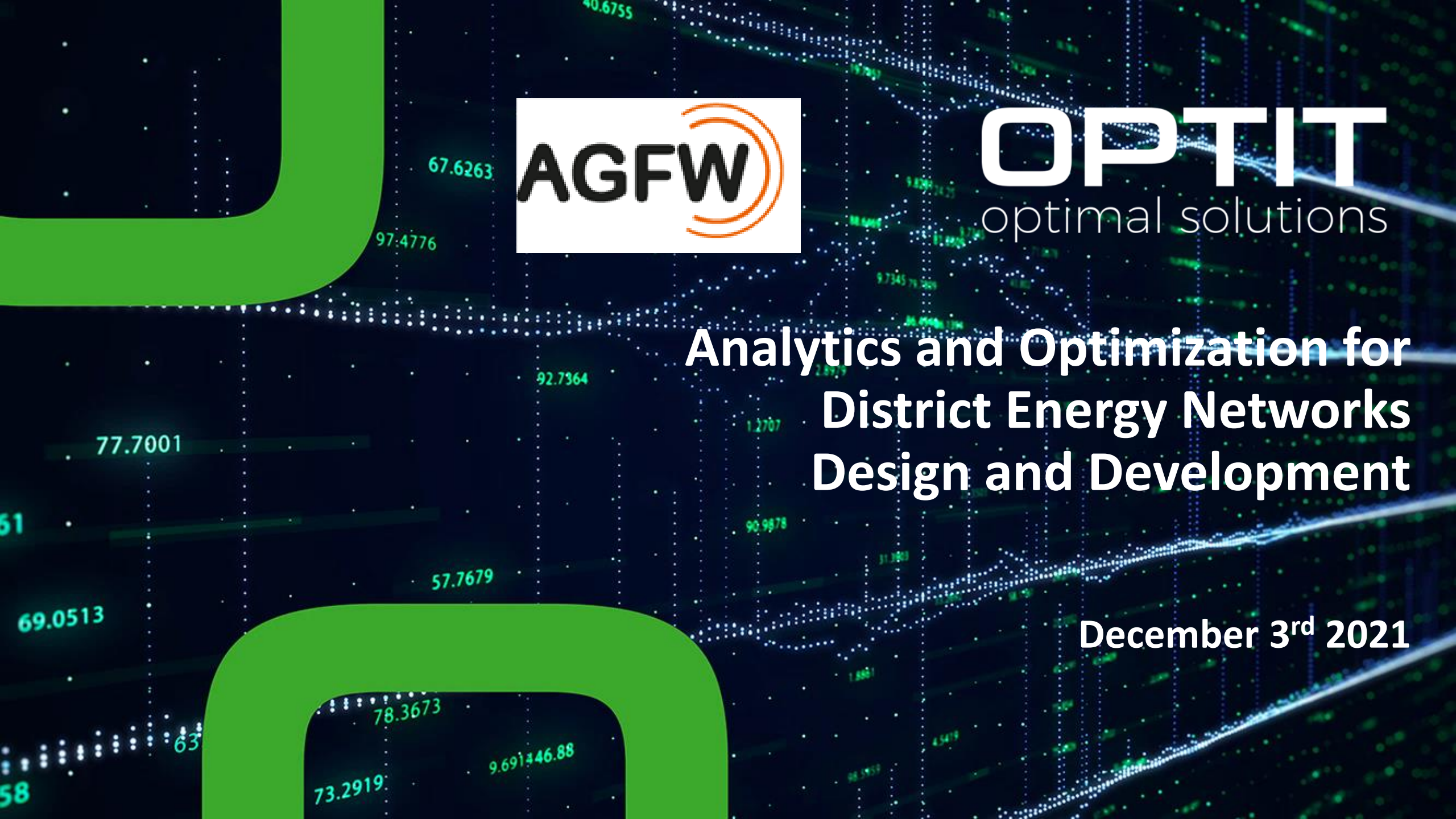


Analytics and Optimization for District Energy Networks Design and Development

December 3rd 2021

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

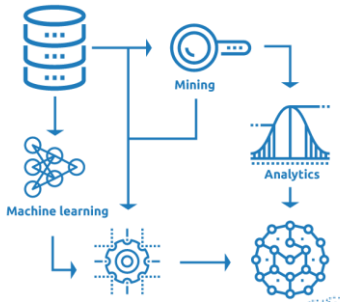
Over 40 talented professional to support Digital Innovation

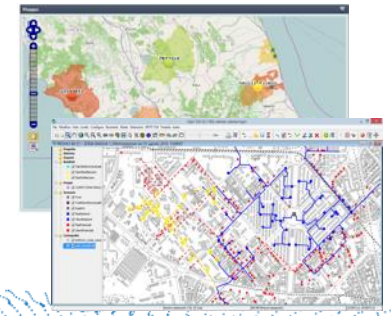
OPTIT optimal solutions

Bologna: HQ & Main Office

Cesena: Software Factory

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



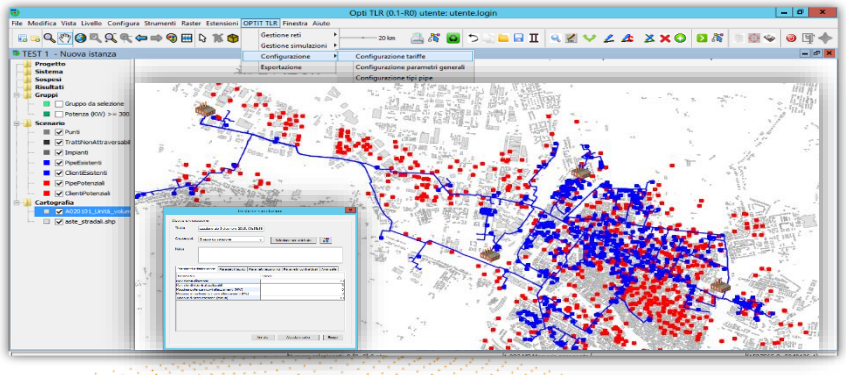


Optit’s solution for DHC network development optimization

Energy Distribution Network Optimisation

Business Objective

- District Heating Planning
- Return on Invested Capital Optimization
- Optimization/improvement of Existing Networks



Challenges for Decision Makers

- Economic Evaluation
- Complex Thermal-Hydraulic configurations
- Network Geographical Extension management
- Multiple Scenarios Evaluation

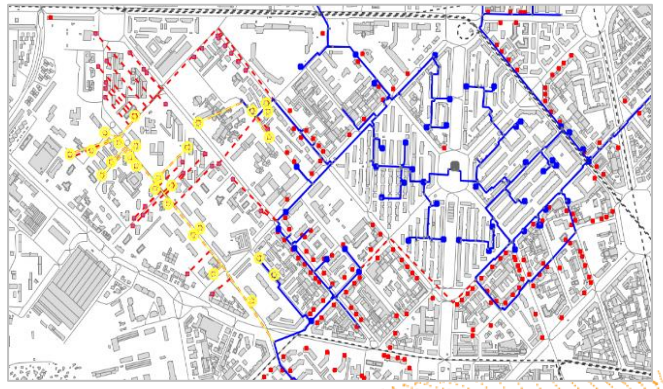
Optimization Management

New Network Development

- **ROIC** Optimization
- **Optimal Network Design** considering thermo-hydraulic constraints
- **KPIs** Analysis for every scenario

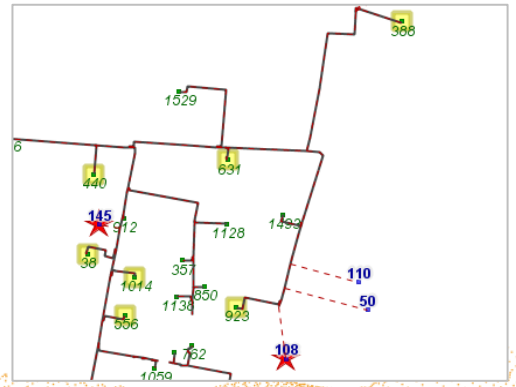
Network Expansion

- Client acquisition Plan
- Design Optimization
- Technical Simulations of future network configurations



Saturated Network

- Contracts Analysis
- Demand Reduction
- Optimization of Energy Generation for future developments



Engineering Economic Analysis

Investment Evaluation

- **Investment Validation** for network expansion
- Evaluation of **new equipment** integration
- Evaluation of Policy Framework **Impact**

Parametri input

Parametro	Valore
GRUPPO DI RIFERIMENTO	Potenza (KW) >= 50.0 Distanza (m) <= ...
Costo fisso contratto nuovo allaccio (€)	0
Costo fisso contratto ricontrattualizzazion...	100
Pressione min cliente (bar)	0,4
Fattore contemporaneità	0,6
Tasso di interesse VAN	0,065
Max clienti allacciabili	50
Max clienti ricontrattualizzabili	100
Profilo min ricontrattualizzabilità (h)	400
Profilo max ricontrattualizzabilità (h)	1.100
Pressione max impianto	
Pressione ritorno cliente	
Orizzonte temporale (an	
Sconto allacciamento (%	
Tariffa assegnata ai clie	
Fattore consumo equiva	
Soglia potenza per prev	
Rapporto minimo ricontr	
Rapporto massimo ricon	

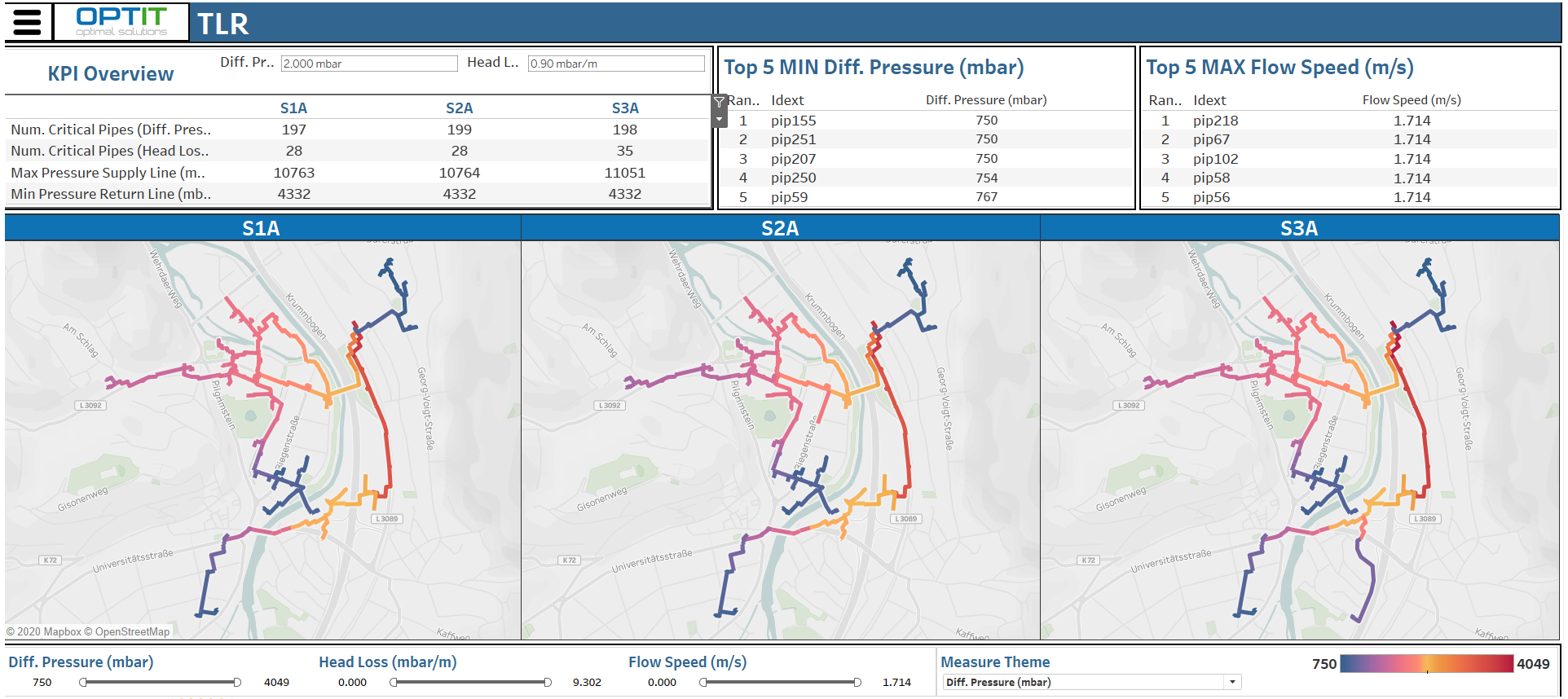
INDICE	VALORE
VAN	€ 399.739
TIR	12,1%
BPT	14

ANNO	RICAVO	COSTO	AMMORTAMENTO	IMPONIBILE	TASSE	FLUSSO_NETTO	COEFF	VALORE ATTUALIZZATO	VALORE_ATT_CUMULATO
0	€ 221.612	€ 1.093.214	€ 23.296	€ 65.348	€ 20.519	-€ 892.122	1,000	-€ 892.122	-€ 892.122
1	€ 354.579	€ 357.999	€ 28.656	€ 113.175	€ 35.537	-€ 38.957	0,926	-€ 36.071	-€ 928.193
2	€ 443.223	€ 362.768	€ 32.229	€ 145.060	€ 45.549	€ 34.906	0,857	€ 29.926	-€ 898.267
3	€ 487.546	€ 340.945	€ 34.016	€ 161.002	€ 50.555	€ 96.046	0,794	€ 76.245	-€ 822.022
4	€ 531.868	€ 367.538	€ 35.802	€ 176.945	€ 55.561	€ 108.769	0,735	€ 79.949	-€ 742.074
5	€ 576.190	€ 394.131	€ 37.589	€ 192.887	€ 60.567	€ 121.492	0,681	€ 82.686	-€ 659.388

Technical Analysis

- Proprietary Hydraulic Model (flow and pressure profiles)
- Existing Network Design Analysis and Optimization
- Risk and Maintenance Assessment

Advanced scenario analysis functionalities



The implementation 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

Based on specific needs and project scope, more agile one-off consulting activities may be leveraged upon instead of a more structured and integrated SW service

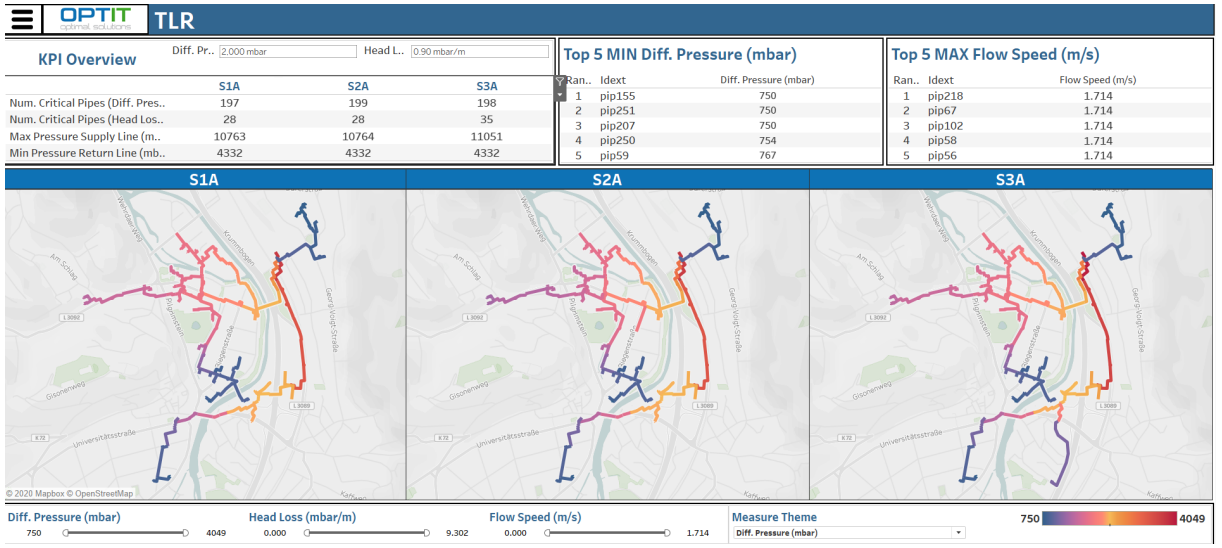
Highlights & Success Stories

Hydraulic Analyses and Expansion strategies in Marburg (Germany)

A modelling-based approach validated previous “on-paper designed” and novel strategies for future network development

A TECHNICAL ANALYSIS OF THE NETWORK

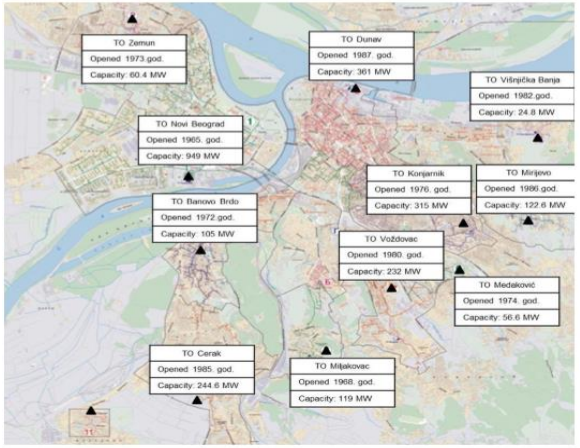
- **Hydraulic balance** of the network in the current operational status at different load levels, identifying **potential bottlenecks** and **critical areas**
- Impacts on the network with respect to **perspective expansion scenarios**, where new customers are connected to the system
- Impacts of **potential changes in the technical configuration** of the heat supply in the various branches, e.g. loops, booster pumps, branch separation, etc.



Analysis of interconnection opportunities in Belgrade (Serbia)

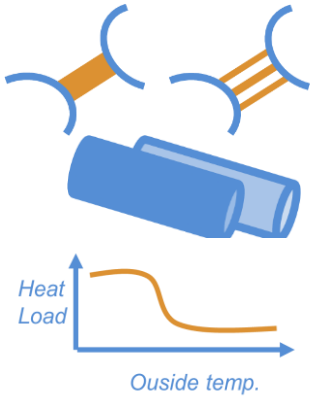
Scope of the Study

- The key challenge: identify the optimal new network configuration
- Technical and economic impacts of different interconnection scenarios and refurbishment strategies



Goal: striking a balance

Technical and operational drivers	One vs multi-connections
Resource allocation	Renovation vs New Piping
Reference load to dimension	Peak vs Low Load



Preliminary Activities → **Calibration** → **Scenarios Analyses** → **Delivery**

Reliable characterization of the current system

Benchmark 3 major sub-grids:
Optit's model vs **SCADA data** vs **TERMIS**

Pre-feasibility studies of investment scenarios

Produced, analyzed and discussed several (50+)
potential new network configurations

From Analysis to Construction works in Milan (Italy)

The issue:

A2A, one of the biggest Italian utilities, was looking for solutions that could help in the expansion of its district heating networks maximizing the return on invested capital.

The solution:

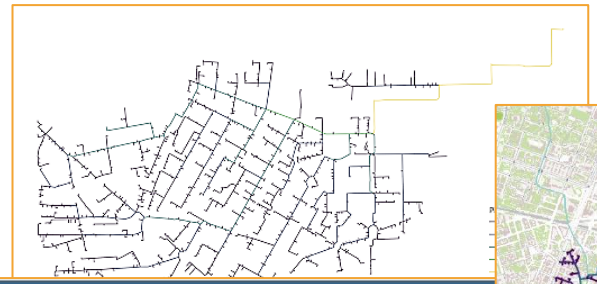
Optit with its dedicated tool for district heating network was able to help A2A in the development of a 6km new expansion in the city of Milan, optimizing the net present value of different possible expansion scenarios

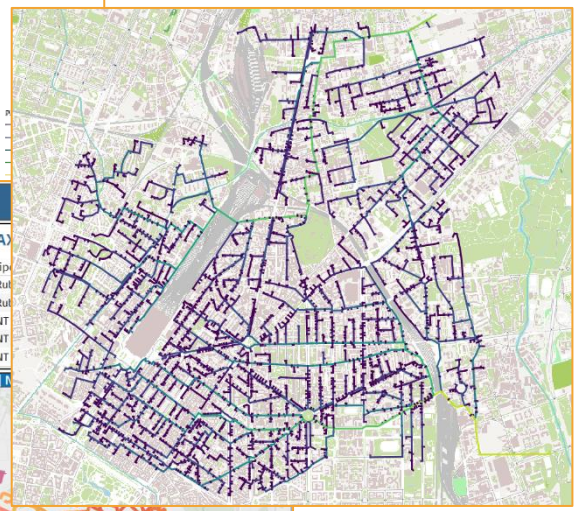
Project Key information:

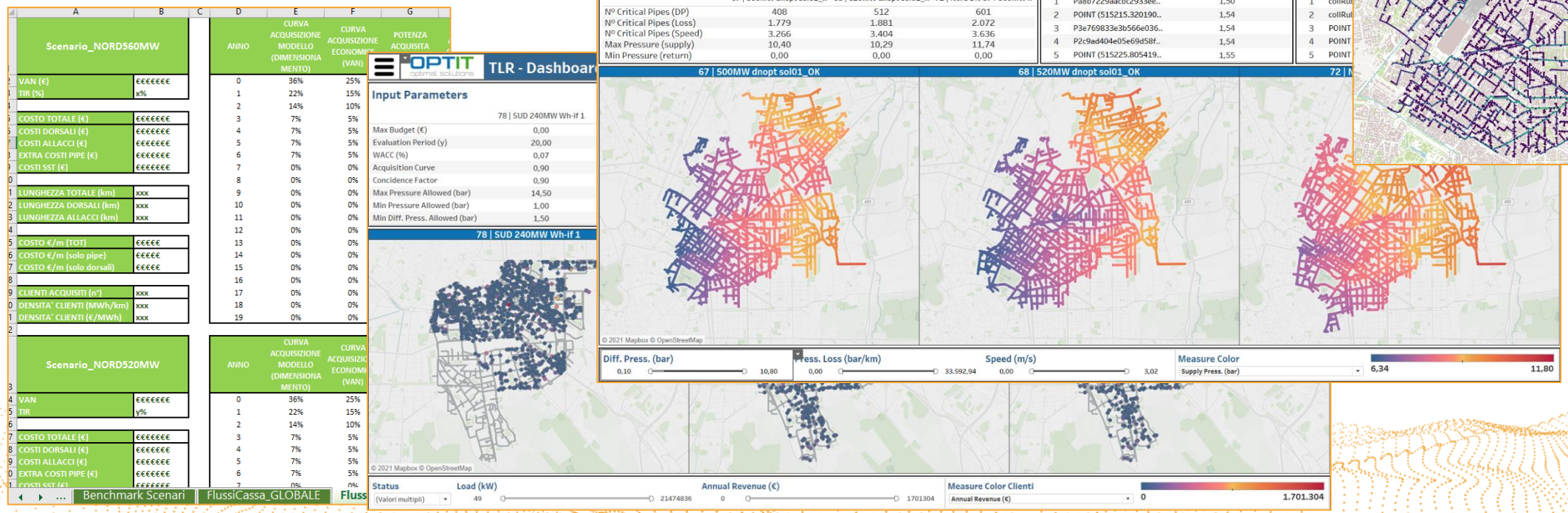
- Over 100MW power allocated to optimal customer portfolio along a 6 km backbone through a densely populated area
- Investment Payback **< 3 months**
- Integration of technical and economic decision drivers
- Vast scenario and what-if analysis capability

Blank Canvas expansion opportunities in Milan (Italy)

- Opportunity to exploit 1TWh waste heat
- Analysis over 34 km^2 of urban area
- Full pre-feasibility and what-if analysis







Future Refurbishment and Expansion Roadmap in Salcininkai (Lithuania)

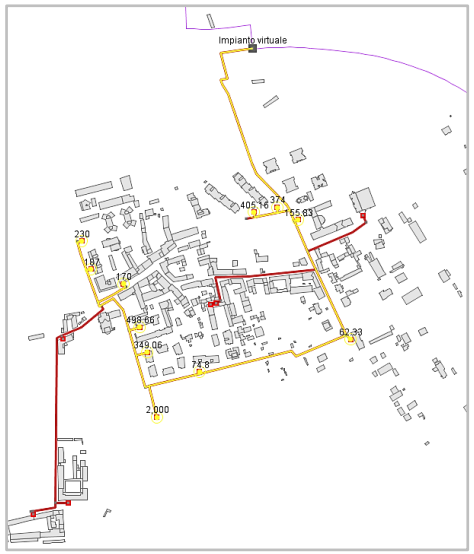
Poor state of the pipeline, leading to issues with quality of service.
How to revamp the asset?

Integrate innovative technological approaches in Mgmt & Ops:
Network modeling, optimal key refurbishing opportunities & investment analyses

NETWORK EXPANSION

Targeted analysis on a new expansion area:

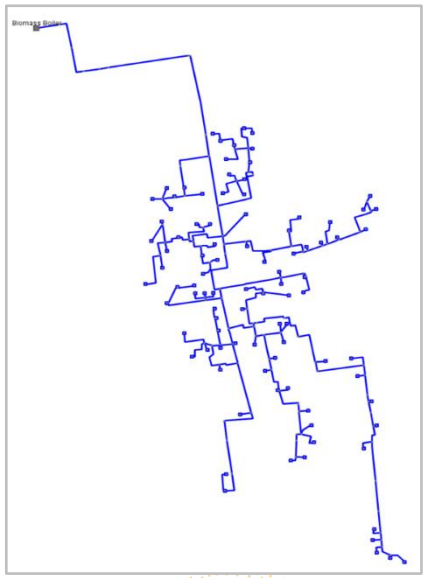
- Which potential customer to connect?
- How to size the new piping?
- Sensitivity on heat production cost?



NETWORK DESIGN

Targeted analysis on an existing network:

- Validation of the hydraulic model?
- Optimal dimensioning of refurbished pipes?
- Sensitivity on heat demand variation?



OPTIT

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