

# Policy Brief

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## Integrating Sensors and Real-Time Water and Air Quality Monitoring for Sustainable Environmental Decision-Making in Riau Province

### Target audience

The Riau Provincial Government, environmental authorities, policymakers, and relevant stakeholders, including regency and city governments and national institutions responsible for environmental monitoring.

### Policy options

- Expand WAQMS in stages across Riau, using Kampar Regency, Pekanbaru City, and Siak Regency as pilot areas.
- Coordinate with the responsible national environmental institutions to integrate WAQMS data with national monitoring systems.
- Train local stakeholders to operate the dashboard, interpret data, and use the findings in environmental decisions.
- Provide installation infrastructure, reliable connectivity, and safety equipment suited to local site conditions.
- Allocate recurring funding for sensor calibration, maintenance, data quality assurance, and technology upgrades.

### Executive summary

Population growth, industrial expansion, and human activities increase pressure on air and water quality. Environmental monitoring is needed to identify pollution, assess risks, and guide mitigation. Conventional approaches can limit the timely availability of information.

This study developed a sensor-based Water and Air Quality Monitoring System (WAQMS), integrating air and water monitoring with a real-time dashboard. Pilot implementation covered Kampar Regency, Pekanbaru City, and Siak Regency.

The dashboard makes environmental information accessible to relevant stakeholders and supports the identification of changes and trends. Its policy value depends on reliable sensors, validated data, trained operators, and a clear response mechanism.

A phased expansion, supported by routine maintenance and coordination across government levels, can strengthen evidence-based environmental management in Riau.

### Introduction

Riau Province needs timely information to manage air and water quality. Limited monitoring points and fragmented systems can constrain environmental responses. This study addresses those challenges by integrating the Air Quality Monitoring System (AQMS) and Water Quality Monitoring System (WQMS) into WAQMS, with a unified dashboard.

### Research objectives

- Analyze water and air quality in Riau using integrated sensors and real-time monitoring.
- Develop an effective system that integrates sensors, data transmission, and a monitoring dashboard.
- Examine how real-time environmental information can support sustainable decision-making in Riau Province.

### Approach and results

The study developed an integrated sensor-based system combining AQMS and WQMS in a single WAQMS platform. A real-time dashboard enables relevant stakeholders to access and visualize environmental data.

Pilot installations were undertaken at selected monitoring points in Kampar Regency, Pekanbaru City, and Siak Regency. Data are transmitted to a centralized dashboard. Monitored parameters include PM2.5, PM10, temperature, humidity, pH, turbidity, and other relevant indicators.

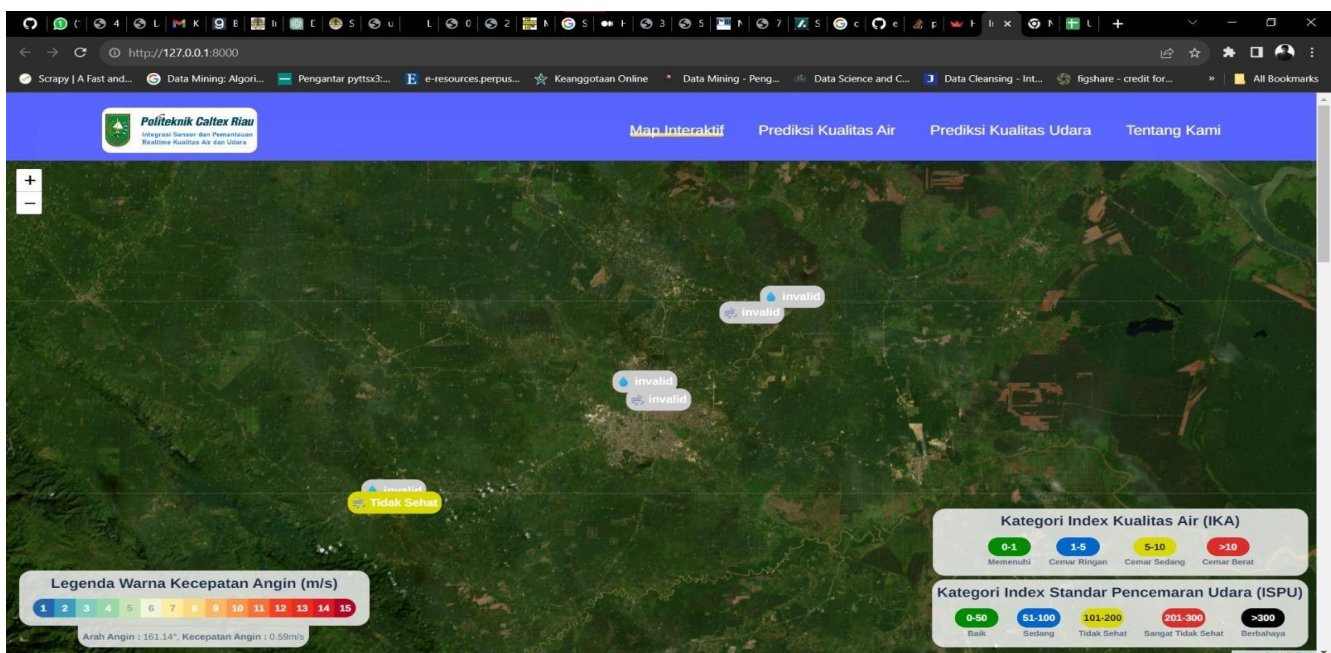
The study reports that the system provides timely information and that local stakeholders found the dashboard useful for environmental management. These findings support its potential use in early warning and response planning.

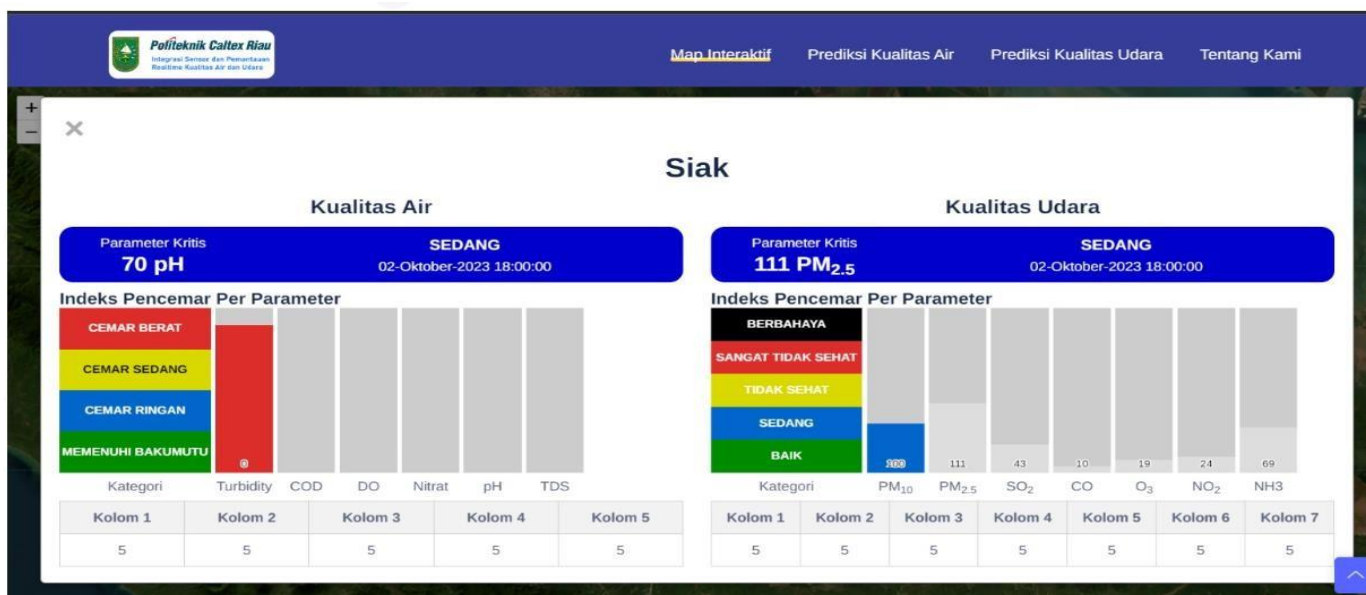
However, this brief does not present quantitative accuracy, predictive-performance, or cost-comparison results. Operational decisions should therefore be supported by calibration, data validation, and site-specific evaluation.

### WAQMS installations in Kampar, Siak, and Pekanbaru



### Integrated AQMS and WQMS monitoring dashboard (WAQMS)





## Policy implications and recommendations

### a. Phased implementation

Expand coverage using pilot experience and local monitoring priorities.

### b. National integration

Agree on data standards and exchange mechanisms with the responsible national institutions.

### c. Capacity building

Train operators in dashboard use, interpretation, and response procedures.

### d. Infrastructure support

Ensure secure installations, connectivity, power supply, and field safety.

### e. Sustained operation

Provide recurring budgets for calibration, maintenance, validation, and upgrades.

## Conclusion

WAQMS integrates water and air quality sensors with a real-time dashboard to support environmental management in Riau. The three pilot areas provide a basis for considering wider deployment.

Its value for policy depends on data quality, operational continuity, and the ability of institutions to act on the information. A phased approach, coordinated data integration, and sustained funding are therefore recommended.

Claims of accuracy, predictive capability, and affordability require further quantitative evidence before wider adoption decisions are made.

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Source references retained; entry 4 is incomplete in the original.