Filippos Lygerakis, PhD

Environmental Engineer | Postdoctoral Researcher

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Sustainable Built Environment Laboratory, Technical University of Crete

RESEARCH PROFILE

Postdoctoral researcher at the Technical University of Crete and environmental engineer working across building energy performance, advanced materials and knowledge-based decision support. Combines EnergyPlus simulation and experimental assessment of phase-change materials with semantic data integration, digital twins and collaborative research on occupant-centric methods and neural analytics. Experience coordinating technical contributions in European research projects and producing peer-reviewed publications and public research outputs.

RESEARCH APPOINTMENTS

Nov 2021-present
Associate Researcher - Sustainable Built Environment Laboratory
Technical University of Crete. Building-energy modelling, knowledge graphs, digital twins, neural analytics and decision support.

Nov 2021-present
Research Associate - Technical University of Crete
Research contributions in European and national projects.

Nov 2021-Nov 2025
Doctoral Researcher - Technical University of Crete
Methods linking energy-efficient building technologies, simulation, lifecycle indicators and neighbourhood decision-support workflows.

EDUCATION

Nov 2021-Nov 2025
PhD in Environmental Engineering - Technical University of Crete
Dissertation: Integration of Innovative Energy Efficient Technologies in Buildings and Neighborhoods. Awarded 5 November 2025; defended 22 October 2025.

Oct 2020-Nov 2021
MSc in Environmental Management, Sustainable Energy & Climate Change
Technical University of Crete. Field: Environmental Engineering. Thesis: Energy Assessment of a Near Zero Energy Building (nZEB) Using Knowledge Graphs.

Sep 2015-Sep 2020
Integrated MEng in Environmental Engineering
Technical University of Crete. Grade: 7.78/10. Diploma thesis: Storage Systems in Autonomous Zero-Energy Buildings.

TECHNICAL EXPERTISE

Building & energy modelling
EnergyPlus, OpenStudio, building-retrofit assessment, thermal comfort (PMV), operational and lifecycle performance indicators.

Semantic technologies & digital twins
RDF/OWL, SPARQL, Protégé, Neo4j/Cypher and knowledge graphs; Brick, SAREF, SOSA/SSN and related built-environment ontologies.

AI & data analytics
Python, Keras/TensorFlow, scikit-learn; neural surrogates, time-series prediction, anomaly detection and uncertainty quantification.

Optimisation & sustainability assessment
Agent-based modelling, LCA/LCC integration and multi-criteria decision support; collaborative research on occupant-centric, rolling-horizon and multi-objective optimisation.

Research & experimental work

RESEARCH PROJECTS & TECHNICAL CONTRIBUTIONS

2022-present
PROBONO | Horizon 2020, GA 101037075
Knowledge graphs, agent-based modelling and digital-twin services for Green Building Neighborhoods. Day-to-day WP3 coordination under Professor Dionysia Kolokotsa's scientific supervision; co-author of public deliverable D3.18. Project website.

2025-present
INTEGRATES | Horizon Europe, GA 101235856
WP4 research on building-data interoperability and the integration of structured knowledge with time-series models for anomaly detection, prediction and uncertainty evaluation. Project website.

2026-present
Re-Growth | Horizon Europe, GA 101309331
T3.3 team contribution to thermal, optical and acoustic performance assessment of bio-based building materials. CORDIS project record.

2022-2025
GreenMat | National Flagship Research Action, Greece
Phase-change-material-enhanced cement and gypsum systems, experimental characterisation and whole-building energy performance. Funded under Greece 2.0 / NextGenerationEU. Official project record.

2024-2025
New Innovative Museum of Archanes
Material documentation and development of a digital reference model within a Technical University of Crete research contract.

Dec 2024
LC3 Pilot Area
EnergyPlus modelling of pilot buildings in Limassol under WP2 (A.2.2.2). Project website.

MATERIALS & EXPERIMENTAL RESEARCH

Advanced building materials. Shape-stabilised PCM composites in lightweight ceramic/carbon foam carriers and PCM-enhanced cement and gypsum boards. Latent-heat storage, thermal and optical characterisation, accelerated weather-ageing durability, and integration of measured properties into EnergyPlus CondFD and phase-change/hysteresis models.

Laboratory characterisation. Experience with NETZSCH DSC 214 Polyma differential scanning calorimetry, Hot Disk TPS 1500 thermal-property measurements, Cary 5000 UV-Vis-NIR spectrophotometry with integrating sphere, emissometry, thermogravimetric analysis and Q-SUN Xe-1 xenon-arc accelerated weathering.

TEACHING & LANGUAGES

2022
Teaching support - Technical University of Crete
Supplementary teaching for Optimization of Environmental and Energy Systems (8th semester), School of Chemical and Environmental Engineering.

English - C2, Michigan Certificate of Proficiency in English
German - B2, Goethe-Institut.

Additional professional skills - Engineering, presentations, problem solving, Microsoft Excel and leadership.

ACADEMIC SERVICE

Peer reviewer, **Solar Energy Advances** (2025–2026); seven review records verified on ORCID, 17 November 2026.

Publications & preprint

PEER-REVIEWED JOURNAL ARTICLES

01 Lygerakis, F., Kampelis, N., & Kolokotsa, D. (2026). **Smart, data-driven decision support for neighborhood-scale energy retrofit planning.** Energy and Buildings, 362, 117524.
doi.org/10.1016/j.enbuild.2026.117524

02 Lygerakis, F., Gioti, C., Karakassides, M. A., Gournis, D. P., Yentekakis, I. V., & Kolokotsa, D. (2025). **Impact of accelerated weather aging on building energy efficiency using cement and gypsum boards with shape-stabilized phase change materials.** Scientific Reports, 15, 40884.
doi.org/10.1038/s41598-025-24728-8

03 Lygerakis, F., Gioti, C., Gournis, D., Yentekakis, I. V., Karakassides, M., & Kolokotsa, D. (2024). **Enhancing Building Energy Efficiency with Innovative Paraffin-Based Phase Change Materials.** Energies, 17, 4155.
doi.org/10.3390/en17164155

04 Lygerakis, F., Kampelis, N., & Kolokotsa, D. (2022). **Knowledge Graphs' Ontologies and Applications for Energy Efficiency in Buildings: A Review.** Energies, 15, 7520.
doi.org/10.3390/en15207520

PUBLISHED CONFERENCE PAPERS

Lygerakis, F., Malisovas, A., Lilli, A., Tsekeri, E., Diangelakis, N. A., & Kolokotsa, D. (2026). Towards a Neurosymbolic Architecture for Neighborhood-Level Time-Series Intelligence. 11th International Conference on Smart and Sustainable Technologies (SpliTech 2026), Split/Bol, Croatia, 23-26 June 2026. Published conference paper; presenter. IEEE Xplore publication: 16 September 2026.
doi.org/10.23919/SpliTech70133.2026.11685543

Lygerakis, F., Kolokotsa, D., Drosou, C., Gournis, D., Yentekakis, I. V., Gioti, C., & Karakassides, M. A. (2024). Enhancing building energy efficiency with innovative paraffin-based phase change materials. 14th Panhellenic Scientific Conference of Chemical Engineering, Thessaloniki, Greece, 29-31 May 2024. Published conference paper.
Official conference paper (PDF)

Kampelis, N., Lygerakis, F., & Kolokotsa, D. (2023). Towards the development of a knowledge graph-based decision support framework for Green Building Neighborhoods. 6th International Conference on Countermeasures to Urban Heat Islands (IC2UHI), Melbourne, Australia, 4-7 December 2023. RMIT University, pp. 723-732. Published conference proceedings paper.
Official conference proceedings

PUBLISHED EXTENDED ABSTRACT

Kolokotsa, D., Lygerakis, F., Kyriakou, L., Pirone, L., Abbasi, H., Converso, S., Haik, R., Peled, A., Álvarez, J. I., Dallas, V., Vlachogianni, M., Sfetsos, T., Tziviloglou, E., & Karatasios, I. (2025). HBIM and BEM driven design and selection of repair mortars for enhancing energy performance of historic buildings under climate change. HMC 2025, Padova, Italy, 2-4 September 2025. Book of extended abstracts, pp. 653-655.
Official book of extended abstracts (PDF)

PUBLIC PREPRINT - NOT PEER REVIEWED

Chytis, T. M., Diangelakis, N. A., Lygerakis, F., Kampelis, N., & Kolokotsa, D. (2026). Occupant-centric rolling-horizon optimisation of thermal comfort and HVAC energy use using ReLU neural-network surrogates. SSRN preprint, posted 8 July 2026. Not peer reviewed.
doi.org/10.2139/ssrn.7079434

Conferences & open outputs

FURTHER CONFERENCE CONTRIBUTIONS & PRESENTATIONS

2026 **From Vision to Implementation: A Scenario-Driven Architecture for Sustainable Neighborhood Transformation.** Sustainability in Energy and Buildings (SEB-26), Chania, Greece, 8-10 July 2026. Presenter.

2026 **Ontology-Driven Knowledge Graph Integration of Representative Digital Twin Use Cases for Sustainability Assessment in Green Building Neighborhoods.** SEB-26, Chania, Greece, 8-10 July 2026. Presenter.

2026 **Neurosymbolic Data and Knowledge Architecture for Digital Twin Applications in the Building Sector.** 15th Panhellenic Scientific Conference of Chemical Engineering, Chania, Greece, 3-5 June 2026. Official project report.

2026 **Neural Enhancement Layer for Time-Series Intelligence in Neighborhood-Scale Digital Twin Environments.** 15th Panhellenic Scientific Conference of Chemical Engineering, Chania, Greece, 3-5 June 2026. Official project report.

2024 **Towards a Digital Twin-based conceptual framework for Green Building Neighbourhoods.** 14th Panhellenic Scientific Conference of Chemical Engineering, Thessaloniki, Greece, 29-31 May 2024. Lab contribution page.

2024 **Occupant behaviour optimisation towards thermal comfort and energy efficiency in buildings.** 1st International Conference on Net Zero Carbon Built Environment, Nottingham, UK, 3-5 July 2024. Conference presentation.

SELECTED PUBLIC DELIVERABLES & OPEN RESEARCH

PROBONO D3.1 - SOTA Reports and DT Models (I). Public deliverable.

PROBONO D1.6 - GBN Scenario Generation and Strategic Case Studies (FINAL), 2025. Public deliverable.

PROBONO D3.18 - Knowledge Graphs and Agent-Based Modelling (FINAL), 2026. Public deliverable, Ref. Ares(2026)630273.

NCREM Ontology - open research ontology. Release v1.2.1, published 17 July 2026; Creative Commons Attribution 4.0 (CC BY 4.0).
Repository | v1.2.1 release

PATENT & INTELLECTUAL PROPERTY

Knowledge graph (KG)-centric decision support for green building neighborhood renovation scenario modeling.
Inventors: Filippos Lygerakis, Nikolaos Kampelis and Dionysia Kolokotsa. Technical University of Crete. One invention with Greek patent publication GR1010914B (20 March 2025) and corresponding European application EP25386016.7 (filed 10 March 2025), published as EP4617935A1 on 17 September 2025.
Greek patent publication | European application publication

RESEARCH TALKS & DOCTORAL RESEARCH

21 December 2023 Knowledge Graph-based Architecture for Decision Support on Neighborhood-level Construction and Renovation. Research seminar, Chair of Cyber-Physical Systems, Montanuniversität Leoben.
Author announcement

30 April 2025 Integration of Innovative Energy Efficient Technologies in Buildings and Neighborhoods. 6th Annual PhD Conference, Technical University of Crete. Doctoral research pitch/poster.
Official TUC conference announcement