AI4CITIES

Accelerating carbon neutrality

Phase 3 Mid-term review June 14th 2022

Martin Vahi, ENERBRAIN

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.**

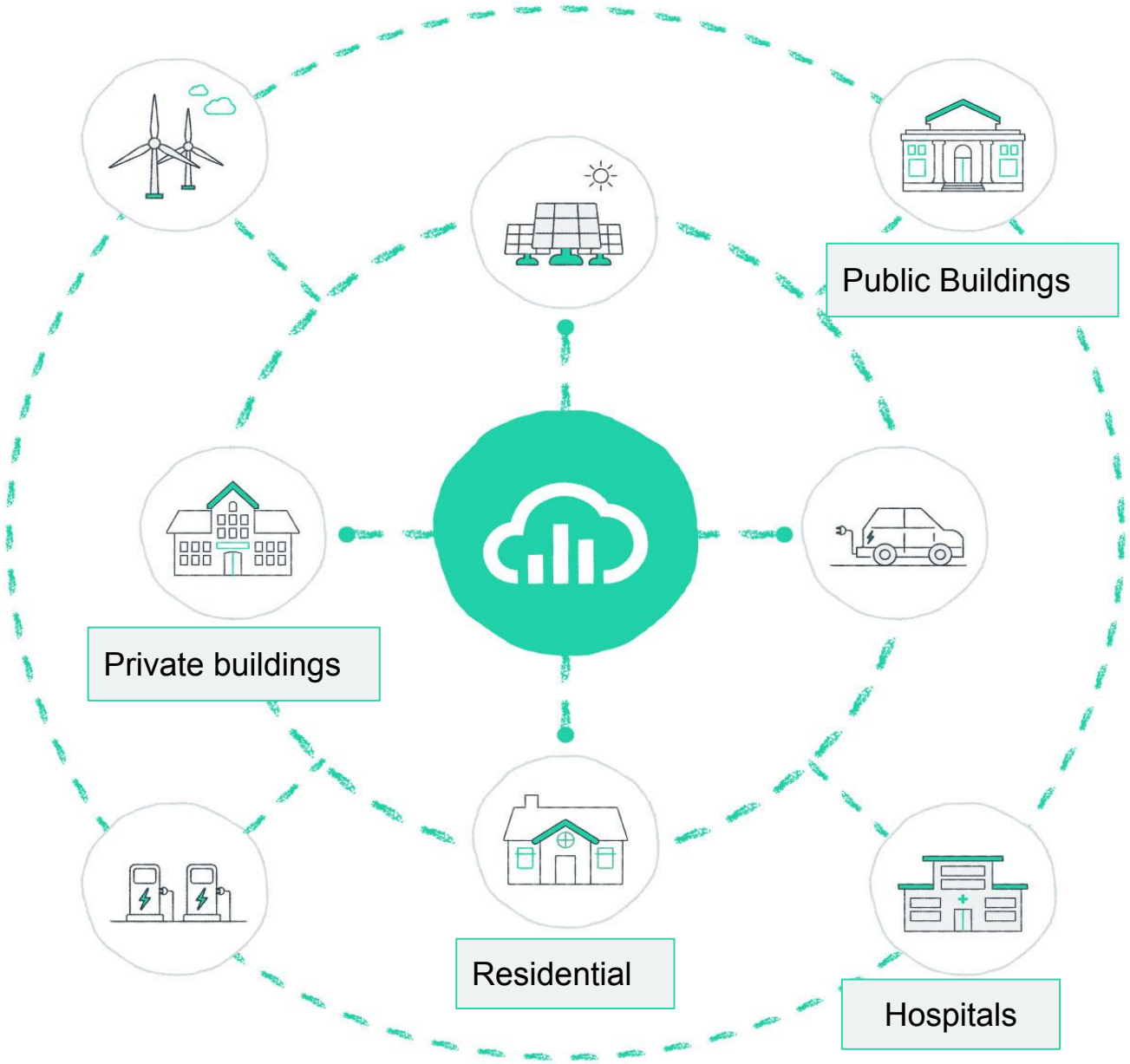
SPIKE

Sustainable
Plug&Play
IoT
Kit for
Energy

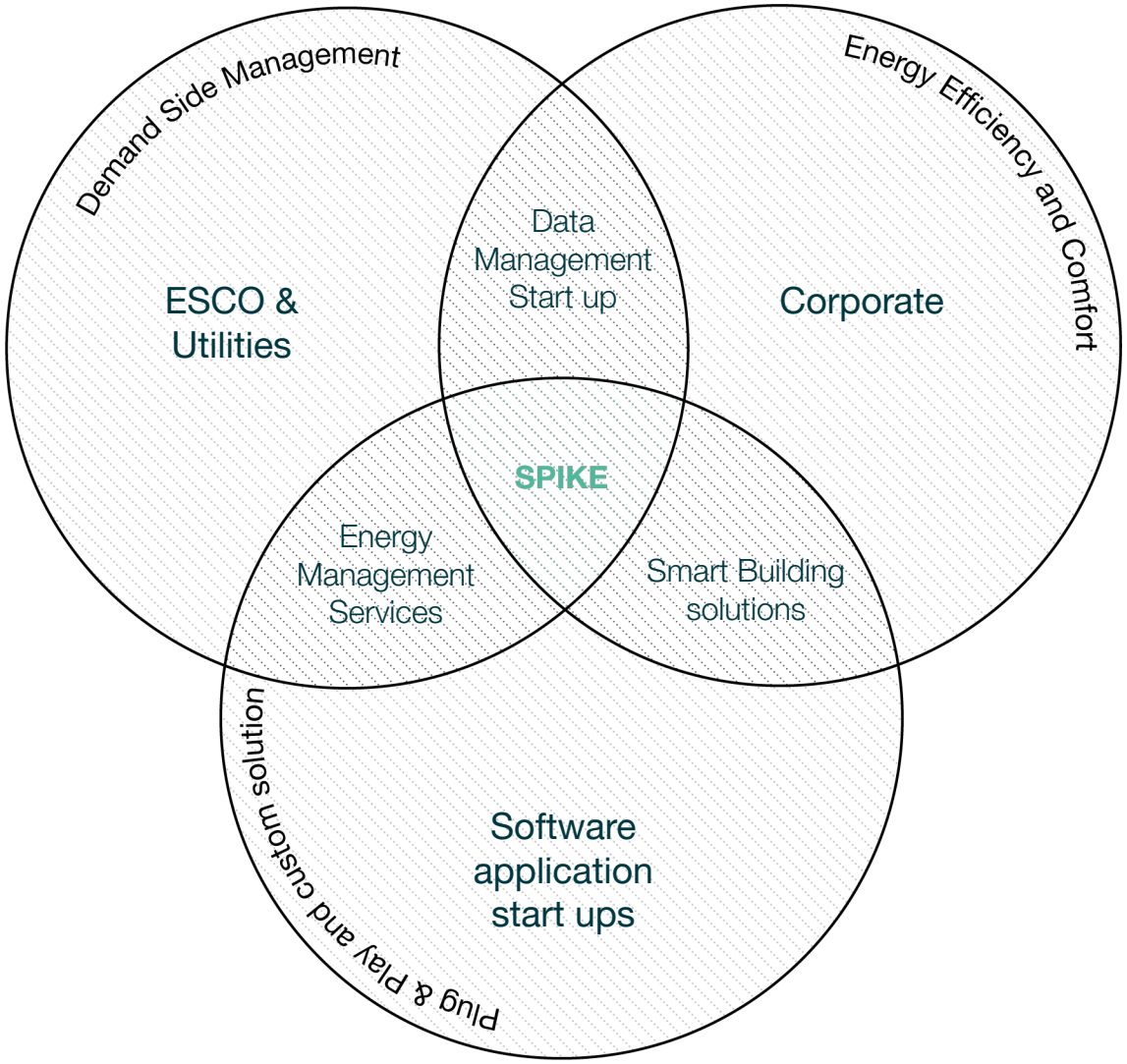
Optimal control & orchestration of

- Energy Production
- Consumption
- Storage

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



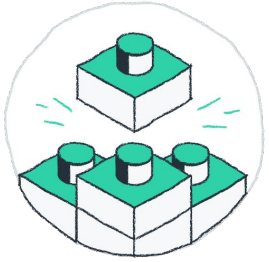
Why we believe in SPIKE



Other key innovative features

Full plug&play retrofit solution

Combination of proprietary Hardware & Software



Integration with existing BMS

How do we measure CO_2 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

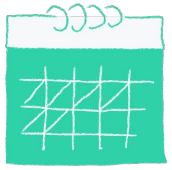
Energy savings are determined by the difference between the post-intervention measured consumption and the baseline energy model

Calculation of CO_2 emitted can be calculated by converting the amount of energy saved by a factor, depending on the energy production source

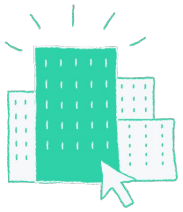
CO_2 emissions calculation

External conditions

Heating season (Summer vs. Winter)



Type of building and HVAC and BMS in place

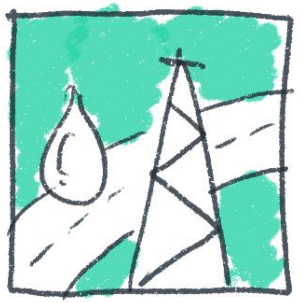


Building occupancy and client preferences (saving vs. comfort)

Energy saving

Building energy model and energy savings calculation

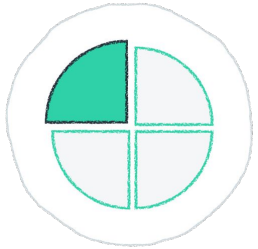
CO_2 emission reduction



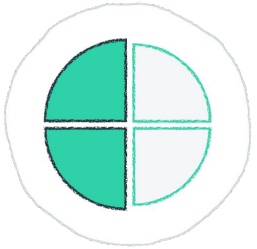
If saved energy was obtained by

- Hard Coal: 1.1*X Tons of CO_2
- Natural gas: 0.8*X Tons of CO_2
- Solar energy: 0.2*X Tons of CO_2

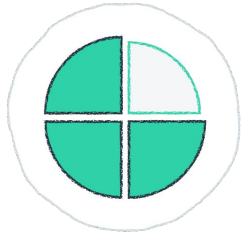
Forecasting CO_2 reduction in AI4Cities Pilots



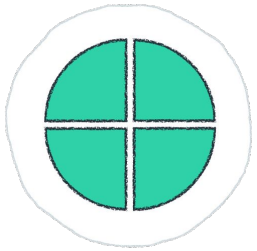
Enerbrain standard solution **15-20%** energy saving, e.g. av in 89 buildings' in Torino



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



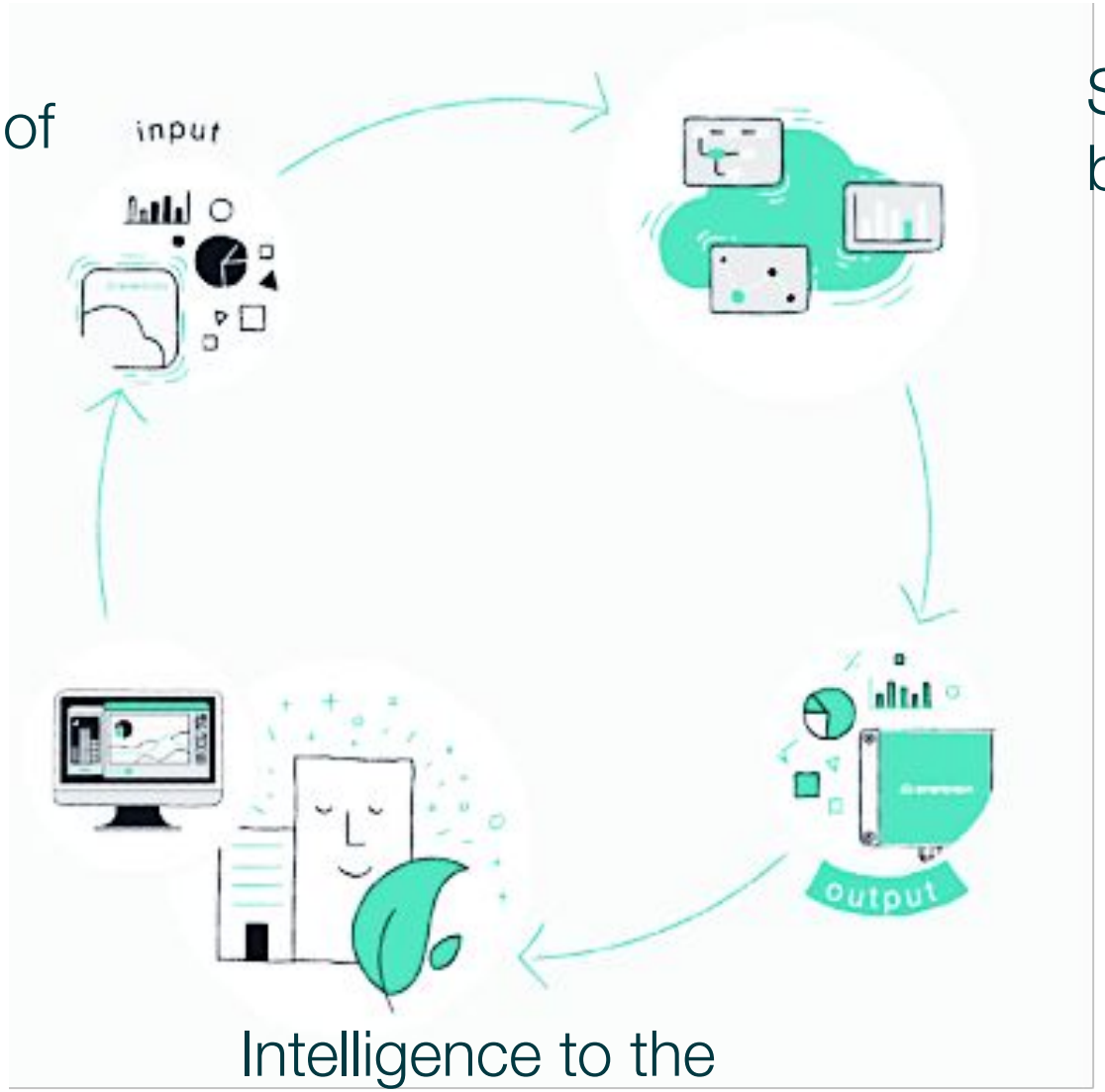
SPIKE can trigger Demand Response for extra **3-5%**



This gives us confidence to estimate CO_2 reduction in a range of **18-28%**

Our Algorithm

Mathematical model of the building



Simulation of building behaviour

Maximize energy saving while preserving comfort levels

Intelligence to the building

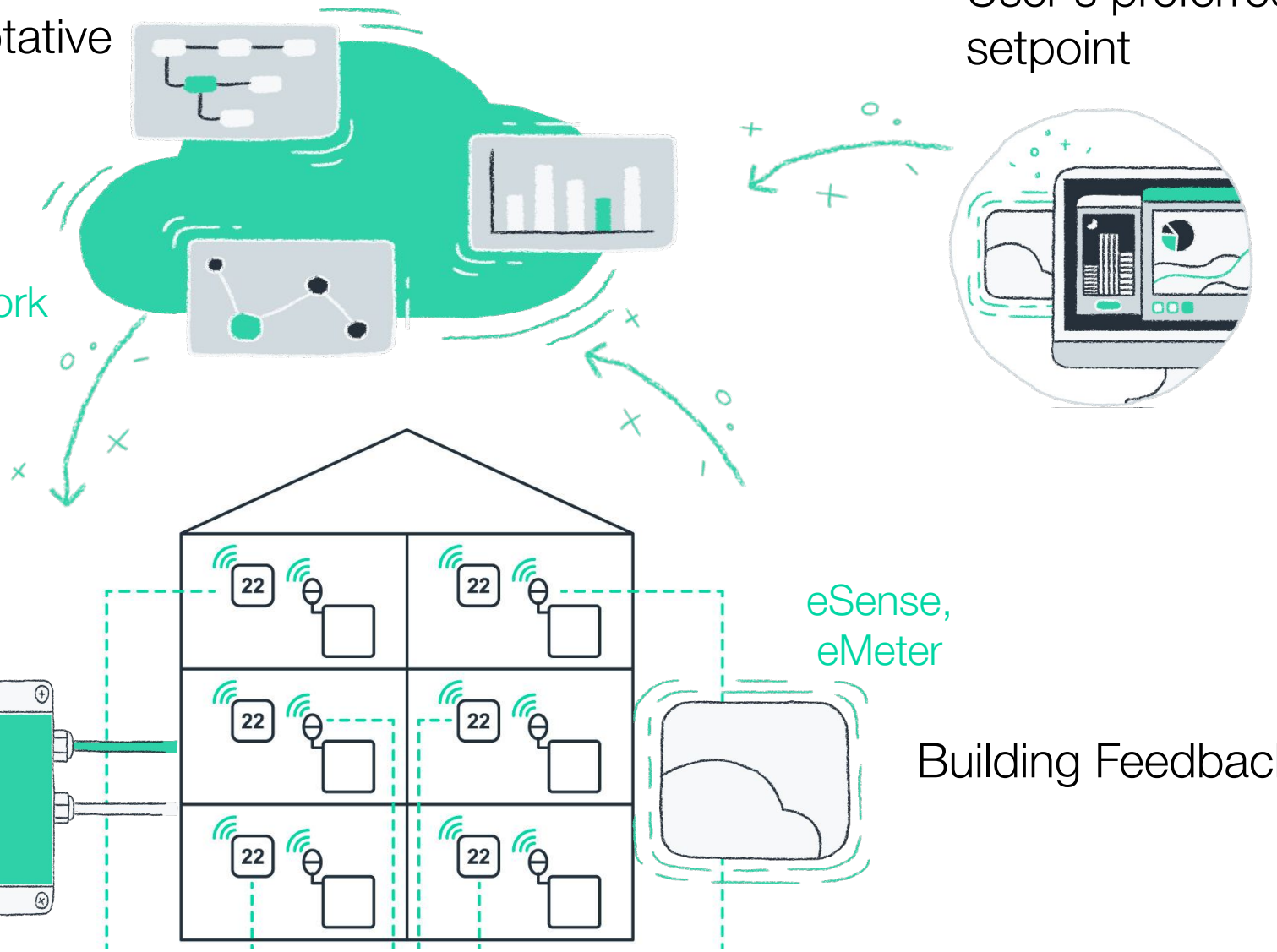
Definition of an Optimal Strategy

How we bring intelligence to a building

SPIKE Algorithm

Locally adaptative

User's preferred setpoint



TRADE OFF

COMFORT

VS.

ENERGY CONSUMPTION

An optimal control

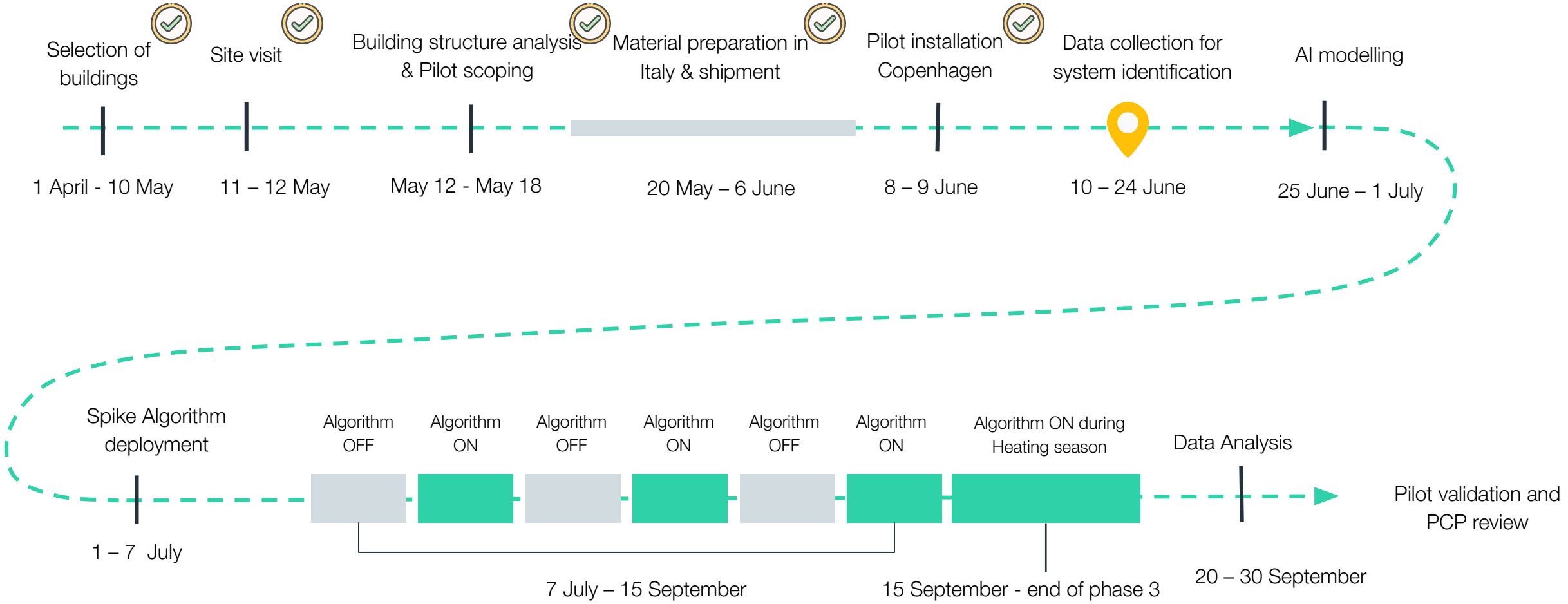
can optimize PERFORMANCE INDIXES over a suitable time horizon

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

Copenhagen Pilot Journey



Copenhagen Pilot

Blegdamsvej 132 2100 Copenhagen

Our Objectives

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

The Building

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

Total surface 807 m^2

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

Copenhagen Pilot

Forbindelsesvej 9, 2100 Copenhagen

Our Objectives

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

The Building

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

Total surface 1039 m^2

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

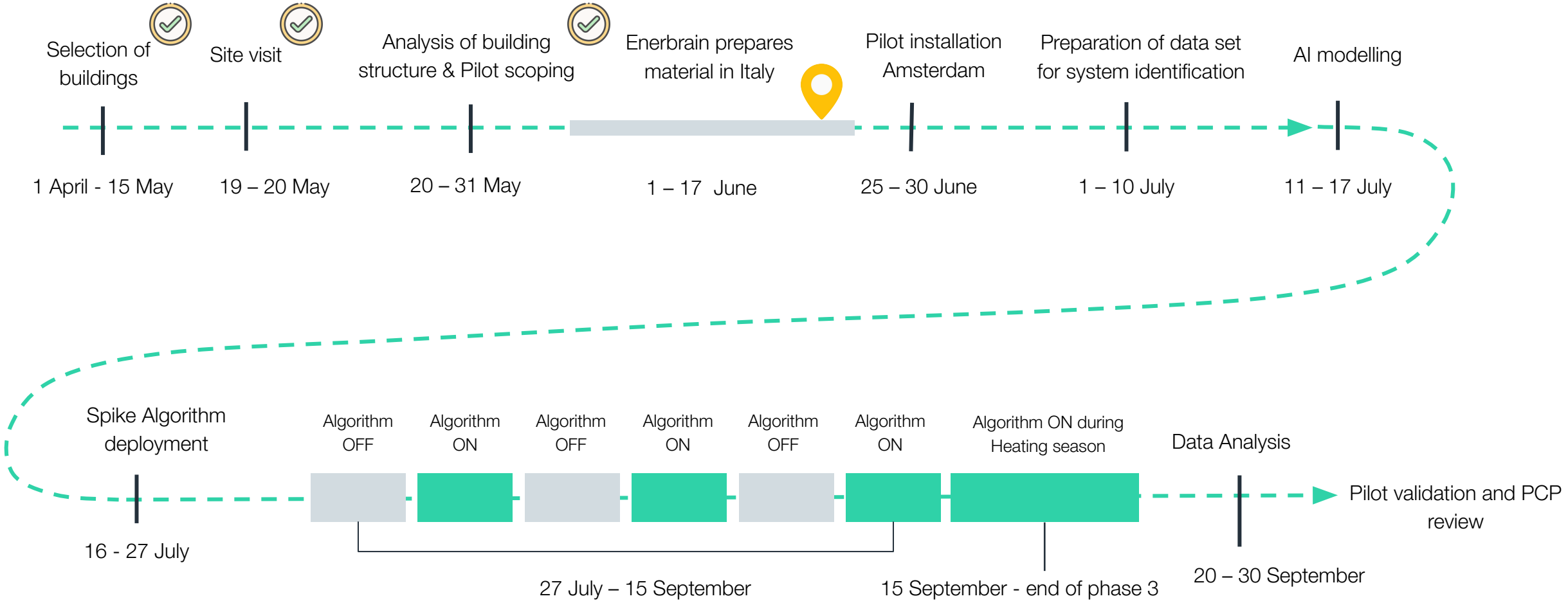
20 eSense

5 eNode

8 PT probe

1 eMeter

Amsterdam Pilot Journey



Amsterdam Pilot

Anton de Komplein 150 1102 CW Amsterdam

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

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^2

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

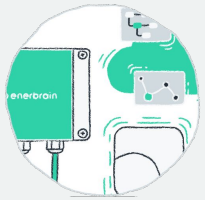
What is going on in Phase 3

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

enerbrain®

SPIKE

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