# ARCHIMEDES

## EXHIBITION

### The Science of Archimedes

287 BC — TO THE FUTURE

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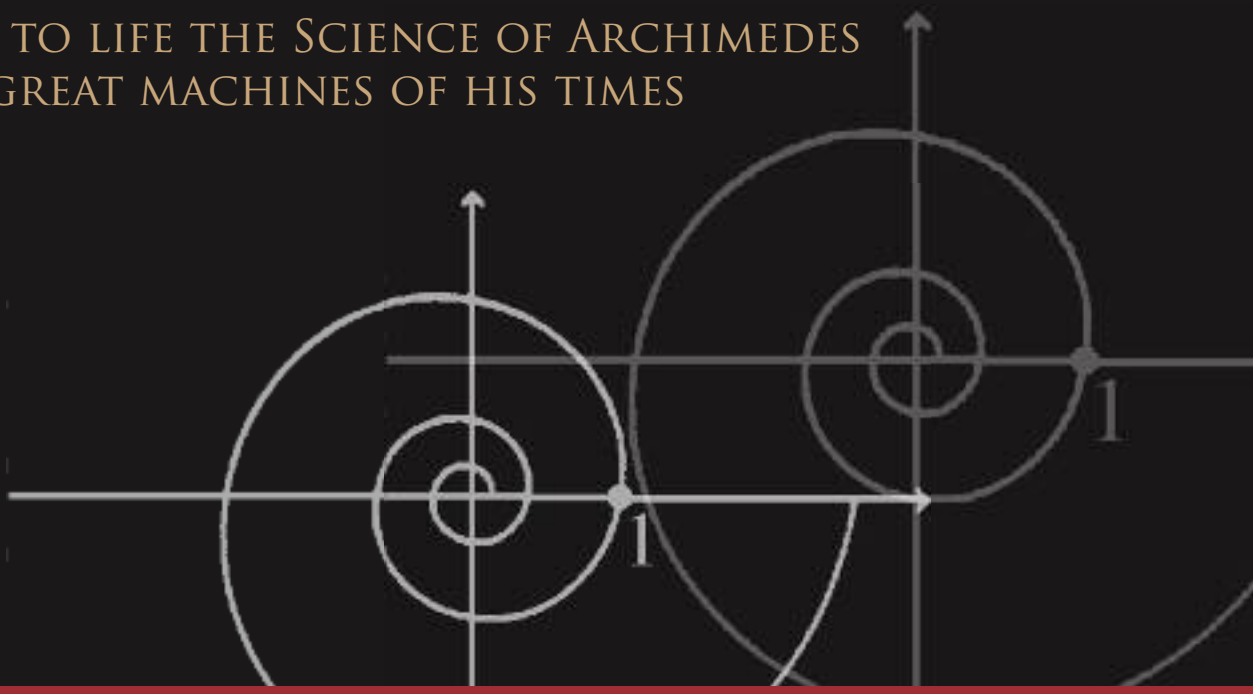
# ARCHIMEDES EXHIBITION

## The Science of Archimedes

bringing to life the Science of Archimedes
and the great machines of his times




## FEATURING THE EUREKA RENEWABLE ENERGY PROJECT

Proudly presented by
THE NICCOLAI GROUP



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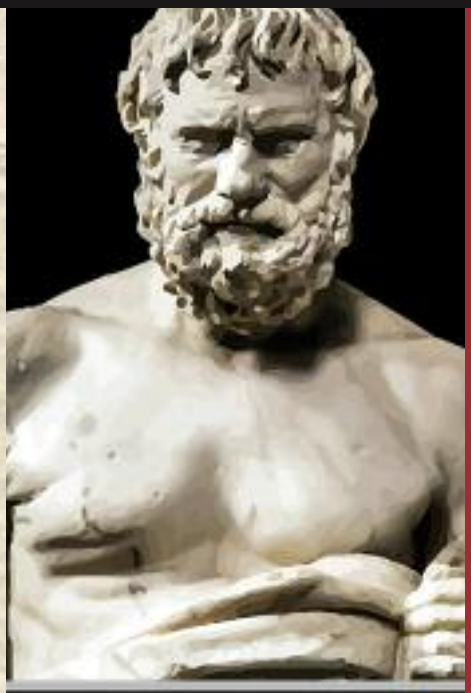
# ACKNOWLEDGMENTS

ARCHIMEDES RETURNS TO SIRACUSA




In 2011 “Arkimedeion”,the first ever exhibition totally devoted to the great scientific achievements of Archimedes was held in his birth place of Siracusa (Sicily, Italy).
We acknowledge The National Centre for Research, Italy (Istituto Nazionale di scienza) for the great success of “Arkimedeion”.

We are extremely grateful that, two years later, the City of Syracuse and particularly City councillor Assessore Francesco Italia and Maria Gabriella Capizzi, president of the Cultural Association - Leonardo da Vinci – Siracusa, begun a new initiative to hilight the direct connection between the great geniuses: Leonardo da Vinci and Archimedes. Thus providing the stimulus for a new interactive collection of Archimedes machines that validate key links between the “son of Siracusa” and other masters from the sciente of the Renaissance to modern days.

Thus in 2015 was born the ultimate interactive Archimedes Exhibition once again premiered in Siracusa, receiving great public support to incourage a new international edition based on the expertise of Artisan of Florence, already known for his achievements in this field.

ORGANISING COMMITTEE

SCIENTIFIC PARTNERS
**Maria Gabriella Capizzi**
**Gabriele Niccolai**
**Luigi Rizzo**

EDUCATION
**Andrea De Carria**
**Marty Ellen**

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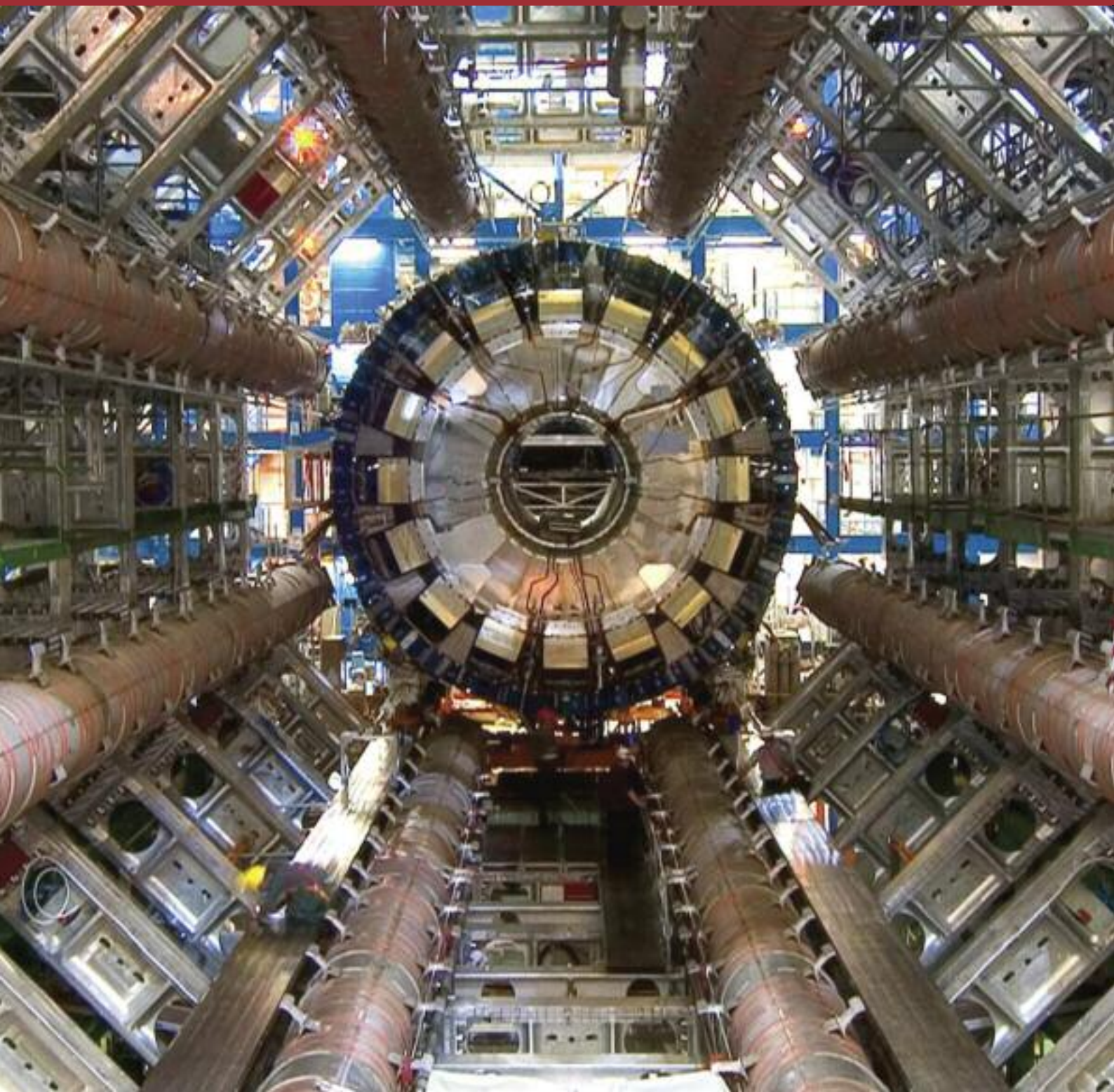
**Andrew Davis**
**Alessandro Innocenti**

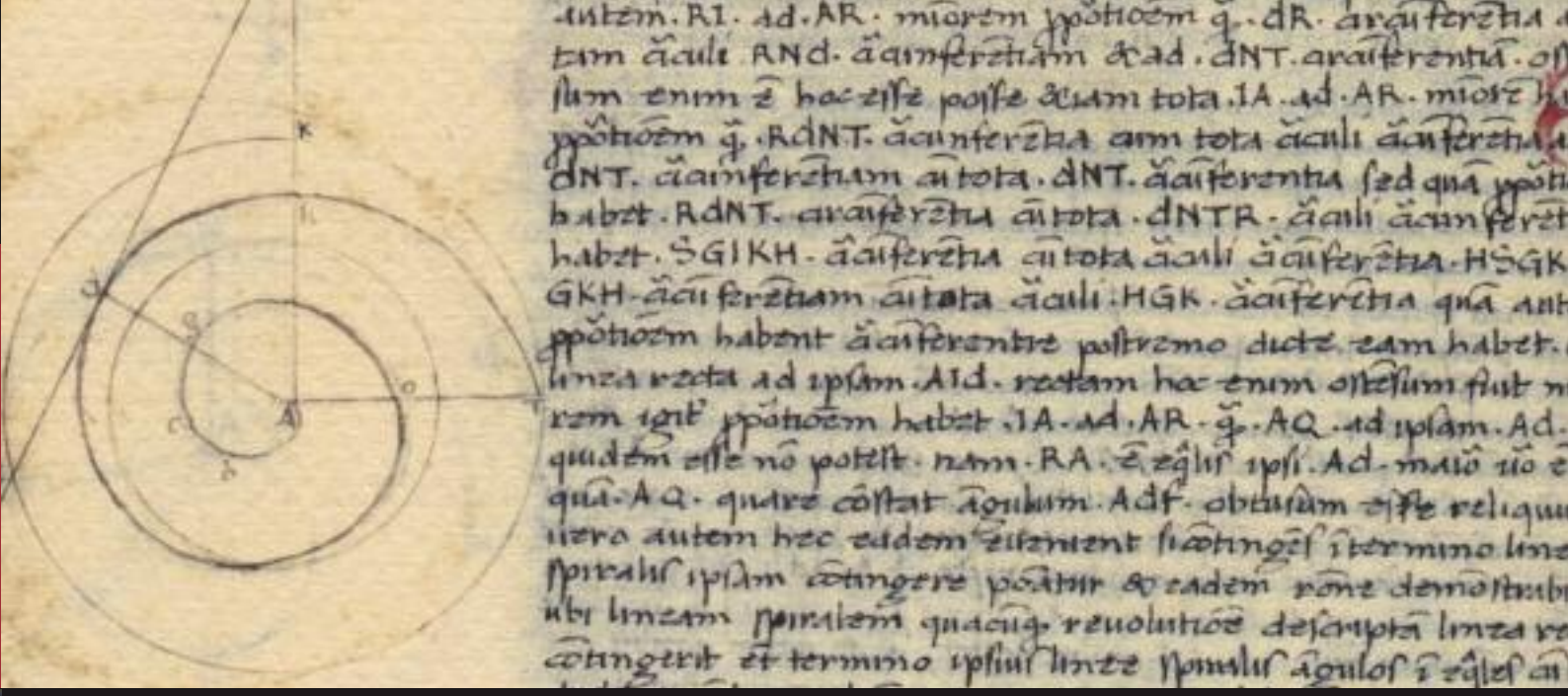
# Archimedes Palimpsest

## How do you read a two-thousand-year-old manuscript that has been erased, cut up, written on and painted over? With a powerful particle accelerator, of course!

Since 1999 Noel has spearheaded the conservation of a manuscript known as the Archimedes Palimpsest. The palimpsest is a unique Byzantine prayer book made up of parchments which contain hidden writings from three original previously-unknown texts: treatises written by Archimedes; works by the 4th-century B.C. Attic Orator Hyperides; and 3rd-century commentary on Aristotle's *Categories*, by an unknown author. Using a powerful particle accelerator Noel and his team were able to uncover the hidden texts and publish all their images and findings on the Internet, available to anyone for free under a Creative Commons license.

For this exhibition we consulted copies of Ancient Greek texts: Archimedes' Palimpsest and Taccola's Codex; Roman Texts: Vitruvious' books of Architecture; Renaissance Texts: Da Vinci's Codices, and Treaties by Galileo Galilei





# CONTENTS


ABOUT THE EXHIBITION
EXHIBITION CONCEPT AND RESEARCH

**HISTORICAL PERSPECTIVE**
THE ERA OF ARCHIMEDES
LIFE OF ARCHIMEDES AND HIS LEGACY
THE HISTORY OF SOLAR ENERGY BY WAYS OF REFLECTIVE MIRRORS

**THE SCIENCE OF ARCHIMEDES**
Theme 1 - MACHINES of the ANCIENT WORLD (18)
Theme 2 - ENERGY MACHINES (12)
Theme 3 - THE POWER OF SHAPES (8)
Theme 4 - ARCHIMEDES LEGACY (18)
LEONARDO and GALILEO

THE EUREKA WORKBENCH (6)

**EDUCATION PROGRAM**
- Fun activities for **the Eureka Workbench**
- **The Eureka Renewable Energy Project** the Farm
- **Ideas for the future**: Biomass and Straw Bales
- **Primary Physics**: Energy Ideals Behind Archimedes' Science


# About the Exhibition

If you visit Museums of Science around the world you would most probably find a few inventions attributed to Archimedes, the Classical Genius of Hellenistic times - alerting us that, 2,200 years after his death, Archimedes' science is still alive. But despite all his acclaim we wondered why there were-always "just a few" - So scant a sample for such a famous man!?... Armed with our successes of 4 ancient technology exhibitions, this being our 5th, we begun probing for answers. So in 2013 begun our journey for the ultimate ARCHIMEDES TECHNOLOGY EXHIBITION bringing to life the Science of Archimedes and the great machines of his times.

We soon realized that his science had been lost, only rediscovered and partially reconstructed 1,500 years after his death. What an intriguing detective story! What a great subject for an exhibition full of surprises and discoveries. In unraveling the story we were "lucky" to receive unwitting assistance from the Renaissance Masters Da Vinci and Galileo; we are also grateful to William Noel and his team at The Walters Art Museum in Baltimore, Maryland, for restoring the 13th century manuscript - the only surviving ancient copy of the lost codex of Archimedes - the so called Archimedes Palimpsest, and for making it available to the public through the internet. A book we had to have (an antiquary copy is on display).

In our reconstruction we paid particular attention to those machines and concepts that have made their way unbeknown to many into modern science. What's more, we were as surprised -as you will be - to discover that some of his "inventions" can be used to solve today's energy problems!! This we felt was a great opportunity to flush out an attractive and comprehensive EDUCATION PROGRAM, and a fun challenge: The Eureka Renewable Energy Project!

Finally,

To begin to appreciate our quest we need to immerse ourselves in the period .. and the thinking of the era of Archimedes.

*In the Hellenistic Period Alexandria – a new city founded by Alexander the Great himself in 331BC, became the de facto centre of Hellenistic Science & Technology – which was what had given the Greeks the military edge over their enemies; besides Alexandria other important centres of science were Syracuse (Sicily, Italy) and Byzantium (Turkey). Its cities were spread throughout the Mediterranean coast and were culturally connected. People traveled mainly by boat or communicated by letters (mainly scrolls). The "thinkers" of the time were divided into two main camps the Philosophers like Aristotle, as Plato before him, were preoccupied with the broad philosophical questions of life and the rules of law -their arguments were purely abstract and loosely based on logic and supported by superficial observation of nature. In the other camp were the Mathematikos, those who believed in the strict discipline of Euclid's Geometry. In geometry they saw the rules of nature and with geometry they discovered "mechanical advantage" to invent new machines for civil and mechanical engineering and machines-of-war, like torsion Ballistae. They perfected projectile motion with the study of conic-sections; they uncovered the rules of light-rays to build lighthouses; they harnessed the sun's energy using mirrors; they studied the power of the flows of water & air and the expansion of gasses and tested their hypotheses. They discovered the static power of liquid (buoyancy) to balance large objects in order to build huge ships and to discover properties of solids like density and the centre-of-mass. With geometry they even measured the Sun's distance, the spherical size of Earth and their heliocentric relative motion. Euclid, Ctesibius, Erathostenes, Philo of Byzantium, Aristarcus , Heron of Alexandria… were all great minds - But the star, the real genius of them all, without any doubt, from all accounts, was Archimedes (287 ~221 BC). He was the one that mastered curved geometry - hence his symbol of the spiral - and introduced the "method" to science. He was on the cusp of a truly remarkable scientific revolution. Compare all this with Aristotle ideas, who thought of a universe made of perfect spheres and a world explained by the theory of the 4 elements: earth, fire, air, water.*

Unfortunately a chain of catastrophic events tipped the scale in favor of the Philosophers! ((see historical note pp 6,9). So for the next 1,500 years society delved in religion and the mumbo-jumbo of pseudo-science that followed the end of the Roman Empire. Just imagine if the
"Mathematikos" had won!!

**Luigi Rizzo**
Msc.Dip.Ed.Director and CEO
Artisans of Florence - International Pty LtdOct. 2015

# Concept, Research

And so we come to our 5th exhibition! Back in 1995 we had no idea that by constructing our foundation Leonardo Da Vinci Exhibitions of his famous machines and fantastic Robots we were not only probing into his futuristic mind, but were capturing glimpses of "lost" ancient technologies (we now hold a US patent for the Da Vinci robot: Patent no. US 8,858,293 B2). We were the first to reconstruct and present in a complete exhibition, the awesome machines of the Roman Empire, we were able to explore the technology and science behind the art of Michelangelo's Renaissance World. Finally we came to re-evaluate the ancient wisdom of Archimedes' Era – the third century BC. To arrive at the final prototypes we consulted copies of Ancient Greek texts: Archimedes' Palimpsest and Taccola's Codex; Roman Texts: Vitruvious' books of Architecture; Renaissance Texts: Da Vinci's Codices, and Treaties by Galileo Galilei. In this we were inspired by scholars and friends who were lucky enough to live in Siracusa (Sicily) - the birth of Archimedes himself.

CONCEPTS OF INTERACTIVITY and DESIGN OF MODELS:
Our goal was to reconstruct Archimedes' inventions and the technologies to demonstrate their function in a way for all to understand and enjoy. For this we built sturdy models made with materials of his time: timber, rope, glass, worked iron etc... by applying our tried-and-tested interactive elements and methodology.
Each model is complete with descriptive label explaining the fundamental principles of the science behind the technology with examples of the science of our time. The exhibition incorporates video animation and 3D visual displays. Further more, THE EUREKA WORKBENCH is a new addition providing a new level of interactivity - it has proven so popular that we will soon produce a version for sale.

ARCHIMEDES EXHIBITION
Bringing to life the Science of Archimedes and the great machines of his time.
This exhibition consists of around 60 historical, interactive models.
In Theme 1 - MACHINES OF THE ANCIENT WORLD we feature ancient machines associated with Archimedes' history or legends; like Balistae, the Iron Hands - huge levers with secrets gears to kill the Romans, to lift huge ships, or for children to swing on.
In Theme 2 – ENERGY MACHINES we see how energy was captured and used from the flow of wind, water and solar rays. Optical illusions, sound propagation and tricks of dynamics make this section unexpected and most entertaining.
In Theme 3 - The POWER of SHAPES we have fun with Geometry; we play with puzzles and blocks like the children of the 1st century BC – that are not dissimilar to modern day Lego blocks and Rubik's Cubes.
In this last theme: Theme 4 - ARCHIMEDES LEGACY we were lucky that a great body of work was already available from our studies on Leonardo da Vinci and Galileo, here we see how relevant Archimedes is for the development of modern science. It's eye-opening to see how the same machines have evolved over the centuries.

THE EUREKA RENEWABLE ENERGY PROJECT – As a grand-finale we propose a modern day application forthe technical minded; a fully automated GREEN ENERGY FARM.Using Archimedes' technology and renewable sauces of energy with a biomass-fuel back-up. Parabolic mirror combined with the Stirling Engine are the most efficient solar energy harvester yet invented, whose scientific principles goes back to Archimedes times.
When in March 2015, we presented our premiere exhibition of over 55 exhibits in the city of Siracusa, Archimedes birth place (Sicily, Italy), even the local authorities and academics were surprised to learn how much Archimedes had done and howrelevant it is still today!

**Gabriele Niccolai**
Director of Projects
Head of Research & Development
THE NICCOLAI GROUP
Artisans of Florence Pty Ltd

# HISTORICAL PERSPECTIVE

## SECTION 1

Homo Sapience emerged from the passage out-of-Africa about 70,000 years ago, it took around 50,000 years for him/her to spread over all the habitable corners of the world, progressing from the early Paleolithic to a Neolithic (new stone age) lifestyle – the village life of the hunters' gatherers . It was around 10,000 years ago, in an area not far from the out-of-Africa passage, in and around the Fertile Crescent (modern Turkey, Iraq, Iran, Syria, Egypt), that Early human civilizations begun with the invention of Cities, farming, writing, numeracy, technologies, kingdoms and even Empires. By around 4,000 years ago, at the edge of the Mediterranean Sea, the cities of the Peloponnesus (modern Greece) begun a more sophisticated culture based on discussion and logic arguments, we call the Hellenic period. It was an exciting era for exploring new ideas and theories on the laws of society and philosophy of life, unafraid of cultural clashes (sometimes physical) the cities thrived but kept their existence jealously apart. It was Alexander the Great, young new King of Macedonia, then a small kingdom at the margin of Greek culture, that brought together - by force, all the Hellenic cities. Following his father example and tutored by Aristotle, the great Greek philosopher, he soon waged war to the Kingdoms and Empires of the East - thus established a huge empire of his own. At his sudden death, at the young age of 33, the Hellenic Empire crumbled into many smaller Kingdoms. But Alexander greatest legacy was to have brought together the practical knowhow of the East with the new Hellenic method of logic arguments and the two merged into the first truly scientific period. Thus in 323 BC begun The Hellenistic Period.. It's centre "The Big Apple", was the super-modern city of Alexandria (Now Egypt) , the repository of all the scientific knowledge of the time. - Officially The Hellenistic Period ended, crushed, by the emerging Roman Empire in the 1st century AD. It was a short period of about 350 years that saw the invention of Science and all the important disciplines we study from our first day of school to University.

What follows was a period where little new was invented. There was enough technology to keep the practical Romans in power for a 1000 years. After the chaos that followed the end of the empire, humanity, having lost self-confidence and the scientific-way, remained preoccupied with existential problems, and religion... until the time of Da Vinci.

# The Era of Archimedes
# THE HELLENISTIC WORLD


To the East, the GREEKEMPIRE conquered by Alexander, is a fusion of cultures from the Near East, Middle East and Southwest Asia. Advanced societies like Persia, Phoenicia, Samaria, Babylonia, Egypt, Northern India… had developed ways to build pyramids, great temples, agricultural machinery, weaponry… and large scale economics systems. Archimedes lived in the Hellenistic Age, a period in history defined as the time between the death of Alexander the Great and the rise of Roman domination. During this time, Greek culture was dominant throughout the Mediterranean, thus the name Hellenistic, which is derived from the Greek "Hellas" meaning, Greece. Hellenistic Culture was a fusion of culturesv vof the Eastern Kingdoms conquered by Alexander. This brought, under one community, all the practical mechanical inventions of the East together with the Ancient Greek World… a society influenced by great philosophical minds, and had developed a powerful new way of investigating nature in a logical-consequential manner… that we now call mathematics and science.

The "thinkers" of the time were divided into two main camps the Philosophers like Aristotle, as Plato before him, were preoccupied with the broad philosophical questions of life and the rules of law -their arguments were purely abstract and loosely based on logic and supported by superficial observation of nature. In the other camp were the Mathematikos, those that believed in the strict discipline of Euclid's Geometry. In geometry they saw the rules of nature and with geometry they discovered "mechanical advantage" to invent new machines for engineering and machines of war, like torsion Ballistae, they perfected projectile motion with the study of conic-sections, they uncovered the rules of light-rays to build lighthouses, they harnessed the sun's energy using mirrors, they studied the power of the flows of water and gasses and tested their hypotheses. They discovered the static power of liquid to balance large objects in order to build huge ships and to discover properties of solids like density and the centre-of-mass.. With geometry they even measured the Sun's distance, the spherical size of Earth and their heliocentric relative motion.

Euclid, Ctesibius, Erathostenes, Philo of Byzantium, Aristarcus , Heron of Alexandria… were all great minds - But the star, the real genius of them all, without any doubt, from all accounts, was Archimedes (287 ~221 BC). Who had mastered curved geometry – hence his symbol of the spiral - and introduced the "method" to science. He was on the cusp of a truly remarkable scientific revolution.. But μ as we know... came the Romans.

To the West, Greek culture was dominant throughout the Mediterranean, due to its' many colonies, ruled independently but collectively known as "Magna Grecia". In this world philosophers and scientists were highly regarded. Science and technology was extensively used for construction, entertainment (magical illusions) but above all, for military purposes. Important centres for learning and discovery were: Alexandria (now Egypt), Syracuse (now Italy) and Byzantium (now Istanbu How and way such a successful "school" lead by Archimedes was so suddenly lost, is a matter of conjecture. Certainly his "accidental" death by the hands of a Roman soldier didn't help. Nor the subsequent destructions and upheaval caused by the brutal battle for survival between Rome and Carthage and their allied cities of Magna Grecia. Historians* report that with the Carthagenian final defeat in 146 BC this shift of power sparked a systematic repression against the 'Greeks", not so much by the Romans who valued the technology, but by the other cities allied to Rome wanting to ingratiate themselves with the new power. The Romans salvaged what they found practical and useful… With the scalars dispersed or dead the Scientific "method" pioneered by Archimedes was lost. Only the vague notion that "he knew more than the rest" lingered on in the form of legends.. His contribution was so great that in the period that followed he was associated with all major scientific knowledge even though the meaning of what he did was lost. How it was rediscovers in the Renaissance is another dramatic and fascinating Detective Story...

# Life & Achievements
# ARCHIMEDES 287 – 212 BC

Full Name: Archimedes of Syracuse Nationality: Citizen of Syracuse (Magna Grecia) Ethnicity/culture Hellenistic (Greek) Born: 287 BC, Syracuse, Died: 212 BC, Syracuse, (Killed by Roman Soldier who did not know who he was) Mostly known as a mathematician, Archimedes was also a physicist, engineer, inventor and scientist. Regarded as one of the leading scientists of classical antiquity and one of the three greatest mathematicians of all time.

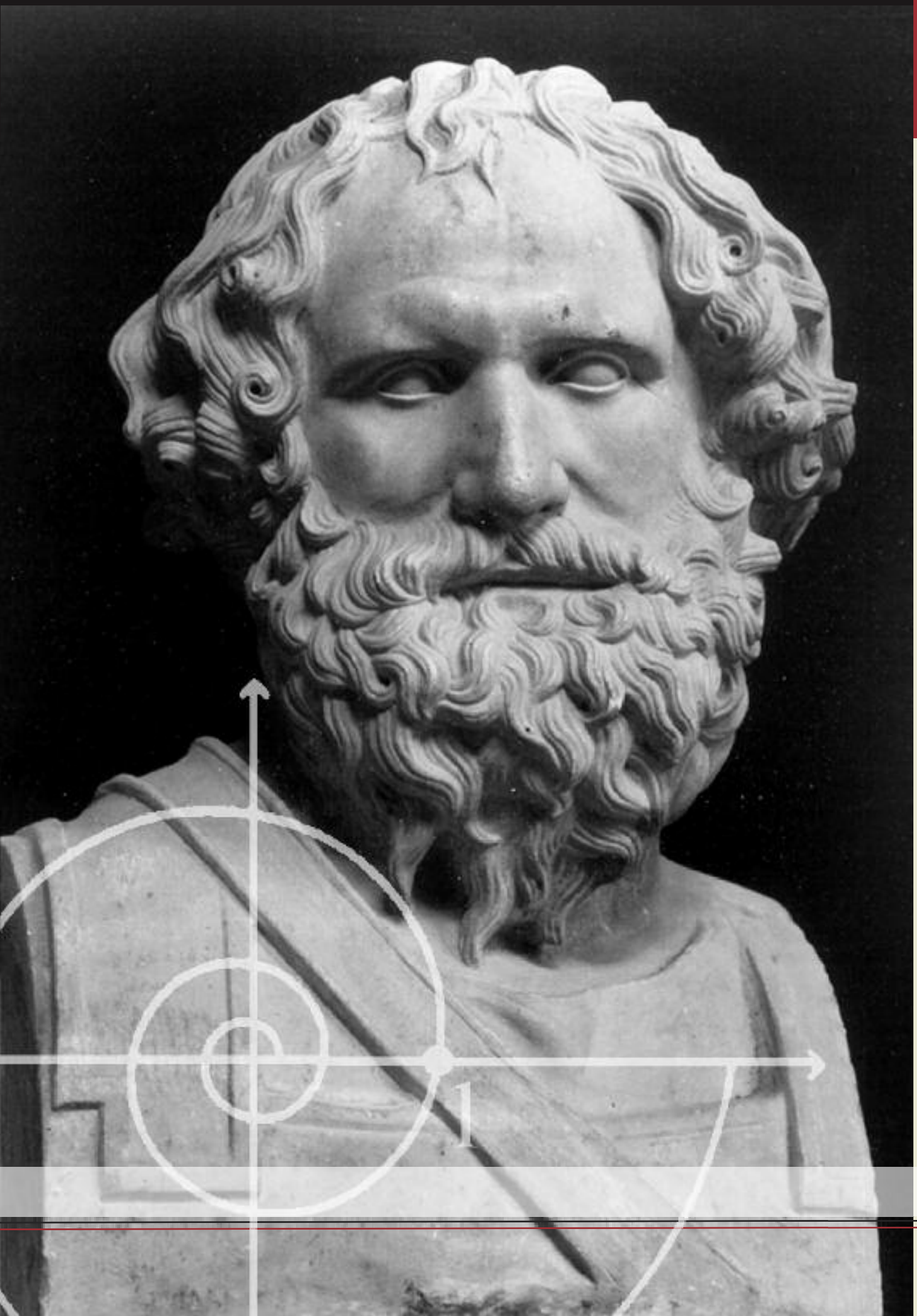
## HIS LIFE

Archimedes was born in Syracuse when it was a city of Ancient Greek culture. At a young age Archimedes developed a natural curiosity and penchant for problem solving. He travelled to Alexandria in Egypt, being the centre for great learning and scholarship, to further his studies. Amongst the influences in Alexandria were the geometrical treatises of Euclid, a renowned mathematician. After his studies in Alexandria he returned to Syracuse to pursue a life of ideas and inventions. He endeared himself to King Hiero II, discovering solutions to problems that puzzled the King.
Caught up in the war of Carthage against Rome, the King set Archimedes to work to defend the city walls and the fortress, from sea attack. Archimedes constructed many war machines including his 'burning mirrors' and the 'iron hand' to set ships alight and to topple them into the sea.

## FACTS AND MYTHS

For two years the ingenious inventions of Archimedes protected Syracuse from Roman invasion. He was killed by a Roman soldier in 212 BC, being unaware that the Romans had stormed the city he refused to be taken away to meet with General Marcellus. The soldier struck him. Distressed by his death and out of respect, Roman General Marcellus ordered Archimedes to be buried with honours.

Through the medium of geometry and the principles of physics he invented and explained the theoretical framework for many devices that are still in use today, such as: the pulley, the lever, the screw, the centre of mass, buoyancy..., His discovery of buoyancy - the static power of liquid that balances large objects afloat, enabled the building of huge ships. He had mastered curved geometry – discovered the formulas for sphere, cylinder, cones, spirals and parabolas... hence the symbol of the spiral and the invention of the screw is associated with him , he had even begun development of calculus and introduced the "method" to science. He was on the cusp of a truly remarkable scientific revolution.



# The History of Burning Mirrors
# FROM LEGEND TO SCIENCE

## The use of Solar Energy by ways of reflective Mirrors go Back to the Remotest of Times.

As early as 800 BC Olympic Games had begun by lighting the sacred flame with solar rays reflected from a bronze concave mirror. Plutarch (45-120 AD): "Apollo God of the Sun, and of light, send your rays to light up the sacred torch of Athena…" "Burning mirrors" for military use are attributed by legend to Archimedes the genius of Syracuse; however nothing is known about these mirrors directly from him or any historian of the time. The historical context of the famous "Death Ray Mirrors" occurred on the occasion of the 2nd Punic War between Syracuse, allied with the Carthaginians against their arch enemy – Rome. The Roman army, led by Roman General Marcellus, encircled the city by land and by sea with a fleet of 60 quinqueremes. Archimedes organized the sea defence employing some amazing weapons: catapults, levers, Manus Ferrea (the hand of iron), and the so-called "burning mirrors". So effective was the defence that Syracuse was taken by the Romans by land, and only when a traitor let the Romans in. With the end of the Roman Empire, the Arab world became the most technologically advanced society and Arab scholars contributed to the development in this field. In a study on mechanical paradoxes "The Burning Mirrors of Archimedes", it was concluded that to be able to position a mirror firstly Archimedes had to prove that the angle of incidence was equal to the angle of reflection, (which in fact he knew) and to actually burn he had to use a multiple number of mirrors.

In Western Europe Roger Bacon (1214-1294), an English friar, philosopher and scientist, was able to demonstrate to Pope Clement IV how these mirrors can work. Leonardo da Vinci even designed machines for making curved mirrors - Da Vinci Codex Atlanticus ca. 1500 AD. From this period on, the subject was treated scientifically and mathematically, but it was not until the 1700's that we have actual, documented experiments.

By the dawn of the industrial revolution successful patents wes  achieved in France, England and the US. Today there are new “green Energy firms with industrial applications waiting to be exploited commercially.
South African site manager Jean-Pierre Fourie, whose team have been testing the system of Parabplic mirrors and stirling engine – the most efficient in the world -  for the past
four years. The massive 100 square metre dishes slowly rotate, following the sun. Light clicks and taps fill the still desert air as they constantly adjust to capture the maximum solar energy.
This is one of the few operational small-scale concentrated solar energy systems of its kind in the world. 34% of the sun’s energy hitting the mirrors is converted directly to grid-available electric power, compared to roughly half that for standard solar panels. Traditional photovoltaic panels are able to turn as much as 20% of the solar energy that strikes them into an average output for most systems is about 15% directly usable by the grid.

# THE SCIENCE OF ARCHIMEDES

## THEME 1

## MACHINES OF THE ANCIENT WORLD

Archimedes Lever / The Balance (Egyptian) / The Shaduf (Egyptian) / Inclined Planes / Machines Hellenistic Pulley / The Archimedes Screw / The Press Screw / Gears Of Archimedes With The Syracuse Ship / Mechanical Paradox (Anti-Gravity Cones) / Archimedes Planetarium / The Hand Of Iron / Torsion Ballista / Archimedes Meridian / The Water Clock / Vitruvian Crane / The Faros / Herodotus Machine (Egyptian)

*Artisans of Florence, presents an exhibition dedicated to Archimedes in Syracuse. For the first time the legacy of the great scientist of Syracuse finds direct parallels with the genius of the Renaissance Leonardo da Vinci, and Galileo Galilei, bringing to the fore his legacy to modern science and current energy considerations.*

THE SCIENCE OF ARCHIMEDES

# Machines of the Ancient World

*Archimedes Lever*

*The Balance*

*The Shaduf*

*Inclined Planes*

*Machines Hellenistic Pulley*

*The Launch of the Syracusia*

*Mechanical Paradox (Anti-Gravity Cones)*

*Archimedes Meridian*

*Herodotus Machine*

# THE SCIENCE OF ARCHIMEDES

## THEME 2

## ENERGY MACHINES

Crown of King Gerone / Archimedes Thrust Buoyancy / Heron's Turbine / Gushing Fountain / The Rotating Alter / The Stirling Piston Principle / Diffusion of Sound in a Theatre / Parabolic Mirrors for Sound / Parabolic Mirrors / For Sun Rays / The Parabola's Mirage (Holograms) / The Stirling Engine / Parabolic Mirrors

THE SCIENCE OF ARCHIMEDES

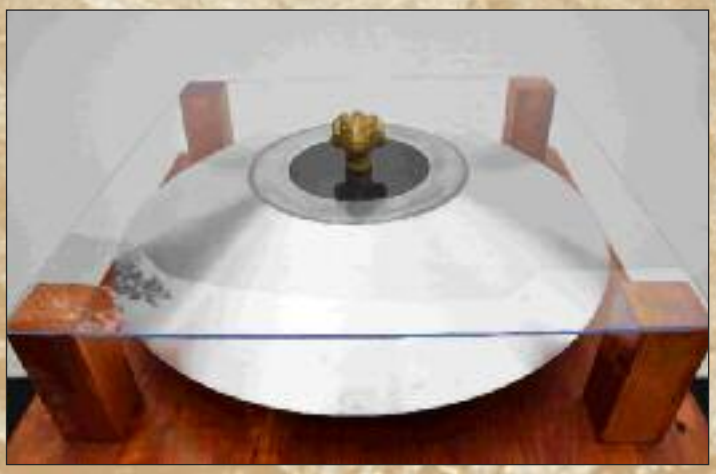
# Energy Machines

*Crown of King Gerone*

*Parabolic Mirrors for Sun Rays*

*Heron Turbine*

*Parabolic Mirrors for Sound*



*The Parabola's Mirage (Holograms)*

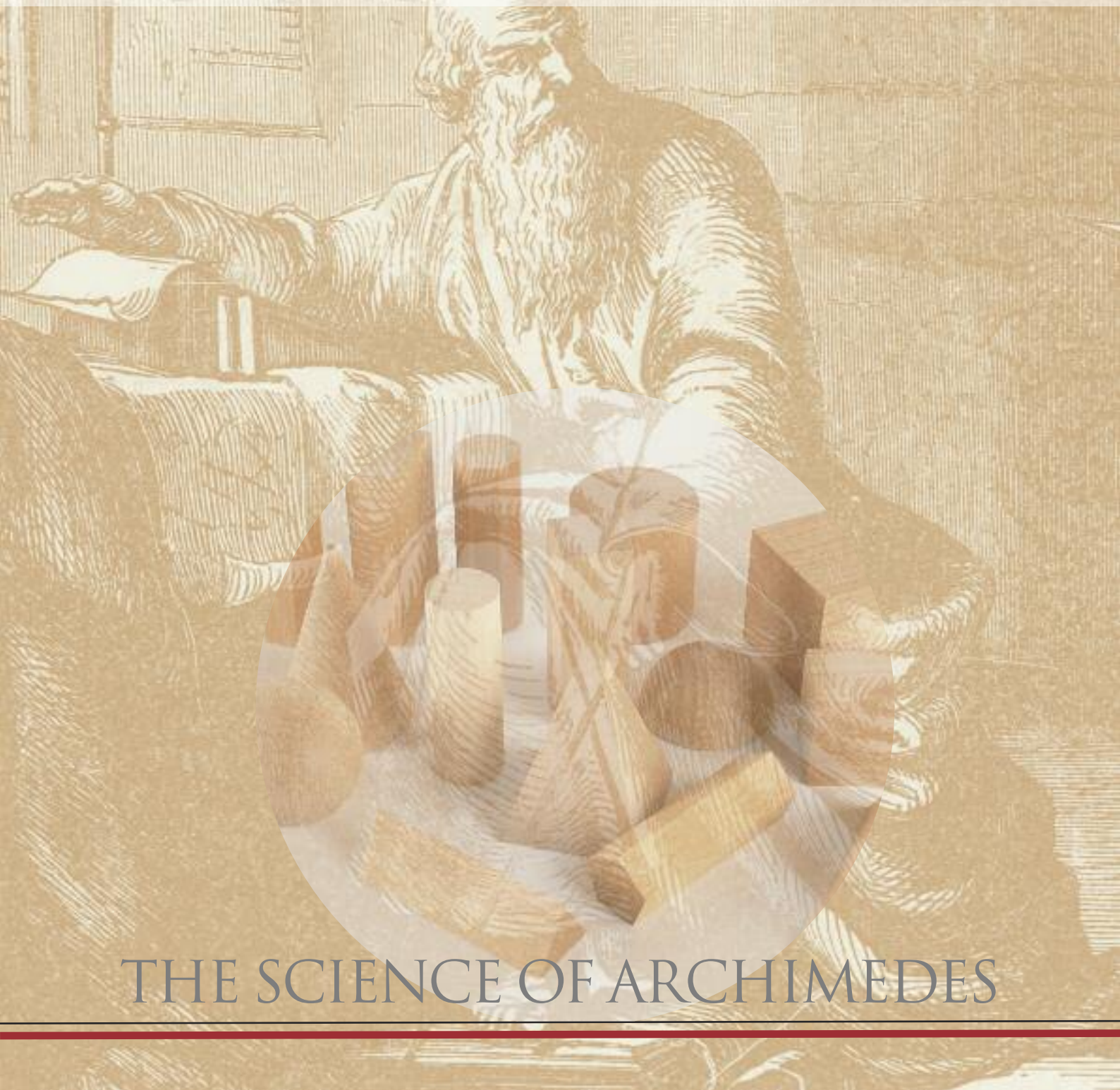
*Parabolic Mirrov With Stirling Engine*

# THE SCIENCE OF ARCHIMEDES

## THEME 3

## The Power of Shapes

Solids: Sphere, Cylinder, Pyramid, Cone / Puzzle Of Archimedes “Stomachions” / Archimedes Spiral / Spiral Staircase / Spiral Machine / Archimedes / Truncated / Polyhedrons



THE SCIENCE OF ARCHIMEDES

# The Power of Shapes

*Conic section*

*Polyhedron*

*Spiral*

*Archimedes Spiral*

*Puzzle of Archimedes "Stomachions"*

*Archimedes screw*

*Polyhedrons*

*Play with Polyhedron*

# THEME 4
# ARCHIMEDES LEGACY

## LEONARDO DA VINCI 1452 ~ 1519

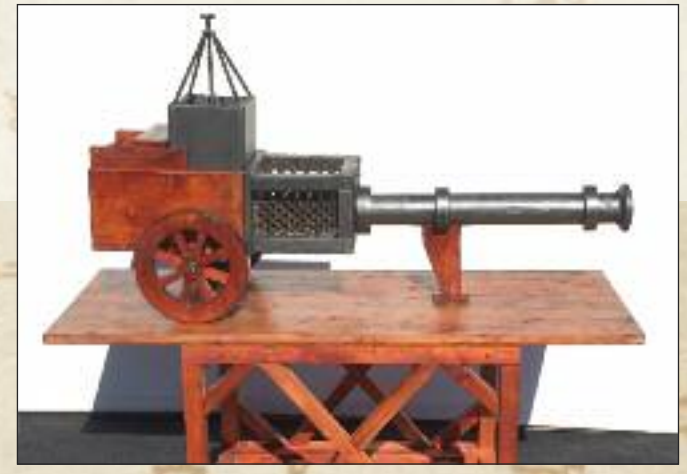
**Leonardo da Vinci**, (born April 15, 1452, Anchiano, near Vinci, Republic of Florence [now in Italy]- died May 2, 1519, Cloux [now Clos-Lucé], France), Italian painter, creative designer, sculptor, architect, and engineer whose genius, perhaps more than anyone, epitomized the Renaissance ideal. His Last Supper (~1498) and Mona Lisa (~. 1506) are the two most influential paintings of the Renaissance. His notebooks reveal a spirit of scientific inquiry and a mechanical inventiveness that were centuries ahead of their time. He was one of the first to perceive the importance of the Archimedean way: amongst his machines we find the Archimedes Screw, the Flying Screw, the Concave Mirror Machine and the Architronico - Archimedes' steam cannon, and his studies of light-rays were not just for painting. He is one of the first to perceive the importance of Geometry by illustrating Paccioli's Renaissance book on polyhedrons.

The Vertical Flying Machine / The Da Vinci Gym / The Air Screw / The Archimedean Screw / The Herodotus Machine / The Spot Light / The Concave Mirror Machine / The Odometer / The Steam Cannon

*The Spot Light*

*The Air Screw*

*The Odometer*



*The Steam Cannon*

*Erotodo*

*Moto Perpetuo*

# THEME 4
# ARCHIMEDES LEGACY

## GALILEO GALILEI 1564 ~ 1642

**Galileo** (born February 15, 1564, Pisa [Italy]–died January 8, 1642, Arcetri, near Florence), Italian natural philosopher, astronomer, and mathematician who made fundamental contributions to the sciences of motion, astronomy, and strength of materials and to the development of the scientific method. His formulation of (circular) inertia, the law of falling bodies, and parabolic trajectories marked the beginning of a fundamental change in the study of motion. His insistence that the book of nature was written in the language of mathematics changed natural philosophy from a verbal, qualitative account (the Aristotelian way) to a mathematical one – hence returning to the Archimedean "method". in which experimentation combined with mathematics became a recognized method for discovering the facts of nature. Finally, his discoveries with the telescope revolutionized astronomy and paved the way for the acceptance of the Copernican heliocentric system (sun in the centre) that was first proposed by Archimedes friend and confidants Aristarcus. These revolutionary ideas eventually resulted in an Inquisition process against him. Pleasingly, in more recent times the Church has apologized.

Galileo Accelerating Inclined Planes / Galileo Lever: Type 1, Type 2, Type 3 / Ballistics Measurements Tool / The Interactive Telescope

*Leva 1*

*Leva 2*

*Piano Inclinato*

*Telescopio*

EDUCATION PROGRAM THE EUREKA PROJECT

# FUN ACTIVITIES FOR THE EUREKA WORKBENCH

**ARCHIMEDES WORKBENCH**

**CHILDREN PLAYING WITH THE WORKBENCH**

# IDEAS FOR THE FUTURE

## THE EUREKA RENEWABLE ENERGY PROJECT

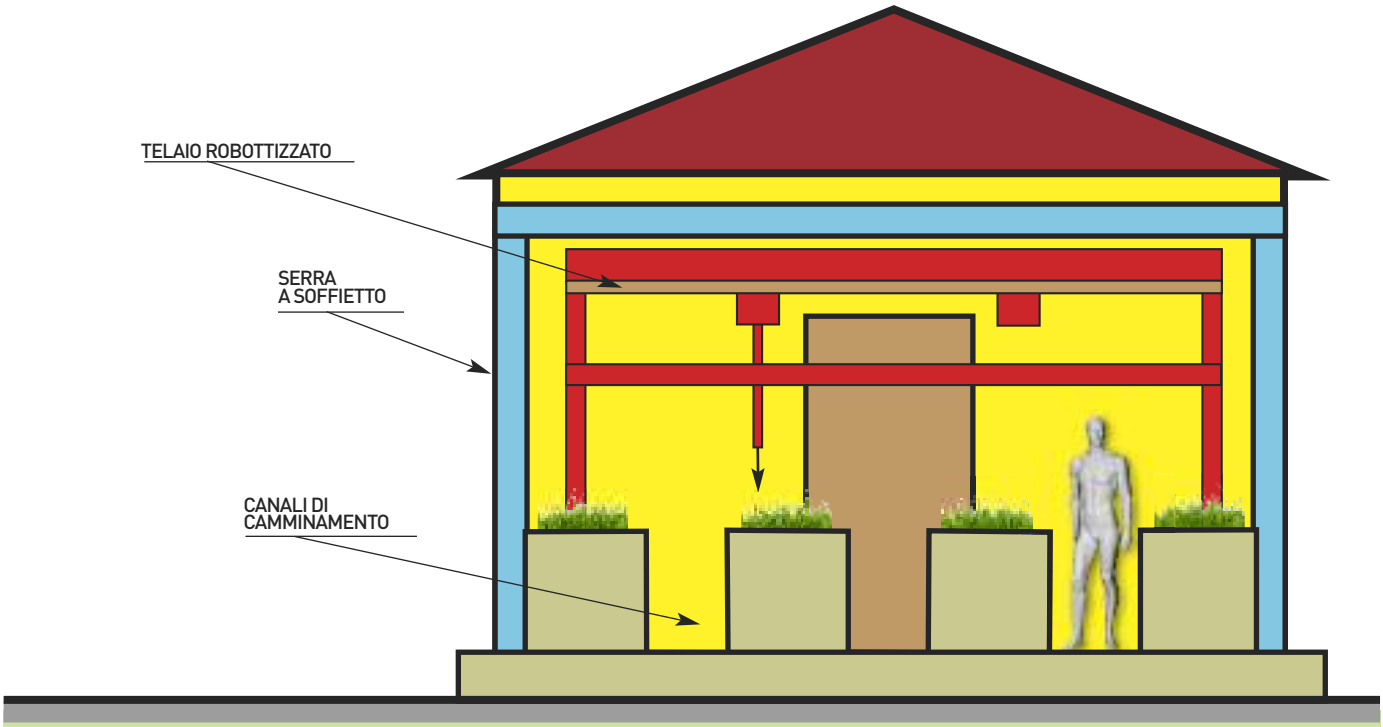
# GREEN HOUSE FARM

Utilising ARCHIMEDES' SCIENCE to create a modern **Renewable, Sustainable and Clean-Energy Environment** for everyday use

**Application:** Production Of Vegetables - Optimizing Spaces And Creating A Functional And Desirable Environment. This Model Of Greenhouse Allows An Internal Irrigation Program With Self Regulated Heating, Tilling And Watering. The Soil Channels Are 80 Cm High To Allow Easy Care Of The Vegetables, Providing A Life- Long Food Supply To The Lucky Dwellers…

**Apparatus:** Green House Constructed With Straw Bales (See Below), Heated With A Biomass Heater (See Below), Cooled With Solar -Sterling Energy System (See Above), Hot/Cold Water & Power Supplied By Solar-Sterling Engine Refrigerator System. Tilling And Watering By Mechanical System*.

**An Automated Computerized System Allows Integrated Use Of All The Above Alternative Renewable Energy Use And Most Of The Required Farming Functions Providing A Comfortable Life And A Yearly Supply Of Fresh Vegetable.*

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## IDEA FOR THE FUTURE

By applying the lessons learnt from "antiquity", combining them with modern, practical but basic modifications, it is possible to create sustainable energy solutions that are not-dependent on large scale industrial infrastructures.

By taking active part in implementing this simple, clean-energy regime, in our "home" we contribute directly - each of us - improving our world.

By spreading this knowledge we will be actively promoting and spreading the word that a sustainable energy future for our planet is – not only achievable- but within our capabilities …

Are you game to start?

# EDUCATION PROGRAM THE EUREKA PROJECT

# BIOMASS FOR EFFICIENT ENERGY COMBUSTION

## NOTES ON BIOMASS AS A FUEL

Dry biomass and ecological wood must have the following characteristics:
- From dead trees felled and not damaging living trees
- Dry biomass – leaves, twigs, agricultural processing waste, pruned debris from reserves, parks and gardens
- Use of non-industrial methods ie.no power tools.

**Pellets**

Wood pellets produced from compressed virgin dried sawdust, woodchips or recycled scraps with no additives or chemicals, has output of double compared to ordinary wood.

**Cereals**

Plants of the grass family cultivated to obtain grain and seed, collected in large quantity and in many countries is the main food source. The waste product of such grain can also be used as a fuel and source of alternative energy. Compressed into pellets for burning or into straw bales for building.

## BUILDING A HOUSES WITH STRAW - BALES

**Building a House of Straw**

Why Building Straw Bales Homes? They Are Sustainable, Warm In Winter, Cool In Summer, Robust, Open Plan, Light And Airy And Unique. They Are Built With Natural And Sustainable Building Materials, Built To Reduce Your Carbon Footprint, Power And Water Usage. They Use Nature To Keep An Even Temperature Throughout The Year And Have No Chemical Additive Which Gives Off Gas.

**History of Straw Bale Building**

An Ancient Method, Employed In Antiquity In Asia And Europe, Traditionally Using Compacted Loose Straw Coated With Clay Or Mud For Walls. In The Last Ten Years It Has Had A Huge Comeback As Humans Have Become More Environmentally Aware. The Last 5 Years Have Seen The Pioneering Of Cheap And Efficient Straw Bale Building Systems Which People With No Trade Skills Easily Master.

**Environmental advantages**

The slow rate at which straw rots makes its disposal a problem for farmers because unlike nitrogen-rich hay, straw is not used for animal fodder, and the stems are too long to be thoroughly tilled into the soil. Straw bale construction could also be useful in the effort to control global warming and atmospheric deterioration. A large reduction in the amount of straw burned would dramatically cut back the production of carbon monoxide, carbon dioxide and nitrous oxides by many thousands of tons per year. Significant decline in the devastation of timber sources for the wood-hungry construction methods so common today. In many developing countries, the cutting of firewood for heating is as devastating to forests as wood cutting for the building

**Sustainability**

In contrast to the timber used for building houses, straw can be grown in less than a year in a sustainable production system. Straw can also be grown on saline or low quality land.

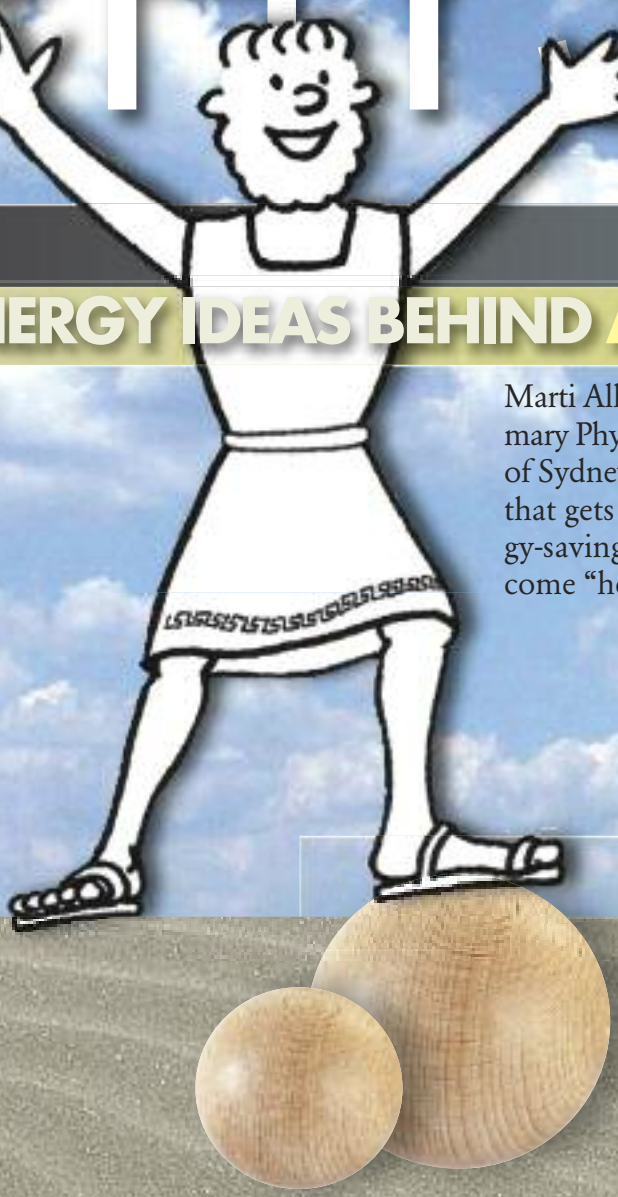
**Cool in summer, warm in winter**

A straw bale wall is made of hundreds of thousands of stalks of straw, each one containing and trapping air. Air is a great insulator so if you can keep it still in the wall, almost no heat can move through it. Straw bale walls can provide improved comfort and energy savings compared to more expensive conventional building systems, as they allow smaller heating/cooling to be installed.

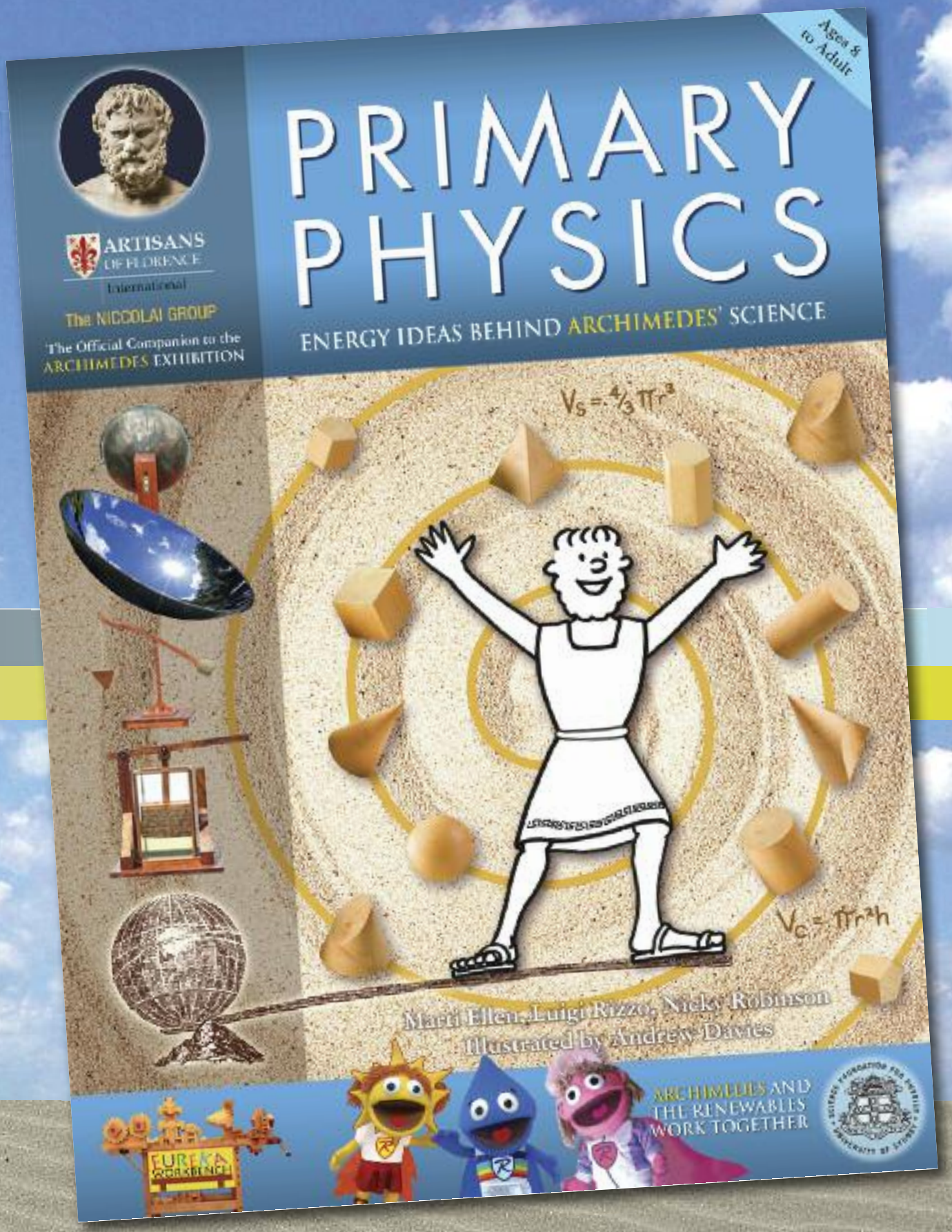
**Fire resistance -** Straw bale buildings are extremely hard to burn, holding enough air for good insulation but compacted tightly so they don't hold enough air to permit combustion.

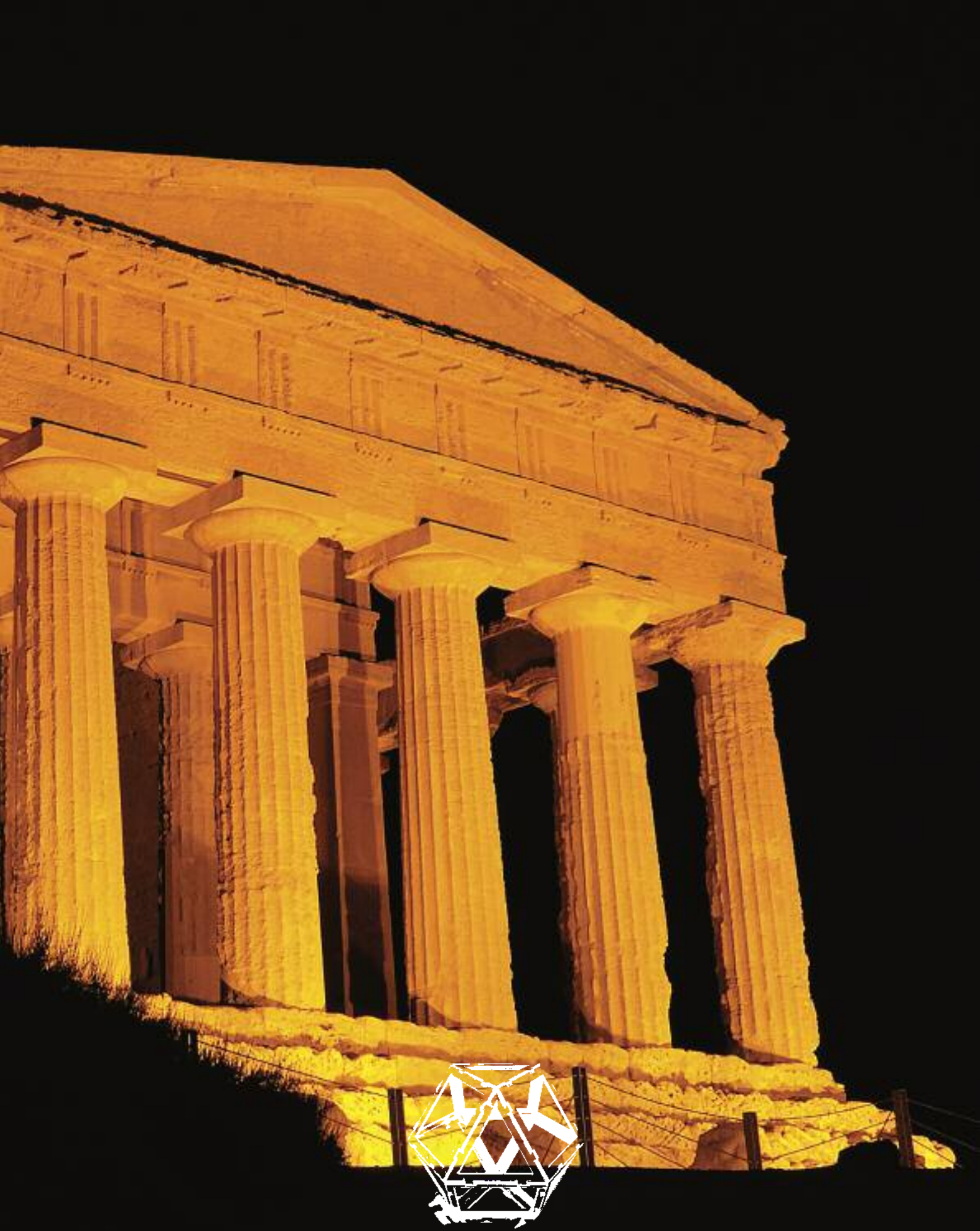
# PRIMARY PHYSICS

## ENERGY IDEAS BEHIND ARCHIMEDES' SCIENCE



Marti Allen - the education team leader who started the Primary Physics series with the Science Foundation - University of Sydney, presents a fun book end video of "super-heroes" that gets everyone involved with recycling and great energy-saving ideas. Hopefully this will inspire everyone to become "heroes" - starting in our homes!


Ages 8 to Adult
PRIMARY PHYSICS
ENERGY IDEAS BEHIND ARCHIMEDES' SCIENCE
ARTISANS OF FLORENCE
International
The NICCOLAI GROUP
The Official Companion to the ARCHIMEDES EXHIBITION
$V_S = \frac{4}{3}\pi r^3$
$V_C = \pi r^2 h$
Marti Ellen, Luigi Rizzo, Nicky Robinson
Illustrated by Andrew Davies
EUREKA WORKBENCH
ARCHIMEDES AND THE RENEWABLES WORK TOGETHER



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