OPENAIR

Operational Network of
Air quality Impact Resources

Best Practice Guide

BP106 | Identify

Smart air quality monitoring

Introduction

Smart air quality monitoring is a rapidly emerging field that involves the use of smart low-cost sensing networks to capture data about air quality at the community scale, where people live, work, and play. This kind of monitoring makes air quality information easily available to local governments, communities, and researchers, and helps to support air quality action.

This OPENAIR Best Practice Guide chapter introduces smart air quality monitoring as a practical way to learn about – and respond to – ambient outdoor air quality issues at a local scale. It establishes smart sensing as a smart city activity that is accessible to local governments, and discusses the benefits these types of projects can deliver.

The OPENAIR project aims to increase the uptake of smart low-cost air quality monitoring in New South Wales (NSW) and across Australia through two main strategies:

1. **Supporting collaboration** between local governments, state government authorities, the wider community, universities, and the private sector by nurturing and growing a community of practice (see the OPENAIR Best Practice Guide chapter *Building a community of practice: networks, collaboration, and wider impact creation*)
2. **Establishing best practice for smart air quality monitoring** to ensure that trusted, useable, and reliable data is appropriately collected, interpreted, managed, and shared for the benefit of everyone.

Who is this resource for?

This chapter is a guide for local governments tasked with designing and delivering a smart low-cost air quality monitoring project, and may be useful to staff in the following roles:

- people leading new air quality monitoring projects
- information, communication and technology professionals
- elected local government leaders and senior management
- urban designers
- community engagement teams
- planners
- environmental officers.

How to use this resource

This chapter is a non-technical introduction to the topic of smart air quality monitoring. It is written primarily for local governments considering the use of air quality sensing devices in their local area.

The information within this chapter should be considered foundational to any initiative that engages with smart air quality monitoring, and should inform your approach to the project from the very beginning.

The benefits of smart air quality monitoring

A smart low-cost sensing device. Image source: Clarity Movement Co.

Smart low-cost sensing devices are generally easy to set up, install, and operate. They can be a game changer for local governments, enabling measurements of air quality at a scale that really matters to the communities that they serve.

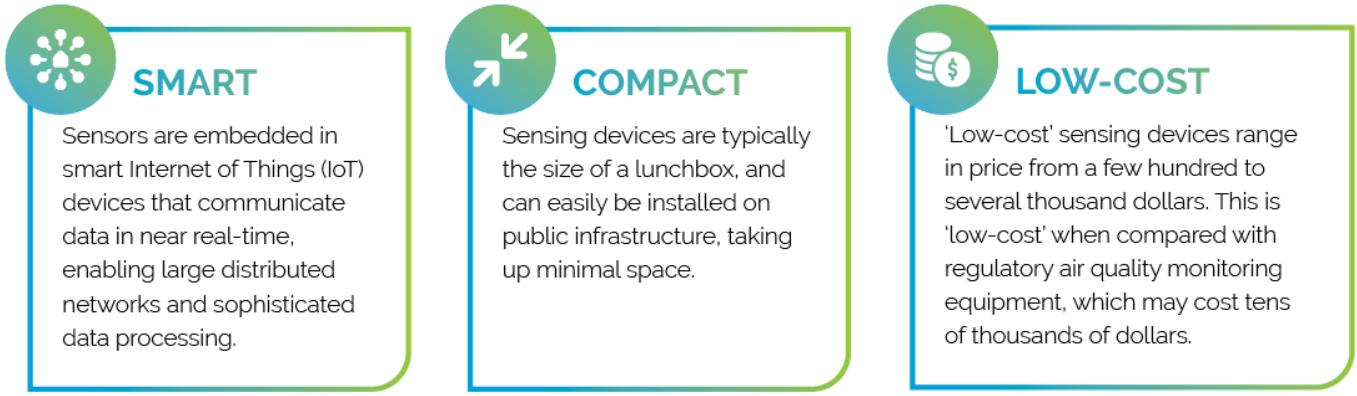
There are many benefits to smart air quality monitoring projects at local government level, such as:

- **gathering reliable air quality information at the community scale**, where people live, work, and play
- **contributing to a better understanding of highly localised pollution hotspots**, which in turn supports policy development, priority activities, and communications, and enables informed, evidence-based engagement with authorities (such as the EPA)
- **supporting community participation and education** through citizen science projects and community involvement
- **generating deeper, place-based data insights** by using data from smart low-cost air quality sensing devices alongside other local data (e.g. traffic flow)
- **using live data to support targeted, real-time responses to local events** (e.g. highly localised public alerts on bushfire smoke levels and associated asthma risk)
- **enabling local governments and communities to develop their own air quality agenda** by using accessible, affordable sensing technology that generates locally relevant data
- **allowing local governments to manage and share air quality data on their terms**, in accordance with their own policies and strategies
- **providing more flexible technology options** to suit different needs and budgets.

Air quality monitoring for smart places

Smart air quality monitoring is fundamentally a smart city activity, and should be approached as such by local governments. The aim of a smart city or place is to connect people, place, and technology to create outcomes that support a better quality of life for all. This includes improved public health, environmental sustainability, a thriving economy, and a strong, fair, and democratic civic culture.

Smart air quality sensing devices are:



Good smart city practice is informed by two core principles:

1. **People first**
   Air quality affects us all, and smart air quality monitoring is a powerful new tool to support community engagement and participation. Make sure you put the needs of your community front and centre, and include citizens as active co-creators of smart solutions and outcomes.

2. **Integration**
   Smart air quality monitoring should be established as part of a broader, growing ecosystem of smart technologies and data flows. This means making sure it is integrated with the operational processes of local government, and with the broader social and institutional landscape of a place. This kind of integration supports real-world, practical outcomes across your entire organisation (e.g. transport planning, urban greening policy, events co-ordination, or community services).

For more information about smart places and cities, please refer to the OPENAIR Best Practice Guide chapter *Smart places best practice*.

Different types and scales of air quality monitoring

Until recently, the only type of air quality monitoring at significant scale was regulatory monitoring, which is conducted by state government agencies. With the development of the Internet of Things (IoT) and smart cities, smart low-cost sensing devices are now driving a paradigm shift in how air quality can be monitored, dramatically improving understandings of – and responses to – air quality issues at a local level. Figure 1 shows the different types and scales of air quality monitoring that are possible.

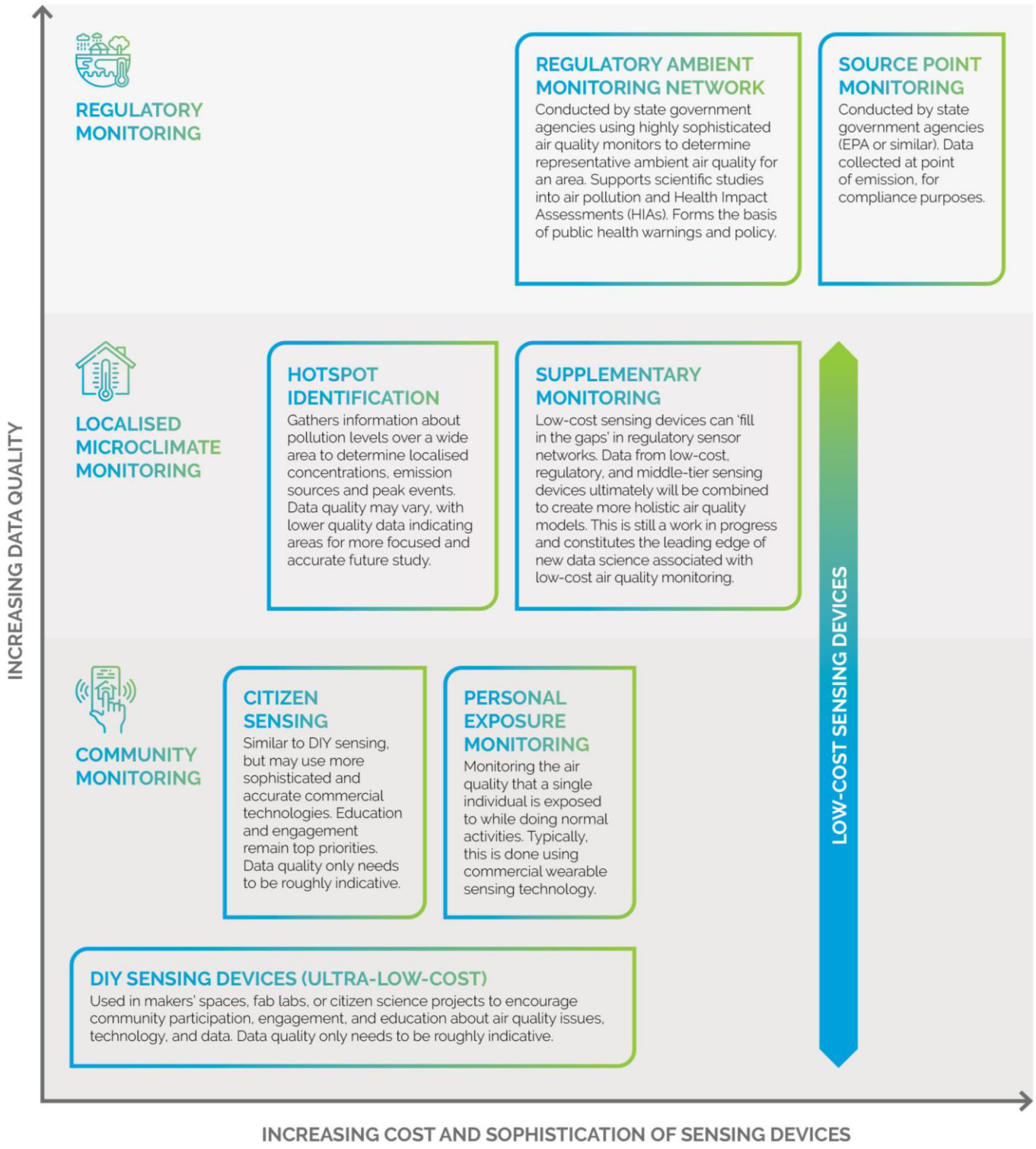


Figure 1. Different types and scales of air quality monitoring

Smart low-cost sensing devices can fill regulatory monitoring gaps

Regulatory monitoring stations are located based on several factors including population and the availability of suitable infrastructure. The relatively low number of these stations mean that they tend to provide an accurate overview of average air quality for a town or district. However, air quality can vary significantly at different scales, with some places experiencing highly localised pollution that affects specific neighbourhoods or even streets.

Smart low-cost sensing devices can fill in these gaps in the regulatory monitoring networks. This makes it possible to improve understandings of how air pollution is formed and dispersed, how it affects vulnerable populations, and how to reduce those impacts. Figure 2 shows how smart low-cost sensing devices can be used to gather air quality data at local pollution hotspots.

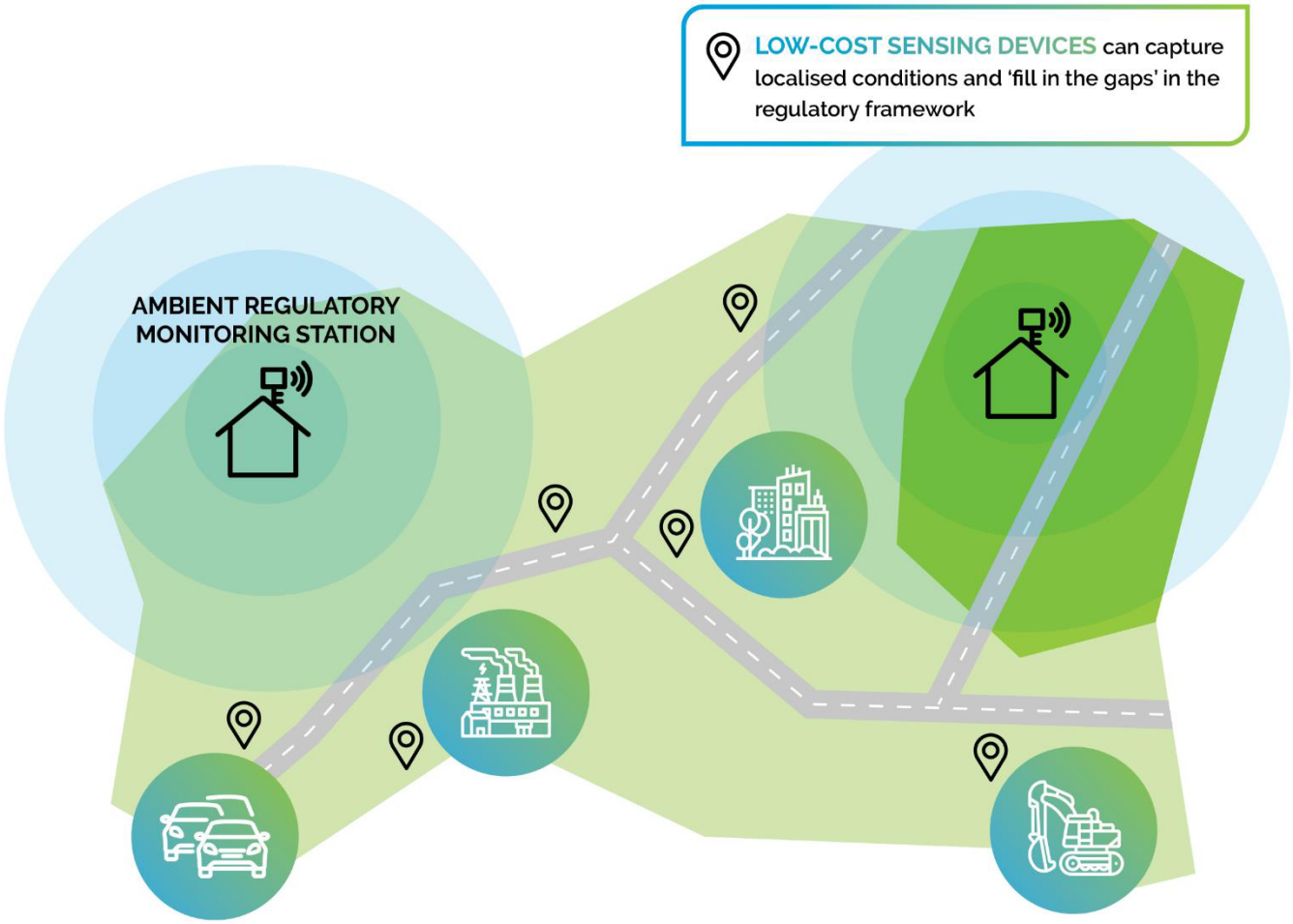


Figure 2. Smart low-cost sensing devices at multiple locations can measure air quality at local pollution hotspots

The emerging role of smart air quality monitoring

A smart air quality sensing device deployed next to urban bushland in Lake Macquarie, NSW. Image source: UTS

Smart air quality monitoring is an emerging field that uses a range of new sensing technologies to more accurately measure, understand, and respond to air quality issues at the local scale.

All air quality monitoring technologies have an important role to play, regardless of whether they are classified as regulatory-grade equipment, 'low-cost', or ultra-low-cost sensing devices (often used by citizen scientists). Each has a distinct purpose and set of technical and operational requirements. A hybrid and complementary approach to data gathering and interpretation across all of these scales holds the most promise for understanding and responding to urban air quality concerns now and into the future.

Additional resources

Environmental Defense Fund | Making the invisible visible: A guide for mapping hyperlocal air pollution to drive clean air action

This guide (created by the New York City-based Environmental Defense Fund) provides a comprehensive overview of many different aspects of designing and delivering a smart low-cost air quality monitoring network.

Environmental Defense Fund | The Breathe London Blueprint: How cities can use hyperlocal air pollution monitoring to support their clean air goals

Informed by the *Breathe London* project, this guide (created by Environmental Defense Fund Europe) provides valuable insights and practical advice on how to design and deliver a hyperlocal air quality monitoring project capable of accelerating clean air action.

Improving the Smart Control of Air Pollution in Europe (iSCAPE) | iSCAPE 'Knowledge Package'

iSCAPE (a European research and innovation project active from September 2016 to December 2019) focused on the use of smart air quality monitoring by city governments. Their 'Knowledge Package' is a collection of practical resources aimed at local governments, including the *iSCAPE Playbook* and the *Living Lab Guidebook for Cities fighting against Air Pollution*.

United States Environmental Protection Agency (U.S. EPA) | Air Sensor Toolbox

The Air Sensor Toolbox (produced by the U.S. EPA) is an extensive list of resources related to the technical aspects of smart air quality monitoring.

Associated OPENAIR resources

Best Practice Guide chapters

Building a community of practice: networks, collaboration, and wider impact creation

This Best Practice Guide chapter introduces the idea of a community of practice for smart air quality monitoring. By connecting with others, knowledge and insights can be shared, collaborations can be created, new funding can be accessed, and increased value and impact for communities can be leveraged. This resource provides guidance on three domains of community building: within one's own organisation; within the local community; and at a larger scale (state/national/global).

Smart places best practice

This Best Practice Guide chapter positions smart air quality monitoring as a smart city activity that should be guided by smart city best practice.

Further information

For more information about this project, please contact:

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This Best Practice Guide section is part of a suite of resources designed to support local government action on air quality through the use of smart low-cost sensing technologies. It is the first Australian project of its kind. Visit www.openair.org.au for more information.

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