District Heating Network
Best Practices

International District Cooling & Heating Conference
Introduction
Best Practices
1. Energy sales management
2. Energy sources management
3. Energy efficiency
4. Continuity of supply
Torrelago District Heating
Introduction: Veolia Global Figures 2016

24,390 M€ turnover

163,226 employees

WATER

100 million people supplied with drinking water
61 million people connected to wastewater systems
4,052 water production plants managed
2,928 wastewater treatment plants operated

WASTE

40 million people provided with collection services on behalf of municipalities
45 million metric tons of treated waste recovered into energy
764,477 business customers
591 waste treatment facilities operated

ENERGY

44 million MWh produced
37,339 thermal installations managed
2,086 industrial sites managed
551 heating and cooling networks operated
Introduction: Best Practices

*Best Practices:* all replicable operational practices which can improve performance. It can include methods, tools, equipment, organization...

- Energy Sales Management
- Energy Sources Management
- Energy Efficiency
- Continuity of Supply
Best Practices

District Heating Networks
Energy Sales Management

- Energy meter verification
- Energy sales follow up
- Supply parameters monitoring
**ESaM: Energy meter verification**

<table>
<thead>
<tr>
<th><strong>ISSUE</strong></th>
<th>Improvement of the operating performance of meters.</th>
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</table>
| **SOLUTION** | 1) To ensure the compliance of heat meters with technical references, in terms of installation and inspection.  
2) To do an appropriate choice when a new heat meter shall be ordered.  
3) To perform suitable maintenance inspection. |
| **SCOPE AND SUCCESS CRITERIA** | 1) Compliance with site conditions (design and operation requirements/Real):  
Flowmeter : Flow (min/max), Pressure and Temperature.  
Calculator : Electrical power.  
Temperature : Range and Delta T.  
2) Other: Straight length upstream/downstream, Meters sealing, Supply cables and connections, Electromagnetic compatibility, Protection filter, Temperature sensors installation, Sensors data, Sensors installation and Security and maintenance |
| **BENEFITS** | To avoid counting problems / uncertainties.  
To control the process.  
To improve client relationship / satisfaction. |
## ESaM: Energy sales follow up

| ISSUE | Allows knowing the system load and the consumption profile for each energy meters. An investigation is necessary for identify sales signature in order to:
- Create budget close to reality and explain each gap between real and Budget.
- Compare current sales with a theoretical approach |
| SOLUCTION | The purpose of technical management is to control forecast budget closing, comparing real consumption and the budget in different steps: **Analyzing** consumption and the methods of energy production and distribution, **Modeling** the process, **Quantifying** effects, **Measuring** gaps and **Following** investment impact. |
| SCOPE AND SUCCESS CRITERIA | Take into account “Energy meters verification” and to apply for each energy meter. Quantify for each billing energy meters the consumption rules with the methods described. Propose a process in order to define the steps for validation of heat meters values. |
| BENEFITS | Identify effects (climate, commercial, counters...). Follow up the budget. Detect a drift. Improve customer relationship / satisfaction. |
### ISSUE
Before the introduction of the monitoring system, the analyses relied on data from monthly/bimonthly manual readings of the billing systems. The analyses were averaged, hence were burdened with error – allowed for detection of exclusively major deviations of long-term nature.

### SOLUTION
Telemetry system was built, and a database repertory for all facilities. The system allows for collection of data from energy meters and basic parameters made available by external conditions regulators. The data are collected by standard every hour, which is a value sufficient for rather slowly changing processes occurring in the heating system. The set of the aforementioned parameters allows for performing analyses and choosing technical facilities for verification.

### SCOPE AND SUCCESS CRITERIA
Reports, anomaly searching and repair procedure implementation in DHN system.

### BENEFITS
Adjustment of return temperature and better sale efficiency. In addition, the maintenance of substation is mainly based on anomalies detection instead of planned intervention.
Energy Sources Management

- Smart Thermal Grid
- Load forecast
**ESoM: Smart Thermal Grid**

**ISSUE**
For the better network operating and with the goal of transformation to the 4G district heating and systems and with that related challengers like variable temperature in the network, prosumers, flexible network for decentralized production, energy accumulation and other it is necessary to implement smart energy management system and smart thermal grid.

**SOLUTION**
1) Smart Energy Management: modelling, forecasting, monitoring, control and communication.
2) Customer interaction.
3) Cascade usage of resources
4) Balancing smart grids: integration into the urban energy system.

**SCOPE AND SUCCESS CRITERIA**
Integrity, completeness and flexibility of the network operating.

**BENEFITS**
Flexible network that is reached by use of serval smart thermal grid tools; Prompt actions during failures liquidation; Accurate maintenance according network criticality; Accurate investment planning according network criticality; Accurate dispatching and online control of processes; Risk control; Decision making time;
ESoM: Load Forecast

**ISSUE**
Load Forecast Tool is an application that receives required information regarding meteorological forecasts, historical, and actual zone data. The Load Forecast generates a short term load forecast on an hourly basis typically for the next 24 to 72 hours.

**SOLUTION**
Forecast a system heat load to come means to forecast the average hourly power demand on a period ranging between 24 and 72 hours. The purpose is to calculate the optimal set points for: Energy Production (choice of best unit and load) and Energy Distribution (pressure and temperature from plants).

**SCOPE AND SUCCESS CRITERIA**
Load forecast is necessary when the network operation requires anticipation. Load forecast allows better managing the constraints:
1) Commitment of the energy producers depending on: Energy purchase constraint, Production constraints, Electric power sales forecast, Valuation of the heat storage, Maintenance operations and Management of the energy mix.
2) Distribution management: Feeding temperature optimisation, Commitment of the different plants and Maintenance operations.

**BENEFITS**
Reduction of the on-call service requests during the night and weekends to start additional boilers. Allows operator to improve the energy mix and to decrease thermal losses and electricity consumption due to more accurate setting parameters.
Energy Efficiency

- Temperature Optimization
- Pumping Optimization
- TERMIS Software
**ISSUE**  
Heat losses in heating network depend on many factors: Length of pipes, Pipe insulation, Outside temperature, ... Reducing the distribution temperature at the minimum required level for customer satisfaction allows reducing thermal losses.

**SOLUTION**  
Implementation of the weather dependent set point according to the expected loads and of the forecast outside temperature. Three solution are proposed:  
1) Basic: Implementation of a weather setpoint according to an external temperature sensor.  
2) Optimum: Supply temperature setpoint is given via a matrix dependent of the outside temperature and hours of the days in order to respect the system load  
3) Optimum+: Optimization program.

**SCOPE AND SUCCESS CRITERIA**  
Installing standards substation in order to control and maximize ΔT to terminals of substations.  
Communication with Substations/Network/Plant  
Identifying the worst substation.  
Finding the optimum between electrical vs heat losses costs

**BENEFITS**  
To maximize ΔT on the district heating network in order to minimize pumping cost.  
To reduce heat losses (Reducing supply temperature by 1°C, heat losses can be reduce by 2%)
### ISSUE
Pumping in heating and cooling networks represents a sensitive portion of networks electrical consumption. The objective is to reach the optimum level of the pump operation. Improving the control of these pumps, allow to reduce pumping costs, while the heating supply required by clients is still fulfilled and optimized.

### SOLUTION
1) Analysis the initial situation and optimization principle
2) Basic solution: implementation of differential pressure set points according to the outdoor temperature with a network or plant differential pressure sensor.
3) Optimum solution: the pumps are controlled via the position of the valves, or differential pressure in several substations.

### SCOPE AND SUCCESS CRITERIA
To install standards substation in order to control and maximize ΔT.
Communication with Substations /Network /Plant.
To choose the best strategy: Basic / Optimum mode.
To Identify the worst substation.

### BENEFITS
These strategies must be combined with the reduction of the supply temperature of the networks. The prioritization of the reduction of temperatures along with the optimization of pump speed on the networks highly improves the network efficiency, reduces the pumping effects in the substations, etc.
# EE: TERMIS Software

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<th>ISSUE</th>
<th>TREMIS is a thermo-hydraulic tool for simulation and optimization of district heating and cooling networks</th>
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<tbody>
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<td>SOLUTION</td>
<td>TERMIS is a suite of tool for thermo-hydraulic simulation and district heating network optimisation. The are different modules: Model creator (studies), Steam, TERMIS operation, TERMIS online, Optimizer units, Production scheduler, ...</td>
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<td>SCOPE AND SUCCESS CRITERIA</td>
<td>Know the system load for each substation. Have a GIS in order to import localization data for each element (Plant, pipe, substation...) Network monitoring (Temperature, pressure, flow), for calibration.</td>
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<td>BENEFITS</td>
<td>Studies and planning : Design heating and cooling networks (from scratch or from an existing network), Sizing the power plants supplying the networks (Integrate new production units) and Developing Business Model with accurate figures of the operation of the whole system Operation: Optimizing operation (managing heat losses cost and pumping costs), Managing energy mix and Improving the service to the clients.</td>
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Continuity of Supply

Temperature Optimization

Pumping Optimization
### ISSUE
The DHN significant source of network water losses are micro-damages into the heating pipelines. In the context of heating network, the best way to determine the degree of network seal is to carry out pressure tests. Based on data from pressure tests and technical data of networks, a theoretical method for determining the size of the leak has been implemented to assess economical losses in order to decide the opportunity to repair the leak.

### SOLUTION
The analysis is based on the theory of flow from the holes of the small diameter. The basis for determining the size of the leak was the assumption that the pressure in the pipelines district heating network at runtime trial is only a phenomenon caused by the compressibility of water.

### SCOPE AND SUCCESS CRITERIA
Decision making method

### BENEFITS
- Possibility to assess the cost of losses for small leaks.
- Compare the repair costs with the costs of losses.
- Arguments to decide whether to fix the leak.
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<tr>
<th>ISSUE</th>
<th>Buried district heating piping systems are very difficult to inspect and are key elements to maintain reliability of DH and its level of services for municipalities. Having the capacity to inspect part of the piping system is key to reduce risk to exposure.</th>
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<td>SOLUTION</td>
<td>A robot equipped with a high-definition omnidirectional camera is operated by a technician seated in a specially designed inspection vehicle. As the robot crawler moves around valve chambers, it sends back images to allow operators to view equipment and identify appropriate repairs (collapsed upper slabs, faulty lagging, etc.). The aim is to inspect sensitive areas, such as junctions with sewer systems, areas near fire hydrants, main feeders or non-backed-up branch lines.</td>
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<td>SCOPE AND SUCCESS CRITERIA</td>
<td>Robot inspection is for pipes in channel and excludes pre-insulated pipes. The clearance between the pipes should be wide enough to robot can move freely (diameter pipelines DN≥ 350). Daily inspectable length (taking into logistical constraints) : 150 m per day</td>
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<td>BENEFITS</td>
<td>Scheduling preventive maintenance and prioritizing renovations. Performing internal damage surveys. Supplementing and refining aerial infrared thermal surveys or suspicious water leakage without excavation. Assessing the overall condition of systems.</td>
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