Renewable Energy Sources & Energy Efficiency as the new quality parameter of Network infrastructure

A1 Serbia

PV project

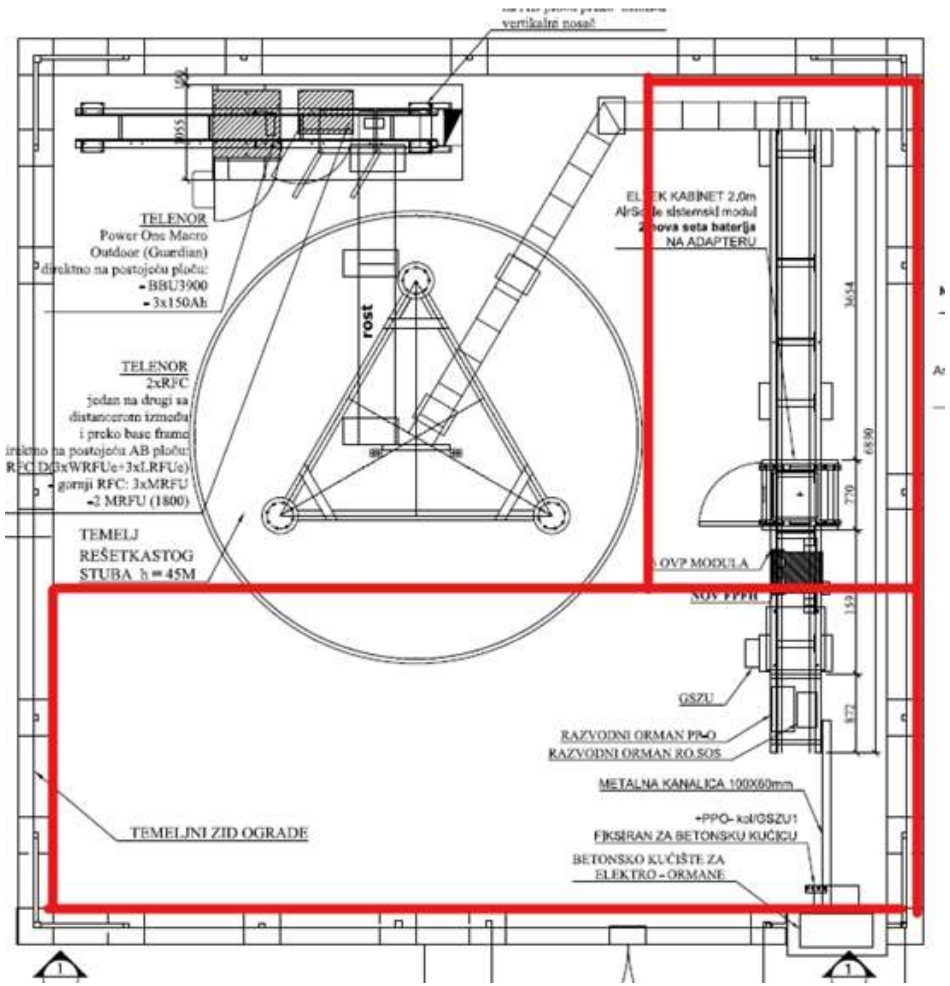
Vladimir Spasenovski, Power supply expert

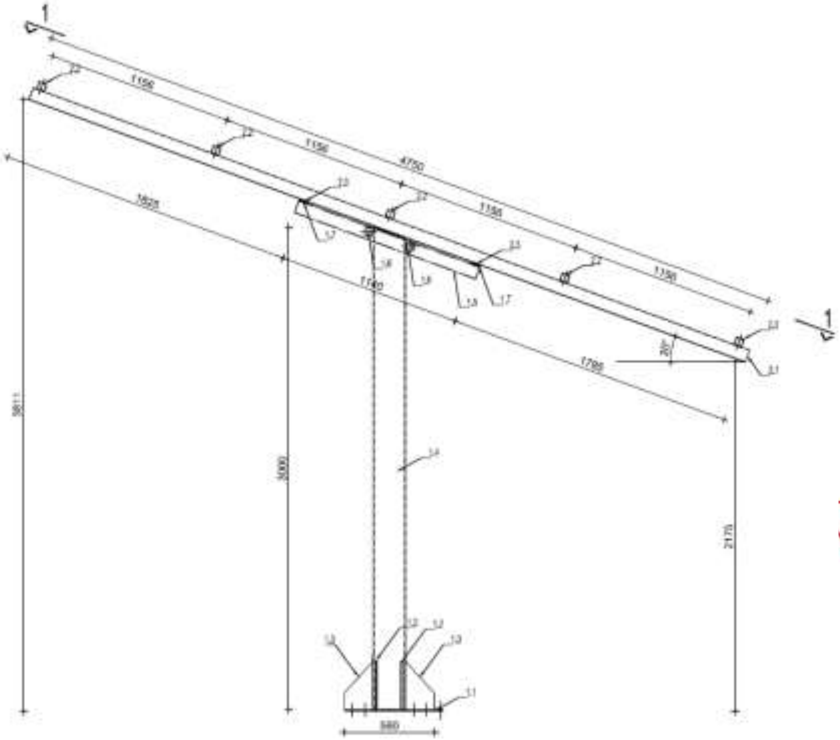
New Laws & Regulations on Renewables

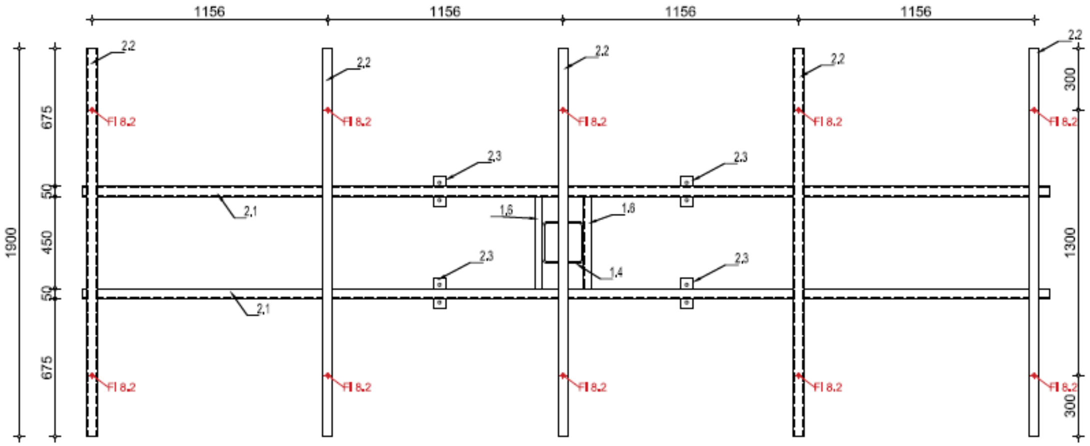
- Regulations adopted 1 year ago.
- Missing documents published in March 2022
- Up to 10,8kW – Subject of a streamlined procedure, identical to the grid connection procedure for households. Construction permit is not required

Source: EPS

Typical site layout



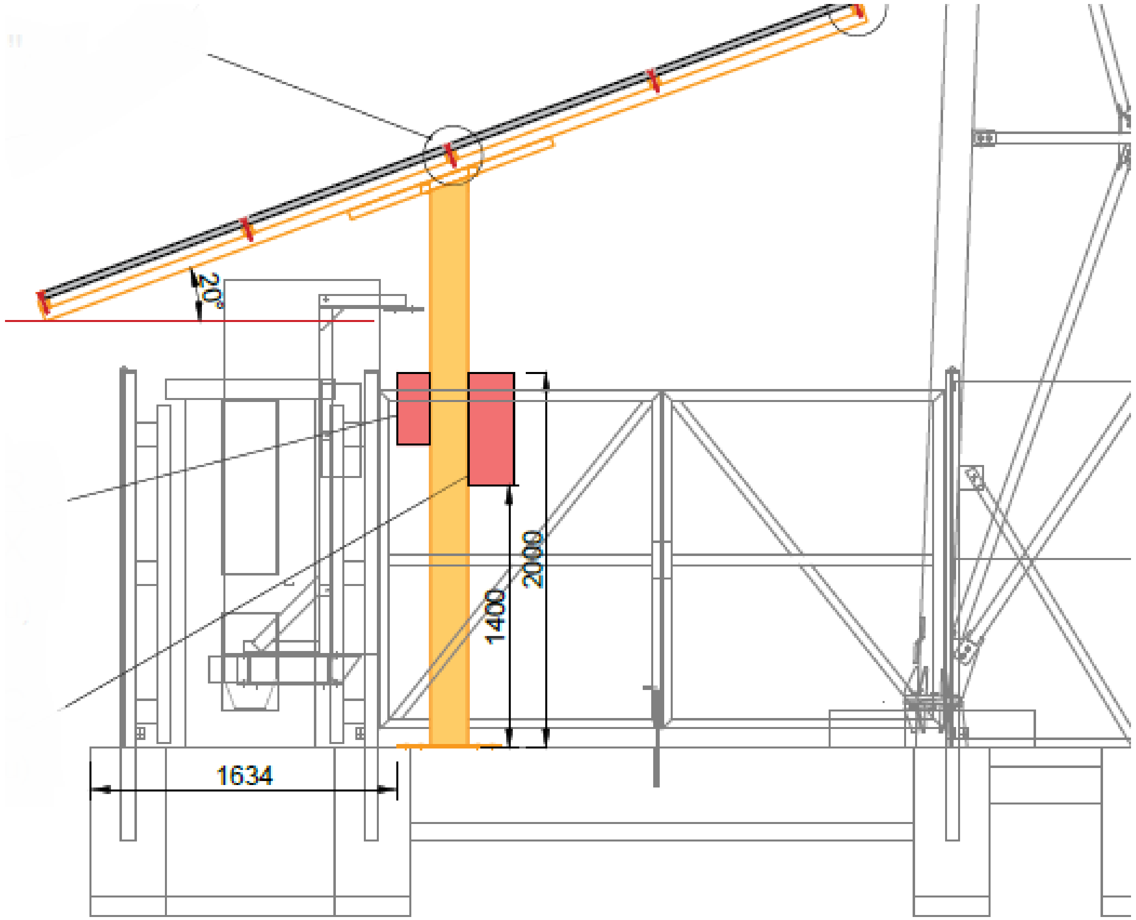


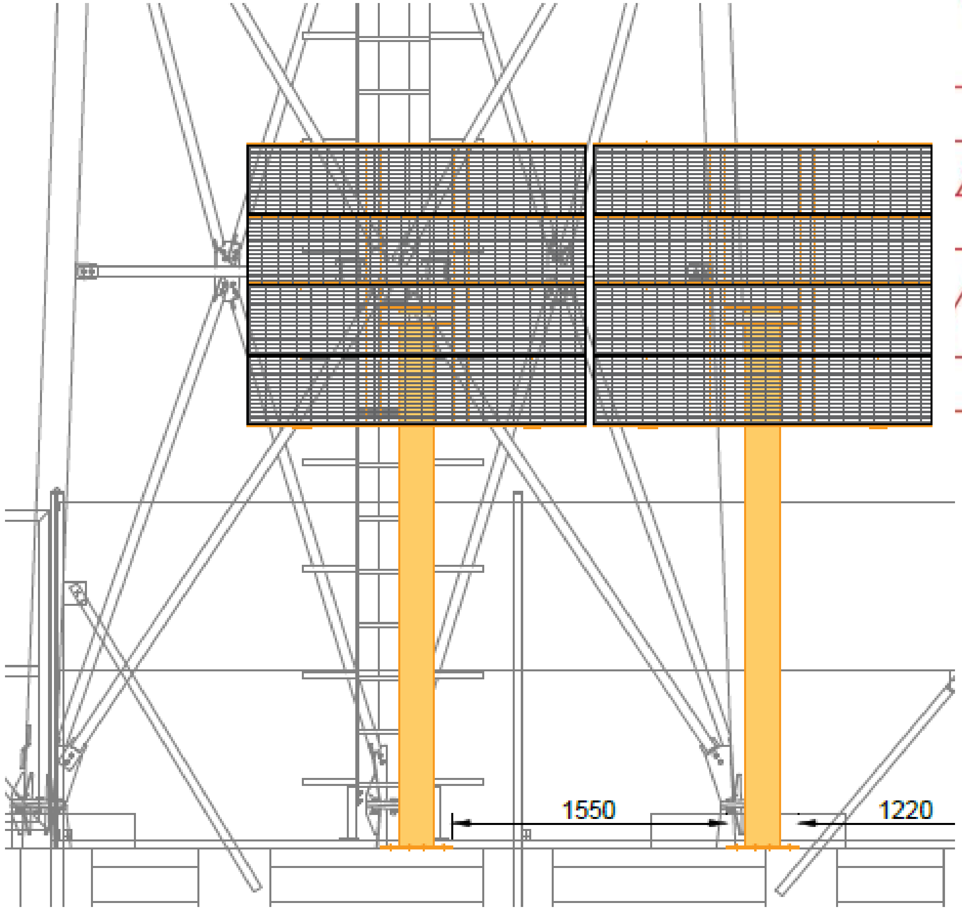


- Standard site design – ~50m2 available space

Construction

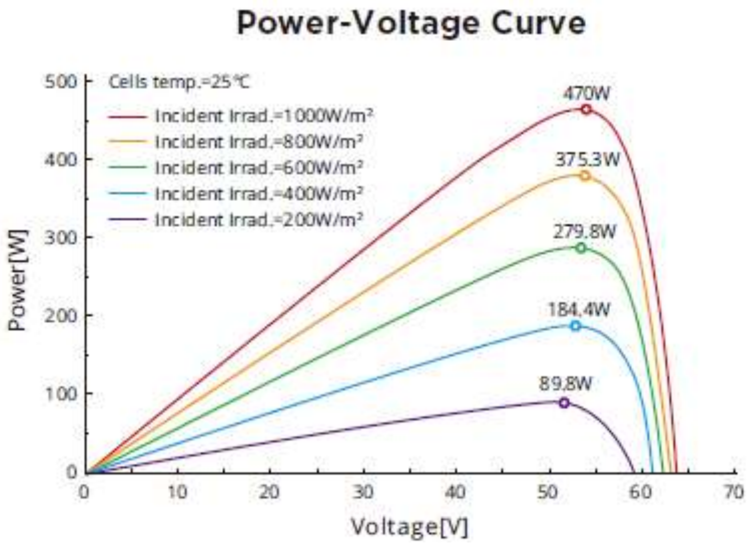
- Steel construction
- Modular type
- Suitable for different site configuration





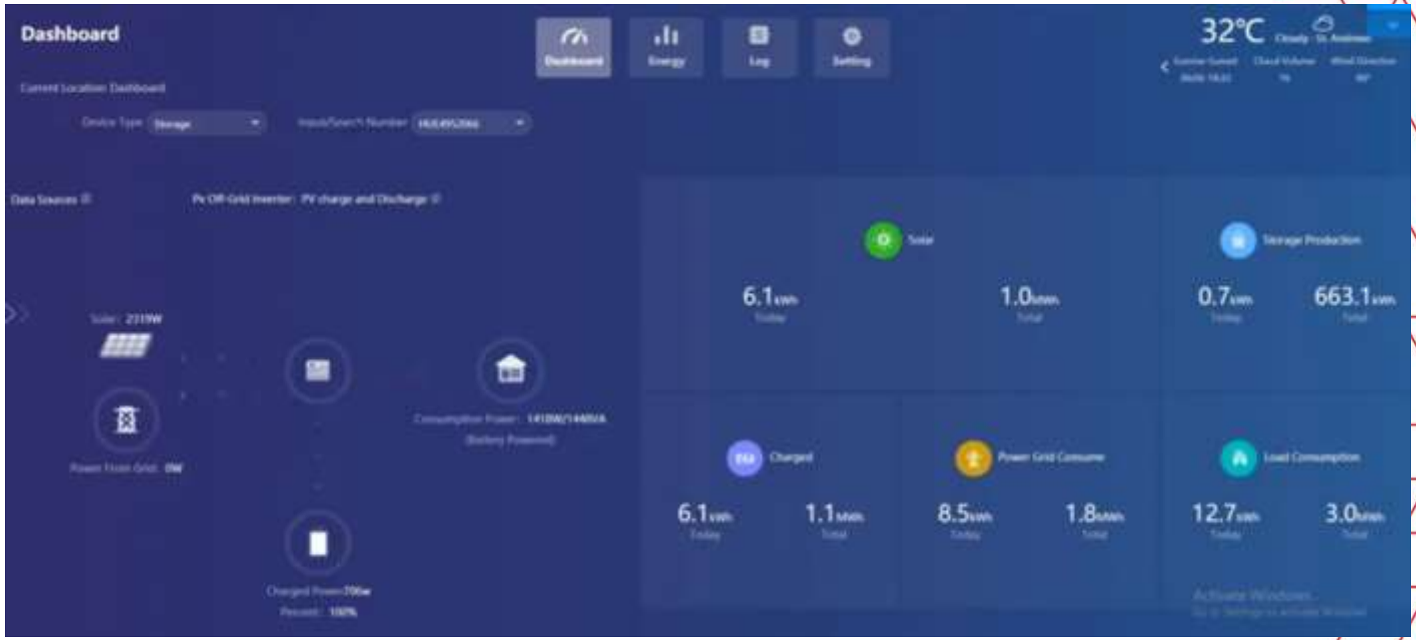
PV panels

- Nominal peak power - 550Wp
- Monochrystal
- Half-cut design
- 3 By-pass diodes
- Dimensions
- Efficiency – 21,3 %



Draft for internal discussion

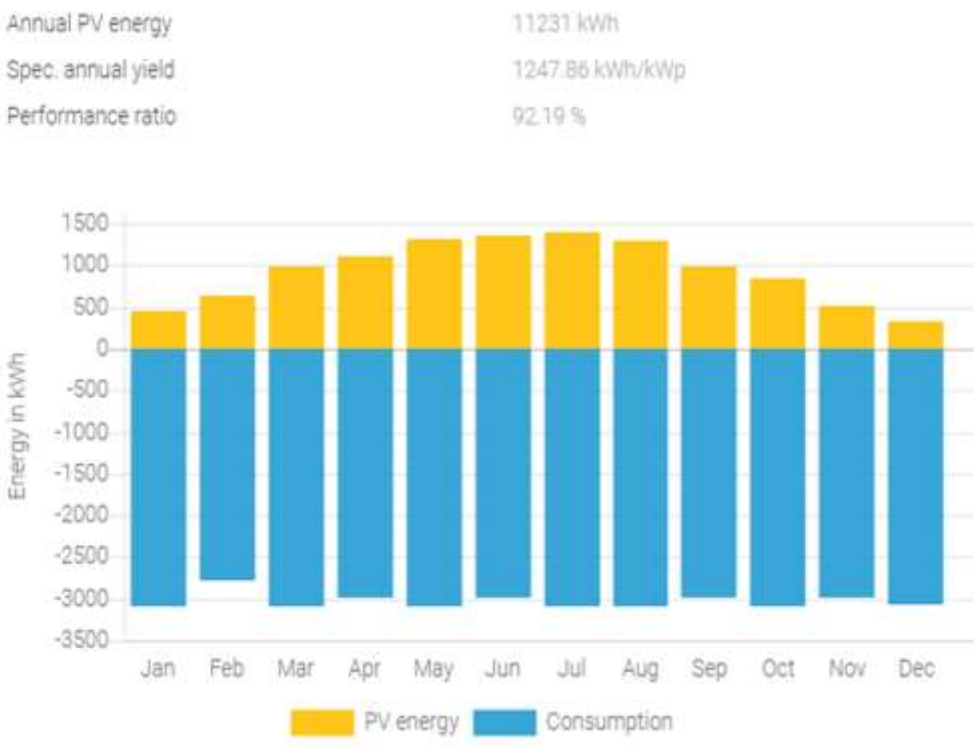
Inverter



- Nominal power – 8kW or 10kW
- On grid
- Efficiency index 98,6%
- Online monitoring
- 2 inputs – possibility to connect 2 strings

PV panels as additional power source on existing sites

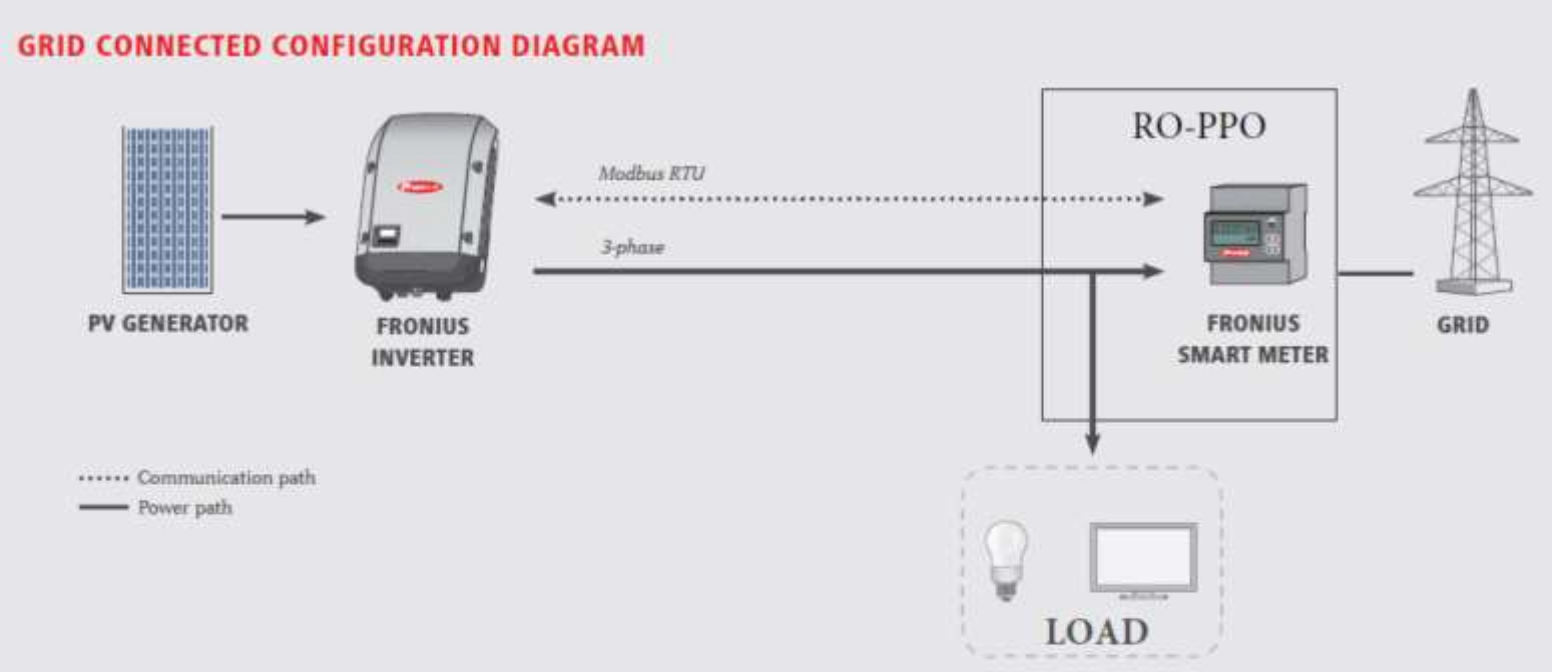
- Sites with towers (GF) – 330 sites till eoy 2023
- 16 panels per site (8,8kWp)



- Almost 11 MWh – Annual solar energy per site
- 9,3 MWh – used for own consumption
- 1,7 MWh – returned to grid
- Solar factor – 25%

	Produced solar energy - kWh
January	445
February	642
March	989
April	1,116
May	1,316
June	1,363
July	1,404
August	1,297
September	992
October	837
November	505
December	325
	11,231

330 sites

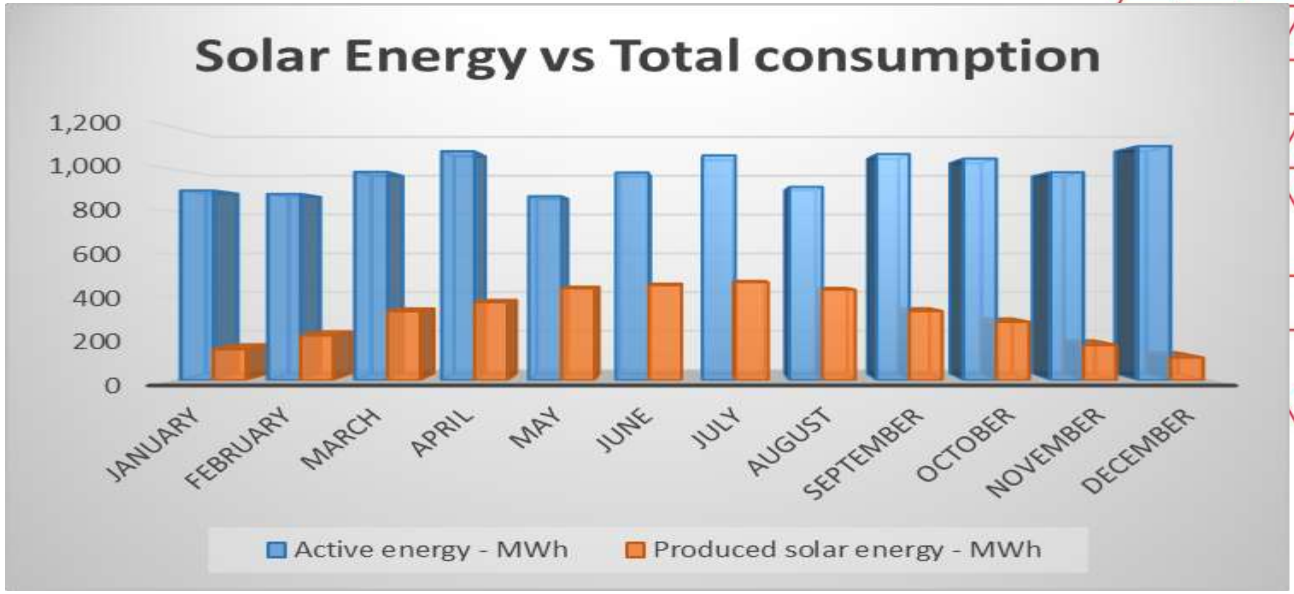


Total installed power:

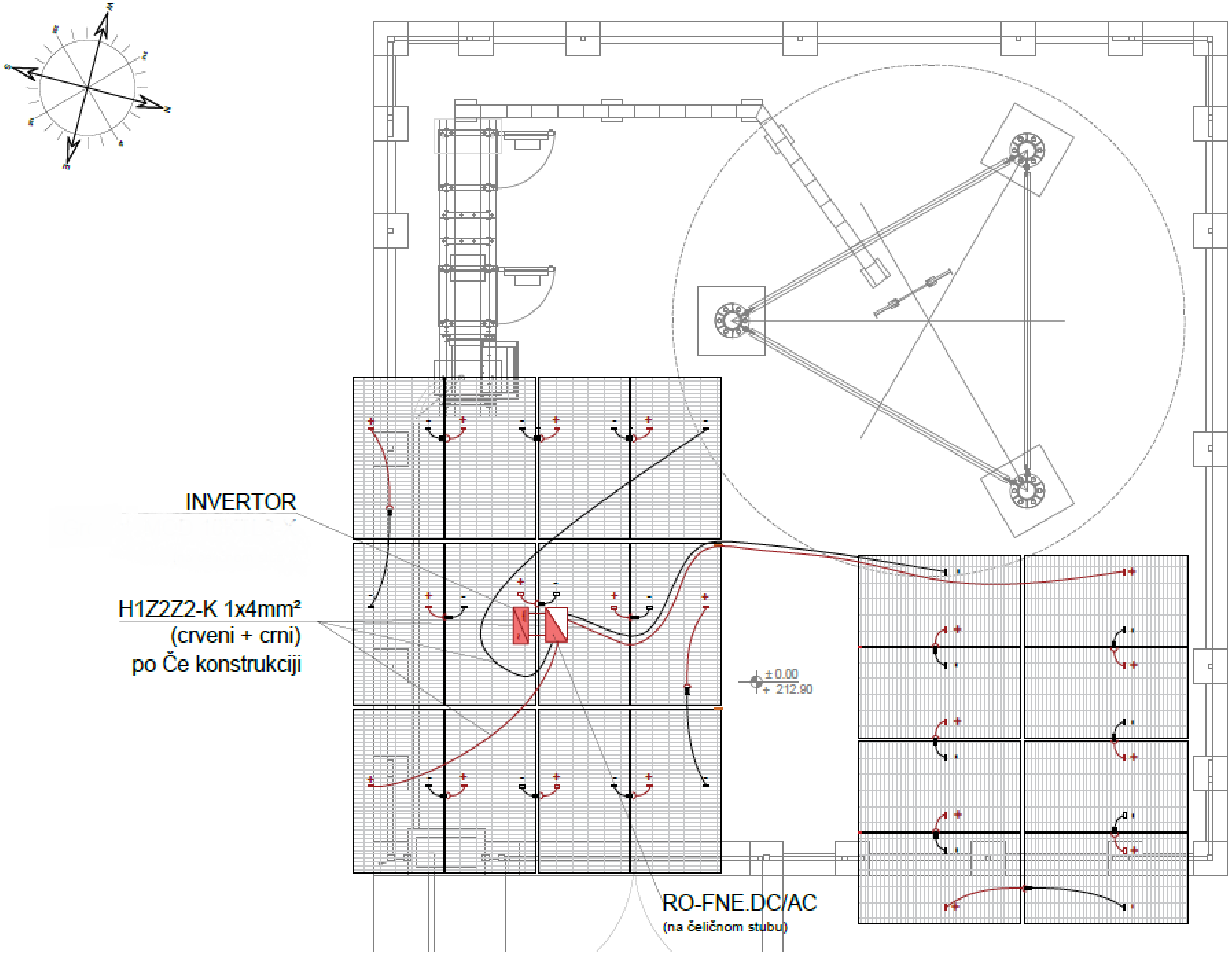
Almost 3 MWp

Avoided CO2 emissions:

1980 t / year



Draft for internal discussion



Draft for internal discussion

Project status

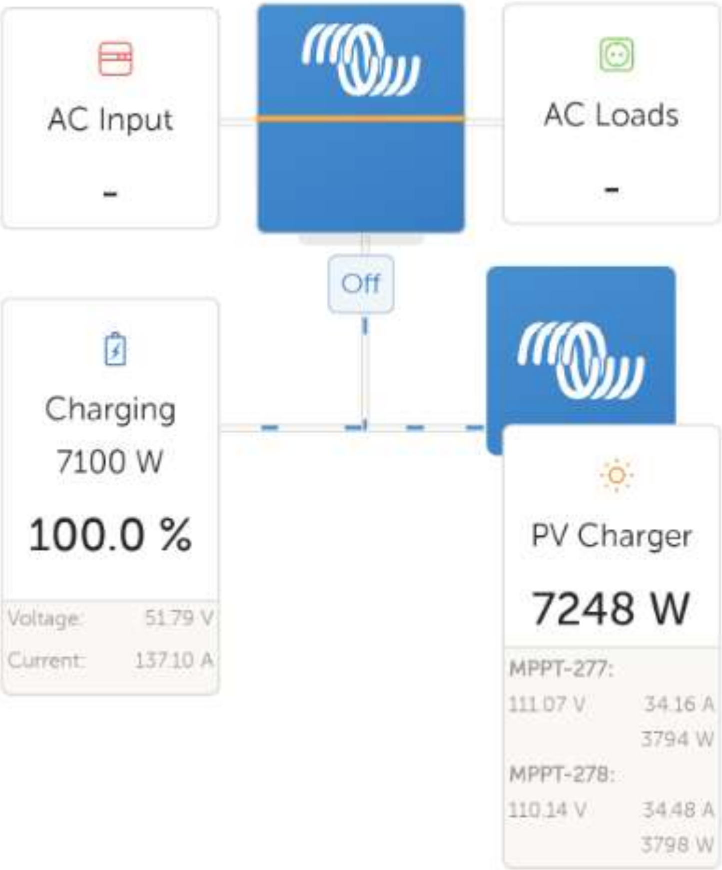
- Panels installed on more than 200 sites
- 230 sites in 2022
- 110 sites more in 2023
- Installed power 1.8MWp, almost 3MWp after project closing
- 6 Off grid sites with solar as primary power source and batteries as secondary
- Continious rollout of mini solar plants in next years

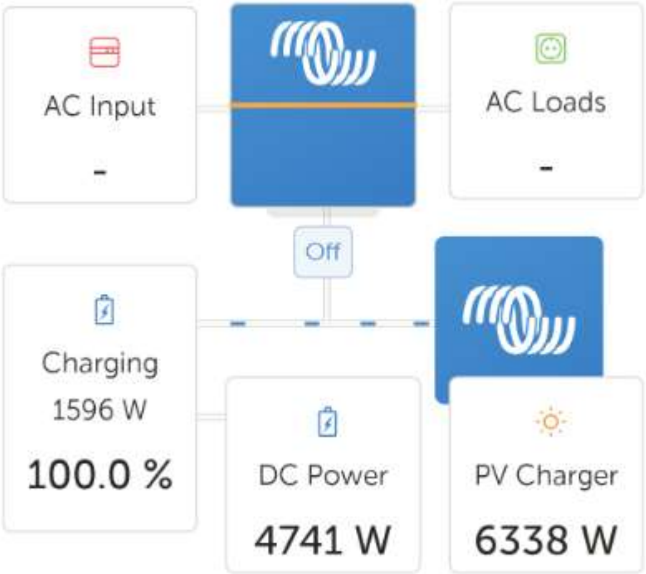
Construction works


A1 Serbia

Off-grid sites

- 6 sites without grid connection
- Off-grid solution with converter



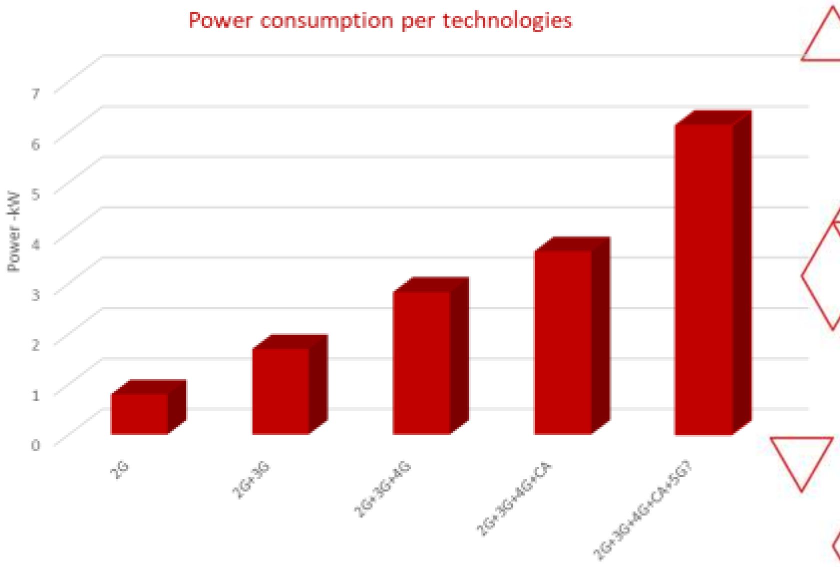


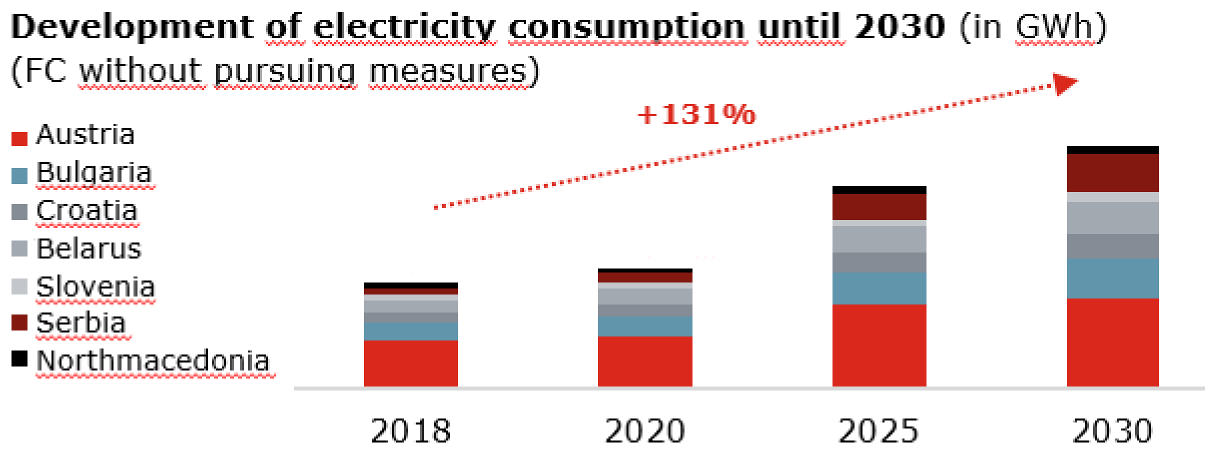
Network efficiency

Ivana Urošević, Power supply lead expert

Net Zero Breakthrough

- Telecom networks – almost 2% of global power consumption
- Mobile industry’s carbon emissions - around 220 mt carbon dioxide or approximately 0.4 % of total global carbon emissions
- 5G rollout – upwards pressure on energy usage



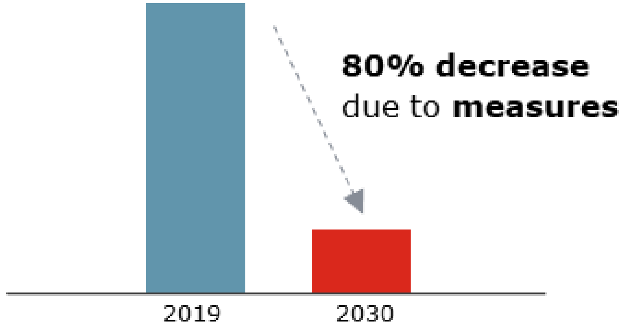


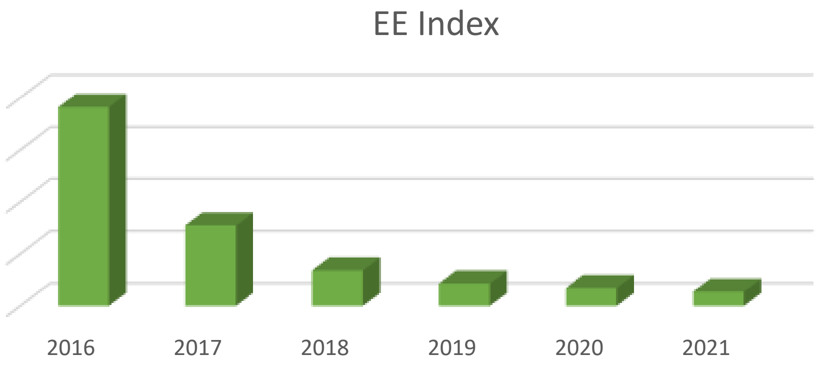
- Most of the main operators are comitted to reach Net zero carbon emissions by 2030

A1 ESG Ambition 2030

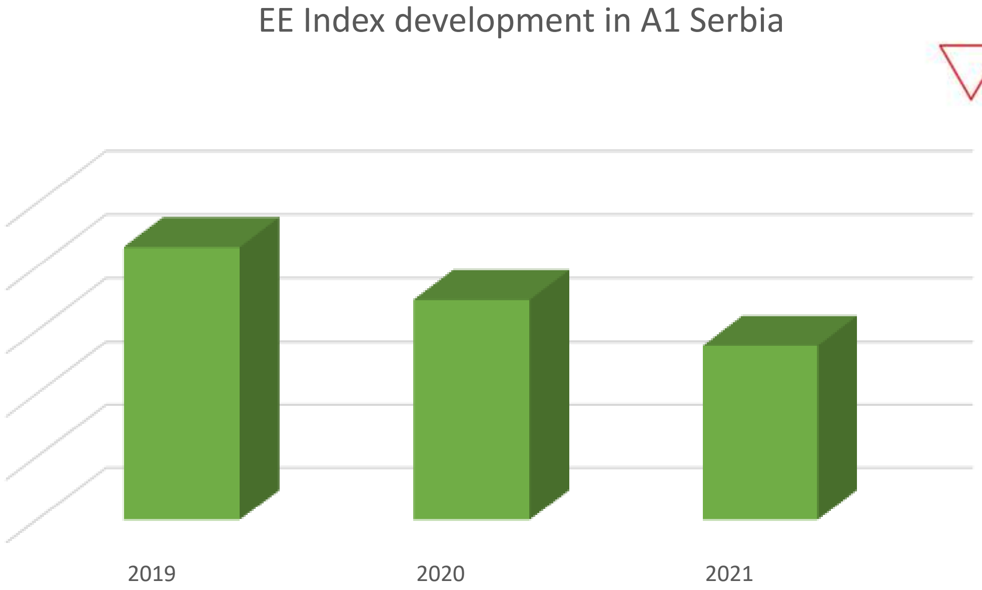
Energy Efficiency Index

- Relative unit for comparison
- Defined as amount of energy needed for transport 1 terabyte of data – MWh / TB
- A1 target – 80% decrease in 2030 vs 2019





- 36% decrease comparing with 2019.



Draft for internal discussion

Effective ways for reaching Net Zero

Renewable energy sourcing

- Green tarifs
- Power purchase agreements
- Own Production

Energy Efficient networks

- Equipment modernization
- Using EE SW tools
- Network optimization using AI & ML
- Decomission of legacy equipment

4 pillars

Infrastructure optimization

- Cooling efficiency increase
- Equipment modernization
- Batteries

Data centers

- Equipment modernization
- Cooling efficiency
- Space utilization

Infrastructure modernization

Installation of free cooling units where feasible.

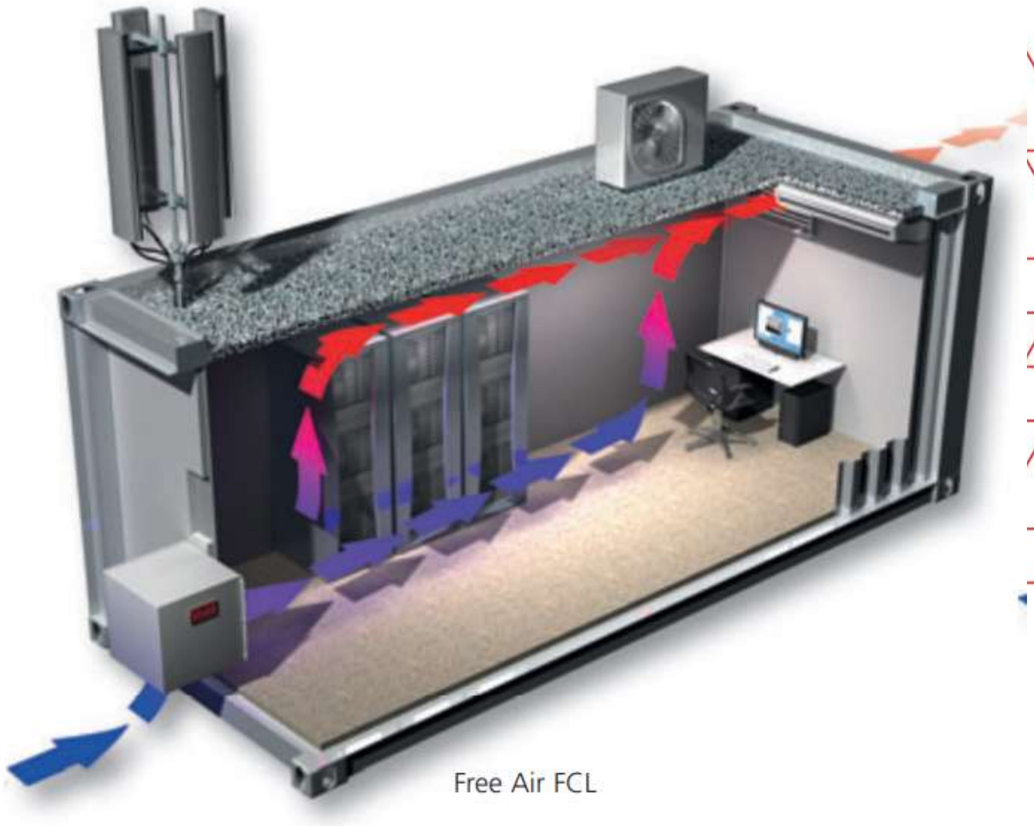
4 MWh/site/year

SWAP of old Air conditioning units with new with better characteristics & energy efficiency index

5.1MWh/site/year

Power supply units modernization – better efficiency, effective cooling

Battery modernization – using new techologies



Free Air FCL

Draft for internal discussion

Energy efficient network

Equipment modernization

- Decomissioning of legacy equipment
- RAN modernization

Energy Efficiency SW features

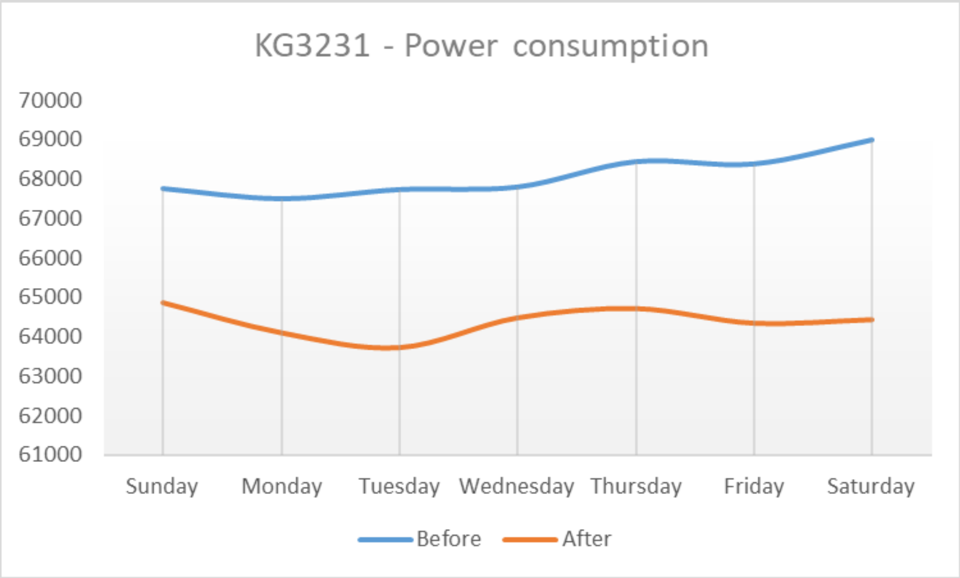
- Sleep mode
- Switch off layers during night

AI driven network optimization

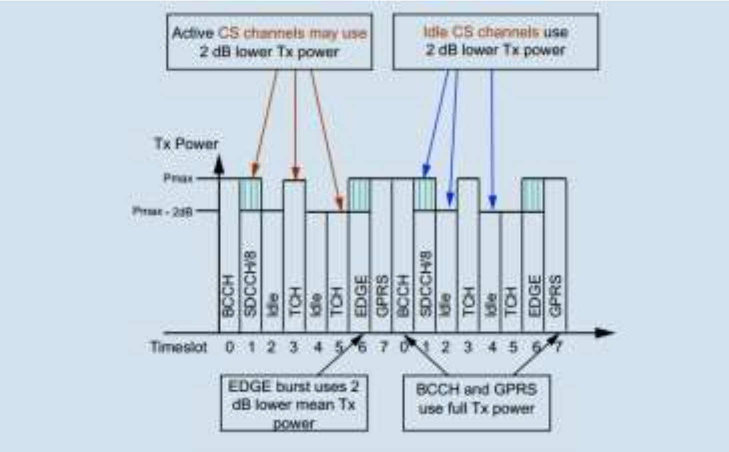
- Using Artificial Inteligence & Machine learning in network optimization

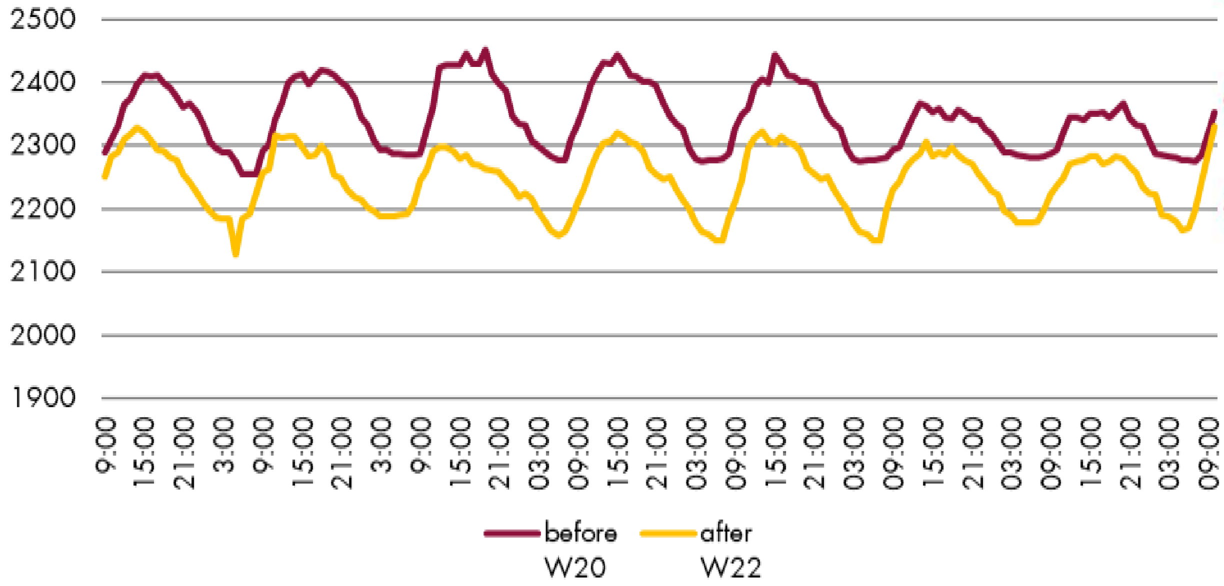
Enhanced BCCH Energy savings

- Reduce power on BCCH during low traffic periods.
- No negative impact on KPI’s
- 4% Lower consumption



Site in trial cluster – results:

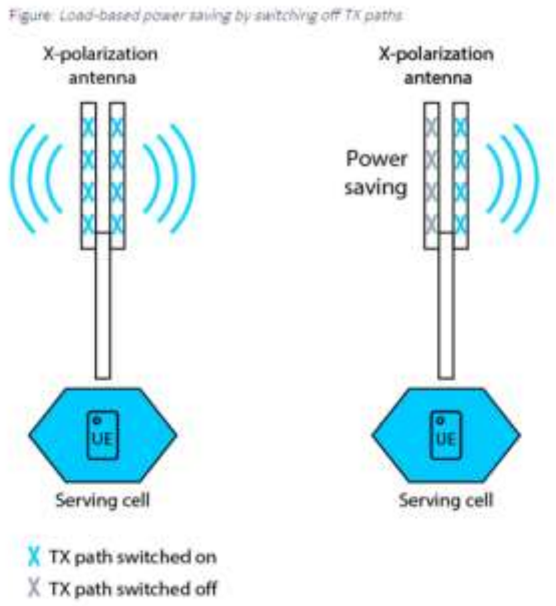




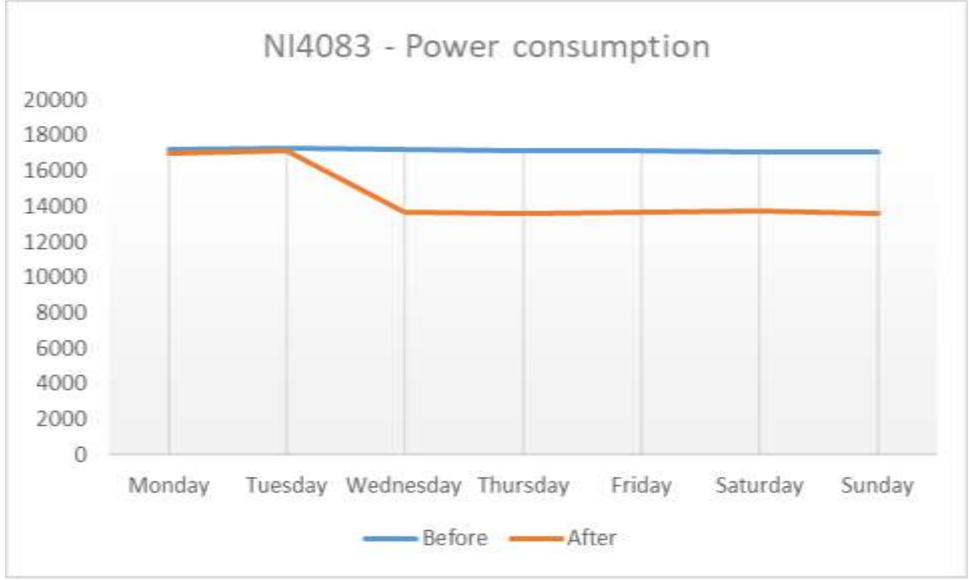
LTE Energy savings features

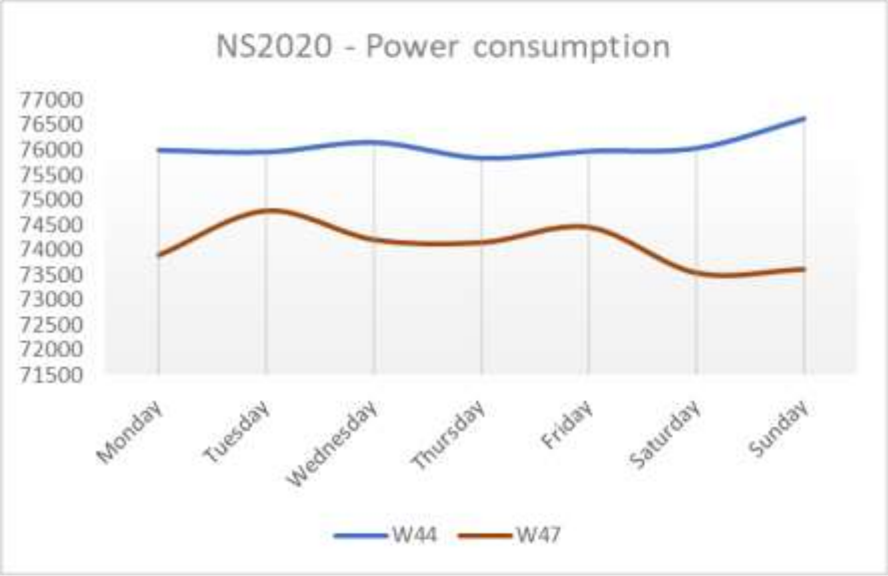
- Multi-layer coverage areas
- Cell switch-off during low-load periods
- More layers -> more savings
- 3% Lower consumption

- Aditional feature – works on top
- Transmitter paths switch-off during low-load periods
- Single-layer coverage areas
- Aditionally 5% Lower consumption



Site in trial cluster – results:





Micro DTX feature

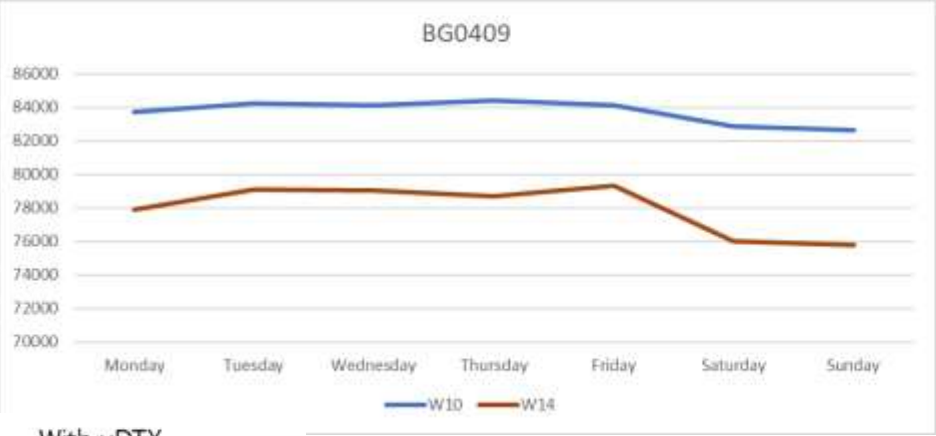
RU's capability to reduce power consumption of its power amplifiers (PA) whenever there are no symbols to be sent.
Feature can be activated only on new gen radio modules.

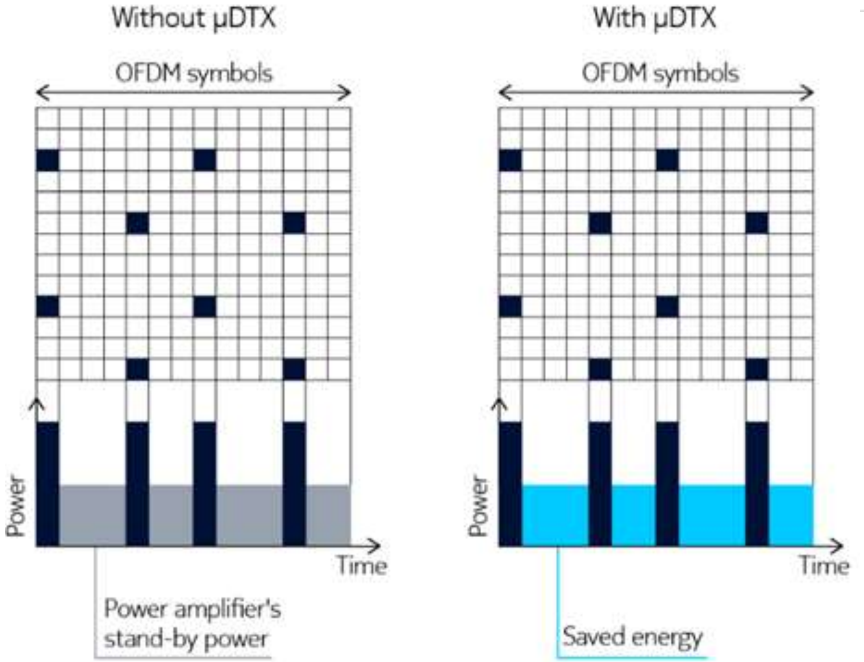
In Rel5 RU PA muting is based on autonomous self-detection of empty OFDM symbols. PA is muted when zero is detected by RU on combined signal from all inputs to the PA.

PA1 is muted for the duration of the Tzero
zero, if Tzero duration is enough to produce savings

Radio Unit energy consumption is reduced
RU

Site in trial cluster – results:



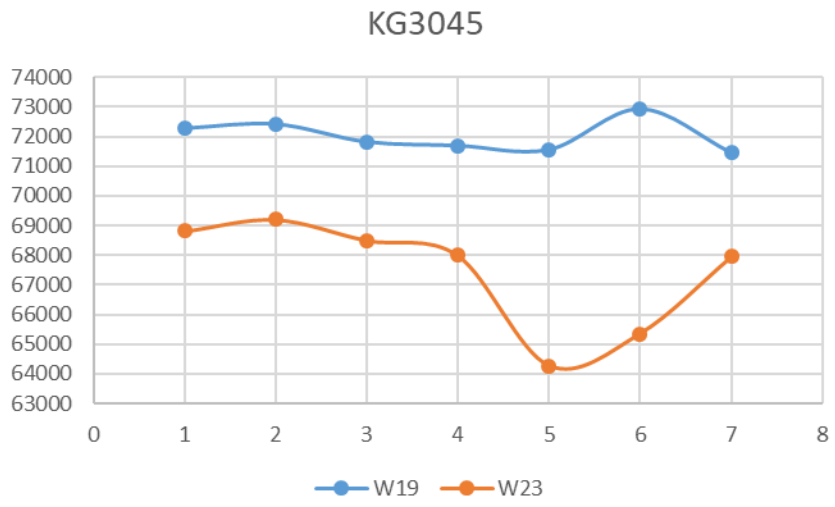


Further savings:

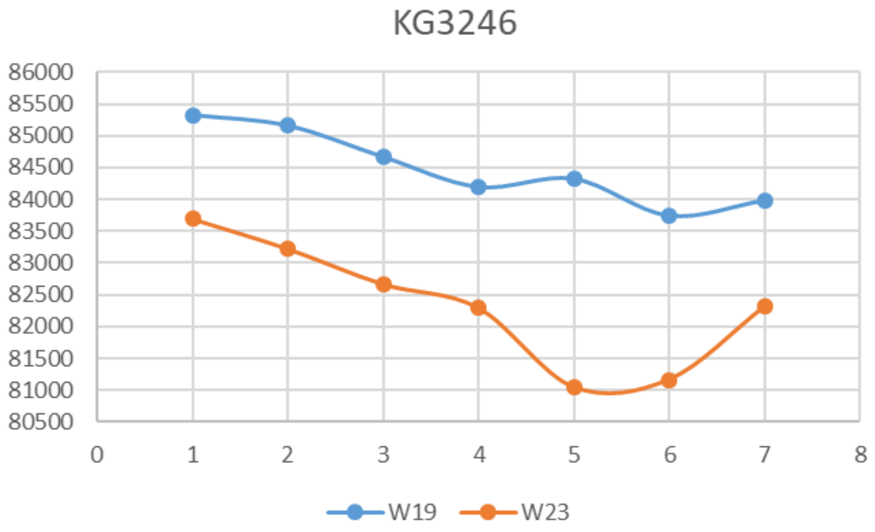
~5.8 %

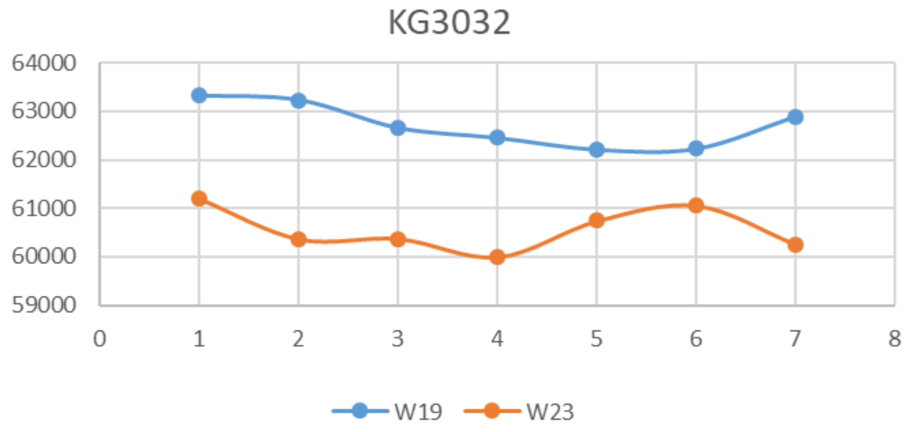
Smart Energy saving by S-cluster

- Artificial Inteligence & Machine Learning Algorithms
- Prediction of traffic pattern and possible power savings period for week ahead
- 8,4% lower consumption
- Further development



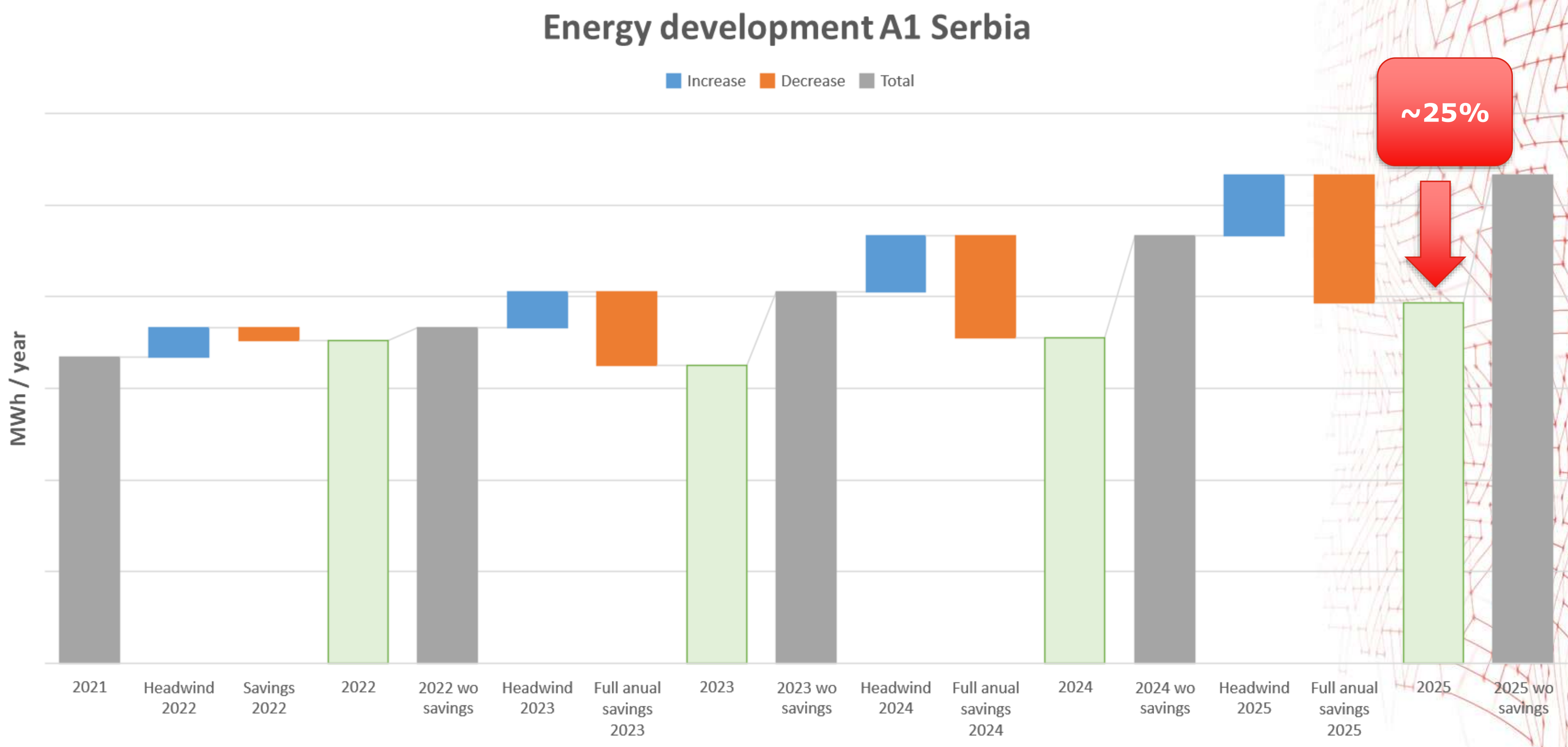
Site in trial cluster – results:





Draft for internal discussion

A1 Serbia Energy development



Smart Energy Saving

Sanja Bjekovic, RAN Quality Development Expert

Smart Energy Saving in 4G network

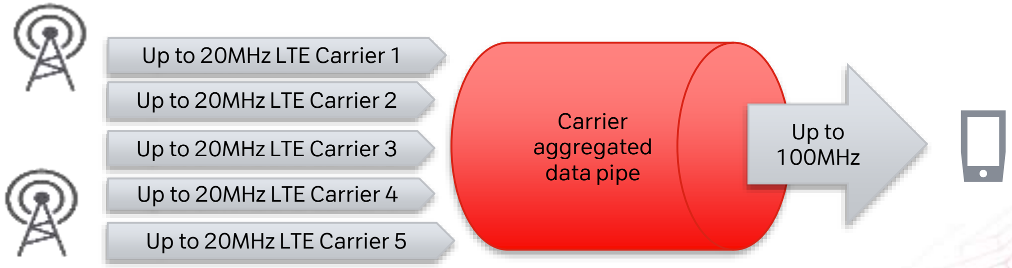
The Importance of Power Saving

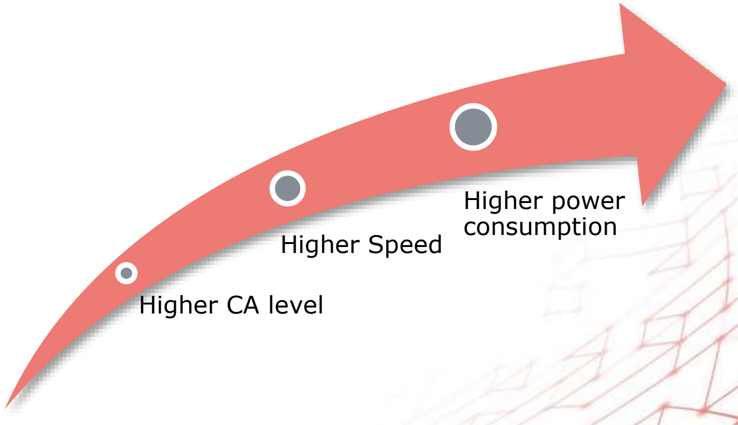
- 4G network evolution and introduction of carrier aggregation has a lots of benefits such as:
  - Better user experience
  - Higher throughputs
  - Better coverage
  - More simultaneous services

- Advanced carrier aggregation brings also higher power consumption

- Traffic has strong periodical pattern in telco world so there is no need to have all carriers active all the time

- One of Energy Efficiency initiatives is automation based on Self Organizing Networks for energy consumption reduction



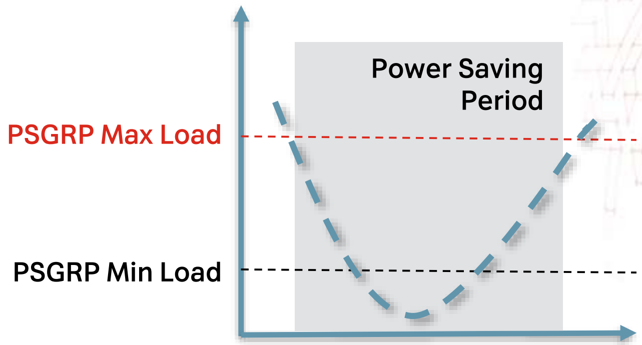


Standard Approach – Power Saving

- Standard Power Saving approach is based on vendor feature where power saving groups are created
- In each power saving group one cell must always be on while remaining cells can be switched off once when minimum load threshold is reached

- Layers can be switched off in predefined time period and once when predefined load threshold is reached

- Defining of power saving groups and applying power saving feature is time consuming process and requires many resources and constant tuning and optimization to keep up with network traffic changes -> automatized approach is needed

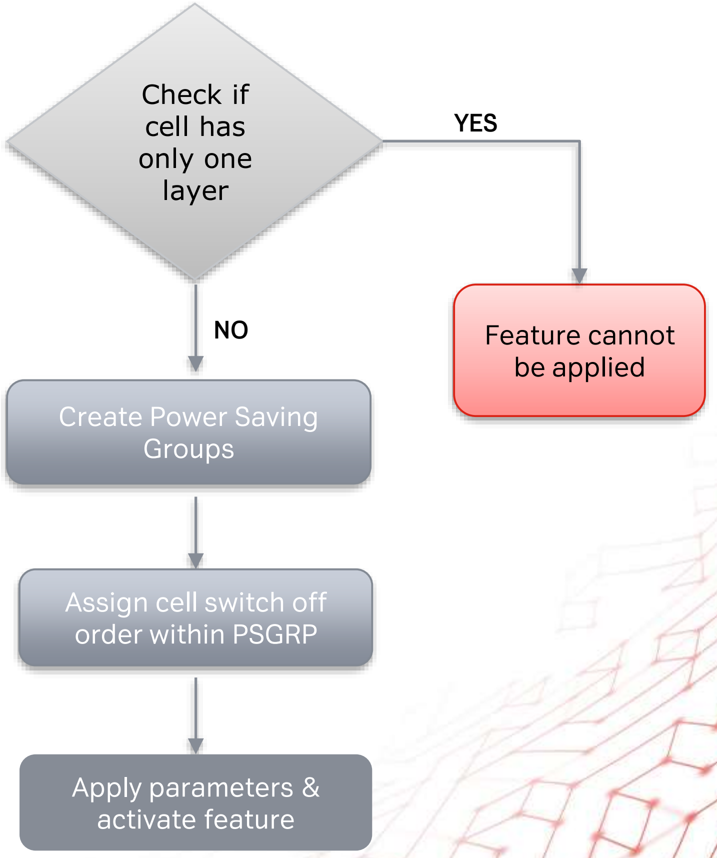


SON Enabled Energy Saving

SON module for Energy Consumption reduction will:

- Select cells with more than one layer
- Create PSGRP per sector
- Assign cell switch off order
  where cell with highest order will always be on while remaining cells can be powered off once when min load threshold is reached

- On each site/cell apply specific parameters which will:
  - Activate feature
  - Define minimum and maximum load to switch off/on layers in PSGRP
  - Define period of day when layer can be switched off



SON Enabled Smart Energy Saving

SON Enabled Energy Saving brings:

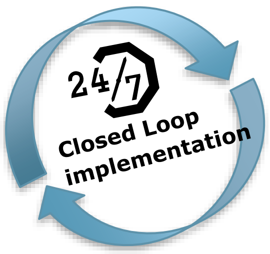
- Smooth deployment and activation of power saving feature on whole network
- Controlled period when layers may be switched off

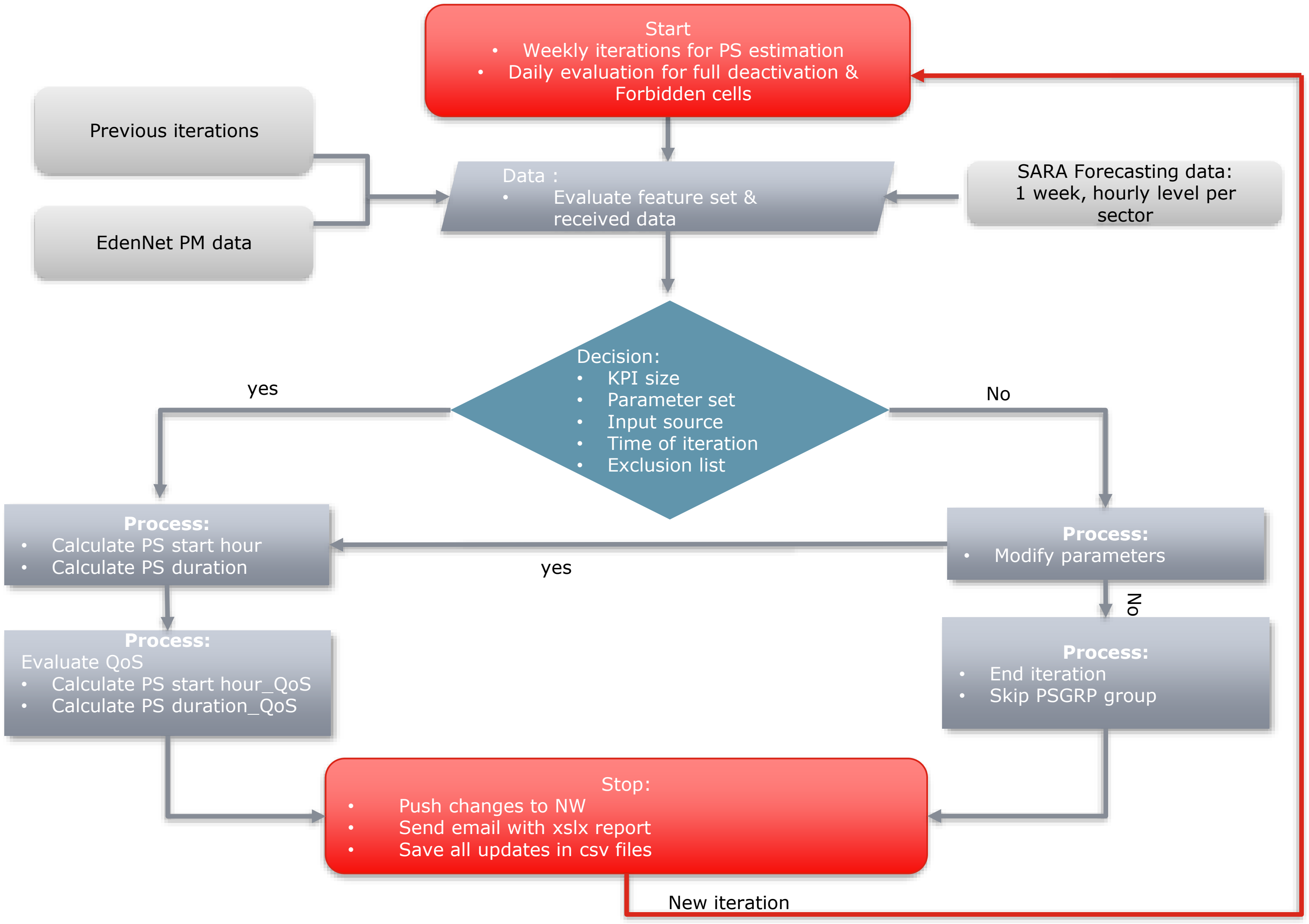
! Static setting of parameters on whole network
! Cell specific traffic patterns not considered

SON Enabled Smart Energy Saving

- Improved version of SON enabled Energy Saving module which introduces advanced ML algorithms to predict site/sector utilization
- Proactive feature deployment which is not limited to specific time period
- Start hour and Layer Switch off duration are calculated based on predictive models and QoS KPIs are evaluated

SON Enabled Smart Energy Saving – how it works?





SON Enabled Energy Saving - QoS

- Power Saving can have impact on customer experience
- Less capacity implies less bandwidth, increased latency and therefore reduced throughput -> end user experience has to be monitored
- Goal of Energy Saving module should be best trade off between energy consumption reduction and quality of end user experience

- Smart Energy Saving evaluates several OSS KPIs to reflect QoS, such as throughput, drop ratio, HO success ratio, setup success ratio etc…

- For each PSGRP, power saving start time and duration are calculated based on forecasting model
- QoS evaluation starts after initial proposals are generated and proposed thresholds are ‘corrected’ according to QoS evaluation

- Cell level OSS KPIs don’t necessary reflect exact end user experience -> correlation of OSS KPIs with data form drive test measurements, crowed sourcing applications and passive probes to reflect QoS

SON Enabled Smart Energy Saving – Savings

- In order to evaluate benefits, module was tested on several clusters with different site configurations

- Savings have strong correlation with site configuration. More layers on site -> more space for potential savings with layer switch off

- Estimated savings with Smart Energy Saving module are ~8.4% lower consumption

SON Smart Energy Saving - Conclusion

Power Saving with traditional feature deployment can be timeconsuming and requires constant optimization & tuning

With the constant network evolution and new technologies, energy efficiency is becoming an important topic

SON Smart Energy Saving predicts site/sector load, activates feature at any time during the day, if thresholds are reached, and takes in account QoS KPIs

SON automatized feature deployment brings smooth feature activation but within fixed time period

Estimated savings on tested clusters have strong correlation with site configuration


Thank you