Analytics and Optimization for District Energy Networks Design and Development

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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 professionals to support Digital Innovation.

Bologna: HQ & Main Office
Cesena: Software Factory
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**

**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

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**
- Reliable characterization of the current system
  - Benchmark 3 major sub-grids: Optit’s model vs SCADA data vs TERMIS

**Scenarios Analyses**
- Pre-feasibility studies of investment scenarios
  - Produced, analyzed and discussed several (50+) potential new network configurations

**Delivery**
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 km² of urban area
- Full pre-feasibility and what-if analysis
Future Refurbishment and Expansion Roadmap in Salcininkai (Lithuania)

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?

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