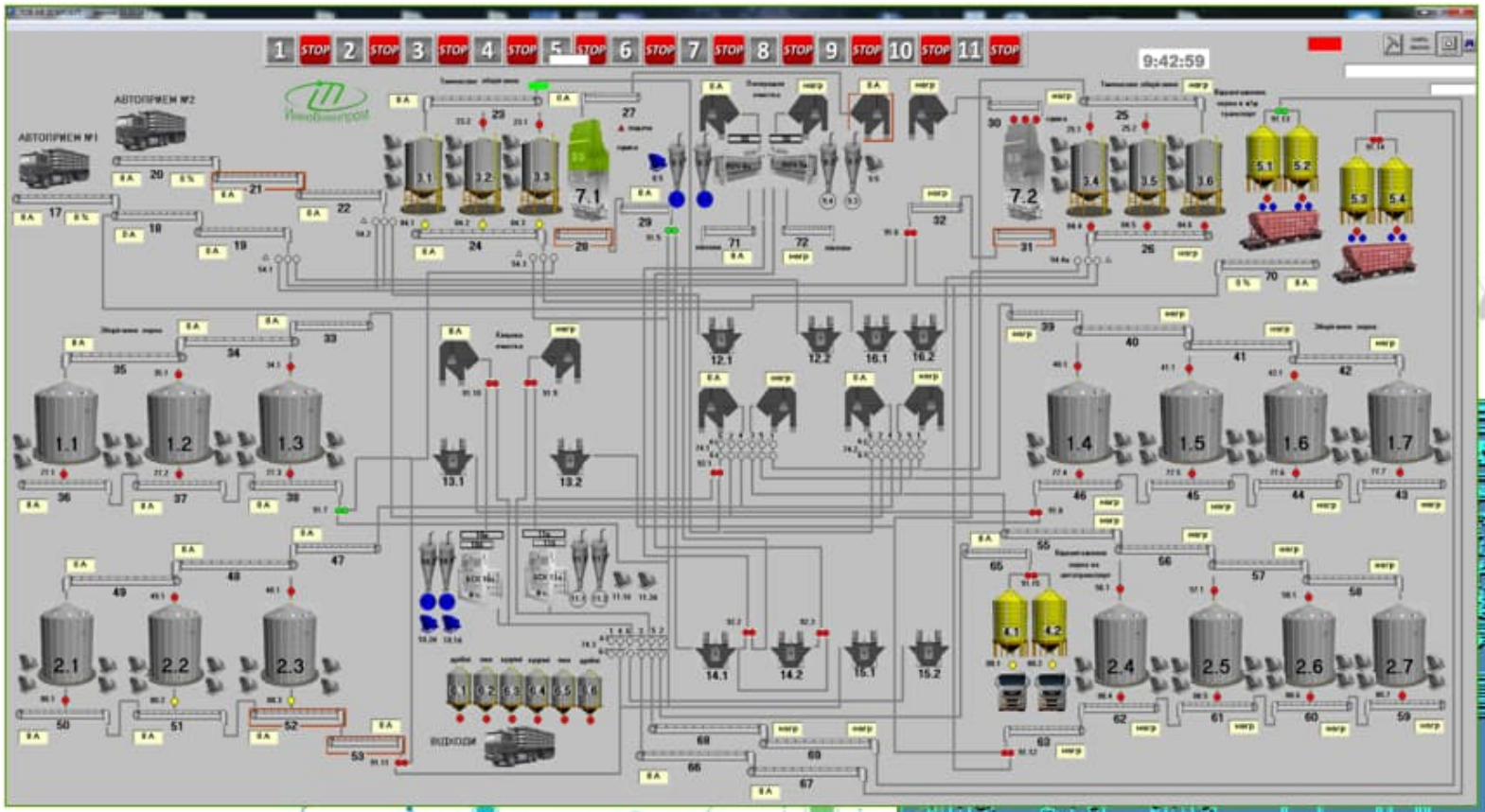
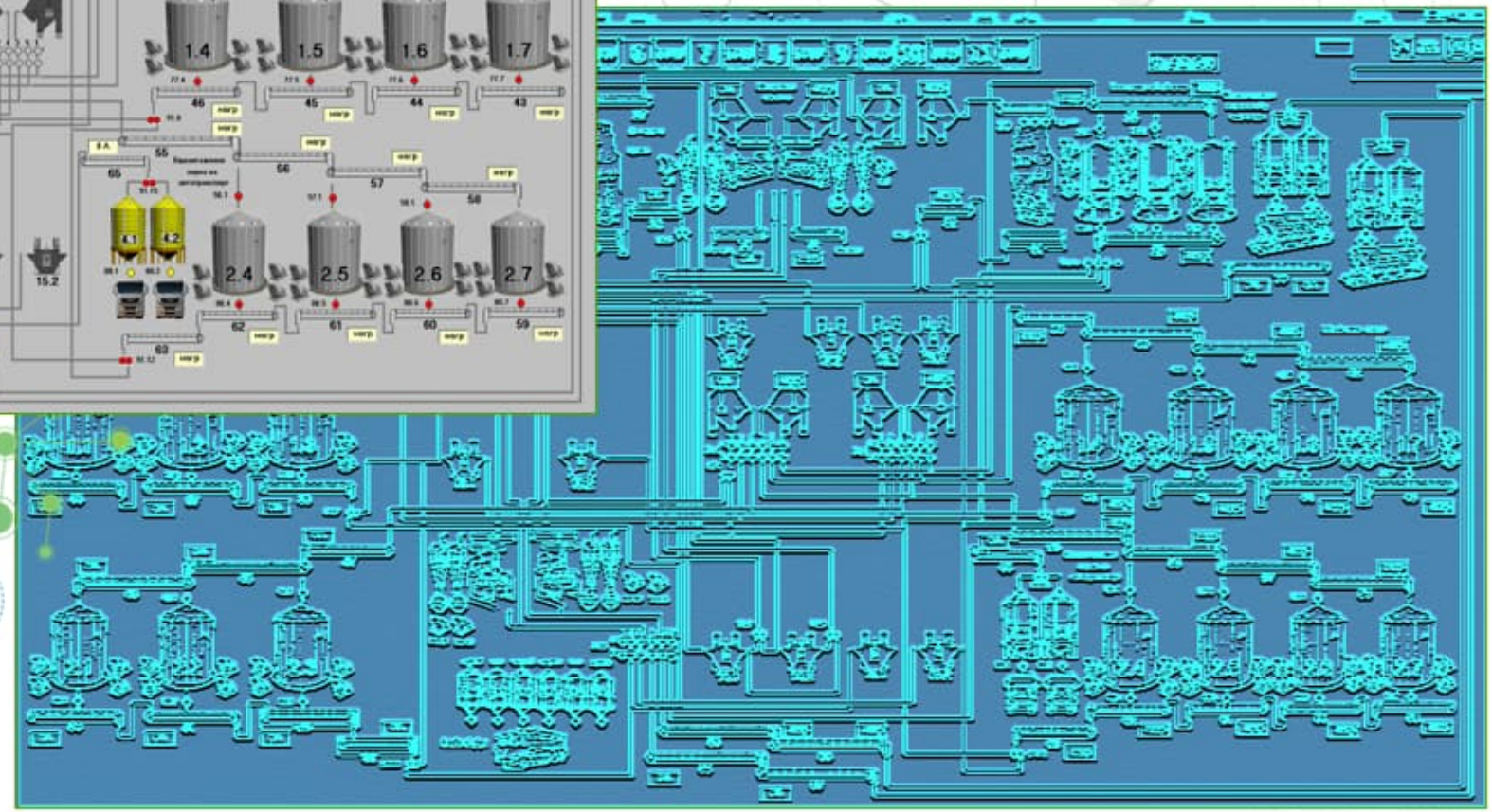
Digital Twin of Grain Elevator



Equipment control:

Total equipment	203 units
IoT control	65 units
Technological routes	11 units
Route options	2806 units



Digital Twin of Grain Elevator

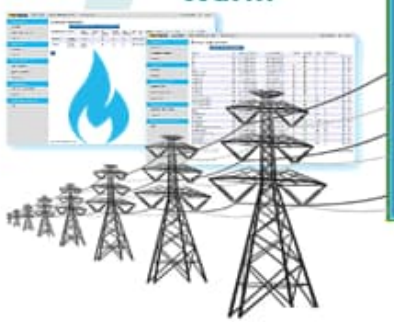
INNOVINNPROM

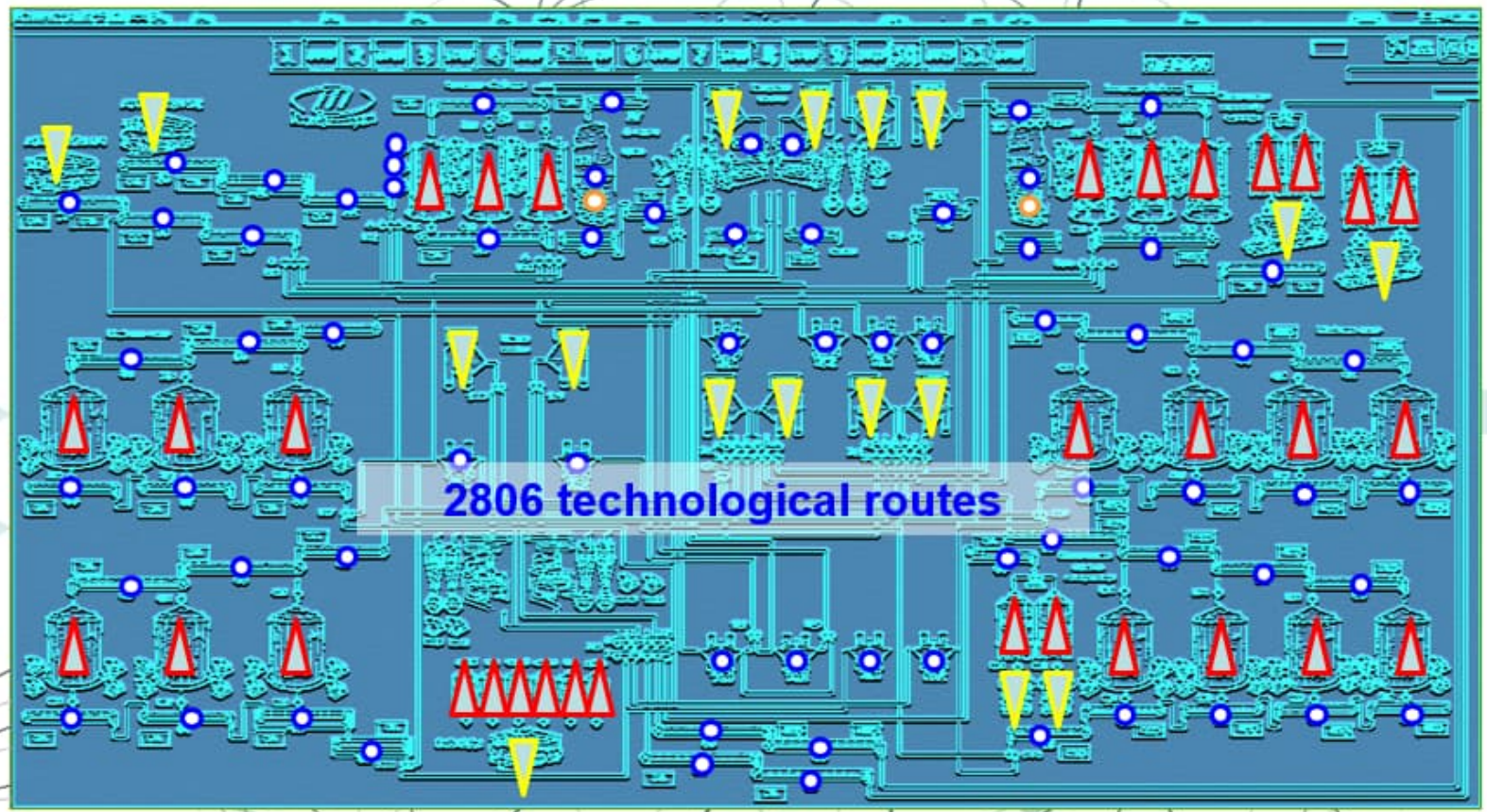
SAP SAKURA-B

Holding Software
Enterprise Software

Data:
Raw material weight
Raw material parameters
Production task

Data:
Electricity
Gas
Warm





SAP SAKURA-B

Holding Software
Enterprise Software

Data:
Product weight
Product parameters
Production task

Data simulation required

Pict	Description	Ideal Model	Real
	Level meters	32	0
	Weight systems	17	4/0
	Power meter	208	57
	Gas meter	2	0

The neural network for each of the 57 controlled objects and the general neural network of the enterprise are deployed.

Missing data for equipment that is not physically installed is simulated

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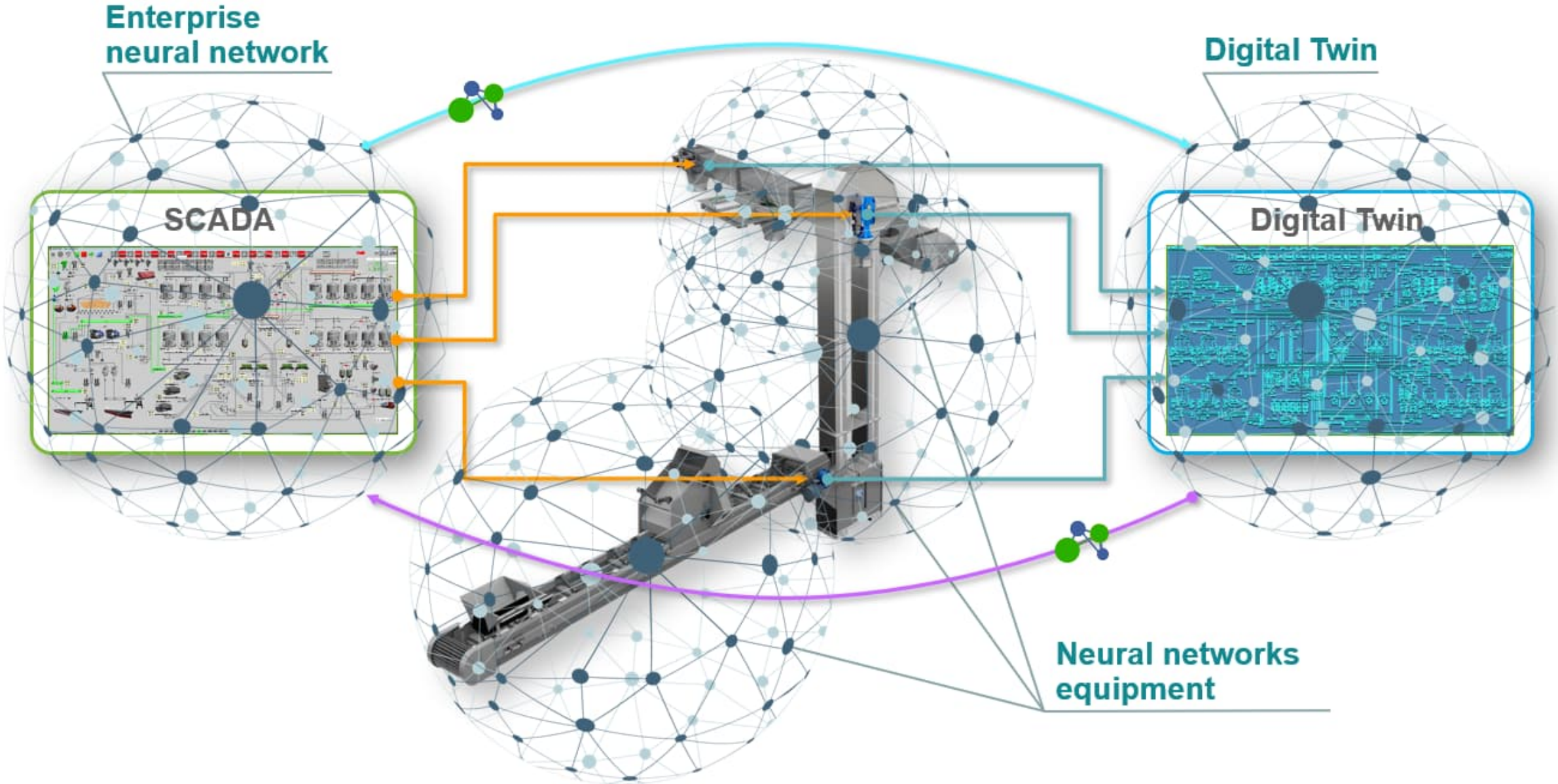
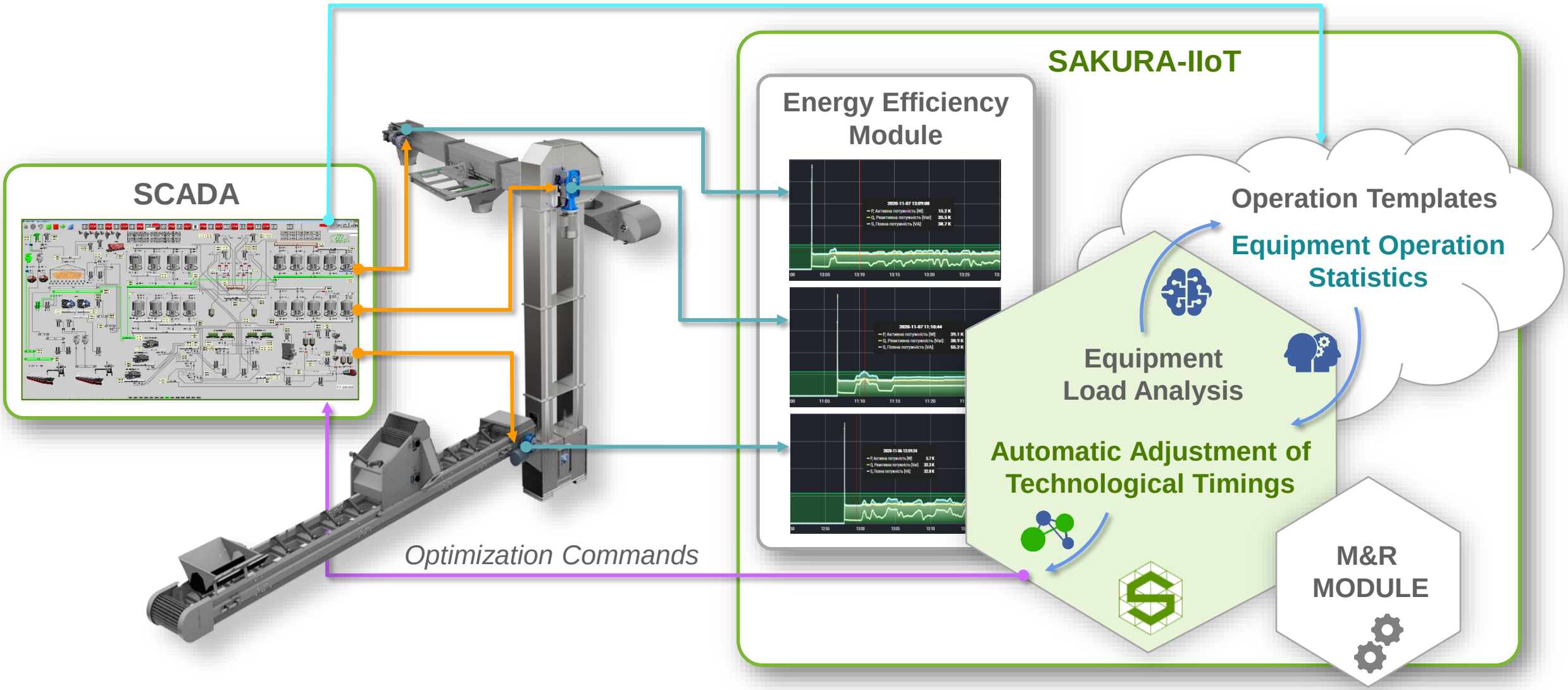
AI & ML Neural networks

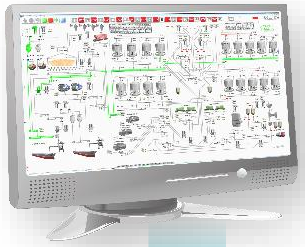


Automatic adjustment of the technological process



KPIs of Production Processes

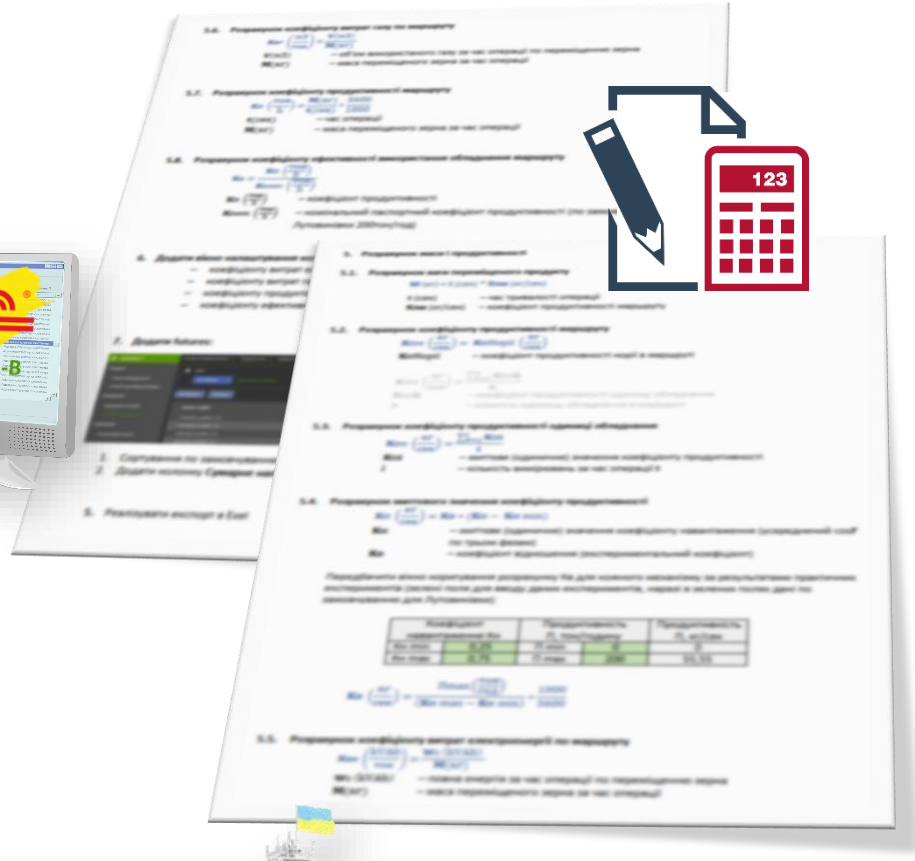
INNOVINNPROM has developed its own method for calculating the energy efficiency of technological processes in grain elevators



SCADA

Data on grain movement routes

Enterprise Sources



Flow meters

Сакура-Т

Data on the quantity and quality of received and shipped grain

Data on the amount of moved, dried grain

Energy consumption data for grain movement

Smart Power Meters
IoT-gateways

Economic Advantages

Reduction of energy consumption of technological equipment - up to 10%

Achieved by selecting and exploiting the most energy-efficient modes of operation of the equipment and optimization of technological delays

Reduction of technological losses - up to 15%

Made possible by preventing violations of established algorithms and standards at all stages of production, continuous monitoring of technological operations and personnel actions

Improving energy efficiency of production - up to 20%

Attained through continuous monitoring and analysis of energy efficiency of production, control of accuracy and timeliness of completing technological tasks

Extend equipment service life - up to 25%

As a result ofplanning and monitoring the maintenance and repair of equipment, quality control of spare parts from different manufacturers

BWI Technology Application Roadmap

INNOVINNPROM

Task number 1	Task number 2	Task number 3	Task number 4	Task number 5
Planning	Mid term evaluation targets	Final evaluation and demonstration	Demonstration of system	Business development
TAR	Data processing algorithms	SKADA version update	Final Report	Implementation Plan
Ethical deliverable	Digital Twin of SCADA	Neural network training	Video of TTE results	Business plan
Requirements specifications	Frontend and backend software	Conducting experiments	Public presentation	Business analysis
Updated presentation	Neural network software	Business analysis	Cooperation with the client	Cooperation with the client

Team

ВНТУ

SCADA Team

AI & ML Team

Project Team

BA Team

INDUSTRY 4.0