VISIONAIR

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INCREASING THE VISIBILITY AND KNOWLEDGE BASE ON AIR QUALITY WITH BIG DATA AND ITS IMPACT ON THE POPULATION HEALTH

Erasmus+ KA220 Cooperation Partnerships

CLEANER AIR IN PRACTICE

Manual for national, local and individual action

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Reading Guide

Label	Meaning in this manual
Legal requirement	A rule or limit that must be checked against the applicable law and implementation date.
Health guideline	A science-based benchmark for protecting health. A guideline is not automatically a legal limit.
Recommendation	A practical action that should be adapted to local conditions, budget and evidence.
Illustrative calculation	A transparent decision aid with assumptions. It is not a guaranteed financial result.

hy Air Quality Matters

Air pollution is a health, environmental and economic issue. It affects how people breathe, work, travel, learn and use public space. It also affects public budgets through healthcare demand, missed working days, maintenance costs and the need to adapt infrastructure. *The European Environment Agency (EEA)* describes air pollution as Europe's greatest environmental health risk. Although concentrations have declined over the past two decades, the latest EEA status report shows that additional action is still needed.

The pollutants most often discussed in this manual are particulate matter with diameters of up to 2.5 and 10 micrometres (PM2.5 and PM10), nitrogen dioxide (NO2), ground-level ozone (O3), sulphur dioxide (SO2) and benzo(a)pyrene (BaP). Their sources vary by place and season:

- **Road transport** contributes exhaust emissions, tyre and brake wear, and resuspended road dust. NO2 is especially relevant near busy roads.
- **Domestic heating** can be a major source of particulate pollution in colder regions, particularly where inefficient appliances or unsuitable fuels are used.
- **Industry and energy production** can contribute particulate matter, NOx, SO2 and other pollutants when emissions are not prevented or controlled.
- **Agriculture** contributes ammonia, which is involved in the formation of secondary particulate matter.
- **Shipping and ports** matter for coastal areas and cities with significant maritime traffic.
- **Natural conditions** such as temperature inversions, drought or transported dust can worsen episodes and influence how measured concentrations should be interpreted.

Health impacts are not limited to visible smog. Fine particles can penetrate deep into the lungs, and smaller particles are associated with cardiovascular and respiratory harm. NO2 is closely associated with combustion sources and traffic exposure. Ground-level ozone is formed through atmospheric reactions and can worsen respiratory symptoms. The same pollutant may require different responses depending on whether the problem is a long-term annual exposure, a recurring seasonal pattern or a short pollution episode.

A practical action model

Air-quality work succeeds when responsibilities reinforce one another. National authorities set standards, reporting duties and funding mechanisms. Cities and municipalities translate those rules into mobility, heating, land-use and communication decisions. Organisations manage their own sites, fleets and procurement. Individuals reduce exposure and make informed choices. Monitoring and social equity connect every level.

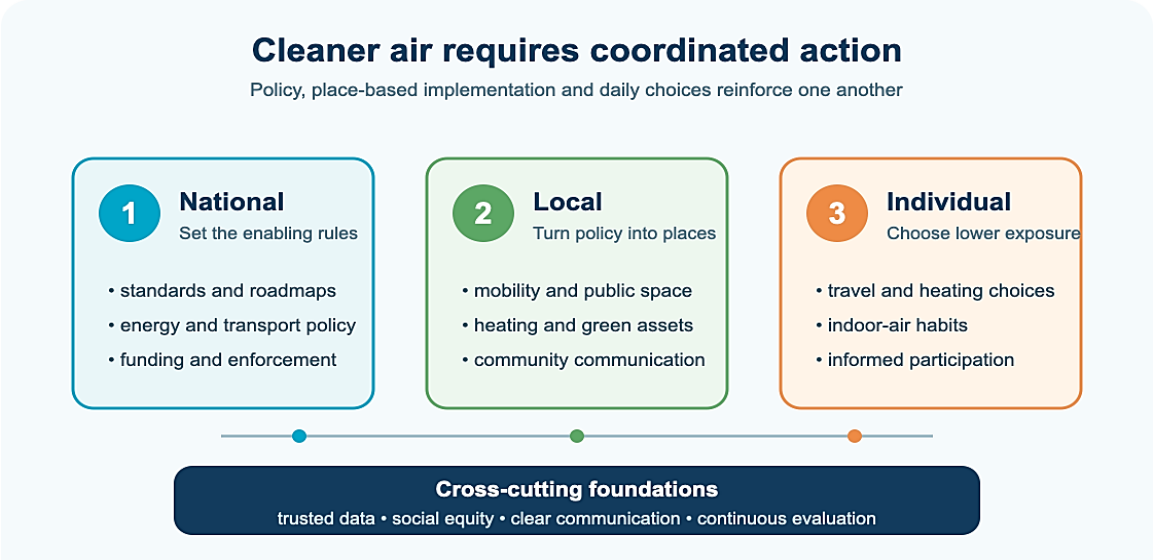


Figure 1 VISIONAIR action framework. Source: VISIONAIR manual authors, 2026.

Five principles

1. **Protect health first.** Use the stricter WHO guidelines to understand the health ambition, while clearly separating them from legally binding EU and national requirements.
2. **Measure before and after action.** A measure needs a baseline, an implementation record and an evaluation method.
3. **Match the response to the source.** A traffic hotspot needs a different intervention package from a winter heating problem or a port-related issue.
4. **Design for affordability.** A technically sound measure can fail if vulnerable households cannot comply or if support is inaccessible.
5. **Communicate uncertainty honestly.** Preliminary data, modelled maps, low-cost sensors and regulatory stations answer different questions.

From observation to action

Use the same short workflow before proposing a measure. This prevents a project from starting with a preferred technology rather than a documented problem.

Step	Ask	Record
Observe	What pattern is visible, and over what period?	Pollutant, place, averaging period and dataset
Verify	Is the evidence official, supplementary, modelled or anecdotal?	Source, validation status and limitations
Explain	Which sources are plausible and what evidence supports them?	Source hypothesis and contextual data
Design	Which level of government or organisation can act?	Owner, intervention package and timeline
Deliver	Who may face barriers to participation or compliance?	Affordability, access and communication actions
Review	How will the result be compared with baseline?	Indicator, review date and publication method

Read the Numbers Correctly

WHO guidelines are not EU legal limits

The *WHO Global Air Quality Guidelines 2021* provide health-based recommendations. They are deliberately ambitious and are not legally binding by themselves. EU limit values are legal standards. A city or country can comply with a current legal limit while still remaining above a WHO guideline. Both comparisons are useful, but they answer different questions.

Pollutant	WHO 2021 AQG annual	WHO 2021 AQG 24-hour	Current EU annual limit	EU annual limit to be attained by 2030
PM2.5	5 µg/m^3	15 µg/m^3	25 µg/m^3	10 µg/m^3
PM10	15 µg/m^3	45 µg/m^3	40 µg/m^3	20 µg/m^3
NO2	10 µg/m^3	25 µg/m^3	40 µg/m^3	20 µg/m^3

Table 1 Selected WHO guidelines and EU annual limit values. Sources: WHO, 2021; Directive (EU) 2024/2881. WHO 24-hour AQG levels use the percentile definitions specified by WHO.

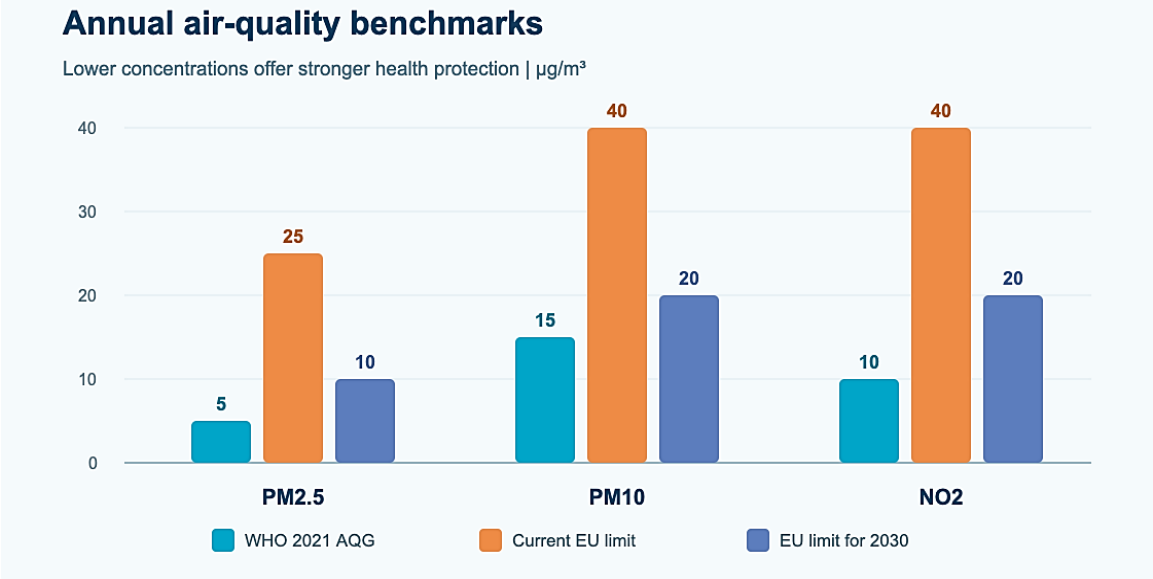


Figure 2 Annual air-quality benchmarks. Sources: WHO, 2021; Directive (EU) 2024/2881. Graphic: VISIONAIR manual authors, 2026.

Directive (EU) 2024/2881: use the timeline

The revised Ambient Air Quality Directive *(EU) 2024/2881* entered into force on **10 December 2024**. Member States must transpose it by **11 December 2026**. Its stricter limit values are to be attained by **1 January 2030**.

This sequence matters. The 2030 values are useful for planning and distance-to-target analysis. They are not the same as today's compliance test. The EEA states that its 2024-data comparison with the revised standards is a preliminary distance-to-target analysis rather than a compliance assessment.

Date	What it means for implementers
10 December 2024	Revised Directive entered into force.
2026–2029	Where levels are above future standards, Member States must assess whether they are on track and prepare roadmaps where required.
11 December 2026	National transposition deadline.
1 January 2030	Revised limit values must be attained.

Use the newest report without mislabelling the data year

The EEA publication *Air quality status in Europe 2026* was published on **30 April 2026**, but it analyses reported concentrations for **2024** and preliminary information for **2025**. A publication year is not the same as a measurement year.

The report states that more than nine out of ten Europeans are exposed to concentrations above WHO guideline levels. For annual PM2.5, only **166 of 2,223** reporting stations in 2024 were below the WHO AQG level. These figures show why legal compliance and health protection should be discussed separately.

Interpret measurements in context

Before drawing conclusions from a chart or dashboard, record:

- pollutant and averaging period;
- station type and location;
- measurement year and whether the data are validated or preliminary;
- benchmark used: WHO guideline, current legal standard or future planning threshold;
- relevant meteorology and seasonal conditions;
- source contribution evidence, if available.

Publish a data note with every chart

A chart is a numerical claim. Place a compact source line below every graphic or dashboard panel and retain the underlying record in the project files.

Required field	Example of the question to answer
Title	Which pollutant, location and time period does the graphic describe?
Data year	Is the year the measurement year, publication year or both?
Validation status	Are the values validated, preliminary, modelled or sensor-based?
Averaging period	Are the values annual, daily, hourly or episode-based?
Benchmark	Is the comparison a WHO guideline, current legal limit or 2030 planning value?
Source	Which official page, dataset or report supports the visual?
Access date	When was a live source last checked?

Build a Trustworthy Monitoring System

Monitoring has two purposes: it describes exposure and it supports decisions. The design should start with the question. A national compliance network, a city hotspot study, a school campaign and an operational dashboard do not require identical equipment or identical interpretation.

Reference stations and supplementary sensors

Regulatory-grade reference stations provide the foundation for compliance assessment and long-term trends. Smaller, lower-cost sensors can add spatial detail, support education and help identify patterns worth investigating. Their readings require documented calibration, quality assurance and careful interpretation. They should not be described as a replacement for the official network.

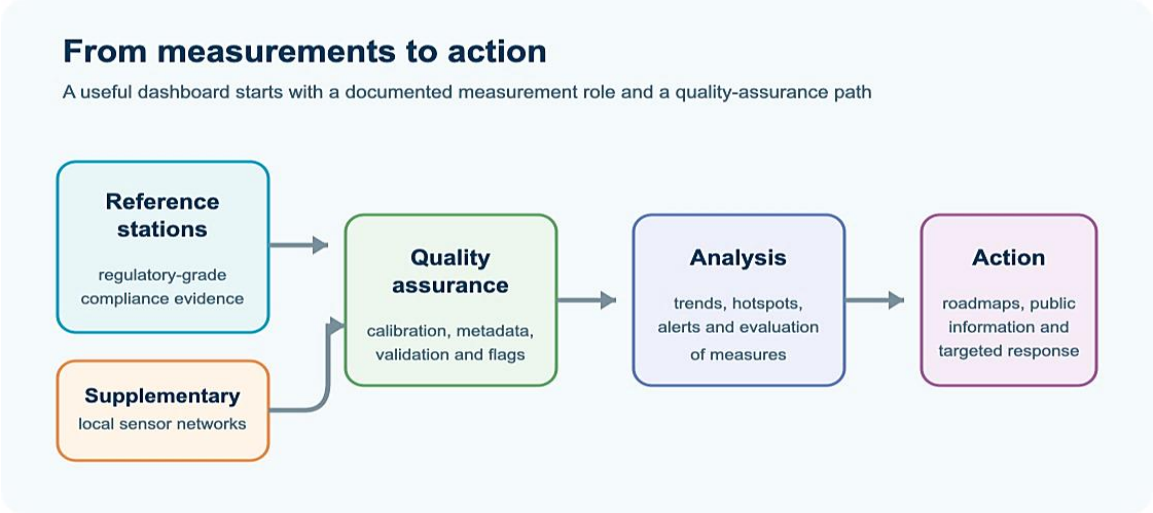


Figure 3 Monitoring data pipeline. Source: VISIONAIR manual authors, 2026. The distinction between regulatory monitoring and supplementary sensing reflects the measurement roles used in European air-quality practice.

A minimum data architecture

Layer	Minimum content	Practical use
Regulatory network	Validated concentrations, station classification, quality-control metadata	Compliance, official reporting and long-term trends

Layer	Minimum content	Practical use
Supplementary network	Sensor identifier, location, calibration status, uptime and data flags	Local patterns, education and screening
Context data	Meteorology, traffic intensity, heating season, land use and known episodes	Interpretation and source analysis
Decision layer	Alerts, hotspot review, intervention log and evaluation dashboard	Targeted action and public communication

An effective local project documents where each dataset comes from, what update interval it uses, who checks it and what decisions it may influence. A polished map without this documentation can create false confidence.

Big data: start with governance

"Big data" is useful only when the collection and decision process is clear. A practical sequence is:

1. define the question, such as school-route exposure, winter heating hotspots or port-related peaks;
2. identify the authoritative datasets and supplementary sources;
3. document calibration, missing-data handling and quality flags;
4. analyse patterns at a scale that fits the evidence;
5. communicate what is measured, modelled or inferred;
6. evaluate whether the chosen action changed exposure or emissions.

Data protection also matters. A public dashboard usually needs pollutant values and locations, not personal data. Household-level programmes should avoid publishing information that identifies vulnerable households.

SPU Nitra prototype: describe it precisely

The Faculty of Economics and Management at the Slovak University of Agriculture in Nitra presented a prototype air-quality monitor developed by its researchers. The *SPU source* describes measurements processed using special algorithms. This manual therefore uses **algorithmic evaluation**, not an unverified claim that the system uses artificial intelligence.

A monitoring procurement checklist

- Define the pollutant, location and decision use before buying devices.
- Require a calibration and maintenance plan.
- Require exportable data, timestamps, sensor metadata and quality flags.
- Separate public-facing simplification from the underlying technical record.
- Plan how measurements will be compared with official stations where appropriate.
- Budget for operation, not only installation.
- Publish a contact point for questions and correction requests.

Dashboard publication guardrails

Guardrail	Why it matters
Show update time and timezone	Users need to know whether a reading is current.
Label validated and preliminary data separately	A rapidly updated value may not have passed the same checks as an official annual assessment.
Describe sensor role	A supplementary device can support screening and education without becoming a compliance station.
Explain missing values	Blank periods, maintenance and calibration should not be silently filled.
Link to methodology	A public-facing simplification needs an accessible route to the technical record.
Preserve an export	Analysts should be able to reproduce a chart and review decisions later.

Act at National Level

National authorities create the enabling conditions for cleaner air. Their strongest levers are law, enforcement, funding, infrastructure, data standards and cross-sector coordination.



Figure 4 National-level action pillars. Source: VISIONAIR manual authors, 2026.

National priorities

1. Implement the revised air-quality framework

Translate Directive (EU) 2024/2881 into clear national responsibilities, timelines and roadmaps. Make current compliance standards and future 2030 standards visible side by side so that planning is not mistaken for legal status.

2. Target the main sources

Use national inventories, official monitoring and source-apportionment work to identify where the largest health gains can be achieved. Priority packages may combine:

- cleaner domestic heating and building renovation;
- industrial emission prevention and best available techniques;
- public transport and rail investment;
- fleet renewal and charging infrastructure;
- agricultural ammonia measures;

- energy efficiency and renewable energy deployment.

3. Fund implementation that people can use

Support schemes should have plain eligibility rules, practical application support and an equity component. A subsidy that excludes households with limited upfront cash or administrative capacity may not reach the locations where it is most needed.

4. Treat hydrogen selectively

Hydrogen may be relevant where direct electrification is difficult and where a lifecycle assessment supports its use. It is not a universal air-quality answer. Any proposal should state the use case, production pathway, local pollutant implications, energy efficiency, infrastructure need and alternative options.

5. Build interoperable public data services

Official portals should expose reliable data, explain validation status and offer accessible health guidance. National authorities should make it easy for municipalities, schools and researchers to reuse data without blurring the line between validated measurements and supplementary sensors.

National benefits and delivery risks

Potential benefit	Delivery risk to manage
Lower health burden and reduced absenteeism	High upfront infrastructure and retrofit costs
Better energy security through efficiency and diversified supply	Poorly targeted support can deepen inequality
Cleaner transport and more attractive public space	Infrastructure may lag behind regulation
More reliable evidence for planning	Weak data governance can undermine trust
Innovation in monitoring, buildings and mobility	Technology-first projects may ignore the main source

National implementation questions

- Which pollutant-source combinations create the largest health burden?
- Which regions need roadmaps to attain the 2030 standards?

- Can low-income households access support without unaffordable pre-financing?
- Are monitoring and inventory datasets interoperable?
- Does the evaluation framework measure outcomes rather than only spending?

Act at Local Level

Municipalities can translate broad rules into street-level changes. Their advantage is proximity: they know where schools, housing, roads, heating systems, ports, public transport and vulnerable groups meet.

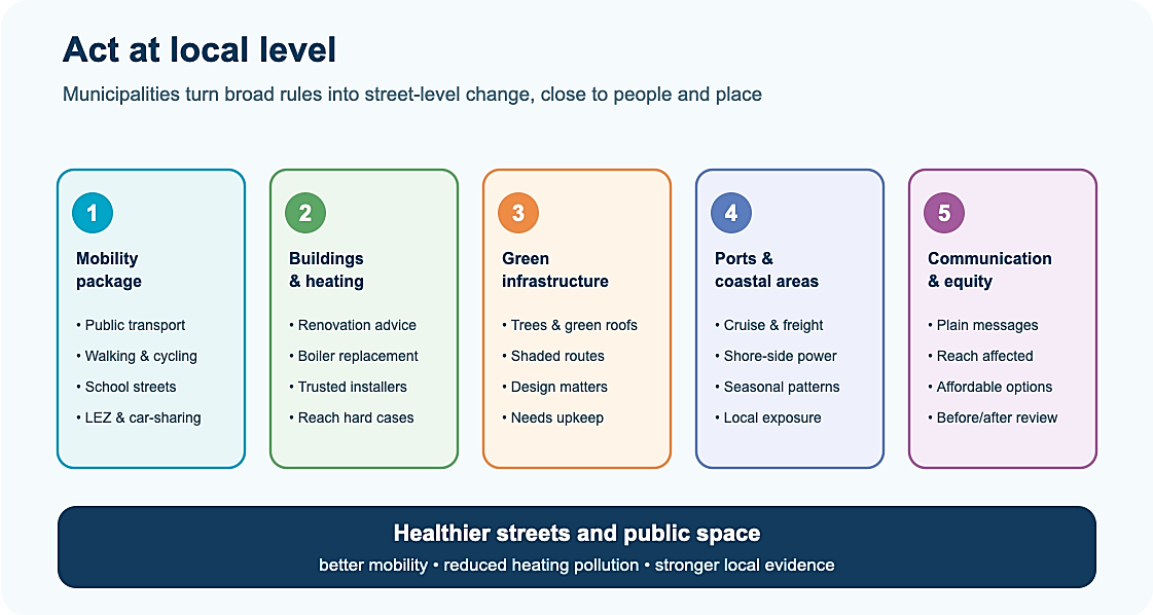


Figure 5 Local-level action pillars. Source: VISIONAIR manual authors, 2026.

Start with a local problem statement

A local plan should identify:

1. the pollutant and averaging period;
2. the affected places and groups;
3. the dominant or suspected sources;
4. the baseline dataset and its limitations;
5. the intervention package;
6. the implementation owner and timeline;
7. the indicators used for evaluation.

Mobility measures

Use mobility measures as a package rather than a single sign at the city boundary. Depending on the evidence, a city may combine:

- reliable public transport and service improvements;

- walking and cycling connections;
- school-street and safe-route measures;
- parking management and park-and-ride facilities;
- traffic calming where it improves safety and reduces stop-start driving;
- low-emission zones where national law, local evidence, proportionality and enforceability support them;
- freight management and delivery windows;
- car-sharing as an option for reducing the need for private car ownership.

Car-sharing is not automatically an emission reduction. Its value depends on whether it reduces private vehicle ownership and kilometres travelled, connects well with public transport and uses an appropriate fleet.

Buildings and heating

Local authorities can provide renovation guidance, heating replacement support, trusted installers and outreach to households that are difficult to reach through online forms. Enforcement against unsuitable burning should be paired with practical alternatives, waste services and social support.

Green infrastructure

Trees, green roofs, shaded routes and connected public spaces improve urban resilience, thermal comfort and liveability. Their air-quality effects vary by design and location. Avoid claims that greenery alone can solve a pollution hotspot. Street geometry, ventilation and maintenance matter.

Ports and coastal areas

Coastal municipalities should connect local transport plans with port and shipping policy. Relevant questions include cruise and freight traffic, shore-side operations, access routes, monitoring locations and seasonal patterns. International fuel rules can create an important baseline, while local authorities still need to understand neighbourhood exposure.

Local benefits and delivery risks

Potential benefit	Delivery risk to manage
Healthier streets and school environments	Public opposition if goals and trade-offs are unclear

Potential benefit	Delivery risk to manage
Better public transport and safer active travel	Measures can displace traffic without corridor analysis
Reduced heating-related pollution	Households may lack affordable alternatives
More usable public space and climate resilience	Green assets require maintenance and appropriate design
Stronger local evidence	Sensor dashboards can overstate certainty

A 90-day municipal starter plan

Period	Deliverable
Days 1–30	Name the priority pollutant-source problem, baseline and responsible team.
Days 31–60	Select a small package of measures, identify affected groups and publish an evidence note.
Days 61–90	Launch implementation, communication and a before/after evaluation record.

Before launching a local measure

Check	Record before launch
Problem	Pollutant, place, affected groups and baseline period
Authority	Legal basis, responsible team and delivery partners
Package	Infrastructure, service, communication and support actions
Equity	Costs, alternatives, accessibility and groups needing assistance
Displacement	Whether traffic, exposure or burden may move elsewhere
Evaluation	Indicator, comparison period, review date and public reporting format

Act as an Organisation

Businesses, schools, public bodies and non-profit organisations can reduce emissions, exposure and operational risk. The most credible organisational plans focus on material sources and measurable actions.



Figure 6 Organisational action pillars. Source: VISIONAIR manual authors, 2026.

ESG recommendations with an air-quality link

Environmental, social and governance reporting becomes useful when it changes operations. For air quality, an organisation should:

- map combustion sources, fleet emissions, deliveries and employee travel;
- assess exposure-sensitive locations such as schools, care facilities and workplaces near traffic;
- include air-quality criteria in fleet, heating and procurement decisions;
- record maintenance of filters, boilers and ventilation systems;
- coordinate travel planning with public transport and active mobility;
- publish a short action log with owners, timelines and outcomes;
- avoid substituting a generic “green” claim for a measured reduction.

School and workplace actions

Schools and workplaces can use official alerts, adjust outdoor activities during episodes, improve ventilation practice, identify safer routes and teach staff how to

interpret dashboards. Monitoring projects work best as learning tools when they explain measurement limitations.

Operational checklist

Area	First question	Useful indicator
Fleet	Which trips can be avoided, shifted or electrified?	Vehicle kilometres by mode and fuel
Deliveries	Can timing, consolidation or route choice reduce local exposure?	Deliveries per week and vehicle class
Heating	Is the system maintained and appropriate for the building?	Fuel use, service record and replacement plan
Indoor air	Are source control and ventilation practices documented?	Filter/service log and occupant feedback
Governance	Who owns the action plan and reviews results?	Named owner, review date and status

A one-page organisation action log

An organisation does not need a large ESG report to start. It needs a traceable operating record.

Field	Record
Material source or exposure point	Fleet, deliveries, heating, ventilation, site location or another evidenced issue
Baseline	Existing indicator and measurement period
Action	Avoid, reduce, shift, maintain, replace or investigate
Owner	Named role responsible for delivery
Equity and access	Effects on staff, visitors, pupils, residents or suppliers
Review	Completion status, outcome indicator and next review date

Act at Household and Individual Level

Individual choices do not replace public policy, but they matter. The goal is to reduce exposure and support lower-emission systems without placing the entire burden on households.



Figure 7 Household and individual action pillars. Source: VISIONAIR manual authors, 2026

Travel choices

- Walk, cycle or use public transport where the route and personal circumstances make it practical.
- Combine trips and avoid unnecessary car journeys.
- Use car-sharing where it replaces the need to own or regularly use a private vehicle.
- Maintain vehicles correctly, including tyres and emission-control systems.
- When replacing a vehicle, consider the whole mobility need rather than assuming a larger new vehicle is the only option.

Heating and energy

- Never burn waste, plastics, rubber, treated materials or wet wood.
- Maintain heating systems and follow the applicable national and local rules.

- Improve insulation, window sealing and temperature control before oversizing a new heating system.
- Use qualified advice when considering a heat pump, district heating connection, renewable solution or appliance replacement.
- Seek available support early, especially where an application requires documentation or co-financing.

Indoor air: source control comes first

Indoor air is affected by outdoor pollution, combustion, moisture, cleaning products, smoking, cooking and ventilation. A practical hierarchy is:

1. remove or reduce the source;
2. ventilate appropriately for the building and outdoor conditions;
3. maintain heating and ventilation equipment;
4. use filtration where it is suitable for the pollutant and room;
5. review whether the intervention improved the problem.

Portable air cleaners with appropriate HEPA filtration can reduce airborne particles in a room when correctly sized and maintained. They are a supplement, not a replacement for source control or ventilation. Houseplants may improve comfort and wellbeing, but they should not be marketed as a reliable substitute for ventilation or filtration.

During a pollution episode

- Check the official national or local information service.
- Follow health advice for sensitive groups.
- Reduce strenuous outdoor activity near busy roads when advised.
- Ventilate at times when outdoor conditions are more favourable, while considering indoor sources and heat safety.
- Avoid adding indoor pollution through burning, smoking or unnecessary aerosol products.

Evaluate Costs, Benefits and Equity

Cleaner-air projects compete for public and private budgets. A transparent calculation helps decision-makers compare options, but it should not create false precision.

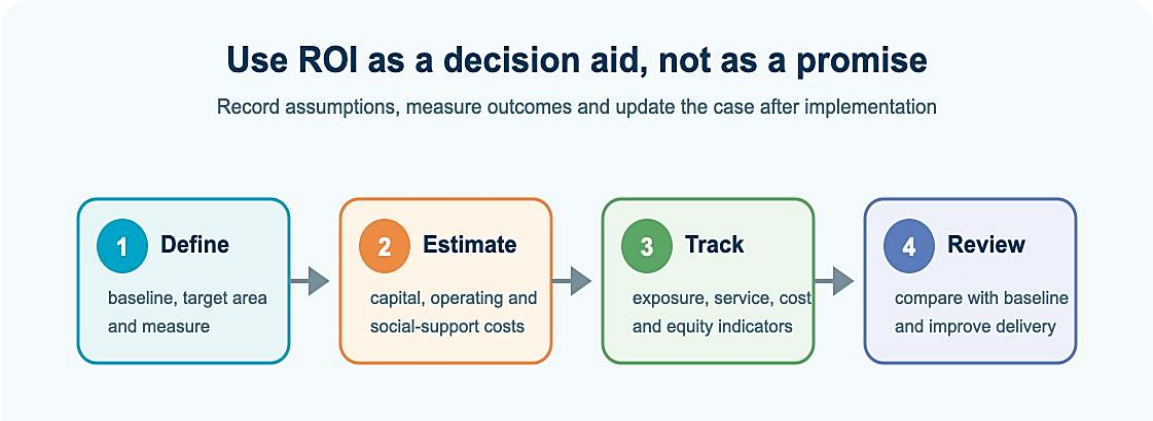


Figure 8 Illustrative ROI cycle for air-quality measures. Source: VISIONAIR manual authors, 2026.

An illustrative ROI template

Field	Record explicitly
Intervention	What changes, where, for whom and from what baseline?
Capital cost	Equipment, construction, design, permits and setup
Operating cost	Energy, maintenance, staffing, calibration and communications
Support cost	Outreach, application assistance and affordability measures
Direct savings	Energy, fuel, maintenance or service efficiencies
Health-related benefit	Use an approved method and cite the source; avoid inventing a monetary value

Field	Record explicitly
Equity test	Who pays upfront, who benefits and who may be excluded?
Evaluation date	When will measured outcomes be compared with baseline?

Illustrative formula

Simple payback period = eligible upfront cost / expected annual direct savings

This formula can be useful for a building retrofit, but it is not a full social cost-benefit analysis. It does not automatically capture health gains, avoided emissions, comfort, maintenance risk, financing costs or unequal impacts.

Equity is an implementation requirement

Measures fail when they assume that every household has the same cash flow, information, housing quality, transport options or administrative capacity. Equity-aware delivery should:

- identify affected groups before regulation begins;
- provide accessible application support;
- combine enforcement with realistic alternatives;
- avoid stigmatising communities;
- involve trusted local organisations;
- monitor whether benefits reach the intended places.

Low-income communities and heating

Where households face energy poverty, unsuitable burning can be connected to lack of affordable heat, poor-quality housing and weak waste services. The response should combine heating alternatives, renovation support, waste collection, education and proportionate enforcement. Public communication should describe the structural problem without blaming residents.

Equity delivery record

Question	Record before implementation
Who pays upfront?	Household, municipality, employer, landlord, programme or shared contribution
Who may be excluded?	Groups facing cost, documentation, language, digital or mobility barriers
Which alternative exists?	Practical route for people who cannot immediately comply or participate
Who can assist?	Public contact point, trusted local organisation or in-person support
What will be reviewed?	Participation, geographic reach, complaints, unresolved barriers and outcomes

Communicate and Educate

People need information they can act on. A useful campaign explains the pollutant, health relevance, local source, action and time horizon.

A public message template

Question	Example answer structure
What is happening?	"PM2.5 concentrations are elevated in the affected area."
What does the number mean?	State averaging period and benchmark.
Who should take care?	Identify sensitive groups using official health guidance.
What can people do now?	Give practical short-term actions.
What is being done long term?	Name the responsible authority and intervention package.
Where is the source?	Link to the official dashboard and methodology.

Education activities

- Compare WHO guidelines with legal limits using Table 1.
- Use a local official dashboard to identify patterns over a week.
- Discuss why a supplementary sensor and a regulatory station have different roles.
- Ask students to design a safe school-route information campaign.
- Evaluate a proposed measure using the ROI template and an equity test.

Campaign review record

Review question	Evidence to retain
Did the message identify the pollutant and averaging period?	Published message and dashboard link

Review question	Evidence to retain
Did it distinguish advice from legal requirements?	Approved wording and source
Did it reach affected groups?	Channel list, distribution record and accessibility review
Did it explain what the authority is doing?	Named action, owner and timeline
Did questions reveal a recurring misunderstanding?	Frequently asked questions and revised wording

Country Annexes

These notes are modular starting points. They identify official sources and implementation themes. They are not exhaustive national legal summaries.

How to use the country modules

Each module separates a verified starting point from implementation questions. It deliberately avoids unsupported detail. Before reusing a country example, recheck the official source and add local evidence.

Module	Verified starting point	Keep out unless an official current source is added
Slovakia	SHMÚ final 2024 assessment and preliminary 2025 assessment	Any national ban or funding figure not confirmed by a current Slovak legal or ministry source
Czechia	ČHMÚ evidence base, Prague PZKO 2020+ and the official boiler-rule source	Any specific institutional or operational role not confirmed by a primary source
Croatia	Mediterranean Sea SOx ECA and Dubrovnik's special traffic regime	Describing the Dubrovnik permit zone as a low-emission zone
Spain	MITECO framework and live Madrid and Barcelona operating pages	Treating every municipal ZBE as identical or reusing stale legal status

Slovakia (SK)

Evidence base

The *Slovak Hydrometeorological Institute (SHMÚ)* publishes official air-quality information, including the **preliminary assessment for 2025** and the full assessment for **2024**. When presenting Slovak data, label the assessment year and validation status.

Priority themes

- Domestic heating and energy efficiency remain relevant where particulate pollution is connected with local combustion.
- Support should be accessible to low-income households and communities facing energy poverty.
- Municipal work should connect heating advice, renovation, waste services and education.
- Supplementary sensors may help identify local patterns when used with a quality-assurance plan and the official network.

Implementation focus

Question	Practical response
Where should work start?	Select locations where official SHMÚ evidence and local experience indicate a recurring winter problem.
What should be combined?	Heating advice, renovation support, waste services, municipal outreach and a clear route to available assistance.
How should equity be handled?	Use accessible language, in-person support where needed and communication that does not stigmatise residents.
What should be measured?	Record the official baseline, the delivered support, local participation and the monitoring method used for follow-up.

Suggested first action

Select one winter hotspot, document the official evidence, map available household support and design an outreach pathway with the municipality and trusted local partners.

Before publishing a Slovak local example

- Link the relevant SHMÚ page and state whether the evidence is final or preliminary.
- Describe the local heating problem without assuming that one national claim applies to every municipality.
- Record which support routes are actually available to households at the time of publication.
- Review wording with partners who understand local access barriers and community context.

Delivery record

Field	Record locally
Baseline	Official dataset, hotspot description and review period
Household pathway	Advice, support, application help and trusted contact
Municipal pathway	Heating, renovation, waste-service and communication actions
Follow-up	Participation record, monitoring method and review date

Czechia (CZ)

Evidence base

Czech air-quality information is provided through the national monitoring and information system managed by the Czech Hydrometeorological Institute (ČHMÚ). Prague also publishes city information on air quality and its *Air Quality Improvement Programme 2020+ for the Prague agglomeration (CZ01)*.

Priority themes

- The Czech Ministry of the Environment states that the use of solid-fuel boilers in emission classes 1 and 2 has been prohibited since **1 September 2024**, with enforcement and replacement support described by the *official MŽP source*.
- Prague's PZKO 2020+ action planning connects heating controls, public information, mobility and supporting measures.
- Urban work should connect city planning with the ČHMÚ evidence base and transparent evaluation.

Implementation focus

Question	Practical response
What is the legal starting point?	Use the official MŽP source for the class 1 and 2 boiler prohibition and check current ministry guidance before local communication.
How can Prague be used as a learning example?	Separate binding measures from supporting activities and identify the responsible delivery body for each item.
What should municipalities document?	Record outreach, inspection practice, replacement support and the evidence used to assess local progress.
How should monitoring be explained?	Use the ČHMÚ evidence base as the official reference and describe supplementary sensors only as an additional layer.

Suggested first action

Use Prague's published action plan as a teaching example: identify one binding measure, one supporting measure and the evidence needed to evaluate delivery.

Before publishing a Czech local example

- Link the current MŽP information used to describe boiler rules and support.
- Distinguish a national rule from a Prague-specific action-planning example.
- Use ČHMÚ information as the official air-quality evidence base.

Delivery record

Field	Record locally
Baseline	Official dataset, municipality and review period
Rule or plan	National requirement, Prague example or local delivery action
Support	Outreach, replacement pathway and implementation owner
Follow-up	Evidence of delivery, monitoring method and review date

Croatia (HR)

Coastal air-quality context

Shipping and port activity are relevant to coastal air-quality planning. The Mediterranean Sea SOx Emission Control Area under MARPOL Annex VI took effect on **1 May 2025**. The *International Maritime Organization* states that ships operating in the area must use fuel with a sulphur content of no more than **0.10%**, compared with **0.50%** outside SOx ECAs.

Dubrovnik: describe the measure correctly

Dubrovnik introduced a *special traffic regulation zone* around its historic core on **2 June 2025**. It is a permit-based traffic and congestion measure, not an emission-class low-emission zone. Its potential air-quality value is indirect and should be evaluated with traffic and monitoring evidence.

Priority themes

- Monitor coastal and port-related patterns with appropriate station placement and seasonal interpretation.
- Connect local access management with public transport, visitor flows and resident needs.
- Use official sources before describing renewable-energy funds or programme eligibility.

Implementation focus

Question	Practical response
Which measure is international?	Treat the Mediterranean Sea SOx ECA as the shipping-fuel baseline in force since 1 May 2025.
Which measure is local?	Treat Dubrovnik's special traffic zone as access and congestion management, with indirect air-quality relevance.
What should coastal monitoring capture?	Record station location, seasonal traffic, port operations and the time period used for comparison.

Question	Practical response
What should not be assumed?	Do not claim that a traffic permit zone is an LEZ, or that a funding programme applies without a current official source.

Suggested first action

Create a seasonal monitoring and traffic-evaluation note that distinguishes international shipping rules, port operations and local road access.

Before publishing a Croatian local example

- Cite IMO for the Med SOx ECA baseline and keep the fuel rule separate from local traffic measures.
- Cite the City of Dubrovnik for the permit-based traffic regime and describe its air-quality effect as indirect unless evaluated.
- State the monitoring period because coastal patterns and visitor flows can be seasonal.
- Add renewable-energy funding only when the current programme and eligibility source are recorded.

Delivery record

Field	Record locally
International baseline	Med SOx ECA source and effective date
Local traffic action	Zone, season, access design and implementation owner
Monitoring	Station context, review period and traffic or port data
Follow-up	Evaluation question, publication date and next check

Spain (ES)

National framework

Spain's low-emission-zone framework is described by the *Ministry for the Ecological Transition and the Demographic Challenge (MITECO)*. Implementation should be described city by city because legal instruments and operating rules can change.

Madrid and Barcelona: use the current operating sources

- Madrid's official page describes the active *Madrid Low Emission Zone (Madrid ZBE)*. The official page records an amendment approved on **24 March 2026**, in force from **7 April 2026**.
- Barcelona's official page describes the active *Barcelona ZBE* and states that a new ordinance entered into force on **22 February 2023**.

These examples should not be presented as a claim that every Spanish municipality operates an identical scheme. A live legal and operational check is required before reuse.

Priority themes

- Evaluate mobility packages with proportionality, accessibility and enforcement in mind.
- Use official regional sources before citing Andalusian solar support or electric-mobility statistics.
- Connect coastal monitoring with transport, port and seasonal visitor patterns where relevant.

Implementation focus

Question	Practical response
How should ZBE status be reported?	Check the current national framework and the live municipal operating page before publishing a city example.
Why compare Madrid and Barcelona separately?	Their legal instruments, operating conditions and amendment histories are city-specific.
What belongs in a regional addition?	Add Andalusian solar, electric-mobility or coastal-monitoring facts only when an official current source is recorded.

Question	Practical response
How should transferability be tested?	Separate the policy objective from the local legal basis, enforcement design, accessibility measures and evaluation method.

Suggested first action

Compare one Madrid and one Barcelona operating rule using the live official pages, then identify which elements can be transferred and which depend on the city's legal context.

Before publishing a Spanish local example

- Check the MITECO framework and the current municipal page on the day the example is prepared.
- State the city, ordinance or amendment date and operating context used in the explanation.
- Do not infer a uniform national operating model from Madrid or Barcelona.
- Add Andalusian, coastal-monitoring or electric-mobility detail only with a recorded official source and access date.

Delivery record

Field	Record locally
Framework	MITECO page and access date
City rule	Municipal page, operating status and relevant date
Transfer test	Which elements depend on local law, access design or enforcement
Follow-up	Next live-source check and review owner

Implementation Checklist

National authority

- ☐ Publish current legal standards and 2030 planning values side by side.
- ☐ Identify pollutants and sources requiring roadmaps.
- ☐ Connect funding with accessibility and evaluation.
- ☐ Make validated data reusable and clearly labelled.
- ☐ Review whether communication distinguishes compliance from health ambition.

Municipality

- ☐ Define a pollutant-source-place problem statement.
- ☐ Record baseline, owner, timeline and evaluation method.
- ☐ Combine mobility, heating, public-space and communication measures as appropriate.
- ☐ Test affordability and displacement effects.
- ☐ Publish an implementation note using plain language.

Organisation

- ☐ Map material emission and exposure points.
- ☐ Name an owner for fleet, heating and indoor-air actions.
- ☐ Add air-quality criteria to procurement and maintenance.
- ☐ Record before/after indicators.
- ☐ Avoid unsupported ESG claims.

Household or individual

- ☐ Check the official dashboard and alerts.
- ☐ Avoid burning unsuitable materials.
- ☐ Maintain heating and vehicles.
- ☐ Use source control and ventilation before relying on filtration.
- ☐ Seek support early when considering a heating or renovation change.

Sources and QR Links

The QR codes point to live official pages. URLs were checked on **2 June 2026**. Because online pages can change, the project working files also include a source registry and local snapshots where the site permitted download.

WHO guidelines	EEA status report	SHMÚ preliminary 2025	VISIONAIR project
			

Core official sources

1. World Health Organization. *WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*. 2021. https://www.who.int/publications/i/item/9789240034228
2. European Environment Agency. *Air quality status in Europe 2026*. Published 30 April 2026; analyses 2024 concentrations and preliminary 2025 information. https://www.eea.europa.eu/en/analysis/publications/air-quality-status-report-2026
3. European Union. *Directive (EU) 2024/2881 of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L2881
4. Slovak Hydrometeorological Institute. *Predbežné hodnotenie kvality ovzdušia za rok 2025*. https://www.shmu.sk/sk/?page=2049&id=1736
5. Czech Ministry of the Environment. *Od prvního září začne platit zákaz používání kotlů 1. a 2. emisní třídy*. 20 May 2024. https://mzp.gov.cz/cz/news_20240520_Od-prvniho-zari-zacne-platit-zakaz-pouzivani-kotlu-1-a-2-emisni-tridy-MZP-upravilo-podporu-vymeny-kotlu-od-zari-a-oznamilo-jak-budou-probihat-kontroly
6. City of Prague. *Základní koncepční dokumenty a aktivity města v oblasti ochrany ovzduší*. https://praha.eu/web/portalzp/plany-a-koncepce-ovzdusi

7. International Maritime Organization. *Mediterranean Sea Emission Control Area for Sulphur Oxides and particulate matter*. https://www.imo.org/en/MediaCentre/Pages/WhatsNew-2254.aspx
8. City of Dubrovnik. *Zona posebnog prometnog režima*. https://www.dubrovnik.hr/za-gradane/zona-posebnog-prometnog-rezima-19560
9. MITECO. *Zonas de bajas emisiones en España*. https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/movilidad/zonas_de_bajas_emisiones_en_espana.html
10. City of Madrid. *Madrid Zona de Bajas Emisiones (ZBE)*. https://www.madrid.es/portales/munimadrid/es/Inicio/Movilidad-y-transportes/Zonas-de-Bajas-Emisiones/Madrid-Zona-de-Bajas-Emisiones/Madrid-Zona-de-Bajas-Emisiones-ZBE-/?vgnextchannel=d2d2edf0f70ab710VgnVCM2000001f4a900aRCRD&vgnextfmt=default&vgnextoid=93e63877029eb710VgnVCM1000001d4a900aRCRD
11. Barcelona City Council. *Zona de baixes emissions de Barcelona*. https://ajuntament.barcelona.cat/qualitataire/ca/afectacions-la-mobilitat/que-es-la-zona-de-baixes-emissions-de-barcelona
12. Slovak University of Agriculture in Nitra, Faculty of Economics and Management. *SUA presented the largest virtual lungs in Slovakia and an air quality monitor developed at FEM*. https://www.fem.uniag.sk/en/news-reader/sua-presented-the-largest-virtual-lungs-in-slovakia-and-an-air-quality-monitor-developed-at-fem
13. VISIONAIR project. https://www.visionairproject.eu/

Scope note

This English edition covers the common European core and the modular country starting points for Slovakia, Czechia, Croatia and Spain. Planned future additions include an interactive platform, risk-zone maps and additional language versions.