Webinar 4 – Investigation and prospects of CCS technology for climate change mitigation in Greece, West Macedonia

Centre for Research and Technology Hellas

Chemical Process and Energy Resources Institute (CPERI)

PilotSTRATEGY - Webinar 4 - 31st October 2024

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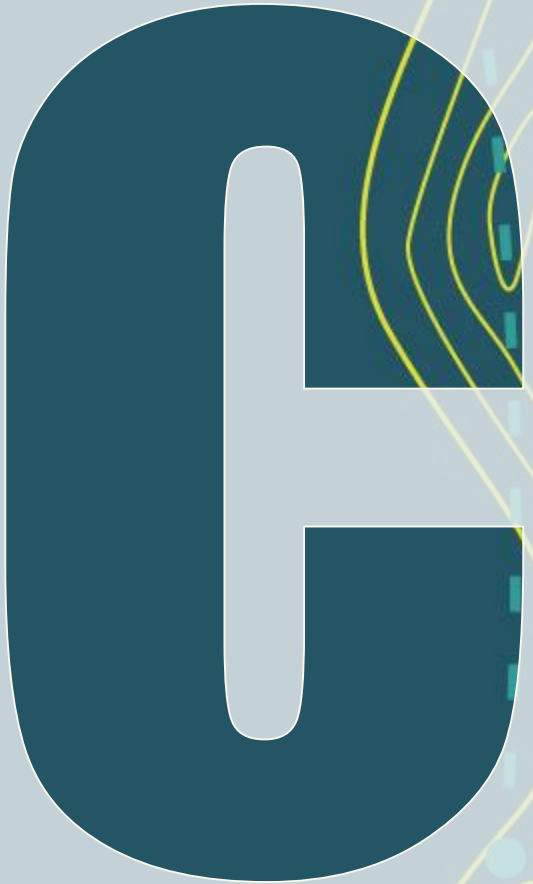


GENERAL AIM

The capability of implementing carbon capture, utilization, and storage (CCUS) technologies.

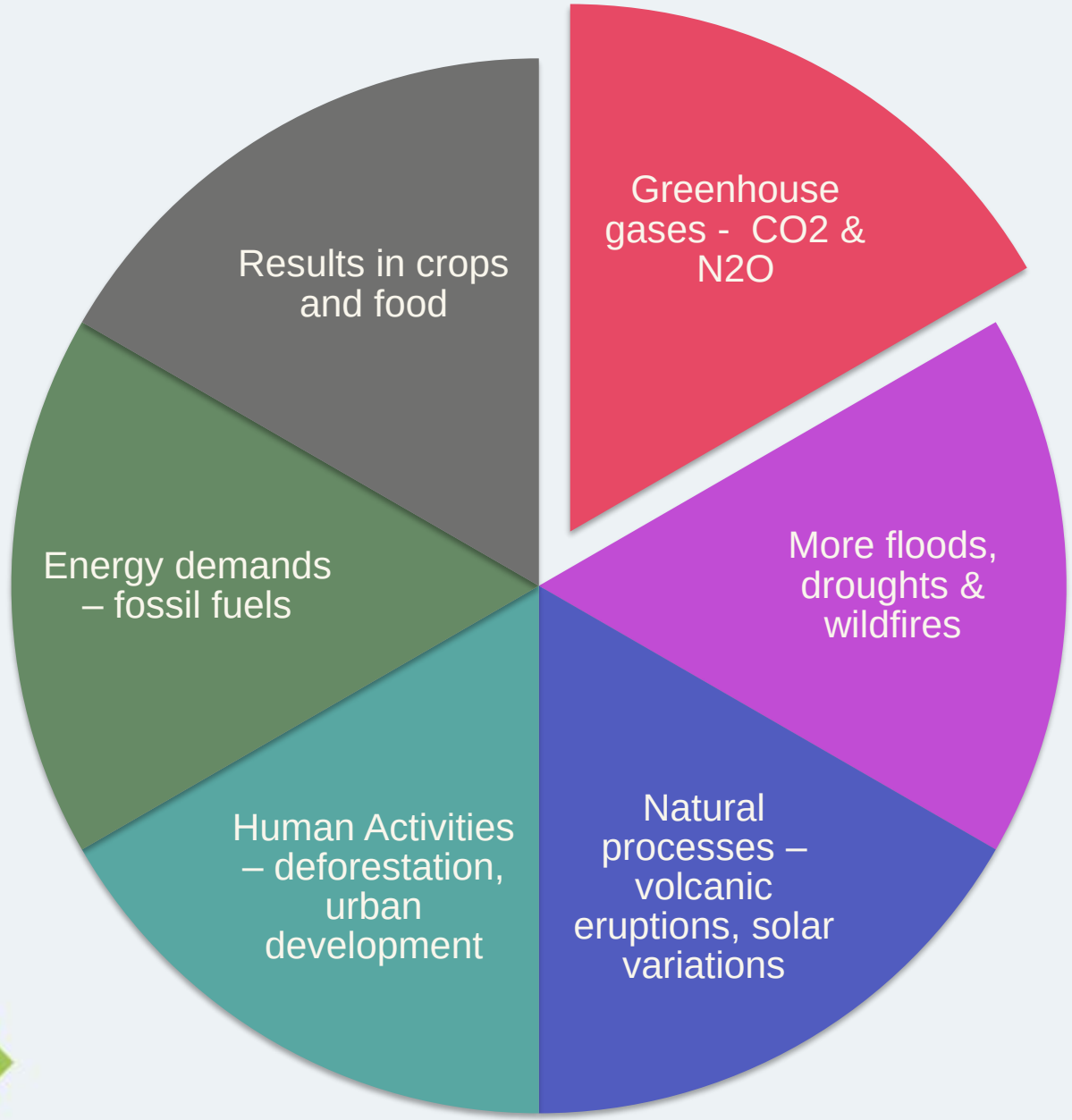
PROJECT AIM

Investigation of appropriate sites for CO_2 storage in West Macedonia, Greece

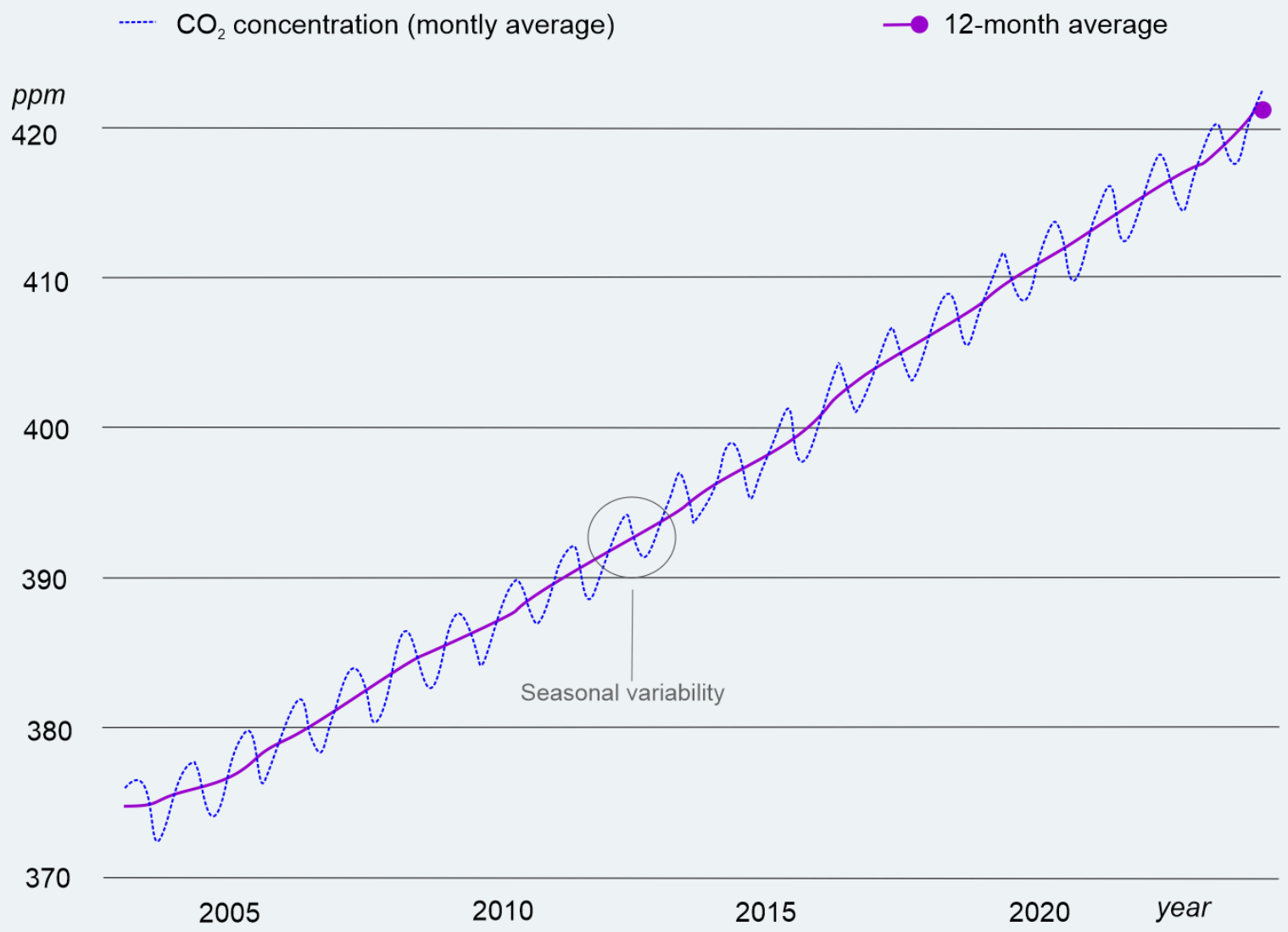
CLIMATE CHANGE

Facts & Figures

CLIMATE CHANGE FACTORS

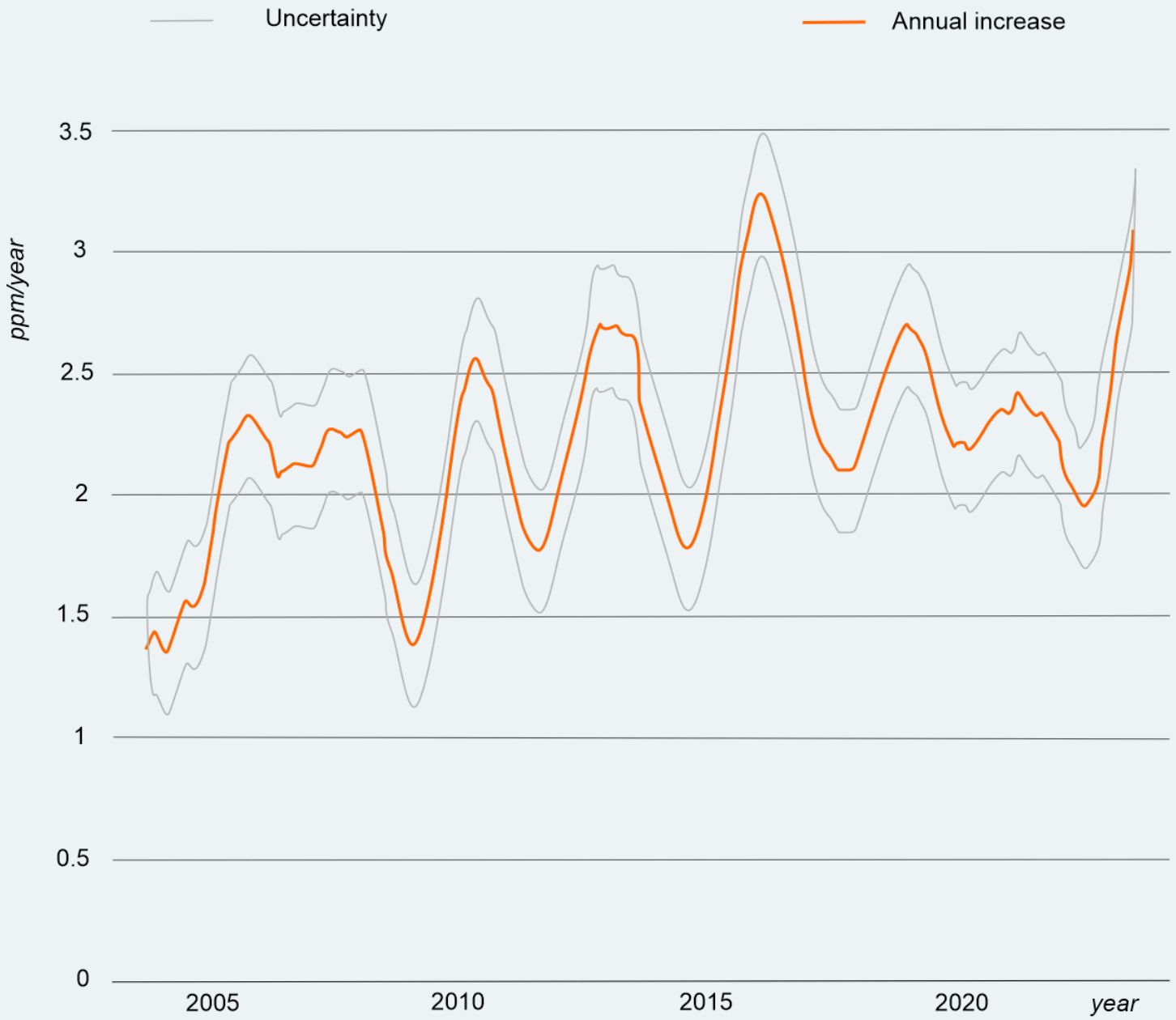


Atmospheric concentration of CO_2 globally



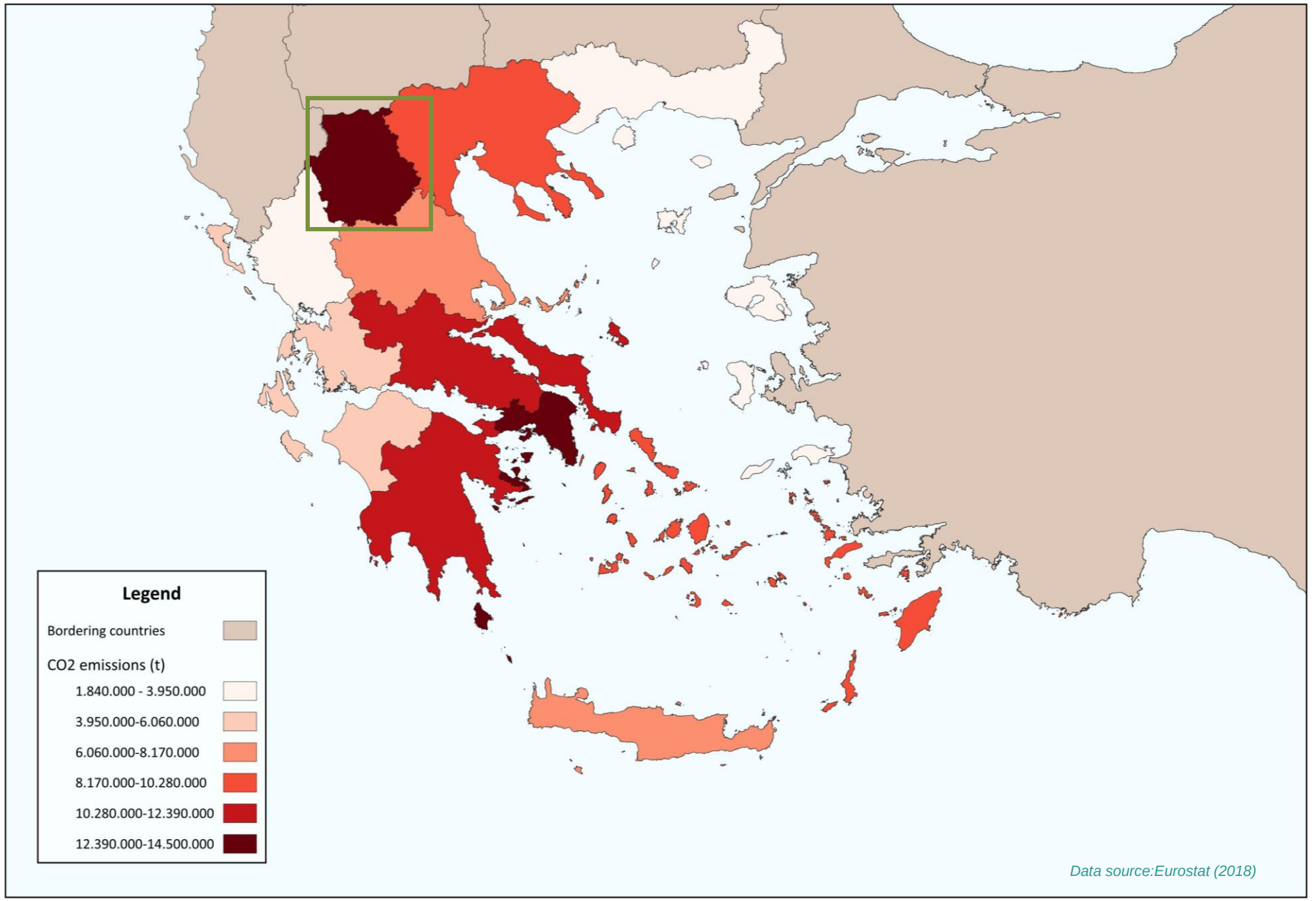
Data source: Copernicus - Climate Change Service

Annual increase in CO_2



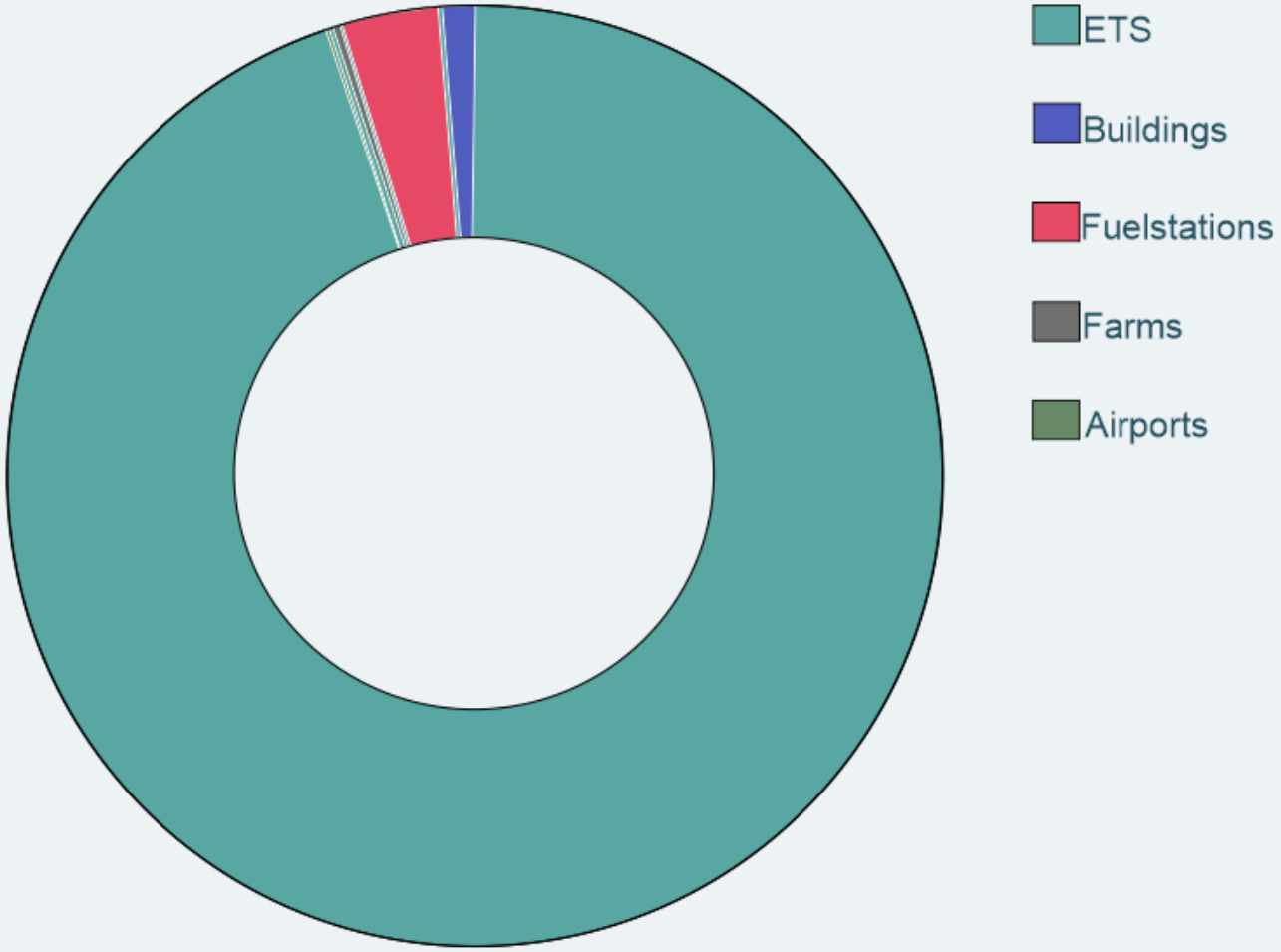
Data source: Copernicus - Climate Change Service

CO_2 emissions per Regional Unit

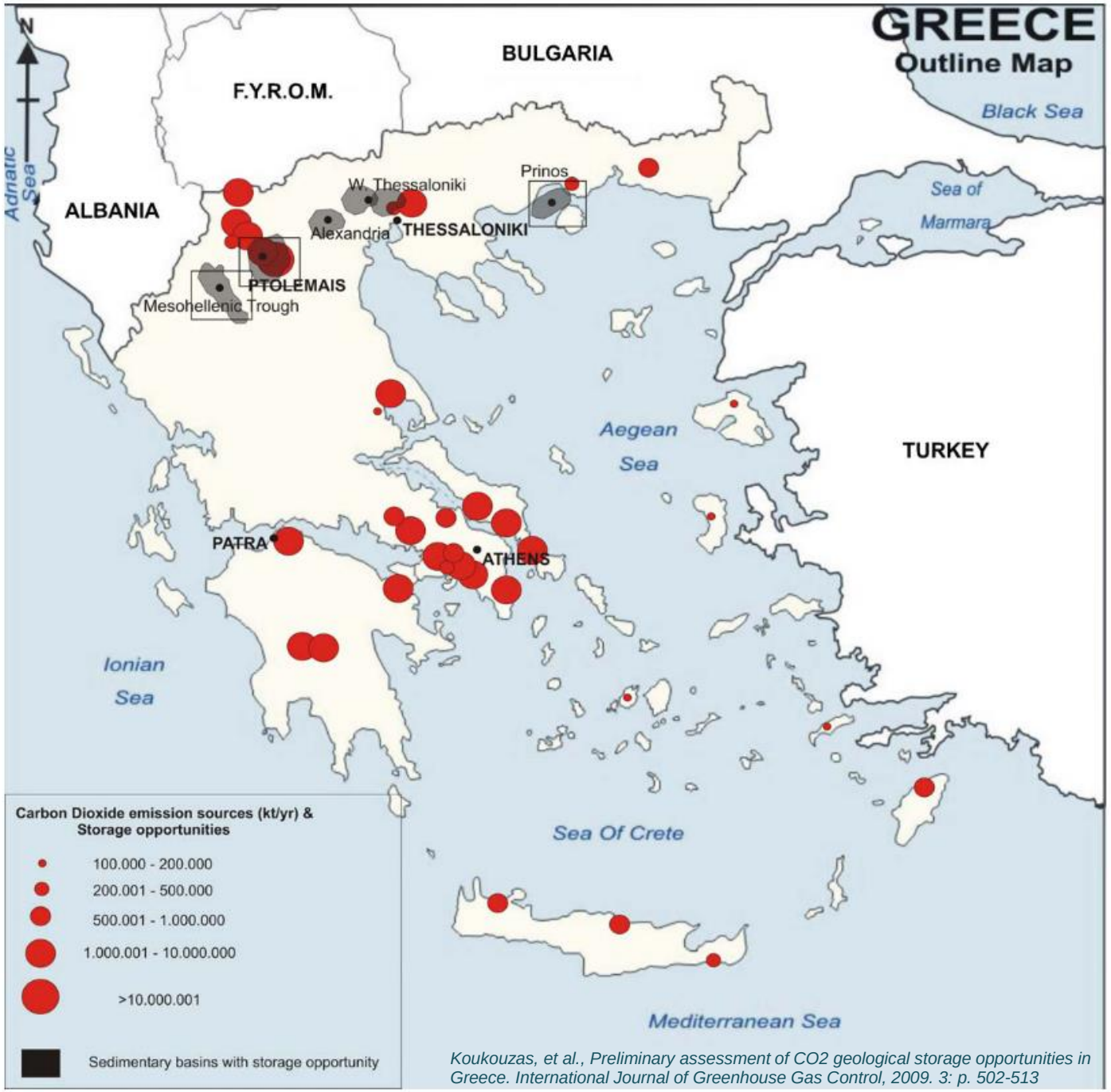


Data source:Eurostat (2018)

Sources of CO_2 Emissions in West Macedonia



CO_2 emissions & storage opportunities in Greece

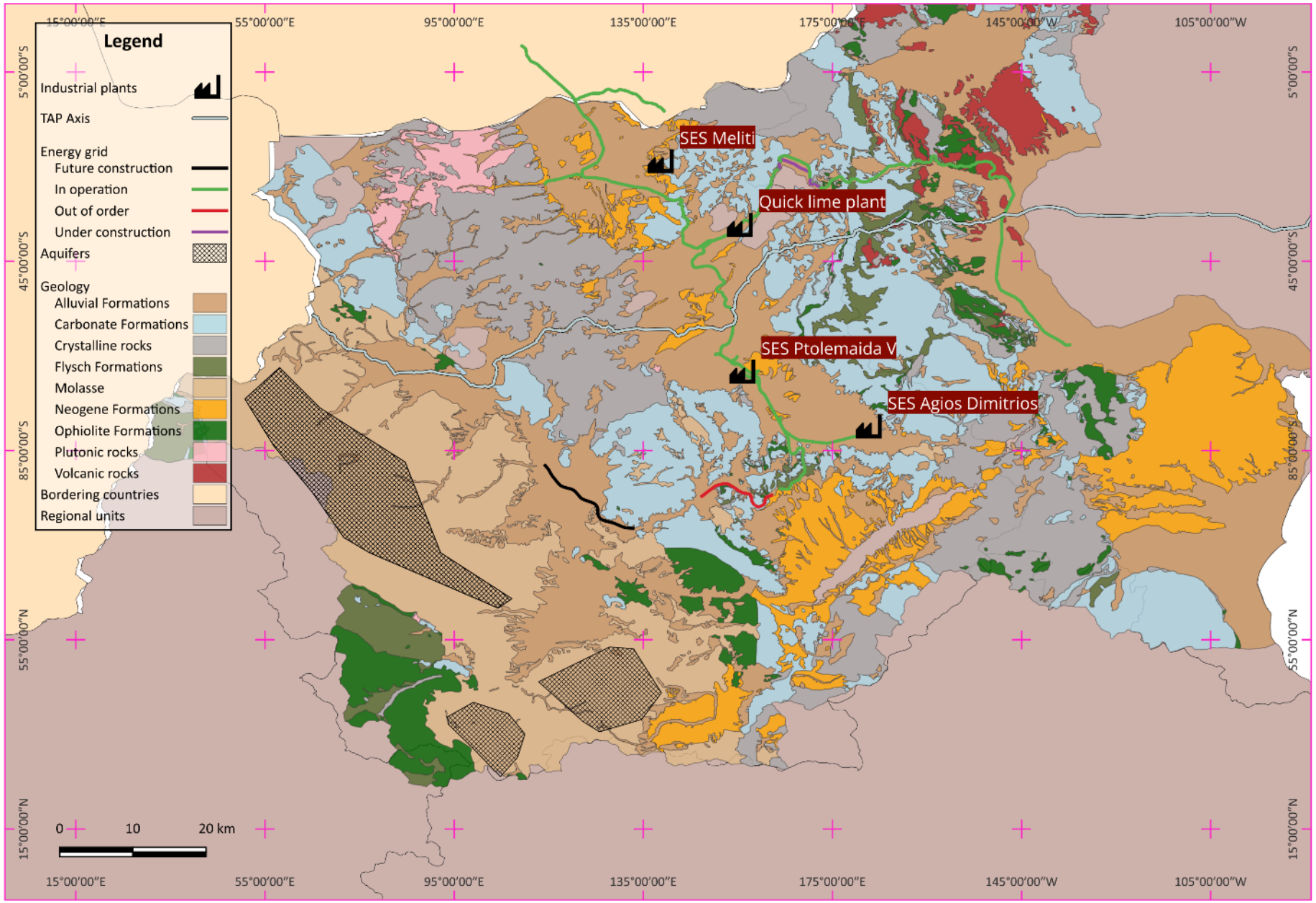


Koukouzas, et al., Preliminary assessment of CO2 geological storage opportunities in Greece. International Journal of Greenhouse Gas Control, 2009. 3: p. 502-513

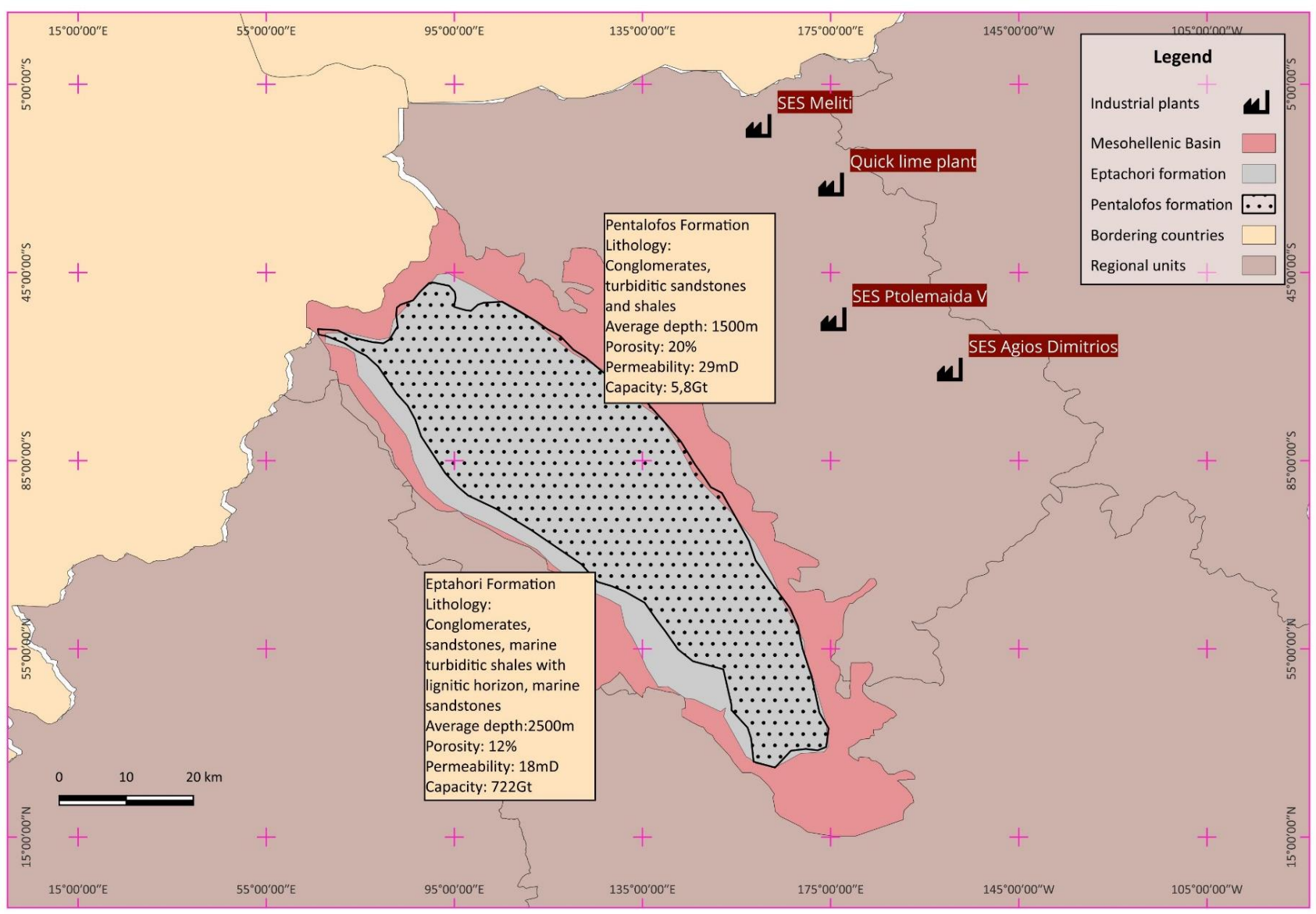
CO_2 Storage

Storage opportunities and capacity

Aquifers in West Macedonia



Storage capacity



Seismic Data

Processing and Greece’s Legislation

Reprocessing Legacy Seismic Data

HEREMA's Actions

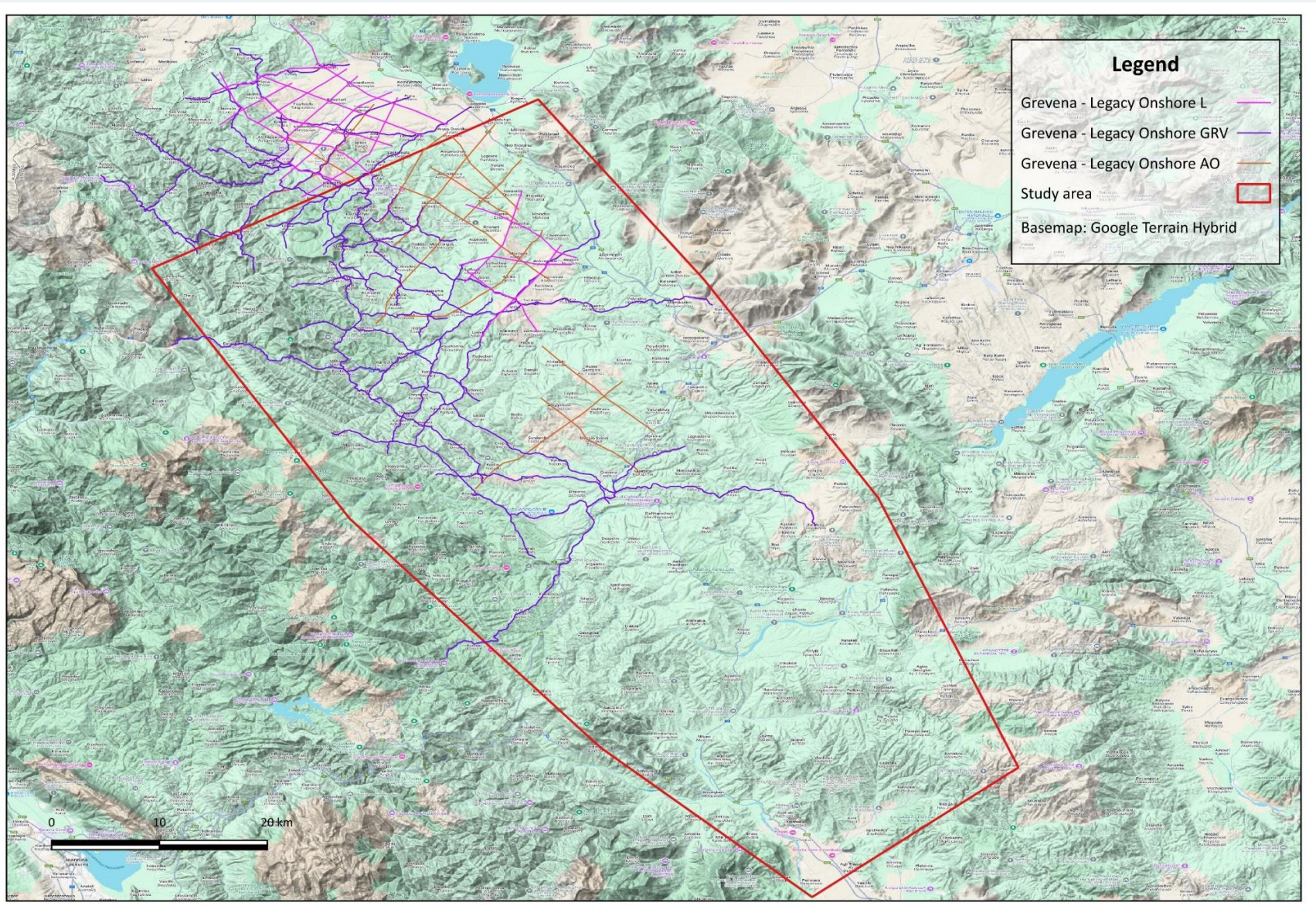
GEOFIZYKA TOR

HEREMA
Hellenic Hydrocarbons and Energy Resources Management Company

GRUPA ORLEN

Name	Completion
HHREM Greece Mesohellenic 2D	100
Stage 1: Geometry and Pre-processing	100
Stage 2: Signal merging and Denoise	100
Stage 3: Statics corrections and VA	100
Stage 4: Demultiple and Interpolation	100
Stage 5: Stack, Post-stack Time Migration	100
Stage 6: Pre-Stack Time Migration	100
Stage 7: Final Deliverables	100

Seismic data



CO2 storage permitting process in Greece

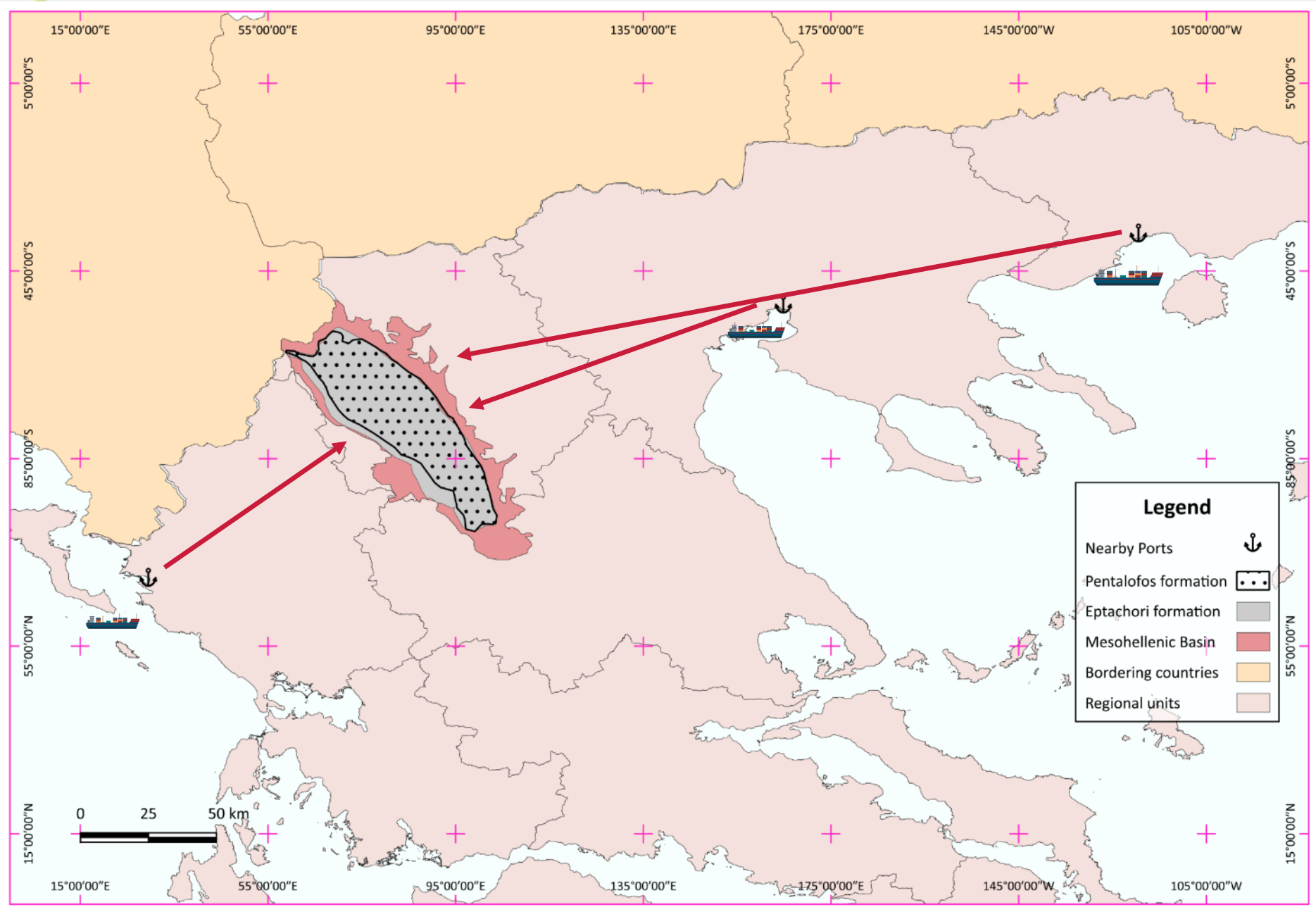
HEREMA
Hellenic Hydrocarbons and Energy Resources Management Company

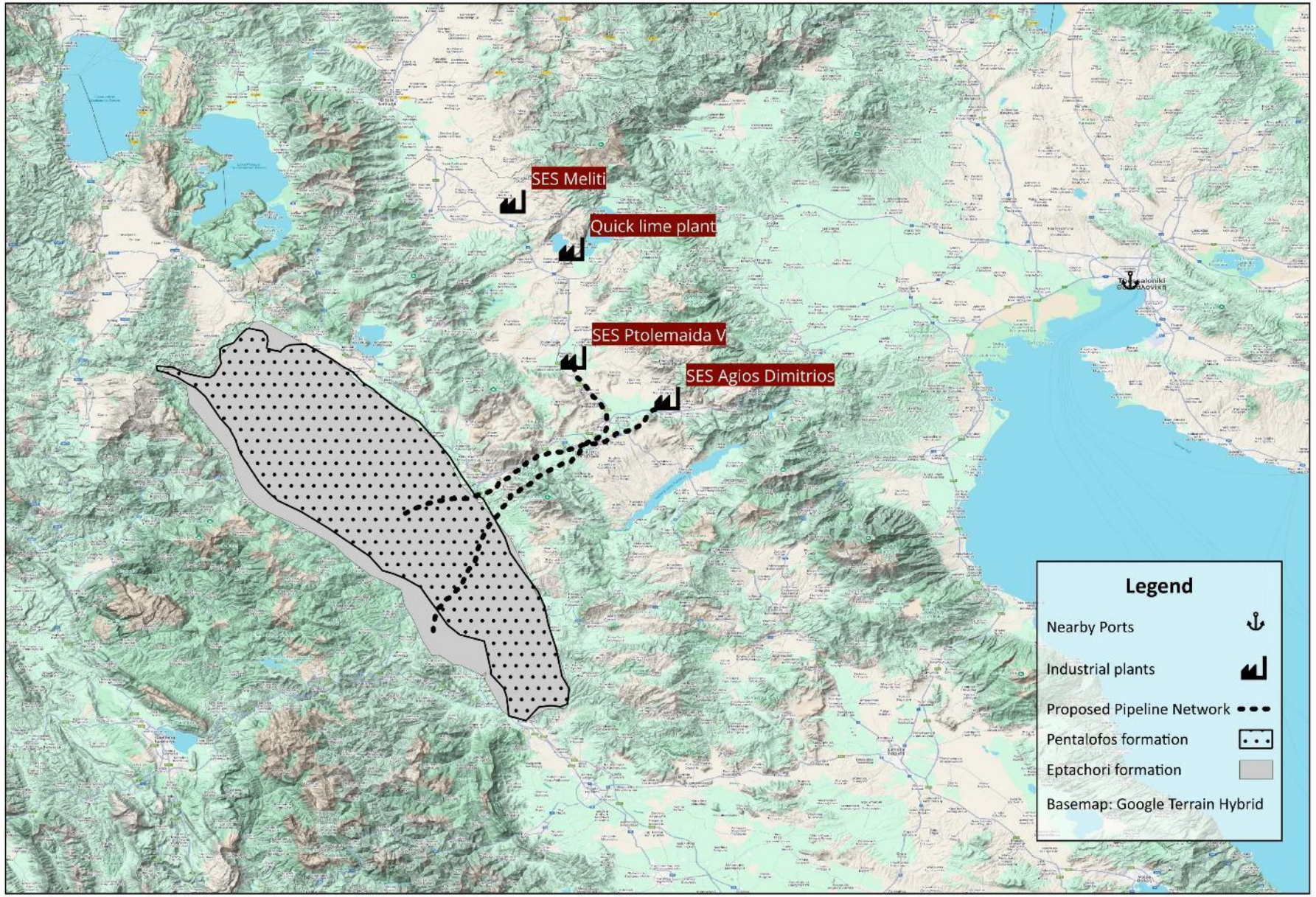
- CO_2 storage permitting in Greece is governed by the 2011 Common Ministerial Decision (Government Gazette B 2516_2011), which transposed the EU CCS Directive into National Law.
- Law 4920/2022 designated HEREMA S.A. as the licensing authority for CO2 exploration and storage permits in geological formations.
- In September 2022, HEREMA awarded the first exploration permit to Energean for the (almost depleted) Prinos oil field (Government Gazette B 5247_2022).
- In order for HEREMA to issue the CO2 storage permit, it is also necessary that the environmental terms are approved by the Environmental Permitting Directorate of the Ministry of Environment and Energy, following the submission of the project's Environmental and Social Impact Assessment (ESIA) study by the exploration permit holder.
- This ESIA will be the subject of a Public Consultation process, as per applicable national law.

Transportation Network

Import CO_2, Transportation Network Types & Construction Cost

Import of CO_2





Agios Dimitrios - Pentalofos

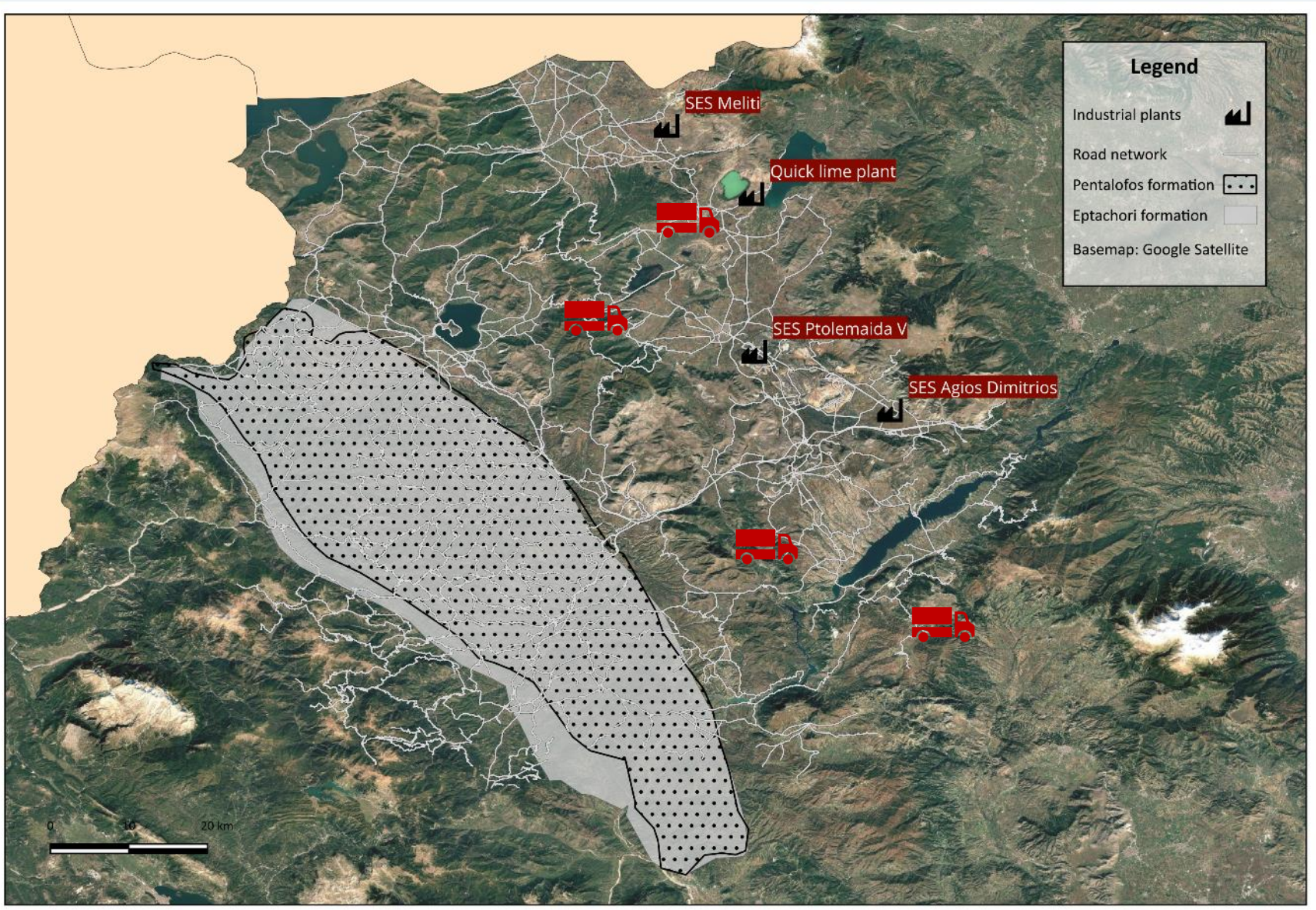
50-60 km

Prolemaida V- Eptachori

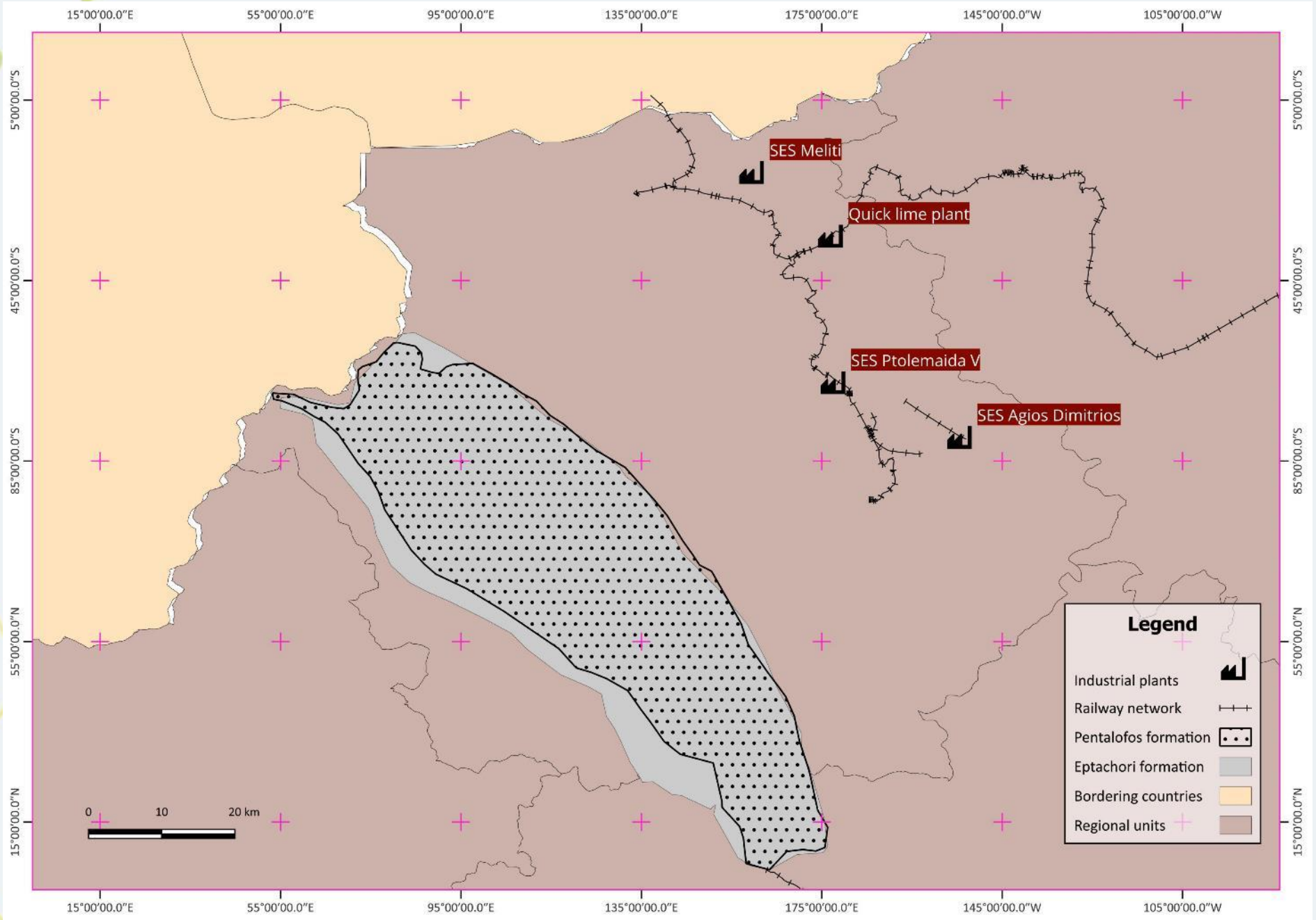
80-100 km

Option 1- Pipeline network

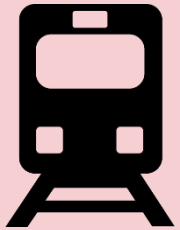
Option 2- Road Network



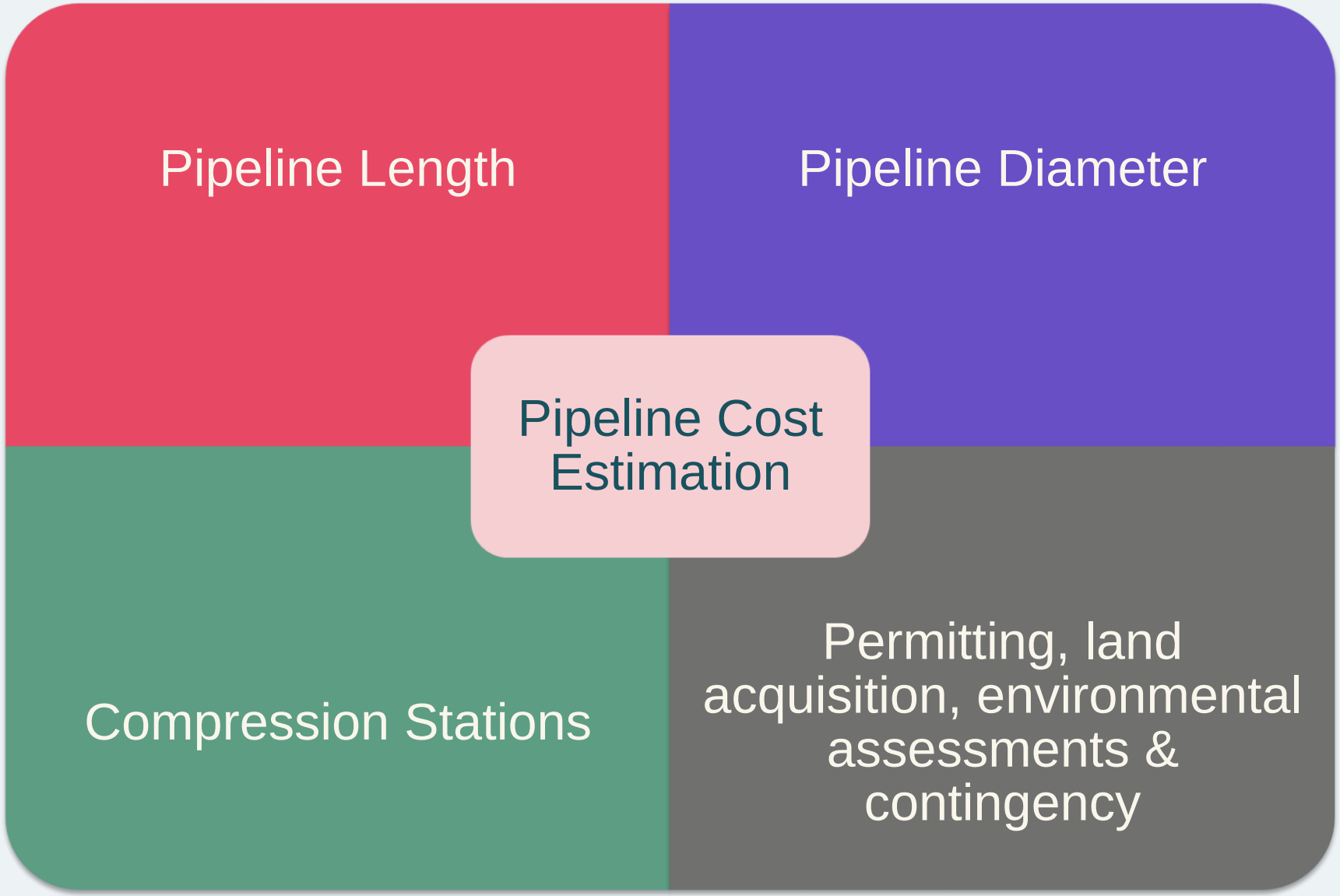
Option 3- Rail network



Pros and cons of transportation network types

TYPE		Pros	Cons
	Pipeline	✓ Suitable for long distances and large volumes ✓ Continuous flow ✓ Lower operational cost in the long run	✓ High initial cost for construction ✓ Requires additional compression stations depending on terrain
	Road Network	✓ Flexible for short distances or small volumes ✓ Can be used temporarily or for pilot projects	✓ Limited capacity ✓ Expensive over time due to fuel, maintenance, and driver costs ✓ Challenging terrain in mountainous areas
	Railway Network	✓ Existing infrastructure in some areas ✓ Can be used for smaller-scale projects ✓ Multi-modal options possible»	✓ Not all emitters and storage sites are close to railway lines ✓ Complex logistics ✓ Requires adaptation of rail routes and

Key Factors for Pipeline Cost Estimation



Estimated Pipeline Cost – D4.9

Pipeline route	Length (km)	Pipeline cost (€ M)	Compression Stations	Total Cost (including 25% additional costs)
Agios Dimitrios - Pentalofos	50-60	40-48	5-10	56-73
Ptolemaida - Eptachori	80-100	64-80		86-113
Overall Cost (€ M)				**142-186**

Capture, Transportation and Storage Costs - D4.9

Capturing CO_2	• €5 million tons of CO_2 • €150 to €350 millions
Transportation cost	• €142 to €186 millions • For 20-30 years of operation = €5 to €10 million per year
Storage cost	• €10-€20 per tonne • €50 million to €100 million per year for the expected capture volume

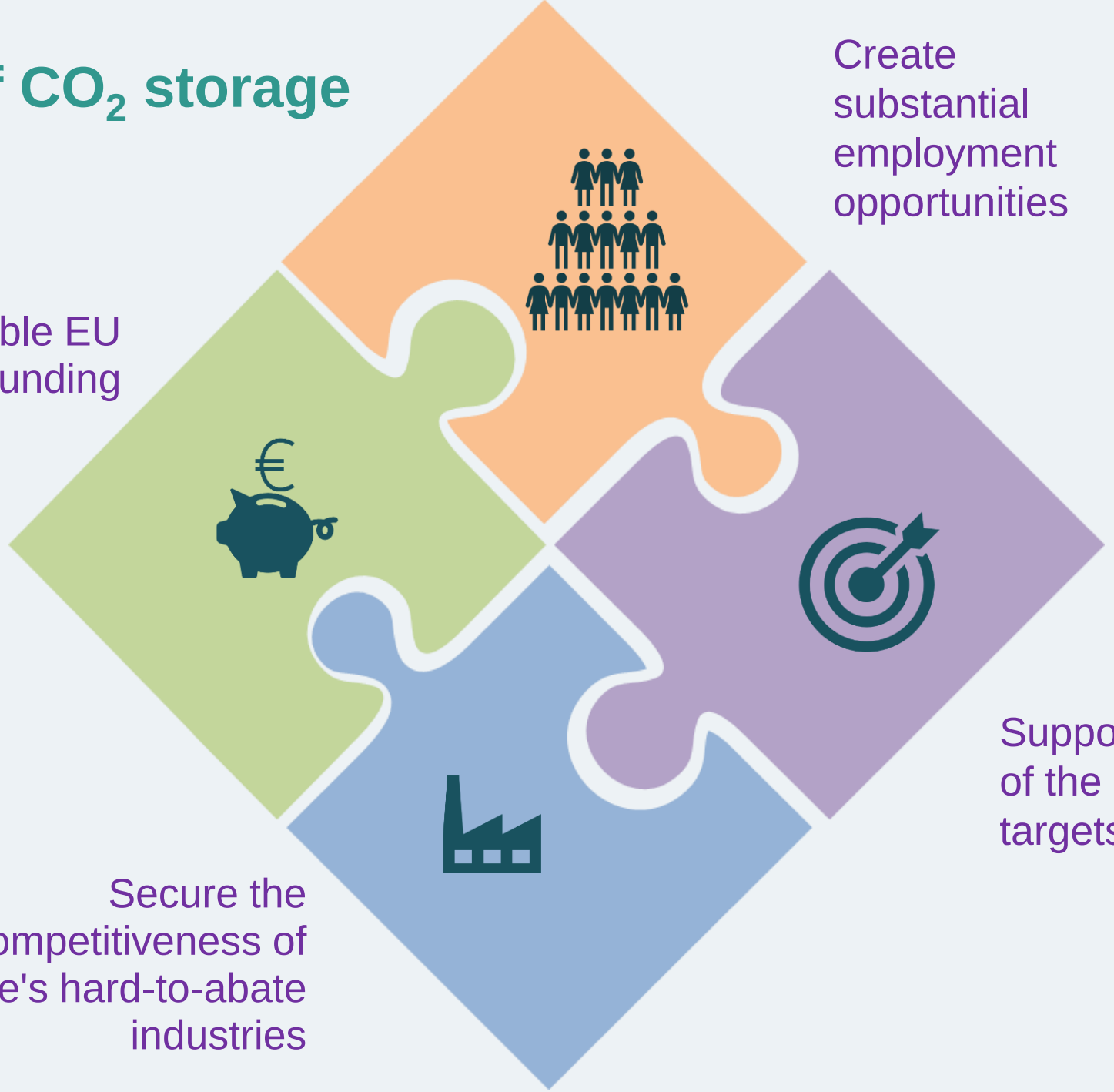
Opportunities

Societal and Economic opportunities

Benefits of CO_2 storage

Create substantial employment opportunities

Gain considerable EU funding



Support the achievement of the National Net-Zero targets

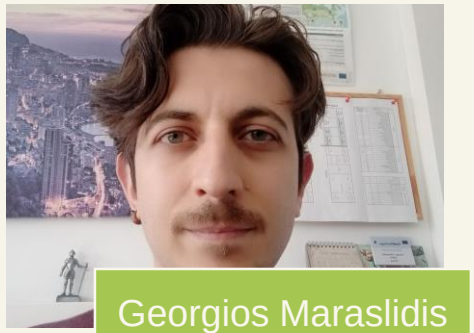
Secure the competitiveness of Greece's hard-to-abate industries

CERTH/CPERI Team members

Dr. Pavlos Tyrologou

Dr. Christos Stergiou

Christina Karatrantou



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Thank you for listening

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PilotSTRATEGY

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