

# Industrial data collection and analysis in multi-family residential buildings for dynamic performance evaluation

Prepared by:

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# Neogrid Technologies ApS

SME based in Aalborg (Denmark)

Extensive experience in research and demonstration projects in the building energy sector

Provides commercial cloud-based solutions for:

- Data collection and control infrastructure
- Energy and indoor climate management systems
- Optimised control of space and water heating (24/7 in > 400 buildings)
- Online monitoring and fault detection of HVAC installations



## E-DYCE demonstration sites in Denmark

- 3 buildings from 1960-1970s
- 18-40 apartments / 1,500-3,300 m<sup>2</sup>
- Renovated in 2010s
- Managed by housing associations
- Supplied by district heating
- & representative of Neogrid's main customer segment



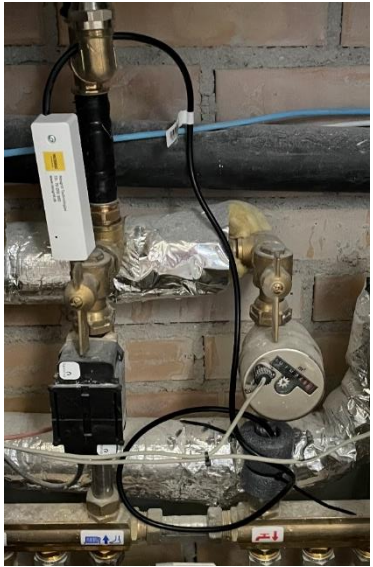
# Data collection technology for dynamic performance evaluation

## What do we want to measure?

	Level	Essential	Valuable
Energy	Central	Total heat supplied Total electricity demand	
	Apartment		Heating demand (space) Hot water flow
Hydronic system	Central	Supply and return temperatures (space and water heating)	
	Apartment		Supply & return temperature (space heating) Radiator settings ('smart' thermostats)
Indoor climate	Apartment	Indoor temperature	Relative humidity CO <sub>2</sub> concentration Window opening
Ventilation (if any)	Central		Setpoints, electricity demand, temperatures

& we want it with high resolution (i.e. hourly or better)

## How do we measure it?



At central level



At apartment-level



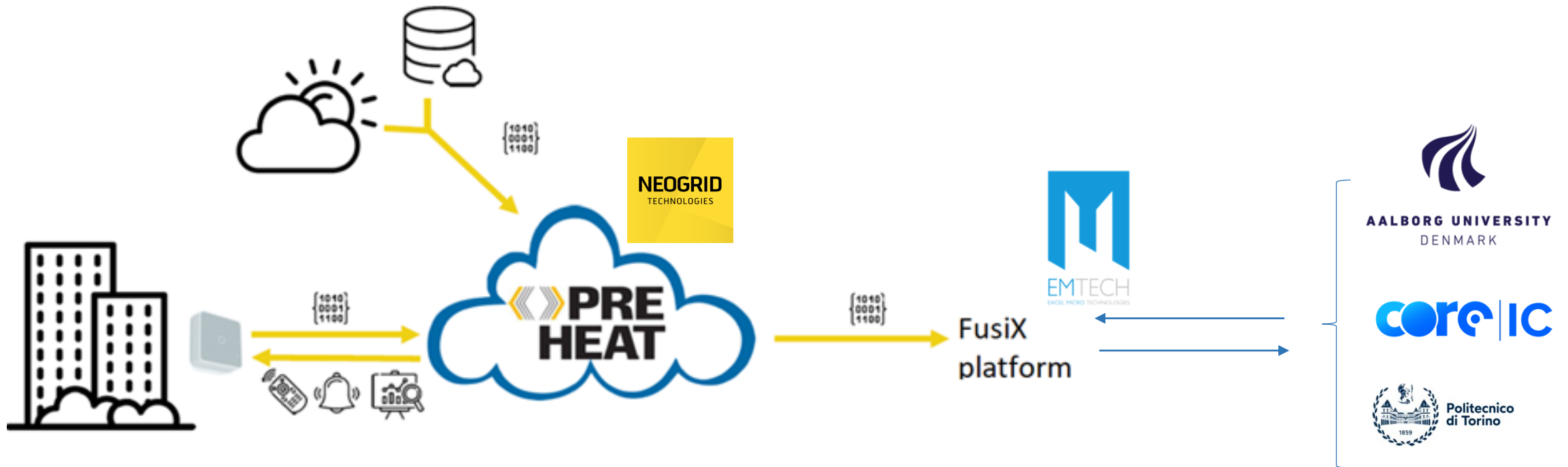
Our strategy: interface to as much of the existing as possible, and complete where necessary

## Communication protocols

	Protocol	Advantages	Drawbacks
Wired	M-Bus	Cheap sensing	Limited range and sensor options
	1-wire	Cheap sensing	Limited range and sensor options
	Modbus (/ IP)	Typical BMS protocol	Mapping of registers is often needed
	Bacnet (/ IP)	Typical BMS protocol, no mapping need	
Wireless	Wireless M-Bus	Flexible and lower price IoT sensors	Often requires repeaters
	Lo-Ra WAN	Long range	Can be expensive
	Bluetooth		Short range, drains battery
API	(custom integrations)	Direct reuse of 'smart' equipment	Requires some volume to justify investment, limitation/dependence on existing API functionalities

# Integration with existing services

## E-Dyce relies on cross-platform integration



## Cross-platform facilitation is the future

Growing number of digital platforms used in data-driven services to buildings:

- data is often available
- a typical approach is monolithic (i.e. data is locked in platform)
- accessing data as a third party is the difficult point

To facilitate this, we for example provide:

- a documented open API allowing usage ( <https://neogrid-technologies.gitlab.io/neogrid-api/> )
- open-source API wrappers for Python and Matlab ( <https://gitlab.com/neogrid-technologies-public> )
- structured data in a source-agnostic format

# Challenges of data acquisition in buildings

## Market and technical challenges

### **Sensing/technology:**

- Global supply issues for sensors and meters
- Resources also required for maintenance of data collection (not only installation)
- Interface to legacy equipment (ventilation) using old protocols with lost documentation

### **Market & service:**

- Transition from a 'deliver and forget' business model (current EPC) to an ongoing service delivery

# Challenges of the multi-family built environment

## **Bottlenecks:**

- GDPR complexifies the landscape
- Consent per household, and tenants are hard to access (both for prior information and then agreement, issues at tenancy change)
- Typical consent is usage-specific and limited (e.g. control/billing vs. performance evaluation, or new data processing partner)

## **Challenges:**

- Contact typically needs to be made via the housing association (multi-stakeholder collaboration)



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