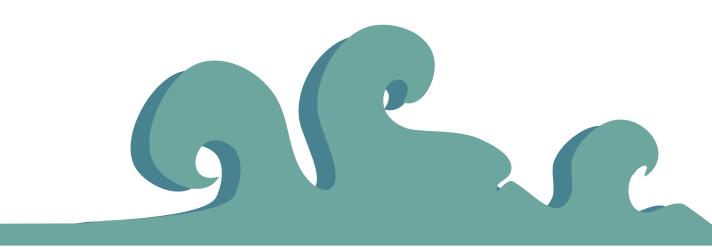
Games As Educational Tools in eARTh Science: MAREOPOLI and THE ENERGY CHALLENGE (EGUGENERAL)



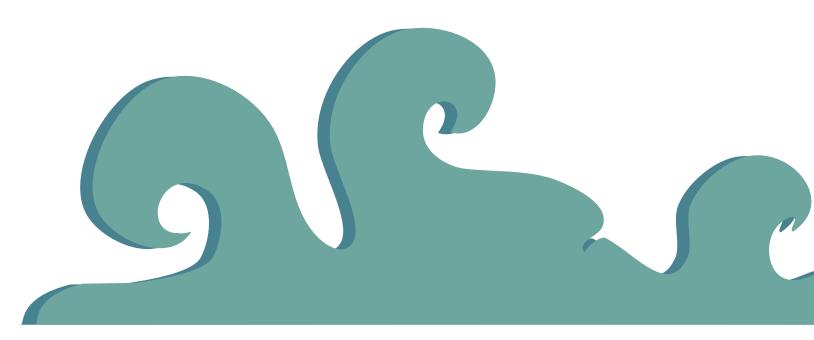
Sara Garvani (1,2), Marina Locritani (1), Francesca di Laura (1), Mascha Stroobant (3), and Silvia Merlino (4)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; (2) Historical Oceanography Society, Villa Pezzino, Via P



Sustainable, Blue and Green Growth isn't an unreachable goal....

Awareness on environmental issues must reach a growing number of people: we can't wait anymore and we need to lay the foundation for our future change towards Sustainable, Blue and Green Growth while translating - or understanding how to translate - European) and National directives and policies into concrete actions.



When you can split a big problem in several small resolvable topics treach

We need to encourage citizens to think about their impact on the planet when purchasing, and on their consequences of societal behavior in relation to waste production, energy, climate change and to promote co-responsibility among different actors. As pointed out by Hartley et al. (2015) "children are important agents of social change in society. They represent the future citizens and consumers who will develop attitudes and make decisions that will inevitably

affect the environment."

Recommendation 2006/962/EC shows the support of EC towards every Member State for developing instruction and education strategies following a specific and harmonized plan that should offer to everybody the possibility to develop its own core competences in the form of

knowledge, abilities, skills and attitudes while engaging in an active and democratic participation in social life (especially in increasingly diverse societies). Mathematical, scientific and technological competence is the third of the 8 key competences that this recommendation has identified as fundamental for each individual in a knowledge-based society, because "Science, being one of the most remarkable achievements of human culture" and must "...be shared with

all, especially when extreme

knowledge of the oceanography's

history and the scientific historical

specializations of scientific disciplines and complexity of their results seem to hopelessly increase the gap between science and the average person" (Wilgenbus and Léna, 2011).

Let's focus on edutainment: La Spezia Gulf of Science

Since 2007 in the territory of La Spezia a growing number of outreach events has been carried out. This work has been possible thanks to the team cooperation of the Research Centres (CMRE NATO -Centre for Maritime Research and Experimentation, CNR ISMAR -Istituto di Scienze Marine,

CSSN - Centro di Supporto e Sperimentazione Navale della Marina Militare, ENEA - Centro Ricerche Ambiente Marino, INGV -Istituto Nazionale di Geofisica e Vulcanologia, DLTM Distretto Ligure delle Tecnologie Marine), Entreprises, Cultural Associations, Museums, Universities and Schools of the territory that clustered in order to show research to general public and to meet the growing demand for knowledge of the society (Locritani et al. 2013; Merlino et al. 2014). The scientific outreach events organized by the Scientific Dissemination Group "La Spezia Gulf of Science - La Spezia Golfo delle Scienze" use different methods and activities to inform children, students, and people about the more innovative scientific findings and

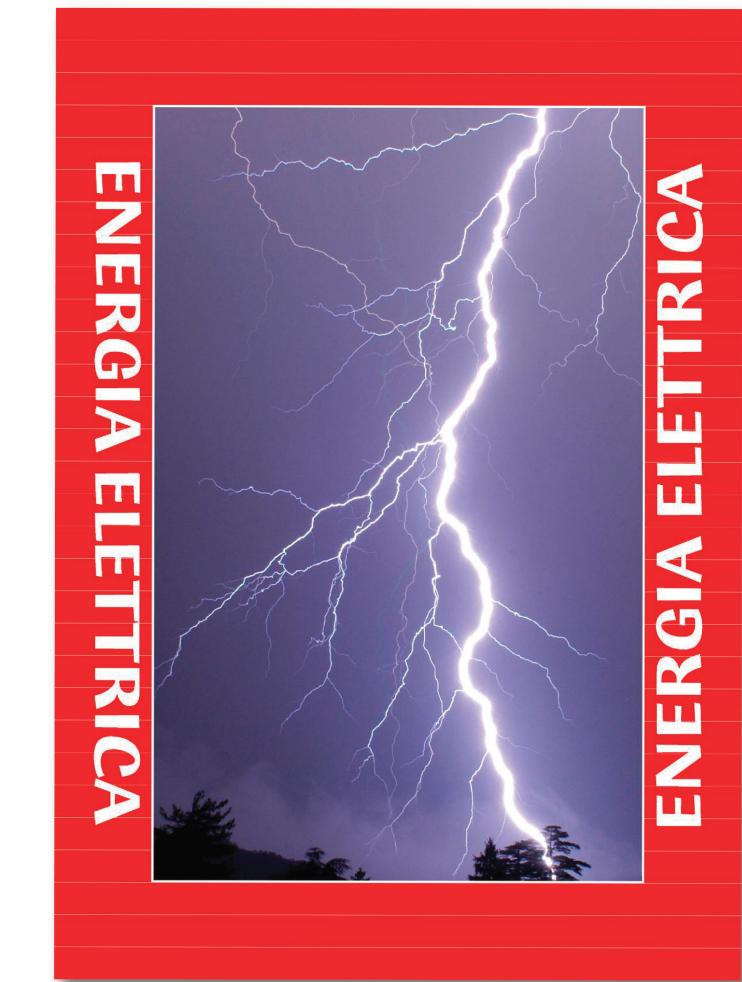
recent technologies. The role of the science communicator is to disseminate this knowledge in simple, attractive, direct way and to find a tool, a game or an experience to reach this objective. Seminar, movie screenings, citizen science activities, games, exhibitions, educational and training programs, school-related internships, etc...

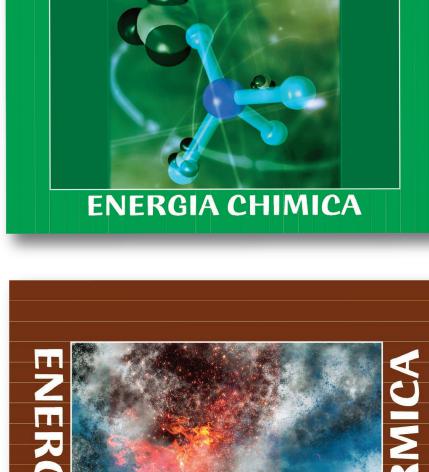
The decadal experience of the working group prioritized recreational-scientific activities, strengthening relationship between artists (graphics, illustrators, dancers, photographers ...) and researchers, for the realization of laboratories and scientific games, aimed to enhance and promote scientific knowledge, and all the tools for personal and societal growth and education.

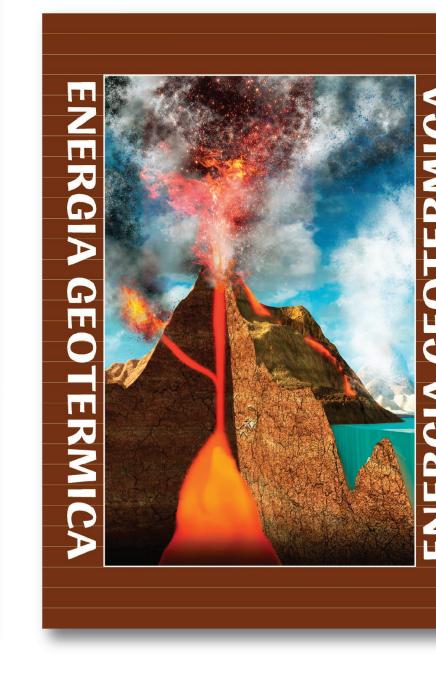
The aim of the game is to present the the **Energy**, the transformations

different forms in which it presents from one form to the other,



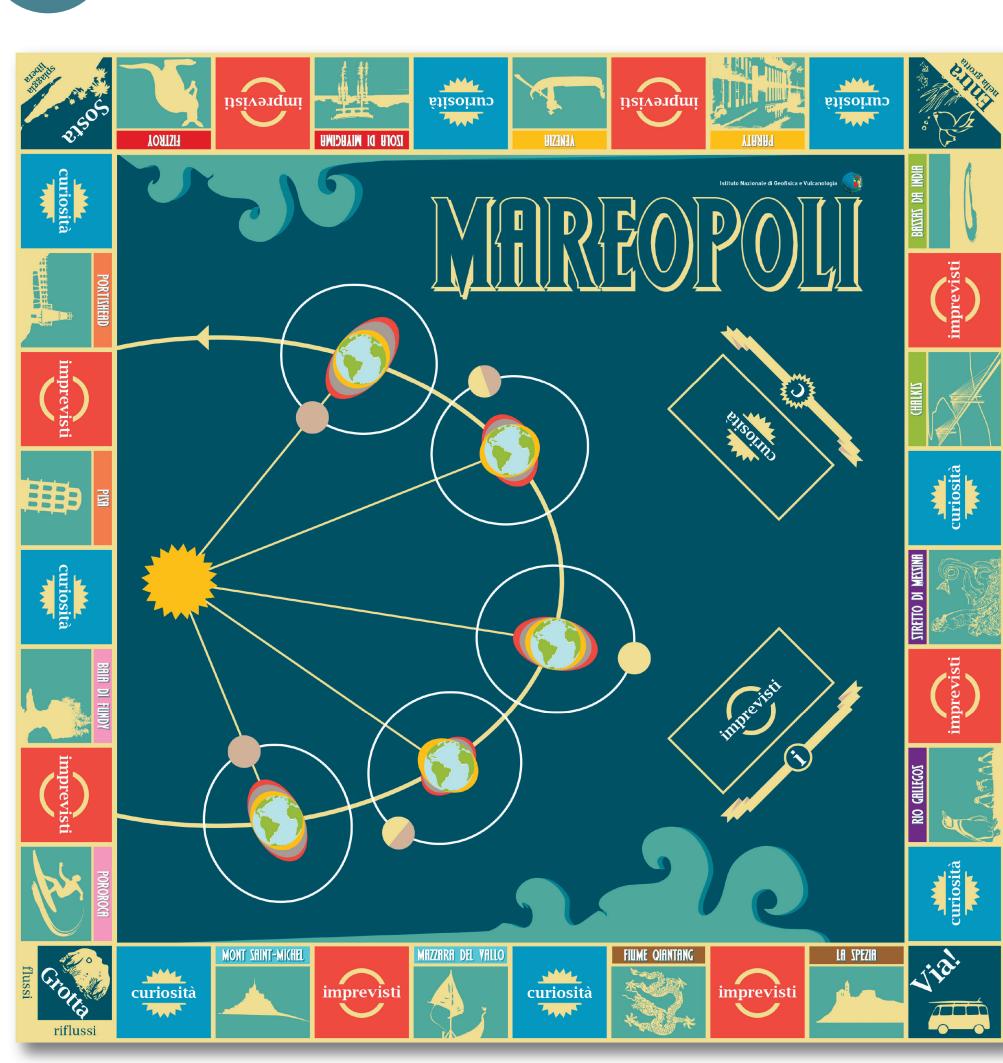


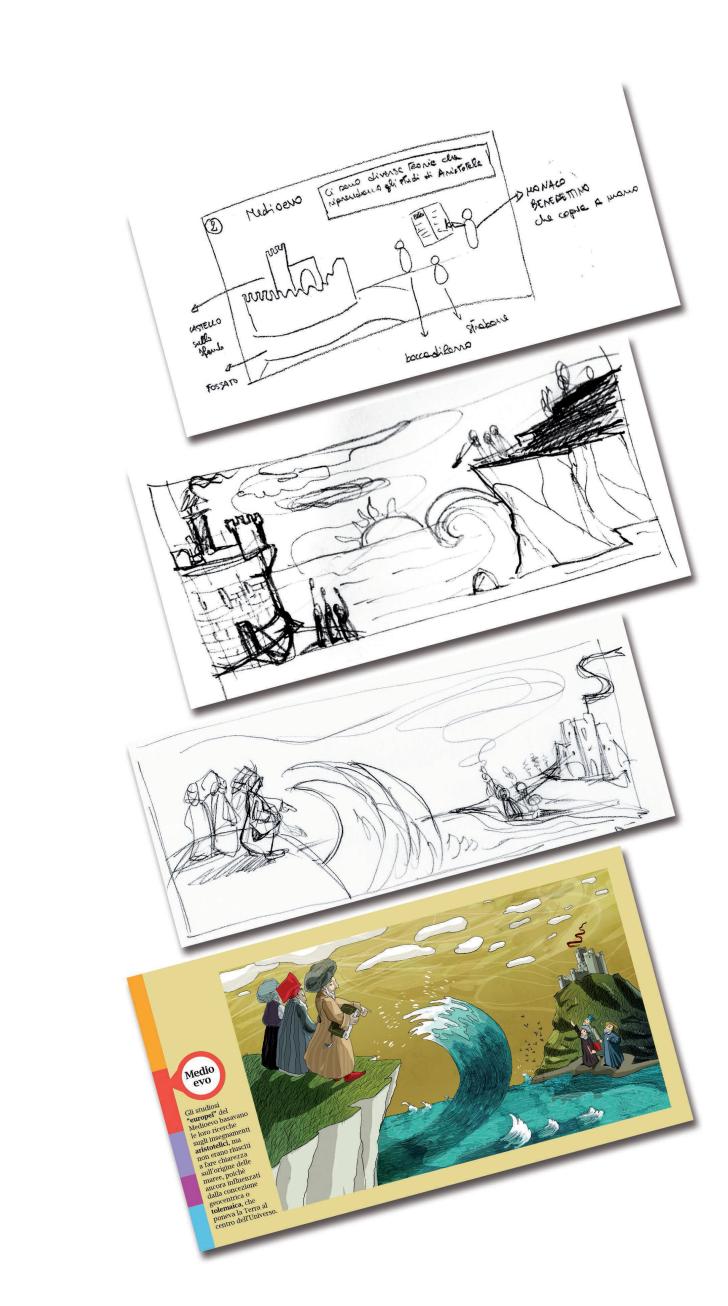












The game describes scientifically tides and historical theories on their origin from the greek period till the end 18th century (Taramaschi, 2013). Many scientists have tried to

The game is inspired by the famous and a small version as a gift for board game MONOPOLY. It will be participants and as a take-home realized in two formats, a big version message. The game has 36 boxes: 8 curiosity, 8 unexpected; in order to be played in groups at 1 free beach; 1 cave (ebb and flow); recreational-scientific laboratories, understand and interpret this phenomenon. Among the oldest

path of theories about tides.

The game is addressed to childr

from middle and high schools.

the game quotes *Aristotle* and

compelling and direct images.

The most relevant historic and

into fundamental concepts, while

maintaining a common conceptual

scientific topics have been simplified

Eratosthenes, but also other eminent

scientists of the seventeenth century scientific information on

1 "go to the cave"; 1 "GO" and **16 cities.** The curiosity and unexpected boxes correspond to "Curiosity" and "Unexpected" cards cities. with historical, cultural facts and

such as *Galileo Galilei*, up to the

physicists who formulated the

modern theory as *Newton* and

Laplace. Finally the game gives

and stylistic line, and choosing

motion. Nevertheless, it has been

two-dimensional drawings, although

some shading is used to introduce a in order to convey specific ideas

sense of background, perspective or in a more effective way.

but also to adults. In fact,

the "Curiosity Cards" have been

designed in order to be used as

scientific questions on tides. City boxes match 16 cards describing the typical tidal phenomena in these

cross-cutting issues related to

the tides as: renewable energy.

biodiversity, ecosystem conservation.

attempted to keep the drawings as

simple, plain and clear as possible

play-card in the game or just read

as a comic strip if taken out from

the game context.

Large tiles must be approached in a logical manner as in a Domino:

The game focuses on **energy**

sources that mankind used for

starting from an assigned initial "source of energy", by means of

transformation from one form of energy to another, players must

which we started using in recent

times (nuclear energy, solar energy

of "energy conservation".

get to put the last tile in the chain without making mistakes.

through the photovoltaic effect).

Energy Forms and Energy sources have been represented by images taken from every-day life. For **Energy Forms** (kinetic, thermal nuclear, electric, gravitational, electromagnetic, etc.) we selected

Istituto Nazionale d

Geofisica e Vulcanologia

Mouvement water, etc.) and those

representative, and through graphical *secondary sources*. Finally, we have elaboration we adapted them to our chosen to show the **Energy change** target. For **Energy sources**, *Sun* and through images of the tools used by the *Nuclear atom's images* represent man to convert energy from one to **primary sources**, while *Water*, *Wind*, another one: power plants, wind and

and *Fossil fuels* represent the

water turbines and the dams. The work have been done in collaboration with the graphical studio Carlo Gardini and the cultural association "Parma-Casa della Scienza" (Merlino, 2013).

New World. doi:10.1109/OCEANS Genova.2015.7271629

"PARMASCIENZALab 2012". Edicta Ed., Parma 2013. ISBN 978-88-8998-55-7 Technology Society Journal 49. doi:10.4031/MTSJ.49.4.3

This game is the result of continuous

collaboration between researchers

and graphic designers: working

together simplified scientific

of the International Astronomical Union 5, 629–641. doi:10.1017/S1743921311002948 Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning (OJ L 394, 30.12.2006, pp. 10-18) testi, le tecniche e gli strumenti. Degree thesis. University of Genoa.

improved our ideas for MAREOPOLI board game.

Wilgenbus, D., Léna, P., 2011, Early science education and astronomy, Proceedings







