Energy Management System

Energy Management Software is designed to manage consumption of electricity, collect data from Iskra products and generate analysis reports.

The software to meet criteria of Managing Energy Consumption, Integrating MiQen and Control it needs to include:

- Web App Solution
- Energy Analytics
- Energy Source
- Power Analytics
- Measurements
- Smart Control
- Automations
- Energy Activities Management
- Alerts & Notifications
- Tariffs
- Reports
- Local Web App Service
- Settings & Hardware Integration

The software shows all kinds of data collected from the devices such MC's, MT's and ICC, these generated data are mainly for consumption of electricity, analyzing any abnormal load into specific devices or areas and other events, alarms, schedules and measurements.

The software is designed to be very easy to use but to offer maximum of opportunity to identify consumers, set plans, automations and manage consumption of energy with an aim to increase energy savings.

Features that describe the software in general include: collecting data from all installed devices, visualization of these data so the user can analyze all these data for potential energy savings and automating processes.

Analyzing Electricity performance inside the factory or building, managing activity of all devices, generating alerts based on activities, integrating electricity tariffs and generating reports for all types of needed activities.

This solution provides all necessary means for equipping your distribution grid to have all relevant data always centrally available for monitoring as well as for basic data analysis. All instrument settings together with their measurements, alarms or PQ data can now always be available at the tip of your fingers. The solution can assure some crucial advantages in your grid such as:

· System protection improvements,

· More reliable operation,

· Faster responses to failures,

· Better maintenance,

· Control over power consumption and losses within the network,

· Historic data for better planning,

· Power quality improvement,

· Better control over the installed equipment

Dashboard

Showing overall Electricity consumption today and compared with yesterday (-9% since yesterday). Showing Electricity production today from Solar Panels with the same details as Electricity Consumption, Battery Level in % and whether there are Alarms triggered.
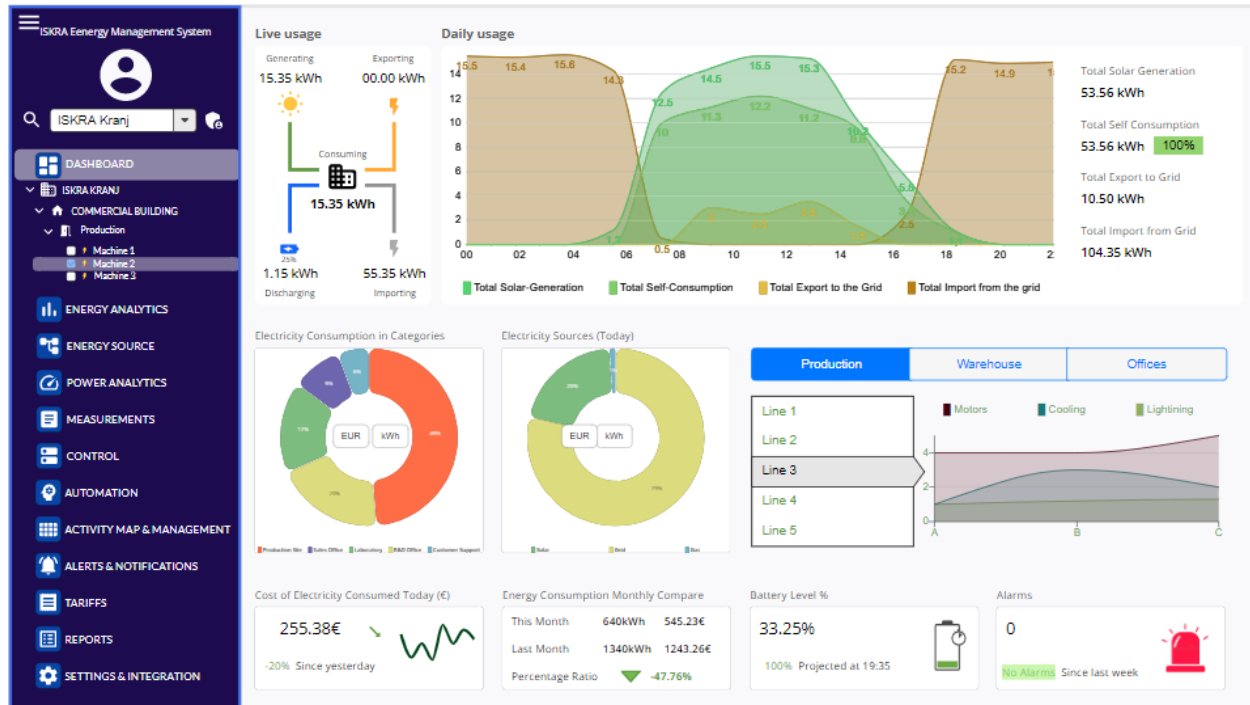
Monthly cost so far and daily cost so far.

Energy Source will be shown also if it comes from Grid or other sources (ex. 79.55% from Grid and 20.45% from Solar).

Operation Status shows what types of products are integrated and number of products such as: Gateways, Smart Meters, Switches and Sensors.

Biggest Consumers of total electricity are shown on Pie Chart.

Energy Consumption Month Comparing Shows total energy consumed to this date in this month 640kWh (ex. June 2022) and compares with the last month 1340kWh by showing Percentage Ratio (-47.76%).

Energy Produced Month Comparing Shows total energy produced to this date in this month 120kWh (ex. June 2022) and compares with the last month 366kWh by showing Percentage Ratio (-32.78%).

Location on the map shows integrated sites into the system, users can select sites directly on the map and data of the selected location will be shown.

The 24h graph is shown to consumption and production of electricity during the 24h interval.

Table of sectors will be shown on the side of the dashboard, if you have ex. Production Site, Warehouse or Office, user can select one of these sectors along with floors or levels and check top consumers.

Energy Analytics

Analyzing all kinds of the measured data from the hardware system.

All data from energy consumption, historical events and KPI comparison are possible through data analytics.

Data are shown on the graph in which users can select if they want to see the consumption of electricity in kWh or Cost in EUR (other currencies) and CO_2e emissions.

Energy analytics are possible for the whole operating site, buildings, floors, sectors and devices specifically.

Analytics of the data can be shown on graphs such as shown.
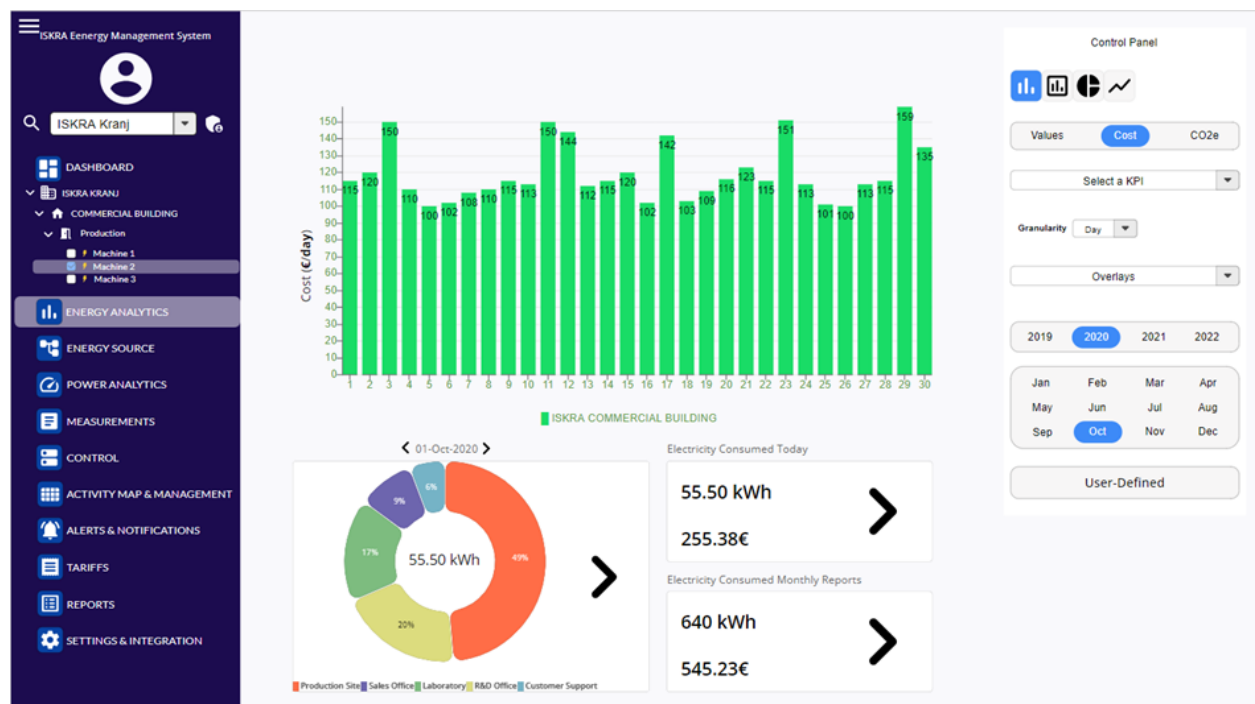
Electricity consumption in hourly, daily, weekly, monthly, yearly, multiyear and date-to-date comparison.

Electricity consumption history of data:

Multiyear	Year	Month
Week	Day	From/To

Monthly:

January	February	March	April
May	June	July	August
September	October	November	December

Showing data on different charts types: Areas, Column Charts, Pie Charts, Line chart

Download data on formats: PNG, JPEG, PDF, SVG, CSV and XLS. Also print charts.

Energy Sources

Showing all types of energy sources integrated to the system.

System calculates energy coming from the grid, exported to the grid, energy generated from solar panels or wind turbines and battery level (all if integrated).
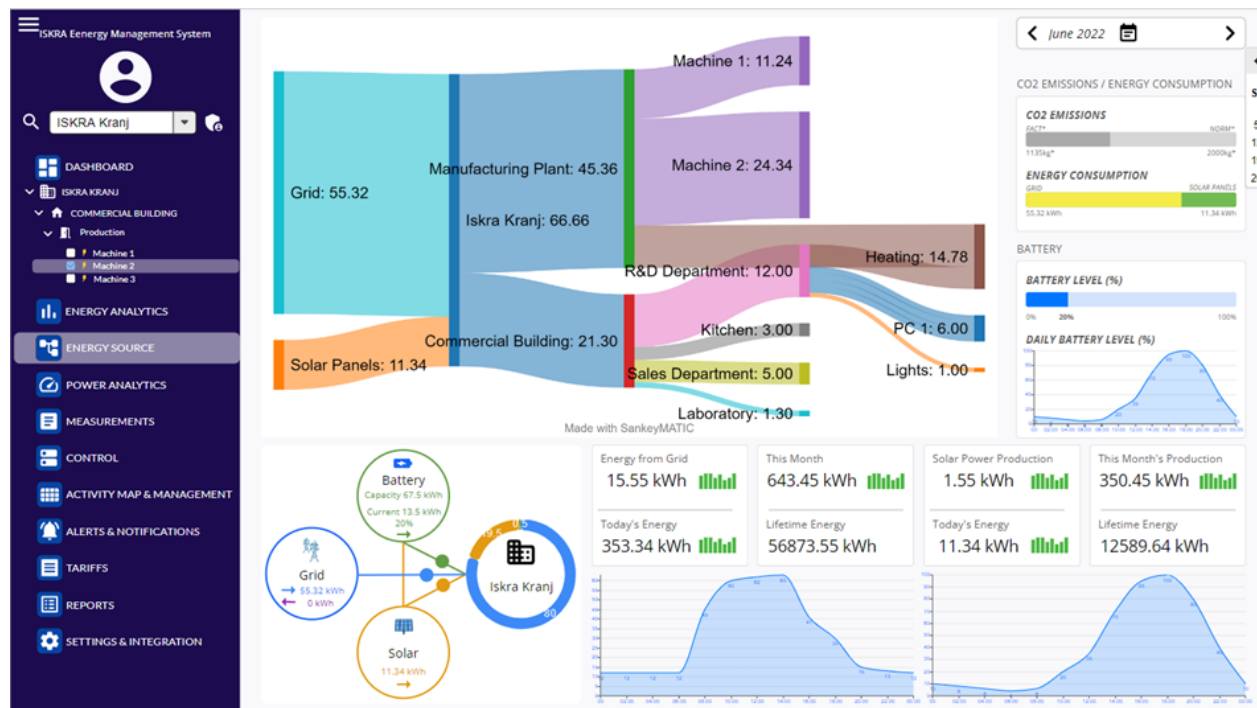
Power Analytics

Analysis of the electricity performance of the selected device (MC) or for Entire Sector or even for the Building.

Users can analyze Active Power, Apparent, Power Factor, Reactive Power, Voltage, L-L Voltage, Current and Cumulative in Total or Per Phase.

There's 2 types of Peak Demand Finder: Average 15 minutes and Average 30 minutes.

The system will automatically identify when there's a peak in the selected date and show it.

Also based on the graph and data shown, users can directly download the data generated on different formats: PNG, JPEG, PDF, SVG, CSV and XLS.
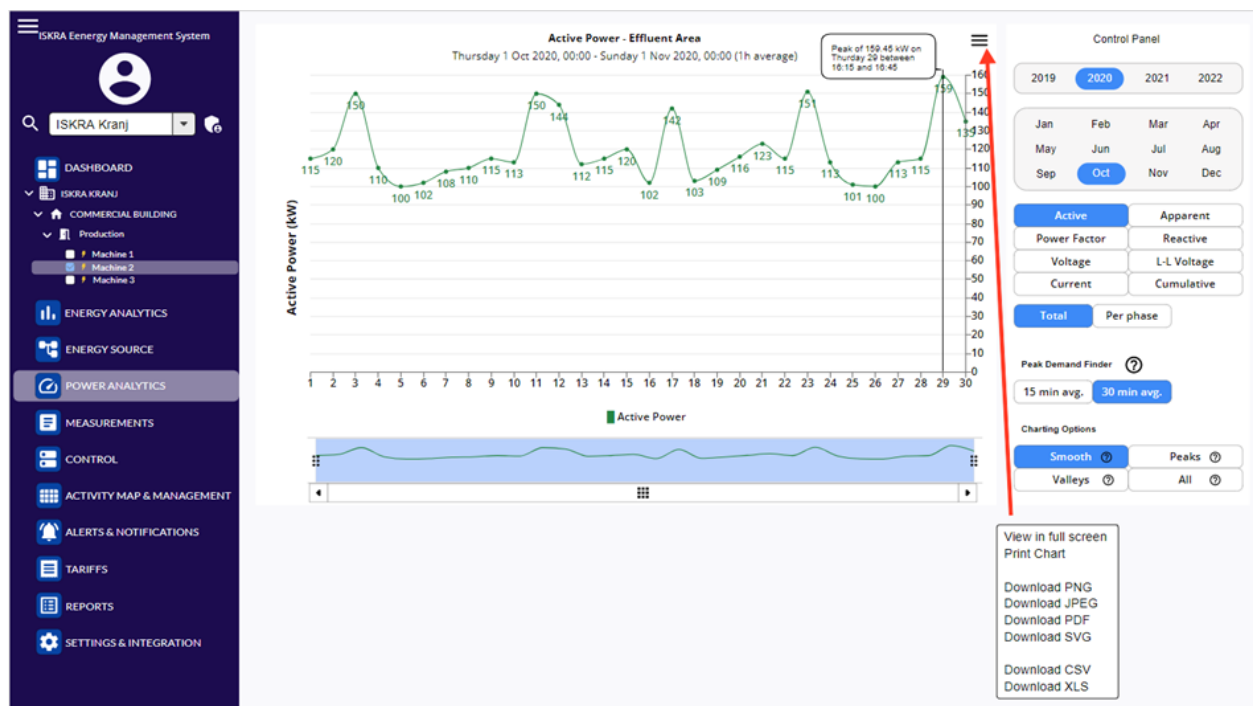
Measurements

Showing all parameters from a device connected to the software.
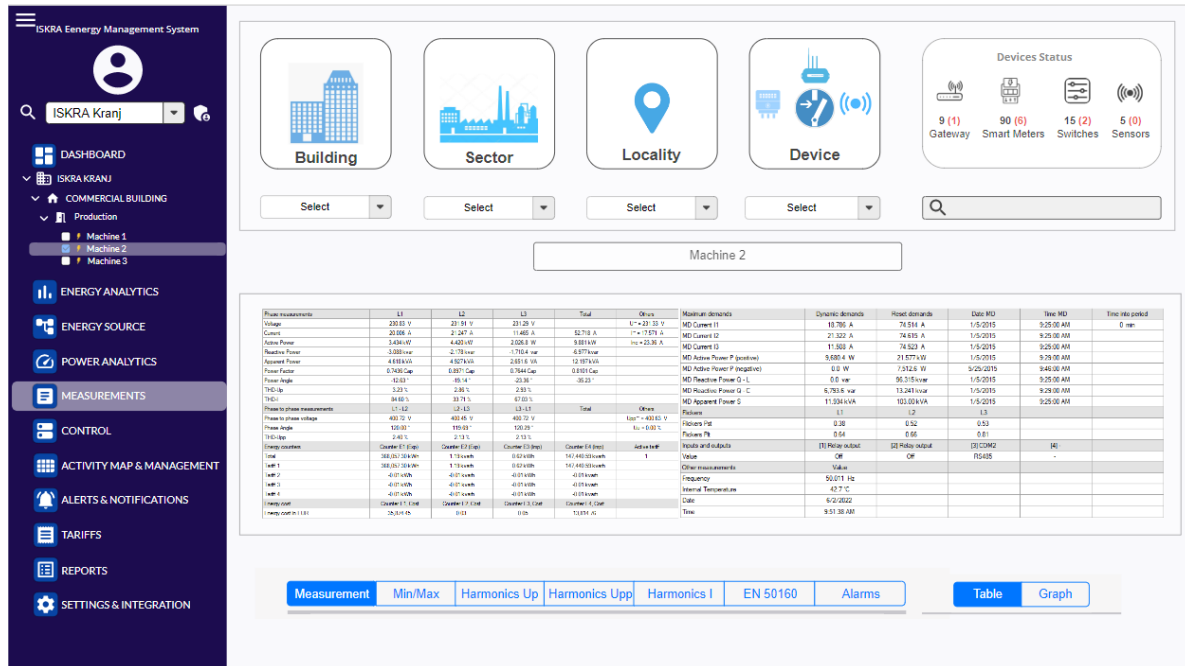
Also data to be shown on graph mode.
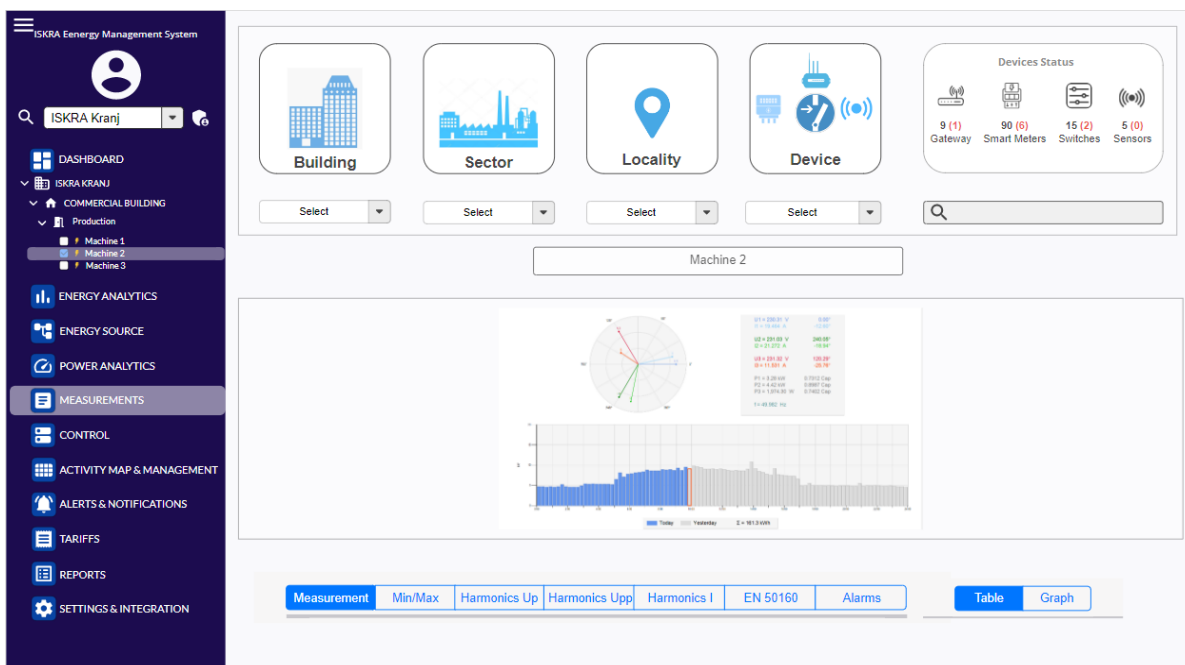
Control

The users through Software will be able to control integrated devices.
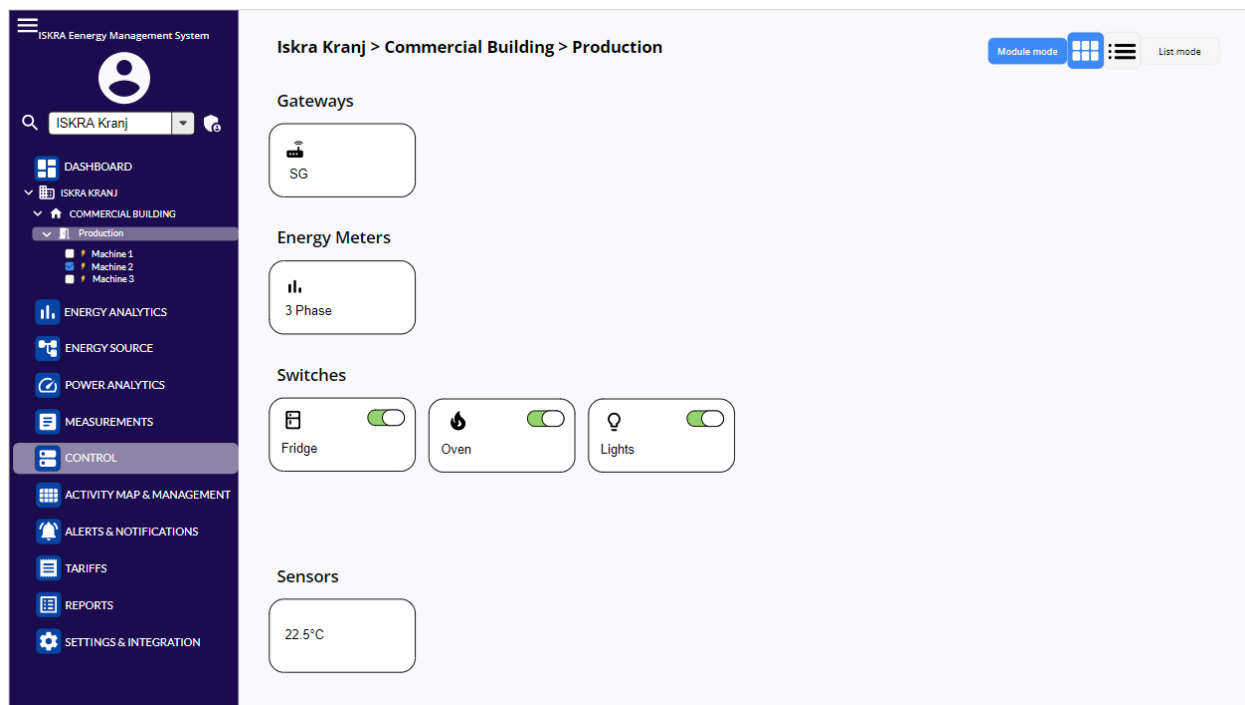
Automations

Changing functionalities of a device if a set condition is met.

Ex. If Machine 1, Energy consumption is 30kWh
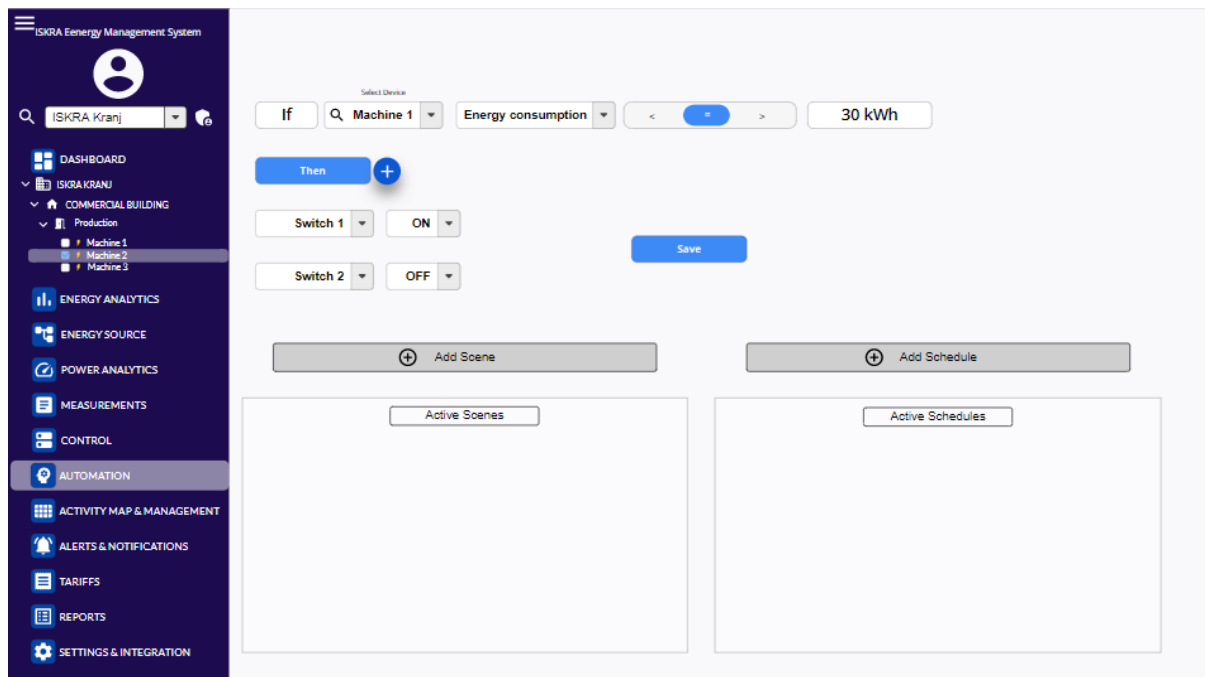
Then,

Turn ON Switch 1 and Turn Off Switch 2

A 'scene' is a combination of software controls saved under a unique name for a specific time and date, or action. Scenes can be programmed by admin user or created by a specific department user that knows a process. Scenes allow you to customize the sequences of technology in your sector or building and tie them together to create an experience.

The Scheduled Actions feature allows users to conveniently schedule a software command to trigger at a later time (time, daily, weekly etc).

This feature will run locally also.

Activity Map

A brief activity map of an appliance, sector or building showed in detail for the entire day and month.

When the user puts a cursor to the square, the system shows how much energy is consumed during this period.

The activity map helps to understand in detail if the appliance or heating is running during non-working hours or weekends.

Through activity management, users can select non-working hours and compare the consumption of energy for that appliance that used to work during weekends. With an up-to-date schedule to see how much money would be saved if this schedule activates.

Activity map is built to show detailed consumption and manage energy easier.

Users can manage activity of the selected ''Machine 2'' on ''Activity Management''.

A detailed table will be generated to let user's select time slots when to turn off devices during specific time by selecting each slot.

Below the table, costs on monthly intervals are shown.
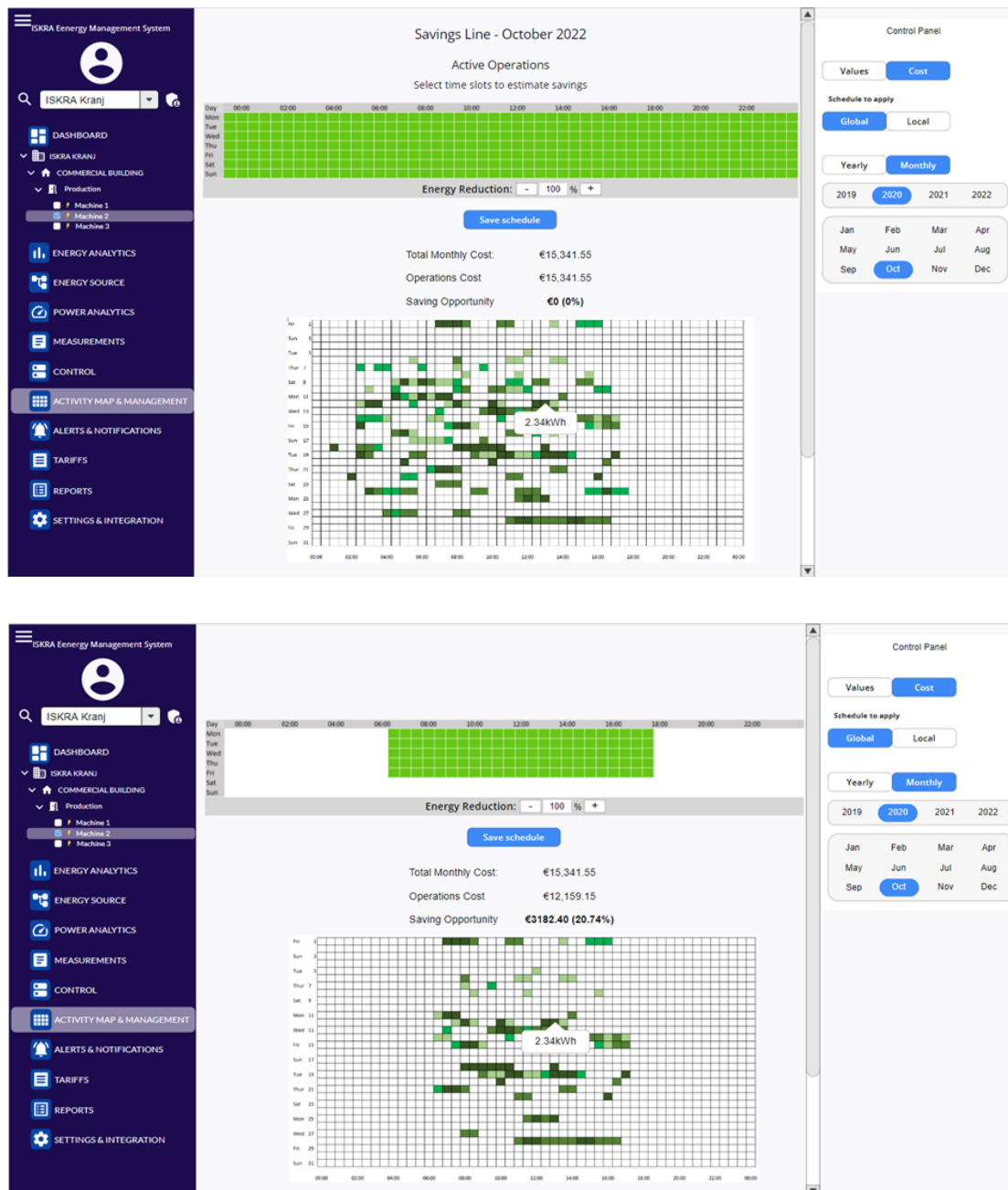
By saving the new plans at ''Save schedule'', a new table will be generated to show time slots when the device will be active and when it is scheduled to be deactivated along with potential savings.
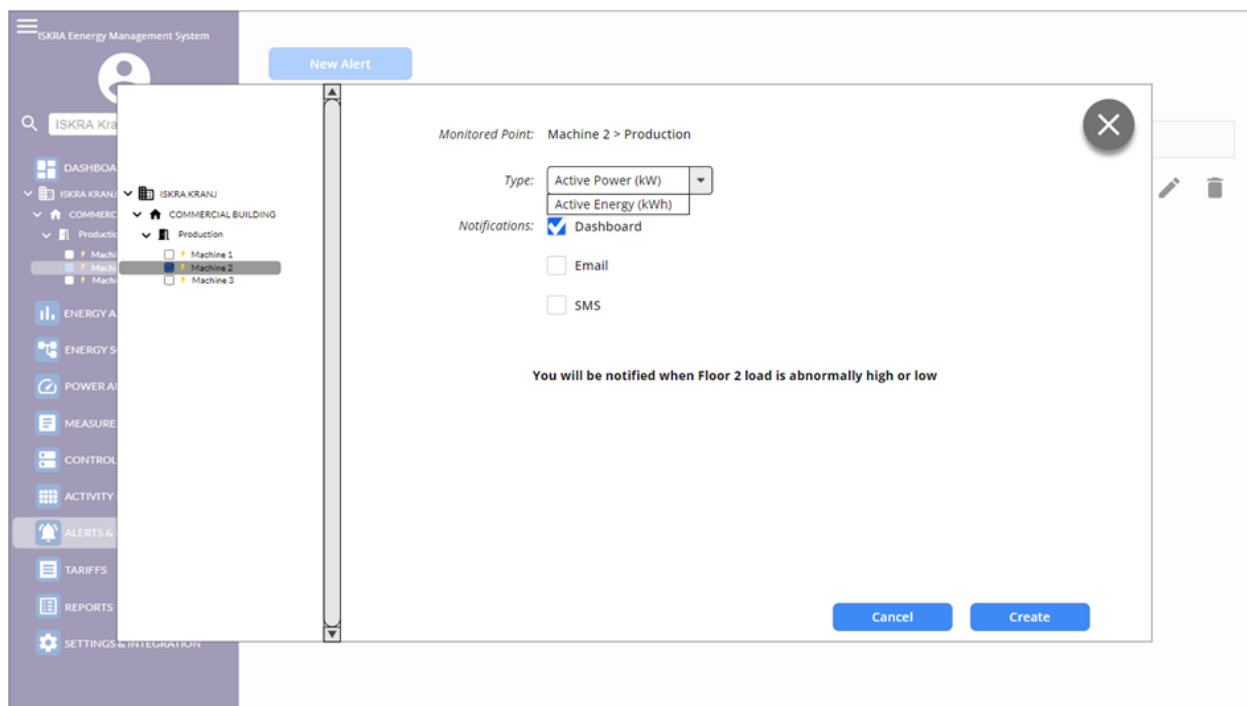
Alerts & Notifications

Alerts and Notifications are designed to notify users when there's abnormal load or another parameter set by the admin is exceeded.
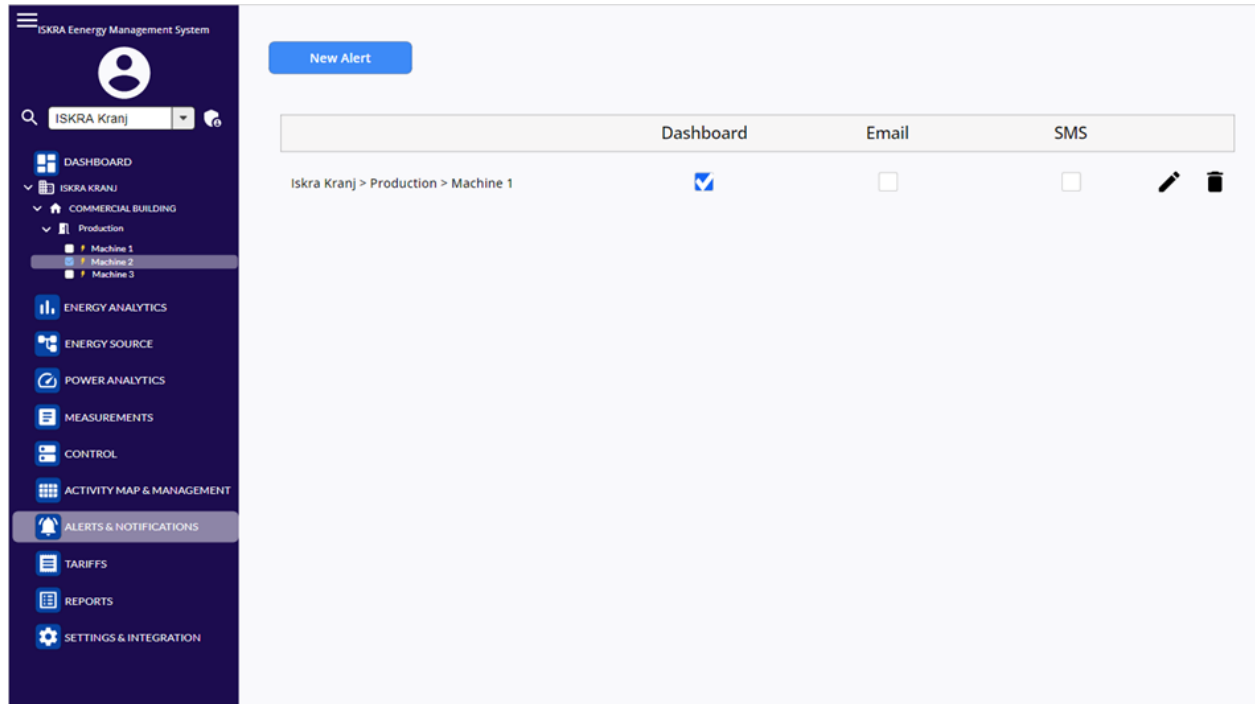
In the alerts section, users will have a list of historical sets of Alerts.

By clicking ''New Alert'', users are able to create an alert by selecting for which machine or device they want to have the alert, select the type of alert and notification shown on Dashboard, Email or SMS.

Users will be able also to set parameters on their own.

Tariffs

Tariffs are designed to calculate energy consumed based on inputs integrated by the users.

In the tariff section, there's a possibility to calculate electricity consumption by integrating tariff rate, dates and periods of the day (24h).

Users can view historical tariff and add new tariffs bly clicking on the button ''Add Tariff''

Users will give tariff a name, the validation of the tariff from date-to-date, CO2 emission factor and rates.

Based on the rates, on the table below users can write Tariff rate for each hour if it's different.
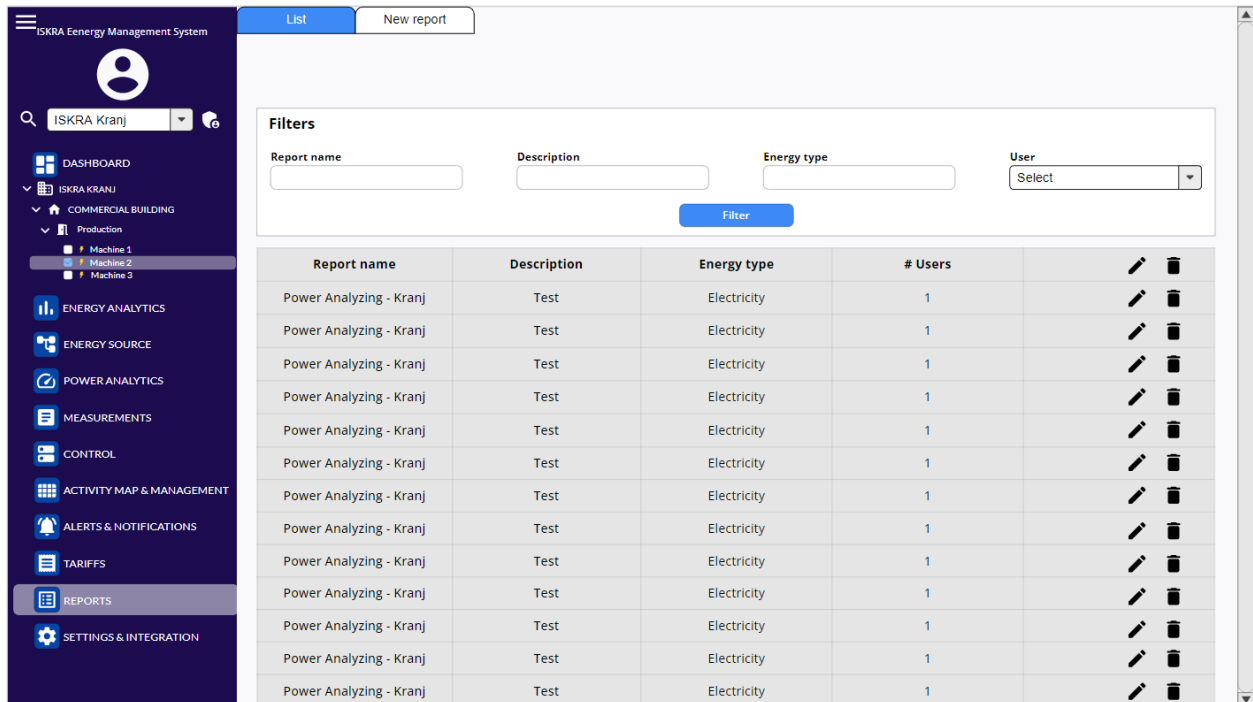
Ex. If Company ''X'' is supplied with electricity from ''Supplier Y'' with random tariffs, the system will calculate all electricity consumption based on tariffs of ''Supplier Y'', in the case a new electricity supplier ''Supplier Z'' comes with new tariffs, users can compare tariffs of ''Supplier Y'' with ''Supplier Z''.

ISKRA Eenergy Management System

ISKRA Kranj

- DASHBOARD
- ISKRA KRANJ
  - COMMERCIAL BUILDING
    - Production
      - Machine 1
      - Machine 2
      - Machine 3
- ENERGY ANALYTICS
- ENERGY SOURCE
- POWER ANALYTICS
- MEASUREMENTS
- CONTROL
- ACTIVITY MAP & MANAGEMENT
- ALERTS & NOTIFICATIONS
- TARIFFS
- REPORTS
- SETTINGS & INTEGRATION

Past 12 months cost analysis*

Tariffs	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021	Oct 2021	Nov 2021	Dec 2021	Total
Current	14,981€	14,622€	13,551€	11,250€	12,357€	14,385€	11,479€	15,112€	11,353€	13,457€	13,257€	15,167€	160,971€
new tariff	13,378€	14,557€	12,567€	10,987€	11,351€	13,056€	10,258€	13,871€	10,150€	12,150€	11,983€	15,167€	149,475€ (-7.14%)

Add a new tariff to the analysis

Reports

Send your teams & clients daily/monthly consumption reports or electricity. Automate reports so that you don't have to set these up every time you need to send them. There are 12 pre-built reports available which can be scheduled so you can scale your reporting & save time.

(The reports can be generated only for electricity)

Reports are generated into the ''New report'' section.

Users can generate reports by selecting multiple pages to be included in the report.

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New Report

Report name *	Electricity bill
Description *	
Energy type*	Electricity
Frequency *	Monthly
Transmission day *	2
Time shift in months*	1
Sites to be reported *	Send reports for all the sites associated with the user's dashboard

Select pages to be included in the report

☑	ıl.	**Trend analysis**	• Shows the month consumption, compares with previous month and same month in the previous year. Also shows the breakdown consumption per weekday. • One page per site (level 2). • Available for electricity and gas.	
☐	∿	**Trend analysis & Compare charts**	• Shows the month consumption, compares with previous month and same month in the previous year. Also shows the month-to-month comparison with previous year. • One page per site (level 2). • Available for electricity and gas.	
☐	ıl.	**Active power & weekdays**	• Shows the load demand variations over the month and breakdown of consumption per weekday. • One page per meter (level 3). • Available for electricity.	

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☐	ıl.	**Operations analyzer & weekdays**	• Shows consumption per weekday and breakdown of consumption and cost for workdays/weekends. • This page allows insertion of custom comments. • One page per meter (level 3). • Available for electricity and gas.	
☐	∿	**Top 3 consuming areas**	• Shows top customers for a site. • One page per site (level 2). • Available for electricity.	
☐	ıl.	**Top 3 consuming sub-areas**	• Shows top consumers (appliance, level 4) for top 3 consuming meters. • One page per meter (level 3). • Available for electricity.	
☐	∿	**Deployment**	• Shows which points are monitored with physical meters. • One page per site (level 2). • Available for electricity and gas.	
☐	∿	**Energy Performance**	• Shows the points with KPIs marked to be used for report. • One point per page • Available for electricity and gas.	
☐	∿	**Utility bill**	• Shows an utility bill based on the consumption.	

☐	〰	**Utility bill**	• Shows an utility bill based on the consumption. • One page per site (level 2). • Available for electricity.
☐	〰	**CO2 Report**	• Shows CO2 emissions from the reported month. • Compare CO2 emissions from the reported month with the previous month. • Compare CO2 emissions from the current year with the previous year. • One page per site (level 2).
☐	〰	**Power Quality Report**	• Shows Active Power, Reactive Power, Apparent Power, Power Factor, RMS Voltage and RMS Current. • One meter (level 3) per page
☐	〰	**Heat map & operations analyzer**	• Shows month heat map and the wastage analysis. • This page allows insertion of custom comments. • One page per meter (level 3). • Available for electricity.

Billing types:

Trend analysis	- Shows the month consumption, compared with previous month and same month in the previous year. Also shows the breakdown consumption per weekday. - One page per site (level 2). - Available for electricity and gas.
Trend analysis & compare charts	- Shows the month consumption, compared with previous month and same month in the previous year. Also shows the month-to-month comparison with previous year. - One page per site (level 2). - Available for electricity and gas.
Active power & weekdays	- Shows the load demand variations over the month and breakdown of consumption per weekday. - One page per meter (level 3). - Available for electricity.
Heat map & operations analyser	- Shows month heat map and the wastage analysis. - This page allows insertion of custom comments - One page per meter (level 3). - Available for electricity.

Operations analyser & weekdays	- Shows consumption per weekday and breakdown of consumption and cost for workdays/weekends. - This page allows insertion of custom comments. - One page per meter (level 3). - Available for electricity and gas.
Top 3 consuming areas	- Shows top customers for a site. - One page per site (level 2). - Available for electricity.
Top 3 consuming sub-areas	- Shows top consumers (appliance, level 4) for top 3 consuming meters. - One page per meter (level 3). - Available for electricity.
Deployment	- Shows which points are monitored with physical meters. - One page per site (level 2). - Available for electricity and gas.
Energy performance	- Shows the points with KPIs marked to be used for reporting. - One point per page - Available for electricity and gas.
Utility bill	- Shows an utility bill based on the consumption - One page per site (level 2). - Available for electricity.
CO2 Report	- Shows CO_2 emissions from the reported month. - Compare CO_2 emissions from the reported month with the previous month. - Compare CO_2 emissions from the current year with the previous year. - One page per site (level 2).
Power Quality Report	- Shows Active Power, Reactive Power, Apparent Power, Power Factor, RMS Voltage and RMS Current. - One meter (level 3) per page

Settings & Integration

Products that will be implemented in this solution with TCP/IP and WIFI connection:

- MC (measuring Centers),
- MT (Measuring Transducers),
- ICC (Iskra Cabinet Control).

Integrating Iskra products (such as Power Analysers, SG, Energy meters and Bistable switches) to an energy management system which is able to monitor consumption of energy, manage consumption and control devices with an aim to increase energy savings.

The system needs to generate rules based on historical decisions

Types of users can be: Production Plants, Commercial Buildings, Solar Plants and Residential sector.

Comparing KPI, ex. Production of energy compared with reduction of CO_2 emissions.

Set a day average consumption on energy by the user and when compare with usage of energy to show the difference in graph

Automatic reports generating (ex. Every-month or Every-day at 18:00 reports on consumption or other indicators).

Technical Features and architecture

- Reading data locally from connected devices(TCP/IP and Wifi)
- Connecting devices to Cloud
- Web integration solution with Cloud
- Data visualization
- Control implementation
- Control and Automations, etc.
-

Potential Iskra hardware for implementation in the software:

Iskra Cabinet Control

IE14xx

IE38x

Bistable Switches

SG

Local Server

WM3M4, WM3M4C

WM3x6

WM 1

WS 1102
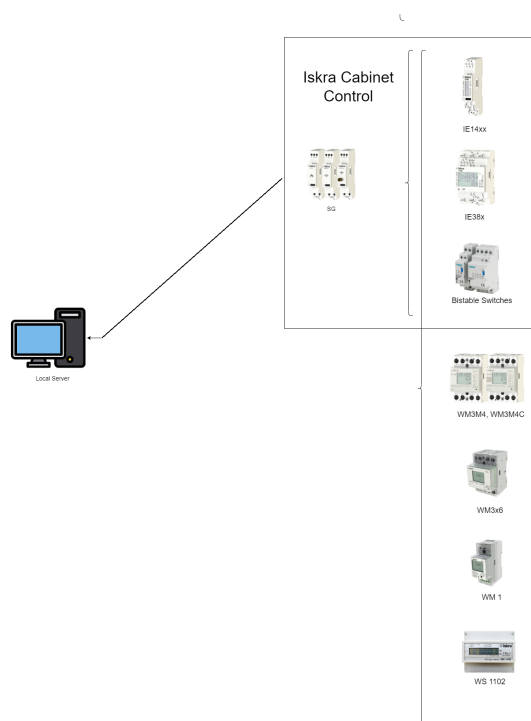
Note: Some products may have some technical problems and may be excluded from the implementation list.

-Overall Architecture-

:
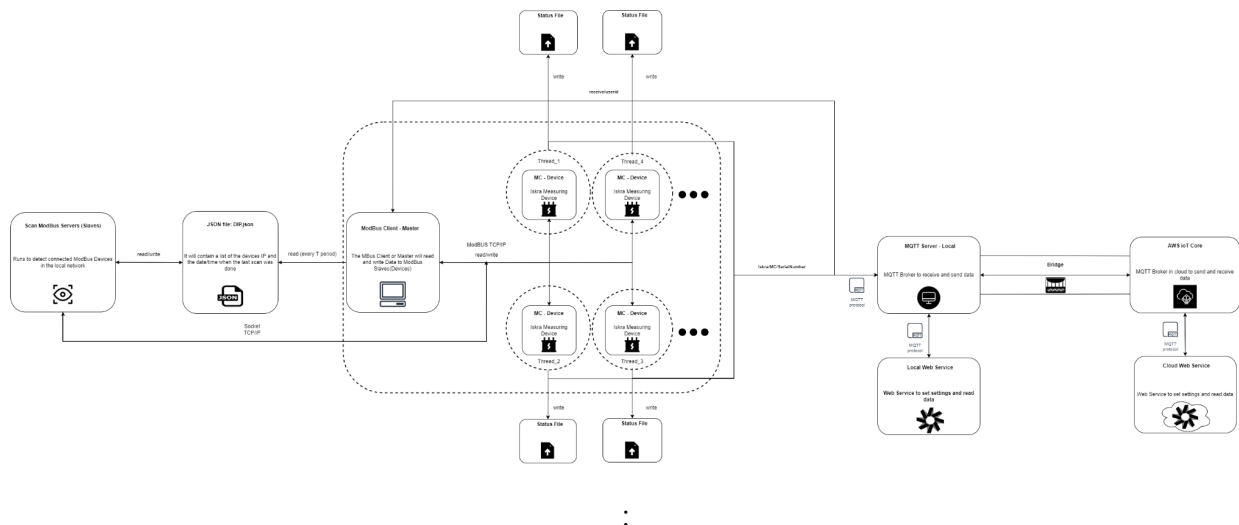
-In production settings-

- Implementing a system to try basics read and write via Modbus TCP/IP.
- Implementing a system to set basic and initial settings for the new users.
- Implementing a Database that takes important records for every produced device after the tests are made in the last phase of production

-User Installation-.

- Implementing a system that will install all necessary scripts, software and dependencies automatically.
- Check the operating system and read the system requirements of the server.
- Scan for updates and upgrades of the server.

-Modbus device detector-

- Implementing a system to scan devices in the local network.
- Detects Devices available at a port that they are listening to.
- Distinguishing between Modbus devices and other devices.
- Generating a file with the list of the available Modbus Devices.

- Modbus Master-

- Implementing a Modbus client with these features:
- Reading and pushing data to the local server from the settings and measurements via Modbus TCP/IP
- Writing Settings from incoming data from the Local Server.
- Threads so that the data will be pushed simultaneously from every Modbus Server (Device).
- Every thread pushes data to the Local Server and generates a status file which is important for the automations and control phase

-Set up Local Server-

- Implement a local Server for the data to follow locally
- Support Connection of SG(ICC)
- Receive and send data from the local web service, and from the cloud web service.
- Setup a bridge between Local Server and Cloud Broker
- Create a script for monitoring, upgrading and updating SSL certificates of the local server.
- Set up Cloud Broker

<u>-Set up AWS account for Iskra-</u>

● Create a script for generating, monitoring, upgrading and updating SSL certificates.

<u>-Automation Control System-</u>

● Implement a system hierarchy of subsystems consisting of the (AGS) - Automation Generator System which is responsible for creating an (ASM) - Automation Monitoring System per user. The ASM is responsible to start, pause, stop and destroy finished (AR) - Automations Rules. The ARs are the last level of the hierarchy whose task is to listen our IoT devices and check if the conditions are met to execute a certain task set by user.

SOFTWARE ROADMAP

Roadmap of Software Development if Development Starts from 01-July-2022.

The day the software development starts until the deadline is 7 months.

Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7
Design Tree of the Software	User Management	Progress Integrating Control	Integrating Control	Integrating Alerts and Notifications	Writing Settings through Modbus Client	Reports Integration (Trend analysis, active power, energy performance, etc.)
Creating the Database	Integrating MC, MT and ICC	Progress Integrating Automations	Integrating Automations	Tariff Implementation	Progress Reports Integration (Trend analysis, active power, energy performance, etc.)	Software Testing and Upgrade
Device Provisioning	Modbus Client Implementation (read, send settings and measurements	Integrating Power Analytics	Integrating Activity Map and management	Software Testing and Upgrade	Software Testing and Upgrade	Final Delivery
Local web service	Integrating Energy Analytics	Integrating Data visualization	Software Phase 1 Launch			
		Modbus Client Implementation (read, send settings and measurements	Testing the facility and getting feedback to improve			

Energy Management Software — 15-Oct-2022

MiQen Integration — 31-Nov-2022

Full Software — 31-Jan-2023

TASKS FOR ISKRA

These tasks are required to be completed in these months to meet with the development of software

Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7
Iskra Products Samples (MC, MT and ICC)	Energy Data Expert	Transforming the OT data into contextual IT data with modeling and properties such as engineering units, serial numbers, etc.	Installing products in Iskra Kranj, Semic and ELKA.	Business Model and Use cases		
Documentation of Iskra Products	Finding Added value from data					
	Finding the right hardware					