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INTEGRATING COMMUNITY POWER IN ENERGY ISLANDS

WP 5: Pilot sites

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PETROL Energy for life

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Pilot site Luče - Slovenia

- Milestones & Timeline
- Results
- Challenges

Pilot site Timeline

- Signing of contract between Petrol and members of RES EnC Luče;
- Selection and order of the community battery storage.

April 2019 (M6)

- Signing of contract for preparation of project documentation for transformer station upgrade and community battery integration;
- Installation of PVs;
- Description of demo site Luče;
- The architecture of the Luče system is defined.

July 2019 (M9)

- Installation of smart meters by DSO Elektro Celje;
- PVs installed and connected to the grid;
- Project documentation for transformer station upgrade and community battery integration prepared.

August 2019 (M10)

- Household batteries selection procedure performed;
- Signed contract for transformer station upgrade implementation and community battery integration;
- Establishment of user groups and co-creation process.

September 2019 (M11)

- Upgrade of transformer station completed;
- Community battery installation;
- Micro-grid system integration;
- Household battery storage installation;
- HEMS integration;

October 2019 (M12)

- EV charging point installation;
- First workshop for EnC leaders.

December 2019 (M14)

- First modelling setup ready;
- First control strategies for the full demos ready.

January 2020 (M15)

- Training Workshop Successful;
- Training Program Concluded.

February 2020 (M16)

- Pilot site Luče operational

April 2020 (M18)

- Established exchange of data from Luče with Virtual Community Management platforms.

October 2021 (M36)

- Development of advanced control and management algorithms and strategies integrated in EnC;
- Algorithms and control strategies validated and calibrated;
- Advanced models and technologies of local storage and electromobility;
- Integrated algorithm and control strategies in the EnC.

January 2022 (M39)

- Handbook chapter of demo pilot sites ready;
- Plan to replicate business models and project solutions.

February 2022 (M40) ➡ M46

April 2022 (M42) ➡ M48

- Handbook on the EnC creation;
- Economic and environmental impact assessment.

Achievements & milestones

- Signing of PV contracts

Installation of HEMS

- We developed and installed 9 “Home Energy Management System” (HEMS), that dynamically limits the PV output power according to the real voltage conditions in the network.

Construction of PV

- Installation of 102 kW PV on 9 houses.
- Instead of 65 kW (firstly only 25kW) as the first limitation from DSO.
- In Luče there was already installed 50 kW PV in 3,5 kW wind turbine.








Installation of home batteries

- **Installation of 5 home batteries:**
  - ✓ 2x 10 kW/2x 11,6 kWh
  - ✓ 1x 10 kW/11,6 kWh
  - ✓ 1x 5 kW/9,8 kWh
  - ✓ 1x 3,5 kW/7 kWh
  - ✓ + 1x 15 kW/18 kWh

Public EV charging station

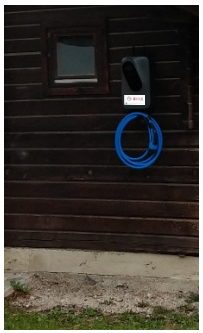
- Installation of 22 kW public e-charging station.
- Installation of 9x 22 kW home e-charging stations.

Installation of community battery BESS

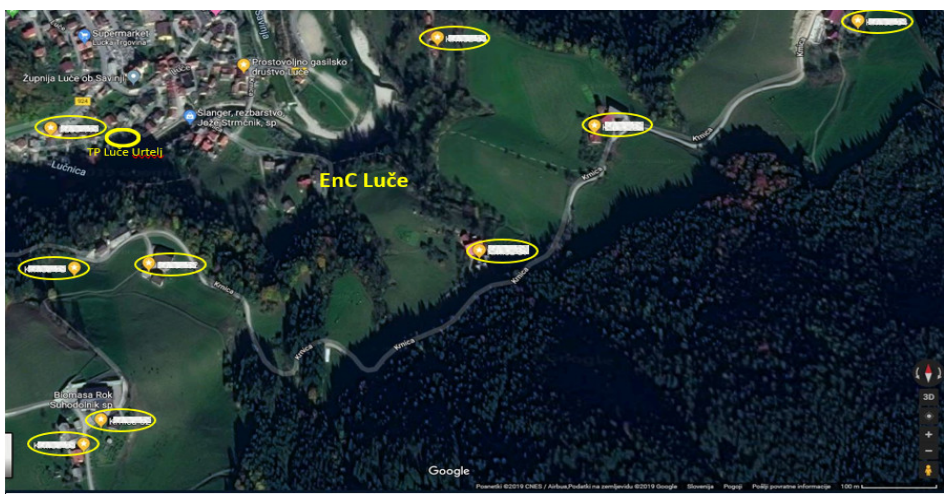
- Installation of community battery BESS (150 kW/333 kWh).

Additional challenge – renovation of transformer station

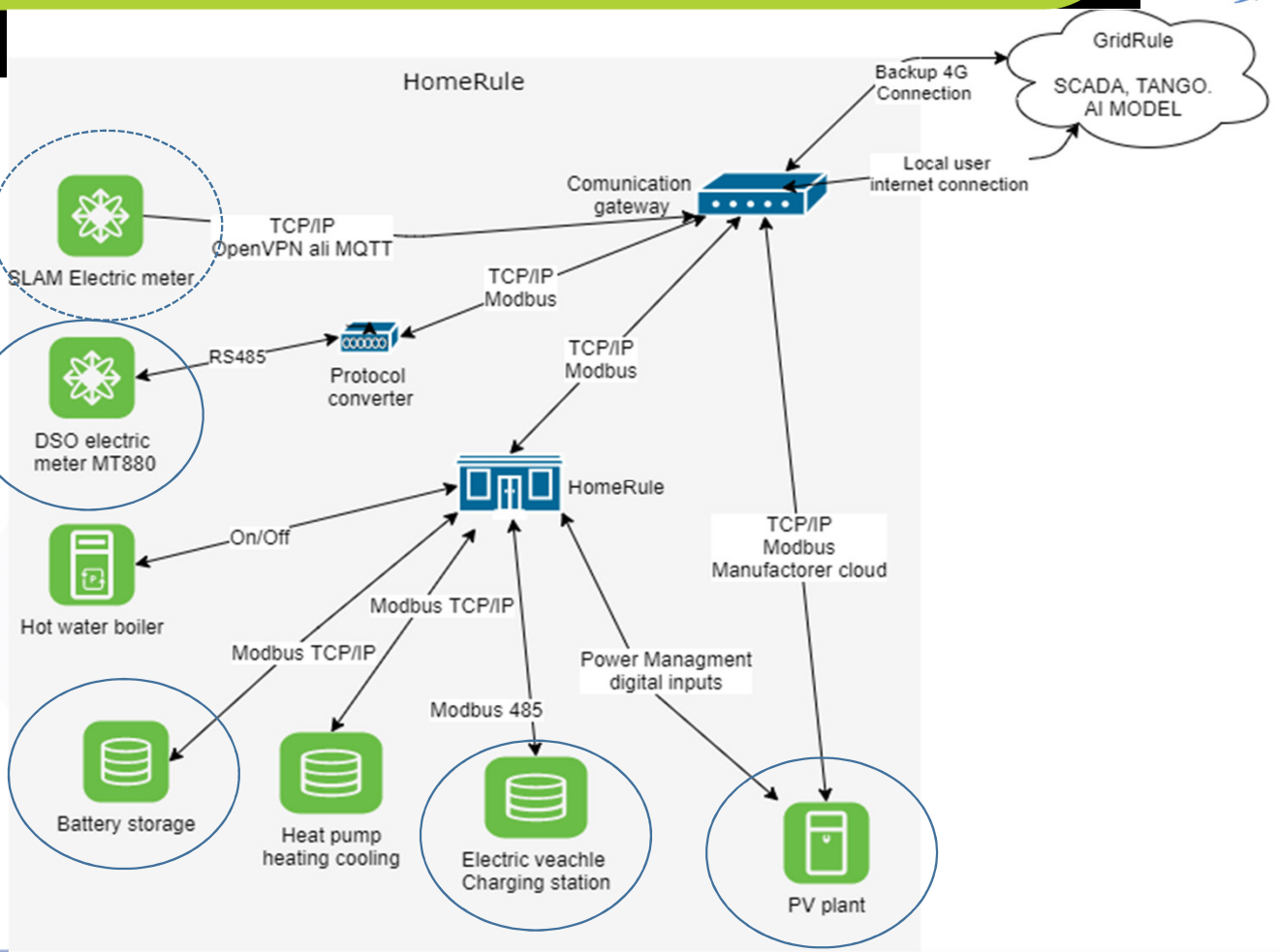
Additional activity – installation of Home EV Charger Stations



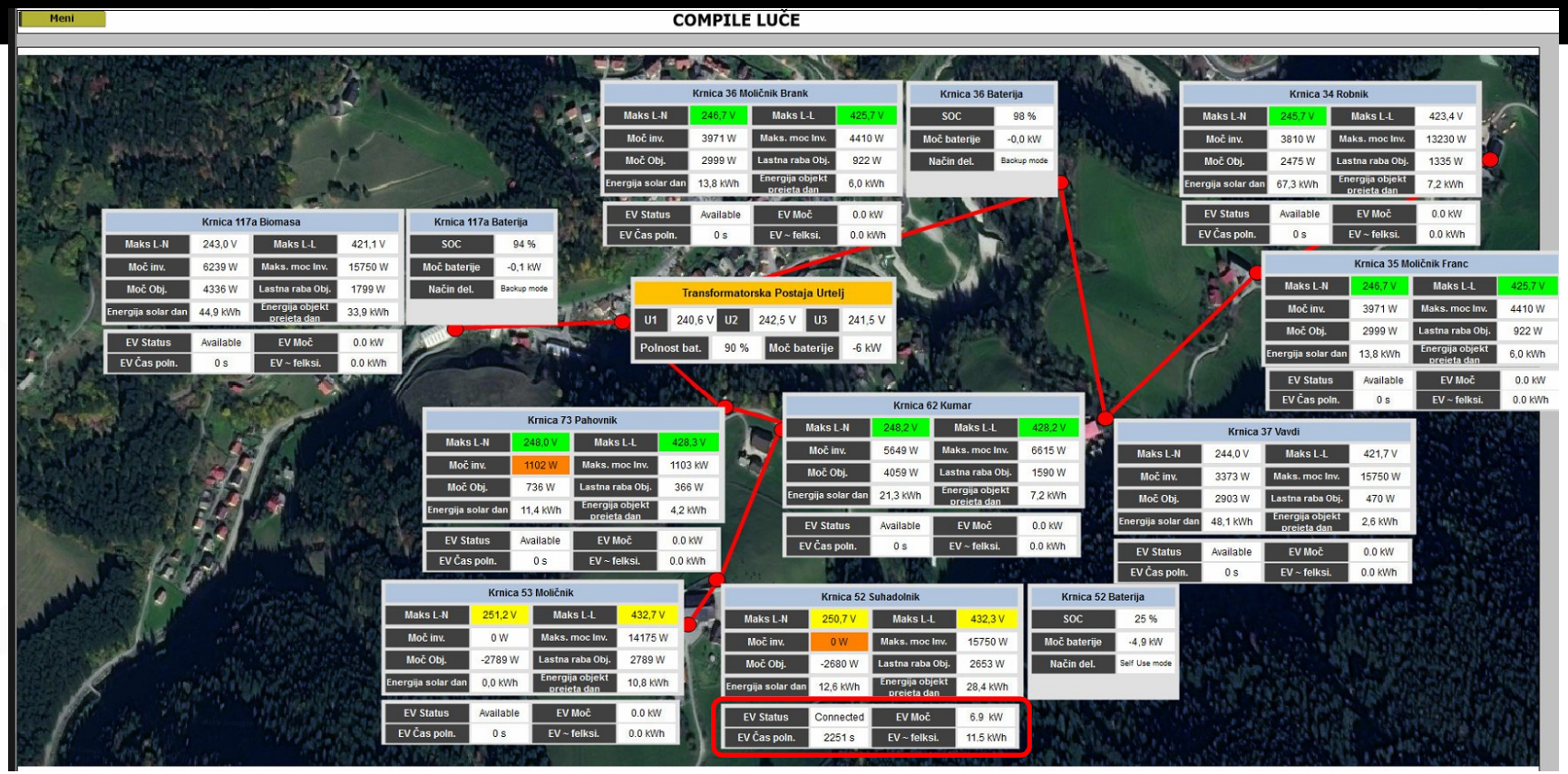
- Locations of the installed Home EV charging stations



HomeRule


HomeRule
GridRule
SCADA, TANGO.
AI MODEL
Backup 4G
Connection
Local user
internet connection
Comunication
gateway
SLAM Electric meter
TCP/IP
OpenVPN ali MQTT
TCP/IP
Modbus
RS485
Protocol
converter
DSO electric
meter MT880
TCP/IP
Modbus
HomeRule
On/Off
Hot water boiler
TCP/IP
Modbus
Manufactorer cloud
Modbus TCP/IP
Modbus TCP/IP
Power Managment
digital inputs
Modbus 485
Battery storage
Heat pump
heating cooling
Electric veachle
Charging station
PV plant

SCADA VIEW


Meni
COMPILE LUČE
Krnica 36 Moličnik Brank
Maks L-N 246,7 V Maks L-L 425,7 V
Moč inv. 3971 W Maks. moc Inv. 4410 W
Moč Obj. 2999 W Lastna raba Obj. 922 W
Energija solar dan 13,8 kWh Energija objekt preteta dan 6,0 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 36 Baterija
SOC 98 %
Moč baterije -0,0 kW
Način del. Backup mode
Krnica 34 Robnik
Maks L-N 245,7 V Maks L-L 423,4 V
Moč inv. 3810 W Maks. moc Inv. 13230 W
Moč Obj. 2475 W Lastna raba Obj. 1335 W
Energija solar dan 67,3 kWh Energija objekt preteta dan 7,2 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 117a Biomasa
Maks L-N 243,0 V Maks L-L 421,1 V
Moč inv. 6239 W Maks. moc Inv. 15750 W
Moč Obj. 4336 W Lastna raba Obj. 1799 W
Energija solar dan 44,9 kWh Energija objekt preteta dan 33,9 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 117a Baterija
SOC 94 %
Moč baterije -0,1 kW
Način del. Backup mode
Transformatorska Postaja Urtelj
U1 240,6 V U2 242,5 V U3 241,5 V
Polnost bat. 90 % Moč baterije -6 kW
Krnica 35 Moličnik Franc
Maks L-N 246,7 V Maks L-L 425,7 V
Moč inv. 3971 W Maks. moc Inv. 4410 W
Moč Obj. 2999 W Lastna raba Obj. 922 W
Energija solar dan 13,8 kWh Energija objekt preteta dan 6,0 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 73 Pahovnik
Maks L-N 248,0 V Maks L-L 428,3 V
Moč inv. 1102 W Maks. moc Inv. 1103 kW
Moč Obj. 736 W Lastna raba Obj. 366 W
Energija solar dan 11,4 kWh Energija objekt preteta dan 4,2 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 62 Kumar
Maks L-N 248,2 V Maks L-L 428,2 V
Moč inv. 5649 W Maks. moc Inv. 6615 W
Moč Obj. 4059 W Lastna raba Obj. 1590 W
Energija solar dan 21,3 kWh Energija objekt preteta dan 7,2 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 37 Vavdi
Maks L-N 244,0 V Maks L-L 421,7 V
Moč inv. 3373 W Maks. moc Inv. 15750 W
Moč Obj. 2903 W Lastna raba Obj. 470 W
Energija solar dan 48,1 kWh Energija objekt preteta dan 2,6 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 53 Moličnik
Maks L-N 251,2 V Maks L-L 432,7 V
Moč inv. 0 W Maks. moc Inv. 14175 W
Moč Obj. -2789 W Lastna raba Obj. 2789 W
Energija solar dan 0,0 kWh Energija objekt preteta dan 10,8 kWh
EV Status Available EV Moč 0.0 kW
EV Čas poln. 0 s EV ~ felksi. 0.0 kWh
Krnica 52 Suhadolnik
Maks L-N 250,7 V Maks L-L 432,3 V
Moč inv. 0 W Maks. moc Inv. 15750 W
Moč Obj. -2680 W Lastna raba Obj. 2653 W
Energija solar dan 12,6 kWh Energija objekt preteta dan 28,4 kWh
EV Status Connected EV Moč 6.9 kW
EV Čas poln. 2251 s EV ~ felksi. 11.5 kWh
Krnica 52 Baterija
SOC 25 %
Moč baterije -4,9 kW
Način del. Self Use mode

GridRule – BESS user interface

Additional activity – Testing of use cases of Home EV Charger Stations

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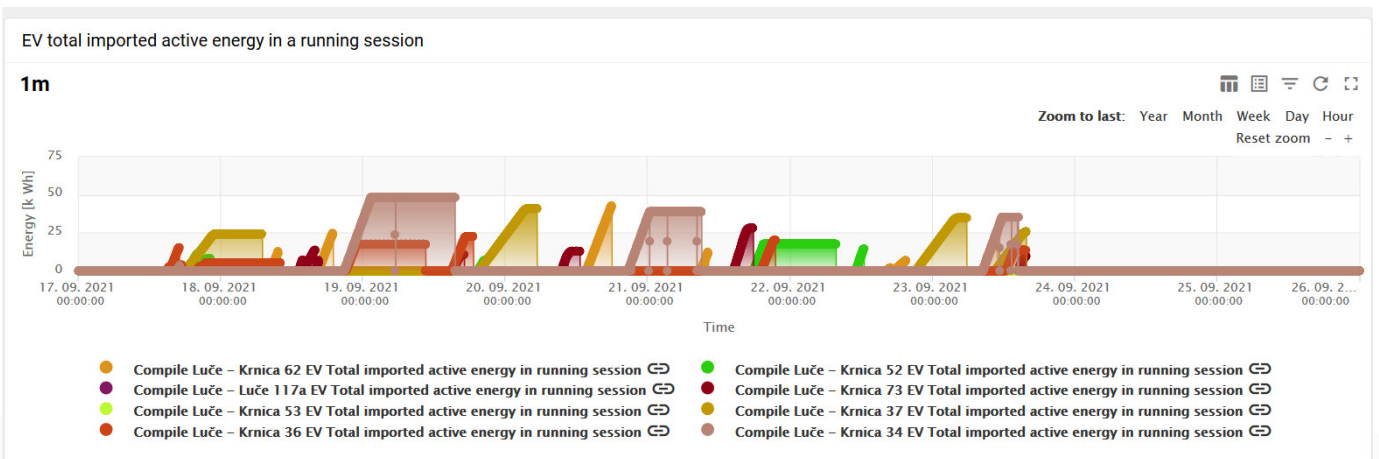
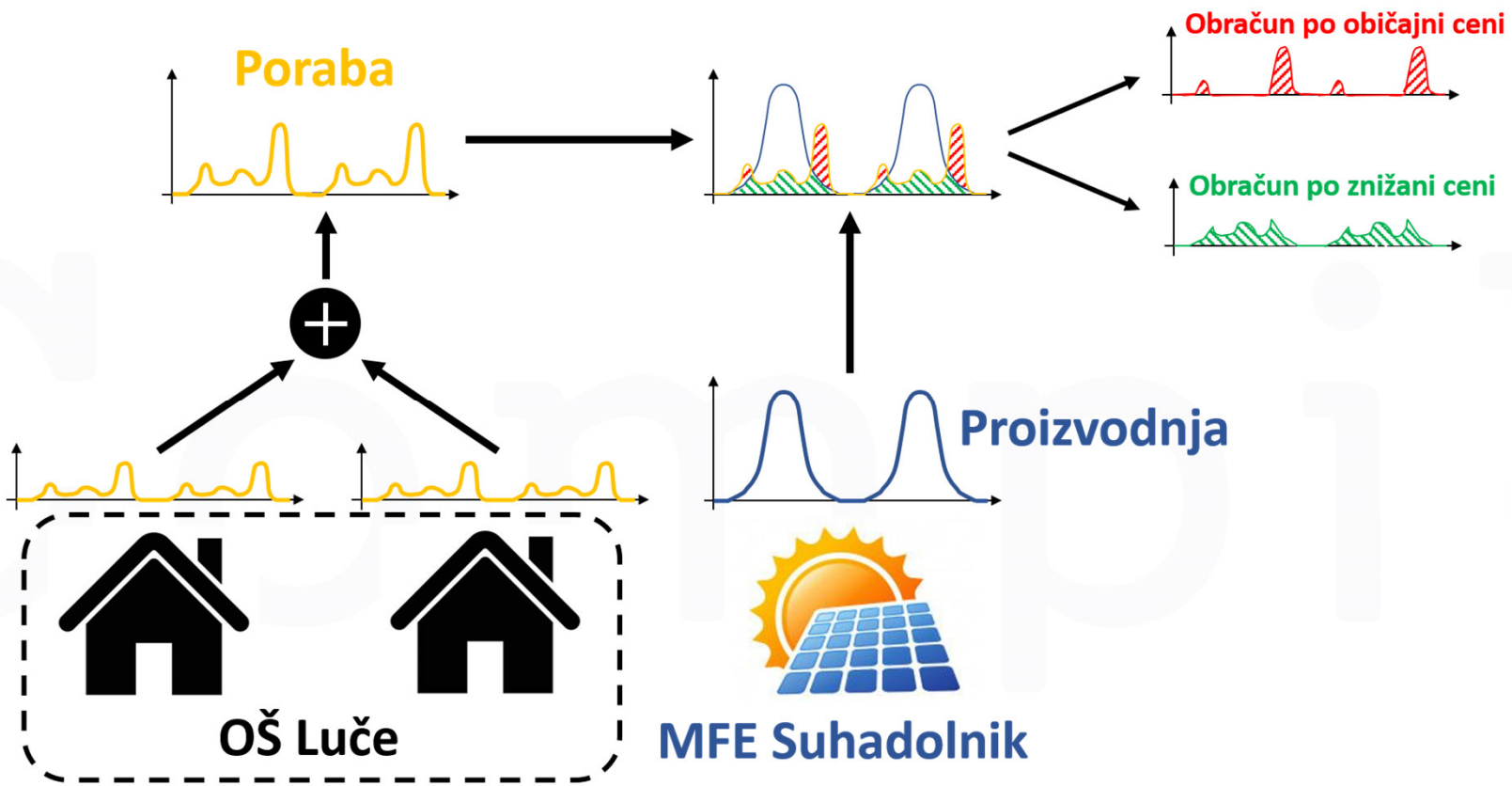
- Handing out the keys for e-vehicles (17.9.2021)

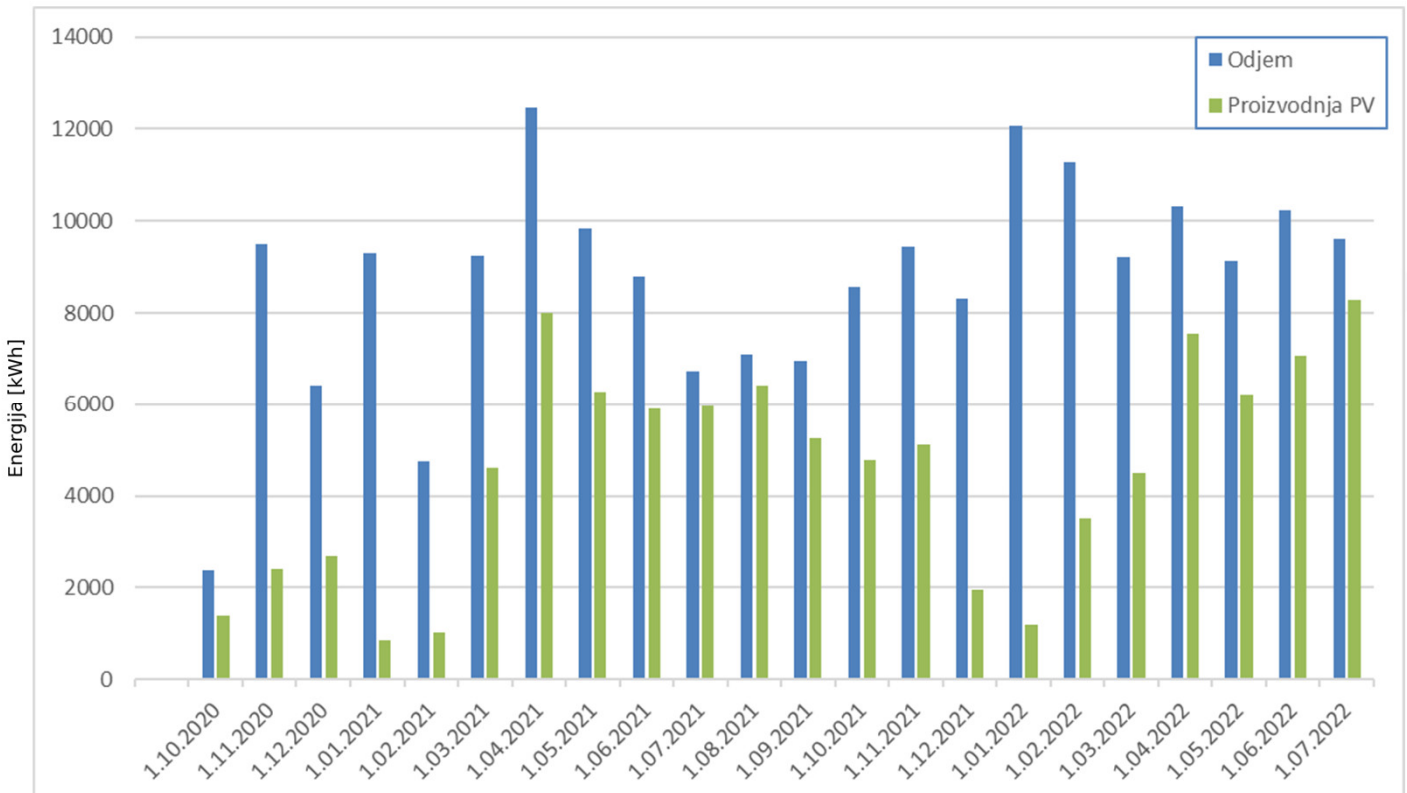


- Use cases from 17.9. – 23.9. 2021 on Tango

Additional activity: pilot EnC based on billing of network charges



Results – production and consumption



Results – production, consumption, self-sufficiency

	Without EnC and with active management	With EnC and with active management	WithEnC and with active management and system BESS
Production of PV	200,96 MWh	227,30 MWh	227,30 MWh
Consumption	185,06 MWh	185,06 MWh	201,99 MWh
Neto balance	15,90 MWh	42,24 MWh	25,31 MWh
Self-sufficiency on hourly level	31,30 %	32,40 %	71,80 %
Longest period of self-sufficiency	13,00 h	13,00 h	519,00 h

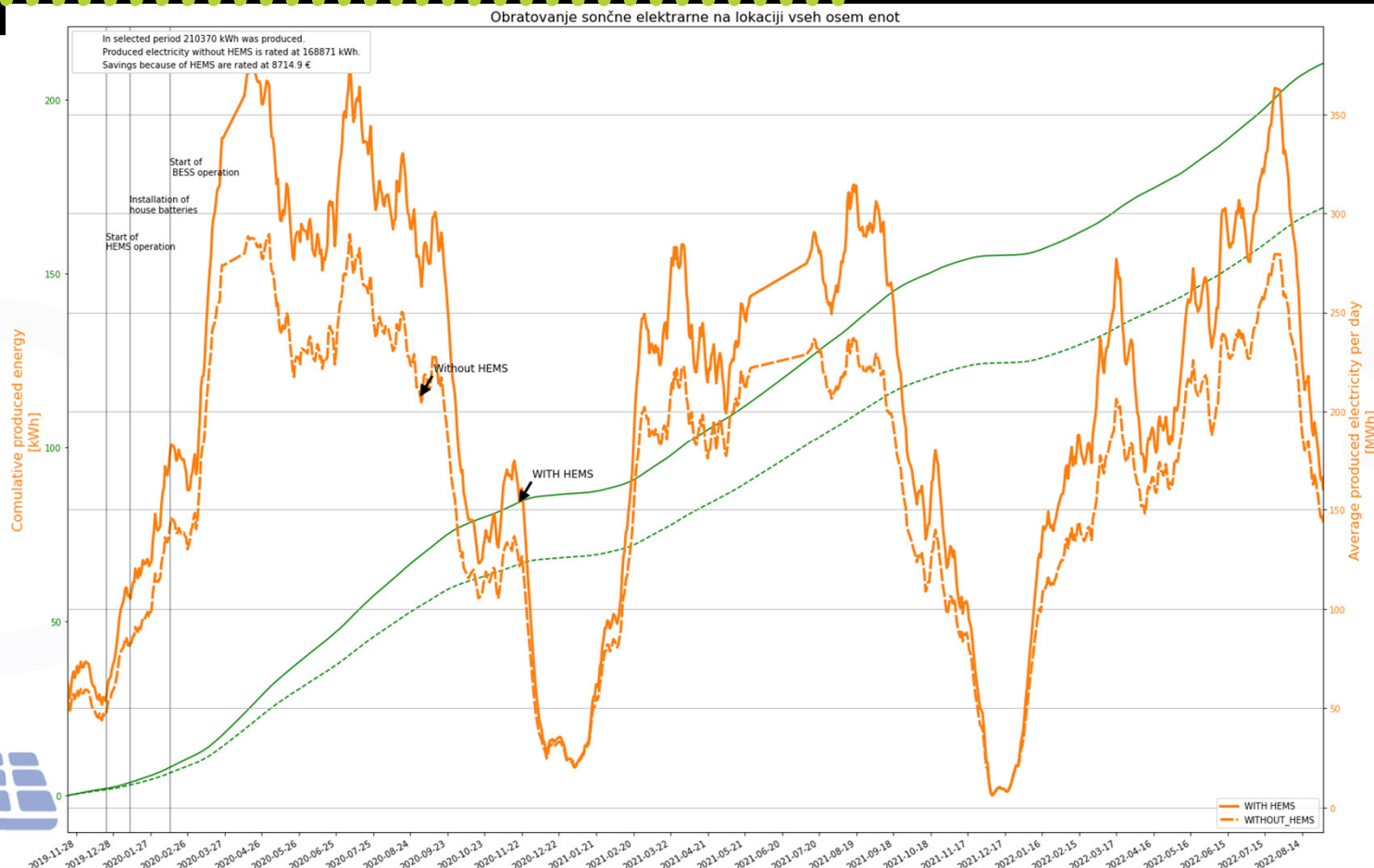
Analysis of production and consumption by object (unlimited part of network)

	Krnica 34	Krnica 36	Krnica 37	Luče 117a
Consumption	32.768 kWh	12.646 kWh	12.965 kWh	32.350 kWh
Production	19.052 kWh	12.723 kWh	14.365 kWh	15.204 kWh
Theoretical production of PV without management	19.052 kWh	12.723 kWh	14.365 kWh	15.204 kWh
Theoretical max production without limitations	19.340 kWh	13.105 kWh	14.702 kWh	15.369 kWh
Increasing revenues due to EnC	**0,0 EUR**	**0,0 EUR**	**0,0 EUR**	**0,0 EUR**
Average production	40,37 kWh/dan	27,13 kWh/dan	29,93 kWh/dan	32,77 kWh/dan
% limitation in hours	3,0%	5,7%	4,9%	3,0%
Number of limitations	1 min/dan	21 min/dan	10 min/dan	10 min/dan
Number of disconections /non-functioning of PV	15 min/dan	9 min/dan	15 min/dan	6 min/dan

Analysis of production and consumption by object (limited part of network)

	Krnica 52	Krnica 53	Krnica 62	Krnica 73
Consumption	34.704 kWh	12.690 kWh	14.055 kWh	12.433 kWh
Production	13.584 kWh	10.817 kWh	14.017 kWh	12.846 kWh
Theoretical production of PV without management	4.246 kWh	4.122 kWh	9.695 kWh	10.212 kWh
Theoretical max production without limitations	14.345 kWh	13.786 kWh	14.886 kWh	14.988 kWh
Increasing revenues due to EnC per year	**879,4 EUR**	**630,5 EUR**	**407,0 EUR**	**248,0 EUR**
Average production	28,96 kWh/dan	22,07 kWh/dan	28,61 kWh/dan	24,7 kWh/dan
% limitation in hours	8,0%	21,7%	10,0%	21,9%
Number of limitations	20 min/dan	46 min/dan	26 min/dan	99 min/dan
Number of disconnections /non-functioning of PV	23 min/dan	68 min/dan	26 min/dan	17 min/dan

Operation of PV in EnC



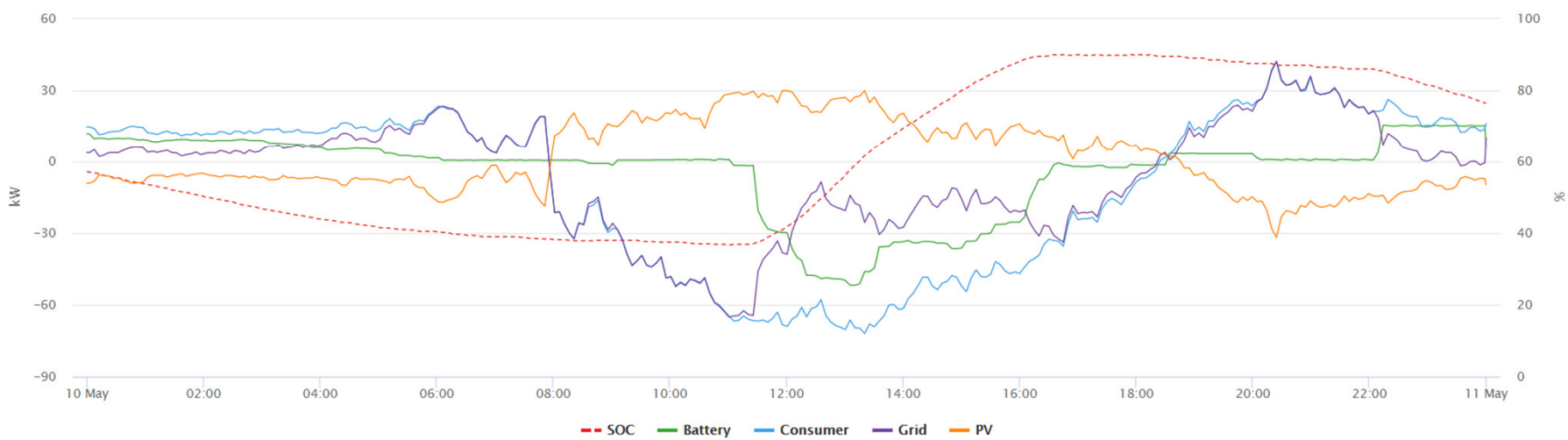
Actual data from operation of the critical part of local network show that with the help of tools and measures implemented in this part of network we managed to **increase the RES production for 125 % on average during 3 years (accumulated savings > 8.715 €)**, while in individual members of EnC this increase is even up for 320%.

BESS operation

Diagrams System Overview

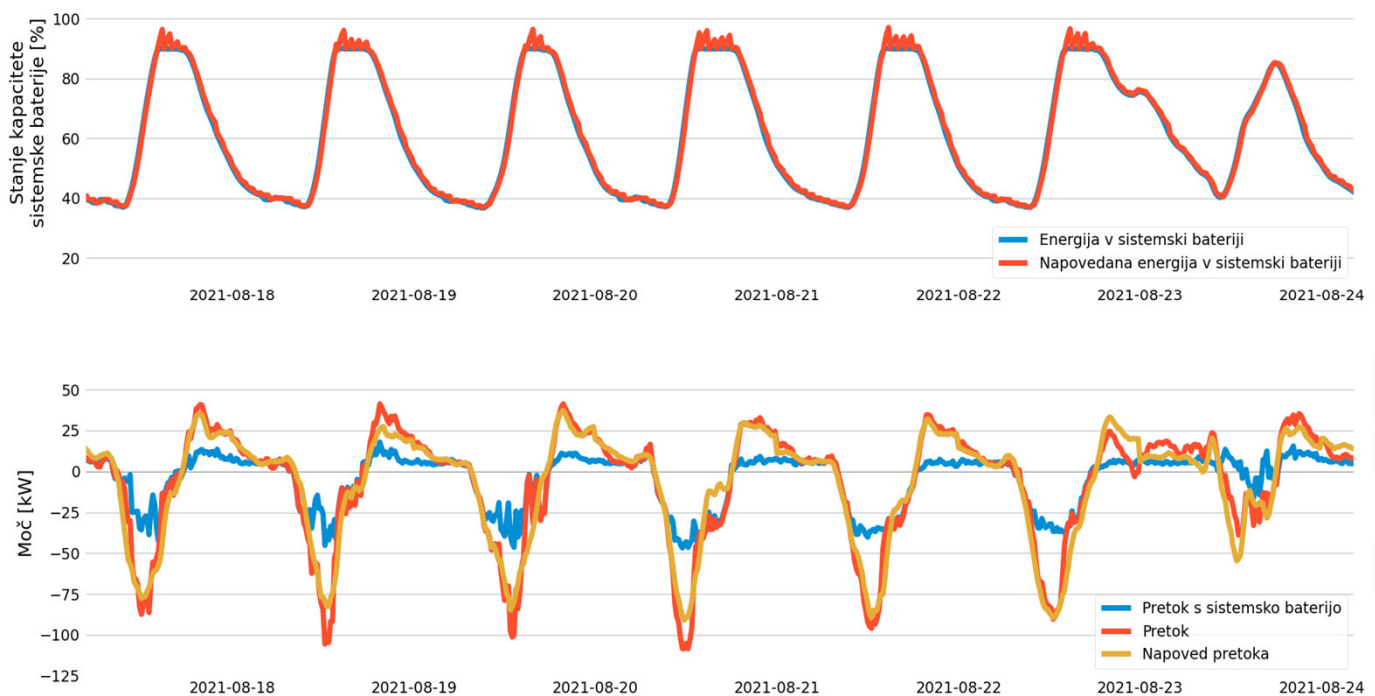
10 May 2021

Day Week



Operation and management of BESS

SELF-SUFFICIENCY: 58-75%



Opportunities & Challenges for the future

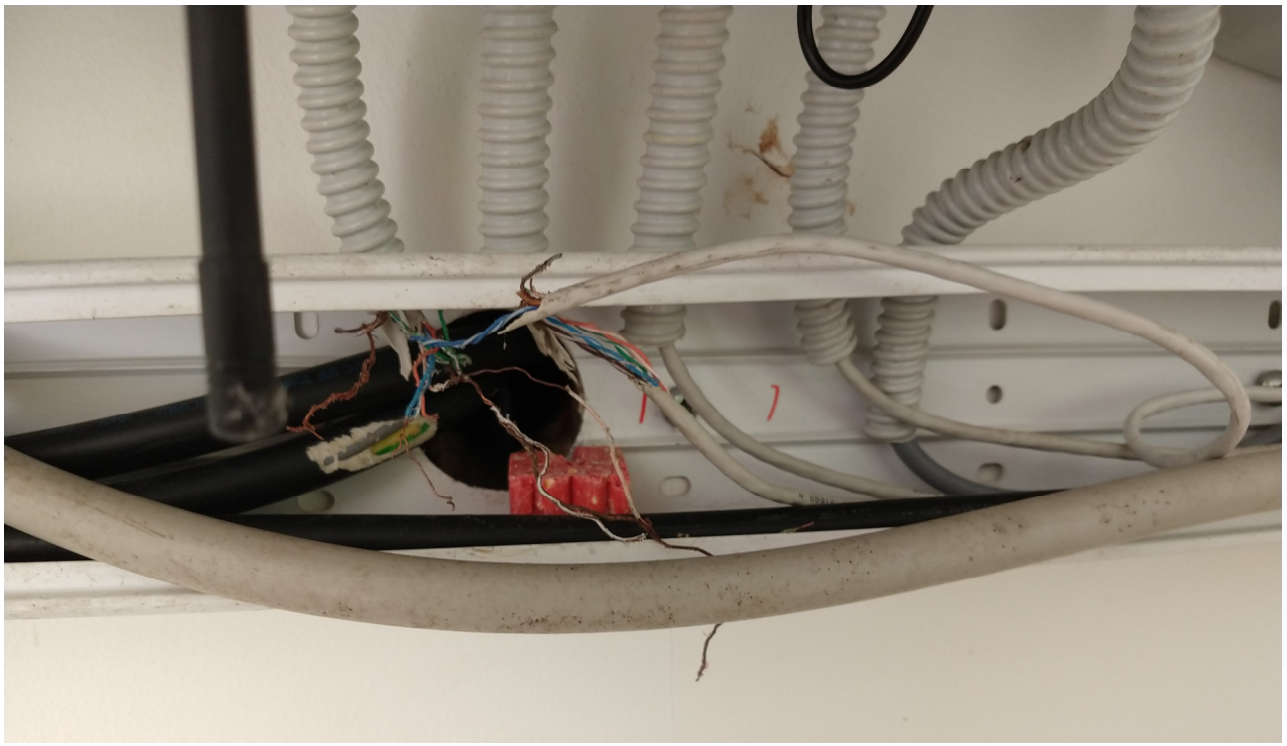
CHALENGES:

- **Legislative, social and technical challenges for EnC development**
  - Same supplier needed, additional meters for PV, same transformer station, static sharing key, muti-apartment buildings need 75% support)
  - Community self-sufficiency is increasingly more complex than in the case of individual self-sufficiency.
  - For multi-apartment buildings almost three times more documentation. It also takes a lot of time to obtain various consents - including the consents of everyone involved in community self-sufficiency.
- **New proposed law** is eliminating net-metering, connection to the same transformer station will no longer be obligatory, virtual metering points, producers of RES will be paid for surpluses of energy;

OPPORTUNITIES:

- **Harness the potential of PVs that will run out of feed-in tariff**
- **Linking to set up larger PVs with better economics (group financing) on public buildings**
- **Opportunities for new research and industrial projects**
  - Especially communities in multi-apartment housing and in connection with e-mobility.

“Technical problems” i.e. Hungry mouse



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Thank you!

Questions?

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