HEAT UP THE DATA

A Data Science Use Case for Thermotechnology Data

DS PORTUGAL BOSCH

Agenda

1. Presentation
2. Bosch Thermotechnology
3. Motivation
4. Use case

PRESENTATION

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Event and company

BOSCH

BOSCH
THERMOTECHNOLOGY

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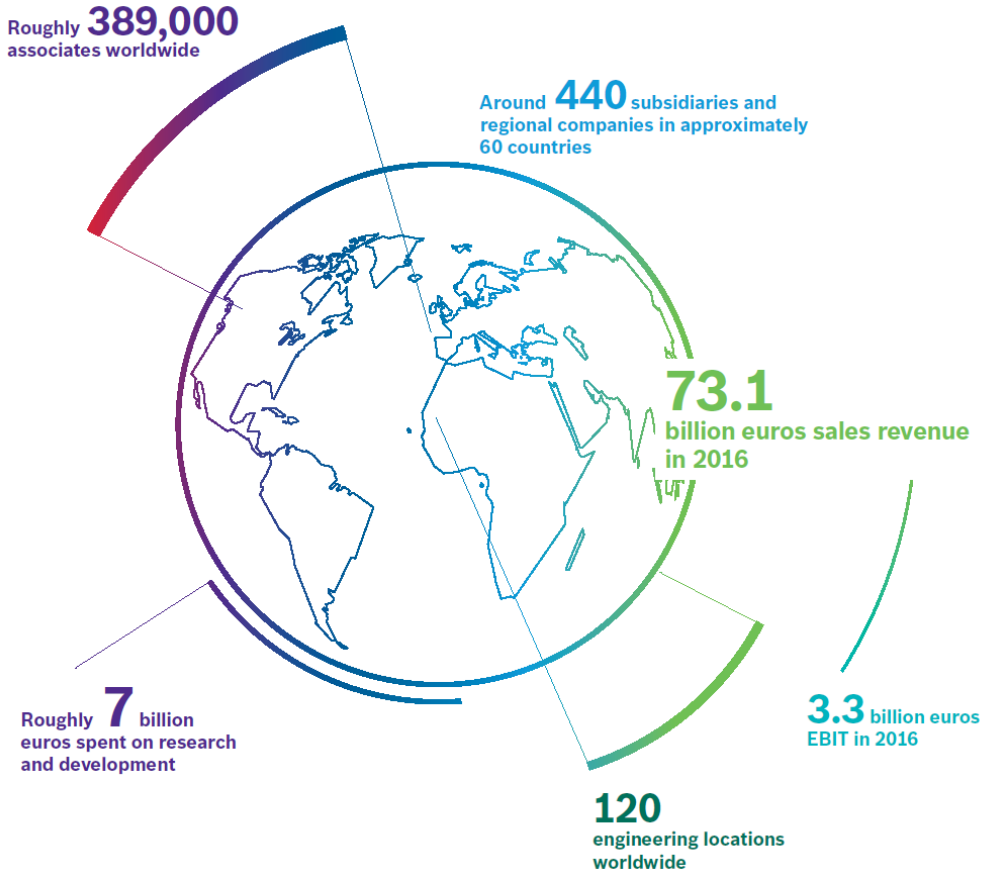
Bosch Group in numbers from 2016



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Bosch Thermotechnology at a glance

13,400
associates

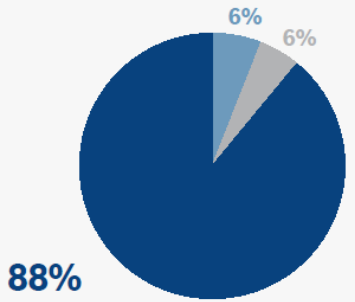
2% Asia

4% America

94% Europe

144m
euros invested in R&D

3.3bn
euros sales revenues



88 Europe
6 Asia / Pacific / Africa
6 America

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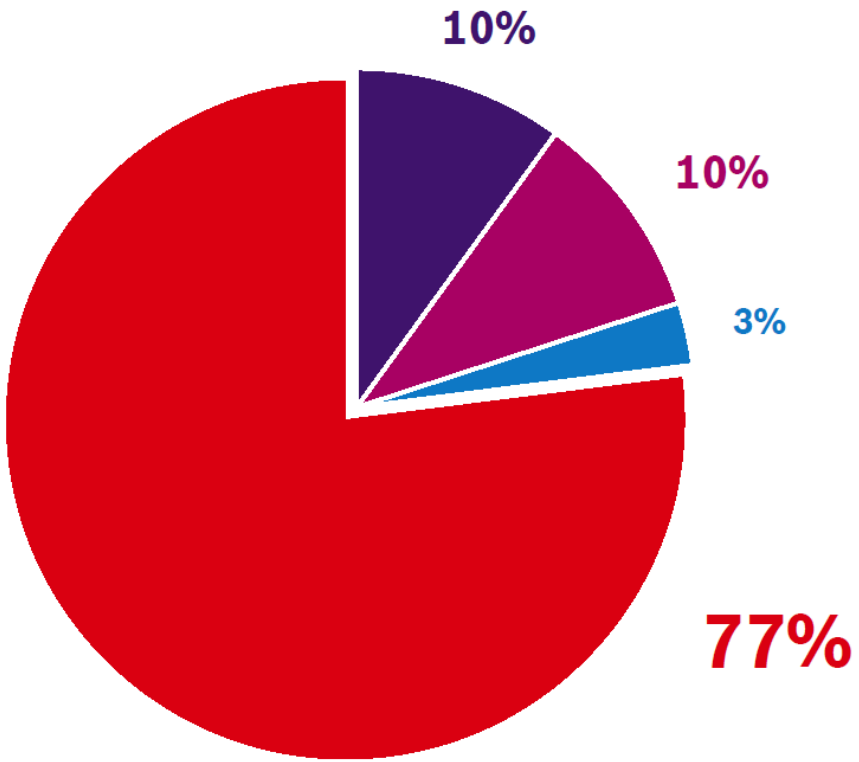
Bosch Thermotechnology revenues by segments

2,466m euros
Residential Heating

322m euros
Commercial / Industrial Heating

380m euros
Residential Water

137m euros
Commercial Air-Conditioning and Ventilation



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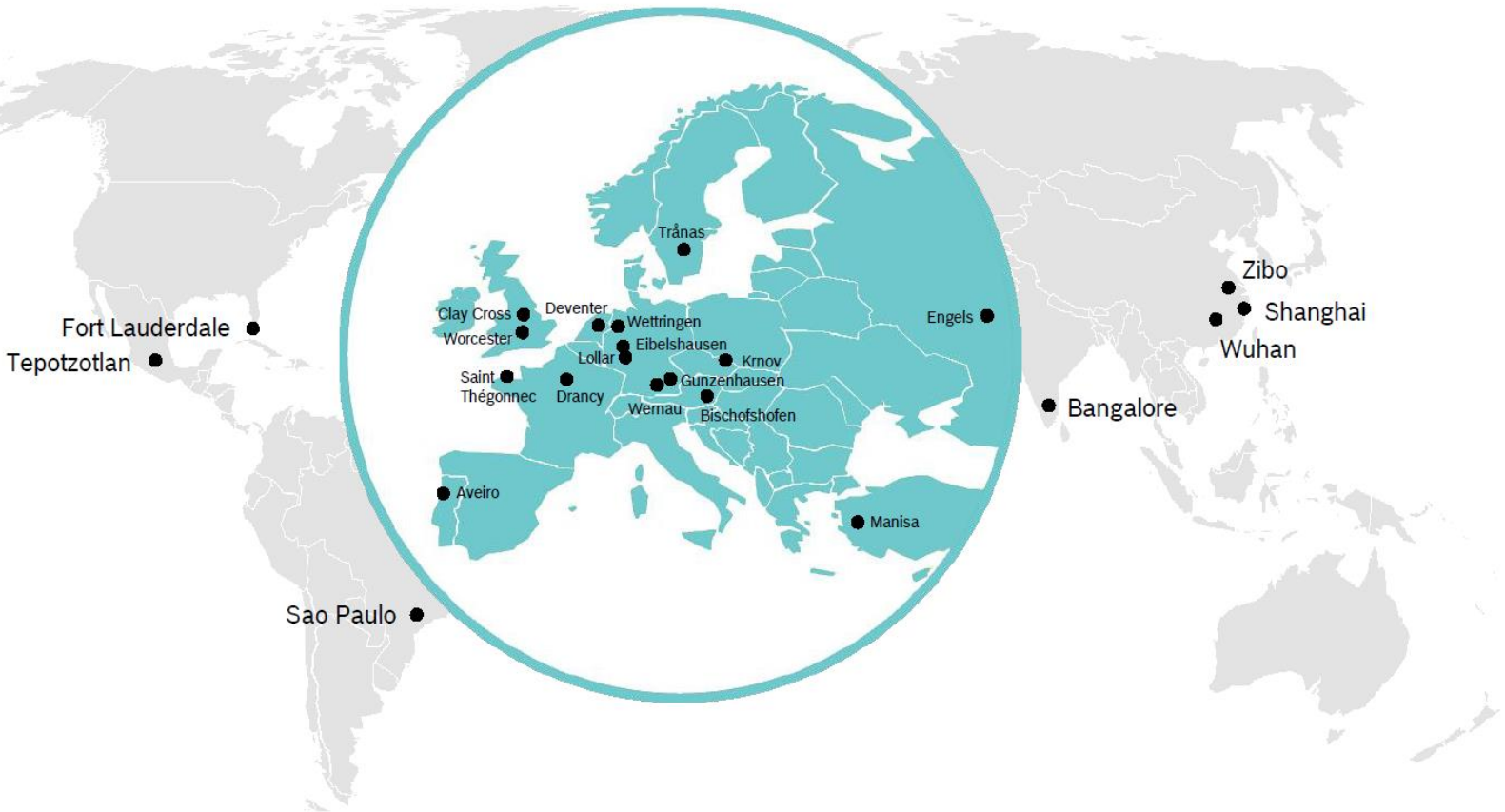
Bosch Thermotechnology production sites



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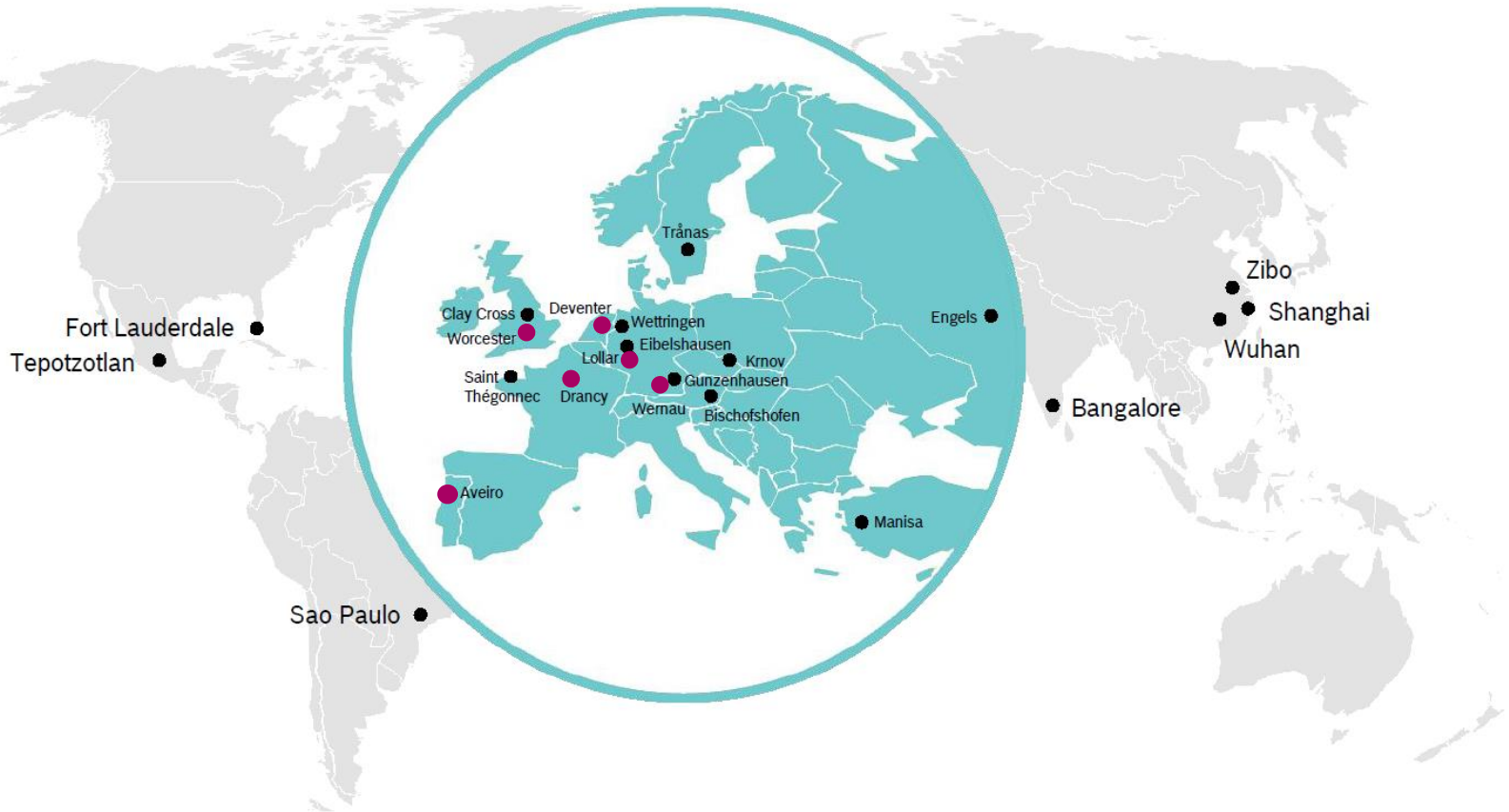
Bosch Thermotechnology DS & BI teams



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Examples of Residential Heating Devices

Hot water solutions

Wall-hung heating devices

Heat pumps

MOTIVATION

A Data Science Use Case for Thermotechnology Data Monitoring

- Shorter time between breakdown and repair
  - Less time without hot water or heating

- Information on heating device efficiency and usage
  - Save money for heating
  - Improve products

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Diagnostic and Prediction

- Streamlined and pro-active service
  - Less stress and hassle

- Prevent breakdowns
  - Replace parts and components before breakdowns
  - Never be without hot water or heating

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Benefits

- Customer (B2C):
  - Peace of mind driven by 24/7 system monitoring and diagnostic

- Service Organization (B2B):
  - Service Optimization (e.g. avoid re-visits) → cost reduction
  - Offer enhanced maintenance contracts

- Manufacturer (TT internal):
  - Product improvements based on observed user and system behavior

USE CASE

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Boiler Defective Pump Detection

- Problem description
  - The pump allows the water to circulate in loop of heating baseboard inside the boiler
  - If the pump is blocked and no water is running in the loop, the boiler will heat in dry

- Target
  - Pattern detection
  - Mathematical model definition

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Boiler Defective Pump Detection

- Risks
  - Overheating the system
  - Overheating on long term defects on components
  - System blocks due to overheating, no HW or heating

- Business value
  - Prevent possible boiler damage
  - Service support via spare part recommendation

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Slice the Elephant

- Boiler experts
- Dataset
- Connectivity system
- Train & test dataset
- Challenges

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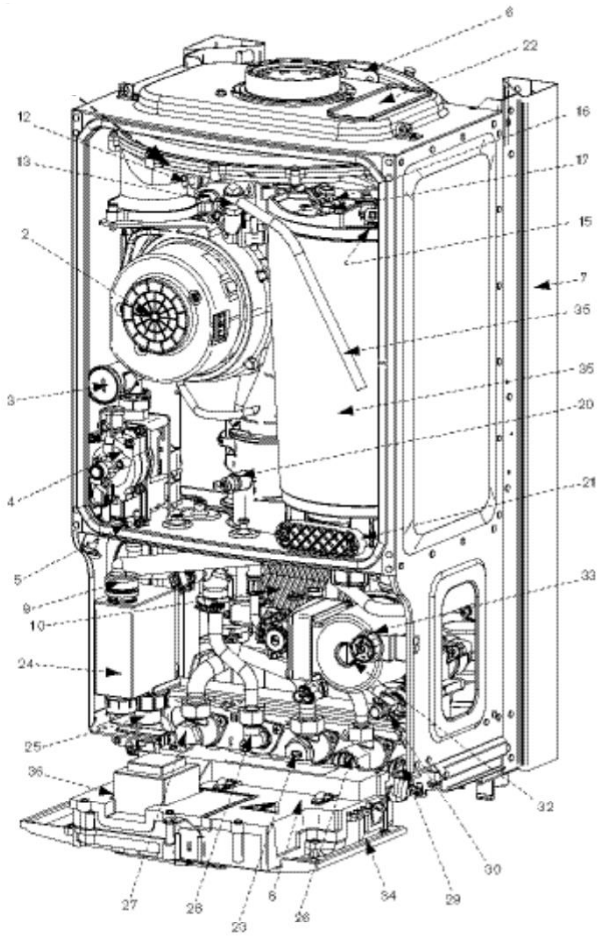
Boiler

- Main components:
  - ECU
  - Heat cell
  - Heat exchanger
  - Fan
  - Water pump
  - Water valve
  - Gas valve



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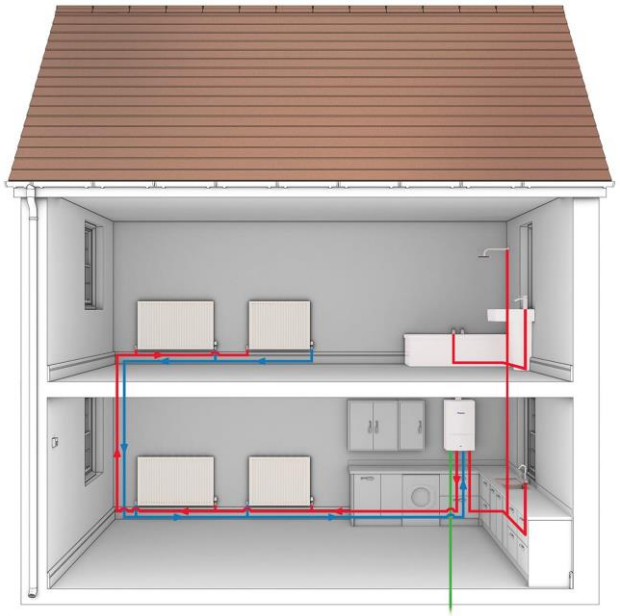
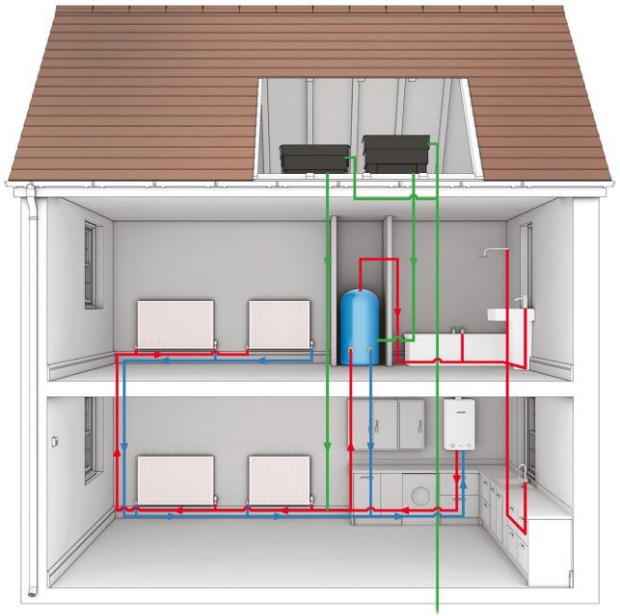
Types of Boiler

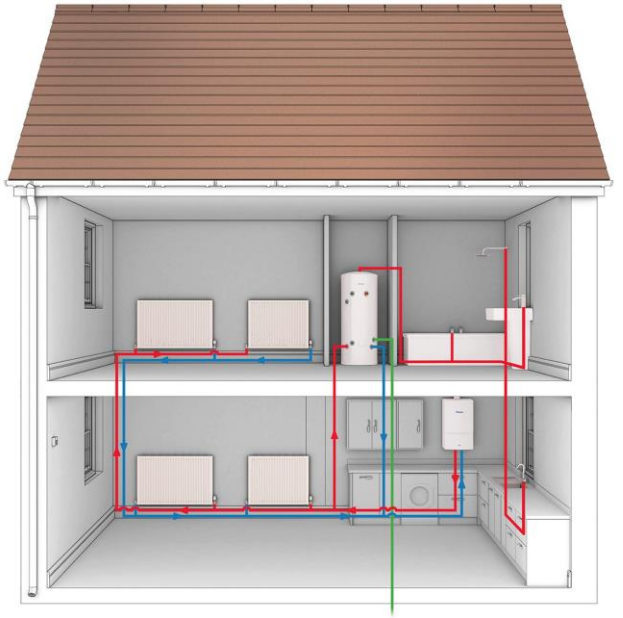
- Combi Boiler



- Regular Boiler



- System Boiler



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Dataset

- Metadata
  - Numerical vs categorical
  - Sensor reads vs ECU command vs gateway calculations
  - Sensor accuracy

- Data
  - Timeseries
  - Sample rate
  - Logging duration
  - Data gap (no connectivity)
  - Sanity check

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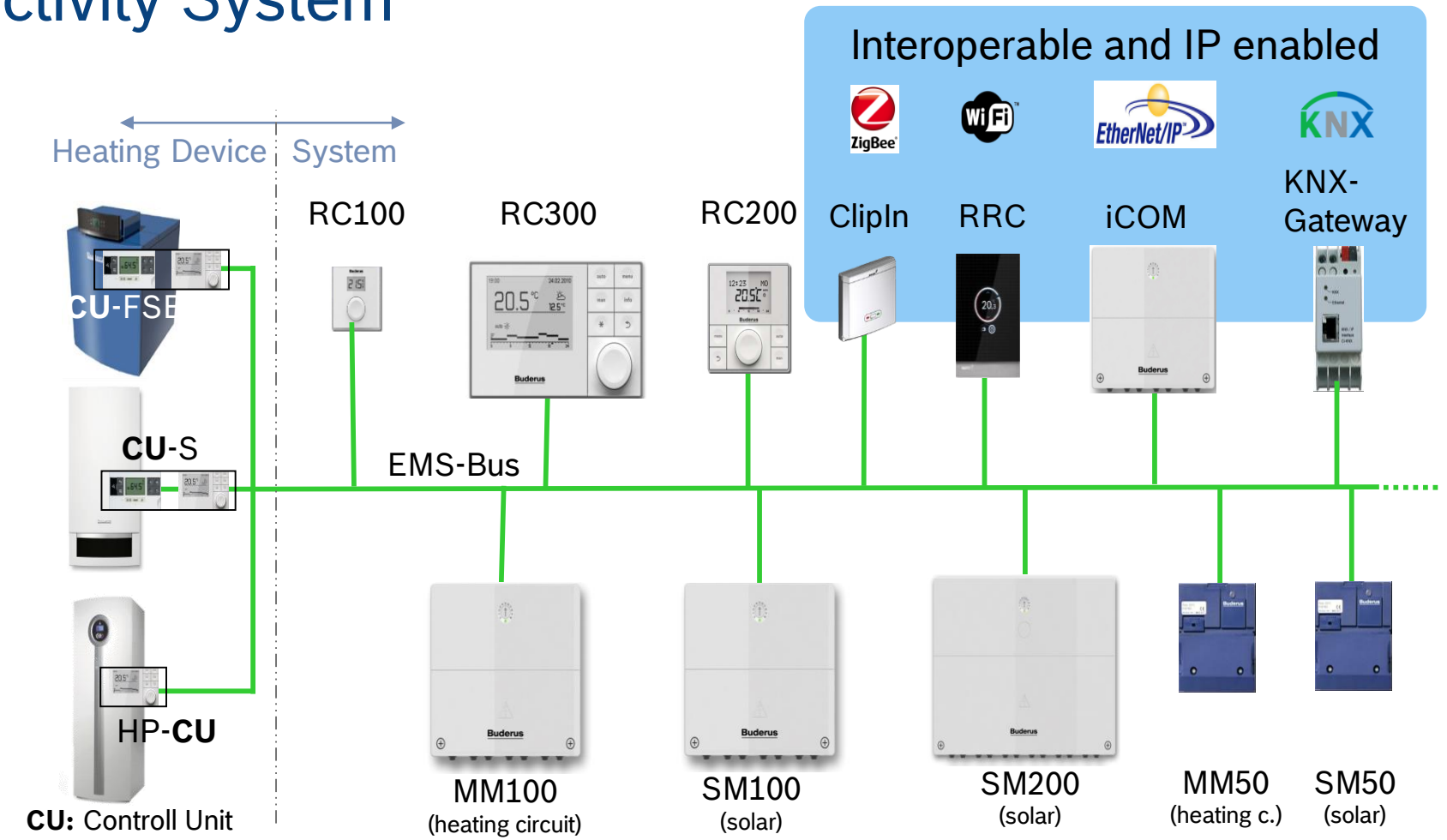
Connectivity System



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Connectivity Data

- Connectivity gateway responsible for transmitting the sensors data, ECU commands and calculations
  - Measurement sample rate
  - Transmission rules
  - Data aggregation
  - Add sequence number to messages
  - Add timestamp to messages (to be done)

- Proprietary communication protocol
  - Expert knowledge
  - Data translation application with message sorting

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Train & Test Dataset

- Lab tests
  - Installers sent us blocked pumps from the field
- Field tests
  - Selected customers to simulate the defect
- Data logging
  - Unlabelled

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Challenges

- Target
  - Pattern detection for boiler defective pump detection

- How is the data collection affecting the dataset?
- How to transform the data?
- Which algorithms to use?

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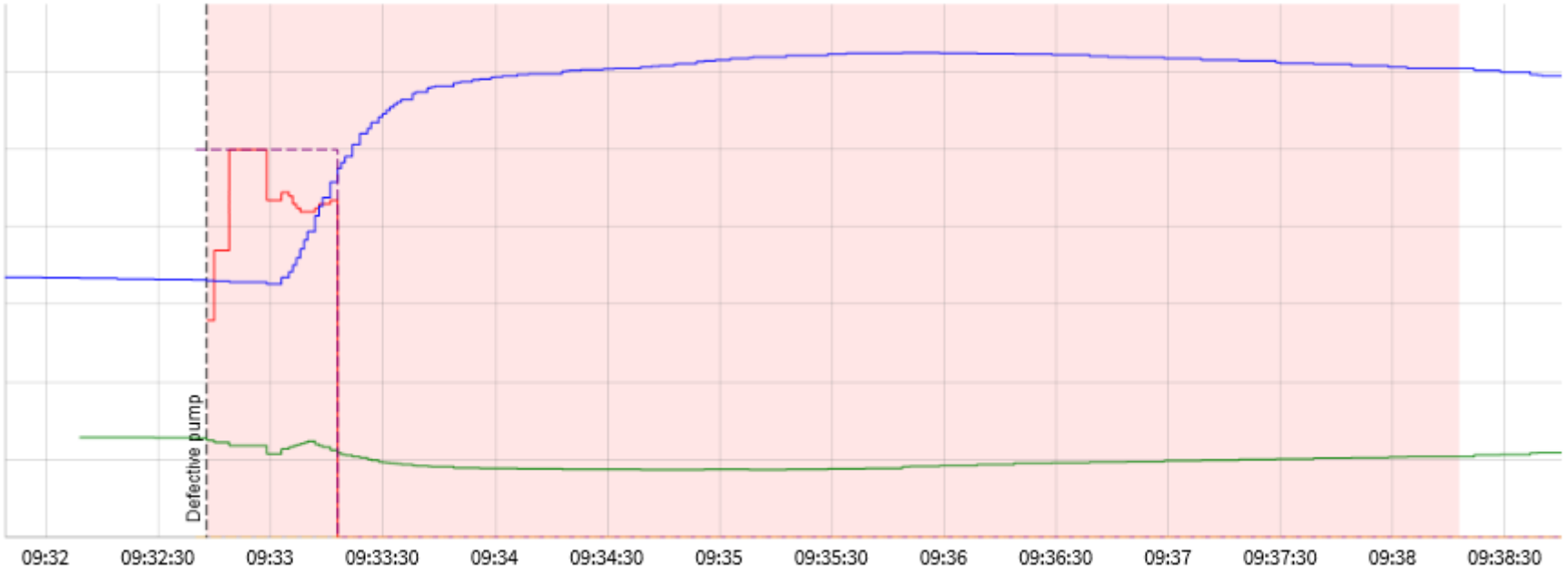
Example Data for Boiler Defective Pump



Thank you!

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