



OPTIT
optimal solutions

Analytics and Optimization towards Operational Excellence

District Energy Supply Optimisation

15th October 2021

By matteo.pozzi@optit.net

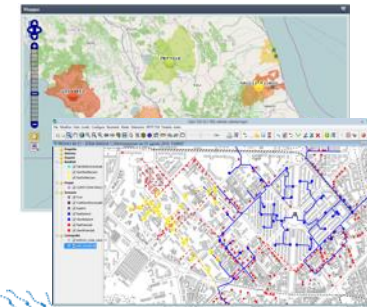
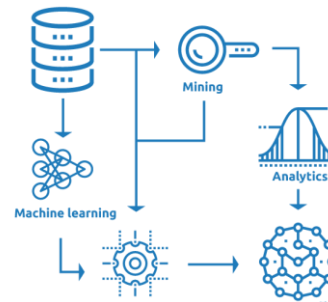
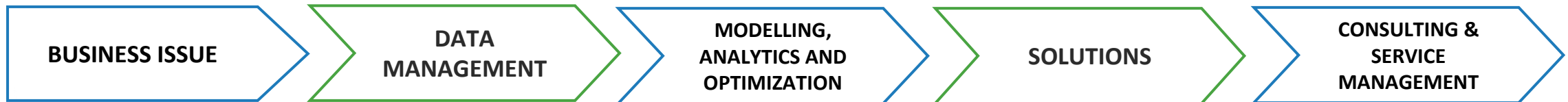
Spin-off of the Alma Mater Università di Bologna, we apply **Operations Research, Data Science and Artificial Intelligence** to design, develop and provide state-of-art **Analytics and Optimization Solutions** in Italy, EU & US



Over 40 talented professional
to support Digital Innovation



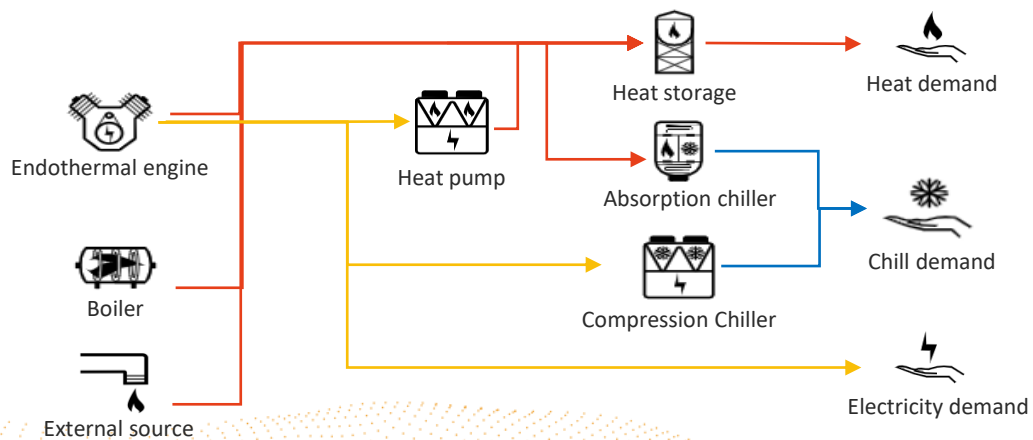
Bologna: HQ & Main Office
Cesena: Software Factory



Energy Generation (unit commitment) Optimisation

BUSINESS OBJECTIVES

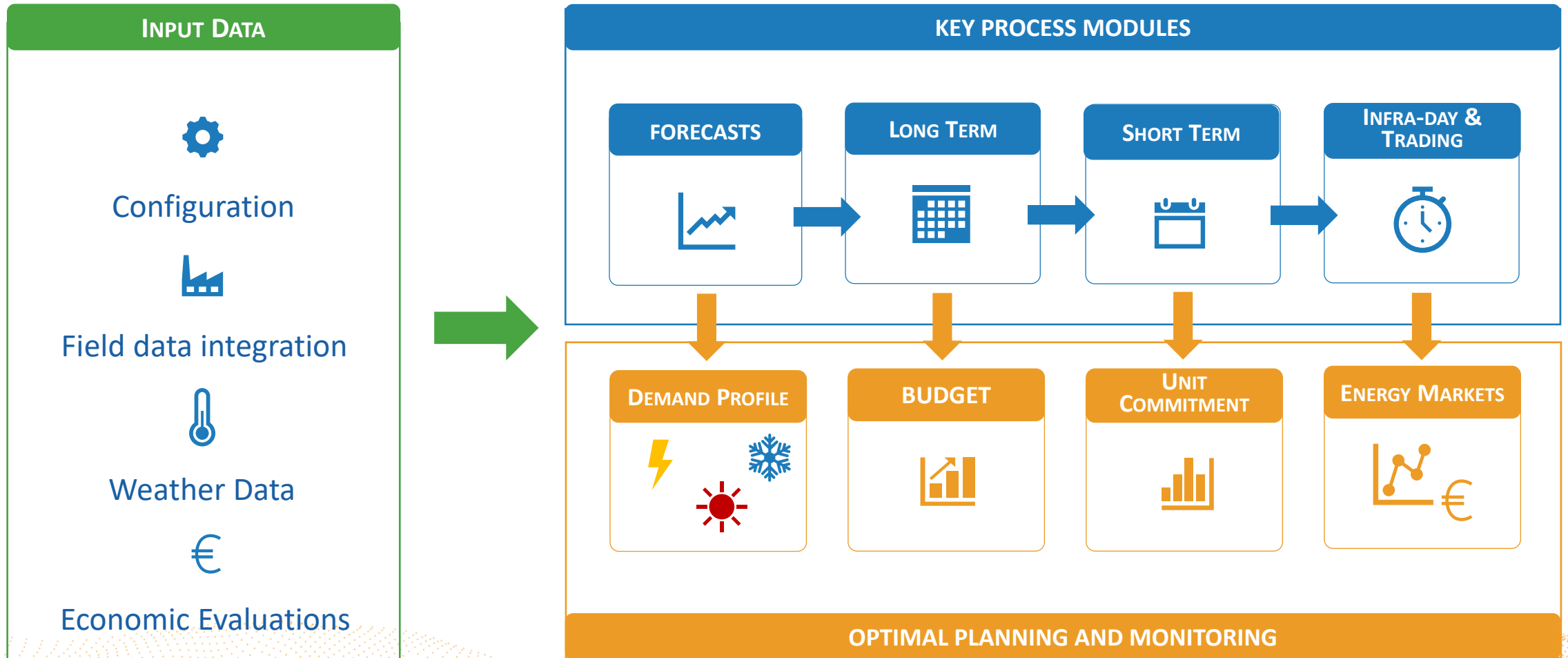
- € € EBITDA Maximization
- 📈 Increase Asset Value
- ⚙️ Optimal management of operative variables in **complex CHCP systems** (demand, supply, prices and constraints)



CHALLENGES FOR DECISION MAKERS

- 📈 Energy Demand **Forecasting**
- € € Multiple **cost/revenues** considerations
- 🏗️ Complex plant **configurations**
- ⬆️⬆️ Operative and Technical **Constraints**
- 📊 **Operating** and **managerial** reports
- ⋯ High data **Intensity** (hourly planning)

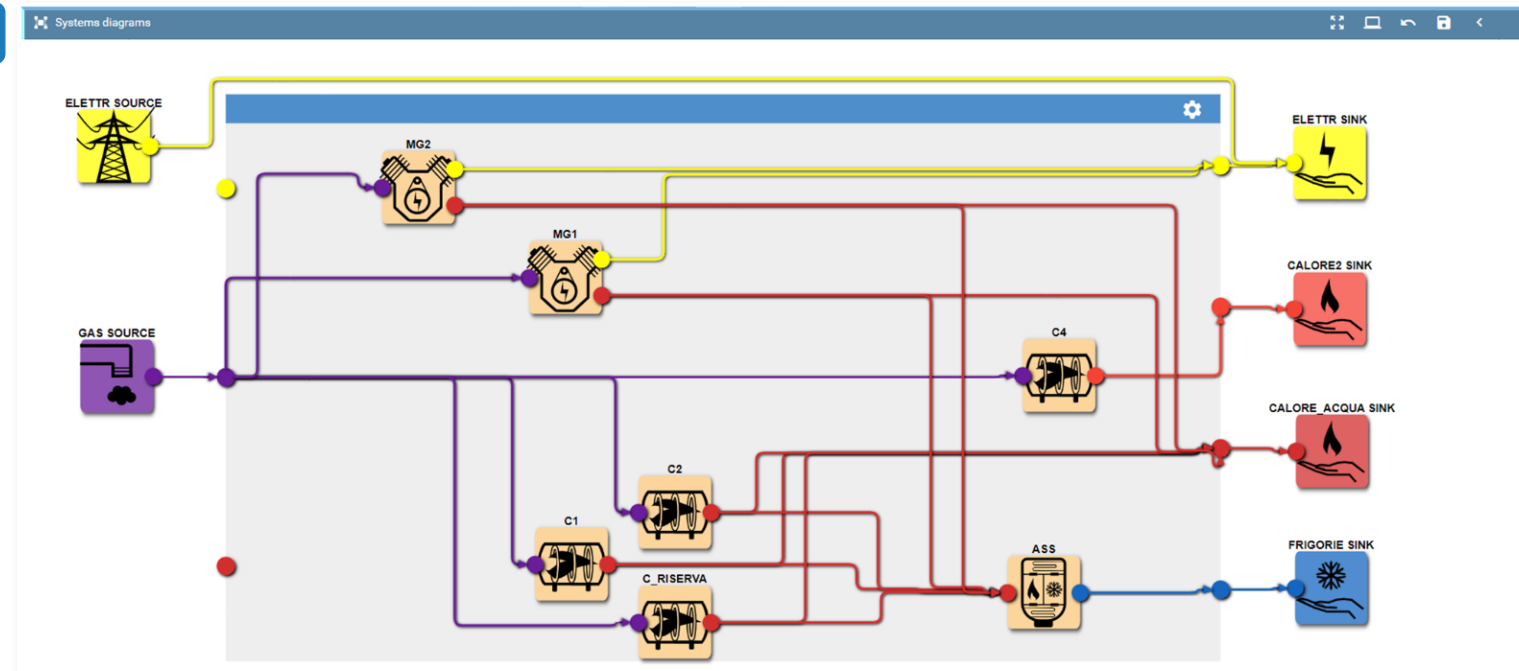
A fully Engineered Solution



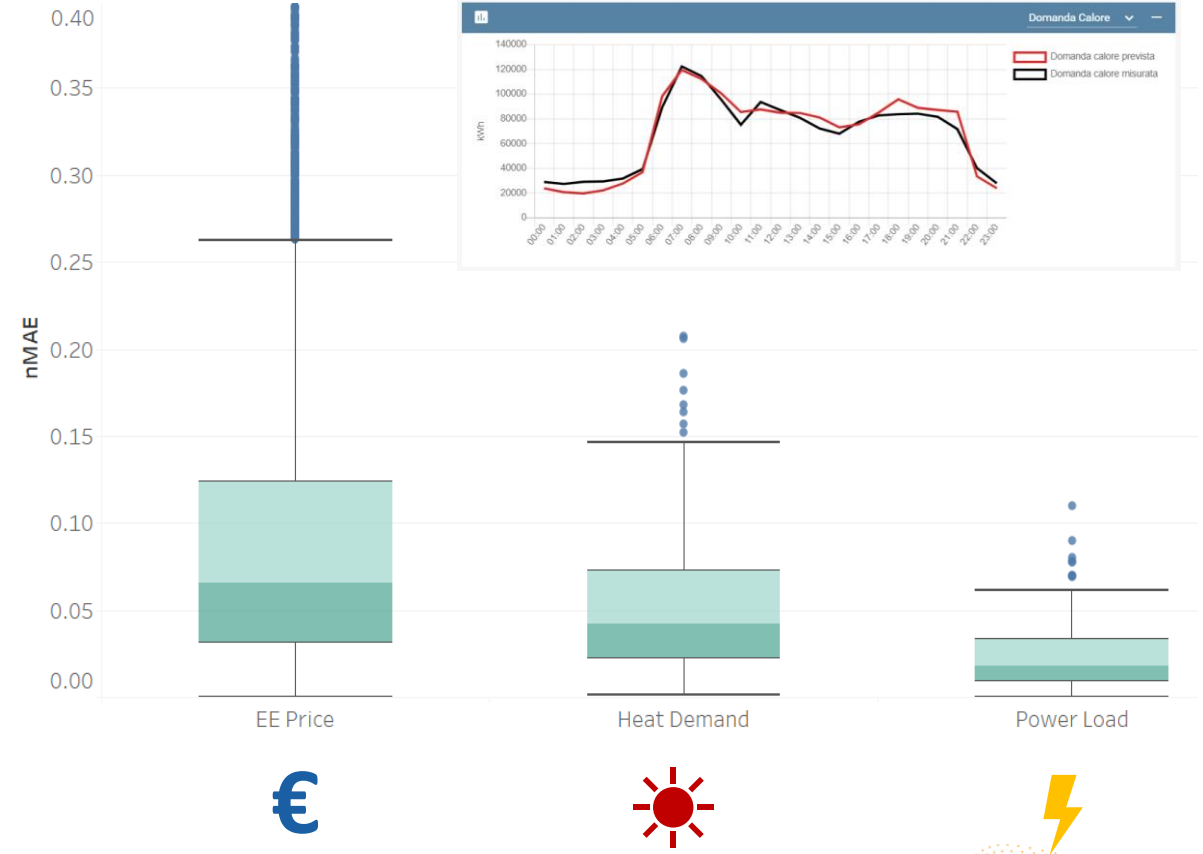
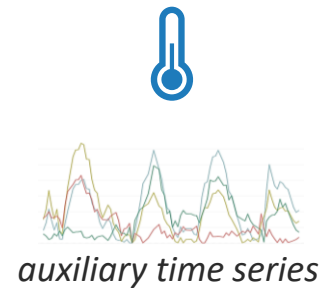
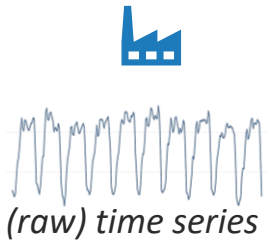
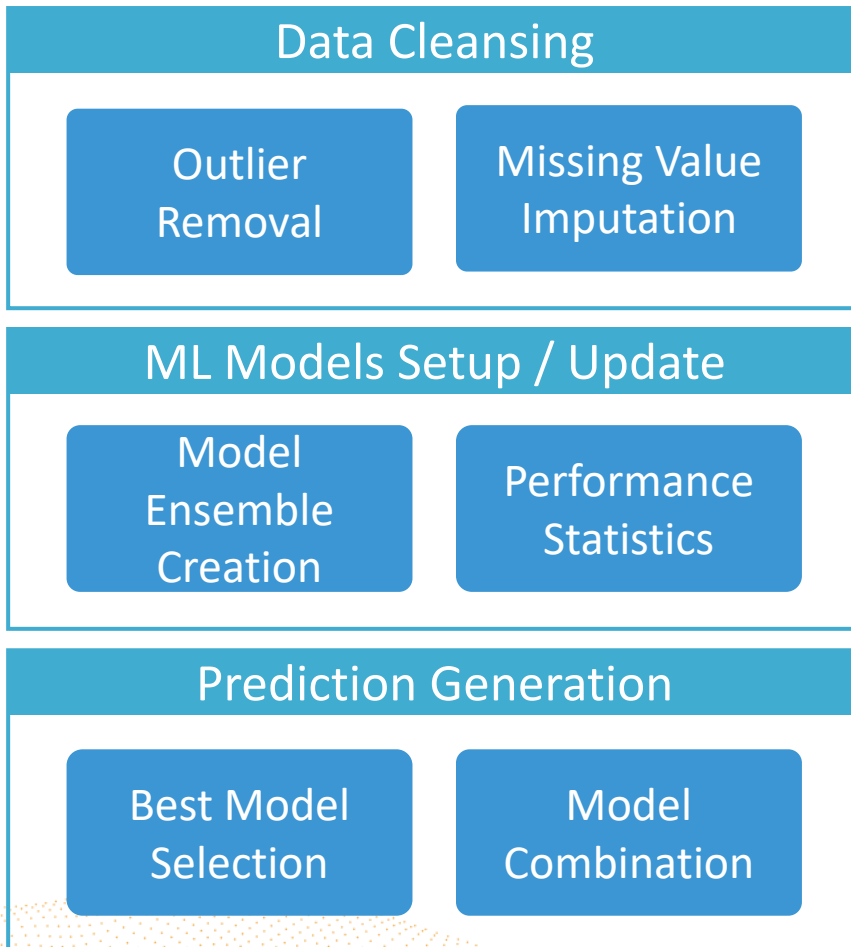
Flexible Block based Design and Configuration of Generation Systems

KEY FEATURES:

- **Modular** configuration
- Extensive **Block Library**
- Each energy vector is defined by **separate flows**
- Energy flows defined by **topological constraints**
- **Multi-plant** interactions



Advanced Demand Forecasting



Long Term Planning

LONG TERM PLANNING

- Advanced **budget** scenario functionalities
- Optimal management of **annual constraints**
- **Detailed operating plans** for each plant

WHAT-IF

- Production assets **redesign**
- **Sensitivity** analysis on demand & prices
- **Investment** analysis

The screenshot displays the OPTIT software interface for a budget scenario. The main content area is divided into two sections: 'Energy Balance' and 'Cash flow', both showing a 12-month forecast for 2020.

Energy Balance

	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Elettricità (kWh)													
PRODUZIONE	34.260.153	8.210.861	6.908.918	4.337.543	3.064.172	495.283	10.080	41.580	0	10.080	1.842.031	4.184.007	5.155.598
ACQUISTO DA RETE	1.400.700	28.460	120.064	339.618	82.089	67.436	25.612	30.206	25.318	29.869	132.489	341.290	178.248
CONSUMO INTERNO													
Consumo boiler elettrico	187.808	83.851	13.065	33.211	0	0	0	0	0	0	17.172	30.437	10.072
Consumo pompe di calore	23.636.872	3.961.979	3.648.220	3.586.319	2.704.260	493.164	0	0	0	0	1.750.405	3.554.263	3.938.263
Consumo ausiliari	2.853.246	616.302	478.890	353.955	200.354	59.684	25.612	30.921	25.318	30.128	168.011	406.320	467.750
IMMESSO IN RETE	8.982.930	3.577.189	2.888.808	703.677	241.647	9.871	10.080	40.865	0	9.821	48.931	534.277	917.762
Calore (kWh)													
PRODUZIONE													
Produzione CHPs	31.681.275	7.606.126	6.413.046	4.015.044	2.755.522	443.897	9.960	41.400	0	9.960	1.631.283	3.887.968	4.867.070
Produzione caldaie	13.470.846	8.172.412	2.321.606	267.038	0	0	0	0	0	0	54.000	923.699	1.732.090
Produzione pompe di calore	66.232.588	11.110.808	10.228.552	10.040.426	7.564.752	1.379.043	0	0	0	0	4.897.542	9.962.906	11.048.559
Produzione boiler elettrico	186.874	83.434	13.000	33.045	0	0	0	0	0	0	17.087	30.286	10.022
ACQUISTO	119.056.417	22.598.413	19.556.051	14.411.707	5.861.215	3.047.681	2.039.022	2.432.384	2.025.458	2.400.283	6.372.055	18.067.933	20.244.216
IMMESSO IN RETE	228.761.254	49.304.145	38.311.204	28.570.839	16.028.304	4.774.714	2.048.982	2.473.675	2.025.458	2.410.243	12.887.815	32.505.837	37.420.038
Gas (Smc)													
CONSUMO													
Consumo caldaie	1.535.138	931.328	264.570	30.432	0	0	0	0	0	0	6.154	105.265	197.389
Consumo CHPs	8.405.942	2.011.541	1.694.210	1.061.698	743.484	119.792	2.617	10.452	0	2.617	444.446	1.033.245	1.281.837

Cash flow

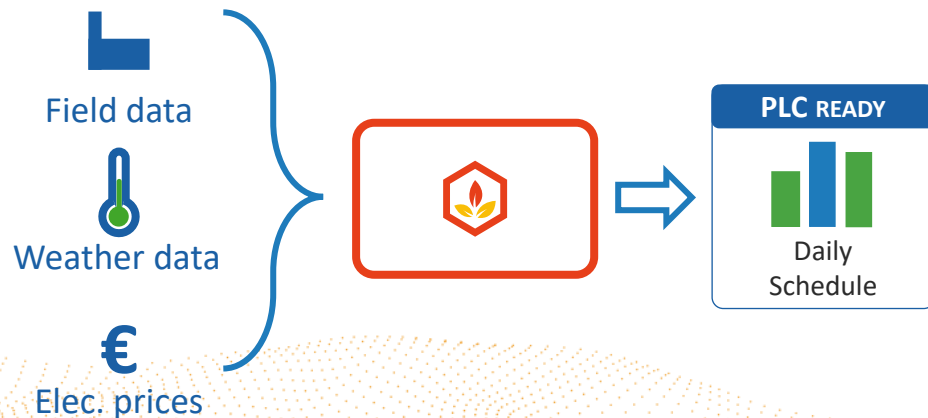
	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ricavi (€)													
ELETTRICITÀ	461.292	186.633	163.307	38.865	13.530	543	420	2.508	0	450	2.102	19.476	33.456
CALORE	15.441.385	3.328.030	2.586.006	1.928.532	1.081.910	322.293	138.306	166.973	136.718	162.691	869.928	2.194.144	2.525.853
Costi (€)													
ELETTRICITÀ	146.016	3.072	13.490	37.712	9.028	7.415	2.491	3.524	2.480	3.033	13.063	31.078	19.630
CALORE	3.701.944	715.001	615.327	439.065	175.840	91.430	61.171	72.972	60.764	72.008	191.355	566.375	640.036
GAS	3.604.167	1.062.522	709.218	400.936	269.685	43.278	948	3.783	0	948	164.096	414.145	534.607
MANUTENZIONE	215.400	50.850	43.200	26.625	17.150	2.675	100	325	0	100	9.675	28.000	36.700
CO2	379.250	122.792	80.592	42.923	28.006	953	-3.968	-3.766	-4.217	-3.968	15.224	45.055	59.624
Margine (€)													
MARGINE	7.856.500	1.560.426	1.287.485	1.020.136	595.731	177.086	77.984	92.644	77.692	91.020	478.617	1.128.968	1.268.712

Short Term Optimization

SHORT-TERM PLANNING

- Plant assets **operating plans**
- **Infra-day** optimization
- Small time-step **granularity** (hourly)

PROCESS AUTOMATION



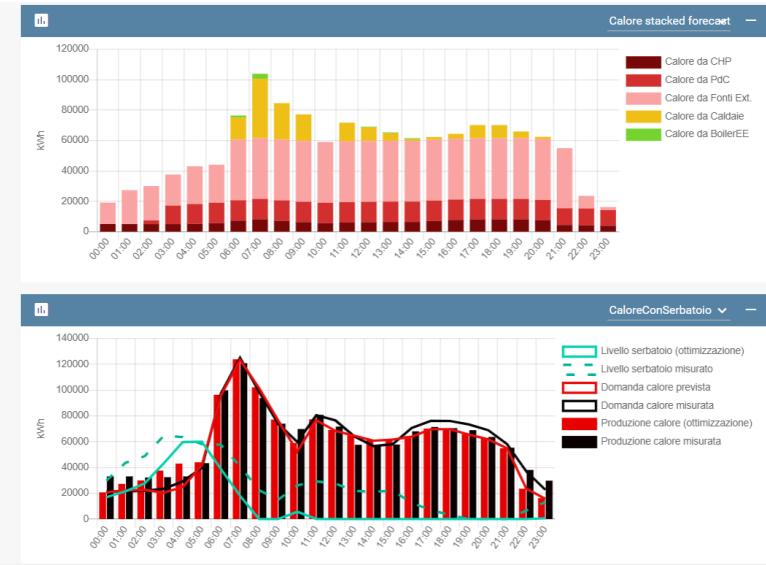
Instance + System tree +

KPI KPI Produzione Calore

KPI	Full For...	Forecast	Measu...	Delta
Prod. Calore Boiler	150'150 kWh	150'150 kWh	154'185 kWh	-2.6 %
Prod. Calore PdC	274'189 kWh	274'189 kWh	300'424 kWh	-8.7 %
Prod. Calore Fonte Ext.	779'147 kWh	779'147 kWh	607'622 kWh	28.2 %
Prod. Calore CHP	149'847 kWh	149'847 kWh	298'832 kWh	-49.9 %

Budget KPIs 01-01-2020 - 08-04-2020 Valutazione Margine

KPI	Forecast	Measured	Delta
Calore Imnesso	107'619'972 kWh	115'204'771 kWh	-6.6 %
Margine Operativo	3'515'512 €	3'303'068 €	6.4 %
Costo Marginale	32.7 €/MWh	28.7 €/MWh	13.9 %



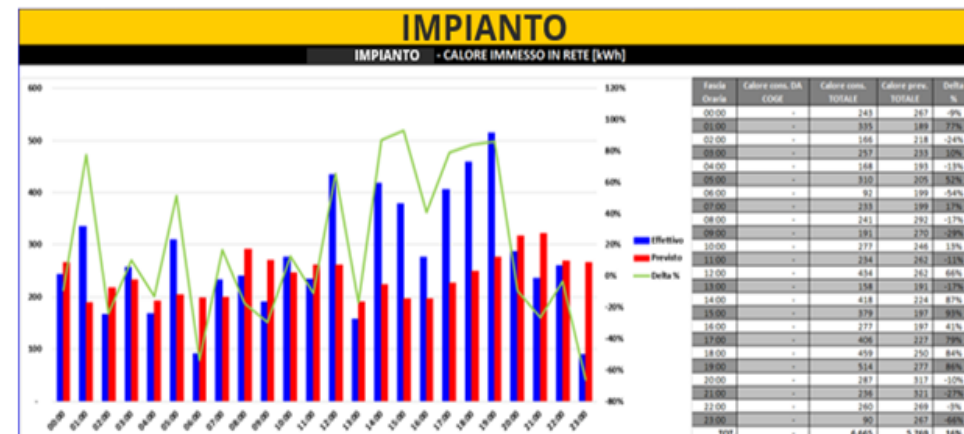
EBITDA Optimization

Reporting & monitoring

	HEADER 1	HEADER 2	HEADER 3	HEADER 4
dateTime	KPI 1	KPI 2	KPI 3	KPI 4
2022/01/01 00:00+01:00	626	204.900	500	0
2022/01/01 01:00+01:00	604	204.899	500	0
2022/01/01 02:00+01:00	571	204.901	500	0
2022/01/01 03:00+01:00	573	204.900	500	0
2022/01/01 04:00+01:00	629	204.900	500	0
2022/01/01 05:00+01:00	704	204.898	500	0

- Flexible and extensive **reporting** capabilities
- **Alerts** and monitoring functionalities
- Data **integration** with legacy and BI systems

ENERGIA TERMICA IMMESSA [MWh]			ENERGIA TERMICA VENDUTA [MWh]			ENERGIA ELETTRICA IMMESSA [MWh]		
MESE CORRENTE	BUDGET	ANNO PRECEDENTE	MESE CORRENTE	BUDGET	ANNO PRECEDENTE	MESE CORRENTE	BUDGET	ANNO PRECEDENTE
3 694	3 909	3 546	1 145	1 360	1 166	0	0	0
3 713	4 199	4 086	1 880	2 366	2 424	0	0	0
711	800	662	125	214	84	0	0	0
1 154	1 859	1 476	831	1 452	747	0	0	0
1 486	1 120	929	1 108	450	240	1 387	689	469
729	779	730	350	400	350	276	0	0
629	573	564	223	167	250	999	379	233
2 375	739	1 452	1 462	419	631	1 329	784	1 024
492	380	385	226	115	108	428	19	0
405	190	146	127	124	90	283	6	0
209	362	330	77	184	172	0	0	0
86	156	163	65	106	107	0	7	0
225	174	204	81	30	57	188	3	2
233	405	213	55	222	20	0	0	0
89	94	63	34	39	1	-7	0	0
16 231	15 738	14 949	7 790	7 647	6 448	4 883	1 887	1 728
	3%	9%		2%	21%		159%	183%



System Integration

INPUT DATA

Meteo & forecasts



SCADA input



Market systems



Parameters



Assets availability



Prices & bids



External Sources



OUTPUT DATA



Optimal planning



SCADA output



Market systems



Monitoring & KPIs



Alerts

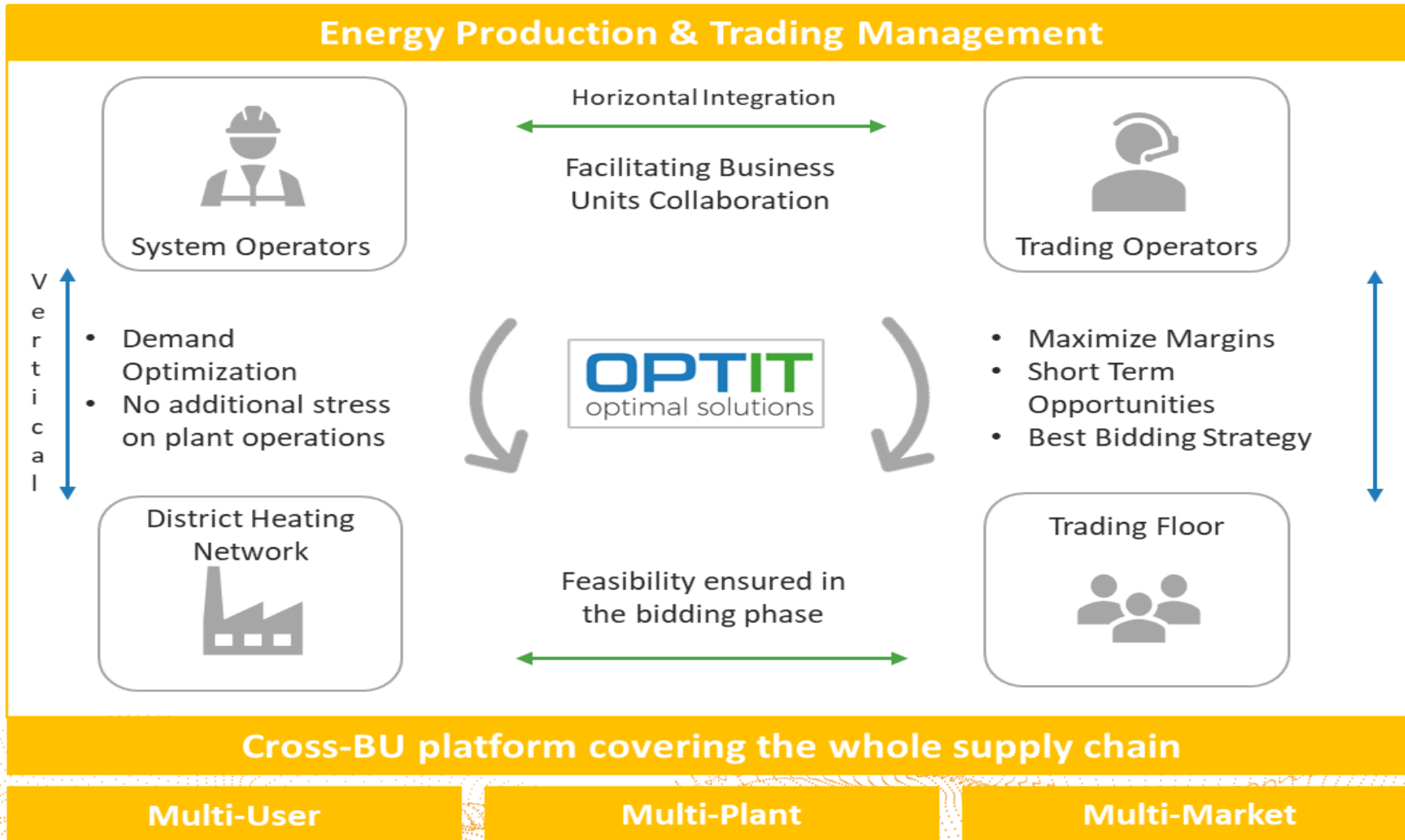


Bidding program

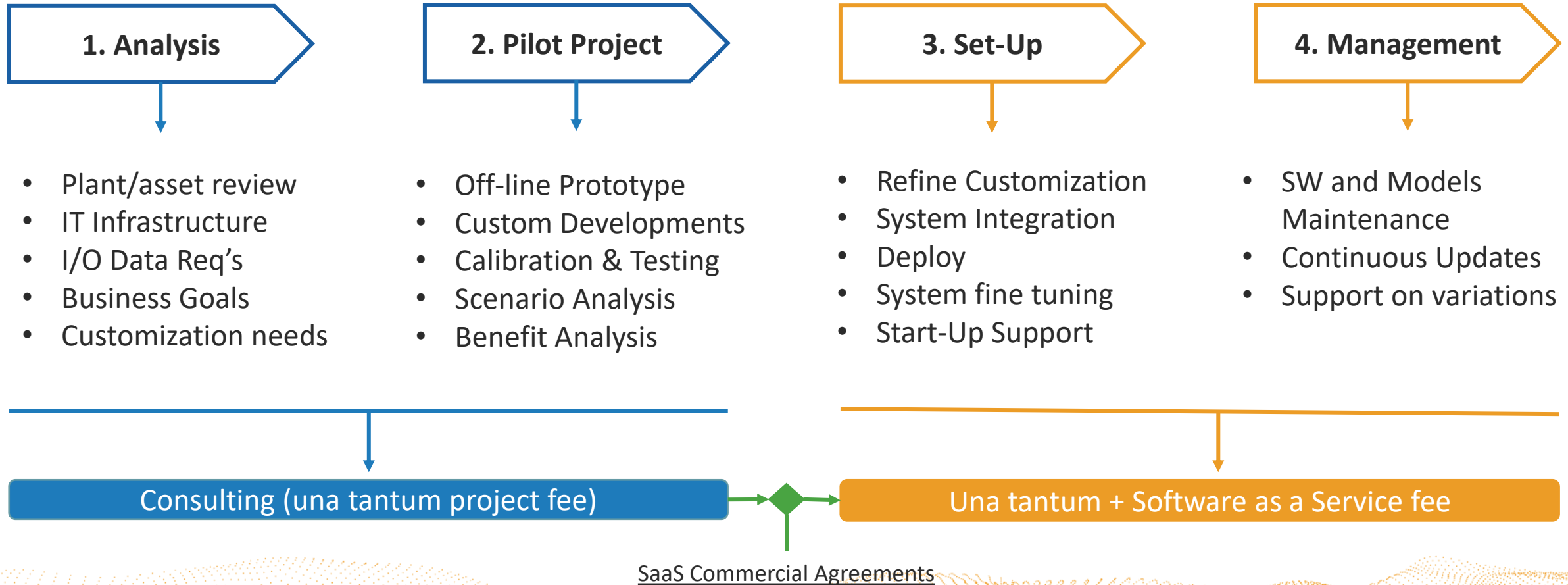


Reporting

Trading Optimization: Business Integration with conflicting objectives



Our Approach



Benefits of Optit's solutions

ADVANCED PLANNING SOLUTIONS DELIVER



Optimization delivers proven benefits

Advanced Planning Systems to optimize reduce operating costs and improve margins



Increase planning speed and accuracy

Automated forecasting and can process data faster and evaluate more options, representing a marked upgrade wrt manual planning



Improved service quality

Stricter management of constraints , operating policies and rules results in better overall quality of service (economic and environmental)



Standardized Knowledge

Optit's solution incorporates human knowledge and company business rules to make the planning process a company standard



Environmental impacts

Economic optimisation and operational constraints management guarantee a decreased impact on GHG and emissions KPIs

CHARACTERISTICS OF OPTIT'S SOLUTIONS



Scalability

Innovative interoperable solution fully web-based easily accessible from a web-browser



In-house Optimization algorithms

The solution is designed and developed entirely by Optit, that owns the code and methodologies. Hence specific customer implementation are easily incorporated



Flexible business process

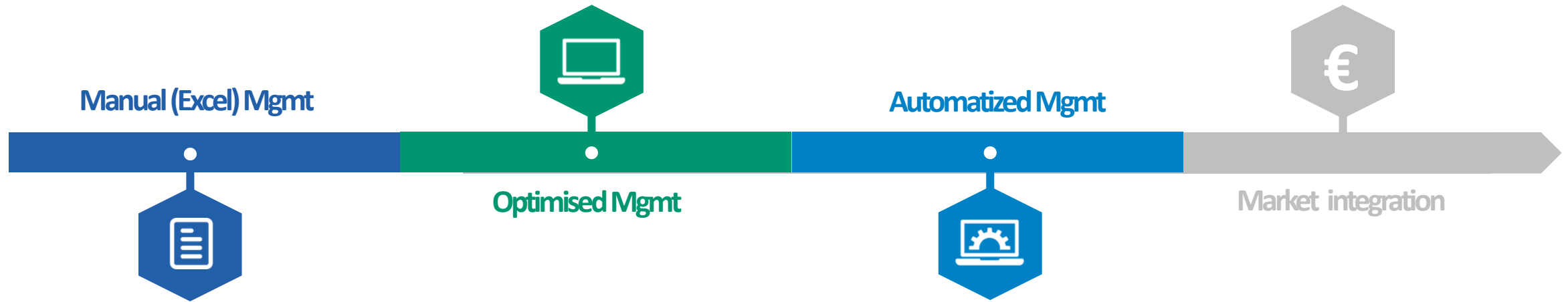
The solution is easily adapted to the customer business process from a functional/ operational and technological user perspective



System Integration

Proven capacity to interface with key company's and external data sources, to achieve a fully integrated approach

Final remarks



- A structured **DH Digitalisation Strategy**, powered by **Advanced Analytics DSS**, is key to operate efficiently modern Energy Systems
- **Sector coupling** and energy market integration introduces new levels of **complexity** to DH Utilities, requiring structured Enterprise approaches enabling **new business & operating models**, yet unlocking interesting new **revenue streams** with significant impact on overall business performance

OPTIT

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Via Mazzini, 82 - 40138 Bologna (BO) Tel: +39 051 4381574

Via Ravennate, 959 - 47522 Cesena (FC) Tel: +39 0547 385703



www.optit.net



info@optit.net



[@optitsrl_en](https://twitter.com/optitsrl_en)



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MANUAL

OPTIMISATION

AUTOMATISATION

MARKET
INTEGRATION



INDUSTRY KNOWLEDGE AND EXPERTISE

Optit is one of the leader in the development of digital solutions and services for the district energy industry. We are actively involved in numerous innovative projects for both the development and expansion of **district energy** partnering with some of the world leading organizations.

Our team combines expertise from both the energy and digital industry making it the perfect match for company looking to innovate their operations.

- **Energy and Mechanical Engineers** experts in the district energy industry
- **Software Engineers** experts in the development of advanced digital solutions
- **Data Scientists** experts in data handling, data management and data driven analysis and model creations
- **OR Specialist** expert in the development of optimization models and algorithms for the energy sector

MEMBERSHIP AND ACTIVE ROLES



Matteo Pozzi (Optit's CEO)
Vice-Chairman of EuroHeat and Power technology platform



Actively involved in the EU debate about the future of district energy and smart systems



DISTRICT ENERGY IN CITIES INITIATIVE

Partner of the UN's initiative (Belgrade project).



Sponsors and promoters for the Italian's participation to the IEA DHC Technology Collaboration Programme



Irish District Energy Association

Active member involved of several national DHC associations.

Energy Trading – high level concepts (based on the Italian market rules)

DAY-AHEAD MARKET

- Hourly bids can be placed until 12:00 on the previous day
- Market price is formed (for each zone) by demand/supply intersection
- Once offers are accepted, the producer is committed to the dispatching plan

INFRA-DAY MARKETS

- Further bids can be placed on multiple markets at different cut-offs
- Mechanisms similar to Day Ahead
- The dispatching plan is updated throughout the day

BALANCING MARKET

- Large Plants or Aggregated Virtual Units can offer hourly flexibility in production increase or decrease to support grid balance
- Pre-requisite is integration for direct connection to TSO calls
- Fixed + variable remuneration

XBID MARKETS

- Additional market leading towards continuous trading
- Hourly bids can be placed (at given price) for future time slots
- Should kick-off before the end of 2021

Management of complex Plant Portfolio

Grouping by participation to
Balancing Markets

Grouping by participation to
Infra-day Markets

Characterization of each plant in
the portfolio

Cluster	Market Zone
0	NORD
0	NORD
CLUSTER	NORD

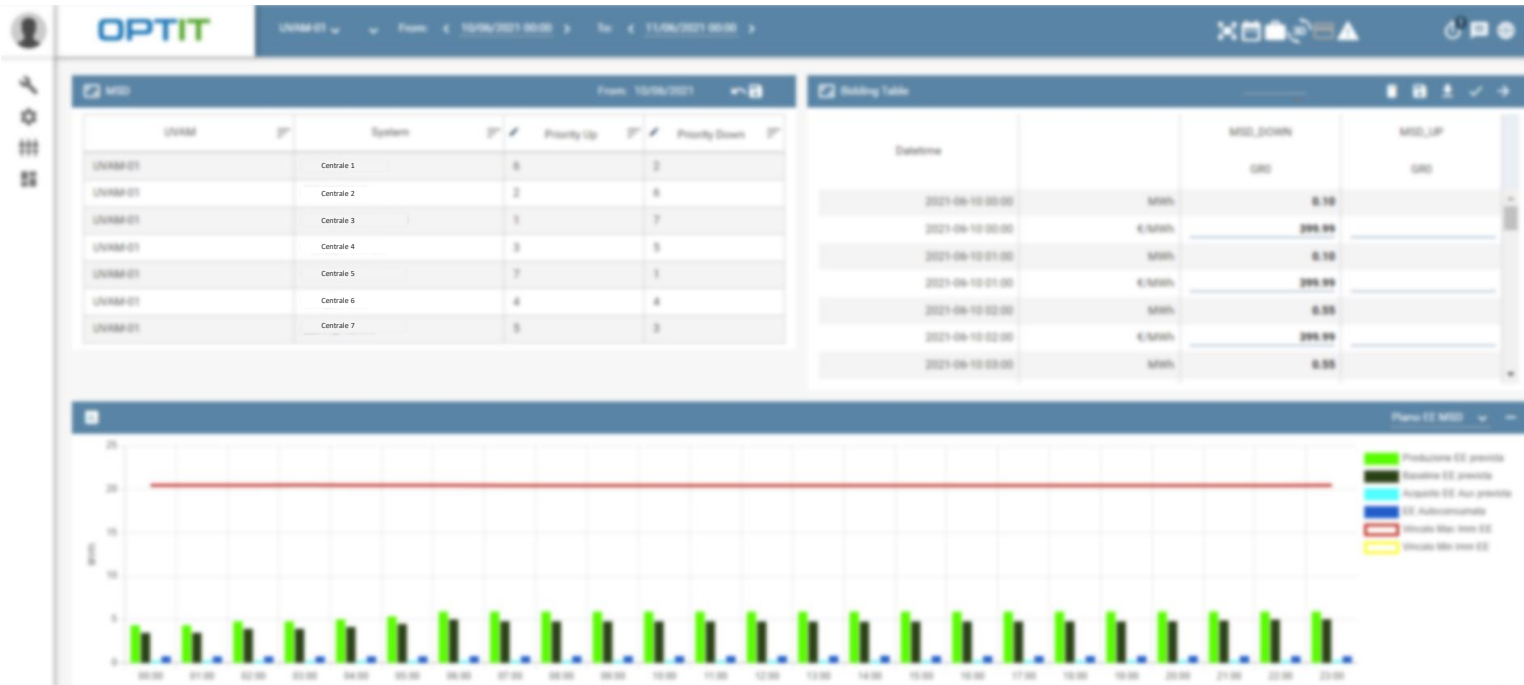
UVM	MSO Hours	Start Window	End Window
UVM-01	4	14:00	20:00

Group	Description
TLR	TLR

System	Geo Zone	Cluster	UVM	Group	MSO Reserve
Centrale 1	CMZ 1	0	UVM-01	TLR	0
Centrale 2	CMZ 2	0		TLR	0
Centrale 3	CMZ 3				
Centrale 4	CMZ 4				
Centrale 5	CMZ 5			TLR	0
Centrale 6	CMZ 6	0	UVM-01	TLR	0
Centrale 7	CMZ 7	0	UVM-01	TLR	0.5
Centrale 8	CMZ 8	0	UVM-01	TLR	0
Centrale 9	CMZ 9				
Centrale 10	CMZ 10				
Centrale 11	CMZ 11	0	UVM-01	TLR	0
Centrale 12	CMZ 12	0		TLR	0
Centrale 13	CMZ 13	0	UVM-01	TLR	0

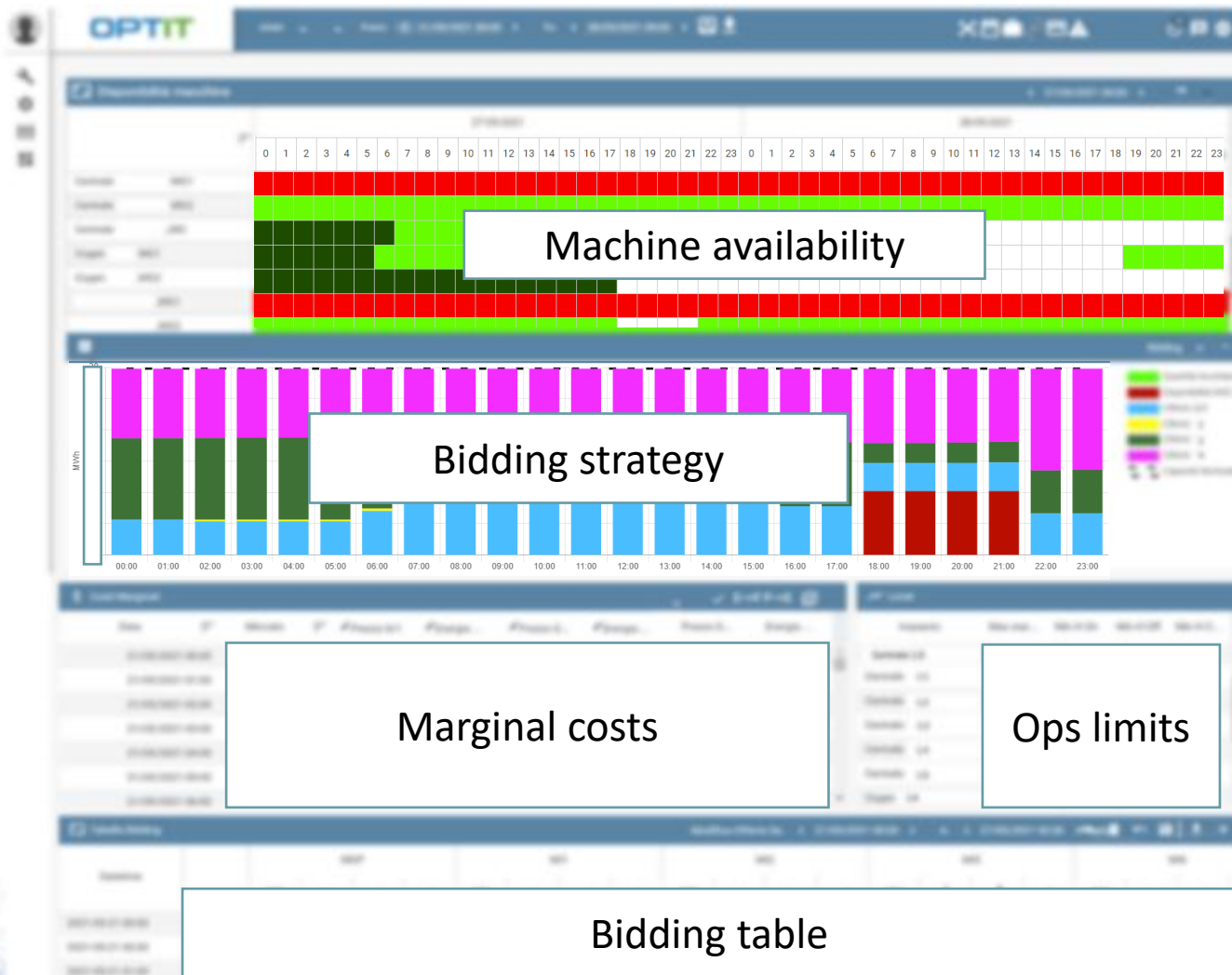
Complex plant portfolios and engagement with different electricity markets (with a view to XBID) must be managed

MSD (Dispatchment Services Market)



- Management of capacity reserved for TSO flexibility needs
- Heavily regulated process

Advanced Trading Management



- Monitoring of assets **availability**
- Dynamic **marginal costs** calculation for each production asset in the portfolio
- Sophisticated calculation of convenient production portfolio at given **price**
- Workflow with multiple decision **cut-offs** (Day-ahead, Infra-day sessions, XBID)
- Possibility to customise specific Trading Strategy