



G E O F I T[®]
SMART GEOTHERMAL

GEOFIT training – BEMS

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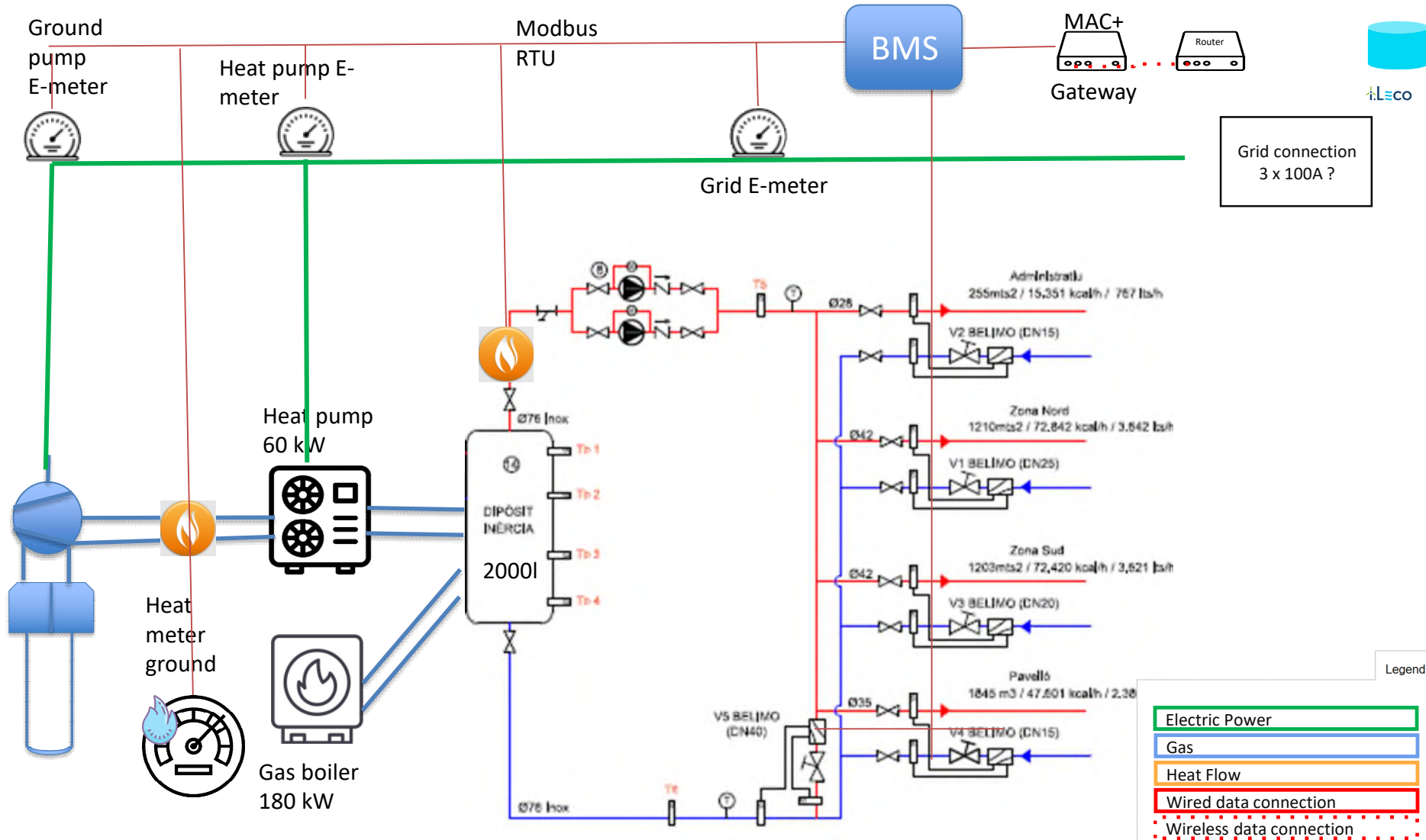
BEMS: Building **Energy** Management System

- Awareness
 - Energy & Data Diagrams
 - Dashboards
 - Energy → Electricity
- BEMS → Cloud
 - Data monitoring
 - Potential optimizations
- Output(s) of a BEMS in Geofit
 - Advise for local assets





Sant Cugat Energy&Data diagram





E&D diagram Perugia

Parameters sent

Legend

Heat meter

Electricity meter

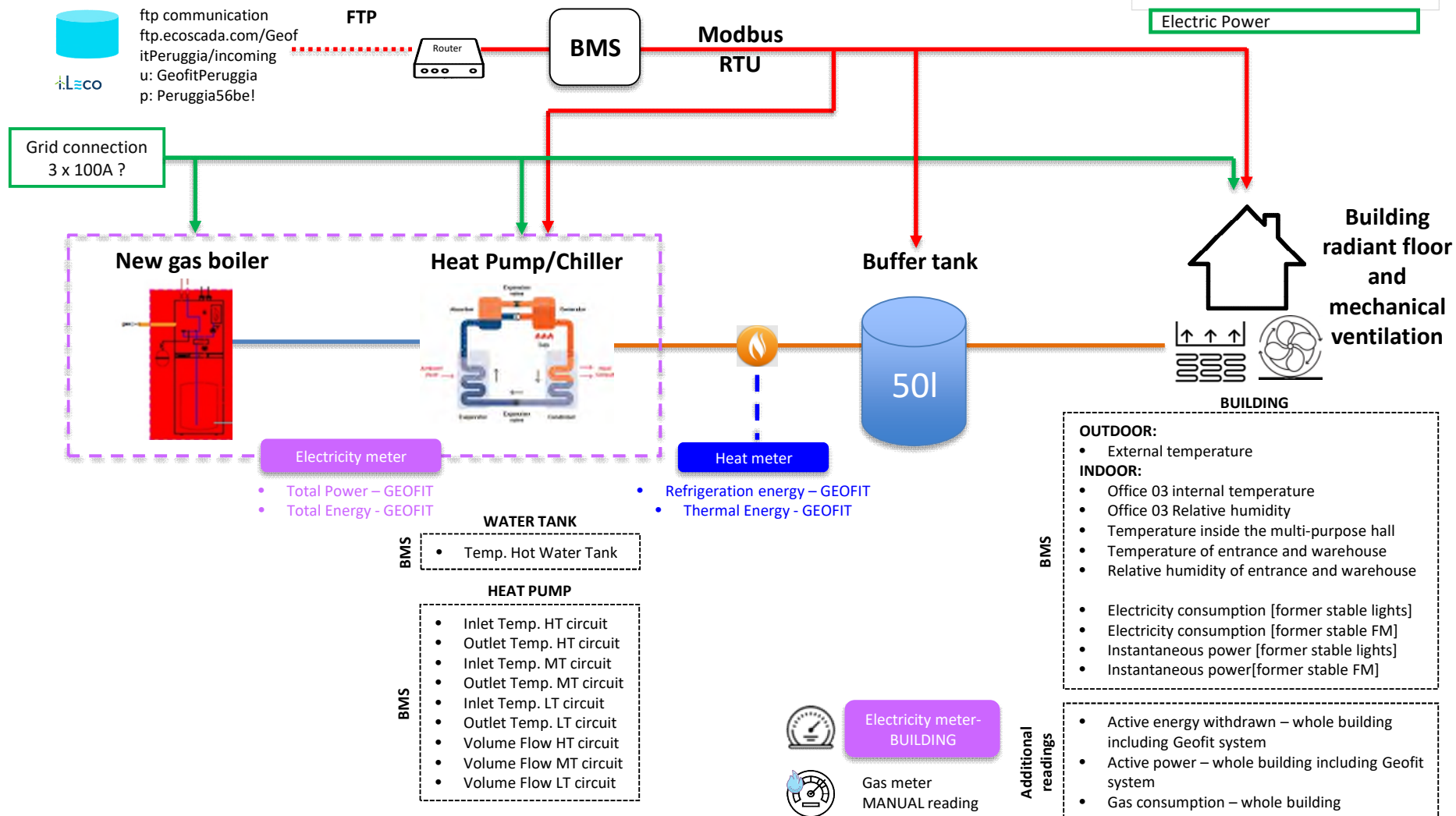
Gas

Heat Flow

Wired data connection

Wireless data connection

Electric Power





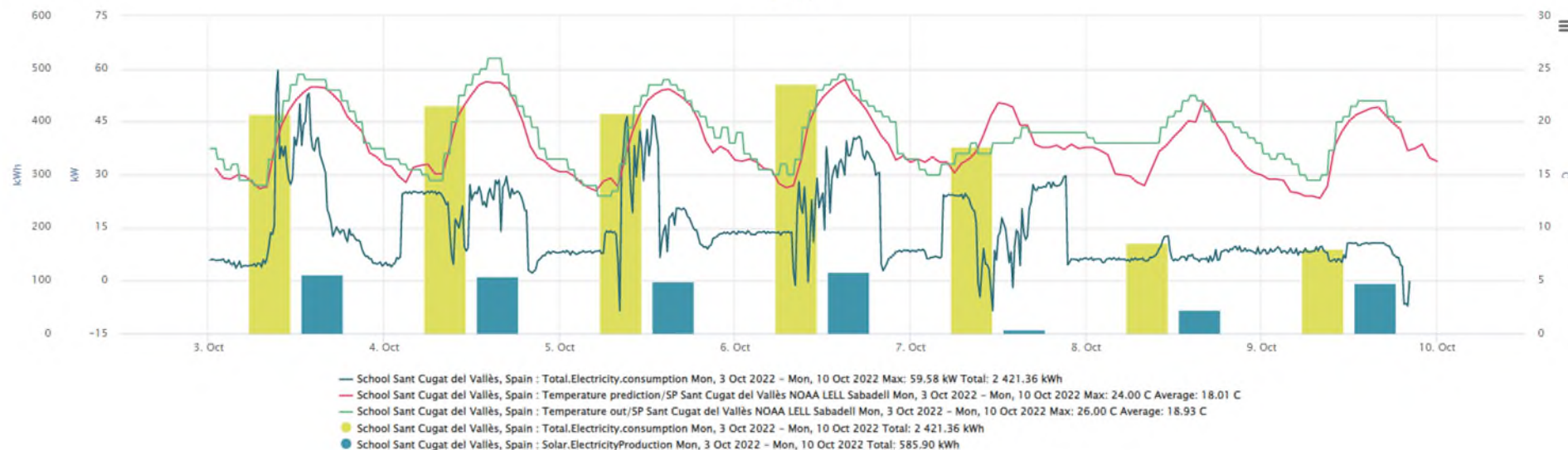
Dashboards





Technical analysis & downloads

Profiles



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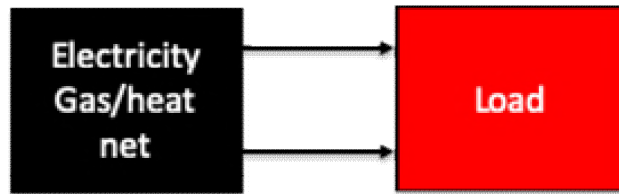
Measurement	Medium	Gate time	InputID	Input name	Input type	Input gate time	AIMR ID	AIMRs name	Last aimr activity	Sign	Factor	Virtual (Manual)	Formula
Total.Electricity.consumption	Active energy (kWh)	15 min.	124142	WholeInstallationExeptSolar/ElectricityConsumption	Meter Reading	15 min.	38000	School Sant Cugat del Vallès, Spain [MAC+ 00-00-60-00-00-47]	2022-10-09 20:10	+	2	No	No
			124143	WholeInstallationWithSolar/ElectricityConsumption	Meter Reading	15 min.	38000	School Sant Cugat del Vallès, Spain [MAC+ 00-00-60-00-00-47]	2022-10-09 20:10	-	1	No	
Temperature prediction/SP Sant Cugat del Vallès NOAA LELL Sabadell	Temperature (C)	30 min.	88179	Sant Cugat del Vallès_Temperature	Pulse	15 min.	18853	Spain	2022-10-19 02:00	+	1	No	No
Temperature out/SP Sant Cugat del Vallès NOAA LELL Sabadell	Temperature (C)	30 min.	88159	LELL Sabadell	Pulse	1 hour	2942	Temperatures for Spain	2022-10-09 19:30	+	1	No	No



BEMS: Building **Energy** Management System

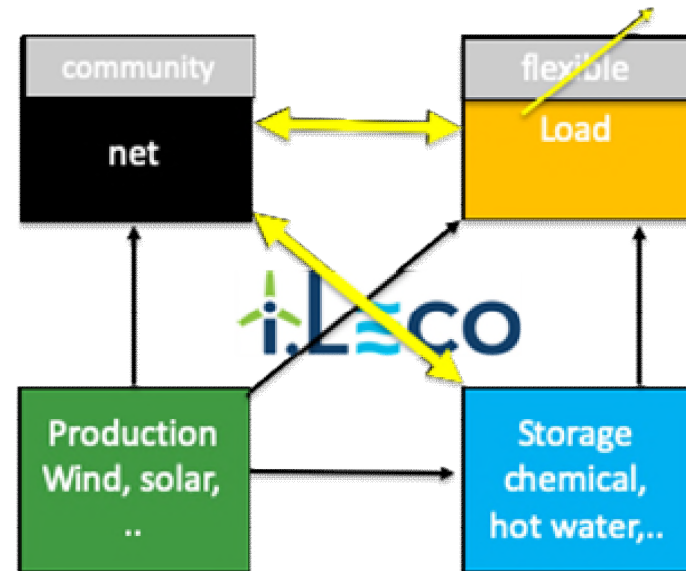
- More electrical consumers
- Heat (gas, oil)
 - → (electrical) heat pumps
 - Dry coolers
- Mobility (driving force behind real-estate investment)
 - Cars (EV)
 - Charging stations
- Local electricity and heat production
 - Solar panels, solar heat, wind
- Local storage
 - Batteries, pump storage, heat storage (buffers)

Electrification



Contracts:

- Ppeak
- kWh
- Day
- Day/night
- Other but fixed



- FCR (Frequency containment reserve)
- Other Auxilliary services
- 1 day ahead market
- Blockchain
- Self-consumption

- → Difficult task for a Building Management System



What adds a BEMS to a BMS

- Lower energy usage (= target Geofit)
 - Eq for NUIG what resource to use at a certain day (HP or cooler)
- Optimize the flows of energy during a day
- Reduce the cost of the total energy by Advanced Control algorithms as Model Predictive Control (MPC) (Real-Time (hourly – daily))
 - Reduce the risk of exceeding constraints
 - use optimal local produced energy
 - valorization of the flexibility (tariff time series)
 - Limit peak power
 - Be active on energy market
 - Long term contract
 - Day ahead market
 - Imbalance
 - FCR
- *Reduce total of CO2*
- *Regeneration renewable sources over the years and within a year*



Opex – possibilities of BEMS

- Energy
 - Optimize COP
 - ground source temperature as high as possible
 - Tbuffer lower
 - Less losses
 - Timing heating (less losses)
 - Start just in time
 - Stop so that buffer of the building is used
 - Setpoint temperature heating/buffer lower
 - Optimal use HP
 - Predict need on (additional) heat
 - Preheat the building



- Cost
 - Predictive maintenance
 - COP(t)
 - SPF(t) visualization
 - Markets
 - Long term, day ahead,
 - imbalance
 - Capacity
- Regulations

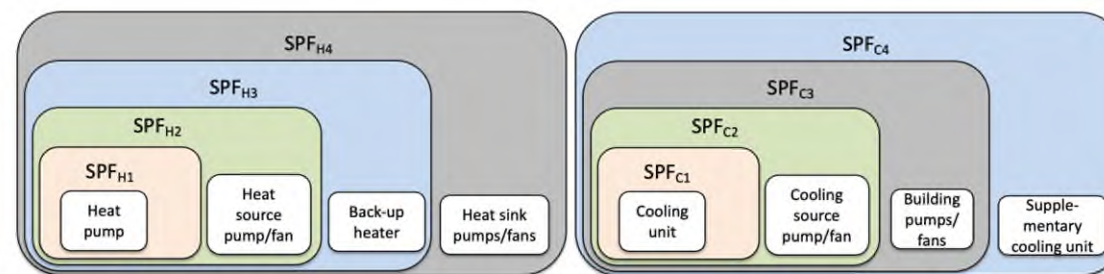
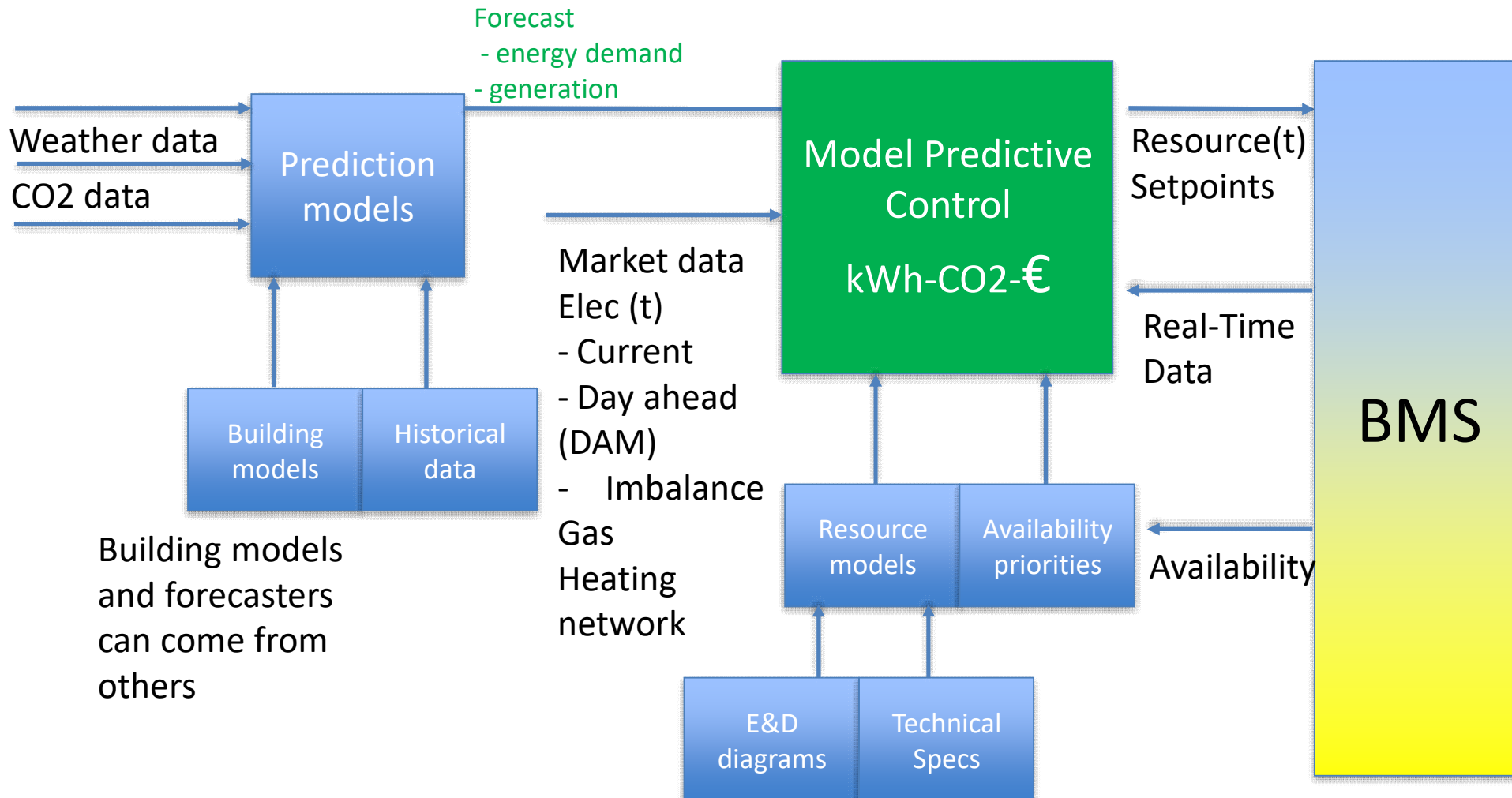


Figure 3.1.1: SEPEMO boundaries for heating (left) and cooling (right). Figures based on Nordman, R., et al. (2012).



Cloud optimization (kWh – CO₂ – Euro)



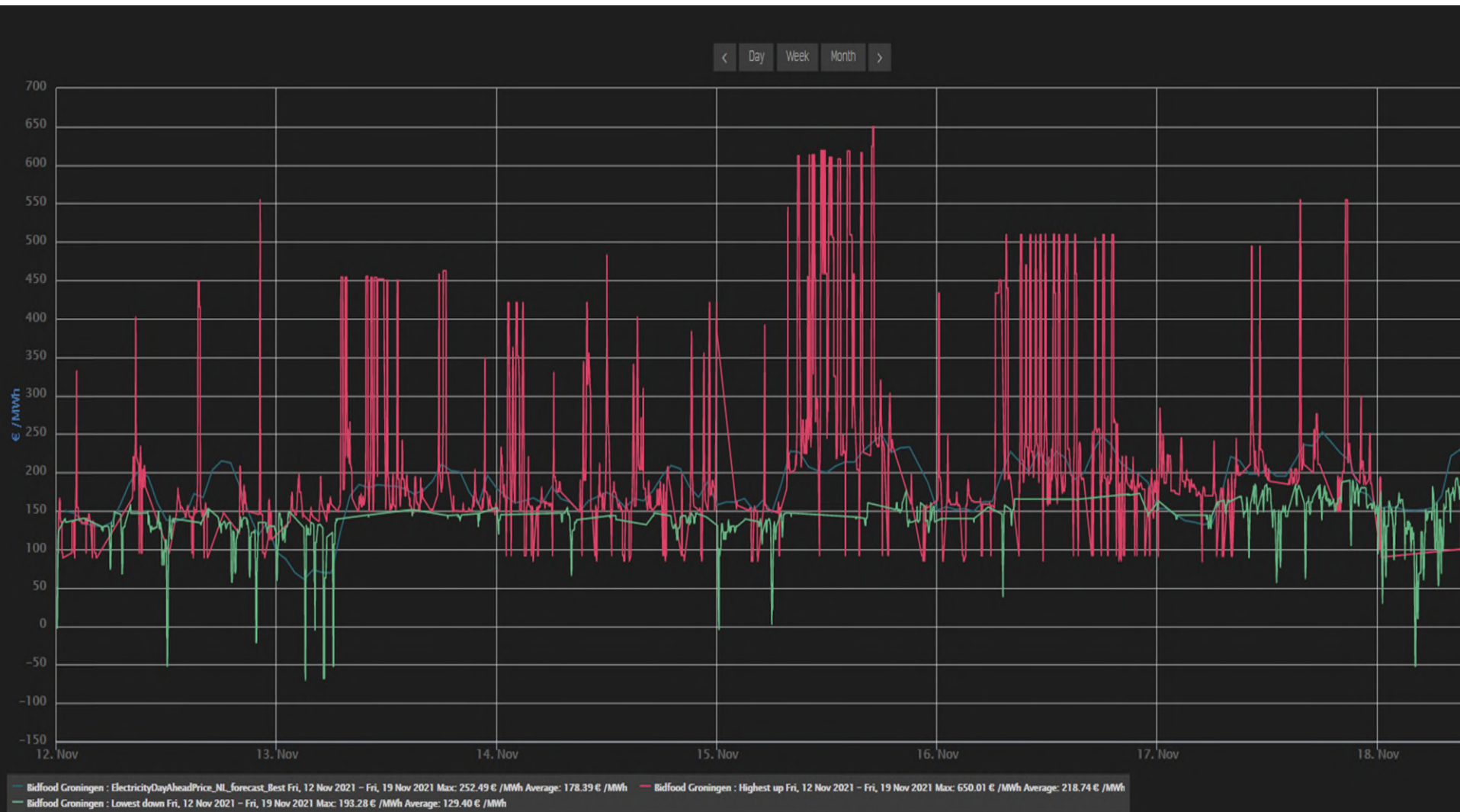


Models for MPC

- Heat Pumps (with different specifications)
- Thermal Buffer
- Gas boiler (different specs)
- Solar panels
- Solar Heat
- Building heating/cooling/ventilation
- *EV...*

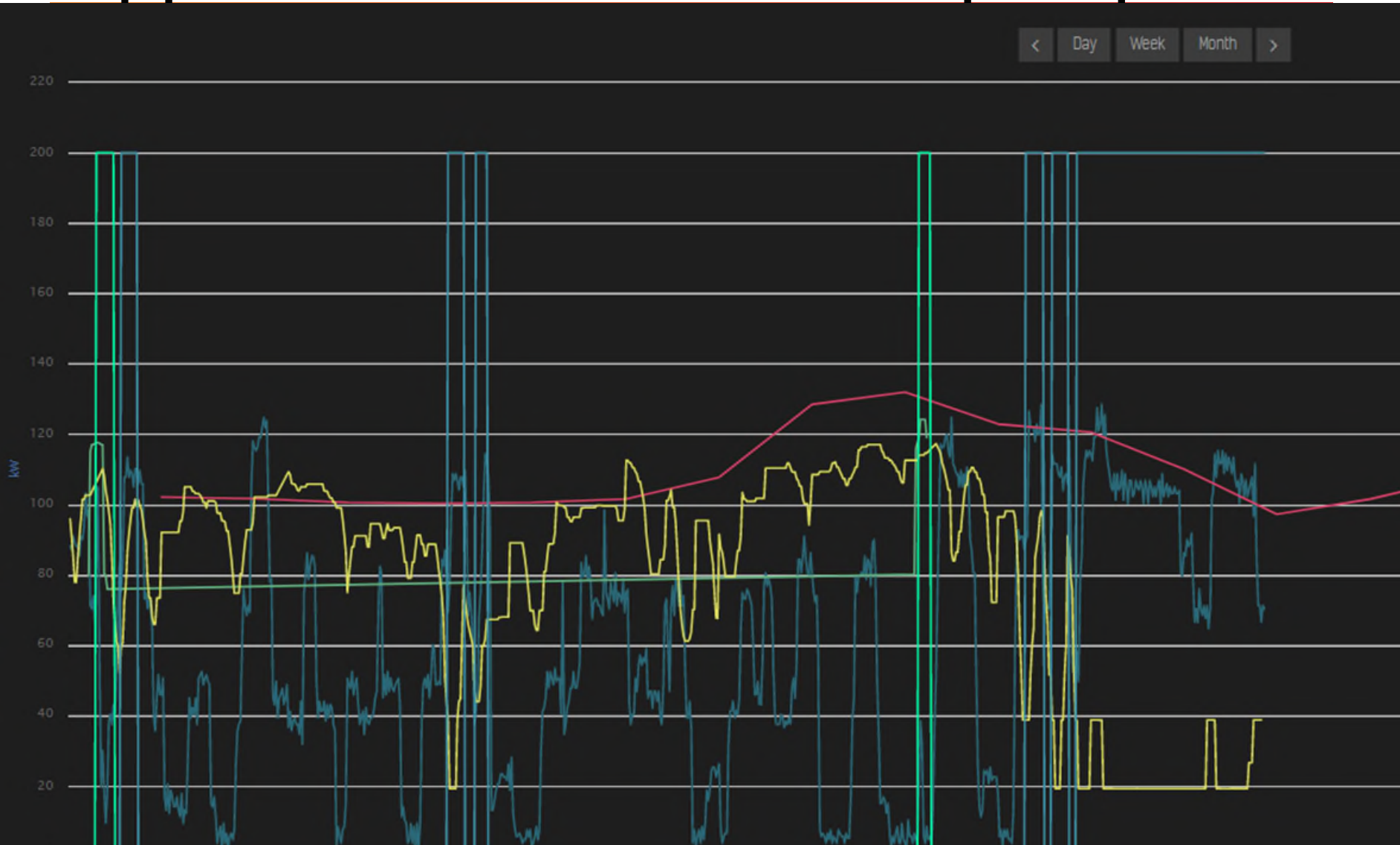


Day Ahead Market – Imbalance market





Applied control to a 'heat pump' (freezer)





Output for Geofit pilots

- Sant Cugat
 - heat resource schedule (HP - Gas boiler) – use solar where possible
 - Setpoint for intelligent valves (power profiles)
- Perugia
 - smart thermostat
- Bordeaux
- NUIG Galway
 - Heat resource schedule (HEX – Dry cooler) with DAM
- Aran
 - Monitor of the capacity of electricity Ireland -- Aran



Commercialization

- Advisor for investment (Knowledge – IP)
 - → lower CAPEX
- Services for implementation BEMS (Services)
- Platform for (Products)
 - → lower OPEX
 - Monitoring
 - Models for assets
 - MPC real-time (1h typically)
 - Market action (1 min typically) → energy provider connection
- Reporting on the results (Services)
 - Reporting
 - dashboards

Thank You



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