Hellenic Republic
Ministry of National Defence
General Directorate of National Defence Policy and International Relations

***Conference on "Critical Undersea Infrastructure"***
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# Protecting Critical Undersea Energy Infrastructure

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INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

# Outline

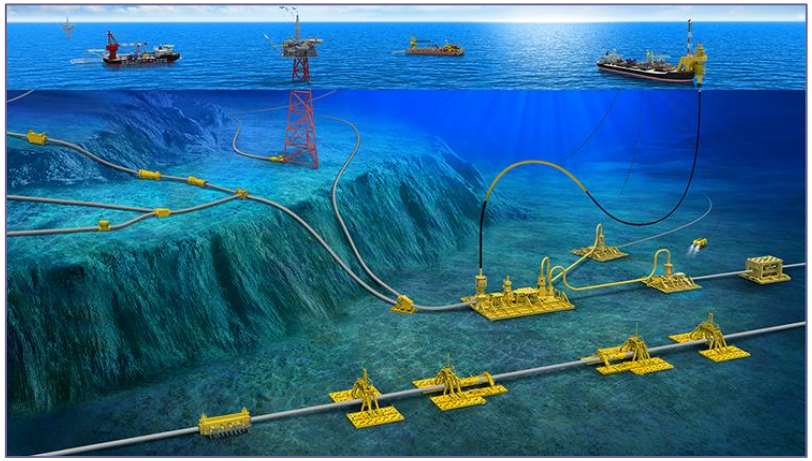
- Overview of critical undersea energy infrastructure and safety concerns
- Hydrocarbon exploration and production
- Gas transmission
- Subsea electricity cables
- Offshore windfarm installations
- Key parameters involved in the planning of effective protection measures of undersea energy infrastructure

# Overview of critical undersea energy infrastructure

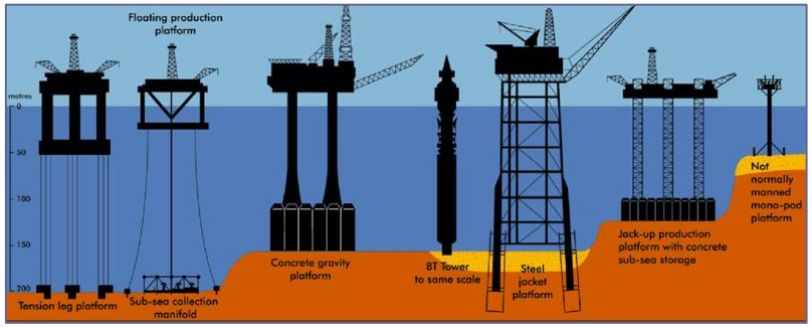
- As global and regional energy needs continue to increase and the energy transformation process gathers pace (i.e towards more electrification) substantial energy infrastructure will be required.
- From the current level of 442 EJ (2022 data) global final energy consumption this is expected to reach 536 EJ by 2050 according to IEA's stated policies scenario.
- A significant part of the required infrastructure (oil & gas, hydrogen, electricity) will be underwater
- Such infrastructure will involve both production and transmission capacity
- As energy systems tend to get more interconnected we expect to see a lot more electricity and gas transmission networks move underwater.
- Already in the SE Europe and the East Mediterranean region we see a proliferation of projects both for oil & gas production, and electricity and gas transmission.
- At the same time we notice an increase of asymmetric threats to energy infrastructure mainly stemming from terrorist acts but also from covert enemy action
- The need to plan ahead and anticipate asymmetric threats is paramount together with the need to organise and implement protective measures.
- Although we have at our disposal today an array of sophisticated inspection and monitoring technologies we need to develop effective counter measures which are lacking at present as far as energy infrastructure is concerned.
- In order to develop such counter measures specifically geared to energy infrastructure we shall need to borrow expertise and experience from appropriate defence systems.

# Hydrocarbon exploration and production

- Subsea wells
  - Extracting oil and gas from beneath the seabed
- Subsea manifolds
  - Distributing and controlling the flow of oil and gas from multiple wells
- Subsea trees
  - Controlling the flow of oil and gas from wells on the seabed
- Subsea boosting and compression systems
  - Enhancing the pressure of the extracted fluids to facilitate transportation
- Subsea umbilicals, risers and flowlines
  - Connecting subsea installations to floating platforms or onshore facilities



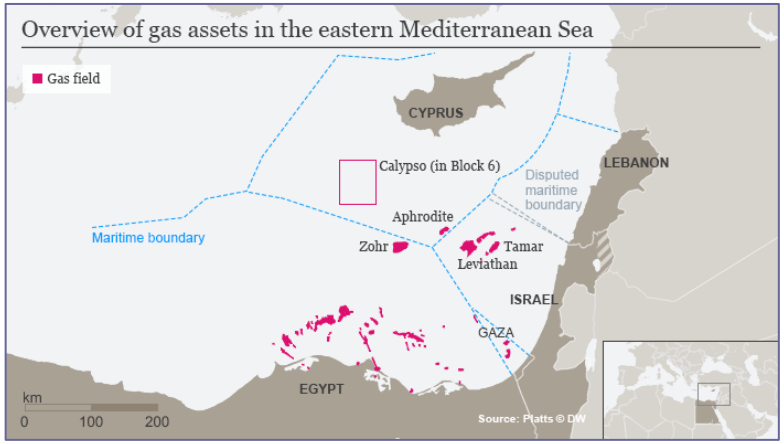
***Source:*** *Oil States Industries*



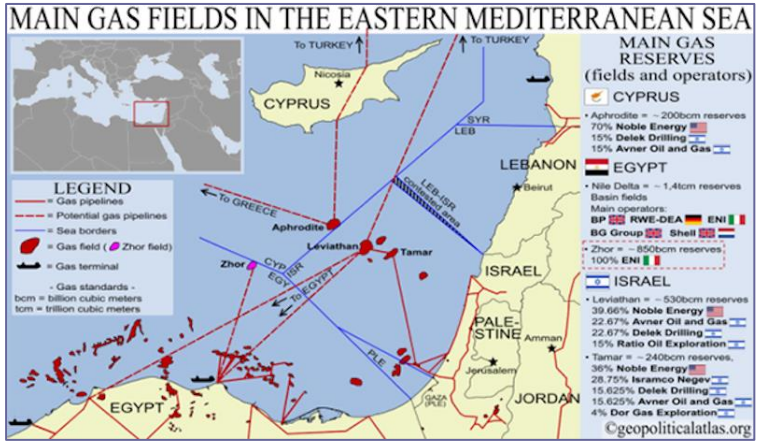

**Risks:**

High pressures, geohazards (i.e. landslides, faults, earthquakes etc.), corrosion, effective sealing and gasket systems, currents, waves, vessel movements, terrorist attacks, sabotage

# E&P activity in the East Med

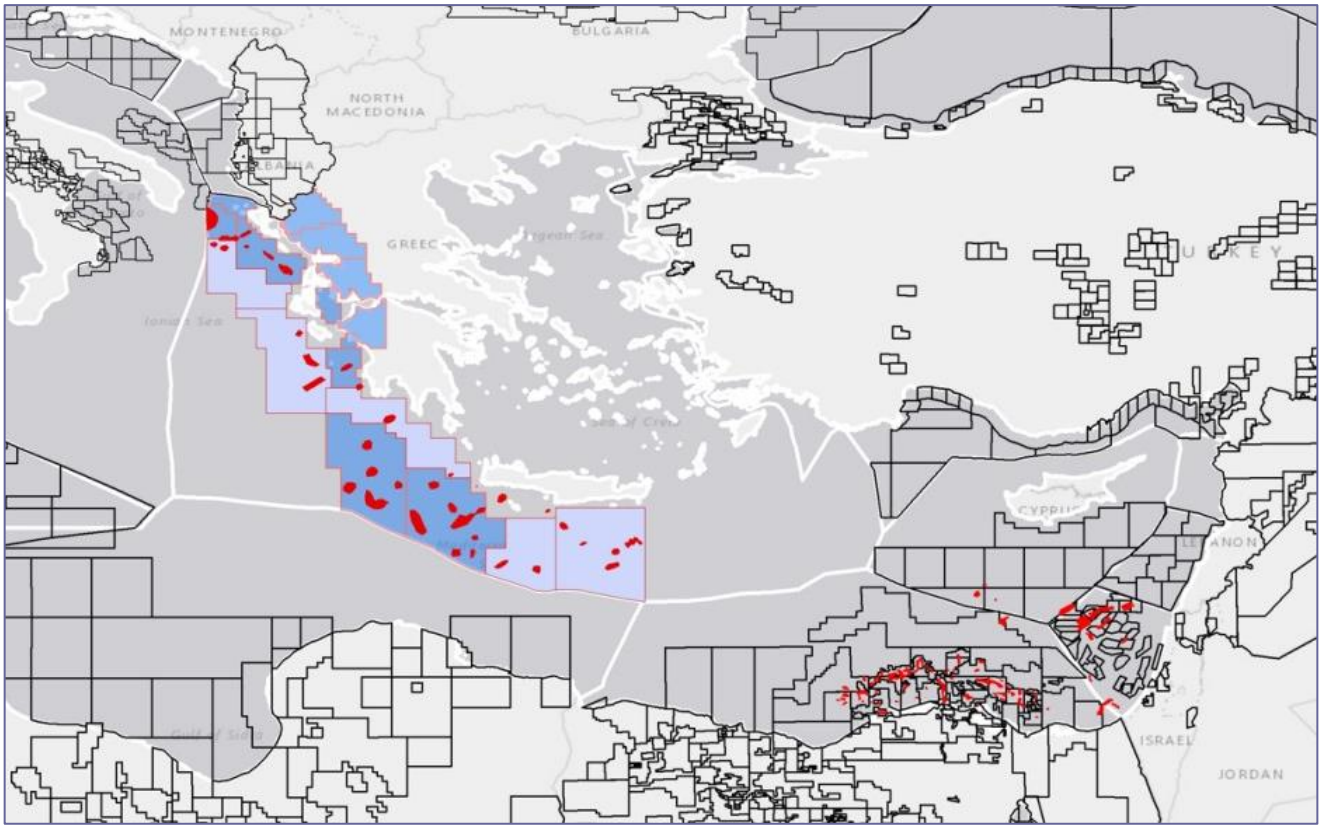



***Source:*** *www.themanews.com*




***Source:*** *NATO Association of Canada*

# Hydrocarbon fields and leads in the East Med




***Source:*** *HEREMA SA (2017)*

# Gas transmission

- Gas pipelines
  - Transmitting gas from the seabed to processing facilities or other locations

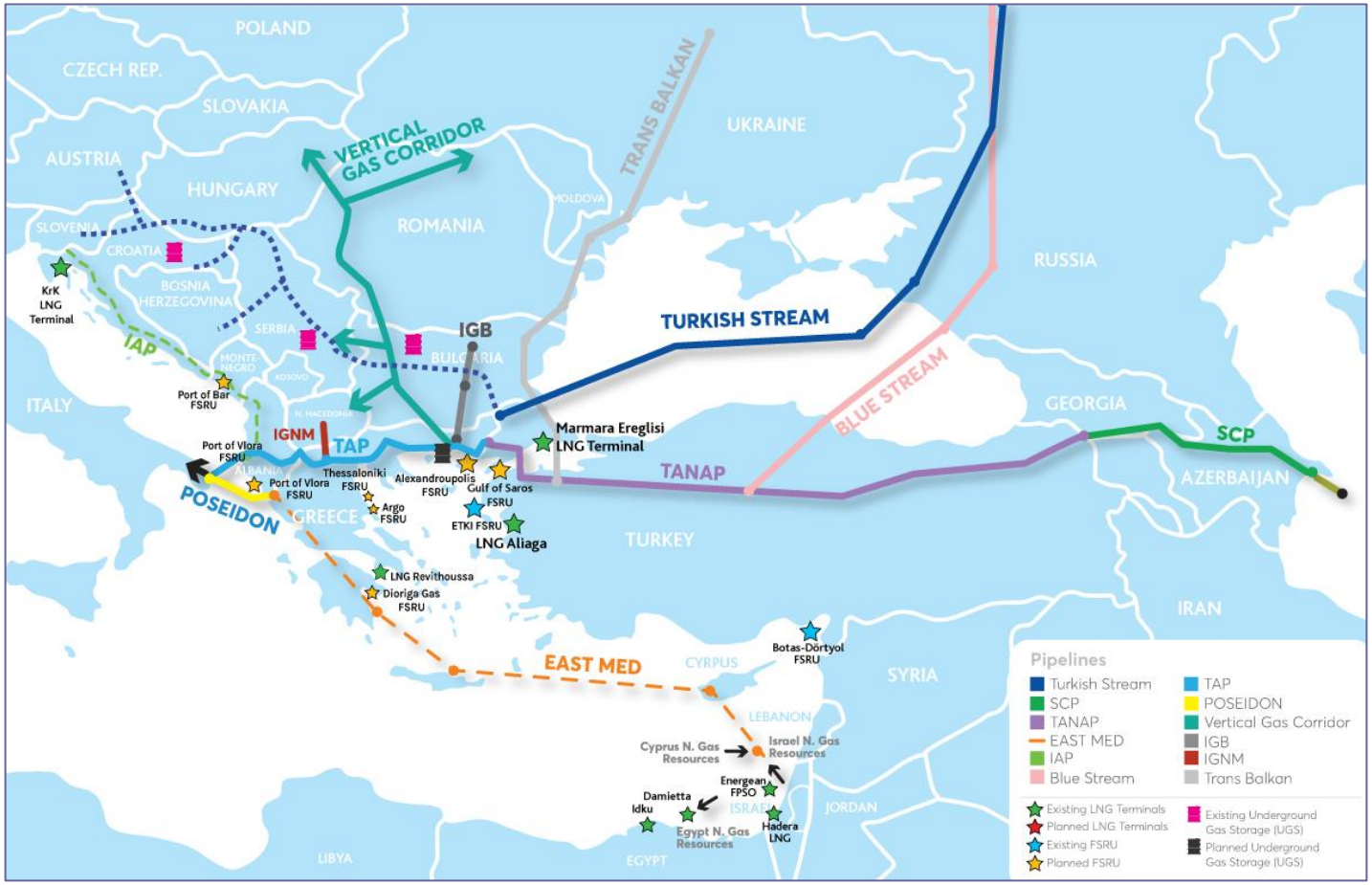
*Source:* https://en.topcor.ru/

**Risks:**

Geohazards, corrosion, erosion, risk of damage from ship anchors and fishing activities, terrorist attacks, sabotage

*Source:* Reuters

# The expanded gas corridor in SEE



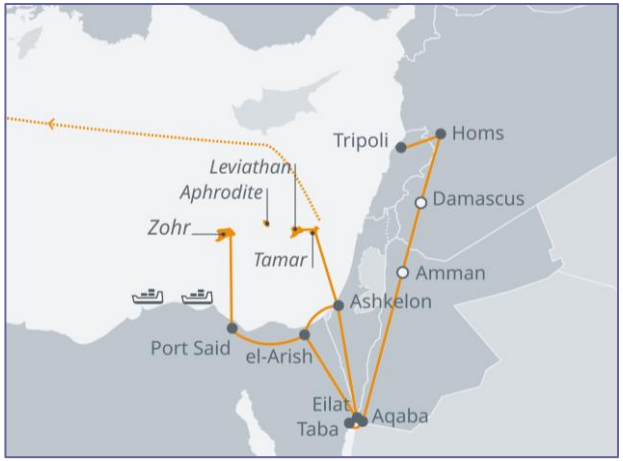

***Source:*** *IENE, 2022*

# Gas pipelines in the East Med

Proposed East Med gas pipeline route


***Source:*** *Financial Times*

Existing pipeline infrastructure in the East Med




***Source:*** *DW*

# Subsea electricity cables

- Transmitting electrical power between offshore installations and onshore facilities

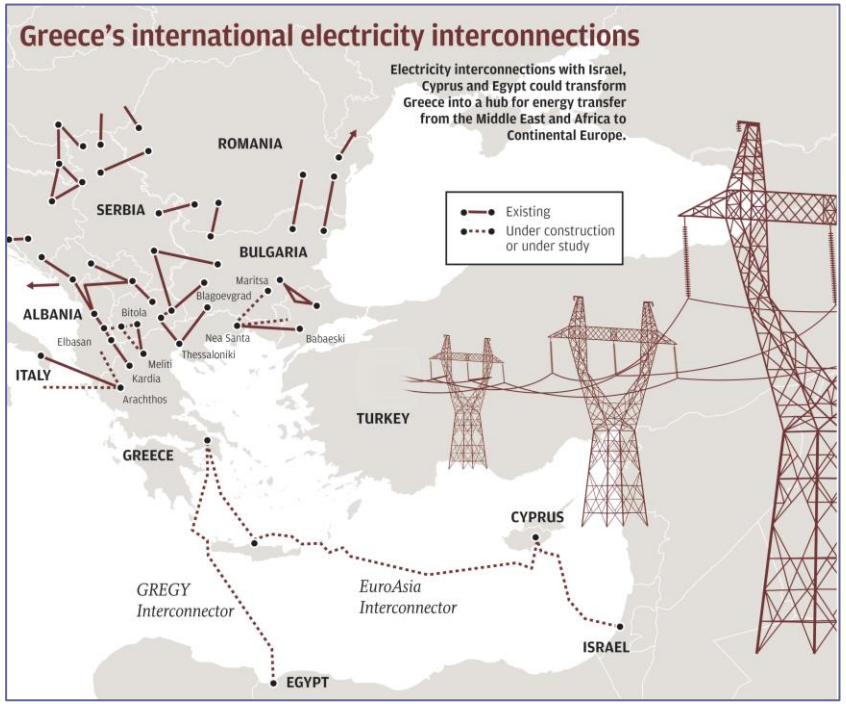
**Source:** *Seatools*

**Risks:**

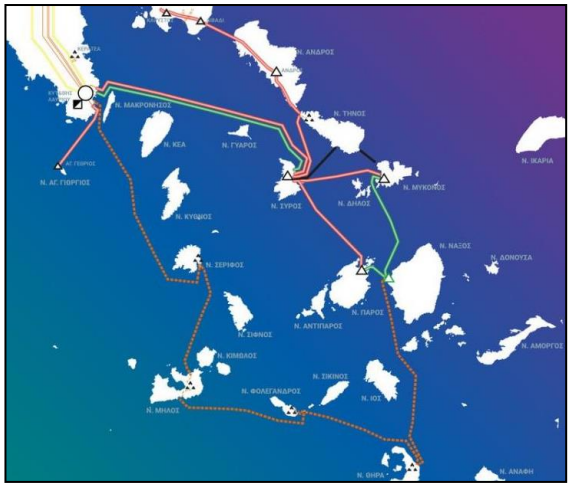
Leaks and insulation, currents, geohazards, precision in laying the cables, anchors, fishing activities, terrorist attacks, sabotage

**Source:** *Starbroek News*

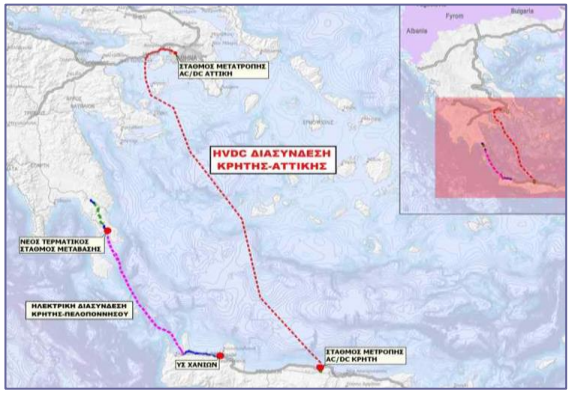
# Electricity interconnectors




***Source:*** https://www.ekathimerini.com/



***Source:*** *ΙΡΤΟ (ΑΔΜΗΕ)*




***Source:*** *Ariadne Interconnection*

# Offshore windfarm installations

- Harnessing wind energy from onshore locations using wind turbines

**Risks:**

Stable foundation systems (monopiles, jacket, floating platforms), weather conditions, waves, terrorist attacks, sabotage

***Source:*** *www.ukpandi.com*

***Source:*** *UK Research and Innovation*

# Planning effective protection measures (key parameters) - 1

- Site Selection and Assessment
  - Conduct thorough geological and environmental surveys to select suitable sites for infrastructure placement.
  - Assess the seabed conditions, currents, tides, and natural disaster risks (e.g., earthquakes, tsunamis) in the area.
- Engineering and Design
  - Design structures that can withstand underwater pressures, currents, and potential impacts from ships or other marine activities.
  - Use corrosion-resistant materials to prolong the lifespan of the infrastructure.
  - Implement redundancy and modularity in design to ensure continuous operation in case of partial system failures.
- Security Measures
  - Implement security protocols to prevent unauthorized access, vandalism, or sabotage.
  - Utilize advanced surveillance technologies such as underwater cameras, sensors, and sonar systems to monitor the infrastructure continuously.
- Maintenance and Inspection
  - Develop regular inspection schedules to identify and address wear and tear, corrosion, or any potential weaknesses.
  - Establish maintenance protocols to ensure the infrastructure remains in optimal condition over its operational lifespan.

# Planning effective protection measures (key parameters) - 2

- Environmental Impact Mitigation
  - Implement measures to minimize the impact of infrastructure installation on the local marine ecosystem.
  - Monitor and address any environmental disturbances caused by the infrastructure, such as noise pollution or disruption of marine habitats.
- Emergency Response and Contingency Planning
  - Develop comprehensive emergency response plans to address potential accidents, leaks, or other emergencies.
  - Establish communication protocols with relevant authorities and response teams to coordinate swift actions in case of emergencies.
- International and Regulatory Compliance
  - Ensure compliance with international maritime laws and regulations related to undersea energy infrastructure.
  - Obtain necessary permits and approvals from regulatory authorities before the installation and operation of the infrastructure.
- Cybersecurity Measures
  - Implement robust cybersecurity protocols to safeguard against cyber threats, including hacking attempts and data breaches.
  - Regularly update security systems to stay ahead of evolving cyber threats.

# Planning effective protection measures (key parameters) - 3

- Stakeholder Engagement
  - Engage with local communities, environmental organizations, and other stakeholders to address concerns, provide information, and garner support for the project.
  - Foster positive relationships with local communities to enhance cooperation and minimize opposition.
- Risk Assessment and Management
  - Conduct comprehensive risk assessments to identify potential risks and vulnerabilities.
  - Develop risk management strategies to mitigate identified risks and enhance the resilience of the infrastructure.

***Source:*** *Synthetex*

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