ENTERPRISES/0618/0052

Development of a cost-effective solution for a building-integrated photovoltaic (BIPV) system for façade and window application in Cyprus, with compliance with all PV & Building safety regulations.

OUTLINE

- Project Overview
- Project Objectives
- Challenges and Troubleshooting

PROJECT OVERVIEW

- Title: ENTERPRISES/0618/0052 – Impact-BIPV
- 36 months – start date: 15/5/2019
- Partners:
  - M.G.F.K. ENERGY LTD
  - University of Cyprus - FOSS
  - Deloitte Limited

PROJECT OBJECTIVES

- The development of a cost-effective solution for a building-integrated photovoltaic (BIPV) system for façade and window application in Cyprus, with compliance with all PV & Building safety regulations.

- Small-scale pilot window installation in an existing commercial building.

- The creation of the technical skills required in the local industry to grow and sustain this market in Cyprus.

- Commercialization and effectively utilized BIPV system by architects/engineers in new building in Cyprus.

MANAGEMENT

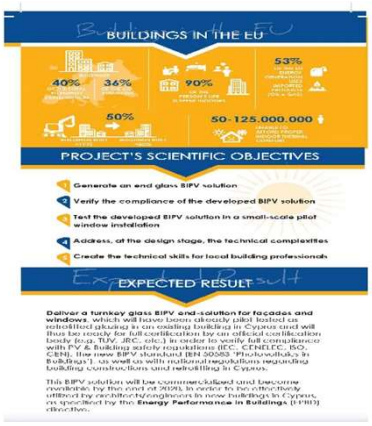
DISSEMINATION / COMMUNICATION

- All actions done so far (project logo, communication plan, flyer, social media).
  - https://www.linkedin.com/company/impact-bipv
  - https://www.k-energy.com.cy/impact-bipv/
- Not enough progress due to covid delays.


Η καινοτομία συναντά τον σχεδιασμό

Λωρεάν σημαντικός αριθμός προϊόντων που αφορούν ατομικό προστατευτικό και ιατροτεχνολογικό εξοπλισμό

Δράσεις ΕΤΕΚ για στήριξη στην αντιμετώπιση των προβλημάτων της πανδημίας Covid-19



DESIGN OF BIPV SOLUTION

- Aim: Define the BIPV solution focusing on two glazing application: facades and windows.

- Main points from the deliverable reports generated :

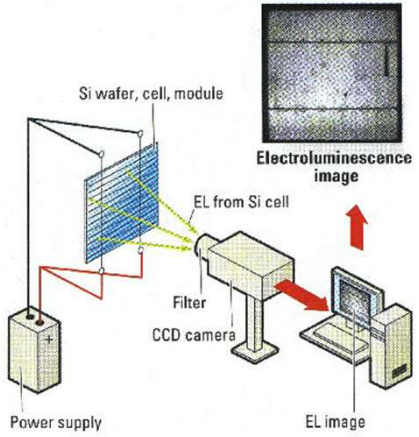
  - ✓ Specific building types in Cyprus were defined/analyzed to satisfy criteria conditions restrictions in order to derive the best solution for the BIPV to be developed.
  - ✓ A review was written outlining solution technologies in the market investigating different aspects such as cell technologies, efficiency and output, module design, cost etc. thus enabling the most appropriate design as well as cost effective solution for Cyprus for the pilot testing.
  - ✓ The final product is a BIPV solution that can be used as a building component that produces energy and can fully replace construction elements of the building envelope. The development of a PV glass from scratch was high risk, so existing products from the market were used instead. The assembly of the PV film within the aluminium frame has been implemented, using glass that is fully complying with all building regulations. The location and orientation of the building and the fact that it is under construction, are the reason of its selection plus provides convenient monitoring, control and demonstration of the prototypes.

DEVELOPMENT OF THE BIPV SYSTEM

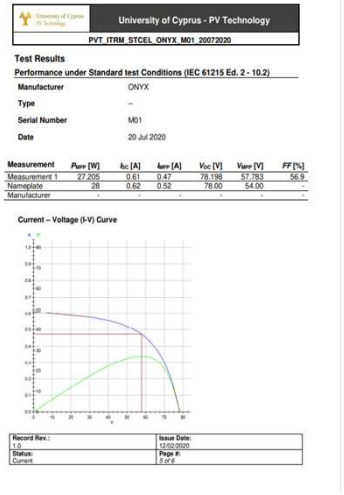
The development and validation of the BIPV solution designed.

Thickness Configuration (mm)	SHGC (%)	U-value (W/m^2K)	U-value (ft^2)	External Light Reflection (%)	Transparency (%)	Peak Power (Wp/m^2)
6T+3.2+6T/12Air/6T low-e	12	1.6	0.28	7.3	20	28

Solar Simulator



Electroluminescence Apparatus



Test report (performance, EL)

- Indoor tests performed at FOSS laboratory for validation purpose. Output Performance test (solar simulator; under STC was investigated using the IEC 61215, Ed. 2, Procedure 10.2.) and Electroluminescence test.

DEVELOPMENT OF THE BIPV SYSTEM

- Modules from ONYX.

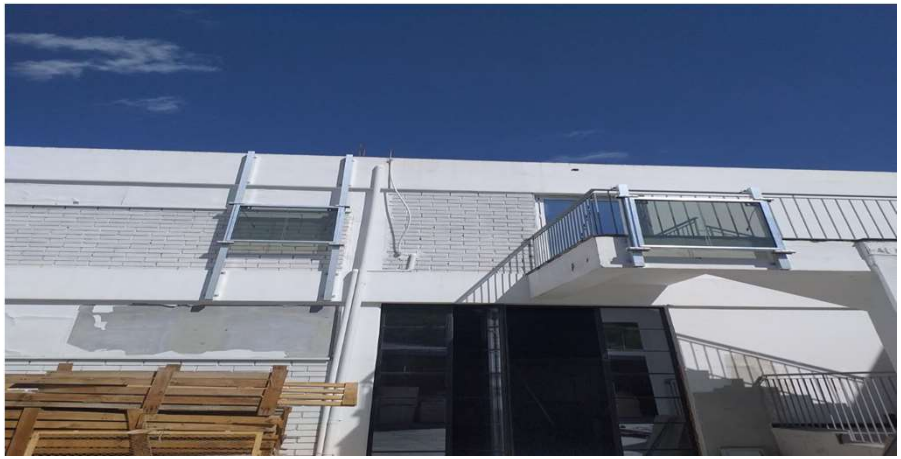
- Progress: The assembly of the modules within the aluminium frame, has been implemented by Rabel on the 28th of September 2021. Technical constraints: All electrical connections and cables must be hidden inside the substructure.

Rear Junction Box & PV Module

SMALL-SCALE DEMONSTRATION OF THE INTEGRATION OF THE BIPV

- Assess the final solution development in a real final environment/ building in Cyprus and moreover to gain vital expertise in BIPV technology and addressing the challenges relating to the pilot implementation.

- The installation of the PV window modules took place on October 6, 2021. The PV modules were electrically wired in series and were connected to a maximum power point tracker (MPPT) circuit (power converter).



Both PV module windows installed on site

Site installation of the system. (left) Load unit. (right) Power converter

COST BENEFIT ANALYSIS

- Develop a comprehensive report that addresses the financial dimension of the designed BIPV solution based on the capital expenditure and the operating costs, taking into consideration all the qualitative and quantitative benefits of the solution.

- CBA includes some general info as well as:
  - Methodology
  - Installation of BIPV (capex/opex/capacity…)
  - Installation of conventional PV panels (capex/opex)
  - Other qualitative parameters

CHALLENGES AND TROUBLESHOOTING

- **The risk of developing a solar PV glass** from scratch was high, so existing products from the market were used instead (Two units of amorphous silicon technology were purchased from Onyx Solar).
- Testing in the FOSS lab the two ONYX modules proved not trivial due to innovative and custom design modules (all glass, heavy panels, non-standard dimensions) → **complicated the investigation procedure at FOSS** lab and required significant modification of existing infrastructure
- **The assembly of the PV film** within the aluminium frame has been implemented by Rabel.

  The technical constraints that we had to face were the following:

  α. **Junction box** (must be hidden in the given space)

  b. **All electrical connections and cables** (must be hidden inside the substructure to achieve a uniform, aesthetically appealing result with no distracting cableways).
- **Pandemic crisis** and lockdowns slightly **delayed** project progress (e.g. public events not feasible in this period).
- **Transition to the IRIS online reporting system**, slightly **delayed** some reporting deliverables of the project **and increased the administrative burden and effort.**

THANK YOU

Fanos Karantonis

M.G.F.K ENERGY LTD