

## Accelerating carbon neutrality





## Vision

We set up Enerbrain because we believe **our towns and cities must be sustainable, smart and people-oriented**

## Mission

We use artificial intelligence to make our commitment as humans to improving **the performance of buildings and make them more sustainable for the ecosystem in which we live, a reality.**

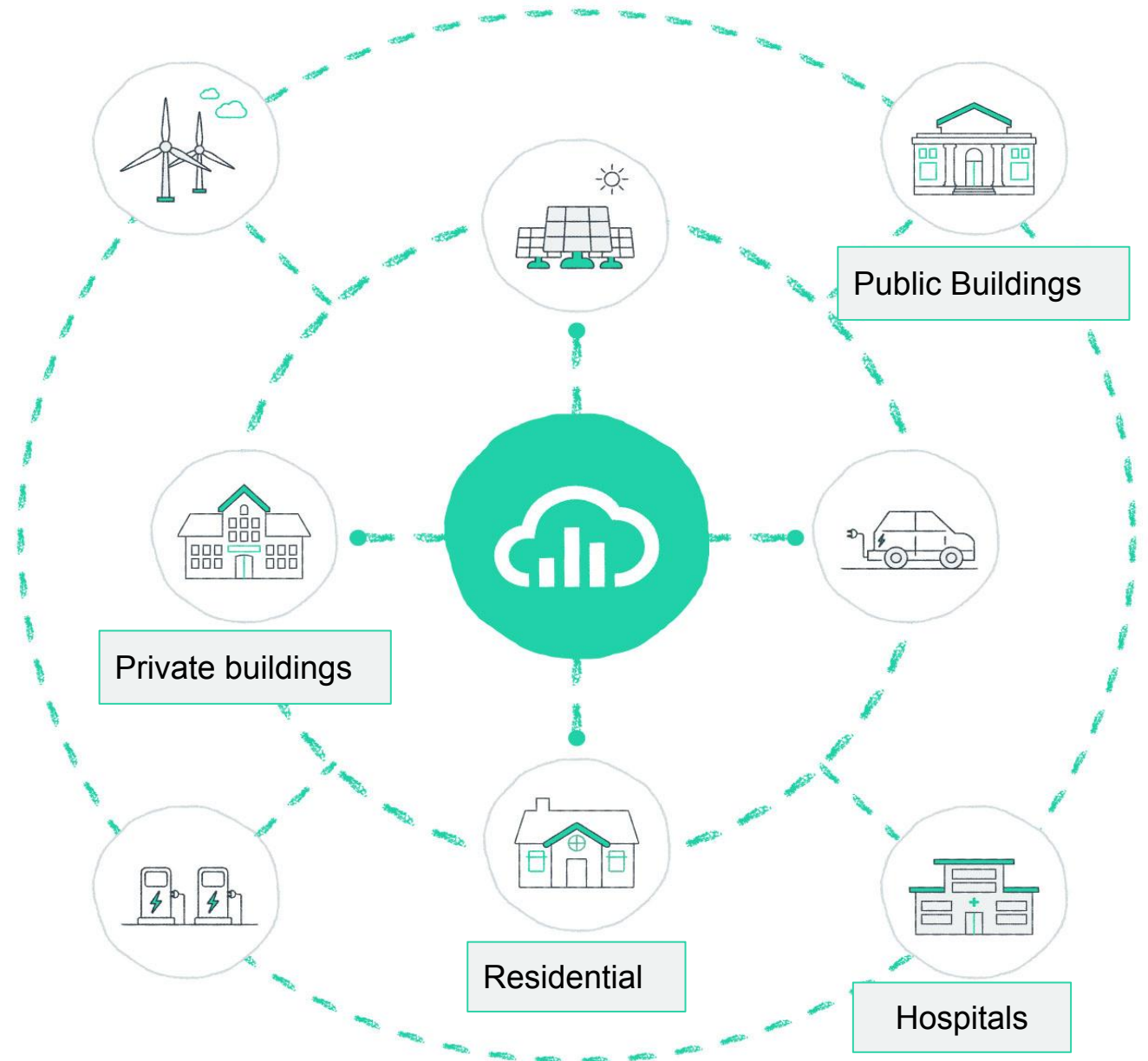
# SPIKE

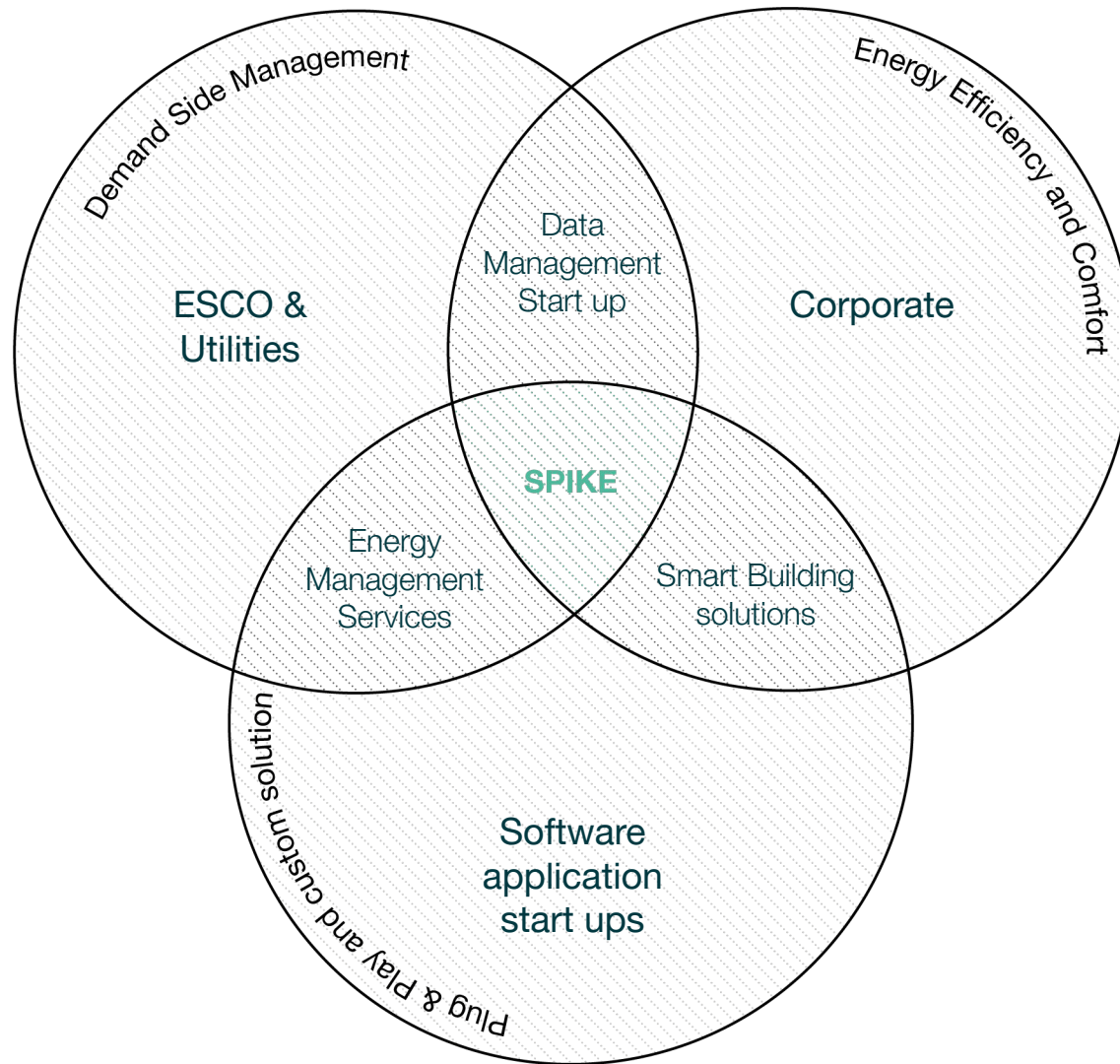
Sustainable  
Plug&Play  
IoT  
Kit for  
Energy

Optimal control & orchestration  
of

- Energy Production
- Consumption
- Storage

With weather forecast, forecast of  
cost of energy and **demand side**  
management integrations

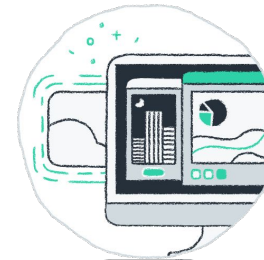




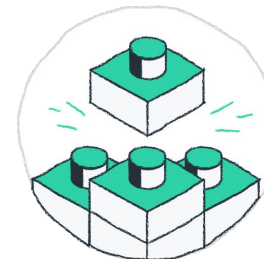
## Other key innovative features



Full plug&play retrofit solution



Combination of proprietary Hardware & Software



Integration with existing BMS

# How do we measure CO<sub>2</sub> reduction?

## 1. DATA CAPTURING

Energy use and other key parameters (external temperature, degree days, occupancy, etc..)

## 2. ENERGY MODEL

Mathematical models combine different data to describe the normal behaviour of a building's energy consumption, which can be used as a baseline for comparison

## 3. ENERGY SAVINGS

Energy savings are determined by the difference between the post-intervention measured consumption and the baseline energy model



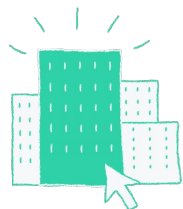
Calculation of CO<sub>2</sub> emitted can be calculated by converting the amount of energy saved by a factor, depending on the energy production source

## External conditions

Heating season  
(Summer vs. Winter)



Type of building  
and HVAC and  
BMS in place



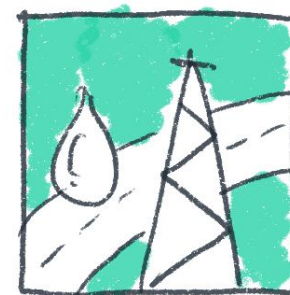
Building occupancy  
and client preferences  
(saving vs. comfort)



## Energy saving



Building energy model and  
energy savings calculation

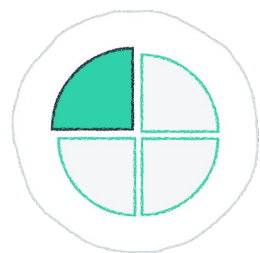
CO<sub>2</sub> emission reduction

If saved energy  
was obtained by

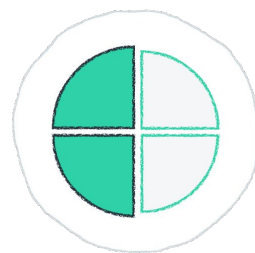
Hard Coal:  
1.1\*X Tons of CO<sub>2</sub>

Natural gas:  
0.8\*X Tons of CO<sub>2</sub>

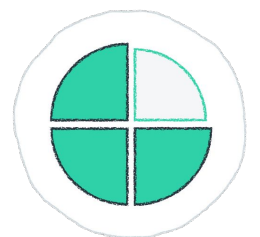
Solar energy:  
0.2\*X Tons of CO<sub>2</sub>



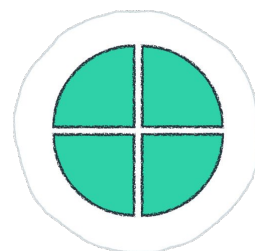
Enerbrain standard solution  
**15-20%** energy saving, e.g.  
av in 89 buildings' in Torino



Additional reduction thanks to  
optimal control strategy  
additional **8-10%**



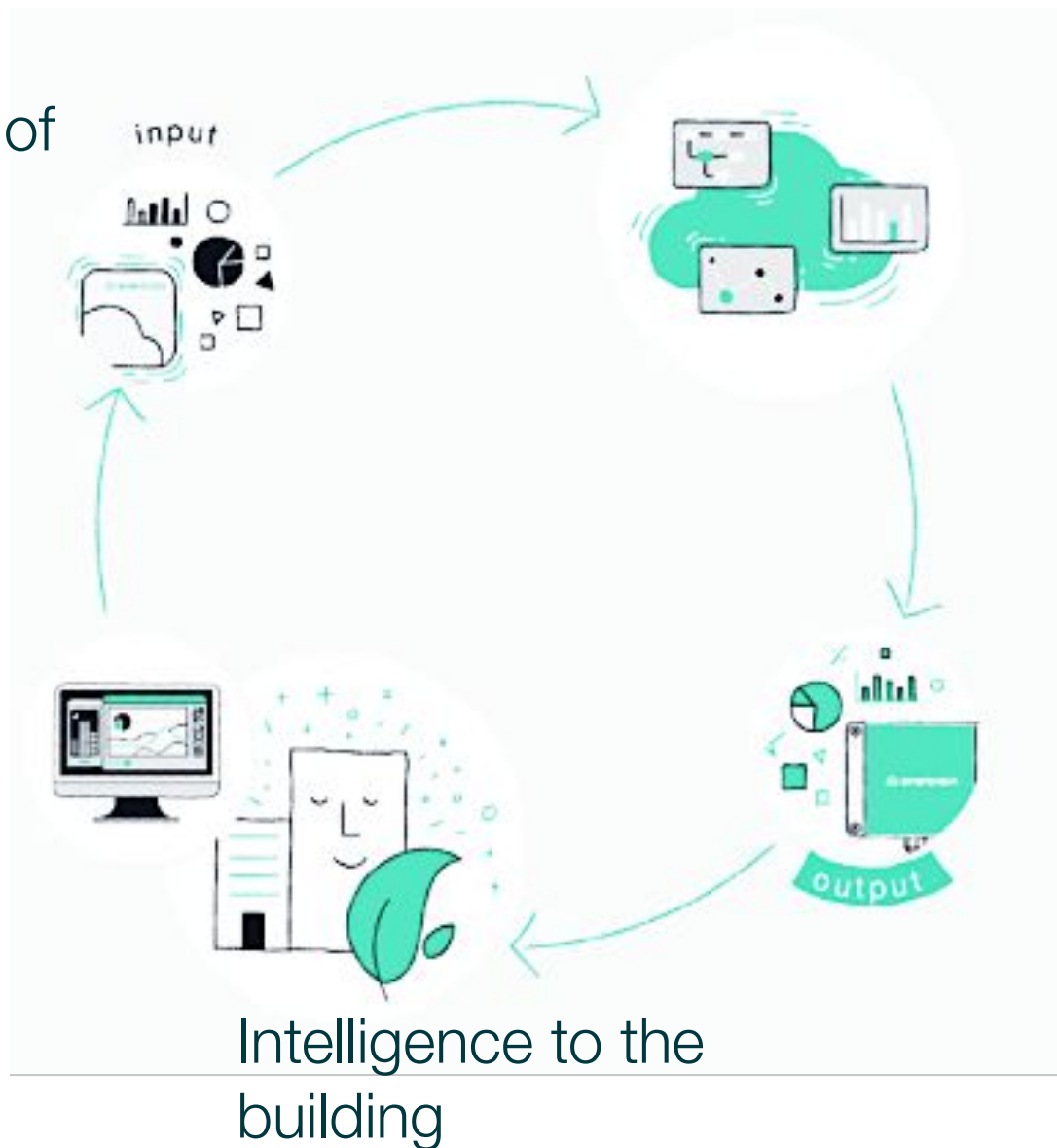
SPIKE can trigger Demand  
Response for extra **3-5%**



This gives us confidence to  
estimate CO<sub>2</sub> reduction in a  
range of **18-28%**

Mathematical model of the building

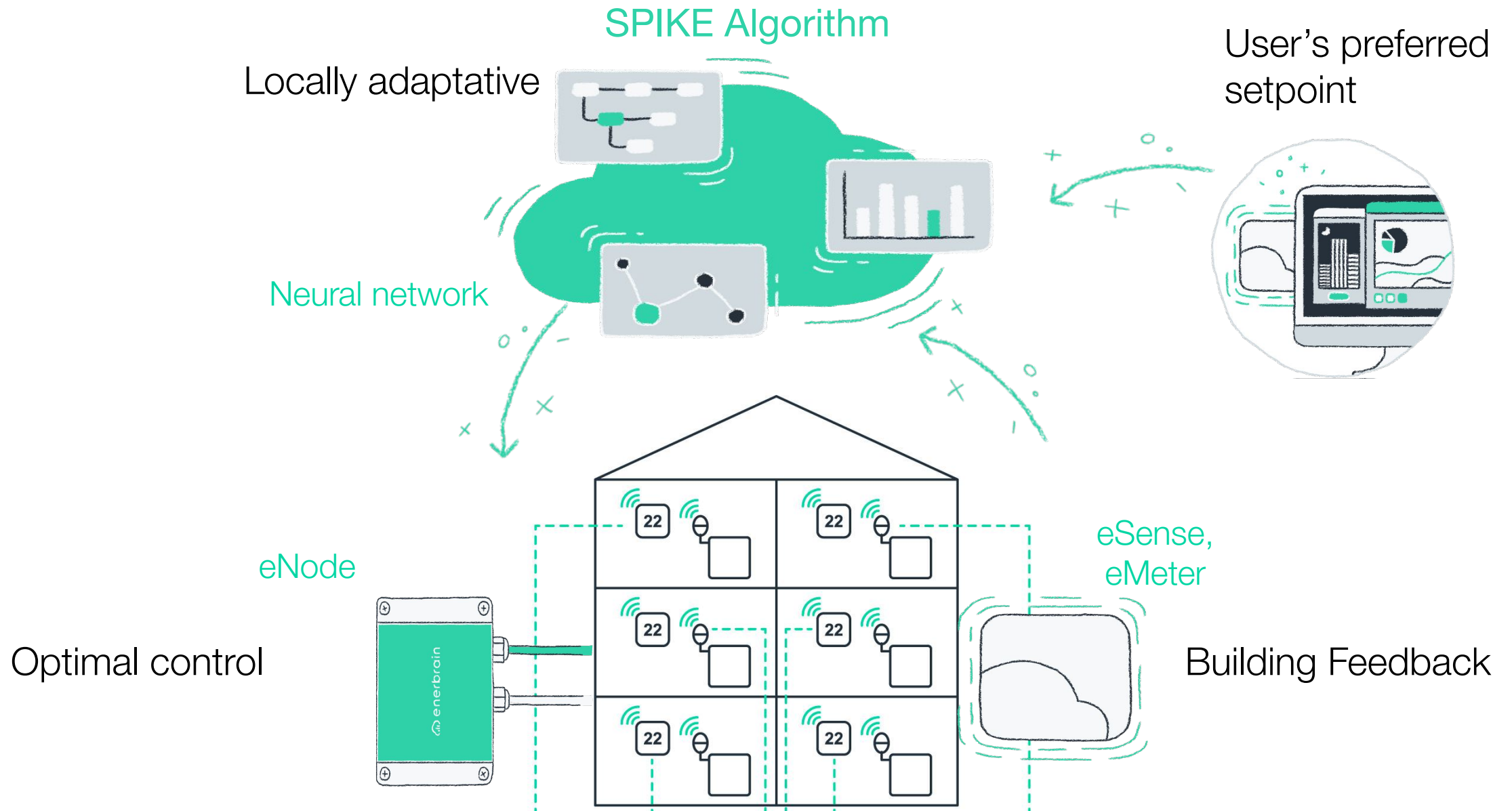
Maximize energy saving while preserving comfort levels



Simulation of building behaviour

Definition of an Optimal Strategy

Intelligence to the building



## TRADE OFF

COMFORT

VS.

ENERGY CONSUMPTION

# An optimal control

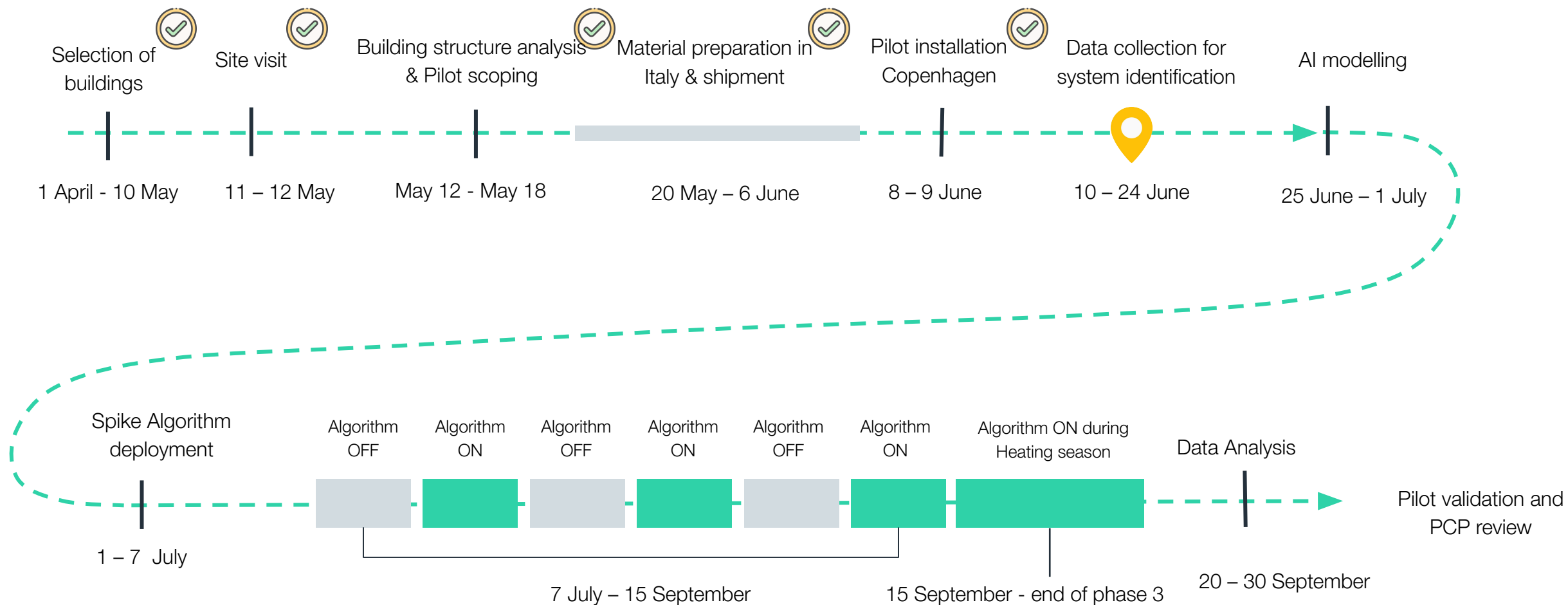
can optimize **PERFORMANCE INDEXES**  
over a suitable time horizon

Performance indexes

- C: depends on environmental parameters, like the internal T
- E: depends on the energy consumption

HOLISTIC CONTROL TO  
MAXIMIZE BOTH OR TO  
PRIORITIZE ONE OBJECTIVE







Blegdamsvej 132 2100 Copenhagen

## The Building

- Kid's Playground
- 3 Areas
- 1 Air Handling Unit + Fan Coils

Total surface 807 m<sup>2</sup>

## What we control

- Air Handling Unit on Ground Floor
- Heating Circuit on Ground Floor
- Indoor environmental conditions in the areas served by the HVAC components
- Electrical consumptions of circulation pumps, AHU's fans
- Thermal consumption

## The Devices

8 eSense

4 eNode

8 PT probe

1 eMeter

## Our Objectives

- > 5% Energy saving in summer from smart management of ventilation & shutters
- > 10 % Energy saving in winter
- 90 – 95% time in comfort



Forbindelsesvej 9, 2100 Copenhagen

## The Building

- Kindergarten
- 3 Floors
- 1 Air Handling Unit + Radiators

Total surface 1039 m<sup>2</sup>

## What we control

- Air Handling Unit
- Heating Circuit to radiator
- Indoor environmental conditions in the areas served by the HVAC components
- Electrical consumption
- Thermal consumption

## The Devices

20 eSense

5 eNode

8 PT probe

1 eMeter

## Our Objectives

- Approx 10 % Energy saving in summer from optimal management of HVAC system
- > 15% Energy saving in winter
- 90 – 95% time in comfort





Anton de Komplein 150 1102 CW Amsterdam

## The Building

- Offices + Restaurant and Kitchen
- 7 Floors in Wing A
- 5 Floors in Wing B
- 3 Air Handling Units + heating circuits

Total surface 13.550 m<sup>2</sup>

## What we control

- Heat pump
- Gas boiler
- Emergency cooler/free cooling circuit
- Heat and cool thermal storage system
- Thermal distribution system (TDS) circuits
- Indoor environmental conditions in the areas served by the HVAC components
- Electrical consumption of circulation pumps
- Thermal consumption

## The Devices

65 eSense

13 eNode

23 PT Probe

1 eMeter

2 Clamp on eMeter

## Our Objectives

- > 10 % Energy saving in summer from optimal management of ventilation system
- +5% Energy saving for optimal control of thermal distribution system
- > 15 % Energy saving in winter
- 90 – 95% time in comfort

## What is blocking us

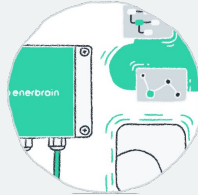


Limited energy saving opportunity in summer

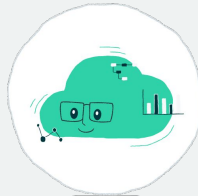


Industrial processes & supply chain are suffering historic blockades

## What we are doing



Optimal control of ventilation systems



Observe the thermodynamic behavior of the building to predict its winter consumption



Perform a hybrid installation to speed up the process

## How you can help



Extend the data analysis period during the next fall/winter heating season



Provide us with continuous feedback on pilot execution

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