Analytics and Optimization towards Operational Excellence

District Energy Supply Optimisation

15th October 2021

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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

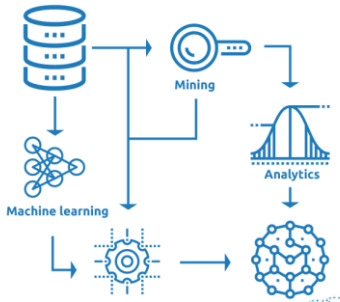
Over 40 talented professional to support Digital Innovation

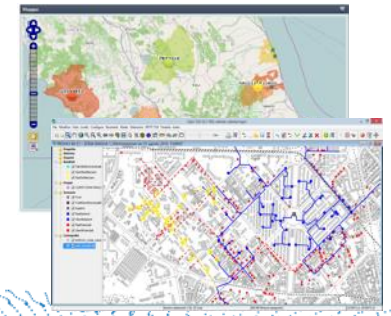
OPTIT optimal solutions

Bologna: HQ & Main Office

Cesena: Software Factory

BUSINESS ISSUE → **DATA MANAGEMENT** → **MODELLING, ANALYTICS AND OPTIMIZATION** → **SOLUTIONS** → **CONSULTING & SERVICE MANAGEMENT**

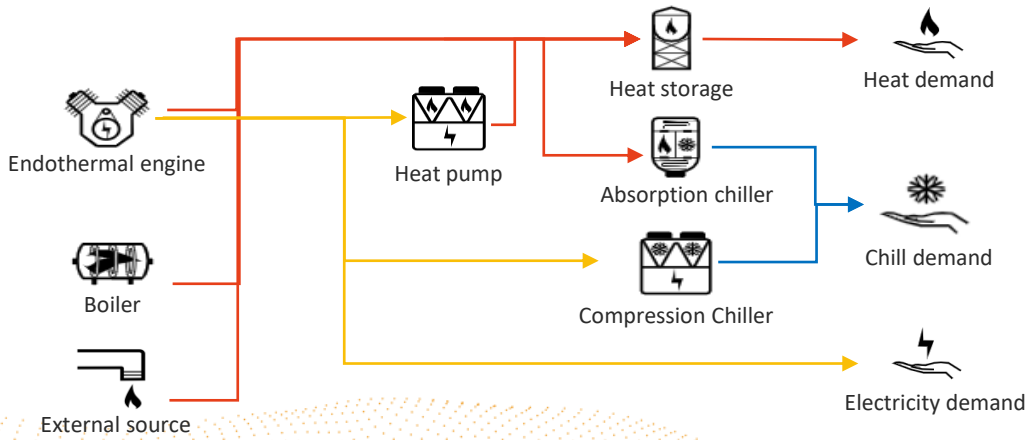




Energy Generation (unit committment) Optimisation

Business Objectives

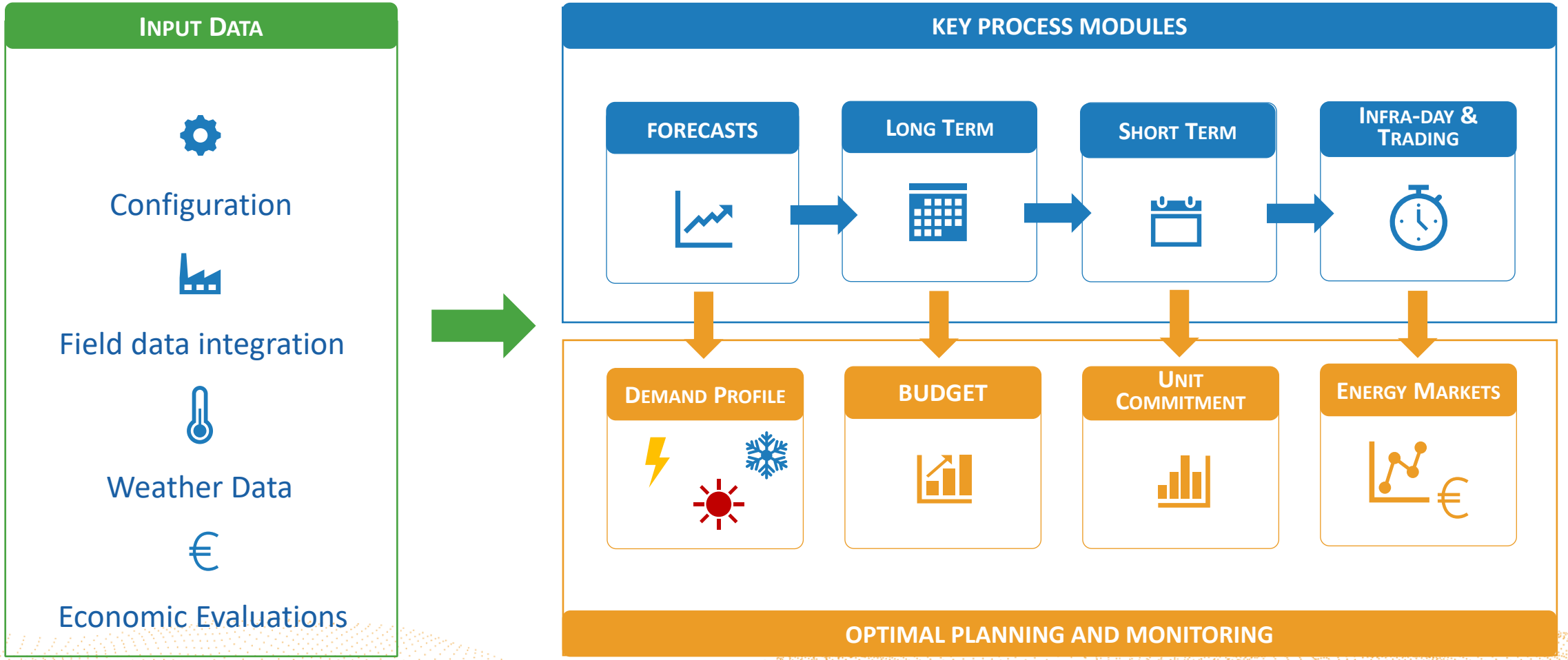
- **EBITDA** Maximization
- Increase **Asset Value**
- Optimal management of operative variables in **complex CHCP systems** (demand, supply, prices and constraints)



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)

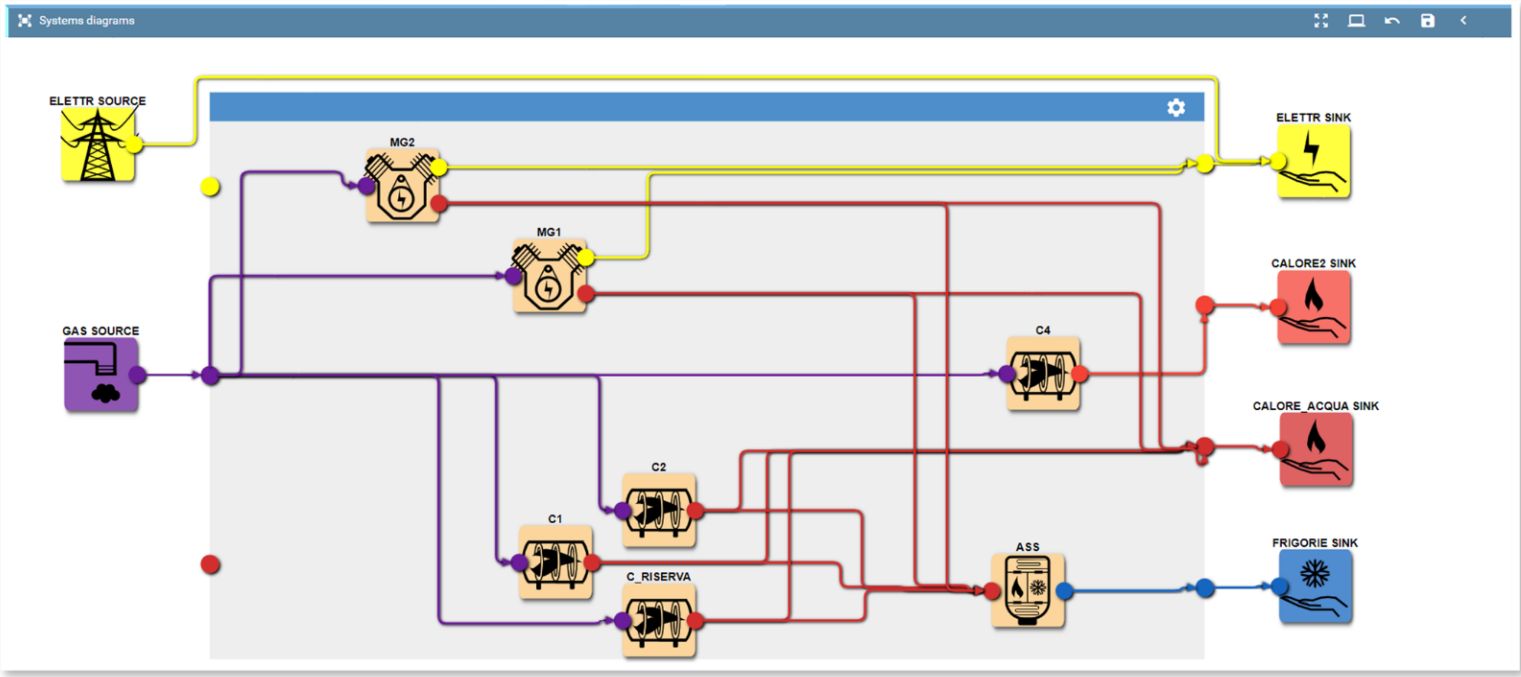
A fully Engineered Solution



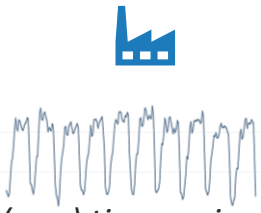
Flexible Block based Design and Configuration of Generation Systems

KEY FEATURES:

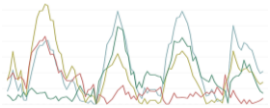
- **Modular** configuration
- Extensive **Block Library**
- Each energy vector is defined by **separate flows**
- Energy flows defined by **topological constraints**
- **Multi-plant** interactions



Advanced Demand Forecasting



(raw) time series



auxiliary time series

Data Cleansing

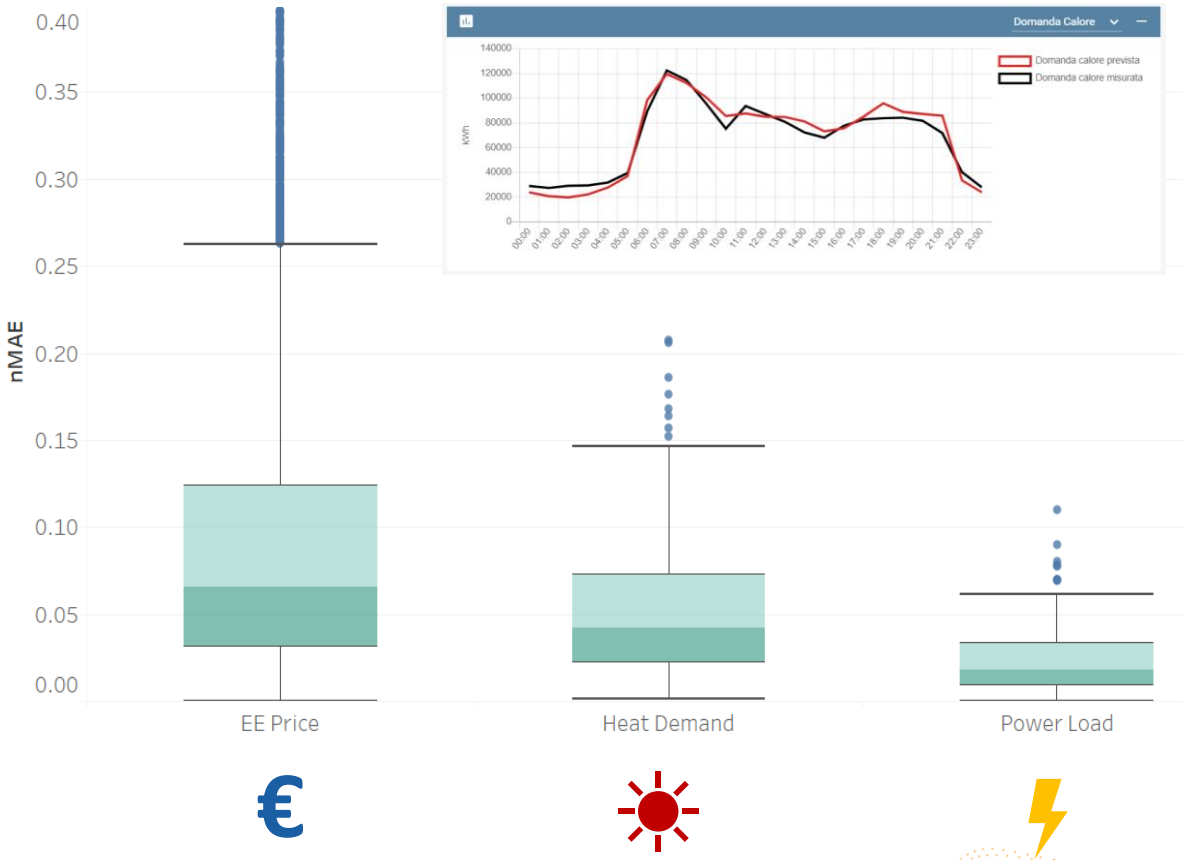
- Outlier Removal
- Missing Value Imputation

ML Models Setup / Update

- Model Ensemble Creation
- Performance Statistics

Prediction Generation

- Best Model Selection
- Model Combination



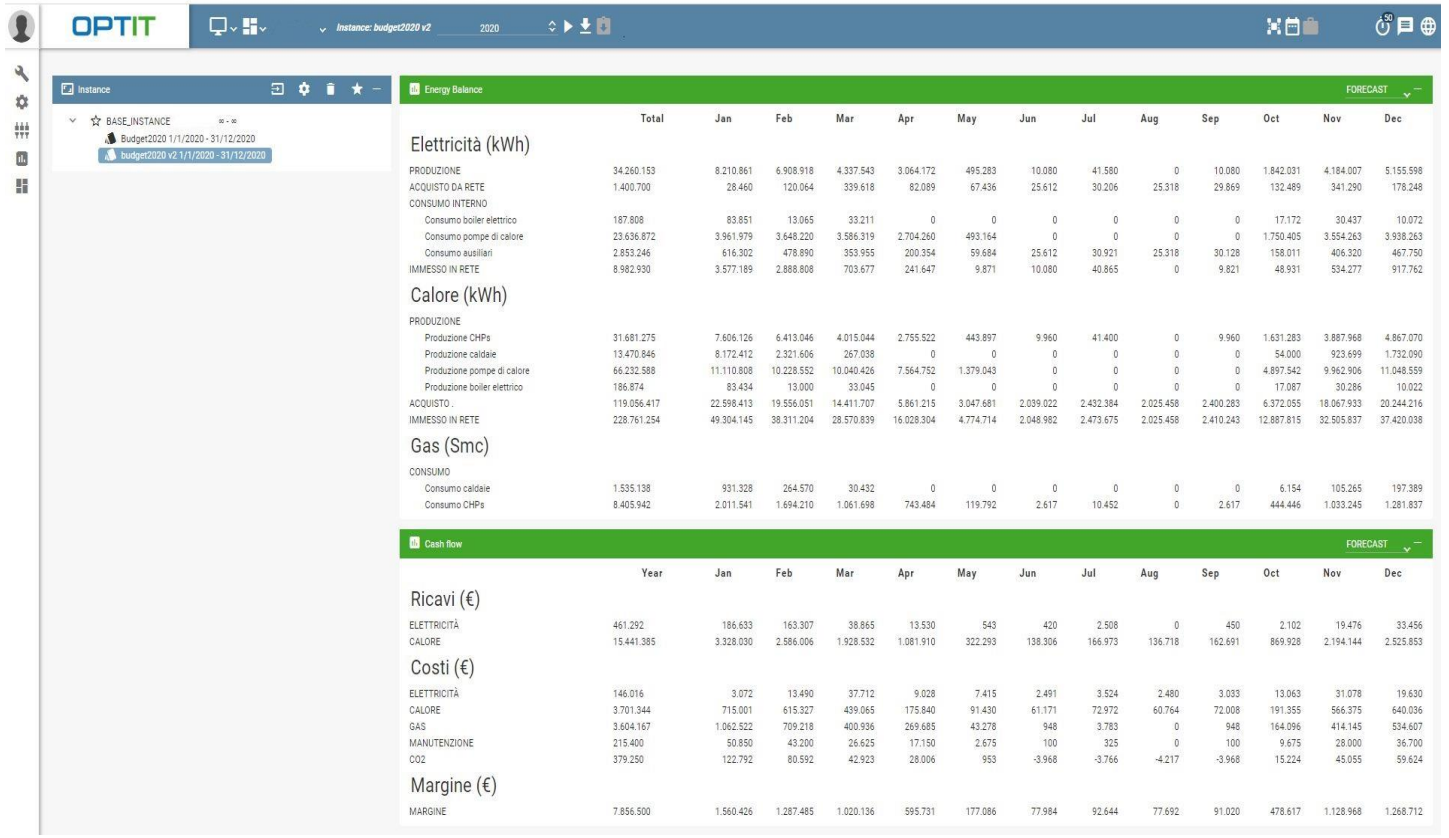
Long Term Planning

LONG TERM PLANNING

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

WHAT-IF

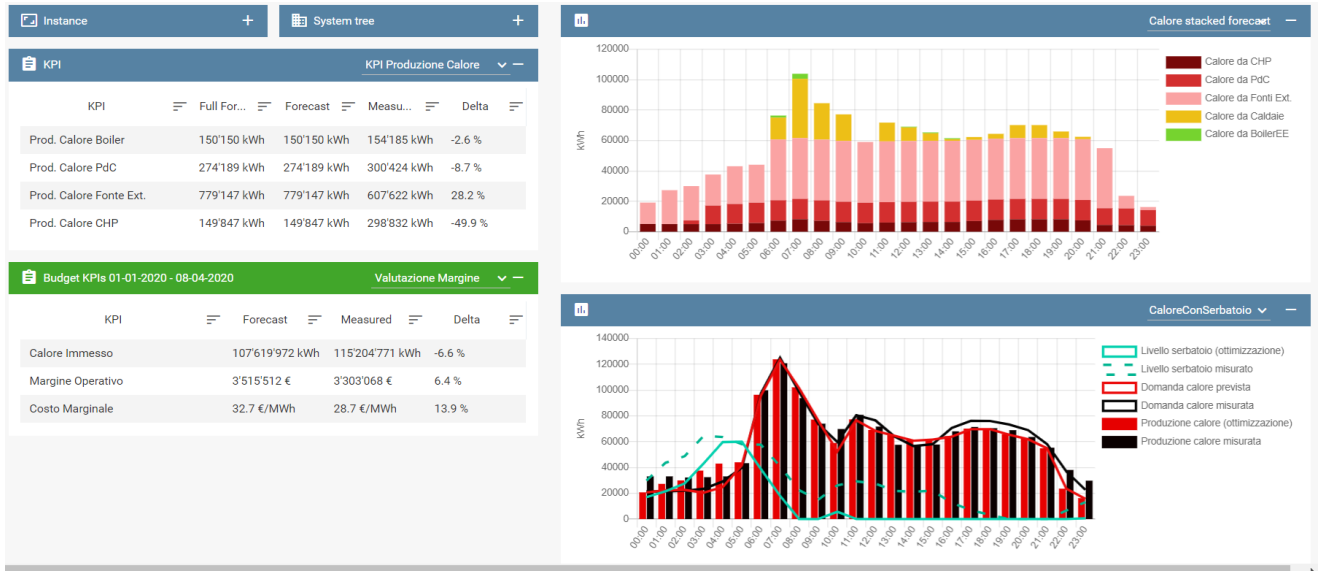
- Production assets **redesign**
- **Sensitivity** analysis on demand & prices
- **Investment** analysis



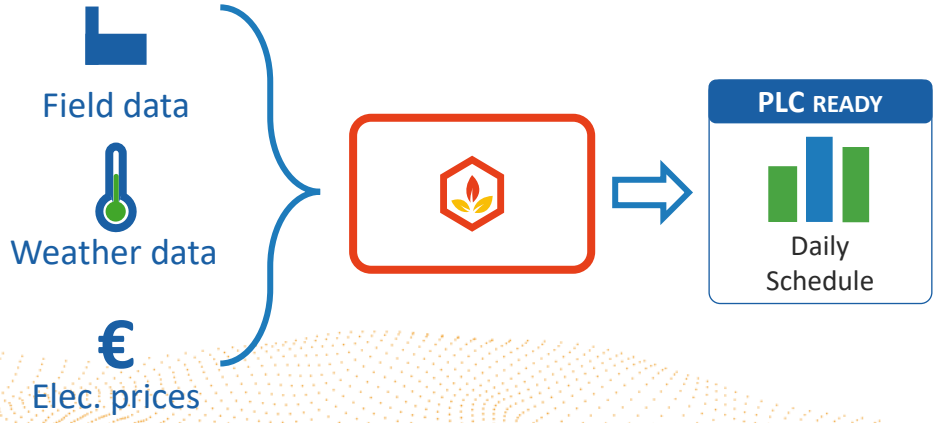
Short Term Optimization

SHORT-TERM PLANNING

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



PROCESS AUTOMATION



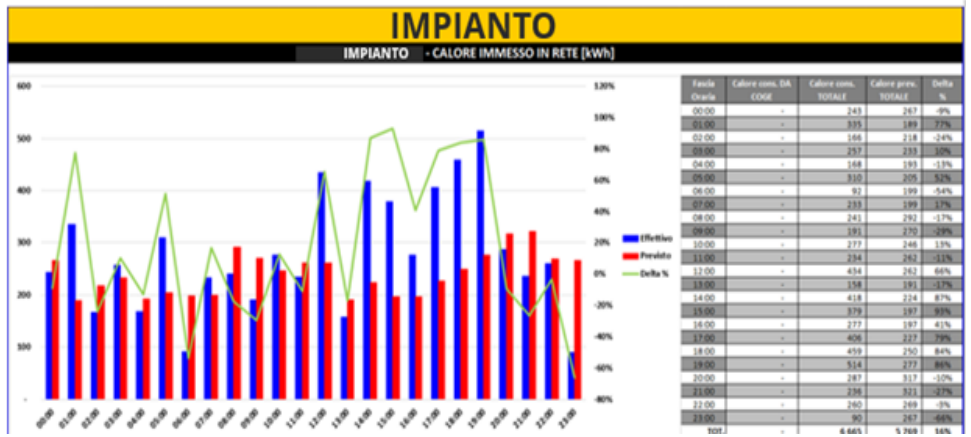
EBITDA Optimization

Reporting & monitoring

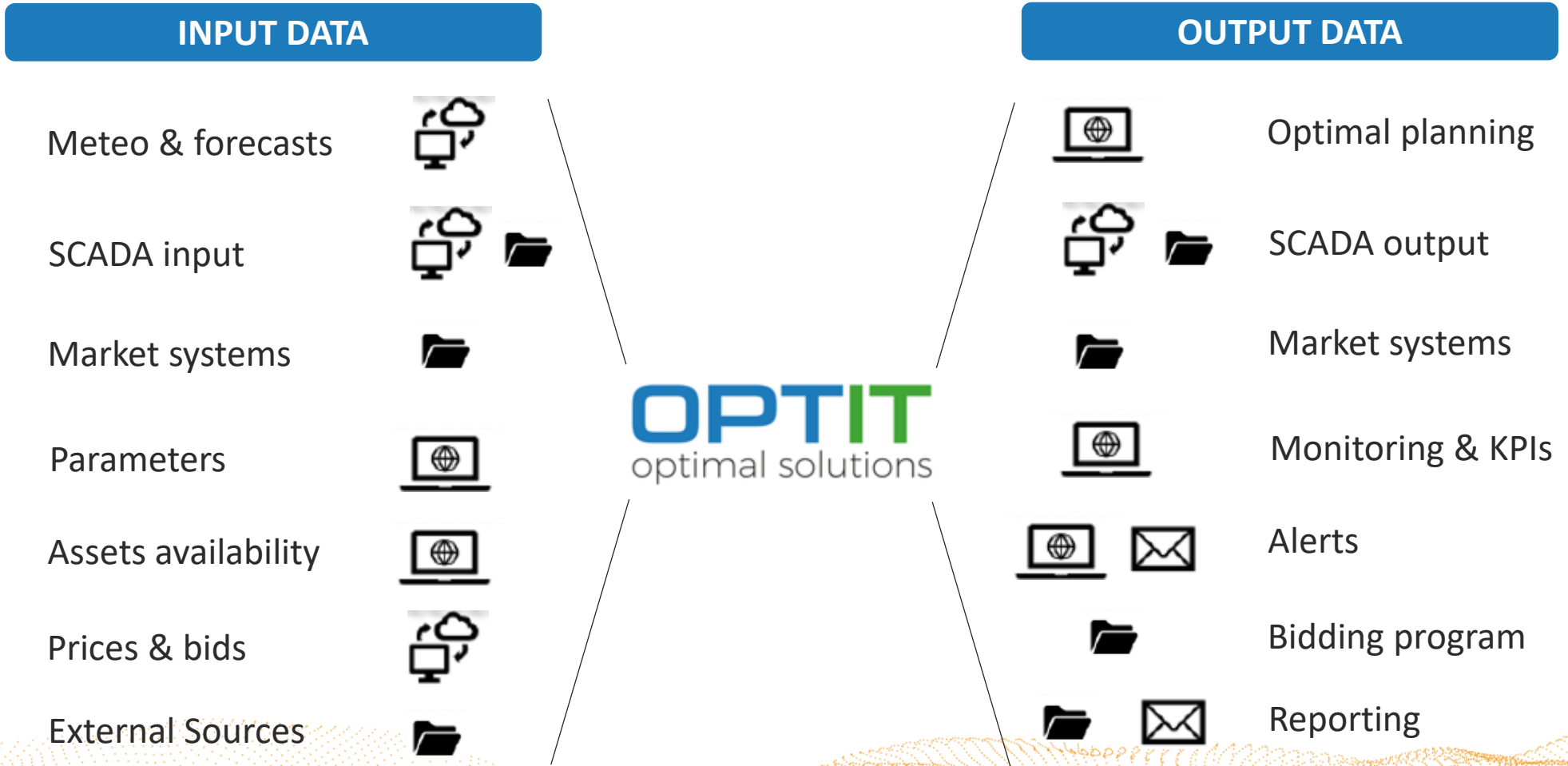
	HEADER 1		HEADER 2	
dateTime	KPI 1	KPI 2	KPI 3	KPI 4
2022/01/01 00:00+01:00	626	204.900	500	0
2022/01/01 01:00+01:00	604	204.899	500	0
2022/01/01 02:00+01:00	571	204.901	500	0
2022/01/01 03:00+01:00	573	204.900	500	0
2022/01/01 04:00+01:00	629	204.900	500	0
2022/01/01 05:00+01:00	704	204.898	500	0

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

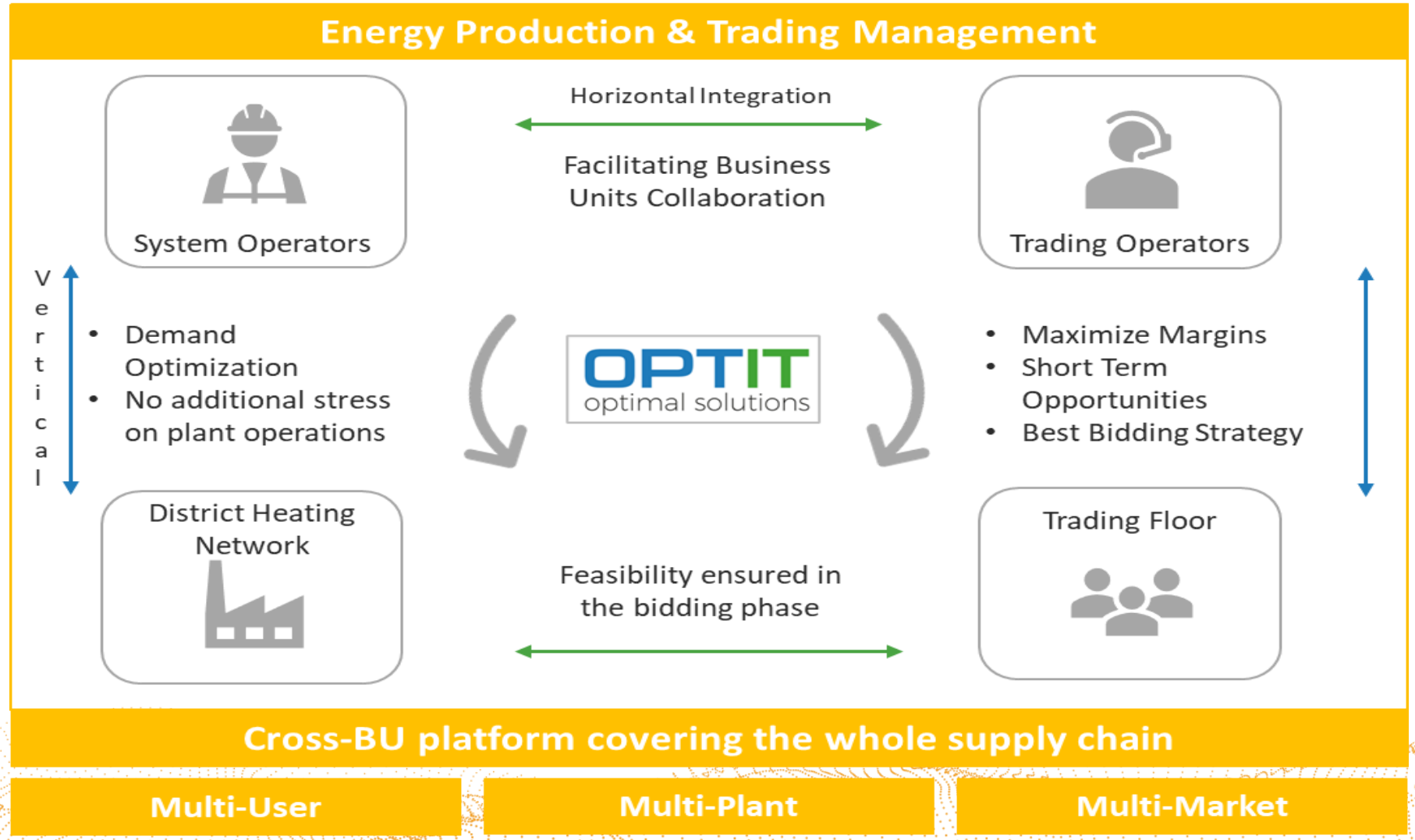
ENERGIA TERMICA IMMESSA [MWh]			ENERGIA TERMICA VENDUTA [MWh]			ENERGIA ELETTRICA IMMESSA [MWh]		
MESE CORRENTE	BUDGET	ANNO PRECEDENTE	MESE CORRENTE	BUDGET	ANNO PRECEDENTE	MESE CORRENTE	BUDGET	ANNO PRECEDENTE
3 694	3 909	3 546	1 145	1 360	1 166	0	0	0
3 713	4 199	4 086	1 880	2 366	2 424	0	0	0
711	800	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



Trading Optimization: Business Integration with conflicting objectives



Our Approach

1. Analysis

- Plant/asset review
- IT Infrastructure
- I/O Data Req's
- Business Goals
- Customization needs

2. Pilot Project

- Off-line Prototype
- Custom Developments
- Calibration & Testing
- Scenario Analysis
- Benefit Analysis

3. Set-Up

- Refine Customization
- System Integration
- Deploy
- System fine tuning
- Start-Up Support

4. Management

- SW and Models Maintenance
- Continuous Updates
- Support on variations

Consulting (una tantum project fee)

Una tantum + Software as a Service fee

SaaS Commercial Agreements

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 standad

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-broser

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

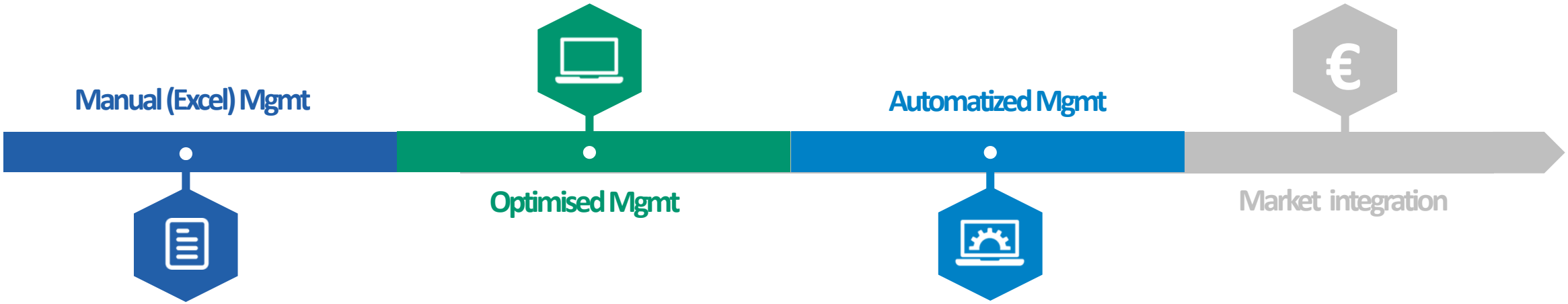
Flexible business process

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

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Our References in the Energy Industry (overview):

MANUAL → OPTIMISATION → AUTOMATISATION → MARKET INTEGRATION

CPL CONCORDIA Group

iren

a2a calore e servizi

LINEA GREEN

GRUPPO HERA

AIMAG

ADR Aeroporti di Roma

Danfoss

ENOVA CONSULTANTS AND ENGINEERS

ЈАВНО КОМУНАЛНО ПРЕДУЗЕЋЕ БЕОГРАДСКЕ ЕЛЕКТРАНЕ

ŠALČININKŲ ŠILUMOS TINKLAI

STADTWERKE MARBURG

xD

DISTRICT ENERGY IN CITIES INITIATIVE

UN environment

upgradeDH

PlaMES

Retrofeed smart retrofitting in process industry

EFFICITY efficient energy systems for smart urban districts

ENERGYNIUS ENERGY Networks Integration for Urban Systems

Our positioning in the District Energy Community

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

EUROHEAT & POWER DHC+ TECHNOLOGY PLATFORM

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

celsius smart cities

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

UN environment — DISTRICT ENERGY IN CITIES INITIATIVE

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

IEA DHC

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

AIRU associazione italiana riscaldamento urbano

IRDEA 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

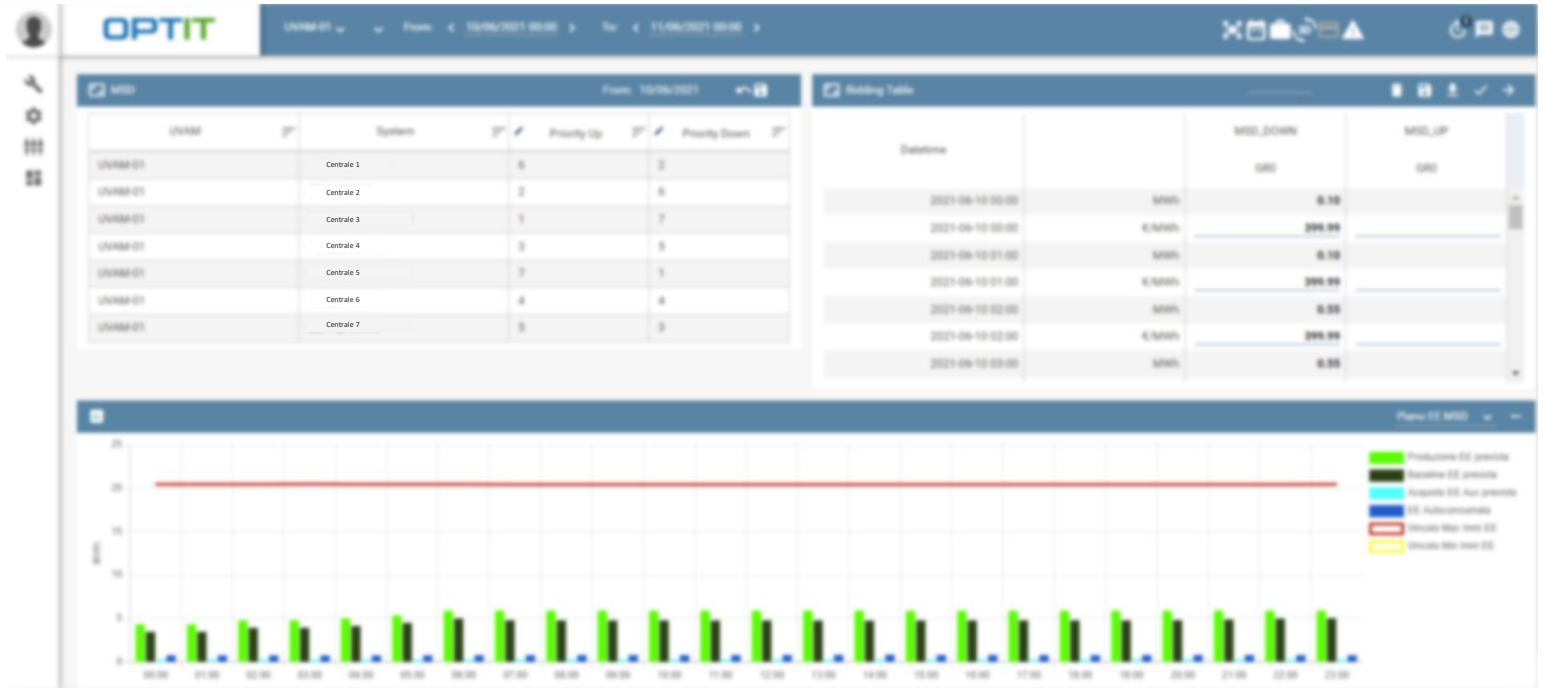
Grouping by partecipation to Balancing Markets

Grouping by partecipation to Infra-day Markets

Characterization of each plant in the portfolio

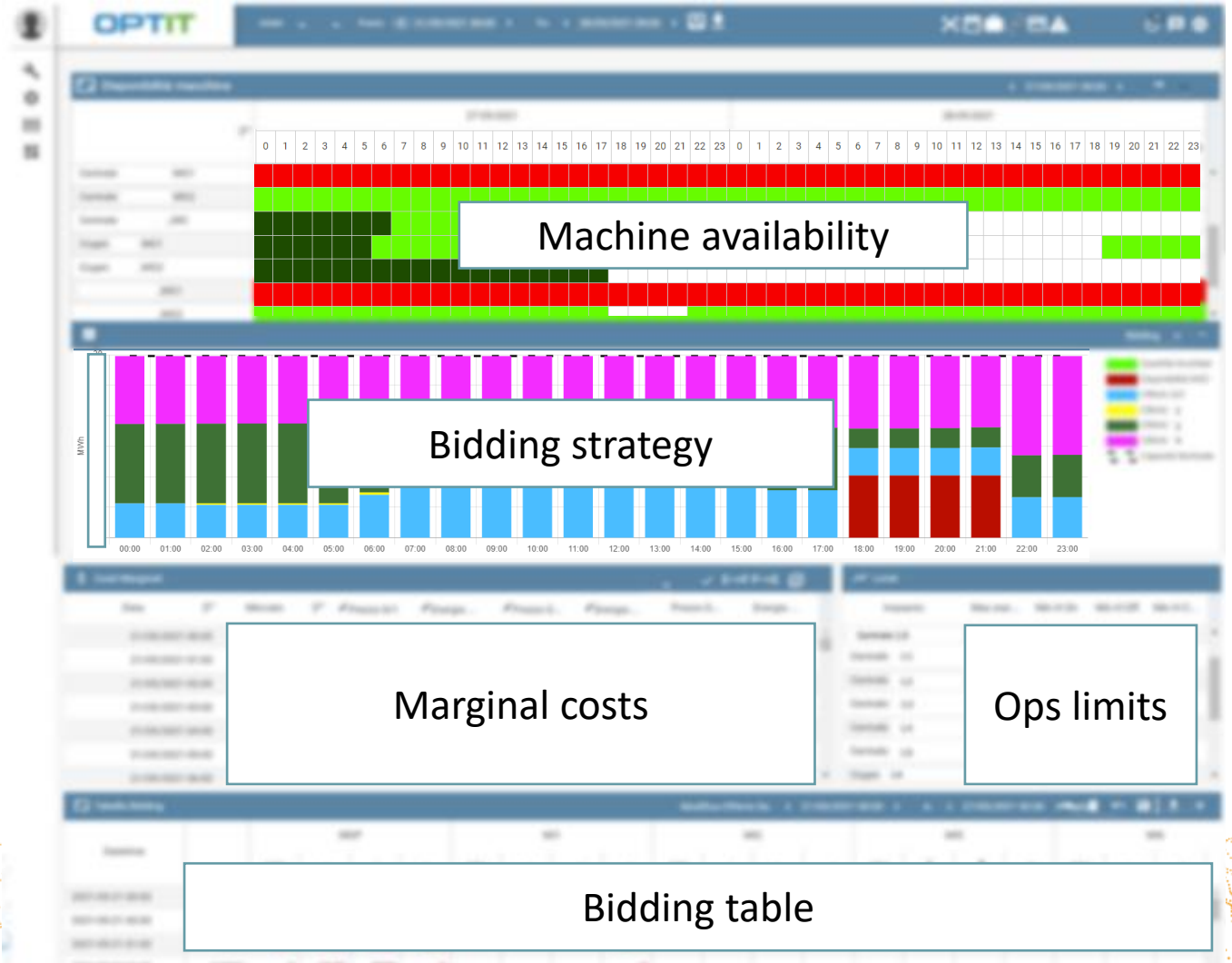
Complex plant portfolios and engagement with different electricity markets (with a view to XBID) must be managed

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