



SMAGRINET

POWERING SMART GRID
EXPERTISE IN EUROPE



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ETL
EUTRACON ELECTRICITY NETWORKS



UNIVERSITÉ
DE LORRAINE

DELIVERABLE 3.1

3 CHALLENGE AND CASE-BASED MODULES

DELIVERABLE TYPE

Other

MONTH AND DATE OF DELIVERY

Month 9 | December 2019

WORK PACKAGE

WP 3

LEADER

TUB

DISSEMINATION LEVEL

Report | public

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PROGRAMME

H2020

CONTRACT NUMBER

837626

DURATION

30 Months

START

April 2019

Contributors

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Revision History

Version	Date	Reviewer	Modifications
1.0	31/12/2019	Christine Michalek	Finalisation of materials
1.1	26/03/2020	Karl Kull	Final version of report

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1. Executive Summary

With the lead by KTUs Emilija Zimkute the result is a set of 3 challenge and case-based master level (MA, MSc or ME) modules (each 3 EAP). The modules have been built on the needs and challenges identified under WP2 and by further internal analysis at partnering universities. The materials cover multiple interdisciplinary skills, competences and knowledge

The modules have been finalized, approved by the partnering universities and integrated to the engineering curricula for the implementation of the modules and the piloting of these modules has already started in some of the partnering universities from January 2020 and other partnering universities will start teaching the courses in the second part of 2020. The modules are targeted to the master level students that are required by the industry the most.

Additionally, on-line teaching materials will be made available for the students and respective manuals for the teaching staff will be developed under the WP5 in order to provide replication at other universities.

As a part of the modules - simulation(s) will be held at the end of each academic year after the students have passed the modules. The simulations will be organized before the annual conferences so that their results could be presented there for the stakeholders.

The co-ordination process is led by TUB with active participation of all consortium partner universities.

2. Description of the deliverable

2.1. Physical form of the deliverable

The deliverable is an information package that consists of:

- 34 academic lectures.
 - 14 for the module “Connection planning in smartgrids”
 - 10 for the module “Economic operation and societal challenges”
 - 9 for the module “AI role in smartgrid with prosumers”
- 3 laboratory tasks.
- Material for individual learning and seminars.

2.2. Formulation of the content

As the partners represented in the consortium had been chosen on the basis of their long-time experience and expertise in the field of electrical and smart-grid market development, each partner with their expertise was responsible for contributing for certain parts in the modules/courses.

The provided modules cover the latest EU related policies, societal courses regarding the energy shift process taking place in the EU and the best practice methods in power and smart grid engineering.

3. MODULE: AI role in smartgrid with prosumers

3.1. Module content register

1. What is AI and why AI?
2. Data representation, exploration and visualisation
3. Linear models
4. Nonlinear models
5. Deep learning
6. Generalisation issues, model assessment and selection
7. Unsupervised learning
8. Applications of AI and conventional technologies:
 - Demand management, load forecast, power prediction, yield optimisation
 - Consumer and consumption insights, virtual agents, predictive maintenance
 - Participation in energy markets
 - SCADA/EMS systems
 - Cyber security, power system protection

3.2. Module format:

Lectures (2 hrs/occasion)

- Oral examination (40%)

A project

- Projects concern application of AI technologies. You will do projects in groups of two students.
- Results: Written report & oral presentation (40%)

Seminars (1 each student)

- Each student has to give a seminar (15 mins). Seminars will be on applications, typically based on research papers.
- Material is provided by the course responsible.
- Evaluation (20%)

4. MODULE: Economic operation and societal changes

4.1. Module content

1. EU energy policy
2. Power sector regulation
3. Electricity prices
4. Power sector regulation and policy
5. Electricity market pricing
6. Long-term energy demand forecasting
7. Congestion management
8. Transmission tariff
9. Power planning
10. Electricity financial market and its risk management
11. Cost and benefit analysis
12. Environmental issues
13. Societal Changes

4.2. Module Format

Lectures (2 hrs/occasion)

- Oral examination (40%)

2 projects

- Powerplant cost benefit analysis
- Power stock planning

Seminars (1 each student)

- Each student has to give a seminar (15 mins). Seminars will
- Seminar will be on the research articles. Examples are provided on the following subjects:
 - Consumer behaviour
 - Distributed energy
 - Energy models for demand forecasting
 - Future of energy system
 - EU internal Electricity Market
 - Efficient technologies or user behaviour
 - Energy-saving behaviour
 - Manipulation in the market
 - Reshaping design
 - Bottom up models
 - Information in EE
 - Strategic withholding
 - Consumer Behaviour
- Material is provided by the course responsible.
- Evaluation

5. MODULE: Connection planning in smartgrids

5.1. Module content

1. General characteristics of distribution network
2. Distributed generation
3. Rayleigh statistics
4. Load and distributed generation forecasting
5. Demand characteristics of consumers and prosumers
6. Allocation of distributed generation
7. Integration of energy storages
8. Optimization
9. Electric vehicle impact on the distribution network
10. Smart grid technologies
11. Power quality
12. Virtual powerplant
13. Power flow
14. Planning of distributed network expansion by modelling equipment
15. Planning of distributed network expansion by power flow and protection

5.2. Module Format

Lectures (2 hrs/occasion)

2 projects

- Prosumer modelling
- Simulation of the AC/DC/AC power conversion system
-
- Material is provided by the course responsible.



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