



## COST-EFFECTIVE REHABILITATION OF PUBLIC BUILDINGS INTO SMART AND RESILIENT NANO-GRIDS USING STORAGE

### DEAR READERS,

It is our pleasure to welcome you to the fifth edition of the BERLIN Newsletter!

"BERLIN Cost-effective rehabilitation of public buildings into smart and resilient nano-grids using storage" is an ambitious project funded by the European Union under the ENI CBC Med Programme that brings together seven organizations from four Mediterranean countries, Cyprus, Greece, Israel, and Italy.

In this newsletter, we present the latest developments of the project including the progress of pilot activities as well as highlights from meetings, trainings, and events where the project was presented.

If you would like to keep up with all the latest developments of our project, follow us on Facebook and Twitter.

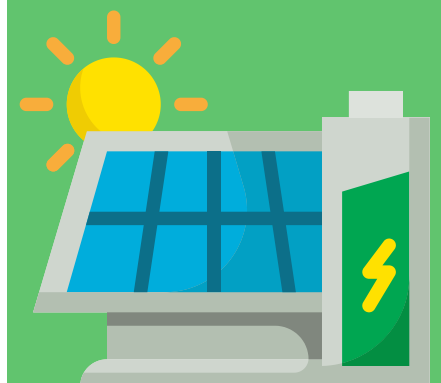
Kind Regards,  
The BERLIN Consortium

## PROJECT DURATION

02 September 2019

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01 September 2023



## ABOUT BERLIN

BERLIN focuses on increasing photovoltaics (PV) grid penetration, combined with energy storage systems (ESS) and demand side management (DSM), along with enhancement of energy efficiency in buildings. BERLIN will implement six pilots in Cyprus, Greece, Italy and Israel. The pilots will optimally integrate PV/ESS/DSM in an innovative way and transform each pilot into a self-sufficient nanogrid, as an energy rehabilitation solution in a range of climatic zones. Such a solution can contribute to alleviating the regional and global problem of high-energy consumption in buildings - 1/3 of energy consumption in Mediterranean Partner Countries, 40% in EU- and of resulting CO<sub>2</sub> emissions increase. Equally important is the need to support weak grids that are particularly common in MENA region and rural areas, with low reliability and frequent outages.

To this end, BERLIN will provide knowledge on achieving high levels of building energy self-resilience using smart nanogrids and design the solution as a cost-effective renovation. In addition, MED countries, despite their excellent solar potential, face the problem of its low grid penetration. BERLIN through onsite PV/ESS/DSM, will contribute to achieving higher levels of PV entering the grid whilst ensuring grid stability and power quality. Through these interventions, MED countries will benefit greatly from project's learning curves.

## AIM OF THE PROJECT

BERLIN aims to implement cross-border pilot measures to support innovative and cost-effective energy rehabilitations in public buildings based on the nanogrid concept, the building block for smart microgrids.

The motivation is multi-fold:

- to **address** high energy consumption in building sector that is primarily fossil-fuel based,
- to **support** areas of weak grids, common in MENA region & rural areas, as high energy consumption in buildings can compromise electric service reliability,
- to **achieve** higher grid penetration of RES whilst ensuring grid stability and power quality.



€2.5 MILLION  
EU  
CONTRIBUTION

€2.8 MILLION  
TOTAL BUDGET



## PROJECT IN NUMBERS



7

PARTNERS



4

COUNTRIES



6

TECHNICAL OUTPUTS

### WHAT WILL BE IMPROVED

- **Reduction of energy consumption** and CO2 emissions at the level of pilot buildings.
- **Replication in other Mediterranean/EU regions** and enhanced interest and capacity of public authorities in building energy retrofits.
- **Encourage a widespread policy adoption** for high photovoltaic grid penetration and high levels of self-sufficiency in buildings.
- **Boost SMEs competitiveness, R&D growth, investments** in photovoltaic grid integration, interest from local building professionals to train in new innovations for high efficient buildings, and business and job opportunities in building retrofitting.

### WHO WILL BENEFIT

The main target groups and final beneficiaries are:

1. **Energy stakeholders** (e.g. policy-makers, investors, distribution system operators, regulatory authorities, energy consultants, photovoltaic installers).
2. **Local/regional/national authorities** & their employees and building users.
3. The **scientific community**.
4. **Project consortium**.
5. **General public**.

### EXPECTED ACHIEVEMENTS

- **6 case studies** on the photovoltaic, energy storage solutions and demand side management hybrid technology.
- **Country-specific recommendations** to stimulate the uptake of photovoltaic, energy storage solutions and demand-side management.
- **2 tools** developed for renovating public buildings using photovoltaic, demand-side management and energy storage systems.
- **6 pilot actions** in buildings in 4 countries.
- **3 cost-effective technologies** in public buildings optimally integrated.
- **5 public institutions supported** towards the adoption of cost-effective policies to increase the use and local consumption of photovoltaic energy.



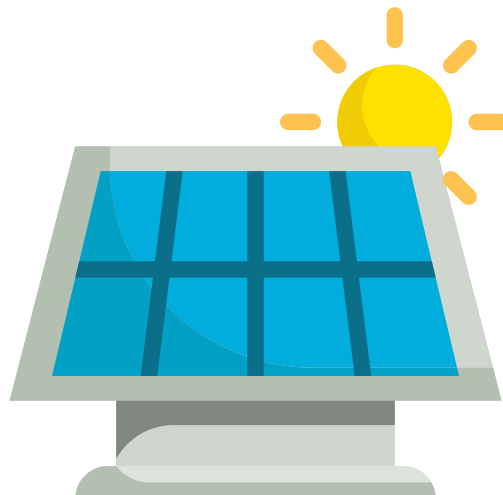


## PROGRESS SO FAR

During the period May 2022 to December 2022, the project activities ran smoothly after a long period of obstacles due to the escalation of COVID-19 situation. Due to the dedication, collaboration and hard work of partners, the difficulties were surpassed, and the project is on track towards its final phase.

The pilots in the four countries are going very well. In **Italy** and **Greece** all the equipment is installed, and the data collection phase has begun. In **Israel** and **Cyprus**, the installation of the pilots is in progress and are expected to be fully operational in early 2023.

In addition to the pilot site installations, there is currently work in progress regarding the cost and benefit analysis, policy recommendations and trainings. At the same time partners are actively participating in networking events and scientific conferences in order to disseminate the results of the project effectively and maximise the project impact.



## PILOT PHASE DEVELOPMENTS

The main goal for the building pilot sites is to create a demonstrative installation (and living lab) of a nanogrid for existing buildings to show the feasibility of a greener, ecologically sustainable, and economically profitable future scenario. In particular, the **nanogrid will reduce the building energy consumption**, for minimising the electricity bill, and providing flexibility services if required. By evaluating the meteorological information, the energy consumption and the PV energy production, the Energy Management System (EMS) of the nanogrid will handle the controllable loads and the Battery Energy Storage System (BESS) in order to maximise self-consumption and minimise the CO<sub>2</sub> building production.



### CYPRUS

The University of Cyprus announced the tender for the supply and installation of a turnkey solution, smart nanogrid at its premises in the PV Lab. Interested parties to submit an offer, were given the opportunity to visit the pilot site on several occasions. After the evaluation process, the successful tenderer was announced in August 2022 and desk works started as soon as the contract was signed i.e. September 2022, expected to be completed by early 2023.



### ISRAEL

So far, installation of the photovoltaics on the school's pergolas are finalized. The installation has 126 kWp capacity and the bus station/parking capacity is 302 kWp. The installation of the BESS is in its final design according to the consumption data collected. The final plans and the order for the BESS were completed by the end of September.



### GREECE

The two pilots located in Greece are operational and measurements are collected to assess the energy performance of the buildings. In particular, a system of 12.5kWp PV and 11 kWh of battery capacity is operating in the student dormitories of the university and a system of 10 kWp PV and 13.8 kWh of battery capacity is operating in a municipality building. An electric vehicle charger is also operating at the dormitories. Except from the electrical measurements, also meteorological data are collected for the two pilots.



### ITALY

The installation of outdoor weather station and of smart multi-meters in the pilot building of the Campus has been completed in 2021, starting a measuring campaign of the solar irradiation in the pilot site and of the building electricity consumption. The BESS and EMS has been purchased in 2021, tested in the UNICA Laboratory at the Department of Electrical and Electronic Engineering, and finally installed in the buried MV/LV substation of the pilot building. The photovoltaic system on the rooftop of the pilot building and the DSM equipment within the building have been the last installed in summer 2022. The integrated pilot system has been tested for its correct operation and it will be shortly connected to the grid.



## LEARN ABOUT NANOGRID TECHNOLOGY TESTED IN BERLIN'S PILOT ACTIVITIES

BERLIN project is all about cost-effective rehabilitation of public buildings into smart and resilient nano-grids using storage. How does this technology work?

In simple terms, **a nanogrid is a small-scale, decentralized power grid** which can operate autonomously, but can also remain connected to the central power grid. A nanogrid can be **based on sustainable electricity sources** like solar PVs, and can **integrate them with energy storage technologies**, like batteries, and energy management strategies to maximize efficiency and minimize power imports and exports to the central power grid. The BERLIN project combines three key technologies, namely: PVs, BESS and DSM.

The nanogrid is expected to have a huge impact on the development of novel integrated energy systems and set a new paradigm for the future energy infrastructure in the Mediterranean area. Specifically, the nanogrid serves two main purposes: (a) it will **increase the self-sufficiency** level of pilot buildings through onsite generation, storage, and consumption, with minimum dependence from the central power grid, and (b) it will allow the researchers of PV labs to operate the nanogrid system, conduct various tests on the system components, and take **valuable experimental data**.



## MEETINGS AND TRAININGS HIGHLIGHTS

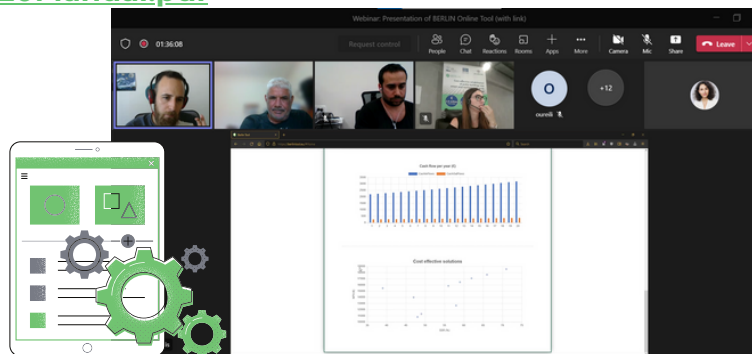
### BERLIN Smart Online Tool Training

On the 7th of June 2022, a webinar was organised on the Online Tool, addressed to professionals, stakeholders, and other experts from the energy sector, to show the functionalities of the tool. The team of experts from the University of Western Macedonia led the initiative of the tool development and the organization of the webinar with the support and contribution of all partners. There was a **live presentation for each functionality** and there was also an interactive session with questions from the attendees and answers from the research team.

The **online tool aims to promote self-sufficiency** in buildings with flexible loads, by properly sizing the photovoltaic and battery storage systems to be installed in a building, and by providing an efficient schedule for the flexible loads. It can be used by **building owners or managers to enhance the energy self-sufficiency** of buildings exploiting photovoltaics, energy storage, and demand-side management.

You may find the tool here: <https://berlintool.eu/#Home>

The manual of the tool is available here: <https://www.enicbcmed.eu/sites/default/files/2022-02/BERLIN%20Tool%20Manual.pdf>



### Consortium Meeting in Greece

Between the 19th and 21st of October, BERLIN consortium was reunited for a physical meeting this time, after COVID-19 restrictions have been lifted. The meeting took place in Thessaloniki and Kozani in Greece.

Partners had the chance to have **constructive discussions on the development of the pilot installations** in the regions involved. In Cyprus and Israel, there are significant improvements concerning the installation of equipment, while in Greece and Italy, the installations are fully completed and operational, and data are being collected for analysis. In addition, partners had the chance to plan the **next project activities including trainings and webinars**, which are going to be announced in the upcoming months.

Lastly, the partners had the chance to visit the dormitories' buildings at the campus of the University of Western Macedonia, which was selected to implement the pilot project activities. All the equipment, including the energy storage (batteries), the e-vehicle charging station and the monitoring system was presented to the partners.



## EVENTS HIGHLIGHTS

### EU Sustainable Energy Week

The energy performance of the building stock remains extremely low at Mediterranean level. To address this, the European Neighborhood Instrument for Cross Border Cooperation in the Mediterranean Programme (ENI CBC MED) identified **renewable energy and energy efficiency as major priorities** and funded 8 projects. The session, which was part of the Policy Conference at this year's edition of the EU Sustainable Energy Week, portrayed concrete **examples of how to perform cost-effective energy renovations of public buildings**. These examples were put in the context of global policies, as per the Status Report of the Global Alliance for Buildings and Construction (Global ABC).

Among the projects participating from both shores of the Mediterranean was **BERLIN project, presented as a good example of energy efficiency solution** in public buildings. Gianni Celli, Associate Professor from University of Cagliari presented the solutions of the project and actively participated in the discussion regarding the policy recommendations.

The Policy Conference was fully successful in **bringing together public authorities, private companies, projects, NGOs, and consumers to promote initiatives to save energy** and move towards renewables for clean, secure, and efficient energies and covered various topics such as REPowerEU, the digitalisation and integration of energy systems, energy efficiency, renewables, consumers and a fair energy transition, decarbonisation policies and international cooperation.

In parallel to the Policy Conference, the Energy Fair was an excellent opportunity for both BERLIN and other projects to be exhibited and interact with the wider public on their work and find new ways of collaboration and replication.





## SYNERGY MED 2022

The Synergy MED - 2nd International Conference on Energy Transition in the Mediterranean Area took place in Thessaloniki, Greece, between 17-19 October 2022. The Conference continues the idea of **establishing a major energy platform** in the region, focusing on topics of interest to the **Energy Challenges in the Mediterranean area** and addressing the vast technological changes in all areas of the electric energy business, products, equipment, methods, and so on.

The BERLIN project was presented at the Conference by Dr Alexandros Arsalis, Special Scientist at the FOSS Research Centre for Sustainable Energy of the University of Cyprus. The presentation described how the BERLIN project can set the foundations for future advanced energy systems that can help achieve decarbonization targets by exploring energy storage technologies that can include storage beyond batteries. This could include the **additional integration of a PV battery microgrid system with a regenerative hydrogen fuel cell subsystem**. Such a subsystem includes electrolyzer, fuel cell, and hydrogen storage units; it can provide **long term energy storage**, with a reduction of the capacity of the battery units in the overall system. Such a configuration may also provide green hydrogen for the fuelling of hydrogen electric vehicles. In this study a preliminary investigation of integrating a green hydrogen subsystem to a predefined PV-battery nanogrid is conducted.



## COP 27

COP27 took place in Sharm el-Sheikh between 6th-18th of November 2022. BERLIN's partner representing Eilat Municipality had the chance to participate in one of the discussions during the COP27, namely **“Leveraging local adaptation – should mayors run the world?”**. Local government's policies aim to make the region of Eilat-Eilat energy independent and free from carbon emissions by 2025. In this context, BERLIN was presented during the discussion as a case of best practice, which enhances Eilat municipality's efforts to become a carbon free community.



## PROJECT PARTNERS



### UNIVERSITY OF CYPRUS COORDINATOR

[www.ucy.ac.cy](http://www.ucy.ac.cy)

FOSS Research Centre for Sustainable Energy of the University of Cyprus (UCY) is a research powerhouse in the field of sustainable energy solutions and in particular Photovoltaics. Committed to undertaking high quality research in order to tackle the climate and energy security challenges of today and the future, FOSS has currently over 40 active research projects, mainly funded by European grants, achieving imposing results. Through its research projects, FOSS has substantial experience in pilots where Photovoltaics are integrated with Energy Storage, and this knowledge will be transferred in the BERLIN project.

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### UNIVERSITY OF WESTERN MACEDONIA

[www.uowm.gr](http://www.uowm.gr)

The Department of Electrical & Computer Engineering of University of Western Macedonia (UoWM) has been involved in several European, regional and national projects with various tasks such as the integration of renewable energy resources, intelligent control of electric power generation and consumption, photovoltaics and storage hybridization and relevant pilot activities, smart grids and cyber security.

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### THE MUNICIPALITY OF EILAT

[www.eilat.city](http://www.eilat.city)

The Municipality of Eilat city is a leader in energy efficiency, as 75% of the city's daytime electricity is supplied by renewable energy (RE), and by 2020, the city will become energy independent. As in Eilat region there is more than 1850 sun hours per year, there is an advantage of using PV. The current state and the planned solutions are based on solar PV systems and energy efficiency, mostly in the cooling systems. Eilat is also a member of several H2020 projects in which a planning for a positive energy district is being developed.

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Università degli Studi di Cagliari



## UNIVERSITY OF CAGLIARI

[www.unica.it](http://www.unica.it)

UNICA participates in the BERLIN project through the Department of Electrical and Electronic Engineering (DIEE) that has a long history of participation to EU projects and calls and each year a significant portion of its budget is based on EU projects. The department cooperates with research labs (both industrial and public) and with other academic institutions worldwide.

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## BEN GURION UNIVERSITY

[www.in.bgu.ac.il](http://www.in.bgu.ac.il)

BGU is one of Israel's leading research universities and among the world leaders in many fields. BGU participates in the BERLIN project through the Department of Structural Engineering adding much needed structural/architecture expertise to consortium. Modern structural engineers face a variety of technological developments and challenges.

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# Deloitte.

## DELOITTE LIMITED

[www2.deloitte.com/cy](http://www2.deloitte.com/cy)

Deloitte participates in BERLIN through the Innovation and Entrepreneurship Centre (Deloitte IEC). Deloitte has an important role in the project as it has vast experience in managing successful European and local funded projects. The team of Deloitte IEC uses multiple research methods and tools for European Union-funded and ad hoc research for internal or external purposes in a number of areas covering Cyprus and the rest of Europe. Specifically, Deloitte IEC involvement in EU-funded projects is mainly on socio-economic impact studies, cost-benefit analyses, project and financial management, quality management and communication and dissemination.

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## HEVEL EILOT REGIONAL COUNCIL

<https://www.eilat.org.il>

Hevel Eilat Regional Council contribution will be on the off-grid applications, policy making at regional level and multi-level governance. Hevel Eilat is at the forefront of RE in Israel. The Eilat region established the Company for Renewable Energy (NGO) that works on the regulation and assimilation of innovation in the region. The regional council was the first one in Israel to build a PV solar farm and its developing new project as well as supporting start-ups.

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## ASSOCIATED PARTNERS

	Organization	Country
Associate 1	 <b>MUNICIPALITY OF KOZANI</b>	Greece
Associate 2	 <b>Municipality of Ussaramanna</b>	Italy
Associate 3	 REGIONE AUTÒNOMA DE SARDIGNA REGIONE AUTONOMA DELLA SARDEGNA	Italy

For more information please contact the project coordinator Prof. George E. Georghiou, Director of FOSS Research Centre for Sustainable Energy, University of Cyprus, Tel. +357 22892272, email: geg@ucy.ac.cy.

