

I EDITION

APRIL 2021 - APRIL 2022

SMART GRIDS

SECOND LEVEL SPECIALIZING MASTER



POLITECNICO
MILANO 1863

DIPARTIMENTO DI ENERGIA



ABOUT POLITECNICO DI MILANO

Politecnico di Milano is a scientific-technological university which trains engineers, architects and industrial designers.

The University has always focused on the quality and innovation of its teaching and research, developing a fruitful relationship with business and productive world by means of experimental research and technological transfer. Research has always been linked to didactics and it is a priority commitment which has allowed Politecnico Milano to achieve high quality results at an international level as to join the university to the business world.

Research constitutes a parallel path to that formed by cooperation and alliances with the industrial system.

Knowing the world in which they are going to work is a vital requirement for training students.

By referring back to the needs of the industrial world and public administration, research is facilitated in following new paths and dealing with the need for constant and rapid innovation.

The alliance with the industrial world, in many cases favored by Fondazione Politecnico and by consortiums to which Politecnico belong, allows the university to follow the vocation of the territories in which it operates and to be a stimulus for their development.

ABOUT ENEL GROUP

Enel is a multinational power company operating on 5 continents, and a leading integrated player in the global power, gas and renewables markets.

As Distribution System Operator, Enel is committed in providing accessible, efficient and reliable energy to over 73 million customers through 2.2 million kilometres of power lines.

Thanks to its leadership in Smart Grids, Enel is at the forefront of the energy transition: smart grids are a key lever not only to improve the quality and continuity of service, but also to enable advanced and innovative services to all market actors and to develop flexibility tools to integrate renewables, energy storage and decentralized generation.



MISSION

The Second Level Specializing Master in Smart Grids aims at forming highly-qualified professionals able to face complex design problems and foster technological innovation in the field of electrical power systems.

It builds on basic disciplines and provides solid skills in the areas of design and automation of electrical systems.

The programme includes theoretical classes and a strong experimental training in laboratories; the Specializing Master is organized and run in collaboration with the Enel Group.

LOCATION

Milano @ Facilities

- Politecnico di Milano | Campus Bovisa | Via Lambruschini

Milano @ Smart Grid Labs

- Enel Group | Laboratories | Via Raffaele Rubattino

LANGUAGE

English (Classes and Labs will be held in English).



STRUCTURE

The Specializing Master is arranged in theoretical classes of 330 hours plus 100 hours for laboratories (both numerical and experimental).

Classes will start in April 2021 over a one year program. Lectures and Labs will be held twice a week.

Module 1 | ENERGY OUTLOOK

108 h + 4 h | labs

Module 2 | SMART GRIDS

80 h + 28 h | numerical labs

Module 3 | HEALT & SAFETY

34 h + 12 h | labs

Module 4 | SMART GRIDS IMPLEMENTATION

60 h + 56 h | labs

Module 5 | SOFT SKILLS & INNOVATION LAB

48 h

Module 6 | PROJECT WORK

200 h + 10 h | tutorship

* A one week class will be arranged before the official activation of the Master in order to share a common theoretical background with all the attendees.

** In case of bounds correlated with local or international un-safe conditions, Module 1 to 3 could be arranged in distance learning mode.

The Specializing Master focuses on the study of the evolution of electricity systems needed to enable a significant supply from Renewable Energy Sources (RES).

In this perspective, the Specializing Master focuses on the impact of RES on the electricity system (market & networks).

Market rules should ensure that conventional power stations are suitably operated even in the presence of large contributions from renewable generation.

Distribution networks play a key role to enable the Energy Transition, to allow the full integration of the Distributed Energy Resources (DER) and the development of new services to customers and market, moving towards a decarbonised, decentralized and sustainable energy system.

The evolution of distribution network will be addressed in the context of smart grids perspective to which distribution systems are gradually moving.

For this topic, some details about technical solutions, about the use of ICT as enabling key will be given.

Finally, some case studies and real life implementations will be described, with the relevant costs and benefits.

SYLLABUS

Module 1 | ENERGY OUTLOOK

- Energy outlook
- Industrial ecology
- Introduction to power systems & Evolution and decarbonization of power generation (including Carbon Sequestration, Cogeneration, Trigeneneration and Hydrogen technology)
- National and EU energy outlooks and planning actions (Policy) - PNIEC - Long Term Strategy 2050
- Power distribution networks. Grid technical constraints. International framework, focus on the Italian power system
- Dispersed generation: impact on electrical grids of RES penetration, electrification of final energy uses and new actors
- Energy efficiency in the final uses of energy (storage, district heating, energy impact of EV recharging processes)
- Electrical network modeling - short circuit analysis
- Electricity market. Fundamentals on the international context and Focus on the Italian scenario
- Electricity market. Regulatory framework and quality of services
- Power electronics, theoretical notions, evaluation of the impact on the grid
- Electrical measurements and signal elaboration
- Power systems digitalization: IT System, Networks & Architecture (Basics, IP networks, IT system etc.); Cyber Security & Interoperability Standards (normative framework and focus on electrical sector/critical assets); Integrated Communications Protocols & Technologies

Module 2 | SMART GRIDS

- New power system actors
- Traditional and innovative network components
- Advanced management of power distribution systems: technical connection rules; DERs integration; grid protection, automation and control; power flow optimization
- Storage: technologies, services, performance, modeling
- Advanced flexibility management (EV smart EV charging, demand response, DER ancillary services)
- Quality of service: continuity, power quality and technical solutions for QoS improvement
- Smart Metering features
- Power systems resilience: impact of climate changes on network operation (case studies analysis)
- Evolution of the role of Distribution System Operators (possible regulatory and market future scenarios, TSO/DSO coordination)
- Network planning and operation: from the fit&forget approach to the flexibility management
- Smart City

Module 3 | HEALTH & SAFETY

- Introduction to Health & safety
- Management systems for the H&S
- H&S in the ENEL group
- Accident prevention: the main action tools
- Role of DSO training centers
- Accidents to third parties: a phenomenon to be countered
- Design and safety: normative references and points of attention



Module 4 | SMART GRIDS IMPLEMENTATION

- RTDS: dynamic simulation of protection and control systems (models, signals and quantities evaluation, etc.)
- Fault selection techniques (smart fault selection and further logics)
- Identification and isolation of the faulted line section
- IEC 61850 protocol
- Intelligent distributed devices for remote control, automation and MV/LV protections
- Digital (primary & secondary) substations
- Power Quality

Module 5 | SOFT SKILLS & INNOVATION LAB

- Project Management
- Negotiation, stakeholder management, communication, relationship with Public Institutions
- Leadership
- Guidance to the results
- Innovative Thinking
- Technical Visit to Microgrids Labs in Politecnico di Milano
- Drone technology for the inspection of the electrical network and power plants monitoring
- GIS tools for the planning and operation of distribution networks
- Big Data analytics and Models and systems for integrating and storing Big Data

ELIGIBILITY

Requirements

- LM17 Master of Science in Physics
- LM25 Master of Science in Automation Engineering
- LM27 Master of Science in Telecommunications Engineering
- LM28 Master of Science in Electrical Engineering
- LM29 Master of Science in Electronic Engineering
- LM30 Master of Science in Energy and Nuclear Engineering
- LM31 Master of Science in Management Engineering
- LM32 Master of Science in Computer Engineering
- LM33 Master of Science in Mechanical Engineering
- LM40 Master of Science in Mathematics
- LM82 Master of Science in Statistical Sciences

Age not exceeding 29 years and 364 days on 30/04/2021

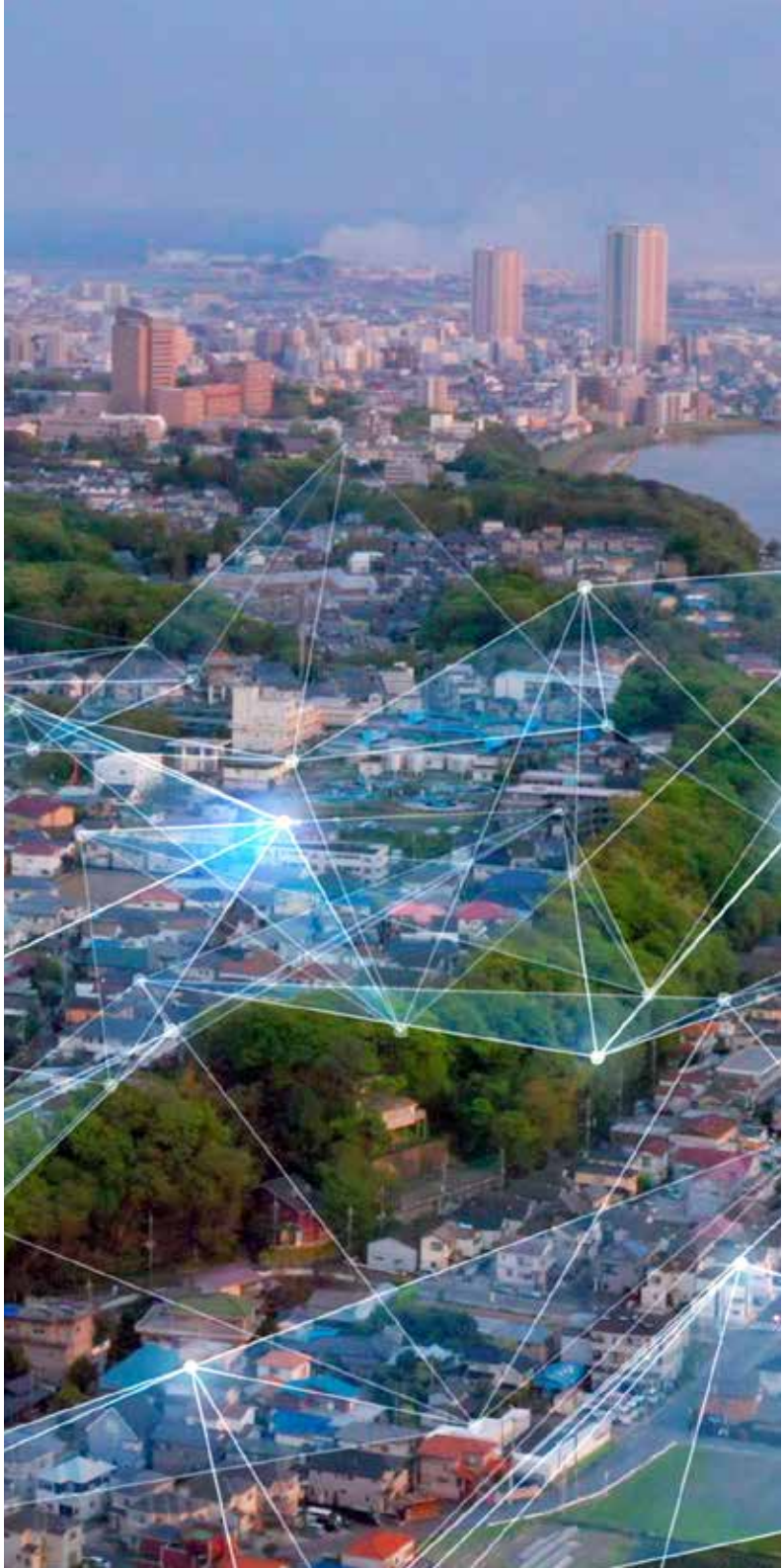
APPRENTICESHIP

This course offers **20 positions in Enel Group for young talents who will be hired on an Apprenticeship Contract for Higher Education and Research** (3rd level Apprenticeship), lasting 12 months.

Enel Group is looking for talented candidates with team working spirit, digital mindset, entrepreneurs, problem solving capacity, project management, innovative and design thinking, passionate and intellectual curiosity.

Career opportunities in Enel Group in the following areas: Network Planning and Development, Network Commercial Operations, Network Technologies and Innovation, Operation and Maintenance.

The **workplace** is Rome (at least 3 days per week) with courses offered in blended learning (2 days per week) in PoliMi and other Enel locations.



FEES AND REMUNERATION

Annual salary (April 2021-April 2022) of € **22.000** and enrolment fee of 10 k€ plus a 500 € tax fee **fully funded by Enel Group**.

ADMISSION

The deadline for the application is **January 6th, 2021** (the on-line application format is available on <http://www.masterenel-smartgrids.polimi.it>).

The selection of candidates is arranged in three phases:

- First, the examining committee will select a limited number of applicants after screening the CVs and the motivation letters received;
- Secondly, the chosen candidates will undergo a technical on-line test.
- Candidates, who will pass the second phase of selection, will have an interview with the examining committee.

DEGREE

Throughout the Academic Year students will undergo specific examinations.

Those who will suitably complete the programme of study will be awarded by the Second Level Specializing Master's Degree of Smart Grids.

The selected talents will work in Enel Group for at least 3 days per week.

CALENDAR 2021

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
01 Fr	01 Mo	01 Mo	01 Th	01 Sa	01 Tu	01 Th	01 Su	01 We	01 Fr	01 Mo	01 We
02 Sa	02 Tu	02 Tu	02 Fr	02 Su	02 We	02 Fr	02 Mo	02 Th	02 Sa	02 Tu	02 Th
03 Su	03 We	03 We	03 Sa	03 Mo	03 Th	03 Sa	03 Tu	03 Fr	03 Su	03 We	03 Fr
04 Mo	04 Th	04 Th	04 Su	04 Tu	04 Fr	04 Su	04 We	04 Sa	04 Mo	04 Th	04 Sa
05 Tu	05 Fr	05 Fr	05 Mo	05 We	05 Sa	05 Mo	05 Th	05 Su	05 Tu	05 Fr	05 Su
06 We	06 Sa	06 Sa	06 Tu	06 Th	06 Su	06 Tu	06 Fr	06 Mo	06 We	06 Sa	06 Mo
07 Th	07 Su	07 Su	07 We	07 Fr	07 Mo	07 We	07 Sa	07 Tu	07 Th	07 Su	07 Tu
08 Fr	08 Mo	08 Mo	08 Th	08 Sa	08 Tu	08 Th	08 Su	08 We	08 Fr	08 Mo	08 We
09 Sa	09 Tu	09 Tu	09 Fr	09 Su	09 We	09 Fr	09 Mo	09 Th	09 Sa	09 Tu	09 Th
10 Su	10 We	10 We	10 Sa	10 Mo	10 Th	10 Sa	10 Tu	10 Fr	10 Su	10 We	10 Fr
11 Mo	11 Th	11 Th	11 Su	11 Tu	11 Fr	11 Su	11 We	11 Sa	11 Mo	11 Th	11 Sa
12 Tu	12 Fr	12 Fr	12 Mo	12 We	12 Sa	12 Mo	12 Th	12 Su	12 Tu	12 Fr	12 Su
13 We	13 Sa	13 Sa	13 Tu	13 Th	13 Su	13 Tu	13 Fr	13 Mo	13 We	13 Sa	13 Mo
14 Th	14 Su	14 Su	14 We	14 Fr	14 Mo	14 We	14 Sa	14 Tu	14 Th	14 Su	14 Tu
15 Fr	15 Mo	15 Mo	15 Th	15 Sa	15 Tu	15 Th	15 Su	15 We	15 Fr	15 Mo	15 We
16 Sa	16 Tu	16 Tu	16 Fr	16 Su	16 We	16 Fr	16 Mo	16 Th	16 Sa	16 Tu	16 Th
17 Su	17 We	17 We	17 Sa	17 Mo	17 Th	17 Sa	17 Tu	17 Fr	17 Su	17 We	17 Fr
18 Mo	18 Th	18 Th	18 Su	18 Tu	18 Fr	18 Su	18 We	18 Sa	18 Mo	18 Th	18 Sa
19 Tu	19 Fr	19 Fr	19 Mo	19 We	19 Sa	19 Mo	19 Th	19 Su	19 Tu	19 Fr	19 Su
20 We	20 Sa	20 Sa	20 Tu	20 Th	20 Su	20 Tu	20 Fr	20 Mo	20 We	20 Sa	20 Mo
21 Th	21 Su	21 Su	21 We	21 Fr	21 Mo	21 We	21 Sa	21 Tu	21 Th	21 Su	21 Tu
22 Fr	22 Mo	22 Mo	22 Th	22 Sa	22 Tu	22 Th	22 Su	22 We	22 Fr	22 Mo	22 We
23 Sa	23 Tu	23 Tu	23 Fr	23 Su	23 We	23 Fr	23 Mo	23 Th	23 Sa	23 Tu	23 Th
24 Su	24 We	24 We	24 Sa	24 Mo	24 Th	24 Sa	24 Tu	24 Fr	24 Su	24 We	24 Fr
25 Mo	25 Th	25 Th	25 Su	25 Tu	25 Fr	25 Su	25 We	25 Sa	25 Mo	25 Th	25 Sa
26 Tu	26 Fr	26 Fr	26 Mo	26 We	26 Sa	26 Mo	26 Th	26 Su	26 Tu	26 Fr	26 Su
27 We	27 Sa	27 Sa	27 Tu	27 Th	27 Su	27 Tu	27 Fr	27 Mo	27 We	27 Sa	27 Mo
28 Th	28 Su	28 Su	28 We	28 Fr	28 Mo	28 We	28 Sa	28 Tu	28 Th	28 Su	28 Tu
29 Fr		29 Mo	29 Th	29 Sa	29 Tu	29 Th	29 Su	29 We	29 Fr	29 Mo	29 We
30 Sa		30 Tu	30 Fr	30 Su	30 We	30 Fr	30 Mo	30 Th	30 Sa	30 Tu	30 Th
31 Su		31 We		31 Mo		31 Sa	31 Tu		31 Su		31 Fr

Registration Closes

On-line Admission Test
Soft Skills

Leveling Classes
E-Learning

On-line Admission Test
Hard Skills

Public Conference

General Framework | POLIMI
E-Learning

Industrial Training | ENEL
E-Learning

Smart Grids Framework | POLIMI
Classroom Lessons

Soft Skills | POLIMI
Classroom Lessons

Technical Focus | ENEL (Lab)
Laboratory classrooms

APRIL 2022
Final Exam Session
and Graduation day



Politecnico di Milano - Dipartimento di Energia

Via Lambruschini, 4 - MILANO | Tel. +39 02.2399.3855 - 8509

✉ masterenel-smartgrids@polimi.it

🌐 www.masterenel-smartgrids.polimi.it