

ירידת זיהום אוויר כתוצאה מהפעלת אזור אוויר נקי בחיפה

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סביבה – יועץ חיצוני של מנ"א, חברת שלהבת
מערכות מידע בע"מ

מבוסס על מאמר

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**Air quality impacts of the low emission
zone policy in Haifa**

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Background

- Low Emission Zones (LEZ) are urban areas in which entry of polluting vehicles is either prohibited or restricted.
- LEZ mainly affect heavy diesel trucks and buses.
- The idea behind LEZ is to reduce traffic-related air pollution within the city center.

Aims

- This work summarizes changes in air quality following the first year of enforcement of the Haifa LEZ, February 2018 - January 2019.

Methods I

- Pollutant levels in the first year of enforcement of the Haifa LEZ were compared to those from the previous year, before commencing the Haifa LEZ.
- We examined the following pollutants: black carbon (BC), NO_x, benzene, PM_{2.5} and PM₁ which were monitored at the Atzmaut traffic AQM station.
- We examined various time periods: all daytime hours, all nighttime hours, workdays' daytime hours, Fridays' and holiday eves' daytime hours and Saturdays' and holidays' daytime hours.

Methods II

- The non-parametric Mann-Whitney statistical test (significance level of 0.05) was applied in order to examine the significance of the observations.
- We also examined the BC fraction in the PM1.
- The criterion for inclusion of AQM data was >75% observation coverage throughout the study period.

Traffic related air pollution in Haifa

- According to IMoEP, traffic contributes 48% of the total NO_x emissions, 46% of the total particulate matter emissions, and 31% of the total VOC emissions in Haifa Bay area.
- Trucks – only 3% of the vehicle fleet but contribute 40% of the vehicular NO_x emissions.

Haifa LEZ I

- Haifa LEZ program started on February 2018 and included all the city residential areas.
- Polluting diesel vehicles were prohibited from entering the LEZ, and were not allowed to use the Neve Shaanan exit of the Carmel tunnels.
- 25 municipal diesel garbage trucks were replaced with trucks operated on natural gas.

Haifa LEZ II

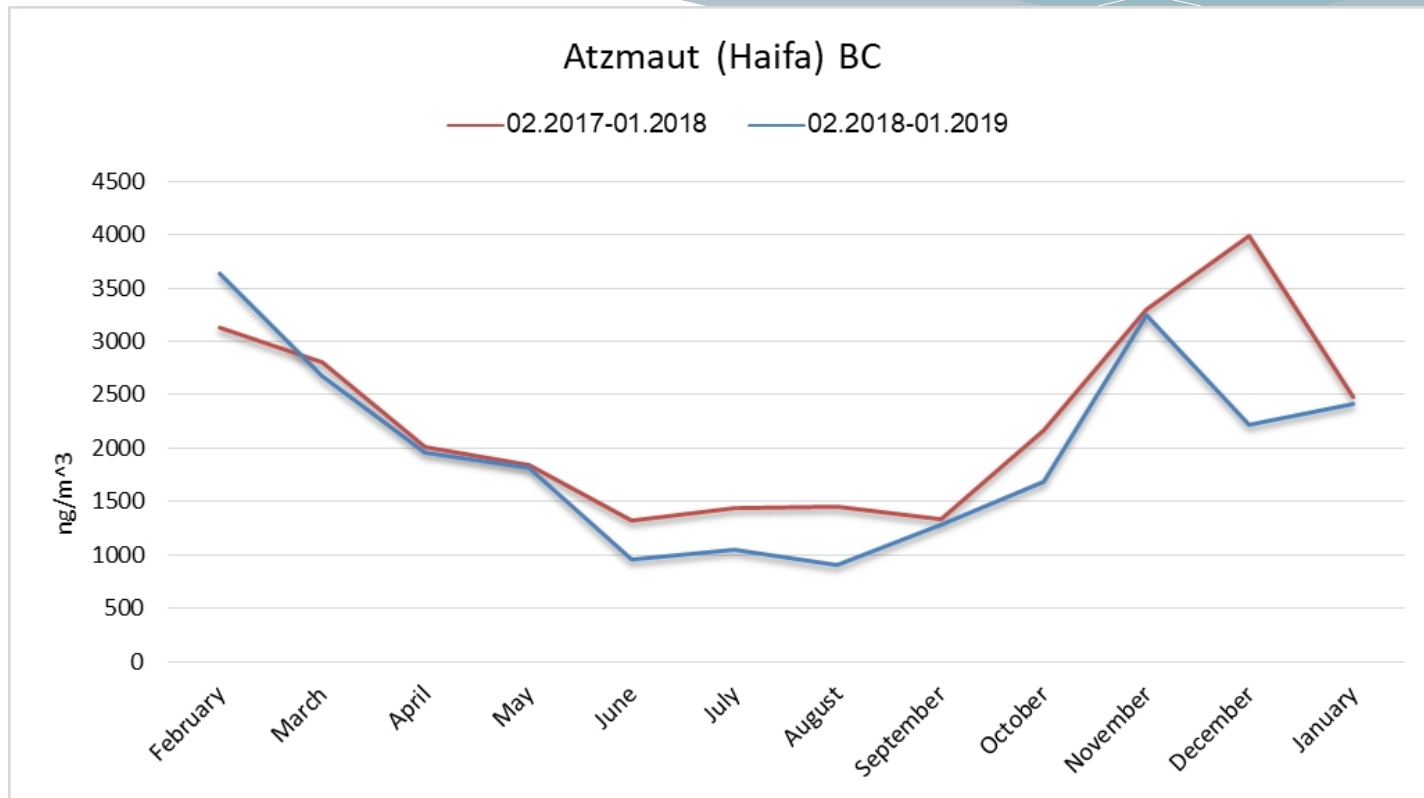
- 50 diesel buses were replaced with electrical buses.
- Electric car sharing was promoted.
- Installation of particle traps in diesel vehicles was supported.
- Total cost: 11 million NIS (abt. 3 million USD).

Haifa LEZ III



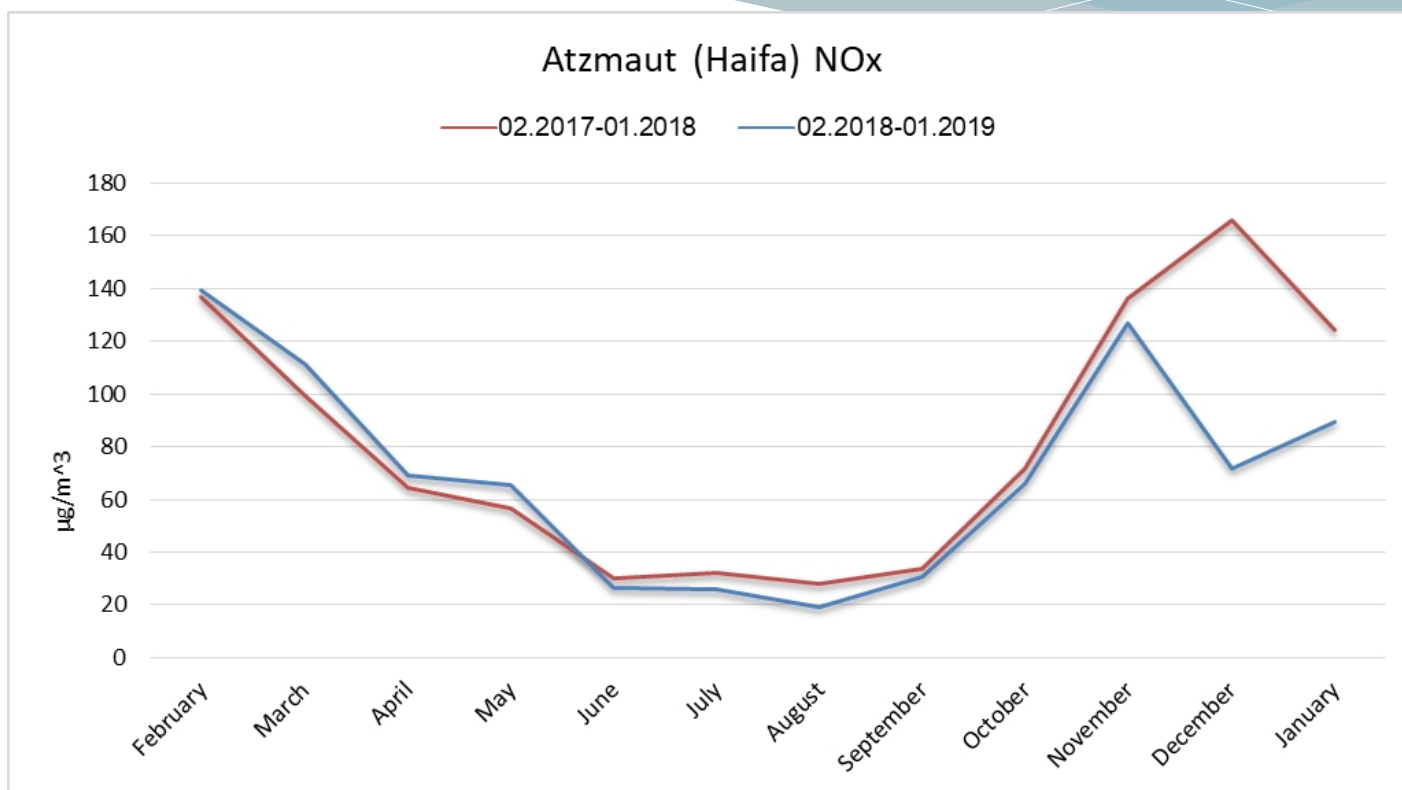
- Map of Haifa LEZ (green) and the locations of the traffic and Kiryat Yam background AQM stations that measure the examined pollutants in Haifa Bay area.

Results I



- Average BC concentrations decreased by 12.9%.

Results II

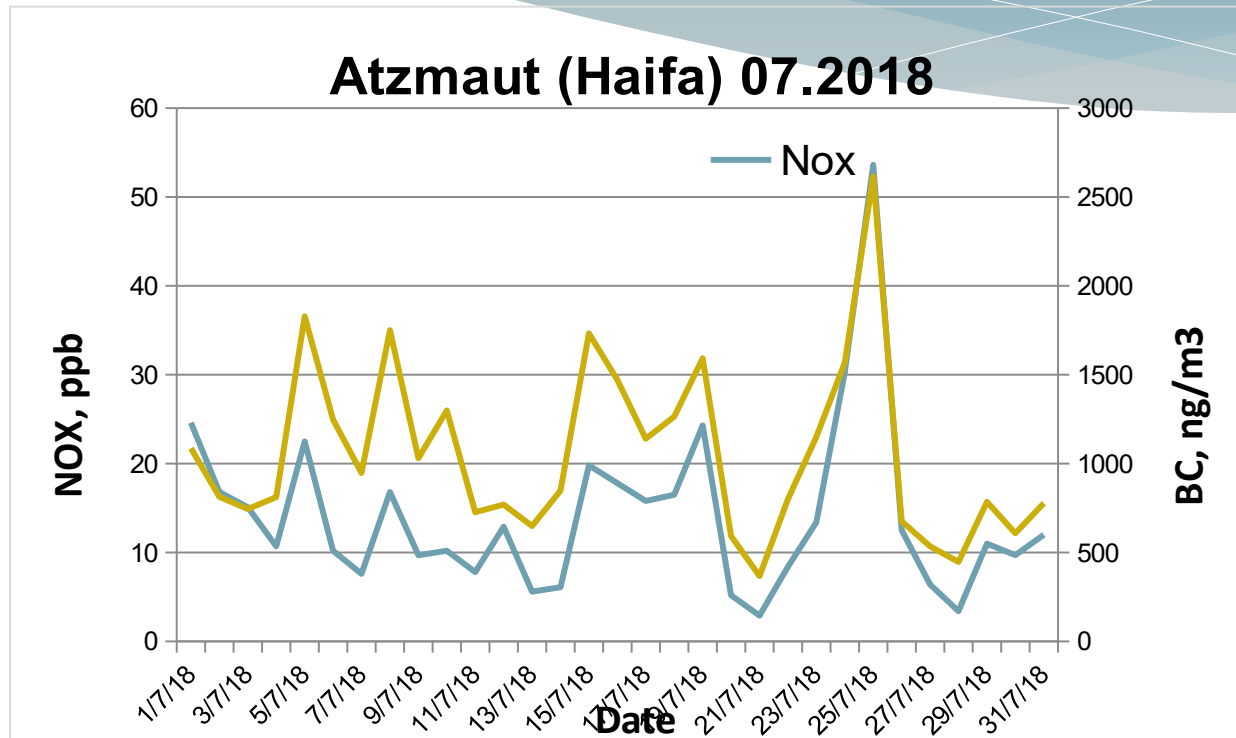


- Average NOx concentrations decreased by 10.6%.

Results III

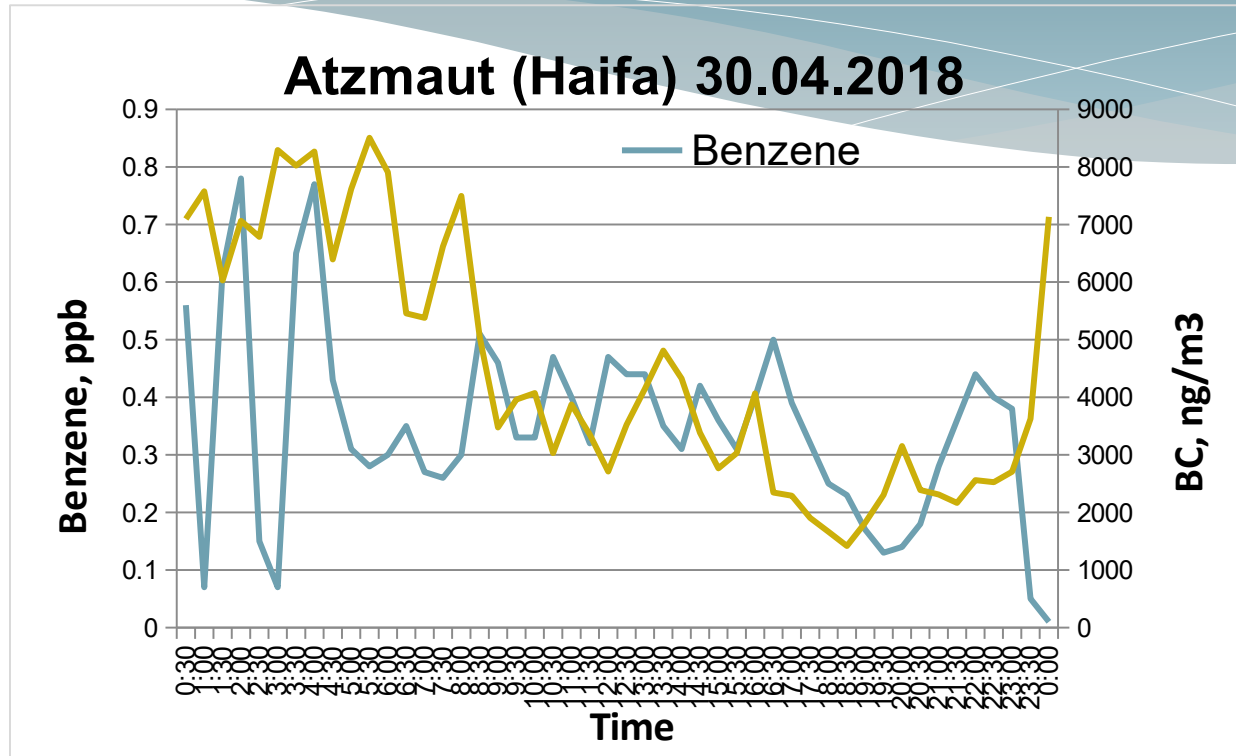
- Concentrations reduction was statistically significant.
- The highest concentration reduction was observed on Fridays and holiday eves during both daytime and nighttime hours.
- The smallest concentration reduction was observed on Saturdays' and holidays' daytime hours.
- The BC fraction in PM1 at the Atzmaut monitoring station declined by 9%.

Results IV



- BC and NO_x trends showed good agreement on both a daily and half-hourly basis.
- Both BC and NO_x serve as proxies for traffic emissions in urban areas.

Results V



- Trends of BC, benzene, PM2.5 and PM1 agreed relatively nicely on a daily basis but only partially on a half-hourly basis.
- Diesel-operated vehicles affected BC results to a greater extent than gasoline-operated vehicles.

Results VI

- In contrast to BC and NO_x, the average PM_{2.5} concentration at the Atzmaut AQM station in the LEZ period increased by 4.4% relative to the control period, and the corresponding average PM₁ concentration decreased by 3.7% relative to the control period (not stat. sig.).
- PM_{2.5} and PM₁ have other, more significant, sources than traffic, e. g. dust and possibly also industrial emissions.

Results VII

- Average BC concentrations decreased by 12.9% - less than previously reported in European cities (mostly 14-60%).
- Average NO_x concentrations decreased by 10.6% - more than previously reported in European cities (mostly 0-7%).
- Each city applied somewhat different LEZ regulations.
- Each city has distinct characteristics.
- Comparison of LEZ performance across cities is not simple.

Conclusions

- Overall, the measures taken to reduce air pollution as part of the Haifa LEZ were successful but require further in depth evaluation.
- Applying a similar LEZ policy in other cities in Israel and throughout the Middle East could result in significant impact on urban air quality.

Acknowledgment

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