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# M.Sc. Business Engineering Energy



**berlin** **CAMPUS**  
**EL GOUNA**



## Technische Universität Berlin Campus El Gouna

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### **Imprint**

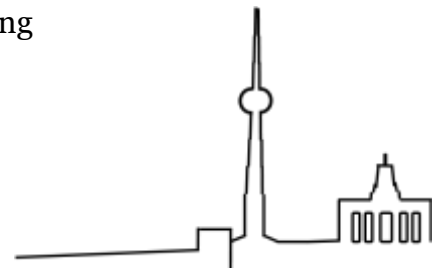
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Prof. Dr. Tetyana Morozyuk, Dean of the Department Energy Engineering





Graduation ceremony, January 2015

## Foreword Dean

Energy is of crucial importance to global development. Challenges in the power sector are nowadays more far-reaching than to any other point in time, facing significant political, economic, social and ecological consequences. To tackle these complexities, highly qualified engineers with awareness of the true scope of most recent needs of the energy sector are urgently required. The Campus El Gouna of Technische Universität Berlin provides young passionate engineers with most necessary skills to achieve excellence.

Pursuing a master program at TU Berlin Campus El Gouna, offers the exceptional opportunity to study at two very distinct locations that differ tremendously not only in size but also in their social, cultural, and ecological characteristics. The campus houses apart from the energy department, a water department and urban development department.

Consequently, students from more than 20 nations are exposed to a true interdisciplinary and international surrounding. This unique set-up constitutes ideal conditions for the students of Business Engineering Energy to apply their newly gained knowledge to a wide number of diverse conditions, environments and applications.

In great hopefulness, that this brochure can not only reveal the true potential of the master program in Business Engineering Energy but also catch your personal interest. In any case, we succeeded in reaching your curiosity, we are very much looking forward to your application and meeting you soon at the campus.

Sincerely,

*Prof. Tetyana Morozyuk*

Dean Energy Engineering Department





## Introduction to the Project

Since October 2012, the TU Berlin maintains a Satellite Campus in El Gouna, Egypt. The Central Institute el Gouna is responsible for the scientific operation of the legally full-valued location of the Technische Universität Berlin.

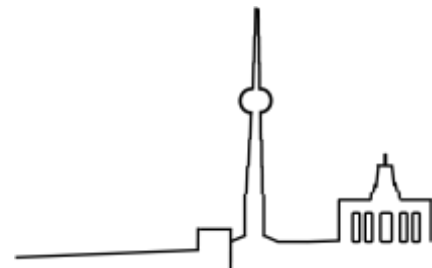
The foundation of the campus dates to the TU alumnus Samih Sawiris, today CEO of Orascom Development Holding AG, who aimed to create the possibility of scientific study at German standard, as he enjoyed at the TU Berlin, in Egypt and with dedication to the corresponding needs of the region.

Campus El Gouna takes an important role within the internationalization strategy of TU Berlin. The MENA region is a geographical focal point for international activities and cooperation of the TU Berlin. The campus serves as a branch office and destination for teaching, research, scientific and cultural events, open to all disciplines.

Since its opening, the TU Berlin Campus El Gouna offers three advanced Master programs: Energy Engineering, Water Engineering and Urban Development.

Within the DAAD funded project, the study courses offered should be extended by two additional Master Programs Business Engineering and IT for Energy, which shall meet the growing demand for engineers in these promising fields. As peculiarity additionally, a PhD program is established at Campus El Gouna to supply the regions call for young scientists.

Overall, the project El Gouna Graduate School of TU Berlin Campus El Gouna aims to further establish and expand international visibility of TU Berlin in the MENA region.





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## I. Why study Business Energy?

It is no secret that mastering both business and engineering is the key to a successful career in industry, this is even more recognizable in the energy sector. Hence, the Energy Engineering Department of TU Berlin Campus El Gouna decided to offer a new Master program in Business Engineering with distinctive emphasis on energy. Certainly, energy is of crucial influence to global development. Concerns in the power sector confront major political, social, ecological and particularly economic consequences.

The Master program Business Engineering Energy (MBE) is adjusted to the strong demand for engineers with a convincing technical background but also managerial skills and knowledge of today's economy. Within the energy sector this need is particularly strong as the gap between technical and economic feasibility is especially prominent. In other words, as MBE is especially accustomed to the energy industry it is unique in its kind, dealing with energy economic challenges particularly significant in the MENA region. The off-shore Campus El Gouna brings together the education of TU Berlin Professors and staff to a research hub in the MENA region. Both winter terms of the 2-year program take place at the brand new Campus in El Gouna. In summer the whole campus travels to Berlin. Students are thus exposed to two very different study environments, offering a unique interdisciplinary and intercultural experience.

The Business Engineering (MBE) program is shaped to prepare professionals for doing advanced research or take on leadership positions in industry as it teaches at a level beyond that of a bachelor's degree.



Students at the world wide most significant industrial fare, Hannover, Germany.  
Students of intake 2012 after winning best-paper-award at Desert Energy Conference in Morocco.



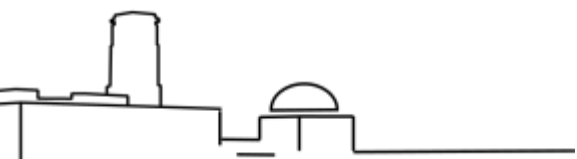
## II. Why Campus El Gouna?

On 28 October 2012, the Technische Universität Berlin has initiated its first satellite campuses in El Gouna, a touristic town in Egypt. With three departments: Energy Engineering, Urban Development and Water Engineering, the campus's scientific focus addresses the main issues of the MENA (Middle East and North Africa) region at present. Acting as the scientific hub of TU Berlin in the MENA region. As a scientific field office of Technische Universität Berlin in Egypt, the campus provides a fully equipped environment for studying, research and development as well as for cultural and scientific events.

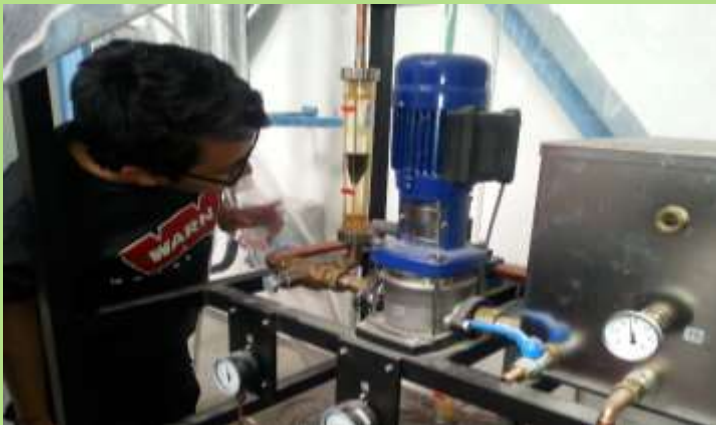
The practical orientation of the master's programs offered at the Campus El Gouna necessitates high quality equipment. The large technical hall of the energy department, along with different laboratories, field and testing equipment, offers a wide range of research opportunities. The Campus El Gouna allows lab-scale testing of most recent technologies, such as a solar thermal energy assisted absorption chiller or a fuel cell training system. As well as an extraordinary variety of education plants and test benches is available (e.g. desalination unit, ice stores in refrigeration, steam power plant).



Facilities and lab of TU Berlin Campus El Gouna



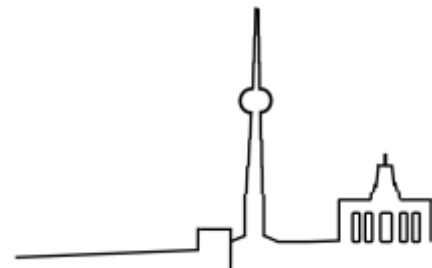




Teaching methods at TU Berlin Campus El Gouna

Apart from the photovoltaic (PV) test field comparing eight different PV panel technologies and various system configurations, the campus is equipped with its own weather station. Recently the installment of a combined power system on campus ground started (PV, Wind, Battery storage and variable consumer). Furthermore, all computers in the campus' PC pool are equipped with latest software such as (Aspen, Dymola, EpsilonProfessional, Matlab, Modelica, Meteonorm, Polysun etc.) extending the analysis and performance tests with simulation and calculation tools.

Not only the brand-new campus and its facilities offer unique study environment but as well its location. As TU Berlin's professor are flown in only for teaching their module in intensive classes, students are awarded an out of the ordinary attention. In addition, classes are kept at about 30 students, allowing a large variety of most effective teaching method and a personal contact to most renowned professors.

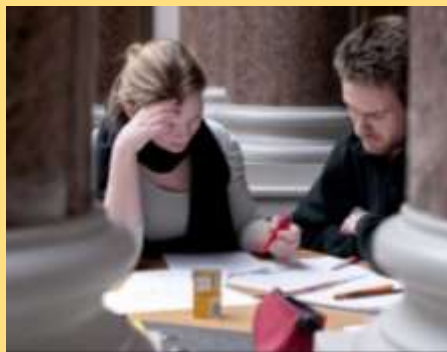




### III. Why TU Berlin?

The Technische Universität Berlin counts to Germany's internationally renowned technical universities with nearly 32,000 students at Technische Universität Berlin, the main campus is not only a significant contrast to the off-shore Campus El Gouna but also one of the largest and most traditional universities in all Germany. Technische Universität Berlin not only stands out in its size but rather with its exceptional

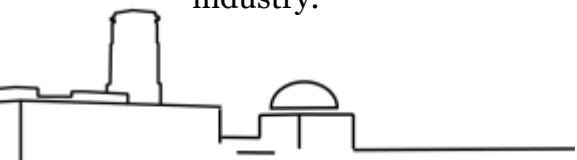
Education and outstanding research achievements. TU Berlins' core goal is "to facilitate the development, implementation and transfer of innovative technologies". The seven faculties of Universität Berlin bridge the gap between natural and technical science, planning, economics and social science and humanities. About 100 different programs



Main Campus of Technische Universität Berlin  
(study hall, main building, light hall of main building, study area at math building marstraße)

are offered by a total of 40 institutes.

Berlin, Germany's Capital city, is at "the heart of Europe" and thus TU Berlin has a broad international outreach. Berlin houses headquarters to many high-ranked international companies enabling TU Berlin to ensure a close cooperation between science and industry.

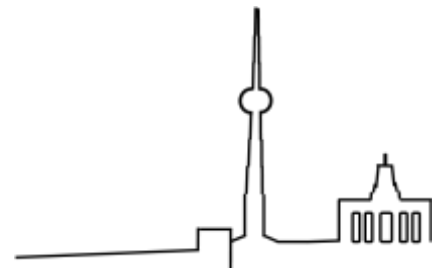


Moreover, Technische Universität invests large effort into promoting gender equality and increasing the involvement of women in study and research. There are a lot of initiatives at TU Berlin supporting e.g. women, young families, young entrepreneurs and entry level graduates. Students of TU Berlin Campus El Gouna can take part in all activities offered in TU Berlin being considered and matriculated as regular students.



Activities offered at TU Berlin main campus  
(Power-Fitness-Mix class, Berlin Long Night of Science, Berlin Firmenlauf 2015, TU Berlin gym)

This includes entrance to most modern libraries, personal internet access at most universities across Europe, career advisory services, as well as leisure at TU Berlin Sports, discount prices for most activities (e.g. cinemas, concerts, museums etc.), free public transportation in Berlin, foreign language training and much more. Number of famous scientists and researcher graduated from TU Berlin such as Konrad Zuse (1910-1996) First Process-Controlled Calculating Machine.



## IV. Study content

The Master's degree program Business Engineering Energy at Campus El Gouna focuses on fundamental aspects of managerial tasks within the energy sector and the application of business tools on energy challenges, including both conventional and renewable energies.

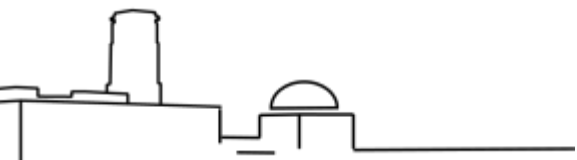
While the study program integrates the latest scientific developments and methods, it also pays attention to the economic, ecological, social and industrial applicability. Moreover, energy systems design, evaluation and optimization with the application of learned business and engineering tools are core learning goals realized in several term projects.

Energy Engineering, Energy Economics and Project Energy System Optimization along with Intercultural Competence, and the interdisciplinary term project and the master's thesis are mandatory for the master program in Business Engineering Energy. A total of 120 European Credit Transfer and Accumulation system (ECTS) will be awarded. After successful completion the Master of Science of the Technische Universität Berlin will be granted.

The master program in Business Engineering Energy aims the following learning outcomes,

MBE graduates should:






- Master in planning and operation of power engineering processes, along with applicable methods for analysis and optimization.
- Know and be able to choose appropriate approaches for energy and cost savings (in consideration off all boundary condition including environmental issues), and integration of appropriate measures in power engineering processes.
- Master the use of commercial simulation tools and evaluate the strengths and weaknesses of power engineering processes.
- Know how to develop concepts for economical and environmental friendly system operation.



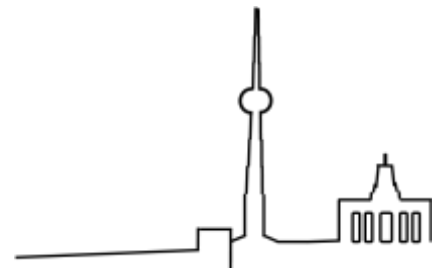


## V. Curriculum

CP	1st Semester El Gouna	2nd Semester Berlin	3rd Semester El Gouna	4th Semester
6	Energy Engineering 1	Energy Economics 1	Energy Systems Optimization	Master Thesis
12	Intercultural Communication & Project Management	Energy Economics 2	Interdisciplinary Project	
18	Engineering Elective	Economics & Law Electives	Engineering Elective	
24	Engineering Elective	Economics & Law Electives	Engineering Elective	
30	Engineering Elective	IT, Economics & Law Electives	Engineering Elective    Internship    IT, Economics Elective	

	Comp. Interdisciplinary & -cultural competency
	Compulsory Business Engineering
	Engineering Electives
	Master Thesis
	Economics & Law Electives

Curriculum of the Business Engineering Energy Master's program at TU Berlin Campus



## Compulsory Business Engineering

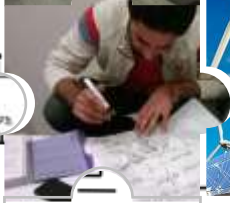
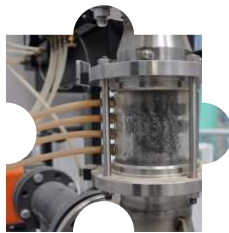
In order to tackle the most current challenges within the energy sector, students need to firstly need a detailed knowledge of energy conversion system design and operation on system and component level. The module Energy Engineering I emphasizes applied and advanced thermodynamic as well as economic and environmental aspects for analysis and optimization of energy-conversion systems. Within the module Energy Economics further deals with the complex structure of diverse energy markets, economic calculation, fundamentals of energy trade and market incentives.

## Energy Engineering Electives

In order to get a deeper understanding of Energy Engineering students are able to select modules out of the following core study areas: Energy Engineering and Components, Energy Systems, Electrical Engineering. The student can freely decide upon which energy topics to focus on: Energy Engineering II, Integration of Renewable Energy, Conversion Technologies for Renewable Energies, Energy for Buildings, Refrigeration and Air Conditioning, Photovoltaics, Energy Storage and Conversion, Components of Energy Conversion Systems. The program thereby aims to target issues most common in the MENA region, covering on the one hand fundamentals and on the other hand advanced application.

## Economics and Law Electives

The study area of Economics and Law debates the challenges and obstacles while applying energy technologies. One of the biggest challenges is the integration of renewable energies without compromising a secure, stable and affordable energy supply. Respectfully the economic, ecological, political and social framework is issued in different electives. Energy Economics further deals with the complex structure of diverse energy markets, economic calculation, fundamentals of energy trade and market incentives. Economics and Law is a diverse still expanding set of electives aiming to provide students with different backgrounds with knowledge about the wide scope of business engineering in the energy sector.







## Compulsory Modules

### Energy Engineering I & II

Modern energy systems need to be on the one hand energy efficient and on the other hand cost efficient without compromising environmental restrictions. A competent energy engineer must be able to design and optimize an energy system accordingly, the module energy engineering aims to provide the students with necessary understanding and skills set to do so.

The module Energy Engineering is dissected into fundamentals and advanced energy engineering. Both modules have a capacity of six credit points, the modules take place in the first and second semester.

Students familiarize themselves with modern methods of analysis and evaluation of thermal systems and principles from the operation and design of the most commonly used energy conversion devices.

Thereby, students learn to:

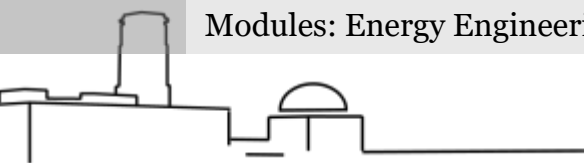
- be able to optimize energy supply systems by ensuring a good compromise among efficiency, cost of product(s) and environmental impact,
- be able to identify the inefficiencies of energy conversion systems and develop options for improvements,
- process creativity to optimize energy-conversion systems,
- have skills in preparing data and information for the design of such systems.

Prof. Dr.-Ing. Prof. e.h. Dr. h.c. George Tsatsaronis,  
Institute for Energy Engineering, Technical University of Berlin



After completion of his Diploma in mechanical engineering at NTU Athens, Greece, Prof. George Tsatsaronis received both MBA, a Ph.D. in combustion, and a Doctor Habilitatus Degree in Thermoeconomics, at RWTH Aachen, Germany. Counting above forty years of experience and related scholastic background Prof. Tsatsaronis is an expert in the fields of exergy-based methods, combustion technology as well as the development, design, simulation and analysis of energy-conversion processes and the optimization of design and operation of energy systems. His contribution to the fundamentals of exergoeconomics is significant. Apart from publishing over 250 papers and co-editing 20 bound volumes, Prof. Tsatsaronis co-authored the book “Thermal Design and Optimization”, which is base to the modules “Energy

Modules: Energy Engineering I, Energy Engineering II, Project Energy Systems



## Energy Economics I

Energy markets have complex structures and regulations determining prices and market behavior of key actor groups e.g. developers, investors, generators, shippers and customers. It is crucial for energy engineers to understand market behavior in order to be a successful player for instance while introducing new energy technologies to the market.

The courses Energy Economics I and II consider markets for different energy carriers along with markets for electricity and heat which have different properties and include both renewable and non-renewable sources. The key elements of this course include methodological issues, such as cost calculations including external costs, and energy modeling based on energy balances and scenarios. A focus is also put on the market liberalization of the grid business and the related trading at energy exchanges and over the counter.

In addition to the supply side of energy markets, the demand side is also covered by analyzing energy efficiency measures and instruments.

Understanding the particularities of energy markets is crucial for managers in the energy business, even if their key competence is energy or environmental engineering. In the first part of this module students gain a general understanding of methodological instruments for analyzing energy markets, secondly a practical insight into advanced energy markets by cooperating with companies and experts in industry is given.

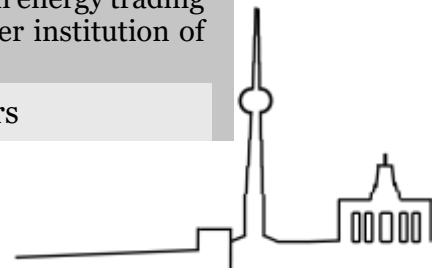
Prof. Dr. rer. pol. Georg Erdmann,  
Department of Energy Systems, Technical University of Berlin



Prof. Georg Erdmann is Professor for Energy Systems at the Department of Energy Technology at TU Berlin. Research area of Prof. Erdmann includes but not limited to energy economics containing energy market reform, market modeling and forecasting, energy trade and investment strategies along with financing and risk management. His field of study was Mathematics and Economics, and he is holding a PhD degree in Economics from Münster University. Prof. Erdmann was Post doc researcher and Assistant Professor at the Center for Economic Research, Swiss Federal Institute of Technology, Zürich (1982–1995). Moreover, his research includes market admission of novel energy technologies comprising for instance electric vehicles, battery storage and fuel cells. He published several books and scientific articles.

Prof. Erdmann is the President of the Board, KSB Energie AG Berlin, involved in energy trading services and among several other mandates, chair of the GEE German member institution of the International Association for Energy Economics (IAEE).

Modules: Energy Economics I and II, Economic Principles for Engineers



## Energy Economics II

Goal of the module Energy Economics II is for students to be able to define themselves as experts within the group and to the outside world. Accordingly, they apply the treated theoretical approaches taught in Energy Economics I and II in their own initiative. The conveyed contents and skills create above average conditions for a successful career start in the energy economy sector and belong to the conditions which are necessary for future management responsibilities.

### Content Energy Economics I

1. Energy balancing
2. Economic calculation with External costs
3. Fundamentals of energy trade
4. Markets for emission certificates
5. Markets for power generation
6. Markets for crude oil and natural gas
7. Markets for petroleum products
8. Transport and distribution of piped energy systems

### Content Energy Economics II

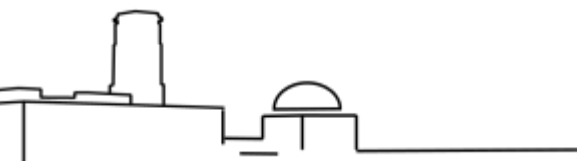
1. Determination of energy demand,
2. Energy prognosis and timetable forecasts,
3. Energy and development,
4. Energy efficiency,
5. Energy management,
6. Political influence to the developments at the energy market,
7. Long-term energy scenarios,
8. Innovation processes in the energy sector

Dr.-Ing., Prof Aaron Praktiknjo  
Faculty of economics, RWTH Aachen



Aaron Praktiknjo has been an Assistant Professor ("Juniorprofessor") of Energy Resource and Innovation Economics at RWTH Aachen University since October 2015. Before joining RWTH Aachen, he was a team leader and lecturer at the Institute for Energy Engineering, TU Berlin, and served as a consultant for national and international agencies and companies. After studying industrial and civil engineering, Aaron Praktiknjo completed a PhD on the topic of energy supply security at the Chair of Energy Systems at TU Berlin, graduating in 2013 with highest honors. Aaron Praktiknjo has received awards for his research from the International Association for Energy Economics (IAEE) and the European Energy Exchange (EEX).

Modules: Energy Economics I and II, Economic Principles for Engineers





## Project Systems Optimization

Mastering the design and planning of energy systems is an asset that any energy engineer must grasp. The arrangement of many complex interrelated components needs to be carefully considered, simulated or tested and optimized. As well economic, ecologic and environmental aspects may not be neglected. There is no denying the fact that advanced knowledge of the means of information technology in this context is crucial. Concept realization, process synthesis, economic analysis, exergoeconomic analysis and iterative process improvement, are methods that need to be taught and applied in the module Project Systems Optimization.

The planning and design of energy supply systems for power, heat and cold systems forms the focus of this project. The analysis and evaluation under energetically, exergetical, economic and ecologic aspects will also form part of the project. The students will be separated into smaller project groups and cluster the specified problem. The size of the groups depends on the respective topic to begin with, the problem is outlined and possible solutions are discussed. The participants in the project organize themselves to solve sub-problems on the way to developing the overall solution.

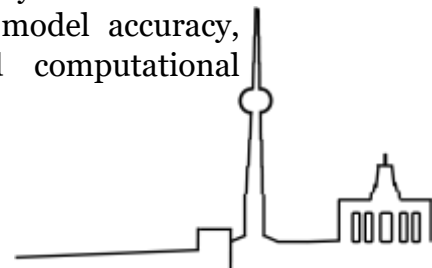
Skills necessary attempted are: mathematical optimization methods, mathematical modelling, the optimization of the design of power plants, optimal unit commitment in power systems.

Students are responsible for their time management, reporting and results. The tutors may also teach several technological topics in addition. Finally, there is a written report and a final presentation. Students are also required to participate in a cross-disciplinary seminar.



Students working in the PC pool at Campus

Students will apply, deepen and extend their knowledge in energy engineering and energy economics. Depending on the students' previous knowledge, fundamentals will also be part of this module. The project-based work will enhance the students' scientific and collaborative problem-solving skills. After participating in this module, the students will be familiar with systematic mathematical methods to optimize the design and operation of energy conversion systems. They will be aware of problems, such as model accuracy, model reliability and computational effort.



## Intercultural Communications and Project Management

Communication skills, team work in an intercultural context, working in international networks, conflict management, mediation, facilitation, presentation, as well as computer-mediated communication are key aspects in work life. Moreover, time management is of crucial importance. Hence, more and more companies ask for managerial and project coordination expertise in a new employee.

The aim of the course Intercultural Communications and Project Management is on the one hand to provide students with an awareness of cultural differences and to equip them with skills required for tackling problems of intercultural communication in a global setting, and on the other hand to introduce them with project management and its application in different situations.

As the study program takes place in Germany and Egypt, the cultural differences and similarities within the Western and the Arab World are of particular interest. Multiple aspects of communication and intercultural competencies will be provided. In addition, the following fields will be covered in form of theoretical inputs, role games, working groups and interactive exercises:

Basic knowledge about culture, cultural dimensions, communication, diversity and intercultural competence. Reflected dealing with different cultural values, behavior, perceptions, working patterns, stereotypes and prejudices and conflicts resulting out of diversity. Develop basic competencies, interpersonal skills and strategies for successful inter-cultural and -gender communication. Develop basic knowledge for establishing continuous dialogue with stakeholders from science, industry, NGOs as well as with customers, employees or the local population.

Within the Project Management taught in the module, students acquire knowledge of the law on the implementation of projects, particularly in the energy sector, from the perspective of clients and of service providers. Knowledge about the management tasks, management techniques and leadership means written for the planning and execution of projects mediated by the lifecycle orientation will be discussed. Project organization, schedule management, cost management, quality management, project management tools will be explicated within case studies.



Students from TU Berlin Campus El Gouna during project work, lecture and presentation.



## Interdisciplinary Project

Energy engineers are continuously confronted with diverse issues external to their background or expertise. Furthermore, companies generally prefer to employ people with dissimilar proficiency to create a diverse and strong team. An interdisciplinary work environment and tasks freestanding from one's familiarities necessitate a large scale of skills that can only be gained with experience.

The goal of the module is to familiarize students with:

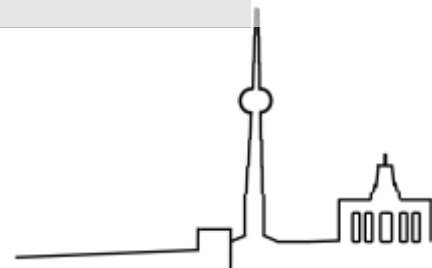
- Analysis and research methods of scientific working
- Independent completion of research and studies in interdisciplinary groups
- Work on unfamiliar challenging topics
- Report writing and presentation skills.

Goal of this module is to teach the students the significance of interdisciplinary collaboration as well as to make students experience the challenges and benefits of intercultural and cross-disciplinary team work. After participating in this module, the students will be able to tackle a problem, formulate the right research questions, find and evaluate possible solutions, conduct a feasibility study, and present their research work.

The topics tackled in the Interdisciplinary Project alter annually. The content is adjusted to confront latest issues in the field of sustainability and will differ from contents of other modules as energy engineering, water engineering and urban development students participate. In interactive input sessions the students will be provided with the necessary concepts, knowledge and skills to tackle the Interdisciplinary Term Project. Visiting professors, external experts, and the organizing team will conduct lectures, workshops and seminars to cover the related subjects. Determined by the terms task technical background, sustainability, feasibility study, questionnaire design, and report writing will be issued. Interactive lectures, Group work, discussions, and presentations dominate the project. Result of the Project is a joint report.



Students from TU Berlin Campus El Gouna during group work, self-study time and experiments.



## Master Thesis and Internship

The German higher education system is dominated by learning of self-management and organization along with an independent and systematic approach to scientific tasks. Thus, students can choose among electives, locate the company for their two-month industrial internship and independently select the subject of their projects and their Master's thesis topic, supervising institution and professors individually.

### Internship

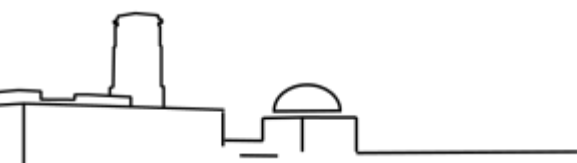
The industrial internship should be completed during the summer vacation in Berlin and will last a minimum of six weeks. During the internship the students can gain an insight into the work flows in industry, planning companies, or servicing firms. There are several possibilities for completing an internship in Berlin and the students will be supported by the El Gouna team. Students must also, create an internship report on a weekly basis, describing their activities during their time in the company or organization.

### Master's Thesis

The master's thesis requires students to develop the knowledge they have acquired during their studies and to transfer it into a novel scientific energy engineering topic solved with Information Technology based on their individual research. This relates to the development of innovative energy solutions for the challenges in the MENA region in the context of a practical or theoretical study of a self-selected topic in the field of energy conversion, efficiency, systems or infrastructure. The students are encouraged to carry out their own, individual research, preferably in the framework of a research project specified by their supervisor, or possibly in cooperation with an industrial, administrative or governmental organization in a global setting. To ensure the progress of their scientific work students will also receive support from research assistants. The master's thesis ends with the presentation of the research results to supervisors and fellow students.



First intake of students of TU Berlin Campus El Gouna after their Master thesis defense.



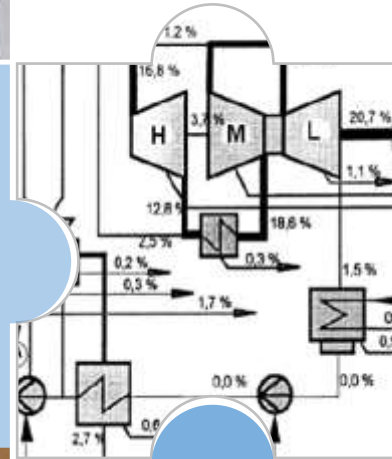




Cooling Modules



Refrigeration and Air Conditioning



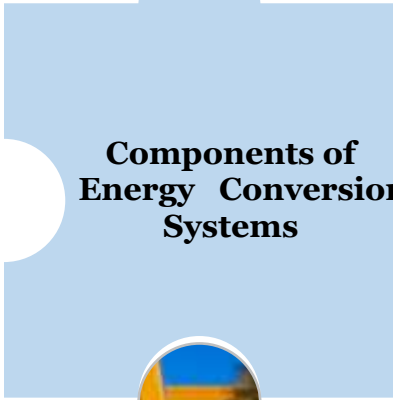
Conversion Technologies for Renewable Energies



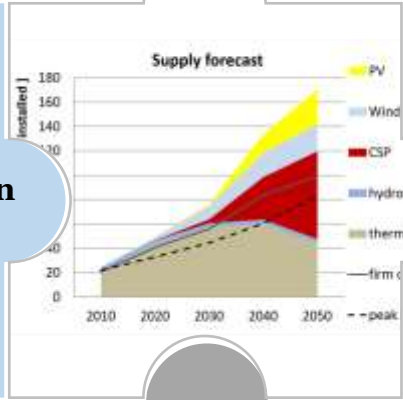
Energy Engineering II



Integration of Renewable Energies



Components of Energy Conversion Systems



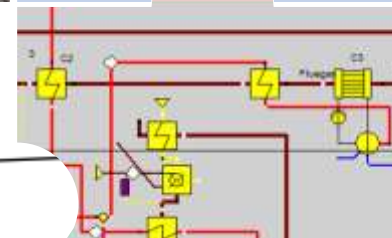
Photovoltaics



Energy Storage and Conversion



Energy for Buildings



## Refrigeration and Air Conditioning

Complementary to increasing the efficiency of energy supply and introducing higher penetration of renewable energy sources, the reduction of energy demand is an even more relevant manner while aiming for a more sustainable energy system. Especially in countries of the MENA region and generally hot regions, the electricity required for air conditioning and refrigeration dominates the overall electricity consumption, resulting in power fadeouts on hot summer days as the power supply does not meet the demand.

The course Refrigeration and Air Conditioning firstly introduces principles of operation of compression refrigeration machines and principles from the design of the most commonly used types of components. Furthermore, modern methods of analysis and evaluation of compression refrigeration machines are taught.

After completion of the module, students can choose an adequate tool for the optimization of a system. Moreover, students should gain the creativity to design new tools for the optimization of processes, have skills in preparing data and information for the design of the system and can independently solve tasks in the field of thermal design of compression refrigeration machines starting with insulation, thermodynamic cycles, working fluids, main and additional components for single and multi-stage refrigeration machines. As well cascade refrigeration machines, special refrigeration machines and thermally driven refrigeration machines are part of the class.

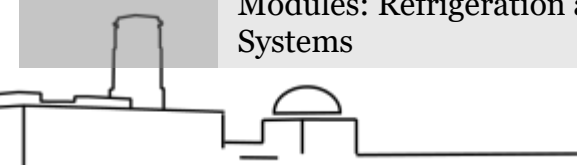
For each topic the terminology, historical background, rational field of application as well as energy and exergy analyses, economic aspects, ways for improving or optimizing the machines, principles of control and automatic systems will be discussed.

Prof. Dr. Tetyana Morozyuk,  
Institute for Energy Engineering, Technical University of Berlin



Tetyana Morozyuk is professor at the Institute for Energy Engineering at the Technical University Berlin, Germany. She studied refrigeration engineering in the Odessa State Academy of Refrigeration, Ukraine, and received her Diploma in 1990. She received her Ph.D. in 1994 and a Doctor Habilitatus Degree in 2001, all in Ukraine. Professor Morozyuk has over twenty years teaching experience in the fields of refrigeration and energy engineering (development, design, simulation and analysis of energy conversion processes) and applied thermodynamics (exergy-based methods). She is the author or co-author of 7 books and more than 250 research publications, and has 10 patents. Professor Morozyuk is associated with several scientific organizations (ASME - USA and IIF/IIR – France) as well as many international energy-related conferences and recognized International Journals.

Modules: Refrigeration and Air conditioning, Energy Engineering, Project Energy Systems



## Integration of Renewable Energies

Dominated by environmental concerns, as in local pollution and global warming, limited economic fossil fuel resources, escalation of fossil fuel prices accompanied by price volatility and rapid increase in energy demand the power sector decided for a shift towards higher penetration of renewable energy production. Yet the drastic modification from conventional on-demand power generation based on fossil fuel to non-dispatchable strongly intermittent renewable energy generation introduces a large range of considerable challenges and is only successful under careful consideration of technical feasibility, policy framework, environmental and social impact.

The module Integration of Renewable Energies teaches the most important systemic, ecologic and economic connections for the effective integration of renewable energies in electrical grids, supply systems and markets under the constraints of sustainability with respect to the different solutions. Furthermore, the students will be able to assess the information concerning energy potentials, demand scenarios, systems solutions and market strategies using scientific methods about economic decisions.

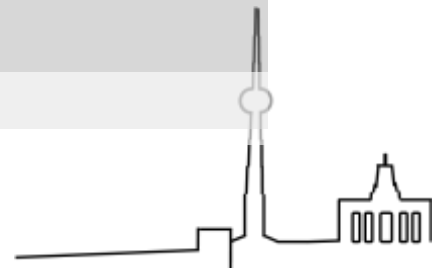
The description of obstacles enables the students to create the conditions for a possible transition of the electricity industries to sustainable concepts and allows the assessment of respective actions. The lecture introduces different analytical methods and instruments which help to understand the complex interdependencies. The focus lays not on detailed technical design and engineering but on strategic assessment and implementation of learned context.

Dr. Franz Trieb,  
Institute of Engineering Thermodynamics, German Aerospace Center



Dr. Franz Trieb achieved his Diploma in mechanical and process engineering at the Technical University of Clausthal, Germany. At Oldenburg University he accomplished his PhD degree. Being a senior research associate in the Department of Systems Analysis and Technology Assessment at the Institute of Technical Thermodynamics at DLR in Stuttgart, Germany, specialized in scenario analysis, solar thermal technology assessment and resource exploration.

Module: Integration of Renewable Energies



## Conversion Technologies of Renewable Energies

Environmental concerns, escalating and highly volatile fossil fuel prices and an ever-rising energy demand pushed the power sector towards an energy transition: from conventional fossil fuel based power generation towards low-emission renewable energy generation. Especially wind and solar power have recently experienced a significant boost in globally installed capacity. This module is aiming to introduce the students to the full range of renewable energy conversion technologies.

The generation, conversion and utilization of renewable energies form the focus of this module. The direct and indirect utilization of solar energy including photovoltaic panels, concentrating power plants and wind power plants is presented in its fundamental principle and technical resource assessment. The diverse exploitation possibilities of biomass and waste as an energy carrier with biochemical and thermochemical conversion technologies also content of the course, as well as hydropower plants and geothermal heat.

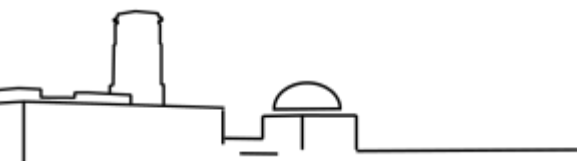
Students will have the possibility of deepening their knowledge in practical laboratory experiments regarding fuel characterization and fluidized bed conversion. Students should subsequently be able to understand, evaluate and design conversion systems of various renewable energies sources.

Prof. Dr. rer. nat. habil. Frank Behrendt,  
Institute for Energy Engineering, Technical University of Berlin



Prof. Behrendt is an expert in the field of biomass combustion. Prof. Behrendt received his Ph.D. degree at Heidelberg University, continued his academic career at Chalmers University of Technology at Gothenborg, Sweden and the Combustion Research Facility of Sandia National Laboratories, California, USA. He conducted his habilitation at Stuttgart University. Apart from teaching at TUB Campus EL Gouna, Prof. Behrendt is Professor for Energy Process Engineering and Conversion Technologies for Renewable Energies at TU Berlin as well as CEO at the TU-Campus EUREF. In 2007 Prof. Behrendt took on the responsibility for coordination of the entire energy-related research at TU Berlin, as a speaker of the Innovation Centre Energy. Moreover, he is the German representative of the International Energy

Modules: Conversion Technologies of Renewable Energies





## Energy for Buildings

The building sector make up above 60% of the global energy consumption. In the MENA region a noteworthy part of this share can easily be reduce by simple indirect and direct measures, making the module Energy for Buildings essential to the Master of Energy engineering program.

This module focuses on energy systems in buildings to understand the complex energy flows and media required in the context of sustainable aspects in the MENA region to comply with human needs. In terms of the physiology of people with respect to thermal comfort and air quality, the measurement of meteorological data such as solar radiation, air temperature, humidity and winds are crucial in respect of comfort. The goal is to enable students to understand the different energy flows in a building and to use calculation methods for planning and constructions with respect to different building purposes.

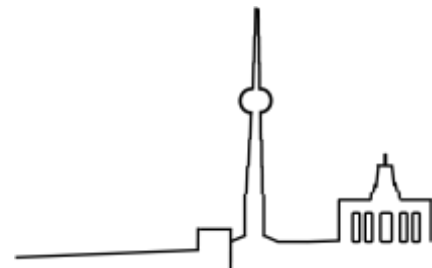
This also includes the design of thermal heat insulation and the suitable materials. This will be explained using the primary energy consumption for the heating and cooling system. Comparisons between the annual energy needs for heat/cold generation as well as losses of transfer and distribution are discussed. The course provides examples of classical and solar heat supply systems in terms of primary energy consumption for ventilation and air conditioning. It also includes theoretical exercises to develop the learned methods, as well as practical experiments in specially designed test rooms e.g. for visualizing air flows.

Univ.-Prof. Dr.-Ing. Christoph Nytsch-Geusen,  
Institute for Energy Engineering, Technical University of Berlin



Prof. Nytsch-Geusen conducted his diploma in energy engineering and his PhD on energy efficiency of buildings at the Technical University Berlin. With work experience as a project engineer and as a research assistant at two different institutes of the Fraunhofer Gesellschaft, Prof. Nytsch-Geusen was assigned as university professor in the field of "Care Planning and Supply Technology " within a degree program in Architecture at the University of Arts in Berlin.

Modules: Energy for Buildings, Interdisciplinary Project



## Components of Energy Conversion Systems

So as for any energy system to run properly, each of the numerous interrelated components needs to function correctly. To supervise the design, installment and operation of a complex energy system, energy engineers need to be familiar with each components behavior and limitation, as even a malfunctioning water pump in the cooling system can cause system failure.

This module focuses in detail on the most important components of all kinds of energy conversion systems. These include pumps, compressors, turbines and heat rejection devices (cooling towers) as well as internal combustion engines, Stirling engines, Organic Rankine Cycles and Fuel Cells. The theoretical knowledge will be demonstrated on a practical basis in the technical hall with the various test rigs for the respective machines. In addition to this, fundamental measuring techniques for parameters, such as temperatures and pressures, are also presented on an experimental basis, along with the uncertainty, which is of the utmost importance for scientific work. With the calculation of state variables, the machines can be balanced by the students using the measured data.

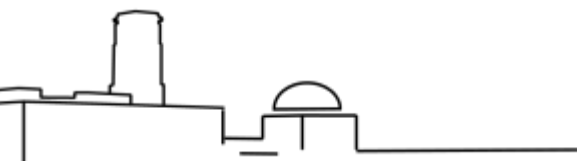
The students shall know the basic physical phenomena which are used for mechanical energy conversion systems and they shall know associated methods of design, evaluation, and improvement of technical solutions. The students will be able to design and optimize components of the energy systems about economic and ecologic aspects.

Prof. Dr.-Ing. Felix Ziegler,  
Institute for Energy Engineering, Technical University of Berlin



Prof. Felix Ziegler is the Dean of the Faculty for Process Science of TU Berlin. Apart from his responsibility for the faculties undergraduate program and the graduate program “Renewable Energy Systems“, He studied mechanical engineering in Technische Universität München, and received his Diploma in 1981. In TU München Prof. Ziegler also completed his Ph.D. in 1991 and a Doctor Habilitatus Degree in 1998. His research field is Evaporation, Absorption and Desorption; Absorption Chillers, Heat and Mass Transfer; Heat Pumps and Transformers; Sorption Power and Storage Cycles; Closed and Open Sorption Cooling Systems; Steam Jet Processes; Energy Systems Engineering.

Modules: Components of Energy Conversion Systems



## Energy Storage and Conversion

Most renewable energy sources are neither capable to provide constant nor on-demand power generation. Energy storage and the production of alternative energy carrier such as Hydrogen are the most commonly discussed approaches to ensure a secure and stable energy supply dealing with the introduction of intermittent renewable energy generation.

The module Energy Storage and Conversion is split into two sections. An overview on diverse energy storage systems is content to the first set of lectures. The second part will specifically discuss electrochemical energy storage.

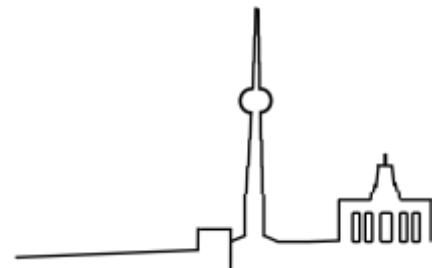
The overview on stationary electrical and thermal energy storage systems includes large scale technologies such as pumped hydro, compressed air, long and short term thermal energy storages, Power-to-gas-concepts, decentralized electric technologies like cell batteries (Lead Acid, Sodium Sulfur, Lithium Ion), Flow batteries (Vanadium, Zinc Bromide), flywheels and double layer capacitors. Each technology will be explained in terms of functionality and application cases, where necessary the underlying working principles are presented. Consequently, students will learn to perform a comparative analysis of different storage technologies and to define typical application cases in the context of system integration of intermittent renewable energies. Special attention will be paid to understand thermodynamical mechanisms to optimize selected storage technologies such as thermal storages in Compressed Air Energy Storage and thermal management of cell batteries.

Dr. Daniel Wolf,  
System Engineering, Heliocentris Energy Solutions AG



Dr. Wolf is researcher at Heliocentris Energy Solutions AG, a technology leader in the fields of distributed power solutions and energy efficiency services. Dr. Wolf conducted his PhD at the chair of thermodynamics of Ruhr-University Bochum. His research focus is on integration of renewable energy, particularly compressed air energy storage. As well the design of energy market mechanisms caught his attention.

Modules: Energy Storage and Conversion



In the second set of lectures and lab work, the students get familiar with basic concepts and experimental methods of Electrochemistry, Surface Catalysis, electrochemical energy conversion and storage, such as fuel cells, batteries, electrolyzes, photo electrochemical cells and others. The students will also be exposed to some additional concepts at the borderline of electrochemistry and catalysis and solid-state physics, surface science, materials science. Participants can independently research and analyze topics related to electrochemistry, catalysis, electrochemical energy storage and conversion and will be given an opportunity to present their literature research to the course in form of a short slide presentation.

**Prof. Dr. Peter Strasser,**  
Department of Chemistry, Technical University of Berlin



Prof. Peter Strasser is Head of The Electrochemical Catalysis, Energy, and Materials Science Laboratory at TU Berlin. Both his Master degree from Tübingen University and his PhD Fritz-Haber Institute of Max-Planck-Society, Berlin were obtained in Physical Chemistry. Moreover, he is a member of the excellence cluster UniCat. Together with colleagues from the US, Prof. Strasser was able to significantly reduce fuel cell costs which was published in “Nature Chemistry”.

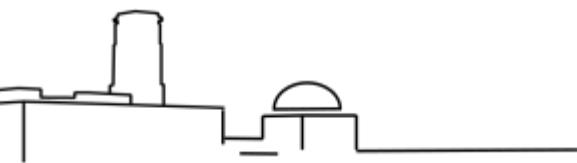
Modules: Energy Storage and Conversion

**Dr. Stefan Gall,**  
Institute of Silicon Photovoltaics, Helmholtz-Zentrum Berlin



Dr. Gall conducted his Ph.D. thesis at TU Berlin. Dr. Gall gained experience in Industry as Technology Director for Polycrystalline silicon thin-film solar modules at CSG Solar AG, Thalheim and as Development Engineer within the central research division of Infineon Technologies AG and Siemens AG, both based in Munich. Now Dr. Gall is the senior researcher at the Helmholtz-Zentrum Berlin at the Institute of Silicon Photovoltaics.

Modules: Photovoltaics





## Photovoltaics

The harvest of energy emitted by the sun and convert it to electrical energy in only one step is not only brilliant but also has the largest range of applications. Photovoltaics is available and economically feasible at any scale and the most attractive renewable energy technology for off-grid application particularly in the MENA region. The module Photovoltaics introduces the students to the true scope of semiconductor technologies.

This module starts with the physical fundamentals for understanding the concept of semiconductors and function of this technology, as well as the respective raw materials. In addition to the physical understanding of the solar cells, new techniques such as thin layer cells are also explained and characterized. This includes material supply, component design, component characterization and integrated circuits.

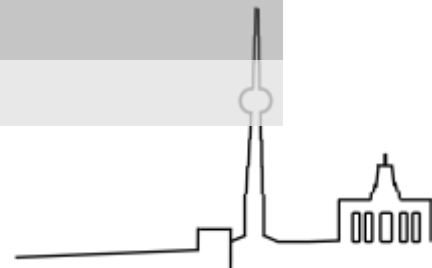
After successful completion, students should be able to work effectively in the development of solar cells, solar modules and systems. As part of the module, students are expected to acquire a basic understanding particularly in the following areas of photovoltaics (PV): Electrical and physical properties and relationships, radiation of the sun, interaction between radiation and PV materials, preparation and properties of PV materials, as well as PV components, characterization of PV materials and PV components. Standard concepts as well as special concepts will be discussed. The course combines the transmission of knowledge (lecture) with the theoretical (exercise) and practical (labratory) application.

Prof. Dr. Bernd Szyszka,  
Institute of High-Frequency and Semiconductor System Technologies,  
Technical University of Berlin



Prof. Bernd Szyszka is an expert in applied physics and electrical engineering in the field of thin film photovoltaics and oxide electronics. He received his PhD from TU Braunschweig. Meanwhile Prof. Szyszka built up the area "Large Area Coating" at the Fraunhofer IST. Moreover Prof. Szyszka is chair of smart materials in the Society of Vacuum Coaters of Vacuum.

Modules: Photovoltaics



## Fundamentals of Electrical Networks

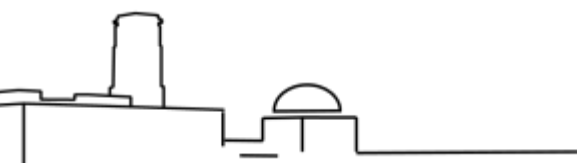
Nowadays the power network is facing a rapid transition, more and more highly fluctuating, non-dispatch-able, distributed and small capacity renewable energy generators, flexible loads and energy storage is introduced endangering the demand-supply-equilibrium essential to maintaining grid stability. For energy engineers it is of great essence to be aware of the complexity of electrical networks and their behavior.

In this module basic knowledge for operation of networks of electric power supply is taught to the students. This includes complex numbers, sources and load, nodal analysis, three-phase systems, load flow calculation, network control, modeling.

- Content taught within the module: Harmonic sizes: Representation of time functions by harmonic series, vector representation
- Load curves
- Switching processes in simple electrical networks: Switching on and off DC voltages, circuit with R, L and C
- Source and load: voltage and current sources, controlled source, replacement sources
- Analysis of network: mesh analysis, node potential method
- Multi-pole networks: n poles, n gates, scattering parameters
- Four poles (two goals): Two-port network equations, equivalent circuits, frequency response of two gates,
- Transfer functions, Bode diagrams, pole/zero maps

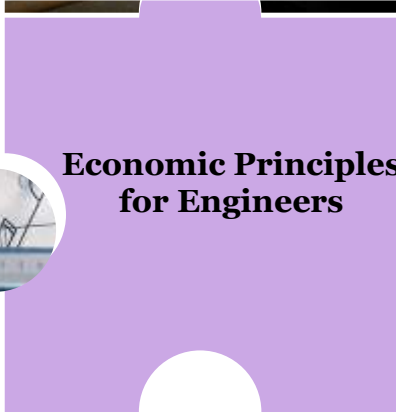


Lecture at TU Berlin Campus El Gouna, PV panel at test field behind the campus

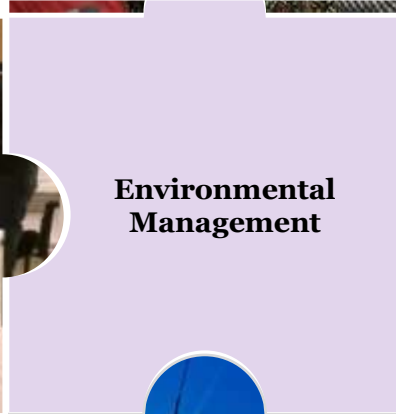




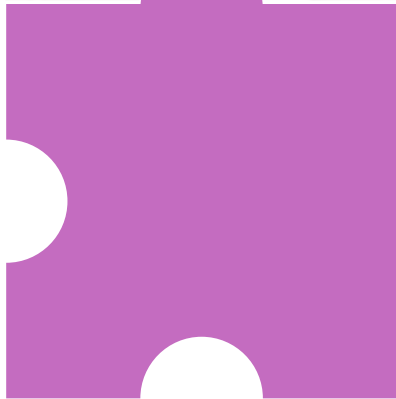
# Management Modules



**Economic Principles for Engineers**



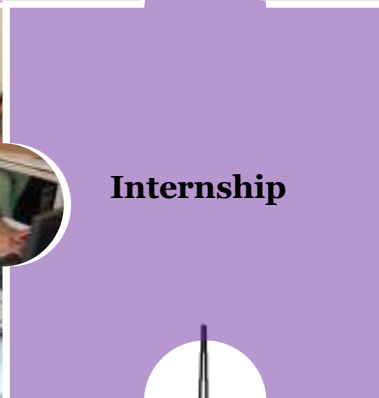
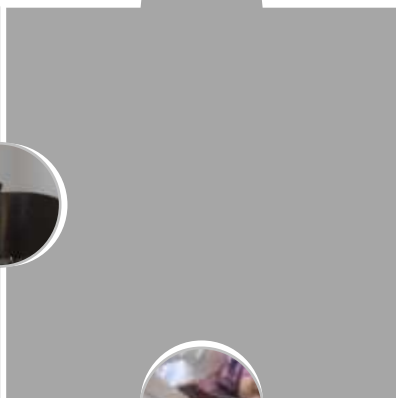
**Environmental Management**



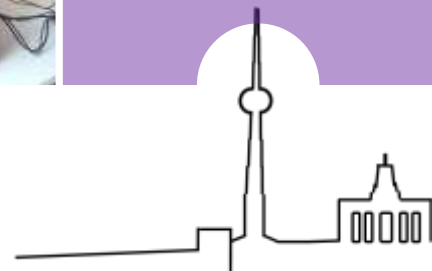
**International Contract and Competition Law**



**Innovation Management**



**Internship**



## Environmental Management

Any day-to-day action has environmental impact that needs to be measured and managed. Decent environmental management can be very beneficial, not only from a moral point of view to improve a business' image or reputation but rather decreases risks, brings about cost savings and enables meeting stakeholder expectations and ensures submission of related environmental regulations.<sup>1</sup>

Within this module the students shall gain applicable knowledge on the environmental policy instruments. The Environmental Management lecture further comprises instruments for environmental protection management with the focus on companies' environmental protection. Most of these tools is standardized in the ISO 14000 series. Besides, a short look is taken on environmental policy instruments directed to industry.

The core topics discussed in this class are:

1. Introduction to environmental protection and environmental management
2. Life Cycle Assessment and Footprints
3. Environmental costing, Life Cycle Costing
4. Environmental product development and labels
5. Environmental Management Systems and auditing
6. Environmental policy instruments

**Dr.-Ing. Elisabeth Strecker**

Department of sustainable Engineering, Technical University of Berlin

Energy Entrepreneurship in Developing Countries



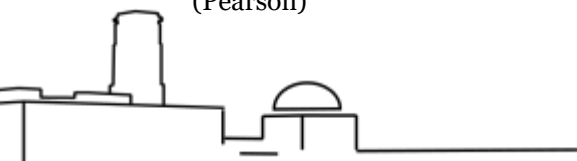
Dr. Strecker, born in 1955 in Rüdersdorf, she studied Food Technology in Berlin and gained experience as a manager in industry. Dr. Strecker completed her doctorate in 1988. She is the academic director of the course Environmental Management and Auditing and a lecturer at Hochschule für Technik und Wirtschaft Berlin. Dr. Strecker is an expert and consultant in companies to introduce environmental quality standards, integrating the management requirements and systems.

Energy Entrepreneurship in Developing Countries (EEDC) course aims at how entrepreneurship can create positive impacts and value for companies with clean energy technologies. The course is a learning process for students and lecturers. During the course, participants will have the opportunity to create their own draft of a supply based on adapted energy technologies.

Module: Environmental Management

The two core tracks, “Entrepreneurship” and “Energy in Developing Countries”, will be offered providing a mix of theoretically oriented presentation, guest speakers and hands-

<sup>1</sup> Environmental Management System  
Importance of Environmental Management  
(Pearson)





on opportunities in assessing the potential of a business idea and develop the start of an entrepreneurial venture.

### CORE LEARNING OUTCOMES

- Understand of connection between energy access and economic development
- Describe the energy ladder and the standard rural electrification approaches
- Assess whether an idea is a good opportunity for entrepreneurial initiatives in developing countries
- Learn from relevant examples of social entrepreneurs how to create value and develop innovative both technical solutions and business models
- Put the customers at the center of the business strategy by assessing their needs
- Learn how to draft a valid business model and a sound business strategy
- Build a successful team and cultivate ideas into a working plan for an entrepreneurial venture
- Develop idea pitches and answer questions
- Identify start-up funding sources

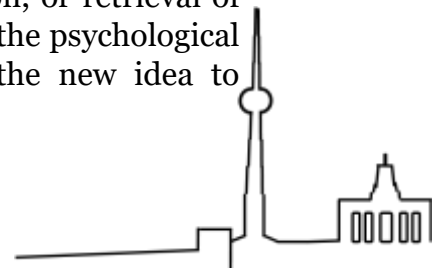


Modules: Energy Entrepreneurship in Developing Countries SS-2017

## Innovation Management

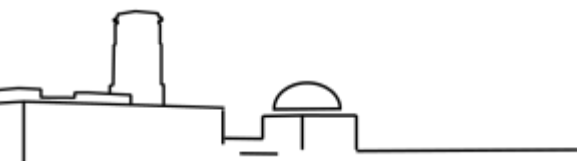
The course Innovation Management arms the student with powerful techniques of Modern TRIZ self-training and real problem solving.

Within this module the students shall gain applicable knowledge on the Innovation and Management. It is designed as a simple and efficient, step-by-step course in primary TRIZ models based on the professor's methods of extraction and reinvention, or retrieval of invention models from any real-life objects. Special content addresses the psychological support of the person during problem solving and promotion of the new idea to realization.



The core topics discussed in this class are:

1. Theory of Developing the creative Personality
2. Standard model presentation of the problem solving
3. Four step Meta-Algorithm of Invention



## Economic Principles for Engineers

For students coming from an engineering intensive backgrounds and no previous experience in economics, the basic economic principles are an asset in order to understand micro- and macroeconomics and business administration.

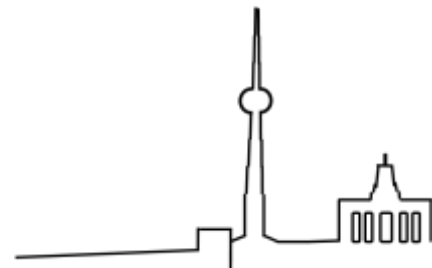
Within the module “Economic Principles for Engineers” the students shall learn a basic understanding of economic issues and contexts and become acquainted with the functioning of important economic institutions. Moreover, the procurement of literature and other sources of information for processing and classifying this information in scientific and practical contexts is a major learning outcome of the module.

The students will carry out independently simple investing and financing bills and gain an overview about selected key terms and concepts of business administration, micro- and macroeconomics by a contractarian introduction to the nature of business. Thereby the focus is on the acting contractor or its production, investment and financing decisions.

To work out decision criteria and the most important restrictions, and the understanding and application of professional knowledge by use of case studies are major learning goals of “Economic Principles for Engineers”.

Main content of the module:

1. Market/Supply & Demand
2. Business forms
3. Balances & profit and loss account
4. Production decisions  
(Polypol/Monopoly)
5. Investment decisions  
(static & dynamic processes)
6. Taxes
7. Financing
8. Risk and business valuation



## Project Energy Markets

It is important to understand that the electricity market is different from other markets, and the ways in which it is different, through learning the fundamentals of electricity economics. More advanced topics such as balancing power, electricity storage, and others should also be acquired by the students as renewable energy continues to expand. Learning the policy frameworks that shape decision-making in energy is vital, since the energy sector is heavily influenced by policy

The “Project Energy Markets” module consists of six main topics:

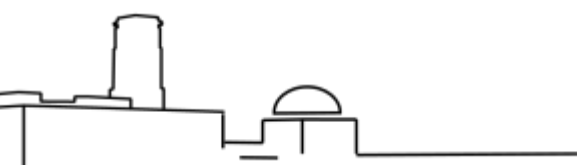
1. Fundamentals of electricity economics
2. Renewable-based power systems
3. Current topics in electricity economics
4. Energy policy:
5. Power market modeling (excel)
6. Power market modeling (GAMS)

Prof. Dr. Lion Hirth,  
Founder and Director of Neon GmbH



Prof. Lion Hirth is founder and director of Neon. He is an energy economist and expert in wind and solar power, power market modeling, and electricity market design. He advises clients in the private and in the public sector. Previously, Prof. Lion was working five years in Sweden at Vattenfall. He holds a Ph.D. in energy economics and has published a number of highly cited academic articles.

Modules: Project Energy Markets





## Project Market Coupling

What is market coupling? What is the economic benefit of coupling different markets? There are various ways to couple markets, such as price coupling, tight or loose volume coupling, or market splitting. Each method of coupling markets has its own advantages and disadvantages, but the main purpose is to allocate scarce border grid capacity in the most efficient way.

The focus of the module “Project Market Coupling” is to explain what does coupling of different markets mean, and the economic benefit of coupling different markets, such as electricity, heat, etc. The course also explains which technologies of market coupling are discussed presently, the advantages that market coupling can bring to Egypt, and power-to-X processes.

Furthermore, the course focuses on some modeling aspects, such as explaining what Python is and its advantages over GAMS, explaining what Github is used for, and why should we use OpenAccess. Detailed description of energy system models will also be provided. Finally, a power-to-fuel process in Egypt with transport to Germany will be modelled in Python. This includes modelling the cost of photovoltaics in Egypt with a detailed modelling in Python, modelling the hydrogen production costs, the transport infrastructure, etc., and the use of time series aggregation models.

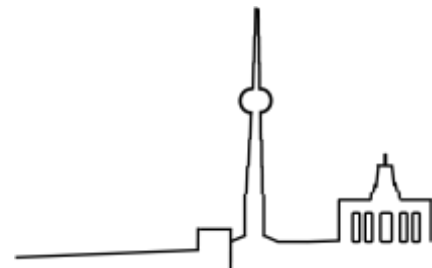
**Dr. Ing. Martin Robinius**

Head of Process and Systems Analysis, Forschungszentrum Jülich GmbH



Dr. Martin Robinius is the head of the Process and Systems Analysis Department at the Institute of Energy and Climate research. The department’s main research activities are power-to-gas, fuel cell cars and renewable energy sources. He wrote his PhD thesis at the RWTH Aachen, for which he won several awards. In this time, he also a visiting researcher at the National Renewable Energy Laboratory (USA). He began his career at the Fraunhofer Institute for Wind Energy and Energy System Technology.

Module: Project Market Coupling



## Economics of Grid Operators

One of the main challenges for the future power systems is to design an appropriate electricity market that facilitates both trading and the system integration of new technologies. In order to integrate a larger share of renewable energy sources (RES) into the system, as well as other developments such as smart grids and energy storage, the power system needs to be more flexible, which impacts the design of the electricity markets.

One of the focus points of this course is congestion management, which is the key to mitigate the anticipated network bottlenecks. These congestions in the transmission network occur due to high penetration levels of RES. RES also have a significant impact on the balancing of the system due to their fluctuating nature, which transmission system operators (TSOs) need to handle. Another focus of this course is balancing and ancillary services, which TSOs provide a trading platform for. Network codes define the requirements and guidelines for the different stakeholders participating in such platforms. When done correctly, this increases the efficiency of the market platforms and enables the integration of new technologies in the system, which enhances the system flexibility to host more RES.

A further important topic is interconnections and capacity calculation. Network operators will have to find ways of making more transmission capacity available. Introducing cross-border interconnections also presents future challenges for electricity markets. Therefore, developing processes to calculate cross-border transmission capacity is critical, such as coordinating regional assessments of net transfer capacity, and determining bilateral net transfer capacity. Finally, regulation of energy utilities will be discussed, which includes the regulation, design, implementation, and refinement of tariffs, as well as inter-TSO compensation mechanisms that could cover costs linked to cross-border flows

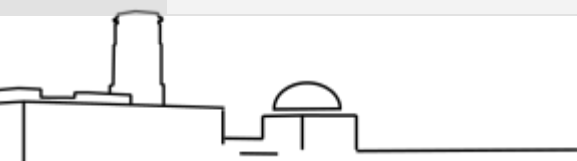
Dr. Tarek Fawzy

Expert Power System Operation and Security, Elia Grid International



Dr. Tarek Fawzy is an expert in power system operation and security at Elia Grid International GmbH Company (since 2015). He is responsible for contingency and load flow analysis, grid impact studies, static and dynamic stability studies, among others. Previously, he was a System Engineer at SMA Solar Technology AG for 7 years. He obtained his Ph.D. from Technische Universität Braunschweig in 2014, and published many papers related to photovoltaic plants.

Module: Economics of Grid Operators



## VI. What happens after the Masters? – Alumni Reports



Mohamed Magdeldin, Doctoral candidate at Aalto University, Finland

### **Mohamed Magdeldin, intake 2012**

Mohamed Magdeldin is currently in pursuit of his Ph.D, in Energy Technology at Aalto University School of Engineering after graduating from TUB El-Gouna campus in 2015.

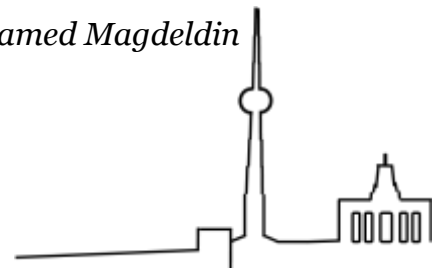
He joined the M.Sc. program earlier after obtaining a degree in Chemical Engineering from the University of Technology PETRONAS, Malaysia. During his enrollment and as a result of presenting a research paper on the development of Energy policy frameworks in Egypt, Mohamed received the best paper award at the 4th Desertec Energy Conference held in Rabat, Morocco in 2012.

As a partial fulfillment of the M.Sc. program, Mohamed joined Industrial Solar GmbH based in Freiburg, Germany for a two-month internship period. The scope of work involved working closely with the engineering team on the development of the company's solar direct steam generation pilot plant based on the Linear Fresnel technology.

Mohamed culminated the program with a Master thesis research titled: “The development of optimized conceptual plant designs for the supercritical water gasification of biomass process”. The thesis work was prepared and conducted at Aalto University in Finland, as part of the European mobility ERASMUS exchange program.

Mohamed's current doctoral research is a continuation to the thesis project he started at TUB El-Gouna. According to Mohamed, the Master program enabled his personal and technical aptitude with “the necessary skill set to pursuit a future career in the field of innovative energy technologies”. It also provided several opportunities to exchange knowledge and contribute within the global energy research community.

*Mohamed Magdeldin*





**FRENELL**



Karim Rizk, Business Development Manager at FRENELL GmbH,

### **Karim Rizk, intake 2012**

Karim Rizk is a former nuclear energy engineer from Alexandria with experience in project management and worked as research engineer at Bibliotheca Alexandria for a period of three years. Nowadays, Karim is employed by FRENELL GmbH a German company recently established resuming the work of the former company NOVATEC Solar GmbH that undertakes manufacture, supply and turnkey delivery of solar fields and thermal energy storage systems.

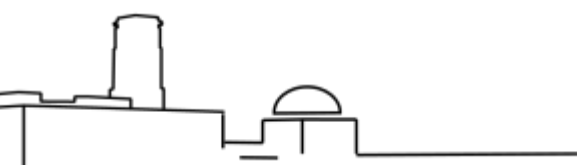
Karim was part of the first intake at Campus El Gouna, as a part of his master study in Energy Engineering Karim conducted his internship and his master thesis at NOVATEC in Karlsruhe, Germany. After performing market assessment on the MENA region and analyzing the integration of “Direct-Molten-Salt-Based Integrated Solar Combined Cycle for Egypt’s Power Generation Market in 2020” at NOVATEC. Karim was offered a position as Business Development Engineer. Karim is currently engaged heavily in the Egyptian power generation market believing that Concentrated Solar power is Egypt’s future.

According to Karim, the Energy Engineering master program was a major shift from being an observant of the Egyptian power sector crisis into an actor that contributes to the solution of the energy crisis. “This shift would have never been possible without being taught and supervised by the eminent professors of the modules Energy Engineering, Integration of renewable energies and Energy Economics.”, Karim stated.

Moreover, Karim shares the opinion, that TUB campus el gouna is a great example of interdisciplinary teaching in a multicultural environment, as “the topics you have out of class are unlimited and it opens the mind to new ideas and concepts from the four corners of the world”.

TUB Campus EL Gouna has a huge potential to be a leading Energy and water research institute, not only serving Egypt but the whole MENA region. Karim is always looking forward to support TUB campus el gouna to be one of the leading institutes in the MENA region.

*Karim Rizk*







Louay Hossam, Project Coordinator at Orascom Construction, Egypt

### Louay Hossam, intake 2012

Louay Hossam was one of the first students of Campus El Gouna, starting his Master's degree in 2012. With him being a Mechatronics undergraduate from Helwan University in Egypt, his present career in the energy sector is significantly determined by his performance in the campus' master program Energy Engineering.

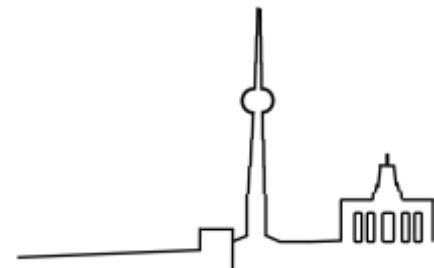
Apart from his Master thesis on “Exergy-based methods applied to Egyptian Concentrated Solar Power Plants” winning the best paper award, he was one of the students travelling to Morocco presenting the project output from the module - Integration of Renewable Energies - at the 4<sup>th</sup> Dii Desert Energy Conference 2013.

Since 2015, Louay is working as Project Coordinator at Orascom construction (OC) Ltd one of the biggest Egyptian companies with convincing regional presence.<sup>2</sup> Being in the lead as global engineering and construction contractor predominantly concentrating on commercial and industrial infrastructure projects, Orascom construction took on two of the three planned 4.8 GW gas fired Combined-Cycle Power Plants.<sup>3</sup> Though his recent graduation, Louay was handed the responsibility to coordinate the construction of the largest power plant in the MENA region, ensuring a trouble-free cooperation of multiple large international companies.

Louay signified the Energy Engineering program at TU Berlin Campus El Gouna as “unique” and is proud to have graduated from “one of the most reputable technical universities worldwide”. The switch to the self-managerially dominated German education system he commended as a broad intellectual experience enhancing his personal endurance. In future he would like to continue to encourage scientific and commercial cooperation between Germany and Egypt, in addition to proceeding with his PhD studies.

<sup>2</sup><http://www.dailynewsegypt.com/2015/03/28>

<sup>3</sup> <http://www.orascom.com/>



*Louay Hossam*



Mohamed Nabil, Energy Engineer at toughTrough GmbH, Germany

### **Mohamed Nabil, intake 2013**

Mohamed Nabil graduated in 2011 from Helwan University with a bachelor's degree in Energy Engineering. At the beginning of the summer term of 2015 Nabil went from being a Master's student of the Energy Engineering program at TU Berlin Campus El Gouna to a part time energy engineer at toughTrough GmbH, a global acting solar company.

ToughTrough is a German enterprise, specialized in innovative light-weight solar application.<sup>4</sup> Nabil not only had the chance to do his Master's thesis with toughTrough but was also sent to Thailand to coordinate and supervise one of the company's CSP projects.

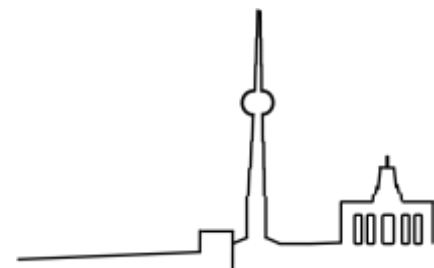
According to Nabil's narration the Energy Engineering program was a main contributor to his personal success story. Apart from the program being the motivation for him heading to Germany and learning the German language in the first place he especially complimented the push towards independent work and critical thinking in addition to the content taught. Moreover, he appreciated the focus on most critical challenges in the energy sector covering state of the art technologies for conventional and renewable energy sources.

Nabil made clear, that El Gouna's - life as it should be - atmosphere is not as relaxing as it seems: "You will always be chased by deadlines, but the studying atmosphere is real fun." Moreover, he stated: "Although the campus is located in Egypt, you will always get the feeling that you are in one of the building extensions from Berlin. Starting from the great German professors (...)"

All in all, the hard work was worth it and the energy engineering is very proud that Mohamed Nabil made it in the harshly competitive CSP business.

*Mohamed Nabil*

<sup>4</sup> <http://www.toughtrough.com/>

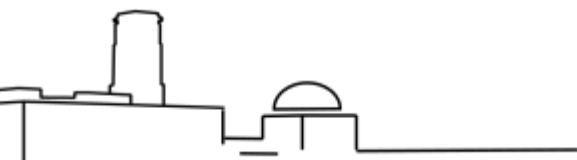


## VII. What's in it for me? – Leisure

There is no denying the fact, that the Master programs at TU Berlin Campus El Gouna are very intense in means of time and place. Students travel almost every six months back and forth between El Gouna and Berlin with hardly any break. Yet this brings along as much as it costs, despite the limited spare time, in the touristic town El Gouna on the coast of the red sea, the few free time students spend with yoga, soccer turnements, basketball, kyte surfing, beach volleyball,

social gatherings and much more. It is hard not to find pleasure in a touristic town entitled: "live as it should be".

Attracting five million visitors yearly, Berlin is the to go to city in Europe. Specially in the recent years the German capital experienced a wave of artists, designers and media professionals. Berlin is a very diverse and alive city with unique charm and an outstanding status for cultural vitality.



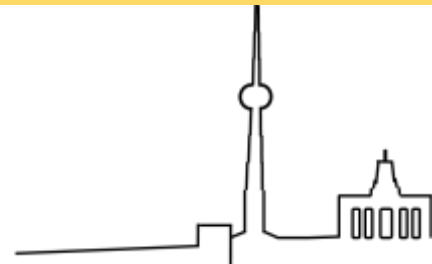


Apart from their private activities, students are provided with very diverse exposure. Tu Berlin Campus El Gouna strives to provide a number of excursions and cultural activity in both Egypt and Germany. The annual visit of the Hannover Messe, the most significant industrial fair worldwide, became a tradition within the energy department.

Moreover, visits to different power plants such as: Reuter-West power plant, Oil fired power plant Hurgada, Wind Farm and PV power plants in Germany and Egypt. Cultural activities are for instance visits of local museums, the freshers-day safari, visit of the German Reichstag, German and Arabic courses.



Field trip to PV power plant in Germany, excursion to Wind park in Hurgada, visit of the German Parliament, daytrip to the Hannover Messe.



## VIII. Frequently Asked Questions & Answers

### **Where can I find information about the. program?**

Please visit the Business Engineering Energy. program website at:

[http://www.campus-elgouna.tu-berlin.de/energy/v\\_menu/msc\\_business\\_engineering/](http://www.campus-elgouna.tu-berlin.de/energy/v_menu/msc_business_engineering/)

### **What are the application requirements?**

Please refer to the Business Engineering Energy Admissions web page at:

[http://www.campus-elgouna.tu-berlin.de/energy/v\\_menu/msc\\_business\\_engineering/admission\\_process/](http://www.campus-elgouna.tu-berlin.de/energy/v_menu/msc_business_engineering/admission_process/)

### **When does the application become available?**

Applications for the program MSc. Business Engineering Energy becomes available in early October.

### **What are the application deadlines?**

Applications, including all supporting documents, are due in early February, end-May, and end-August.

### **Can I still apply after the deadline?**

Application deadlines are strictly enforced. Applications and supporting documentation must be received by the appropriate deadline. Supporting documentation received after the deadline may not be considered.

### **What is the application fee?**

There is NO application fee.

### **What is the duration of this program?**

The duration of the program is for 2 years.

### **What is the start date for this program?**

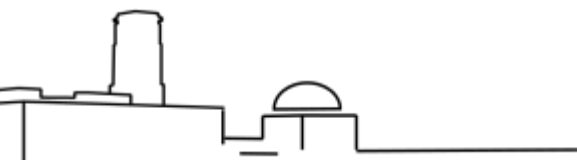
The start date of the program is early October.

### **What is the end date for this program?**

The end date for the program is end-October.

### **In what language is this program taught?**

The program is purely taught in English.



### **How much does this program cost?**

Please refer to the website at:

[http://www.campus-elgouna.tu-berlin.de/v\\_menu/admission\\_process/expenses\\_and\\_tuition\\_fees/](http://www.campus-elgouna.tu-berlin.de/v_menu/admission_process/expenses_and_tuition_fees/)

### **Are there any scholarships for the students?**

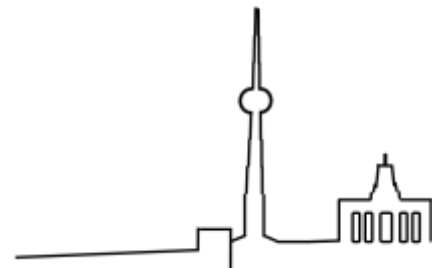
You can find the details of the scholarships at:

[https://www.campus-elgouna.tu-berlin.de/v\\_menu/admission\\_process/scholarships/](https://www.campus-elgouna.tu-berlin.de/v_menu/admission_process/scholarships/)

### **Where is the campus located?**

Full details about the campus can be found at:

[http://www.campus-elgouna.tu-berlin.de/v\\_menu/about\\_us/location/](http://www.campus-elgouna.tu-berlin.de/v_menu/about_us/location/)



## IX. Application and Admission

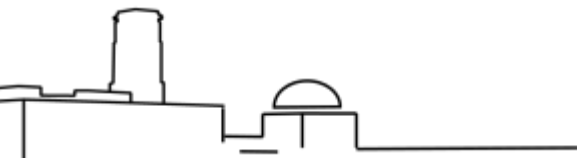
### Application for the master program

Application requirements are listed on our website at:

[http://www.campus-elgouna.tu-berlin.de/energy/v\\_menu/msc\\_business\\_engineering/admission\\_process/](http://www.campus-elgouna.tu-berlin.de/energy/v_menu/msc_business_engineering/admission_process/)

If you have any questions please contact us at:

[apply-mbe@campus-elgouna.tu-berlin.de](mailto:apply-mbe@campus-elgouna.tu-berlin.de)







And be part of TU Berlin Campus El Gounas community

