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# Development of a HArmonized MOdular Curriculum for the Smart Grid "DAMOC" Coordination Meeting

*Stellenbosch, 7<sup>th</sup> to 11<sup>th</sup> June 2021*



**Prof. Cuthbert Kimambo**  
**Dr. Joseph Kihedu**



# Presentation Outlines

## **Main achievements according proposed tasks**

- Development of Modules and Block Course
- Updated MSc Renewable Energy Curriculum
- Training of Future Staff and Exchange of Students
- Dissemination activities

## **State of Courses/Modules**

- Accreditation process (in Progress)
- Teaching Plan for MSc Renewable Energy (Lecturers for Modules)
- Training Plan for MSc Renewable Energy (Activity Timeframe)

## **Complications/Challenges**

- Laboratory Equipment



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# Main achievements according proposed tasks



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# Development of Modules and Block Course

- Introduced **four (4) modules** to strengthen learning outcomes;
  - EE661 - Smart Grid Technologies
  - ME662 - Renewable Energy based Hybrid Systems
  - ME663 - Energy Storage Systems
  - ME664 - Renewable Energy Financing and Pricing
- ✓ Developed courses presented in block course at NM-AIST
  - Course description and content discussed and reviewed



# Updated MSc Renewable Energy Curriculum

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Semester I Compulsory Modules	Credits	Semester II		Semester II	
		Solar Energy Specialization		Bioenergy Specialization	
Research Methods	12	Solar Cell Technology	12	Design and Modeling of Thermal Power Systems	12
Mathematical Analysis	12	Electrical Energy Conversion in PV systems	12	Biochemical Conversion Processes and Applications	12
Electrical Energy System	12	Solar Thermal Technology	12	Biochemical Conversion Processes and Applications	12
Solar Energy	12	Hydropower Specialization		Energy Efficiency in Buildings	
Hydropower	12	Development of small Hydropower	12	Low Energy Architecture	12
Bioenergy	12	Hydropower Electro-Mechanical Equipment	12	Energy, Comfort and Building	12
<i>*Other Forms of Renewable Energy*</i>	<i>*12*</i>	Hydraulic Structures in Hvdropower	12	Thermal Insulation in Building	12
<b>Total Credits per Semester</b>	<b>72</b>	Elective Courses		Mini and Smart Grid Specialization	
		Energy Policy and Planning	12	Smart Grid Technologies	12
		Optimization of Energy Systems	12	Renewable Energy based Hybrid Systems	12
		Other semester II module		Energy Storage Systems	12
				Renewable Energy Financing and Pricing	12

*\*Normally offered in Semester II*

Total of 60 to 84 credits per semester



# Training of Future Staff and Exchange of Students

## ➤ Training of **future teaching staff**

- Two attended junior members of staff trained at KU
- Dr. Sarah Ayeng'o – completed PhD and reported at UDSM
- Mr. Michael John – finalizing PhD

## ➤ Plan to involve lecturers from other departments at UDSM

- Telecommunication Engineering
- Physics and Electronics
- Business and Finance

## ➤ **Exchange of students**

- Two masters student visited TDU
- Mr. Daudi Nkubile – graduated and work at Standards Beareu
- Mr. Deogratus Maliwa – finalizing MSc, work with utility agency



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# Dissemination

- Participation in UDSM outreach program
  - **Research Week (April 2019)**
    - ✓ DAMOC as part of RE Research Group





# Dissemination

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## Energy Research Group

Prof Cuthbert Z.M. Kimambo and Dr. Joseph Kikedu

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### Mission

"To build capacity for research and postgraduate training covering fields of renewable energy, oil and gas technology, through development of strong collaborations in the region and internationally"

### Research Focus and PhD Thesis

Research Focus	Year	Description	Status
Oil and Gas Pipelines	2016-2020	Characterization of Three Phase Flow in Inclined Pipelines	In-progress
	2016-2020	Investigation of Flow Transients in Gas Pipeline Networks	In-progress
Solar Thermal Systems	2015-2019	Development of Solar Adsorption Refrigeration System for Off-Grid Application	In-progress
Hydro Turbines	2015-2019	Prediction Methods for Selecting Pump as Turbine for Micro Hydropower Systems	Submitted
	2011-2014	Design Optimisation and Characterisation of Crossflow Turbine	Completed



### Research Projects, Outputs and Impacts

Year	Donor	Budget	Project Title and Outputs	Impacts
2018-2023	NORAD NORPART	NOK 2,300,000	Mobility Scheme in Energy Technology a) 23 MSc from UDSM to NTNU, Norway b) 5 UDSM staff to NTNU, Norway c) Selected laboratory equipment acquired Development of Harmonized Smart Grid Modules (DAMOC)	• Visiting professor position
2017-2020	EU Erasmus+	EURO 80,000	a) 4 Smart Grid Modules introduced b) 3 MSc exchange TUD, Germany & SU, South Africa c) 3 UDSM staff trained at KAU, Sweden d) Simulation laboratory developed <b>Establishment of MSc in Oil and Gas Technology (OG&amp;T)</b>	• Enhanced MSc curriculum • Enhanced training capacity
2016-2020	NORAD Energy and Petroleum (EnPe)	NOK 4,600,000	a) 10 MSc scholarships at UDSM b) 2 PhD scholarships at UDSM, with NTNU Sandwich c) 11 UDSM staff trained at NTNU, Norway d) Oil and Gas Technology laboratory developed Renewable Energy Research & Education (Capacity:5)	• 8 Conference papers • Collaboration with industry • UDSM staff linked with NTNU visiting professors
2015-2019	NORAD Energy and Petroleum (EnPe)	NOK 2,200,000	a) 4 MSc scholarships at UDSM b) 2 PhD scholarships at UDSM, with NTNU Sandwich c) Hydropower & Solar Energy laboratory equipment Renewable Energy Research & Education	• 3 Journal publications • 10 Conference papers • Enhanced research capacity
2011-2014	NORAD EnPe	NOK 500,000	a) 1 PhD scholarship at UDSM, with NTNU Sandwich <b>Establishment of MSc in Renewable Energy</b>	• 3 Journal publications • 3 Conference papers
2008-2013	NORAD Master (NOMA)	NOK 4,400,000	a) 43 MSc scholarships at UDSM b) Renewable Energy laboratory developed Development of Wind Energy System	• Enhanced training capacity • Collaboration with industry
2006-2008	JICA-AICAD	USD 58,000	a) 2 MSc scholarships at UDSM b) Wind Energy laboratory equipment acquired	• 2 Conference papers • Enhanced research capacity
			59 MSc scholarships at UDSM, 5 PhD scholarships with NTNU Sandwich 8 Journal publications, and 18 Conference papers MSc Renewable Energy & MSc Oil and Gas Technology established Renewable Energy, Oil and Gas, Simulation Laboratory developed	







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# State of Courses/Modules



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## Accreditation Process in Progress

- Four (4) modules developed under DAMOC project framework
  - Used to formulate **Mini and Smart Grid Specialization** for existing master program
- Course descriptions added to **Updated MSc Renewable Energy Curriculum**
  - Resubmitted for accreditation process (with other PG programs)



# Teaching Plan for MSc Renewable Energy

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➤ Lecturers for new courses (participated during **block course in Arusha**);

- **Dr. Avit Thadei, and Dr Jaqueline Damas**
  - ✓ *Electrical/Telecommunication Engineering*
  - ✓ *EE661 Smart Grid Technologies*
- **Dr. Justo Jackson, and Dr Joseph Kihedu**
  - ✓ *Electrical/Electro-Mechanical Engineering*
  - ✓ *ME662 Renewable Energy based Hybrid Systems*
- **Dr Sarah Ayeng'o, and Mr. Michael John**
  - ✓ *Electro-Mechanical Engineering*
  - ✓ *ME663 Energy Storage Systems*
- **Prof Cuthbert Kimambo, and Mr. Joseph Ngowi**
  - ✓ *Renewable Energy/Engineering Economics*
  - ✓ *ME664 Renewable Energy Financing and Pricing*



# Training Plan for MSc Renewable Energy

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MSc Renewable Energy (*and other Coursework and Dissertation 18 months programs at UDSM*)

<b>February</b>	<b>Advertisement</b> for application to available programs Qualification; <b>2.7/5 GPA</b> in relevant MSc program
<b>July</b>	Application window closes
<b>October</b>	Registration opens
<b>Nov – Feb</b>	First Semester (Compulsory Modules)*
<b>April – July</b>	Second Semester ( <b>Specialization Modules</b> , Electives)*
<b>Aug – Oct</b>	Dissertation proposal decided, supervisors allocated
<b>Nov – April</b>	Dissertation period Internal and external examination*
<b>November</b>	Graduation

\* Assessment follow General University Exam Regulations (**GUER**)



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# Complications/Challenges



# Laboratory Equipment

- Targeted at developing a **computer laboratory**
  - Specifications submitted to Procurement Office
    - ✓ Processor: Intel Core i9, 7960X
    - ✓ Memory: 256GB RAM, DDR4 2666
    - ✓ Hard drive: 512GB, SSD Storage + 4TB HDD
    - ✓ Graphics: NVIDIA Quadro P2000
    - ✓ Monitor: 31.5" 4K IPS UHD
- **Three quotations solicited and submitted**
- Procurement process failed on **tax exemption issues**



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# Thank you!

Asante!



**Prof. Cuthbert Kimambo**  
**Dr. Joseph Kihedu**