



POLITECNICO
MILANO 1863

Double Degree

Energy Engineering and Management Engineering

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1. Professional profile

1.1 Why this programme is relevant for industry and society? Trends and scenarios

At the current world economic growth rate and technological landscape, global energy demand and CO₂ emissions will more than double by 2050. Energy technologies that already exist or are under development can contribute to a radical change in this baseline scenario. Improved energy, low carbon and low impact systems, CO₂ sequestration, use of renewables and nuclear in power generation, as well as biofuels in transport, are envisaged as the key technologies able to make future energy consumption more sustainable. Despite this expected significant transformation of the energy sector over the next 40 years, demand for fossil fuels will remain at current levels. Hence, investment and innovation in conventional energy sources remain essential.

To support and accelerate this transformation of the energy industry, a new generation of industrial engineers and managers is needed, new professional profiles able to transform the potentials of new technologies into well-established industrial practices and new business endeavours on both the energy supply and demand sides.

Energy industry is looking for engineers where technical and managerial knowledge and skills are seamlessly blended, and thus well equipped to face some of the most relevant challenges brought by developing trends and scenarios:

- assessment and benchmarking of current and future technologies under alternative energy consumption scenarios;
- selection and strategic design of future industrial investments to better integrate renewables with conventional power generation and Oil&Gas installations;
- increasing the successful rate of mega projects and programmes (higher than 1 billion \$) in the energy and Oil&Gas sectors;
- developing and innovating the energy service supply chain on a global scale.

1.2 What makes this programme unique? A harmonised profile connected with the industrial world

The Internal Double Master of Science degree in Energy and Management Engineering grounds on the strong tradition and reputation of the corresponding single degrees at Politecnico di Milano. Energy and Management Engineering research and teaching schools of Politecnico di Milano offer a wide spectrum of subjects and internationally relevant expertise.

This is the perfect background for the design of a balanced and harmonised Double degree programme, which assures a complete set of fundamentals from both disciplines and elevates the training value with cutting-edge knowledge and unique pre-professional experiences. Indeed, the Double degree in Energy and Management Engineering benefits of the tight cooperation of Politecnico di Milano with the most



renowned Italian companies and industrial associations in the energy sector, aiming at offering internship and thesis opportunities in line with the potentials and expectations of talented students.

1.3 Why this programme is essential for those interested in elevating energy engineering? What you get more if you are studying Energy Engineering

Today's energy technological challenges cannot be faced without broadened knowledge and abilities, encompassing the whole energy value chain. Actually, technology advancement and innovation are based on a deep understanding of energy conversion processes while the implementation of a new sustainable energy systems require the ability to manage project in a context of increased complexity and high variability due to the swift evolution of science, energy needs and markets.

1.4 Why this programme is essential for those interested in elevating management engineering? What you get more if you are studying Management Engineering

Energy leaders nowadays are not asked anymore to simply manage technology and production processes. They have to be able to innovate and change those processes towards more service-oriented organisations, while moving rapidly in spite of largely uncertain context conditions. They need to have the capability for making sense of complex energy markets, understanding technological trends and making first-mover strategic decisions in a capital-intensive industry.

This capability of competing through technology-driven innovation builds on enriched technical knowledge and stronger engineering skills, as they are the key enablers of sound managerial decisions at different company levels and functions.

1.5 Who can I become? The expertise profile of the programme

By attending this programme, you will achieve high level of education attaining advanced knowledge and skills in designing and managing conventional and innovative systems for generation, distribution and use of energy, and service models as well. More specifically, you will gain professional capabilities oriented to:

- Techno-economic analysis and benchmark of innovative technologies;
- Outlook of technologies and solutions for the energy sector;
- Design, selection and operation of conversion plants from both conventional and renewable energy sources;
- Feasibility studies and project management for the energy sector;
- Oil&Gas Engineering;
- System Safety Engineering and HSE;
- Innovation of processes and services in the energy production/supply chain.

Typical jobs for double-graduates in Energy and Management Engineering may include:

- Energy asset management in companies and public boards supplying energy;



- Designing, manufacturing and dealing with energy systems, equipment and components;
- O&M and project development for global energy services companies;
- EPC Contractors: Project Engineer, Proposal Engineer, Procurement, Construction, HSE and R&D;
- Consulting.

Organizations that are interested in this profile are both private companies and public institutions or agencies.

1.6 Why a double degree? The advantage of being two.

The skills that we have described before cannot be achieved by a programme that simply blend a little of energy technology and a little of management. To envision, design and run advanced energy solutions and business models one need to master both fields in depth. For this reason, beside the traditional offer of specific tracks in the two separated programmes, we have decided to offer to a few selected talented and highly motivated students the chance of fully developing both skills, in a harmonised and effective way.

This implies that you will really attend classes of energy engineering and classes of management engineering. You will be immersed in both worlds, be in touch with professors and other students attending traditional energy and management MSc programmes. You will thus absorb the way of thinking of both communities, instead of living into a separate world.

On top, by attending a Double Master of science degree programme you will share this experience with a few other selected students like you. You will have the chances to share, discuss, and create a new culture of industrial engineering and management in the energy sector with a few other likeminded talented students and with the professors, managers and engineers, who are engaged in the programme.

2. Enrolment

2.1 Entry requirements

The Energy Engineering and Management Engineering Design Double Degree is open to 20 students selected from Energy Engineering and Management Engineering Master of Science.

Applications for the Internal Double Master of Science degree may be submitted, in compliance with the rules set out in this Teaching Regulation <http://www.polimi.it/en/programmes/course-catalogue/degree-programmes/> by students of the Politecnico di Milano enrolled in:

- Master of Science (equivalent to Laurea Magistrale) Programme in Energy Engineering;
or
- Master of Science (equivalent to Laurea Magistrale) Programme in Management Engineering.

Hence, **students enrolled in “individual” courses (equivalent to Corsi Singoli) cannot apply to the Double Master of Science degree in Energy Engineering - Management Engineering.**



To apply for the Double Master of Science degree, students should fulfil the following admission requirements

- an average for the bachelor equal to $24 + (N-3)/2$, where N is number of academic years for achieving the Bachelor of Science degree, starting from the first enrolment to Politecnico di Milano;
- a positive result to a specific test, which will be administered to candidates with a Bachelor Degree in Management Engineering, or equivalent, to evaluate the accomplishment of the pre-requisite on Mathematical Methods for Energy Engineering (8 CFU).

2.2 Articulation of the selection process and general criteria used for students' selection

Students from Politecnico di Milano interested in applying in the Internal Double Master of science degree in Energy - Management Engineering must submit the documents within the timeframe that will be published on the Course website (at www.dig.polimi.it/internaldd), to the following addresses:

- Energy Engineering students: energy-engineering@polimi.it
- Management Engineering students: management-engineering@polimi.it

List of the documents required:

- A motivation letter where the candidates describes the reasons for the application in the Double Degree and the contribution that they will offer to the community of the project;
- Academic CV of the Bachelor Degree obtained at other universities, with self-declaration of transcripts with marks and the final degree grade;
- Personal CV outlining skills and extra-bachelor experiences (extra-curricula courses, work experiences, workshops and summer schools, etc.) and that highlights experience and skills acquired consistent with the second degree;
- An extended abstract of the final thesis or overview of the Business Game experience (for applicants from the Laurea in Ingegneria Gestionale). The manuscript must not exceed 5 standard Word pages.
-

An evaluation Committee composed by professors appointed by the Study Course of Management Engineering and the Study Course of Energy Engineering, will be in charge of the candidates' selection process.

The Committee will make a first evaluation of the academic background, the motivation letter and the CV of the candidate and will assign up to 70 points as follows:



- Motivation letter, up to 10 points assigned;
- Academic CV of the Bachelor Degree obtained at other universities, with self-declaration of transcripts with marks and the final degree grade, up to 30 points assigned;
- Personal CV, up to 15 points assigned;
- Thesis or Business Game experience, up to 15 points assigned.

Candidates who are assigned **at least 60 points** will be interviewed individually.

The same Committee will do a second evaluation based on an individual interview that will assess:

- The extent to which the Double Degree is consistent with the candidate's expectations and motivations;
- The extent to which the objectives of the Double Degree are consistent with the specific skills acquired by the candidate during the Bachelor's Degree and through other curriculum experiences;
- The extent to which the candidate is motivated to acquire knowledge in the areas covered by the Double Degree in particular with respect to the second degree (evaluated via questions during the individual interview and the development of a case study).
- Candidates with a Bachelor Degree in Management Engineering, or equivalent, will be administered of a specific test to evaluate the accomplishment of the pre-requisite on Mathematical Methods for Energy Engineering (8 CFU). A positive result in the test is mandatory for the final admission to the Double Degree.

The one-to-one interview will be assigned **a maximum of 30 points**.

2.3 Main deadlines and time-frame

The deadlines of the selection process will be published on the Course websites (at www.dig.polimi.it/internaldd and <http://www.ingindinf.polimi.it/en/didactics/internal-double-degree-projects/>).

This year, the call for applications will follow this timeline:

- Presentation of candidate applications: by January 13th 2017 at 12.00 (noon)
- Selection process and interviews: between January 13th 2017 and February 15th 2017
- Publication of the final results and formal acceptance by candidates: by February 20th 2017

3. Tuition fees

Details will be published on the University websites: <http://www.polimi.it/en/students/from-enrolment-to-degree/fees/> and http://www.polimi.it/uploads/media/Tuition_Fees_and_Exemptions_Guide_Magistrale-MSc_2016-17.pdf

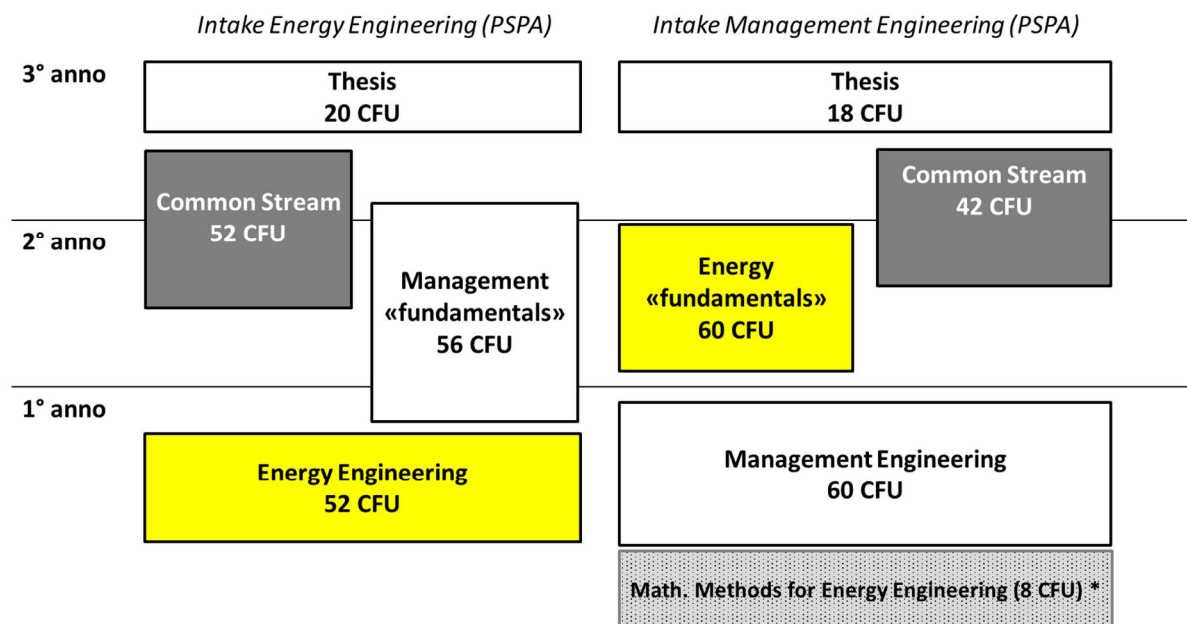
4. Study Plan

4.1 General framework of the double degree

The double degree is founded on two Master of Science programmes of Politecnico di Milano: the MSc in Energy Engineering and the MSc in Management Engineering (both from the School of Industrial Engineering and IT). You will enrol both the programmes.

You can start the Internal Double Degree from one or the other according to your specific inclination and background: i.e. an intake from MSc in Energy Engineering or from MSc in Management Engineering. This enable you to go deeper first in one of the two topics, then move to the other, and finally integrate them together.

The programme therefore is organised as shown in the following diagram:



* Pre-requisite for the admission to the Double Degree Programme. Accomplished with a positive result in the specific written test administered to candidate students during the selection process.

If you start with a focus on **energy engineering**, therefore you will:

- First develop the skills and thinking attitude to challenge Science and Technology issues in the Energy field, attending advanced courses from our Master of Science in Energy Engineering, ranging from Heat and Mass Transfer, Advanced Thermodynamics and Energy Conversion to Fundamental of Chemical Processes and Technologies, Electric Power Systems, for a total of 52 ECTS.



- Then you introduce the fundamentals of Management Engineering covering Strategy & Marketing, Accounting & Finance, Innovation, Economics, Technology Management, Manufacturing Operations and Logistics, for a total of 56 ECTS.
- In the meantime and beyond, you will start a stream of subjects that merge and harmonise energy and management engineering contents to deepen your skills in mastering technology innovation and techno-economic analysis in the energy production/supply chain. The common stream (52 ECTS) is conceived to offer a consistent managerial framework for a very wide spectrum of technological and engineering contents in Energy.
- Finally, you conclude with a thesis (20 ECTS) of relevance for technological advancement and business innovation in the energy sector.

If you start with a focus on **management engineering**, therefore you will:

- First, develop knowledge, skills and thinking attitude of industrial management and engineering, with basic courses from our Management Engineering programme, ranging from Strategy & Marketing, Accounting & Finance, Innovation, Economics, Technology Management, Manufacturing Operations and Logistics, for a total of 60 ECTS.
- Then you introduce the fundamentals of energy engineering, covering methodological and modelling subjects as well as theoretical and technological, for a total of 60 ECTS;
- In the meantime and beyond you will start a stream of subjects where energy and management engineering contents are addressed in a coordinated way to deepen your skills in mastering industrial investments and services in the energy sector. The common stream (42 ECTS) is conceived to offer a very wide spectrum of technological and engineering contents in energy, all connected under a consistent managerial framework;
- Finally, you conclude with a thesis (18 ECTS) of relevance for the business innovation and technological advancement of the energy sector.



4.2 Detailed description of the study programme for the Intake Energy Engineering (PSPA)

First year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
095902		ING-IND/10	Heat Mass Transfer		1	10	10
095909		ING-IND/09	Energy Conversion		1	10	10
095910		ING-IND/27	Fund. Chemical Processes		1	8	8
095916		ING-IND/33	Electric Power System		2	8	8
095918		ING-IND/25	Chemical processes and Technologies		2	8	8
095917		ING-IND/30	Fund. Oil&Gas Eng.		2	8	8
095924		ING-INF/04	Control Systems		2	8	
095912		ING-IND/10	Advanced Thermod. & Thermoecon.		2	8	
095914		ING-IND/35	Energy Economics		2	8	8
095915		ING-IND/35	Management Control Systems		2	8	
096868		ING-IND/17	Project and Programme management B		2	8	

Second year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
096080		ING-IND/35	Strategy and Marketing		1	10	10
096076		ING-IND/35	Leadership and Innovation		2	10	10
095914		ING-IND/35	Energy Economics		2	8	16
095915		ING-IND/35	Management Control Systems		2	8	
096868		ING-IND/17	Project and Programme Management B		2	8	
096090		ING-IND/17	Industrial Technologies		2	10	10
096088		ING-IND/17	Operations Management		1	10	
096086		ING-IND/16	Quality engineering		2	10	
096089		ING-IND/17	Logistics Management		2	10	
097394		ING-IND/09	Power Prod. Renew. Energy		1	8	8
097348		ING-IND/08	Internal combustion engine B		1	8	8
097354		ING-IND/08	Turbomachinery B		1	8	



Third year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
096090		ING-IND/17	Industrial Technologies		2	10	10
096086		ING-IND/16	Quality engineering		2	10	
096088		ING-IND/17	Operations Management		1	10	
096089		ING-IND/17	Logistics Management		2	10	
097350		ING-IND/35	Management of Energy and Sustainability		1	10	10
097355		ING-IND/35	Financial Risk Management		2	5	
097353		IUS/10	Energy and Environmental Law		2	5	
097319		ING-IND/17	Asset Life Cycle Management		1	10	10
097315		ING-IND/17	Safety Engineering and Management		1	5	
097335		ING-IND/35	Economics of Network Industries		1	5	
097365		ING-IND/11	Engineering Solar Thermal Processes		1	8	8
097359		ING-IND/10	CFD for energy engineering		1	8	
095936		ING-IND/09	Oil&Gas Field Devel. & Production		1	8	
097344		ING-IND/11	Heating and cooling systems B		1	8	
095918		ING-IND/25	Chemical processes and technologies		1	8	
			One course taken from S4 group			8	
			Graduation thesis and final work			20	20

4.3 Detailed description of the study programme for the Intake Management Engineering (PSPA)

First year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
096080		ING-IND/35	Strategy and Marketing		1	10	10
096076		ING-IND/35	Leadership and Innovation		2	10	10
096078		ING-IND/35	Accounting, Finance and Control		1	10	10
096092		ING-IND/35	Business and industrial Economics		2	10	10
096090		ING-IND/17	Industrial Technologies		2	10	20
096088		ING-IND/17	Operations Management		1	10	
096086		ING-IND/16	Quality engineering		2	10	
096089		ING-IND/17	Logistics Management		2	10	



Second year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
095902		ING-IND/10	Heat Mass Transfer		1	10	10
095909		ING-IND/09	Energy Conversion		1	10	10
095910		ING-IND/27	Fund. Chemical Processes		1	8	8
095916		ING-IND/33	Electric Power System		2	8	8
095918		ING-IND/30	Fund. Oil&Gas Eng.		2	8	8
096868		ING-IND/17	Project and Programme Management B		2	8	8
095912		ING-IND/10	Advanced Thermod. & Thermoecon.		2	8	8

Third year courses

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
097394		ING-IND/09	Power Prod. Renew. Energy			8	8
097348		ING-IND/08	Internal Comb. Eng. B			8	8
097354		ING-IND/08	Turbomachinery B			8	
097344		ING-IND/11	Heating and cooling systems B			8	
095918		ING-IND/25	Chemical processes and technologies			8	
097350		ING-IND/35	Management of Energy and Sustainability		1	10	10
097319		ING-IND/17	Asset Life Cycle Management		1	10	
097315		ING-IND/17	Safety Engineering and Management		1	5	
097353		IUS/10	Energy and Environmental Law		2	5	
097355		ING-IND/35	Financial Risk Management		2	5	
097335		ING-IND/35	Economics of Network Industries		2	5	
097365		ING-IND/11	Engineering Solar Thermal Processes			8	16
097359		ING-IND/10	CFD for energy engineering			8	
095936		ING-IND/09	Oil&Gas Field Devel. & Production			8	
097348		ING-IND/08	Internal Comb. Eng. B			8	
097354		ING-IND/08	Turbomachinery B			8	
097344		ING-IND/11	Heating and cooling systems B			8	
			One course taken from S3 group			8	
			Graduation thesis and final work			18	18



Table S3

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
097348		ING-IND/08	Internal combustion engines B		1	8	8
097354		ING-IND/08	Turbomachinery B		1	8	
097344		ING-IND/11	Heating and cooling systems B		1	8	
097397		ING-IND/08	Design of fluid machines for clean power generation		2	8	
097359		ING-IND/10	CFD for energy engineering		1	8	
097365		ING/IND/11	Engineering of solar thermal processes		1	8	
097393		ING-IND/11	Clean room and building HVAC		1	8	
095922		ING-IND/22	Corrosion and material protection		2	8	
095918		ING-IND/25	Chemical processes and technologies		2	8	
097400		ING-IND/19	Reliability, Safety and Risk analysis C		2	8	
097396		ING-IND/35	Energy modeling and scenarios		2	8	
095924		ING-INF/04	Control Systems		2	8	
089786		ING-IND/07	Combustione e sicurezza		2	8	
090929		ING-IND/09	Sistemi energetici avanzati		1	8	
090932		ING-IND/11	Efficienza energetica negli edifici		1	8	

Table S4

Code	Act	SSD	Course title	Type	Sem	ECTS	ECTS group
097348		ING-IND/08	Internal combustion engines B		1	8	8
097354		ING-IND/08	Turbomachinery B		1	8	
097344		ING-IND/11	Heating and cooling systems B		1	8	
097397		ING-IND/08	Design of fluid machines for clean power generation		2	8	
097359		ING-IND/10	CFD for energy engineering		1	8	
097365		ING/IND/11	Engineering of solar thermal processes		1	8	
097393		ING-IND/11	Clean room and building HVAC		1	8	
095918		ING-IND/25	Chemical processes and technologies		2	8	
097400		ING-IND/19	Reliability, Safety and Risk analysis C		2	8	
090929		ING-IND/09	Sistemi energetici avanzati		1	8	
090932		ING-IND/11	Efficienza energetica negli edifici		1	8	



5. Further Information

Withdrawal from the Double Degree programme must follow the procedures and timeframes established by the School's schedules.

Students applying to the Double Degree may apply for ASP (Alta Scuola Politecnica), the Erasmus + and non-EU international mobility programmes. However, if students are selected for both programmes, they must withdraw from one of them as per the relevant procedures and timeframes.

Any delay in communicating withdrawal from the Double degree programme will seriously affect replacement candidates and cause administrative difficulties.

Students who undertake the Double degree programme and decide to finish their studies after completing only one of the degrees must present a new study plan detailing a change in curriculum/PSPA (previously approved study plan), within the established deadline.

6. Contacts

- Energy Engineering students: energy-engineering@polimi.it
- Management Engineering students: management-engineering@polimi.it

The Dean of the School of Industrial and Information Engineering

F.to Prof. Giovanni Lozza