



HELLENIC REPUBLIC
MINISTRY OF
DEVELOPMENT AND INVESTMENTS

GSRI

GENERAL SECRETARIAT FOR
RESEARCH AND INNOVATION



Federal Ministry
of Education
and Research



The 2nd German-Greek Research and Innovation Programme

- 2023 -



Background information

Launched with its first round in 2013, the current German-Greek Research and Innovation Programme is the flagship cooperation instrument of the Greek-German partnership initiative signed in 2010.

Following the success achieved by German-Greek research and innovation partnerships during the first funding period, the German Federal Ministry for Research and Education and the Greek Secretariat for Research and Technology (now the Greek Secretariat for Research and Innovation) agreed to launch a second round of the programme in 2016.

The programme focused on the topics of health, bioeconomy, renewable energy, culture and tourism, materials research and key technologies. Its overarching goals were to include young scientists in the projects, connect to projects of the European Framework Programmes and strengthen cooperation between academia and industry. The latter was one of the main features of the programme, as it emphasized knowledge and technology transfer in connection with the use of research results. In this context, one university – or research institute – and one industrial enterprise from each country worked together in the framework of what are known as “2+2” projects.

With a financial contribution of €8 million each, Greece and Germany have financed twenty-four “2+2 projects” since 2018. Each of the three-year projects was eligible to receive a maximum amount of €350,000 (per project, per country).

To encourage knowledge and technology transfer in each of the twenty-four projects, two workshops addressing this topic were held: one in Athens in 2019 and one virtually, due to the COVID-19 pandemic, in 2021. The workshops focused on networking, strategy and validation, specifically addressing the challenges of commercialisation from a market perspective.





Foreword by Minister Adonis Georgiadis and Federal Minister Bettina Stark-Watzinger

Second German-Greek Research and Innovation Programme

The German-Greek cooperation in research and innovation has been long-lasting and thriving. Its foundations were laid in Bonn in 1978 with the signing of the Bilateral Agreement on Scientific and Technological Cooperation. The implementation of the Agreement commenced in the late 1980s with small-scale projects, mainly in the form of scientific exchanges and fellowships, co-funded by our two countries. Over the last decade, Greek-German bilateral cooperation entered a new, more ambitious phase with the launching of the first round of a new cooperation instrument – the German-Greek Research and Innovation Programme.

Today, we can present the outcomes of the second round of this German-Greek programme for which our two countries invested a total of 18 million Euros. 24 joint projects yielded significant advances in the fields of energy, health, bioeconomy, materials research, key technologies as well as in the social sciences and humanities.

However, the programme does not stand alone. Collaboration in research and innovation is a key element of the Greek-German partnership initiative which was established in 2010. The initiative makes a significant contribution to the bilateral German-Greek action plan which was renewed during the 5th Greek-German State Secretary consultations in Berlin in May 2022.

This continuity exists not only on a political level but also in the fields of cooperation to date. The field of energy deserves special mention here. As a scientific area that deals with climate change and our efforts to achieve sustainability and protection of the environment, it is more relevant than ever. Early on, in the first round of the programme, the focus was on safe, secure and efficient supply of clean energy, an idea that was taken up and continued in the second round of the programme. The focus in the field of energy during that second round was on technologies for energy saving


and for generating and storing renewable energy, but also on reducing the environmental and climate impact of energy production from conventional sources. This clearly shows how much the German-Greek collaboration in research and innovation has been geared towards the future over the past decade.


The outstanding research conducted in the joint projects and the resulting collaborations between researchers from both countries make an important contribution to consolidating the partnership between our two countries.

One element of utmost importance from the design phase of the programme was the emphasis on the application of the research results in real-life practice. This was reflected in the close cooperation between science and industry in the joint projects. The model of “2+2 projects”, with two partners from science and the private sector from each country in every project, helps to strengthen the innovation systems of both countries by creating close ties between the worlds of academia and industry.

The two main goals of the programme are to foster innovation culture and to recognise potential for innovation at an early stage. With our programme we hope to support all participants in the exploitation of their research by explicitly promoting the transfer of knowledge and new technologies. The successful transfer of research results into innovative products or services is essential for competitiveness and growth. In recent years we promoted this approach within the research programme by organizing two successful hands-on workshops on knowledge and technology transfer.

Greek-German relations in research and innovation continue to be very close and we would like to keep it this way. The call for proposals for a third German-Greek Research and Innovation Programme will be announced in both countries in due course. We are pleased that this successful initiative will be continued.

 **Bettina Stark-Watzinger**
Member of the German Bundestag
Federal Minister of Education and Research

 **Adonis Georgiadis**
Minister of Development & Investments
of the Hellenic Republic



Vorwort von Minister Adonis Georgiadis und Bundesministerin Bettina Stark-Watzinger

Zweites Deutsch-Griechisches Forschungs- und Innovationsprogramm

Die deutsch-griechische Forschungszusammenarbeit besteht seit vielen Jahren. Der Grundstein dazu wurde 1978 mit der Unterzeichnung der Vereinbarung über wissenschaftlich-technische Zusammenarbeit in Bonn gelegt. Die Vereinbarung wurde ab Ende der Achtzigerjahre zunächst mit kleineren Projekten umgesetzt, insbesondere in Form von Wissenschaftsaustausch und Stipendien, die von beiden Ländern gefördert wurden. In den vergangenen zehn Jahren hat mit der ersten Runde eines neuen Kooperationsinstruments, dem Deutsch-Griechischen Forschungs- und Innovationsprogramm, eine neue, ambitioniertere Phase in der deutsch-griechischen Forschungszusammenarbeit begonnen.

Heute können wir die Ergebnisse der zweiten Runde dieser deutsch - griechischen Fördermaßnahme vorlegen. Insgesamt rund 18 Mio. € haben unsere beiden Länder in dieses Programm investiert. 24 gemeinsame Projekte konnten bedeutende Fortschritte in den Bereichen Energie, Gesundheit, Bioökonomie, Materialforschung, Schlüsseltechnologien sowie Sozial- und Geisteswissenschaften erzielen.

Dabei steht das Programm nicht für sich alleine. Die Zusammenarbeit in Forschung und Innovation ist ein bedeutender Teil der im Jahr 2010 begonnenen Deutsch-Griechischen Partnerschaftsinitiative und liefert einen wesentlichen Beitrag zum bilateralen deutsch-griechischen Aktionsplan, der bei den "5. Staatssekretärskonsultationen" in Berlin im Mai 2022 erneut bestätigt wurde.

Die Kontinuität zeigt sich aber nicht nur auf politischer Ebene, sondern auch in den Themen der bisherigen Kooperationen. Insbesondere das Themenfeld "Energie" ist dabei hervorzuheben. Ein Wissenschaftsbereich, der mit Blick auf den Klimawandel, eine angestrebte nachhaltigere Lebensweise und den Umweltschutz aktueller ist denn je. So lag bereits in der ersten Programmrunde ein Fokus auf sicherer, sauberer und effizienter Energie – ein Gedanke, der in der zweiten Programmauflage konsequent fortgeführt worden ist. Hier richtete sich das Augenmerk im Bereich Energie unter anderem auf energiesparende Technologien, Technologien zur Erzeugung und Speicherung erneuerbarer Energie, aber auch auf der Reduzierung von umwelt- und kli-

maschädlichen Auswirkungen der Energieerzeugung aus konventionellen Energieträgern. Dies zeigt deutlich, wie sehr die deutsch-griechische Kooperation bei Forschung und Innovation im letzten Jahrzehnt bereits in die Zukunft geblickt hat.


Die hervorragenden wissenschaftlichen Ergebnisse der gemeinsamen Projekte und die daraus entstandenen Kooperationen zwischen Forschenden beider Länder haben einen wichtigen Anteil an der Festigung der Partnerschaft zwischen unseren Ländern.


Wichtig für die Gestaltung des Programms war von Anfang an die Betonung der praktischen Anwendbarkeit der Ergebnisse, die sich in der engen Kooperation von Wissenschaft und Wirtschaft in den gemeinsamen Projekten widerspiegelt. Das Modell der "2+2 - Projekte" mit zwei wissenschaftlichen und privatwirtschaftlichen Partnern aus jedem Land trägt durch die enge Verzahnung von akademischer Welt und Industrie zur Stärkung der Innovationssysteme beider Länder bei.

Hierbei sind die Förderung der Innovationsorientierung und das Erkennen von Innovationspotentialen in der Frühphase zwei der Hauptziele des Programms. Durch die explizite Förderung des Wissens- und Technologietransfers verfolgen wir die Absicht, die Programmteilnehmenden bei der Verwertung ihrer wissenschaftlichen Erkenntnisse zu unterstützen. Der erfolgreiche Transfer von Forschungsergebnissen in innovative Produkte und Dienstleistungen ist wesentlich für Wettbewerbsfähigkeit und Wachstum. Diesen Ansatz haben wir im Rahmen des Forschungsprogramms in den letzten Jahren durch zwei erfolgreiche praxisnahe Workshops zum Wissens- und Technologietransfer gefördert.

Die Beziehung zwischen Deutschland und Griechenland in den Bereichen Forschung und Innovation war und ist eng und soll es auch in Zukunft bleiben. Daher freuen wir uns, dass diese erfolgreiche Initiative eine Fortsetzung in einem dritten Deutsch-Griechischen Forschungs- und Innovationsprogramm finden wird, dessen Förderbekanntmachung bald in beiden Ländern veröffentlicht wird.



 **Bettina Stark-Watzinger**
Mitglied des Deutschen Bundestages
Bundesministerin für Bildung und Forschung

 **Adonis Georgiadis**
Minister für Entwicklung und Investitionen
der Hellenischen Republik

Πρόλογος του Υπουργού Άδωνι Γεωργιάδη και της Ομοσπονδιακής Υπουργού Bettina Stark-Watzinger

Δεύτερο Ελληνογερμανικό Πρόγραμμα Έρευνας και Καινοτομίας

Η Ελληνογερμανική συνεργασία στους τομείς της έρευνας και της καινοτομίας είναι μακροχρόνια και ακμάζουσα. Τα θεμέλιά της τέθηκαν στη Βόννη το 1978 με την υπογραφή της Διμερούς Συμφωνίας Επιστημονικής και Τεχνολογικής Συνεργασίας. Η εφαρμογή της Συμφωνίας ξεκίνησε στα τέλη της δεκαετίας του 1980 με έργα μικρής κλίμακας, κυρίως με τη μορφή επιστημονικών ανταλλαγών και υποτροφιών, που συγχρηματοδοτήθηκαν από τις δύο χώρες. Κατά την τελευταία δεκαετία, η διμερής συνεργασία Ελλάδας-Γερμανίας εισήλθε σε μια νέα, πιο φιλόδοξη φάση, με την έναρξη του πρώτου γύρου ενός νέου μέσου συνεργασίας - του Ελληνογερμανικού Προγράμματος Έρευνας και Καινοτομίας.

Σήμερα, είμαστε σε θέση να παρουσιάσουμε τα αποτελέσματα του δεύτερου γύρου αυτού του Προγράμματος, για το οποίο οι δύο χώρες μας επένδυσαν συνολικά δεκαοκτώ (18) εκατομμύρια ευρώ. Είκοσι τέσσερα (24) κοινά έργα επέφεραν σημαντική πρόοδο στους τομείς της ενέργειας, της υγείας, της βιοοικονομίας, της επιστήμης υλικών, των βασικών τεχνολογιών, καθώς και στις κοινωνικές και ανθρωπιστικές επιστήμες.

Ωστόσο, το πρόγραμμα δεν αποτελεί τη μοναδική διάσταση της συνεργασίας. Η συνεργασία στην έρευνα και την καινοτομία αποτελεί βασικό στοιχείο της ελληνογερμανικής εταιρικής σχέσης, μιας πρωτοβουλίας που εκκίνησε το 2010 και συμβάλλει σημαντικά στο διμερές ελληνογερμανικό σχέδιο δράσης, το οποίο ανανεώθηκε κατά τον 5^ο γύρο διυπουργικών διαβουλεύσεων στο Βερολίνο τον Μάιο του 2022.

Αυτή η συνέχεια αντανakλάται όχι μόνο σε πολιτικό επίπεδο, αλλά και στους τομείς συνεργασίας μέχρι σήμερα. Ιδιαίτερη μνεία αξίζει ο τομέας της ενέργειας, καθώς ως ο επιστημονικός τομέας που ασχολείται με την κλιματική αλλαγή και τις προσπάθειές μας για την επίτευξη βιωσιμότητας και προστασίας του περιβάλλοντος, είναι πιο επίκαιρος από ποτέ. Κατά την έναρξη του προγράμματος, στο πλαίσιο του πρώτου γύρου, δόθηκε έμφαση στην βιώσιμη, ασφαλή και αποτελεσματική παροχή καθαρής ενέργειας, μια ιδέα που υιοθετήθηκε και συνεχίστηκε και στον δεύτερο γύρο του προγράμματος. Κατά τη διάρκεια αυτού του δεύτερου γύρου, σε ό,τι αφορά στον τομέα της ενέργειας, έμφαση δόθηκε στις τεχνολογίες για εξοικονόμηση ενέργειας


και για την παραγωγή και αποθήκευση ανανεώσιμης ενέργειας, αλλά και στη μείωση των περιβαλλοντικών και κλιματικών επιπτώσεων της παραγωγής ενέργειας από συμβατικές πηγές. Αυτό δείχνει ξεκάθαρα σε ποιο βαθμό η ελληνογερμανική συνεργασία στην έρευνα και την καινοτομία κατά την τελευταία δεκαετία έχει προσανατολιστεί προς το μέλλον.


Η υψηλής ποιότητας έρευνα που διεξήχθη στο πλαίσιο των κοινών έργων και οι παρεπόμενες συνεργασίες μεταξύ ερευνητών και από τις δύο χώρες συμβάλλουν σημαντικά στην εδραίωση της εταιρικής σχέσης μεταξύ των δύο χωρών μας.

Ένα στοιχείο υψίστης σημασίας από τη φάση του σχεδιασμού του προγράμματος ήταν η έμφαση στην εφαρμογή των ερευνητικών αποτελεσμάτων στην καθημερινή πραγματικότητα, η οποία αντικατοπτρίστηκε στη στενή συνεργασία μεταξύ επιστήμης και βιομηχανίας στα κοινά έργα. Το μοντέλο των «2+2 έργων», με δύο εταιρους από την επιστήμη και τον ιδιωτικό τομέα από κάθε χώρα σε κάθε έργο, συμβάλλει στην ενίσχυση των συστημάτων καινοτομίας και των δύο χωρών δημιουργώντας στενούς δεσμούς μεταξύ του ακαδημαϊκού κόσμου και της βιομηχανίας.

Οι δύο κύριοι στόχοι του προγράμματος είναι η προώθηση της κουλτούρας καινοτομίας και η αναγνώριση του καινοτομικού δυναμικού σε πρώιμο στάδιο. Με το πρόγραμμά μας ελπίζουμε να υποστηρίξουμε όλους τους συμμετέχοντες στην αξιοποίηση της έρευνάς τους, προωθώντας ρητώς τη μεταφορά γνώσης και νέων τεχνολογιών. Η επιτυχής μεταφορά των αποτελεσμάτων της έρευνας σε καινοτόμα προϊόντα ή υπηρεσίες είναι απαραίτητη για την ανταγωνιστικότητα και την ανάπτυξη. Τα τελευταία χρόνια προωθήσαμε αυτήν την προσέγγιση στο πλαίσιο του ερευνητικού προγράμματος οργανώνοντας δύο επιτυχημένα πρακτικά εργαστήρια για τη μεταφορά γνώσης και τεχνολογίας.

Οι ελληνογερμανικές σχέσεις στην έρευνα και την καινοτομία συνεχίζουν να είναι πολύ στενές και θα θέλαμε να διατηρηθούν έτσι. Η πρόσκληση υποβολής προτάσεων για ένα τρίτο ελληνογερμανικό πρόγραμμα έρευνας και καινοτομίας θα ανακοινωθεί και στις δύο χώρες σε εύθετο χρόνο. Είμαστε ευτυχείς που αυτή η επιτυχημένη πρωτοβουλία θα συνεχιστεί.

 **Σπυρίδων-Άδωνις Γεωργιάδης**
Μέλος του Ελληνικού Κοινοβουλίου
Υπουργός Ανάπτυξης και Επενδύσεων

 **Bettina Stark-Watzinger**
Μέλος του Γερμανικού Κοινοβουλίου
Ομοσπονδιακή Υπουργός Παιδείας και Έρευνας





Results of the midterm evaluation survey of the second German-Greek Research and Innovation Programme

The aim of the online survey, conducted by DLR Project Management Agency (DLR-PT) from 20 November to 6 December 2020, was to evaluate the second German-Greek Research and Innovation Programme at the project's halfway point.

Key findings of the midterm evaluation were that the programme is perceived by the participants as scientifically and technically excellent. In particular, working together with outstanding scientific partners and the benefits of strengthening international cooperation were highlighted as the most positive aspects of the cooperation initiative. The cooperation was rated highly in terms of quality and was frequently considered as a catalyst for the participants' competitiveness.

The biggest challenge for the Greek-German Research and Innovation Programme was the COVID-19 pandemic, due to the resulting inability to hold face-to-face meetings, although regular video conferences were mentioned as a valuable replacement. Furthermore, survey participants stated that administrative differences and large bureaucratic hurdles have prevented cooperation from being even more fruitful.

In general, academic partners tend to rate the programme more highly than their private sector counterparts, presumably as a result of the driving role played by the academic partners in the early phase of the networking process. Consequently, the focus on scientific goals has been criticised by the private actors, who also state that the commercialisation of products

and services has not been adequately addressed. As a result, academic participants were delighted with the scientific results, while the private sector actors valued the programme mainly as a tool to improve international and transnational cooperation.

Knowledge transfer has been achieved through the cooperation of academic and non-academic actors, although there is still room for improvement, as only one patent application has been filed so far. In the online survey, non-academic actors stated that it is essential to translate more project results into market-oriented innovations. Survey participants agreed that it is difficult to achieve the goals of the programme in a three-year timeframe and therefore suggested a continuation of the programme in follow-up projects.

According to the interim evaluation results and in view of a possible third German-Greek Research and Innovation Programme, programme participants propose further encouraging the involvement of young scientists and offering fellowships or allocating specific amounts of funding for the training of young scientists. In order to meet the need to commercialise products and services, participants stated that it would be advantageous to require applicants to provide more details about how they plan to commercialise their research results. Finally, a third round of the programme could be enhanced by providing an increase in total funding, enhancing cooperation between science and industry and thus creating common ground for applied research and development.



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- ADVENTUS -

Advanced Small Wind Turbines

INFO BOX

Project title

ADVENTUS - Advanced Small Wind Turbines

Funding amount

(from both countries)
770.365,00 €

Project duration

29/05/2018 - 28/11/2021

Partner Institutions

Laboratory of Fluid Mechanics and Turbomachinery (LFMT)
Aristotle University of Thessaloniki

CARBON FIBER TECHNOLOGIES PRIVATE COMPANY (CFT)

Institute of Turbomachinery and Fluid Dynamics (TFD) of Leibniz University of Hannover

PSW Energiesysteme GmbH (PSW)

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ADVENTUS WEB Link:

www.lfmt.gr/adventus

WHAT WE DID!

In ADVENTUS, an innovative and more efficient wind turbine blade design was developed and manufactured.

The new design incorporated advanced aerodynamic components (winglets, tubercles, vortex generators, plasma) and was manufactured with innovative blade materials (Carbon Fiber Reinforced Polymers).

Efficiency was improved up to 10% in relation to standard, more conventional, Small Wind Turbines.

PROJECT GOALS

- Develop scientific knowledge and advanced technologies for Small Horizontal Axis Wind Turbines
- Increase Small Wind Turbines efficiency
- Increase annual electricity production
- Increase Wind Energy market share
- Decrease maintenance and operational cost
- Maximize Renewable Energy public awareness



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- ADVENTUS Small Wind Turbine (SWT) design improves efficiency up to 10% in relation to standard, more conventional, SWT designs
- ADVENTUS Small Wind Turbine design cost is expected to be reduced in relation to standard, more conventional, SWT designs
- ADVENTUS Small Wind Turbine innovative design is based on the use of highly aerodynamic winglets and tubercles and is manufactured mainly by lighter, yet stronger, materials, such as Carbon Fiber Reinforced Polymers

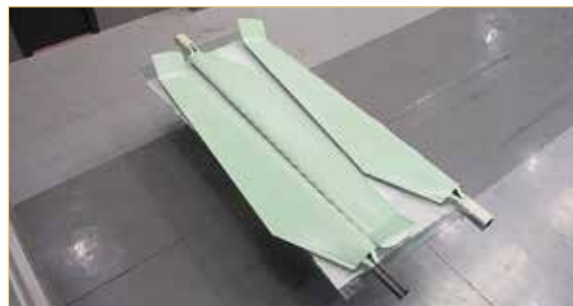
THE BENEFITS OF INTERNATIONAL COOPERATION

ADVENTUS was implemented through the successful collaboration between two Greek (LFMT and CFT) and two German partners (TFD and PSW) performed through various physical and virtual meetings and two workshops. The benefits of the cooperation arose from the combination of the partners complementary scientific and technical methods and comprehensive experience which allowed for a successful implementation of the project goals.

More specifically, in ADVENTUS project:

- CFT advanced its manufacturing know-how and inserted into Renewable Energy market
- PSW increased its products efficiency and manufacturing know-how
- TFD and LFMT increased their know-how in the design and development of advanced Small Wind Turbines using innovative methods and tools
- All partners increased their knowledge about the Wind Energy market in Greece and Germany

INSIGHTS



Various views of the ADVENTUS innovative CFRP-based wind turbine blades incorporating winglets and tubercle achieving increased efficiency



CAD view of the ADVENTUS project wind turbine



- AgriTexSil -

Development of a textile with Silica coating for environmental friendly control of insects in agricultural production

INFO BOX

Project title

AgriTexSil - Development of a textile with Silica coating for environmental friendly control of insects in agricultural production

Funding amount

(from both countries)

722.624,00 €

Project duration

27/03/2018 – 27/08/2022

Partner Institutions

University of Thessaly

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Institute for Textile Technology
at RWTH Aachen University

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WHAT WE DID!

Insect-proof screens were coated through a plasma coating process with silica nanoparticles (SiO_2) and their efficiency against various stored and greenhouse insects was evaluated under lab conditions. After selecting the most efficient SiO_2 formulation, screens of different porosities were integrated into the vent openings of small-scale screenhouses. These screens were also tested for their aerodynamic properties. Based on the results, the incorporation of an insect-proof screen with relatively larger pores coated with SiO_2 into the vent openings of a screen greenhouse presented a 50% increase in air permeability followed by a greater than 80% reduction in insect infestation compared to standard dense screens used in commercial greenhouses.

PROJECT GOALS

Within this project the goal was to develop an eco-friendly, non-toxic agro-textile, which could actively protect plants against greenhouse insects by killing them, when sufficient contact of the insect to the textile was achieved. Thereby, nature is being protected, because the use of toxic insecticides and the accompanying contamination of food, i.e. fruits and vegetables is avoided.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

The conventional screen characterized by smaller pores acted as a barrier to the insects, but had no effect on those that managed to pass through it.

The SiO₂ screen acted as a weaker barrier, but successfully suppressed insects' population growth by 80%.

During the project, better design of screens and adapted cultivation techniques were achieved to ultimately increase the profitability of growers with minimal impact on the environment.

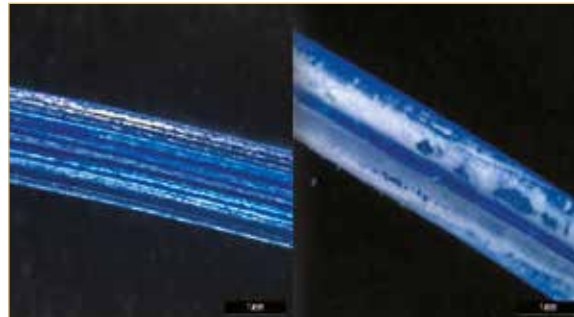
THE BENEFITS OF INTERNATIONAL COOPERATION

The two sides may continue working together to further enhance their outstanding bilateral relations and practical cooperation, to their mutual benefit.

On the bilateral level, both sides confirmed the importance they attach to further developing and fostering their cooperation in the agricultural sector, including investments, technology, and education.

Finally, collaboration and knowledge sharing between partners contributed to patent filing.

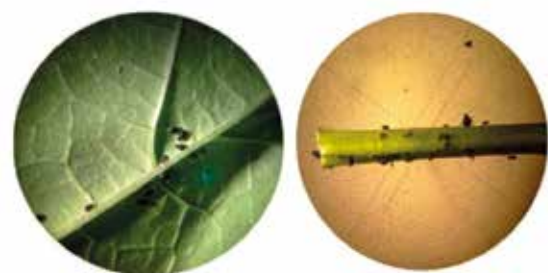
INSIGHTS



Non-coated (left) versus SiO₂-coated (right) monofilament yarns



Small-scale greenhouse covered by the SiO₂ coated screen



Measuring the insect infestation on the leaves and stems of the plants



- BIOMUSE -

The genomic heritage of ancient Greece: Bringing digitalised human bio-history to museums

INFO BOX

Project title

BIOMUSE - The genomic heritage of ancient Greece: Bringing digitalised human bio-history to museums

Funding amount

(from both countries)

762.008,00 €

Project duration

29/5/2018 – 28/11/2021

Partner Institutions

Laboratory of Physical Anthropology, Democritus University of Thrace

Palaeogenetics Group Mainz, Johannes Gutenberg University Mainz

Reiss-Engelhorn Museen
TETRAGON

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BIOMUSE WEB Link:

www.biomuse.eu

WHAT WE DID!

The research innovation of BioMuse:

For the study of the skeletal material, cutting-edge technologies were applied **ancient DNA** analyses **stable isotope** analyses **anthropological study**.

The bones and genome of approximately 100 individuals from 26 archaeological sites were studied.

The most representative cases were selected. Their nutrition, phenotype, diseases and all information that compose their image and biological history were reconstructed.

The following were created: **interactive application** in the form of a printed book that features information on the biographies and the research itself, in an augmented reality experience **audiovisual production website** with multiple applications and a digital repository **independent exhibition panels** that showcase the life-size biographies.

PROJECT GOALS

- Application of analytical and cutting-edge imaging technologies in order to reconstruct the diet, the genetic history and the daily life of humans who lived in Greece from the Mesolithic to the Byzantine period
- Synergy between natural and social sciences such as palaeogenetics, anthropology, archaeology and museology, aiming at producing, analyzing and showcasing innovative research results
- Interpretation of the research data within the historical and archaeological context, in order to narrate the story of real humans who lived in the past, reinforcing our understanding and awareness on our cultural and biological heritage
- Cooperation between public and private sectors, aiming at promoting the research results to the general public and to cultural and tourism entities, in an attractive, educational and accessible format.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

We narrate the biographies of humans who lived in Greece during the last 11,000 years, as reconstructed by the holistic study of their skeletal remains.

Putting together these biographies was the successful result of multidisciplinary collaboration. Anthropologists, archaeologists and geneticists studied and analyzed the data, while museologists, graphic designers and architects developed their presentation.

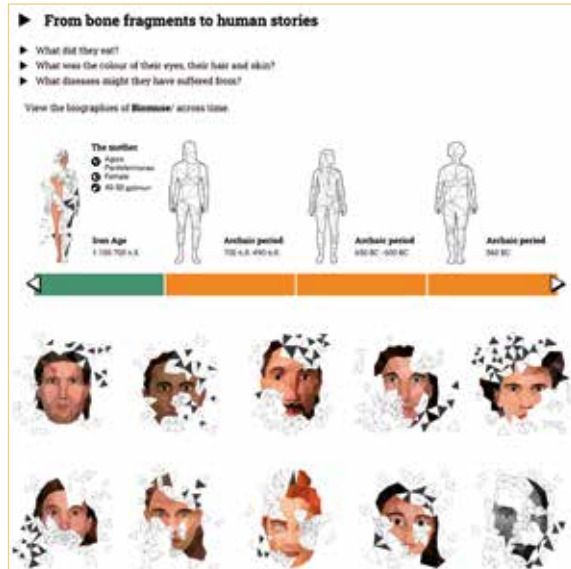
THE BENEFITS OF INTERNATIONAL COOPERATION

Within the framework of this project, our interdisciplinary team developed cutting-edge methodologies for the study of human remains especially on the field of palaeogenomics and stable isotope analysis, but also augmented reality applications for the novel representation of the results to the public.

The international cooperation allowed our teams to pool their resources and expertise to address research and societal challenges and to increase our efficiency as we shared knowledge, technologies, and best practices reducing duplication of efforts.



INSIGHTS



Screenshot from the official website of the project showing reconstructed osteobiographies



3D facial reconstruction implementing cutting-edge digitization methods and ancient DNA analysis to create realistic facial characteristics



The AR-Book, an implemented augmented reality application that brings to life the reconstructed osteobiographies and the applied methodology for children and adults



- BRIDGING -

BRucellosis IDendification in Greece and Germany

Novel targets for diagnostic stratification and epidemiologic surveillance of human brucellosis: host-guided molecular study in an endemic area at the crossroads between Asia and Europe

INFO BOX

Project title

BRIDGING - BRucellosis IDendification in Greece and Germany

Funding amount

(from both countries)
714.754,00 €

Project duration

29/05/2018 – 28/05/2022

Partner Institutions

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BRIDGING WEB Link:

www.bridgingproject.eu

WHAT WE DID!

We determined, for the first-time, the gene expression map of the immune cells involved in human brucellosis, uncovering candidate molecular targets and pathways that characterize active infection and disease therapy. These data provided the principles of a novel diagnostic tool for this global and continually re-emerging zoonotic disease.

PROJECT GOALS

- Identify novel molecules for the diagnosis, stratification and epidemiologic surveillance of different types of human brucellosis, especially in endemic regions and immigrants from these regions
- Investigate the possible impact of brucellosis on population health by assessing the effect of Brucella on key host immune cells
- Provide the principles of a novel diagnostic assay for active brucellosis
- Increase medical community awareness on brucellosis and initiate a long-term co-operation between the Greek & German partners.



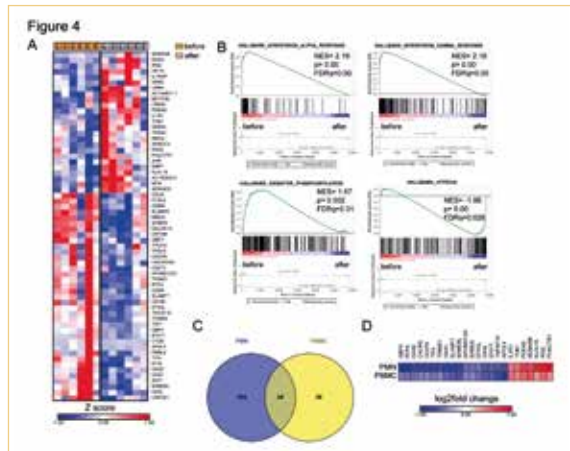
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- The molecular alterations that take place in human phagocytes upon infection, and in peripheral blood immune populations during active disease were identified. Large body of data for the better understanding of host-pathogen interactions and pathways for future therapeutic purposes.
- A prototype database of epidemiological, clinical, serological, microbiological and RNA-seq data for human brucellosis in Greece has been developed and can be further expanded and exploited by the scientific community in the future.
- Transfer of this knowledge in industry. A diagnostic kit and algorithm for brucellosis diagnosis and monitoring may be developed based on the prototypes of the study.
- The awareness of medical/vet community about brucellosis and its impact on host immunity will be increased.

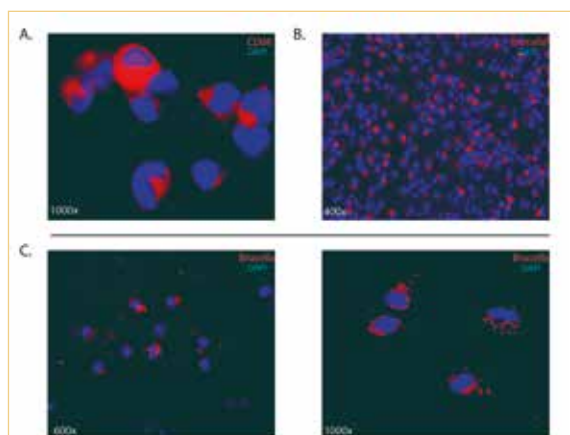
THE BENEFITS OF INTERNATIONAL COOPERATION

The project provided an attractive and inspiring environment for the young/early-stage researchers who were actively involved in BRIDGING. All the partners in BRIDGING project have benefited with new personnel and novel infrastructures, such as deep sequencing facility, multi-analyte flow cytometry instruments and new generation analysis software for bioinformatics. This enhanced their competitive advantage in both commercial and research field. PZAF, the Greek SME of the project, has benefited from the design of a brand - new product line, suitable for combined analysis of molecules in brucellosis diagnosis. This could be commercially exploited by PZAF in the future, leading to the development and commercialization of finished products for in-vitro diagnostic (IVD) use in the EU market.

INSIGHTS



Transcriptomic analysis of peripheral blood mononuclear cells (PBMCs) from patients with brucellosis before treatment initiation and after successful antibiotic therapy. We identified 24 common genes that were significantly altered in both neutrophils and PBMCs (Front Immunol. 2022; 13:951232)



Macrophages and neutrophils from healthy donors were infected with *Brucella* to assess the impact of the pathogen in several molecular and cellular functions of innate immunity (Front Immunol. 2022; 13:951232)



Increasing the awareness of biomedical & vet community about brucellosis and its impact on host immunity in national and GR/DE BRIDGING meetings



- CAERUS -

Carbon nAnofilters of Enhanced Rigidity for Unpolluted air and gas Sensing

INFO BOX

Project title

CAERUS - Carbon nAnofilters of Enhanced Rigidity for Unpolluted air and gas Sensing

Funding amount

(from both countries)

803.159,00 €

Project duration

29/05/2018 – 28/02/2022

Partner Institutions

University of Bielefeld
Technologies GmbH
Partner Institute of Chemical Engineering Sciences (CarbonNanoMembranes)
Alfa Measurements

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WHAT WE DID!

We developed separation membranes based on molecular thin Carbon Nanomembranes for demanding separation tasks. Water filtration is especially promising, due to the exceptionally high permeance of water combined with very high selectivity against anything else. Furthermore, polymeric membranes containing graphene were produced and used successfully as gas barriers.

PROJECT GOALS

Gas manipulation technologies are widely applied throughout different sectors of the modern industry and even in many households, aiming to sense or block certain gaseous substances. Thus, fast and precise monitoring of gaseous and volatile species enables the detection of hazardous chemicals, control and optimization of processes, reduced air pollution etc. Although several various sensors are available for specific applications, their performance can substantially suffer from the interference of untargeted molecules and particles resulting in poor performance and short lifetime. The simplest way of increasing the sensor's effectiveness is to equip it with a selective membrane.

The aim of the overall project was to develop such selective gas filters based on carbon nanomembranes (CNMs). CNMs are the type of two-dimensional (2D) sheet materials that can be produced on a large scale and whose properties can be widely tuned.

Furthermore, in parallel with the selective filtering approach, CAERUS aimed to research the formulation of polymer-based membranes incorporating graphene (in the form of films or nano-platelets) for gas barrier applications.



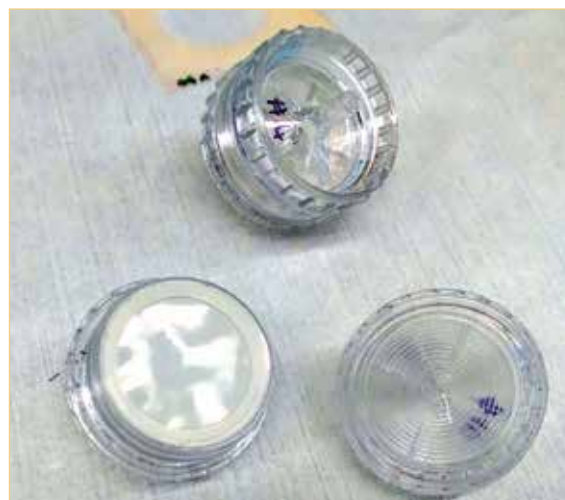
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

One important result of CAERUS was that CNMs have an exceptional high permeance of water, due to the extremely low thickness of only a few nanometer or even below. This high permeance is combined with a very high selectivity against anything else. This insight led to the decision to initially focus the commercialization of CNM-hybrid membranes for water filtration and at a later stage for gas separation. The knowledge gained in CAERUS on targeted control of properties like intrinsic porosity and mechanical strength of CNMs, as well as on production methods of CNM-hybrid membranes, is of great value for further development of CNMs also in other applications, ranging from semiconductor production to sensor development. Also, the excellent performance of polymer/graphene membranes, such as gas barrier materials, expanded the perspective for further development of such films.

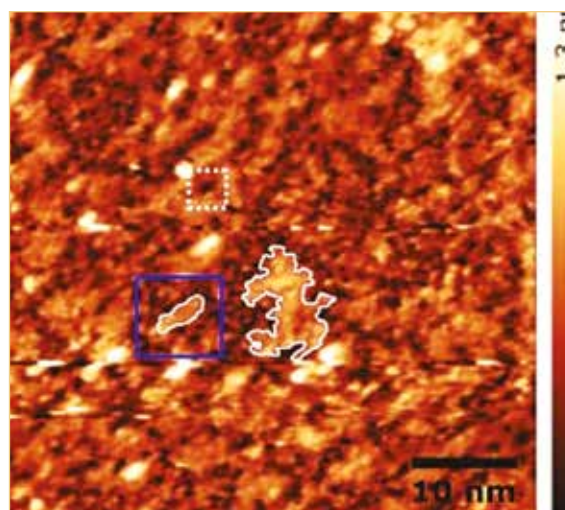
THE BENEFITS OF INTERNATIONAL COOPERATION

Without CAERUS, the combination of basic research at Bielefeld University and FORTH/ICE-HT, as well as application research at ALFA Measurements and the targeted development of a CNM hybrid membrane at CNM Technologies could not have taken place. Thanks to CAERUS, the chances are now significantly higher that the promising material class of CNMs developed in Germany can also be commercially exploited in Europe and worldwide, with the core competence remaining at the project partners. The good co-operation of the partners led to a successful application of Bielefeld University, FORTH/ICE-HT and CNM Technologies together with five further partners for a prestigious European Horizon 2020 FET Open grant called "Water separation revolutionized by ultrathin carbon nanomembranes - ITS-THIN" (Grant Agreement No. 899528). ITS-THIN has the goal of developing the technological equivalent of highly efficient biological filtration membranes from nature based on carbon nanomembranes and bringing them into initial applications.

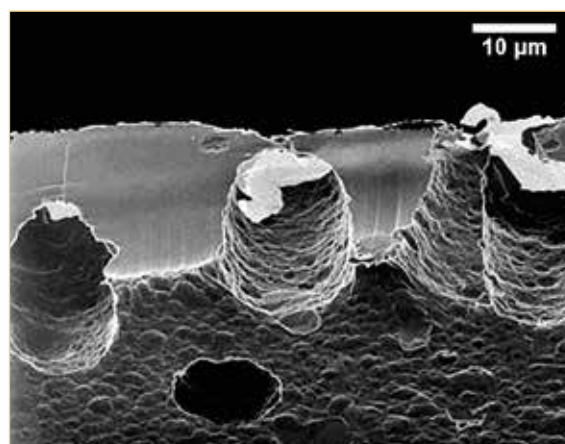
INSIGHTS



CNM-hybrid membranes in syringe filter holders for gas separation



High-magnification scanning tunneling microscopy image of a specific CNM



Cross section of a CNM hybrid membrane. The free-standing CNM can be clearly seen



- CARBATECH -

Novel technologies for surveillance and characterization of Extended-spectrum β -lactamase and Carbapenemase producing Enterobacteriaceae, in humans and animals

INFO BOX

Project title

CARBATECH -Novel technologies for surveillance and characterization of Extended-spectrum β -lactamase and Carbapenemase producing Enterobacteriaceae, in humans and animals

Funding amount

(from both countries)

716.704,00 €

Project duration

29/05/2018 – 29/04/2022

Partner Institutions

Laboratory of Microbiology and Parasitology, Faculty of Veterinary Science, University of Thessaly
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WHAT WE DID!

First detection and characterization of Extended Spectrum β -lactamase (ESBL) and carbapenemase producing Enterobacteriaceae (CPE) among domestic animals and wild birds in Greece.

PROJECT GOALS

- Investigation of the presence of important AMR bacteria, and particularly of ESBL-PE and CPE, among humans, domestic and wild animals in Greece
- Determination of the genes conferring extended-spectrum cephalosporin and carbapenem resistance among the isolated strains
- Classification of the strains to clones
- Study of the genome of all ESBL-PE and CPE isolates by the method of gene microarrays
- Evaluation of the use of Raman spectroscopic approaches for the characterization of ESBL-PE and CPE isolates
- Design and application of a “Customer Support Service” for the rational use of antibiotics among livestock.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- The examination of 2003 human samples led to the identification of 208 CPE positive and 353 ESBL positive samples
- The examination of 804 domestic animal (swine, cattle, poultry) samples led to the isolation of 12 CPE, 12 AmpC and 149 ESBL positive strains, while from the 222 environmental farm samples 7 ESBL positive strains were obtained
- The examination of 362 wild animal (birds, boars, hares) samples led to the isolation of 2 CPE, 1 AmpC and 19 ESBL positive strains. These strains were obtained from 12 different wild bird species. All human and animal strains possessed a plethora of genes conferring resistance to different antimicrobial classes, according to the performed analysis (PCR, NGS, microarray, VITEK, Raman)
 - The wide dissemination of bacteria resistant to critically important antimicrobials, such as cephalosporins and carbapenems, among humans domestic and wild animals in Greece is evident
 - Future research shall be focused on antimicrobial stewardship under a One Health approach, to implement measures that will enable overcoming the threat of antimicrobial resistance.

THE BENEFITS OF INTERNATIONAL COOPERATION

After the formation of the present collaborative structure, both Greek and German teams had the chance to share opinions, information, resources and expertise. This international partnership thus facilitated the acquisition of new research skills and pushed the boundaries of research methods and techniques, in order to produce results that are relevant and to understand many angles and perspectives of the selected subject.

Many opportunities additionally emanated for researchers themselves, including meeting diverse groups of people from differing working cultures and immersing in those cultures. CARBATECH subsequently benefitted to a great extent via the productive Greek-German cooperation that led to the successful completion of the project and a perspective for the continuance of the partnership in the future.

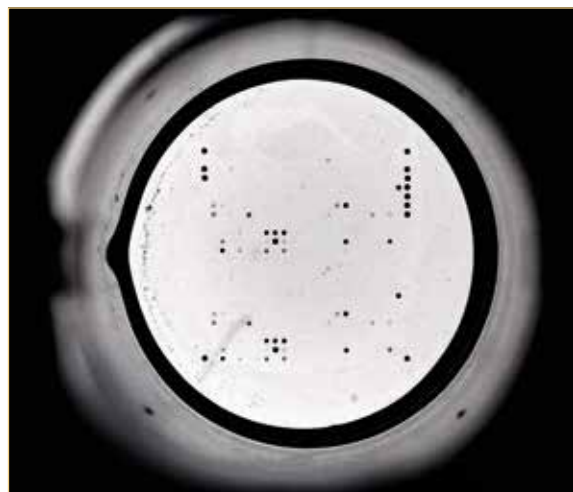
INSIGHTS



Disclosure meeting organized in 2021 for Work Package 5 of the project



Antibiogram of a CPE Escherichia coli isolated from a bovine fecal sample for the first time in Greece



Microarray results for an ESBL E. coli strain isolated from the fecal sample of a Common buzzard for the first time in Greece



- CasH -

Cascade Hydroponics: an integrated approach to increase productivity, resource use efficiency and sustainability of protected horticulture

INFO BOX

Project title

CasH - Cascade Hydroponics an integrated approach to increase productivity, resource use efficiency and sustainability of protected horticulture

Funding amount

(from both countries)

739.579,00 €

Project duration

01/06/2018 – 30/11/2022

Partner Institutions

University of Thessaly (UTH)

Hochschule Geisenheim
University (HGU)

Agrostis Ltd, Agricultural
Information Systems (AAIS)

Phytowelt Green Technologies
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CasH WEB Link:

www.cascade-hydroponics.eu

WHAT WE DID!

Two pilot cascade hydroponic systems were developed, one in Greece and one in Germany. Experimental measurements and pilot trials of the system were carried out for three years. In addition, the water and nutrients flow in the cascade hydroponic system was modeled. The model was used to develop a simulation of the cascade system. The modeled water and nutrients flow data were compared with the experimental one and a good agreement between the measured and simulated data was observed. The experimental results showed that the cascade hydroponic system could result in higher water and nutrients use efficiency in greenhouses. The simulation system developed can be further used to evaluate different cascade crop case studies.

PROJECT GOALS

- Reduction of greenhouse nutrient solution effluents to the environment by optimization of the reuse of the drainage fertigation solution in cascade hydroponic crops
- Identification of crop species suitable as secondary and tertiary crops
- Accompanying breeding aiming at the optimization of the plant cultivars to be used
- Development and iterative optimization of cultivation practices for secondary / tertiary crops
- Scientific evaluation of the systems' performance (plant responses, yield, quality etc.)
- Development of new models for the DSS, e.g., to simulate the fertigation of the primary crop
- Evaluation of environmental impacts and economic viability.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- Application of the pilot cascade hydroponic system resulted in more than 30% increase of the water and nutrients use efficiency in greenhouse hydroponics.
- Monitoring nutrients concentration in the nutrient solution, at frequent intervals and at various positions in a cascade (or one loop) hydroponic system is an option, but it requires a significant number of samples to be analyzed. To facilitate the practical application of drainage nutrient solution management, a simulation model of nutrients concentration in a cascade system has been developed. The system has been built to simulate the nutrient flow in a series of three crops: a primary, a secondary and a tertiary crop. The drained nutrient solution from the primary crop is used to fertigate the secondary crop, while the drained solution from the secondary crop is used to fertigate the tertiary crop. The model was validated and can be used for different case studies of cascade crops.

THE BENEFITS OF INTERNATIONAL COOPERATION

The cooperation between the Greek and the German partners under the scope of this project led to an extensive knowledge exchange related to technology transfer, covering the entire product development chain. Another important advantage of this cooperation resulted from the fact that the operability of the overall systems, as well as of individual components, were tested under the climatic conditions of both partner countries. Moreover, the involved researchers, particularly young scientist, gained the valuable experience of collecting and interpreting data with reference to the two different climates and cooperated and exchanged knowledge and ideas within the academia and SME partners.

INSIGHTS



Control screen for the automatic management of the cascade system in Greece



- CICI -

Conditions for Institutional and Cultural Innovations

INFO BOX

Project title

CICI - Conditions for Institutional and Cultural Innovations

Funding amount

(from both countries)

761.618,00 €

Project duration

29/05/2018 – 28/11/2021

Partner Institutions

National and Kapodistrian
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Technical University of
Darmstadt

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WHAT WE DID!

Using the example of 10 innovative cities, the research project CICI empirically investigated communicative interaction that has led to a shared understanding of relevant restraints and possibilities of change. We collected 2889 documents (council minutes, media reports, policy documents, etc.) and conducted 173 interviews with local actors. These texts have been analysed using the MAXQDA software.

PROJECT GOALS

The project intended to show how innovation can be developed through discursive interaction that leads to action mobilization and impacts practices in local government and local civil society. A major challenge was to identify the communicative mechanisms and their dosing linked to the prevailing local narrative about the city and its potential for innovation.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

Within an extremely competitive and demanding environment, cities must improve their resilience and their efficiency to resolve both conventional and novel problems. Ambitious urban leaders and stakeholders are searching for new ways and inventive methods to tackle unsolved problems or further consolidate existing advantages.

The results of the CICI project include an academic book in English, German and Greek and four journal articles, policy papers and a handbook for practitioners, offer of guidance to local actors who need to know what needs to be said and how to get their ideas accepted and promote the necessary innovations in their cities.

THE BENEFITS OF INTERNATIONAL COOPERATION

For the project, the "most different cases design" brings additional value, since cases embedded in Greek and German contexts display a particularly wide variety of characteristics that could hardly be found if cities in more similar countries would be included and compared. Therefore, it was necessary to find a basic definition of innovation that could be applied to cities in Germany as well as in Greece – namely that innovations are referring to the deliberate introduction of something that is understood in a particular local context as new and an improvement. "This insight has been published in an article in the International Review of Public Policy 2022 (Vol. 4, No. 2)".

Furthermore, the research teams are facing quite different circumstances in their countries and learned to adjust, cooperate, and learn from each other, thus promoting their relationships and mutual trust.

INSIGHTS



- CuRe -

Cultures and Remembrances: Virtual time travels to the encounters of people from the 13th to 20th centuries. The Cretan experience

INFO BOX

Project title

CuRe - Cultures and Remembrances: Virtual time travels to the encounters of people from the 13th to 20th centuries. The Cretan experience

Funding amount

(from both countries)

761.198,00 €

Project duration

01/05/2018 – 28/11/2022

Partner Institutions

Ludwig - Maximilians -Universität München, Institute of Byzantine Studies, History of Byzantine Art and Modern Greek Studies

Universität Hamburg, Department SLM II

Institute of Computer Science, Institute for Mediterranean Studies (Foundation for Research and Technology) Hellas

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CuRe WEB Link:

www.explore.cure-project.gr

WHAT WE DID!

The project constituted an ambitious step initiating from theoretical sciences (Byzantine Studies, Ottoman Studies, Modern Greek Studies) to provide enhanced cultural experiences via applied ICT.

It proposed novel ways of approaching and understanding history and culture and an innovative approach to designing and promoting a mobile application targeted to visitors interested in the history and cultural memories of Crete.

PROJECT GOALS

- collecting pieces of information relevant to the collective memory of the history of Crete and turning them into narratives
- linking these narratives to material remains, such as buildings, objects of cultural heritage and places of memory, which are recorded digitally
- combining these textual and visual data in a cloud - based repository
- offering location-based, instant access to all material compiled, through a dedicated application for mobile devices / tablets and a web portal supporting map-based representations of important historical periods and narrative-based representations that can be accessed through the web from home and on-site
- creating an enhanced experience for museum visitors, tourists, and other stakeholders.



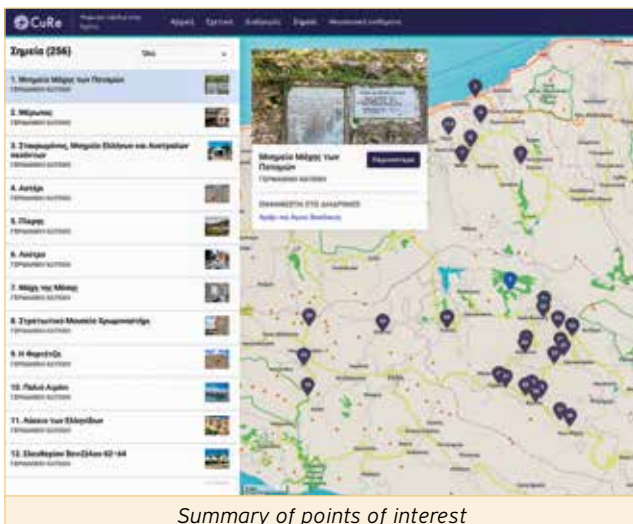
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

An innovative way to approaching and understanding history and culture, targeted to visitors interested in the history and cultural memories of Crete by:

- facilitating access to, reusing and exploiting digital cultural resources both offline and online, in the museum and on the go
- providing novel forms of information retrieval
- demonstrating the use of AR applications to allow visitors to extract the story through interacting with actual historical artefacts
- extending the interaction with digital exhibits and enhancing mainstream museum visits
- offering personalization through adaptation of histories and narratives, personalization of the way the stories are structured and adaptation of the interaction and user interface.

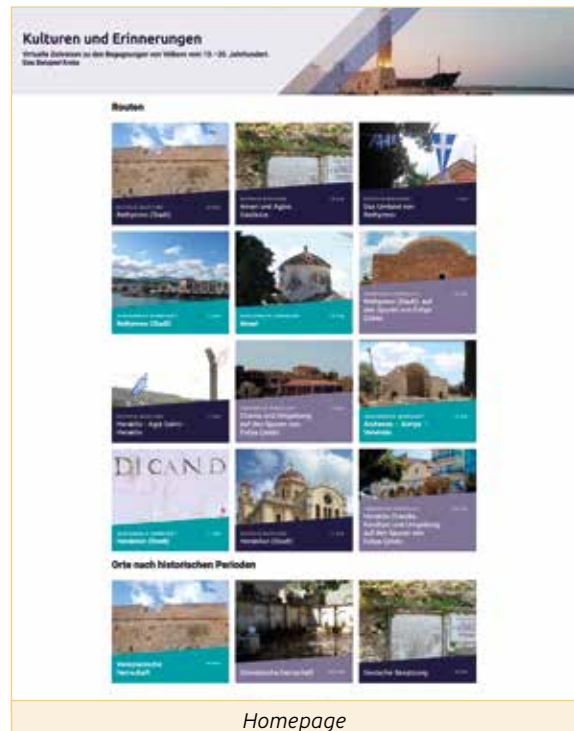
THE BENEFITS OF INTERNATIONAL COOPERATION

A team involving experts from different scientific areas, but also cultural and organizational backgrounds, the combination of interdisciplinary work, and the variety of working cultures was a challenge to address, but produced an excellent result through effective cooperation between all partners.



Summary of points of interest

INSIGHTS



Homepage



Point of interest: detailed view



AR view screen (left) and AR scanning screen (right)



- EWSMD -

Establishment of an Early Warning System for Mosquito - borne Diseases

INFO BOX

Project title

EWSMD - Establishment of an Early Warning System for Mosquito-borne Diseases

Funding amount

(from both countries)
676.581,00 €

Project duration

29/05/2018 – 28/05/2021

Partner Institutions

Aristotle University of Thessaloniki (AUTH)
- Department of Microbiology, School of Medicine
- Department of Meteorology and Climatology, School of Geology

Bernhard Nocht Institute for Tropical Medicine (BNITM)

Gesellschaft zur Förderung der Stechmückenbekämpfung e.V. (GFS/Ifd)

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WHAT WE DID!

We identified high risk areas and critical time periods for West Nile virus (WNV) and Usutu virus (USUV) circulation in Greece and Germany following modeling from entomological and epidemiological data produced by the partners retrospectively and prospectively during the study period.

PROJECT GOALS

- Connect major European actors in virus detection and mosquito surveillance and control from Germany and Greece.
- Reanalyze the epidemiological data from the severe WNV epidemic in Northern Greece from 2010 and onwards for the preparedness of Germany and Greece against WNV and other arboviruses.
- Identify high risk areas and critical time intervals for WNV and USUV circulation based on modeling from entomological and epidemiological data.
- Provide good practices and innovative tools and methods for the control of container-breeding mosquitoes in urban settings, with special consideration of *Culex pipiens* and *Aedes albopictus*, which are the major European vectors for existing and/or threatening mosquito-borne diseases (WNV, USUV, dengue virus, chikungunya virus, Zika virus)
- Produce, update and make available the information to concerned Public Health Institutions and/or other bodies of both countries, a functional webGIS, in which the users will have the possibility to view, explore, query, and display the periodical risk maps of the early warning system for mosquito-borne diseases.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

In the framework of the EWSMD project, powerful tools were developed that facilitated the identification of at-risk areas, time periods and communities to inform on measures to be taken for the anticipation and reduction of human WNV infections that happened to occur in Central Macedonia, Greece. The four pillars of an early warning system (1. Risk knowledge, 2. Monitoring networks, 3. Response actions, and 4. Communication) were integrated into strategic and operational planning for the management of the ongoing wide-area vector control program. The project strengthened citizens' awareness and sensitization about the transition from nuisance centered mosquito control to vector control and needed mitigation actions.

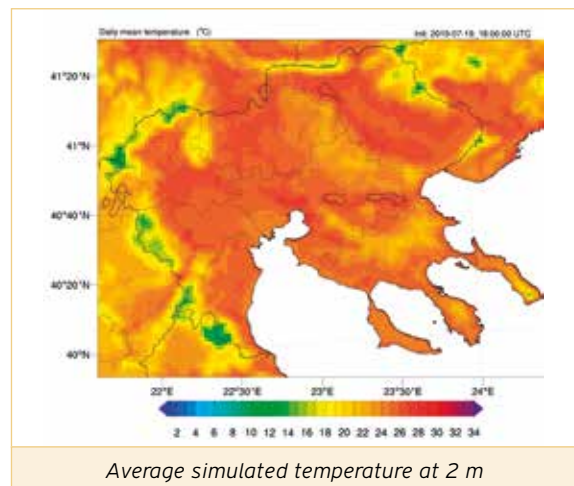
THE BENEFITS OF INTERNATIONAL COOPERATION

The engagement and active involvement of key stakeholders from academia and mosquito control from Germany and Greece resulted in the exchange of knowledge and new methodologies for risk prediction between the two countries with different epidemiological settings: Greece, heavily affected by WNV, and Germany, with USUV circulation and recent emergence of human cases of WNV infection. This exchange of experience was of great help for the public health.

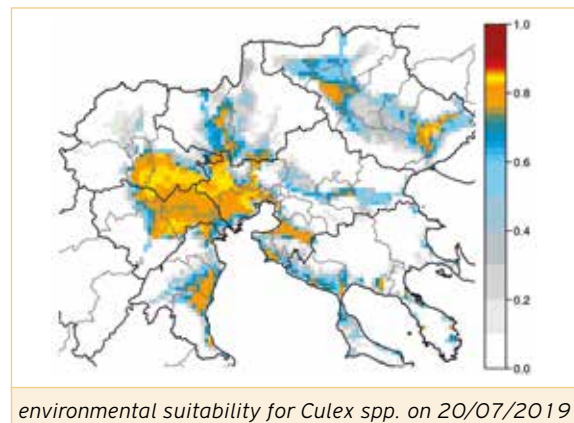


Mosquito adult trap with CO₂ supply

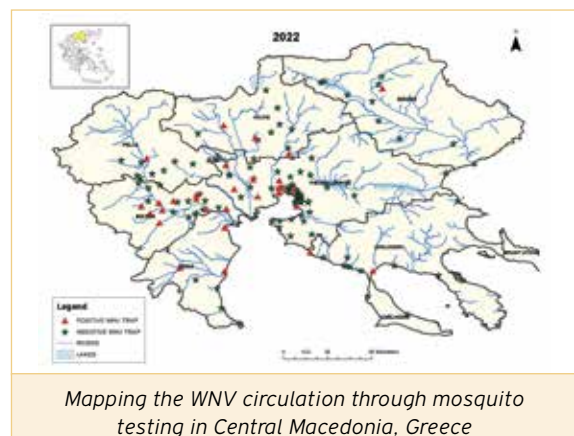
INSIGHTS



Average simulated temperature at 2 m



environmental suitability for Culex spp. on 20/07/2019



Mapping the WNV circulation through mosquito testing in Central Macedonia, Greece



- GG-CO₂ -

CO₂ separations by using mixed matrix, based on nano-carbon materials, membranes

INFO BOX

Project title

GG-CO₂ - CO₂ separations by using mixed matrix, based on nano-carbon materials, membranes

Funding amount

(from both countries)

710.038,00 €

Project duration

29/05/2018 – 28/11/2021

Partner Institutions

Institute of Nanoscience and Nanotechnology (National Center for Scientific Research)

ADVISE Ltd

Cologne University of Applied Sciences

FutureCarbon GmbH

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GG-CO₂ WEB Link:

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WHAT WE DID!

A new green technology for the fabrication of CO₂ selective mixed matrix membranes employing cheap carbon-based nanomaterials was established introducing, in parallel, a novel membrane module, as a smart and versatile tool for the investigation of membrane's workability.

CO₂/CH₄ and He/N₂ selectivities up to 82 and 20, respectively with CO₂ and He 3 and 2.7 GPU, respectively were achieved under real binary gas mixture conditions at 1.3 bar(a) at room298K.

PROJECT GOALS

By reducing the emission of CO₂ into the atmosphere, and by switching to an alternative power generation with zero-emission, it is possible to prevent future catastrophic effects. Thus, CO₂ can be captured using a liquid solvent or other separation methods. Indeed, there are three methods of CO₂ capture: pre-combustion carbon capture (through fuel gasification with oxygen), post-combustion carbon capture (CO₂ capture from flue gas i.e., separation from N₂, CO₂ separation from fuel i.e., separation from CH₄ in natural gas) and the oxy-combustion carbon capture method (separation CO₂ generated during the oxy-combustion process using an oxygen gas turbine).

In recent years, these gas separations are achieved with polymeric membranes competing satisfactorily with well-established separation processes. However, the gas separation performance of polymeric membranes is frequently restricted by Robeson's trade-off upper bound. Hereafter, nanoporous carbon-based nanofillers are incorporated into polymer, which subsequently can provide an increase in selectivity and permeability simultaneously. On the other hand, high-pressure operation leads to membrane plasticization. Therefore, the necessity for the development of a new generation of CO₂ selective membranes by using green chemistry and at the same time the development of a novel smart tool for the in-situ characterization/optimization of the membrane gas separation performance emerged.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

Theoretical and practical knowledge was obtained and the measurement method of swelling phenomena of polymeric mixed matrix membranes was systematically studied.

Firstly, we proposed a new green technology (by using green solvents) for the fabrication of CO₂ selective mixed matrix membranes following the directions of green chemistry and sustainability regarding the membranes preparation. This turn towards green solvents is crucial, as the use of traditional toxic organic solvents induces the increase of the waste solvents burden constituting a highly impact risk for the environment and the human health.

Furthermore, we provided new experimental data and a novel tool (prototype module) for yielding the evaluation/testing of the membranes "smarter".

The novel membrane module and experimental data of employing the membrane characterization technique was described and presented in details in our upcoming patent, journal papers and international conferences.

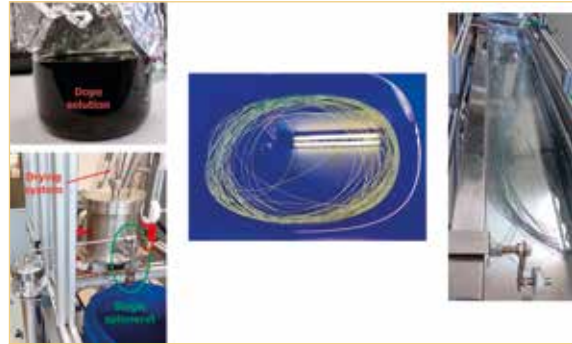
THE BENEFITS OF INTERNATIONAL COOPERATION

International collaboration enables researchers to access additional, often specific, expertise, gain new perspectives on research and build relationships with others in the field, which for early-stage researchers can be crucial for career development. This harmonic and flawless cooperation between GG-CO₂ project led to patent (impending) and journal papers publications and international conferences presentations.

Moreover, research collaboration may provide opportunities for investigators to learn how approaches from complementary disciplines may be applied to existing problems and lead to the development of innovative solutions. This may occur when discussions among colleagues stimulate and inspire new and novel ideas.

Overall, collaboration during GG-CO₂ project encouraged the establishment of effective communication and partnerships between all partners. This accelerating joint progress through collaboration was more valuable, as global warming and CO₂ capture/separation are global public problems.

INSIGHTS



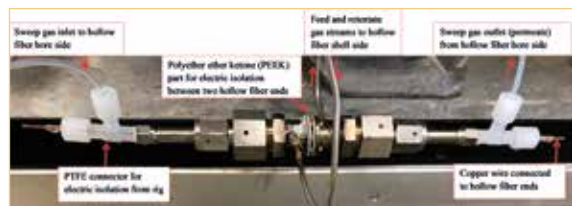
Mixed matrix hollow fiber membrane process (in details: the facile homemade drying system of the polymeric solution and the single spinneret connection)



Characteristic images depicted the total process of hollow fiber membranes fabrication (initial solution to final product)



Mixed matrix hollow fiber membranes process steps: from dope solution to developed hollow fibers mounted on a PVC module



Special module for combined gas separation – impedance spectroscopy measurements on hollow fiber membranes



- ILLIAS -

Injection Locked Mid-Infrared Interband Cascade Laser based gas sensor

INFO BOX

Project title

ILLIAS - Injection Locked Mid-Infrared Interband Cascade Laser based gas sensor

Funding amount

(from both countries)

682.443,00 €

Project duration

29/05/2018 – 28/05/2022

Partner Institutions

Technical University of Darmstadt (TUD)

NanoPlus GmbH

National and Kapodestrian University of Athens

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WHAT WE DID!

Detection of different types of gases is of paramount importance in a broad range of human activities, starting from everyday life (detection of natural gas leaks, explosive gases, etc.) and extending to a large number of industrial applications, safety, security, as well as health related applications.

In the project we developed a new type of optical gas sensor with similar performance to the existing ones but at potentially much lower cost and smaller footprint and appropriate for photonic integration schemes.

PROJECT GOALS

The ultimate goal of the project was to study and prove theoretically and experimentally that the proposed gas detection technique (i.e use an optically coupled pair of specific semiconductor lasers instead of a laser and a conventional detector at the Mid- Infrared part of the spectrum) is feasible and exhibits similar performance with the conventional techniques. In more detail, the objectives of the project activities included theoretical/numerical investigations, experimental study and building and testing a final gas sensor prototype.

The German partners were involved in part to the theory and simulation and experimental investigation (TUD) and development and provision of the special semiconductor lasers (Nanoplus). The Greek partners were involved in detailed study and simulation of different architectures, experimental investigation and prototype development (NKUA) and evaluation and testing (PPC).



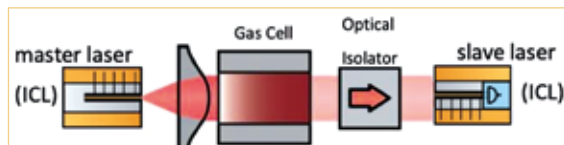
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

The goal of the project has been achieved. We proposed, implemented and evaluated different architectures of our concept and proved that it is possible to replace the bulky and expensive conventional MCT detector used in the existing optical gas detectors at Mid-Infrared wavelengths with a second diode laser optically coupled to the first one. The obtained results pave the way to the implementation of compact and low-cost gas detectors using specific laser diode pair arrangements with an obvious economic impact. Moreover, the broader availability of such detectors will largely increase the installation base with an obvious impact to the safety and security of the people.

THE BENEFITS OF INTERNATIONAL COOPERATION

The implementation of the project would be infeasible without the collaboration of partners from the two countries. The German part provided the specific semiconductor lasers (Interband Cascade Lasers emitting at Mid-Infrared) by Nanoplus. Also, a first experimental setup was built by the TUD group. The Greek side developed the detailed numerical models and calculated the crucial parameters needed for the final experimental demonstration and prototype development (NKUA), while evaluating the prototype (PPC). Continuation of the collaboration would be highly beneficial for both sides, whereas the exchange of experience between the groups was of significant importance for both sides.

INSIGHTS



Schematic of the detection principle studied in the project. Consists of a master laser as an optical source and a slave laser used as detector by monitoring the voltage at its terminals



The optical / optoelectronic unit of the prototype consisting of the two lasers properly mounted and temp. stabilized and the gas cell in between



The prototype consisting of the optical / optoelectronic unit and the control and data acquisition system on the left



- INNOMSME -

On the INNOvativeness of Micro, Small and Medium Sized Enterprises in Greece and Germany

INFO BOX

Project title

INNOMSME - On the INNOvativeness of Micro, Small and Medium Sized Enterprises in Greece and Germany

Funding amount

(from both countries)

669.427,00 €

Project duration

29/05/2018 – 28/05/2022

Partner Institutions

Foundation for Economic and Industrial Research (IOBE)

German Institute for Economic Research (DIW Berlin)

Crowd Policy

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WHAT WE DID!

We analyzed the innovation potential of German and Greek firms, and especially the factors that drive micro- and small-sized firms to engage in innovation activities which in turn can enhance their productivity and growth performance.

PROJECT GOALS

- To explore the link between R&D, innovation, and productivity of German service sector firms and of Greek manufacturing firms during the prolonged crisis by comparing small vs. large firms
- To identify the driving forces of fast-growing firms (the so-called “gazelles”) with a special emphasis on the impact of innovation activities
- To examine intangible capital, also referred to as Knowledge-Based Capital, and how investments in this form of capital affect the SME performance
- To investigate the knowledge diffusion in the wider economy from small knowledge-intensive firms operating in the creative industries
- To examine what drives SMEs to reach the productivity frontier
- To identify common trends and/or differences between Greek and German firms in issues related to their innovation considering the role of crisis
- To provide policy and managerial implications expected to support the competitiveness of Greek and German small-sized firms.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

Our main findings indicate that:

- The link between the three aspects involving innovative activities-R&D, innovative output, and productivity-emerges also for knowledge- intensive services (KIS), with the firm size advantage of large firms that is found for manufacturing almost disappearing in KIS
- However, the continuation of the crisis is harmful for the linkages between R&D - innovation - productivity of smaller firms
- Adopting a geographical and product diversification strategy and taking advantage of R&D capabilities to foster small firms to grow fast
- Various individual factors (such as the personality or the motivation of the firm owners), as well as higher investment in ICT-related intangibles, favor substantially the rapid growth of MSMEs
- The innovation output of creative small-sized firms constitutes a crucial input for the innovativeness of their business clients from other (creative or non-creative) industries
- R&D collaborations and qualified human capital drive SMEs to reach the productivity frontier
- In many European countries, over almost two decades, professional services suffered a dramatic decline in productivity of up to 40 percent.

THE BENEFITS OF INTERNATIONAL COOPERATION

- At the personal level: German and Greek researchers benefitted greatly from the mutual exchange and the specialized knowledge on both sides at the theoretical, institutional and econometric level
- At the methodological level: By jointly developing statistical approaches and by applying identical codes, we ensured the compatibility of results, even when using official data that cannot be merged for legal reasons
- At the topic level: Through joint analysis of the innovativeness of Greek and German MSMEs and comparisons of results, we were better able to identify different drivers of growth, preventing, thus, a “one fits all” fallacy, with policy measures that worked well in one country being simply promoted in another.

INSIGHTS

INNOMSME
data collaboration platform for MSMEs

ΣΥΜΜΕΤΟΧΗ ΣΤΗΝ ΕΡΕΥΝΑ

www.innomsme.gr
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ΕΤΑΙΡΟΙ

www.crowdpolicy.com www.jobbe.gr www.diw.de/en

Έργο στο πλαίσιο της δράσης Εθνικής Εμβέλειας «Διμερείς και Πολυμερείς Ε&Τ Συνεργασίες», Διμερείς και Πολυμερείς Ε&Τ Συνεργασία Ελλάδας Γερμανίας (ΕΠΑΝΕΚ, ΓΓΕΤ)

ΣΥΜΜΕΤΟΧΗ ΣΤΗΝ ΕΡΕΥΝΑ

INNOMSME
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ΤΟ ΠΡΟΪΓΝΩΜΟ

Η νέα ανακάλυψη της μεσοαμερικανικής και της βόρειας ευρωπαϊκής οικονομίας... Η μεσοαμερικανική οικονομία... Η βόρεια ευρωπαϊκή οικονομία...

ΟΒΣΑΩΜΕΝΟΙ

Η μεσοαμερικανική οικονομία... Η βόρεια ευρωπαϊκή οικονομία... Η μεσοαμερικανική οικονομία...

ΕΤΩΣΕΙΣ

Η μεσοαμερικανική οικονομία... Η βόρεια ευρωπαϊκή οικονομία... Η μεσοαμερικανική οικονομία...



- INVIVO -

Inspection and visualization of vehicles in motion based on optical 3D-metrology and embedded Vision for an innovative fleet monitoring and turnaround management

INFO BOX

Project title

INVIVO - Inspection and visualization of vehicles in motion based on optical 3D-metrology and embedded Vision for an innovative fleet monitoring and turnaround management

Funding amount

(from both countries)

646.553,00 €

Project duration

01/05/2018 – 31/01/2021

Partner Institutions

iKnowHow Informatics S.A.
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Fraunhofer Institute for
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INVIVO WEB Link:

www.invivo-project.eu

WHAT WE DID!

We built a 3D scanner system equipped with multiple high-resolution sensors and lighting that can document the status of vehicles passing through and can be used by car rental and fleet management companies. The system is able to track the current status with previous ones from multiple-site installations using a graphical cloud interface.

PROJECT GOALS

The project aims at proposing a new inspection and visualization system of vehicles motion, which is based on embedded vision in order to realize an innovative fleet monitoring and car rental return management. Multiple cameras and 3D sensors will be integrated on a prototype scanner system with intelligent lighting and data processing technologies will be developed. The system will cover a broad spectrum of requirements for an objective tracking of time, place and extent of vehicle defaults.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

A mechanical scanner prototype that supports a network of multiple sensors has been tested in a real-time environment. An autonomous illumination system has been developed in order to control the specularity of the vehicles and increase image quality. The vehicles are digitalized using low cost sensors and accelerated data processing algorithms using machine learning. For the visualization and inspection of results, a cloud platform has been developed and a portable software solution is provided for typical desktop application or touch screen version.

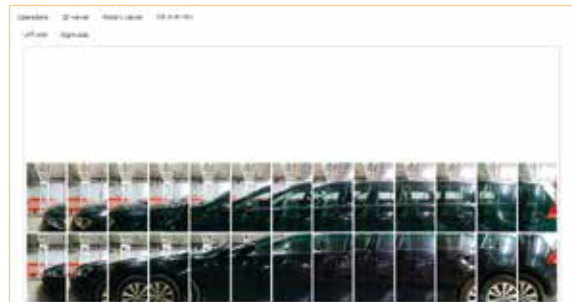
THE BENEFITS OF INTERNATIONAL COOPERATION

An important first step for the project was to define the market-driven requirements needed for the business case and how technology solutions can be efficiently applied. For this, we used the large experience of the project partners with dedicated expertise in multi discipline areas of science and technology. International partners provided the knowledge and experience for machine vision solutions using smart sensors and hardware platforms and also provided experience on how to connect research and development with manufacturing industry from international scene. The partners were given the opportunity, through the project, to share with each other the knowledge on their fields and work together to firstly design and build a system that integrates multiple technologies, overcome development problems quickly with efficient solutions, test it in real-time environment and lastly to examine channels on how to enter international market.

INSIGHTS



The INVIVO system comprises multiple cameras, lighting and a scanning frame.



The vehicle is scanned while passing through INVIVO system.



The 3D models of the vehicles are created through the digitalization process.



The user can visualize the results, inspect the surface and annotate damages using a portable solution or a cloud interface



- MetroHESS -

Hybrid Energy Storage System for the Utilization of Regenerative Braking Energy in Metro stations

INFO BOX

Project title

MetroHESS - Hybrid Energy Storage System for the Utilization of Regenerative Braking Energy in Metro stations

Funding amount

(from both countries)
822.224,00 €

Project duration

20/07/2018 – 19/01/2022

Partner Institutions

Centre for Renewable Energy Sources & Saving (CRES)

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www.metrohess-project.eu

WHAT WE DID!

Within the framework of the MetroHESS project, we developed a Hybrid Energy Storage System designed to harness train braking regenerated energy, store it and reuse it in stationary electrical loads of Metro stations. As a result, this energy storage system allows Metro operators to benefit from significant energy and cost savings, while reducing their environmental impact considerably.

PROJECT GOALS

The primary project goal has been the development of a Hybrid Energy Storage System that would utilize the energy from the regenerative braking in Athens Metro trains to cover auxiliary loads of electromechanical systems in Metro stations, such as lighting, escalators, elevators and other base loads.

Up until now, a large amount of this energy remains unused and is released as heat to the environment.



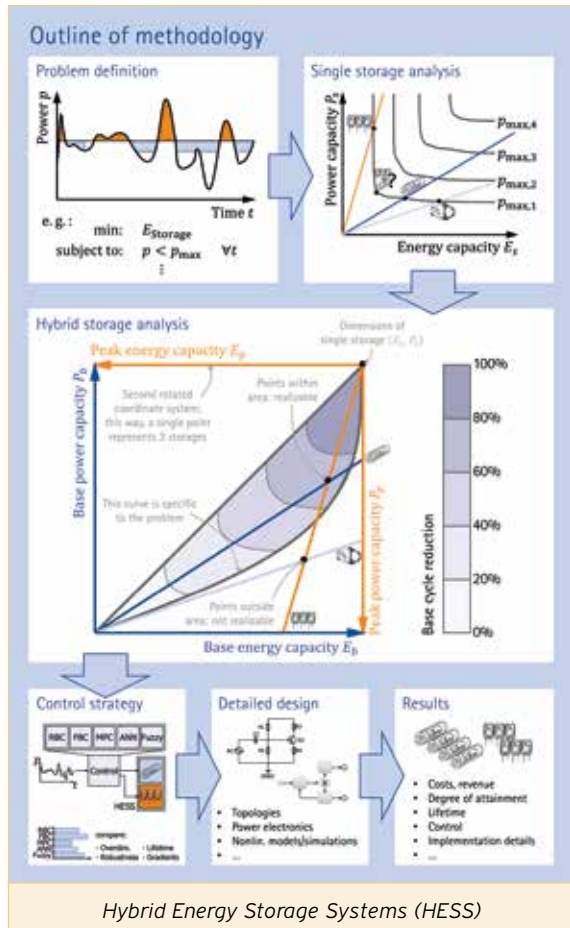
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- Reduction of the energy consumption of selected metro stations, since part of their base loads will be covered by the energy stored in the Hybrid Energy Storage System.
- Reduced local temperature outbursts in metro Platforms, since non-utilized regenerative braking Energy will not be transformed into heat via Resistors placed on the train traction system
- Significant reduction of electricity cost for the Metro Operator
- Reduced environmental impact of the Metro operations
- According to the MetroHESS results, the hybrid energy storage system implementation in the Athens metro could utilize 30% of the regenerative braking energy produced, covering the energy needs of metro stations at a rate of 90%.

THE BENEFITS OF INTERNATIONAL COOPERATION

The project managed to effectively use the diversified expertise of the project partners, bringing added value to the consortium. The German partners provided expertise in power electronics and energy storage design. The Greek partners provided measurement data from metro stations, operating trains and rectifier substations, while specifying technical specifications and operational requirements and constraints, as well as providing of a test-bed for the storage system in real-life conditions.

INSIGHTS



During the project meeting in Hannover



- NAMED -

Development of NAnotechnology-enabled “next-generation” MEmbranes and their applications in Low-Energy, zero liquid discharge Desalination membrane systems

INFO BOX**Project title**

NAMED - Development of NAnotechnology-enabled “next-generation” MEmbranes and their applications in Low-Energy, zero liquid discharge Desalination membrane systems

Funding amount

(from both countries)
678.129,00 €

Project duration

01/03/2018 – 29/11/2022

Partner Institutions

International Hellenic University

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NAMED WEB Link:

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WHAT WE DID!

New membranes suitable for forward osmosis (FO) were prepared and a lab-pilot, powered by photovoltaic, was developed. This desalination system works with zero liquid discharge (ZLD) and low energy consumption. Nanobubbles (NBs) technology was introduced.

More specifically

A lab-scale Nanofiltration, Forward Osmosis, and Membrane Distillation (NF-FO-MD) pilot, powered by photovoltaics, has been developed and operated to achieve Zero Liquid Discharge (ZLD) conditions. NBs have been deployed to enhance mass transfer. In addition, the partner ECOTECH has developed a second, small NF/FO unit. The NAMED technology has been compared with other desalination systems and a feasibility study has been prepared.

PROJECT GOALS

- To prepare NF, FO and MD membranes.
 - To develop a pilot unit powered by solar energy.
 - To demonstrate a zero liquid discharge.
 - To demonstrate the effectiveness of using of NBs.
 - To prepare a feasibility study.
- The effectiveness of combinations of NF, FO and MD membranes in two pilot units is demonstrated.
 - The energy efficiency of the system is enhanced by using photovoltaics.
 - The use of NBs: i) accelerate the process, ii) improve the result, and iii) clean the membranes.
 - By feeding back the discharge salt to the draw solution, ZLD is achieved.
 - The NAMED methodology was compared with RO and FO/RO methodologies.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

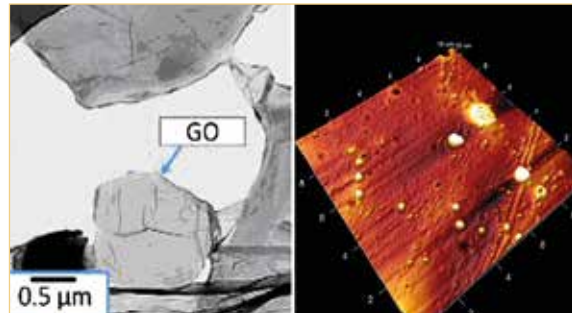
- Single-layer graphene oxide was produced by using the Hummers method. Thin non-porous polymeric membranes based on polymer intrinsic microporosity were developed (Pic. 1).
- A pilot unit is constructed. (Pic. 2)
- NBs accelerate the process by 34%, improve the result by 10%, and clean the membranes (Pic. 3).
- Operation expenditure (OPEX) for FO desalination of 1L saline water is 2.8W, plus 134W for distillation, whereas for RO it is 21.7W. The use of solar energy is therefore a must in order for FO to become competitive to RO.
- Capital expenditure (CAPEX) is for NF 45\$/m², FO 1,000\$/m², and MD \$100/m², whereas a solar heating boiler is much cheaper than a photovoltaic system.

Addressing the water scarcity problem, by developing and demonstrating more efficient, less energy consuming, low fouling, ZLD desalination systems.

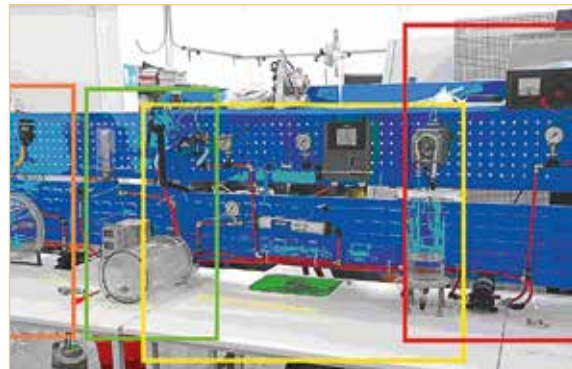
THE BENEFITS OF INTERNATIONAL COOPERATION

- To enhance synergies among complementary German and Greek research groups and minimize duplication in developing "next-generation" membranes and low-energy demand, ZLD innovative desalination systems.
- To develop novel desalination systems based on combinations of novel membranes and replace the high energy demand for RO desalination systems.
- To set the foundation for collaboration for further development of the NAMED technology.
- The project's added value stems from scientific discoveries, as they lead to the development of a cost-effective process for desalination and wastewater treatment.

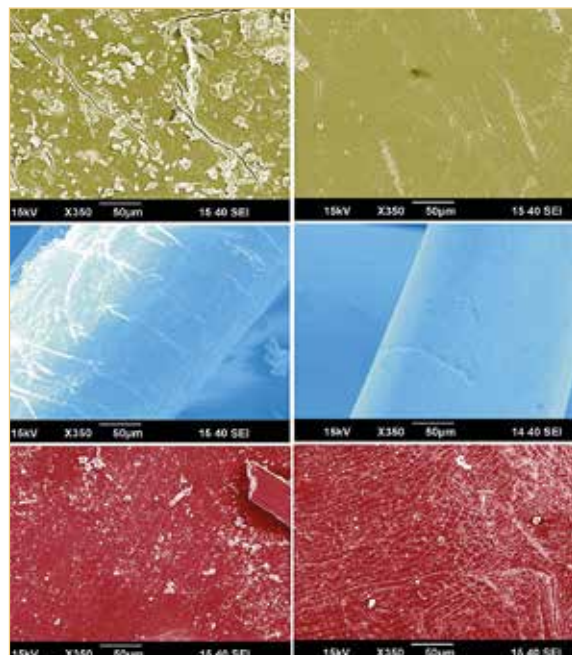
INSIGHTS



Picture 1: Left: single-layer GO (TEM) Right: AFM on poly-mer non-porous membrane



Picture 2: Forward osmosis lab pilot unit. Frames from left to right: Orange: brackish water reservoir, green: NB pre-treatment and NF, yellow: FO, and red: MD and draw solution circulation



Picture 3: Effect of NBs on cleaning membrane after im-mersing them in sea water. Left column loaded with sea salts and right column cleaned. Top: NF; middle: FO; and bottom: MD



- NANOFUM -

Development of carbon nanotube-based wireless gas sensors and applications in stored product protection and food safety

INFO BOX

Project title

NANOFUM - Development of carbon nanotube-based wireless gas sensors and applications in stored product protection and food safety

Funding amount

(from both countries)
712.906,00 €

Project duration

04/03/2017 – 28/11/2021

Partner Institutions

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WHAT WE DID!

NANOFUM designed highly evolved, smart gas sensors and cloud-based tools, to address specific safety challenges in sanitation and protection of stored products and especially foods.

PROJECT GOALS

NANOFUM aimed to promote the use of new technologies developments with the design of a sensor device and system for achieving real time monitoring and traceability of fumigants and other gases in stored products, with the goal of fully controlling product conditions and risk of infestation.

NANOFUM proposed a technology that can be a game changer in the stored product environment enabling real time cloud-based monitoring with efficient sensors that can be placed in different locations previously not possible e.g. packaging of grains.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

For thousands of years, stored product insects have been a problem associated with product storage. There is a need to protect stored commodities to reduce losses at the post-harvest stages. For the control of stored product insects, the main measure is fumigation with gases such as phosphine. Recently phosphine was approved for the disinfestation of several other major commodities e.g. fruits and vegetables. Two are the main important reasons for the continuous use of phosphine- the development of resistance and poor sealing. Currently, the only use to measure phosphine are external measurement devices. NANOFUM developed a sensor sensitive to phosphine, which can provide phosphine concentration in real time during a treatment.

All data was provided through mobile friendly cloud apps. Moreover, NANOFUM has evaluated the sensors in “real world” and semi fields conditions against major stored product insects and found in most cases complete mortality of different stored product species. NANOFUM project has published 7 papers and participated in 12 national and international conferences.

THE BENEFITS OF INTERNATIONAL COOPERATION

There are several advantages when partners of different countries are working together. Each partner had qualified personnel to work for the project and mutual skills were shared. Moreover, companies and universities cooperated closely to support the project and find wider markets for the new development of the project, the sensor.

INSIGHTS



Sensors cloud platform



Sensors developed



Sensors in “real world” application



- PrintPero -

Printed Perovskite Modules for Building Integrated Photovoltaics

INFO BOX

Project title

PrintPero - Printed Perovskite Modules for Building Integrated Photovoltaics

Funding amount

(from both countries)

820.325,00 €

Project duration

01/03/2018 – 31/12/2022

Partner Institutions

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WHAT WE DID!

Perovskite solar cells (PSC) are the most promising technology for next generation high efficiency and low-cost solar panels. In contrast to other glass-based and flexible type module PV prototypes, our carbon-based perovskite solar cell structure and inkjet printing for material deposition gives us a distinct competitive advantage in terms of flexibility by supplying efficient panels of different sizes in a market, such as BIPV, while the whole process is made by printing methods at ambient conditions.

PROJECT GOALS

The project goals that were all achieved are summarized to:

- The development of inkjet printable nanoparticle - based inks for solar cell construction
- Film morphology and interface engineering for optimized process to achieve high-efficiency all - printed PSCs at lab-scale
- Demonstration of translucency via printing discontinued layers
- Series interconnection of the PSCs to form a high - voltage module (~400 cm²)
- Encapsulation of the module for protection against moisture-induced degradation.



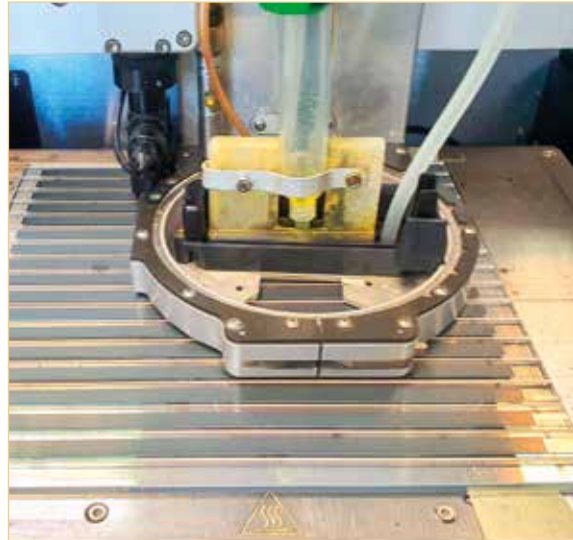
SPECIFIC RESULTS AND IMPACT OF THE MEASURE

The project collaboration led to the creation of PVs from perovskite in large dimensions with the use of inkjet printing technique. The project goals were achieved, as the research team was able to present prototypes of PV from perovskite in the dimension of 20x20 cm². BRITE, as partner company, acquired significant expertise in this emerging technology with the cooperation of other partners, while an efficient PV array was made of perovskite with printing methods under fully uncontrolled environment (i.e. humidity, temperature, inert atmosphere, etc.). This method guarantees that this practice can eventually lead to a product that requires minimal investment for its implementation, contrary to what has been suggested by other research teams that refer to conditions of fully controlled atmosphere. Many foreign material companies have already expressed their interest in cooperating with Brite.

THE BENEFITS OF INTERNATIONAL COOPERATION

The cooperation of the partners involved in this proposal was definitely essential to deliver the stated scientific objectives. For BRITE, one of the few SMEs worldwide developing products based on DSSCs, PSCs is the next logical step that can provide their solar windows with a significant boost in conversion efficiency. Sunovation has successfully brought to the market BIPV facades and rooftops based on silicon solar cells. However, they have identified PSCs as a key enabler for the development of new generation products with greater flexibility in terms of translucency, shape, colour and uniformity of appearance, as well as lower manufacturing cost. Both SMEs, though, currently lack the expertise on PSCs and they can benefit from the collaboration with the academic partners who are active in this field of research and have the necessary knowledge base to develop the technology further.

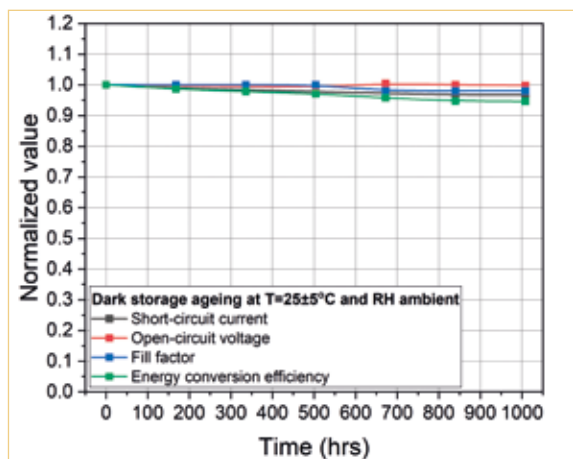
INSIGHTS



*Inkjet printing stage of perovskite solar module
(left corner: microscopy analysis
of perovskite material)*



High efficient perovskite solar module



*Stability performance over time of main
photovoltaic parameters for perovskite
solar module*



- PROMETHEUS -

Proton and oxygen co-ionic conductors for CO₂/H₂O co-electrolysis and intermittent RES conversion to methanol and other chemicals towards EU sustainability

INFO BOX

Project title

PROMETHEUS - Proton and oxygen co-ionic conductors for CO₂/H₂O co-electrolysis and intermittent RES conversion to methanol and other chemicals towards EU sustainability

Funding amount

(from both countries)

685.883,00 €

Project duration

01/04/2018 – 30/09/2021

Partner Institutions

Forschungszentrum Jülich GmbH

WZR ceramic solutions GmbH

Aristotle University of Thessaloniki

Hellenic Petroleum Renewable Energy Sources S.A.

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WHAT WE DID!

In the PROMETHEUS project we studied the application of co-ionic (H⁺ and O²⁻) electrochemical membrane reactors (ci-EMRs) for the H₂O/CO₂ co-electrolysis. It is used to efficiently convert / store surplus intermittent renewable power into synthetic e-fuels from atmospheric or industrial CO₂. The targeted products were methanol (MeOH), methane (CH₄) and synthesis gas (CO + H₂).

PROJECT GOALS

The project goals can be divided into 4 subtopics.

Materials: Development and synthesis of promising ceramic materials. Optimization of the materials regarding H⁺ and O²⁻ conductivity.

ci-EMR: Cost effective fabrication of cells using sequential tape-casting and additive manufacturing methods.

Modelling: Microkinetic modelling of the electrochemical reactions. Integrated model for electrochemical cells. Macroscopic balances of mass, momentum, energy and electrical current.

System analysis: Technical and economic life cycle assessment of the whole processes for synthesis of methanol, methane and synthesis gas.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

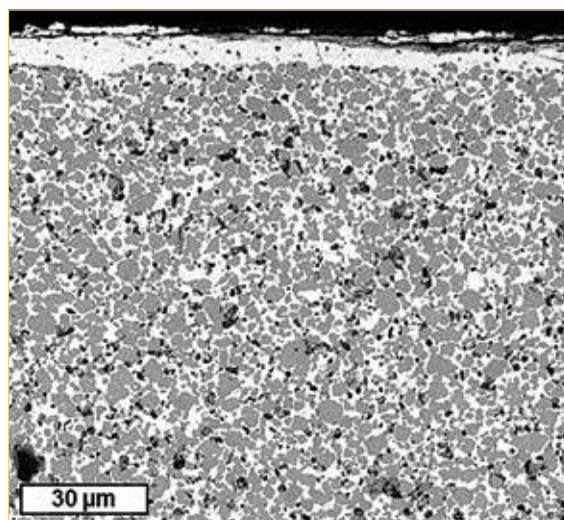
Membrane layers were fabricated at Forschungszentrum Jülich using tape-casting, while WZR undertook the 3D printing. A new process, 3D screen printing was successfully established for the fabrication of MgO substrates with a diameter of 50 mm. Catalysts were successfully introduced into the porous support structure by the Greek partners of AUTH. Performance tests were able to show basic operation. Thermodynamic and electrochemical calculations were also carried out at AUTH based on the reaction equations, which will allow to define the optimal conditions in case of a later operation. Additionally, a workshop entitled "High Temperature Membrane Reactors and their Potential Applications" was successfully held in September 2021.

THE BENEFITS OF INTERNATIONAL COOPERATION

Chemists, material scientists, physicists and engineers worked closely together in the project. The consortium included the university partner AUTH, the Helmholtz Centre Forschungszentrum Jülich GmbH, the two industrial partners Hellenic Petroleum Renewable Energy Sources S.A. and WZR ceramic solutions GmbH. The different competences of the institutions complement each other optimally. The Forschungszentrum Jülich group has experience in the field of ceramic materials and manufacturing processes, which is supported by comprehensive experimental characterisation methods. This competence is supported by the expertise of industrial-scale component manufacturing using additive manufacturing from WZR ceramic solutions GmbH. AUTH, GR is known worldwide in the field of chemical engineering and electrochemistry.

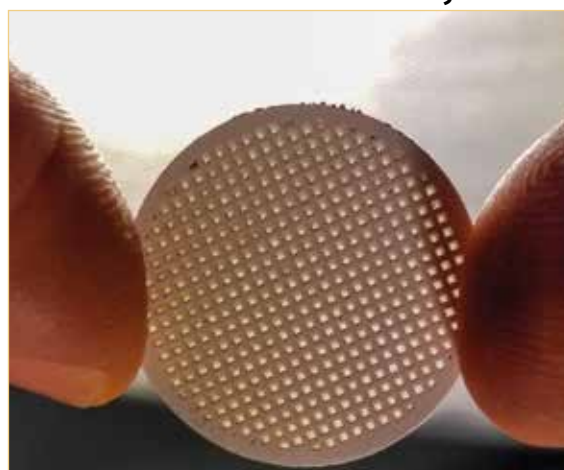
INSIGHTS

Membrane reactor cell



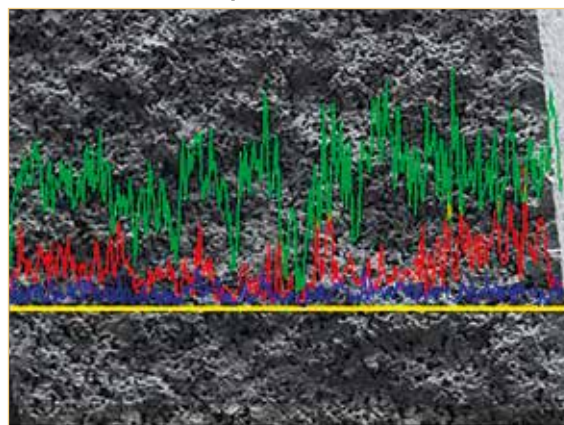
Cross section of a H⁺ conducting cell after heat treatment at 1500 °C for 3 h

Additive manufacturing



MgO support manufactured by 3D-screen printing

Catalyst infiltration



Infiltration of porous support structure with Co-catalyst



- SCoSCo - Solar Collectors with Static Concentrators, for solar thermal applications at intermediate to medium temperatures

INFO BOX

Project title

SCoSCo - Solar Collectors with Static Concentrators, for solar thermal applications at intermediate to medium temperatures

Funding amount

(from both countries)
669.681,00 €

Project duration

29/05/2018 – 22/04/2022

Partner Institutions

University of Patras
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Solar-Institut Jülich
Hilger GmbH
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WHAT WE DID!

An innovative solar concentrating thermal system operating at intermediate to medium temperatures is proposed. The proposed system concentrates the solar radiation to the receiver using a micro-mirror array.

PROJECT GOALS

To study, construct and test a prototype concentrating solar thermal collector for medium and intermediate temperatures that:

- has a point-focusing feature allowing high concentration rates of ~50, even with relatively large optical and tracking errors
- and
- instead of an expensive vacuum receiver tube, a small non-evacuated flat-plate receiver can be used.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

Development of a new concept of concentrating thermal solar collector able to achieve high concentration ratios and use a flat plate receiver, leading to a low-cost and market competitive product.

THE BENEFITS OF INTERNATIONAL COOPERATION

The added value of the cooperation for the project and for the partners is that it enabled the exchange of ideas and specific practices related to the development, construction and testing of the suggested system.

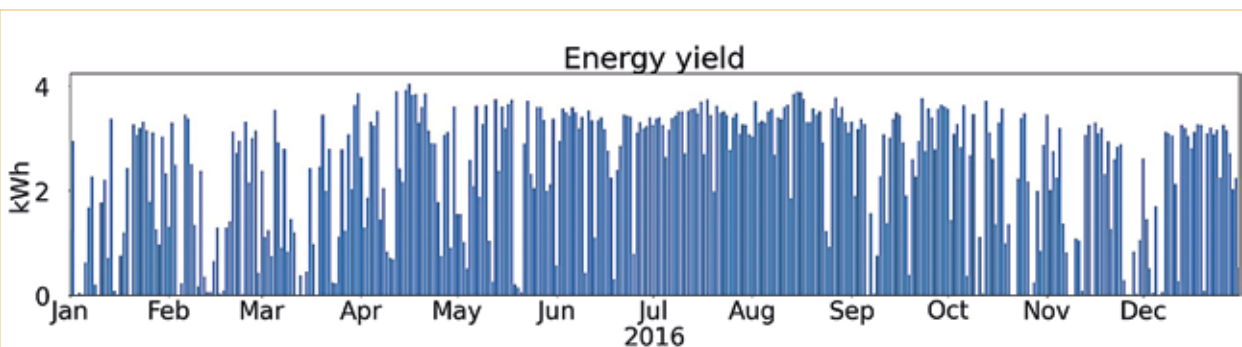
INSIGHTS



Prototype solar collector



Absorber with concentrated sun rays



Estimated annual energy yield



- Siphnos and Beyond - Ancient strategies of land use in a diachronic perspective and their impact for modern infrastructure concepts

INFO BOX

Project title

Siphnos and Beyond - Ancient strategies of land use in a diachronic perspective and their impact for modern infrastructure concepts

Funding amount

(from both countries)

558.011,00 €

Project duration

19/07/2018 – 31/12/2022

Partner Institutions

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of Cyclades

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WHAT WE DID!

A Greek-German cooperation, in the framework of which we conducted intensive archaeological field research on SW Siphnos, and especially the area between the bay of Vathy and the port of Kamares, which still retains its natural and man-made environment largely intact.

PROJECT GOALS

The program focuses on the rich in archaeological remains area that extends from the bay of Vathy to the port of Kamares and attempts to the systematic documentation of the antiquities of this part of the island in a diachronic perspective, from prehistoric to Byzantine times. The systematization of the archaeological knowledge of the island and its enrichment with new data, as a product of the field research in the framework of the program, constitutes one of the main objectives/axes of the program. This documentation is expected to provide conclusions over long periods of time with regard to the land use, road systems, settlement clusters, as well as the management of natural resources.

As part of the project, two PhD theses were conducted at the Universities of Jena and Ioannina respectively. Both studies aim to grasp diachronic land use patterns that may provide solutions to modern infrastructure planning, with a focus on sustainability and sustainable development.

At the same time, a database of the archaeological sites of Siphnos was updated, necessary for the development of a mobile multimedia augmented reality application. The application includes interactive panoramic tours, aerial photographs, images of finds, as well as 3D models of selected monuments.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

- Two PhD theses (Mycenaean acropolis of tis Baronas to Froudi; ancient towers of Siphnos and their environment).
- Surface surveys at the acropolis of tis Baronas to Froudi and the further area, between the bay of Vathy and the settlement of Mavro Chorio.
- A mobile multimedia augmented reality application.
- An archaeological exhibition related to the results of the program.
- A two-day symposium about archaeology of Siphnos and the islands of the Cyclades in general. Publication of the proceedings of the symposium.
- A new catalogue of the towers of Siphnos.

THE BENEFITS OF INTERNATIONAL COOPERATION

Through the international cooperation and the different theoretical and methodological approaches, we were able to document, enlarge and update our knowledge about the antiquities of this specific area of Siphnos island.

The program sensitized all members of the project, on both the Greek and the German side, to the different scientific traditions, as well as to the concrete requirements of local archaeological and communal institutions.

It also served to create public awareness for the preservation of common cultural heritage within archaeology. On the other hand, the tourism industry benefits greatly from transferring its results into society.

INSIGHTS



The Greek and German colleagues at the acropolis of tis Baronas to Froudi



The Greek team carrying out survey at the acropolis tis Baronas to Froudi



The German team documenting the ancient towers of Siphnos



- SIT4Energy -

Smart IT for Energy Efficiency and Integrated Demand Management

INFO BOX

Project title

SIT4Energy - Smart IT for Energy Efficiency and Integrated Demand Management

Funding amount

(from both countries)
759.594.00 €

Project duration

01/06/2018 – 31/07/2021

Partner Institutions

Centre for Research and Technology, Hellas
Information Technology for Market Leadership, solutions for energy-efficient and high-performance (ITML)
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Stadtwerke Hassfurt GmbH

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SIT4Energy WEB Link:

www.sit4energy.eu

WHAT WE DID!

The goal of the project is to demonstrate how integrated energy management for prosumer scenarios can be realized through a smart IT solution that considers both efficiency potentials in the local energy production and consumption. The project provides visual analytics tools and recommendations for better management of energy consumption and production.

PROJECT GOALS

The main goals of SIT4Energy project are:

- Exploit micro-moments (idle times on mobile phones) in order to implement individualized energy-related strategies and recommendations
- Implement context-based mobile recommendation services towards advising end-users how to be more efficient
- Develop adaptive incentivisation and context-aware triggering services, in order to increase energy efficiency and change the behavior of the end-users
- Develop a smart analytics dashboard enabling energy management for both consumption and generation
- Validate a consumer-empowerment framework to trigger sustainable consumer/prosumer practices through their behavioral change.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

SIT4Energy develops two main tools:

- Smart Energy Dashboard to provide interactive visualizations to energy prosumers about their energy consumption and production as well as to provide recommendations on how to increase their self-sufficiency.
- Mobile Application to offer graphical representation to energy consumers about their energy consumption per selected timeframe or equipment category (i.e. light, HVAC or PC). Additionally, “adaptive incentive service”, “context - aware attention triggering service”, “micro-moments service” have been developed in order to support the above mentioned tools.

The impact of the project is:

- Integration with energy price tariffs
- Creation of cost-effective products
- Creation of knowledge intensive services
- Support the decision making process towards energy efficiency
- Low-energy and low-emission buildings.

THE BENEFITS OF INTERNATIONAL COOPERATION

- Understanding the common and different market needs of each country
- Understanding the difference in end-users' mentality from each country
- Developing an energy efficiency solution adapted to the needs of both countries
- Multidisciplinary cooperation among Greece and German partners
- Knowledge sharing among consortium partners;
- Close cooperation at all levels towards bringing the desired integrated technical solution and tested in real-life scenarios.

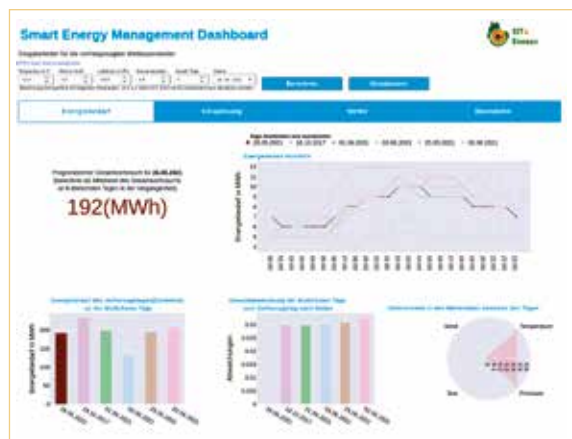
INSIGHTS



Pilot Sites



Mobile App



Smart Energy Management Dashboard



- SUNIES -

SUstainable and Novel fuel cell applications for Islands Energy Systems

INFO BOX

Project title

SUNIES - SUstainable and Novel fuel cell applications for Island Energy Systems

Funding amount

(from both countries)

635.376,00 €

Project duration

29/05/2018 – 28/12/2021

Partner Institutions

Centre for Research & Technology, Hellas (CERTH)

Public Power Corporation (PPC)

Gas-und Warme Institut Essen e.V. (GWI)

Mitsubishi Hitachi Power Systems Europe GmbH

Universität Duisburg Essen Lehrstuhl für Umweltverfahrenstechnik und Anlagentechnik (LUAT - DE and MHPSE)

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WHAT WE DID!

A 250 kW SOFC-MTG prototype (hybrid-SOFC system) was modeled and the model was optimized for covering the energy needs of non-interconnected islands (electricity, heat, refrigeration and drinking water). A techno-economic analysis revealed that a hybrid-SOFC system of 1 MW is a profitable investment based on current conditions. Comparing the conventional diesel engines with the SOFC system, a reduction of 75% in fuel cost was observed in the case of hybrid-SOFC use.

PROJECT GOALS

Greece's unique geographical location with its large number of islands provides excellent opportunities to identify island cases with certain energy profile demands. Main objective of SUNIES is to develop an integrated solution on poly-generation covering the specific needs of island systems (electricity, heat, refrigeration and drinking water). This can be achieved with the development of (a) a hybrid solid oxide fuel cell – micro-gas turbine (hybrid-SOFC system) and (b) a "Triple Cycle concept", a combination of a SOFC, a GT and a steam cycle (SOFC-GT-ST). Feasibility assessment of a solid oxide electrolysis cell (SOEC) towards hydrogen production and storage is also elaborated.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

Chios and Patmos were identified as the most suitable cases for hybrid-SOFC implementation. Chios, a typical case of a medium-size island with a small RES percentage of 5% and Patmos, a small-island with a higher RES of 15%.

Development of a simulation tool for evaluation of the different modes of operation. The simulation model was validated fairly well by the experimental data.

A techno-economic assessment revealed that a hybrid-SOFC system of 1 MW is a profitable investment based on current conditions, while the 250 kW is not financially viable. Nevertheless, with a reduction of manufacturing cost or fuel cost, the sensitivity analysis showed more favorable economic scenarios, making the unit very profitable for application on non-interconnected islands.

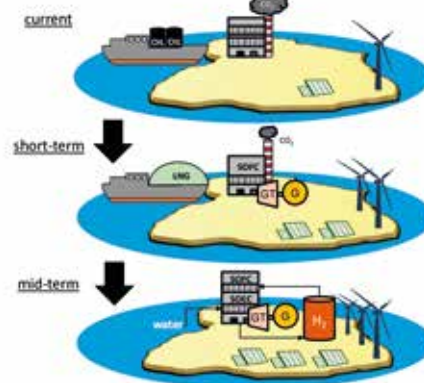
THE BENEFITS OF INTERNATIONAL COOPERATION

With the international cooperation between Greece and German, knowledge and significant experience was exchanged in technology aspects. German partners were able to provide real input regarding the technical equipment for the technical and economic assessments. These assessments included documentation from several simulation cases, based on the experience of the Greek Electricity Authority (Public Power Corporation) concerning the energy consumption of the selected islands.

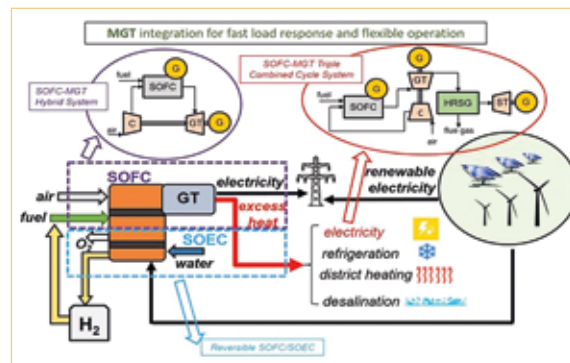
INSIGHTS



Solid Oxide Fuel Cell System of Mitsubishi Power Europe GmbH



SUNIES Vision



SUNIES 2nd Workshop, 25-26 June 2021, Patmos Island



- WasserMOD2 -

Adsorptive Heat Transformation: Fundamental Research toward Next Generation Adsorbers and Application in Solar Cooling

INFO BOX

Project title

WasserMOD2 - Adsorptive
Heat Transformation

Funding amount

(from both countries)
727.825,00 €

Project duration

29/05/2018 – 28/11/2022

Partner Institutions

National Technical University
of Athens (NTUA)

Leipzig University

Fraunhofer Institute for Solar
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FAHRENHEIT GmbH, Halle

Global Sol Energy, Athens

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WHAT WE DID!

Cooling with the Sun: We utilized solar heat as the driving energy, and water sorbed in selected porous materials as the working fluid, in order to engineer advanced units based on sorption-desorption thermodynamic cycles, toward heat pumping and chilling; the pertained application is a zero-emissions ultra-low primary energy technology, to be used in buildings and industrial processes.

PROJECT GOALS

In order to design state-of-the-art adsorptive-heat-exchange units powered by sunlight, we developed innovative material solutions with which highly efficient and compact adsorption modules can be built. To predict the relationship between the sorbent's microscopic structure and their macroscopic properties, we conducted advanced computational modeling rooted in statistical mechanics. We also adapted a smart system design for the control unit, with an open interface for coupling with standard building automation systems; at building level, the availability of a building energy management system which smartly matches user needs (in terms of energy and comfort) with energy savings, is a significant element of future smart buildings implementing the concept of solar cooling systems.



SPECIFIC RESULTS AND IMPACT OF THE MEASURE

The developed technology within WasserMOD2 relies on a renewable energy source: the Sun. It harnesses heat from the sun to chill buildings, not via the familiar solar panels that harvest light to make electricity, but through a neat bit of thermodynamic sleight of hand. This technology will help fighting global energy crisis by lowering peak demand on the electrical grid. It is worth stressing that approximately 100 million conventional air conditioners, which rely on compressors powered by electricity are added each year. The thermally-driven cooling is expected to be particularly beneficial to people residing in sunny areas or developing countries where conventional cooling is difficult or even impossible.

THE BENEFITS OF INTERNATIONAL COOPERATION

The WasserMOD2 project is the result of an innovative and fruitful complementary know-how developed by research groups residing in Greece and Germany. The added value of this bilateral collaboration is reflected by the high-impact publications regarding the theoretical aspects of the work, as well as the produced end product. An equally important result of our cooperation is the involvement of several young early stage researchers from both countries who interacted and shaped the ideas of the project.

INSIGHTS



The WasserMod2 project was represented in the "Innovation Forum" organized by the German-Hellenic Chamber of Commerce and Industry, and the Embassy of Germany, held at the Stavros Niarchos Foundation on 18/11/2019. First row, left to right: Mr. Thomas Rachel (Minister, BMBF), Prof. George K. Papadopoulos (Greek coordinator, School of Chem. Engineering, NTUA) and Dr. Gerrit Fuldner (German coordinator, Fraunhofer, ISE)

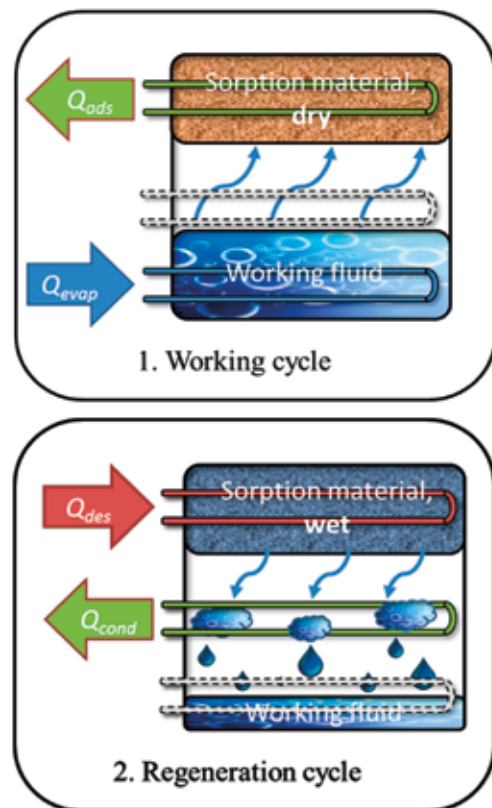
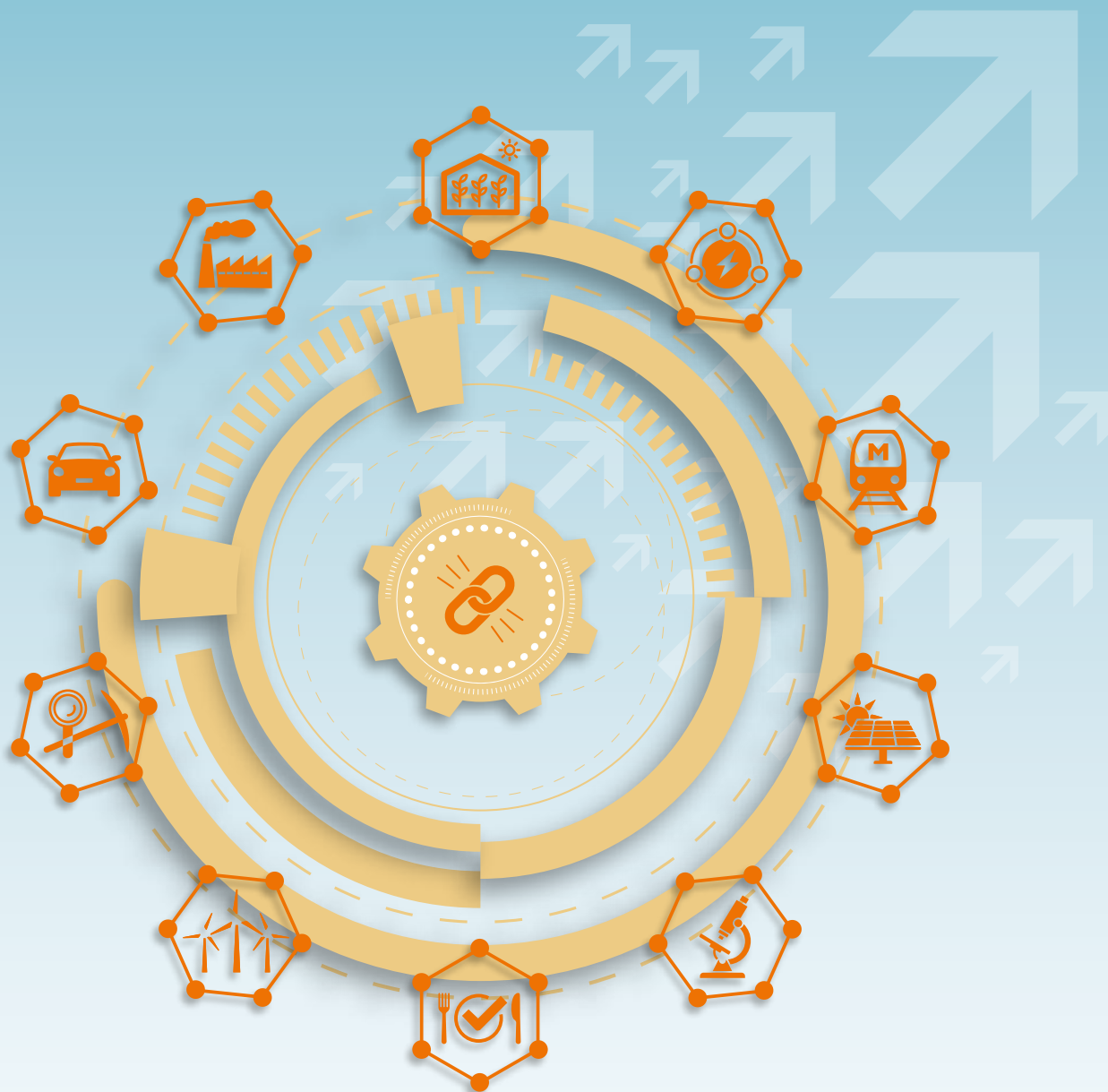


FIGURE X.

Top: (Working cycle). Water (working fluid) evaporates absorbing heat; subsequently, the vapor is sorbed in the porous material releasing heat of higher temperature

Bottom: (regeneration cycle). Porous material absorbs heat and the desorbed vapor condenses emitting heat of lower temperature





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European Union
European Structural
and Investment Funds

ΕΡΑνεΚ 2014-2020
OPERATIONAL PROGRAMME
**COMPETITIVENESS
ENTREPRENEURSHIP
INNOVATION**

Co-financed by Greece and the European Union


ΕΣΠΑ
 **2014-2020**
ανάπτυξη - εργασία - αλληλεγγύη
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2014-2020