A new research direction in FORTH...

Prof. Nikos Pasadakis, Director IPR-Forth





Necessity and Actuality

- Expected intense growth of oil activities in Greece and in Eastern Mediterranean. Economical and geopolitical significance of the new institute
- The first integrated scientific research body in petroleum exploration and production for Greece, as well as for Eastern Mediterranean
- □ Greece is mostly *unexplored* for its petroleum potential. Specific challenges due to the complicated geology, the extreme sea depths etc. as well as for environmental friendly exploitation of oil reserves due to the highly developed tourism sector
- □ The new Institute as *scientific advisor* for Greek governmental bodies and as *coordinator* of the existing petroleum research groups in Greece





January 2019

The IPR-FORTH was established by the Greek Parliament (Law 4589 article 36.1)

Άρθρο 36

Ρυθμίσεις για τους ερευνητικούς φορείς

 Η περίπτωση 10 της παρ. Α΄ του άρθρου 13Α του
ν. 4310/2014, όπως τροποποιήθηκε με την παρ. 7 του άρθρου 20 του ν. 4521/2018, αντικαθίσταται ως εξής

«10. Το Ίδρυμα Τεχνολογίας και Έρευνας (Ι.Τ.Ε.), το οποίο αποτελείται από τα εξής Ινστιτούτα:

α. Ινστιτούτο Μοριακής Βιολογίας και Βιοτεχνολογίας
(I.M.B.B.).

β. Ινστιτούτο Επιστημών Χημικής Μηχανικής (I.Ε.Χ.ΜΗ.).

γ. Ινστιτούτο Ηλεκτρονικής Δομής και Λέιζερ (Ι.Η.Δ.Λ.). δ. Ινστιτούτο Μεσογειακών Σπουδών (Ι.Μ.Σ.). ε. Ινστιτούτο Πληροφορικής (Ι.Π.). στ. Ινστιτούτο Υπολογιστικών Μαθηματικών (Ι.Υ.Μ.). ζ. Ινστιτούτο Αστροφυσικής (Ι.Α.). η. Ινστιτούτο Πετρελαϊκής Έρευνας (Ι.Π.Ε.).»





The official announcement in Chania 21-01-2019



February 2019

Technical University of Crete (TUC) allocated 500m² space for temporal housing of the new institute and 35 acres for the construction of permanent installations in the TUC Campus

now...



...near future!!!





Summer 2019

- Application process for three new positions of researchers was completed successfully
- First Director of the Institute was elected
- □ Sponsorship agreement of 500.000 euros with "Hellenic Petroleum S.A." for the upcoming next five years
- Submission of two research proposal in the frame of GSRT, aiming to finance the experimental infrastructure of IPR/FORTH

Ongoing work

- Preparation of the collaboration of the IPR/FORTH with research groups of the TUC, ICE-HT/FORTH, oil companies, etc.
- Preparation of the premises of the new institute at the Technical University of Crete campus
- Preparation of the organization structure and design of lab facilities





Research Directions

1. Petroleum Exploration

Basic and applied research in petroleum basins (Geology, Geophysics, Geochemistry)

2. Petroleum Production

Basic and applied research in drilling and production of petroleum reservoirs (Drilling Engineering, Production Engineering)

3. Safety and Environment

Basic and applied research for safe and environmental friendly exploitation of oil and gas reservoirs (Environmental Engineering)





1. Petroleum Exploration

Existing Capabilities

- Integrated system (equipment, methodologies, data evaluation) for geochemical studies in petroleum basins, compatible with common industrial standards. Unique in Greece.
- Modeling of petroleum basins, (including experimental kinetic modeling of kerogen) using advanced industrial software (Petrel & Petromod, Schlumberger)
- ✓ Detailed characterization of petroleum fluids and sediments in source rocks and reservoirs, including GC, GC-MS, HPLC, Rock-Eval, DTG, CHNS analyses....

Results

- ✓ More than 40 research works in specialized scientific journals and conferences
- ✓ Applied research projects with oil companies
- ✓ Semi-commercial library of petroleum biomarkers mass spectra





1. Petroleum Exploration



GC-MS



DTA



Existing experimental setup



HPLC



FT-IR



Rock-Eval

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AND TECHNOLOGY - HELLAS

1. Petroleum Exploration

Needs & perspectives in applied research

- ✓ Update experimental setup to fulfill current requirements
- ✓ Incorporate geophysical data analysis and modeling in the existing basin modelling scheme
- ✓ Update modelling software with additional tools under commercial license
- ✓ Act as scientific contractor to oil companies

Directions of basic research

- ✓ Research on biochemical processes of oil generation (collaboration with IMBB-FORTH)
- ✓ Analysis and modelling of geophysical data (collaboration with IACM-FORTH)
- ✓ Modelling of hydrocarbons' generation & migration (collaboration with ICE-HT)





2. Petroleum Production

Existing Capabilities

- ✓ Phase equilibria and thermodynamic behaviour (PVT, MMP, viscosity) studies of multiphase mixtures (ex. VLL, GH, asphaltenes) at high pressures and temperatures. HPHT density meter unique in Greece.
- ✓ Core Analysis testing (permeability, porosimetry, water saturation)
- ✓ Phase equilibria modeling for oil, gas and gas hydrates
- ✓ Rheological measurements on oil-water emulsions and drilling/cement slurries
- ✓ Flow assurance measurements in 5m long flow loop

Results

- ✓ More than 80 research works in specialized scientific journals and conferences
- ✓ Applied research projects with oil companies (Schlumberger, KAPPA, OilPhase, Energean Oil & Gas)
- ✓ In house developed multiphase equilibrium simulator (HYDTUC) for gas/oil/brine/GH/ice





2. Petroleum Production



Flow loop

Existing experimental setup



HPHT density meter



Optical cells





Autoclave reactor setup

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Core holder setup





2. Petroleum Production

Needs & perspectives in applied research

- ✓ Update experimental setup to fulfill current requirements
- ✓ Incorporate existing component databases and new phase models to the existing simulation scheme
- ✓ Update rheological and drilling modelling software with additional tools
- ✓ Act as scientific contractor to oil companies, carry out industrial projects

Directions of future research

- ✓ Multiphase fluids and emulsions PVT data, Collaboration with ICE-HT/FORTH
- ✓ Analysis and modelling of flow assurance issues
- \checkmark Integration of geophysical tools to existing core analysis and flow loop setup





3. Safety and Environment

Existing Capabilities

- Basic and Applied research on the field of Bioremediation Technologies (biodegradation of hydrocarbon contaminants on surface and deep waters – oil spills)
- ✓ Sediments decontamination & environmental monitoring (landfarming)
- Microbiological and molecular characterization of Hydrocarbon degrading bacterial communities (q-PCR, flow cytometry)
- ✓ Modeling of oil spill fate and transport in the marine environment (MEDSLIK-III)

Results

- ✓ Numerous publications in specialized scientific journals and conferences, and patents
- ✓ More than 10 EU funded projects in the last 8 years on environmental clean up biotechnology (KILL SPILL)
- ✓ 2 Postdoctoral funded projects on Deep sea bioremediation of hydrocarbons
- ✓ Innovative product development for combating oil spills bioremediation agents (bioPad, Biosurfer)





Immobilized oil

droplets

3. Safety and Environment



Flow cytometry



Bioreactors



Biofilm characterization



Light+ fluorescence microscopes with camera



FORTH FOUNDATION FOR RESEARCH AND TECHNOLOGY - HELLAS



DEEP SEA oil release emulation -High Pressure reactor

3. Safety and Environment

Needs & perspectives in applied research

- ✓ Update experimental setup to fulfill current requirements
- \checkmark Incorporate biotechnology cleanup methods in the existing oil spill response scheme
- ✓ Incorporate data analysis and modeling in the existing oil spill modelling scheme
- ✓ Pursue funding and Act as scientific/project coordinator in funded projects
- ✓ Offshore Petroleum Regulator for Environment / connect with the Environmental Protection companies

Directions of basic research

- ✓ Research on biochemical processes of oil degradation (collaboration with IMBB-FORTH)
- ✓ Environmental Biotechnology
- ✓ Analysis and modeling of oil spill fate in the environment (collaboration with IACM-FORTH)





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Summary

A timely and critical research structure for the Greece

Our goals

- ✓ High operating standards & research excellence
- ✓ Credibility in the scientific community and in the oil industry
- ✓ Reference point, as a petroleum science center





Thank you



