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SMAGRINET

POWERING SMART GRID
EXPERTISE IN EUROPE

his project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 837626

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DELIVERABLE 2.2.

NEEDS, CAPACITIES AND RESOURCE BASE MAPPING REPORT

DELIVERABLE TYPE
Report

MONTH AND DATE OF DELVERY
Month 9

WORK PACKAGE
WP 2

LEATHER
TU Dresden

DISSEMINATION LEVEL
Report

AUTRHORS
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PROGRAMME
H2020

CONTRACT NUMBER
837626

DURATION
30 Months

START
April 2019

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Contributors

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Peer Review

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Karl Kull	TalTech

Revision History

Version	Date	Reviewer	Modifications
1.0	30/12/2019	Olga Kyselova	Final Version

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This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 837626

1. Validating the skills, competences and research and innovation needs for the energy transition

In the first period of the SMAGRINET project the consortium has **organized several workshops** and carried out an **online questionnaire** for the validation of skills, competences and research and innovation needs for the energy transition.

The SMAGRINET competence hub stakeholders were asked to give input via on-line questionnaires and workshops to identify the current chellangies, needs and tasks for training next generation Smart Grid Engineers.

Throughout this period, **7 workshops** "Electrical Engineers for Smart Grid – needs mapping and experience exchange" were carried out. These needs mapping and experience exchange workshops (that received around 25 participants each) took place in 6 EU and Associated MS countries. Workshops were organised at partner universities (**Tallinn University of Technology, University of Ljubljana, Kaunas University of Technology, Université de Lorraine, Technische Universitaet Dresden**), as well as integrated to several conferences that enable wide stakeholder engagement, such as:

- 2019 IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), Bucharest, Romania, 02 October 2019 (Workshop organised by T**echnische Universitaet Dresden** in collaboration with **Technische Universität Berlin**)
- 16th European Energy Market Conference, International Conference, Slovakia, 18th to 20th September 2019 **(University of Ljubljana)**
- International Conference "Power Electronics and Energy Efficiency", Kharkiv, Ukraine, 12 September 2019 **(Technische Universitaet Dresden)**
- 2019 IEEE 2nd Ukraine Conference on Electrical and Computer Engineering (UKRCON), Lviv, Ukraine, 04 July 2019 **(Technische Universitaet Dresden)**
- Smart Grid roundtable 2019 in Tallinn, Estonia, 20th of July 2019 (**Tallinn University of Technology**)

Also, several thematic roundtables were organised by the **Union of Electricity Industries of Estonia (ETL)**, who present industry within the project consortium:

- Roundtable with the social partners on bringing older people into the labor market, Tallin, Estonia, 26th of April 2019
- ETL Renewable Energy roundtable 2019, Tallin, Estonia, 24th of May 2019.

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1.1. On-line questionnaires

Online questionnaire "Smart Grid engineers – mapping and validating the needs": for mapping and validating the needs the competence hub experts were asked to fill in the Online questionnaire "Smart Grid engineers – mapping and validating the needs" conducted by the Laboratory of Knowledge Architecture of the Technische Universität Dresden. The questionnaire was focused on validating the skills, competences, research and innovation needs of the industry and energy transition. The questionnaire consists of 16 multiple-choice questions.

The online questionnaire can be accessible via the link
https://forms.gle/fehNoLnmjkquUd1r5

1.1.1. Online questionnaires results: needs mapping report

The report demonstrates the answers of the competence hub experts for the period from September 23 until December 27, 2019. Total number of responses: 60 (all responses consist personal data (name, job title, organisation, email) of questionnaire participants).

- Online questionnaire was available in 3 languages: English, German and French

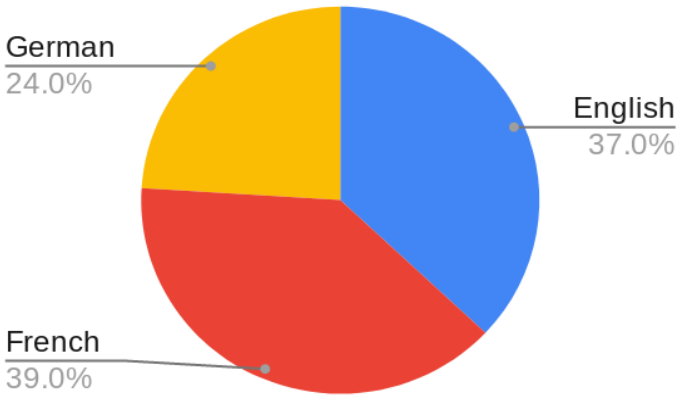

Figure 1 Representation of selected languages

- Online questionnaire participants presented following countries

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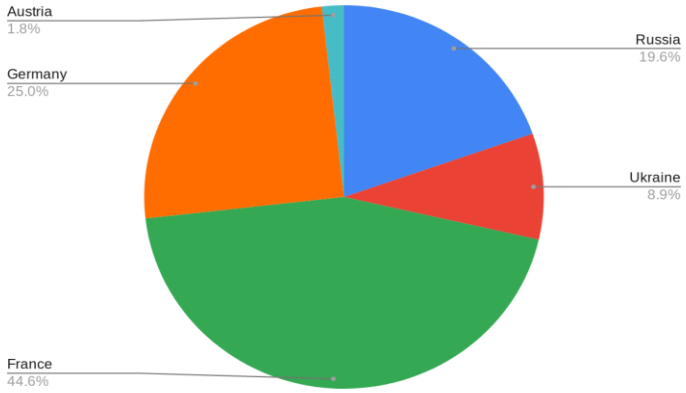
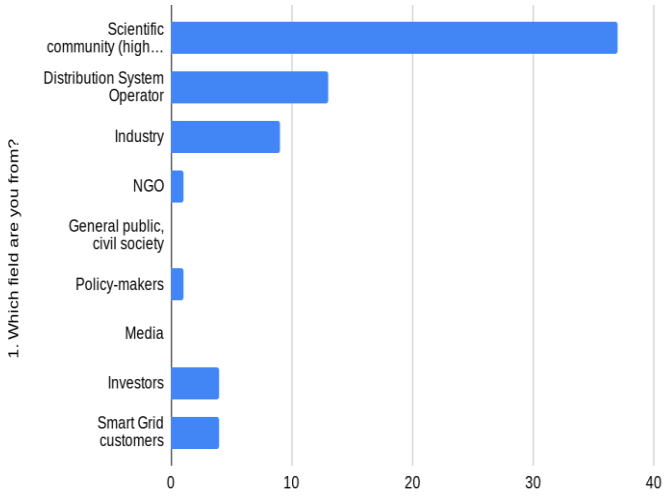


France	25
Germany	14
Russia	11
Ukraine	5
Italy	4
Austria	1

Figure 2 Responders countries representation

- Responders were presented mostly by the **Scientific community** (higher education, research) and **Distribution System Operator**:



Scientific community (higher education, research)	**37**
Distribution System Operator	**13**
Industry	9
NGO	1
General public, civil society	0
Policy-makers	1
Media	0
Investors	4
Smart Grid customers	4

Figure 3 Responders expertise field

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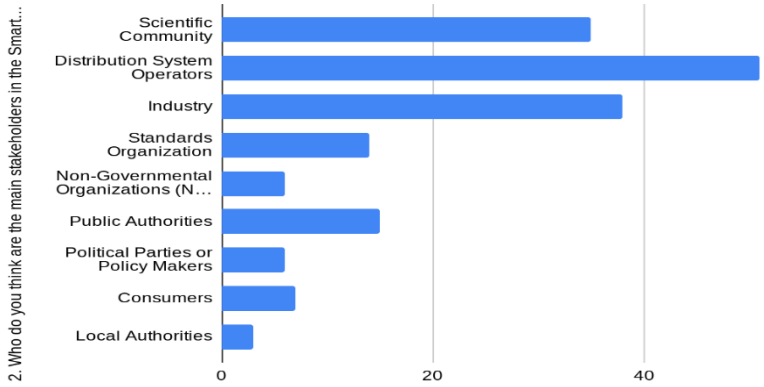
- Next **14 questions** were focused on mapping and validating the needs for training next generation smart grid engineers:

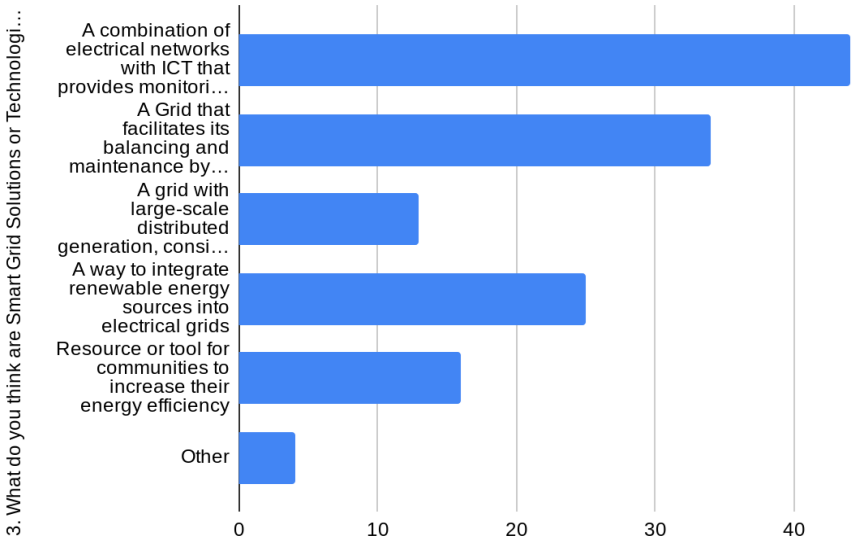
  . Who do you think are the **main stakeholders in Smart Grid technology**?



Scientific Community	35
Distribution System Operators	**51**
Industry	38
Standards Organization	14
Non-Governmental Organizations	6
Public Authorities	15
Political Parties or Policy Makers	6
Consumers	7
Local Authorities	3

Figure 4 Main stakeholders in Smart Grid technology

  . What do you think are **Smart Grid Solutions or Technologies**?



A combination of electrical networks with ICT that provides monitoring and control of energy flows	**44**
A Grid that facilitates its balancing and maintenance by enabling communication between devices connected to it	**34**
A grid with large-scale distributed generation, consisting of mainly renewable generation	13
A way to integrate renewable energy sources into electrical grids	25
Resource or tool for communities to increase their energy efficiency	16

Figure 5 Meaning of Smart Grid Solution/Technology

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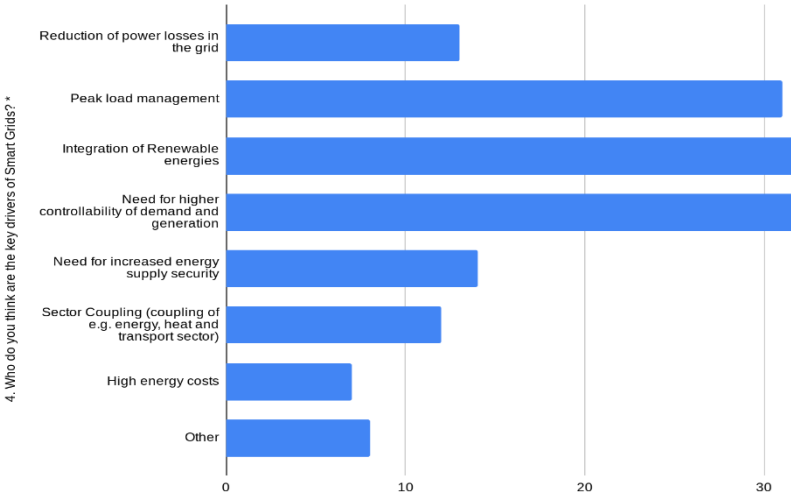
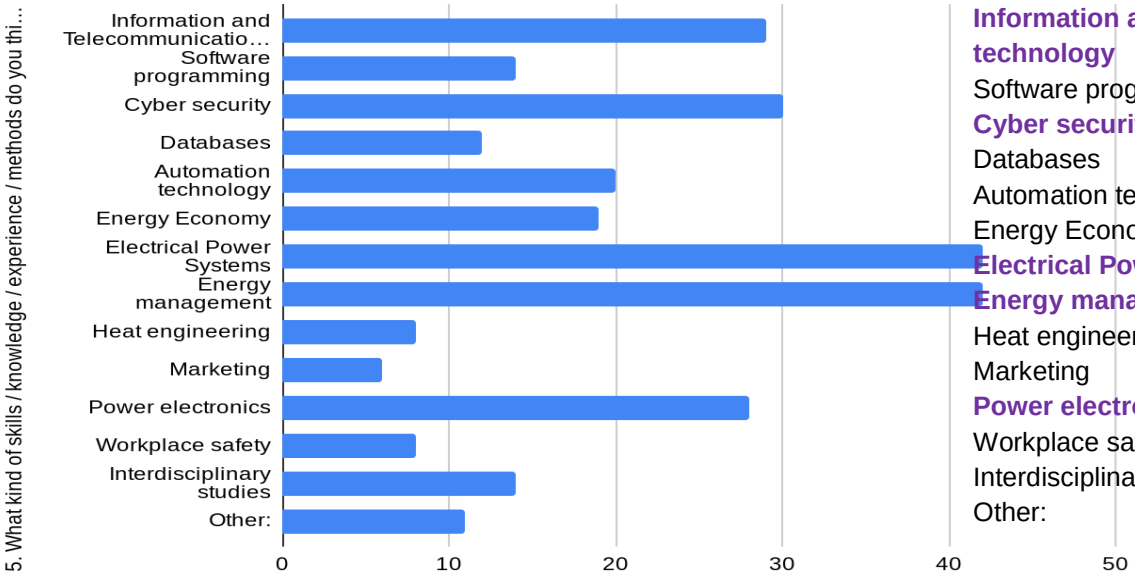
- Who do you think are the **key drivers of Smart Grids**?



Reduction of power losses in the grid	13
Peak load management	31
Integration of Renewable energies	37
Need for higher controllability of demand and generation	40
Need for increased energy supply security	14
Sector Coupling (coupling of e.g. energy, heat and transport sector)	12
High energy costs	7

Figure 6 Key drivers of Smart Grids

- What kind of **skills / knowledge / experience / methods** do you think future smart grid experts should **learn during their university education** in relation to smart grid technology?



Big data analysis and management	**34**
Information and Telecommunication technology	**29**
Software programming	14
Cyber security	**30**
Databases	12
Automation technology	20
Energy Economy	19
Electrical Power Systems	**42**
Energy management	**42**
Heat engineering	8
Marketing	6
Power electronics	**28**
Workplace safety	8
Interdisciplinary studies	14
Other:	11

Figure 7 Skills / knowledge / experience / methods

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- Which **approaches** would you suggest to **train work-ready** Smart Grid **engineers**?

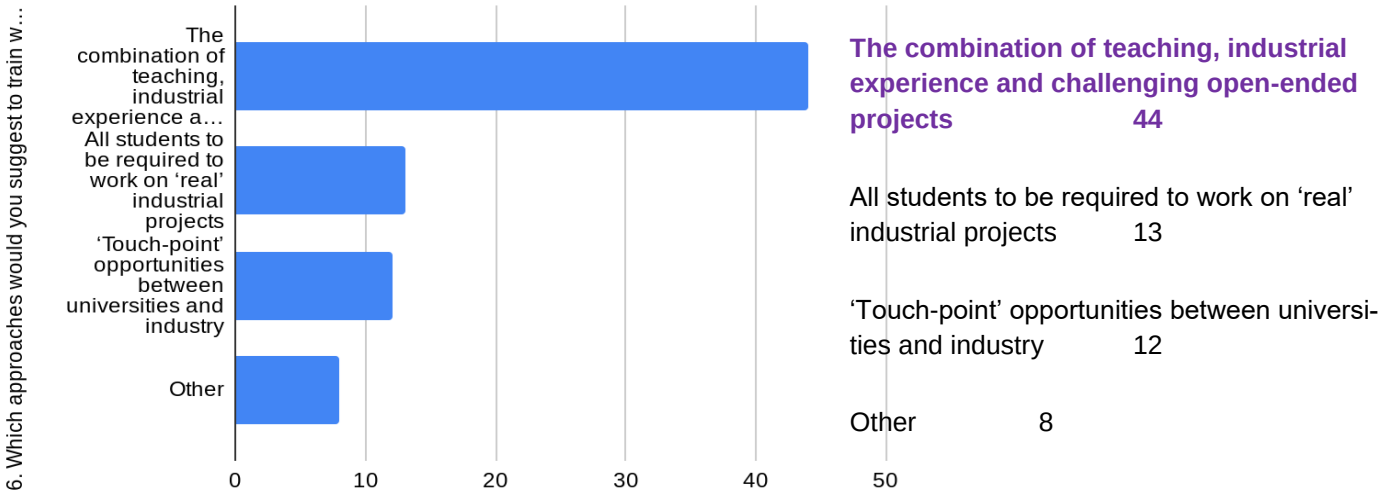

Figure 8 Approaches for train work-ready engineers

- What other kind of **competencies** do you think **are needed** to be trained (**"soft skills"**)?

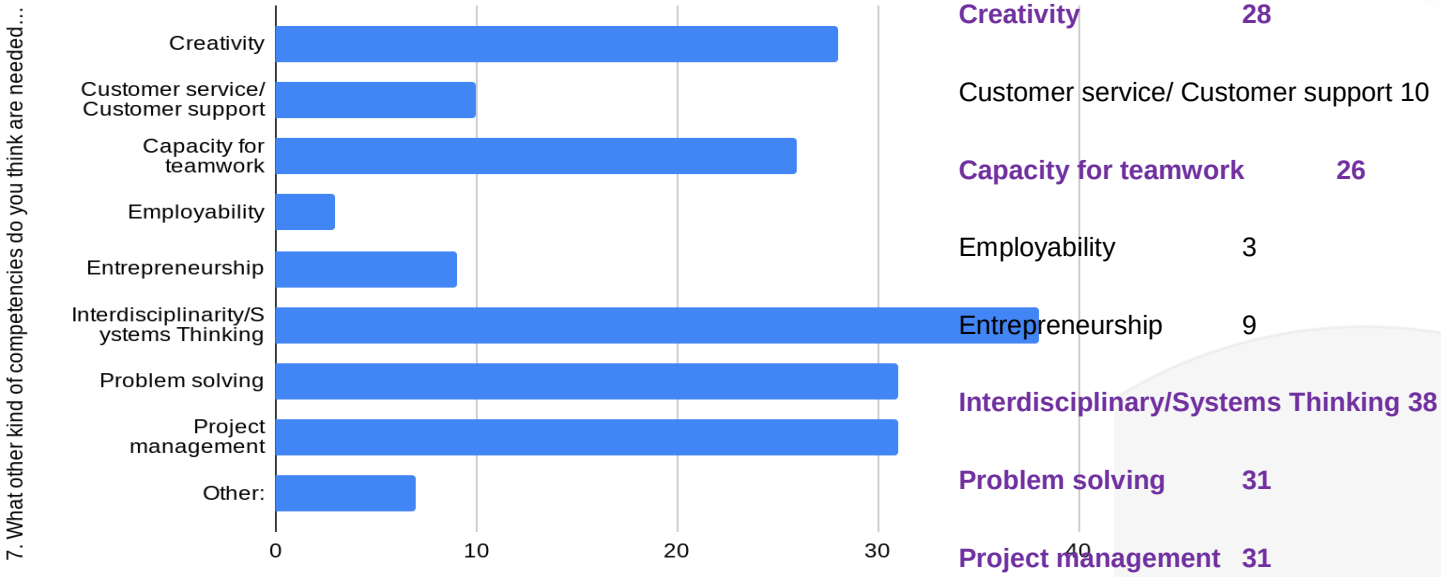

Figure 9 Soft Skills

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- If you need **training in the smart grid field**, which **topics** are you **interested** in the most?

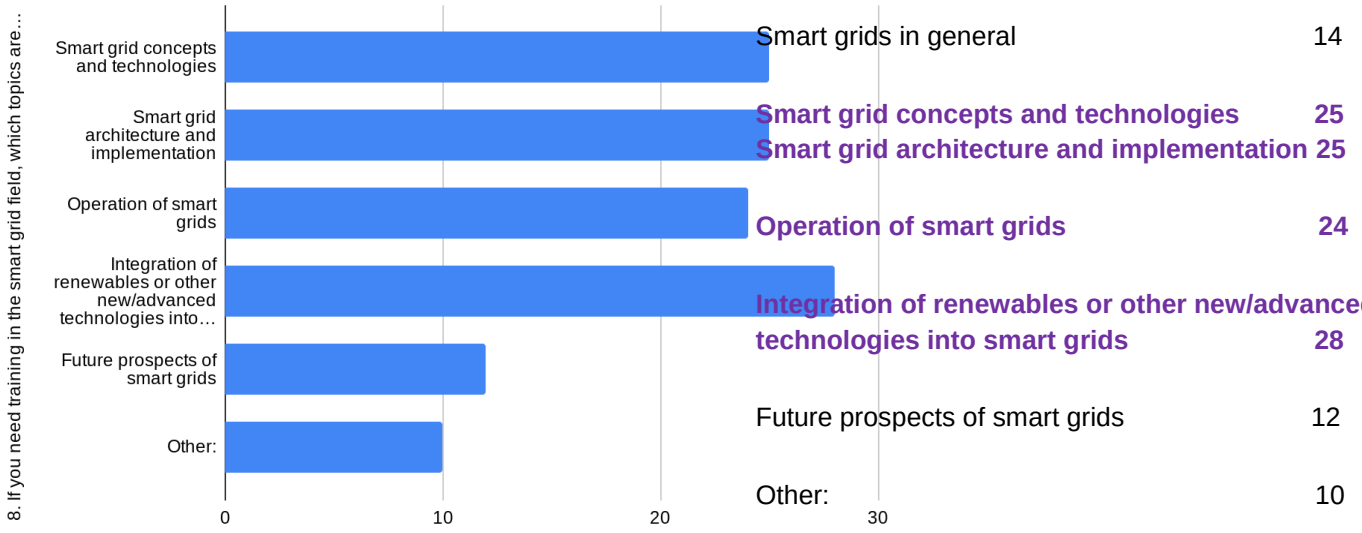

Figure 10 Topics for trainings

- What are your thoughts on how to **increase interest in Smart Grids**?

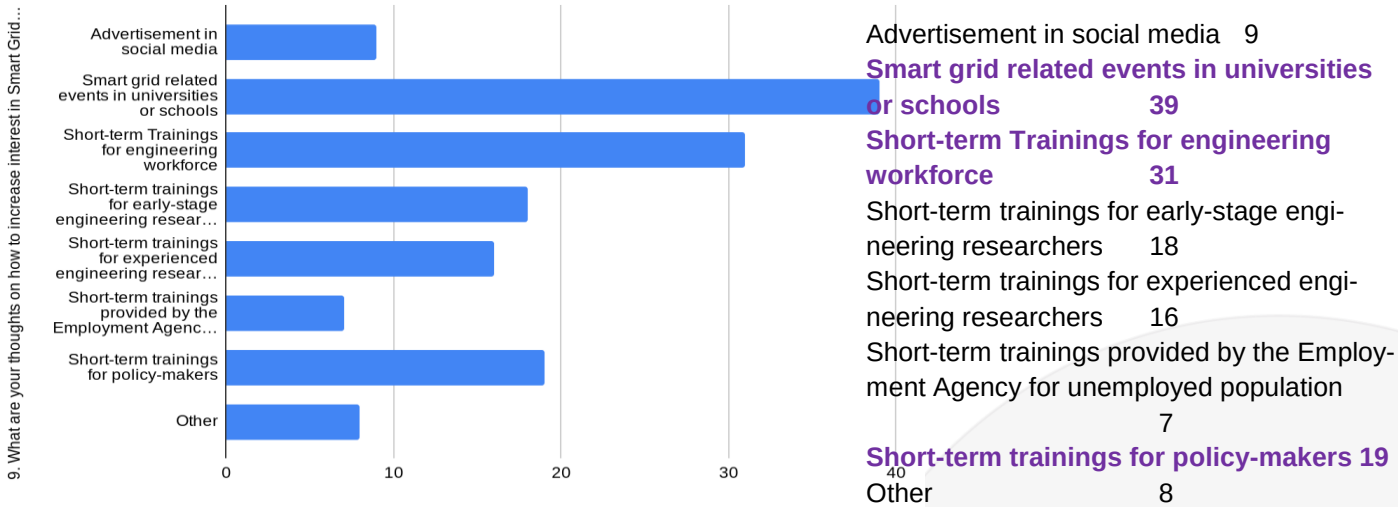

Figure 11 Activities to increase the interest in Smart Grid

- In which **specialities** do you think it would be an advantage for students to **study modules** related to Smart Grids?

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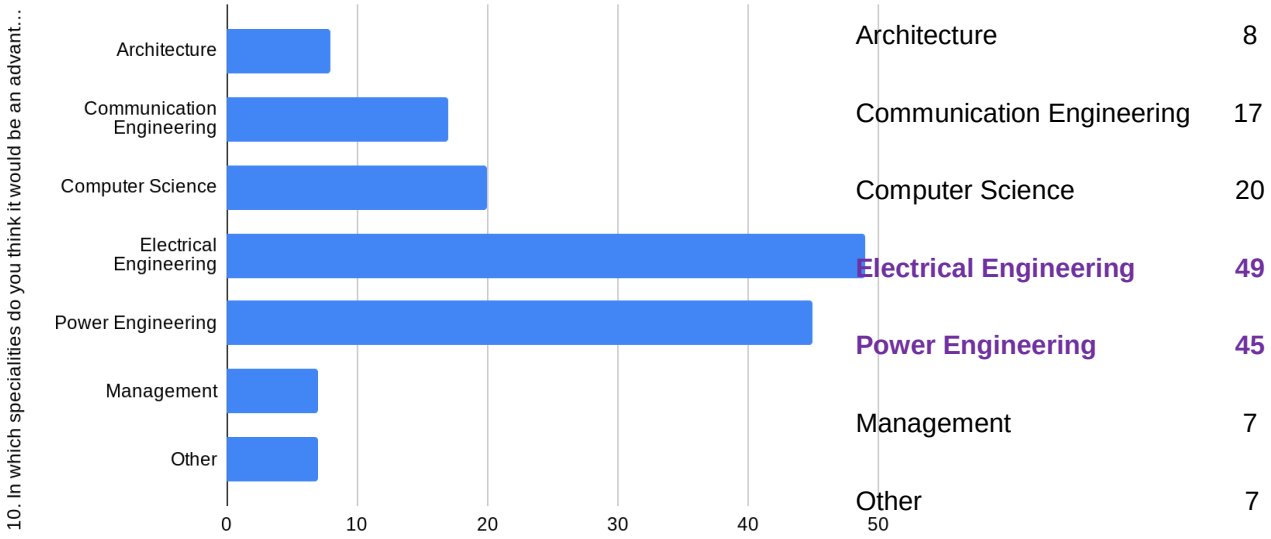

Figure 12 Specialities related to Smart Grid

- Do you think we need to have **Smart Grids** as an **individual speciality** at universities or as a **module** within certain specialities?

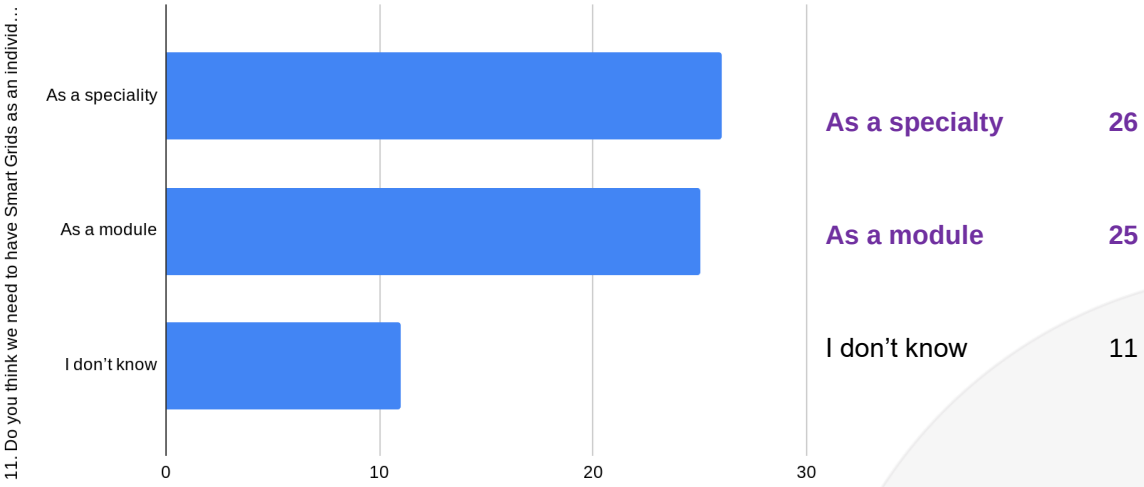

Figure 13 Smart Grid Speciality/Module

- What do you think: For whom or for what do **Smart Grids** mostly **provide benefits**?

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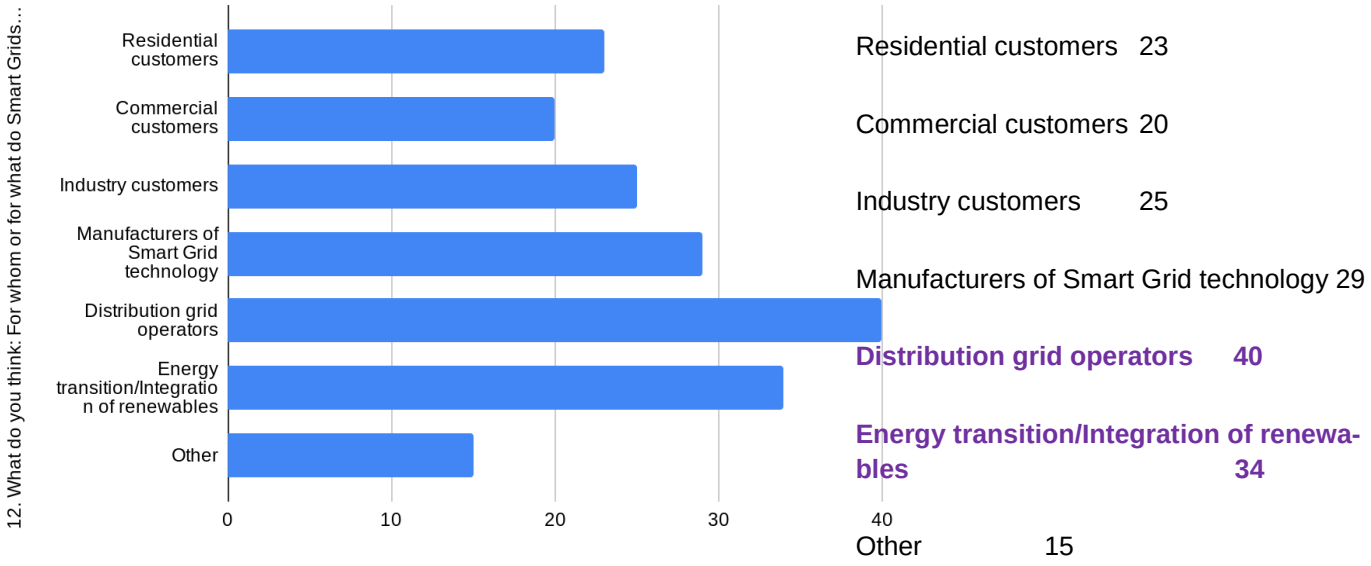

Figure 14 Smart Grid benefits

- What do you think are the **greatest benefits of Smart Grids**?

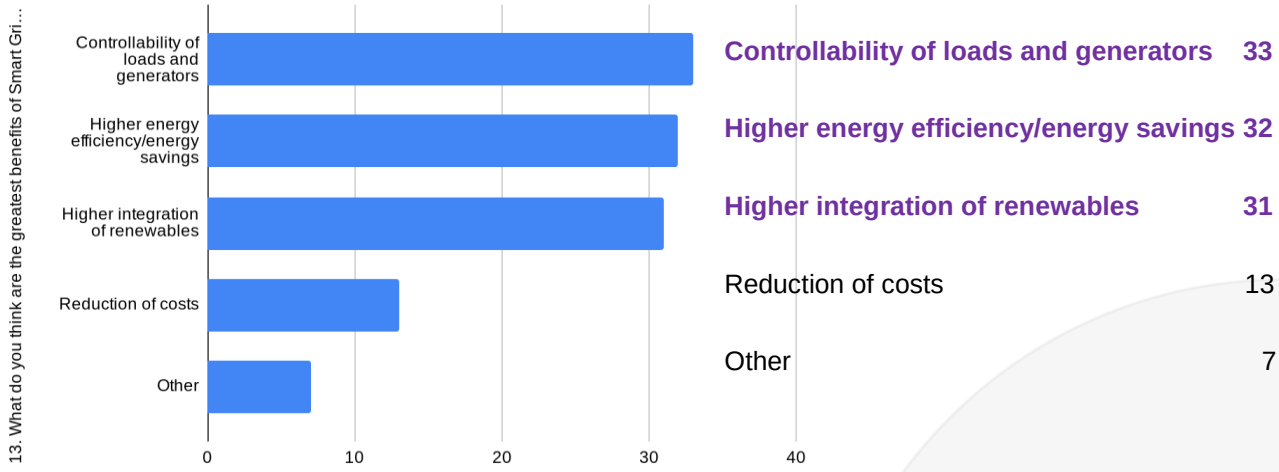

Figure 15 Smart Grid greatest benefits

- What do you think: At which **level of education** Smart Grid Trainings should be started?

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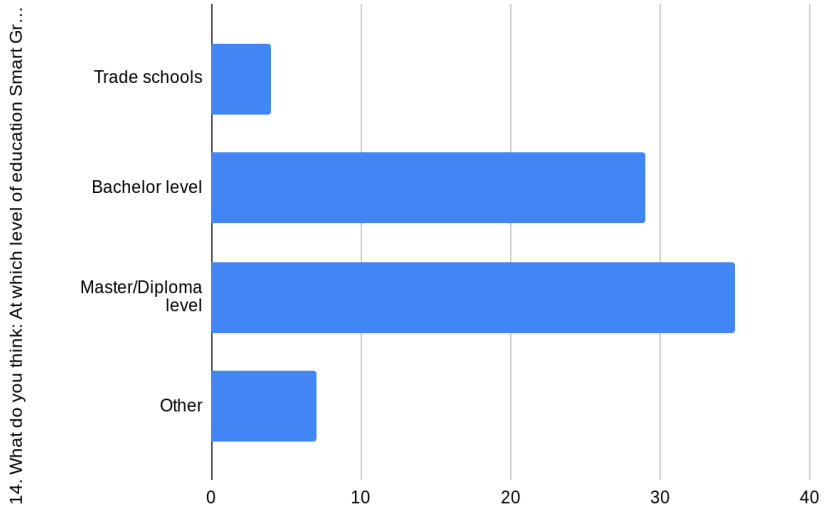

Figure 16 Trainings level of education

- What do you think are the **barriers to implement Smart Grid Solutions or Technologies?**

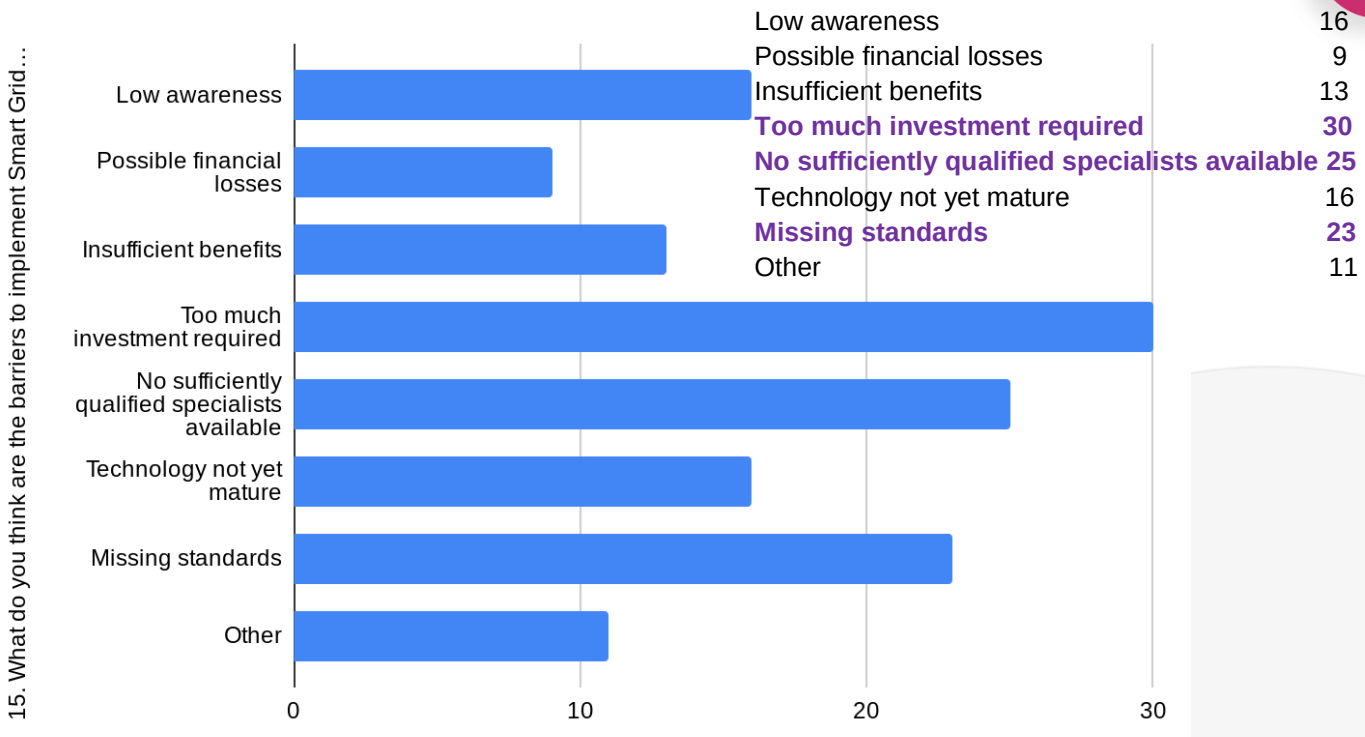

Figure 17 Barriers to implement Smart Grid Solutions or Technologies

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1.2. Workshops

In total, 7 workshops "Electrical Engineers for Smart Grid – needs mapping and experience exchange" were carried out.

The main aim of the workshops was to assess current practices in terms of smart grid university programmes, to identify the needs of the industry and to find solutions to bridge the gap between university teaching programmes and industry needs, as well as:

- networking and knowledge sharing within academia and between academia and business
- to identify and validate urgent and emerging knowledge, skills and competencies needs, pool capacities and allow rapid and wide replication.

The main topics of the workshops were training of the next generation of electrical engineers, who must be knowledgeable to implement the new smart grid technologies and collaboration between universities and industry.

The workshop results were analysed by the consortium and discussed with the advisory board members (December 17, 2019).

TU Dresden developed and provided a common approach to organise the SMAGRINET workshops. It was important that all workshops had the same goals and a common approach to achieve these goals. Also, it helped to compare the workshops results and validate needs, capacities and resources base for training /re-training of specialists.

1.2.1. Workshops Results: needs mapping report

- Workshops main conclutions - **needs mapping:**
  - There is a lack of collaboration between industry and universities, resulting also in students lacking practical skills
  - Students' knowledge is usually focused in one particular domain. For smart grids wide-area knowledge is required, specialization can come afterwards
  - Students often lack soft skills and have a hard time understanding technical documentation
  - There are differences between programming and simulation tools used by the industry and faculties.

- Workshops main conclutions - **capacities and capabilities:**

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- Companies could provide their experts to act as guest speakers and give lectures about their ongoing projects and challenges they are facing
- University courses should be continuously updated and modernized
- The government could be more involved in the observation of what kind of specific specialists are currently needed and their allocation.

Table 1 Needs, capacities and resource mapping during the workshops (main conclusions)

Questions	Ideas
Main challenges of Smart Grid	To make the operation easy for uses, not too much information interchange, economically attractive for users, utilities and government
	Availability, sustainability and Customer participation
	Efficiency in operation and in social-economic way
	RES, Penetration of new equipment
	Integrate it in an old infrastructure, like the power system's one, without increasing its complexity
	Adopting a holistic energy approach
	It's not ready, need more pilot projects to happen
	Mapping from theoretical problems to real life ones
	Interaction between energy markets operation and physical network operation
	Energy flexibility services provisioning in the context of high RES penetration
	Algorithms to optimally plan and schedule the smart grid assets and services
	Complex power flow
	Difficulty between market mechanism and operation
	Knowledge and experience of impact of new technologies (e.g. new planning tools)
	Complexities, communication infrastructure, security
	Make an efficient, secure and ecological grid
	Translating technical language to make it understandable for non-engineers
Main Skills & Competencies & Knowledge of future Smart Grid Employee	Electrical engineering, information technology and communications, social behaviour knowledge
	Broader than today, different competencies needed
	Flexible, competent in self-learning, knowledgeable in where to find information
	Power system processes understanding
	Understanding of new (changed) power systems
	IT skills (basics of programming, telecommunication, AI). Combination of thermal and electrical engineering knowledge
	Programming and IT, economics, optimization, power system
	Technical knowledge two interplay with real energy market, politics, user's behaviour
	Data science, Algorithms and mathematical background (strong)
	Power and electric systems
	Grid operation (not all but at least 2 of them)
	Knowledge and experience of impact of new technologies (e.g. new planning tools)

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	Incorporate some technologies (new) on the network operations
	SLADA, big data analysis, machine learning and cyber security
	3D EM simulation
	Understanding how policy legislation impacts future business cases
	Emotional intelligence / understanding skills
Main Approaches for future Smart Grid Education of ready-to-work	Dual purpose combining theory and work on real projects
	Interaction between different disciplines
	To think about the whole system - is the whole system including the production/resources needed?
	Problem based learning, multidimensional
	Starting education in energy from high-school, with ad-hoc projects
	Awareness and open discussions with co-workers and with other industry experts and having proper training in your area of work
	Combing the fundamentals of the following in education, control and automation, programming, cyber security
	Sharing the actual data for using in the models and simulations
	Study and design the methodology for EMI and EMS
	Specialized learning apps for specific roles

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