College of Science and Technology

African Center of Excellence in Energy for Sustainable Development (ACE-ESD)

P.O.BOX BP 3900, Kigali

CURRICULUM

African Center of Excellence in Energy for Sustainable Development

Master of Science in Energy Economics Degree

PROGRAMME SPECIFICATION

(July, 2017)

1. Programme Details

The table in this section sets out the programme details. It shows the title, which is also the highest qualification obtainable from the programme. The title was selected with the aim to make the programme look both academically sound and useful for employment. In addition, in the table we specify the exit awards, the mode of attendance and the resource group. For the resource group in particular, we opt *a part classroom/part laboratory*. According to the National Qualification Framework, such a class corresponds to category 5 with a staff/student ratio of 1:20.

<table>
<tr><td><u>1.1 Programme Title</u></td><td colspan="4">Master of Science in Electrical Power Systems</td></tr>
<tr><td>1.2 <u>Exit Awards</u></td><td colspan="4"><table><tr><td></td><td>Credits</td></tr><tr><td>• Postgraduate Diploma in Energy Economics
• Master of Science Degree in Energy Economics</td><td>120

240</td></tr></table></td></tr>
<tr><td rowspan="3"><u>1.3 Modes of Attendance</u></td><td>Part-time</td><td>X</td><td>Full-time</td><td>X</td></tr>
<tr><td>Distance Learning</td><td></td><td>Work-based Learning</td><td></td></tr>
<tr><td>Other (please specify)</td><td></td><td>Short course</td><td></td></tr>
<tr><td rowspan="4"><u>1.4 Resource group</u></td><td>1</td><td></td><td>5</td><td>X</td></tr>
<tr><td>2</td><td></td><td>6</td><td></td></tr>
<tr><td>3</td><td></td><td>Other (write in)</td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2"><u>1.5 First year of presentation</u></td><td colspan="3">2017-2018</td><td>X</td></tr>
<tr><td colspan="3"></td><td></td></tr>
<tr><td><u>1.6 Programme Leader</u></td><td colspan="4">Prof. Etienne Ntagwirumugara, Director, ACE-ESD</td></tr>
</table>

1.7 Programme Development Team

Name	**School/Institution**
Prof. Ntagwirumugara Etienne	School of Engineering/CST
Dr. Ndemezo Etienne	School of Economics/CBE
Dr. Kabanda Richard	School of Economics/CBE
Dr. Dieudonne Muhoza	School of Economics/CBE
Dr. Kabanda Richard	School of Economics/CBE
Odax Ugirimbabazi	School of Engineering/CST
JMV Bikorimana	School of Engineering/CST
Fabien Mukundufite	School of Engineering/CST
Geoffrey Gasore	School of Engineering/CST
Yousouf Singirankabo	School of Engineering/CST

Michael Asinyaka	School of Engineering/CST
Dr. William GBoney	RURA, Expert in Energy Economics
Eng. Alfred Byigiro	RURA, HoD of Energy Department

1.8 School/Centre Administratively responsible for the Program	African Center of Excellence in Energy for Sustainable Development (ACE-ESD)

2. PROGRAMME FUNDING AND NEED FOR RESOURCES

2.1 Programme Development Team

The team is composed of the Programme Leader, eleven academic staff from UR-CST and two experts from Rwanda Utilities Regulatory Authority who were involved in the writing and planning of the module descriptors. Also included were representatives from private and public sector such as Rwanda Energy Group (REG) and Ngali Energy Ltd. The Programme leader who is also the Director of the ACE-ESD will be present throughout the planning process, including the validation meetings.

2.2 Students numbers:

Intake per year into Level 6: 20 students/intake
Eventual population, all years: 40 students

2.3 Adequacy of Infrastructure

The programme will be resourced from the existing resources of the College of Science and Technology Campuses. The classrooms and computer laboratories are adequate for the program. A special state lab will be set up by the ACE-ESD –World Bank funds to further enhance infrastructure.

2.4 Adequacy of Staff Resource

Here the numbers and level of staff working on the programme in each year are given with the objective to show how the staff resource is adequate in terms of numbers and seniority as well as to cost the programme in financial terms. The staff figures given in the table are full time equivalents.

Year	2017/18	2018/19	2019/20	2020/21	SOURCE OF FUNDS
Academic Staffing					
Full professors	0	1	1	2	UR/ACE-ESD
Associate professors	0	1	2	3	UR/ ACE-ESD
Senior lecturers	1	2	3	4	UR/ ACE-ESD
Lecturers	2	3	4	5	UR/ ACE-ESD
Support Staff	2	2	4	5	UR/ ACE-ESD
Technical & Other Staff	2	2	2	2	UR/ ACE-ESD

2.5 General accommodation requirements

The figure in this section serves to give an idea on the number and size of rooms that will be needed by the programme.

- Two classrooms and two computer laboratories for at least 30 students are available.
- One computer lab for different software.
- Students will, however, be encouraged to bring their own devices, thus enabling them to access online materials and lectures.

3 PROGRAMME AIMS AND RATIONALE

3.1.Background and Programme Rationale

As the energy sector in most developing countries undergo rapid reforms and restructuring, it is important that a critical mass of professionals are trained to address critical and emerging issues in the energy sector. Rapid development in the fields of privatisation and regulation has led to an increasing need for specialists in energy economics. These activities require a high level of in-depth training, beyond the skills provided in a general engineering and economics degrees and beyond the knowledge that can be acquired through on the job training. The existence of staff with knowledge embedded in energy economics at a postgraduate level, is therefore crucial in order to achieve the overall energy sector objectives, and enhance the credibility of the decisions taken in the eyes of all stakeholders.

It is in this regard that this an MSc programme in Energy Economics for Africa, to be based in Rwanda and hosted by the College of Science and Technology (ACE-ESD), at University of Rwanda, is being proposed. In selecting Rwanda to host this all-important program in Africa, the Program Coordinators took a lot of factors into consideration

particularly the security and safety of visitors (i.e. the visiting lecturers, guest speakers and students).

3.2.Aims and Objectives of MSc Programme in Energy Economics

The aim of the programme is to provide students with in-depth understanding of a blend of *economics, finance, policy and basic engineering principles* and their application, to the resolution of problems in the energy sector. The postgraduate programme will specifically provide specialised training in the concepts and skills involved in energy economics. The programme is expected to make a significant contribution towards transforming the energy sector in Africa. It will train future leaders and strategic thinkers for the sector, and create a cutting edge research and analysis of practical issues confronting the continent's energy sector.

Additionally, by establishing the postgraduate programme in an African University which covers the entire range of courses related to energy economics, this is going to reduce the tuition fees to be paid by African students who would have wanted to pursue a similar courses in Europe or the USA, but could not do so due to the prohibitive tuition fees. These students now have the opportunity to do so in Africa at a reduced cost of almost 30%, compared with the tuition fees in Europe and the USA. The current tuition fees per student for a similar course in the UK, excluding living allowances, is at least £20,000. The tuition fees for such a programme is very high and prohibitive for most developing countries, especially for African countries and this limits the training of critical mass of professional skills and experts on the continent in the area of energy economics.

4. PROGRAMME LEARNING OUTCOMES

A. Knowledge and Understanding

At the end of the programme students should be able to:

A1. Carry out technical and economic assessment of off-grid, mini-grid and grid connected power generation systems (i.e. conventional and non-conventional power generation technologies)

A2. Carry out technical and economic assessment of power transmission and generation systems

A3. Develop analytical skills required to apply results of economic analysis in the energy sector, to assist in both policy and regulatory decision making

A4. Understand the basic tools for financial analysis**,** including basic accounting principles, as well as principles of financial management

A5. Understand the risks associated with the energy sector and be able to apply the risk management tools available to mitigate them

A6. Understand the theoretical and practical perspectives of individual and industrial demand for energy, energy supply, energy markets and carry out energy modelling to determine energy supply and demand

B. Cognitive/Intellectual skills/Application of Knowledge

At the end of the programme students should be able to:

B1. Apply the knowledge to carry out technical and economic assessment of solar photovoltaic, wind, geothermal, biomass, waste-to-power, Biogas, Micro and pico-hydroelectric power systems, as well as mini and large hydroelectric power systems

B2. Use applied microeconomic models to assist in policy, regulatory and long-term investment decision-making.

B3. Apply knowledge gained to solve the practical issues in the energy sector related to financing of joint ventures, project finance, infrastructure finance, public-private partnerships (PPPs) and privatization

B4. Manage the risks inherent in business transactions in the energy sector

B5. Apply knowledge in developing renewable energy, energy efficiency and climate change policies for controlling emission

B6. Acquire sufficient knowledge and techniques to be able to analyse the relationship between macroeconomic factors and energy sector issues

C. Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the programme, students should be able to:

C1. Use the analytical techniques and steps involved in carrying out technical evaluation and economic assessment of energy systems

C2. Effectively communicate the results of the analysis to enable policy makers and power system planners

C3. Use empirical techniques to explain micro-economic concepts, and how these are used in the energy sector to solve practical problems

C4. Carry out and publish results of financial analysis of energy sector projects and communicate the results to stakeholders

C5. Manage the major risks associated with energy trading and in other energy sectors.

C6. Develop Renewable energy and energy efficiency policies

D. General transferable skills

At the end of the programme students should be able to:

D1. Explain the key analytic steps used in technical and economic evaluation of power system projects

D2. Use the application of the analytical methods to large new projects, smaller rehabilitation/retrofitting projects, and use knowledge to assist in policy analysis

D3. Undertake independent research/problem solving and present the results at international energy conferences, and also publish papers in international journals

D4. Have the skills in identifying the links between theory, policy, and practice

D5. Provide support on project evaluation as well as policy and regulatory advisory services on public-private partnerships (PPPs)

D6. Model energy demand for different end-users including the industrial sector for policy and regulatory decision making

D7. Work with macroeconomic models to produce results which can help to solve practical policy and regulatory problems in the energy sector

5. PROGRAMME STRUCTURE

The Master of Science degree programme in Energy Economics is designed to produce students who can undertake insightful analysis of energy sector issues. In order to obtain an MSc degree, it is necessary to attain 160 credits from taught modules and complete a dissertation of 80 credits, thus bringing the total number of credits for the programme to 240. The programme has been designed to be flexible to incentivise working students to enrol. This is to encourage employers to sponsor their workers so that students can "block" one or two weeks within each agreed period from their work places, in order to attend a particular module. This approach implies that students would not necessarily have to take a 2-year study leave to enrol in the programme. The MSc programme in Energy Economics is structured as follows:

- **Academic Period 1 (15 credits each, except Energy Economics I)**

√ Power and Energy Systems
√ Microeconomics of the energy sector
√ Energy Economics I (20 credits)

√ Econometrics I
√ Corporate Finance and Business Communication

- **Academic Period 2 (15 credits each, except Energy Economics II)**

√ Research Methodology
√ Risk Management in the Energy Sector
√ Energy Economics II (20 credits)
√ Advance Econometrics
√ Macroeconomics

- **Academic Period 3&4**

√ Dissertation – 80 credits

In addition to the Master Degree Programmes, a Centre of Excellence on Energy Sustainability has been created. This Centre will serve as a hub where in-depth studies and research works would be carried out on major issues affecting Africa's energy sector. The Centre will also organise short-term Executive Training Courses on selected topics which are practically oriented and relevant to most African countries' energy sector. The results of the research works would be disseminated to the donor partners, other academic institutions and published in international academic and industry journal.

Semester 1					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
EEC 6161	Power and Energy Systems	15	48	6	A1-A6,B1-B6,C1-C6, D1-D7
ENE 6165	Microeconomics of the energy sector	15	48	6	A1-A6,B1-B6,C1-C6, D1-D7
EEC 6162	Energy Economics I	20	72	6	A1-A6,B1-B6,C1-C6, D1-D7
EEC 6163	Econometrics I	15	48	6	A1-A6,B1-B6,C1-C6, D1-D7
ENE 6164	Research Methodology	15	48	6	A1-A6, B1-B6, C1-C6, D1-D7
	Sub-total	80	264	-	

Semester 2					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
ENE 6262	Corporate Finance and Business Communication	15	48	6	A1-A6, B1-B6, C1-C6, D1-D7
EEC 6261	Risk Management in the Energy Sector	15	48	6	A1-A6,B1-B6,C1-C6, D1-D7
EEC6262	Energy Economics II	20	72	6	A1-A6,B1-B6,C1-C6, D1-D7
EEC 6263	Advance Econometrics	15	48	6	A1-A3,A5,A6, B1-B6,C1-C6, D1-D7
EEC6264	Macroeconomics	15	48	6	A1-A3,A5,A6,B1-B6,C1-C6, D1-D7
	Sub-total	80	264	--	
Semester 3					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
EEC6461	Dissertation	-	-	6	A1-A6,B1-B6,C1-C6, D1-D7
	Sub-total	-	-	-	
Semester 4					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
EEC6461	Dissertation	80	288	6	A1-A6,B1-B6,C1-C6, D1-D7
	Sub-total	**80**	**288**		
	Total	**240**	**816**	**-**	

Program Learning outcomes mapping

Semester 1																										
Module Code	Module	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7
EEC 6161	Power and Energy Systems	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ENE 6165	Microeconomics of the energy sector	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC 6162	Energy Economics I	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC 6163	Econometrics I	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ENE 6164	Research Methodology	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Semester 2																										
Module Code	Module	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7
ENE 6262	Corporate Finance and Business Communication	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC 6261	Risk Management in the Energy Sector	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC6262	Energy Economics II	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC 6263	Advance Econometrics	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EEC6264	Macroeconomics	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Semester 3																										
Module Code	Module	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7
EEC6461	Dissertation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Semester 4																										
Module Code	Module	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7
EEC6461	Dissertation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

6. LEARNING AND TEACHING STRATEGY

The programme is designed to be flexible in the range of teaching methods used. The programme will be delivered through a mixture of lectures, class discussion/seminars, student presentations, analysis of case studies and interactive computer based exercises particularly in relation to the econometric component of the programme.

7. ASSESSMENT STRATEGY

The module evaluation will be based upon individual assessment submitted by Lecturer at the end of the module. The special tools/software's and strategies will be used to avoid plagiarism, cheating and other malpractices. The specific marking criteria for each module will be provided in individual module descriptions. The Final Exam shall be of 3 hours following general master's programme format as already followed. A tentative guide is provided for lecturer to use for continuous assessment but may vary with different module but at least 2 different elements shall be covered.

Category 1: Theory course with Practical's or 15/20 credit module

The assessment shall include 60% of continuous tests and 40% of the final examination. The assessments shall be made 50% each for practical and theoretical aspects. A completed module will be considered passed only if a minimum score of 60% or above is achieved during the evaluation.

For Example:

One/two practical assignment (20%), one research seminar or mini project for presentation (20%), one tutorial session (20%) followed by final assessment (40%) of End of Module Examination divided equally into practical viva-voce and theoretical examination.

Category 2: Dissertation with 80 credits

The dissertation will be evaluated by a written report, presentation and oral examination by the internal and external examiner(s) during the Project Defence. The guidelines shall be provided during Research Methodology module.

• Examination.
To evaluate the accomplishment of the module learning outcomes, an examination could be used to assess a complete module, especially the foundation modules where students are either physically present face-to-face or electronic (on-line) tools can be used. However, this method may not be flexible enough to cover advanced modules, where understanding demonstrated through projects and exercises will be much more important
• Essays.
An essay will be used to demonstrate a student's understanding of the content of a particular module. This would demonstrate a student's ability to assimilate a subject in depth and objectively analyze the material that has been provided. However, marking of essays can be time consuming for the course tutor and lead to a degree of subjective assessment which depends, for example, on the student's knowledge of English rather than on their level of knowledge of the subject.
• Projects.
A project can be set which requires the student (or a group of students) to research a subject in more depth than has been provided on the course. The thoroughness with which a project has been completed and the adequacy of the results obtained could be an excellent way to assess whether a student has fully understood the concepts and methods used in the module. Ideally, around 50% of the marks for a particular module should be based on the results of projects or interactive exercises if these can be set in the required context and timescale.
• Research seminars.
Every module will have a component called Research Seminar. The seminar topic relates to the content of the study course. The students work on the topic on their own, present it for discussion.
• Interactive exercises.
These can be a fun way of quickly allocating marks to a student or a group of students. A problem can be outlined and the student or group of students asked to work out the best way of solving it. Enough scope should be given to allow the student to come up with innovative ways of solving the problem. An option of online assessment can be considered if possible.

8. STUDENT PROFILE

The admission to Master's degree in Energy Economics at University of Rwanda, College of Science and Technology (CST), requires the candidate to be a Bachelor's degree holder in the following fields:

- Graduates in Economics, Finance, Accounting and Business Administration with a strong interest in the energy sector or have working experience in the energy sector;
- Graduates in Engineering with interest in the energy sector or have a working experience in the energy sector;

9. SPECIFIC ADMISSION CRITERIA

To be admitted to MSc. Degree Programme in Energy Economics, the student must:

- Have a Bachelor's degree in Economics, Commerce, Statistics, Mathematics, Engineering, Agricultural Economics, Quantitative Economics, Finance, Accounting, physics with Energy option and related fields with second class, upper division;
- A Bachelor's degree in the same areas/specialisations as above, with second class, lower division, with at least a 2-year working experience;
- Demonstrate sufficient ability in English to undertake masters-level work.

10. STRATEGY FOR STUDENT SUPPORT

Each student will be allocated a supervisory team. The students will meet their supervisors on the regular basis in the face-to-face mode (in the case of local lecturers) or in the blended mode - face-to-face and communication through Internet (in case of visiting lecturers). The meetings will take place at least once a week with record keeping as per UR/CST guidelines.

In case of a suspected conflict, bias, discrimination, harassment or any other issues, students are advised to address the Head of Department or the Programme Coordinator. Alternatively, the Director of Research, Innovation and Postgraduate Studies (DRIPGS) shall serve the final verdict in case of any disputes after seeking prior order from the higher authorities being well informed on any such instance if it occurs on individual basis.

All students shall be provided with study materials, assignments, exercises, necessary guidelines, templates and supplementary materials. Those materials will also be posted on e-learning systems of UR/CST. Students will be given an opportunity to interact with lecturers through communication tools embedded into the e-learning system currently under progress. The programme coordinator shall form a committee to monitor the performance of students including quality of supervision.

11. PROGRAMME-SPECIFIC NEED FOR RESOURCES AND UNUSUAL DEMANDS ON UNIVERSITY RESOURCES

- Use of main library;

- E-learning;
- Computer Lab for all students, with computers in good working conditions and statistical software;
- Internet connectivity ICT laboratory;
- Journals related to the field of energy economics;
- Photocopying machine to photocopy exercises, case studies and question papers;
- LCD projector;
- Laptop for the lecturers.

12. STRATEGIES FOR CONTINUOUS ENHANCEMENT AND FUTURE DEVELOPMENT

- Continuous update of training modules in Energy Economics to be consistent with the labour market needs and also to meet international competitive standards;
- Create a relationship with other institutions and Universities providing the same programme in order to share reciprocal experiences and ideas;
- Students to undergo practical training in various companies and institutions as a part of the course, so that students will have a practical knowledge of the activities to be undertaken after completion of the programme.

13. STAFF DEVELOPMENT PRIORITIES

- To recruit qualified staff;
- To train the existing staff through co-teaching in accordance with their needs and priorities;
- To create a partnership with other institutions in order to exchange staff for reciprocal experiences;
- Participation in national and international conferences;
- Conducting faculty development programmes/workshops to deepen knowledge;
- Encouraging staff to take up research and consultancy in order to sharpen their expertise in the field of energy.
- The Centre will train in four years around 5 PhD Rwandan students under University of Rwanda who will be module leaders.

14. PROGRAMME ADMINISTRATION

The programme will be administered by ACE-in Energy for Sustainability Development (ACE-ESD), College of Science and Technology, University of Rwanda.

15. FUNDING SUPPORT

Funding for the MSc. in Energy Economics programme is provided by the World Bank and Government of Rwanda.

16. OTHER ESSENTIAL INFORMATION

To achieve the learning outcomes of the program, the teaching and supervision side of the programme will involve the use of experienced academic experts from City, University of London, Massachusetts Institute of Technology (MIT), Barcelona Graduate School, UR, and other Universities from USA and Europe, as well as lecturers from other African universities who have in-depth knowledge of Africa's energy sector. However, in order to ensure the long term sustainability of the programme, the UR policy of co-teaching and co-supervision will be applied.

For each module or thesis supervision, academic experts from UR and other Universities will partner to achieve the set objectives. Employees and other experts from other institutions, either within or outside Rwanda, could be invited as Guest Speakers to present case studies on key topics, to ensure that the programme is practically oriented. Such experts could also be invited to assist in thesis supervision, subject to their meeting the University of Rwanda requirements.

17. Unit Approval

Members of Approval Panel

Role/ Location	**Dean /Director**	**Date**
1 Principal	Signature	
	Print Name: Dr. Ignace Gatare	
2 ACE Director	Signature	
	Print Name: Prof. Etienne Ntagwirumugara	
3 Master's Coordinator	Signature	
	Print Name	

Seen and noted

Library	Signature Print Name	
ICT	Signature Print Name	
Teaching and Learning Enhancement	Signature Print Name	
Finance	Signature Print Name	