

## Advancing CCUS in the Romanian Cluster: Strategic Decarbonisation Through Multi-Modal CO2 Transport and Offshore Storage

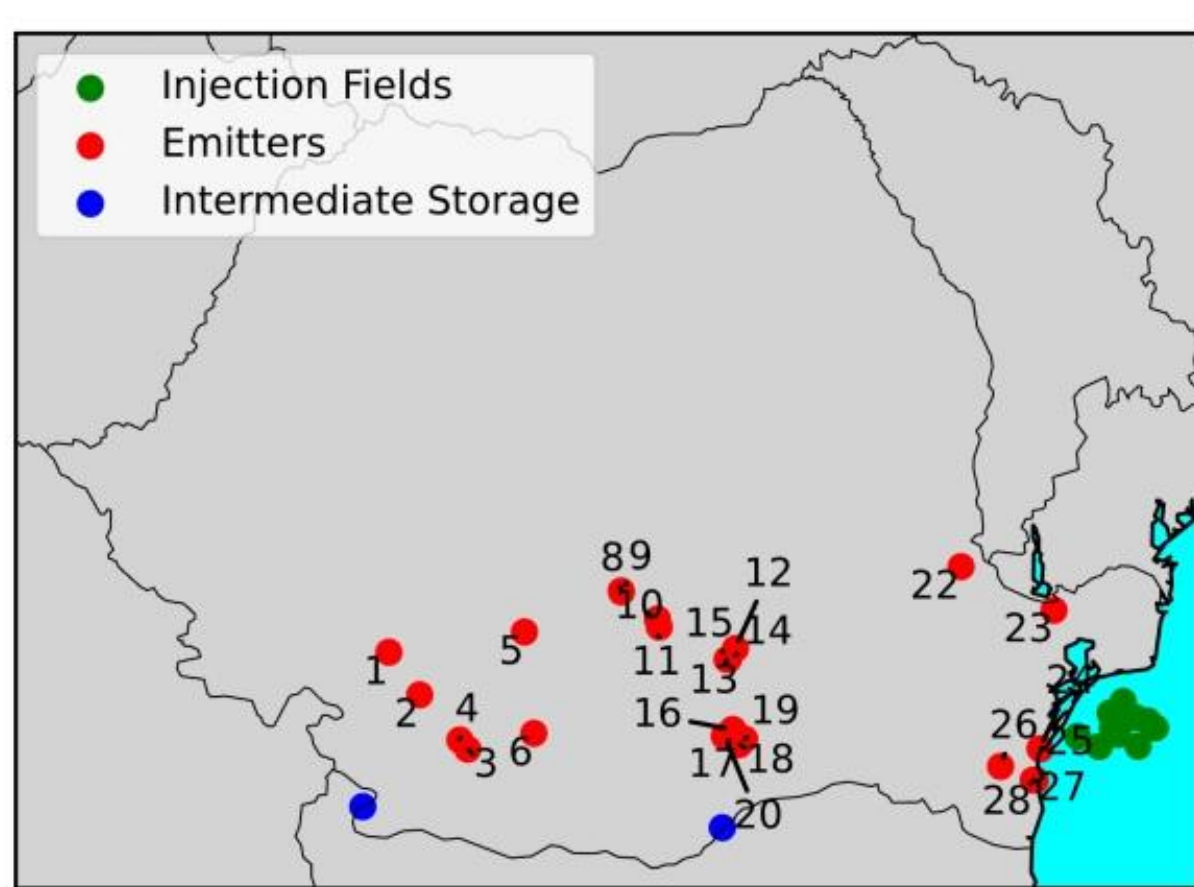
Sorin Anghel, Alexandra Dudu, Constantin Sava

National Institute for Marine Geology and Geo-ecology – GeoEcoMar, Romania

Abstract:

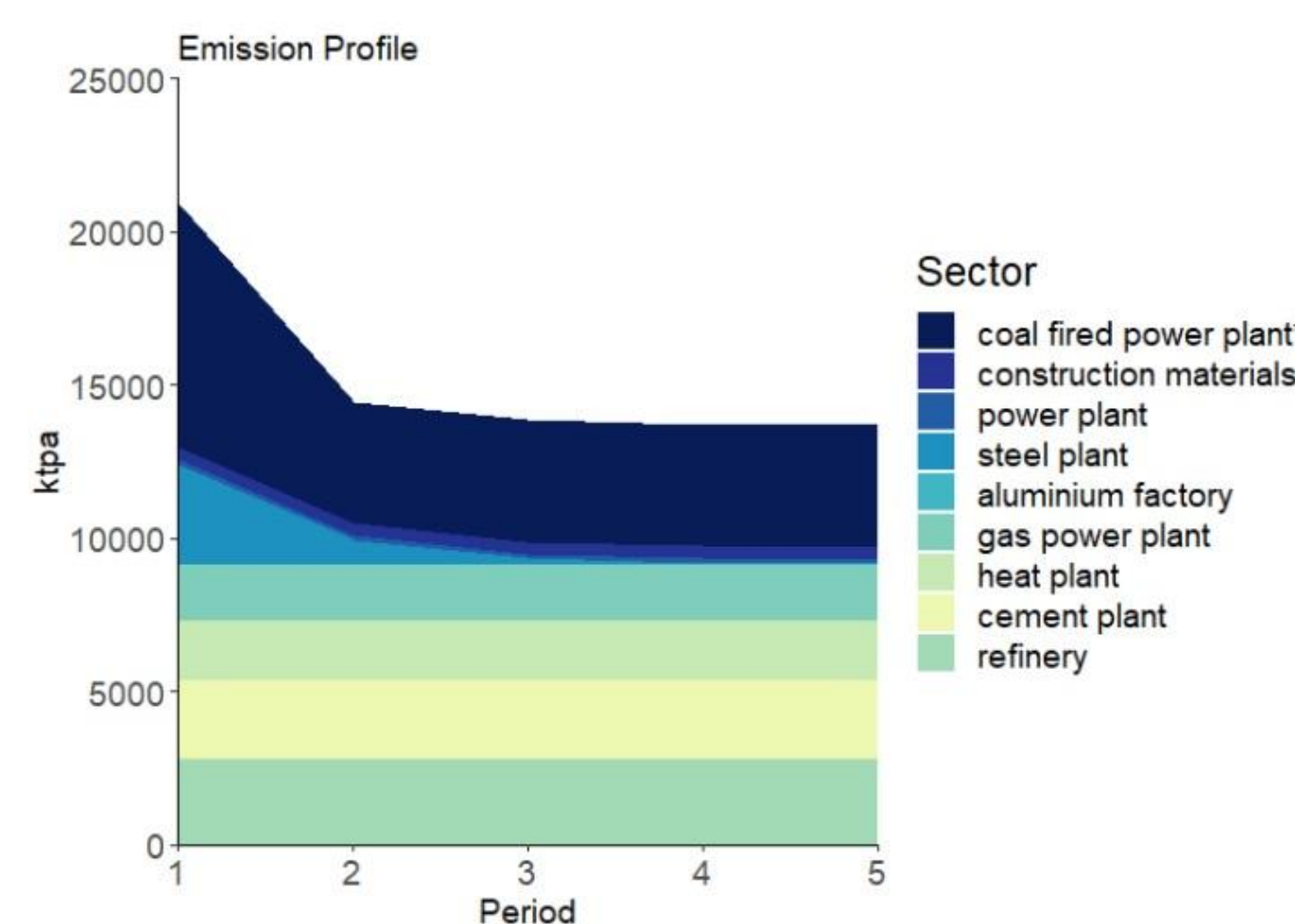
This paper relating to the ACT!ON project is focused on advancing the strategic decarbonization of Carbon Capture, Utilisation, and Storage (CCUS) technologies in six industrial regions, including a targeted study on the Romanian cluster. This initiative aims to address the specific development and research needs of the Oltenia region by leveraging the scenario design framework as an extension to the national Getica CCS project. The primary goal is to explore and assess the viability of full-chain CCUS projects that encompass CO2 capture, multi-modal transport, and offshore storage solutions. The work on the Romanian cluster will focus on designing decarbonization scenarios that integrate multiple CO2 sources within the Oltenia region (south part of Romania). These scenarios will consider various transportation methods, including pipeline transport, barge transport via the Danube River to the Port of Constanța, and alternative rail or road transport options. Once transported, the CO2 will be stored in offshore and onshore sites, taking into account the region's unique geographic and infrastructural characteristics. Given the data access restrictions currently faced, proxy models for storage and CO2-EOR (Enhanced Oil Recovery) will be employed to evaluate the potential of these storage sites. The project will also explore the benefits of these storage solutions in contributing to the overall strategic decarbonization of the Romanian cluster, focusing on their role in reducing greenhouse gas (GHG) emissions. The research will provide detailed analyses of the logistics and technical challenges associated with transporting CO2 from emitters in Oltenia, evaluating the economic and environmental impacts of each transport method. By examining the integration of these systems into the broader energy infrastructure, the study aims to develop scalable and replicable strategies for CO2 management that can be adapted to other regions. The outcomes will not only enhance the understanding of CCUS potential in Romania but will also contribute to the development of best practices for decarbonization efforts across Europe and beyond. The conclusions will offer valuable insights for policymakers, industry stakeholders, and researchers involved in global decarbonization initiatives.

### Romanian cluster

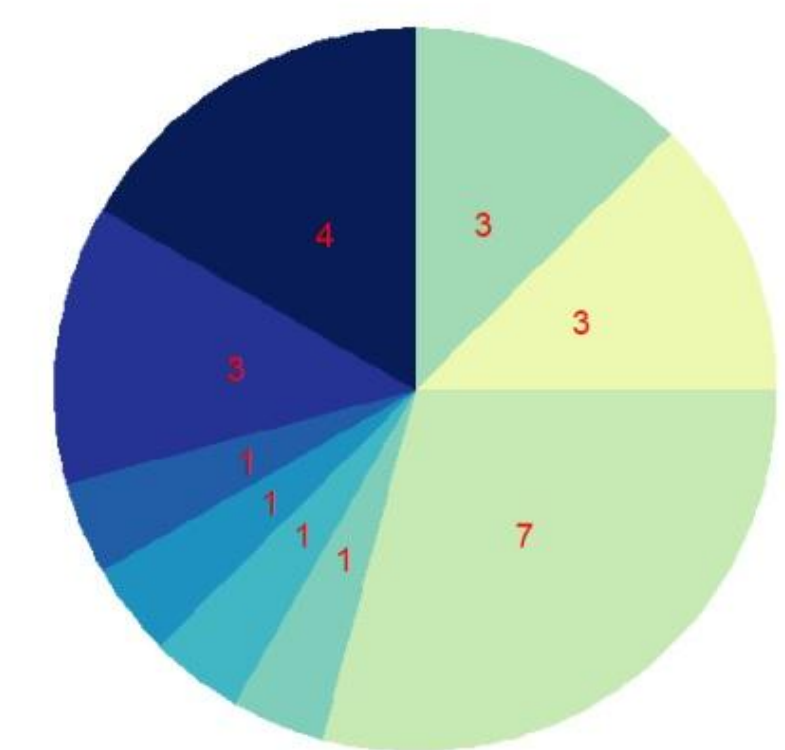


- 28 stationary emitters
  - approx. 15 Mtpa
  - 9 sectors
- 10 storage sites
  - 6 saline aquifer (i.e. 278 – 350 Mt)
  - 4 hydrocarbons (i.e. 368 – 460 Mt)
- 2 ports considered for intermediate storage

### Romanian cluster – Emission profile

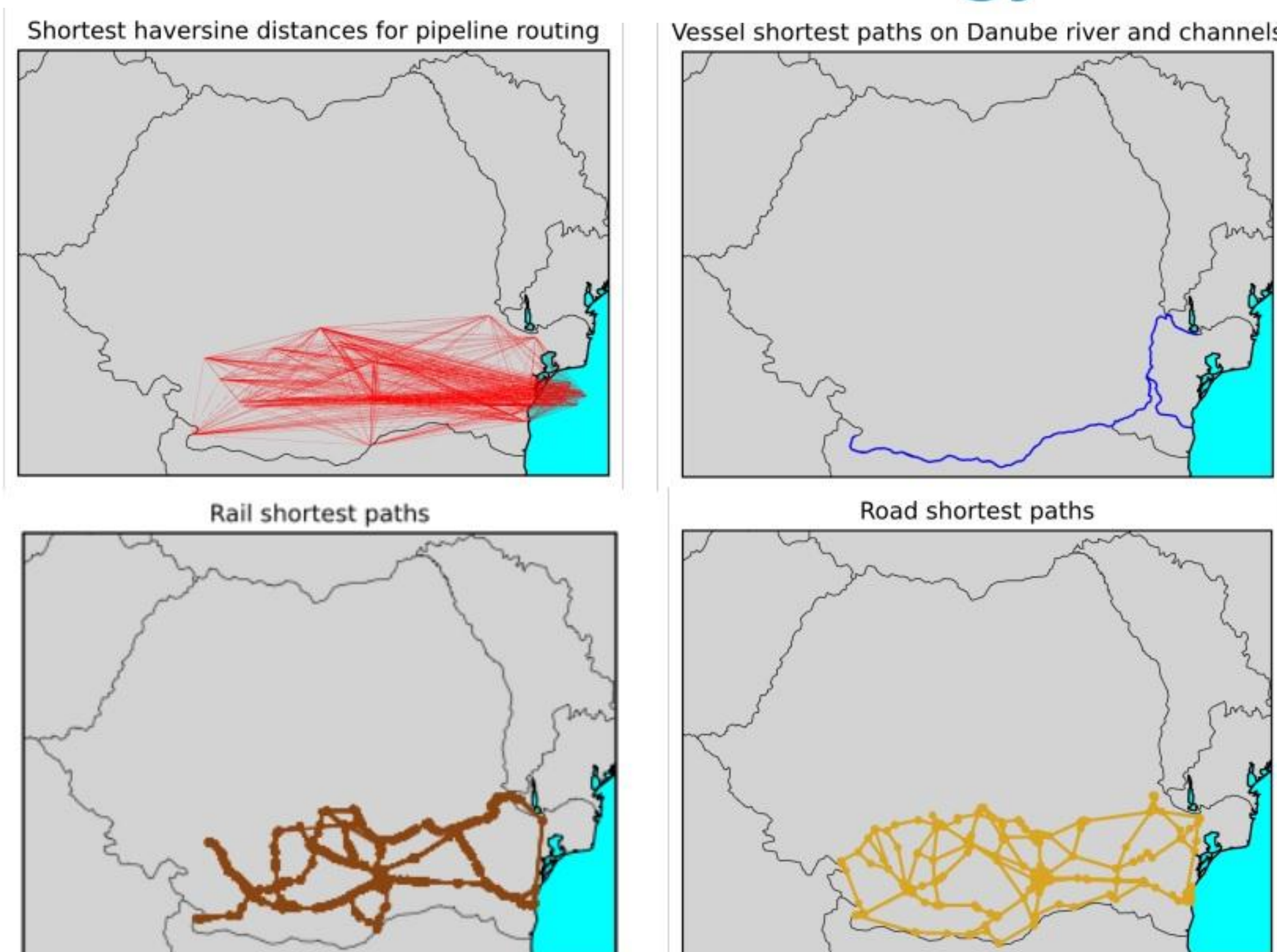


28 stationary emitters



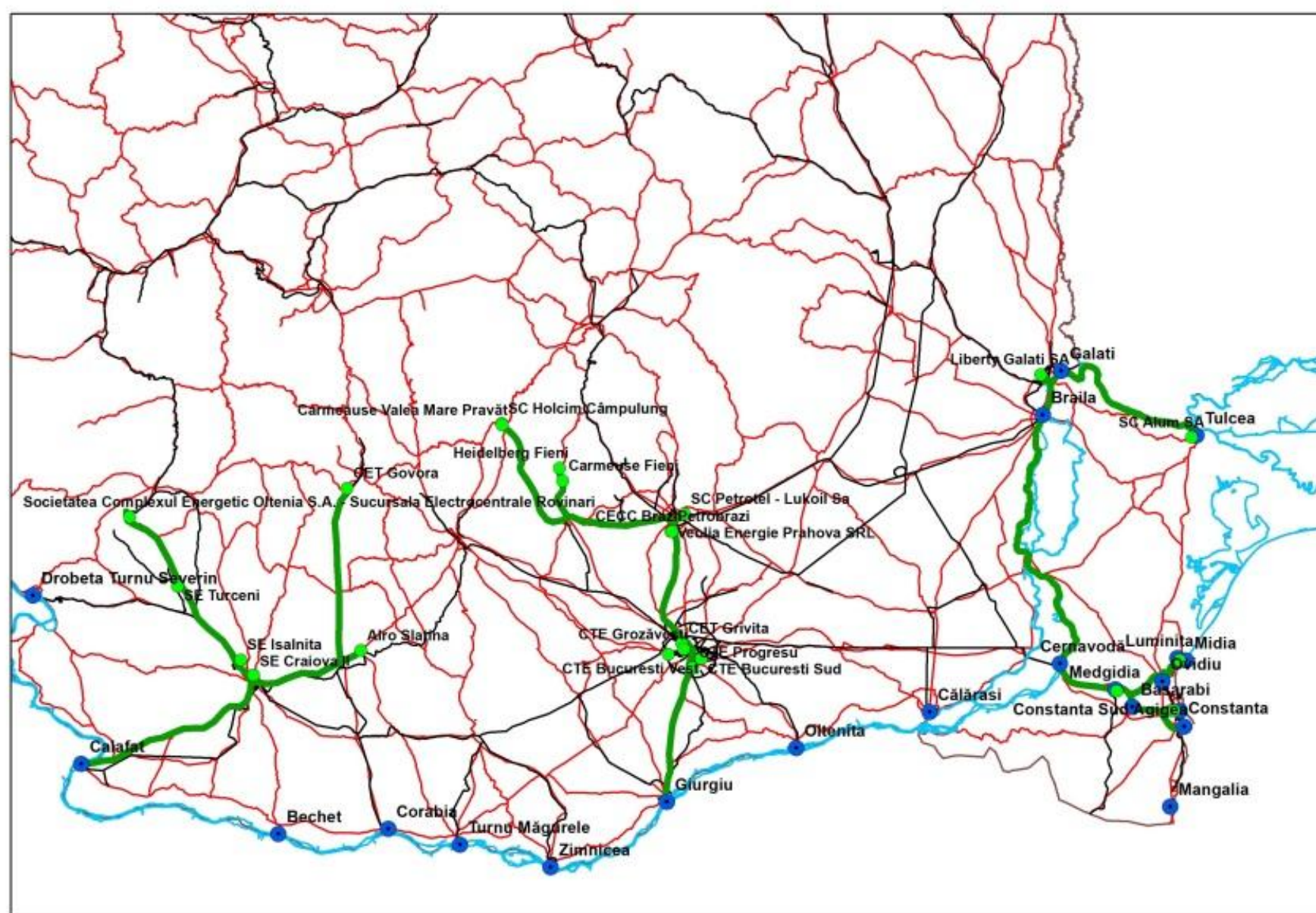
459.8 Mt CO<sub>2</sub> in 30 years

### Methodology



- Pipeline, lorries, rail and ship routing models devised
  - Current infrastructure
- Multi-period incidence matrix was devised.
  - Reflect current evidence on project development.
  - Smaller capacity ship available in the first periods.

### Romanian cluster – Network Draft

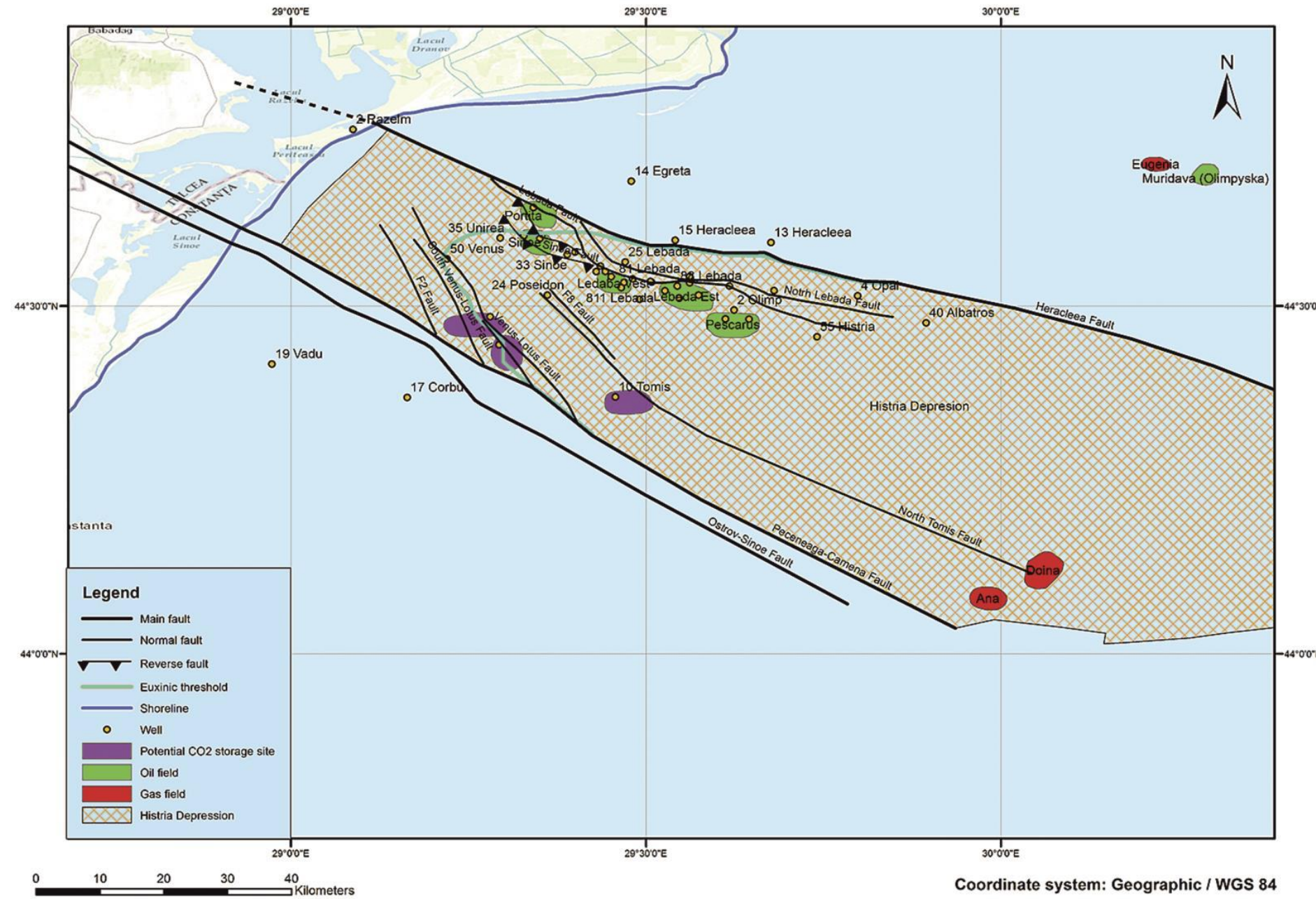


Batch-wise design in period 5	
Ships 7.5 kt capacity	15
Trips per year	1.723

Total cost (M €)	11.231
Unit cost (€ t <sup>-1</sup> CO <sub>2</sub> )	26,7
Levelised cost (€ t <sup>-1</sup> CO <sub>2</sub> )	35,2

Well design in period 5	
Total wells	6
Template	5
Satellite	1

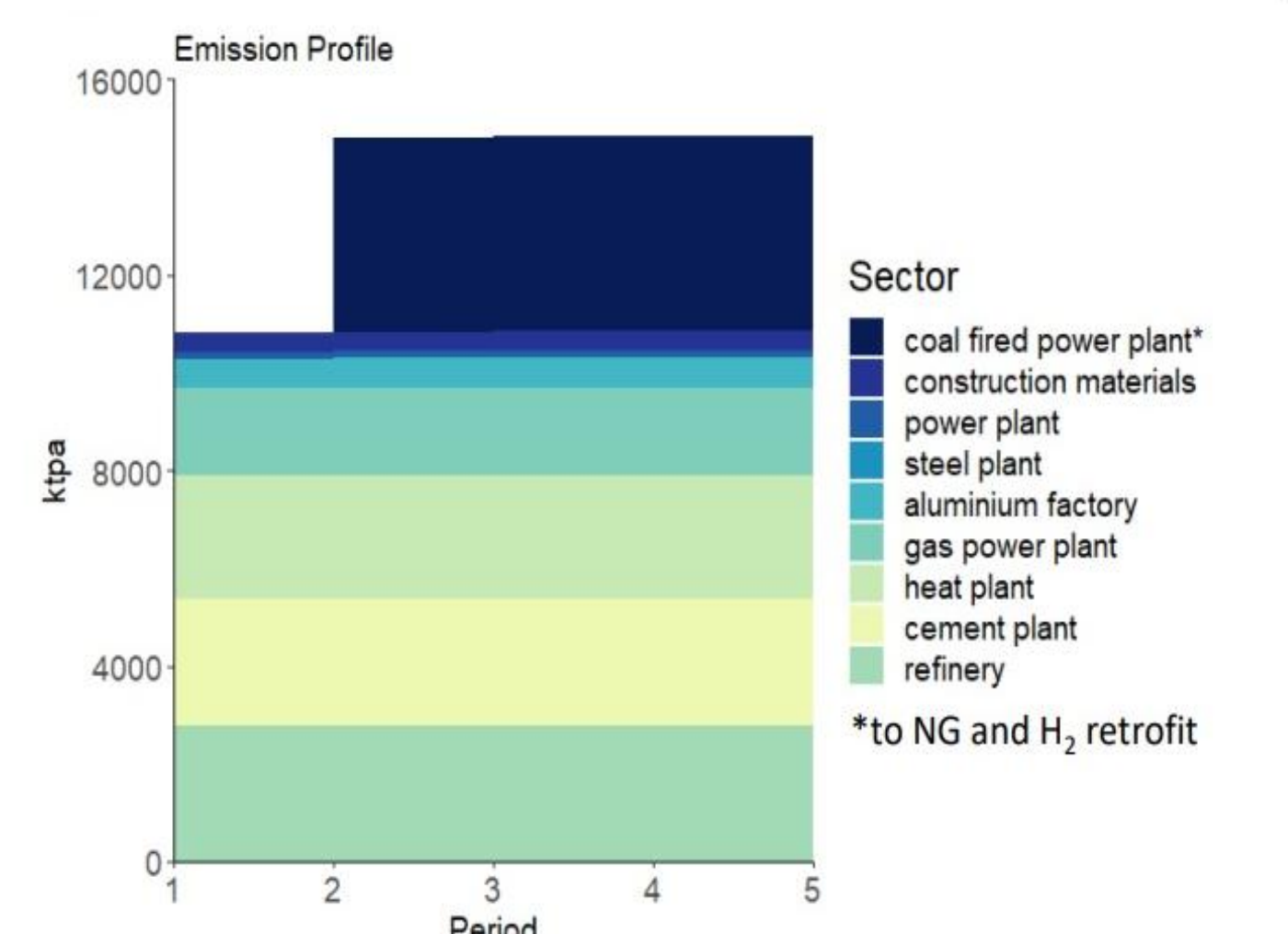
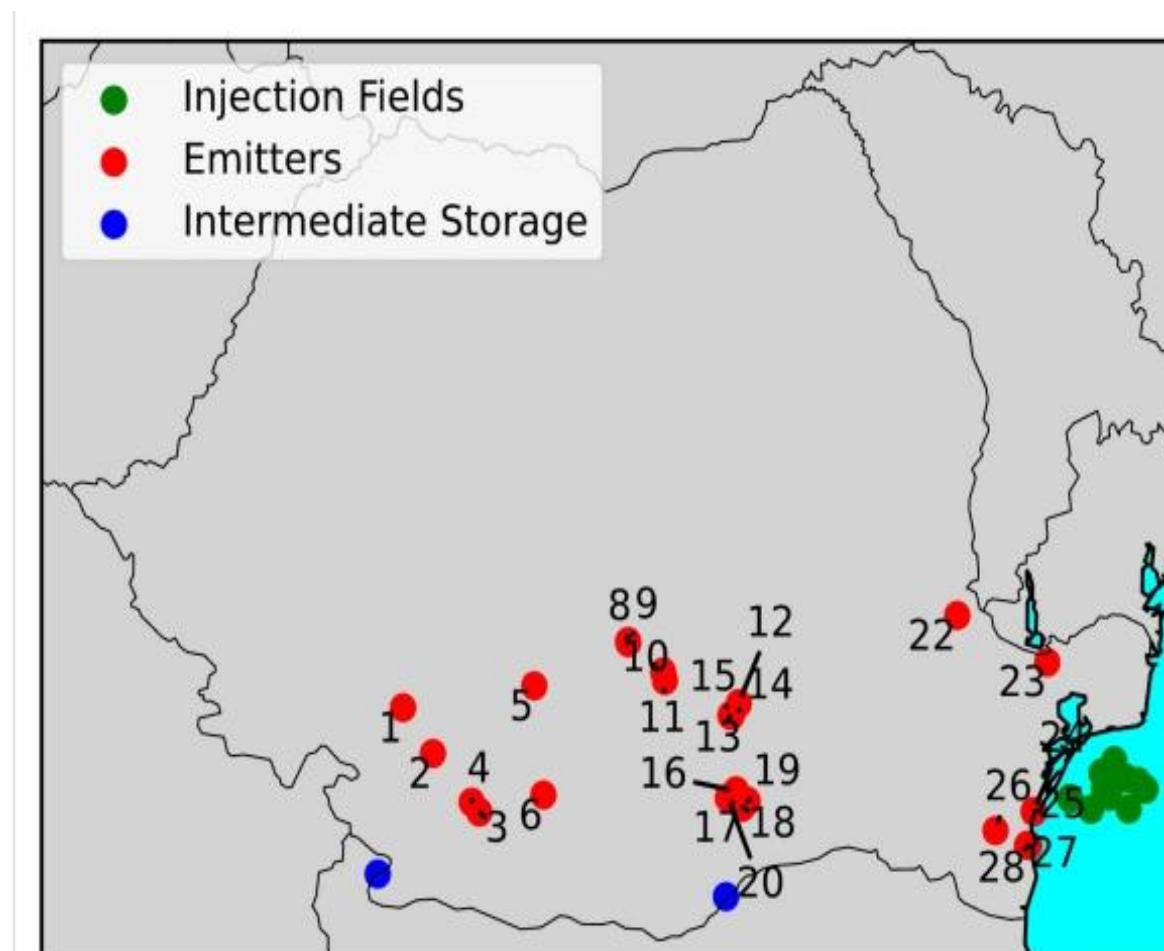
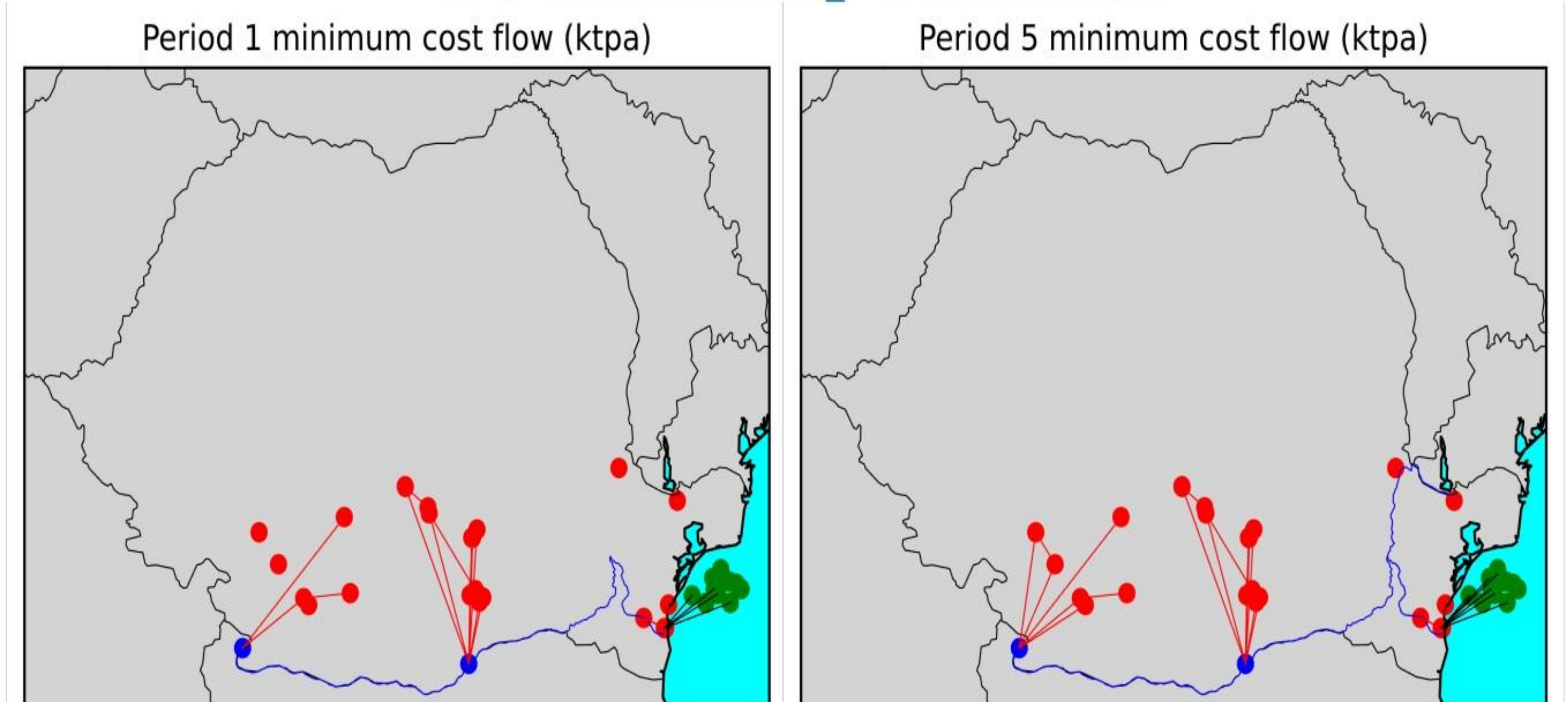
Pipeline segments in period 5	
Total segments	37
Onshore	31
Offshore	6



Opportunities in Histria Depression (Black Sea) - an important unit for hydrocarbon exploration and exploitation.

- Potential storage sites in deep saline aquifers Iris, Lotus and Tomis, located on the southern flank of the Histria Depression
- Good reservoir formations in Albian, Lower and Upper Cretaceous and Middle Eocene. Protected by shale sequences on top and secondary by the Oligocene shale formation.

### Preliminary Results



- Coal-fired power plants are considered after retrofitting works.
- Total amount of CO<sub>2</sub> is 420.4 Mt over the 30 years