NOTICE OF COMPETITION FOR ADMISSION TO THE COURSES OF

PHD OF THE XXXIX CYCLE

A.A. 2023-2024

ANNEX 3 TO DECREE NO. 1 OF 12 JULY 2023

<table>
<tr><th colspan="4">PHD IN
PHYSICAL AND ENGINEERING SCIENCES FOR INNOVATION AND SUSTAINABILITY</th></tr>
<tr><td>ADMINISTRATIVE HEADQUARTERS</td><td colspan="3">Guglielmo Marconi' University</td></tr>
<tr><td>PROPOSING STRUCTURE</td><td colspan="3">FACULTY OF ENGINEERING</td></tr>
<tr><td>SCIENTIFIC AREAS</td><td>01 - Mathematical Sciences
02 - Physical Sciences
08 - Civil Engineering and Architecture
09 - Industrial and Information Engineering</td><td colspan="2">SS.SS.DD.
FIS/01 - Experimental Physics;
ICAR/07 - Geotechnics;
ICAR/09 - Construction Technology;
ICAR/20 - Technique and Planning; Urbanism
ING-IND/08 - Fluid Machines;
ING-IND/09 - Energy and Environmental Systems;
ING-IND/11 - Technical Environmental Physics;
ING-IND/12 - Mechanical and Thermal Measurements;
ING-IND/14- Mechanical Design and Machine Construction;
ING-INF/03 - Telecommunications;
ING-INF/05- Information Processing Systems;
MAT/05 Mathematical Analysis
MAT/07 Mathematical Physics</td></tr>
<tr><td>COORDINATOR SCIENTIFIC</td><td colspan="3">Prof. Fabio Orecchini, Professor of Energy and Environmental Systems at the Guglielmo Marconi University</td></tr>
<tr><td>COURSE DURATION</td><td colspan="3">3 Years</td></tr>
<tr><td rowspan="3">POSTS</td><td rowspan="2">WITH GRANT</td><td>n. 2</td><td>Financed by the University</td></tr>
<tr><td>n.6</td><td>Financed with PNRR funds pursuant to Ministerial Decree 118 of 02.03.2023. It should be noted that in the event that the MUR does not pay the funding to cover the scholarships, the scholarships will not be disbursed, with the consequent forfeiture of the positions awarded to the successful candidates. The winners will therefore only be able to enrol following this ministerial verification.</td></tr>
<tr><td>WITHOUT GRANT</td><td>n. 2</td><td>The above-mentioned places will be allocated, in the order of the ranking list,</td></tr>
</table>

			to candidates who are eligible in the relevant ranking list, but with a lower score than the one with which the last scholarship was awarded.
	TOTAL POSITIONS	**n. 10**	
	SUPERNUMERARIES	At the end of the competition, the Board of Teachers, having assessed the actual compatibility with: ✓ the research facilities of the University; ✓ the ability of the teaching staff to support doctoral students in their work and research activities; ✓ the possible employment of doctoral candidates; may admit an appropriate number of eligible candidates in the ranking list who fall within the following situations, without a scholarship: a) recipients of research grants pursuant to Article 22 of Law No. 240 of 30 December 2010; b) foreign nationals who do not compete for scholarships; c) employees of public administrations, who may benefit from the leave of absence provided for by collective bargaining for the period of the normal duration of the course or, for employees under public law, from extraordinary leave for study purposes, compatibly with the needs of the administration, pursuant to art. 2 of Law no. 476 of 13 August 1984 and subsequent amendments, with or without pay and unless explicitly waived, only if they are enrolled for the first time in a doctoral course, regardless of the disciplinary field; d) recipients of a personal gross annual income for the tax period relating to the calendar year of the grant equal to or greater than the grant, currently set at EUR 16,243.00; e) citizens of non-EU states who hold scholarships awarded by the Italian government or national and international institutions and holders of research scholarships funded by the European Union or other European or international scientific institutions; f) holders of PhD apprenticeship contracts, who are not included in the vacancies; g) those who, having already been selected within the framework of research programmes of the European Union or other international cooperation programmes, although not having submitted an application for admission to the competition within the terms established by	

<table>
<tr><td></td><td></td><td>the Announcement, apply for enrolment in the Doctoral Programme. Enrolment is in any case subject to verification of the qualifications possessed and to the prior approval of the Board of teachers of the Doctorate, which, in the case of candidates holding a qualification obtained abroad, shall decide on the suitability of the qualification;
h) those who are enrolled in PhD courses at foreign universities and have signed agreements with the University for the award of a joint PhD degree.
It will be the responsibility of the University Administration to inform those who have applied how to proceed with registration.</td></tr>
<tr><td>EXAMINATION TESTS</td><td colspan="2">Admission to the doctoral course requires:
a) ASSESSMENT OF TITLES (max. 20 points)
The categories of <u>titles</u> and their evaluation criteria are as follows:
<table>
<tr><th></th><th>Title</th><th colspan="2">Criteria From / To</th><th>Points</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Degree type and thesis. In the event that the applicant holds and has indicated more than one degree in the application, he/she must indicate the degree to be taken into consideration. For undergraduates, the relevance will be assessed in relation to the examinations taken at the deadline of this call for applications (max. 2 points).</td><td colspan="2">Relevant to the 'Scientific Areas' of the PhD Course (Mathematical Sciences, Physical Sciences, Civil Engineering and Architecture, Industrial and Information Engineering) to the 'Research Areas'.</td><td>4</td></tr>
<tr><td colspan="2">Partially relevant</td><td>2</td></tr>
<tr><td colspan="2">Not Relevant</td><td>0</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Degree mark. If the applicant holds and has indicated more than one degree in the application, he/she must indicate the degree to be taken into consideration. For undergraduates, the mark will be calculated on the weighted average of the marks of all the examinations taken on the date</td><td>105 (average exam 27)</td><td>110 cum laude (average exam 30)</td><td>2</td></tr>
<tr><td>102 (average exam 25)</td><td>104 (average exam 26.99)</td><td>1</td></tr>
<tr><td colspan="2"><102 (average exam <25)</td><td>0</td></tr>
</table></td></tr>
</table>

	of expiry of this call for applications (max. 2 points).		
3	Academic and study qualifications: Level I and II Masters, Postgraduate courses, Postgraduate diplomas, Awards, etc. In the event that the candidate holds and has indicated more than one qualification in the application, he/she must indicate the qualification to be taken into consideration (max. 2 points).	Relevant to the 'Research Areas' and 'Scientific Areas' of the PhD Course	2
		Partially relevant	1
		Not relevant	0
4	Documented work and research activities at possibly qualified institutions (universities, research centres, qualified research and development centres of companies and institutions). In the event that the applicant holds and has indicated in the application different work and research activities, he/she must indicate the title to be taken into consideration (max. 5 points).	Relevant and qualified entity.	5
		Relevant and unqualified entity.	4
		Partially Relevant and Qualified Entity	3
		Partially Relevant and Qualified Entity	2
		Not relevant and qualified entity	1
		Not relevant and unqualified entity	0
5	Participation as a speaker at national and international conferences and congresses. In the event that the applicant holds and has indicated in the application several participations in conferences, he/she must indicate the title to be taken into consideration (max. 2 points).	Relevant to the 'Research Areas' and 'Scientific Areas' of the PhD Course	2
		Partially relevant	1
		Not relevant	0
6	Publications possibly in bibliometric journals (ISI, SCOPUS). If the applicant has more than one publication and	Relevant and bibliometric journal	5
		Partially Relevant and Bibliometric Journal	4

	has indicated this in the application, he/she must indicate the title to be taken into consideration (max. 7 points).	Relevant and non-bibliometric journal	3
		Partially relevant and non-bibliometric journal	2
		Not relevant and bibliometric journal	1
		Not relevant and non-bibliometric journal	0

b) RESEARCH DRAFT (max. 40 points) shall:

- ✓ focus on the areas of research listed in the 'Research Areas' section and on subjects related to one or more of the SSDs listed in the 'Scientific Areas' section of this form;
- ✓ be written in Italian or English
- ✓ contain a maximum of 20,000 characters (including spaces)
- ✓ be accompanied by bibliographical references
- ✓ divided into the following sections:

1. Name of PhD Course and Cycle, Name of Candidate, Title of Research
2. State of the art, methodological framework and impact of the research accompanied by bibliography with clear indication of the objectives in relation to the state of the art
3. Summary of the three-year research programme with indication of the theoretical/experimental methodologies, programmes/applications for analysis, activities and timelines.
4. Expected results in 3 years with evidence of progress against the state of the art and impact in research and society.
5. Bibliographic references

The research project consists of drawing up a document that can be used to assess the researcher's propensity for research and his or her ability to organise the various stages of the project independently. The evaluation criteria are:

	Criterion	**From**	**A**
1	Relevance to the 'Research Areas' and 'Scientific Areas' of the PhD Course	0	10
2	Knowledge State Art/Bibliography	0	10
3	Clarity and completeness of presentation of objectives, methodologies and potential outcomes	0	10

4	State-of-the-art advancement and impact of research	0	10

c) ORAL TEST

The oral test will focus on the discussion of the qualifications and the research project and will be aimed at ascertaining

- ✓ knowledge of the topics covered by the PhD;
- ✓ the ability to present one's CV and research project
- ✓ an aptitude for research
- ✓ **knowledge of English or, alternatively, of another foreign language useful for carrying out the research project**.

The evaluation criteria are:

	Criterion	**From**	**A**
1	Knowledge of the 'Research Areas' and 'Scientific Areas' of the PhD Course	0	10
2	Clarity and completeness of the presentation of one's CV and research project	0	10
3	Aptitude for research and advancement of the state of the art and ability to organise work independently and in a team	0	10
4	Ability to read/understand/explain a text in a foreign language	0	10

SCORES ATTRIBUTABLE TO INDIVIDUAL TESTS

The Commission has a total number of 100 points, distributed as follows:

- ✓ **Research project: 40/60**
- ✓ **Titles and Publications: 20/60;**
- ✓ **Oral test: up to 40 points**

- Only candidates who have obtained a total score of at least 40/60 in the evaluation of their qualifications and research project will be admitted to the oral test;
- The oral test is deemed to have been passed with a mark of not less than 25/40;
- Once the oral test has been completed, the Commission draws up the overall merit list by adding up the marks obtained in the individual tests for each candidate;
- Candidates with a minimum total score of 65/100 will be declared successful in the competition.

The date, time and procedures for the oral test will be announced **at least 7 days in advance** through the publication of an appropriate notice in the "Announcements and Competitions" and "Research Doctorates" sections of the University website. By means of such notice, the fulfilment of the requirement of publicity of the acts

CALENDAR OF EXAMINATIONS	shall be deemed to have been fulfilled, whereby **such publication shall to all intents and purposes count as notification of convocation.** Candidates for the admission competition are therefore required to present themselves on the day and at the time indicated without waiting for further personal communications in this regard, with a valid identity document. The absence of the candidate on the appointed day and time will be considered as formal renouncement of participation in the Competition.
COURSE REGISTRATION FEE	Candidates declared eligible without a scholarship and supernumerary candidates admitted to the Course are required, at the time of enrolment, to pay an **annual contribution of € 5,000.00 (five thousand/00 euros).** To this contribution is added the payment of the regional tax for the right to university study of the Lazio Region. Grant recipients are also required to pay the regional tax for the right to study. **Contributions paid will not be returned under any circumstances, even in the event of exclusion from the PhD programme.** **Applicants may request payment in instalments, subject to payment of 50% of the tuition fee upon enrolment.**
TRAINING OBJECTIVES	The PhD programme aims to promote the preparation of researchers and professionals capable of being a fulcrum of innovation for industry and society, of contributing to the development of new knowledge, of managing original research and development projects, and of independently carrying out programmes of strategic importance. In order to achieve this objective, the Course promotes and supports a strong integration between basic and applied research with a high degree of interdisciplinarity, with a particular focus on both the production realities active in this sector (see the various collaborations in the various research projects of the members of the college such as the Maire Tecnimont group, the SOLIDpower, Walter Tosto, ENERECO and HyGear companies that are partners in the BLAZE research project, the ICI Caldaie, Calida Technologies and Marion Technologies companies that are partners in the GICO research project, the SNAM and Rampini companies that are partners in the LIFE3H project, etc.) and to research by means of the LIFE3H project.) and towards research by means of possible spin-offs that can be developed within the framework of the PhD itself, thus creating new productive realities that do not exist at the moment (using not only the Marconi laboratory, as the operational structure of this PhD, but also the recent Marconi Innovation Hub and CERITED - Centre for Ecological and Digital Transition and the structures of other bodies with which USGM or directly the Department of Engineering Sciences already have agreements). This multidisciplinarity is conceived as an inevitable integration and synergy between design, energy and computer science engineering skills with those of physics and mathematics and those of civil engineering and architecture, but also with the related skills of economics, political science and law (collaborating, this PhD, with members of the Department of Economic and Business Sciences and the Department of Legal and Political Sciences of the University of Studies 'Guglielmo Marconi'), in order to promote a path capable of training people who are self-sufficient, both in the use of tools and methods for research, and in the ability to transfer these high skills to the field of business innovation. In particular, the doctorate is intended as a tool for the advanced training of professionals capable of moving within the future technological scenarios in the various contexts (Energy and Environmental Systems; Technical Environmental Physics; Fluid Machines; Mechanical and Thermal Measurements; Mechanical Design and Machine Construction; Telecommunications; Information Processing

	Systems; Geotechnics; Construction Technology; Urban Planning and Technology; Experimental Physics; Mathematical Physics; Mathematical Analysis) with a multi-disciplinary background (also including related research in Economics, Political Science and Law) capable of managing technologically advanced industrial production and services from all points of view, where product and process innovation is also carried out in an integrated manner with the territory and the environment, with the management of big data and with an eye to sustainability and basic science, the engine of innovation. Knowledge also of product development methodologies, process management and analysis, materials, energy production, storage and utilisation systems, including advanced mobility systems, will facilitate the implementation of advanced engineering, economic, political and regulatory approaches required by today's labour market. The territory and urban, industrial and rural transformations (including regeneration of the existing) will be the right context. All this explains the innovative potential in terms of the patent possibilities associated with this activity and the personal growth of the eventual winner of this PhD.
AREAS OF RESEARCH	The PhD in PHYSICAL AND ENGINEERING SCIENCES FOR INNOVATION AND SUSTAINABILITY carries out higher education and scientific research activities related to 3 areas: INDUSTRIAL AND INFORMATION ENGINEERING, CIVIL AND ARCHITECTURAL ENGINEERING and PHYSICAL AND MATHEMATICAL SCIENCES covered by the scientific fields of the members of the college: energy, thermomechanical and nuclear engineering, mechanical, aerospace and naval engineering, electrical engineering, electronics and measurements, telecommunications engineering and electromagnetic fields, physics and mathematics, urban and territorial planning and design, structural and geotechnical engineering. In fact, research in industrial and information engineering increasingly requires advanced skills in the physical and mathematical sciences and, with regard to land application, in civil engineering and architecture. An example of this is research on the development and integration of renewable energy, hydrogen and fuel cell systems, measurement, control, automation and management systems, advanced geotechnical and structural analyses, urban and landscape analyses, and in general the planning/design/management of innovative and sustainable systems, which can be found in the publications, projects, patents and awards of the members of the doctoral college and in the related activities carried out by the Department of Engineering Sciences (DSI, department of this doctorate) and the University of Guglielmo Marconi, both experimentally, through the laboratory with the rig testing of electrochemical processes (e.e.g. batteries/supercapacitors/fuel cells/electrolysers) and of thermochemical processes (e.g. conditioning, pyrolysis, gasification), as well as simulatively, via the DSI server to which lecturers, researchers and students have access equipped with various programmes (e.g. ASPEN, SIMAPRO) and collaborations with members of the Department of Economics and Business Sciences and the Department of Legal and Political Sciences of the University of Studies 'Guglielmo Marconi' for the evaluation of the relevant economic, political and regulatory aspects. Therefore, the PhD Course has training and research contents in the strategic themes for high-level innovation such as: ° **Evaluation, design, measurement, control, realisation, optimisation, management and decommissioning** (through simulation of behaviour and performance in steady-state and transient conditions and experimental testing) of **innovative materials, processes, components, machines, plants and systems** for the **production, conversion/transformation, storage, transport, distribution and use of energy in the civil and**

industrial sectors, with particular reference to production from local and renewable resources, distributed generation, innovative energy vectors industrial and agricultural buildings and production, and environmental protection such as renewable energy plants with the use of fuel cells (e.g. European projects UNIFHY, BLAZE, GICO, SO-FREE, LIFE3H focusing on production from results or renewables, storage and distribution of hydrogen and its use in stationary systems and for fuel cell mobility) mainly through the **development of theoretical (**black box, mono-, bi- and tri-dimensional) **models** (matter and energy balances, thermodynamic, kinetic, fluid-dynamic models and their mixes) and/or **experimental** (and theoretical-experimental mixes) using software (e. g. MATLAB, ASPENET, ASPENET, ASPENET, etc.).e.g. MATLAB, ASPEN, SIMAPRO, FLUENT) and test benches/test-rigs and pilot plants (e.g. batteries/supercapacitors/fuel cells/electrolysers, sorbents/catalysts, combustion/pyrolysis/gasification through programmable resistive power supplies and benches, EIS, GC, MS, TGA/DSC, furnaces, etc.), as well as other instruments (e.g. the Marconi laboratory's present in the Marconi laboratory and other laboratory instrumentation and pilot plants present in institutions with which Marconi has collaboration agreements) and the study of the physical, chemical and thermal properties of **materials** including additive manufacturing techniques; eco-design and green design and biomaterials and nanomaterials;

- **Energy Systems for Mobility**: Innovative power train, HEV (Hybrid Electric Vehicle), BEV (Battery Electric Vehicle), FCEV (Fuel Cell Electric Vehicle); Drive cycles and energy-emissive analysis of real-life (on-road) vehicle usage; Research and development activities on technologies (including **power electronic systems**) and innovative solutions (including those related to **power grid management**) for motor vehicles and industrial mobility, communication and energy systems; Self-driving cars, V2I (Vehicle to Infrastructure) and V2V (Vehicle to Vehicle); smart mobility;
- **Energy and environmental certification** of **innovative materials, processes, components, machines, plants and systems including buildings**; Study of the **lighting and acoustic** problems of confined and unconfined environments; Research and development of new methodologies for the **thermo-hygrometric well-being** of confined environments;
- **Energy and environmental planning, efficient use of energy** in the industrial, tertiary and residential sectors and analysis of needs, local production from renewables, import/export of energy and related **emissions** in different atmospheres with particular reference to the application of the technologies and systems described in the previous points and the environmental impact of energy systems including **LCA** (Life Cycle Assessment), **LCC** (Life Cycle Cost), **S-LCA** (Social Life Cycle Analysis);
- **Reverse engineering, rapid prototyping, integrated design techniques (Desing for X, DESS), Lean Six Sigma,** accelerated **testing** for decay prediction; predictive **maintenance;** industrial automation and home automation; **quality and safety**;
- Evaluation, design, measurement, control, implementation, optimisation, management and decommissioning of **computer systems and networks**; Next generation computer architectures; Cloud and distributed systems; Software engineering; Reliability and security; Databases and knowledge

bases; Innovative architectures for the web; Natural language processing; Machine learning; Distributed databases; Artificial intelligence; Next generation wireless **telecommunication systems** and networks; Satellite systems; Advanced terrestrial, airborne and satellite traffic control systems; Use of Machine Learning to improve performance in telecommunications at both application (Theme 1) and transmission (Theme 2) levels. In detail, use of ML techniques such as Gen AI, CV, NLP, etc., to improve communications at the transmission level or to evaluate the performance of new services related to XR or connected everything for applications such as automotive, smart industry and ehealth based on the concept of human-centred AI. With particular reference to **Smart Grids, Smart Cities and Social** Innovation;

- **Land governance, urban planning and land consumption**; Seismic **risk** mitigation for land and buildings, Basic concepts and approaches related to seismic risk identification for land and buildings, Soil consolidation and support, Survey techniques for land monitoring, Seismic vulnerability of buildings and intervention techniques, Regulatory tools for the assessment and design of interventions for seismic risk mitigation for land and buildings.
- Theoretical and applied aspects of physics and mathematics such as **High Energy Physics** and related experimental apparatus; **Mathematical Physics and applications of energy and engineering interest**; **Theoretical Physics of fundamental interactions** and applications to the development of new technologies.
- The use of Machine Learning and AI for the detection, analysis and monitoring of the **expected benefits and plant and operating costs** resulting from the implementation of **circular economy** models and innovative systems for the production and distribution of energy from alternative sources within simple or complex production combinations, in different sectors and industries with the generation of alternative scenarios and impact simulations of the application of **sustainable technologies and business models**, orienting the analyses towards evolutionary approaches of **business planning and risk management.** The same analysis of R&D projects in industry requires optional based approaches based on alternative scenario generation and deep data analysis.
- Innovative and sustainable technologies for **frontal and distance education systems**.

The research areas listed above are directly, transversally and/or indirectly reflected in almost all the strategic policies of the PNRR, In particular, the **research scope of the PhD for projects carried out with a grant ex D.M. no. 118 of 2 March 2023, concerns PNRR** Research themes ("generic PNRR") and PNRR Digital and Environmental Transitions themes such as Mission 2 *Green Revolution and Ecological Transition* (covering all the components of this measure: M2C1: sustainable agriculture and *circular economy*; *M2C2: renewable energy, hydrogen, grid and sustainable mobility*; M2C3: *energy efficiency and rehabilitation of buildings*; M2C4: *protection of land* and water resources); but also in Mission 1 digitalisation, innovation, competitiveness, culture and tourism (main focus is on component M1C2: *digitisation, innovation and competitiveness in the production system*), in mission 3 *infrastructures for sustainable mobility* (covering all components of this measure M3C1: investments on the railway network M3C2: intermodality and integrated logistics), in mission 4 Education and Research (covering M4C1 e.g. with the development of the Marconi laboratory in remote and for long term tests, see European project RE-OPEN and M4C2 e.g. with the

	development of patents and spin-offs). Furthermore, some strong connection points can be found in the general themes of 'Smart Growth. Sustainable and Inclusive Growth' of 'Social and Territorial Cohesion', 'Health and Economic, Social and Institutional Resilience' and 'Green Transaction'. Particular attention in the doctorate will be given (in full coherence with the objectives of the PNRR, which dedicates numerous investments to the sector) to the theme of "urban regeneration", understood as a tool aimed at "reducing situations of marginalisation and social decay as well as improving the quality of urban decorum as well as the social and environmental context", and to the definition of tools (such as Integrated Urban Plans) that can provide for "*participatory urban planning, with the* aim of transforming vulnerable territories into smart and sustainable cities, limiting the consumption of building land" (cit. PNRR). In general, the PhD is perfectly in line with Italian, European and international 2030 and 2050 targets for a progressive and complete defossilisation. These objectives call for the development of **innovative and sustainable materials, processes, components, machines, plants and systems,** particularly in the energy sector, with a view to environmental compatibility, energy security and competitiveness. Hence the need, and the enormous potential, to invest in the development of the entire value chain of new technologies and new vectors such as hydrogen; processes that start with research, innovation, technology transfer and higher education, and embrace the entire field of production (e.g. green hydrogen, electrolysers, fuel cells), infrastructures (e.g. multi-platform stations, hydrogen pipelines, purification and pressurisation sites and storage) and uses (e.g. sustainable mobility, hard-to-abate sectors and power plants, grid stabilisation, civil and industrial uses) including economic, policy and regulatory analyses.
EDUCATIONAL TRAINING AND RESEARCH METHODOLOGY	The doctoral programme is based on training processes characterised by the use of a combination of disciplinary and interdisciplinary methodological approaches aimed at ensuring the development of research in the areas described in the previous point, bearing in mind the state of the art and innovations at national, European and international level. The working methodology is characterised by strong interaction between lecturers and students/doctoral students and also involves figures, laboratories and facilities belonging to institutions with which Marconi has joint research projects or collaboration agreements. In order to increase the skills of doctoral students, the course provides a range of training programmes that, on the basis of the specific scientific expertise of the members of the college, aims to define an engineering profile characterised by a high degree of specialisation and a critical understanding of current and innovative technologies in the national, European and international context. The relative didactic offer, subdivided into common activities and specialised activities, therefore envisages 1) specific training activities with interdisciplinary content and in particular various ad hoc teaching modules structured in cycles of frontal and interactive lessons progressively open to the direct participation of PhD students with final assessment (e.g. Language and IT Advanced Training, Management, valorisation and ethics of research, Physics, Chemistry and Mathematics Laboratory) and 2) specialised courses on topics related to the training objectives of each individual PhD student (e.g. Laboratory of Innovative Technologies for Sustainable Energy Systems, Urban Design, Industry 4 0, Modern Physics Meetings, Use of test rigs and equipment present in Marconi such as test batteries/ batteries, use of the test rigs and equipment present in the Marconi University, such as the test rigs for batteries and batteries in the Marconi University).e.g. Laboratory of Innovative Technologies for Sustainable Energy

	Systems, Urban Design, Industry 4.0, Modern Physics Meetings, Use of test rigs and equipment present at Marconi such as the test rig for batteries/supercapacitors/fuel cells/electrolysers, sorbents/catalysts, combustion/pyrolysis/gasification, use of programmable resistive power supplies and benches, EIS, GC, MS, TGA/DSC, ovens, etc.). These activities are complemented by participation in the main seminars, conferences and study days in the sector.
EMPLOYMENT OUTLETS	The aim of the PhD is to train experts who, thanks to the skills acquired, are able to lead the development of process and product innovation in various industrial, civil and research fields, such as the development of efficient and sustainable energy systems from renewable sources and fuel cells. In this sense, the future PhDs, possessing both specialised technical skills and operational capabilities to manage the development of innovation, will be able to work, for example, as Innovation Manager, Energy Manager, Fleet Manager, Product Manager or within the Research and Development, Design, Production, Application and Management departments of public and/or private bodies, for, for example, the design or management of energy production, distribution, storage and use plants; the control of plant safety and the analysis and monitoring of their environmental impact; the rationalisation and optimisation of the use of resources; the assessment of the seismic risk of the territory and the built environment and the design of specific interventions. Furthermore, thanks to the disciplines inherent to territorial governance, the future PhDs will possess the cognitive and cognitive foundations of a decision-maker in the Public Sector and, in general, in the management activities of urban transformations. They will be able to design and implement, in adherence to the existing regulatory framework, the administrative and management systems that best meet the requirements of its positive functionality. In order to provide a multi-disciplinary preparation, and thanks to the combination of applied research and basic science, future PhDs will have the opportunity to learn the most advanced data processing and process analysis techniques, thus widening the possibilities of employment in different sectors. Future PhDs will therefore be able to find employment at universities, public or private research centres, mechanical, energy, automotive and information industries, companies and bodies for the production and conversion of energy and for the mobility of people and goods, plant engineering companies, automation and robotics industries, manufacturing companies in general and in the service sector, in the public administration and local authorities. The transactional and services sector, both for Public and Private Bodies, as well as the Applied Biotechnology sector in the field of technological innovation in Industrial and Information Engineering, Civil Engineering and Architecture, and Physical and Mathematical Sciences, will also be able to develop employment. Furthermore, should the results obtained during the PhD lead to the development of original and marketable products/processes, it will be possible to participate as a protagonist in the creation of patents, new enterprises and spin-offs, especially through the Marconi Innovation hub
LIST OF NATIONAL AND INTERNATIONAL PARTNERS WITH WHOM INSTITUTIONALISED RELATIONSHIPS EXIST	**NATIONAL REFERENCES** • ENEA (Casaccia and Trisaia research centres) • CNR (INFN, ITAE, etc.) • Sapienza University (DIAEE and SBAI departments) • University of L'Aquila (DIIE department) • Tor Vegata University (DII department) • Campus Biomedico University (Department of ICD) • Roma 3 University (DII department)

	• University of Genoa (DICCA department) • Politecnico di Milano (DE department) • Institute of Information Science and Technology (ISTI) • FERRARI SpA - Maranello (MO) • FIAT RESEARCH CENTRE - Orbassano (TO) • GE OIL & GAS - NEW PIGNONE - Florence (FI) • BONFIGLIOLI RIDUTTORI S.p.A. (BO) • PIAGGIO & C. SpA - Pontedera (PI) • ASSOKNOWLEDGE - Rome (RM) • TOYOTA MOTOR ITALIA S.p.A - Rome (RM) • SOLIDPOWER SpA - Trento (TN) • WALTER TOSTO SpA - Chieti (CH) • ENERECO SpA - Fano (PU) • ICI CALDAIE SpA - Verona (VR) • SNAM SpA - San Donato Milanese (MI) • RAMPINI SpA - Passignano sul Trasimeno (PG) **INTERNATIONAL REFERENCES** • Imperial College London - UK • Ohio State University Columbus - USA • Fermilab - USA • CERN - SWITZERLAND • MIT - Massachusetts Institute Of Technology - USA • FZJ - Germany • University of California (Computer Science Department) - USA • Stanford University (Electrical Engineering Department) - USA • Universitè de Strasbourg - France • Huelva University - Spain • Eindhoven University of Technology - The Netherlands • Technischen Universität Wien - Austria • MARIE TECNIMONT SpA - France • IDIADA SpA - Spain • BALLARD Spa - Sweden • MARION TECHNOLOGIES SpA - France • CALIDA CLEANTECH Srl - Germany • MAYHTEC - France • HYGEAR - The Netherlands
OFFICE FROM WHICH TO REQUEST INFORMATION	PHD OFFICE UNIVERSITY OF STUDIES 'GUGLIELMO MARCONI' Via Plinio, 44 00193 - ROME Tel. 06/37725205 PEC: dottoratidiricerca@pecunimarconi.it e-mail: dottoratidiricerca@unimarconi.it

	web. www.unimarconi.it
DEADLINE PRESENTATION QUESTIONS	**Applications must be received, under penalty of forfeiture, within 30 days of the day following the publication of the relevant notice in the Official Gazette - IV Special Series - in accordance with the procedure indicated in Article 4 of the notice.**