



Integrating education with consumer behaviour relevant to energy efficiency and climate change at the universities of Russia, Sri Lanka and Bangladesh (BECK)

MODULE SPECIFICATION

Originating Institution, Department	Module Co-ordinator(s)
Kaliningrad State Technical University, Department of Electrical Equipment of Ships and Electrical Power Engineering	Prof. Dr. Habil Valeriy Beley

TITLE OF THE MODULE

Title of the module	Module code¹
Energy Efficiency Technologies in the Electric Power Industry	Б1.В.ДБ.02.01.04

PROGRAMME(S) IN WHICH TO BE OFFERED:

13.03.02 «Electric power industry and electrical power engineering»

LEVEL OF STUDIES²

First cycle (BSc/BA) <input checked="" type="checkbox"/>	Second cycle (MSc/MA) <input type="checkbox"/>	Third cycle (PhD) <input type="checkbox"/>
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CREDITS AND LEARNING HOURS

Credit Value ³	ECTS Value ⁴	Indicative academic learning hours ⁵	Length (in Semesters) ⁶	Year in which to be offered
3	-	108	1	4

ANNOTATION OF THE MODULE⁷

The course introduces a detailed introduction to the energy efficient technologies use in the electric power industry in relation to climate change and consumer behaviour, based on examples

¹ To be indicated by the Institution

² According to the Framework of Qualifications for the European Higher Education Area, Annex 8: http://www.aic.lv/ace/ace_disk/Bologna/Bergen_conf/Reports/EQFreport.pdf

³ Permissible credit values as set out in Institution's Academic Regulations

⁴ European Credit Transfer System, 1 ECTS = 25-30 academic learning hours. Please refer to ECTS Users' Guide: https://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf

⁵ 1 academic learning hour is equal to 45 minutes

⁶ Indicate 0.5, 1, 1.5 or 2

⁷ Please provide brief summary of the module, up to 200 words





of international good practice and the latest findings of scientific research. The course is dealing with the field of energy, electrical engineering and energy management as affecting the climate change. The concept of demand response is used to describe the consumer behaviour in modern electrical energy supply system

The module focuses international case studies and best practices. The theory and methodology of the subject is learned, and certain specific and general skills are developed at the BECK Simulated Big Data Interuniversity Networked Affective Educational Centre by using computer learning systems, big data mining, an affective tutoring system, e-sources and the Moodle Virtual Learning Environment.

AIM OF THE MODULE⁸

Aims of Module:

- To introduce the concept of energy efficiency and energy-efficient technologies in the field of electric power industry and consumer perspective;
- To indicate the benefits attainable by improving energy efficiency in both supply and demand of electrical energy;
- To outline a range of approaches to achieve increased levels of energy efficiency including consumer behavior in form of demand response;
- To outline the typical barriers to enhanced energy efficiency.

MOOC LEARNING AND TEACHING STRATEGIES

The MOOC course has to contribute to an opening up of education to the benefit of both learners and the society at large while reflecting values such as equity, quality and diversity. The common features of the course are:

- Openness to learners: open entry (no formal pre-requisites, except technical, such as basic knowledge of electrotechnic), freedom to study at the time, place and pace of your choice, flexible pathways, fit for a wide variety of lifelong learners;
- Digital openness: courses available online;
- Learner-centred approach: courses aid students to construct their own learning from a rich environment, and to share and communicate it with others;
- Independent learning: a MOOC provides high quality materials to enable the progress of an independent learner through self-study;
- Media-supported interaction: course materials make best use of online affordances (interactivity, communication, collaboration) as well as rich media (video and audio) to engage students with their learning.
- Recognition options: successful course completion will be recognised as indicating worthwhile educational achievement.
- Quality focus: focus on quality in the production and presentation of a MOOC.
- Spectrum of diversity: the course is inclusive and accessible to very diverse citizens.

The delivery of the new certificated and recognized adaptive BECK MOOCs is enabled by the use of the innovative Simulated Big Data Interuniversity Networked Affective Educational Centre. Affective computing technologies and neuro decision matrices, big data and text analytics, and an adapted Yerkes–Dodson law are the foundation of the BECK system. Affective computing is the

⁸ Aim of the module must correspond to the BECK Capacity Building Framework





study and development of systems and devices that can recognize, interpret, process and simulate human affects. The BECK system will interpret the emotional state of a student and adapt the learning process to that particular student by providing an appropriate response to relevant emotions and requirements.

Six major components have been identified for the development of the Simulated Big Data Interuniversity Networked Affective Educational Centre (the BECK Centre):

- 1) Adaptive MOOCs;
- 2) Computer learning systems;
- 3) Big Data Mining;
- 4) Affective Tutoring System;
- 5) Access to e-sources;
- 6) Moodle Virtual Learning Environment.

The computer learning system is understood as an object (with its components) for managing and investigating data, information, and expressed and unexpressed knowledge. It is a modelling system that accumulates data and information from various resources and then processes that data and information by means of various mathematical, logical and informational models.

The data mining will enable integrated analysis of the following data and information from multiple locations: weather, climate, dwelling envelope, utilities, occupancy, market data (government data, trade association data, financial data from major players, customer surveys), climate change, best practices, human influences, the behaviour of users, etc.

The Affective Tutoring System integrates the student self-assessment procedures with biometric (facial expression analysis) and intelligent techniques and technologies.

The centre will offer open-source videos, simulators (calculators and software), case studies from the best universities around the world to enhance the module.

The following main features have been identified for the development of the Moodle Virtual Learning Environment: adaptable design, modern and easy to use interface, personalized dashboard, collaborative tools and activities (Assignments, Chat, Choice, Database, Feedback, Forum, Glossary, Lesson, Quiz, Survey, Wiki, Workshop), all-in-one calendar, convenient file management, simple and intuitive text editor, notifications, progress track, secure authentication and mass enrolment, multilingual capability, high interoperability, user role and permission management, etc.

MOOC is accessible for various target groups. Its activities aid participants to construct their own learning and communicate it to others. The activities, tasks and routes are designed in such a way that they can be performed at specific levels of difficulty or complexity, to accommodate the broad spectrum of participants' knowledge and skills that is expected. The course contains sufficient interactivity (learner to content, learner to learner and learner to teacher) to encourage active engagement. The feedback of the academic tutor is limited and scalable. The course provides learners with regular feedback through self-assessment activities, tests or peer feedback. The MOOC has possibilities to follow the score and progression.

The pedagogical model of the course is such that the efforts of all services do not increase significantly as the number of participants increases. All aspects of the course are delivered online. Learning outcomes are assessed using the balance of formative and summative assessment appropriate to the level of certification.

INTENDED LEARNING OUTCOMES AND ASSESSMENT





Learning Outcomes of the module⁹	Methods of studies	Assessment methods of student achievements¹⁰	Assessment criteria of student achievements by assessment levels
O1. Able to explain and apply the concepts, theories and perspectives of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change	Blended learning, integrated affective tutoring and affective computing methods. The Integrated Method includes computer learning systems, big data mining, an affective tutoring system, access to e-sources (open-source videos, simulators such as calculators and software, and case studies from the best universities around the world), self-study in the Moodle Virtual Environment (learning materials including audiovisual materials, text materials, online interactions in forums to build a learning community, and exercises with an integrated feedback mechanism), live events (video conferencing)	<input checked="" type="checkbox"/> Problematic questions <input checked="" type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects <input checked="" type="checkbox"/> Peer evaluation <input type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input checked="" type="checkbox"/> Other: assessment of a written group project work	<i>Threshold achievement level</i> Knows the concepts, theories and perspectives of energy efficiency technologies in the electric power industry to consumer behaviour relevant to energy efficiency and climate change, but is not able to explain and apply in a wider context
			<i>Typical achievement level</i> Able to explain and apply the concepts, theories and perspectives of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change
			<i>Excellent achievement level</i> Able to explain and apply the concepts, theories and perspectives of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change in a wider context
		<input checked="" type="checkbox"/> Problematic questions	<i>Threshold achievement level</i>

⁹ Learning outcomes are specified in three categories – as **knowledge, skills and competence**. This signals that qualifications – in different combinations – capture a broad scope of learning outcomes, including theoretical knowledge, practical and technical skills, and social competences where the ability to work with others will be crucial. Please refer to Cedefop (2017). Defining, writing and applying learning outcomes: a European handbook. Luxembourg: Publications Office of the European Union. https://www.cedefop.europa.eu/files/4156_en.pdf. Learning outcomes of the module must correspond to the BECK Capacity Building Framework.

¹⁰ Please select from the list. Additional assessment methods may be added.





<p>O2. Able to research and make decisions in the development of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies</p>	<p>Blended learning, integrated affective tutoring and affective computing methods.</p>	<p> <input type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects <input type="checkbox"/> Peer evaluation <input checked="" type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input type="checkbox"/> Other: </p>	<p>Able to research and make decisions in the development of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies at a basic level</p> <hr/> <p><i>Typical achievement level</i> Able to research and make decisions in the development of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies</p> <hr/> <p><i>Excellent achievement level</i> Able to research and make decisions in the development of energy efficiency technologies in the electric power industry in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies at an advanced level</p>
<p>O3. Able to communicate and manage consumer attitudes related to mitigation of climate change in the energy efficiency technologies in the electric power industry (demand response)</p>	<p>Blended learning, integrated affective tutoring and affective computing methods.</p>	<p> <input checked="" type="checkbox"/> Problematic questions <input type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects <input checked="" type="checkbox"/> Peer evaluation <input type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input checked="" type="checkbox"/> Other: activity assessment </p>	<p><i>Threshold achievement level</i> Has basic skills to communicate and manage industrial and domestic consumer attitudes related to the mitigation of climate change in built environment (demand response)</p> <hr/> <p><i>Typical achievement level</i> Has intermediate skills to communicate and manage industrial and domestic consumer attitudes related to the mitigation of climate change in built environment (demand response)</p> <hr/> <p><i>Excellent achievement level</i></p>





			Has advanced skills to communicate and manage industrial and domestic consumer attitudes related to the mitigation of climate change in built environment (demand response)
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MODULE MARK CALCULATION¹¹:

Assessment components (in chronological order of submission/examination date)				
Type of assessment ¹²	Weighting, %	Duration (if exam)	Word count (if essay or similar):	Component pass required ¹³
Assessment of the degree of interaction and participation of the students	30%			Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Written Group Project Report	50%		10 000	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Online examination (test)	20%	20 minutes		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Total:	100%			

SYLLABUS OUTLINE

No.	Topic ¹⁴	Number of hours ¹⁵
1.	Introduction to the module	4
2.	Basic introduction into energy efficiency: concept of energy efficiency, importance of energy increase measures.	10
3.	Common barriers to implementation of energy efficiency measures: policy and regulatory, financial and investment, technological.	16
4.	Energy audit in industry: general information, benefits from interventions, energy audit types, general procedure, the purpose and requirements, objectivity, tools, schedules, design criteria, preliminary energy vision, proposed project.	20

¹¹ Please list all components, sum must be equal to 100%. Note that successful course completion should be recognised as indicating worthwhile educational achievement.

¹² Please indicate in chronological order of submission date each assessment component by type, e.g. examination, home work, coursework, project

¹³ Indicate Yes to specify the assessment component(s) to be passed in order to pass the module

¹⁴ Please add as many topics as needed

¹⁵ Includes self-learning, on-line conferences and consultations





5.	Energy efficiency in power energy sector: power factor, power converters (rectifiers, inverters), efficient motors and transformers, efficient lighting, control systems, power quality, calculations, examples.	20
6.	Typical examples of energy efficiency increase measures for industrial plants and processes - current state (machinery, lighting, cooling and heating, electricity, cooling, ventilation, control systems), measurements, saving and energy recovery interventions, economic evaluation of interventions.	12
7.	Basic energy analysis, documentation and economy of energy efficiency increase measures: power balance sheets, chronological charts, electrical consumption balances, estimated annual energy consumption.	14
8.	Industrial and domestic consumer behaviour on electrical energy market in the concept of demand response	12
Total:		108

LEARNING MATERIALS¹⁶

Core materials (up to 5 references):

1. WC Turner and Steve Doty: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
2. Sumper Andreas and Baggini Angelo: Electrical Energy Efficiency: Technologies and Applications (John Wiley 2012)
3. Iliev, Iliya & Kaloyanov, Nikola & Gramatikov, Plamen & Terziev, Angel & Palov, Ivan & Stefanov, Stefan & Sirakov, Kiril & Kamburova, Veselka. (2012). Energy Efficiency and Energy Management Handbook.
4. Beley V. F. i dr. Spravochnik modulya: vozobnovlyaemye istochniki energii: spravochnoe izdanie //Kaliningrad: Izd-vo OOO «TESK. – 2015.

Supplementary materials (up to 10 references):

1. Sibikin, M.YU. Tekhnologiya energosberezheniya [Elektronnyj resurs] : uchebnik / M.YU. Sibikin, YU.D. Sibikin. - 4-e izd., pererab. i dop. - Moskva ; Berlin : Direkt-Media, 2014. - 352 s. (EBS «Universitetskaya biblioteka onlajn»).
2. Sibikin, YU.D. Osnovy proektirovaniya elektrosnabzheniya ob'ektov [Elektronnyj resurs] : uchebnoe posobie / YU.D. Sibikin. - Moskva ; Berlin : Direkt-Media, 2015. - 357 s. (EBS «Universitetskaya biblioteka onlajn»).
3. Ekspluatatsiya linij raspreditel'nyh setej sistem elektrosnabzheniya [Elektronnyj resurs]: uchebnoe posobie / E.E. Privalov, A.V. Efanov, S.S. YAstrebov, V.A. YArash ; FGBOU VO Stavropol'skij gosudarstvennyj agrarnyj universitet ; pod red. E.E. Privalova. - Stavropol' : Paragraf, 2018. - 169 s. (EBS «Universitetskaya biblioteka onlajn»).

¹⁶ Courses should provide high quality materials to enable an independent learner to progress through self-study. Materials should make best use of online affordances (interactivity, communication, collaboration) as well as rich media (video and audio) to engage students with their learning.





4. Privalov, E.E. Eksploataciya linij elektroperedach sistem elektrosnabzheniya [Elektronnyj resurs] : uchebnoe posobie / E.E. Privalov. - 2-e izd., ster. - Moskva ; Berlin : Direkt-Media, 2017. - 215 s. (EBS «Universitetskaya biblioteka onlajn»).

5. Sibikin, YU.D. Osnovy elektrosnabzheniya ob"ektov [Elektronnyj resurs] : uchebnoe posobie / YU.D. Sibikin. - Moskva ; Berlin : Direkt-Media, 2014. - 328 s. (EBS «Universitetskaya biblioteka onlajn»).Andrić, I., Koc., M., & Al-Ghamdi, S. G. (2019).

6. Energy Efficiency: <https://link.springer.com/journal/12053>

7. Open Journal of Energy Efficiency: <https://www.scirp.org/journal/ojee/>

8. Energy and Buildings: <https://www.journals.elsevier.com/energy-and-buildings>

On-line resources¹⁷:

1. International Energy Association: <https://www.iea.org/topics/energyefficiency/>

2. European Council for an Energy Efficient Economy: <https://www.eceee.org>

3. The European Energy Efficiency Fund: <https://www.eeef.eu/home.html>

Other materials:

Lecture materials available at the BECK Simulated Big Data Interuniversity Networked Affective Educational Centre.

REQUIRED IT RESOURCES¹⁸

No.	Software, manufacturer
1.	MS Word
2.	MS Excel
3.	MS Power Point
4.	Adobe Acrobat reader
5.	RastrWin3
6	Mathcad

Date of completion of this version of Module Specification

Date of approval by the Faculty:

¹⁷ Please provide links

¹⁸ Please add as many software as needed for the course

