

# I. Rechts- und Verwaltungsvorschriften

## Fakultäten

**Studien- und Prüfungsordnung für den internationalen weiterbildenden Masterstudiengang IT for Energy (ITE) am Zentralinstitut El Gouna der Technischen Universität Berlin**

**vom 27. Januar 2016**

Der Institutsrat des Zentralinstituts El Gouna der Technischen Universität Berlin hat am 27.1.2016 gemäß § 18 Abs. 1 Nr. 1 der Grundordnung der Technischen Universität Berlin, § 71 Abs. 1 Nr. 1 des Gesetzes über die Hochschulen im Land Berlin (Berliner Hochschulgesetz – BerlHG) in der Fassung vom 26. Juli 2011 (GVBl. S. 378), die folgende Studien- und Prüfungsordnung des internationalen weiterbildenden Masterstudiengangs IT for Energy (ITE) beschlossen.\*)

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## I. Allgemeiner Teil

### § 1 – Geltungsbereich

Diese Studien- und Prüfungsordnung regelt die Ziele und die Ausgestaltung des Studiums sowie die Anforderungen und Durchführung der Prüfungen im internationalen weiterbildenden Masterstudiengang IT for Energy (ITE). Sie ergänzt die Ordnung zur Regelung des allgemeinen Studien- und Prüfungsverfahrens der Technischen Universität Berlin (AllgStuPO) um studiengangspezifische Bestimmungen.

### § 2 – Inkrafttreten

Diese Ordnung tritt am Tag nach ihrer Veröffentlichung im Amtlichen Mitteilungsblatt der Technischen Universität Berlin in Kraft.

\*) Bestätigt von der Senatsverwaltung für Bildung, Jugend und Wissenschaft am 12.10.2016

## II. Ziele und Ausgestaltung des Studiums

### § 3 – Qualifikationsziele, Inhalte und berufliche Tätigkeitsfelder

(1) Die Absolventen und Absolventinnen kennen die praktischen und wissenschaftlichen Prinzipien der Implementierung der Informationstechnologien im Energiesektor. Sie sind gut vertraut mit den Grundsätzen der Verteilung der Primär- und Sekundärenergieträger und des effizienten Einsatzes der Endprodukte. Die Absolventinnen und Absolventen sind in der Lage, Organisations- und Managementprinzipien anzuwenden, zur Entwicklung der Informationstechnologie-Infrastruktur des Energiesektors sowie Anwendung dafür zu formulieren und Optimierungsaufgaben des Energiesektors durch Anwendungen verschiedener Methoden mathematischer Optimierung sowohl für gesamte Anlagen (Kraftwerke) als auch für Einzelkomponenten zu lösen. Die Absolventen und Absolventinnen werden detaillierte Kenntnisse der Informations- und Prozess-Modellierung als auch über heterogene verteilte Informationssysteme erlernt haben. Besondere Beachtung wird dabei auf die Vor- und Aufbereitung der Daten gelegt, die in den Bereichen Energietechnik und Energieökonomie erhoben werden können. Sie werden befähigt statische (strukturell) und dynamische (Prozesse und Verhalten) Modellierungsansätze für diese Klasse von Informationssystemen zu integrieren. Einsatz und Veränderung fortgeschrittener Modellierungsmethoden, und deren Anwendung zur modellbasierten Integration von Software und Daten sind Teil dieser Qualifikationsziele. Schließlich ist es das Ziel, dass die Absolventinnen und Absolventen selbständig und unabhängig Aufgaben im Bereich des Einsatzes der Informationstechnologien im Energiesektor und dessen Untersektoren analysieren und zielgerichtet bearbeiten und lösen können.

(2) Wichtige Inhalte sind die Feststellung informationstechnischer Probleme und Aufgaben des Energiesektors, fachgerechte Auswertung, Beurteilung und Bewertung dieser Aufgaben und die Entwicklung von Lösungsstrategien mit anschließender Optimierung. Zur Erfüllung dieses Ziels werden verschiedene energie-technische Aspekte (Energieressourcen, Versorgung/Nachfrage, Energieträger als auch Energieerzeugungssysteme und energieintensive Abnehmer) mit modernen Analysemethoden, Evaluation und die Prinzipien der Entwicklung und des Betriebs detailliert behandelt. Nach dem Modellieren von Energie-umwandlungsanlagen und der damit einhergehenden Datenvorbereitung und Kenntnis des Entwurfs und Betriebs erlernen die Studierenden den innovativen Einsatz der Optimierung für diese Systeme. Datenabstraktion und Modularisierung, objektorientierte Informationsmodellierung in Verbindung verschiedener Modellierungsparadigmen, Informationsverknüpfung und Geschäftsprozessmodellierung werden dafür auf den Energiesektor angewandt. Ein weiterer Schwerpunkt liegt auf der Implementierung der Informationstechnologien zur Organisation, Verwaltung und zum Ausbau der Infrastruktur und die Optimierung des Energiesektors.

Dazu werden sowohl verschiedene Methoden der mathematischen Modellierung thermodynamischer und physikalischer Systemcharakteristika, technischer Restriktionen, optimaler Parameterwahl für thermische Größen, Speicherung, Integration erneuerbarer Ressourcen als auch Optimierungsmethoden inkl. linearer und nicht-linearer Programmierung, konvexe (ganzzahlige) Optimierung und evolutionäre Algorithmen eingesetzt. Zur Erreichung dieser und anderer Querschnittsziele (z.B. interkulturelle und interdisziplinäre Kompetenz) arbeiten die Studierenden häufig in Kleingruppen zusammen. Die Selbstorganisation von Projektteams wird im Projekt trainiert. Selbstorganisation von Projektteams, Erwerb und Präsentation aktuellen Fachwissens werden während der Projektarbeit weiterentwickelt. Die selbständige Vorbereitung, Planung und Realisierung eines Forschungsprojekts erlernen die Studierenden bei der Erstellung der Masterarbeit.

(3) Für Absolventinnen und Absolventen des internationalen weiterbildenden Masterstudiengangs IT for Energy (ITE) gilt insbesondere:

- Sie können Wissen verschiedener Fachgebiete miteinander verbinden, wissenschaftlich fundierte Entscheidungen treffen und deren mögliche Folgen abschätzen. Dazu gehört auch die schnelle Reaktion auf sich ändernde Bedingungen und die flexible Entscheidungsanpassung.
- Sie kennen die einzelnen Schritte der Projektoptimierung und die Versorgungskette Kraftwerk-Stromnetz-Verbraucher und beherrschen die Methoden zur Beherrschung dieser Supply Chain.
- Sie können frühzeitig umweltfreundliche Potentiale für Energie- und Kostenersparnisse aufdecken und diese durch geeignete Maßnahmen in Prozesse integrieren.
- Sie sind in der Lage Datenbankmodelle zu entwerfen, können deren Stärken und Schwächen beurteilen und sind somit in der Lage energietechnische Systems methodisch zu optimieren.
- Sie können Konzepte zum wirtschaftlichen Anlagenbetrieb entwickeln.
- Sie können energietechnische Prozesse als Ganzes erfassen und Optimierungspotentiale herausarbeiten.
- Sie können ihre kulturelle und nationale Identität erweitern und einen Einblick in Geschichte und Eigenheiten verschiedener Kulturen erlangen.

#### § 4 – Studienbeginn, Regelstudienzeit und Studienumfang

- (1) Das Studium beginnt in der Regel im Wintersemester.
- (2) Die Regelstudienzeit einschließlich der Anfertigung der Masterarbeit umfasst vier Semester.
- (3) Der Studienumfang des Masterstudiengangs beträgt 120 Leistungspunkte.
- (4) Das Lehrprogramm sowie das gesamte Prüfungsverfahren sind so gestaltet und organisiert, dass das Studium innerhalb der Regelstudienzeit absolviert werden kann.

#### § 5 – Gliederung des Studiums

(1) Die Studierenden haben das Recht, ihren Studienablauf individuell zu gestalten. Sie sind jedoch verpflichtet, die Vorgaben dieser Studien- und Prüfungsordnung einzuhalten. Die Abfolge der Module wird durch den exemplarischen Studienverlaufsplan als Anlage 2 dieser Ordnung empfohlen. Davon unbenommen sind Zwänge, die sich aus der Definition fachlicher Zulassungsvoraussetzungen für Module ergeben.

(2) Es sind Leistungen im Gesamtvolumen von 120 Leistungspunkten zu absolvieren; davon 90 LP in Modulen und 30 LP in der Masterarbeit.

Alle Module sind in 4 Modulgruppen zusammengefasst:

- Interdisziplinäre Kompetenz (6 LP)
- Energy Engineering & IT (30 LP)
- Wahlpflicht IT, Economics, Law (18 - 24 LP)
- Wahlpflicht Engineering (30 - 36 LP)

(3) Der Pflichtbereich hat einen Umfang von 36 LP und gliedert sich in folgende Bereiche: Interdisziplinäre Kompetenz (6 LP) und Energy Engineering & IT (30 LP). Die den Bereichen jeweils zugeordneten Module sind der Modulliste zu entnehmen (Anlage 1).

(4) Im Wahlpflichtbereich sind Module in einem Umfang von 54 LP zu absolvieren. Der Wahlpflichtbereich gliedert sich in folgende Bereiche: Wahlpflicht Engineering (30 – 36 LP) und Wahlpflicht IT, Economics, Law (18 – 24 LP). Durch die Wahlmöglichkeiten, die die Modulgruppen bieten, können die Studierenden weitere berufsqualifizierende Fähigkeiten erwerben und ihr eigenes Profil erarbeiten.

(5) Es kann ein Fachpraktikum (Internship) im Umfang von 6 LP in einem der Wahlpflichtbereiche absolviert werden. Näheres regeln die Vorschriften und Richtlinien für das Praktikum des internationalen weiterbildenden Masterstudiengangs IT for Energy.

### III. Anforderung und Durchführung der Prüfungen

#### § 6 – Zweck der Masterprüfung

Durch die Masterprüfung wird festgestellt, ob ein Kandidat oder eine Kandidatin die Qualifikationsziele gemäß § 3 dieser Ordnung erreicht hat.

#### § 7 – Mastergrad

Aufgrund der bestandenen Masterprüfung verleiht die Technische Universität Berlin durch das Zentralinstitut El Gouna den akademischen Grad „Master of Science“ (M.Sc.).

#### § 8 – Umfang der Masterprüfung

(1) Die Masterprüfung besteht aus den in der Modulliste aufgeführten und in der Gesamtnote gewichteten Modulprüfungen (Anlage 1) und der Masterarbeit gemäß § 9.

(2) Die Gesamtnote wird nach den Grundsätzen in § 47 AllgStuPO aus den in der Modulliste als benotet und in die Gesamtnote eingehend gekennzeichneten Modulprüfungen gebildet. Werden das Fachpraktikum und/oder eines oder beide Module mit Gewichtung 0 aus dem Wahlpflichtbereich nicht gewählt, so wird bei der Bildung der Gesamtnote die entsprechende Anzahl (1-3) der am schlechtesten abgeschlossenen Module aus dem Wahlpflichtbereich bei der Bildung der Gesamtnote nicht berücksichtigt. Bei Rangleichheit bleibt jeweils das später abgelegte Modul unberücksichtigt.

#### § 9 – Masterarbeit

(1) Die Masterarbeit wird i. d. R. im vierten Fachsemester angefertigt. Sie hat einen Umfang von 30 LP. Die Abgabe der Masterarbeit hat spätestens sechs Monate nach Ausgabe des Themas zu erfolgen. Liegt ein wichtiger Grund vor, den der oder die Studierende nicht zu vertreten hat, kann der Prüfungsausschuss nach Rücksprache mit der Betreuerin oder dem Betreuer eine Fristverlängerung bis zu einem Monat, im Krankheitsfall bis zu drei Monaten gewähren.

(2) Das Thema der Masterarbeit kann einmal zurückgegeben werden, jedoch nur innerhalb des ersten Monats nach der Aushändigung durch die zuständige Stelle.

(3) Die Verfahren zum Antrag auf Zulassung zu sowie zur Bewertung der Abschlussarbeiten sind in der jeweils geltenden Fassung der AllgStuPO geregelt.

(4) In der beruflichen Praxis und Ausbildung erfahrene Personen können zu Prüferinnen oder Prüfern in Abschlussarbeiten bestellt werden. Das gilt lediglich für die Erstellung des Zweitgutachtens.

#### **§ 10 – Prüfungsformen und Prüfungsanmeldung**

Prüfungsformen sowie das Verfahren zur Anmeldung zu den Modulprüfungen ist in der jeweils geltenden Fassung der AllgStuPO geregelt.

## Anlage 1: Modulliste

Modul	LP	Prüfungsform	Benotung	Gewichtung in Gesamtnote
<b>Pflichtmodule Interdisziplinäre und – kulturelle Kompetenz</b>	<b>6</b>			
Project Management and Intercultural Communication	6	Schriftlich, 90 min	nein	0
<b>Pflichtmodule Energy Engineering and IT</b>	<b>30</b>			
Energy Engineering I	6	Portfolio	ja	1
Energy Systems Optimization Project	12	Portfolio	ja	0
Information Technologies for Energy	6	Portfolio	ja	1
Advanced Information Modelling	6	Portfolio	ja	1
<b>Wahlpflichtmodule Engineering</b>	<b>30-36</b>			
Introduction to Energy Engineering	6	Schriftlich, 90 min	ja	0
Energy Engineering II	6	Portfolio	ja	1
Refrigeration and Air Conditioning	6	Portfolio	ja	1
Integration of Renewable Energies	6	Portfolio	ja	1
Conversion Technologies for Renewable Energies	6	Schriftlich, 90 min	ja	1
Components of Energy Conversion Systems	6	Schriftlich, 90 min	ja	1
Energy for Buildings	6	Schriftlich, 90 min	ja	1
Energy Storage	6	Schriftlich, 90 min	ja	1
Photovoltaics	6	Schriftlich, 90 min	ja	1
<b>Wahlpflichtmodule IT, Economics, Law</b>	<b>18-24</b>			
Economic Principles for Engineers	6	Schriftlich, 90 min	ja	0
Environmental Management	6	Schriftlich, 90 min	ja	1
Fundamentals of Electrical Networks	6	Schriftlich, 90 min	ja	1
Heterogeneous and Distributed Information Systems	6	Portfolio	ja	1
International Contract and Competition Law	6	Schriftlich, 90 min	ja	1
Energy Economics I	6	Mündlich, 30 min	ja	1
Energy Economics II	6	Mündlich, 30 min	ja	1

Anlage 2: Exemplarischer Studienverlaufsplan mit Angabe der Leistungspunkte pro Semester

Studienbeginn Wintersemester

Semester →	1 (El Gouna)	2 (Berlin)	3 (El Gouna)	4 (themenabhängig)
1	Intercultural Communication & Project Management	Information Technologies for Energy	Energy Systems Optimization	Masterarbeit
2				
3				
4				
5				
6				
7	Energy Engineering 1	Advanced Information Modelling	Wahlpflicht Engineering 5	
8				
9				
10				
11				
12				
13	Wahlpflicht Engineering 1	Wahlpflicht Engineering 3	Wahlpflicht Engineering 6	
14				
15				
16				
17				
18				
19	Wahlpflicht Engineering 2	Wahlpflicht Engineering 4	Internship	
20				
21				
22				
23				
24				
25	Wahlpflicht IT, Economics, Law 1	Wahlpflicht IT, Economics, Law 2	Wahlpflicht IT, Economics, Law 3	
26				
27				
28				
29				
30				
LP ↑	30	30	30	30

Legende:

Gesamt LP	120
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Pflicht Interdisziplinäre & kulturelle Kompetenz	6
Pflicht Energy Engineering & IT	30
Wahlpflicht Engineering	30 - 36
Wahlpflicht IT, Economics, Law	18 - 24
Fachpraktikum (Internship)	0 - 6
Masterarbeit	30

Anlage 3: Modulbeschreibungen

<b>Titel des Moduls:</b> <i>Energy Engineering I</i>	<b>LP (nach ECTS):</b> 6	<b>Kurzbezeichnung:</b> <i>EEI</i>
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. - Ing. Georgios Tsatsaronis</i>	<b>Sekr.:</b> <i>KTI</i>	<b>Email:</b> <i>tsatsaronis@iet.tu-berlin.de</i>
<b>Module description, Stand 27.05.2015</b>		
<b>1. Learning Outcomes</b>		
The students should		
<ul style="list-style-type: none"> <li>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,</li> <li>be able to optimize energy supply systems by ensuring a good compromise among efficiency, cost of product(s) and environmental impact,</li> <li>be able to identify the inefficiencies of energy conversion systems and develop options for improvements,</li> <li>process creativity to optimise energy-conversion systems,</li> <li>have skills in preparing data and information for the design of such systems.</li> </ul>		
The module conveys: 20% Knowledge & Comprehension, 20% Analysis & Method, 20% Inventor & Design, 20 % Research & Evaluation, 20 % Application & Practice		
<b>2. Content</b>		
<ul style="list-style-type: none"> <li>energy resources, supply, and prices of energy carriers</li> <li>thermodynamic analysis</li> <li>energy conversion equipment</li> <li>exergy analysis</li> <li>economic analysis</li> <li>fundamentals of combustion</li> <li>steam power plants</li> <li>gas turbines and gas-turbine based processes</li> </ul>		
<b>3. Modul components</b>		
Module title	Module type	SWS
Energy Engineering I	IV	4
		Credits (ECTS)
		6
		Semester (WS / SS)
		WS
<b>4. Description of Teaching Methods</b>		
Contents are presented in lectures illustrated by exercises and case studies.		
<b>5. Entrance requirements</b>		
Preferable: good knowledge of thermodynamics and process technology, heat transfer and fluid dynamics		
<b>6. Applicability</b>		
Compulsory for MSc IT for Energy		

<b>7. Workload and credit points</b>
Lecture and case studies: 60 hours
preparation and homework: 60 hours
literature reading and preparation of case study 30 hours
preparation for the examination 30 hours
Total: <b>180 hours: 30 = 6 CP</b>
<b>8. Examination and grading of the module</b>
Examination as so called „Portfolioprüfung“: 30% - home work, 70% - written examination.
<b>9. Duration of module</b>
The module can be completed within one semester.
<b>10. Number of Participants</b>
Max. 30 Participants
<b>11. Enrolment procedure</b>
None
<b>12. References, scripts</b>
Printed script in English is available.
<b>Literature:</b>
A. Bejan, G. Tsatsaronis and M. Moran, <i>Thermal Design and Optimization</i> , Wiley, 1996.
<b>13. Miscellaneous</b>
The module is conducted on campus in El Gouna, Egypt

<b>Titel des Moduls :</b> <i>Advanced Information Modeling</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>AIM</i>
<b>Verantwortlicher für das Modul:</b> <i>Dr. Ralf-Detlef Kutsche</i>	<b>Sekr.:</b> <i>EN 7</i>	<b>Email:</b> <i>ralf-detlef.kutsche@tu-berlin.de</i>
<b>Module description, Stand 27.05.2015</b>		
<b>1. Qualifikationsziele</b>		
<p>This module offers an advanced course in "Information Modeling" and "Modeling Methodology".</p> <p>Participants will achieve detailed competences in modeling as well classical databases and information systems as well as highly heterogeneous distributed information systems. They will be enabled to integrate static (structure) and dynamic (processes and behavior) modeling approaches for these classes of information systems.</p> <p>The competence of critically choosing (or even developing) an appropriate set of modeling techniques and the modeling methodology for complex information modeling tasks by understanding the foundations of modeling languages (semantics and metamodeling approaches) is the main qualification objective. Participants are enabled to use and modify advanced modeling constructs, applying (meta-)modeling methodology to model-based integration of software and data components.</p> <p>The course is principally designed to impart:</p> <p>Technical skills 40%, Method skills 50%, System skills 5%, Social skills 5%</p>		

<b>4. Beschreibung der Lehrformen</b>	2 h/week Lecture + 2 h/week Guided Practical Exercises (modeling tasks, to be worked out collaboratively); home exercises; written exam at the end of the term.
<b>5. Voraussetzungen für die Teilnahme</b>	The basic knowledge in "Computer Science" is required.
<b>6. Verwendbarkeit</b>	Compulsory for MSc IT for Energy
<b>7. Arbeitsaufwand und Leistungspunkte</b>	Lecture (VL): 15 * 2 h = 30 h Preparation and consolidation of lectures: 15 * 2 h = 30 h Tutorials and labs (UE): 15 * 2 h = 30 h Preparation and consolidation of Tutorials and labs (UE): 15 * 2 h = 30 h Homework: 60 h Preparation and consolidation, preparation for the exam: 30 h <b>Summe: 180h = 6 LP</b>

<b>8. Prüfung und Benotung des Moduls</b>	Examination as so called „Portfolioprüfung“: 30% - home work (working in small groups), 70% - written examination.
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<b>9. Dauer des Moduls</b>	The module can be completed within one semester.
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<b>10. Teilnehmer(innen)zahl</b>	Max. 30 Teilnehmer
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<b>11. Anmeldeformalitäten</b>	
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<b>12. Literaturhinweise, Skripte</b>	Script: only soft copy available. <b>Literatur:</b> G. Booch, J. Rumbaugh, I. Jacobson: The Unified Modeling Language User Guide. Addison-Wesley, 1999 Resource Description Framework RDF, and RDF Schema, v1.0, 2004 Extensible Markup Language XML 1.0 (5th ed, Nov 2008) Meta Object Facility (MOF) Core Spec., v2.0, 2006 Standards of the W3C: Unified Modeling Language (UML) Spec. (Infrastructure & Superstructure), v2.1.2., 2007.
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<b>13. Sonstiges</b>	The module is conducted in TU Berlin, Germany
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<b>2. Inhalte</b>	<ul style="list-style-type: none"> <li>Abstraction and Modularization in Information, Software and Business Process Modeling</li> <li>Object-oriented Information Modeling</li> <li>Models and Modeling Languages for Semi-structured Data</li> <li>Metamodels / MOF-Hierarchy</li> <li>Semantics of Modeling Languages</li> <li>Combining Different Modeling Paradigms (Modeling) Language Extensions via Metamodels and/or Math. Formalisms</li> <li>Connecting Information and Business Process Modeling</li> <li>Model Management, e.g. Model Transformation, Model Integration (matching/merging/...)</li> <li>Business Applications of Model-Based Software &amp; Data Integration</li> </ul>
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<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Advanced Information Modeling	VL	2	3	SS
Advanced Information Modeling	UE	2	3	SS

<b>Titel des Moduls :</b> <i>Economic Principles for Engineers</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>EPE</i>															
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Georg Erdmann</i>	<b>Sekr.:</b> <i>TA08</i>	<b>Email:</b> <i>georg.erdmann@tu-berlin.de</i>															
<b>Module description. Stand 27.05.2015</b>																	
<p><b>1. Qualification goals</b></p> <p>The students shall:</p> <ul style="list-style-type: none"> <li>• show a basic understanding of economic issues and contexts,</li> <li>• know the functioning of important economic institutions,</li> <li>• procure literature and other sources of information for their work and classify this information in scientific and practical contexts,</li> <li>• carry out independently simple investing and financing bills,</li> <li>• have an overview about selected key terms and concepts of business administration, micro- and macroeconomics by an contractarian introduction to the nature of business (here, the focus is on the acting contractor or its production, investment and financing decisions)</li> <li>• work out decision criteria and the most important restrictions,</li> <li>• understand and apply the professional knowledge by use of case studies</li> </ul> <p>The module imparts predominantly the following competence: 40% knowledge &amp; understanding, 40% Analysis &amp; methodology, 20% research &amp; evaluation</p>																	
<p><b>2. Content</b></p> <ul style="list-style-type: none"> <li>• Market/Supply &amp; Demand</li> <li>• Business forms</li> <li>• Balances &amp; profit and loss account</li> <li>• Production decisions (Polypol/Monopol)</li> <li>• Investment decisions (static &amp; dynamic processes)</li> <li>• Taxes</li> <li>• Financing</li> <li>• Risk and business valuation</li> </ul>																	
<p><b>3. Modul components</b></p> <table border="1"> <thead> <tr> <th>Module title</th> <th>Module type</th> <th>SWS</th> <th>Credits (ECTS)</th> <th>Semester (WS / SS)</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>LEC</td> <td>2</td> <td>3</td> <td>WS</td> </tr> <tr> <td>Exercises</td> <td>EX</td> <td>2</td> <td>3</td> <td>WS</td> </tr> </tbody> </table>			Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)	Lecture	LEC	2	3	WS	Exercises	EX	2	3	WS
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)													
Lecture	LEC	2	3	WS													
Exercises	EX	2	3	WS													
<p><b>4. Description of teaching methods</b></p>																	
<p><b>5. Requirements for participation</b></p>																	

<b>6. Applicability</b>
Compulsory MSc IT for Energy
<b>7. Effort and credits</b>
Attendance lectures/exercises: 15 weeks * 4h = 60h
Lecture preparation and post-processing: 15 weeks * 4h = 60h
Preparation of examination: = 60h
<b>Sum</b> = <b>180h : 30=6 ECTS</b>
<b>8. Examination and Grading</b>
Written examination, 90 min
<b>9. Module duration</b>
The module can be completed in one semester
<b>10. Number of participants</b>
30 Students
<b>11. Enrollment</b>
<b>12. Bibliography, Scripts</b>
<b>Literature:</b>
E. F. Brigham, F. Eugene (1995) Fundamentals OF Financial Management (7. Auflage), Chicago: Dryden Press
K. Spremann (1996) Wirtschaft, Investition und Finanzierung (5. Auflage), München: Oldenbourg
E. Fischer (1996) Finanzwirtschaft für Anfänger (2. Auflage) München: Oldenbourg
S. Peters (1994) Betriebswirtschaftslehre (6. Auflage), München: Oldenbourg, Lehrbuchs.: 5 LD 649
<b>13. Others</b>
The module is carried out in El Gouna, Egypt

<b>Titel des Moduls:</b> <i>Energy Engineering II</i>	<b>LP (nach ECTS):</b> 6	<b>Kurzbezeichnung:</b> <i>EE2</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. - Ing. Georgios Tsatsaronis</i>	<b>Sekr.:</b> <i>KTI</i>	<b>E-Mail:</b> <i>tsatsaronis@iet.tu-berlin.de</i>		
<b>Module description, Stand 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
<p>The students should</p> <ul style="list-style-type: none"> <li>• have a wide knowledge about modern methods of analysis and evaluation of thermal systems and principles from the operation and design of the most commonly used energy conversion devices as well as skills in engineering economics,</li> <li>• be able to optimize an energy supply system by ensuring a good compromise among efficiency, cost of product(s) and environmental impact,</li> <li>• be able to identify the sources of inefficiencies and costs in energy conversion systems and develop options for improvements,</li> <li>• possess creativity to optimise energy-conversion systems,</li> <li>• have skills in preparing data and information for the design of such systems.</li> </ul> <p>The module conveys:</p> <p>20% Knowledge &amp; Comprehension, 20% Analysis &amp; Method, 20% Inventor &amp; Design, 20 % Research &amp; Evaluation, 20 % Application &amp; Practice</p>				
<b>2. Content</b>				
<ul style="list-style-type: none"> <li>• various processes for electricity generation,</li> <li>• cogeneration plants,</li> <li>• combined cycle power plants,</li> <li>• systems using renewable energies,</li> <li>• heat pumps and refrigeration systems,</li> <li>• exergoeconomic and exergoenvironmental analysis</li> <li>• rational use of energy.</li> </ul>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Energy Engineering II	IV	4	6	SS
<b>4. Description of teaching and learning forms</b>				
Contents are presented in lectures illustrated by exercises and case studies.				
<b>5. Entrance requirements</b>				
Energy Engineering I Preferable: basic knowledge of thermodynamics and process technology, heat transfer and fluid dynamics				

<b>6. Applicability</b>
Compulsory elective for MSc IT for Energy
<b>7. Workload and credit points</b>
Lecture and case studies: 60 hours preparation and homework: 60 hours literature reading and preparation of case study 30 hours preparation for the examination 30 hours Total: <b>180 hours: 30 = 6 CP</b>
<b>8. Examination and grading of the module</b>
Examination as so called „Portfolioprüfung“: 30% - home work, 70% - written examination.
<b>9. Duration of module</b>
The module can be completed within one semester.
<b>10. Number of Participants</b>
Max. 30 Participants
<b>11. Enrolment procedure</b>
<b>12. References, scripts</b>
Printed script in English is available, Sekr. KTI, Room 8, 10 a.m. - 3 p.m. <b>Literature:</b> A. Bejan, G. Tsatsaronis and M. Moran, A. Wiley, <i>Thermal Design and Optimization</i> , 1996.
<b>13. Miscellaneous</b>
The module is conducted in TU Berlin, Germany

<b>Titel des Moduls:</b> <i>Refrigeration and Air Conditioning</i>	<b>LP (nach ECTS):</b> 6	<b>Kurzbezeichnung:</b> <i>REF</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Tetyana Morozjuk</i>	<b>Sekr.:</b> <i>KTI</i>	<b>Email:</b> <i>morozjuk@iet.tu-berlin.de</i>		
<b>Module description, Stand 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
The students:				
<ul style="list-style-type: none"> <li>know the principles of operation of compression refrigeration machines, modern methods of analysis and evaluation of compression refrigeration machines and principles from the design of the most commonly used types of components of compression refrigeration machines,</li> <li>are able to choose an adequate tool for the optimisation of a system,</li> <li>possess the creativity to design new tools for the optimisation of processes,</li> <li>have skills in preparing data and informations for the design of the system,</li> <li>have the ability to independently solve tasks in the field of thermal design of compression refrigeration machines.</li> </ul>				
The module conveys:				
20% Knowledge & Comprehension, 20% Analysis & Method, 20% Inventor & Design, 20 % Research & Evaluation, 20 % Application & Practice				
<b>2. Content</b>				
1. Introduction. 2. Machines working on inverse thermodynamic cycles: refrigeration machine, heat pump, co-generation machine. 3. Methods for "cold production". 4. Working fluids for refrigeration machines. Optimal choice of a working fluid. 5. One-stage refrigeration machine. Main and additional components. 6. Two-stage refrigeration machines. Modern and special types of two-stage refrigeration machines. 7. Three-stage refrigeration machines. 8. Cascade refrigeration machines. 9. Air refrigeration machines. 10. Heat using refrigeration machines.				
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.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Refrigeration and air conditioning	IV	4	6	WS
<b>4. Description of Teaching Methods</b>				
The theory is presented in lectures and its applications are demonstrated in exercises and case studies.				
<b>5. Entrance requirements</b>				
Preferable: Basic knowledge of thermodynamics				

<b>6. Applicability</b>
Compulsory elective for MSc IT for Energy
<b>7. Workload and credit points</b>
Lecture and case studies: 60 hours preparation and homework: 60 hours literature reading and preparation of case study 30 hours preparation for the examination 30 hours Total: <b>180 hours: 30 = 6 LP</b>
<b>8. Examination and grading of the module</b>
Examination as so called „Portfoliprüfung“: 30% - home work, 70% - written examination.
<b>9. Duration of module</b>
The module can be completed within one semester.
<b>10. Number of Participants</b>
Max. 30 Participants
<b>11. Enrolment procedure</b>
Keine
<b>12. References, scripts</b>
Script is available. Additional literature will be provided at the end of each chapter.
<b>13. Miscellaneous</b>
The module is conducted on campus in El Gouna, Egypt

<b>Titel des Moduls:</b> <i>Conversion Technologies of Renewable Energies</i>	<b>LP (nach ECTS):</b> 6	<b>Abbreviation:</b> CON		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Frank Behrendt</i>	<b>Sekr.:</b> RDH09	<b>Email:</b> <i>Frank.behrendt@tu-berlin.de</i>		
<b>Module description, update 22.07.2009</b>				
<b>1. Learning Outcomes</b>				
The students should be able to understand the conversion of renewable energies using various energy sources. There will be given an overview about generation, conversion and utilization of renewable energies.				
The module imparts predominantly the following competence: Technical 50% Methodology 30% Systematic 20% Social competence 0%				
<b>2. Content</b>				
This module will illustrate the several utilization possibilities of biomass as energy carrier, which includes biochemical and thermochemical conversion technologies. The power generation using different product gases enables fuel cells for further research.  Another focus will be on solar energy utilization such as photovoltaics, thermal power plants and wind power plants. Other renewable energy generation technologies with water power plants and geothermal heat is also a part of this module. To further illustrate the conversion there will be practical experiments in terms of fuel characterization (laboratory) and fluidized bed conversion (experiment hall).				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Conversion Technologies of renewable energies	IV	4	6	WS
<b>4. Description of Teaching Methods</b>				
The lecture contains some experiments and excursions, if possible.				
<b>5. Entrance requirements</b>				
<b>6. Applicability</b>				
Compulsory elective for MSc IT for Energy				

<b>7. Workload and credit points und Leistungspunkte</b>	
<b>Präsenzzeit:</b>	
IV	2 h x 30 weeks = 60h
<b>Vor- und Nachbereitung:</b>	
IV	30 weeks x 2h = 60h
<b>Vorbereitung der Prüfungsleistung:</b>	
Oral examination	= 60h
<b>Summe</b>	= <b>180h : 30=6 LP</b>

<b>8. Examination and grading of the module</b>
Written examination, 90 min

<b>9. Duration of module</b>
The module can be completed within one semester.

<b>10. Number of Participants</b>
Max. 30 Participants

<b>11. Enrolment procedure</b>

<b>12. References, scripts</b>
Lecture slides, no script available. More information will be given in the lecture.

<b>13. Miscellaneous</b>
The module is conducted on campus in El Gouna, Egypt

<b>Titel des Moduls: Components of Energy Conversion Systems</b>	<b>LP (nach ECTS):</b> 6	<b>Abbreviation:</b> CECS		
<b>Verantwortlicher für das Modul:</b> Prof. Dr.-Ing. Felix Ziegler	<b>Sekr.:</b> KT 2	<b>Email:</b> felix.ziegler@tu-berlin.de		
<b>Module description, update 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
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 optimise components of the energy systems with regard to economic and ecologic aspects.				
The module imparts predominantly the following competence: Technical 40% Methodology 30% Systematic 25% Social competence 5%				
<b>2. Content</b>				
This module contains basics and some technical details of the most important components of steam power plants and gas turbine power plants: pumps, turbines, heat rejection devices (cooling towers), etc.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Components of Energy Conversion systems	VL	2	2	WS
Lab course to CECS	PR	2	4	WS
<b>4. Description of Teaching Methods</b>				
The Lab course is composed of practical and theoretical exercises. The project contains design, analysis and optimisation of energy conversion systems. Lab and project are being done in small groups.				
<b>5. Entrance requirements</b>				
Energy Engineering I				
<b>6. Applicability</b>				
Compulsory elective for MSc IT for Energy				

<b>7. Workload and credit points</b>	
<b>Attendance:</b>	
VL Components	2 SWS * 15 Weeks = 30 h
PR	2 SWS * 15 Weeks = 30 h
<b>Preparation and follow up-time:</b>	
VL	15 Weeks * 2 h = 30 h
PR	15 Weeks * 4 h = 60 h
Exam preparation:	30 h
<b>Sum</b>	<b>= 180 h: 30 = 6LP</b>
<b>8. Examination and grading of the module</b>	
Written examination, 90 min	
<b>9. Duration of module</b>	
The module can be completed within one semester.	
<b>10. Number of Participants</b>	
Max. 30 Participants In the exercises approx. 5 per group	
<b>11. Enrolment procedure</b>	
<b>12. References, scripts</b>	
<b>Literatur:</b> Information will be given in the lecture.	
<b>13. Miscellaneous</b>	
The module is conducted on campus in El Gouma, Egypt	

<b>Title des Moduls:</b> <i>Integration of Renewable Energies</i>	<b>LP (nach ECTS):</b> 6	<b>Abbreviation:</b> <i>IRE</i>		
<b>Verantwortlicher für das Modul:</b> <i>Dr. rer. nat. Franz Trieb</i>	<b>Sekr.:</b> <i>DLR</i>	<b>Email:</b> <i>franz.trieb@dlr.de</i>		
<b>Module description, update 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
<p>The lectures teach the most important systemic, ecologic and economic connections for the integration of renewable energies in electrical grids, supply systems and markets under the constraints of sustainability with respect to the different solutions.</p> <p>Furthermore, the students will be able to assess the informations concerning energy potentials, demand scenarios, systems solutions and market strategies using scientific methods with regard to economical decisions.</p> <p>The description of the 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.</p> <p>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.</p> <p>The module imparts predominantly the following competence:</p> <p>Technical comp. 40% methodological comp. 20% systems competence 40% social competence 0%</p>				
<b>2. Content</b>				
<ol style="list-style-type: none"> <li>1. Renewable Energy Achievements (regular update of status quo)</li> <li>2. Scenarios for Sustainable Energy Supply including Renewable Energies</li> <li>3. Concentrating Solar Thermal Power</li> <li>4. Photovoltaic Power</li> <li>5. Wind Power</li> <li>6. Wind Resource Assessment</li> <li>7. Solar Energy Resource Assessment</li> <li>8. Renewable Energy Integration into National Power Supply Systems</li> <li>9. CSP Performance Model</li> <li>10. PV Performance Model</li> <li>11. Wind Power performance Model</li> <li>12. Renewable Energy Policy and Finance</li> </ol>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Integration of Renewable Energies	IV	2	3	WS
Seminar (case studies)	SE	2	3	WS
<b>4. Description of Teaching Methods</b>				
Block classes, integrated course (IV) and seminar (SE).				
<b>5. Entrance requirements</b>				
<b>6. Applicability</b>				
Compulsory elective for MSc IT for Energy				

<b>7. Workload and credit points</b>	
Attendance:	
IV	2 SWS * 15 Weeks = 30 h
SE	2 SWS * 15 Weeks = 30 h
Preparation and follow up-time:	
IV	15 Weeks * 2 h = 30 h
SE	15 Weeks * 2 h = 30 h
Exam preparation:	
	Sum = 180 h = 6LP

<b>8. Examination and grading of the module</b>
Examination as so called „Portfolioprüfung“: 40% - seminar presentation, 40% - oral examination, 20% - written report.

<b>9. Duration of module</b>
The module can be completed within one semester.

<b>10. Number of Participants</b>
Max. 30 Participants

<b>11. Enrolment procedure</b>

<b>12. References, scripts</b>
<b>Literature:</b>

1. Indexmundi (2012), Global statistical information website, Commodity Price Indices, <http://www.indexmundi.com/commodities/?commodity=crude-oil&months=120>
2. Neij, L., Cost development of future technologies for power generation-A study based on experience curves and complementary bottom-up assessments, Energy Policy 36 (2008) 2200- 2211
3. Trieb, F., Schillings, C., Pregger, T., O'Sullivan, M., Solar electricity imports from the Middle East and North Africa to Europe, Energy Policy 42 (2012), 341-353, doi:10.1016/j.enpol.2011.11.091
4. BMU (2011), Renewable Energies - Perspectives for a Sustainable Energy Future, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Berlin [http://www.bmu.de/files/pdfs/allgemein/application/pdf/ee\\_innovationen\\_energiezukunfts\\_n\\_bf.pdf](http://www.bmu.de/files/pdfs/allgemein/application/pdf/ee_innovationen_energiezukunfts_n_bf.pdf)
5. European Photovoltaic Industry Association (EPIA), Market Report 2011, internet publication (2012), <http://www.epia.org/publications/photovoltaic-publications-global-market-outlook.html>
6. European Solar Thermal Electricity Industry Association (ESTELA), internet information on existing CSP plants (2012), <http://www.estelasolar.eu/index.php?id=32>
7. Federal Environment Agency (Umweltbundesamt), Role and Potential of Renewable Energy and Energy Efficiency for Global Energy Supply, CLIMATE CHANGE 18/2009, Berlin (2009), internet publication [http://www.umweltbundesamt.de/uba-info-medien/mysql\\_medien.php?anfrage=Kennummer&Suchwort=3768](http://www.umweltbundesamt.de/uba-info-medien/mysql_medien.php?anfrage=Kennummer&Suchwort=3768)
8. Global Wind Energy Council (GWEC), Global Wind Statistics 2011, Brussels (2012) [http://www.gwec.net/fileadmin/images/News/Press/GWEC\\_-\\_Global\\_Wind\\_Statistics\\_2011.pdf](http://www.gwec.net/fileadmin/images/News/Press/GWEC_-_Global_Wind_Statistics_2011.pdf)

<b>13. Miscellaneous</b>
The module is conducted on campus in El Gouna, Egypt

<b>Titel des Moduls :</b> <i>Energy for Buildings</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>EFB</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr.-Ing. Christoph Nytsch-Geusen</i>	<b>Sekr.:</b> <i>UDK</i>	<b>Email:</b> <i>nytsch@udk-berlin.de</i>		
<b>Module description, Stand 27.05.2012</b>				
<b>1. Learning Outcomes</b>				
The students should be able to know the relevant energy and mass flows in buildings under the requirements of people to interiors and with respect to outside climate. The calculation methods for energetically planning and construction of private homes and offices will be illustrated. Another focus is the application of scientific and special knowledge to the practice, which includes literature research and the ability of scientific discussions.				
The module imparts predominantly the following competence: Technical 30%, Methodical 30%, Systematical 30%, Social 10%				
<b>2. Content</b>				
The course is designed to provide a deep understanding of building prime energy demand and the influencing factors. Therefore, the energy and mass flows between environment and interior are analyzed under different climatic boundary conditions. The impact of different building materials, such as insulation or glazing, is part of the course as well as user behavior and thermal comfort. The satisfaction of these demands with different building energy supply systems are taught as well as the possible use of renewable energy sources. The reduction of the building prime energy demand for new built buildings and refurbishment is a key content of this lecture. The lecture includes the understanding of: <ul style="list-style-type: none"> <li>• the physiology of people with respect to thermal comfort and air quality</li> <li>• handling and analyzing metrological data such as solar radiation, air temperature, humidity and wind conditions</li> <li>• basics in primary energy consumption for the heating system, heat load calculations, annual energy needs, heat generation, transfer and distribution, examples for classical and solar heat generation systems</li> <li>• focus on primary energy consumption for ventilation and air conditioning, demand for fresh air, cooling load calculation, annual energy consumption, dimensioning of air conditioning systems, air distribution systems and indoor air flows, cold generation</li> <li>• there will be given practical calculation examples and at least one laboratory exercise.</li> </ul>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Lecture	IV	2	3	WS
Labs	IV	2	3	WS
<b>4. Description of Teaching Methods</b>				
Integrated lecture with problem solving (IV) some laboratory exercises.				

<b>5. Entrance requirements</b>
Preferable: knowledge of building physics
<b>6. Applicability</b>
Compulsory elective for MSc IT for Energy
<b>7. Workload and credit points</b>
contact for lectures and exercises 60 hours hours post - processing and homework 60 hours preparation for examination 60 hours <b>total: 180 h = 6 LP</b>
<b>8. Examination and grading of the module</b>
Written examination, 90 min
<b>9. Duration of module</b>
The module can be completed within one semester.
<b>10. Number of Participants</b>
Max. 30 Participants
<b>11. Enrolment procedure</b>
<b>12. References, scripts</b>
Lecture slides, no script available. More information will be given in the lecture.
<b>13. Miscellaneous</b>
The module is conducted on campus in El Gouma, Egypt

<b>Titel des Moduls :</b> <i>Energy Economics I</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>EES</i>															
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Georg Erdmann</i>	<b>Sekr.:</b> <i>TA08</i>	<b>Email:</b> <i>georg.erdmann@tu-berlin.de</i>															
<b>Module description, Stand 27.05.2015</b>																	
<p><b>1. Learning Outcomes</b> Energy markets are complex. When someone wants to move successfully on these markets, he must understand its fundamental dynamics. Therefore this course describes the energy markets with respect to energy constraints, cost structures (especially investment costs) and time-profiles of energy demands. This includes also social and political guidelines like the liberalisation and regulation of energy supply, climate protection goals and demands for security of supply. The goal of this course is the fundamental understanding of energy markets and trade, price formation and the behaviour of actors among the value chain.</p> <p>The students should be able to familiarize with the terminology of relevant technical literature and publications. They should be able to use this for their future career and to learn how the processes of energy markets work with respect to models of the industry organisations.</p> <p>The module imparts predominantly the following competence: 40% knowledge and understanding, 40% Analysis and methodology, 20% Systematical</p>																	
<p><b>2. Content</b></p> <ol style="list-style-type: none"> <li>1. Energy balancing</li> <li>2. Economic calculation with external costs</li> <li>3. Fundamentals of energy trade</li> <li>4. Markets for emission certificates</li> <li>5. Markets for power generation</li> <li>6. Markets for crude oil and natural gas</li> <li>7. Markets for petroleum products</li> <li>8. Transport and distribution of piped energy systems</li> </ol>																	
<p><b>3. Modul components</b></p> <table border="1"> <thead> <tr> <th>Module title</th> <th>Module type</th> <th>SWS</th> <th>Credits (ECTS)</th> <th>Semester (WS / SS)</th> </tr> </thead> <tbody> <tr> <td>Energy Economics I</td> <td>VL</td> <td>2</td> <td>3</td> <td>SS</td> </tr> <tr> <td>Energy Economics I</td> <td>UE</td> <td>2</td> <td>3</td> <td>SS</td> </tr> </tbody> </table>			Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)	Energy Economics I	VL	2	3	SS	Energy Economics I	UE	2	3	SS
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)													
Energy Economics I	VL	2	3	SS													
Energy Economics I	UE	2	3	SS													
<p><b>4. Description of Teaching Methods</b> The lecture will give the students basic knowledge about the subject and supports discussions. Exercises will have practical relevant aspects. Regular tests will ensure that.</p>																	
<p><b>5. Entrance requirements</b> Basic economic knowledge, especially production planning (marginal costs) and investment calculation. Statistical knowledge and probability calculation are advantageous, work with EXCEL</p>																	

<b>6. Applicability</b> Compulsory elective for MSc IT for Energy
<b>7. Workload and credit points</b> Lectures/exercises: 60 hours Post processing: 60 hours Exam preparation: 60 hours Total: <b>180 hours = 6 LP</b>
<b>8. Examination and grading of the module</b> Oral Exam, 30 min
<b>9. Duration of module</b> The module can be completed within one semester.
<b>10. Number of Participants</b> Max. 30 Participants
<b>11. Enrolment procedure</b>
<b>12. References, scripts</b> Lecture slides, no script available. More information will be given in the lecture.
<b>13. Miscellaneous</b> The module is conducted in TU Berlin, Germany.

<b>Titel des Moduls :</b> <i>Energy Storage</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>ESC</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Peter Strasser</i>	<b>Sekr.:</b> <i>TC3</i>	<b>Email:</b> <i>pstrasser@tu-berlin.de</i>		
<b>Module description, Stand 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
<p>The first part of the lecture gives an overview on stationary electrical and thermal energy storage systems. This includes large scale technologies like Pumped Hydro Energy Storage, Compressed Air Energy Storage, Power-to-gas-concepts, long and short term thermal storages, 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. A deeper understanding of electrochemistry and surface science is not included and will be provided in the second part of the lecture.</p> <p>In the second part, the students get familiar with basic concepts and experimental methods of Electrochemistry, Surface Catalysis, electrochemical energy conversion and storage, such as fuel cells, batteries, electrolyzers, photo electrochemical cells and others. They will also be exposed to some additional concepts at the borderline of electrochemistry and catalysis and solid state physics, surface science, materials science. Participants are able to 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.</p>				
<b>2. Content</b>				
<p>The students will learn how to perform a comparative analysis of different storage technologies and define typical application cases in the context of system integration of intermittent renewable energies. Special attention will be paid to understand thermodynamical mechanisms in order to optimize selected storage technologies such as thermal storages in Compressed Air Energy Storage and thermal management of cell batteries.</p> <p>Fundamentals of electrochemical galvanic and electrolyser cells, electrolytes, thermodynamic and kinetic of electrochemical cells, the concept of the electrochemical overpotential, surface science and surface catalysis and electrocatalysis. Methods in electrochemistry and surface catalysis. Applications of electrochemical concepts for electrochemical and catalytic energy conversion and storage devices for academic and industrial purposes</p>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Integrated course "Energy storage"	IV	1,5	2	WS
Integrated course "Electrochemistry"	IV	1,5	2	WS
Lab course	PR	1	2	WS
<b>4. Description of Teaching Methods</b>				
Integrated lecture with problem solving (IV) laboratory course (PR).				

<b>5. Entrance requirements</b>	
1. Fundamentals of physical chemistry and electrochemistry 2. Fundamentals of physics and electrical engineering	
<b>6. Applicability</b>	
Compulsory elective for MSc IT for Energy	
<b>7. Workload and credit points</b>	
<b>Attendance:</b>	
IV PR	2 SWS * 15 Weeks = 30 h 2 SWS * 15 Weeks = 30 h
<b>Preparation and follow up-time:</b>	
VL PR	15 Weeks * 2 h = 30 h 15 Weeks * 2 h = 30 h
Exam preparation:	= 60 h
<b>Sum</b>	<b>= 180 h = 6LP</b>
<b>8. Examination and grading of the module</b>	
Written examination, 90 min	
<b>9. Duration of module</b>	
The module can be completed within one semester.	
<b>10. Number of Participants</b>	
Max. 30 Participants	
<b>11. Enrolment procedure</b>	
<b>12. References, scripts</b>	
<b>Textbooks:</b>	
1. Hamann, Vielstich, Hamnett: <i>Electrochemistry</i> ; Wiley-VCH Verlag GmbH & Co. KGaA; (2007)	
2. R. Schloegl, Editor, <i>Chemical Energy Storage, De Gruyter: Berlin, (2012)</i>	
<b>Other literature:</b>	
3. Geoffrey A Prentice <i>Electrochemical Engineering Principles</i> Prentice Hall International Series in the Physical and Chemical Engineering Sciences Prentice Hall (1990)	
4. Nilsson, Pettersson, and Norskov, Editors, <i>Chemical Bonding at Surfaces and Interfaces, Elsevier: New York. (2007)</i>	
5. Bagotsky, V.S., <i>Fundamentals of Electrochemistry</i> . Second ed. The Electrochemical Society, Pennington, New Jersey: The Electrochemical Society 2006	
6. Bard, A.J. and L.R. Faulkner, <i>Electrochemical methods : fundamentals and applications</i> . 2nd edition ed., New York: John Wiley & Sons, Inc. 2001	
7. Ertl, G., H. Knözinger, F. Schueth, and J. Weitkamp, <i>Handbook of Heterogeneous Catalysis</i> , Weinheim: Wiley-VCH. 2008	
<b>13. Miscellaneous</b>	
The module is conducted on campus in El Gouna, Egypt	

<b>Titel des Moduls :</b> <i>Photovoltaics</i>	<b>LP (nach ECTS):</b> 6 ECTS	<b>Kurzbezeichnung:</b> PV		
<b>Verantwortlicher für das Modul:</b> Prof. Dr. Bernd Szyszka	<b>Sekr.:</b> HFT 5-2	<b>Email:</b> bernd.szyszka@tu-berlin.de		
<b>Modul components, Stand 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
After successful completion, students should be able to work successfully 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.				
The module "photovoltaic" provides: Expertise: 40%, method competence: 30%, system competence: 30%, social competence: 0%				
<b>2. Content</b>				
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 (laboratory) application.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Photovoltaics 1 (PV1)	IV	s.u.	2	WS
Photovoltaics 2 (PV2)	IV	s.u.	2	WS
Photovoltaics 3 (PV3)	IV	s.u.	2	WS
<b>4. Description of Teaching Methods</b>				
The module "photovoltaics" consists of three integrated courses (IV), each as a one-week block course in the winter semester (WS). The IVs integrate this lecture (L), exercise (E) and practical (LAB).				
<b>5. Entrance requirements</b>				
Basic knowledge of electrical engineering and physics, especially in semiconductor physics				
<b>6. Applicability</b>				
Compulsory elective for MSc Business Engineering (Energy)				

<b>7. Workload and credit points</b>	
<b>Attendance time:</b>	1 week * 20 SWS = 20 h 1 week * 20 SWS = 20 h 1 week * 20 SWS = 20 h
<b>Photovoltaics 1 (PV1)</b>	
<b>Photovoltaics 2 (PV2)</b>	
<b>Photovoltaics 3 (PV3)</b>	
<b>Preparation and postprocessing</b>	4 weeks * 5 SWS = 20 h 4 weeks * 5 SWS = 20 h 4 weeks * 5 SWS = 20 h
<b>Exam preparation:</b>	60 h
<b>Sum:</b>	<b>180 h (= 6 ECTS)</b>
<b>8. Examination and grading of the module</b>	
Written exam, 90 min	
<b>9. Duration of module</b>	
The module can be completed in one semester.	
<b>9. Participants</b>	
Max. 30 Participants	
<b>11. Enrolment procedure</b>	
<b>12. References, scripts</b>	
Documents for the lecture will be provided electronically on the Internet: <a href="https://www.isis.tu-berlin.de/course/category.php?id=2420">https://www.isis.tu-berlin.de/course/category.php?id=2420</a>	
<b>Literature:</b>	
1) M.A. Green: "Solar Cells: Operating Principles, Technology and System Applications", Centre for Photovoltaic Engineering, University of New South Wales (UNSW), Australia (1998)	
2) M.A. Green: "Silicon Solar Cells: Advanced Principles & Practice", Centre for Photovoltaic Engineering, University of New South Wales (UNSW), Australia (1995)	
3) S.R. Wenham, M.A. Green, M.E. Watt, R. Corkish: "Applied Photovoltaics", 2 <sup>nd</sup> Edition, Centre for Photovoltaic Engineering, University of New South Wales (UNSW), Australia (2009)	
<b>13. Miscellaneous</b>	
The module is conducted on campus in El Gouna, Egypt	

<b>3. Modul components</b>			
Module title	Module type	SWS	Semester (WS / SS)
Project management	VL	2	WS
Intercultural communications	SE	2	WS
<b>4. Description of Teaching Methods</b>			
Project management contains out of lectures (VL), Intercultural communications has a seminar character (SE).			
<b>5. Entrance requirements</b>			
<b>6. Applicability</b>			
Compulsory for MSc IT for Energy			
<b>7. Workload and credit points</b>			
Project Management: Lecture time 30 h, postprocessing 30 h, preparation for examination 30 h = 90 h			
Intercultural Communications: Seminar time 30 h, postprocessing 30 h, preparation for examination 30 h = 90 h			
<b>Sum = 180 h = 6LP</b>			
<b>8. Examination and grading of the module</b>			
Written examination, 90 min			
<b>9. Duration of module</b>			
The module can be completed within one semester			
<b>10. Number of Participants</b>			
Max. 30 Participants			
<b>11. Enrolment procedure</b>			
<b>12. References, scripts</b>			
<b>Literature:</b> Lecture slides, no script available. More information will be given in the lecture.			
<b>13. Miscellaneous</b>			
The module is conducted on campus in El Gouna, Egypt			

<b>Titel des Moduls :</b> <i>Project Management and Intercultural Communications</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>PMIC</i>
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Bend Köchendorfer</i>	<b>Sekt.:</b> <i>TIB 13b</i>	<b>Email:</b> <i>Bernd.koehendoerfer@tu-berlin.de</i>
<b>Module description, Stand 27.05.2015</b>		
<b>1. Learning Outcomes</b>		
Project management: In diesem Modul erwerben die Studierenden Kenntnisse über die Umsetzung von Projekten, insbesondere im Energiebereich, aus der Sicht von Auftraggebern und von Dienstleistern. Es werden Kenntnisse über die Führungsaufgaben, Führungstechniken und Führungsmittel für die Planung und Abwicklung von Projekten mit lebenszyklusorientierter Ausrichtung vermittelt		
Intercultural communications:		
<ul style="list-style-type: none"> <li>• Basic knowledge about culture, cultural dimensions, communication, diversity and intercultural competence</li> <li>• Reflected dealing with different cultural values, behavior, perceptions, working patterns, stereotypes and prejudices and conflicts resulting out of diversity</li> <li>• Develop basic competencies, interpersonal skills and strategies for successful intercultural and -gender communication</li> <li>• Develop basic knowledge for establishing continuous dialogue with stakeholders from science, industry, NGOs as well as with customers, employees or the local population</li> </ul>		
The module imparts predominantly the following competence:		
Technical 20% Methodology 30% Systematic 20% Social competence 30%		
<b>2. Content</b>		
Project management: Handlungsbereiche im Projektmanagement, Projektorganisation, Terminmanagement, Kostenmanagement, Qualitätsmanagement, Tools im Projektmanagement, Praxisbeispiele		
Intercultural communications:		
This module provides the students with the basic knowledge about the multiple aspects of communication and intercultural competencies. The following fields will be covered in form of theoretical inputs, role games, working groups and interactive exercises:		
<ul style="list-style-type: none"> <li>• Culture and diversity: <ul style="list-style-type: none"> <li>○ Definitions, theories and models</li> <li>○ Cultural dimensions and cultural standards</li> <li>○ Stereotypes and their functions</li> <li>○ Managing diversity as a strategically imperative</li> </ul> </li> <li>• Communication, conflicts and cooperation in an intercultural working-setup: <ul style="list-style-type: none"> <li>○ Models of communication</li> <li>○ Non-verbal and media supported communication</li> <li>○ Basic tools for establishing continuous dialogue with stakeholders</li> <li>○ Models and strategies how to communicate with diverse others and how to deal with critical incidents and cultural conflicts in an intercultural and inter-gender context</li> </ul> </li> <li>• Intercultural competencies as social competence, competence of action and concepts of attitudes: <ul style="list-style-type: none"> <li>○ Definitions and aspects of intercultural competencies</li> <li>○ Critical reflection of own values and perceptions</li> </ul> </li> </ul>		
Reflecting hard and soft skills such as tolerance, empathy, change in perspectives, distance of roles, tolerance of ambiguity and communication skills.		

<b>Titel des Moduls:</b> <i>Environmental Management</i>	<b>LP (nach ECTS):</b> 6	<b>Abbreviation:</b> <i>EM</i>		
<b>Verantwortlicher für das Modul:</b> <i>Dr. Elisabeth Strecker</i>	<b>Sekr.:</b> <i>RDH09</i>	<b>Email:</b> <i>e.strecker@tu-berlin.de</i>		
<b>Module description, update 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
The students shall gain applicable knowledge on the environmental policy instruments.				
The module imparts predominantly the following competence:				
Expertise 40%	Methodological skills 40%	System expertise 10%    Social competence 10%		
<b>2. Content</b>				
The Environmental Management lecture comprises instruments for environmental protection management with the focus on companies' environmental protection. The majority of these tools is standardized in the ISO 14000 series. Besides, a short look is taken on environmental policy instruments directed to industry.				
Topics				
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				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Environmental Management	IV	4	6	WS or SS
<b>4. Description of Teaching Methods</b>				
The module consists of lectures and exercises. The lecture applies case studies and training partly computer based.				
<b>5. Entrance requirements</b>				
<b>6. Applicability</b>				
Compulsory elective MSc IT for Energy				
<b>7. Workload and credit points</b>				
Attendance lectures and exercises:	4 SWS*15 weeks	=	60h	
Lecture preparation and post-processing:	15 weeks * 2h	=	30h	
Exercise preparation and post-processing:	15 weeks * 3h	=	45h	
Examination preparation		=	45h	
<b>Sum</b>			<b>180h</b>	<b>= 30=6 ECTS</b>

<b>8. Examination and grading of the module</b>
Written examination, 90 min
<b>9. Duration of module</b>
The module can be completed in one semester
<b>10. Number of Participants</b>
30 Students
<b>11. Enrolment procedure</b>
<b>12. References, scripts</b>
Participants will be provided lecture notes and materials on the topics in electronic / paper form.
<b>13. Miscellaneous</b>
The module is carried out in El Gouna, Egypt or TU Berlin, Germany

<b>Titel des Moduls:</b> <i>Fundamentals of Electrical Networks</i>	<b>LP (nach ECTS):</b> 6	<b>Abbreviation:</b> FEN		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr.-Ing. Kai Strunz</i>	<b>Office:</b> EUREF	<b>Email:</b> <i>kai.strunz@tu-berlin.de</i>		
<b>Module description, State 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
The module imparts predominantly the following competence: Expertise 40% Methodological skills 40% System expertise 10% Social competence 10%				
<b>2. Content</b>				
There are taught basic knowledge for operation of networks of electric power supply. This include complex numbers, sources and load, nodal analysis, three-phase systems, load flow calculation, network control, modeling.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Fundamentals of electrical networks	VL	2	3	SS
Fundamentals of electrical networks	UE	2	3	SS
<b>4. Description of Teaching Methods</b>				
The module consists of lectures and exercises. The lectures impart the theoretical fundamentals. In the exercises concrete examples are discussed.				
<b>5. Entrance requirements</b>				
Understanding of electrical engineering				
<b>6. Applicability</b>				
Compulsory elective for MSc IT for Energy				
<b>7. Workload and credit points</b>				
Attendance lectures and exercises:	4 SWS*15 weeks	=	60h	
Lecture preparation and post-processing:	15 weeks * 2h	=	30h	
Exercise preparation and post-processing:	15 weeks * 3h	=	45h	
Examination preparation		=	45h	
<b>Sum</b>			<b>= 180h</b>	<b>= 6 ECTS</b>
<b>8. Examination and grading of the module</b>				
Written examination, 90 min				

<b>9. Duration of module</b>
The module can be completed in one semester
<b>10. Number of Participants</b>
30 Students
<b>11. Enrolment procedure</b>
<b>12. References, scripts</b>
Script in electronic form. Literature references are included in the script.
<b>13. Miscellaneous</b>
The module is carried out in TU Berlin, Germany / campus EUREF

<b>Titel des Moduls :</b> <i>Energy Economics II</i>	<b>LP (nach ECTS):</b> <i>6 LP</i>	<b>Kurzbezeichnung:</b> <i>EES</i>
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Georg Erdmann</i>	<b>Sekr.:</b> <i>TA08</i>	<b>Email:</b> <i>georg.erdmann@tu-berlin.de</i>
<b>Module description, Stand 27.05.2015</b>		
<b>1. Learning Outcomes</b>		
The students shall define themselves as experts within the group and to the outside world. In this way they apply the treated theoretical approaches in their own initiative.		
The conveyed contents and skills create good conditions for a successful career start in the energy economy sector and belong to the conditions which are necessary for future management responsibilities.		
The module imparts predominantly the following competence:		
Expertise 30%	Methodological skills 30%	System expertise 30%    Social competence 10%
<b>2. Content</b>		
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		
<b>3. Modul components</b>		
Module title	Module type	SWS    Credits (ECTS)    Semester (WS / SS)
Energy Economics II	VL	2    3    SS
Energy Economics II	UE	2    3    SS
<b>4. Description of Teaching Methods</b>		
The classic character of a lecture does not occur in this module, since the work on current issues and topics is coached by the lecturers. Nevertheless the students should deal independently with the different issues. The objective is to show the participants through research and contact to stakeholders in Germany the complexity of energy economical facts and to identify solutions.		
The work of the participants is presented in seminars. Group work is also possible. The lectures are connected with an intense coaching by professionals from the energy sector. There is also an emphasis on improving the lecture and presentation technology.		
<b>5. Entrance requirements</b>		
Successful completion of the module Energy Economics I.		
Advantageously : Basic knowledge of probability and statistics, EXCEL		
<b>6. Applicability</b>		
Compulsory elective in MSc IT for Energy		

<b>7. Workload and credit points</b>	
Attendance lectures:	15 weeks * 2h = 30h
Lecture preparation and post-processing:	15 weeks * 2h = 30h
Preparation of seminar paper:	= 90h
Attendance seminar	= 30h
<b>Sum</b>	<b>= 180h : 30=6 ECTS</b>

<b>8. Examination and Grading</b>	
Oral examination, 30 min	

<b>9. Duration of module</b>	
The module can be completed in one semester	

<b>10. Number of Participants</b>	
Max. 30 Students	

<b>11. Enrolment procedure</b>	

<b>12. References, scripts</b>	
<b>Literature:</b>	
G. Erdmann, P. Zweifel (2007) Energieökonomik – Theorie und Anwendungen. Springer Verlag	
Präsentationsfolien der Vorlesung mit weiteren Hinweisen	

<b>13. Miscellaneous</b>	
The module is conducted in TU Berlin, Germany.	

<b>Module title:</b> <i>International Contract and Competition Law</i>	<b>LP (acc. to ECTS):</b> 6	<b>Abbreviation:</b> <i>ICCL</i>		
<b>Responsible for the module:</b> <i>Prof. Dr. F.J.Säcker</i>	<b>Secretariat:</b> <i>EUREF</i>	<b>Email:</b> <i>f.j.saecker@fu-berlin.de</i>		
<b>Module description, Stand 27.05.2015</b>				
<b>1. Learning Outcomes</b>				
After assignment of this module, students have a basic overview of the framework conditions of the energy law on the German and European level. They also know the legal basis for energy trading and consumer protection. Based on this, they understand various law related energy concepts. Special focus is also on the ecological energy transition and the resulting issues of energy security and affordable energy. The module imparts predominantly the following competence: Expertise 40% Methodological skills 30% System expertise 20% Social competence 10%				
<b>2. Content</b>				
<ol style="list-style-type: none"> <li>1. Fundamentals of German and European Energy law</li> <li>2. Unbundling provisions, infrastructure regulation, concession contracts and municipal responsibility (energy concepts)</li> <li>3. Energy security, affordable energy prices and ecological energy transition (EnWG, EEG, CHP Act, TEHG)</li> <li>4. Energy trading and energy consumer protection law</li> </ol>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
International Contract and Competition Law	VL	2	3	WS or SS
International Contract and Competition Law	EU	2	3	WS or SS
<b>4. Description of Teaching Methods</b>				
Online lectures and self-study				
<b>5. Entrance requirements</b>				
No requirements				
<b>6. Applicability</b>				
Compulsory elective in MSc IT for Energy				

<b>7. Workload and credit points</b>	
Attendance lectures and exercises:	4 h * 15 weeks = 60h
Lecture preparation and post-processing:	15 weeks * 2h = 30h
Exercise preparation and post-processing:	15 weeks * 3h = 45h
Examination preparation	= 45h
<b>Sum</b>	<b>= 180h : 30=6 ECTS</b>

<b>8. Examination and grading of the module</b>	
Written examination, 90 min	

<b>9. Duration of module</b>	
The module can be completed in one semester	

<b>10. Number of Participants</b>	
30 Students	

<b>11. Enrolment procedure</b>	

<b>12. References, scripts</b>	
Participants will be provided with the information during the lecture.	

<b>13. Miscellaneous</b>	
The module is carried out in El Gouna, Egypt or TU Berlin, Germany / Campus EUREF	

<b>Module title:</b> <i>Introduction to Energy Engineering</i>	<b>Credits (ECTS):</b> 6	<b>Abbreviation:</b> <i>IEE</i>		
<b>Module responsible:</b> <i>Prof. Dr.-Ing. George Tsatsaronis</i>	<b>Office:</b> <i>KT I</i>	<b>Email:</b> <i>tsatsaronis@tu-berlin.de</i>		
<b>Module description. Stand 27.05.2015</b>				
<b>1. Qualification goals</b>				
The objective of this module is to familiarize students with general principles and tools of thermodynamics, like Energy- and mass conservation, material properties and process modelling. Therefore the module is the basic one for many other classes, e.g. Energy Engineering I and Energy Engineering II.				
<b>2. Content</b>				
General principles; energy and the first law of thermodynamics; entropy and the second law of thermodynamics; thermodynamic properties of gases and liquids; exergy; mixtures and mixing processes; basics of heat transfer and fluid dynamics.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Lecture	LEC	2	3	WS
Exercises + Tutorials	EX	2	3	WS
<b>4. Description of teaching methods</b>				
The module consists of lectures and tutorials. The lectures impart the theoretical fundamentals. In the tutorials concrete examples are discussed.				
<b>5. Requirements for participation</b>				
<b>6. Applicability</b>				
Compulsory elective for MSc IT for Energy				
<b>7. Effort and credits</b>				
<b>Attendance:</b>	2 SWS*15 weeks = 30h			
LEC	= 30h			
Exercises and tutorials	2 SWS*15weeks = 60h			
<b>Preparation and post-processing:</b>	= 60h			
Examination preparation	= 60h			
<b>Summe</b>	<b>= 180h : 30=6 LP</b>			
<b>8. Examination and Grading</b>				
Written examination, 90 min				

<b>9. Module duration</b>
The module can be completed in one semester
<b>10. Number of participants</b>
30 Students
<b>11. Enrollment</b>
<b>12. Bibliography, Scripts</b>
A script and various handouts are provided in the lecture, the tutorials and the exercises <b>Literatur:</b> Bejan, A., Tsatsaronis, G., Moran, M.: <i>Thermal Design and Optimization</i> , Wiley, New York, 1996 Moran, M.J.;Shapiro, M.H.:Fundamentals of Engineering Thermodynamics, Wiley, New York, 2003.
<b>13. Others</b>
The module is carried out in El Gouna, Egypt

<b>Titel des Moduls :</b> <i>Energy System Optimization Project</i>	<b>LP (nach ECTS):</b> <i>12 LP</i>	<b>Kurzbezeichnung:</b> <i>ESOP</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr.-Ing. George Tsatsaronis</i>	<b>Sekr.:</b> <i>KT I</i>	<b>Email:</b> <i>tsatsaronis@iet.tu-berlin.de</i>		
<b>Module description, Stand 28.05.2015</b>				
<b>1. Qualifikationsziele</b>				
The goal of the module is to familiarize students with				
(a) mathematical optimization methods,				
(b) mathematical modelling,				
(c) the optimization of the design of power plants,				
(d) optimal unit commitment in power systems.				
Students will apply, deepen and extend their knowledge in the area of 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.				
The course is principally designed to impart:				
Technical skills 30%, Method skills 40%, System skills 20%, Social skills 10%				
<b>2. Inhalte</b>				
<ul style="list-style-type: none"> <li>• Types of methods and problems: linear programming, nonlinear programming, integer programming, evolutionary algorithms</li> <li>• Mathematical modelling: thermodynamics, physical property data, technical constraints</li> <li>• Unit commitment: thermal units, storages, integration of renewable energy sources</li> </ul>				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Energy System Optimization	IV	8	12	WS
<b>4. Beschreibung der Lehrformen</b>				
The module consists of lectures and project work. The theoretical contents are delivered in the lectures. In the project work, the students deal with complex problems in small groups and present three to four times the progress of the projects in short presentations (ca. 20 mins) At the end of the semester a final presentation and an oral examination will take place.				
<b>5. Voraussetzungen für die Teilnahme</b>				
Successful Participation in Energy Engineering I				

<b>6. Verwendbarkeit</b>
Compulsory for MSc IT for Energy
<b>7. Arbeitsaufwand und Leistungspunkte</b>
Contact for lectures and exercises: 90 hours
Post – processing, project work and homework: 180 hours
Readings: 30 hours
Preparation for examination: 60 hours
<b>Summe:</b> 360 h = 12 LP
<b>8. Prüfung und Benotung des Moduls</b>
Examination as so called „Portfolioprüfung“: 30% - oral examination, 70% - presentations and written report.
<b>9. Dauer des Moduls</b>
The module can be completed within one semester.
<b>10. Teilnehmer(innen)zahl</b>
Max. 30 Teilnehmer
<b>11. Anmeldeformalitäten</b>
<b>12. Literaturhinweise, Skripte</b>
<b>Literatur:</b> For each topic during this course appropriate text books, research papers, technical reports and standardization documents will be used.
<b>13. Sonstiges</b>
The module is carried out in El Gouna, Egypt

<b>Titel des Moduls:</b> <i>Information Technologies for Energy</i>	<b>LP (nach ECTS):</b> 6	<b>Kurzbezeichnung:</b> <i>IT4E</i>		
<b>Verantwortlicher für das Modul:</b> <i>Prof. Dr. Tetyana Morozjuk</i>	<b>Sekr.:</b> <i>KTI</i>	<b>Email:</b> <i>morozjuk@iet.tu-berlin.de</i>		
<b>Module description, Stand 27.05.2015</b>				
<b>1. Qualifikationsziele</b>				
The students:				
<ul style="list-style-type: none"> <li>know the principles of implementing the information technologies to the energy sector,</li> <li>know the principles of organization, management, developing the infrastructure and optimization within energy sector,</li> <li>know the principles of distribution of primary and secondary energy carriers, and rational use of the final products,</li> <li>have skills in preparing data and informations for the implementing the information technologies to the energy sector,</li> <li>have the ability to independently solve tasks in the field of implementing the information technologies to the energy sector.</li> </ul>				
The module conveys: <b>20%</b> Knowledge & Comprehension, <b>20%</b> Analysis & Method, <b>20%</b> Inventor & Design, <b>20%</b> Research & Evaluation, <b>20%</b> Application & Practice				
<b>2. Inhalte</b>				
This module will illustrate the principles of analyzing, designing, and implementing information systems in order to increase energy efficiency, cost- and environmental effectiveness of the energy conversion processes/plants, energy storage and consumption. Another focus will be on organization, management, developing the infrastructure and optimization within energy sector including generation of electricity/heat from fossil and renewable sources, distribution of primary and secondary energy carriers, and rational use of the final products, taking into account issues of energy efficiency, cost and environmental effectiveness of these processes.				
<b>3. Modul components</b>				
Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)
Information Technologies for Energy	IV	4	6	WS
<b>4. Beschreibung der Lehrformen</b>				
The theory is presented in lectures and its applications are demonstrated in case studies.				
<b>5. Voraussetzungen für die Teilnahme</b>				
Preferable: Basic knowledge of energy engineering, electrical engineering, information technologies				

<b>6. Verwendbarkeit</b>	Compulsory for MSc IT for Energy
<b>7. Arbeitsaufwand und Leistungspunkte</b>	<p>Lecture and case studies: 60 hours</p> <p>preparation and homework: 60 hours</p> <p>literature reading and preparation of case study: 30 hours</p> <p>preparation for the examination: 30 hours</p> <p>Total: <b>180 hours: 30 = 6 CP</b></p>
<b>8. Prüfung und Benotung des Moduls</b>	Examination as so called „Portfolioprüfung“: 30% - home work, 70% - written examination.
<b>9. Dauer des Moduls</b>	The module can be completed within one semester.
<b>10. Teilnehmer(innen)zahl</b>	Max. 30 Teilnehmer
<b>11. Anmeldeformalitäten</b>	
<b>12. Literaturhinweise, Skripte</b>	The information will be provided for each lecture.
<b>13. Sonstiges</b>	The module is conducted in TU Berlin, Germany

<b>Titel des Moduls :</b> <i>Heterogeneous and Distributed Information Systems</i>	<b>LP (nach ECTS):</b> 6 LP	<b>Kurzbezeichnung:</b> HDIS										
<b>Verantwortlicher für das Modul:</b> <i>Dr. Ralf-Detlef Kutsche</i>	<b>Sekr.:</b> EN 7	<b>Email:</b> <i>ralf-detlef.kutsche@tu-berlin.de</i>										
<b>Module description, Stand 27.05.2015</b>												
<p><b>1. Qualifikationsziele</b></p> <p>The participants of this module will achieve deep conceptual, methodical, technical and practical knowledge in requirements analysis, design, architecture and development of heterogeneous and distributed information systems. This includes firstly classical knowledge about federated databases and mediator-based information systems (tight or loose coupling wrt. the dimensions of distribution, heterogeneity and autonomy). Secondly, different paradigms of heterogeneous information infrastructures and their management (e.g. P2P) and interoperability architectures ('middleware') will be investigated. Finally, modern model-based concepts for the development, integration and evolution of arbitrary information infrastructures, and –under this conceptual frame– model, metamodel, and metadata management as well as semantic concepts will be discussed and brought into practical experience by some larger project-like group work.</p> <p>The course is principally designed to impart: Technical skills 50%, Method skills 30%, System skills 10%, Social skills 10%</p>												
<p><b>2. Inhalte</b></p> <ul style="list-style-type: none"> <li>• Foundations/Terminology of HDIS (FDBS, FIS, MBIS)</li> <li>• Dimensions of HDIS: Distribution, Heterogeneity, Autonomy</li> <li>• Heterogeneous Data Models in HDIS: structured, semistructured, unstructured</li> <li>• Distributed Data Organisation and Software Architectures of HDIS (FIS, P2P, CS, ...)</li> <li>• Interoperability and Middleware Platforms for HDIS</li> <li>• Persistency Services</li> <li>• Metadata Standards and Management in HDIS</li> <li>• Model-based Development of HDIS</li> <li>• Applications from Industry and Public Services</li> </ul>												
<p><b>3. Modul components</b></p> <table border="1"> <thead> <tr> <th>Module title</th> <th>Module type</th> <th>SWS</th> <th>Credits (ECTS)</th> <th>Semester (WS / SS)</th> </tr> </thead> <tbody> <tr> <td>Heterogeneous and Distributed Information Systems</td> <td>IV</td> <td>4</td> <td>6</td> <td>WS</td> </tr> </tbody> </table>			Module title	Module type	SWS	Credits (ECTS)	Semester (WS / SS)	Heterogeneous and Distributed Information Systems	IV	4	6	WS
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Heterogeneous and Distributed Information Systems	IV	4	6	WS								
<p><b>4. Beschreibung der Lehrformen</b></p> <p>This „integrated course“ (IV) consists of a lecture partition and a seminar-like partition, where all participants develop one of the key topics with own literature work and give short presentations. Additionally, there is a practical lab part of smaller and larger exercises, particularly one complex task, to be fulfilled in team work. Active contribution to all parts of the course is essential, as there will be a final report and a final presentation of all members of the course.</p>												

<p><b>5. Voraussetzungen für die Teilnahme</b></p> <p>The basic modules in “Computer Science”, particularly “Database Systems” and “Software Engineering” is required; “Advanced Information Modelling” or equivalent strongly recommended.</p>
<p><b>6. Verwendbarkeit</b></p> <p>Compulsory elective for MSc IT for Energy</p>
<p><b>7. Arbeitsaufwand und Leistungspunkte</b></p> <p>Final report &amp; presentation: 15.0 * 2 h = 30 h  Lab exercises including project task: 15.0 * 4 h = 60 h  Plenary sessions of this integrated course: 15.0 * 4 h = 60 h  Preparation and consolidation: 15.0 * 2 h = 30 h  <b>Summe: 180 h = 6 LP</b></p>
<p><b>8. Prüfung und Benotung des Moduls</b></p> <p>Examination as so called „Portfolioprüfung“: 10% Active Lab Participation, 25% - Project Work / Homework, 25% - Seminar Talk, 40% - Written Report.</p>
<p><b>9. Dauer des Moduls</b></p> <p>The module can be completed within one semester.</p>
<p><b>10. Teilnehmer(innen)zahl</b></p> <p>Max. 30 Teilnehmer</p>
<p><b>11. Anmeldeformalitäten</b></p>
<p><b>12. Literaturhinweise, Skripte</b></p> <p>Script: only soft copy available.  <b>Literatur:</b>  For each topic during this course appropriate text books, research papers, technical reports and standardization documents will be used.</p>
<p><b>13. Sonstiges</b></p> <p>The module is conducted on campus in El Gouna, Egypt</p>

