



POSEIDON
MED II
LNG
BUNKERING
PROJECT

Emissions Measurement Campaigns in Greek and Cypriot ports

4th Mediterranean Shipping Conference
On the way to a Mediterranean Emission Control Area

20th November 2019,
10:00 -18:00

Piraeus, Chamber of
Commerce & Industry

Dr. Adamis Mitsotakis
Poseidon Med II Partner
Research Associate, CERTH



CERTH
CENTRE FOR
RESEARCH & TECHNOLOGY
HELLAS



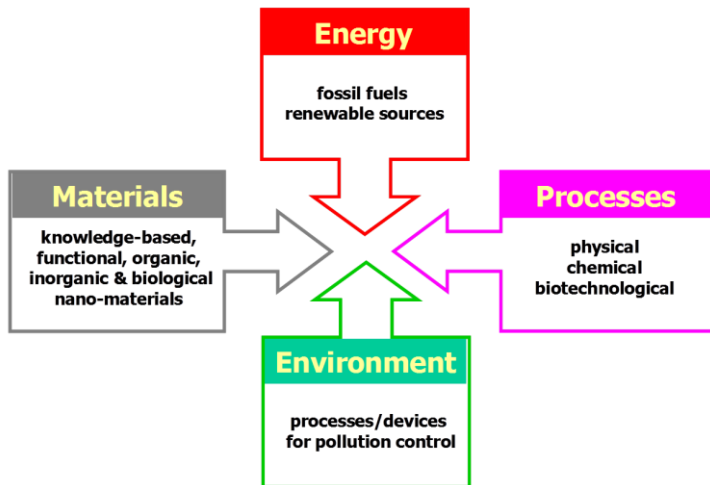


CERTH/CPERI profile



Chemical Process and Energy Resources Institute was established in 2012 by the merger of two existing and long-standing institutes of CERTH:

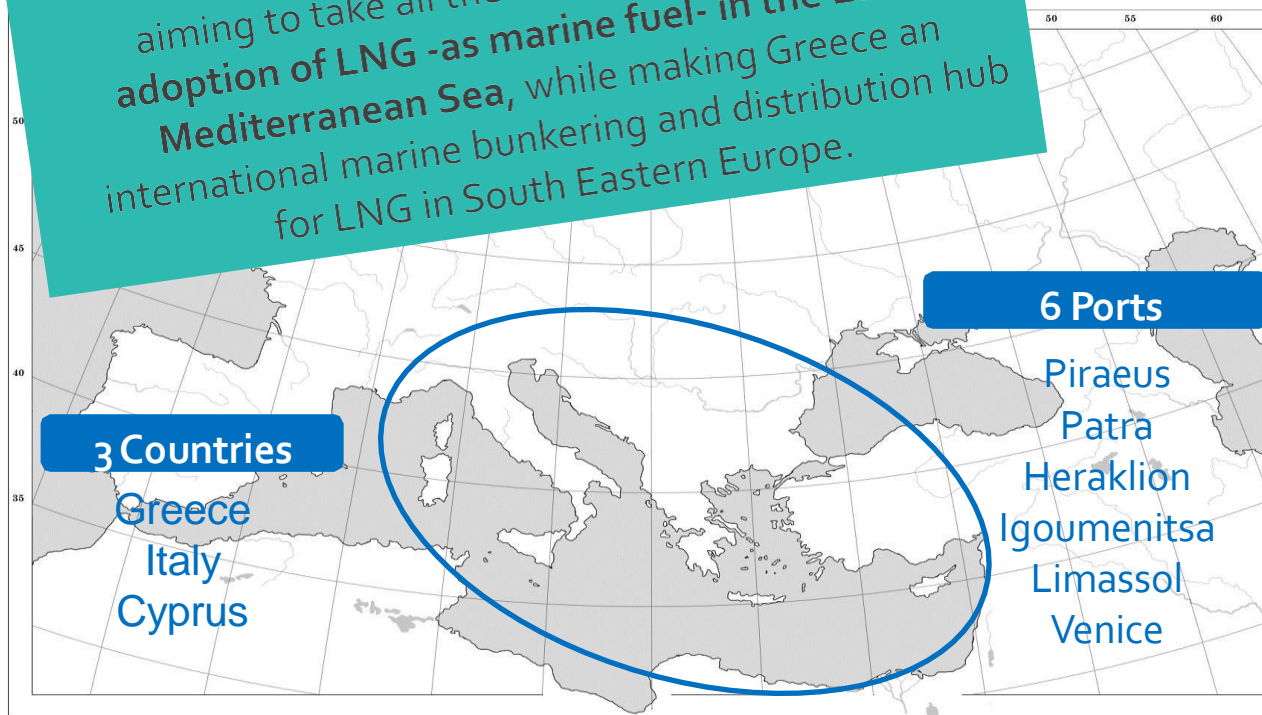
- Institute for Solid Fuels Technology and Applications (est. 1987)
 - Chemical Process Engineering Research Institute (est. 1985)
- ✓ Director: Dr. Spyros Voutetakis
 - ✓ Personnel: ~ 250 people
 - ✓ Turnover: ~ 10 m€/yr
 - ✓ Research and technological areas:
 - Biofuels, utilization and novel production technologies
 - Co-firing of coal and biomass/waste
 - Small scale biomass boilers
 - Gasification and biorefinery concepts
 - Biomass logistics
 - Clean Coal Technologies, CCS
 - By-products utilization
 - Environmental Fuels and Hydrocarbons, Catalytic processes
 - Production and utilization of Hydrogen – Fuel Cells
 - LNG / CNG logistics & applications, e.g. in marine & industrial sectors
 - Energy efficiency in buildings
 -and several more!





Poseidon Med II

Poseidon Med II is a key European project aiming to take all the necessary steps towards adoption of LNG -as marine fuel- in the Eastern Mediterranean Sea, while making Greece an international marine bunkering and distribution hub for LNG in South Eastern Europe.



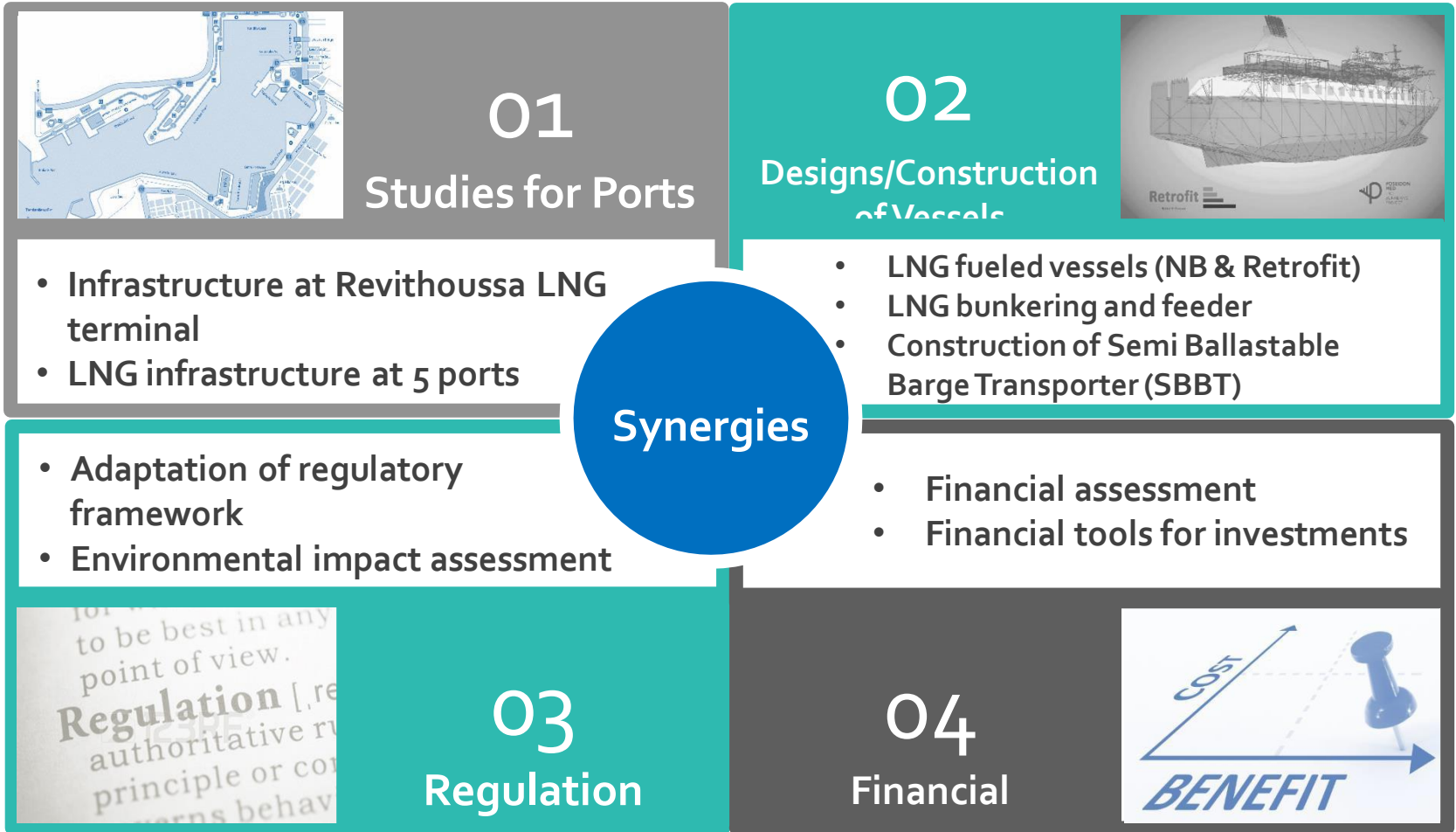
Duration:	Jun.2015 – Dec.2020
Budget:	~€53M
Coordinator:	DEPA
Technical Coordinator:	DESFA
Partners:	26
Co-financed:	50% by EU - CEF Connecting Europe Facility





Partners







Air Quality measurements in East Mediterranean ports (Greece, Cyprus)

In the framework of the EU CEF TRANSPORT project “Poseidon Med II” www.poseidonmedii.eu, CERTH undertook air quality measurements with a van vehicle in the ports of Piraeus, Patras, Igoumenitsa, Iraklion and with a mobile ground station in Limassol and Vasilikos port. The main objective of this Activity is to calculate the impact of ships in the air quality in ports area, identifying emissions peaks caused by ships.

- Measured Emissions $\text{SO}_{x/}$, $\text{NO}_{x/}$, CO , $\text{O}_{2/}$, $\text{PM}_{2.5/}$, PM_{10}
- Campaigns: Low – High season (Spring, Summer)
- Duration: 1 month in each port during 2017-2019



Piraeus Port

4 - 9/5/2017 (Low Season)
27/7- 4/8/2017 (High Season)

Patras Port

11 - 14/5/2017 (Low Season)
4 - 9/8/2017 (High Season)

Heraklion Port

11 - 16/5/2018 (Low Season)
2 - 8/8/2018 (High Season)

Igoumenitsa Port

17 - 25/5/2018 (Low Season)
25/8- 31/8/2018 (High Season)

- ✓ 24-h measurements
- ✓ SO_x, NO_x, CO, O₂, PM_{2.5}, PM₁₀
- ✓ Maritime, Cruise (Piraeus, Heraklion, Limassol)
- ✓ International Maritime (Patras, Igoumenitsa, Limassol)
- ✓ Commercial Marine (Vassilikos)

Limassol Port

12/6 - 11/7/2019

Vassilikos Port

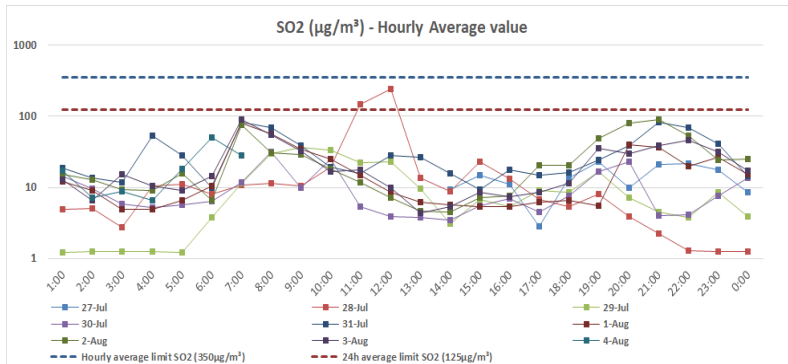
9/9 - 8/10/2019





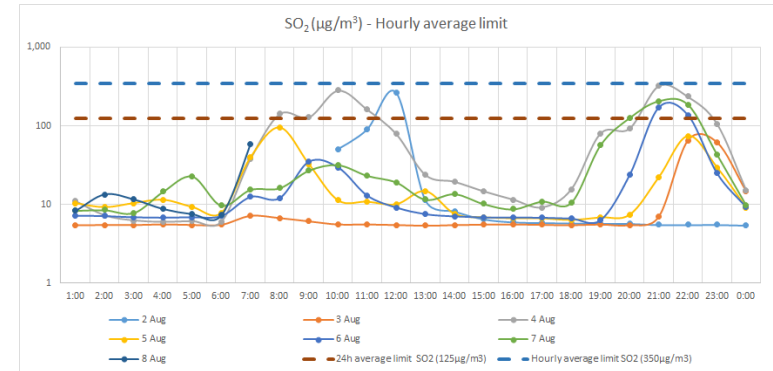
SO₂ Emissions

Piraeus Port



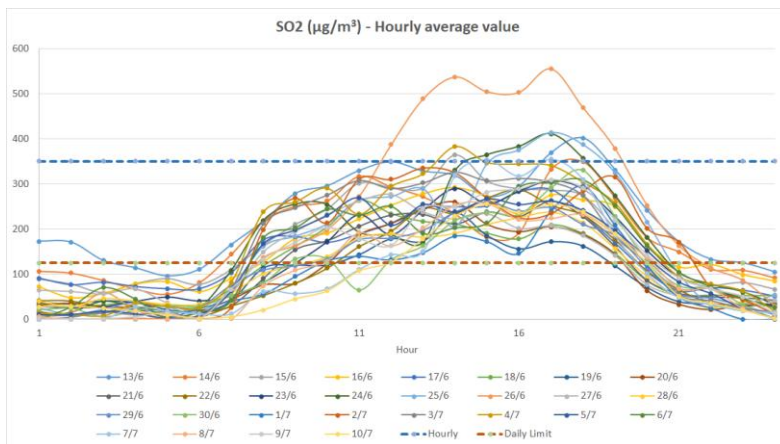
Hourly
Daily

Heraklion Port



Hourly
Daily

Limassol Port



Hourly
Daily

- ✓ Emission measurement results filtered by using shipping routes and wind direction data
- ✓ All ships use HFO/Diesel
- ✓ High emissions level on start up of the engines
- ✓ Ship traffic negative impact on air quality in the port
- ✓ Peak emissions during ship movement (arrival – departure)

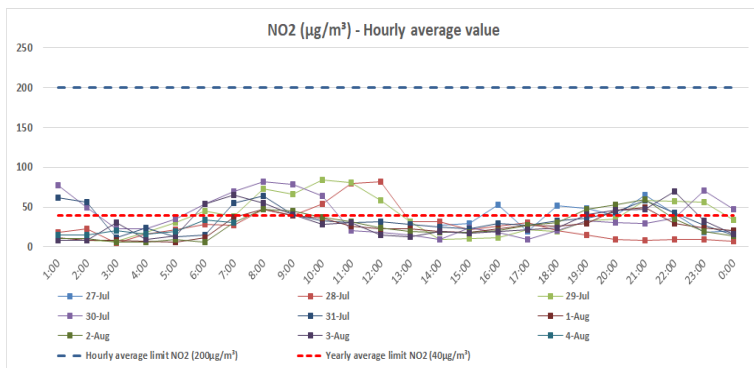




No₂, PM₁₀ Emissions

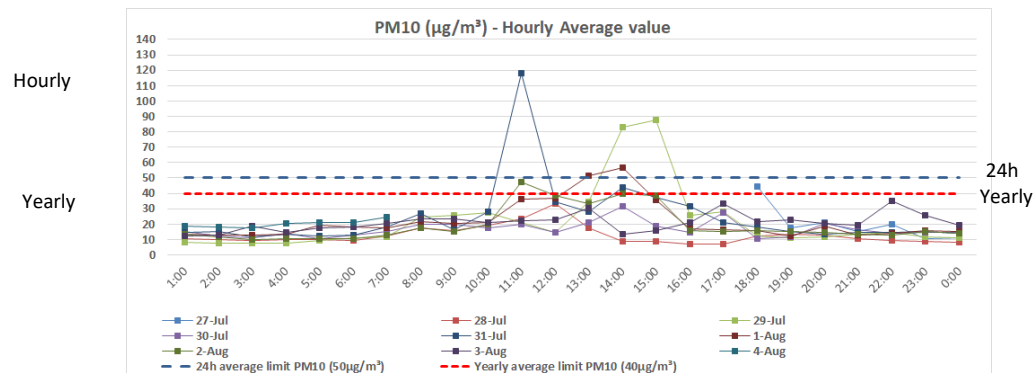
NO₂

Piraeus Port

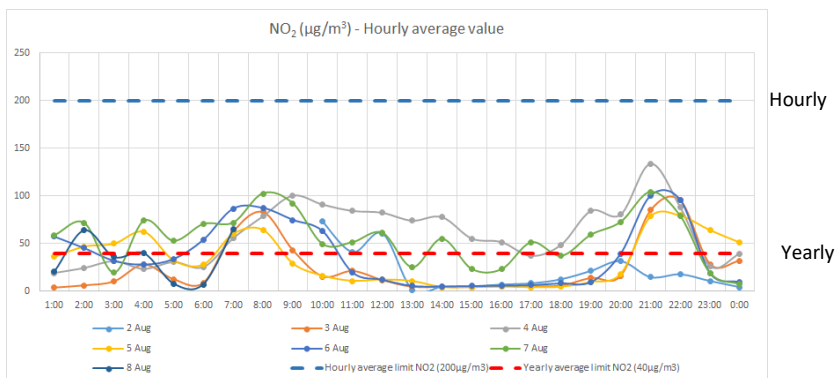


PM₁₀

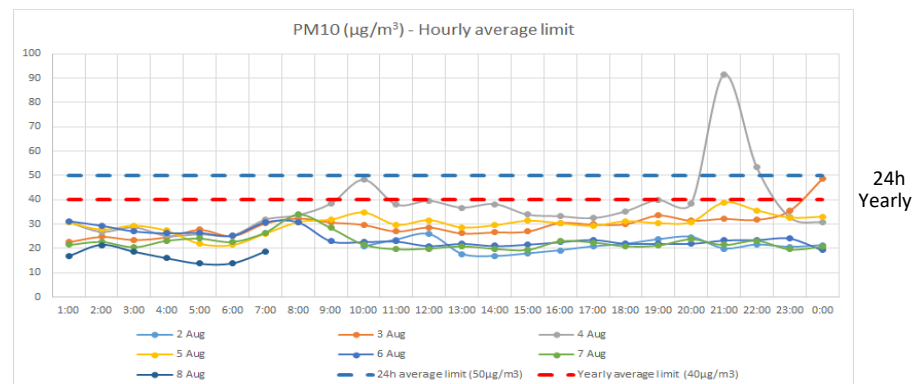
Piraeus Port



Heraklion Port



Heraklion Port





Marine LNG: A sustainable solution for emissions reduction

	SOx (0.5%)	SOx (0.1%) ¹	NOx ²	CO2	PM
HSFO	Red	Red	Red	Red	Red
HSFO + scrubber	Green	Red	Red	Red	Yellow
VLSFO	Green	Red	Red	Red	Yellow
MGO	Green	Green	Red	Red	Yellow
LNG	Green	Green	Yellow	Yellow	Green
Electric	Green	Green	Green	Green	Green

2018 McKinsey

- **LNG** is fully compliant with the Environmental Regulations that will apply from 1st January 2020 (Sulphur cap).
- **LNG** eliminates PM and significantly reduces NOx.
- 25% max achievable reduction in CO₂ emissions when compared to HFO/MGO (depending on methane slippage).



Why LNG?



Safe and proven technology;
safe usage, storage
& transportation



Cost-effective fuel available today-
Viable and sustainable
solution



Environmentally friendly:
lower CO₂, NO_x, SO_x
and PM emissions



Economies of scale and synergies
with power and energy markets





Conclusion - Discussion

Now it is time to reduce emissions in order to tackle climate change!

- X Scrubbers – Environmental problems – Short-term solution**
- ✓ **Need for engine LNG retrofit subsidies, combined with tax policies**

LNG is the best available mature technology to substitute HFO/Diesel in ships, complies with environmental regulations, improving the air quality in the port and the nearby city and minimizing the impact of the ships movement .



Photos / Info



For more info about the emission measurement campaigns in the ports, please contact:

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Thank You



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