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RESEARCH-TECHNOLOGY - INNOVATION
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Ultrafine particles highly hazardous to human health

High-resolution instruments have been developed and tested in modern diesel and gasoline engines to measure the number and particle size distribution of less than 23nm, in real-time



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Soot samples from diesel engine

Ultrafine particles highly hazardous to human health

Vehicles powered by direct injection engines, both Diesel and GDI, are considered a primary source of ambient particle related pollution with impact on climate change and severe adverse effects on public health. In June 2012, the World Health Organization (WHO) confirmed the toxicity of diesel particulates and classified them as a “group 1: definitely carcinogenic to human beings” harmful substance.

Text Eleni Papaioannou, Penelope Baltzopoulou

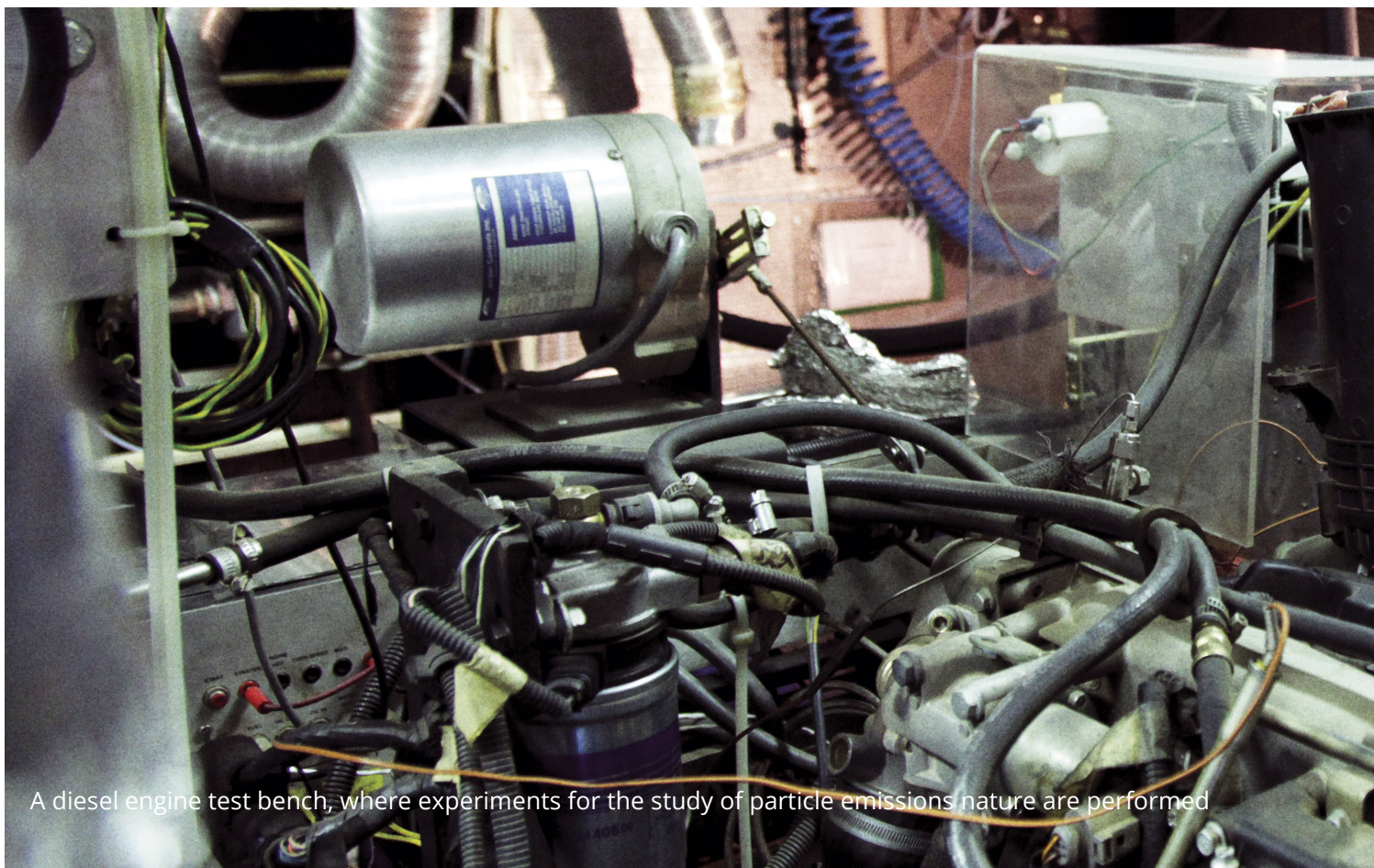
Editing Amalia Drosou



Adverse health effects from vehicle emissions drove many countries, on both sides of the Atlantic, to introduce emission limits. In Europe, emission limits were initially introduced on the basis of emitted particulate mass (Euro 1 to Euro 4).

Ultrafine particles, with no significant contribution to total emitted mass, are more hazardous on a per mass basis to human health than bigger particles

Numerous studies showed that ultrafine particles, with no significant contribution to total emitted mass, are more hazardous on a per mass basis to human health than bigger particles and pushed European legislative authorities to complement the particle emission limits with a solid particle number concentration limit, with a particle size cut-off at 23nm in Euro 5b for Diesel and in Euro 6 for Gasoline Direct Injection (GDI) engines.



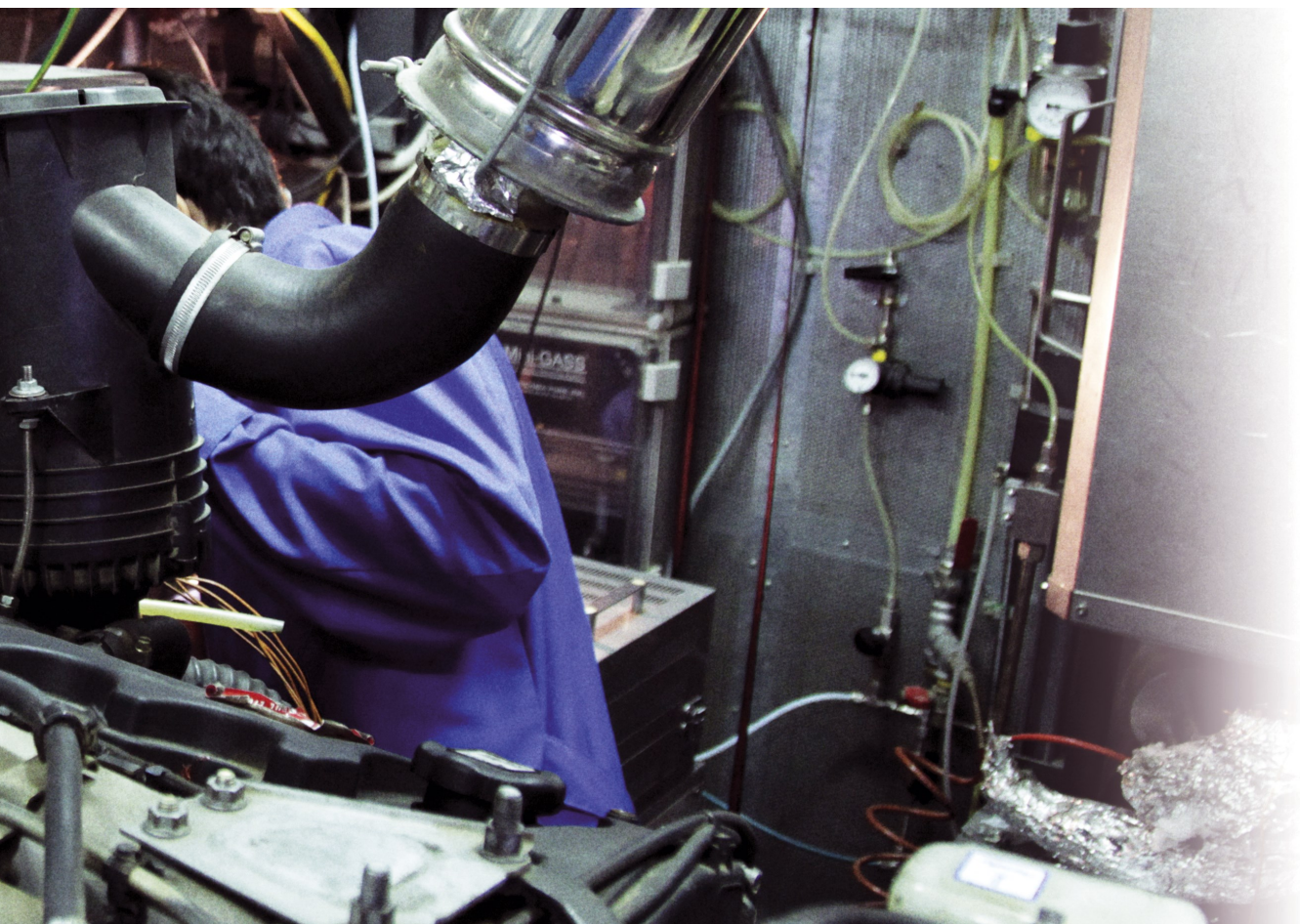
A diesel engine test bench, where experiments for the study of particle emissions nature are performed

The limit of 23nm was set to avoid the possibility of measuring spurious particle populations that are not present in the exhaust gas, the so called *artefacts*, but unfortunately are created in the standard sampling procedure. The difficulties of measuring these very small particles with existing available technologies have led regulators to underestimate their contribution to ambient pollution so far.

According to several reviews on engine exhaust sub-23 nm solid particles, the GDI-emitted sub-23 nm solid particle fraction is around 40% while for diesel engines it is 20%. In light of the changing engine technology landscape and the focus on vehicle emissions, mainly due to evolution in engine and exhaust after-treatment technology, the need to measure below the currently en-

forced 23 nm cut-off in particle size is now well established. Further, better measurement and understanding of these sub-23 nm exhaust particles will also benefit fuel, Internal Combustion (IC) engine and emission control development efforts.

SUREAL-23 project is EU-funded and coordinated by the Aerosol and Particle Technology Laboratory (APTL), unit of Chemical Process and Energy Resources Institute (CPERI) of the Centre for Research and Technology – Hellas (CERTH) with the main objective to investigate in detail the sub-23 nm solid particles emitted by direct injection engines. Starting from October 2016, SUREAL-23 is hosting numerous efforts to:



Develop new instrumentation to provide transient PN measurement as well as size and composition classification specifically for the sub-23 nm size region, while pursuing the reduction/elimination of requirements for exhaust sample conditioning by applying high-temperature operation instruments.

High-resolution instruments will be developed and tested in modern diesel and gasoline engines to measure the number and particle size distribution of less than 23 nm in real time

Investigate the effect of different diesel and gasoline engine operating conditions (fuel additives, bio-content, gas fuel addition, after-treatment type and operation, etc.) on sub-23 nm particle emissions

Integrate the most suitable components of the extended sub-23 nm measurement toolset proposed developments into Portable Emissions Measurement Systems (PEMS) and verify their measurement capability in real driving conditions.



SUREAL-23 partners, at the project's promotion booth, during the 13th International Conference for Engines and Vehicles (ICE 2017), that took place at Capri (Italy), at September 10-14, 2017

“ SUREAL-23 has been able to develop for the first time measuring instruments **resistant to high sampling temperatures**, Eleni Papaioannou—APTL/CERTH

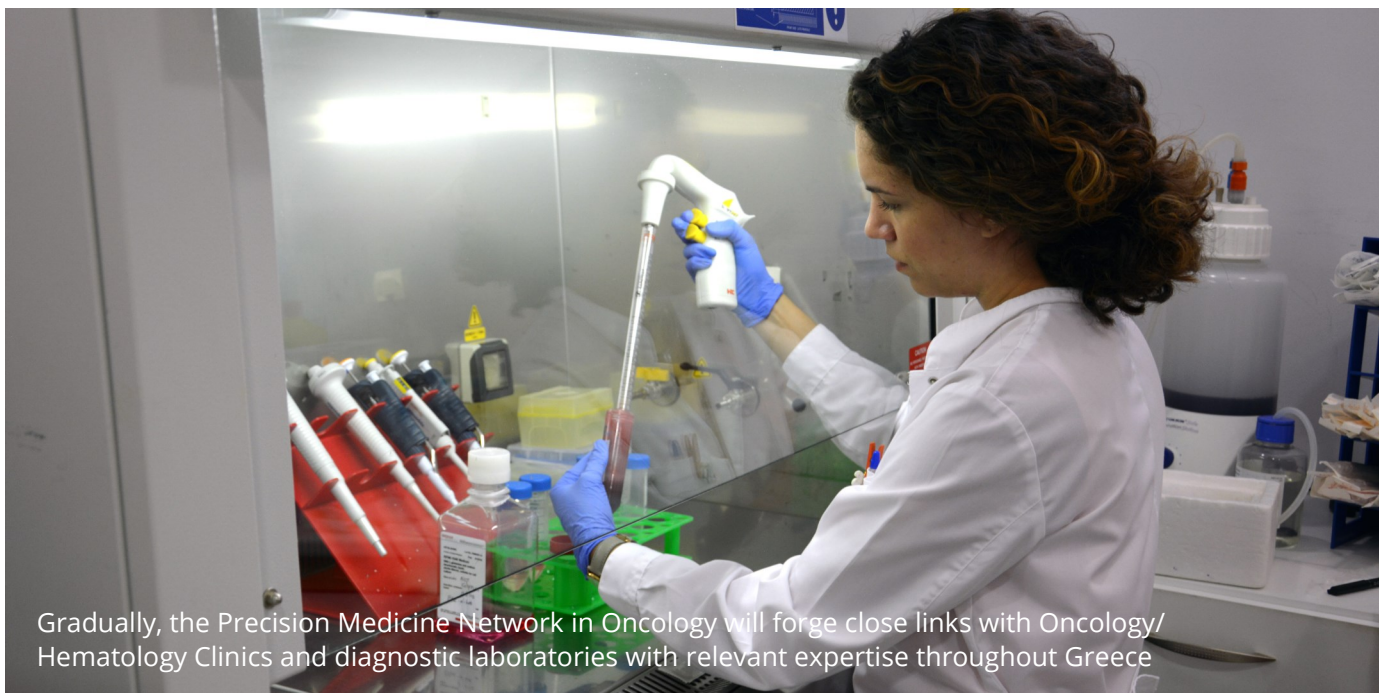
After 18 months of successful implementation of the SUREAL-23 project, high-resolution instruments have been developed and tested in modern diesel and gasoline engines to measure the number and particle size distribution of less than 23nm, in real-time.

sampling temperatures, resulting in strategies to simplify and significantly improve the typical sampling and measurement procedure for particulate pollutants”, adds the coordinator of the project, Mrs Eleni Papaioannou from APTL/CERTH.

“SUREAL-23 has been able to develop for the first time measuring instruments resistant to high

ANNOUNCEMENT:

The coordinators of the three nanoparticle research EU projects SUREAL-23, DOWNTOTEN and PEMS4NANO cordially invite you to a joint workshop on *“Measurement and characterization of nanoparticle emissions from powertrains”*, to be held in Thessaloniki, Greece, on October 9-10, 2018 at the Research and Dissemination Center of the Aristotle University. More information can be found at the SUREAL-23 web-site (<http://surreal-23.cperi.certh.gr/>)



Gradually, the Precision Medicine Network in Oncology will forge close links with Oncology/Hematology Clinics and diagnostic laboratories with relevant expertise throughout Greece

Hope in the fight against cancer

The concept of **Precision Medicine** - prevention and treatment strategies that take individual variability into account - is not new. Blood typing, for instance, has been used to guide blood transfusions for more than a century. But it was in the recent years, when the prospect of applying this concept has been dramatically improved by the advent of powerful technologies of next generation DNA sequencing and computational tools for analyzing large sets of biodata.

Introduction, Interview Amalia Drosou

R Realizing that Precision Medicine is no longer a promise but rather a reality that will transform medical practice, the Division for Research and Innovation of the Ministry of Education in cooperation with the Ministry of Health has established a Precision Medicine Network in Oncology in Greece with a view to upgrade diagnosis, prediction of the outcome and the targeted treatment for cancer patients. The Network aims at providing high quality, robust diagnostic services based on NGS technologies, while at the same time encouraging new research towards the identification of new biomarkers.

Leading national research and academic institutions engaged in research and clinical applications in molecular biology, medicine and data science participate in this Network: in the first phase, four units have been created, two in Athens and one each in Heraklion and Thessaloniki. Gradually, the Precision Medicine Network in Oncology will forge close links with Oncology/Hematology Clinics and diagnostic laboratories with relevant expertise throughout Greece to provide state-of-the-art early diagnosis and monitoring services to cancer patients based on next generation sequencing technologies.

Kostas Stamatopoulos, Director of INAB | CERTH and Scientific Coordinator of the Network, and Anastasia Chatzidimitriou, Researcher of INAB | CERTH and Head of the Technical Committee of the Network, talk about the emerging opportunities of this flagship initiative for Greece and share with us their personal vision with respect to its progress.

Dr. Stamatopoulos, which opportunities are emerging for Greece with the establishment of the Network?

For the first time specialized units of research and academic institutions in close cooperation with clinical excellence units in the wider field of Oncology/Hematology are going to approach the key issue of genomic analysis, which is an essential pre-requisite for personalized treatment, as it takes the individual characteristics of the tumor cells into account. This initiative is going to allow Greece to be a prominent player

and speak the exact same language.

And in what stage are nowadays Network's collaborations with corresponding initiatives?

Anastasia Chatzidimitriou: The Network is already in collaboration with similar initiatives in Europe. In the field of blood malignancies, close collaboration is established with the corresponding national program of Sweden (Genomic Medicine Sweden). In addition, joint actions with international initiatives/networks (e.g. Alliance Against Cancer in Italy) and other entities active in Precision Medicine in many EU countries (Spain, Czech Republic, Serbia, Cyprus, Hungary) are planned for the near future.

“ The choice of treatment based on the particular genomic aberrations of the tumor cell of each individual patient results to **greater effectiveness and less adverse effects**: that translates into **higher efficacy and improved quality of life**, Director of INAB | CERTH and Scientific Coordinator of the Network

in shaping future Medicine and also to cooperate in international projects, fostering research against cancer.

Dr. Chatzidimitriou, what is the current capacity of Greece in promoting the potential of Precision Medicine?

All organizations participating in the Greek Precision Medicine Network in Oncology have the technological competence and the means to perform the genomic analyses that the initiative will offer as a service to cancer patients. During the first phase of the Network's operation, all processes, from the initial sample processing till the final report of the result, will be standardized in order to

Dr. Stamatopoulos, could you please mention the most important benefits that the Network brings to the patients?

The choice of treatment based on the particular genomic aberrations of the tumor cell of each individual patient results to greater effectiveness and less adverse effects: that translates into higher efficacy and improved quality of life. Moreover, gathering information from the analysis of many patients will lead to new knowledge that can be used in biomedical research aiming at better understanding of cancer and the development of new treatments.



Left Dr. Kostas Stamatopoulos, Director of INAB/CERTH and scientific coordinator of the Network
Right: Dr. Anastasia Chatzidimitriou, researcher of INAB/CERTH, Head of the Technical Committee of the Network

My next two questions are addressed to both of you. The Institute of Applied Biosciences coordinates the Network and the Unit in Thessaloniki. Can you please specify more its contribution?

Kostas Stamatopoulos: INAB will support and coordinate the constructive exchange of ideas between the excellent scientists participating in the Network. In addition, it will support and coordinate idea synthesis and effective implementation of the objectives in cooperation with the General Secretariat of Research and Technology, the Division for

(e.g. management of personal data and privacy), always in cooperation with the appropriate scientists, organizations and institutions.

What is your personal wish for the Greek Precision Medicine Network in Oncology?

Kostas Stamatopoulos: The Greek Precision Medicine Network on Oncology should and can contribute to strengthening links between biomedical research and clinical practice. It is this interconnection that will upgrade the health services, and, at the same time create new possibilities for multi-disciplinary research with important implications for promoting knowledge-based economy.

“ Personally I would like to see the Network working **as a platform for daily dialogue** between research centers and clinical institutions in Greece, Researcher of INAB | CERTH and Head of the Technical Committee of the Network

Research and Innovation of the Ministry of Education and the Ministry of Health .

Anastasia Chatzidimitriou: At this point I would like to add that capitalizing on our research and clinical experience as well as the cross thematic structure of our Institute and colleagues, we will search for solutions on multifaceted open issues e.g. in the fields of health economics (e.g. treatment cost-efficacy analysis and companion diagnostics) and bio –ethics

Anastasia Chatzidimitriou: Personally, I would like to see the Network working as a platform for daily dialogue between research centers and clinical institutions in Greece. This will ensure that the Network delivers the best possible care to cancer patients while also contributing to the best possible use of public spending on health and biomedical research.

“Blockchain is able to help overcome a series of organizational and technological boundaries between different entities”

Dr. Konstantinos Votis, ITI/CERTH, on the potential of Blockchain technology in modern times, as well as about its possible vulnerabilities

Introduction, Interview Amalia Drosou

Blockchain remains to be one of the hottest vastly growing technologies in the modern digital world. As it promises to provide, a “trust machine” that enables business transactions of corporations and individuals over the Internet without involving the middlemen, as well as advantages such as transparency and cost reduction, becomes a highly attractive transactions - platform to the global financial sector. But not only to this field.

Blockchain technology is expected to impact digital services and transform business models in a rather wide range of areas such as healthcare, energy, intellectual property rights management and more others. On its side the European Commission encourages governments, the European industry as well as the citizens to benefit from blockchain opportunities in practice. To this end, the EU Blockchain Observatory Forum that has been established on February 2018, is an important step in that direction, by providing all the updates in respect to this technology while at the same time it consists of 60 experts in the field. It is worth mentioning that the European Commission from 2013 up to 2020 will have funded projects that could draw on blockchain technologies for up to 340€ million.

Dr. Votis, you work as a researcher at the Information Technologies Institute of CERTH,

which a high participation in competitive research grants. In which of these research activities is Blockchain activities involved?

The importance of blockchain's use as a technological innovation is becoming a high priority within the Institute of CERTH/ITI, as its potential impact on research and innovation is important. Thus, we focus on further testing of new approaches to better support the innovation, such as the blockchain technologies in areas such as Health, energy, security, etc. In this context, an integrated blockchain technology lab has been set up in order to provide integrated services across sectors and to ensure transparency and security of transactions between users, the incorporation of smart contracts by enhancing efficiency and savings, etc. A series of training seminars are also carried out on Blockchain platforms (e.g. hyperledger, Ethereum, etc.).

In February 2018, you were selected to participate in the EU Blockchain Observatory and Forum, recently launched by the European Commission. What is the potential of this initiative in terms of transforming the services and the markets?

“ The importance of blockchain's use as a technological innovation is becoming a high priority within the Institute of ITI/CERTH, Dr. Konstantinos Votis, researcher C' ITI/CERTH

Indeed, it is with great pleasure that I have been selected to participate in it. This Observatory will analyze - highlight the main developments in this technology, and enhance European cooperation with various stakeholders that are involved in activities that require the use of the blockchain technology. In particular, the European Commission aims to allocate up to € 340 million to finance projects using blockchain technology by 2020.

How can cooperation outside of Europe also be achieved?

Blockchain is able to help overcome a series of organizational and technological boundaries between different entities that need (or want to) automate the data exchange. From this point of view, the blockchain can have a lot of applications in countries within and/or outside Europe such as America, Africa, China, etc. In particular, it can be applied in countries where there is no access to integrated services (e.g. banking services) in cooperation with the global economy. Our goal is to seek opportunities and partnerships outside of Europe, and we have already started a partnership with Latin America in the framework of a project.

Dr. Votis, the emerging opportunities the Blockchain technology offers are widely referred. But, which are the possible risks associated with this technology?

Despite the disagreements, the blockchain technology is open to be used by anyone in the world and adapted to any activity related to trade, transport, health, financial sector, etc. However, as it includes a decentralized network, may present particular vulnerabilities, and it cannot be claimed that it can offer 100% security, even though its data are encrypted. In order to violate the consensus mechanism used in the blockchain, the majority of network nodes (50% + 1) should be evaluated. That should definitely occupy us in the years to come with the use of quantum com



Dr. Konstantinos Votis

puters. After all, there are few exceptions that consider blockchain lacking a complete response protocol in the event of a failure. It is worth noting that many think that blockchain technology consumes enormous energy each year, which may lead to its possible disappearance. More specifically, the use of the Blockchain technology used to create Bitcoin's most popular crypto-technology in the world is estimated that by the end of 2018 energy needs will reach 7.7 gigawatts, around 0.5% of world consumption electricity.

As an expert, how would you rate this technology?

There is a sense that blockchain technology is a distract technology that has the potential to greatly reduce costs and time in the various transactions / processes that have taken place so far, increasing efficiency. However, although it is difficult to predict the evolution and the degree of adoption of this new technology, it is likely that its course will be similar to other innovative proposals of the recent Internet past. Since it is a new technology, security issues, scalability, transaction execution and storage, compatibility with existing data standards, and energy consumption should be further analyzed and explored.

The “Thriving Land” Project

The strengthening of the agri-food sector through the “Thriving Land” project offers opportunities to the people of the Greek rural areas to stay and thrive in their own land

Text Dr. Anagnostis Argirriou

Editing Amalia Drosou

The **THRIVING LAND** project aims at supporting Education, Training and Innovation in the Agri-Food sector, implemented with funding from the Trans Adriatic Pipeline TAP (Pipeline of Good Energy) in all three Regions of Northern Greece traversed by the pipeline. The project falls under TAP’s Social and Environmental Investment (SEI) program, in collaboration with the Bodossaki Foundation. Additional implementation partners are the American Farm School (AFS) and the Institute of Applied Biosciences of the Centre for Research and Technology Hellas (INAB | CERTH).

The project unfolds at two levels: education/consulting and an agri-biotechnology. As regards the first aspect, personalized education activities are delivered by the AFS experts. These are addressed to producers, small businesses and collaborative business ventures interested in commercializing and promoting their products.

The project’s second pillar pertains to agri-biotechnological research and laboratory analysis, undertaken by the project’s scientific associates at INAB | CERTH. The process aims to identify and quantify the specific characteristics and qualities of the selected agri-food products, in order to develop their genetic and biochemical “identity” and highlight their added value, with the goal to promote them in both local and international markets.

The aim of the partners is THRIVING LAND will act as a paradigmatic project for regional development and the promotion of the rural sector at large, with implications for the thousands of people active in this sector in Northern Greece.

“ The Thriving Land Project offers to farmers, growers and livestock farmers from one part theoretical and personalized training in all their activities – ranging from farm to fork, and from the other, by applying cutting-edge technologies, the opportunity to **create an identity of their products in order to differentiate, valorize and promote them in local and international markets,**

Dr. Anagnostis Argirriou, Senior Researcher, INAB/CERTH



The aim of the partners is THRIVING LAND will act as a paradigmatic project for regional development and the promotion of the rural sector at large,



OIKOPOLIS 2018 Award – Scientific Work to Prof. Anastasios Karabelas



The *OIKOPOLIS 2018 Award –Scientific Work*, was bestowed on Professor Anastasios Karabelas*, who directs the Laboratory of Natural Resources and Renewable Energies in the Chemical Process and Energy Resources Institute at CERTH. This award recognizes the scientific work and contributions of Prof. Karabelas in various fields including the optimum utilization of natural resources.

The OIKOPOLIS Awards recognize and honor Environmental Awareness and Sensitivity of individuals and organizations, for activities aiming at environmental protection. The OIKOPOLIS 2018 Awards ceremony, organized by ECOCITY (as in the past 13 years), took place in the Convention Centre of Milos island on June 2, 2018, with the kind support of the Milos Municipality.

Anastasios Karabelas holds degrees in Chemical Engineering (Diploma, NTU Athens; MS & PhD, Univ. of Illinois, USA). He was employed (1970-1978) as Senior Research Engineer at Shell Research Center, Houston. Since 1978, as Professor of the new Chemical Engineering Department at Aristotle Univ. of Thessaloniki, contributed to its organization and rapid development. He is a founding member of *Chemical Process Engineering Research Institute (CPERI)*, that preceded *CERTH*, heading the *Laboratory of Natural Resources & Renewable Energies (NRRE)* since 1985. His research interests include membrane technology and multiphase flow systems, with assorted applications to water and effluent treatment (for desalination, purification/recycling) and *maximum utilization of natural resources*, through development of novel processes. Professor Karabelas in addition to various scientific, educational & technical activities, internationally, he has been pursuing application of R&D results for the benefit of Greek economy.



Inspiration for Sustainable Urban Mobility Planning: Good Practices from REFORM project

As part of the Interreg [REFORM](#) project, a consortium of seven organisations, located in five different European countries, supports the implementation and deployment of Sustainable Urban Mobility Plans (SUMPs) as an instrument for shifting mobility towards low-carbon patterns. This project gives particular attention to regions which play a central role to encourage the adoption of SUMPs by local authorities, including small towns and medium-sized cities. REFORM started in January 2017 and is coordinated by the Hellenic Institute of Transport of the Centre for Research and Technology Hellas (HIT/CERTH).

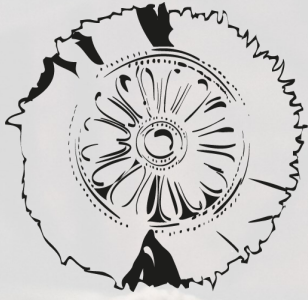
In this framework, REFORM project just published a collection of 26 Good Practices on sustainable urban mobility, consisting of implemented initiatives, projects, processes and techniques which have proved to be successful in the area of sustainable urban mobility planning. The Good Practices come both from the four REFORM regions: Emilia-Romagna (Italy), Central Macedonia (Greece), Greater Manchester (UK) and Parkstad

Limburg (Netherlands) and from other European regions and cities and have been selected according to the REFORM regions needs and priorities regarding the development of sustainable urban mobility planning both regionally and locally.

An analysis of the Good Practices shows that they mainly cover the following topics: the integration of SUMP and other urban planning instruments; capacity development for in local administrations; stakeholders' involvement and participation in SUMPs, standardization of SUMPs and the use of Information and Communication Technologies (ICT) to support SUMP development.

These Good Practices will serve as an inspiration for REFORM regions and will be integrated in the regional Action Plans (APs) for Sustainable Urban Mobility Planning that the regions are preparing.

The Good Practices have been compiled into a single booklet: [EU good practices on sustainable mobility planning and SUMP](#).



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The **Centre for Research and Technology-Hellas (CERTH)** founded in 2000 is one of the leading research centres in Greece and listed among the TOP-20 E.U. institutions with the highest participation in competitive research grants.

Today CERTH includes the following five institutes with indicated major fields of research:

- **Chemical Process and Energy Resources Institute (CPERI)** Sustainable & Clean Energy, Environmental Technologies, Chemical & Biochemical Processes, New Functional Materials
- **Information Technologies Institute (ITI)** Informatics, Telematics and Telecommunication Technologies, Safety and Security
- **Hellenic Institute of Transport (HIT)** Smart Sustainable Mobility, Transport Safety
- **Institute of Applied Biosciences (INAB)** Agri-biotechnology, Health Translational Research, Informatics for big bio-data
- **Institute for Bio-economy and Agri-Technology (IBO)** Bio-economy, Agri-technology

CENTRE FOR RESEARCH AND
TECHNOLOGY HELLAS

6th km Charilaou-Thermi Rd
P.O. Box 60361

GR 57001 Thermi, Thessaloniki
Greece

Tel: +30 2310 498100

Fax: +30 2310 498110

Extroversion and Networking Services

Tel: 2310 498205

email: liaison@certh.gr

Press and media enquiries

Tel: 2310 498214

email: amelidr@certh.gr



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