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AALBORG UNIVERSITY DENMARK

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY TOMORROW TODAY

THE TEMPO PROJECT: CHALLENGES AND OPPORTUNITIES FOR IMPLEMENTING INNOVATIVE SOLUTIONS FOR LOWERING THE TEMPERATURES IN THE DISTRICT HEATING NETWORK OF BRESCIA (ITALY).

4th International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 13-14 November 2018

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4DH
4th Generation District Heating Technologies and Systems

OUTLINE

- Overview on TEMPO project
- Details on the demonstrator in Brescia (Italy)
  - Status-quo and project goal
  - Innovation actions
  - Smart solutions for secondary-side optimization
  - Expected results

TEMPO - TEMPERATURE OPTIMISATION FOR LOW TEMPERATURE DISTRICT HEATING ACROSS EUROPE

- **Objectives:** demonstrate the applicability of low temperature district heating through different solution packages including:
  - technological innovations on the network and building side,
  - consumers’ empowerment enabled by digital solutions,
  - and innovative business models for EU replication.

- **Duration:** October 2017 – September 2021

- **Funding frame:** EU H2020 EE-04-2016-2017: New heating and cooling solutions using low grade sources of thermal energy, GA 768936

- **Web-site:** www.tempo-dhc.eu

TEMPO - TEMPERATURE OPTIMISATION FOR LOW TEMPERATURE DISTRICT HEATING ACROSS EUROPE

TEMPO
USE CASES

LÜBECK
VATTENFALL
NEW LT NETWORKS
IN URBAN AREAS

WINDSBACH REGION
ENERPIPE
NEW LT NETWORKS
IN RURAL AREAS

BRESCIA
A2A
EXISTING HT
NETWORKS

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It’s *tempo** for TEMPO

in Brescia

www.tempo-dhc.eu

* in Italian = time

USE CASE BRESCIA
PERSPECTIVES

- **DH operational temperatures reduction is a key target:**
  - RES integration, EU 2020 goals
  - Local primary energy supply (e.g. heat recovery from industrial processes, etc.) integration
  - Smart grids integration and sustainability
  - Legislation evolution in the building sector

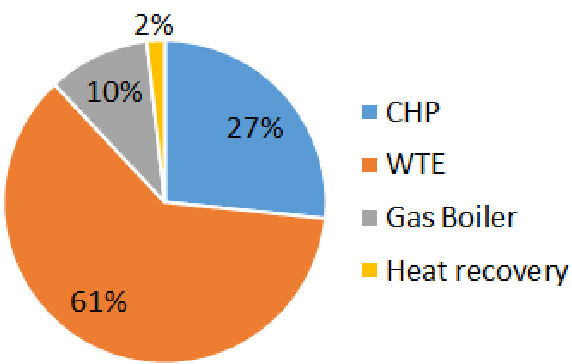
- **Goal of TEMPO project:**
  - Demonstrate a lower supply temperature in one network branch

→ Easily replicable solution
Customers’ engagement

USE CASE BRESCIA OVERVIEW

- DH in Brescia covers around 70% of the heat demand; the first part of the system has been in operation since 1972.
- Today this is **the largest system in Italy**; it is a mix of 2nd and 3rd generation distribution technologies.

Energy by source (2017)



	Heat volumes sales	Heat losses
OPERATING DATA	***GWht/y***	***%***
Mean over the period 2008-2017	**1.085**	**17,5**

Total pipeline extension (pair of pipes)	Single family houses	Others	**Total Customers**	**Heated volumes**	**Peak load (maximum)**
(km)	*(n.)*	*(n.)*	***(n.)***	***(Mm^3)***	***(MW)***
670	13.894	7.215	**21.109**	**42,2**	**636**

last update 31/12/2017

Operating temperature

- winter: 120˚C supply, 60˚C return
- summer: 80˚C÷90˚C supply, 60˚C return

Operating pressure

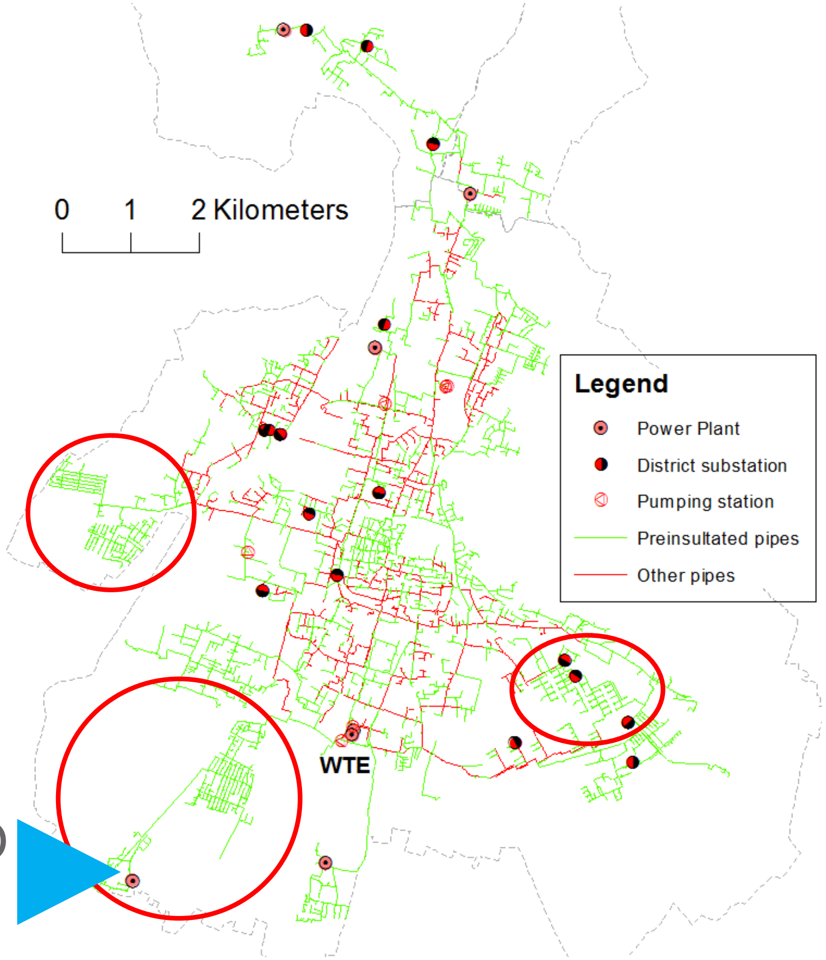
- up to 14 bar

USE CASE BRESCIA (1)

Is it possible to decrease the network temperatures in low heat-density areas?

- Main constraints:
  - existing buildings
  - existing radiator and exchanger (to be adapted?)
  - small diameter for house connections

TEMPO Project



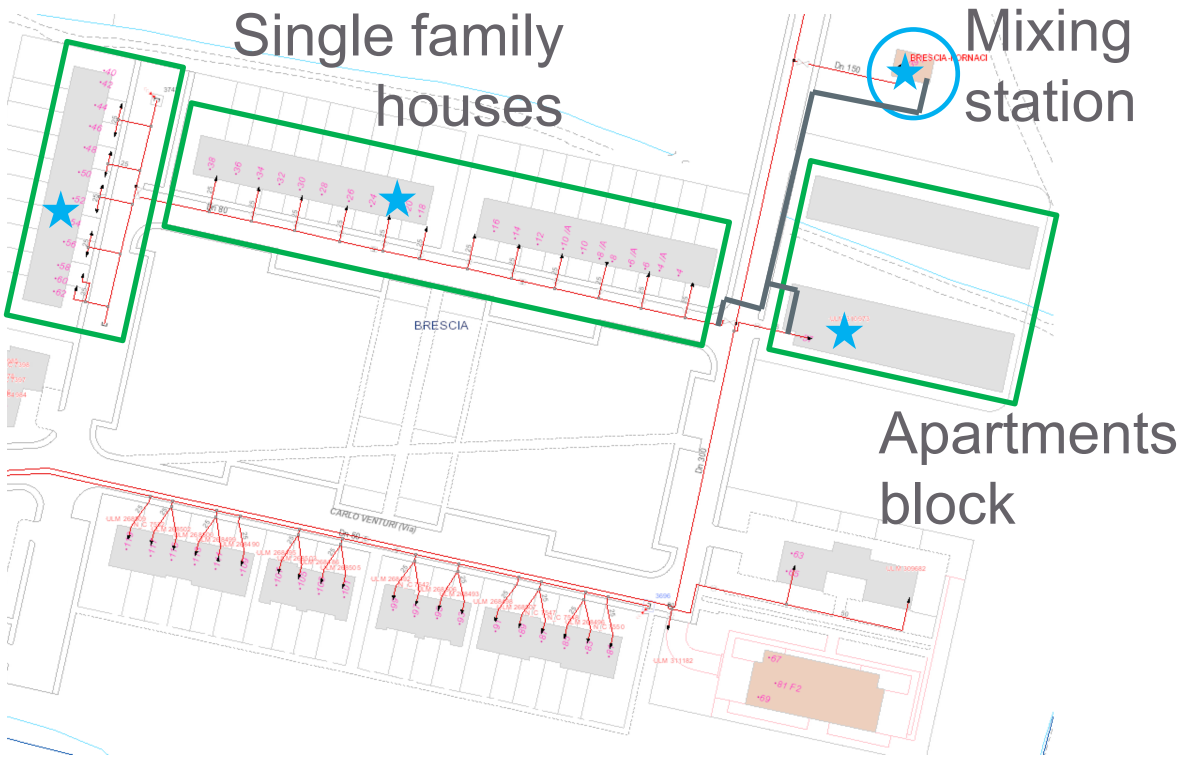
USE CASE BRESCIA (2)

planned

existing

buildings to connect

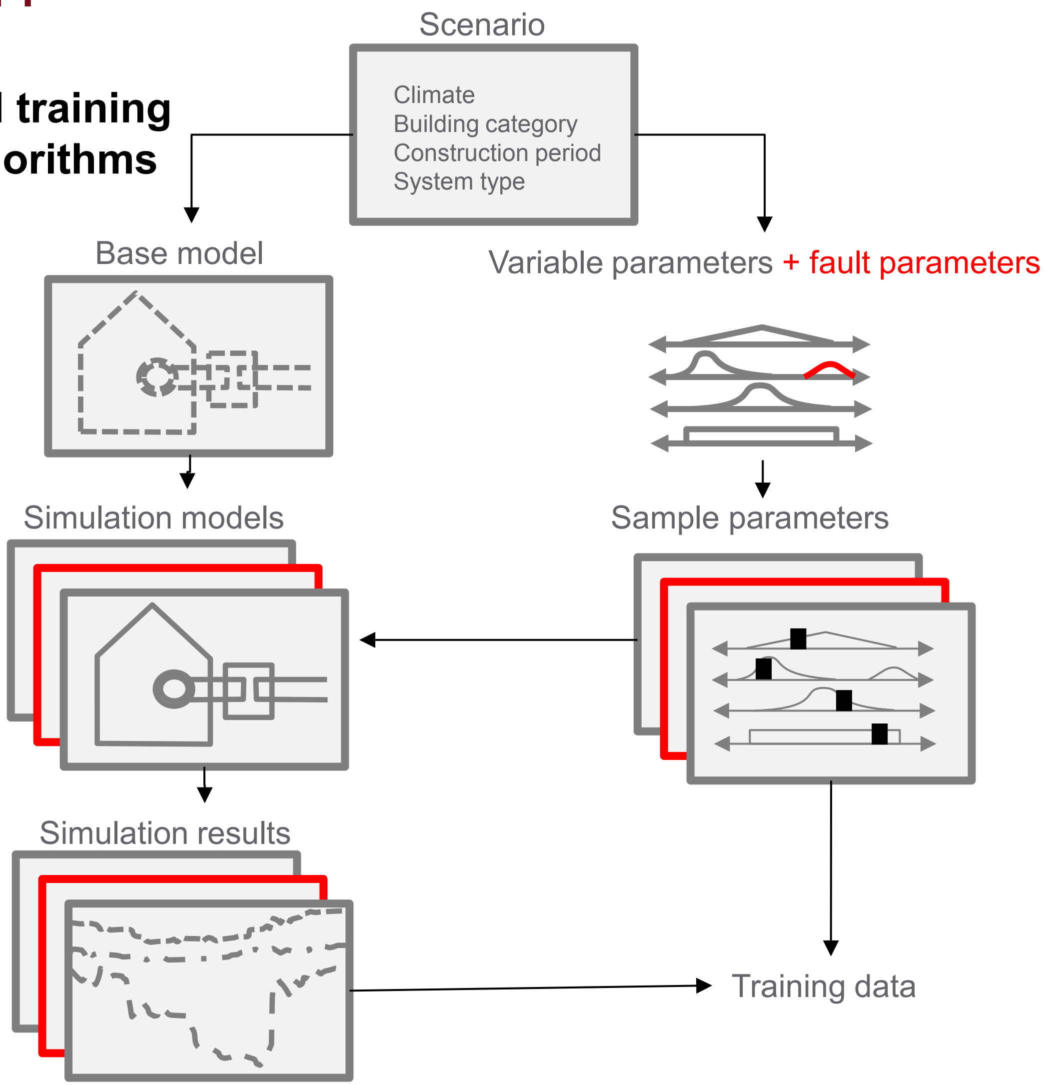
TEMPO ICT innovations



SECONDARY-SIDE OPTIMIZATION SIMULATION APPROACH

Simulation-based development and training of fault detection and diagnosis algorithms

- Several scenarios:
  - Building and system type
  - Climate
- Several hundreds simulations for each scenario:
  - Cover parameter variability
  - With and without faults
- FMI-based co-simulation:
  - EnergyPlus (building model)
  - TRNSYS (technical systems)



USE CASE BRESCIA
RECAP ON SOLUTION PACKAGE

Improving building behaviour to allow lower supply temperatures

- **Optimisation through digitalisation:**
  - Supervision ICT platform for fault detection in substations
  - Visualisation tools for expert and non-expert users
  - Smart DHC controller: balance demand and supply and minimize return T

- **Optimisation of the building installations:**
  - Diagnosis of secondary-side situations leading to high return T (simulation-based + self-learning)

Leaking substation valve
Radiators hidden behind furniture
Suboptimal heat transfer (air, scaling)
Undersized heat exchanger
Constant set-point of secondary T

USE CASE BRESCIA
EXPECTED RESULTS

Innovation action	Efficiency in peak time	Efficiency off peak time
ICT Platform	+4%	+4%
Visualisation tool	+3%	+3%
Smart DH controller	+7%	+15%
Building-side smart optimisation	+10÷17%	+10÷17%
Total	**about +25%**	**about +30%**

Customers' engagement

DSM and T minimization

Fault detection

(Self-learning) diagnostics tool of building-side faults

THANK YOU!

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