One Heddon Street © Phillip Vile

TAPAS

Perspectives:

CIBSE Air Quality Working Group & Cundall

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Who am I?

- Chartered Engineer (CEng MCIBSE)
- 13 years' experience mainly in Building Physics & Mechanical Design
- 10 Years at Cundall (London, Hong Kong, and Shanghai)
- Professional interests include:
    - Air quality
    - Building physics
    - Digital engineering
    - Big data & IoT
    - Data-analytics & machine learning.
    - Biotech in the built environment.

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Why the interest in air quality?

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CIBSE Air Quality Group and Knowledge Generation Panel

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AQG - Mission statement

Use engineering skill to support the pursuit of healthy air quality in the built environment

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Why are we doing it?

UK air pollution 'linked to 40,000 early deaths a year'

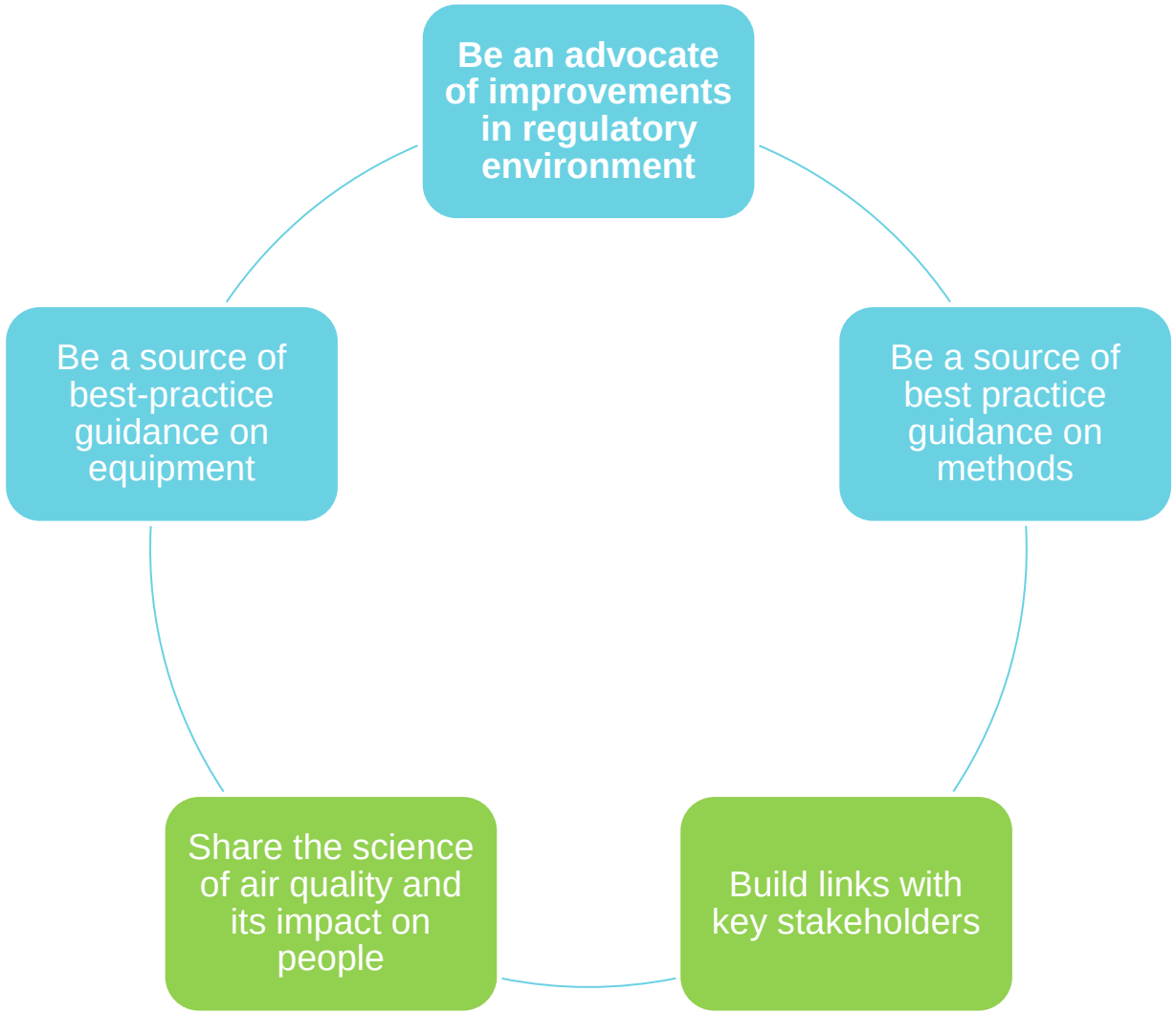
4.2 million

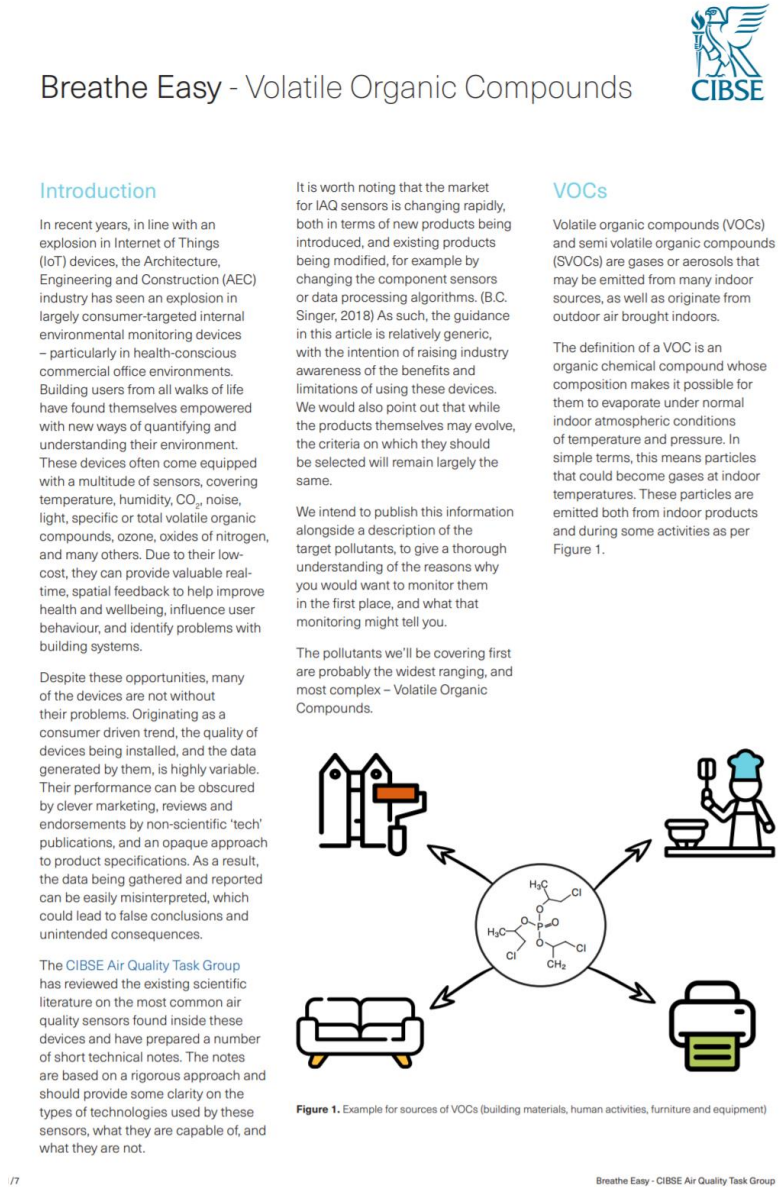
deaths every year as a result of exposure to ambient (outdoor) air pollution

Study of 2,000 children suggests London air pollution is restricting lung development

90% of world's children are breathing toxic air, WHO study finds

What are we doing?





Breathe Easy - Volatile Organic Compounds

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Introduction

In recent years, in line with an explosion in Internet of Things (IoT) devices, the Architecture, Engineering and Construction (AEC) industry has seen an explosion in largely consumer-targeted internal environmental monitoring devices – particularly in health-conscious commercial office environments. Building users from all walks of life have found themselves empowered with new ways of quantifying and understanding their environment. These devices often come equipped with a multitude of sensors, covering temperature, humidity, CO_2, noise, light, specific or total volatile organic compounds, ozone, oxides of nitrogen, and many others. Due to their low-cost, they can provide valuable real-time, spatial feedback to help improve health and wellbeing, influence user behaviour, and identify problems with building systems.

Despite these opportunities, many of the devices are not without their problems. Originating as a consumer driven trend, the quality of devices being installed, and the data generated by them, is highly variable. Their performance can be obscured by clever marketing, reviews and endorsements by non-scientific 'tech' publications, and an opaque approach to product specifications. As a result, the data being gathered and reported can be easily misinterpreted, which could lead to false conclusions and unintended consequences.

The CIBSE Air Quality Task Group has reviewed the existing scientific literature on the most common air quality sensors found inside these devices and have prepared a number of short technical notes. The notes are based on a rigorous approach and should provide some clarity on the types of technologies used by these sensors, what they are capable of, and what they are not.

It is worth noting that the market for IAQ sensors is changing rapidly, both in terms of new products being introduced, and existing products being modified, for example by changing the component sensors or data processing algorithms. (B.C. Singer, 2018) As such, the guidance in this article is relatively generic, with the intention of raising industry awareness of the benefits and limitations of using these devices. We would also point out that while the products themselves may evolve, the criteria on which they should be selected will remain largely the same.

We intend to publish this information alongside a description of the target pollutants, to give a thorough understanding of the reasons why you would want to monitor them in the first place, and what that monitoring might tell you.

The pollutants we'll be covering first are probably the widest ranging, and most complex – Volatile Organic Compounds.

VOCs

Volatile organic compounds (VOCs) and semi volatile organic compounds (SVOCs) are gases or aerosols that may be emitted from many indoor sources, as well as originate from outdoor air brought indoors.

The definition of a VOC is an organic chemical compound whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure. In simple terms, this means particles that could become gases at indoor temperatures. These particles are emitted both from indoor products and during some activities as per Figure 1.

Figure 1. Example for sources of VOCs (building materials, human activities, furniture and equipment)

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Breathe Easy - CIBSE Air Quality Task Group

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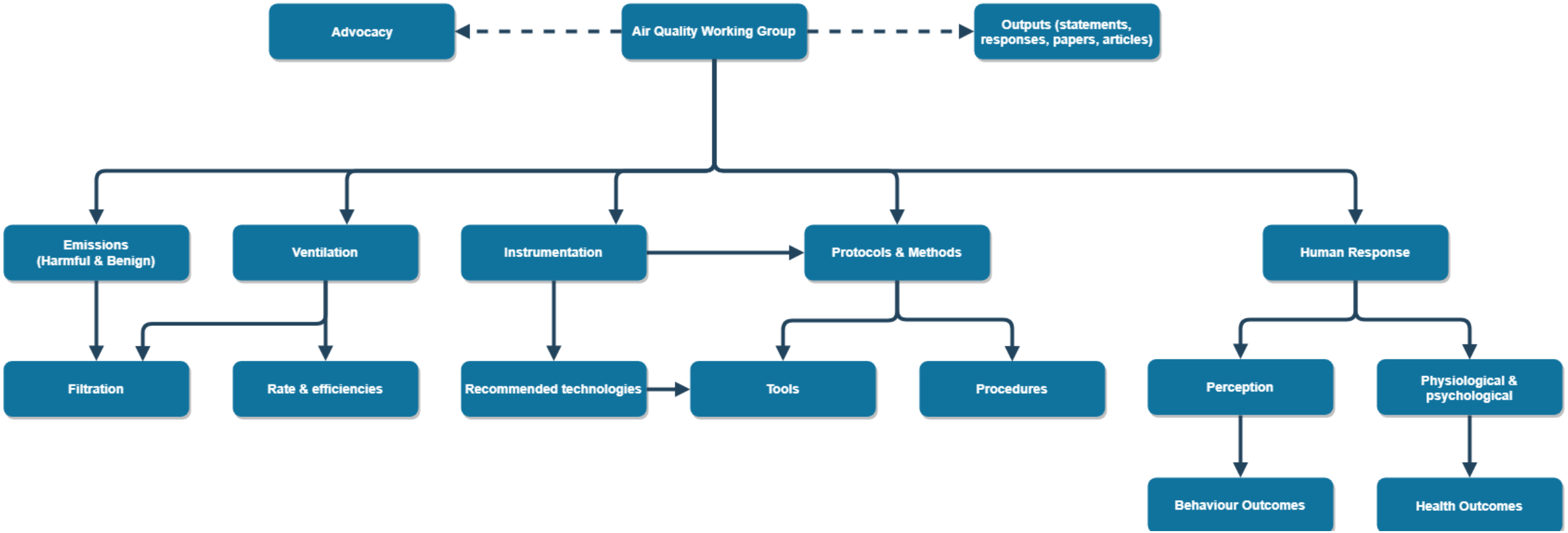
What areas does that cover?



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Who is doing it?

Building services engineers

Air quality consultants

Measuring and monitoring specialists

Academic specialists

Industry bodies

Public health professionals

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What can we do for TAPAS

- Provide real-life gaps in knowledge!
  - E.g. impact of outdoor levels on indoor levels
- Provide route to dissemination
- Provide a multi-disciplinary group of practitioners
- Provide a link to other CIBSE groups


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About Cundall

950+
OFFICES GLOBALLY

ESTABLISHED IN
1976

950+
PEOPLE WORLDWIDE

500+
AWARDS WON

PROJECTS DELIVERED IN
50+ COUNTRIES

35+
LANGUAGES

1st
ONE PLANET COMPANY

2020
NET ZERO CARBON

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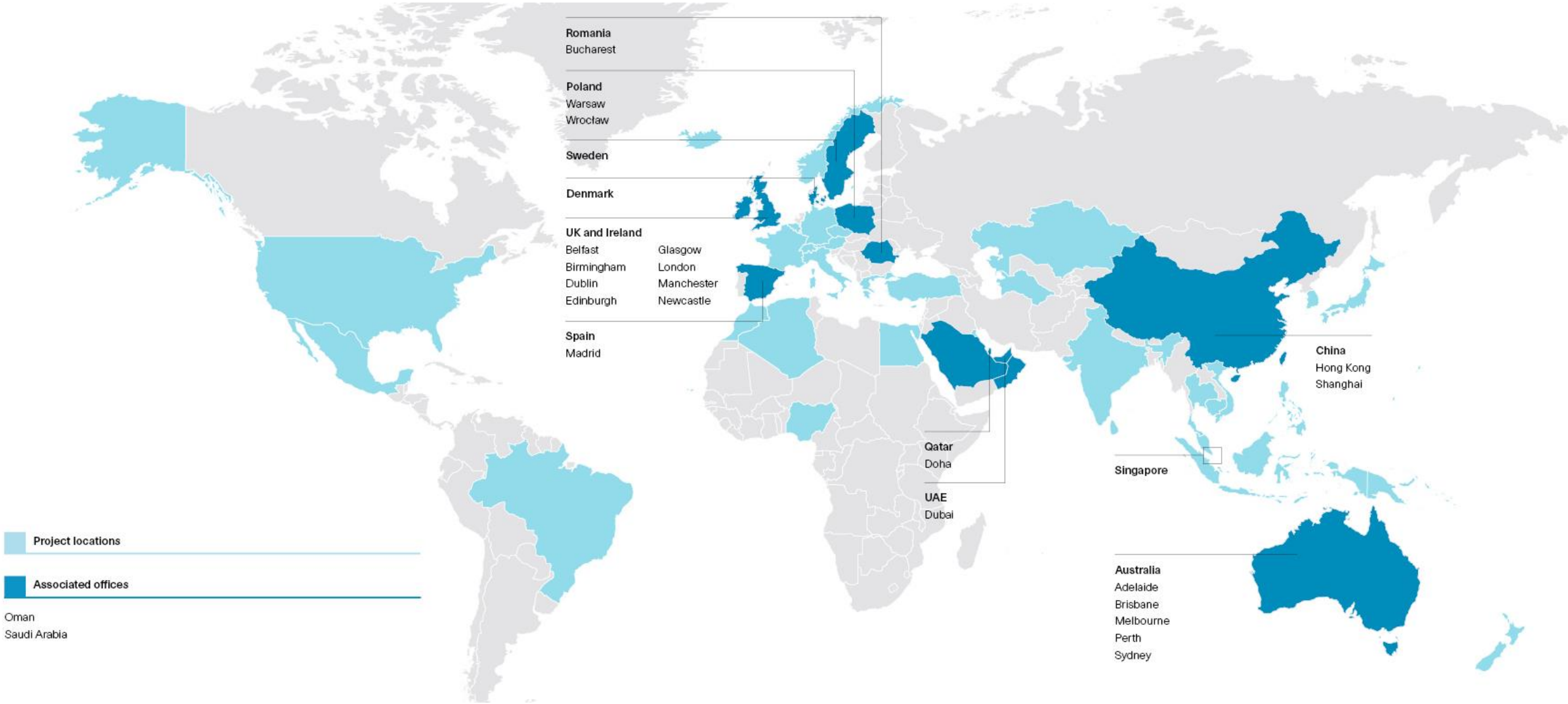
Our Locations



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Cundall Services

Acoustic engineering

Air quality

Building automation

Building information modelling (BIM)

Building services engineering

CDM consultancy

Civil engineering

Fire engineering

Geotechnical

Health and wellbeing

IT and audio visual

Lighting design

Planning

Security consultancy

Structural engineering

Sustainability

Transportation

Vertical transportation

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One Planet | One Chance

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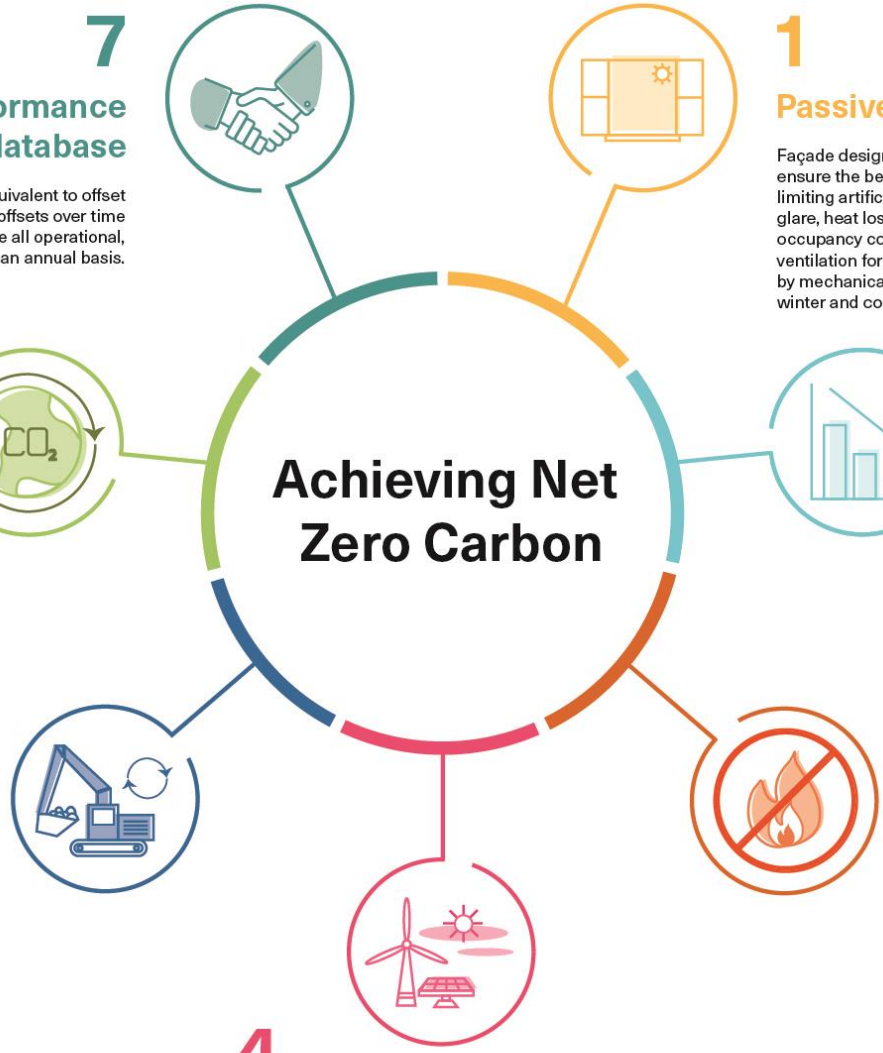
Achieving Net Zero Carbon



1
Passive design optimisation

Façade design is key. Utilise the useful daylight index to ensure the best possible daylight for occupants, whilst limiting artificial lighting use, reducing glazing areas, glare, heat loss, cooling loads and improving views and occupancy comfort. This enables full or partial natural ventilation for a proportion of the year, supplemented by mechanical systems to provide heat recovery in winter and cooling in summer where required.

2
Reduce operational energy demand and consumption

Prioritise fabric measures to drive down heating, cooling and lighting demand. Widen temperature set bands and allow occupants to adapt and control their own comfort by adjusting clothing, using fans and natural air flow. Review drivers of energy consumption to determine suitable alternate approaches that can be taken. Challenge conventional design practices and standards, recognising that the same solutions will result in the same energy intensive buildings and looking for alternative solutions. Utilise industry standards approaches like NABERS, Passivhaus and Design for Performance to embed energy savings at every stage and meet best practice energy intensity targets.

3
Eliminate fossil fuels

Prioritise fifth-generation heat networks and electric heat pump technologies over fossil fuel technologies to supply affordable low carbon energy. When considered in conjunction with zero emission vehicles, this will significantly improve local air quality.

4
Provide onsite renewable energy and storage where possible

Supply all remaining energy from on-site technologies or off-site renewable certified energy sources.

5
Limit upfront embodied carbon

Consider all upfront carbon associated with the initial build and restrict carbon intensity to a maximum of 500kg CO_2/m^2. This applies to all construction materials from extraction to installation, including the emissions associated with the construction works themselves. Use modular construction approaches, design for deconstruction using circular economy principles, and limit waste generated during construction.

6
Consider whole life carbon in conjunction with whole life costing

Measure all upfront and operational carbon emissions, including maintenance, fitouts, minor and major refurbishments, deconstruction and the reuse of building materials. All this must be considered over an extended design life allowing for durability and robustness.

7
Publicly disclose performance annually using the WRAP database

Use Gold Standard carbon offset schemes or equivalent to offset any residual emissions with the aim of reducing offsets over time through further on site reductions. Publicly disclose all operational, embodied and whole-life carbon on an annual basis.

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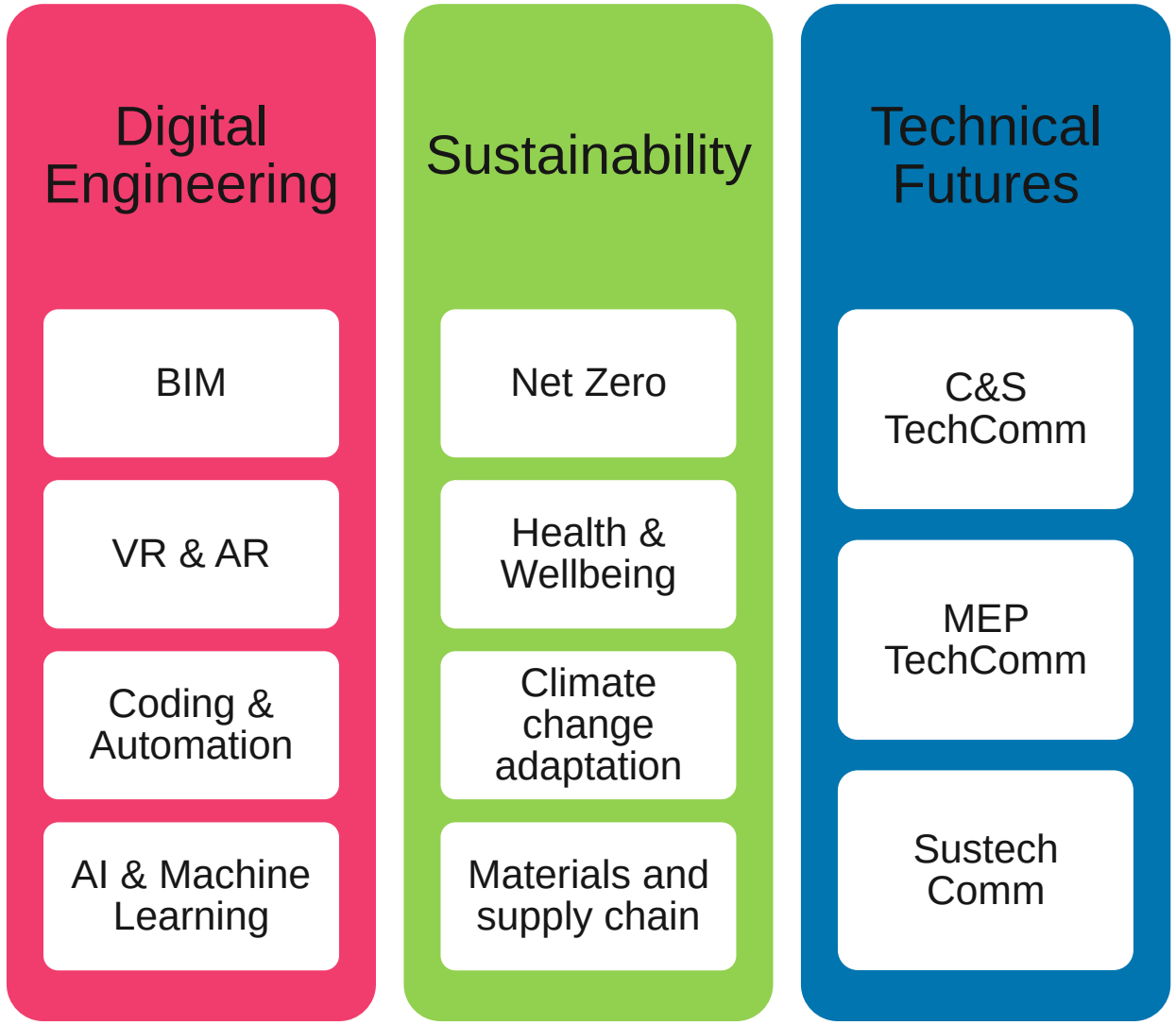
Cundall Research

We are trying to select projects and research which align with core business strategies.

- Sustainability
- Digital Engineering
- Technical Excellence

We have tried to be selective about who we partner with (universities, companies).

We want to align with our client and lead-users (e.g. architects) priorities.



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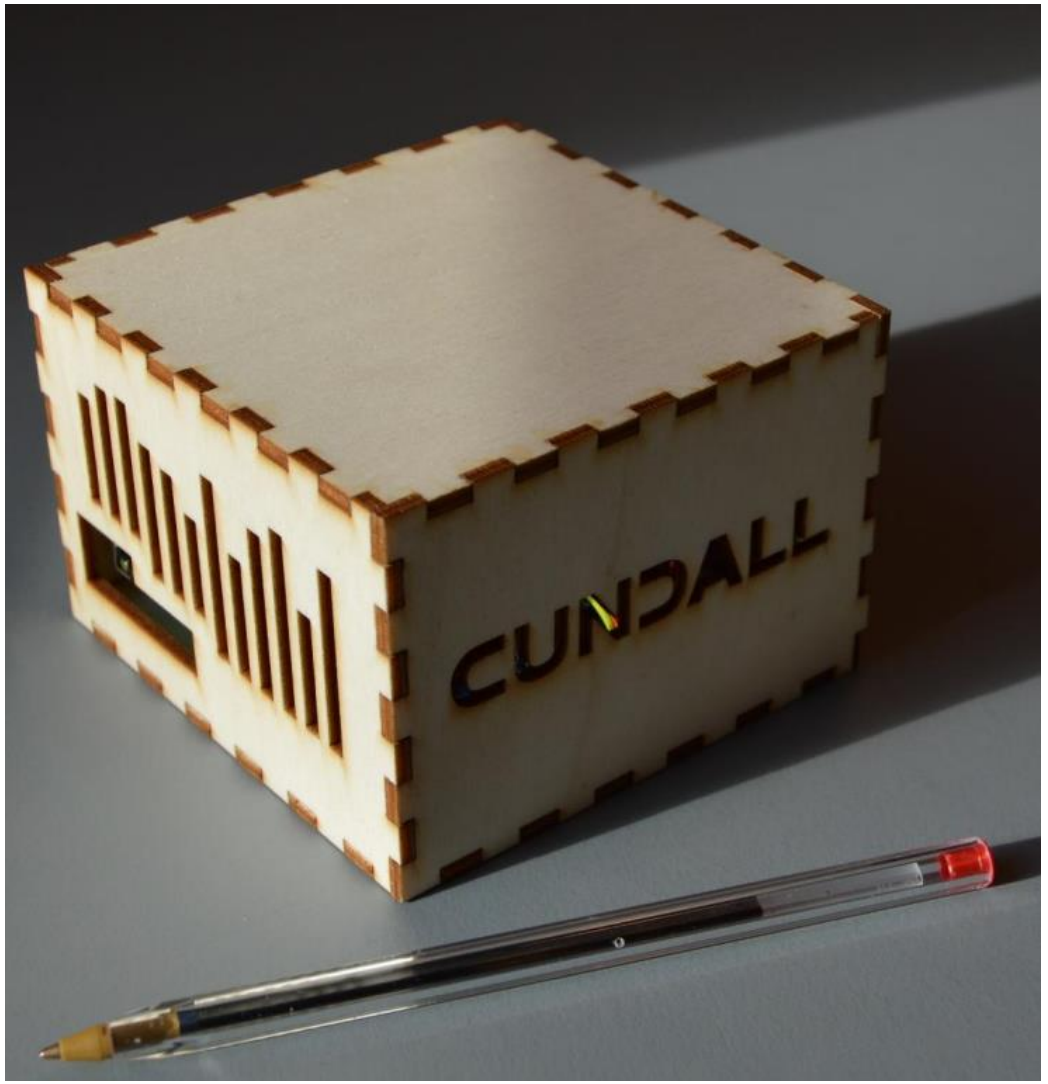
Cundall Research

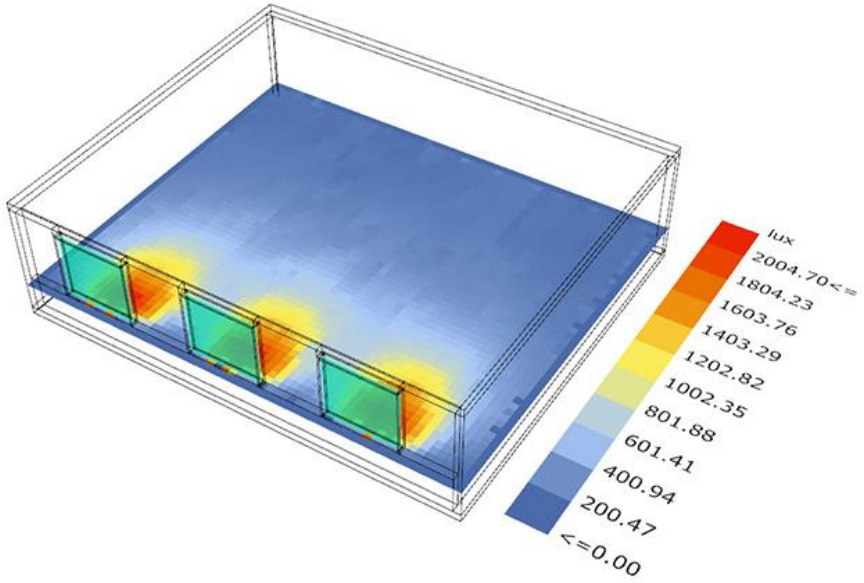
Small team with ability to:

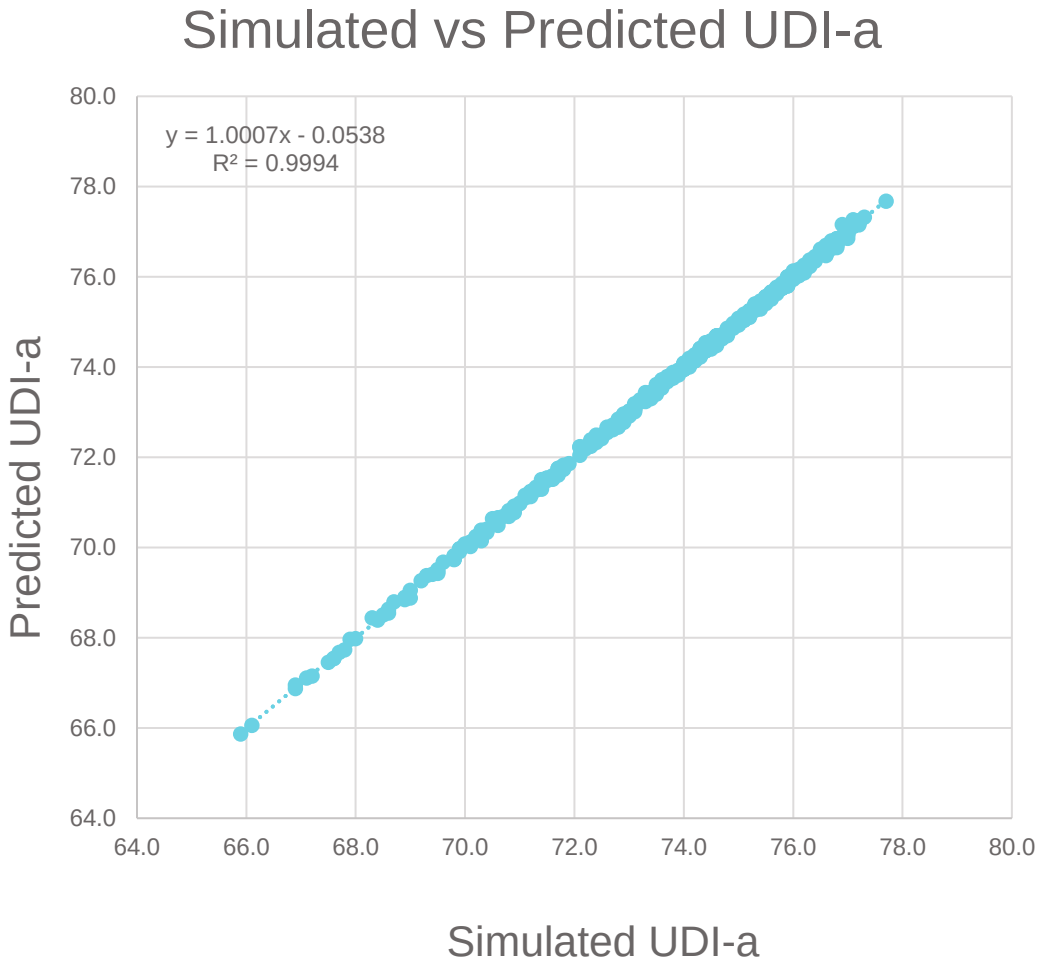
- Seek relationships with clients and institutions who may innovate or help us to innovate
- Understand market demands, and opportunities for us
- Develop thought leadership

Examples – Internal Research



Examples – Daylight prediction with neural networks





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