At the intersection of technology, organisation and governance.

Diploma  MSc Complex Systems Engineering and Management

Tracks  - Built Environment & Spatial Development
         - Energy
         - Information & Communication
         - Transport & Logistics

Credits  120 ECTS, 24 months

Starts in  September

Language of instruction  English

% International students  15%

Are you looking for a Master’s degree programme in which you learn to design in complex technical environments? But do you want more than ‘just’ technical skills? Do you want to look beyond the design of electric vehicles and concentrate on what is needed to implement electric transportation on a large scale? And therefore work on regulations, logistics, behavioural change, financial incentives etc., in order to bring innovations to life? Then choose the unique Master’s degree programme in Complex Systems Engineering and Management (CoSEM).

Programme
In the CoSEM Master’s programme we explore the innovations in complex sociotechnical environments. You learn to work in a broader field than technology alone. After all, when designing technological innovations, you have to deal with matters such as existing regulations, subsidies, distribution channels and infrastructures, as well as interests, cultures and human behaviour. In order to achieve successful innovations, these aspects must be considered and used in your sociotechnical design. Our designs always have an ethical dimension and an international character. The programme therefore spends a great deal on ethical issues and has an international character.

Choose your area of interest from the start
The Master’s degree programme takes two years. You can choose between four different tracks at the beginning of the Master’s programme. In these tracks you’ll gain the profound technical knowledge that you need to make a socio-technical design. This means that you will focus on sociotechnical issues in your area of interest from the start. The tracks are based on major current social themes. There is a lot of room to determine the content of the programme yourself.

The programme starts with a joint bootcamp in which you start with designing in a sociotechnical system, as well as the learning objectives and the modules we offer. In the second year you have the possibility to follow modules at other TU Delft faculties. Continuing your programme abroad is also a possibility.
Programme chart Complex Systems Engineering and Management

<table>
<thead>
<tr>
<th>First year</th>
<th>2nd year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Semester</td>
<td>3rd Semester</td>
</tr>
<tr>
<td>1st period</td>
<td>2nd period</td>
</tr>
<tr>
<td>Complex Systems Engineering (5 EC)</td>
<td>Managing multi-actor decision making (5 EC)</td>
</tr>
<tr>
<td>Track (5 EC)</td>
<td>Track (5 EC)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4th Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electives (15 EC)</td>
</tr>
<tr>
<td>Track electives (10 EC)</td>
</tr>
</tbody>
</table>

1 EC = 28 hours of study, according to the European Credit Transfer System (ECTS).
Total number of credits in the MSc Systems Engineering, Policy Analysis and Management = 120 EC
For more information on all courses: studyguide.tudelft.nl

You can choose from the following tracks:

**Built Environment & Spatial Development (B&S)**
The long lifespan of buildings and the shortage of available land in Western countries necessitate sustainable and flexible solutions for our spatial planning and built environment. People and businesses want good, safe and affordable housing facilities. The plans and designs that we create for this purpose must also meet future needs. A future that likely looks very different from the present. Will the population grow or shrink, can we pay less or more for our housing? Which limitations and opportunities do climate change offer us? The challenge is, in the current arena with the now established interests, to arrive at socio-technical designs for spatial development that will meet the requirements for decades.

**Energy**
The key question in this track is: how do energy systems function and how can possible interventions for their improvement be designed? From physical modifications to changes in the legal system. Can we ensure the demanding energy supply while more and more electricity is produced from solar and wind energy? How should national policy deal with cross-border effects? What role can national policy for energy efficiency and renewable energy play in a free European market? Recent developments in the energy systems such as smart grids, electric vehicles, city heating and shale gas are examples of topics elaborated in the programme.

**Information and Communication (I&C)**
Nowadays, nothing in our society can function without a large-scale digital information infrastructure. The information infrastructure is a technically complex system because it is constructed by components that are publicly or privately owned. This requires a design and governance of the systems that are based on public-private partnerships to make optimal use of the information. As a CoSEM engineer you have to manage and design on the basis of applicable legislation and values and standards. You require a broad interest in designing, for example, applications for smart logistics, platforms for local energy generation or for big and open data to create green energy services within a smart city.

**Transport and Logistics (T&L)**
The transport and logistics sector is constantly in development and requires innovative engineers. In this track you analyse and design urban mobility, freight and logistics systems taking into account the travel behavior, the conflicting interests and competing political, social and economic demands. The right sociotechnical designs should reunite these conflicting interests. You develop alternatives for designing new or improved transport and infrastructure systems and gain insight into problems related to the design and control of transport processes from a multi-actor perspective.

**Global citizens**
The CoSEM Master’s degree programme educates global citizens. We look at the challenges at an international level, and do not confine ourselves to the Netherlands. We encourage our students to follow courses abroad in the first semester of the second year. Studying in a different culture boosts your creativity and flexibility.

**ICT education**
In our programme we use all of the latest teaching techniques, including blended learning. We offer you a combination of learning on campus and e-learning. The more you progress in the programme, the more you can follow your own route with extra modules or research. If you prefer to follow a defined route, you simply follow the standard Master’s programme.
Electives
During the programme you will choose one of the following predefined set of elective courses

- Emerging Technology-Based Innovation & Entrepreneurship (+annotation)
- ICT Management and Design
- Infrastructure and Environmental Governance (+annotation)
- Economics and Finance
- Modelling, Simulation and Gaming
- Cyber Security
- Cyber Security (Only CoSEM I&C students)
- Supply Chain Management
or you will define your own elective package.

Electives at our faculty are subject to constant change, and offered only when there are sufficient participants. Please visit our website for the most recent information about the electives. Two of the electives also offer an abbreviation, meaning that the graduation project is carried out externally in a related organisation.

Career prospects
CoSEM graduates typically take up positions as project managers, policy makers and strategic consultants. Graduates are just as comfortable speaking to technical experts as they are when speaking to managers, and they often work within interdisciplinary environments. They are greatly appreciated for their systematic approach to solving problems and their analytical thinking.

Many CoSEM graduates are currently working in large organisations (Shell, Unilever and Heineken), consultancy firms (Accenture and McKinsey), energy companies (Eneco, TenneT, Alliander), engineering firms (Arcadis and Heijmans), insurance companies and financial institutions, as well as in governmental ministries and agencies. In addition, a substantial number have launched their own ventures or became a PhD candidate within the faculty.

Timo Gerres (Germany)
In general, I was always quite interested in the field of renewable energy technology and the future transition of energy systems, one of the great challenges of our society. In my Bachelor studies – a combination of mechanical engineering and business administration – I learned a lot about different technologies, but the question of how to utilise them on a greater scale was never fully addressed. How do you ensure investments in new energy technologies? How can you increase acceptance? What needs to be done to integrate them into the electricity system? What regulative hurdles have to be taken?

After two years at TPM, I can say that CoSEM was exactly the programme I was looking for. Trying to understand complex systems by studying the different actors involved was new to me, but it provides exactly the perspective on sociotechnological interactions I was missing in my previous studies. Further on, domain courses helped a lot in providing the link between energy sector specific characteristics and system understanding. For my graduation project I developed an algorithm to adjust electric vehicle charging to cope with the production uncertainty of photovoltaic production. Working on something that can actually help us to make the energy transition possible fulfils me with great joy. Not just presenting an engineering solution, but also focusing on the implications and consequences of your doing on the technical system and its stakeholders was one of the reasons I chose CoSEM.

Looking back at CoSEM, I will always remember the great time I had working together in projects with fellow students or researchers. Whether a design project, modelling assignment or sector analysis, working together with Dutch and international fellow students was always a pleasure. I really appreciated the openness of everyone at TPM for unorthodox and new approaches.

After my graduation, I will start working for the project management team of a German electricity grid operator (TenneT) connecting offshore-wind parks to the electricity grid in northern Germany. I am looking forward to this new challenge and I am convinced that CoSEM has provided me with the skills required for this task in a highly complex socio-technical environment.
Admission requirements and application procedures
You have to meet the admission requirements for the MSc Programme Complex Systems Engineering and Management. These depend on your Bachelor’s degree.

Candidates with a multidisciplinary engineering degree may enter the programme directly, i.e. BSc degree in multi-disciplinary Systems Engineering (‘Technische Bestuurskunde’) or a BSc degree in Industrial Engineering & Management. Candidates with a monodisciplinary engineering degree or a degree in a natural science may enter the programme after they have completed the online linkage programme.

Dutch HBO bachelors with an engineering or natural sciences background (with grade point average > 7 within 4 years and final assignment (Bachelor thesis) > 7 ) and university bachelors in architecture or others with deficiencies in their background knowledge, if admitted, will have to follow the online linkage programme as well as an individual bridging program of max 30 ects.

Candidates will be admitted based on the quality and level of their education; individual performance and quality of the educational institute, and their motivation. All candidates for the MSc Programme Complex Systems Engineering and Management are required to submit a motivation letter (essay).

Additional information
To see which Master’s programmes are open to you on completion of your Bachelor’s degree from a non-technical Dutch university go to studychoice.nl. If you’ve completed your Bachelor’s at a technical university, go to doorstroommatrix.nl

Dutch HBO degree students holding a multi-disciplinary engineering HBO degree from a university of applied sciences (HBO) are eligible for admission. If admitted, you have to follow the linkage programme as well as a bridging programme of 30 EC (in Dutch). Please note that the linkage programme will take approximately 80 hours to complete and has to be finished before the deadline of application (July 1st of the calendar year for Dutch students). For the bridging programme, there are two options: courses are distributed over one year with a workload of 20 hours a week, or scheduled as a half-year full-time programme. In some cases, this bridging programme can be taken as a minor embedded in your Bachelor’s programme. The admission committee will inform you about this.

See hbodoorstroom.tudelft.nl for detailed information. Applications through Studielink: tudelft.studielink.nl

International applicants
Non-Dutch students with a monodisciplinary engineering degree who apply for the MSc CoSEM have to follow and complete the online linkage programme before they can be admitted to the CoSEM programme. Candidates holding a multidisciplinary engineering BSc degree have to follow some modules from the online linkage programme which will be advised by the admission committee. For international students, the application period starts October 1st and closes at April 1st. To be considered for admission to an MSc programme you will also need to meet TU Delft’s general admission requirements. For more information about the application procedure and studying at TU Delft in general, go to admissions.tudelft.nl

Online linkage programme
The online Linkage program offered by the faculty of Technology, Policy and Management is designed for the BSc students with a monodisciplinary engineering degree or a degree in a natural science, who wish to enter the CoSEM (Complex Systems Engineering and Management) programme, provided that they have a demonstrable affinity with multidisciplinary education by showing courses of at least 10 ECTS relevant for solving complex multi-actor problems. Next, the students of this group should follow this online linkage program to develop and/or practice basic skills in actor analysis in a socio-technical environment, as well as have insight in complexity theory and the implications for new technologies.

Students of this group with a grade point average of the entire BSc curriculum less than 7.5 should finish the linkage program with an exam in the form of CoSEM Final Essay.