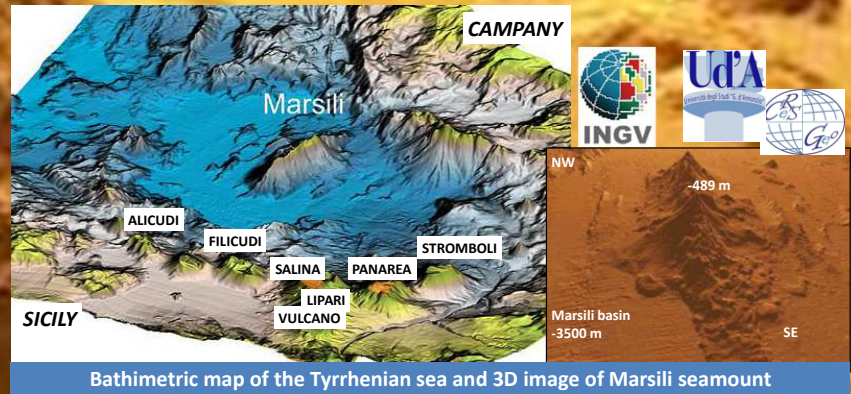
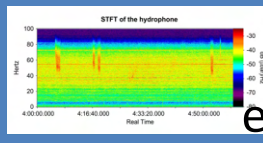
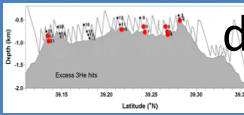
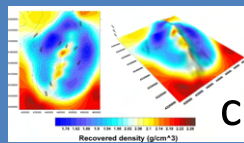
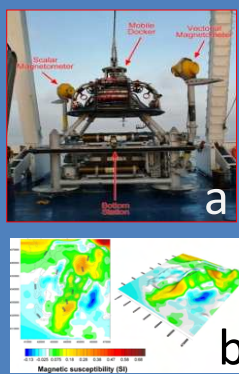


Renewable energy from a natural system: the MARSILI offshore geothermal project. Scientific progresses, technology innovation, industrial exploitation and monitoring

The Marsili seamount is the largest volcano in Europe, with an axial length of more than 70 Km and a width of about 17 km; its height is about 2.5 km with a minimum depth below the sea level at about 490 m. The Marsili basin is by far the most extensional area as well as the area with the highest heat flux in the Tyrrhenian sea. It represents an outstanding natural laboratory for establishing important and lasting synergies between the academic and public research institutions and industry, with the objective of assessing geothermal exploration and exploitation.



Bathimetric map of the Tyrrhenian sea and 3D image of Marsili seamount



High-frequency pressure signals with time duration of a few minutes and dominant frequency between 40 and 90 Hz. Similar signals have been interpreted as sudden vapor emission when water temperature exceeded the boiling point.

Examples of scientific results: a) multidisciplinary abyssal observatory; b) Magnetic susceptibility; c) reconstructed density data; d) geochemical data (³He excess); e) hydroacoustic data

STEPS OF THE MARSILI PROJECT DEVELOPMENT

- ✓ In 2006 a geothermal exploration program started. Scientific Partners; Chieti University CNR and INGV
- ✓ In 2009 the MARSILI research permission has been given by the Ministry of Economic Development (MISE)
- ✓ In 2006-2012 research activities stated the existence of active venting of hydrothermal fluids all along the seamount
- ✓ 2013 the preliminary environmental study about the first geothermal offshore well, has been already sent to Italian Environmental Ministry, but in the meantime the research permission is expired.

PROJECT STRENGTHS AND OPPORTUNITIES

- It will be the first offshore geothermal power-plant in the world
- The power-plant run at full speed around-the-clock and the production is independent from weather conditions
- Geothermal capacity factor is the highest: about 90%
- The production of energy is theoretically unlimited
- Very small environmental footprint
- The project complies with the CO₂ reduction policies and fits with the national objectives for energy production
- Integrated monitoring system for natural and anthropogenic risks (volcanic activity – industrial activities interactions with the deep sea)
- The power-plant does not need reinjection, as inland plants
- Integration with wind-plant or photovoltaic system is possible on the off-shore platform
- Geothermal energy could become the second largest source of renewable energy after hydro-electric power
- The law n° 134 dated 7 August 2012 (former DL n° 83/2012) includes the geothermal energy among the national strategic energy sources (art. 38ter)

The graph shows the technical and economic feasibility of the Marsili Project, which is located in the very favourable “extraordinary conditions” area, with optimal conditions thanks to high enthalpy and low water depth. According to studies, the temperature is higher than 375°C. These conditions will allow to produce about 50 MWe per well and this means reducing investment costs compared to inland geothermal plants.

Electrical production from geothermal sources MWe

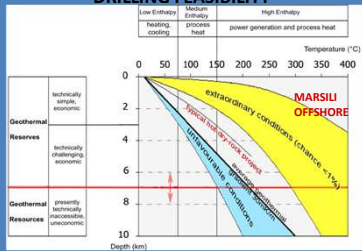
TECNOLOGIE	10 anni	15 anni
GEOTERMALI	2000	3000
EGS	500	1500
EGS con SCAMBIATORI	50	200
OFF SHORE	600	1200
NON CONVENZIONALE	0	500

Source:
PIATTAFORMA GEOTERMICA ITALIANA
Italian MIUR (Research and University Ministry) and MISE (Economic development Ministry)

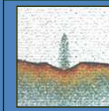
UE SET PLAN

INTEGRATED ROADMAP

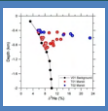
GEOTHERMAL RESOURCES AND RESERVES DRILLING FEASIBILITY



MARSILI PROJECT PLANNING



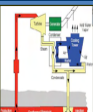
GEOTHERMAL EXPLORATION 2006-2012



OFFSHORE DRILLING (NEXT STEP)



OFFSHORE POWER GENERATION



1.50 TWh (1,500,000 MWh) will be generated each year from each power-plant

The offshore Marsili geothermal system is expected to contain several millions of m³ of high-enthalpy fluids continuously discharged at the surroundings deep sea and recharged by sea waters. If the model is correct the fluids will allow an electrical production of enhanced of a factor 10 to the respect of the traditional geothermal wells. It is estimated that every single well may produce something like 50 MW); From the first offshore 200 MWe offshore platform a production of about 1,5 TWh is expected and about 6,0 TWh for the 4 planned platforms. The total amount of produced energy is estimated to be in the order of 800-1000 MWe as also reported by the "PIATTAFORMA GEOTERMICA"

CONTACTS

P. Signanini – UNICH – signanini@unich.it
D. Paltrinieri – Chief Operation Officer – dpaltrinieri59@gmail.com
F. Italiano – INGV – francesco.italiano@ingv.it
P. Favali – INGV – paolo.favali@ingv.it
M. Rainone – UNICH – rainone@unich.it