Ministry of Environment and Sustainable Development Dakar - Senegal



Air Quality Monitoring in Dakar, Senegal

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Senegal Overview

Senegal is located in the western most part of Africa's Sahel region.

❖National territory spanning is 196,722 km²,
❖Population is estimated at 15.3 million,
❖46.5% of which live in urban zones.

Senegal is bounded by:

➢Atlantic ocean in west:
➢Mauritania in north and east;
➢Mali in east;
➢Guinea and Guinea Bissau in south

The capital city **DAKAR occupies only 550 km2 (0.3% of the country total area) but :**

- Concentrates most of the economic activities
- A population of 3.5 million,
- 330,125 registered vehicles,
- 70% of the industrial plants.

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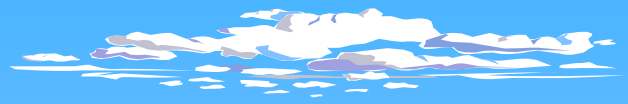
Backgrounds and Justifications

Senegalese Government: being aware of the need to improve the quality of life of people; Taking into account the impacts of air pollution on the human health and the Environment (for example the health cost of air pollution is estimated at 65 billion in 2001 according to a study of the World Bank), created in 2009 an air quality monitoring centre wich is so far, the only one in west Africa.

The centre is funded by the Nordic Development Fund (NDF) and Senegalese Government and put under the supervision of the Direction of Environment and Classified Establishment.

The centre has six monitoring stations and a reference laboratory.

Objectives

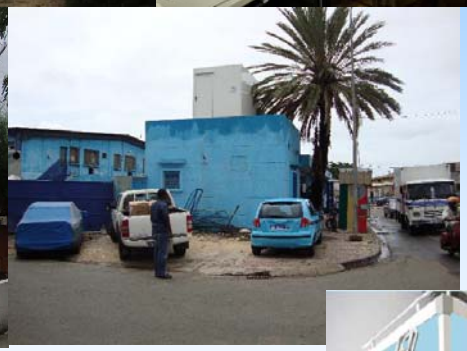


- To keep on watching the ambient air pollution,
- Advocating realistic measures for improving air quality,
- To promote the establishment of a committee on air quality
- To inform the public on air quality and provide reports to the authorities for decision making

Air Quality monitoring center








Background

- Air quality center created within the framework of the Urban Mobility Improvement Program (PAMU) implemented by CETUD (ministry of transport)
- Setup of five monitoring stations in the city of Dakar in november 2009
- The number of stations raised to 6 in november 2017 thanks to the Support Project for Transport and Urban Mobility (PATMUR) implemented by CETUD

Continuous measurement using fixed monitoring stations with ambient air analyzers

Mobile laboratory with analyzers which enable to measure in areas not covered by the fixed stations

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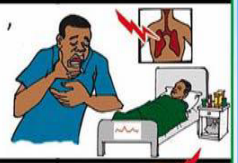
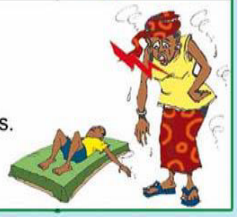
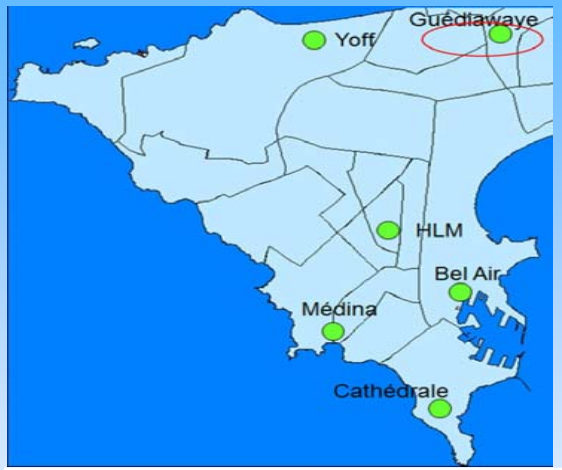
Monitored pollutants and health effects

Monitored pollutant	Source	Health effects
Nitrogen Oxides (NOx)	Transport, combustion plant,	Asthma, susceptibility of children to bronchial infections. 
Ozone (O_3)	Transformation of NOx and hydrocarbons in the presence of sunlight.	Cough, eyes irritation, etc. 
Benzene Toluene Xylene (BTX)	Transport, industry, nature	Nervous system disorders, loss of consciousness 
Particulates matter PM2.5 and PM10	Transport, industry and nature (dust and sandstorm…)	Respiratory and cardiovascular diseases 
Carbon monoxide (CO)	Transport	Chronic intoxication, headaches, vertigos, cardiovascular problems 
Sulphur dioxide (SO2)	Fuel and coal combustion	Adult acute respiratory symptoms and children breathlessness. 



	Station name	Station type	Parameters							
			SO_2	NO_x	NO_2	PM_{10}	$PM_{2.5}$	O_3	CO	BTX
1	Bd. République	Urban roadside	X	X	X	X	X	X	X	
2	Médina	Suburban roadside		X	X	X			X	
3	HLM4	Urban background	X	X	X	X		X		
4	Bel Air	Urban industrial		X	X	X	X			X
5	Yoff	Regional background		X	X	X		X		
6	Guédiawaye	Suburban roadside	X	X	X	X	X	X	X	

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Air Quality Index

Air Quality Index (AQI) values…	Levels of Health Concern	Colors
When the AQI is in this range…	… air quality conditions are:	… as symbolized by this color:
0 – 50	Good	Green
51 - 100	Moderate	yellow
101 - 200	Unhealthy	Orange
> 200	Very Unhealthy	Red

- ✓ Index for reporting daily air quality
- ✓ Disseminated through electronic mails and web site:
  - http://www.denv.gouv.sn
  - http://www.air-dakar.org

The AQI = index for reporting daily air quality:
- how clean or polluted is the air,
- Indicate associated health concerns you should be aware of.

$$AQI = \frac{\text{Pollutant concentration}}{\text{Pollutant limit value}} \times 100$$

Pollutant	Averaging time	Maximum Limit Value	
		WHO	Senegal
Sulphur Dioxide (SO_2)	1 hour 24 hours Year	500 (10 min) 125 50	- 125 50
Nitrogen Dioxide (NO_2)	1 hour Year	200 40-50	200 40
Ozone (O_3)	1 hour 8 hours	150-200 120	- 120
Carbon Monoxide (CO)	1 hour 8 hours	30 000 10 000	- 30 000 (24h)
Particles <10 µm (PM10)	24 hours Year	50 * 20 *	260 80
Lead (Pb)	Year	0.5-1,0	2

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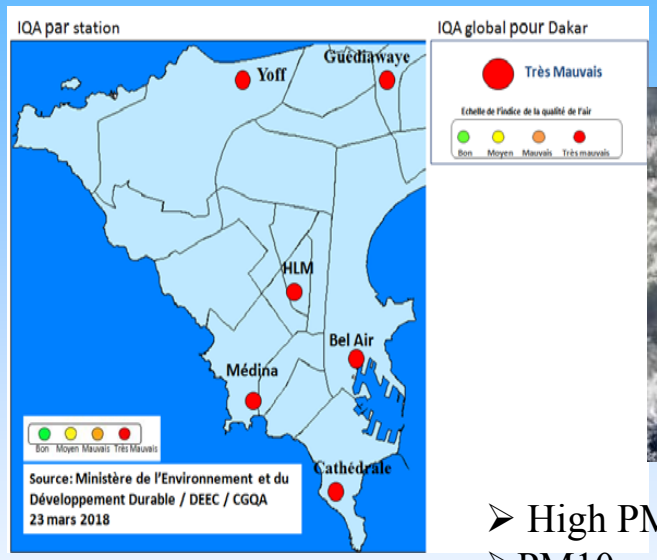
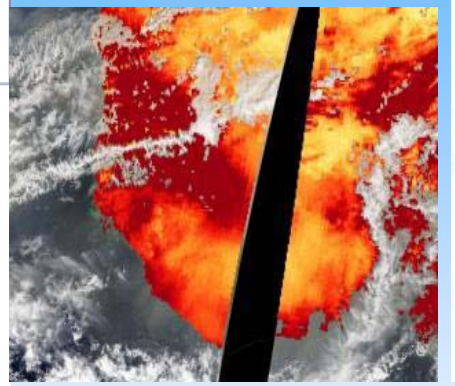
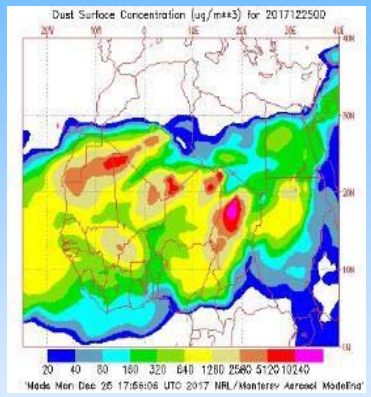
Air pollution episodes



22 - 29 december 2017



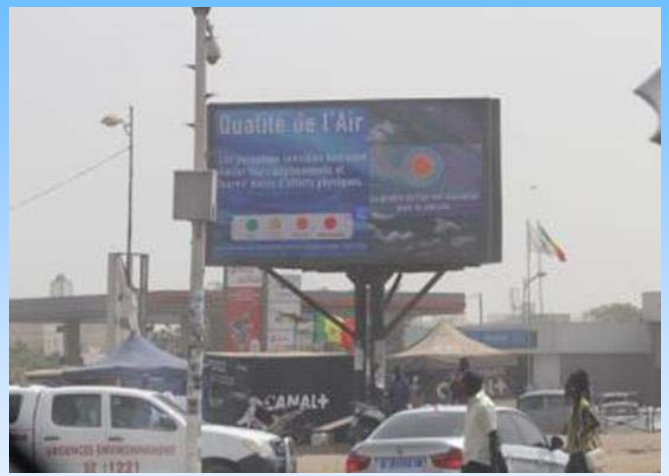


- High PM concentrations
- PM10 maximum values exceeded 800 micrograms per cubic meter in most of the measurement stations
- « Red »AQI which means very unhealthy air quality
- Everyone may experience health effects of air pollution

Air pollution episodes

Particulate pollution episode on 22 - 29 december 2017 Alert message published online and sent to the press and hospitals

« The air quality for today is very unhealthy (Red Index).
Deserts particulates concentrations started increasing yersterday.
This situation could last for the next 72 hours. »



Healthcare professionals contribute to health recommendations

« Children, people with asthma and other chronic lung diseases, the elderly, should remain vigilant and contact a physician if needed. »

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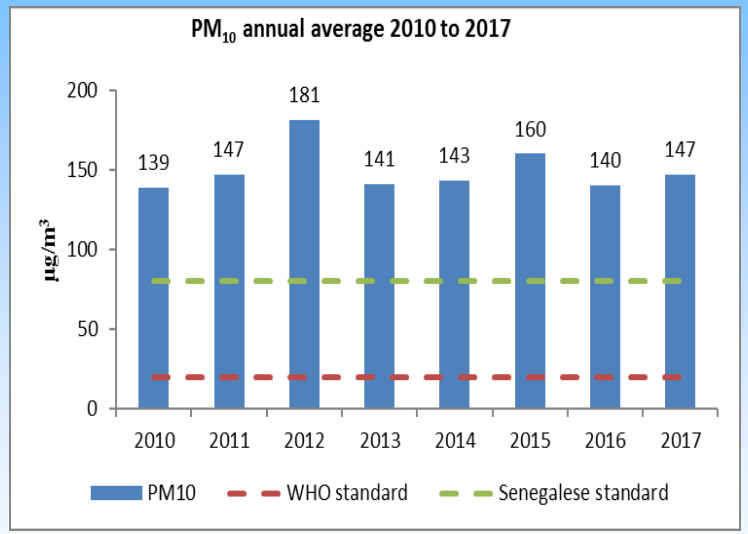
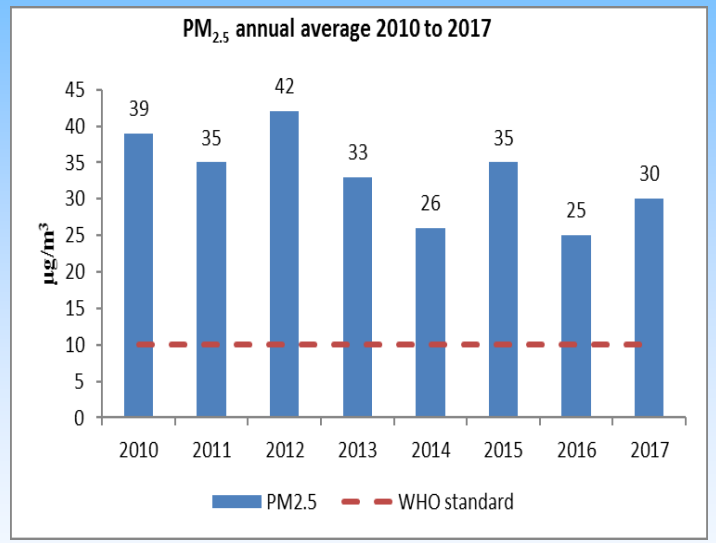
Air pollution mainly due to particles

Annual mean PM concentrations (2010 – 2017)





WHO : 20 µg/m³
Sen.: 80 µg/m³

WHO : 10 µg/m³

Exceed WHO and Senegalese guidelines

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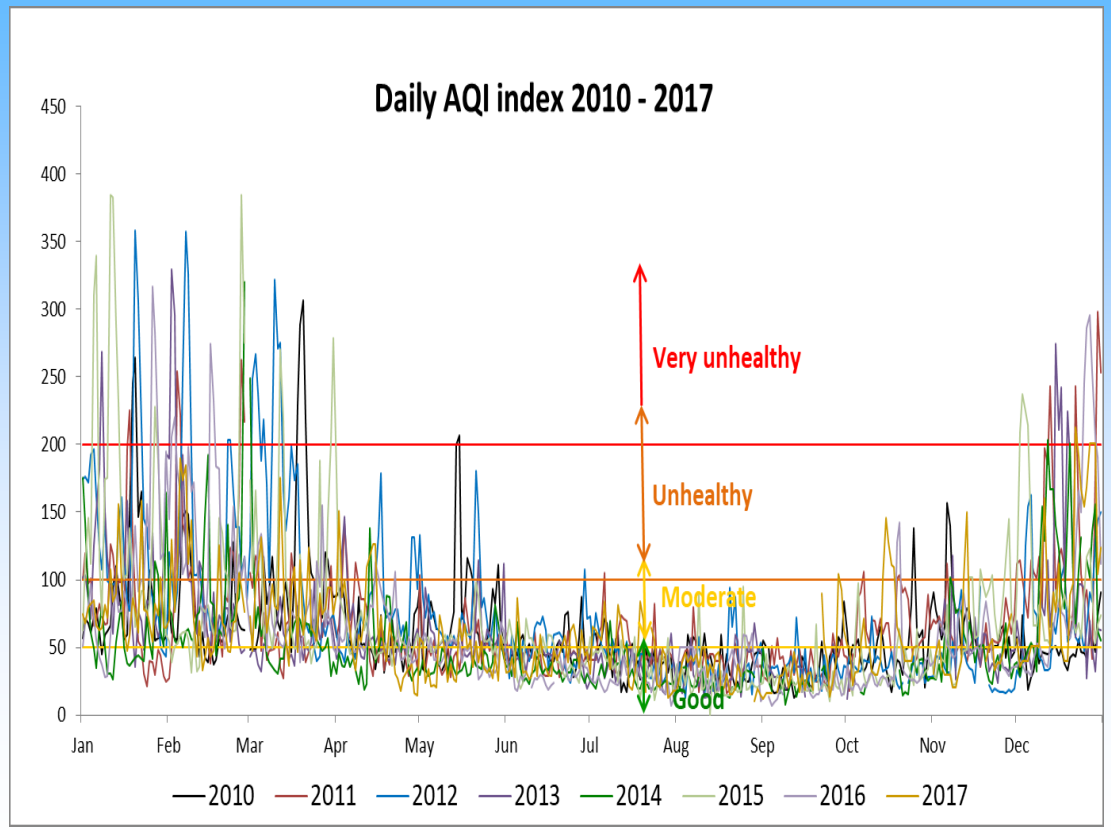
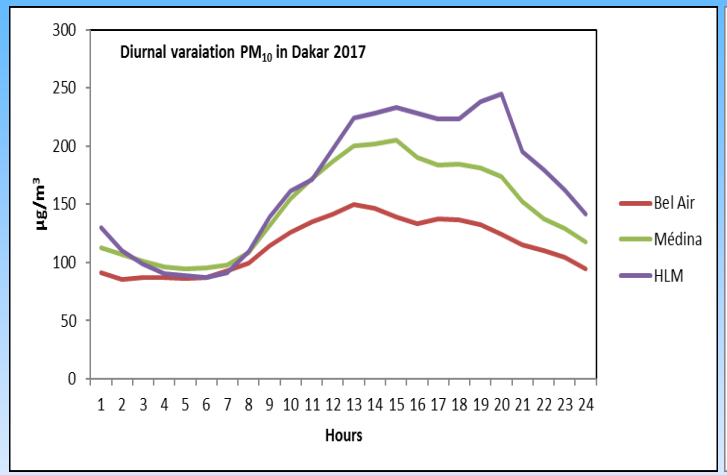
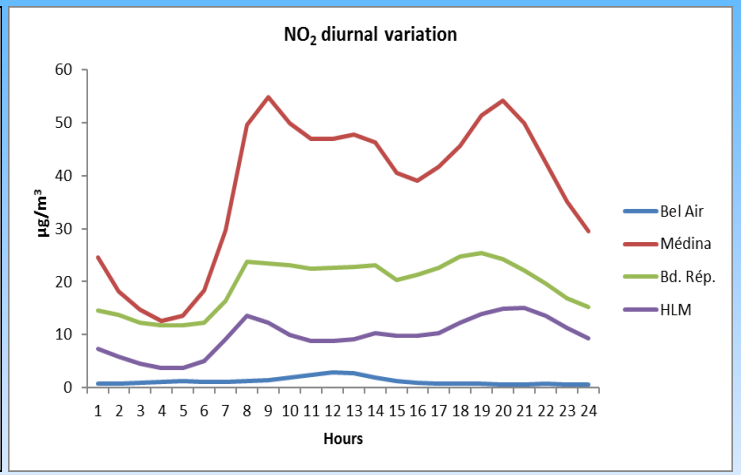
Seasonality of air pollution peaks



✓ Poor air quality during the dry season (mid-november to april)
✓ Good air quality during the rainy season (may to october)

Impact of traffic on air quality





Highest PM and NO2 concentrations are observed during peak hour traffic

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Some of devices

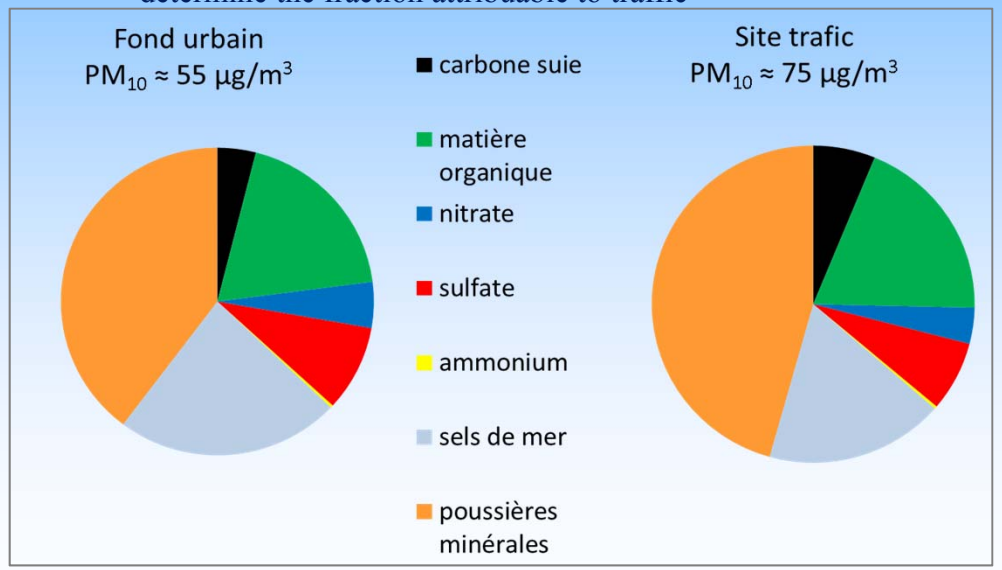
For the sake of improving pollution monitoring, the center acquired portable devices and measurement campaigns were conducted to determine the chemical composition of the particulates (Dust).

- ✓ **02 particle samplers**
- ✓ **05 portable particle analyzers**
- ✓ **03 vehicle pollution measuring devices**
- ✓ **02 portable multi-gas analyzers**
- ✓ **01 VOC measuring device**

Evaluation of pollution from trafic

Particles sampling preliminary results

Objective: characterise PM_{10} chemical composition to determine the fraction attribuable to traffic



Importance of large particles (mineral dust et sea salt) both in urban background and road traffic site

PM_{10} average chemical composition in Dakar (24 june – 16 july 2015) (Source: Rapport d'étude INERIS)

Technical partnership

Air Quality National Focal Point for UNEP and WHO

- ✓ CGQA presentation at side-event on air quality (first United Nations Environment Assembly (UNEA) on june 2014 in Nairobi - Kenya)
- ✓ Participation in the summary report on Senegal air qualiy policies in response to resolution 7 of the UNEA
- ✓ Participation in the 2016 WHO Global Urban Ambient Air Pollution Database
- ✓ Evaluation of health impacts of air pollution - Linkages between pollution episods and respiratory diseases and meningitis (local hospitals and universities, Howard univesity (USA))

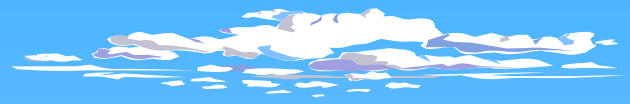
Technical partnership

- ✓ Participation annual workshops of Africa and Asia champion cities on « Clean air and sustainable mobility » launched by the Indian Centre for Science and Environment (CSE- New Dehli)

- ✓ Collaboration with Enda Energie in the implementation of Ivory Coast request submitted to CTCN (Climate Technology Center and Network) - Elaboration of an action plan to setup a strong and comprehensive monitoring, reporting and verification (MRV) system on atmospheric pollution and climate change in the district of Abidjan.

- ✓ Expect to regional / International networking for cooperation and research on air quality.

Perspectives



- ✓ SENEGAL: only one country in West Africa that have a continuous air quality monitoring system
- ✓ Warning system in case of pollution peaks to reduce the short-term effects on people's health
- ✓ Extend the monitoring network to the main senegalese cities by using air sensors
- ✓ A more accurate characterization (PM) and black carbon monitoring in ambient air are necessary to better evaluate traffic related air pollution
- ✓ Assessment of methane emissions (industries, open air dumps)

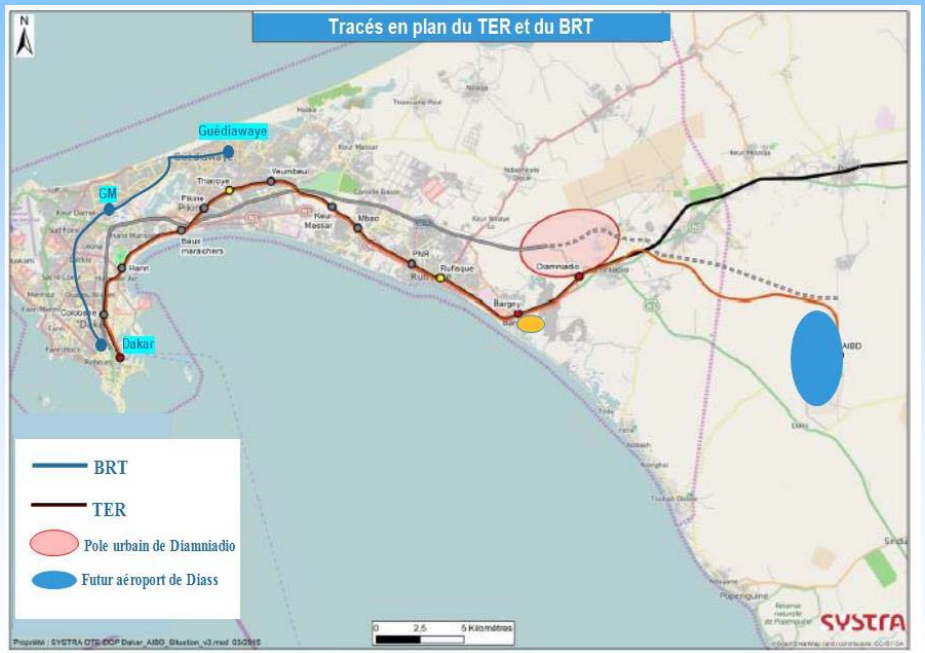
Urban Mobility program promoting air quality : The TER and the BRT project

Objectives

✓Setup a Regional Express Train (Train Express Régional – TER) to deserve Diamniadio urban center, AIBD airport and the Special Economic Zone

✓BRT suggests : Goes through most densely populated and congested areas

✓ Urban mobility improvement and structuration of urbanization



the context of African cities

- Rapid population growth
- Old industries without control Measures
- Increase cars traffic
- Urbanization
- Energy consumption
- Municipal waste dumps
- Striving for economic growth

the context of African cities

Given today the development of African cities and the effects of pollution on the environment and human health, it is time to monitor the air quality in order to have data and take into account this aspect in the projects and development program.

To date there are some countries that have network and the sustainability of this project causes huge problem because of the cost of maintenance hence the need to deploy the passive sensors.

For example, Senegal has submitted a project to the UN Environment for support on the acquisition and use of sensors.

weakness of African states

- Implementation and enforcement of existing legislation is weak
- Lack of monitoring equipment
- Prevalence of ad hoc awareness rising
- Poor participation of stakeholders including the public and the media
- Poor development of risk perception and risk communication
- High costs of awareness raising programmes
- Design and implementation of Air Quality Monitoring strategies often based on poor knowledge and inadequate regulatory, institutional, planning technical, social, and financial capacities

THANK YOU FOR YOUR ATTENTION

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