Application of Compact Sensors for Air Quality Monitoring

Science in Public Services

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環境保護署
Environmental Protection Department

Air quality monitoring network

- EPD operates a network of 18 stations each monitoring 6 air pollutants
- Monitoring instruments provide analogue outputs that need converting to digital form
- Data transmitted via broadband to be published in hourly updated webpage

Traditional air pollutant analyzers

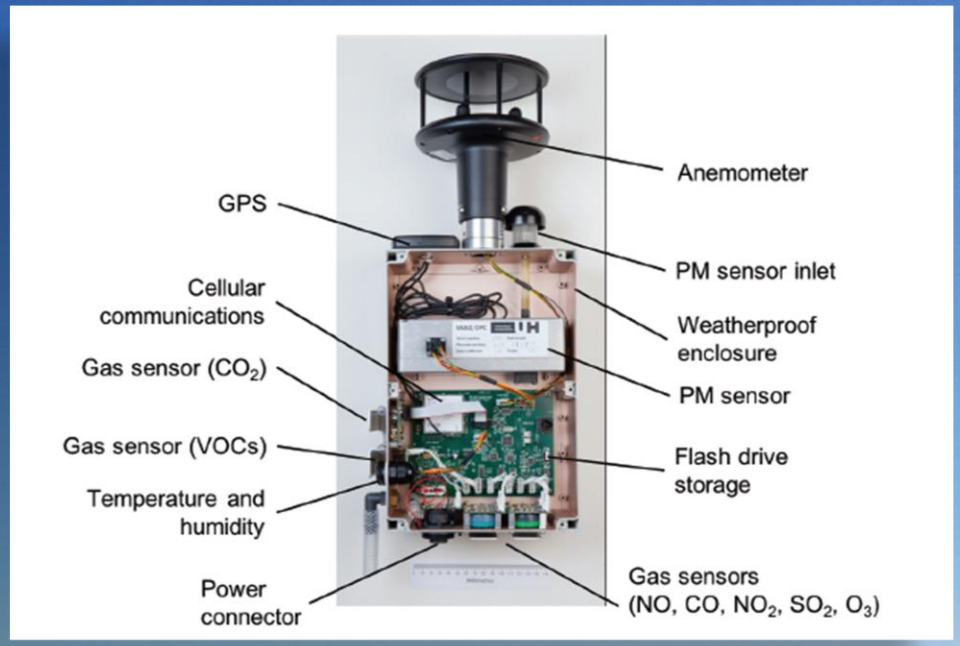
- Based on mature technologies developed decades ago
- Meticulous operation & QA/QC protocol
- Robust data quality

Traditional air pollutant analyzers

- Operate in temperature- and humidity-controlled environment
- Bulky, not expected to be relocated frequently
- Each station needs a set of quality control equipment and data logger to serve the analysers
- Hardware alone costs around $2m per station

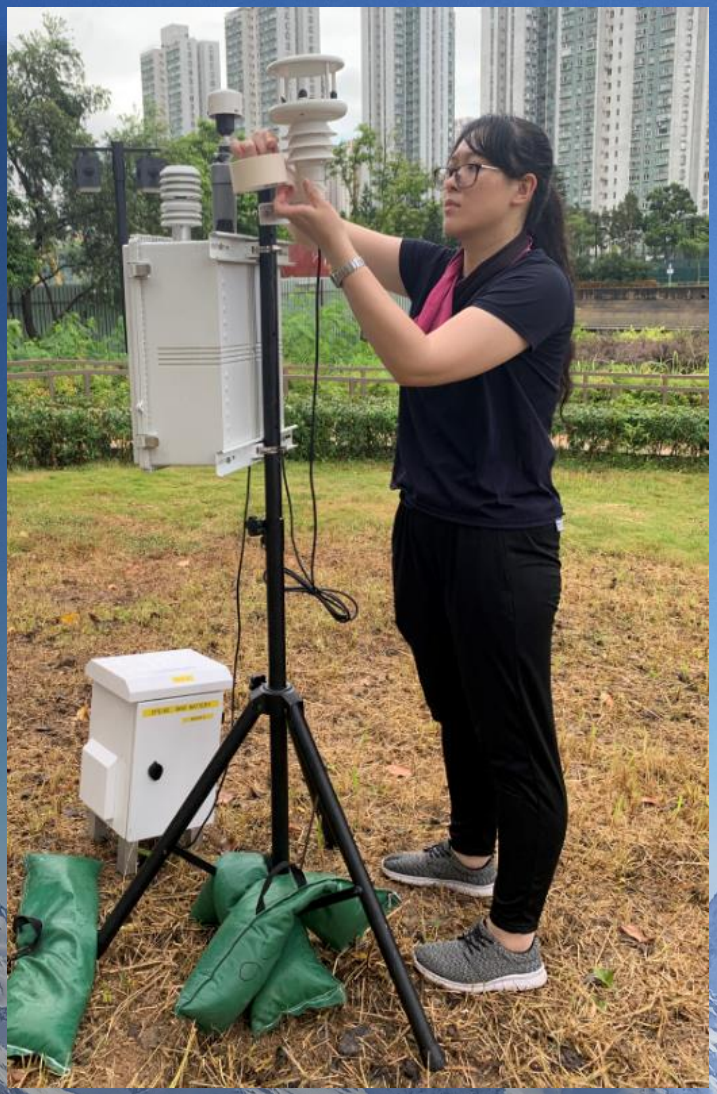
Air quality sensors

- A compact unit typically contains several sensing cells for measuring different pollutants
- Integrated bilateral data transmission via mobile network
- Control and data management often cloud-based



Air quality sensors

- Relative portable
- Low power consumption, can run on battery for extended period
- Operate at locations not possible for traditional analysers
- Deployed in short notice, ideal for *ad hoc* projects



Air quality sensors

- Quality assurance can be performed at a common facility for many sensors at a time
- A good quality sensor measuring six parameters would cost less than $0.2m, 10% of the cost of equivalent traditional analysers

Caution

- Air quality sensors often need to operate without temperature or humidity control
- Many products available but only a few can provide quality output in such conditions

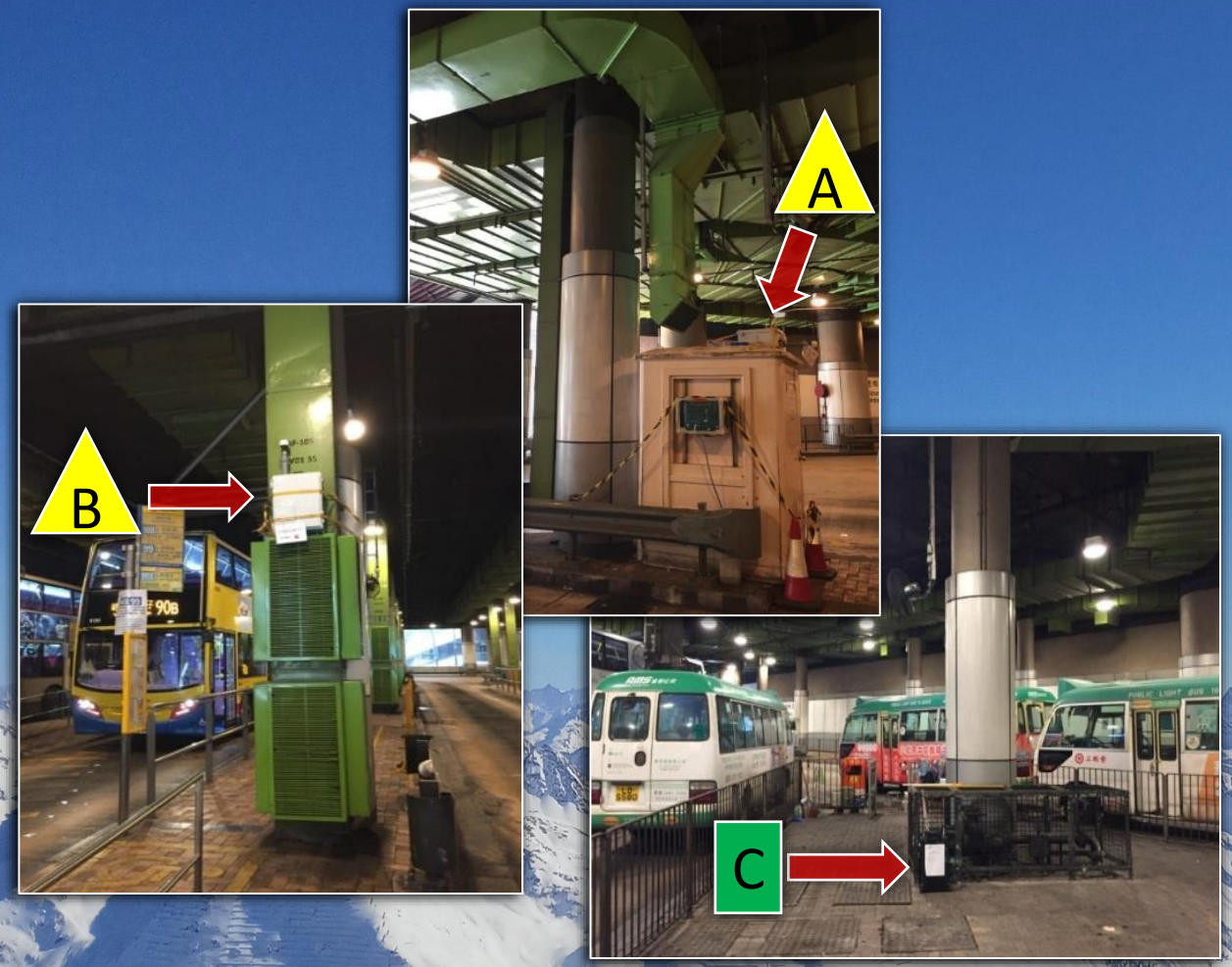

Sensors in *ad hoc* projects

EPD coordinated application

2015 Standard Chartered International Green Marathon

- Provided near-real-time air quality information at various points *en route*

EPD coordinated application



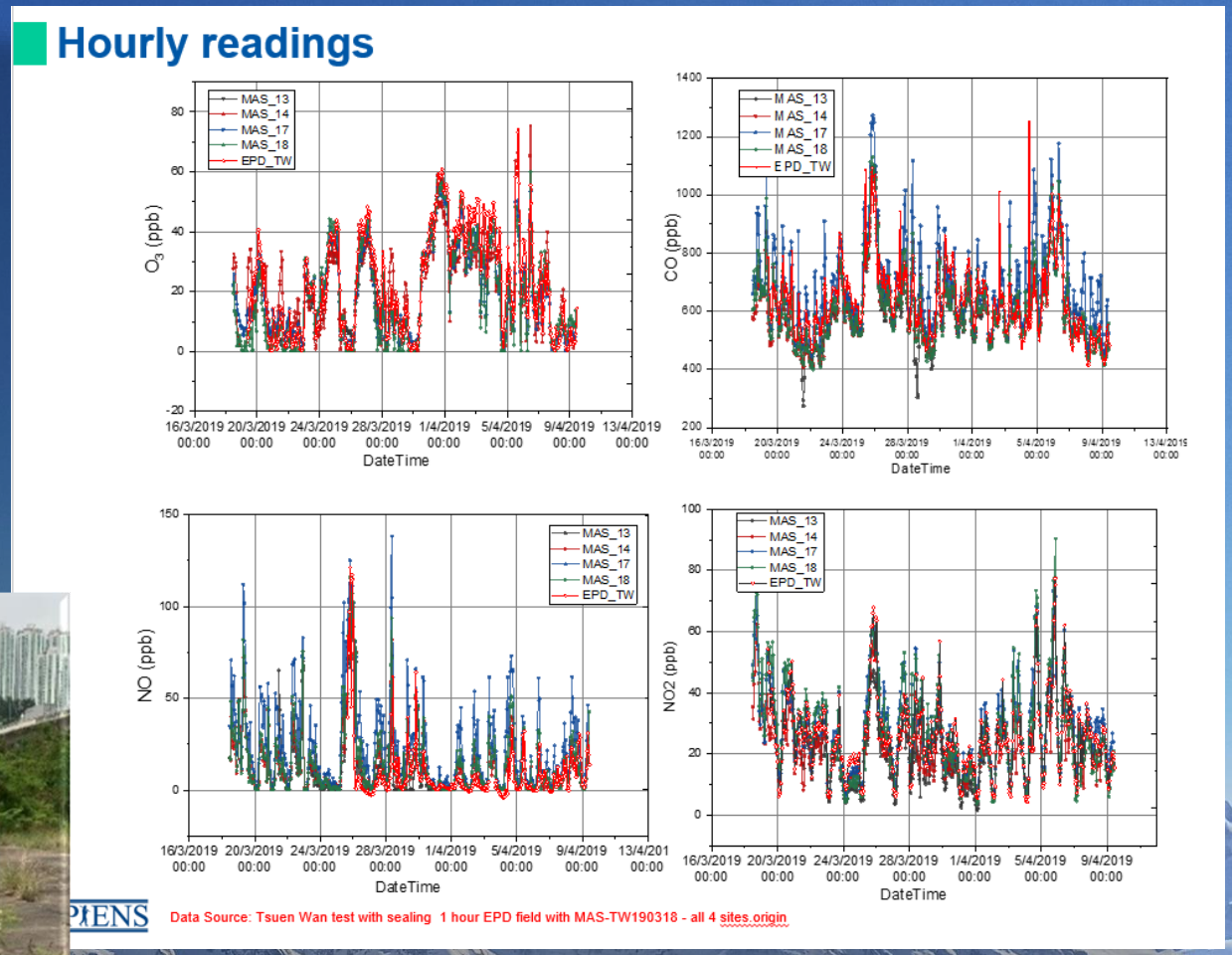
Public Transport Interchange (2018)

- Measured air quality simultaneously at several locations of PTIs to understand the cause of pollution hot spots

EPD executed application

Tsuen Wan Transitional Housing Site (Mar-Apr 2019)

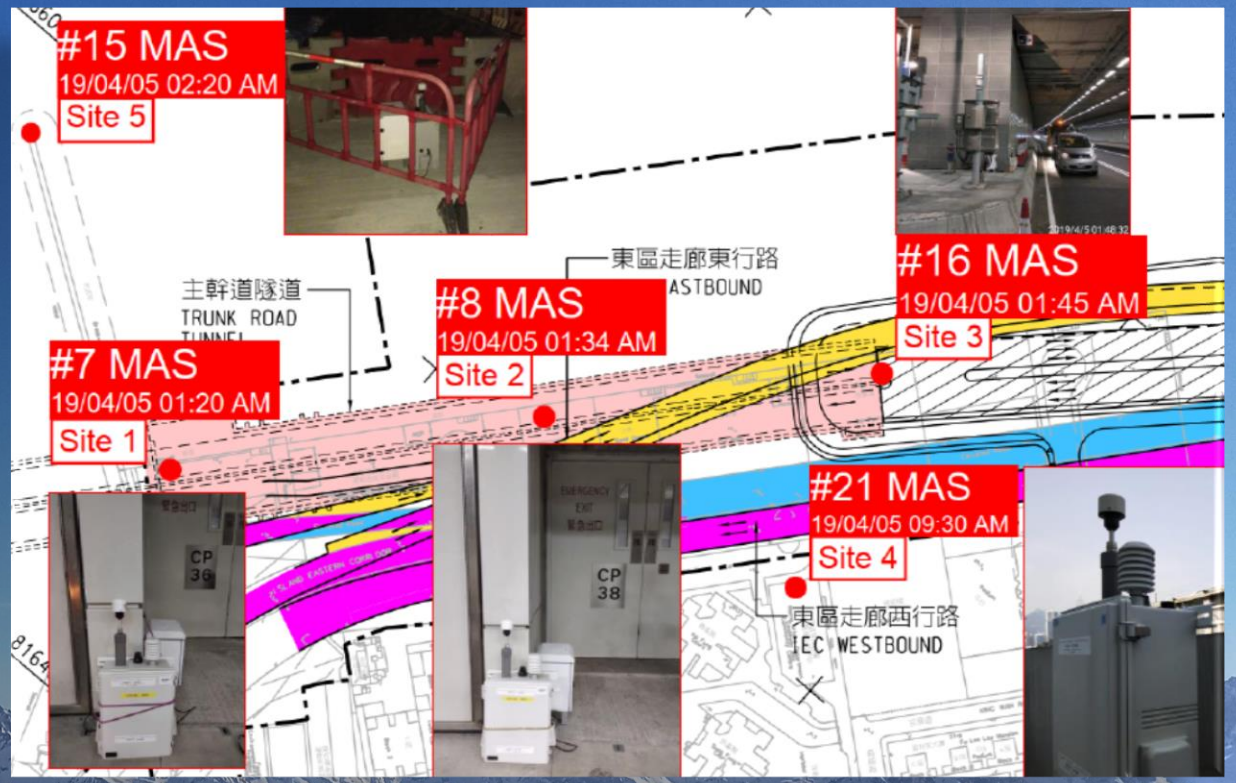
- Data urgently needed to better understand the site air quality and evaluate mitigation measure
- Three-week operation powered by battery only
- Good correlations among sensors and with TW AQMS



EPD coordinated application

Central Wanchai Bypass (Apr - May 2019)

- Data urgently needed to understand if Air Purification System broken down caused any impact on neighborhood
- Sensors operating on site about 24 hours after request to deploy



EPD executed application

Construction site impact snap shots (Jul-Aug 2019)

- Tung Chung East, Shek Mun and Tuen Mun
- Evaluate influence of site activities on neighborhood
- Sunday + 2 weekdays for each site

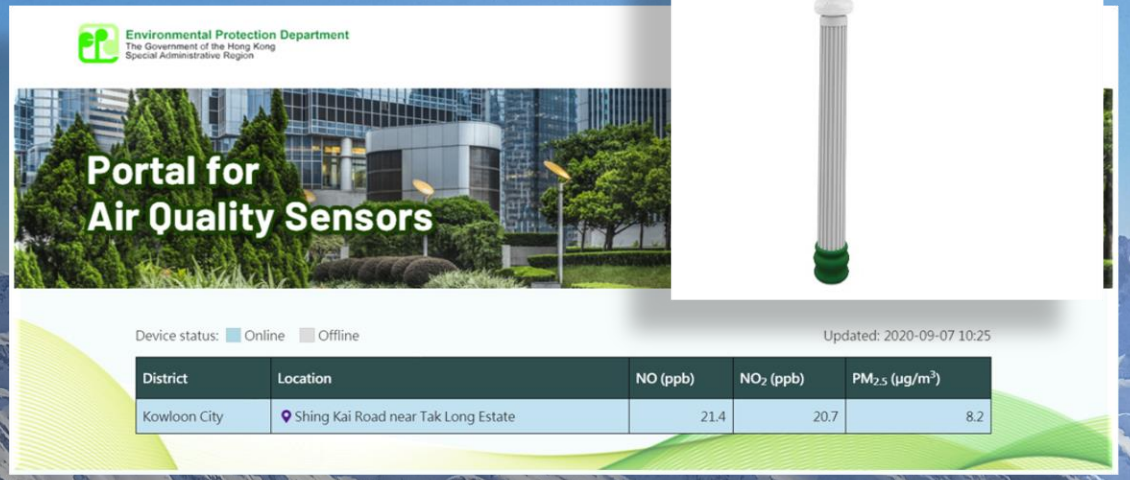
EPD coordinated application

Cross Harbour Tunnel (26-27 Nov 2019)

- Urgently needed to know air quality near tunnel before reopening after being shut down due to protest
- Sensors operating on site about 24 hours after request to deploy

OGCIO smart lamppost

- Started running in June 2020 the first of 9 smart lampposts with air quality sensor in a pilot programme
- EPD provides technical input and is publishing real-time data that are also available from data.gov.hk
- A number of NDAs are planning to have air quality sensors in their smart lampposts

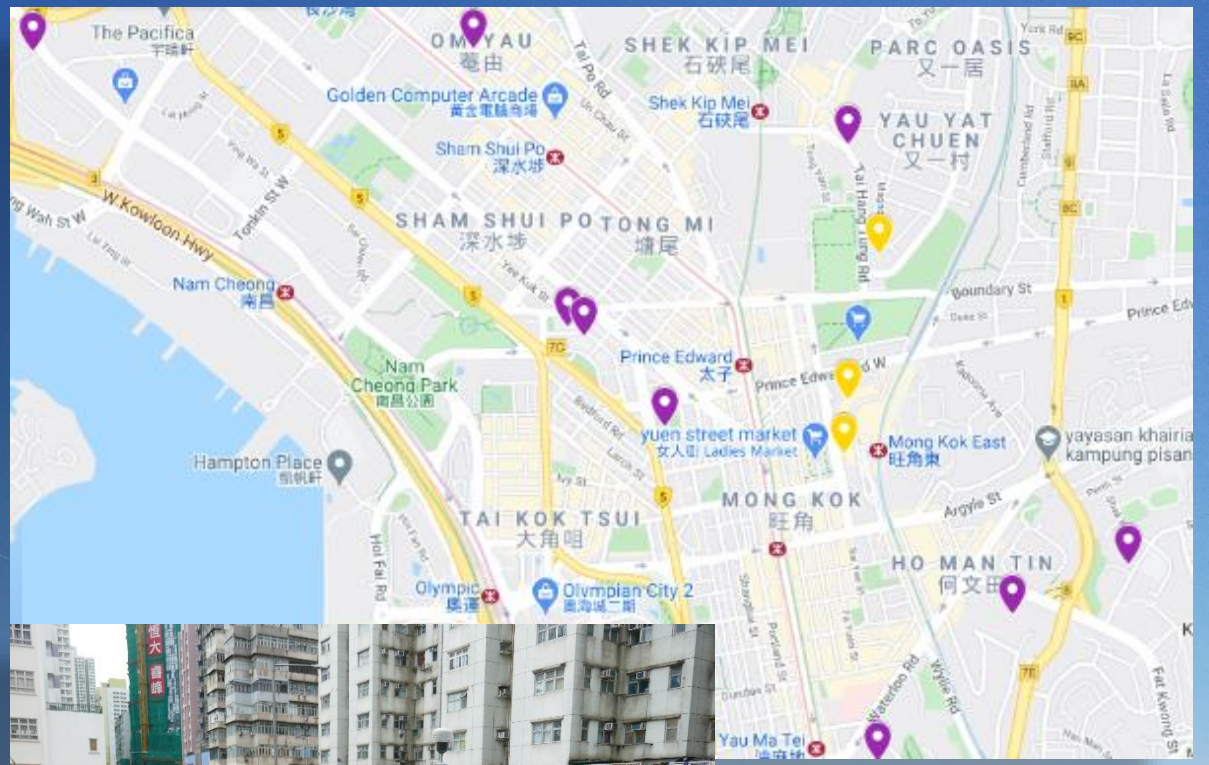


Energizing Kowloon East Office smart lampposts

- Multi-Purpose Lamp Post programme running 7 sets since Aug 2018
- Data available from data.gov.hk

Large scale deployment practicality trial

- 30 sensors are operating in 12 schools in Mong Kok
- 8 sensors started in June 2019
- Compared with 18 AQMS around HK, this is the first time real time air quality data are collected in a small area and for extended period

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Large scale deployment practicality trial

- Better understanding of spatial variation, elevation variation
- Reference for air quality model
- Testing operation logistics, QA/QC, data transmission, reliability

Up Coming Projects

Air quality baseline in preparation for NDA works

- Collect data at strategic locations, some remote and without power
- Better understanding of current situation
- Fine tuning numerical models

Construction activity PM study

- Snap shot of 3 sites in various stages: site formation, piling, structure formation

Summary

- Mobile, quick deployment, cloud based, sensors can collect air quality data at locations not possible for traditional monitors
- Data would enhance understanding and prediction ability
- *Caveats*
  - *Different sensor models have different performance*
  - *Hardware cost low but operation cost may not change much for AQMS comparable data quality*


END