# ENERGETICS

## ENI CORPORATE UNIVERSITY - Integrated Design and Management of a Hybrid System Combining Wind, PV, and Natural Gas Turbine Power Sources

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| **Funded By** | ENI CORPORATE UNIVERSITY S.P.A. [P.iva/CF:12561370151] |

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| **Context of the research activity** | This research aims at the development and optimization of a hybrid energy system integrating wind power, photovoltaic modules, and natural gas turbines with an advanced control and energy management system. The project aims to enhance energy efficiency, reduce greenhouse gas emissions, and utilize flared natural gas in oil upstream installations by designing, modeling, and simulating the system using advanced engineering software.<br><br>Position reserved to candidates selected by the Iraqi Ministry of Oil. |
| **Objectives** | This PhD project focuses on the design, modeling, and optimization of a hybrid energy system integrating wind turbines, photovoltaic (PV) modules, and a natural gas-fired turbine, managed through an intelligent control and energy management unit with battery storage support. The system aims to deliver stable, efficient, and sustainable electrical power while reducing greenhouse gas emissions and utilizing flared natural gas commonly wasted in oil fields.<br><br>The research aims to develop a with multi-attribute decision analysis for site selection, evaluating parameters such as wind potential, solar irradiance, grid accessibility, and environmental suitability. Specific modeling tools will be employed for wind power system design, PV system modeling, while MATLAB/Simulink/Phyton may be used for dynamic simulation, control strategy development, and gas turbine integration.<br><br>An energy management algorithm will be developed to coordinate power generation from all subsystems, optimizing operation based on real-time factors such as load demand, resource availability, and climatic variations. Battery sizing and control logic will ensure system stability during fluctuations or outages.<br><br>The study includes load flow and grid impact analyses, system protection coordination, and cost estimation of the hybrid plant. This integrated approach is expected to significantly enhance energy reliability and |

|  | efficiency, while contributing to transition toward cleaner and more sustainable power generation.<br><br>Application areas may include regions in middle east (i.e., Iraq) and african countries rich in oil fields (i.e., Nigeria, Algeria, etc…) |
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| **Skills and competencies for the development of the activity** | Strong knowledge in renewable energy systems, power system modeling, and control engineering. Proficiency in system simulation and optimization tools. Skills in data analysis, energy management algorithms, battery storage design, and grid integration. Competence in cost estimation, project design, and environmental impact evaluation. |