



# **Co-designing with office workers to reduce energy consumption and improve comfort**

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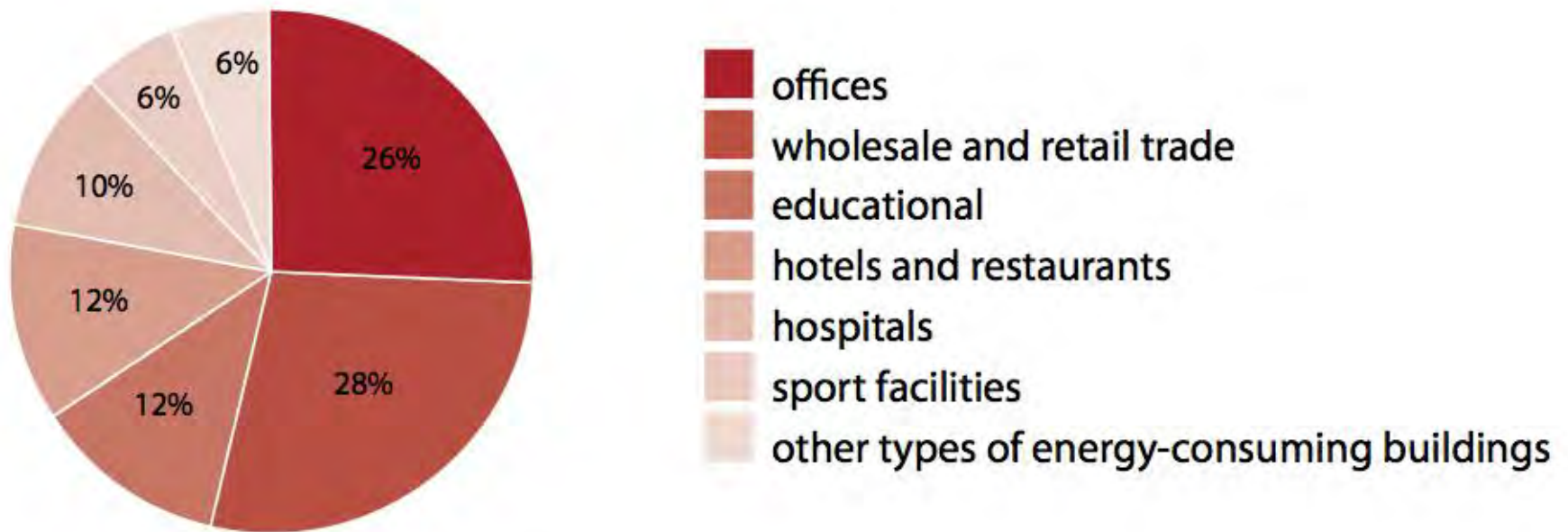




## CO<sub>2</sub> reduction potential



### Energy use in non-residential buildings across Europe (BPIE survey)

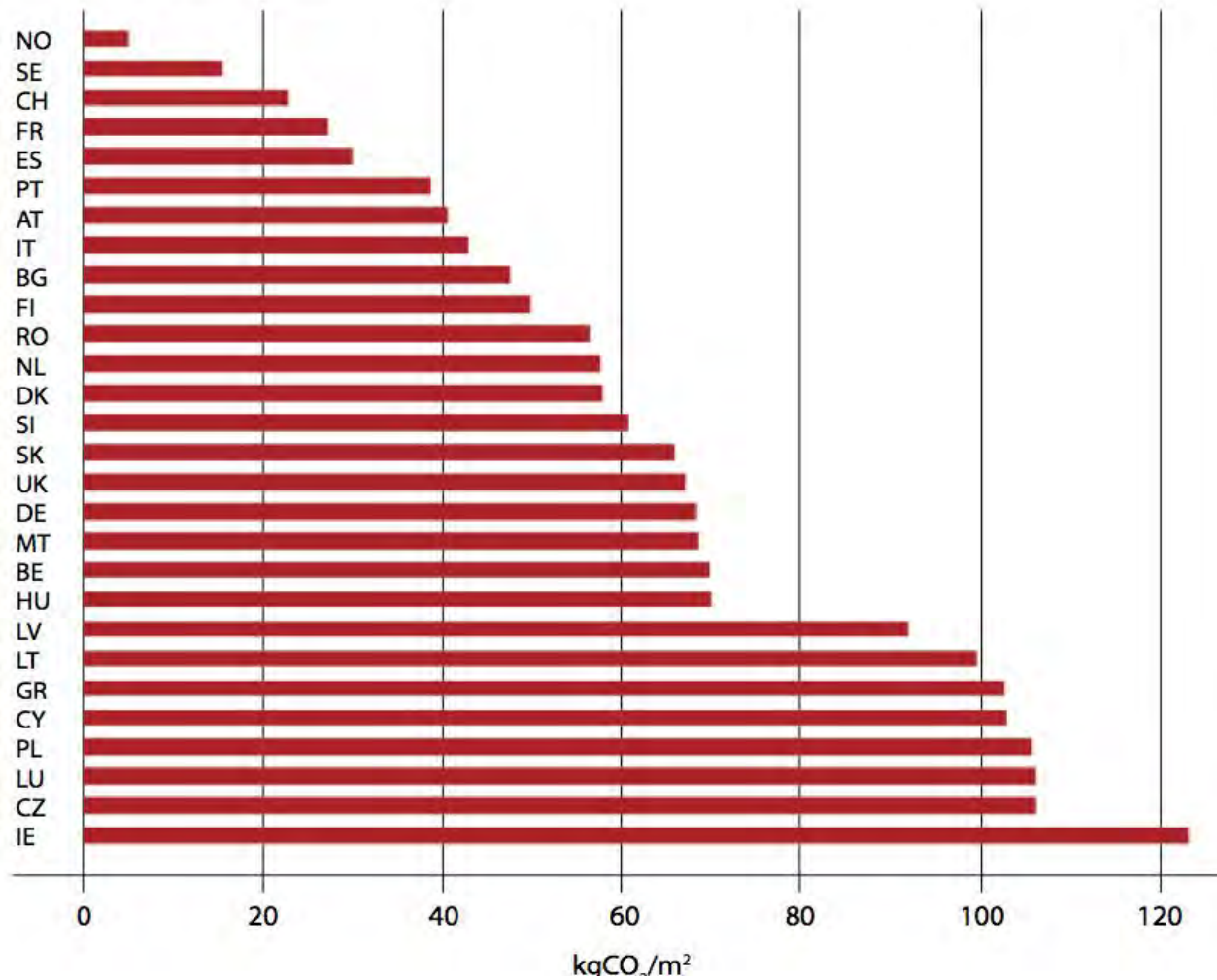




# CO<sub>2</sub> reduction potential

**Figure 1C2 – CO<sub>2</sub> emission per useful floor area**

Source: BPIE survey, Eurostat database





# Building Technology Certification



## Relative Assessment Weights

ESTIDAMA		BREEAM		LEED	
Site selection & natural systems	16%	Site selection & ecology	20.5%	Site selection	24.5%
Water	25%	Water	2.5%	Water	5.5%
Energy	25%	Energy	33%	Energy	33%
Materials	16%	Materials	13.5%	Materials	13.5%
Indoor env. quality	20%	Indoor env. quality	13%	Indoor env.	14%
Innovation	2%	Innovation	6.5%	Innovation	6.5%
Integrated design process	7%	Facility management	12%	Regional Policy	4%



# CO<sub>2</sub> reduction potential



## Stages of assessment

	Design Stage Assessment	Construction Stage Assessment	Post Occupancy Assessment
Estidama	Assessor	Assessor	Operational rating After 2 years, 80% occupancy
BREEAM	Assessor	Assessor	In use certificate (optional)
LEED	Online or Assessor	Online or Assessor	USGBC access to LEED data to rate occupancy, not certificate
Minergie	-	Building compliance standard	-



# Building Occupancy Certification System



## Two-prong strategy

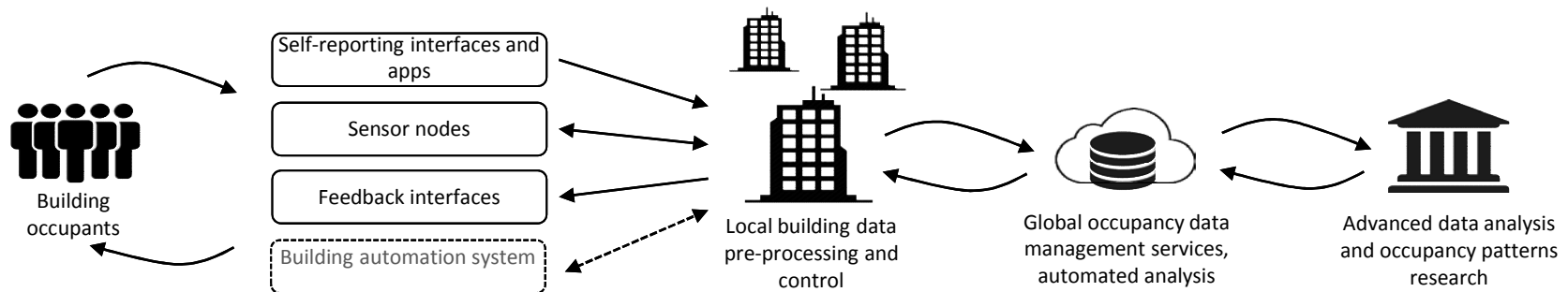
- Large-scale impact using standardized occupancy certification
- Local impact by improvement of energy occupancy feedback





# BOCS as service / product

System for subjective and objective measurement  
of energy occupancy in buildings





# BOCS as service / product

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## Building occupancy certification

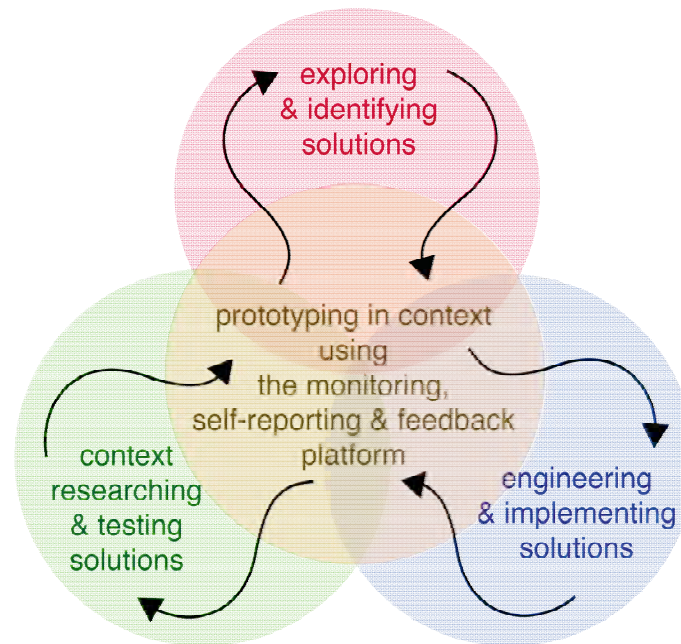
- Inexpensive and easy to deploy
- Non-obtrusive in work environment
- Yearly monitoring intervals





# Approach

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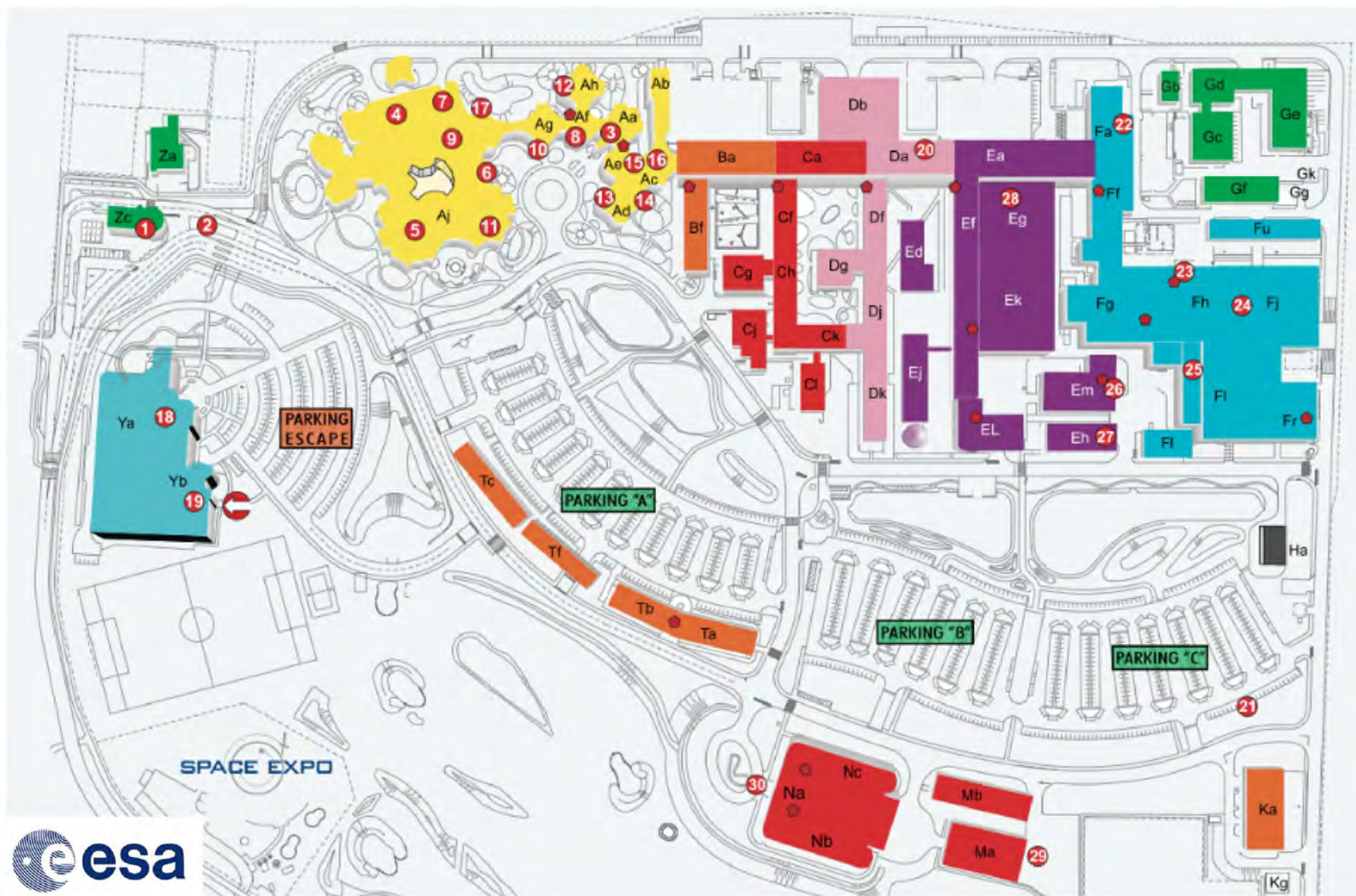
### Situation now:



### Things we aim to add to influence practices:

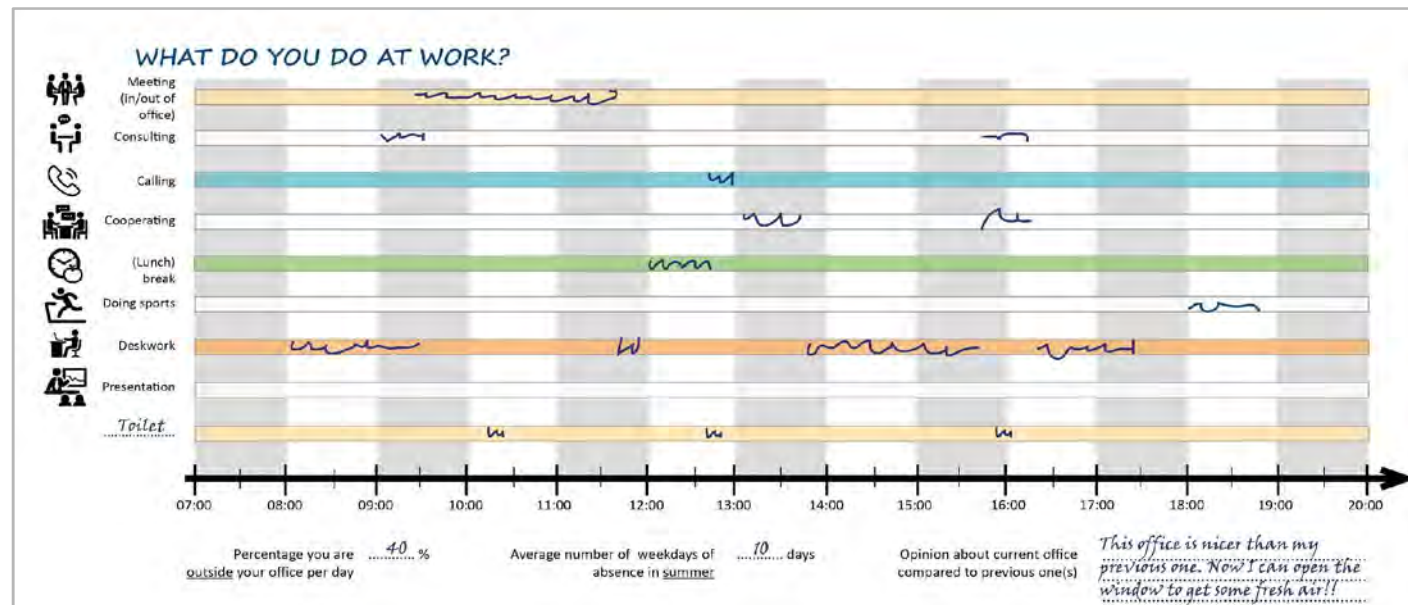








# Contextual Questionnaire









## Sketchy storyboard: observed practices vs. data.





# SusLab Sensor

Light, Noise, Humidity, Motion, Dust, Temp, CO<sup>2</sup>

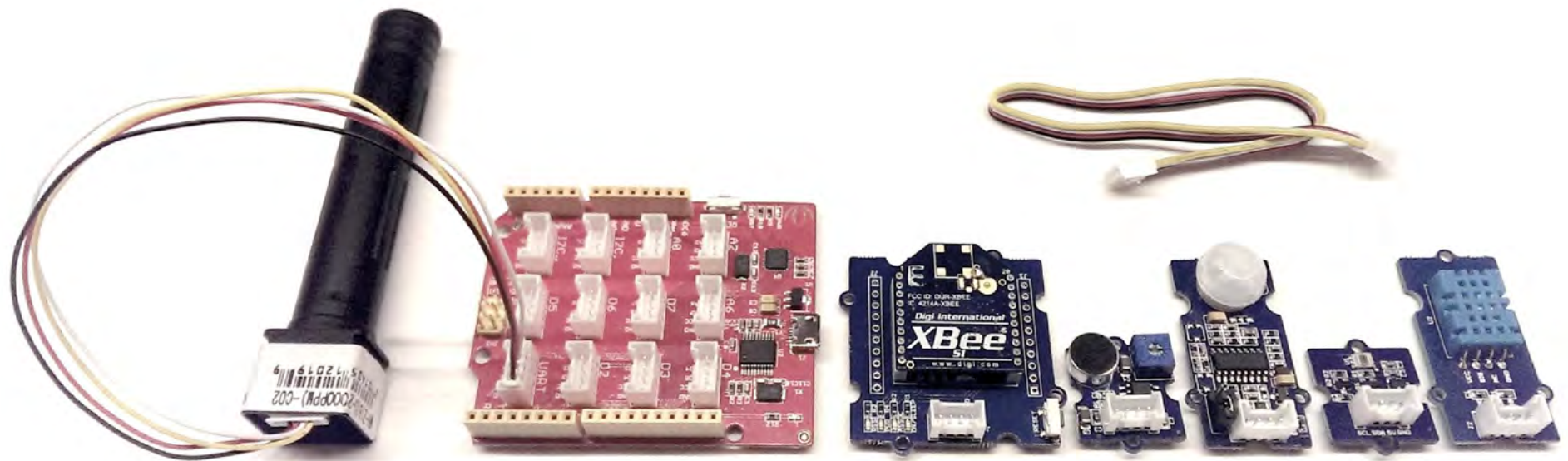




# BOCS as service / product

## Flexible approach to hardware and software

allows modification and adaptation of the system iteratively throughout the development

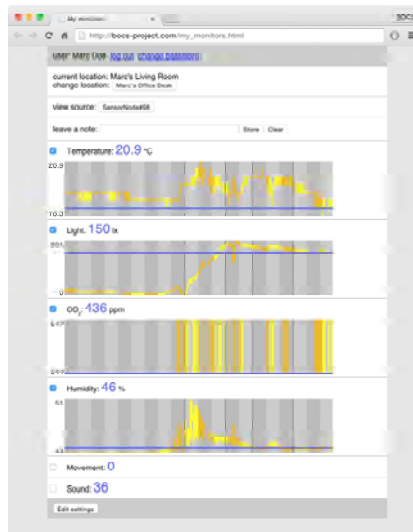




# Rapid Co-Design



Self-reporting, feedback displays, and sensor units





# BOCS as service / product



## Next steps

- Self-reporting app that will be engaging and simple to use
- Inexpensive sensors primarily for self-reporting verification
- Embedded within the social practices of the office environment
- Not relying on any specific building infrastructure, though BMS link potential for area comfort



source: [www.cubesensors.com](http://www.cubesensors.com)