Looking for a "low-cost" air quality monitoring solution?

10 reasons why you should choose AQMesh

1. No other commercially available sensor system can demonstrate better accuracy

The options for measuring gases on a low-cost AQ platform are limited. Metal oxide sensors are power-hungry, which limits power supply options (and therefore location possibilities), and we have only really seen good results from ozone metal oxide sensors. Electrochemical sensors have a poor reputation based on their historic performance, but to achieve a single-figure ppb limit of detection they are really the only show in town. The leading - and possibly only serious - contender in this field is the Alphasense 4-electrode air quality sensors, used by AQMesh and many other commercial and research platforms. But that's not the end of the story; the sensors are highly susceptible to environmental factors and cross-gas effects. Deriving and delivering accurate ppb readings on a real-time basis (or near, i.e: not post-processing an entire dataset) requires smart mathematical processing which can identify the target gas signal from the sensor from all the other 'noise', including environmental factors, electronic noise, and effects of other gases.

To develop such sophisticated mathematical processing requires access to a large number and range of datasets comparing the low cost sensors to a co-located and well-maintained reference station. This is where AQMesh has an advantage, having had equipment out in the field globally for four years. Whilst early efforts produced modest results, largely limited until the end of 2014 due to the

previous NO2 sensors having a massive O3 cross-gas effect (AQMesh v3.0 processing), we have made huge strides since then, particularly focusing on the key gas - NO2. AQMesh v4.0 NO2 processing reliably delivers an R2 of >0.6 in temperatures up to ~25 °C. The new v4.1 and v4.2 processing successfully tackles even higher temperature locations.

So, ask anybody to show you their co-location comparison results from field trials and we don't believe they will come close to AQMesh. This is partly because we have not seen published results which challenge AQMesh on gases, and partly because we are pretty sure that no other developer has access to the same level of comparison datasets that we do. Laboratory test results are meaningless – we have tried very hard to make use of them and failed, as they are generally carried out using a single dry gas in controlled conditions. The results do not predict how electrochemical sensors will react in damp air and a cocktail of gases, and in direct sunlight.

AQMesh typically shows 90% of readings achieving (in ambient comparison trials) an accuracy of ±5ppb for NO and SO2, ±10ppb for NO2 and O3 and ±150ppb for CO (limited by reference resolution and stability).

V4.0 AQMesh needs to be scaled to achieve these accuracy levels but once calculated offline, slope and offset can be applied to the AQMesh server to scale any future readings.

V4.1 for NO2 and forthcoming processing for other gases will achieve accuracy levels similar to those quoted but without scaling, i.e: 'out of the box' performance.

We can also claim to have never observed any long-term drift with electrochemical sensors. Electrochemical sensors are supplied on the basis of a 2-year life but we have many that have been monitoring longer than this and any deviation over time from reference has been attributable to drift on the reference equipment, particularly on CO.

When it comes to particulates, AQMesh's light-scattering optical particle counter (OPC) has been described as a 'mini FIDAS' and this is basically how it performs.

Particles are counted and allocated to sized bins. Any further calculations of mass – and there is considerable scope to use these in combination with on-board temperature, pressure and RH measurements – are based on this. At this point the AQMesh OPC faces all the same challenges as other particle-measuring techniques, including the issue of drying volatile particles. AQMesh does not have a heated inlet – the power requirement and size would be impractical – but there is considerable scope for correction and R2 against FIDAS, TEOM, BAM and GRIMM are typically >0.7, even at this early stage of our exploration and fine-tuning.

2. You can locate it wherever you need to, unconstrained by power and communications infrastructure

The whole point of low cost sensor systems is to be able to monitor exactly where it is required: a diffusion tube with time resolution. That's why we are so determined to keep equipment power requirements low, offer a wide range of independent power options (three different battery variants plus 12V DC / solar) and avoid the product swelling to the size and requirements of existing mini /mobile reference units. Similarly, communications are independent, using the (near) universal mobile phone network – no other arrangement offers such simple and global coverage.

As AQMesh matures we intend to offer other communication options, but right now it is possible to take an AQMesh and a screwdriver to install it, get it running and be waiting for the first batch of online reading in minutes – a team in London installed 20 units in one morning.

AQMesh also confirms what all air quality professionals know: that air quality readings

vary dramatically over short distances. So measuring where measurements are needed will have a larger impact on the validity of readings than the inevitable difference in accuracy between a smaller, mobile, cheaper unit and a full reference station.

3. It's a neat, all-inclusive package

The usual reaction to an AQMesh pod (roughly 20cm in each direction, less than 2Kg) on a meeting table is one of surprise as we reel off what it measures: 5 gases (NO, NO2, NOx, O3, CO, SO2), PM10, PM2.5, PM1, TPC, pod temperature, atmospheric pressure and % relative humidity. The 'one stop shop' approach extends to AQMesh pricing. A single annual charge covers provision of a globally active SIM card, data transmission, data processing (conversion of raw sensor output to ppb / µg/m3 readings, including correction for environmental conditions and cross-gas effects) and online data access. And the package keeps growing, with noise and CO2 measurement available soon.

4. AQMesh benefits from world-class partnerships

The AQMesh concept was born out of a collaboration between AQMesh, Professor Rod Jones' team at the University of

Cambridge and the sensor manufacturer, Alphasense, after the MESSAGE project. This initial partnership has been followed up with open, collaborative arrangements with many key institutions worldwide. We have had an open dialogue with AQ practitioners for some years, taking advice and sharing experience and data. This continues with a wide range of partners and stakeholders, including customers, as it is the way we like to work and the best way to identify opportunities to improve AQMesh performance.

5. Your data is secure

AQMesh gathers your data, processes it to provide the best possible accuracy, and presents it to you online. Nobody else has access to it and AQMesh must not be confused with some low-cost systems which are based on data sharing and an online portal which allows viewers to look at readings taken in any given location. AQMesh data is held on a server to the same level of security you would expect from any online bank, store or reputable operator and can only be accessed using a login.
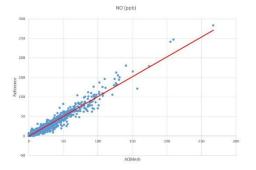

6. Anybody can install, maintain and operate it

The 1-minute video on our website shows just how easy it is to install a freshly delivered AQMesh pod. Experienced technical staff are not required and we have yet to find a new user who does not feel confident to go straight out and install their pods. Any simple measures required to keep AQMesh

performing well, such as replacing a failed electrochemical sensor, are just as easy. This is a good example of the proactive way in which we handle user support. In the event of a sensor failure, diagnosed on the server, we contact the customer and send out a warranty replacement, usually before they realise themselves that there has been a failure.

7. You can manage the instrument settings from an online dashboard

There's more to managing a small AQ sensor system than you might realise: changing reading frequency settings, identifying and managing equipment performance issues, location, power status, and so on. Over the last 4 years we have learned that anything that can be managed remotely should be managed remotely – few users have time to constantly go out to visit equipment to check the situation or change settings. As a result, AQMesh has the most advanced user interface for managing anything from a single pod to hundreds of pods, using an online dashboard and user alerts.

8. The equipment has the quality you expect from a proper manufacturer

AQMesh was designed and built by a team experienced in manufacturing environmental monitoring equipment to the highest international standards, used in the toughest environments. We expect to manufacture and ship equipment and never see it again, whether it is used in the desert, bombarded by rain and snow, a dirty city environment or

anywhere a user may locate it. This is not the same as the more fragile units often prepared by research teams or university spin-offs - just have a look at the quality for yourself.

9. The design is fit for purpose

In the same way that AQMesh is designed for use in all environmental conditions, we have thought about all aspects of the design.

Can a pigeon sit on it? (No). Can an insect make a home inside? (No). Are sensors protected during installation? (Yes). Can basic maintenance be carried out on the street, or on a lamp post? (Yes). And after 4 years of field use we have continued to improve the product, now supplying equipment with our third hardware version, not to mention many iterations of pod firmware and server software. We value the dialogue we have with users, listening to comments and reviewing ideas to continue this process.

10. We provide real, ongoing support for users

Many users comment on our refreshingly prompt response to queries and high level of engagement. We work with many air quality bodies that have never before felt it worthwhile or comfortable to have a meaningful conversation about low cost sensor systems. Through our trials and support of purchased equipment we offer the same level of continued engagement until all questions have been satisfactorily answered and everybody is happy, whatever it takes.