



NATIONAL
TECHNICAL
UNIVERSITY
OF ATHENS



EULIST Blended Intensive Program

“Monitoring clean energy in the EULIST campuses”

31 May – 13 October 2023 | online and onsite in Athens, NTUA

Agenda for onsite courses

Within the framework of the Alliance [EULIST](#) “European Universities Linking Society and Technology”, the National Technical University of Athens (NTUA), organizes in cooperation with Lappeenranta-Lahti University of Technology (LUT), Jönköping University (JU), Leibniz University Hannover (LUH), Institut Mines-Télécom (IMT), Slovak University of Technology in Bratislava (STU), University L’Aquila (UnivAQ), a **Blended Intensive Program (BIP)** with the title “**Monitoring clean energy in the EULIST campuses**”.

TOPICS ADDRESSED

Participating academics and teaching staff members will share as lecturers and mentors’ best practices with students for monitoring the contribution of renewable resources in the energy mix, towards sustainable EULIST campuses. Moreover, during the program, thematic areas to be discussed include the promotion of research on clean energy technology, aligned with SDG 7 to ensure access to affordable, reliable, sustainable energy for all, as well as the European Green Deal and the European Education Area’s Focus Topic “Green Education”.

STRUCTURE

- Action 1 | Online lectures
Wednesdays @14:00-17:00 CEST, May 31st - June 7th - June 14th, 2023
- Action 2 | Onsite Workshops | Athens NTUA
Monday June 19th until Monday June 26th, 2023
- Action 3 | Self-working time
July - August 2023
- Action 4 | Online mentoring
September 2023
- Action 5 | Online projects presentation
October 13th 2023

CONTENT – LEARNING OUTCOMES Language: English (min. B1)

- **Action 1**
Online lectures by academics and teaching staff from the co-organizing universities on green and sustainable campuses, best practices, on monitoring energy and environmental performance in EULiST campuses.
- **Action 2**
Onsite visits and presentation of challenges in three NTUA campuses [Historic Patission campus in the centre of Athens – Lavrion Technological and Cultural Park – main Zografou campus] on renewable energy sources, combination with hydrogen, solar engineering, eco racing, biofuels, monitoring of energy uses, and the NTUA virtual campus. It also includes challenge selection, assignment, and initial preparation on group projects. The first outcomes of the onsite workshop will be presented on Monday June 26th, within the EULiST General Assembly and Open Session “EULiST towards linking Society and Technology” in NTUA, Athens. Social and cultural events are also scheduled in Athens.
- **Action 3**
Self-working time for the preparation of the students’ projects in July and August 2023.
- **Action 4**
Online mentoring for participating student teams by the academics and trainers of the coorganizing Universities in September 2023. *Dates will be announced in due time.*
- **Action 5**
Projects’ presentation will be held online on October 13th, 2023. Following an online assessment, an EULiST award on the best student project will be granted.

Students will work with experts in the field of clean energy, smart and sustainable energy design, using challenge-based learning, hands-on approach and design thinking. Participants will acquire new skills on clean energy sources and management, learn to use new methodologies and tools for monitoring clean energy, and develop a new mindset that will contribute to the achievement of SDGs.

NATIONAL TECHNICAL UNIVERSITY OF ATHENS CAMPUSES



AGENDA • Action 2 | Onsite Workshops | Athens NTUA

Monday, June 19th 2023 – NTUA Patisson Complex

| JUNE 19 th , 2023 10.00 – 17.00 (EEST) | | |
|--|--|--|
| 10:00 – 10:15 | Meeting point at the School of Architecture, NTUA , Patisson Complex], Stournari Gate | PIN: 37.9873544364921, 23.73187961656801 |
| 10:15 – 11.30 | Tour at the Historical Buildings of Patisson Complex | Prof. Alexandrou Eleni Assist. Prof. Bougiatioti Flora |
| 11.30-11.45 | Brief Introduction of BIP “Monitoring Clean Energy in EULiST campuses” | Prof. Adam Katerina, EULiST -NTUA Coordinator Amphitheatre A 008 |
| 11.45 – 13.00 | Get together and self-presentations | Prof. Alexandrou Eleni Assist. Prof. Bougiatioti Flora Amphitheatre A008 |
| 13.00 – 14.00 | <i>Lunch Break</i> | Patisson Complex NTUA Restaurant |
| 14.00 – 15.30 | Meeting with undergraduate students of the School of Architecture involved in Energy efficiency units. | Prof. Alexandrou Eleni Assist. Prof. Bougiatioti Flora |
| 15.30 – 17.00 | Visit of the measurement site | Amphitheatre A008 |

LECTURERS PROFILE

Prof. Eleni Alexandrou

Professor in Architectural Technology, in the School of Architecture of the National Technical University of Athens. Extensive research work on environmental design and energy efficiency of buildings and especially in Historic & Traditional buildings. Teaching in Undergraduate and Post Graduate Programs. Courses: Architectural Technology, Environmental & Climate responsive design, Structural and Energy analysis, Assessment and Restoration of Traditional and Historic buildings, Technology of Materials.

Assist. Prof. Flora Bougiatioti

She graduated from the Department of Architecture of the Polytechnic School of the Aristotle University of Thessaloniki, Greece (2000). She received a M.Sc. in Architectural Design from the School of Architecture of the National Technical University of Athens (2002) and a Ph.D. from the same university (2007), with thesis subject “The thermal behaviour and the environmental impact of the materials, which are used in the urban open spaces and the shell of buildings in Greece”. She teaches as Assistant Professor at the Department of Architectural Technology of the NTUA School of Architecture (2014-), where she has taught as Adjunct staff (2002-2007) and has participated in the NTUA Interdisciplinary Postgraduate Course Architectural Design-Space-Culture (2006-2017). She also taught at the Postgraduate Programme “Environmental Design of Cities and Buildings” of the Hellenic Open University (2009-2010, 2012-14) where she also supervises post-graduate dissertations (2006-2017). She has research work on bioclimatic and environmental architecture, with publications in books, international journals and peer-reviewed conference proceedings. Her architectural work includes awards and participation in architectural competitions, mainly as an environmental consultant.

Tuesday, June 20th 2023 – NTUA, Zografou Campus

| JUNE 20 nd , 2023 09.00 -16.00 (EEST) | | |
|---|---|---|
| 09:00-09.15 | Meeting point at the entrance of NTUA Central Library Welcoming | PIN: 37.97810524982401, 23.782124096841994 |
| 09:15 – 10.00 | <ul style="list-style-type: none"> - Introduction to NTUA Eco-Friendly Sustainable Campus - Monitoring of campus electrical consumption per school, - Energy forecasting of campus buildings - Building decarbonization solutions - Open discussion, interaction <p>Prof. Irene Koronaki, Dr. Mechanical Engineer School of Mechanical Engineering</p> <p>George Orfanos MSc Mechanical Engineer</p> | Teleteaching Room, Ground Floor Central Library |
| 10.00 – 10.20 | Monitoring of PV modules and clean energy technologies at LTCP Chrysa Politi , MSc Mechanical Engineer School of Mining and Metallurgical engineering | |
| 10.20 – 10.30 | Coffee Break | |
| 10.30 – 11.00 | <p>3D Energy Hub Launch</p> <p>Prof. Vassilis Spitas Dr. Mechanical Engineer School of Mechanical Engineering</p> <p>Dr. George Antonakos School of Mechanical Engineering</p> | |
| 11.00 – 12.00 | <p>On site tour to 3D Energy Hub</p> <p>3D printing of energy systems and Building Envelopes School of Mechanical Engineering</p> | |
| 12.00 – 12.30 | Erasmus Student Network Presentation Students' Registration | Teleteaching Room, Ground Floor Central Library |
| 12.30 – 13.00 | <i>Lunch Break</i> | Zografou Campus Restaurant |
| 13.00 – 14.30 | <p>"DeCarboniseMyCampus"</p> <p>Presentation of BIB NTUA project Prototype Building within OpenStudio and Energy Plus Tools</p> <p>Petros Dalavouras Research Associate Architect Engineer MSc, ASHRAE BEMP Certified, BREEAM Assessor, NZEB Designer</p> | Teleteaching Room, Ground Floor Central Library |
| 14.30 – 16.00 | Interactive educational session–Working groups competition George Orfanos MSc. Mechanical Engineer, PhD Candidate | |

LECTURERS PROFILE



Dr. Irene Koronaki (female) is a Professor at the National Technical University of Athens (NTUA), Mechanical Engineering Dept., Thermal Engineering Section and Director in the Laboratory of Applied Thermodynamics. She is teaching undergraduate courses in Thermodynamics, Thermodynamics Software and postgraduate courses in Energy Saving in Buildings, Clean Technologies, Thermodynamics and Heat Transfer. She has experience in the field of Energy Efficiency in the building sector, regarding both building shell and services as well as in solar energy applications in buildings and in the industry sector. She has participated in several research EU projects during her collaboration with the University of Athens, Department of Physics, as also as a collaborator of CRES. She has been involved in several European Projects during the last years, RealSkillsEurope and NRG4CAST, INNOMED. She is a member of ASME (American Society of Mechanical Engineers), ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and a registered engineer (Technical Chamber of Greece).



URL: <http://thermolab.mech.ntua.gr/v2/>



Dr. Vassilis Spitas is a Professor at the National Technical University of Athens (NTUA), Mechanical Engineering Dept. His research areas are kinematic, static and dynamic analysis of machine elements and motion transmissions using computational (i.e. FEMBEM) and experimental (i.e. photoelasticity, caustics, potential drop technique, strain gauges etc.) methods A2 Design of testing machines for thermo-mechanical quasi-static and dynamic testing on components and structures A3 Design of advanced lightweight sandwich panels using multi-scale reinforced thermoplastic polymers.



Dr. Ing. Dipl. Ing. George Antonakos is an expert in the field of innovative onshore energy systems and marine applications. He specializes in the development of computational codes for thermodynamic analysis and dimensioning of advanced thermal and cooling systems, including external combustion engines and closed circuits with working medium engines. Dr. Antonakos' research focuses on renewable energy sources, analysis of combined thermodynamic cycles, phase change materials, design of innovative heat exchangers, heat transfer, cogeneration and trigeneration systems, energy efficiency of industrial facilities and buildings, as well as heat and cooling storage systems and cryogenics. His expertise is evident through his publications in peer-reviewed academic journals and books, which primarily revolve around the field of energy engineering.



Mr. Petros Dalavouras studied Architecture engineering at the National Technical University of Athens (NTUA) and continued his studies with an MSc at the Welsh School of Architecture (WSA). He is currently proceeding with his PhD studies in NTUA at the School of Mechanical Engineering. He is Certified from ASHRAE as Building Energy modeling Professional and from BRE as BREEAM assessor, with demonstrated experience on energy efficient buildings and project management. Both in his professional career and in academia, the energy of buildings has always been the focus of interest. His work experience includes a wide variety of building typologies that include residential, commercial, and industrial buildings which have been provided with a variety of solutions from building design to mechanical equipment. Specializing in simulations

with dynamic simulation software he delivers the best energy solution as well as the highest quality indoor environment at the lowest cost according to the specifications of each customer.



Mr. George Orfanos is a Mechanical Engineer, graduated from National Technical University of Athens. He has participated two times in the ASHRAE's Integrated Sustainable Building Design Competition and won the second 2nd place worldwide in 2021. He is a member of the Technical Chamber of Greece and also active member of ASHRAE. He is a PhD student at the faculty of Mechanical Engineering of National Technical University of Athens, at the Laboratory of Applied Thermodynamics. The title of his research thesis is "Predictive Control and Real Time Optimization of HVAC Systems". He also works as a mechanical engineer and a fleet manager at the Technical Department of Parametros Carriers.

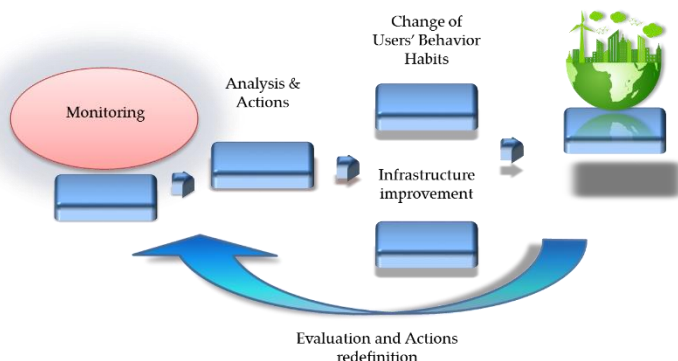
Sustainable Energy Technologies at NTUA Zografou Campus

NTUA campus is comprised of 64 buildings of 256.000 m² with labs, lecture rooms, offices, a library, restaurants, and sports facilities. More specific, there exist a library building, two administration buildings (only with offices), two restaurants, a sports facilities building, several buildings with only lecture rooms, lab buildings and buildings with combination of lecture rooms, offices, and labs.

The main idea behind the installation of an Energy Management tool in NTUA Campus is to assist the Energy Management Commission in taking decisions regarding the energy management strategy for NTUA Campus. The tool is therefore expected to provide useful information regarding not only the distribution of the energy consumption across the campus but also information about decision support energy management solutions.

Annual energy needs are:

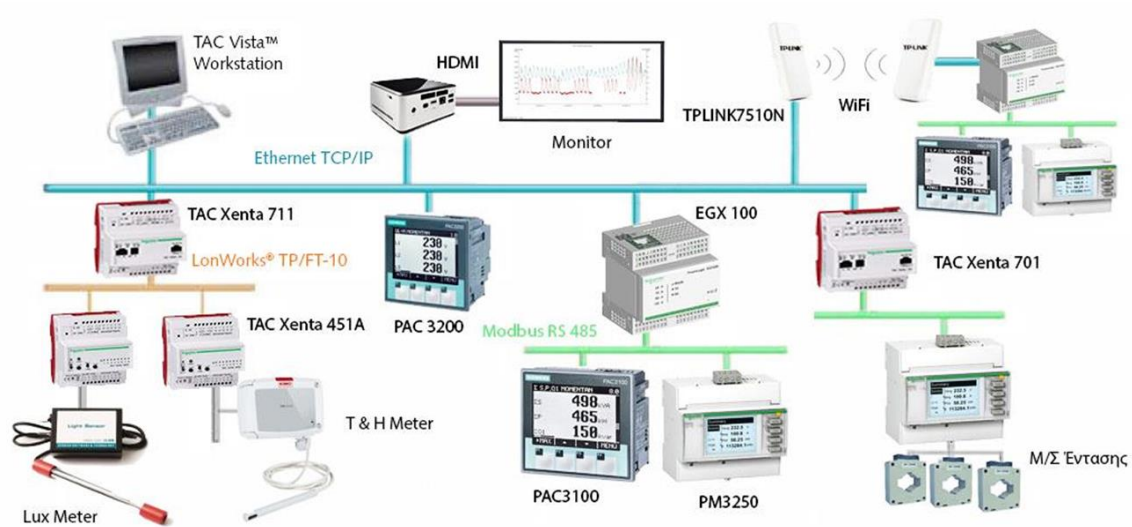
- Annual heating needs: 8100 MWh
- Installed heating power: 25 MW
- Installed cooling capacity: 14.5 MW (70% due to heat pumps)
- Annual electricity needs are round 16,000 MWh and gradually decreasing



The NTUA University Campus pilot case (final rollout) includes the following activities:

- Installation of electricity sensors for all buildings in the Campus:
 - 45 electricity meters SIEMENS (SENTRON PAC3200, PAC3100)
 - 16 electricity meters Schneider (Electric PM3250)

- Installation of sensors for measuring the thermal comfort level in an office in the Campus:
 - 4 temperature & relative humidity sensors: Siemens Q-Series Outdoor Air Relative Humidity and Relative Humidity & Temperature Sensors QFA3171D
 - 4 lux meters ALRE brightness sensor AHS/O-10
- Installation of a central PC unit and a Building Energy Management system to collect, store and visualize all sensors data.
- Installation of a 55' monitor in a central spot inside the Rector's Building, showing the instantaneous energy consumption of all NTUA buildings, for dissemination purposes.
- Installation of other necessary electrical components: 50 power inverters, 22 analogue to digital converters for the connection of the electricity sensors to the Ethernet network, 2 PLCs with wireless connection, 1 analogue to digital converter for the connection of the thermal comfort sensors to the Ethernet network.



Wednesday, June 21st 2023 – NTUA, Zografou Campus

| JUNE 21st, 2023 09.00 – 16.00 (EEST) | | |
|---|--|---|
| 09:00-09.15 | Meeting point at the entrance of NTUA Library Welcoming | PIN: 37.97810524982401, 23.782124096841994 |
| 09:15 – 11.00 | <ul style="list-style-type: none"> - Introduction to NTUA Eco-Friendly Sustainable Campus - Monitoring of the Smart Prototype Building (Living Lab) - Building decarbonisation solutions in term of insulations, energy systems and control strategies - Open discussion, interaction <p>Prof. Sotirios Karellas Dr. Mechanical Engineer School of Mechanical Engineering</p> <p>Dr. Ioannis Atsonios Dr. Mechanical Engineer School of Mechanical Engineering</p> | Teleteaching Room, Ground Floor Central Library |
| 11.00 – 12.00 | Transportation to the National Gallery – Alexandros Soutsos Museum | Using Public Transport |
| 12.00 – 16.00 | Tour to the New Certified Gold Leed Building of National Gallery | |

LECTURERS PROFILE



Prof. Dr.-Ing. Sotirios Karellas (M) is Professor at the School of Mechanical Engineering of NTUA, Director of the laboratory of Thermal Processes, visiting Professor at the Technische Universität München and the Universität Bayreuth Germany. Member of the Greek delegation to the Programme Committee “Secure Clean and Efficient Energy” (2014-2021) and to the Coal and Steel Committee (COSCO) (2014 – 2019).

His research is focusing on central and decentralized energy systems, Carbon Capture Storage and Utilisation, energy storage, Hydrogen energy, Zero Energy Buildings, co-, poly-generation, solar-thermal energy, biomass, Organic Rankine Cycle technology and heat pumps, Waste to energy. He has over 150 relevant publications in scientific Journals and Conferences and more than 5000 citations. He has supervised 6 Ph.Ds and he is currently supervising 7 Ph.D students at NTUA working in the field of CCU, energy conversion systems for Electricity, Heating and Cooling. He has participated in a large number of projects in NTUA (2006-present) and in Technische Universität München (2001-2006), having both technical and coordination responsibilities. He has significant industrial experience in power production plants, co/tri-generation systems, heat pumps, building heating systems and chillers. He is full member of the editorial board of 4 scientific journals dealing with central-decentralised energy systems and renewable energy sources.

Extensive CV and publications:

<http://www.mech.ntua.gr/en/karellas>

http://www.lsbtp.mech.ntua.gr/index.php/en/sotirios_karellas



Dr. Ioannis Atsonios (M) is post-doctoral researcher at the laboratory of Heterogenous Mixtures and Combustion Systems of the School Mechanical Engineering of NTUA. He received his Diploma in Mechanical Engineering (2012), Master's degree in computational Mechanics (2014) and PhD (2018) from NTUA.

His research is focusing on building energy efficiency, Nearly Zero Energy Buildings, building envelope thermal and hygrothermal performance, super-insulation materials, smart facades components, HVAC systems, innovative experimental techniques and building modelling. He has over 20 relevant publications in scientific Journals and Conferences and more than 250 citations. He has participated in several projects in NTUA (2014-present), having both technical and coordination responsibilities.

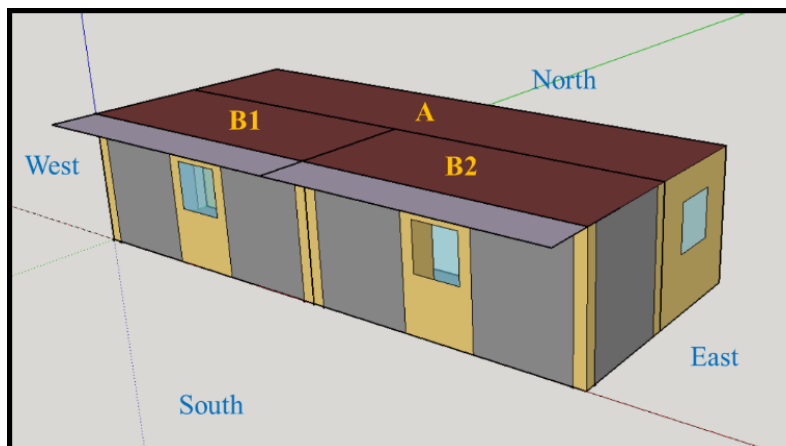
Additional link: <http://hmcs.mech.ntua.gr/>

Sustainable Energy Technologies at NTUA Zografou Campus

PILOT BUILDING TECHNICAL CHARACTERISTICS

Design and construction criteria:

- nZEB and almost Zero Energy Consumption
- Exchangeable masonry and transparent components
- (windows, balcony doors)
- Easy switching of thermal and electricity production and storage systems.
- Complete recording and control of the operation of the passive and active systems of the building.

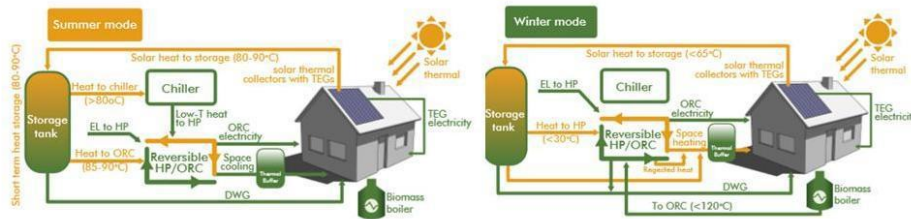


PASSIVE SYSTEMS



- Prefabricated composite construction of ca. 60 m², one floor with south orientation.
- "Cargotecture" standards: Steel load bearing frame from shipping container with detachable and alternating structural elements.
- Strictly controlled thermal zones with six detachable and variable masonry panels.
- Insulating glass with for passive building specifications; Mobile shading.

ACTIVE SYSTEMS



- Underfloor heating / cooling system; low temperature heating system with full autonomy in each thermal zone.
- Solar thermal collectors, PVs, thermal storage tanks and batteries, heat pumps, cooling system with ORC and auxiliary system with biomass boiler.

Supporting projects

PLURAL <https://www.plural-renovation.eu>

SolBioRev <http://www.solbiorev.eu>

SWSHeating <http://www.swsheating.eu>

Switch2Save <https://switch2save.eu>

**Thursday, June 22nd 2023 – NTUA, Lavrion Technological and Cultural Park (LTCP)
“Lavreotiki UNESCO Global Geopark”**

| JUNE 22nd, 2023 08.00 – 16.00 (EEST) | | |
|---|--|--|
| 08:00 – 08:10 | Meeting Point A, Patisson Complex @ the left side of the National Archaeological Museum, Vasileos Irakliou Street | More details will be given one day before |
| 08.40 - 08.50 | Meeting Point B, Zografou Campus @ Parking of the School of Naval Engineering, opposite to the Katexaki Gate (main vehicle entrance) | PIN: 37.9803231431715, 23.784290496474647 |
| 09:30 – 11.00 | <ul style="list-style-type: none"> - Introduction to NTUA-LTCP facilities, Smart Grid topology - Power vs Energy, Building decarbonization solutions - Open discussion, interaction <p>Assist. Prof. Antonis Peppas School of Mining and Metallurgical engineering</p> | nZEB powered by H ₂ |
| 11.00 – 11.45 | <ul style="list-style-type: none"> - Building operation towards grid flexibility - Open discussion, interaction <p>Chrysa Politi, MSc Mechanical Engineer School of Mining and Metallurgical engineering</p> | |
| 11.45-12.30 | Hydrogen potential for decarbonised micro grids Assist. Prof. Antonis Peppas, School of Mining and Metallurgical engineering | |
| 12.30 – 13.00 | <i>Quick Lunch Break</i> | |
| 13.00 – 14.00 | On site tour for demonstrating clean energy technologies at LTCP open discussion | |
| 14.00 – 15.00 | “DeCarboniseMyCampus” Interactive educational session – Working groups competition | |
| 15.00-16.00 | Transportation to Athens, arranged by NTUA | |

LECTURERS PROFILE



Dr. Eng. Antonis Peppas is an Assistant Professor of the School of Mining and Metallurgical Engineering of NTUA, in the scientific field of Energy and environmental optimisation technologies applied to metallurgical industries. He received a B.Sc. and M.Sc. Degree in Mining and Metallurgical Engineering from NTUA and he is holding from 2002 a Ph.D. Degree in Environmental Technologies.

He has an extensive research experience in process design and development, energy optimization of industrial processes and assessment of the environmental impact of products and production processes through LCA analysis, participated as a senior researcher in more than 35 EC funded projects. He is also supervising for more than 15 years the activities implemented in a hybrid smart grid with sustainable energy efficient resources equipped with renewables, hydrogen equipment, batteries banks and other related intelligent energy management systems.

He is a Member of European Commission Expert group on alternative transport fuels, including H₂, appointed by European Commission's Director-General for Mobility and Transport (MOVE). He has

published a great number of scientific papers in international journals and conferences, and he is a reviewer on journals Sustainability, International Journal of Environmental Research and Public Health, Materials, Applied Sciences, Energies and an Editorial Board member of Peer Review Journal of Solar & Photoenergy Systems.

He is teaching in the Postgraduate Studies Program the courses “Alternative energy systems in the industry”, “Laboratory exercises in pyrometallurgy”, “Energy and environment” and he is in charge of the Practical Training / Internship of the students which is a mandatory lesson in School’s curriculum. He is also supporting the educational actions of the courses “Design and techno economic analysis of metallurgical industries”, “Secondary metallurgy” and “Automatic process control”.



Chrysa Politi is an associate researcher and PhD candidate specializing in the field of sustainable energy and engineering. Currently pursuing her doctorate at the National Technical University of Athens, she has made significant contributions to the integration of renewable energy into the transport and building sectors. With a strong academic foundation, holding a Bachelor's and Master's degree in Mechanical Engineering from the same esteemed institution in 2018, Chrysa's expertise lies in energy optimization and the application of deep learning algorithms in the built environment.

Throughout her career, Chrysa has exhibited exceptional analytical thinking, a results-oriented mindset, and a natural inclination towards teamwork. Her commitment to taking on challenging projects and producing impactful outcomes has led her to conduct research at the Laboratory of Metallurgy at NTUA, where she has been involved in 13 EC funded projects. In addition to her role as a researcher, Chrysa actively undertakes various managerial responsibilities, ensuring smooth project operations and efficient coordination among team members, implements research activities and is involved in grant applications preparation. Her current research focus involves the innovative use of form-stable phase change materials to enhance energy efficiency, a topic that has garnered significant attention within the field. Chrysa has presented her research findings at various conferences and academic platforms and she is a reviewer on Journal of sustainable metallurgy.

Sustainable Energy Technologies at LTCP

Lavrion Technological and Cultural Park (LTCP) is located in Lavrion, in South-eastern Attica, Greece, supervised by NTUA. The LTCP covers about 250.000 m² in which 3 building complexes exist. It is essentially the only Technology Park in Attica and specializes in key areas of modern applied technology, such as information technology, electronics technology, telecommunications, robotics, laser technology, environmental technology and energy management. Inside the park there are 48 fully renovated buildings which hosts mainly Research and Development (R&D) activities. About 18 buildings have been restored and are now operated with a total area of 13.000 m². The total area allocated to the housing of businesses is about 10.000 m², while 3.000 m² support the administrative and cultural uses of the park. LTCP site represents an excellent test case for establishing and evaluating a small-scale smart grid community as it consists of diverse **energy producers** and **consumers** interconnected and operated under an advanced energy monitoring and management system.

All these components are connected to the electrical grid through a **single connection node**, having a main MV switchboard (20kV/50Hz). Three MV / LV transformers with capacity from 800 to 1250 KVA are connected to the main MV switchboard. All the above infrastructure is monitored by 54 smart meters. In summary, there are more than **480 measuring points** gathered to one single SQL server synchronizing district and buildings' data.



Figure 2. Lavrion Technological and Cultural Park (LTCP)

Energy production within the LTCP is provided by 2 PV plants, 6 wind turbines and 2 energy storage systems (battery bank with storage capacity of 1364 Ah and hydrogen production and storage with 1 MWh capacity). In addition to that, a **programmable PVs inverter** able to exchange, either injects or absorbs, reactive power with the grid. This operation is supported by a **Remote Terminal Unit (RTU)**, which is installed in the LV side of a MV/LV transformer (1250 kVA) for monitoring parameters for inverter optimization.

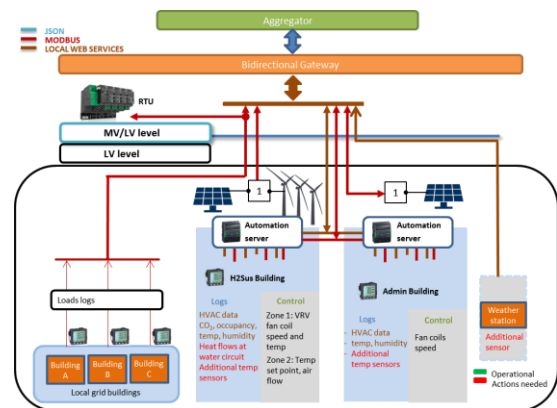


Figure 2. LTCP infrastructure topology

A **weather station** is installed in the perimeter of the park. It provides measurements with a less than 15 minutes interval on **ambient temperature, humidity, solar irradiance, wind speed & direction and rainfall**; data crucial for the development of energy management schemes profile and RES energy production forecasting.

A cable and wireless **communication system** has been commissioned for ensuring **secure and uninterrupted bilateral data communication** between the buildings and all other points of interest (MV/LV transformer, RTU, weather station etc.). In specific, a Wireless Local Area Network (WLAN) provides the bi-directional communication as it has an extensive area that needs to be covered as well as a very demanding topology (steep slopes, long cliffs). The developed system is a low-cost integrated solution with specialized hardware and software for intelligent building systems management and provides a reliable and dynamic communication network.

Within the Park, there are **energy consumers** (i.e. buildings) which have been renovated including a variety of materials in their envelope (i.e. stone, gutter tiles, concrete, bricks etc.) and they are equipped with advanced Heating Ventilation and Air Conditioning (HVAC) systems as well as innovative monitoring systems.

LTCP hosts a **Living Lab** which is a fully controlled nearly-Zero Energy Building (nZEB) (600 m²), which is equipped with an advanced Building Energy Management System (BEMS) for the efficient management and control of its loads. Regarding the management of buildings' internal conditions, variable temperature and humidity sensors are placed, (already existing 40) as well as 10 lighting and occupancy sensors. NTUA has developed an advanced monitoring system together with an online web-based Graphical User Interface (GUI) platform has been developed as a consistency plan to the communication interruptions risk, strengthening the smart grid community principles. This platform integrates and interprets all the different measuring parameters (weather data, buildings' room temperatures, analytical energy consumption and RES production) as well as the current status

of the whole facility in an easy and understandable way for the end-users. In addition, a 5-days weather forecast within a 30-min timestamp is added.



Figure 3. Advanced monitoring and control system

The Living Lab enables the integration of novel circular / carbon neutral materials to energy solutions such as fuel cells; (flexible) photovoltaic products and battery solutions. Advanced sensing and metering equipment are deployed on site and a total of 1.800 monitoring nodes are gathered on a single cloud-based platform. This platform is accessible through an easy GUI and enables real time monitoring and control of the operational status and online evaluation.

All the abovementioned infrastructure enables the demonstration and evaluation of innovative technologies in compliance with the related standards and protocols (IPMVP). The systems with the integrated models are able to forecast in detail energy production, and consumption through intelligent self-learning algorithms. All measurements and predictions are collected in an intelligent monitoring online platform supported by a SQL database and web services for equipment control at building and district level.

The evaluation of smart grids at the distribution level is performed by a set of indicators, concerning system observability, system controllability, active system management and smart grid planning. In this frame, the load cover factor quantifies self-sufficiency as the ratio of usable electricity production to the total electricity demand. Respectively, the supply cover factor quantifies the self-consumption as the ratio of usable electricity production to total electricity production. The reduction of greenhouse gas emissions through reduced energy losses or higher integration of renewables are also essential key performance indicators (KPIs) for the performance of smart grids. To this end, LTCP infrastructure and advanced monitoring and control systems allow the assessment of such essential KPIs considering smart grid flexibility and performance. The reflection of these influential factors on the evaluation results provides a complete overview of the multilevel control approach's performance in a small-scale smart grid community.

Friday, June 23rd 2023 – NTUA Zografou Campus

| JUNE 23 rd , 2023 10.00 -17.00 (EEST) | | |
|---|---|---|
| 10:00 | Meeting point at Zografou Campus School of Rural, Surveying and Geoinformatics Engineering (SRSGE), “Vei” Building | PIN: 37.97554978425205, 23.779725735365506 |
| 10:00 – 11.00 | Introduction to NTUA 3D Digital Campus Modelling Prof. Efi Dimopoulou , School of Rural, Surveying and Geoinformatics Engineering | Auditorium B1 Vei Building SRSGE |
| 11.00 – 12.00 | Impact of clean energy to climate change adaptation and resilience Prof. Maria Papadopoulou , School of Rural, Surveying and Geoinformatics Engineering | |
| 12.00 – 12.30 | Discussion - Interaction | |
| 12.30 – 13.00 | <i>Quick Lunch Break</i> | Cafeteria at SRSGE Zografou Campus |
| 13.00 – 13.30 | Private guided tour at GaioOrama | Mineralogical Museum gaio-ORAMA School of Mining & Metallurgical Engineering https://en.museum.metal.ntua.gr/ |
| 13.30 – 15.30 | Drafting your Project Prof. Katerina Adam , School of Mining & Metallurgical Engineering | |

LECTURERS PROFILE

Prof. Efi Dimopoulou



Professor at the School of Rural, Surveying and Geoinformatics Engineering, N.T.U.A., in the fields of Land Administration LA, Spatial Information Management, 3D Cadastres and 3D Modelling. Programme Director of the N.T.U.A. Inter-Departmental Postgraduate Course «Environment and Development». She has published 3 books; she has authored or co-authored 120 papers in scientific journals and reviewed conference proceedings and editorials, and she chaired International Conferences and Workshops in the fields of LASystems, modelling and standardization.

Prof. Maria Papadopoulou



Dr. Maria P. Papadopoulou is Professor and Director of Laboratory of Physical Geography and Environmental Impacts and since 2017 Deputy Dean at the School of Rural & Surveying Engineering, NTUA. She currently serves as a member of the National Water Council and the National Committee on Climate Change. In June 2020, she was appointed President of the National Environment and Climate Change Agency. Her principal research interests lie in the areas of natural resources management, groundwater modeling and management, groundwater-dependent ecosystem services, climate change adaptation, water-energy-food-climate Nexus, water and carbon footprint in agricultural. In May 2020, she was part of the Sewers4COVID team winning the 1st prize on Pan-European EUvsVirus Hackathon. Since August 2020, she serves as President of the Management Board of Natural Environment and Climate Change Agency (NECCA).

Environment and Climate Change Agency (NECCA).

Prof. Katerina Adam



Katerina Adam, Professor, SMME, NTUA. Studied Mining and Metallurgical Engineering at NTUA and acquired her M.Sc. and Ph.D. as an NSF scholar from the School of Chemical Engineering and Materials Science, University of Minnesota, USA. She joined NTUA as Academic staff in 2007 and before she worked as a Senior Engineer and Manager in Research Institutes, Mining & Metallurgical Industry and Environmental Consultancy firms for the development and environmental management of Greek and International Mining and Industrial Projects. Her Research interest lies in Project & Environmental Management, Sustainable Development of Natural Resources, Reclamation of old industrial sites, Health and

Safety and Engineering Education towards the achievement of SDGs.

She acted as the coordinator or senior researcher in more than 55 National, EU and Internationally funded research projects, and she conducted as an expert on behalf of UNDP mine reclamation studies in the SW Balkans, 2011-2014.

She authored or co-authored 95 scientific articles, and more than 150 Technical, Feasibility and Environmental Impact Studies.

Professor K. Adam is presently a member of the Education Committee of the EIT Raw Materials Eastern CLC, is the Education Advisor of the EIT Raw Materials Hub – Regional Center Greece, and the Coordinator of the NTUA -EULiST Team.

Saturday, June 24th 2023 – Athens City Centre

Transdisciplinarity in education is strongly connected to international exposure and intercultural sensitivity. EULiST aims to strengthen the European identity by supporting diversified experience in intercultural environments. In this framework a visit at the Acropolis Museum, a treasure hunt, and a traditional lunch experience at the historic centre of Athens are organised. These activities will be supported by the NTUA Erasmus Students Network.

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| 11.00 – 13.00 | Visit to Acropolis Museum | Acropolis Museum Dionysiou Areopagitou 15 11742 Athens |
| 13.00 – 14.00 | Treasure Hunt, in the Athens Historical Center | Monastiraki |
| 14.00 | Lunch at Café Avissinia | Kinetou 7, Athina 105 55, Greece |

Sunday, June 25th, 2023

Study day: The students will meet in groups to study and elaborate on their projects. Due to the general elections in Greece, the NTUA campuses and facilities will be closed.

Monday, June 26th, 2023 – NTUA Zografou Campus

On Monday morning the students will work in groups on their projects with the aim to define the vision the key objectives of their projects and the Road Map for their achievement. Till 15.00 the students will have prepared 4-5 slides per group, in the template provided by the BIP Organisers, presenting the Title of the project, Team Members, Key-Project objectives and Road Map for their achievement.

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| 10.30 – 12.30 | Work in groups Students will further elaborate their projects | Teleteaching Room Ground Floor Central Library |
| 12.30 – 13.30 | Lunch break | Zografou Campus Restaurant |
| 13.30 – 15.00 | Work in progress Preparation of the first results to be announced at the EULiST General Assembly Open Session | Teleteaching Room Ground Floor, Central Library |
| 16.30 - 19.00 | EULiST General Assembly Open Session BIP students' projects presentation | Ceremonial Hall Central Administration Building |