

“NHSOS” Project in Chalki Island: Integrated Actions For Waste Management Optimization, Air Quality Monitoring and Carbon Footprint Mitigation

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INTRODUCTION & AIM

Waste management optimization, air quality monitoring and carbon footprint mitigation are core pillars of “GReco” Islands and Smart Specialization Strategies (S3) initiatives.

The “NHSOS” Project offers solutions and best practices for challenging issues such as energy efficiency, circular economy, air quality, etc. focusing on south Aegean Basin.

CERTH/ CPERI focuses their effort on Chalki (Halki) Island delivering:



- waste management solutions - aligned to circular economy practices,
- air quality assessment and (impact of tourism and climate on air pollution variability and
- solutions to reduce the carbon and GHGs in key areas.

METHOD



Waste Management: Current and projected waste management practices on Chalki Island are examined. Sustainable waste management strategies are proposed, prioritizing waste prevention, material re-use, and effective recycling protocols, while addressing the island's unique geographic and socioeconomic characteristics.

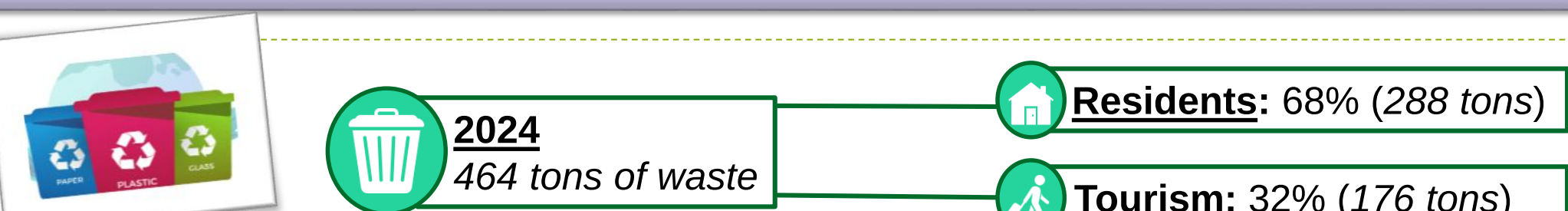


Air Quality: Concentrations of Pollutants as well as meteorological factors are recorded from calibrated mobile air quality systems (AQMS). Air Quality and Discomfort indices (i.e. AQI, DI) are calculated. In addition, data from ECMWF, BSC and satellite images are also employed in order to investigate the variation of air quality in Chalki's Island.

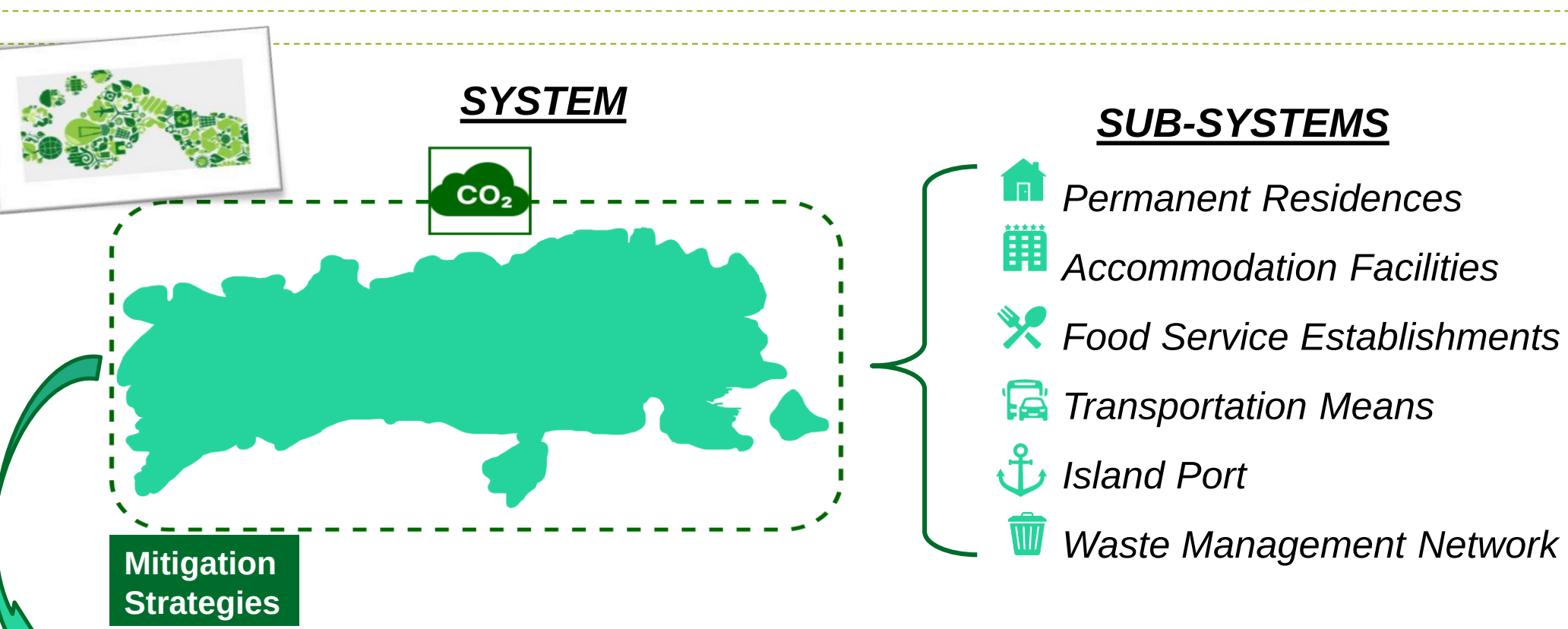
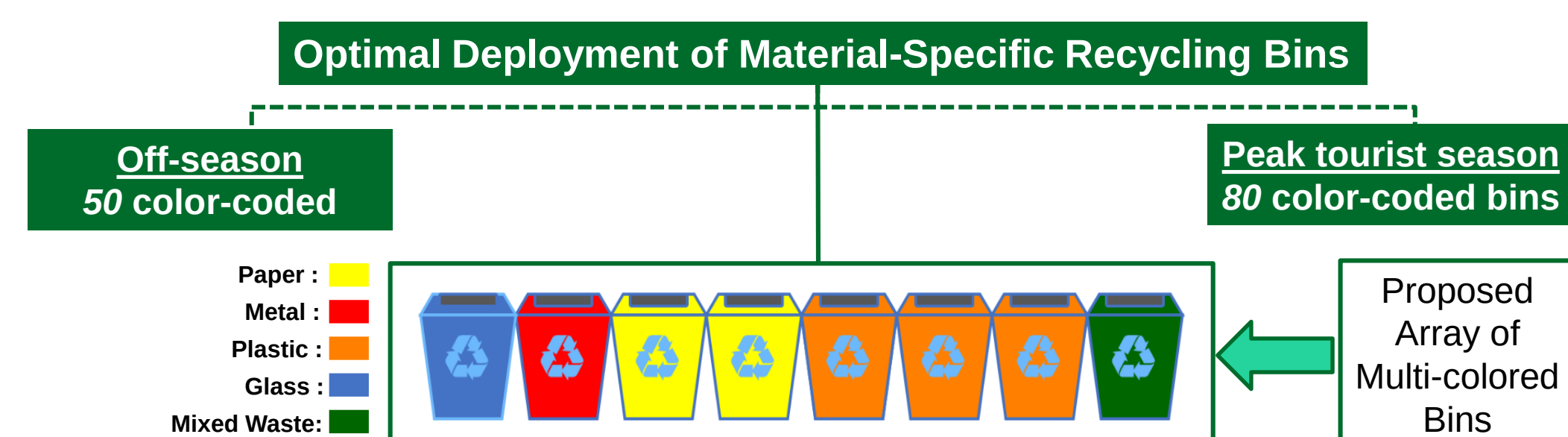


Carbon Footprint: The Island's carbon emission sources are qualitatively characterized following Life Cycle Assessment (LCA) standards, outlining their origin and respective impact. Subsequently, sustainable interventions and energy autonomy solutions are outlined to reduce the island's total carbon footprint.

RESULTS & DISCUSSION



- Sustainable strategies that align with projected waste management practices can both ease their implementation and independently enhance the overall sustainability of the system.



- RES integration into the local grid and utilization of electric vehicles,
- Promotion of material reuse within accommodation facilities,
- Effective separation and composting of the organic fraction of MSW,
- Installation of pre-treatment technologies to reduce waste volume.



- The AQI_{PM2.5} values are classified mainly in “Good” and “Moderate” classes,
- Meteorology affects the variation of AQI_{PM2.5}. For example:
 - The atmospheric circulation explains the unhealthy conditions on 16th January 2024 (African dust transfer episode: AQI_{PM2.5} peaks to 104),
 - PBL is “Moderate” correlated to AQI_{PM2.5} (*cor. coeff.* ~0.4),
- Tourism, vehicle and port (shipping) traffic seems to be dominant factor that affects the variation of air pollutants (AQI_{PM2.5} is ~30% degraded during Aug. as compared to Oct-Nov 2024),
- Air quality is (mainly) degraded during the early morning and evening hours when anthropogenic activities are increased.

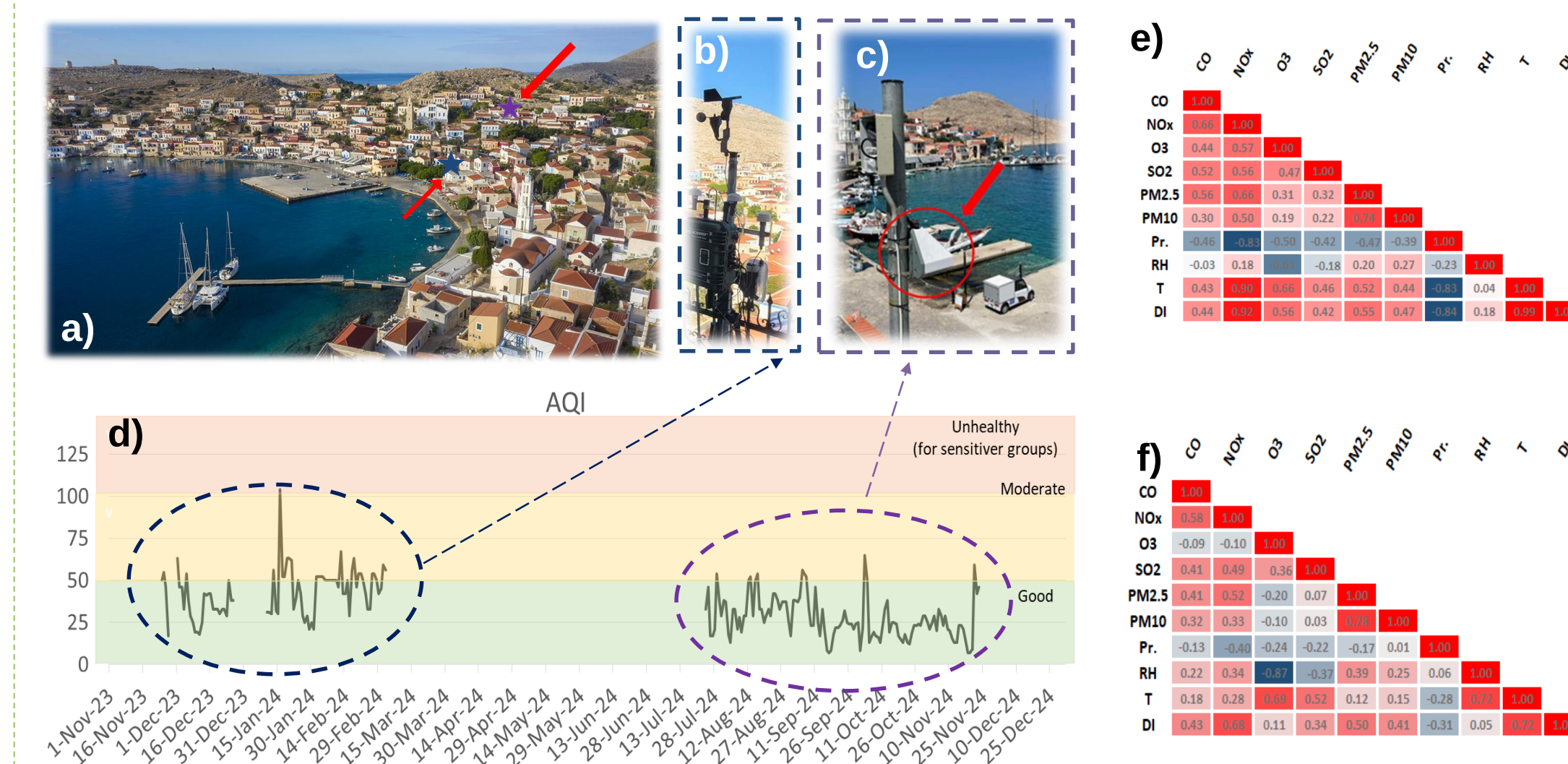


Fig. 1. a) Vision of Chalki's city. Magenta/ Blue stars show the location of AQMS on Town Hall and Port areas, respectively, (b-c) the AQMS in Town Hall location, (d) the AQMS in port area and (e) the AQI of PM2.5 (e) Pearson correlation coefficients among concentration of pollutants, meteorological factors and discomfort index (DI), (f) as (e) but for period from 24 Jul. to 10 Sep. 2024 (high tourist period).

CONCLUSION

- The vehicle & shipping traffic seems to affect the air quality mainly during touristic season,
- Atmospheric conditions also affect Air Quality,
- Sustainable strategies can support projected waste management methods and independently drive the transition to a circular network,
- Current waste management practices and port operations account for a substantial fraction of the Island's carbon emissions.

REFERENCES

- Logotheitis, I., Giakoumakis, G., Mitsotakis, A., and Grammelis, P.: Air pollution and the impact of meteorological factors in air quality of Chalki Island during a winter period of 2023-2024, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-5695, <https://doi.org/10.5194/egusphere-egu25-5695>, 2025.
- Logotheitis, I., Giakoumakis, G., Mitsotakis, A., and Grammelis, P.: The air quality in a touristic area of southeastern Mediterranean: The case of Chalki Island during a summer and autumn period of 2024, Proc. of CSEE 2025, Barcelona, Spain - April, 2025 Paper No. ICEPTP 168, <https://doi.org/10.11159/iceptp25.168>
- Waste framework directive. Environment. (n.d.). https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en#targets