European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

WGs and MC Meeting at Cambridge, 18-20 December 2013

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 2: 1 July 2013 - 30 June 2014 (*Ongoing Action*)

Zafer Ziya ÖZTÜRK

Function in the Action (MC ,WG 1&2 Member, SIG II Member)

Gebze Institute of Technology/ TURKEY

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

Air Quality Monitoring in Turkey

- In Turkey, Ministry of Environment and Urbanization is the competent authority on this issue.
- Ministry has national air quality monitoring network contains 122 measurement stations in 81 cities of the country.
- Air quality parameters, which are particulate matter (PM10) and gaseous pollutants (CO, SO2, NO, NO2, NOX, O3), are measured and
- the measurement results are displayed on the Ministry's air quality monitoring network website, the results are hourly updated on this website: http://www.havaizleme.gov.tr

Air Monitoring Stations

T.C. Cevre ve Sehircilik Bakanligi
Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

http://www.havaizleme.gov.tr

Stations are equipped

- Automatic SO2 analyser (UV Fluorescense)
- Automatic PM10 analyser (Beta absorption)
- Software for data collection and reporting (Envidas for windows) and computer
- GSM Modem
- Air conditioner
- Calibrated SO2
- Gravimetric PM10 measurement system
- Meteorological sensors

Case Study Istanbul

Case Study Istanbul

- **Newspaper headlines in 1990's**
- Common Death Risk in Istanbul.
- Don't Let Your Kids Go Outside
- Air Pollution Level Going up Every Year.
- Living in Istanbul Decreases the Lifetime for 4 Years.

- Air pollution has been monitored since 1995 in Istanbul.
- Metropolitan Municipality (İMM) has 11 monitoring stations.
- It is possible to reach Istanbul's air quality data from the website.

  http://www.ibb.gov.tr

Pollution Prevention

- **Within the policies of Ministry; foremost Environmental Law and all legislation and its implementations cover the European Union's priorities included in the environmental policies of EU.**
- **The priorities are:**

"Pollution Prevention" conceptual ranking.

- **Pollution Prevention at source**
- **Waste minimization.**
- **Best Available Technologies and Techniques.**
- **Energy Efficient Usage.**
- **Effective Monitoring and Audit System Implementation.**
- **"Polluter Pays" principal.**

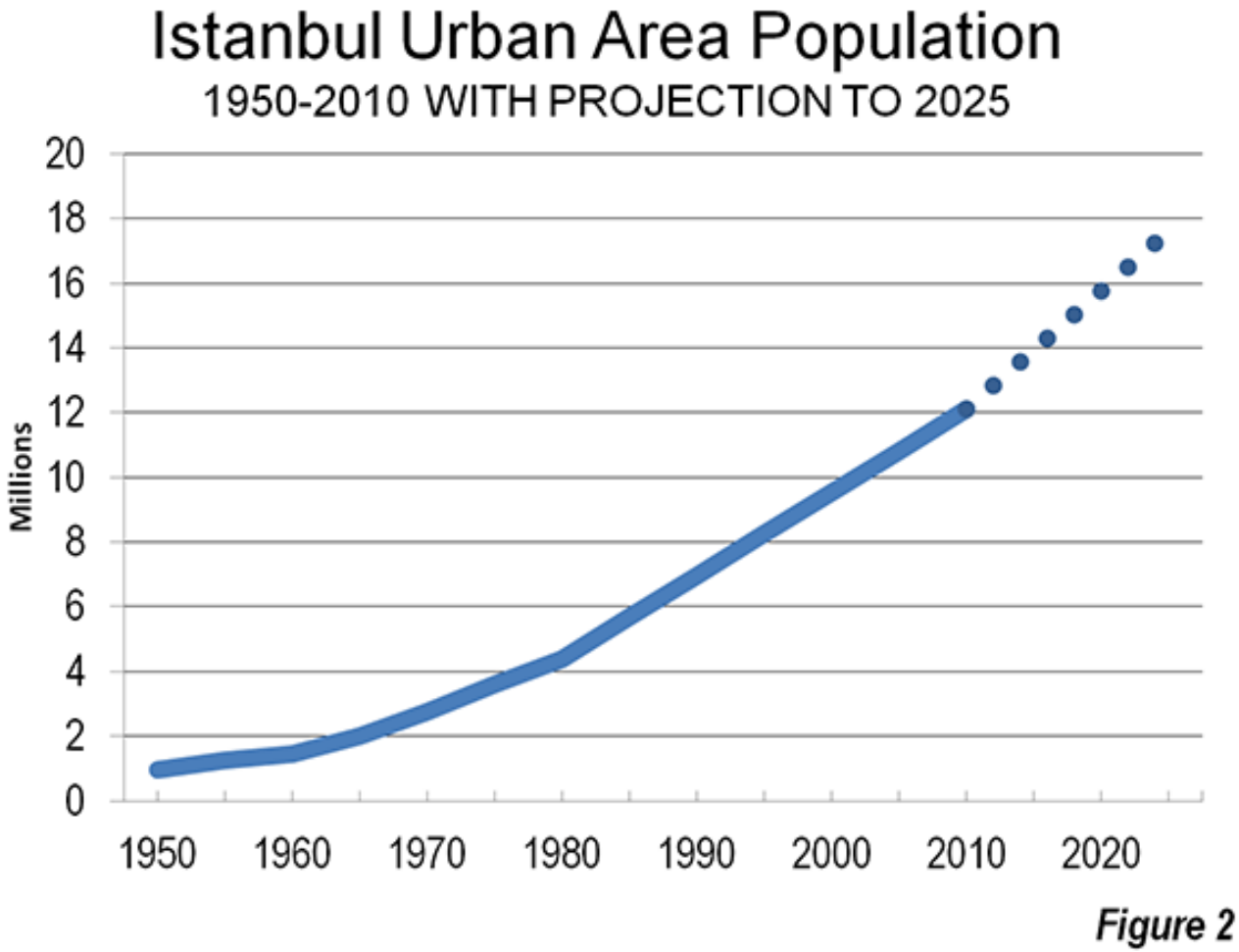


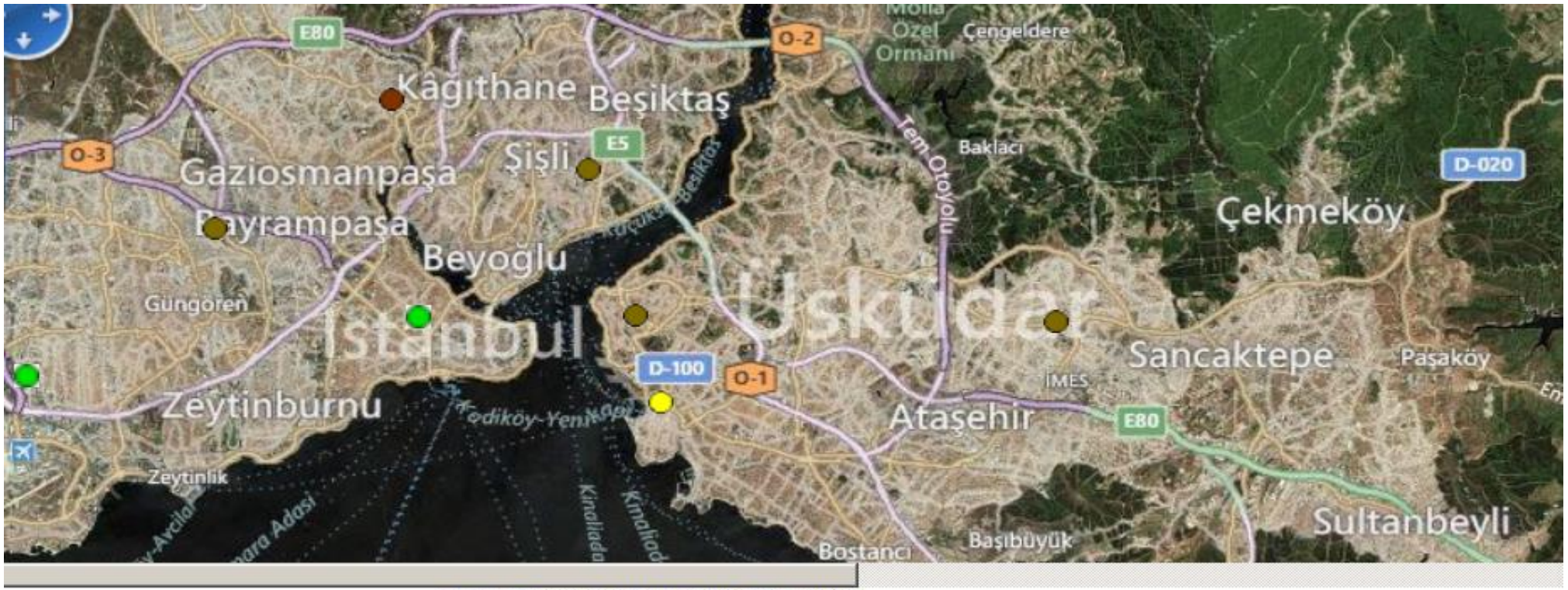
Figure 2

http://www.newgeography.com/content/003020-the-evolving-urban-form-istanbul

Air quality monitoring stations in Istanbul

LIFE06-TCY/TR/000283 project

AQM Stations in Istanbul



T.C. Cevre ve Sehircilik Bakanligi
Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

http://www.havaizleme.gov.tr

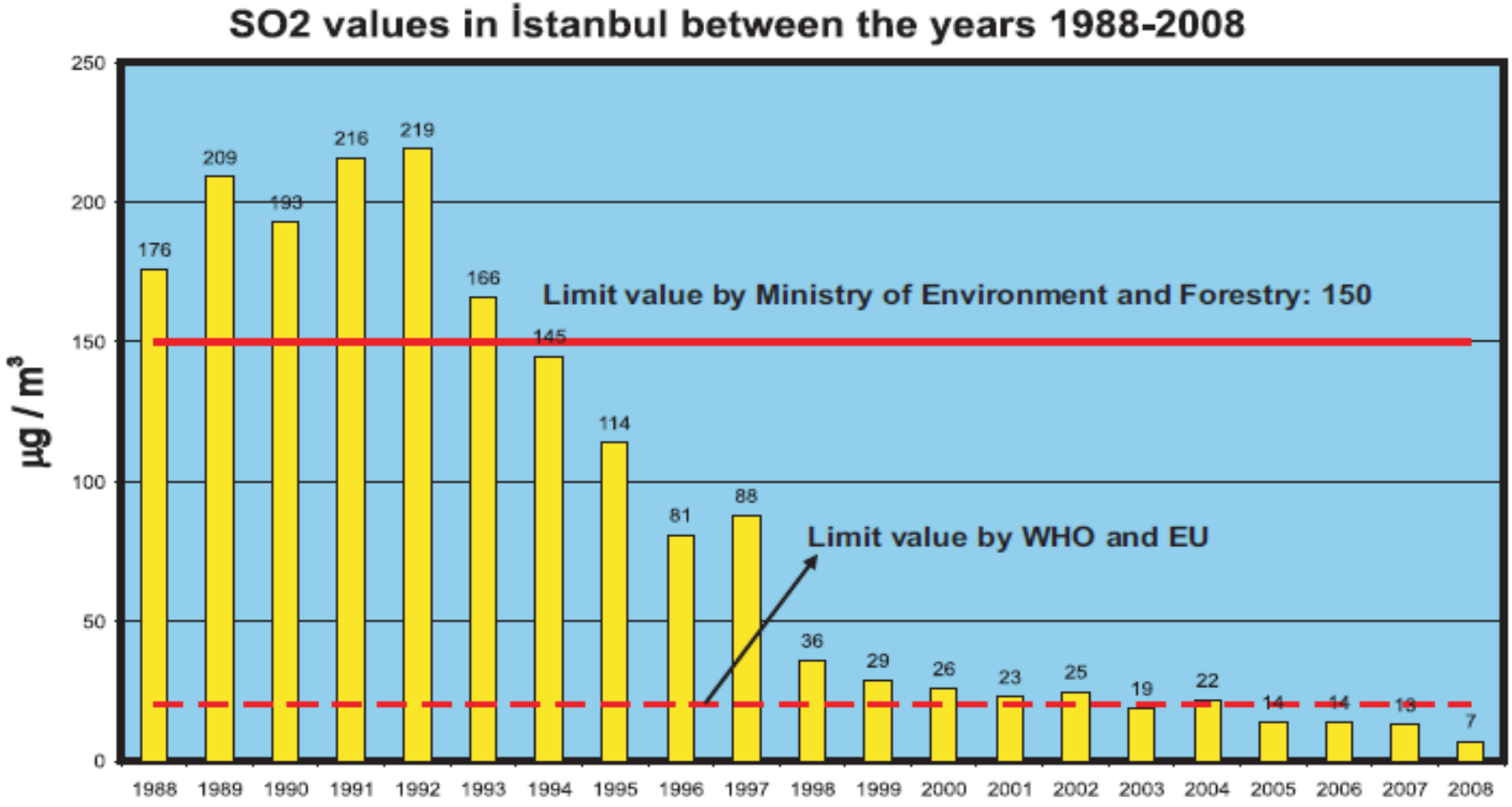
Air Pollution Sources

- Industrial plants
- Motor Vehicles
- Residential Heating
- Others







Sulfur dioxide values in İstanbul between the years 1988-2008

Pollution Reduction

Vehicle Emission Reduction

- **Raising awareness about the environmentally friendly driving techniques.**
- **Improving the substantial transportation infrastructure.**

Industrial Emission Reduction

- **Industrial site selection considering wind direction.**
- **Promoting new technologies in industries.**

Household Emission Reduction

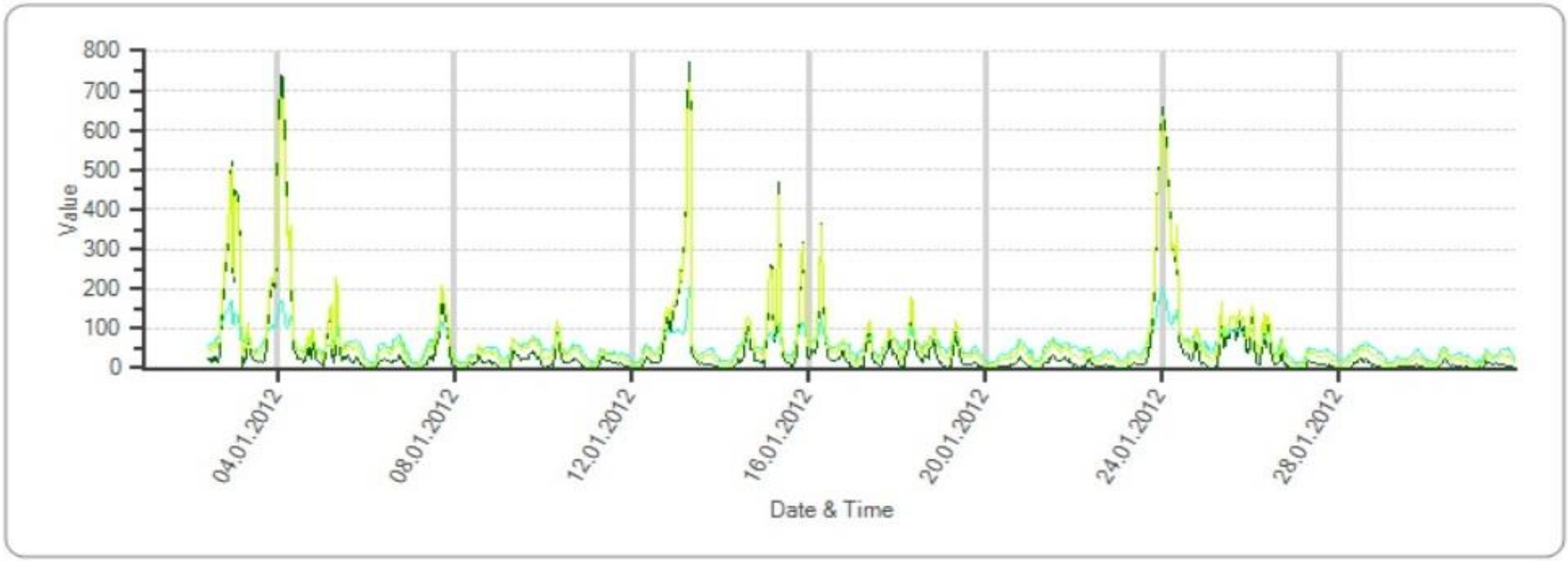
- **Encouraging the use of natural gas in all parts of Istanbul.**
- **Promoting thermal insulation in residential buildings.**
- **Raising awareness about periodic stack cleaning and efficient combustion.**

Other initiatives

- **Raising public's awareness about air quality.**
- **Increasing green areas.**
- **Using the advanced decision support systems for urban and transport planing.**
- **Development of air monitoring network with the new analysers and parameters.**
- Istanbul Metropolitan Municipality
  Environmental Protection and Control Department
  www.ibb.gov.tr/airqualistanbul

LIFE06-TCY/TR/000283 project

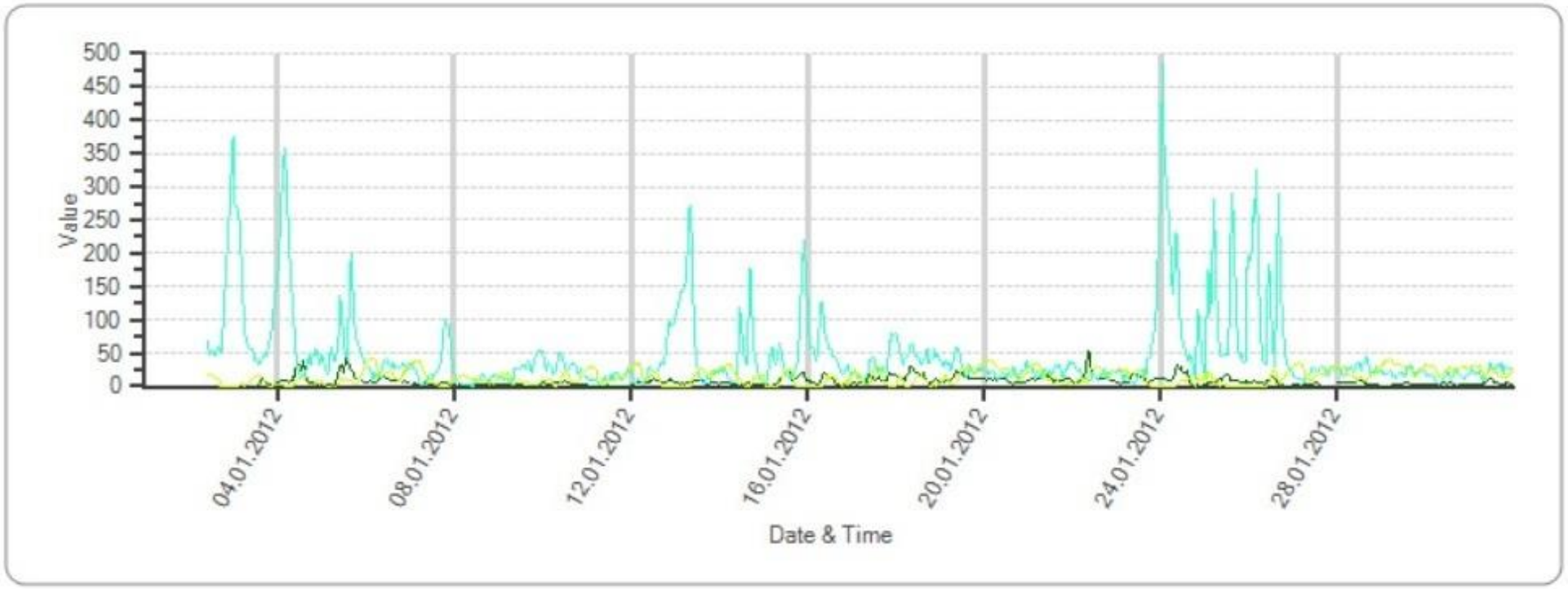
Station:ISTANBUL(KADIKOY) Periodic:01/01/2012 00:00 - 31/01/2012 23:00 Report Type:AVG



T.C. Cevre ve Sehircilik Bakanligi
Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

http://www.havaizleme.gov.tr

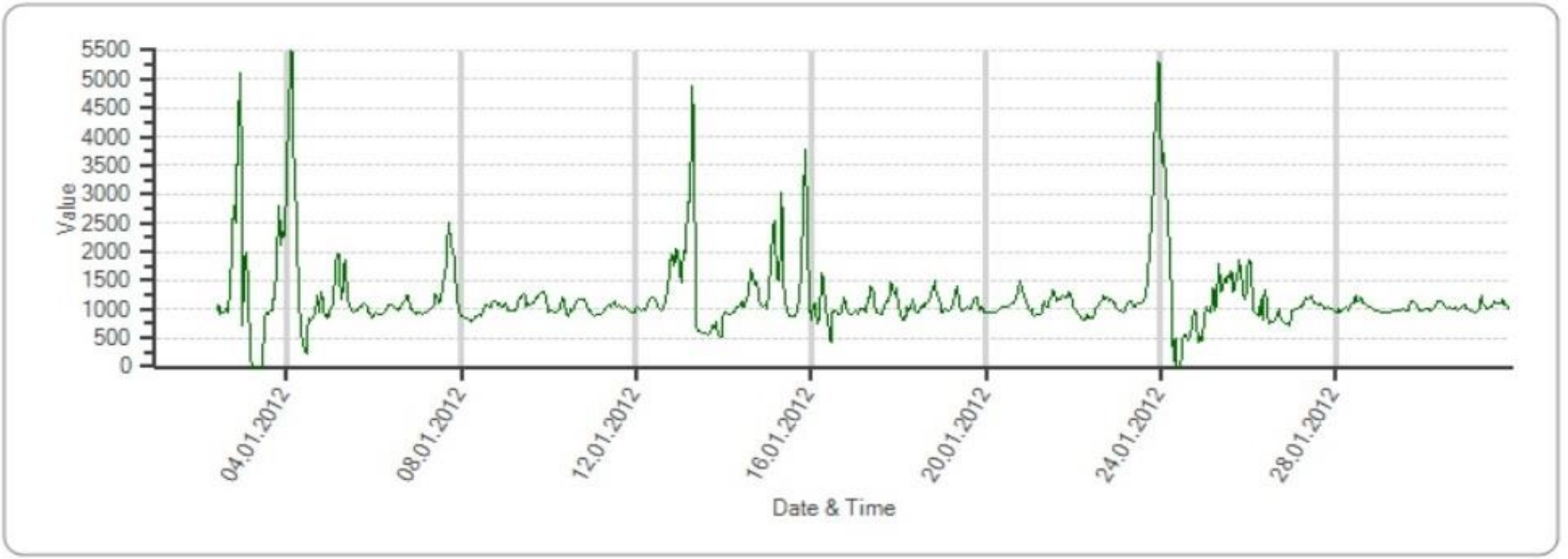
Station:ISTANBUL(KADIKOY) Periodic:01/01/2012 00:00 - 31/01/2012 23:00 Report Type:AVG



T.C. Cevre ve Sehircilik Bakanligi
Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

http://www.havaizleme.gov.tr

Station:ISTANBUL(KADIKOY) Periodic:01/01/2012 00:00 - 31/01/2012 23:00 Report Type:AVG

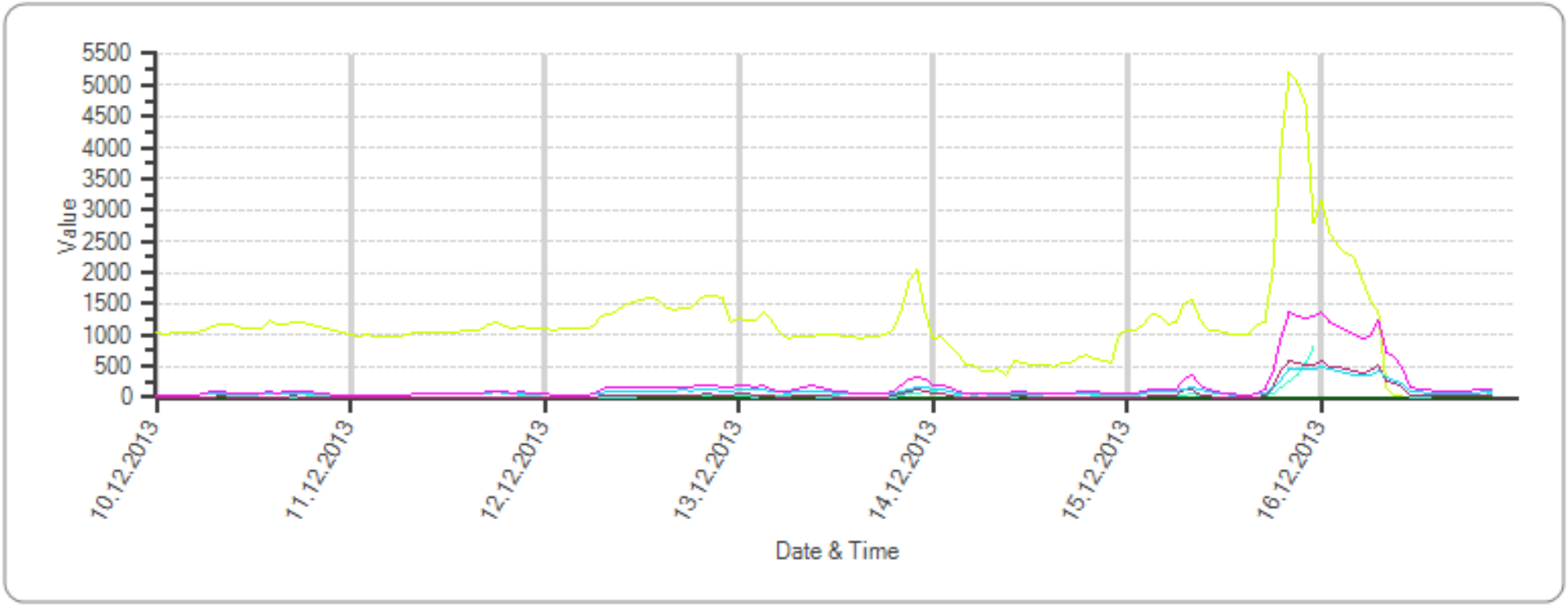


CO[µg/m³]

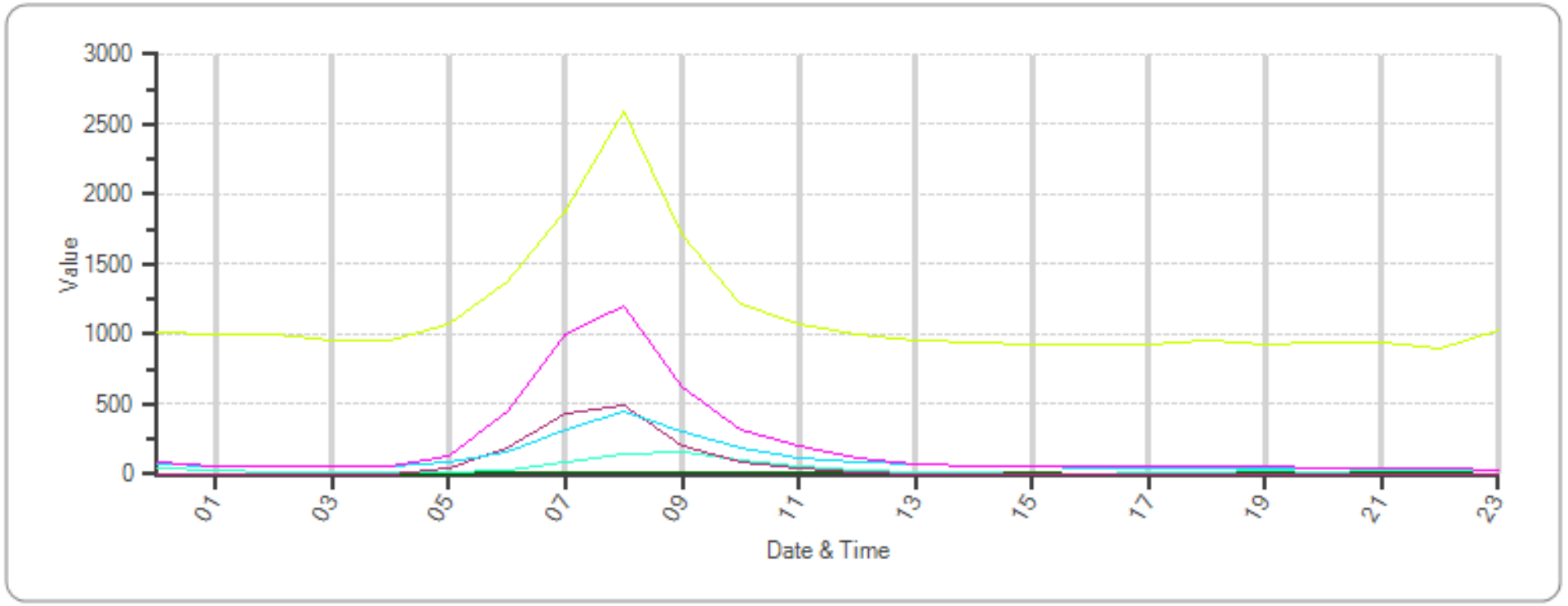
T.C. Cevre ve Sehircilik Bakanligi
Tel: +90 312 410 10 00 - Faks: +90 312 498 21 66

http://www.havaizleme.gov.tr

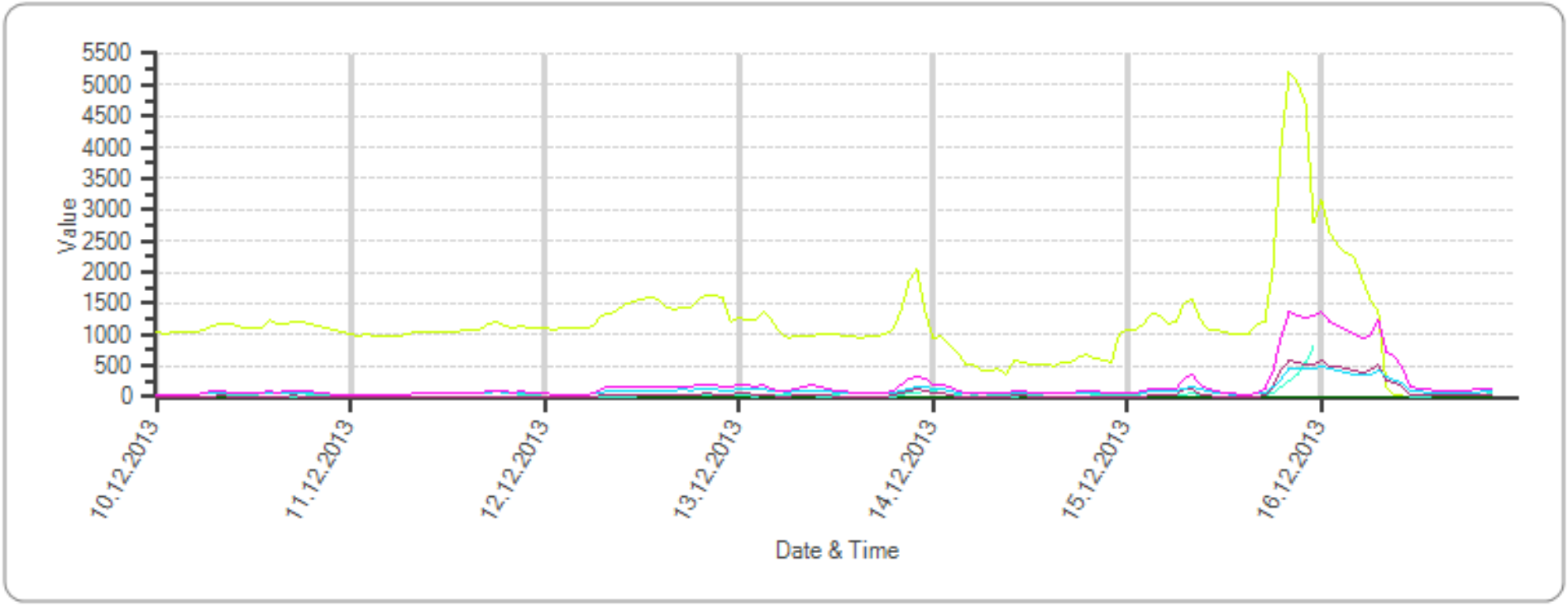
İstasyon:ISTANBUL(KADIKOY) Periyodik:10.12.2013 00:00 - 16.12.2013 23:00 Rapor Türü:AVG



İstasyon:ISTANBUL(KADIKOY) Periyodik:09.12.2013 00:00 - 09.12.2013 23:00 Rapor Türü:AVG



İstasyon:ISTANBUL(KADIKOY) Periyodik:10.12.2013 00:00 - 16.12.2013 23:00 Rapor Türü:AVG

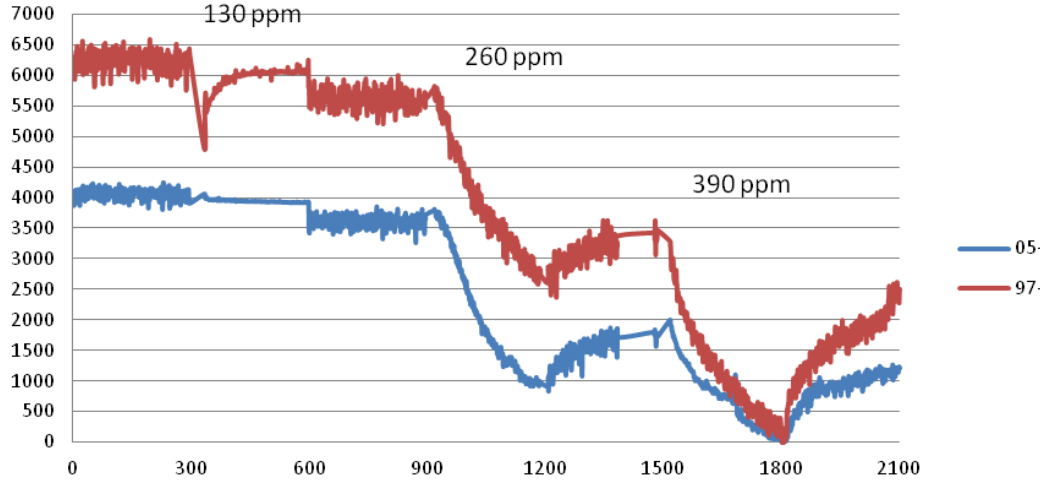


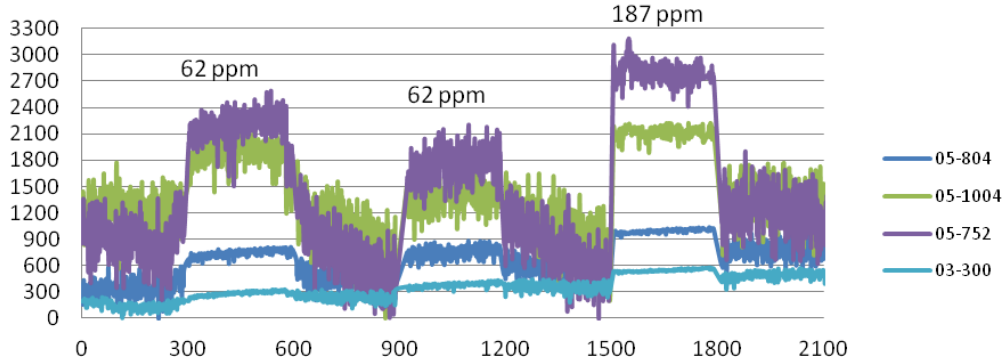
Suggested Priorities for future research

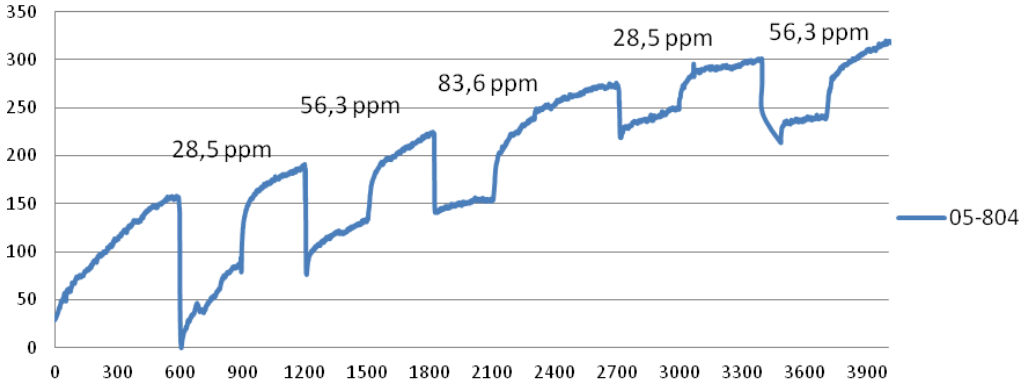
- gas sensors based on doped/undoped nanostructured metal-oxide semiconductors will be developed for toxic gases such as H_2, CO, and NO_2.
- to fabricate inexpensive, sensitive and selective gas sensors for toxic gases in the car cabin from low level to high level concentrations with low power consumption.
- to develope inexpensive sensor system applicable in AQM stations using fabricated sensors.

100MHz QCM Array

NO2, SO2 and CO Results







ZnO based Sensors

ZnO nanorods		Temperature	Min Concentration	Sensitivity DeltaI/I0
	Acetone	300C	1500 ppm	0,55
	RH	300C	10%	0,40
	CO	300C	300 ppm	0,12
	Ethanol	300C	250 ppm	0,70
	NO2	200C	100 ppb	1,50
Pd-ZnO nanorods				
	H2	25C	500 ppm	11,40
	Ethanol	200C	5000ppm	0,01

TiO2 based Sensors

	H_2	Isopropanol	Ethanol	Methanol	Chloroform	DCM	CCl_4
TiO_2 Nanotubes (Ti foil)	100-5000 ppm (25^0C, 100^0C, 150^0C) [1]						
TiO_2 Nanotubes (Thin film)		5000 ppm (200^0C) [3]	5000 ppm (200^0C) [3]	5000 ppm (200^0C) [3]	5000 ppm [3] (200^0C)	5000 ppm [3] (200^0C)	5000 ppm [3] (200^0C)
TiO_2 Nanowires (Ti foil)	5000 ppm (100^0C), 1600-5000 ppm (150^0C), 800-5000 ppm (200^0C)	-	5000 ppm (200^0C)	-	-	-	-
Pd doped TiO_2 Nanowires (Ti foil)	100-5000 ppm (25^0C, 50^0C, 100^0C, 150^0C, 200^0C)	500-5000 ppm (200^0C)	500-5000 ppm (200^0C)	500-5000 ppm (200^0C)	500-5000 ppm (200^0C)	4000-5000 ppm (200^0C)	-
Pd Nanowires (HOPG)	50-5000 ppm (25^0C, 50^0C, 100^0C) [2]						

Acknowledgement

- This work has been funded by The Scientific and Technological Research Council of Turkey **(TUBITAK), Project Number: 111M261**

- COST Action TD1105 EuNetAir

- Organizing Committee