



# SMAGRINET

POWERING SMART GRID  
EXPERTISE IN EUROPE



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## DELIVERABLE 3.3

# MODULES' PILOT REPORT (2)

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Report

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# 1. Executive Summary

This deliverable addresses the implementation of Work Package 3 (WP3) – in particular the task T3.2 – in the SMAGRINET project and is complementary to the deliverable D3.2. While in the previous part, the first piloting phase of the developed modules was described, here the second and third piloting are in focus. WP3 aims at developing, evaluating, and adjusting three teaching modules for the master's level engineering students.

This document outlines:

- Mission, objectives and intended implementation of WP3
- Realisation of the second and third piloting phase, respectively:
  - Participation of consortium universities
  - Timeline of the courses
  - Details of the implementation

## 2. Introduction to Work Package 3

During Work Package 3 of the SMAGRINET project, three challenge and case-based modules targeted at the master's level students were developed and implemented as a part of European university programmes. The main aim was to teach students about operational problems of modern power grids in the context of the social, technological, and industrial dimensions of the energy transition.

To achieve this goal, the content of the modules was prepared and piloted in two stages, with an evaluation and adjustment in-between. Furthermore, since the students' feedback regarding offering such modules was positive, three of the partners decided to conduct also an additional teaching phase and are planning to continue organising similar courses in the coming years.

To provide students with more practical insights and improve problem-oriented skills, traineeships at companies and a simulation session were also part of WP3. All in all, by participating in these activities, the next generation of engineers and researchers will be better prepared for solving current and arising challenges of the energy transition.

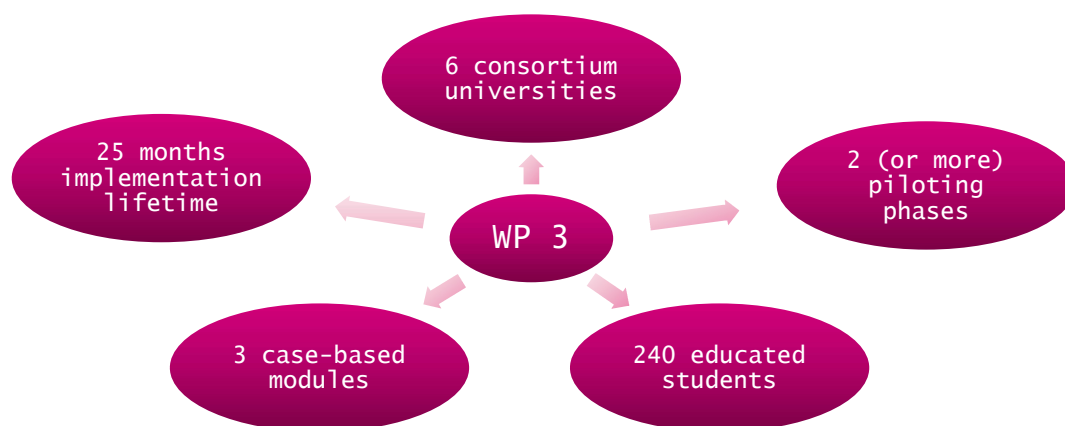


Figure 2-1: Key facts about WP3 of the Smagrinet project

Figure 2-1 summarises characteristics features regarding the implementation of WP3. In the following Chapter, the mission and objectives of the developed modules are elaborated upon in Section 2.1. Then, in Section 2.2, details of the intended implementation are discussed.

### 2.1. Mission and Objectives

The ongoing energy transition is a complex process, involving numerous different stakeholders and perspectives, and requiring new, interdisciplinary skills. Well-trained workforce and researchers are of utmost importance for efficient operation of future power systems. That is why there is a need for revising the currently existing educational programmes in order to comply with the emerging trends in the industrial and technological development. To respond to this challenge, in the WP3 of the SMAGRINET project three master's level modules are designed, with the long-term objective to prepare new generation of future engineers. Key principles for this purpose are:

- Joint use of top-level expertise from European universities and knowledge sharing
- Close collaboration between industry, academia, and societal stakeholders
- Interdisciplinary and involving topics beyond engineering competences and developing skills like communication, teamwork, critical thinking, and problem solving

To achieve the project's goal, the developed challenge and case-based master's level modules are integrated into the teaching programmes of the participating European universities. Furthermore, simulation sessions and a mobility programme are scheduled to complement the theoretical knowledge with practical experience. Figure 2-2 illustrates the context of the project and its contribution towards more sustainable future.

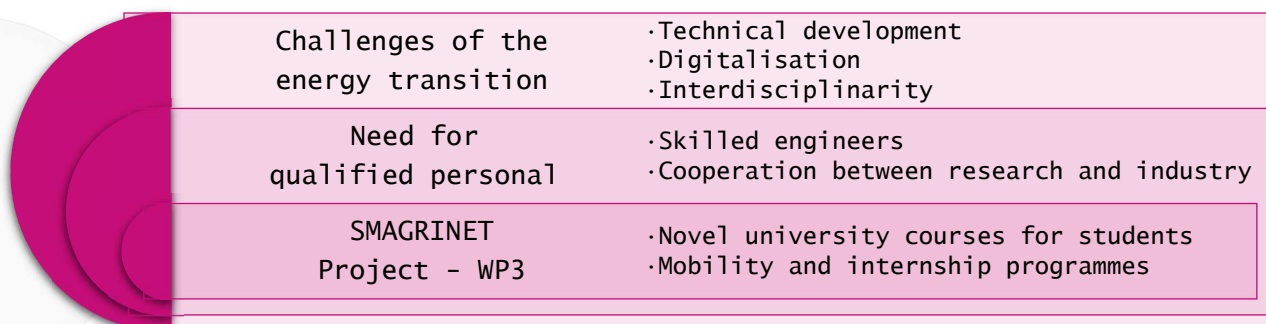


Figure 2-2: Context of the WP3 of the Smagrinet Project

## 2.2. Implementation

As visualised in Figure 2-3, the implementation process of the WP3 objectives consists of the following stages and the corresponding tasks.

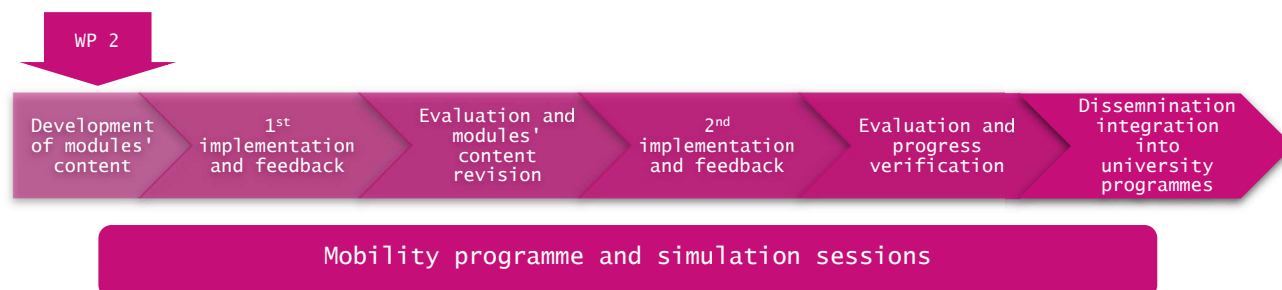


Figure 2-3: Structure of WP3

### 2.2.1. T3.1 Development of Three Challenge and Case-based Modules

Developing the content of the three master's level modules is realised in close cooperation among the researchers from the participating universities and the industrial partners, based on the results obtained from WP2. The set of modules is designed to be implemented within one academic year, which makes it flexible and easily replicable.

### 2.2.2. T3.2 Piloting of the Developed Modules

The implementation of the modules is divided into two phases. During the piloting, every university offers the respective teaching course twice, with the support from all other partners. In total, 240 students are to be educated, which corresponds to 20 participants in each programme. In the first part, the modules are taught by the experts of the



consortium. Afterwards, based on the gathered experience, the Train the Trainers Programme is prepared to allow for future replication of the courses. This serves as a guideline for the local teaching staff for conducting the second pilot by themselves.

In addition, five students from each consortium university who achieved the best examination results in the courses are invited to a two-week simulation session in the TalTech ABB simulation lab in Tallinn. During this event, they have the opportunity to interact with each other and work together, as well as to deepen their understanding of the covered topics by solving practical tasks.

### 2.2.3. T3.3 International Mobility at Enterprises

Another objective of the WP3 is to organise a complementary mobility programme by providing scholarships, again for five students from each consortium university. Within its scope, the participants can spend from one to three weeks at European hosting enterprises and gain practical experience. Afterwards, they are supposed to prepare a knowledge sharing seminar for all fellow students.

### 2.2.4. T3.4 Evaluation of the Pilots and Adjustment of the Modules

After each piloting, students are asked to fill in questionnaires and give feedback about the attended modules. In particular, the evaluation results of the first implementation are taken into account to adjust and improve the programmes before starting the second phase. Furthermore, comparing the feedback gathered after the first and second pilot is a valuable measure of the success of the developed approach. Finally, some additional suggestions can be formulated for future implementations of the courses.

The development of the three challenge and case-based modules was documented in deliverable D3.1. The first piloting phase was subject of the deliverables D3.2. and D3.6. Conducting the mobility programme is presented in deliverables D3.4 and D3.5. This deliverable D3.3 addresses the implementation of the second and third piloting phase, and will be complemented by the evaluation results in deliverable D3.7.



## 3. Second Piloting Phase

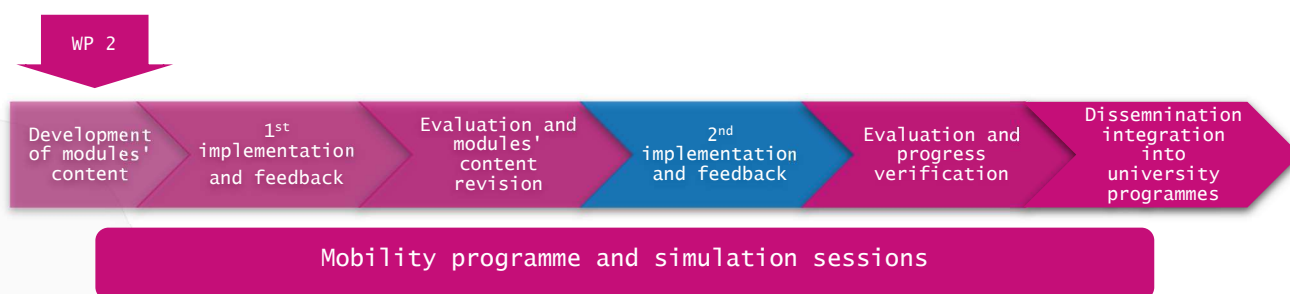


Figure 3-1: Structure of WP3 - 2<sup>nd</sup> piloting phase

Highlighted in Figure 3-1, the second piloting phase started in September 2020 and ended in December 2021. In this Chapter, firstly the allocation of the modules among the consortium partners is explained in Section 3.1. Afterwards, the timeline of the implementation and practical details are presented in Sections 3.2 and 3.3.

### 3.1. Participation

Six consortium partners are involved in realising the aim of WP3 and contribute to the development of three case-based modules. Consequently, each module is taught at two universities, as shown in Table 3-1.

Table 3-1: Allocation of the modules - 2<sup>nd</sup> pilot

Module title	Responsible universities
Module 1 "Artificial Intelligence in a Smart Grid with Prosumers"	Kaunas University of Technology (KTU) Technische Universität Dresden (TUD)
Module 2 "Economic Operation and Societal Challenges"	Université de Lorraine (ULOR) Tallinn University of Technology (TalTech)
Module 3 "Connection Planning in Smart Grids"	Technische Universität Berlin (TUB) University of Ljubljana (ULJUB)

In the second piloting phase, lectures and exercise sessions were mainly led by the local teaching staff at each university, with the aid of the Train the Trainers materials and the results from the first pilot.

### 3.2. Timeline

Depending on the individual organisational issues at each of the consortium universities, the courses were offered between September 2020 and December 2021. The timeline is depicted in Figure 3-2. TalTech and KTU scheduled the teaching activities over a period of a few weeks in autumn 2020. ULOR planned the implementation in February and March 2021. In contrast, TUB and ULJUB conducted a one-week intensive course in January and February 2021 respectively. An important notice is to be made regarding TUD. Due to the difficulties arising with the Covid-19 pandemic, the first piloting phase was postponed and took place in November 2020 – January 2021, as highlighted in Figure 3-2. This also resulted in a

delay in the second pilot, which took place in October till December 2021 (see Figure 4-2).

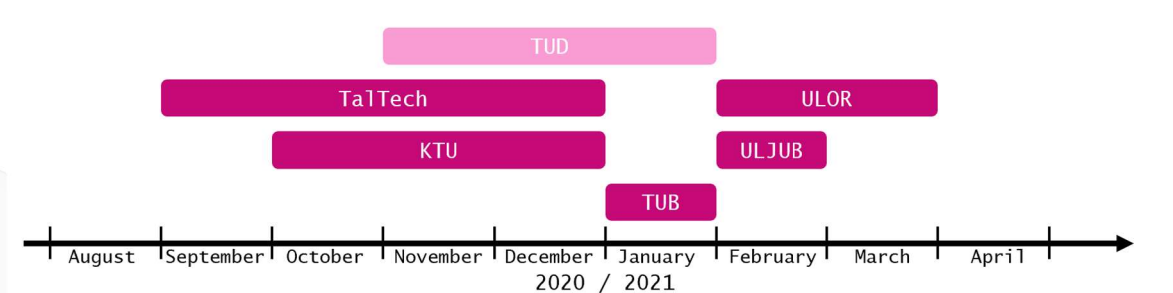


Figure 3-2: Timeline of the 2<sup>nd</sup> piloting phase

### 3.3. Implementation

The experience and feedback gathered during the first implementation constituted substantial background for the preparation of the second round. At the end of the first piloting phase, participants were asked to fill in questionnaires regarding the pedagogical approach, lectures, exercise sessions, and their overall impression of the course. Although most of the students rated the listed aspects positively, some improvements were considered as necessary. The problems that were mentioned most frequently were the lack of pre-existing knowledge, quality of the slides and missing content needed to complete the exercise tasks. On the other hand, numerous students appreciated the balance between lecture and exercise time, interesting exercise topics and active participation. In view of this, the project partners attempted to revise and correct the materials, making them even more clear and understandable. Moreover, in order to supervise the lecture and exercise sessions, local teaching staff had to familiarise themselves with the content prepared by other experts. This was supported by mutual exchange and cooperation between the partners.

The ongoing Covid-19 pandemic remained a challenge also in the second pilot. However, its impact can be regarded as lower in comparison to the first pilot. Having dealt with this situation for several months, the consortium partners were able to utilise their experience and the solutions developed in the meantime. For instance, a large part of the activities had already been adjusted to the online format during the first phase. Additionally, also students became more accustomed to the digital teaching methods. The most affected aspects were the simulation sessions and the mobility programme. Despite some difficulties, the simulation session was performed at the Estonian roadshow in co-operation with CCDCOE (NATO Co-operative Cyber Defence Centre). Students who were not able to participate in the activities personally were given the opportunity to join numerous online talks and presentations. Further, they were supposed to solve practical modelling problems on generation scenarios for carbon-neutral energy supply in different countries.

Thanks to the extension of the project lifetime until March 2022, it was possible to compensate for the delay that occurred at TUD. The second implementation was conducted in autumn 2021, so that, after all, the project's goals were achieved at all participating universities.

## 4. Third Piloting Phase

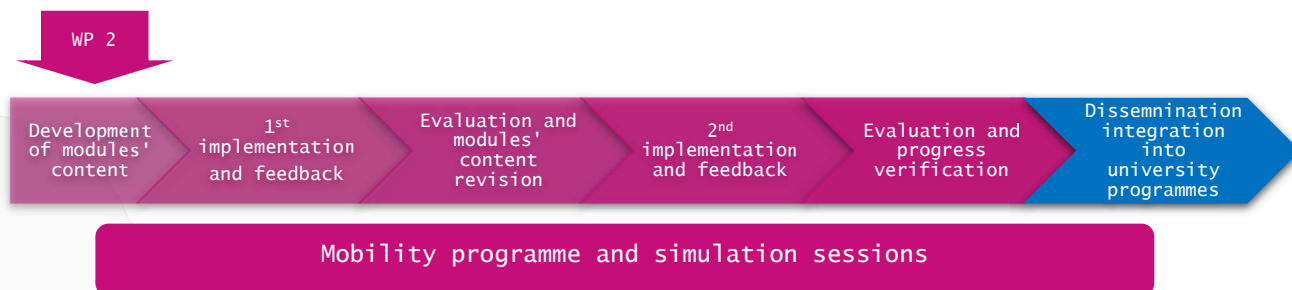


Figure 4-1: Structure of WP3 – 3<sup>rd</sup> piloting phase

In the initial version of the project proposal, two piloting phases were planned. Nevertheless, as a part of the dissemination strategy marked in Figure 4-1, three of the consortium partners decided to continue offering the respective modules also for the third time. These partners, as well as the reasons for their approach, are listed in Section 4.1. Section 4.2 presents the timeline and Section 4.3. – the implementation details.

### 4.1. Participation

Out of six consortium partners, three universities listed in Table 4-1 opted for conducting the additional pilot.

Table 4-1: Allocation of the modules – 3<sup>rd</sup> pilot

Module title	Responsible universities
Module 1 “Artificial Intelligence in a Smart Grid with Prosumers”	Kaunas University of Technology (KTU)
Module 2 “Economic Operation and Societal Challenges”	Tallinn University of Technology (TalTech)
Module 3 “Connection Planning in Smart Grids”	Technische Universität Berlin (TUB)

One of the important reasons was the success of the first and second pilot. The feedback from students proves that the developed modules were interesting and well-designed, and indeed provide a valuable contribution to respond to the challenges of the energy transition. In consequence, at TalTech the SMAGRINET course became a part of Power Engineering curriculum and will be implemented also in the coming years. The same applies for KTU, who added the respective module to their master’s study programme. At the TUB, the developed content was integrated into one of the existing courses and as such will belong to the standard teaching offer. TUD conducted so far only two pilots, but also considers the possibility to extend and introduce its module on regular base.

Another reason for conducting the third piloting phase was the fact that in the first two rounds, 179 students took part in the activities, while the aim was to approach 240 persons. This difference can be attributed to the Covid-19 pandemics, because it was more difficult to contact a large number of students and inform them about the novel courses. Moreover, as the simulation and mobility sessions would certainly evoke interest and increase the motivation of students to join the course, the cancellation or postponement of these project elements caused a significant disadvantage.

## 4.2. Timeline

Figure 4-2 illustrates the timeline of the third piloting phase. TalTech started the course in September 2021 and finished in December 2021. KTU divided its implementation into two sessions in January and in February 2022. TUB again offered a one-week intensive course in January 2022. As already mentioned, the second pilot at the TUD took place between October and December 2021. For the sake of illustration, this is also depicted in Figure 4-2.

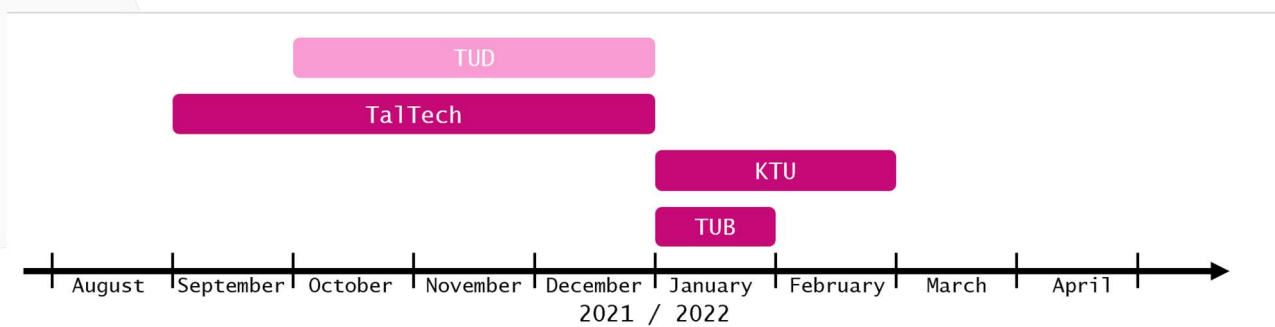


Figure 4-2: Timeline of the 3<sup>rd</sup> piloting phase

## 4.3. Implementation

The third piloting phase can be seen as a continuation or replication of the second one, so that the differences in technical implementation are rather minor. The only relevant change is that KTU split their course into two separate sessions. Additionally, some further improvements in the modules' content and teaching materials were introduced. Since also at the end of this phase feedback from students was collected and evaluated, the quality of the courses can be continuously developed and enhanced. With the evaluation results and the gained experience, the participating universities established a format that allows for long-term exploitation of the projects' achievements.

## 5. Conclusions and Outlook

All in all, it can be stated that, as far as the implementation of the three challenge and case-based master's level modules is concerned, the aim of WP3 was achieved. After evaluating and revising the content developed in the first piloting phase, all consortium partners successfully implemented the second piloting phase among their students. The courses took place between September 2020 and December 2021. They were complemented by a simulation session in Tallin. Moreover, at three universities – TalTech, TUB and KTU – it was possible to extend the initially intended concept and conduct also a third round, scheduled between September 2021 and February 2022.

One of the challenges faced during the project lifetime relates to the training of local teaching personnel, so that they can give lectures and supervise exercise sessions originally prepared by other experts. Another important aspect concerns integrating the collected feedback and improving the modules according to the students' opinions. Thirdly, the Covid-19 pandemic led to postponement of some activities as well as to difficulties in reaching the target number of participants. However, none of these issues impaired the project realisation significantly.

In the final deliverable D3.7 the results of the here described piloting phases will be evaluated, which will build the basis for the overall assessment of WP3. This will also support further implementations in the future that are planned at at least some of the consortium universities. Integrating the SMAGRINET courses into their curricula contributes to sustainability of the project's achievements and ensures realisation of its long-term goals.



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