

# ASE strategy 2015-2020

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## Vision, mission and executive summary

### ASE's mission

**Educating Bachelors of Engineering with a strong professional profile to match the needs and requirements of business and industry.**

- Bachelors of Engineering who are ready to enter the job market, ready to continue their studies towards an MSc in Engineering, and ready to embark on a career as entrepreneurs.

Raison d'être:

Rapid technological advances are bringing new challenges for virtually all sectors and industries and resulting in an increased demand for engineers who can contribute new knowledge and the ability to translate this knowledge into applications and business opportunities which can help ensure Danish competitiveness and welfare.

### ASE's vision

**Aarhus University is the leading university in Denmark when it comes to educating engineers for business and industry and for long-cycle higher education degree programmes.**

In that Aarhus University:

- Educates the highest number of Bachelors of Engineering in Denmark.
- Is the preferred choice for young people in western Denmark wanting to do an engineering degree.
- Attracts the brightest upper secondary school students.
- Attracts students trained as skilled workmen.
- Attracts students with an entrepreneurial mindset.
- Produces the most sought-after engineering graduates.

We want to be known for:

- Educating engineers at the highest international level for careers in business and industry, and for further education.
- Designing/offering degree programmes according to the CDIO concept (Conceive, Design, Implement, Operate).
- Being the natural partner for businesses when it comes to educational activities, innovation and development projects, and a respected player in Denmark within engineering innovation and entrepreneurship.
- Being an attractive workplace which attracts and retains highly competent, independent and dedicated employees, offering both challenges and opportunities for development for individual employees.
- Making significant contributions to addressing global societal challenges and furthering technological development: energy, welfare technology, production technologies, climate and the environment, food, water and the use of BigData.

## Executive summary

ASE's strategy, special focus areas and activities are based on a focus on areas that contribute engineering knowledge and competencies to business and industry, primarily through the production of engineering graduates, but also via project and development partnerships. In the strategy period, focus is on the development of existing degree programmes as well as two new degree programmes, one within the field of food technology and one within the field of production technology.

The strategy includes plans for the offering of new technology-based engineering degree programmes at Herning Campus with a view to increasing the recruitment basis for the engineering degree programmes – and alleviating the shortage of engineers, not least among small as well as large industrial companies in central and western Jutland.

Through ASE's strengths and competencies within the fields of electrical power technology, food engineering, technological production development, learning methods as well as innovation and entrepreneurship, these areas can be developed into important flagships/strategic centres in close cooperation with other units at the Faculty of Science and Technology (ST) at Aarhus University.

Educating the best engineers requires teaching staff who are didactically, academically and professionally competent and who are devoted to the continuous development of course content and forms of instruction. Another focus area is therefore to attract and retain these competencies and to ensure continuous staff development.

To meet the needs of business and industry for more engineers, focus is both on student recruitment and retention activities and on ensuring the framework and the resources needed to offer more student places of a high standard.

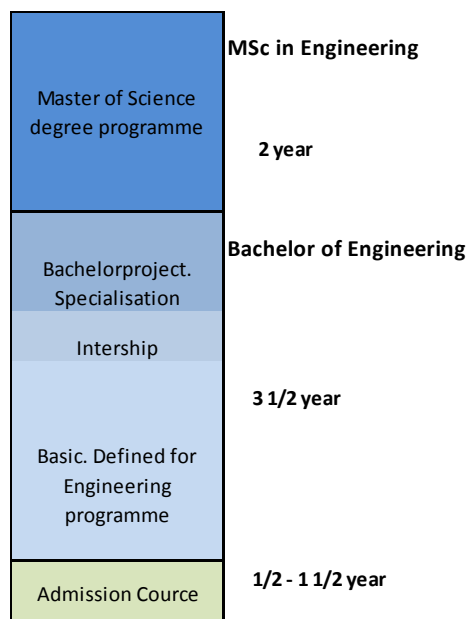
## Programme model

Aarhus University's (AU) engineering degree programmes are structured according to the so-called 'Aarhus model'. A one-string model, where all students become Bachelors of Engineering. They can then choose either to continue their studies on an MSc in Engineering degree programme, or alternatively aim straight for the job market or for a career as an entrepreneur. Having completed their MSc degrees, they are free to pursue a career in engineering or apply to do a PhD degree.

The Aarhus model allows students considerable flexibility in their choice of career path and offers an excellent starting point for their job hunting with either:

- A Bachelor of Engineering degree based on a strong combination of application-oriented knowledge, broad business and industrial insights and knowledge of the latest research.
- An MSc in Engineering degree, which has supplemented their application-oriented knowledge and business and industrial insights with a high level of academic specialisation and a very analytical approach.

Engineering graduates from Aarhus University are sought after by business and industry on account of the combination of



competencies which they have acquired, among other things through internships and project-based work as part of their Bachelor's degree, and a highly specialist focus on the MSc in Engineering degree programmes.

The positive synergies between the profession-oriented study environment at ASE and the research-based environment at the Department of Engineering combined with the requirement for progression between the programmes have strengthened the academic standards of the Bachelor of Engineering programmes.

Through strengthened communication and activities targeted at prospective students at upper secondary schools, awareness of the various engineering degree programmes offered by Aarhus University at both Bachelor's and MSc level has increased significantly. From 2014 to 2015, the number of first-priority applicants increased by 25%. When asked at the commencement of studies, the number of students who are considering continuing their studies on an MSc in Engineering degree programme is up from 14% in 2012 to 61% in 2015.

With continued focus on these activities and the qualities of the Aarhus model, a basis has been created for attracting even more students to the engineering degree programmes offered by Aarhus University. The Aarhus model is, if not a 'Blue Ocean' strategy, then at least a strategy for creating new market opportunities through innovation.

In this context, the greatest challenge has been of a communicative nature, in that we are up against the conventional idea that enrolment on an MSc in Engineering degree programme must be based on the completion of a BSc degree in the technical sciences. A challenge which has been further compounded by a lack of awareness among prospective students of the fact that Aarhus University is also offering MSc in Engineering degree programmes.

However, as evidenced by recent application statistics and expressions of interest, we are succeeding in spreading the word about the Aarhus model and its qualities.

The Aarhus model is in line with the recommendation of the Expert Committee on Quality in Higher Education that more students should enter the job market after completing their Bachelor's degree, with the possibility of coming back to study towards a Master's degree at a later date.

The majority of students on the Bachelor of Engineering programmes come via the upper secondary school leaving exams STX and HTX. Persons, often with a vocational training, may be enrolled on the engineering degree programmes via the admission course.

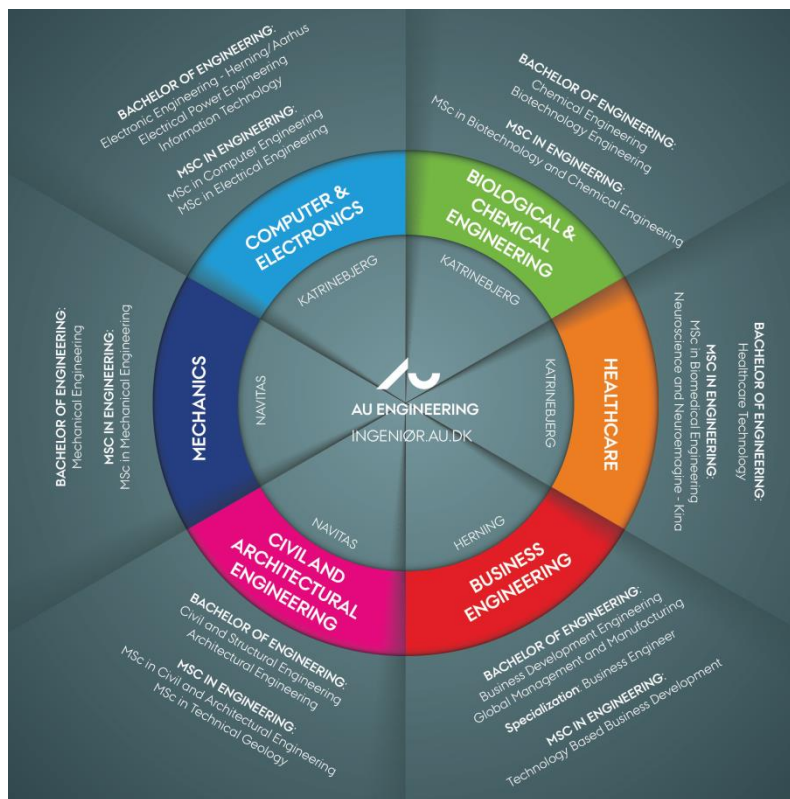
## Bachelor of Engineering programmes at AU

*In addition to the programmes described below, two business-oriented Bachelor of Engineering programmes and one MSc in Engineering degree programme are offered at Aarhus BSS.*

At the moment, a total of ten Bachelor of Engineering programmes are offered, of which the two programmes in electronic engineering in Aarhus and electronics in Herning are very similar. About 2,400 students are currently enrolled on Bachelor of Engineering programmes at Aarhus University.

With a view to ensuring that growth goes hand in hand with quality, the number of places offered has been capped. A cap which is raised in step with the increase in demand/applicant numbers and in step with the necessary resources, premises and teaching staff having been secured.

An eleventh Bachelor of Engineering programme in food technology is being planned jointly with the Department of Food Science in response to a clear desire in the food industry for a Bachelor of Engineering programme in this field. The first intake of students is scheduled for 2017.



ASE's overarching focus is on offering degree programmes based on the classical engineering disciplines while contemporary/application-oriented elements are offered in the form of various lines of specialisation. ASE's focus is thus on offering sustainable degree programmes with good job prospects which meet the need of business and industry for competencies and the ability to develop and innovate – now and in the future.

In view of the competitive situation and in support of a need for growth within strongly application-oriented areas, a couple of programmes are offered which deviate from the focus on the classical disciplines – a programme in healthcare technology engineering and a programme in architectural engineering – which are both based on an interdisciplinary application-oriented approach. However, both programmes still rest on classical engineering disciplines within IT and civil and structural engineering, respectively.

## Organisation and premises

ASE is divided into five development units constituted by the four fields of engineering: Civil and Architectural Engineering (CAE), Electronic and Computer Engineering (ECE), Mechanical Engineering (ME) and Biotechnology and Chemical Engineering (BCE) as well as Admission Course (AK). Each unit is headed by a head of development. The heads are responsible for the HR-related management of teaching staff and the budgets for their respective areas.

The degree programmes are rooted in the various development units, see figure. The degree programme directors are responsible for the degree programmes.

The units ME, CAE and Admission Course are based at Navitas. ECE is based at Finlandsgade (primarily Edison, Shannon, Khan) and at Herning Campus, with BCE at Hangøvej and with classrooms at Jens Baggesensvej.

On 1 January 2016, the ASE unit CDL (CDIO development) was merged with CSE to form ST Learning Lab. This supports the educational/didactic activities and competency development of the teaching staff, the focus being to ensure that the programmes provide the students with the complete range of knowledge and skills needed to embark on a career in engineering.

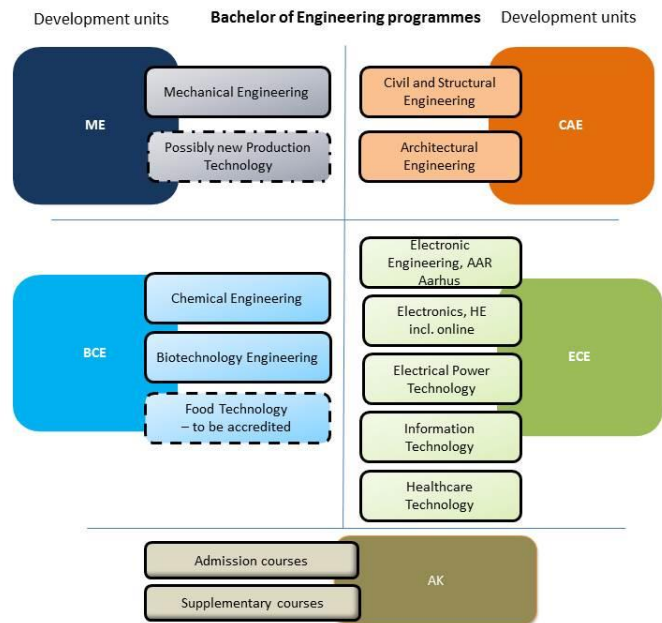
ASE's Student Counsellors' Office coordinates and handles the recruitment activities/guidance targeted at upper secondary schools, and also the general student guidance for students on Bachelor of Engineering programmes and MSc in Engineering degree programmes as well as specific guidance on admission courses. Located at Navitas and at Finlandsgade.

ASE's laboratories and workshop functions are located at Navitas, Finlandsgade and Hangøvej. Tasks include the running and maintenance of workshop facilities, advisory services, guidance and instruction of Bachelor of Engineering and MSc in Engineering students in connection with workshop internships and projects as well as minor construction projects for students and businesses and tasks in connection with Navitas Science and Innovation.

The central coordination and management of ASE is in the hands of the ASE management forum, comprising the director, heads of development, degree programme directors, division managers and business controllers.

Key to the coordination and development of degree programmes and competencies is the cooperation between the head of development and the degree programme directors within the four main fields of engineering.

Through close coordination and cooperation across the four main fields of engineering, we want to ensure a uniform engineering profile and common principles for the management and maintenance of the degree





programmes, while reaping the greatest possible academic synergies. The cooperation involves the heads of development, degree programme directors and teaching staff.

This cooperation is supplemented by coordination with the similar functions (section managers and degree programme heads) at the Department of Engineering, the focus being on involving teaching staff across ASE and the Department of Engineering in the teaching, development and research activities. Moreover, coordination of specialisations and new degree programmes at both Bachelor of Engineering and MSc in Engineering level.

## Employees and culture

A key element of ASE's strategy about educating more and better Bachelor of Engineering students is to ensure that ASE is seen as an attractive workplace capable of recruiting and retaining highly qualified and committed employees, and a workplace where all employees understand and feel a sense of ownership in relation to our common goals.

ASE's staff have so far been characterised by an exceptional sense of community. Following the move to three locations, the integration of Herning Campus and the merger with AU, the sense of community has to some extent been challenged, and initiatives are needed to preserve the sense of togetherness and cohesion in future. A sense of togetherness which not only comprises staff employed by ASE directly, but also staff from the Department of Engineering and in the central administration whose duties and functions are closely related to ASE and the common goal.

It is important that the workplace culture is characterised by a clear sense of responsibility for your colleagues, for the various teaching, supervisory and administrative tasks as well as the students. This must at all times be reflected in that staff members care for and look after each other, that they show a high degree of flexibility and commitment in relation to the planning and execution of tasks, and that they exhibit a special desire to support and help weak students and challenge the strong.

Most of ASE's teaching staff and other staff members have experience from jobs in the private sector, which contributes to creating a strong labour market and result-oriented focus, while ensuring an applied orientation of the degree programmes and good working relations with business and industry.

## Goals

ASE wants all employees to:

- Have a clear understanding of and take ownership of our common goal – educating more and better Bachelor of Engineering graduates.
- Continue to feel that they belong to a unified organisation in spite of being based at different locations.
- Have knowledge of and the possibility of working with colleagues across disciplinary and departmental boundaries.
- Contribute to and feel a responsibility for developing and preserving ASE as an attractive workplace as part of Aarhus University.

## Focus areas

In support of these goals, we are going to:

- Have a managerial focus on common values and policies, through thematic discussions of management-related topics.
- Create clarity about the strategy which ASE will be focusing on in the future, and how the strategy is going to be realised.
- Focus on communication which talks about ASE as a single unit, where all locations and functions are of equal value.

- Establish a joint staff association for ASE and the Department of Engineering for the purpose of supporting activities which promote integration and interaction between the various units, including excursions with a professional content, social events, talks etc.

## Overarching objective, international/national positioning and strengths

- More engineering graduates – and more going on to do an MSc in Engineering degree. (Target figures to be determined for individual areas.)
- Development and innovation projects in collaboration with businesses.

## Analysis of ASE's strengths and weaknesses

Strengths	Weaknesses
<ul style="list-style-type: none"><li>• Acknowledged Bachelor of Engineering programmes.</li><li>• Progression between AU's Bachelor of Engineering programmes and MSc in Engineering degree programmes.</li><li>• Offer of continuing studies towards an MSc in Engineering degree in Aarhus.</li><li>• Long-standing, close collaboration with business and industry.</li><li>• AU as a recognised university and educational institution.</li><li>• Established platform for innovation, in and outside the degree programmes (NSI).</li></ul>	<ul style="list-style-type: none"><li>• The four areas (BCE, ME, CAE and ECE) are geographically dispersed.</li><li>• Limited knowledge of MSc in Engineering degree programmes at AU.</li><li>• Limited offering of MSc in Engineering specialisations.</li><li>• Limited agility/possibility of responding swiftly.</li></ul>

Opportunities	Threats
<ul style="list-style-type: none"><li>• Strong cooperation across the four areas (BCE, CAE, ECE and ME).</li><li>• Development and branding of educational profile (see section on didactics).</li><li>• Aarhus University's strong brand in relation to attracting students.</li><li>• Cooperation with natural sciences and other departments at AU.</li><li>• Strong political focus on promoting degree programmes producing graduates in high demand in business and industry.</li><li>• New upper secondary school reform.</li></ul>	<ul style="list-style-type: none"><li>• Aalborg University's strong image/'ownership' of problem-based learning.</li><li>• Continued attraction of teaching staff with strong development and innovation experience from business and industry.</li><li>• VIA University College's vision for Bachelor of Engineering programmes. Desire for a foothold in Aarhus and exploitation of regional presence.</li><li>• New upper secondary school reform.</li></ul>

## Flagships

### AU Electrical Engineering (AU EE)

#### Energy system of the future

Denmark is to be the first country with a 100% sustainable energy supply in 2050. This is a unique vision which means that we must become better at integrating, for example, solar, wind, hydrogen and biomass in our power system. In the coming years, Danish engineers will be the drivers of this transformation, and will strengthen the Danish Energi export market

To secure the future electricity supply, strong efforts must be dedicated, in particular, to the integration of the new energy forms, systems and products. Electrical power technologies will be the key to the energy solutions of the future, and it is a field in which the demand for skills is great.

The paradigm shift in the energy system, the transformation of the energy system, from a centralised top-down system into a matrix system of energy producers, suppliers and consumers at all levels – also known as the Internet of Energy – requires a great deal of innovation and many new solutions.

Wind power is already the cheapest form of energy, and an energy supply based exclusively on renewables is possible in Europe. The technologies needed for this transformation are available; what is outstanding is the integration of the new products and solutions at systems level.



Energy system of the future (www.siemens.com)

The energy system of the future will consist of many different energy sources at all levels of the power system.

- a) Wind power plants
- b) Solar power plants
- c) Biogas plants
- d) Hydropower systems
- e) Energy storage systems

There is a huge need for ensuring integration of the new energy systems in the power system, which involves:

- a) Infrastructural changes
- b) Adaptation of market mechanism
- c) Ancillary services from new types of energy
- d) Use of new data systems

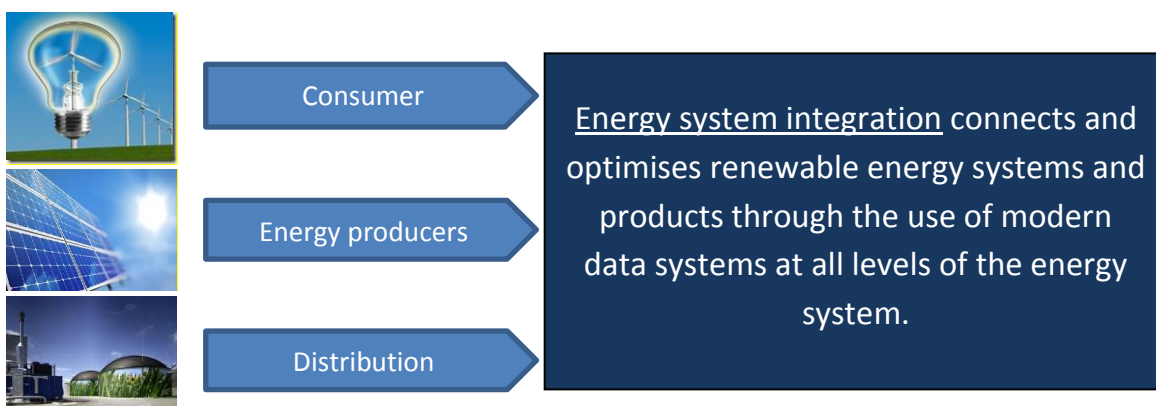
## Status of programme in electrical power technology at AU

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Part of Aarhus University – located in Aarhus</li> <li>• Many students with backgrounds as electricians</li> <li>• Good cooperation with business and industry</li> <li>• Pure Danish education</li> </ul>	<ul style="list-style-type: none"> <li>• No clear profile – ‘invisible’ programme</li> <li>• Weak reputation of AU EE</li> <li>• Limited number of laboratories at AU EE</li> <li>• Limited number of lecturers available to AU EE</li> <li>• Financial support based on student numbers</li> </ul>

Opportunities	Threats
<ul style="list-style-type: none"> <li>• Big need for engineers</li> <li>• Strong focus and awareness of ‘green energy’ in society</li> <li>• Many interdisciplinary partnerships at AU possible</li> <li>• Industry is willing to support the programme</li> </ul>	<ul style="list-style-type: none"> <li>• Limited public financial support</li> <li>• Fierce competition for students – many more fields of study and lower birth rates</li> </ul>

SWOT analysis of programme in electrical power technology at AU ASE.

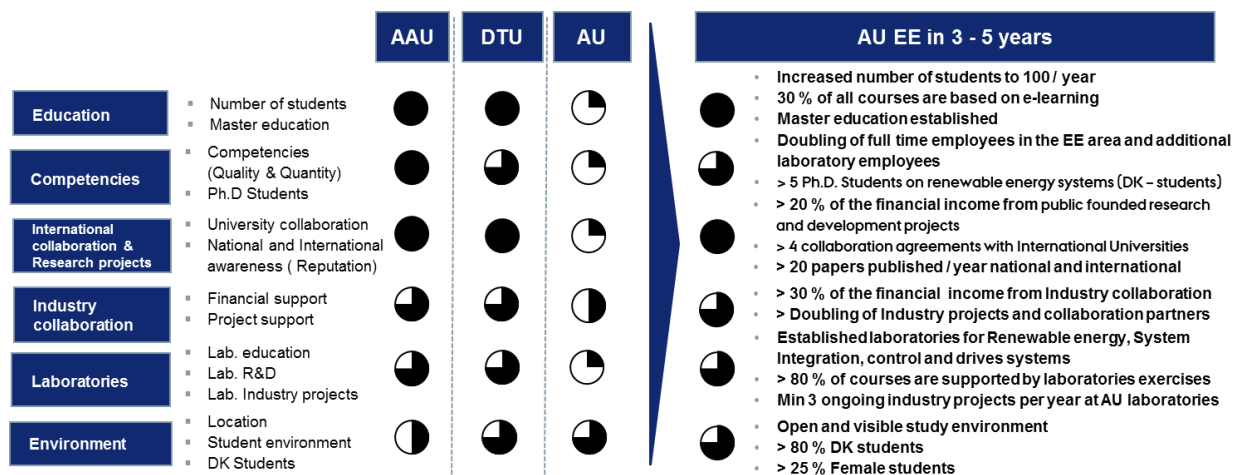
An analysis of the current national and international skills landscape and requirements shows that system design, integration and energy system operation is an area where the engineering demand is high and on which there is today a very limited focus.



Through the further development of ASE’s revitalisation measures, within the next five years, ASE stands an obvious chance of breaking new ground within these areas, of becoming the supplier of the best engineers and the most important partner for business and industry.

Further development is needed to catch up with the Technical University of Denmark (DTU) and Aalborg University (AAU), which are currently the strongest players – DTU with its systems focus, and AAU with its product focus. The University of Southern Denmark (SDU) is also often mentioned by business and industry

as an important university partner. We want to clearly differentiate ourselves through a focus on system integration and interaction, and related system operations.



This will require new investments in more laboratory and educational capacity and in the further development of the quality of the Bachelor of Engineering programme in electrical power technology, as well as the building of research competencies to support an MSc in Engineering degree programme in this field.

The establishment of a system laboratory (RESCUE) which has been initiated at Aarhus University is a unique chance for strengthening cooperation between ST departments and industrial companies within research and development, and the testing and trial operation of integrated energy systems.

### Focus areas

- Marketing of programme in electrical power technology targeted at upper secondary schools.
- Tailoring of courses to reflect challenges of the future and demand from business and industry.
- Expansion of laboratory facilities for future system integration (RESCUE Lab).
- Establishment of a basis for the MSc in Engineering degree programme in electrical power technology.

*Today, AU has no relevant MSc in Engineering degree programme in electrical engineering. Those who want to continue their studies towards an MSc in Engineering degree go to AAU, SDU or DTU.*

### AU Food Engineering

Spurred by an express need in the food industry (producers and system and technology suppliers) for a Bachelor of Engineering programme in food technology, a specification for a Bachelor of Engineering programme in food technology has been developed in cooperation with the Department of Food Science and in close dialogue with representatives from the industry.

The industry is after a degree programme characterised by an engineering perspective, business insights and an innovative approach combined with technological competencies and a strong foundation in the natural sciences. At the same time, the programme must be a good springboard for doing an MSc degree programme at the Department of Food Science.

Market surveys document an increasing need for skills and competencies in the Danish food industry. Businesses with considerable innovation capacity are particularly in need of recruiting new employees.

The strong interest expressed by the industry and sector organisations also means that a number of businesses have already shown an interest in being actively involved in the degree programme, both by giving talks and offering internships, and as development project partners.

The new degree programme initiative is supported by the key role played by food in the growth plans of the EU, Denmark and the Central Denmark Region.



In close cooperation with the Department of Food Science, the new degree programme initiative – combined with ASE’s approach to innovation and entrepreneurship and innovation in the field of learning – will be able to contribute significantly to the Department of Food Science KIC, academically in particular within the area of industrial transformation, but also generally in relation to the called-for development of new forms of instruction, innovation and entrepreneurship as well as extended collaboration with industry. There is thus considerable potential for the food engineering programme to become a natural focal point at AU for development and research partnerships with the food industry, both regionally and internationally.

The degree programme is expected to appeal to a new segment of students and thereby contribute to stimulating interest among young people in Denmark in studying engineering without cannibalising existing engineering degree programmes.

For AU to become a flagship within the field of industrial transformation, strong competencies are needed, together with pilot-scale facilities in the form of a process centre. Initiatives are described in further detail under BCE.

### **Regionalisation. Reach-out programme**

With the reach-out programme, ASE wants to contribute to growth and development in central and western Jutland through the production of more engineers with qualifications targeted at the requirements of the many small and large production and development-oriented industrial companies in the region.

ASE wants to expand the offering of technology-based engineering degree programmes at Herning Campus from the existing electronics engineering programme to include the offering of a mechanical engineering programme with a specialisation pointing towards Advanced Production, Industry 4.0. The specialisation will be developed in close cooperation with research and development activities within, for example, materials, IT in production processes and sensors. These are areas in which AU has internationally strong academic environments.

ASE also wants to offer the programme in electrical power technology at Herning Campus. This programme is currently offered in Aarhus.

This will lead to the creation of a new and exciting education and innovation environment based on strong and well-established teaching, development and innovation competencies in the technical and natural sciences and characterised by interdisciplinary synergies and close affiliation with AU’s strong research environments in a campus environment with a tradition for close interaction with businesses in the region.

A high priority will be given to creating synergies between the three technology-based engineering degree programmes, combined with the technological knowhow of DAMRC and the business-oriented engineering degree programme in global management and manufacturing, and the business development engineer programme.



The purpose of establishing a programme in mechanical engineering with a specialisation in production technology and offering the programme in electrical power technology in Herning is also to increase recruitment to the programmes among young people and not least skilled workmen in central and western Jutland. This is underpinned by the existing offering of admission courses in Herning targeted at skilled workmen and others without the right background for admission. The programmes in Herning are also expected to attract a group of young people with upper secondary school leaving exams (STX, HTX, EUX), whose mobility in relation to moving to Aarhus is low.

The possibility for students to maintain their regional/local contacts during their studies is expected to have a positive impact on companies' recruitment.

Focus areas:

- Specification, dialogue with prospective employers, prequalification and establishment of a mechanical engineering programme with specialisation in production.
- Dialogue with prospective employers, prequalification and establishment of a programme in electrical power technology. Offering expected from September 2018.
- Development of Campus Herning in close cooperation with BSS Herning.

## **Excellent teaching and learning. Methods and technology applications. Didactics.**

Characteristics of the teaching at ASE:

- The students are regarded as junior engineers from day one of their degree programme.
- Close interaction with the students.
- Easy access to teaching staff for students and the lecturers themselves.
- The student is seen as an individual.
- Courses combine theory and practice.

ASE's fundamental view of learning is expressed in Professor Steen Larsen's ultimate formula: You learn something if, and only if (1) you work, (2) on the edge of your competencies, (3) with something you are motivated by. ASE is therefore continuously working with forms of instruction which improve these three aspects of learning.

Students must work: not only physically, but – and this is equally important – mentally. ASE is continuously developing ways of ensuring that students work rather than ending up as passive onlookers in class. Initiatives include virtual laboratories (lab-in-a-box), assignments which involve theoretical calculations followed by practical testing in a laboratory (e.g. when does a concrete beam crack?) and the development of prototypes in workshop/laboratory settings. Combined with the use of the Flipped Classroom instructional strategy, whereby the students view instructions about a topic (video recordings with associated examples and a comprehension test) before lectures. The lecture time is then used to clarify questions from the students and apply what has been learnt – thereby optimising the use of valuable face-to-face time with the lecturers.

On the edge of their competencies: ASE uses assignments, projects, materials, cases etc. of varying complexity to ensure that individual students are challenged at whatever level they are.

With something they are motivated by: Projects are integrated components of all our degree programmes in most semesters. The projects ensure that the students see why theory is important, and how the theory they learn on the various courses in the course of the semester is related. Thanks to their practical experience, the members of ASE's teaching staff can translate theory into practice, thereby explicating why theory is relevant.

ASE has many different kinds of students. For the benefit of students who cannot be present on campus all the time, we are working with e-learning concepts. In 2015, Herning Campus developed a complete engineering degree programme in electronics as well as an admission course intended for distance learning. These two courses integrate off-campus and on-campus students as a supplement to 'traditional' programmes.

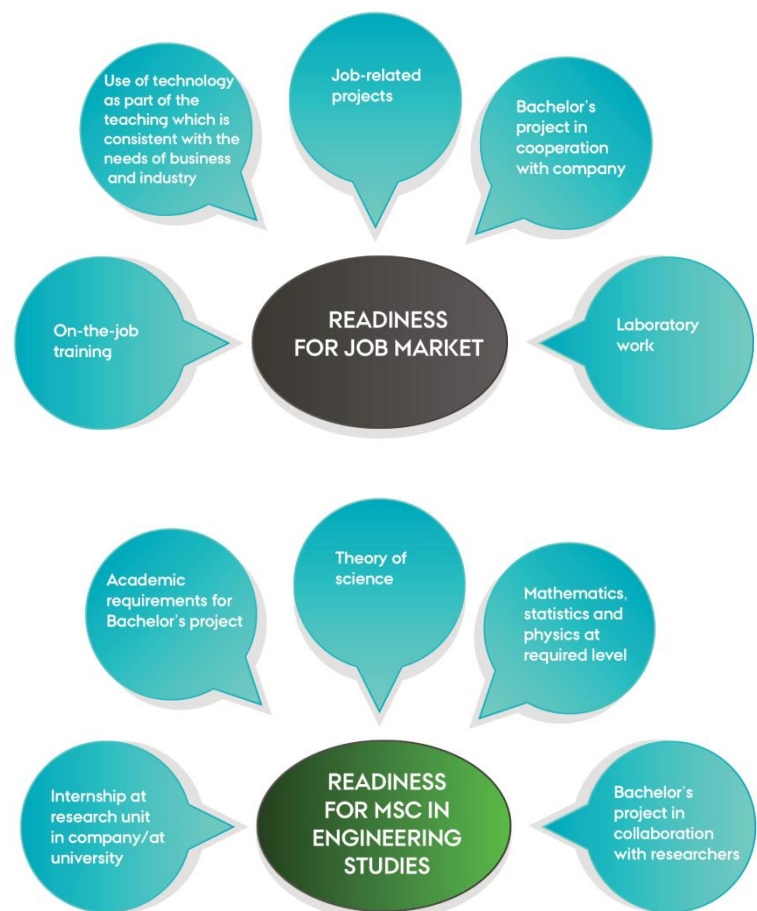
Based on ongoing evaluation, we intend to transfer parts of this concept to other degree programmes. For further details, see the section on education.

### Degrees with several career paths

ASE educates Bachelors of Engineering who are ready to enter the job market, ready to continue their studies towards an MSc in Engineering degree, and ready to embark on a career as entrepreneurs. A number of elements in our degree programmes support these three career paths.

With an educational tradition based on the international CDIO concept (Conceive, Design, Implement and Operate), ASE focuses on ensuring that its degree programmes provide students with the complete range of skills needed to embark on a career in engineering. The skills include basic knowledge in the field of engineering and in the natural sciences (e.g. technology, mathematics, physics and chemistry) supplemented with personal, professional and interpersonal skills such as the ability to work in interdisciplinary teams, do customer presentations and the ability to make ethically sound choices.

The Bachelor of Engineering programme must prepare the students for the job market and create the best possible foundation for continuing their studies towards an MSc in Engineering degree. This is ensured through close cooperation with business and industry, and through coherent academic progression from the first semester to the MSc in Engineering degree level. In close dialogue with the Department of Engineering, we carry out continuous evaluations and updates to ensure



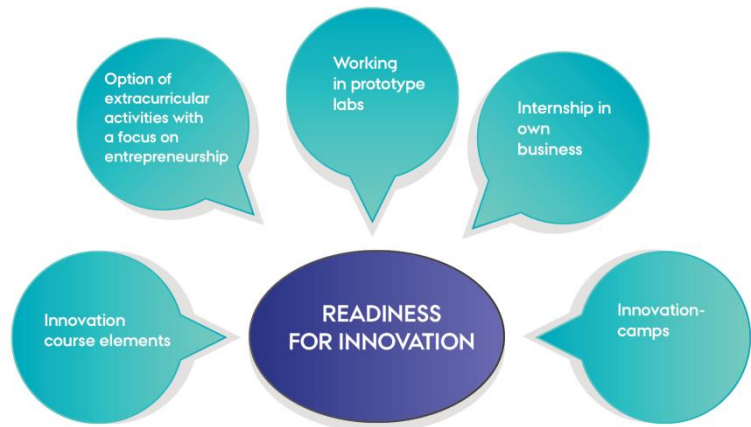
that students are provided with the competencies needed to continue their studies on an MSc in Engineering degree programme.

Via electives in the last semesters, students can sharpen their academic profile with a view to continuing their studies on an MSc in Engineering degree programme, or with a view to further enhancing their job readiness.

An important component in guaranteeing the job/career readiness of our graduates is a semester-long internship.

In support of the three career paths, the traditional company-based internship is supplemented with the option of doing an internship with a research project, and from autumn 2014 with the option of starting up your own business. The last type of internship is offered under NSI.

Some of our students also do an internship abroad – both traditional and research project-based internships.



### Focus areas

The teaching staff at ASE are characterised by their experience and insights into business and development. They therefore have a fundamental understanding of the importance of development, entrepreneurship and innovation.

To maintain the uniqueness of our engineering degree programmes, it is important for their experience and insights to be kept up-to-date. For this purpose we will:

- Equip the teaching staff for being co-creators of courses in innovation and entrepreneurship which make sense for the individual fields of engineering, considering their core expertise, market conditions and business opportunities.
- Maintain and develop the teaching staff's professional and developmental competencies through participation in research and development projects together with businesses.
- Maintain their professional competencies via 'sabbatical semesters' in the private sector. This is a new concept, which is currently being developed. Requires specific agreement with businesses.

### Entrepreneurial talents

There is a long-standing tradition for entrepreneurship among engineers from Aarhus. In the 1994-2012 period, more than 15% had set up their own business. Of these, 29% are still alive, which is a record in Denmark.

Via Navitas Science and Innovation (NSI), which is described in further detail in appendix C, a strong platform has been created for innovation and entrepreneurship activities for students, lecturers and researchers. Moreover, NSI reaches out to the private sector.

We want to continue to support and stimulate interest in innovation and entrepreneurship, and a number of initiatives have been launched, both interdisciplinary and for the individual degree programmes.

Entrepreneurship is a key competency for our students. We want to develop special courses, programmes and opportunities for our students to work with the development of initial ideas for start-ups with growth potential. Depending on the semester, subject area and focus, entrepreneurship can involve the following learning elements:

- Entrepreneurship as effectuation: entrepreneurial behavior and mindset.
- Entrepreneurship as start-up: emphasis on entrepreneurship.
- Creativity skills: the ability to come up with good ideas and to learn from mistakes.
- Innovative competencies: methods of product, service and concept innovation.

Students with a credible business idea are offered admission to an incubator environment to promote good ideas and entrepreneurship. It is possible to get an idea at an early stage of one's studies (beginner's level) to find out whether entrepreneurship is an attractive career path. Programmes are offered, where the primary focus is on finding out whether one's idea is commercially viable.

Also, after the completion of one's studies, the transition from the incubator environment to an independent life as an entrepreneur is facilitated via the close affiliation with INCUBA.

### Focus areas

- Further development of the NSI incubator environment with methods and tools tailored to the various fields of specialisation and offers of specialists and coaches to support the entire entrepreneurship process from idea to growth entrepreneurship.
- **Integrated into all degree programmes:**
- Curricula and extracurricular activities that support the entrepreneurial talents throughout their development.
- Entrepreneurship courses with particular focus on entrepreneurial competencies.
- 'The entrepreneurial Bachelor's project'.
- Cohesive progression for entrepreneurial students with a special talent, from early extracurricular activities to 'internship in the student's own business' in the fifth semester, supplemented with supplementary subject in the sixth semester and an entrepreneurial Bachelor's project.

### Development areas including business collaboration and R&D

**Vision: The natural partner for businesses in connection with development and innovation projects**

### Interdisciplinary research and development activities

Budget for development project income: 2015 = DKK 3 million; 2016 = DKK 3 million; 2017 = DKK 3 million; 2018 = DKK 4 million; 2019 = DKK 5 million. A complete overview of development projects in progress can be seen in appendix G.

Lecturers are expected in average to devote 20% of their time to activities relating to innovation and development. This includes participation in development and research projects, as well as development of course and degree programme contents and didactics. For this to be possible, there is a need to increase staffing levels within a number of designated areas, over and above the increase dictated by the increase in student numbers. Please see the recruitment plan

It is the ambition of Aarhus University School of Engineering to educate competent Bachelor of Engineering graduates. Implicit in this ambition is a desire to ensure that the competencies of new engineering graduates from Aarhus University School of Engineering match the needs and requirements of business and industry, and society in general. It is crucial that the activities of Aarhus University School of Engineering are practically oriented and, in so far as is possible, undertaken in cooperation with business and industry. ASE's strategic focus is therefore on keeping up and further strengthening its already extensive cooperation with SMEs as well as large companies.

We want to use this network to establish research and development partnerships with both small and large companies. ASE sees a strategic opportunity for adding to the development and innovation competencies of businesses which today have only limited capacity in this area, preferably through the use of Innovation Fund Denmark's various types of funding: Knowledge Pilot, InnoBooster and Projects.

ASE wants to exploit the NSI platform to establish cooperation with businesses.

ASE wants to be at the leading edge of development and innovation through cooperation across the four areas. Examples: Joint application to Innovation Fund Denmark from electronic engineering/electronics and civil and structural engineering. Healthcare technology engineering: Mechanical engineering and electronic engineering/electronics. Process technology: Biotechnology engineering, food technology and mechanical engineering. Production and automation: Electronic engineering/electronics, electrical power technology and mechanical engineering.

## **Biotechnology and Chemical Engineering (BCE)**

Biotechnology and Chemical Engineering is the youngest and smallest of the four development areas at ASE.

BCE has a staff of ten permanently employed teaching staff and manages and develops the Bachelor of Engineering programmes in chemical engineering and in biotechnology engineering. Both programmes will see the first intake of students in 2014. The programme in chemical engineering is a brand-new programme, while the programme in biotechnology engineering is the result of a merger of the Bachelor of Engineering programme in bioprocess technology and the BSc programme in biotechnology. The former BSc programme in chemical technology will be continued more or less in the new Bachelor of Engineering programme in chemistry.

Total population October 2015: 280 students. In 2020, the population is expected to have grown to around 400 students.

## Focus areas

1. Development of new degree programme within the field of food technology. Subject to positive pre-qualification and final accreditation, the first students can start in summer 2017. Given the considerable support for the initiative from business and industry and the combined academic strengths and range of the Department of Food Science and ASE, there is every reason to expect a positive pre-qualification and accreditation. Described in further detail in the flagship section.
2. BCE focuses on developing existing competencies in the crossfield between process, equipment and chemical and biotechnology engineering, respectively. These competencies connect insights into the natural sciences with the practical orientation of the technological and engineering disciplines. This is in line with the fact that business and industry is looking for competencies within the fields of chemical and biological processes. Not least in light of the unit's relatively small size, this has meant a very conscious choice to focus on these areas. Research-based competencies in the fields of chemical engineering and biotechnology engineering as a supplement to the unit's own competencies in the natural sciences are added via close cooperation with the Department of Engineering and the Department of Chemistry.
3. Development of competencies within pilot-scale unit operations. Based on the above-mentioned competency and developmental focus area as well as the flagship area of food technology, both of which require pilot-scale facilities. Competencies which are in high demand by business and industry, both in the form of new engineering graduates and possible project partnerships.
4. As part of this, a dynamic process centre must be established where students, researchers and businesses can come together for teaching, development and innovation projects. Offering practical experience in the handling of pilot and full-scale plants in addition to a theoretical foundation will be a powerful argument, but also necessary for AU to be able to attract new students. It is also important in relation to the focus on food production technology. Many foreign and Danish technical universities – including the Technical University of Denmark and the University of Southern Denmark – have invested heavily in this area.

## Research and development activities

Given the relatively low staffing levels and the need to focus on establishing the new degree programmes, only a very limited number of projects are currently being undertaken in partnership with businesses.

Through the realisation of the strategic focus areas, a basis is expected to be created for more research and development cooperation with business and industry within the core disciplines identified.

BCE has recently completed an InnoBooster project in collaboration with the company Nørrevang Flarup ApS. Entitled 'Pre-treatment of biomass', the purpose of the project was to investigate the effects of pre-treating grass and straw with a filamentous fungus.

In addition, BCE is currently involved in a project under the Danish ecoinnovation subsidy scheme (MUDP) in collaboration with the Danish Technological Institute and a number of dairies. The title of the project is 'Better utilisation of whey at small dairies', and the purpose is to contribute to transforming whey into a high-value product of small dairies.

Moreover, an agreement has been made on a PhD degree programme for a BCE employee as part of the HTL project at the Department of Engineering.

## Civil and Architectural Engineering (CAE)

CAE has a staff of 35 permanently employed teaching staff and manages and develops the Bachelor of Engineering programmes in civil and structural engineering and in architectural engineering. It has a total student population of about 760 students.

Around 20% of the lecturers handle a large part of the teaching on the MSc degree programmes in the CAE area (about 10,000 hours). For example, ASE heads the research group within the field of concrete.

### Focus areas

Highlights from CAE's '**Strategy and action plan 2014-2016, civil and structural engineering and architectural engineering**':

### Education

***With the right competencies, we ensure that engineers can perform their functions at the top of the value chain.***

Against this background, a number of activities have been launched with a view to upgrading the degree programmes so as to ensure that they reflect the latest needs and requirements of business and industry:

- Innovation. The construction industry has for a long time been demanding a more systematic approach to innovation. In autumn 2015, a number of initiatives were launched to promote innovation, both the understanding of innovation and the ability to innovate, through increased integration of these competencies into the degree programmes. Further details under Education.
- Sustainability. An upgrading of all semester projects has been initiated with a view to ensuring that they all contain an element of sustainability.
- Buildability – interdisciplinarity. Integrated energy design in new builds and renovations. Integrated into the programmes.
- Internationalisation. A rising degree of internationalisation is seen within the fields of consultancy, development and construction. Danish structural engineers need a more international mindset. More international internships and projects with international partner universities.
- Sharpen architectural engineering profile of the programme in architectural engineering with a view to improving progression in relation to the MSc degree programme in civil and architectural engineering.
- Building Information Modelling (BIM) must be integrated as a method and way of thinking within an increasing number of subject areas.

### Practice-related results

From Bachelor's projects and development projects, e.g.:

- Experiments from Bachelor's projects documented in Proceedings of the Danish Society for Structural Science and Engineering, 'Rotation capacity of concrete beams'.
- Experiments from Bachelor's projects for 'Capacity of Pfeiffer boxes' – sector-specific.
- 'Phase-change materials in future construction projects', article published – research.
- 'Diffuse ceilings for ventilation', article published – sector-specific.



- ASE heads the AU research group within the field of concrete. Increase publication in the period up until 2020.

#### *Development projects:*

- ELFORSK: Comfort cooling – energy-efficient methods. Project period: 2014-2016.
- URO: Interdisciplinary/cross-faculty project in collaboration between ASE, Anthropology, History, Political Science and Aarhus School of Architecture. Research project concerning Urban Orders. Project period: 2015-2018.
- Norwegian Grønn Byggallianse sponsors a combined associate professor/student project with a view to the preparation of a report entitled 'Increased flexibility, good indoor climate and low energy consumption at lower investment and running costs'.
- Ecophon: Project concerning laboratory experiments involving diffuse air inlet through ceilings.
- MBoost: mobile data transfer through window frame. Application to Innovation Fund Denmark. Went on to phase 2, but was rejected in this round.
- Digital Driven Construction: Research project with the Department of Engineering and the Department of Computer Science concerning optimisation of flow on construction sites. Obtained funding from AU's special pool of funding for synergistic industrial cooperation. Project period: 2015-2017.
- 'Earth as a building material' together with Aarhus School of Architecture – NSI/Start-up factory is involved in the process.
- 'Distortion of bolts' together with Bascon. NSI involved with knowledge coupon.

#### *Private and public-sector partnerships:*

- Development of new summer school under the heading 'Intelligent Buildings', involving business and industry in the creation and definition of the concept, intended learning outcomes etc.
- Participation in working group preparing a 'building guide' together with the Danish Energy Agency. The building guide is a sub-element in initiative '1.7 Step up information and communication activities about energy renovation and energy efficiency in the building industry' in the Danish Government's 'Strategy for energy renovation of buildings' from 2014.
- Interns for COWI India – private-sector partnership as part of the internationalisation initiative.
- Holding of a number of talks by external speakers at Navitas, including architects, consulting engineers and contractors, on topics such as 'High-rise buildings in Dubai' or 'Behind Navitas' with a view to promoting Navitas as a new gathering place in Aarhus for the construction industry, thereby strengthening the profiling of civil engineering at AU.

### **Electronics and Computer Engineering (ECE)**

ECE has a staff of 36 permanent employees and manages and develops the Bachelor of Engineering programmes in electronic engineering, electronics, ICT, electrical power technology and healthcare technology engineering. The programme in electronic engineering is offered in Aarhus, and the programme in electronics is offered in Herning. The programmes have a total population of approx. 875 students.

In the past five to seven years, ECE has seen a stable growth in intake – with a dive in 2014 (October 2014, March 2015 figures), which is attributed to low visibility and not least a decline in student numbers in



Herning. This trend was reversed in connection with the 2015 intake, not least in Herning, but also for the degree programmes in Aarhus.

## Focus areas

### *Education:*

- Development of the field of electrical power technology, including establishment of the RESCUE lab. Described in further detail in the flagship section.
- Development of the electronics programme in Herning as combined on-campus and online programme. Start-up of first class of students in summer 2015.
- Development of new offering of electrical power technology in Herning. Separate business case has been prepared.
- Investigation of causes and implementation of initiatives to improve retention.

### *Strategic R&D focus areas*

- System design, integration and management of electrical power systems, see flagship description.
- Electric motors and controls for electrical drive systems, such as electric vehicles and electric bicycles.
- Testing of generators for the wind power industry.
- Robot technology for healthcare technology engineering.
- Web technology and development of apps in collaboration with private and public-sector partners.
- Antenna development.
- 3D printer technology for the healthcare system.
- Technology development for other AU departments, for example physics.
- Audio; units, systems and measurements.
- Embedded software development.

## Mechanical Engineering (ME)

Mechanical Engineering has a staff of 18 permanent employees. The Bachelor of Engineering programme in mechanical engineering has a population of just over 480 students.

Just over 14,500 hours of planning and teaching activities are delivered per semester, which corresponds to a workload of 100% of teaching for the permanent staff members.

As two out of the 18 teaching staff members (10%) are involved in the MSc in Engineering degree programme in mechanical engineering and due to the general staffing situation, the department's core academic focus areas are covered through the affiliation of a number of temporary lecturers, who undertake both project supervision and teaching activities.

ME has seen a strong increase in applicant numbers over the past three years. In light of the high demand for engineers and the high number of first-priority applicants, ASE decided to increase the summer intake in 2015. The plan is for the increase in student places to be maintained in 2016, followed by controlled growth in the coming years, provided that the requisite teaching staff and classroom and workshop facilities can be secured.

In conjunction with the demand among prospective employers for new specialist profiles, this calls for the development of the existing specialisations:

- The two sections Engineering Mathematics & Software Tools and System & Process Engineering are dimensioned to drive the required strategic development.
- Due to staff shortages, the three sections Product Development & Engineering, Manufacturing & Materials Technologies and Robot Applications & Automation Design can only handle the core teaching activities. These three sections are key to the specialisations which ensure progression towards the MSc in Engineering degree programmes and are sought-after by industry as a strengthened development area. To ensure development, progression and the handling of the continued growth in student numbers, there is a need for appointments to be made in the course of 2016 and 2017.

Reference is made to the recruitment plan.

## Focus areas

### *Business collaboration*

- Initiating focused project collaboration through NSI with a targeted benchmark of businesses to strengthen the teaching staff's academic focus areas.
- Maintaining and developing the very extensive network of businesses offering internships, including opportunities for cooperation on development.
- Assisting businesses wanting project proposals to be elevated to semester or Bachelor's projects.

### *Education and innovation*

- Anchoring of specialisations and talent tracks in close collaboration with groups of prospective employers.
- Development of more interdisciplinary student Design-Build projects in MakerSpace\*).
- Development of new specialisation within the field of production and automation to be offered in Herning. Establishment of online/distance learning pilot project on the Bachelor of Engineering programme in mechanical engineering, among other things as part of the Production and Automation specialisation.
- Sharpen the three profiles of the Bachelor of Engineering programme with possible talent track from the third semester to underpin the three career paths: employment in business and industry, MSc in Engineering, entrepreneurship/starting up own business.
- Anchor innovation camp projects in the first semester as part of development projects in collaboration with private companies.

\*) Examples are ROV (Remotely Operated Vehicle), Cartesius 3D printer, Exo skeleton.

The ROV project has, for example, strengthened the profiling of the programme in mechanical engineering at AU and contributed to:

- Hardware sponsorships NI and MacArtney for upwards of DKK 20,000.
- Contact to other underwater-related businesses in Denmark: DNV GL, Multidyk and Eiva as potential future sponsors.
- International recognition and interest in spending time at ASE among academically strong students from other universities.

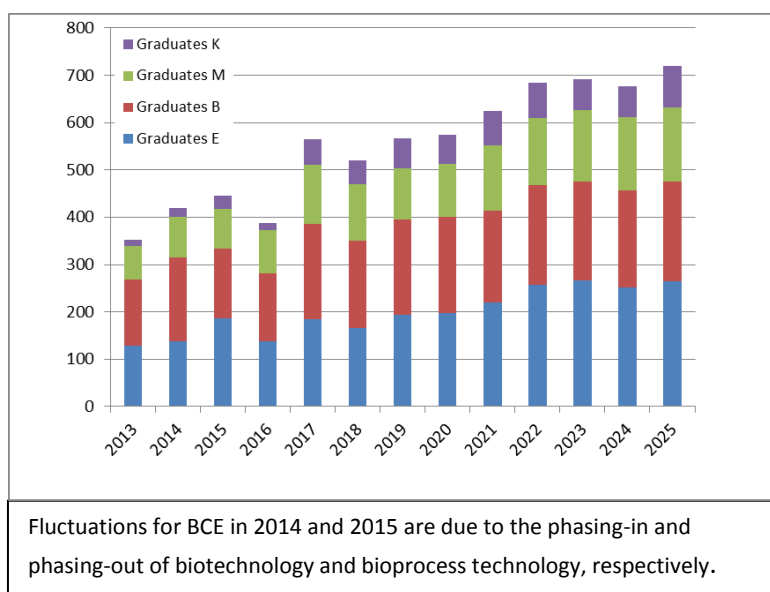
- Bachelor's project cooperation with Bioscience, Aarhus University, in connection with fieldwork under the Arctic ice <http://bios.au.dk/om-instituttet/organisation/akvatisk-biologi/projekter/siap-sea-ice-algae-photobiology/>.
- Contact with Multidyk regarding the strategic research project Novagrass, which is interested in developing an underwater combine harvester.

## Education

According to the latest forecast from IDA, there will be a shortage of approximately 9,300 engineers in the private sector in 2025. To cover this shortfall through an increase in the number of student places, the total number of places available in Denmark would have to increase by approximately 15% a year up until 2025.

The DAMVAD report from 2011, which is based on historical figures up to 2010 and which looks at both the private and public sector, projects a shortage of 14,600 engineers, including almost 8,600 Bachelor of Engineering graduates. A projection based on a *low economic growth scenario* shows a shortage corresponding to approximately 65% of the above. Based on this scenario, the intake of Bachelor of Engineering students must be doubled between 2010 and 2020.

About 250 engineers graduated from AU in 2010, and the plan is for that figure to increase to around 600 in 2020. Factoring in the proportion of Bachelor of Engineering students continuing their studies towards an MSc in Engineering degree (an estimated 20% in 2010 and an estimated 50% in 2020), the number of Bachelor of Engineering graduates entering the labour market will increase from 200 to 300 per year. If AU is to meet the bulk of the demand for engineers in Denmark, this is not enough.



To cover this shortfall through an increase in the number of student places, the total number of places available in Denmark would have to increase by a combined approximately 15% a year up until 2025.

Our strategic focus on educating more engineers concerns both recruitment and retention.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Lecturers primarily involved in teaching.</li> <li>Close interaction with students</li> <li>Background in engineering profession – focus on engineering disciplines and coherence through projects, CDL.</li> </ul>	<ul style="list-style-type: none"> <li>Preservation of professional experience.</li> <li>Available facilities provide framework (curtailing growth).</li> <li>Limited feedback culture.</li> <li>Students who do not assume enough responsibility for their own learning.</li> <li>Teaching culture – rather than learning culture.</li> </ul>

Opportunities	Threats
<ul style="list-style-type: none"> <li>• Technology support (e.g. Blackboard and online teaching).</li> <li>• Development: from lecturer to learning designer.</li> <li>• Increased involvement of business and industry in teaching activities.</li> <li>• Sabbatical/internship for lecturers in businesses. Refreshing of professional experience.</li> </ul>	<ul style="list-style-type: none"> <li>• Facilities curtailing growth (classrooms, laboratories).</li> <li>• Cluster of common core subjects at ST level (for example mathematics).</li> <li>• Financial limitations – lack of renewal.</li> <li>• University culture, recruitment of new employees cumbersome; lack of flexibility.</li> </ul>

## Programmes' building of student qualification profiles

Our Bachelor of Engineering programmes build the students' qualification profiles through:

- Theoretical courses.
- Semester and Bachelor's projects in engineering disciplines.
- Laboratory and workshop activities.
- Engineering internships.
- Teaching of innovation and entrepreneurship.

### Theoretical courses: Qualifications in the natural sciences

In close cooperation with the Department of Engineering, the MSc in Engineering degree programmes and prospective employers, the educational elements of the Bachelor of Engineering programmes are planned so as to progressively create a solid foundation for further studies towards MSc in Engineering and PhD degrees. In this way, coherent academic progression is ensured from the first semester to the MSc in Engineering degree programme – with engineering profiles to match the job market's need for in-depth expertise.

### Semester and Bachelor's projects in engineering disciplines. Collaboration with business and industry

On the Bachelor of Engineering programmes, collaboration with business and industry primarily takes the form of students carrying out experimental, empirical and/or theoretical studies of the problematics of a situation (one or more issues) defined by businesses. The projects come from the engineering degree programmes' extensive network of businesses, which are also the prospective employers of our engineering graduates. The projects train the students' ability to apply theories and methods within the fields of study of the degree programmes.

### Laboratory and workshop activities

The students are offered workshop internships tailored to the requirements of the various programmes. The courses provide insight and experience with processing/handling, work processes involving, for example, concrete, electronics, metal, wood and composites and chemical and biotech products as well as

knowledge about the general health and safety rules which apply to work in the laboratory and workshop environments. Most of the teaching on the workshop internships is undertaken by skilled workers.

In connection with semester projects, the students often use the workshop and laboratory facilities to build prototypes and for testing and trials.

Most of the teaching and supervision on the workshop courses is undertaken by skilled workers.

### **Three types of internships to match the three engineering profiles**

An important component in guaranteeing the job readiness of our graduates is a semester-long internship. As mentioned earlier, we have three types of internships. Traditional internship with a Danish or international company. Internship with a research project as a chance for academic talents to find out at an early stage of their studies whether doing a PhD degree is an attractive career path. And internships focusing on the start-up of the students' own business. Three chose to do this in autumn 2014, and 14 in autumn 2015.

## **Interdisciplinary focus areas**

### **Recruiting more students**

Vision: The natural choice for upper secondary school students with strong natural science competencies and a recognised career path for skilled workmen.

Objectives:

- Attracting a minimum of X% of students with the upper secondary school leaving exam (STX) and Y% of students with the higher technical exam (HTX) with the right competencies from eastern, central and western Jutland. (figures await improved data basis)
- Maintaining the recruitment of students from the skilled workman segment.

### **Focus areas**

We want to increase awareness of and interest in the engineering degree programmes at AU through activities targeted at teachers and students at upper secondary schools. The activities are coordinated and communicated in close collaboration with existing activities at AU/ST. Experience has shown that the existing AU/ST activities are not sufficient on their own, but that additional activities are needed to specifically highlight the opportunities in the engineering field.

### **External events**

We will hold information meetings at selected STX/HTX schools in the region, in the form of evening events for students, their parents and teachers. At these meetings, ASE students will talk about the engineering degree programmes and their projects, supplemented with a presentation by a representative from a local internship/project business.

## Visit ASE

Based on the experience gained from the pilot test performed in autumn 2015, we will offer:

- **Activities for upper secondary school teachers** at ASE. Intended for mathematics, physics and chemistry teachers; with examples of how theory is applied in practice in the engineering field. Continued participation with presentations being given at mathematics/physics teacher events and at primary and lower secondary school teacher events.
- **Specialised study programme projects (SRP)** for upper secondary school students – both in Aarhus and Herning.
- **Study trials.**

## Focus on study environment and forms of instruction

In our recruitment activities, we will highlight the qualities AU can offer, among other things as a countermove to Aalborg University's problem-based learning (PBL) image.

The activities will be based on feedback from current students, who state that what they appreciate the most about the study environment is:

- High availability of teaching staff and student counsellors – they are in the study environment. Sense of close interaction and mutual respect between students, teaching staff and other university staff. Academic guidance provided by teaching staff.
- Laboratory and workshop facilities where theory can be tested and applied in practice. Offer of workshop access where students can 'geek out' 24/7.
- New forms of instruction; learning which involves both theory and practical application – as well as the holistic 'from theory to practice' approach in the engineering disciplines.

## Other measures:

- Increased use of alumni networks.
- Integration and interaction with the 'Engineer the future' activities.
- With a view to getting more students to choose natural science specialisations in upper secondary school – and persuading more students who have done natural science specialisations at a relevant level to choose an engineering degree programme. Including contributing to activities aimed at primary and lower secondary school teachers.

## Increased student retention – higher completion rates

**Vision:** Higher completion rates – course switches at an earlier stage.

**Objectives:** Reducing drop-out rates (%) in the first semester and the first year – target percentages to be determined per programme.

There is a demonstrable positive correlation between the average mark upon admission and completion. Formerly, when restricted admission was used to a limited extent only, there was a distinct spread in students' average marks upon admission. In connection with the most recent student intakes, however, there has been a positive change towards not only more applicants with good marks, but also more applicants with top marks.

Experience has shown that motivation and challenges are factors that are just as important as the average mark for the successful completion of a programme, as evidenced, for example, by students with backgrounds as skilled workmen who are admitted via admission courses. Motivation must also be expected to be higher among first-priority applicants.

### Focus areas

We will continue activities aimed at increasing the intake of students with strong natural science competencies:

- Increasing the number of first-priority applicants – combined with a cap on admissions.
- Attracting more students with higher average marks – and with the highest marks.
- Following up on the distribution between quota 1 and quota 2.

In our focus on increasing the number of students with strong natural science competencies, it is important to still keep in mind the quality of the engineering degree programmes and their ability to promote the ‘hidden potential and abilities’ in young people thanks to the clear practical orientation of the programmes (what can I use this for?).

Given the fact that our students come from widely differing backgrounds, it is important that we have a framework and offer forms of instruction that motivate and challenge the students.

Experience has shown that the interaction between students, not least in connection with project work, is important in terms of student motivation and retention. On the Bachelor of Engineering programme in mechanical engineering, the use of a tool (Insights) for professional personality profiling of students has been trialled. The Insights profile is explained by an external consultant to the individual project group and is used in the project group collaboration. Based on the feedback received so far that this is having a positive effect on student retention and motivation, it has been decided to continue working along these lines with a view to:

- Integrating the work with personal, interpersonal and professional competencies in the degree programme and thus enabling project supervisors to use this as a way of increasing the efficiency of the group work in the first semester.
- Using personality profiling in connection with student guidance to increase student retention.
- If the project has a positive outcome, it will be rolled out to all study areas within the Bachelor of Engineering programmes.

In connection with the rollout, it has been decided that a number of teaching staff will be trained in the use of the tool in order to enable them to provide group feedback. We will follow up on the effect and how the students use the insight obtained.

Follow-up and efforts in relation to drop-out take place at individual student level with counselling sessions being offered to students seeing a lack of progress in their studies as well as at system level where, based on factual information and data analysis, we identify correlations, e.g. between pass and drop-out rates and students’ educational background, prior courses, forms of instruction and choice of principal field of study, as the basis for corrective actions which, for example, may consist of revising teaching elements, reorganising the order of courses and changing class structure/class composition.



## Biotechnology engineering, chemical engineering and food technology

Within Biotechnology and Chemical Engineering (BCE), AU offers two Bachelor of Engineering programmes, one in chemical engineering and one in biotechnology engineering, as well as an MSc in Engineering degree programme in biotechnology and chemical engineering.

Student population as of 1st October	2010	2011	2012	2013	2014
Bioprocesstechnology	92	98	104	74	52
Biotechnology Engineering				56	104
Chemical Engineering				36	71
<b>Student population total</b>	<b>92</b>	<b>98</b>	<b>104</b>	<b>166</b>	<b>227</b>

In collaboration with the Department of Food Science, ASE is working to introduce a new programme in food technology, with the first admissions planned for summer 2017. Reference is made to the flagship section and the development section for a more detailed description of the focus on competencies.

Bachelor of Engineering programme	Specialisation
Biotechnology Engineering	To be further specified
Chemical Engineering	To be further specified
Food Technology	Expected from summer 2017

Collaboration has already been established with the Department of Chemistry, where two courses (Organic Chemistry and Inorganic Chemistry) form part of the compulsory part of the Bachelor of Engineering programme in chemical engineering. Also, teaching staff from the Department of Engineering handle some of the teaching activities on a number of courses.

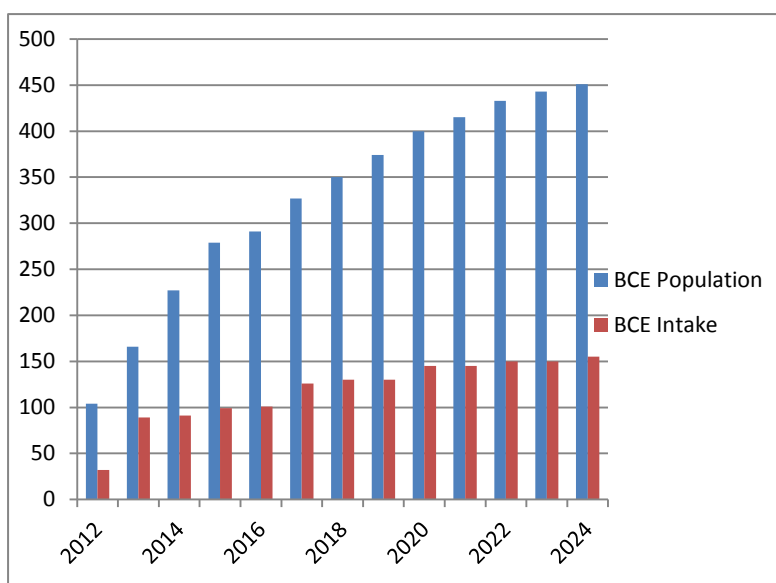
The programme in bioprocess technology is being phased out. In principle, the last students graduate at the next winter exam.

### Student population and student intake – actual and forecast

There was a significant increase in the number of first-priority applications to the Bachelor of Engineering programme in chemical engineering in summer 2015 relative to 2014.

As a consequence of this and due to the demand for engineers, the number of student places was increased by ten to 45.

The budget plans for this increased number of student places to be maintained – which requires extended/larger classroom and laboratory facilities. From 2016, plans are to add another ten student places, provided that the necessary resources are available.



The plan is for the number of student places on the Bachelor of Engineering programme in biotechnology engineering to be maintained at 60. In connection with the 2015 summer admissions, the number of first-priority applications exceeded this figure.

The increased interest at upper secondary schools in both chemical engineering and biotechnology engineering, combined with the good career prospects for graduates with Bachelor of Engineering degrees, means that it is not unlikely that the programmes will continue to attract large numbers of applicants, thus resulting in an increase in admissions to the Bachelor of Engineering programme in chemical engineering to 60 qualified applicants concurrently with an initial admission of 30 applicants to the Bachelor of Engineering programme in food technology – and upholding the admission of at least 60 qualified applicants to the Bachelor of Engineering programme in biotechnology engineering.

### Focus areas

- Being able to exploit the recruitment potential and ensure low drop-out rates is conditional upon the creation of an inspiring and coherent study environment (students) and work environment (teaching staff); with the two – soon to be three – degree programmes being located in close proximity to the necessary teaching and laboratory facilities to ensure optimum utilisation. An environment which can offer students the opportunity to engage in interdisciplinary projects and work with pilot-scale installations (process centre), and which can create a basis for development tasks and projects, both internally and in collaboration with businesses.
- Experience has taught us that maintaining a high and qualified recruitment potential requires constant focus on profiling activities in relation to upper secondary schools.

### Civil and Architectural Engineering (CAE)

Within Civil and Architectural Engineering (CAE), AU offers two Bachelor of Engineering programmes, one in civil and structural engineering and one in architectural engineering, as well as an MSc in Engineering degree programme in civil and architectural engineering. The Bachelor of Engineering programmes are organised with elective courses in the last two semesters for students wishing to enrol on the MSc in Engineering degree programme.

Student population as of 1st October					
Number of Student	2010	2011	2012	2013	2014
Civil and structural Engineering	405	426	436	432	440
Architectural Engineering	266	278	280	277	282
<b>Student population in total</b>	<b>671</b>	<b>704</b>	<b>716</b>	<b>709</b>	<b>722</b>

On the Bachelor of Engineering programme in architectural engineering, an understanding of design is provided through the teaching of design subjects and through specialisation of semester projects. It is possible to switch between the two programmes. The design/architectural elements of the Bachelor of Engineering programme in architectural engineering are continuously being developed, including the development of an adapted version of Tectonic Design, which is continued on the MSc in Engineering degree programme. From the fourth semester, students may choose a specialisation corresponding to the typical areas of employment associated with civil engineering.

As concerns the specialisation in Environmental Engineering and the specialisation in Infrastructure Design, there are currently no natural specialisations within the same subject area at MSc in Engineering degree level, but a combination with the specialisation in Architectural Engineering could make sense.

<b>Bachelor of Engineering programme</b>	<b>Specialisation</b>
<b>Civil and Structural Engineering</b>	Construction
	Energy/Indoor Climate
	Construction Management
	Environmental Engineering
	Infrastructure Design
<b>Architectural Engineering</b>	Geotechnical Engineering
	Construction
	Energy/Indoor Climate

### *Student population and student intake – actual and forecast*

Overall, the number of students on the programmes has increased gradually since 2010. The total increase is 7.6%. In recent years, the increase has been partly controlled by the number of student places offered.

In connection with the 2015 summer admissions, the minimum grade point average for admission was 6.0 and 8.6, respectively, (Technical University of Denmark (DTU): 3.7 and 8.5). To meet the high demand for engineers, the number of student places was increased by ten for each of the two programmes. This meant that the number of applicants exceeded the number of student places by 24%.

For the first time in recent years, restricted admission is expected to be introduced for the 2015/2016 winter admissions. The higher average mark could fuel expectations of an improved student retention rate and an increased share of students continuing on the MSc in Engineering degree programme. In connection with the commencement of studies exam in September 2015, 62% of the newly admitted students replied that it was most likely that they would choose to enrol on the MSc in Engineering degree programme after having completed the Bachelor of Engineering programme.

Together with DTU, AU has the highest student intake and produces the highest number of Bachelor of Engineering graduates within the civil engineering field. This is due not least to the relatively high number of winter admissions at AU.

### **Focus areas**

- Innovation in civil engineering: In autumn 2015, all associate professors/assistant professors will attend an innovation course taught by the consulting firm Smith Innovation with a view to developing a more innovative approach and enabling them to develop learning elements for the teaching of the various specialisations in the fourth semester. The department has received strategic funding from AU's fund for education development.
- Insights: In the first semester, all students must complete an Insights profile test and do exercises to develop their understanding of how to work with their interpersonal skills, as a way of strengthening project work, among other things. A total of seven associate professors will be certified within this field, the last two in the course of 2016, with a view to Insights being incorporated into the programmes through the teaching of students and colleagues. The department has received funding from AU's Competence Fund.
- New course in 'Renovation': The course plan is currently being prepared. Supplement to the specialisation in Construction Management from spring 2016 with involvement of more external partners.

- BIM: A gradual transition to the industry's most used BIM program Revit, with the course initially being taught by an external CAD business in autumn 2015. In addition, a course on 3D BIM models will be launched in collaboration with Raunstrup. The 3D BIM models are to be integrated into the projects on the specialisation in Construction Management.

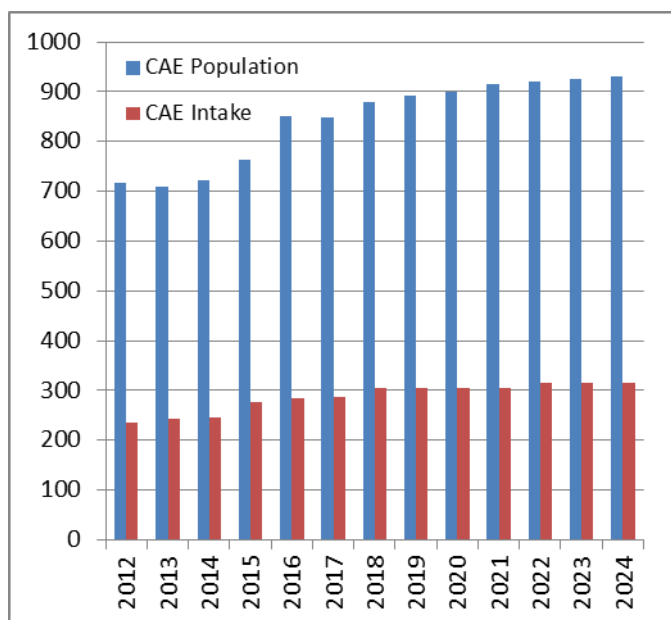
### **Growth and recruitment**

The civil engineering programmes have seen average growth of approx. 10-15% in student intake over the past two years.

Based on the increased interest, the share of quota 1 applications and society's interest in this area, continued growth is expected in the intake of qualified applicants at AU.

To meet the strong demand from business and industry for Bachelor of Engineering graduates and for graduates with an MSc in Engineering degree, an ongoing increase in the number of student places by 10-20 places per year is planned; the possibility/advantage of increasing the winter intake is being considered.

The focus on student retention activities is also maintained.



To ensure that growth and quality go hand in hand, the communication/recruitment activities launched in spring 2015 must be maintained and developed to include activities aimed at teachers and students at upper secondary schools (STX) and technical upper secondary schools (HTX).

Moreover, it must be possible to gradually adapt the school's resources in the form of teaching staff, premises and workshop/laboratory facilities to the growing need.

As regards other programme providers, VIA University College (VIA) started a Bachelor of Engineering programme in supply in summer 2015, i.e. a programme which to some extent overlaps with ASE's two specialisations in Environmental Engineering under the Bachelor of Engineering programme in civil and structural engineering and the Bachelor of Engineering programme in mechanical engineering. The majority of the students admitted here are students from abroad. We will try to strengthen the intake of Danish students for the specialisations in Environmental Engineering.

As neither the University of Southern Denmark (SDU) nor VIA has its own advanced studies within the field of civil and architectural engineering, this is a good opportunity for recruiting more students for AU's MSc in Engineering degree programme.

### **Electronic engineering, electronics, ICT, electrical power technology and healthcare technology engineering**

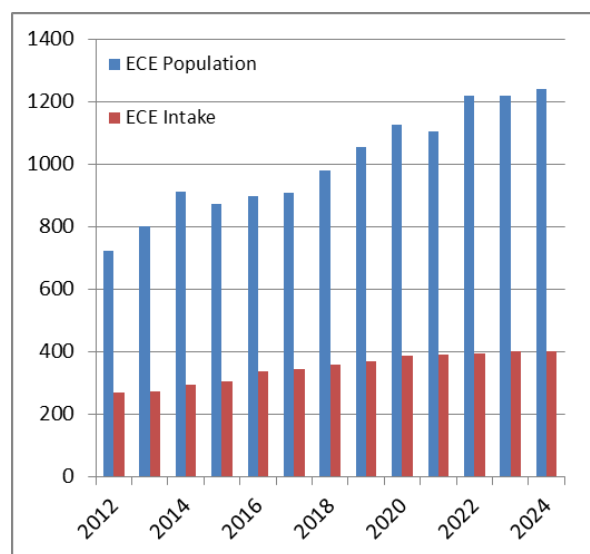
AU offers Bachelor of Engineering programmes in electronic engineering (Aarhus and Herning), information technology, electrical power technology and healthcare technology engineering. Courses are offered in cooperation with the Department of Computer Science (CS). The supplementary subject package for the programmes in ICT, electronic engineering and electronics currently includes six CS courses.

Student population as of 1st October					
Number of Student	2010	2011	2012	2013	2014
Elektronik Engineering	221	228	250	247	275
Electronic Engineering, Herning					65
Electrical power technology Engineering	43	83	126	109	129
ICT	179	196	220	265	298
Healthcare technology Engineering	58	97	122	131	144
<b>Total bestand</b>	<b>501</b>	<b>604</b>	<b>718</b>	<b>752</b>	<b>911</b>

### Student population and student intake – actual and forecast

All five programmes attract students with a broad spectrum of marks from about 4 to 12. As with other Bachelor of Engineering programmes, the work on student motivation and retention is central to realising the end goal of better education for more people.

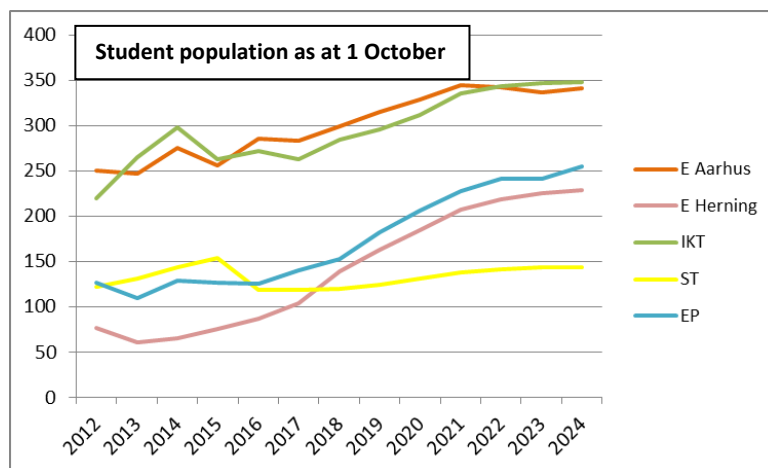
In 2013, ECE took over the responsibility for a programme in electronics offered in Herning from Aarhus BSS. The degree programme had major problems with a declining student intake. In 2014, the intake was down to seven students, and a completely new strategy was needed. From autumn 2015, a combined on-campus and online programme was introduced for the Bachelor of Engineering programme in electronics based in Herning. The purpose is to combine new forms of instruction with the possibility of a flexible course of study.



The result is clearly reflected in the student intake figures for 2015 (38 students). This improvement can be ascribed to the introduction of online studies, the transition to a programme offered in Danish as well as extensive marketing efforts.

At the same time, the admission course in Herning was also offered as an online course, resulting in an increase in the intake figures from 15 to 30 students. Consequently, a larger recruitment base for the Bachelor of Engineering programme in electronics in Herning is expected in 2016.

In 2011, a common basic module was established for the Bachelor of Engineering programmes in electronic engineering, electronics, electrical power technology and ICT, which meant that the courses taught during the first three semesters are the same for all the programmes. With a view to improving student retention and ensuring a clearer specialisation within the individual programmes, a change was implemented in 2014 such that only half of the courses taught on the third semester were the same, while the remaining courses were special to the individual



programmes. This change was primarily introduced for the purpose of motivating more students to choose the programme in electrical power technology (or the programme in electrical power engineering as it was known at the time).

The decision to introduce common course components from 2011 was made out of a need for streamlining and also out of a desire to give students a broader shared foundation within electronics and electrical power technology. Since then, ECE's intake figures have increased markedly, resulting in class sizes of more than 200 students in the first semester. We are also seeing a need for strengthening the specialisation-specific profiling of the individual programmes with a view to supporting subsequent specialisation and continued studies on the MSc in Engineering degree programmes.

The Bachelor of Engineering programme in electrical power technology is one of the engineering degree programmes where the demand far exceeds the number of graduates, and possibly the programme with the greatest shortage of graduates. In 2013, a plan was launched for improving the course content through greater differentiation from the programmes in electronic engineering and electronics and use of an improved/separate teaching laboratory. This has generated positive responses from both the industry and students. The reputation of the programme has improved, as evidenced by a significant increase in the number of applicants for this programme.

The significant increase in awareness of and interest in the Bachelor of Engineering programmes in electrical power technology and electronics in Herning can also be ascribed to dedicated marketing campaigns.

The Bachelor of Engineering programme in healthcare technology engineering was established in 2008 and is now well-established and known by prospective employers. The student intake is limited to 45 students per year despite a larger number of applicants. Basic science courses are co-taught with the other programmes at ECE, and the elective courses are to a large extent the same. Almost half of the graduates choose to continue their studies towards an MSc degree, primarily on the MSc in Engineering degree programme in biomedical engineering, but also on other degree programmes at AU and other universities (Aalborg University (AAU)). The remaining graduates choose to enter the job market based on their Bachelor of Engineering degree.

### Focus areas

- Engineering programme in electronics, Herning: Maintaining the good intake, retaining students and addressing the challenges posed by the new programme structure.
- Developing and establishing the Bachelor of Engineering programme in electrical power technology in Herning according to the same model as the Bachelor of Engineering programme in electronics. The programme can be offered from summer 2018, provided that positive preliminary accreditation can be obtained.
- Continued focus on recruitment activities in relation to upper secondary schools.
- Establishing a clear academic profile, strengthening the core expertise and offering the possibility of a higher degree of specialisation in order to accommodate requests from students, the MSc in Engineering degree level and business and industry. New reform of the ECE Bachelor of Engineering programmes starting in summer 2017.
- Establishing activities underpinning the flagship role of the engineering programme in electrical power technology at AU. The objectives of the efforts outlined are an annual intake of 100

students, close collaboration with the industry and a state-of-the-art laboratory. Recruitment: Focus on admitting Danish students and promoting increased interest among girls.

## Mechanical engineering

Graduates from the Bachelor of Engineering programme in mechanical engineering at Aarhus University School of Engineering have a professional engineering profile; on the programme, and during their specialisation in the fifth to seventh semesters at the latest, students choose a professional profile targeted at the job market, at an entrepreneurial career or at further studies on an MSc in Engineering degree programme.

Student population as of 1st October					
Number of Student	2010	2011	2012	2013	2014
Mechanical Engineering	297	303	356	406	459
<b>Total bestand</b>	<b>297</b>	<b>303</b>	<b>356</b>	<b>406</b>	<b>459</b>

The programme is rooted in mechanical engineering development and enjoys close relations with prospective employers.

In the course of the Bachelor of Engineering programme, the students acquire knowledge and skills which qualify them to perform professional functions, both independently and in collaboration with others, which typically comprise the following mechanical engineering tasks in the private and public sector:

Bachelor of Engineering programme	Specialisation
<b>Mechanical Engineering</b>	Product Development & Engineering
	Robot Applications & Automation Design
	Manufacturing & Materials Technologies
	Energy Systems & Process Engineering

- Construction/design of industrial products/services.
- Manufacture of industrial products/services.
- Planning and control of industrial production.
- Management of employees in industrial production.
- Maintenance and sale of industrial products/services.

Throughout the study programme, students also work with technical challenges in a broader perspective and in commercial contexts. The work with innovation and methodical product development is integrated into the programme, and the students are challenged to use their technical knowledge to create innovative solutions that meet the demand in the market. Understanding of demand and innovation are crucial competencies for the engineers working in a global labour market.

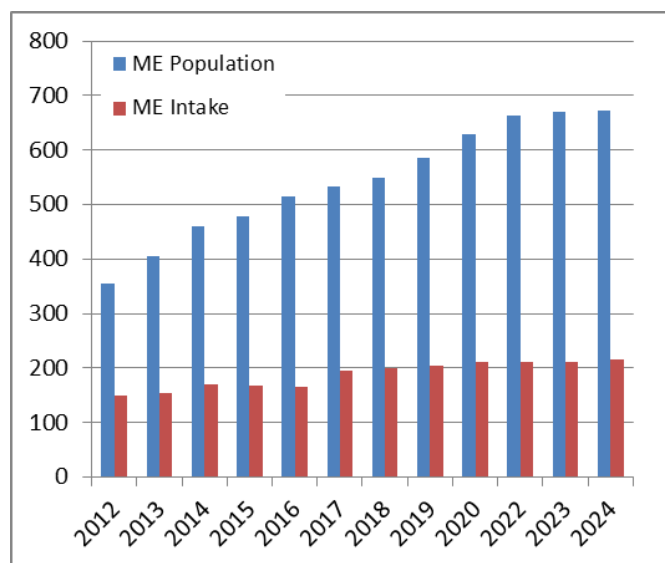
The student is able to:

- Define, formulate, analyse and solve engineering problems.
- Establish a professional project team and form part of the team as both team member and team leader.
- Understand the interrelationship between the theory of various subject areas in the practical design of technological solutions.



- Work with businesses; and the student has a sound business understanding – not least due to the six-month internship in Denmark or abroad.

The Bachelor of Engineering programme in mechanical engineering has been revised, in collaboration with the Department of Engineering, to ensure progression from the Bachelor of Engineering programme to the MSc in Engineering degree programme. As a positive consequence of this work, the academic level in mathematics on the Bachelor of Engineering programme has been strengthened in the first four semesters. The required supplementary subjects in the sixth or seventh semester have thus been reduced to a single 5 ECTS course. Experience shows that the majority of students choose to take this course, regardless of whether or not they intend to enrol on the MSc in Engineering degree programme.



### Focus area

There is a strong demand from businesses for engineers with strong competencies within the entire manufacturing field who can help ensure that the Danish manufacturing industry is using cutting-edge production methods and production setups, with a view to maintaining competitiveness.

The opportunities and needs for expanding the Bachelor of Engineering programme in mechanical engineering at AU with a new programme in production and automation at AU are being investigated. This is described in further detail in the section on education.

As a point of departure, it is expected that this programme will be able to draw on existing expertise at Aarhus BSS within supply chain design (the global management and manufacturing (GMM) programme) and also from the Operations Management team at the Department of Engineering located in Foulum. The programme will also be able to exploit potential synergies with the teaching setups and competencies of the other programme(s) offered under the ECE field in Herning.

### Admission course

The admission course is a youth education programme targeted at students wishing to enrol on a Bachelor of Engineering programme, but who do not have a qualifying exam. The admission course has a duration of 12-18 months. A six-month preparatory course is offered in collaboration with the adult education centres, which ensures D levels in relevant subjects before enrolment on the admission course. In addition, individual subjects on the admission course are offered as supplementary courses for students who have passed a qualifying exam, but who need to take individual courses on certain subjects in order to meet the requirements for admission to the engineering programmes.

The target group for the admission course is primarily skilled workmen wishing to enrol on a Bachelor of Engineering programme, but who do not have a qualifying exam. The course is also intended for students who have not completed a vocational education and training programme, but who instead have two years



of relevant work experience. The target group is aligned with the university's strategy of reaching the hidden talents.

On the engineering programmes, an average of 10-20% of the students have completed an admission course as the qualifying exam.

### Student intake – development

Student intakes declined between 2012 and January 2015, due, among other things, to the receding financial crisis, which has prompted skilled workmen to look for jobs rather than an education.

In spring 2015, a marketing campaign advertising the admission course was launched, and the number of new students did increase in August 2015. However, it is still difficult to attract new students, due, among other things, to the many construction projects taking place in the Central Denmark Region which are resulting in job creation for the target group. In addition, there is a general lack of young people who choose to enrol on vocational education and training programmes, which reduces the number of potential students in the target group. Finally, the admission course is adversely impacted by the fact that it is a small, and thus relatively unknown, youth education programme, and continued efforts to increase awareness of the admission course are therefore required.

Student intake	Autumn 2013	Spring 2014	Autumn 2014	Spring 2015	Autumn 2015
Admission course, Aarhus	57	52	46	42	51
Admission course, Herning*	12		15		25
Supplementary course, Aarhus**	123	34	70	60	**
Supplementary course, Herning***	7	17	5	7	1

\* Herning admits students once a year only.

\*\* The figure covers the fundable number of full-time student equivalents (civil reg. (CPR) no.). The figure for autumn 2015 has not yet been calculated.

\*\*\* After the SU reform in July 2014, students on the supplementary courses in Herning are no longer eligible for the Danish Students' Grants and Loans Scheme (SU).

### Development

At the commencement of studies in August 2015, it became possible to do the admission course in Herning as an online course. The purpose of this is to address the challenge of ensuring geographic mobility. The online offer must be ensured and strengthened over the coming years. Via the online solution, new digital forms of instruction and learning tools will be tested in, for example, Blackboard. The experience gained from the online course is expected to be useful for the ordinary courses as a way of increasing learning outcomes.

### **Focus areas**

ASE started using Blackboard in January 2015. In the coming years, efforts will be made to expand the use of Blackboard into being more than just a file sharing tool, and turning it into a platform which in various ways can contribute to increasing student learning. This will be ensured through the continuous exchange of experience as well as one-day courses for teaching staff with Blackboard on the agenda.

### ***Growth and recruitment***

With a view to increasing awareness of the admission course, a collaboration is planned with Engineer the Future in 2016-2017 on the launch of a national marketing campaign to increase awareness of the possibility of enrolling on the engineering degree programmes via the admission course, as a further education opportunity for students on vocational education and training programmes.

The student guidance efforts must be strengthened. The recruitment efforts should, among other things, be expanded with special focus on the technical colleges, and student completion should be ensured through more follow-up interviews during the course of study. Good student guidance is key to ensuring social mobility. Work is being done to strengthen this area in the coming years.

## **Appendix**

**A) Organisation** (separate document)

**B) Geography/premises** (separate confidential document)

**C) Employee mix (age profile)** (separate confidential document)

**D) Navitas Science and Innovation – NSI** (separate document)

**E) Benchmarking** (separate confidential document)

**F) KPIs – including targets and development** (separate confidential document)

**G) Development projects in progress** (separate confidential document)

**H) Recruitment plan** (separate confidential document)

## Organisation

### Organisational units

#### *Development area*

##### Head of development

The heads of development have the overall responsibility for the development and operation of the various fields of study, their employees and associated laboratories in support of ASE's main activity: educating qualified engineers.

##### Group leader/team leader

Depending on the development unit's size and programme profiles, the head of development may delegate responsibility for sections to a group leader or a team leader.

#### *Educational field*

##### Director of studies

The director of studies at ASE has the overall responsibility for the Bachelor of Engineering programmes and the admission course. The director of studies is appointed by the board of studies. The director of ASE has presently been appointed director of studies for the Bachelor of Engineering programmes. The director of studies is a member of the degree programme director (UL) forum.

The director of studies is the representative of the degree programmes vis-à-vis internal and external relations.

##### Administrative degree programme director

The administrative degree programme director is a personal assistant to the director/director of studies as regards questions and contacts of a general nature in relation to the study area and also in respect of the coordination of activities across the degree programme directors.

##### Interdisciplinary programme management tasks

Delegation of interdisciplinary programme management tasks has been agreed between the director of studies, the degree programme directors and the head of CDL.

This delegation also entails delegation of responsibility for preparing proposals for consideration and decision in the UL forum and/or for coordination with the director of studies.

##### Degree programme directors, Bachelor of Engineering programme and admission course

The degree programme directors report to the director/director of studies.

The degree programme directors are responsible for the organisation and offering of one or more degree programmes. The degree programmes are defined as projects with an independent budget.

## Management forums and committees

### *ASE management forum*

The management forum comprises the director, heads of development, degree programme directors, division managers and business controllers.

The purpose of the management forum is to ensure a common understanding of ASE's business and strategy as well as coordinating activities and development initiatives. ASE is perceived and acts as a unified organisation.

The management forum handles:

- Discussion and determination of any revision of ASE's strategy.
- Coordination of the implementation of interdisciplinary initiatives.
- Review and discussion of ASE's total budget and results.
- Management follow-up and initiatives in relation to ensuring a positive work and study environment.
- Information on and discussion of changes in personnel policy and guidelines.
- Discussion of common/interdisciplinary business issues such as recruitment and retention.
- Interdisciplinary information and coordination, including determination of and follow-up on internal communication.

Meetings are held once a month, and there is an annual strategy meeting.

### *Degree programme director (UL) forum*

The UL forum is comprised of the director of studies and degree programme directors.

The UL forum handles:

- Coordination across the degree programme directors with a view to ensuring uniform, interdisciplinary procedures and implementation of AU and ASE's policy in the field of education as well as ensuring organisation and execution of teaching.
- Decisions on updating the common part of the academic regulations as a result of changes implemented in ASE's and AU/ST's policies and structures as well as changes in ministerial orders.
- Decisions and follow-up on interdisciplinary focus areas.
- Information and coordination in relation to the delegated interdisciplinary tasks.
- Assessment of consultation responses to bills and draft ministerial orders and to AU proposals for policies and procedures within the field of education.

In connection with UL forum meetings, degree programme director coordination meetings are held with the head of CDL, the head of ASE's Student Counsellors' Office as well as the head of Student Services for the Bachelor of Engineering programmes.

Meetings are held every other week.

### ***Heads of development (UC) forum***

The UC forum is comprised of the five heads of development as well as the director and the business controller.

The UC forum handles coordination across the heads of development with a view to:

- Ensuring uniform, cross-disciplinary procedures and implementation of ASE's policy in relation to academic staff/teaching staff. General HR-related issues are considered by the management team.
- Laying down financial targets/KPIs and budget and carrying out follow-up.
- Coordinating commitments/activities in relation to businesses – large, research-intensive companies as well as SMEs.
- Coordinating internationalisation activities – from an academic perspective.

Mutual information on area-specific initiatives and decisions on interdisciplinary initiatives in respect of:

- Summer school camps/programmes and entrepreneurship/innovation courses.
- Further and continuing education courses.

Meetings are held once a month.

### ***Development and research committee (UFU)***

The development and research committee is comprised of the heads of development for the Civil Engineering, Electrical and Computer Engineering, Biotechnology and Chemical Engineering, and Mechanical Engineering areas as well as the NSI coordinator and representative(s) from the programme management.

The purpose of the development and research committee is to strengthen ASE's activities within academic development and research projects by:

- Preparing a proposal for an overall development and research strategy for ASE.
- Ensuring constructive dialogue/review with colleagues and knowledge sharing on development and research project applications.
- Implementing initiatives for the marketing of development and research opportunities at ASE.
- Coordinating and implementing interdisciplinary development and research projects.
- Acting as contact/partner for AU's R&D units, e.g. ST's vice-deans for research as well as the vice-dean for knowledge exchange.

ASE's research committee and industrial cooperation committee are anchored in the development and research committee (UFU) with a view to ensuring interdisciplinary coordination.

### ***Local occupational health and safety committee (LAMU) and local liaison committee (LSU)***

Reference is made to separate descriptions of these committees.

### *Board of Studies, Aarhus University School of Engineering*

The Board of Studies for Aarhus University School of Engineering is responsible for all engineering degree programmes at AU. Reference is made to a separate description of the board of studies' area of responsibility and members.

### *Committee on education*

The committee on education must ensure dialogue about all aspects of the degree programmes and teaching activities and ensure course-specific development of degree programmes and course curricula. The committee on education acts as an advisory body to the board of studies for the engineering degree programmes on the one hand and to the responsible degree programme director at ASE on the other.

The committee on education is comprised of the degree programme director, members of the academic staff and students on the degree programme(s). Students and academic staff members must be equally represented. The total number of members is agreed between the degree programme head and the director of studies. All degree programmes and academic specialisations covered by the committee must be represented.

The degree programme director is chair of the committee. The committee holds at least two meetings per semester with all student representatives. The students are appointed by the degree programme director on the recommendation of the students on the degree programme(s). The academic staff members are appointed by the director of studies on the recommendation of the degree programme director. The degree programme director may attach academic staff members to the committee on an ad hoc basis in connection with specific tasks/questions.

The committees must focus on the following areas:

- Ongoing evaluation of the academic structure of the degree programmes – academic regulations, exams, intended learning outcomes, course descriptions.
- Procedure for study trips, trips abroad, evaluation.
- Educational initiatives, e.g. in relation to new teaching staff.
- Follow-up on employer surveys/graduate surveys.
- Internationalisation.

### *Research committee*

The research committee's tasks include:

- Discussing and advising on the wording of major academic ventures/project ideas.
- Coordinating and advising on major research applications and external sources of funding.
- Discussing possible initiatives for strengthening external and internal collaboration.
- Discussing recruitment plans and initiatives as well as offering advice in connection with permanent tenure for academic staff.
- Discussing and advising on internationalisation initiatives, including initiatives with a view to strengthening the international impact and visibility of the research.

### *Industrial cooperation committee*

The industrial cooperation committee must strengthen the school's existing extensive collaboration with the private sector. The committee's tasks include:

- Acting as point of contact for enquiries from businesses and AU concerning collaboration with business and industry.
- Drawing up annual objectives for the collaboration.
- Describing the school's strengths of relevance to business and industry.
- Contributing to initiating collaboration.
- Contributing information and reporting to the ST faculty management team.

### *Employer panel*

The employer panel is tasked with ensuring dialogue between businesses and the engineering units (ASE and the Department of Engineering) at AU on the quality and relevance of the degree programmes as well as providing input for the development of existing and any new degree programmes.

The panel is composed of representatives of the sectors and businesses employing graduates from the various degree programmes and with which the programmes collaborate.

An employer panel covers Bachelor of Engineering programmes as well as MSc in Engineering degree programmes within the same field of study. The panel holds at least one meeting per semester. The panel members participate on an ad hoc basis in sparring groups concerning specific initiatives.

The degree programme head is chair of the panel. If a panel covers more than one degree programme, all degree programme heads are members of the panel, and the chair is appointed internally from among the degree programme heads.

The head(s) of development is/are member(s) of the committee.

Other teaching staff members and student representatives from the committee on education may be invited to attend meetings on an ad hoc basis.



## Navitas Science and Innovation – NSI

In 2014, the ‘founding-partners’, i.e. the Aarhus School of Marine and Technical Engineering, Aarhus University School of Engineering and INCUBA a/s, established Navitas Science and Innovation (NSI) with support from the Central Denmark Region.

NSI is a project partnership for handling activities, facilities and services with particular focus on:

- Promoting contact between students and business and industry.
- Bolstering older students’ motivation and possibilities for developing their own business.
- Increasing the collaboration between researchers, teaching staff and businesses at NSI.
- Expanding the collaboration with businesses and researchers outside NSI.

From day one, the engineering field at AU as a whole has been considered part of the setup, from students at Bachelor of Engineering level and MSc in Engineering level to development-oriented teaching staff and researchers, irrespective of whether they are based at NSI or one of the other engineering programme locations.

An innovation workshop, an internship hotel, a student entrepreneur environment, a project hotel and workshop facilities as well as various options for business operations have been established, staffed and facilitated.

In addition, collaboration has been established with a number of technical, innovative and financial players, and also with consultants which can contribute to promoting the individual business’s development and growth. INCUBA has entered into agreements with CONNECT Denmark, Business Development Centre Central Denmark, CAPNOVA and the Alexandra Institute on being visible and contributing to a creative business environment also at NSI.

Through events, competitions, workshops etc., progress is created not just at NSI, but also for businesses and institutions outside NSI.

By exploiting the strengths and core competencies of the parties involved, NSI has created a unique competency and activity profile, which brings together the researcher and the innovative development engineer with the entrepreneurial and practical senior machinist.

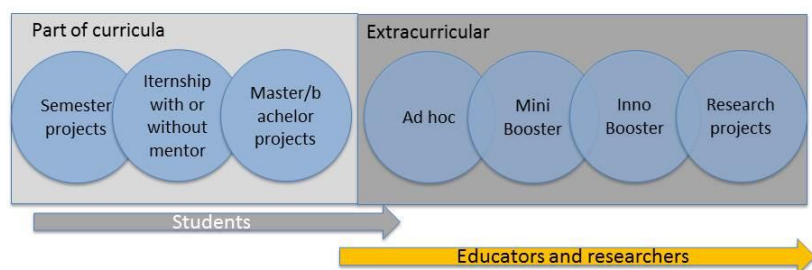
With the establishment of NSI, a strong platform has been created for innovation in and outside the degree programmes.

Focus in the first year has been on innovation/entrepreneurship activities targeted at students in collaboration with businesses. Both as part of and outside the degree programmes.

This has formed part of the expansion of the innovation competencies as an integrated part

### Cooperations between students, educators, researchers and businesses (SMEs)

Aarhus University Engineering & Aarhus School of Marine Engineering

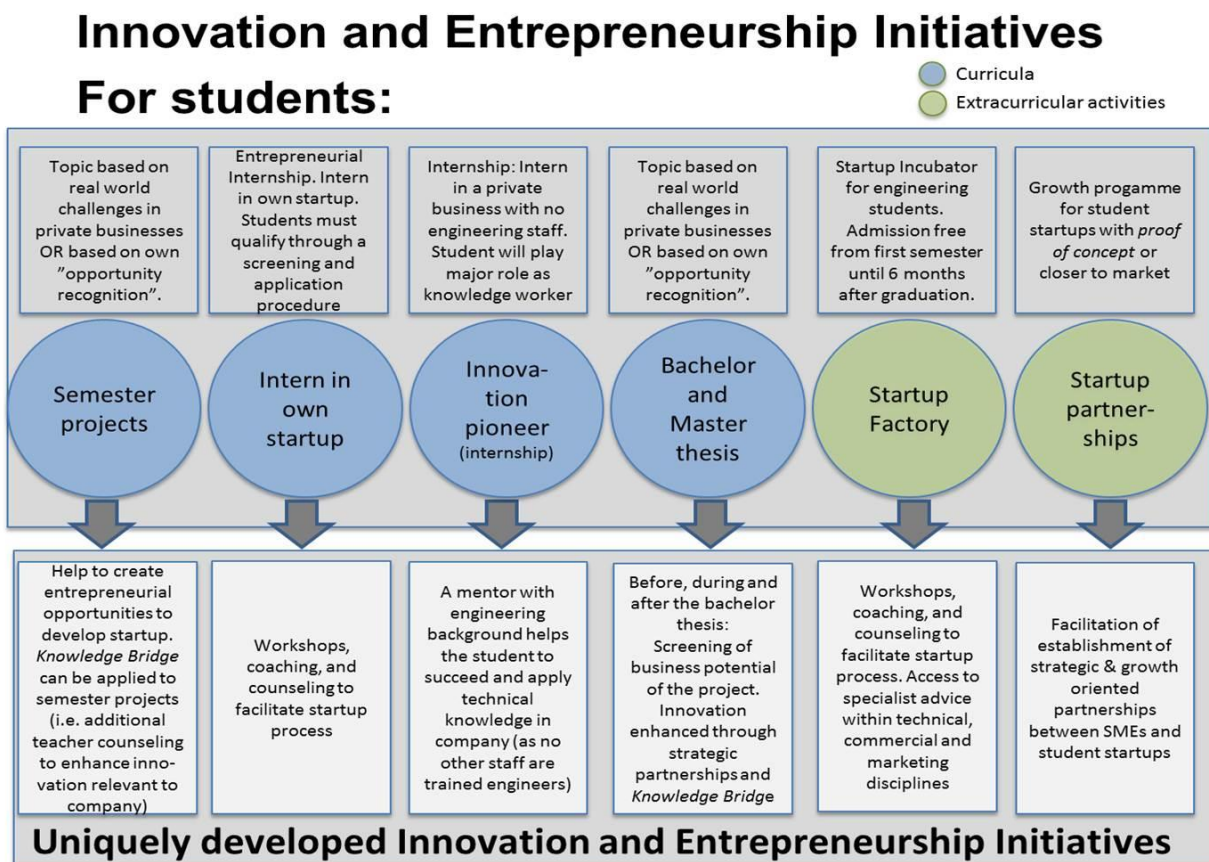


of the existing engineering degree programmes, for example as mentioned under CAE concerning innovation in civil engineering.

The next phase is to identify opportunities aiming broadly at businesses, students and researchers from other areas at AU/ST.

### Offers for students

**Startup Factory:** Students can get help to start up their own business based on their engineering knowledge. A special possibility is the chance for students to do an entrepreneurial internship and work in their own business during the internship period.



### Offers for businesses

Businesses are offered access to all the knowledge available on the engineering degree programmes at AU and the Aarhus School of Marine and Technical Engineering through:

1. **NSI tickets** (small knowledge inputs for the business; up to one day's assistance free of charge).
2. **R&D collaboration** (e.g. under the auspices of the InnoBooster scheme; collaboration between businesses, teaching staff and researchers).
3. **Formulation of Bachelor's projects** and matching with students under internship agreements.

4. **NSI Academy:** Lecture series with focus on cutting-edge technological developments (after-work meetings).
5. **Facilitation of innovation processes:** Businesses can 'book a brainstorm' which may have several purposes depending on the needs of the business, such as the development of ideas, concepts, products, business models, processes etc. (free of charge for businesses – falls under the 'NSI ticket').

**Open events and camps:** For example startup weekend, hackathons and innovation camps.