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ELECTRICAL POWER ENGINEERING EDUCATION: HOW TO BRIDGE THE GAP BETWEEN INDUSTRY AND UNIVERSITIES

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Question 1 – What level of specialization of engineering curricula should be sought for? Is basic, fundamentals knowledge more formative and potentially more effective for industry than up-to-date information ?

- Industry requires both types of curricula, but with different rates.
- The small amount of engineers working at R&D departments should present a strong background in basic engineering, physics and mathematics, as well as specialized knowledge on specific areas, and show interest in cross-disciplinary research.
- The large amount of engineers working at a business development division, either producing, operating or maintaining industrial products or systems, should have updated knowledge about the state of the technique and to present those necessary skills to integrate such a knowledge into a industrial structure.



Question 2 – What are the differences between Industry needs and expectations and Academia ones ?

- In general, Industry requires fresh graduated engineers with immediate applicable knowledge, whereas Academia prints more general fundamental knowledge on its graduated.
- This should not be surprising since:
 - The rhythm of application of technical knowledge by modern Industry, in the form of new products, systems or services, is too fast to be properly tracked by conventional Academia.
 - Academia should offer to graduated engineers a broad enough background to enable them to access to different positions in Industry structure.
 - Industry does not use to take part in designing the curricula of future engineering graduated students and does not actively participate in their training process.



Question 3 – What are the reasons behind the gap between Academia and Industry, if any ?

- Keeping Academia updated about the needs of the modern Industry is a very dynamic and expensive process that requires innovative formulas in which both actors should be proactively involved. Some reasons of the existing gap are given in the following:
 - In many cases, Academia is not properly equipped to train students on the techniques used by Industry at the rhythm required by this last one (e.g. renewable energies).
 - The curricula of the graduated engineers use to be exclusively designed by Academia by following governmental directions, which, in many cases, are disconnected from actual Industry needs.
 - Academia and Industry have two different conceptual and organizational models, i.e., whereas Industry uses a very dynamic competitive model, Academia uses to follow a public incentivised operational model, which uses to have very high inertia.



Question 4 – What is the current status of cooperation between Academia and Industry and in particular the interaction between industry and undergraduate/doctoral programs ?

- Generally speaking, the connection between Academia and Industry should be improved in the field of electrical power engineering.
- However, there are outstanding experiences in highly developed countries, e.g. in Denmark, where cooperation between both institutions is quite strong and fruitful.
- In general, Industry use not to be involved neither in the design of programs of undergraduate students, nor in the training structure.
- At doctoral level, Industry uses to have stronger connections with Academia, mainly by promoting research projects and programs closely related to exploratory research interest of the Industry.



Question 5 – Is at present the number of PhDs produced every year for the higher education establishment too much to be absorbed by Industry?

- Not at all! Demand of fresh PhD gradated students on electrical power engineering is higher and higher every year.
- The electrical power engineering industry is living an outstanding evolution in the last decades. New concepts, such as renewable energies, distributed generation, or smart grids, among others, suddenly got into a very traditional electrical scenario. Such evolution requires an intensive research effort, which cannot be properly addressed without a sustainable inflow of fresh PhDs.
- This is a critical point, since there are many electrical engineers close to their work retirement, which results in a risk of not being able to face up the new challenges set by modern power systems due to the lack of a enough number of new researchers.



Question 6 – Should industry be involved in the management of Educational Establishments?

- Industry should be present in the education of graduated students carried out by Academia, both in taking part in the design of educational programs, and in actively participating in the training process of students.
- Educational Establishments should not understand Industry just as the final collector for their graduates, but as the mechanism for guarantying a properly oriented training for the work market.
- Of course, it does not mean that Industry should manage Academia according to its particular interests. Education is a wonderful and complex process that should be managed by professionals in Academia. Moreover, independence and freedom of thought should be always safeguarded in Academia as a source of new ideas and progress.



Item 7 – Should Professors' background about Industry organization and operation be improved?

- Academia and Industry are two completely different worlds.
 - Excellence vs. Productivity
 - Exploration vs. Application
 - Papering vs. Reporting
 - Long-term vs. Short-term
 - Applying vs. Offering
 - Intangible vs. Palpable
 - Lecturing vs. Meeting
 - Limited resources vs. Limited time
- Cooperation between Academia and Industry requires a wide knowledge of both the blue and the red sides. Engineers in Industry have an idea about what Academia is (mainly as a student). However, many Professors never have been integrated in an Industry organization. This is something to be analysed.



Conclusions

- Connections between Academia and Industry in the field of Electrical Power Systems should be strengthened in order to improve the training of future graduated students.
- Industry should take part in defining the curricula of graduated students in order to improve its alignment toward the make needs.
- Industry should formally participate in the training process of students by regularly giving specialized lectures and courses, hosting internships, and taking part of the evaluation process.
- Industry should be a formal actor of the managerial board of Educational Establishments in order to promote formal cooperation programs supported by a proper transfer of knowledge and resources.
- Academia should be main player of the educational process and act as a source of new ideas and knowledge.

