

Module Descriptions
for the postgraduate and further education programme MBA Renewables

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Module number	M01
Module title	Renewable Energy and Energy Efficiency Systems and Concepts
ECTS credits	10 ECTS credits
Workload and its composition	250 h (200 h self-study; 50 h contact time)
Module aims, trained competencies	This module enhances understanding of renewable energy technologies, system design and applications and gives an overview of energy efficiency concepts. It enables students to appreciate the performance of technologies and sharpens ability to communicate effectively and knowledgeably with relevant stakeholders.
Prerequisites	None
Level	First semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, virtual working group, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Project thesis (40 h); online exam (1.5 h)
Determination of the module grade	2/3 project thesis; 1/3 online exam
Applicability of module for other modules and study programmes	If desired, the modules E01, E03 or E04 could be taken after this module. Applicable for the module "Renewable Energies and Energy Efficiency Systems and Concepts" in the Master's programme Energie- und Ressourceneffizienz.
Content	<ul style="list-style-type: none"> • Energy, electricity, CO₂ emissions • Technology, components, systems sizing, applications for photovoltaics, solar thermal, wind energy, biomass, biogas, biofuels, geothermal heat pumps and hydropower • Energy efficiency in industry and commerce • Energy efficiency in the built environment
Recommended literature	<ul style="list-style-type: none"> • Godfrey Boyle, "Renewable Energy", Oxford University Press, 3rd edition 2012 • William H. Kemp, "The Renewable Energy Handbook", Aztext Press 2009 • Volker Quaschnig, "Understanding Renewable Energy Systems", Earthscan Publications Ltd 2005 • Barney L. Capehart, "Guide to Energy Management", 6th edition, Fairmont Press 2011 Additional references and study literature communicated at beginning of the module.
Comments	3/4 renewable energy; 1/4 energy efficiency

Module number	M02
Module title	Energy Policy and Economic Framework
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	This module provides an overview of the key issues within energy policy, including drivers of the energy market, market structures and concepts, international climate policies, main actors, interests and instruments. Knowledge is relevant for an RE business to become an important part of the global energy supply chain. The second subject of the module is political frameworks for the market introduction of renewable energy technologies. Knowledge about support mechanisms is essential in order to understand how markets for renewable technologies function and so to calculate projects accordingly.
Prerequisites	None
Level	First semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Written assignment (20 h); exam under supervision (1.5 h)
Calculation of module grade	1/3 written assignment; 2/3 exam under supervision
Applicability of module for other modules and study programmes	This module is followed by the module M04. Applicable for the modules “Energy Market, Economic Framework and Policy” in the Master’s programme “Energie- und Ressourceneffizienz and “Legal Framework Conditions and Economics” in the Master’s programme Energy and Resource Efficiency International.
Content	<ul style="list-style-type: none"> • Future challenges of global energy supply • Drivers for energy policy • Energy sectors and related fields • International organisations • International climate policy • Support mechanisms for renewable electricity and heat and energy efficiency in buildings
Recommended literature	<ul style="list-style-type: none"> • Carol A. Dahl, “International Energy Markets: understanding pricing, policies and politics”, PennWell Corporation 2004 • Karl Mallon, "Renewable Energy Policy and Politics – A handbook for decision makers“, Earthscan 2006 • Miguel Mendonca et al., “Powering the Green Economy – The feed-in tariff handbook”, Earthscan 2009 • Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH: “Energy- policy Framework Conditions for Electricity Markets and Renewable Energies, 23 Country Analyses”, Eschborn, September 2007 • Brenda Shaffer, “Energy Politics”, University of Pennsylvania Press 2009 <p>Additional references and study literature communicated at beginning of module.</p>

Module number	M03
Module title	Accounting
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	This module familiarises students with the concepts, processes, principles and the system of accounting. Participants learn to apply the basic concepts of cost accounting and management accounting and are able to use accounting techniques for decision making, planning and control in RE and EE ventures and projects.
Prerequisites	None
Level	First semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, virtual working group, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Written assignment (40 h); online group presentation (1 h)
Calculation of module grade	1/3 written assignment; 2/3 online group presentation
Applicability of module for other modules and study programmes	This module is followed by the module M05.
Content	<ul style="list-style-type: none"> • Fundamentals of financial accounting (incl. overview of P&L and balance sheet) and managerial accounting, accounting cycle • Sustainability accounting, environmental (cost) accounting • Specific product costing issues for RE and EE projects • Project cost accounting with specific issues in RE and EE projects
Recommended literature	<ul style="list-style-type: none"> • Drury, C., "Cost and Management Accounting – An introduction", 7th edition, Andover 2011 • Horngren, C. T.; Harrison, W. T.; Oliver, M. S., "Financial & Managerial Accounting", 2nd edition, Upper Saddle River 2009 • Romney, M. B.; Steinbart, P. J., "Accounting Information Systems", 11th edition, Upper Saddle River 2009 • Weetman, P., "Financial & Management Accounting", 5th edition, Upper Saddle River 2011 <p>Additional references and study literature communicated at beginning of module.</p>

Module number	M04
Module title	International Business Law
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Renewable energy companies are very often “global players” facing the challenge to handle foreign legal systems. This module fosters the understanding of how to determine the legal system applicable for business in other countries, the sources of international law and their underlying principles. It creates a basis to decide upon corporate structures and introduces international regulations for the exchange of goods and services (GATT, CISG). The module will be completed by relevant contracts for the development, construction and operation of renewable energy plants, their specifications and requirements.
Prerequisites	None
Level	Second semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h); online exam (1.5 h)
Calculation/determination of module grade	1/2 written assignment; 1/2 online exam
Applicability of module for other modules and study programmes	This module is preceded by module M02 and is followed by M09.
Content	<p>International Business Law</p> <ul style="list-style-type: none"> European business law, The World Trade Organisation (WTO, General Agreement on Tariffs and Trade (GATT), UN sales law, United Nations Convention on Contracts for the International Sale of Goods (CISG), corporate law, international property and investment law, law of trademarks <p>Relevant contracts for renewable energy projects</p> <ul style="list-style-type: none"> Law of contracts – parties, offer & assumption, definition of subject matter and content, maintenance of compulsory legal provisions and formalities, legal enforceability and other aspects Specific contracts common in renewable energy projects – wind, photovoltaics, biogas; parties and their interests, content, possible conflicts and risks
Recommended literature	<ul style="list-style-type: none"> DiMatteo, L.; Dhooge, L., “International Business Law: A Transactional Approach” 3d ed., Routledge 2017 Keizer, J.; Wevers, H., “A Basic Guide to International Business Law”, Groningen/Houten, Wolters-Noordhoff, 1st edition 2005 Schaffer, R.; Filiberto, A.; Dhooge, L., Earle, B., “International Business Law and Its Environment”, Kentucky, South Western Cengage Learning, 9th edition 2014

Module number	M05
Module title	Investment and Financing
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	This module familiarises students with the concepts and basic principles of corporate investment and financing. Participants learn to apply the basic concepts of corporate finance and corporate investment and are able to use this knowledge for financing and investment decisions in RE and EE ventures and projects.
Prerequisites	None
Level	Second semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, virtual working group, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h); online group presentation (1 h)
Calculation of module grade	1/3 written assignment; 2/3 online group presentation
Applicability of module for other modules and study programmes	This module is preceded by module M03. Applicable for the module "Investment and Financing" in the Master's programme Energie- und Ressourceneffizienz and "Investment Appraisal" in the Master's programme Energy and Resource Efficiency International.
Content	<ul style="list-style-type: none"> Principles of corporate finance Project financing with special focus on RE and EE financing schemes Investment appraisal (techniques), business cases Role of RE and EE support schemes for project finance and RE and EE investment attractiveness
Recommended literature	<ul style="list-style-type: none"> Brealey, Richard; Myers, Stewart; Marcus, Alan, "Fundamentals of Corporate Finance", 12th edition, 2016 Gatti, Stefano, "Project Finance in Theory and Practice", 2nd edition, 2012 KfW Entwicklungsbank (KfW Development Bank) - Energy and Policy Division, "Financing renewable energy. Instruments, strategies, practice approaches", 2005 Kaltschmitt, M.; Wiese, A.; Streicher, W., "Renewable Energy: technological foundations, economical and environmental aspects", Berlin 2007 Short, W.; Packey, D.; Holt, T., "A manual for the economic evaluation of energy efficiency and renewable energy", Golden 1995 Additional references and study literature communicated at beginning of module.

Module number	M06
Module title	Project Management
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	The main character of project driven work is the view of a defined time line with an end. At the beginning of a project, every stakeholder has to know that the project has an end. For many people, working in this structure is a challenge. This module helps to find structures within projects and gives a brief view on methods and techniques to manage projects, but also shows risks and chances to be part of a changing environment.
Prerequisites	None
Level	Third semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, virtual working group, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Written assignment (20 h); online group presentation (1 h)
Calculation of module grade	2/3 written assignment; 1/3 online group presentation
Applicability of module for other modules and study programmes	This module is followed by module M10. Applicable for the module "Project Management" in the Master's programmes Energie- und Ressourceneffizienz.
Content	<ul style="list-style-type: none"> • Positioning of projects in organizations • Project objective and goal • Project structures • Stakeholder management • Scheduling • Cost management/earned value method • Multi project management • Standards in project management • Maturity models
Recommended literature	PMI, "A Guide to the Project Management Body of Knowledge", 5 th edition, Newtown Square, Pennsylvania, USA 2013 Additional references and study literature communicated at beginning of module.

Module number	M07
Module title	Marketing Analysis and Instruments
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	After completing the module, students will be able to develop a marketing concept: definition of specific marketing goals on the basis of the market analysis; formulation of strategies in order to reach the defined goals; and finally development of marketing-mix-instruments to realize the strategy.
Prerequisites	None
Level	Third semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Written assignment (20 h); exam under supervision (1.5 h)
Calculation of module grade	1/3 Written Assignment; 2/3 exam under supervision
Applicability of module for other modules and study programmes	This module is followed by module M11.
Content	This module provides an understanding of marketing and the decision making processes of potential customers in the market of Renewable Energies. Students will be introduced to various techniques that help to analyze the market in order to get a good understanding of needs and wants of customers, the activities as well as the potential of competitors, and finally the resources and capabilities of their own company. These tools help to develop a competitive advantage in the specific market and to address the defined customer segments in the market effectively.
Recommended literature	<ul style="list-style-type: none"> • Kotler, Philip; Keller, Kevin Lane, "Marketing Management", 13th edition, Prentice Hall International 2008 • Seiler, Armin, "Marketing: BWL in der Praxis IV", Orell Fuessli 2006 (German) • Wilson, Richard; Gilligan, Colin, "Strategic Marketing Management: Planning, Implementation and Control", Oxford 2005 Additional references and study literature communicated at beginning of module.

Module number	M08
Module title	HR and People Management
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students learn the central elements of human resource management and understand its central instruments and methods, such as performance management processes, interviews, assessment centres and communication. They gain the competence to conduct and lead communication processes as well as to mitigate or solve conflicts in an intercultural organisational set-up. They have the ability to analyze organisational personnel structures and processes as well as to assess, evaluate and select qualified staff. They are able to conduct objectives-based review discussions for performance management. Furthermore, they learn how to distinguish between management and leadership, and which leadership styles must be used to successfully lead through the change curve.
Prerequisites	None
Level	Third semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every fall semester
Duration of the module	6 months/October to March
Methods and duration of examination	Peer review assignment (20 h); online exam (1.5 h)
Calculation of module grade	1/3 peer review assignment; 2/3 online exam
Applicability of module for other modules and study programmes	This module is preceded by module M04 and is followed by M10.
Content	<ul style="list-style-type: none"> • Central elements of human resource management • Analysis of organisational structures • Communication, feedback, conflict solving, negotiation skills • Recruitment process and different methods of recruiting • Leading performance management • New forms of communication (virtual communication and cooperation) • Intercultural communication and diversity management • Training Needs Assessment (TNA) and capacity building • Leadership styles, change management, coaching
Recommended literature	<ul style="list-style-type: none"> • Scarpello, Vida G., "The Handbook of Human Resource Management Education: Promoting an Effective and Efficient Curriculum", Sage Publications Inc., Thousand Oaks, California 2008 • Bohlander, Scott Snell, "Managing Human Resources", South-Western Cengage Learning 2009 • Perkins, P. S., "The Art and Science of Communication. Tools for Effective Communication in the Workplace", John Wiley & Sons Inc., New Jersey 2008

Module number	M09
Module title	International Management
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students acquire an in-depth knowledge of international management concepts and methods and become familiar with the specific challenges of international business operations. Students can then apply management concepts and techniques to their multinational environments.
Prerequisites	None
Level	Fourth semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h); exam under supervision (1.5 h)
Calculation of module grade	1/3 written assignment; 2/3 exam under supervision
Applicability of module for other modules and study programmes	This module is preceded by module M07 and M09.
Content	<ul style="list-style-type: none"> • International management and the multinational enterprise • Legal, political and economic environment of international operations – globalization • Strategic challenges of multinational management • Internationalization strategies/options • Organising international operations • Performance management in multinational companies • Managing diversity in global operations contexts, the cultural dimension of international business
Recommended literature	<ul style="list-style-type: none"> • Luthans, Fred; Doh, Jonathan P., “International Management: Culture, Strategy and Behavior”, 9th edition, New York, 2014 • Duelfer, Eberhard; Joestingmeier, Bernd, “International Management in Diverse Cultural Areas”, 2nd edition Oldenbourg, München, 2011 • Deresky, Helen, “International Management: Managing Across Borders and Cultures, Text and Cases”, 9th edition, London, 2016 • Sweeney, Paul D.; McFarlin, Dean B., “International Management: Strategic Opportunities and Cultural Challenges”, 5th edition, New York, London, 2015

Module number	M10
Module title	Integrated Business Plan Development
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students learn the importance of business plans and to understand the conceptual approach to the elaboration of a business plan. They learn how to apply central accounting principles and methods to elaborate a business plan. They gain the ability to analyse Business Cases (BCA) and the competence to develop a well-structured business plan. Additionally, students attain the know-how to present a plan to potential investors.
Prerequisites	None
Level	Fourth semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, virtual working group, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (40 h); online group presentation (1 h)
Calculation of module grade	1/3 written assignment; 2/3 online group presentation
Applicability of module for other modules and study programmes	This module is preceded by module M08. Applicable for the module "Business Plan and Contracts" in the Master's programme Energy and Resource Efficiency International.
Content	<ul style="list-style-type: none"> • The central elements and structure of a business plan • Business Case Analysis (BCA), resource allocation • Common planning questions • Assessment of framework conditions, market survey, competitors analysis • Systematical approach on the elaboration of business plans • Software support for the elaboration of business plans • Investor relations • Business plans adaptation • Business plans in practice – presentation of business plans to investors • Business plan examples and case studies
Recommended literature	<ul style="list-style-type: none"> • Learner, J.; Hardyman; Leamon, A., "Venture capital and private equity: A casebook", 5th edition, Wiley 2012 • Pinson, L.; J. Jinnett, "Anatomy of a business plan: A step-by-step guide to starting smart, building the business, and securing your company's future", (Paperback) 7th edition 2008 • Stevenson, H. H.; Roberts, M. J.; Sahlmann, W., "New business ventures and the entrepreneur", 6th edition, McGraw Hill Book 2006 • Swanson, James A.; Baird Michael L., "Engineering your start-up: A guide for the high-tech entrepreneur" 2nd edition, Professional Publications, Inc. 2003

Module number	M11
Module title	Advanced Research Methods
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students learn how to formulate research proposals and questions. They learn about characteristics of important research methods. They gain practical competencies in the design and structure of a Master's thesis and they are able to write a research proposal including research background, significance, methods, references, expected results and a focused literature review.
Prerequisites	None
Level	Fourth semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Compulsory
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Project thesis (40 h)
Calculation of module grade	1/1 Project thesis
Applicability of module for other modules and study programmes	This module is followed by module M13.1 and M13.2. Applicable for the module "Advanced Research Methods" in the Master's programme Energy and Resource Efficiency International.
Content	<ul style="list-style-type: none"> • Introduction to the theory of research • Screening of relevant information and sources • Research frameworks • Formulation of research proposals • Qualitative and quantitative research methods • Application of statistical methods • Verification/falsification of research questions • Phases of research work • Subsuming of research results • Research ethics • Design of a Master's thesis • International citation standards (APA, Harvard,...) • Applying international standards using Microsoft Word
Recommended literature	<ul style="list-style-type: none"> • APA, "Publication manual of the American Psychological Association", American Psychological Association (APA) 6th edition 2009 • Booth, W. C.; Colomb, G. G.; Williams, J. M., "The craft of research", The University of Chicago Press, 3rd edition 2008 • Gloede, D., "The design of Bachelor's and Master's theses", Reports from Department I – Beuth University of Applied Sciences Berlin 2012 • Saunders, M.; Lewis, P.; Thornhill, A., "Research methods for business students" Pearson, 6th edition 2012 • Sekaran, U.; Bougie, R., "Research methods for business: A skill-building

	<p>approach”, Wiley 2013</p> <ul style="list-style-type: none"> • Sreejesh, S.; Mohapatra, S.; Anusree, M. R., “Business research methods. An applied orientation”, Springer International Publishing 2014 • Swales, J. M.; Feak, C. B., “Academic writing for graduate students: Essential tasks and skills”, The University of Michigan Press, 3rd edition 2012 • Additional references and study literature communicated at beginning of module.
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Module number	M12.1
Module title	Master’s Thesis
ECTS credits	15 ECTS credits
Workload and its composition	375 h (325 h self-study; 50 h contact time)
Module aims, trained competencies	Students apply the knowledge gained during the course of studies to a practical problem. Under supervision and guidance of a field expert and/or an academic expert the student works independently on the selected topic respecting scientific standards. Master’s colloquium: information about the structure and design of a Master’s thesis.
Prerequisites	Minimum 65 ECTS credits completed
Level	Fifth semester
Teaching and learning methods	Independent scientific work under individual guidance. Online Master’s colloquium.
Form of module	Compulsory
Frequency of module offer	Every semester
Duration of the module	5 months
Methods and duration of examination	Written Master’s thesis (5 months)
Calculation of module grade	Grading of Master’s thesis by examination commission
Applicability of module for other modules and study programmes	-
Content	Content depends on the topic of the Master’s thesis. Topic must relate to one of the modules and should focus on the practical application of theoretical knowledge to a specific project or venture.
Recommended literature	Depends on the topic of the Master’s thesis.

Module number	M12.2
Module title	Oral Final Examination
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students present the method and the result of the Master's thesis in a scientific discourse. He/she critically reflects the approach selected and links their own results to other research areas, plus illustrates the implications for business practice.
Prerequisites	Master's thesis completed successfully and in particular §30 RSPO 2016.
Level	Fifth semester
Teaching and learning methods	Independent scientific work under individual guidance.
Form of module	Compulsory
Frequency of module offer	Every semester
Duration of the module	2 hours
Methods and duration of examination	Oral examination (2 h)
Calculation of module grade	Assessment of oral examination by examination commission.
Applicability of module for other modules and study programmes	-
Content	Presentation of the essential result of the Master's thesis for a maximum of 15 minutes. Discussion and Q&A session about the students' theoretical background and the practical relevance of the thesis with the examination commission.
Recommended literature	Depends on the topic of the Master's thesis.
Comments	Attendance in Berlin, Germany is compulsory.

Elective Modules

Module number	E01
Module title	Advanced Practical Renewable Energy and Energy Efficiency Implementation
ECTS credits	5 ECTS credits
Workload and its composition	125 h (45 h self-study; 80 h contact time)
Module aims, trained competencies	<p>This elective module combines theory with practicals and site visits during the 2-week on-campus followed by a module assignment to be submitted in August which students complete in groups. International networking with students and companies to build up individual networks is also included.</p> <p>After completing this module students are expected to be able to:</p> <ul style="list-style-type: none"> • Assess the appropriateness of various renewable energy technologies and their use for different requirements • Appraise renewable energy projects taking into account the availability of natural, technical and financial resources • Design a renewable energy system with different renewable energy technologies • Evaluate the economic feasibility of renewable energy projects and energy efficiency measures by taking into consideration varying technical and economic conditions
Prerequisites	Successful completion of M01 RE and EE Systems and Concepts
Level	Second semester
Teaching and learning methods	2-weeks full-time attendance in Berlin, Germany (theory, practice, field trips). Online distance learning (forums, chat and messaging, virtual working group, self-study)
Form of module	Elective
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Exam under supervision (1.5 h) and module assignment (45h)
Calculation of module grade	1/3 exam under supervision; 2/3 module assignment
Applicability of module for other modules and study programmes	This module is preceded by module M01.
Content	<ul style="list-style-type: none"> • Practical hands-on exercises for photovoltaic grid-connected and off-grid, solar thermal, wind energy and energy efficiency • Field trips to wind power plants, biogas plants, energy efficient buildings, energy efficient applications in industry and commerce, photovoltaic and solar thermal installations • Group work to perform in-depth investigation of technical and aspects of renewable energy projects
Recommended	<ul style="list-style-type: none"> • M01 RE and EE Systems and Concepts

<p>literature</p>	<ul style="list-style-type: none"> • RENAC materials handed out during the seminar • Godfrey Boyle, 'Renewable Energy', Oxford University Press • Volker Quaschnig, 'Understanding Renewable Energy Systems', Earthscan Publications Ltd
<p>Comments</p>	<p>Separate registration process, information at the beginning of study. Costs covered by study fee:</p> <ul style="list-style-type: none"> • Seminar fees • Seminar materials • Lunch and coffee breaks on seminar days • Letter of invitation for travel visa will be provided <p>All additional costs must be covered by participants (travel and accommodation, food, weekend activities, personal expenditures, visa fees, etc.).</p>

Module number	E02
Module title	Quality and Supply Chain Management
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	Students gain a critical understanding of the fundamental building blocks of supply chain management and develop the necessary capabilities in modelling, analysing, diagnosing and redesigning/improving supply chains. Students gain a thorough understanding of quality management based on DIN EN ISO 9001 and are familiar with quality assurance tools, such as QFD, FMEA, and SPC.
Prerequisites	None
Level	Second semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Elective
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h) and online exam (1.5 h)
Calculation of module grade	1/3 written assignment; 2/3 online exam
Applicability of module for other modules and study programmes	-
Content	The QM module provides knowledge about the norm (mainly ISO9001:2008), about quality techniques and methods (e.g. FMEA, SPC) while making students familiar with the philosophy of quality management on a pragmatic and customer oriented basis. This module considers the operation of a supply chain and information technology from a managerial perspective. Students will be taught to appreciate the need to balance between responsiveness and efficiency in the four major components of the chain: inventory, transportation, facilities and information, which will be introduced to the students through suitable mathematical and behavioural models. This module provides business students with an understanding of the strategic role of information systems and technology in business organisations: frameworks (e.g. strategic grid, strategic thrusts, customer resource life cycle) for analysing the strategic impact of information technology and the internet on organisational and industry structures are introduced; information systems that support or shape an organisation's competitive strategy are discussed.
Recommended literature	<ul style="list-style-type: none"> • Rushton, A.; Croucher, P.; Baker, P., "Handbook of Logistics and Distribution Management", London/Philadelphia/New Delhi 4th edition 2010 • Boversox, D.; Closs, D.; Brixby Cooper, M., "Supply Chain Logistics Management", New York, 3rd edition 2010 • Langley, C.; Cole, J.; Gibson, B.; Novack, R.; Bardi, E., "Managing Supply Chains – A Logistics Approach", 8th edition 2008

Module number	E03
Module title	Advanced Renewable Energy Technologies
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	<p>This module provides a deeper technical insight in five of the renewable energy technologies (photovoltaics, solar thermal, CSP, wind energy, biomass) that were introduced briefly in module 1.</p> <p>After completing the module, students will be able to:</p> <ul style="list-style-type: none"> understand in detail the technological principles governing solar energy, wind and biomass; be able to assess the suitability for each of the technologies for different applications depending upon the requirements; and get an insight on design and dimensioning principles for large-scale implementation of renewable energy systems.
Prerequisites	Successful completion of M01 RE and EE Systems and Concepts recommended.
Level	Second and fourth semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Elective
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h); online exam (1.5 h)
Calculation/determination of module grade	1/3 written assignment; 2/3 online exam
Applicability of module for other modules and study programmes	This module is preceded by module M01. Applicable for the module “Advanced Renewable Energy Technologies” in the Master’s programme Energie- und Ressourceneffizienz.
Content	<ul style="list-style-type: none"> • Photovoltaics: components, yield analysis and optimization, engineering and construction of grid-connected and stand-alone PV plants, commissioning, monitoring and operation • CSP: the solar field – different CSP technologies, boiler and water-steam cycle, steam turbine and balance of plant system, engineering, construction and optimization aspects • Solar thermal: components, working principles, system design and dimensioning, systems configuration for different applications, maintenance, optimization, monitoring, economic aspects, basics of solar process heat • Wind energy: wind resource measurement, wind farm planning onshore and offshore, repowering

	<ul style="list-style-type: none"> • Biogas: substrates, engineering, operation and maintenance, sustainability aspects • Excursus on <u>grid integration of renewables</u>
<p>Recommended literature</p>	<ul style="list-style-type: none"> • Overview: Martin Kaltschmitt, Andreas Wiese and Wolfgang Streicher, "Renewable Energy: Technological Foundations, Economical and Environmental Aspects", Springer Berlin 2010 • Photovoltaics: Deutsche Gesellschaft für Sonnenenergie, "Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers", Earthscan Publications 2008 • CSP: http://www.solarpaces.org • Solar Thermal: Chris Laughton, "Solar Domestic Water Heating", Earthscan Expert Series 2010 • Wind: The European Wind Energy Association, "Wind Energy – The Facts – A guide to the technology, economics and future of wind power", Earthscan Publications 2009 • http://www.ewea.org/library/ • Biogas: Deutsche Gesellschaft für Sonnenenergie, "Planning and Installing Bioenergy Systems: A Guide for Installers, Architects and Engineers", Earthscan Publications 2006 • Internet sources: Irena Agency: http://www.irena.org/Publications/index.aspx?mnu=cat&PriMenuID=36&CatID=141 • NREL: www.nrel.gov • DENA: https://www.dena.de/en/home/ <p>Additional references and study literature communicated at beginning of module.</p>

Module number	E04
Module title	Energy Management and Energy Efficiency
ECTS credits	5 ECTS credits
Workload and its composition	125 h (100 h self-study; 25 h contact time)
Module aims, trained competencies	This module deepens knowledge on different energy efficiency approaches, potentials, technologies, economics and legal aspects, and highlights the role of different stakeholders. It enhances know-how on project management and energy management and explains relevant aspects based on case studies and operation models for energy efficiency measures.
Prerequisites	Successful completion of M01 RE and EE Systems and Concepts recommended.
Level	Second and fourth semester
Teaching and learning methods	Online distance learning (online lectures, forums, chat and messaging, self-study, exercises, video podcasts)
Form of module	Elective
Frequency of module offer	Every spring semester
Duration of the module	6 months/April to September
Methods and duration of examination	Written assignment (20 h); online examination (1.5 h)
Calculation of module grade	1/3 written assignment; 2/3 online examination
Applicability of module for other modules and study programmes	This module is preceded by module M01.
Content	Energy Efficiency in Industry and Commerce – potentials, methods and instruments, stakeholders, laws, standards, codes, financing, operation models, case studies, energy efficient heating and cooling, ventilation, compressed air, electrical motors, organisational measure; energy management (ISO 50001); energy audits and energy monitoring
Recommended literature	<ul style="list-style-type: none"> • Kreith, Goswami (Editors), “Handbook of energy efficiency and renewable energies” CRC Press 1st edition 2007 • EC DG Joint Research Centre, “Integrated pollution prevention and control: Reference document on best available techniques for energy efficiency” 2055 • Barney L. Capehart, “Guide to energy management”, Fairmont Press 6th edition 2011 • Donald R. Wulfinghoff, “Energy efficiency manual: for everyone who uses energy, pays for utilities, designs and builds, is interested in energy conservation and the environment”, Energy Institute Press 2000 • Zoran Morvaj; Dušan Gvozdenac, “Applied industrial energy and environmental management, Wiley-IEEE Press 2008 (e-book) • Thomas D. Eastop; D. R. Croft, “Energy efficiency: for engineers and technologists”, Longman Scientific & Technical 1990 • Keith Moss, “Energy management in buildings”, Taylor & Francis Group, 2nd edition 2005 • Frank Kreith (Editor); D. Yogi Goswami (Editor), “Handbook of energy

	<p>efficiency and renewable energy”, Taylor & Francis Group 2007 (e-book)</p> <ul style="list-style-type: none">• Wayne C. Turner; Steve Doty, “Energy management handbook”, Fairmont Press 2007 (e-book) <p>Additional references and study literature communicated at beginning of module.</p>
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