



**nulistice** 2018  
National University of Lesotho International Science & Technology Innovation Conference & Expo



**NATIONAL UNIVERSITY  
OF LESOTHO**



**RECP**  
Africa-EU Renewable Energy  
Cooperation Programme

## PROGRAMME

National University of Lesotho International  
Science and Technology Innovation Conference  
and Expo (NULISTICE)

### FEATURING

2<sup>nd</sup> Africa-EU Renewable Energy Research  
& Innovation Symposium (RERIS)

23 – 26 January 2018, Manthabiseng National  
Convention Center, Maseru, Lesotho



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# Welcome

Dear Delegate,

It is a great pleasure and honour to welcome you to this auspicious occasion of the NUL International Science, Technology and Innovation Conference and Expo (NULISTICE) 2018, featuring the second edition of the Africa-EU Renewable Energy Research & Innovation Symposium (RERIS) 2018.

Innovative ideas through research and technology have emerged over the past two decades in a multi-disciplinary approach to solve the problems of society and create jobs in the global economic agenda across all sectors. Sustainable use of resources with responsible entrepreneurship action represents a significant advance in understanding how innovation and business practices can help improve living standards of the society. Such a result is more predictable in its positive sense that the business environment between innovator, researcher and entrepreneur has to be supported by flexible policies to


encourage all stakeholders to hold them accountable to reasonable standards and to be more creative for societal benefit.

This joint conference offers an opportunity to turn ideas into action. It is our collective duty to promote responsible business practices by mobilising resources and assisting entrepreneurship actions in each sector to ensure self-employment and job creation amongst the youth to develop our nation and continents. One of the key messages to be conveyed here is that responsibility cannot be outsourced. We have to develop flexible policies that would help in promoting ideas and give confidence and support to those who want to build the future. Entering into business means taking responsibility to adopt sustainable business practices that take into account both the bottom line and the impact of their activities on society. Academia, governments and civil society organisations have the responsibility to improve and provide a forum for dialogue, peer learning, standard setting, analysis, and best policy recommendations to promote the innovative practices in Lesotho, the African continent, and the world in general.

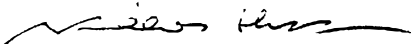
We hope that such a joint international conference and expo on science, technology and innovation will allow us to take joint actions to assist the youth in our respective countries to bring positive changes in societal development and protect the environment.

We wish you an enjoyable stay in the Mountain Kingdom of Lesotho!

Sincerely,



Prof. Manthoto H. Lephoto  
NUL PVC and Chairperson of the NULISTICE 2018



Niklas Hayek  
Project Manager, Africa-EU Renewable Energy Cooperation  
Programme (RECP) and RERIS organiser



# Introduction

## **NATIONAL UNIVERSITY OF LESOTHO INTERNATIONAL SCIENCE AND TECHNOLOGY INNOVATION CONFERENCE AND EXPO (NULISTICE) 2018**

In the recent global economic meltdown of 2008, Lesotho as a small nation experienced a serious decline in the job market for graduates. This posed a challenge to the National University of Lesotho to respond to this 'national crisis' as declared by His Majesty King Letsie III, the Head of State, who is also the Chancellor of the University. Following this, the University shifted its research focus from purely basic only, to applied, innovative and impactful research that addresses the economic challenges of society.

It is in this pursuit that the University held two Science and Technology Research and Innovation Expos in 2015 and 2016 showcasing 60, and 180 projects, respectively, that had potential for driving entrepreneurship to the community and hence, stimulating economic growth for thousands of graduates who would otherwise be lost into poverty. These two expos also exposed the need to infuse international views and expertise; and thus, the idea of hosting an international conference originated.

This 2018 NUL International Science, Technology and Innovation Conference & Expo is meant to provide an opportunity to turn ideas into action. It is expected that the attending scholars from all over the world will share their basic research findings, lessons in university-industry cooperation, successes and failures in commercialisation and policy recommendations in any of the areas mentioned above.

### **NULISTICE 2018 Thematic Areas:**

- Biotechnology and food safety
- Environment and natural resource management
- Agriculture and climate change
- Entrepreneurship and information technology
- Materials science and nanotechnology

## **AFRICA-EU RENEWABLE ENERGY RESEARCH AND INNOVATION SYMPOSIUM (RERIS) 2018**

With more than 600 million Africans living without access to electricity and over 730 million relying on dangerous, inefficient forms of cooking, fast but sustainable development of African renewable energy markets is needed. Applied research and innovative business roll-outs play a key role in boosting this development, helping to secure energy supply in both rural and urban areas, and to increase generation capacities and energy system resilience.

In view of the above, the Africa-EU Renewable Energy Cooperation Programme (RECP) organises the second Africa-EU Symposium on Renewable Energy Research and Innovation (RERIS 2018) on occasion of NULSTICE 2018.

Aiming to facilitate Africa-EU research collaboration, private and public sector participation in research, business innovation and university spin-offs, the symposium will address the following thematic areas:

- Power generation, distribution and transmission
- Decentralised and household energy solutions
- Energy socioeconomics
- Promotion of energy research, innovation, education and entrepreneurship

Selected full papers of oral presentations in RERIS thematic sessions will be published in “Springer Proceedings in Energy”.



# Conference Committees

## CONFERENCE CHAIR

Prof. Manthoto H. Lephoto, Pro-Vice-Chancellor, National University of Lesotho

## ORGANISING COMMITTEE

Dr Timothy Thamae, National University of Lesotho / NULSTICE lead organiser

Mr Niklas Hayek, Africa-EU Renewable Energy Cooperation Programme (RECP) / RERIS lead organiser

Dr Moeketsi Mpholo, National University of Lesotho

Prof. Himanshu Narayan, National University of Lesotho

Mrs Maleshoane Ramoholi, National University of Lesotho

Dr Pulane Nkhabutlane, National University of Lesotho

Dr Mosotho George, National University of Lesotho

Mr Rets'elisitsoe Thamae, National University of Lesotho

Dr Puleng Ranthimo, National University of Lesotho

Mr Kebitsamang Mothibe, National University of Lesotho

Dr Sissay Mekbib, National University of Lesotho

Mr Lefa Thamae, National University of Lesotho

Mr Joshua Takalimane, National University of Lesotho

Mr Benjamin Freischlad, Africa-EU Renewable Energy Cooperation Programme (RECP)

## SCIENTIFIC COMMITTEE NULSTICE

Prof. Himanshu Narayan, National University of Lesotho

Dr Timothy Thamae, National University of Lesotho

Dr Mosotho George, National University of Lesotho

Dr Pulane Nkhabutlane, National University of Lesotho

Dr Puleng Ranthimo, National University of Lesotho

Dr Sissay Mekbib, National University of Lesotho

Mr Joseph Thabana, National University of Lesotho

Mr Rets'elisitsoe Thamae, National University of Lesotho

Mrs Maleshoane Ramoholi, National University of Lesotho

Mr Kebitsamang Mothibe, National University of Lesotho

Dr Maluke Letete, National University of Lesotho

Dr Motlalepula Nete, Senior Lecturer, University Of Freestate, Bloenfontein, South Africa

Prof. Nelson Torto, African Academy Of Sciences, Nairobi, Kenya

Prof. Hailemichael Alemu, National University Lesotho

Prof. Krish Bharuth-Ram, Prof. Emirates, University Of Kwazulu Natal, Durban, South Africa



## SCIENTIFIC COMMITTEE RERIS

Dr Moeketsi Mpholo, Energy Research Centre, National University of Lesotho (RERIS chair)

Prof. Benmansour Abdelhalim, Université Aboubekr Belkaid de Tlemcen, Algeria

Prof. Venkata Ramayya Ancha, Jimma University, Ethiopia

Dr Ed Brown, Loughborough University, United Kingdom

Prof. Thameur Chaibi, National Research Institute for Rural Engineering, Water and Forestry, Tunisia

Prof. Seladji Chakib, Université Aboubekr Belkaid de Tlemcen, Algeria

Dr Zivaye Chiguvare, Namibia University of Science and Technology

Dr Jon Cloke, Loughborough University, United Kingdom

Prof. Emanuela Colombo, Politecnico di Milano, Italy

Prof. Abdellah Khellaf, Centre de Développement des Energies Renouvelables, Algeria

Prof. Izael Pereira Da Silva, Strathmore University, Kenya

Prof. Daniel Egbe, Johannes Kepler University Linz, Austria

Prof. Thomas Hamacher, Technische Universität München, Germany

Dr Jarkko Levänen, Aalto University School of Business, Finland

Prof. Angeles López Agüera, UNESCO-CLRLA / Universidade de Santiago de Compostela, Spain

Prof. Martin Meyer-Renschhausen, Hochschule Darmstadt, Germany

Prof. Joseph Mutale, University of Manchester, United Kingdom

Prof. Wikus van Niekerk, Stellenbosch University, South Africa

Prof. Armando C. Oliveira, University of Porto, Portugal

Prof. Marco Rupprich, MCI - The Entrepreneurial School®, Austria

Prof. Wim Sinke, University of Amsterdam, Netherlands

Prof. Abdellilah Slaoui, University of Strasbourg, France

Prof. Anthony Staak, Cape Peninsula University of Technology (CPUT), South Africa

Dr Dirk Steuerwald, Swiss Academy for Development, Switzerland

Dr Sandor Szabo, European Commission Joint Research Centre, Italy

Dr Leboli Zak Thamae, Energy Research Centre, National University of Lesotho

Dr Daniel Yamegueu, International Institute for Water and Environmental Engineering (2iE), Burkina Faso

Prof. Abdellatif Zerga, Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES), Algeria

# Conference Programme



*Tuesday, 23 January 2018*

8.00 **SHUTTLE FROM HOTELS, REGISTRATION**

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9.00 **OPENING SESSION**

**ROOM:** MACHACHE

**Chair:** Prof. Nqosa Mahao, Vice Chancellor, National University of Lesotho (NUL)

**Introduction:** Honourable Minister of Science & Technology, Mr Joang Molapo

**Opening Remarks:** The Right Honourable Prime Minister, Dr Thomas Motsoahae Thabane

09.45 **TEA BREAK AND GROUP PICTURE**

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10.15 **CONFERENCE PROGRAMM**

**ROOM:** MACHACHE

Mr Markus Theobald, Head of Cooperation, EU Delegation to Lesotho

Dr Timothy Thamae, Senior Lecturer in the Department of Chemistry and Chemical Technology and Coordinator NUL Innovations Committee

Mr Niklas Hayek, Project Manager, Africa-EU Renewable Energy Cooperation Programme (RECP) and RERIS organiser

**Chair:** Dr Moeketsi Mpholo, National University of Lesotho



10.45 **PLENARY SESSION: “TRANSLATE RESEARCH INTO PRACTICE!” (PLENARY)** **ROOM: MACHACHE**

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**Keynote:**

Prof. Wikus van Niekerk, Dean, Faculty of Engineering, Stellenbosch University, South Africa

**Panel:**

Ms Mantopi Lebofa, Director, Technologies for Economic Development (TED), Lesotho

Prof. Dieter Meissner, Tallinn University of Technology, Estonia & Founder and Chief Scientist, Crystalsol

Dr Pulane Nkhabutlane, Lecturer, Department of Agricultural Economics and Extension-Consumer Science, Head SanBio-Fisa Incubation Unit, National University of Lesotho

Mr Kuda Ndhlukula, Executive Director, the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), Namibia

Prof. Wikus van Niekerk, Dean, Faculty of Engineering, Stellenbosch University, South Africa

**Chair:** Dr Albert Butare, Former Minister of State in charge of Energy, Communication and Water in the Republic of Rwanda

12:30 **LUNCH**

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14:00 **THEMATIC SESSIONS I**

*See Page 10 – 31*

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16:00 **POSTER SESSION**

**ROOM: FOYER**

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17:30 **SHUTTLE TO HOTELS**

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# Thematic sessions I (RERIS)



**Tuesday, 23 January 2018 14:00 – 16:00**



ROOM: PHUTHIATSANA 1

## RERIS.I.1: ENERGY SOCIOECONOMICS I

**Keynote:** Economic Viability and Social Impact of Renewable Energy Deployment in Africa – Prof. Abdellah Khellaf, Centre de Développement des Energies Renouvelables, Algeria

**Chair:** Dr Ben Campbell, Durham University, United Kingdom

### Presentations:

Smart grids in the European Union: Assessing Energy Security, Regulation & Social and Ethical Considerations. Possible Synergies with Africa – Prof. Rafael Leal-Arcas, Queen Mary University of London, United Kingdom

Development and energy transitions: lessons from South Africa's Renewable Energy Independent Power Producer Procurement Programme for the Global Energy Transition – Ms Holle Linnea Wlokas, Stellenbosch University, South Africa

A Thermo-Economic Model for Objective Solar Collector Choice and Sizing of a Solar Water Heating System – Mr Tawanda Hove, University of Zimbabwe



ROOM: PHUTHIATSANA 2

## RERIS.I.2: DECENTRALISED RENEWABLE AND HOUSEHOLD ENERGY SOLUTIONS I

**Keynote:** Simulation and Optimisation of Renewable Energy Hybrid Power Systems for Semonkong, Lesotho – Dr Leboli Zak Thamae, National University of Lesotho

**Chair:** Prof. Marco Rupprich, MCI - The Entrepreneurial School®, Austria

### Presentations:

Integrating a Solar PV System with a Household-Based Backup Generator for Hybrid Swarm Electrification in Sub-Saharan Africa: Case Study of Nigeria – Mr Rolex Muceka, Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES), Algeria

Baseline Assessment for the Smooth Operation of a Solar Mini Grid Facility in Umon Island and Bagana Community in Southern Nigeria – Mr Etiosa Uyigue, Community Research and Development Centre, Nigeria

Energy efficiency optimization of Biochar Cook Stoves through computational simulation – Dr Getachew Shunki Tibba, Mettu University, Ethiopia



ROOM: QILOANE

### **RERIS.I.3: POWER GENERATION, DISTRIBUTION AND TRANSMISSION**

**Keynote:** Wide scale Deployment & Integration of solar PV into Electricity Grids: Technical and Economic Implications for Utilities – Prof. Joseph Mutale, University of Manchester, United Kingdom

**Chair:** Prof. Abdellatif Zerga, Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES), Algeria

#### **Presentations:**

Prospects for Electricity Generation from Wind Potential of Zamala in Cameroon – Mr Myrin Ymele, University of Ngaoundere, Cameroon

Printing Powder-based Photovoltaic Modules: An Appropriate Technology to make African Countries Energy-self-sufficient – Prof. Dieter Meissner, Tallinn University of Technology, Estonia

Feasibility Study of a Linear Fresnel Solar Thermal Power Plant in Algeria – Dr Hani Beltagy, University of Blida, Algeria

# Thematic sessions I (NULISTICE)



**Tuesday, 23 January 2018 14:00 – 16:00**



ROOM: MACHACHE

## NULISTICE KEYNOTE 1

Linking Bio Energy with Carbon Sequestration and Soil Fertility for Achieving SDGs in Africa – Prof. Venkata Ramayya Ancha, Jimma University, Ethiopia

**Chair:** Mr Lefa Thamae, Director, Department of Science and Technology, Lesotho



ROOM: MACHACHE 1

## NULISTICE.I.1: ENTREPRENEURSHIP AND INFORMATION TECHNOLOGY

**Chair:** Dr Pulane Nkhabutlane, Department of Agricultural Economics and Extension–Consumer Science, Head San-Bio-Fisa Incubation Unit, National University of Lesotho

### Presentations:

Solar Trees for Outdoor and Household Energy Access and Wi-Fi Hotspots – Ms Lisa Nyamadzawo The National University of Science and Technology, Zimbabwe

Public-Private Partnerships and the Case of the Solar Water Heater Industry – Dr Xavier Lemaire, University College London, Energy Institute, United Kingdom

Problems of Engineering Entrepreneurship in Africa: a Design Optimisation Example in Solar-Thermal Engineering – Dr Kanyarusoke Kant, Mechanical Engineering Department, Cape Peninsula University of Technology, South Africa

Mathematical Assessment of Global Solar Radiation in Sub-Saharan Africa's Tropical Regions: Case of Cameroon and Senegal – Dr Edouard Mboumboue, Environmental Energy Technologies Laboratory (E.E.T.L)/Department of Physics/Faculty of Science/University of Yaoundé, Senegal



ROOM: MACHACHE 2

## SESSION N.I.2: ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT

**Chair:** Dr Puleng Matebesi, Department of Animal Science, National University of Lesotho

### Presentations:

Modelling Drought Recurrence Intervals from Theoretical Probability Distribution and SPI: Semonkong, Lesotho – Mr Bernard Moeketsi Hlalele, University of the Free State, Disaster Management Training and Education Centre for Africa (DIMTEC), South Africa

Co-determination of Heavy Metals, Lead, Cadmium, Mercury and Zinc In Water Samples by Anodic Stripping on Bismuth-Modified Electrodes – Prof Mantoa Sekota, Department of Chemistry and Chemical Technology, National University of Lesotho

Bioenergy for Africa - the Quest for Energy Independence and Food Security, Dr Sissay Mekbib, Department of Biology and Biotechnology, National University of Lesotho

Mineral Production & Processing and Associated Environmental Issues in Sub-Saharan Africa – Dr Motlalepula Nete, Department of Chemistry, University of the Free State, South Africa



ROOM: MOKOROTLO

## SESSION N.I.3: MATERIALS SCIENCE & NANOTECHNOLOGY

**Chair:** Prof. Himanshu Narayan, Head, Department of Physics and Electronics, National University of Lesotho

### Presentations:

Desulphurization of Diesel Fuels using Metal Oxide Loaded Activated Charcoal and Alumina – Mr Liberty Mguni, Material and Process Synthesis (MaPS), Florida campus, University of South Africa

Optical and Electrical Characterisation of Ni-doped CdS Thin Films Prepared by Chemical Bath Deposition – Dr Sheillah Bisach, Department of Physics, University of Nairobi, Kenya

Synthesis and Characterization of Copper Oxide Nanoparticles and their Application as Electrode Modifiers – Prof. Hailemicheal Alemu, Department of Chemistry & Chemical Technology, National University of Lesotho

Assessing the Economic Viability and Practical Application of Organic Photovoltaics in Africa - Ms Nwadiaru Ogechi Vivian, Department of Energy Engineering, Pan African University Institute of Water and Energy Science (Including Climate Change), Algeria

# Conference Programme



**Wednesday, 24 January 2018**

8.00 **SHUTTLE FROM HOTELS**

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9.00 **EU-AFRICA JOINT PROGRAMMES**

**ROOM:** MACHACHE

Ms Irene Bonvisutto, DG Research & Innovation, European Commission

Mr Sjaak de Boer, Delegation of the European Union to the Kingdom of Lesotho

**Chair:** Ms Eva Kagiri, Finnish University Partnership for International Development (UniPID)

10.00 **TEA BREAK**

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10:30 **THEMATIC SESSIONS II**

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12:30 **LUNCH**

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14.00 **THEMATIC SESSIONS III**

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*See Page 20 – 23*

16.00 **POSTER SESSION**

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17:30 **SHUTTLE TO HOTELS**

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# Thematic sessions II (RERIS)



**Wednesday, 24 January 2018 10:30 – 12:30**



ROOM: PHUTHIATSANA 1

## RERIS.II.1: ENERGY SOCIOECONOMICS II

**Keynote:** Why we need a Social Sciences Agenda in International Energy Research – Dr Ed Brown, Loughborough University, United Kingdom

**Chair:** Prof. Thameur Chaibi, National Research Institute for Rural Engineering, Water and Forestry, Tunisia

### Presentations:

A Qualitative Analysis of Renewable Sources of Energy used and Policies in Lesotho – Mr Thato Clement Ramoelotsi, Limkokwing University of Creative Technology, Lesotho

Renewable Energy Law and Policy in Ghana: a Legal Analysis of the Support Schemes under the Regulatory Framework and some Lessons from the EU Experience – Mr Dayann Obeng-Darko, University of Eastern Finland

Solar PV Training Kit, a Novel Community Outreach Programme in Kenya – Dr Robinson Musembi, University of Nairobi, Kenya



ROOM: PHUTHIATSANA 2

## RERIS.II.2: DECENTRALISED RENEWABLE AND HOUSEHOLD ENERGY SOLUTIONS II

**Keynote:** Development of Decentralised Rural Household Biogas Digesters, a Case Study from South Africa – Prof. Sampson Mamphweli, Stellenbosch University, South Africa

**Chair:** Prof. Venkata Ramayya Ancha, Jimma University, Ethiopia

### Presentations:

Plasma Gasification of Biomass using Nitrogen Plasma Reactor to produce Synthesis Gas for Small Scale Communities – Mr Ralph Farai Muvhiiwa, University of South Africa

Storage as the Weak Link of the Biomass Supply Chain – Prof. Marco Rupprich, Management Center Innsbruck, Austria

Minigrid Electricity Service based on Renewable Generation for Isolated or Rural Areas: Sizing Criteria, Management and Sustainability Models, and Case Studies in Africa and Europe – Mr Pol Arranz Piera, UPC Technical University of Catalonia, Spain





ROOM: QILOANE

### **RERIS.II.3: ENERGY RESEARCH, INNOVATION, EDUCATION AND ENTREPRENEURSHIP**

**Keynote:** A Pan-African Research Agenda on Water, Energy and Climate Change – Prof. Abdellatif Zerga and Dr Erick Tambo, Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES), Algeria

**Chair:** Prof. Joseph Mutale, University of Manchester, United Kingdom

#### **Presentations:**

Entrepreneurship as a Leverage for Innovative Energy Technologies in Africa: an Investigation of the Entrepreneurial Framework in Zimbabwe – Ms Hajer Ben Charrada, Technical University of Munich, Germany

Promotion of Energy Research, Innovation and Entrepreneurship by Bilateral and International Projects between Tunisian Research Center and Private/Public European Institutions – Mr Mohamed Barbouche, Research and Technologies Center of Energy (CRTE), Tunisia

The Status of Large-Scale Solar Thermal Systems for Industrial Applications in South Africa and the Promotion of Solar Thermal Research at CRSES Stellenbosch University – Mr Angelo Buckley, Stellenbosch University, South Africa

# Thematic sessions II (NULISTICE)



**Wednesday, 24 January 2018 10:30 – 12:30**



ROOM: MACHACHE

## NULISTICE KEYNOTE 2

Decentralised Water Purification Systems - Prof. Marco Rupprich, MCI – The Entrepreneurial School®, Austria

**Chair:** Mr Lefa Thamae, Director, Department of Science and Technology, Lesotho



ROOM: MACHACHE

## NULISTICE.II.1: AGRICULTURE AND CLIMATE CHANGE

**Chair:** Dr Molapo Setsumi, Department of Animal Science, National University of Lesotho

### Presentations:

The Impact of Climate Change on Food Security in Lesotho: Challenges and Opportunities – Ms Matandare Blessing, Limkokwing University of Creative Technology, Lesotho

Production and Utilisation of Conserved Barley and Oat Grass as Fodder for Merino sheep – Mr Mosebi Poloko, Department of Animal Science, Faculty of Agriculture, National University of Lesotho

Prevalence of Lice in Merino sheep: Case of Roma Valley in Maseru District – Dr Matebesi-Ranthimo, Department of Animal Science, Faculty of Agriculture, National University of Lesotho

Comparison between Liming and Manure Application on Phosphorus Retention in Selected Benchmark Soils of Lesotho – Mr T'sepo Mpela, National University of Lesotho



ROOM: MACHACHE 2

## **NULISTICE.II.2: ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT**

**Chair:** Mr Rets'elitssoe Thamae, Department of Economics, National University of Lesotho

### **Presentations:**

Optimisation of the Photovoltaic Off-Grid System for the Production of Electricity at Nkoteng in Yaoundé – Dr Aloyem Kaze Tchinda, Department of Electrical and Power Engineering, University of Bamenda, Cameroon

Public-private Partnership Investment to enhance Sustainable Renewable Energies in Rwanda – Mr Kazungu Jules, Regional Research Centre for Integrated Development (RCID), Rwanda

Determinants of Livelihood Outcome Differentials among Urban Youth in Nairobi, Kenya – Dr Christine Njuguna, Kenyatta University, Nairobi, Kenya

A Review of Some Best Practices in the Energy Sector with Policy Options for Uganda - Prof Albert Rugumayo, Ndejje University, Uganda



ROOM: MOKOROTLO

## **NULISTICE.II.3: BIOTECHNOLOGY AND FOOD SAFETY**

**Chair:** Dr Sissay Bekele Mekbib, Department of Biology and Biotechnology, National University of Lesotho

### **Presentations:**

Physicochemical and Microbiological Quality Assessment of different Brands of Bottled Water, Maseru, Lesotho – Mr Molefe Khothalang, Department of Biology and Biotechnology, National University of Lesotho

Deploying novel forms of Nisin to control Listeria Monocytogenes in the Food Industry – Mr Lekatsa Teboho, Department of Nutrition, Faculty of Health Sciences, National University of Lesotho

Screening and Extraction of Essential Oils from Different Indigenous Non-food Plants for Detergent Production, Mr Thabiso Letseka, Department of Chemistry and Chemical Technology, National University of Lesotho

Lesotho Medicinal Plants of the Asteraceae Family: A Review of the Ethnobotany, Chemistry and Conservation Status - Mr Mohale Mabaleha, Department of Chemistry, Faculty of Natural and Agricultural Sciences, University of the Free State, South Africa

# Thematic sessions III (RERIS)



**Wednesday, 24 January 2018 14:00–16:00**



ROOM: PHUTHIATSANA 1

## RERIS.III.3: ENERGY SOCIOECONOMICS III

**Keynote:** Lessons from Kenya about what's holding back solar technology in Africa – Prof. Izael Pereira Da Silva, Strathmore University, Kenya

**Chair:** Dr Albert Butare, Former Minister of State in charge of Energy, Communication and Water in the Republic of Rwanda

### Presentations:

Energy System Planning Models for Cities: On the Limits of existent Modeling Tools and a New Approach for Models Tailored to the Needs of Developing Countries – Mrs Aminata Fall, Technical University of Vienna, Austria

Status of Rooftop PV Generation in South Africa – Mr Ndamulelo Mararakanye, Center for Renewable and Sustainable Energy Studies, Stellenbosch University, South Africa

Impacts of Electrification under the Perspective of the Multi-Tier-Framework in Southern Tanzania – Ms Annika Groth, Europa University Flensburg, Germany



ROOM: PHUTHIATSANA 2

## RERIS.III.2: DECENTRALISED RENEWABLE AND HOUSEHOLD ENERGY SOLUTIONS III

**Keynote:** Dynamics of Solar Markets in Africa – Prof. Martin Meyer-Renschhausen, Hochschule Darmstadt, Germany

**Chair:** Prof. Sampson Mamphwel, Stellenbosch University, South Africa

### Presentations:

Parametric Sensivity in Sunflower Oil Ethanolysis using a Shea Nut Shell based Catalyst – Mr Aristide Dejean, International Institute for water and environment engineering, Burkina Faso

Assessment of Decentralised Hybrid Mini-Grids in Sub-Saharan Africa: Market Analysis, Least-Cost Modelling, and Job Creation Analysis – Mr Ayodeji Okunlola, Institute for Advanced Sustainability Studies, Potsdam, Germany

Promoting Rural Electrification in Sub-Saharan Africa: Least-Cost Modelling of Decentralised Energy-Water-Food Systems – Mr Johannes Winklmaier, Technical University of Munich, Germany



ROOM: QILOANE

### **RERIS.III.3: ENERGY RESOURCE MAPPING AND PLANNING**

**Keynote:** Rural Household Electrification in Lesotho –  
Dr Moeketsi Mpholo, Energy Research Centre (ERC),  
National University of Lesotho

**Chair:** Prof. Abdellah Khellaf, Centre de Développement  
des Energies Renouvelables, Algeria

#### **Presentations:**

An Application of the Multilayer Perceptron: Estimation of  
Global Solar Radiation and the Establishment of Solar  
Radiation Maps of Togo – Dr Komi Apélété Amou, Univer-  
sity of Lomé, Togo

Remote Sensing Techniques for Village Identification:  
Improved Electrification Planning for Zambia – Mr Alin  
Radu, Reiner Lemoine Institute, Germany

Analysis of Solar Radiation Models and three-dimensional  
Modelling of Irradiance – Dr Al-Mas Sendegeya, Namibia  
University of Science and Technology, Namibia

# Thematic sessions III (NULISTICE)



**Wednesday, 24 January 2018 14:00–16:00**



ROOM: MACHACHE

## NULISTICE KEYNOTES 3

Could Renewable Energy Driven Systems Save Agriculture in African Arid Areas? – Prof. Thameur Chaibi, National Research Institute for Rural Engineering, Water and Forestry, Tunisia

Research, Innovation and Entrepreneurship in Knowledge Era: Issues of Values and Ethics – Prof. Suresh Chand Garg, Usha Martin University, Ranchi, India

**Chair:** Prof. Manthoto Lephoto, Pro Vice Chancellor, National University of Lesotho



ROOM: MACHACHE 1

## NULISTICE.III.1: ENTREPRENEURSHIP AND INFORMATION TECHNOLOGY

**Chair:** Dr Timothy Thamae, Department of Chemistry and Chemical Technology, National University of Lesotho

### Presentations:

De-Colonising Power Supply in Cameroon: a Community Entrepreneurship Approach – Mr Atembe Roland, Department of Strategic Management, Marketing and Tourism, School of Management, University of Innsbruck, Austria

Design and Optimisation of Solar PV/Diesel Generator Hybrid Power System for Remote Telecommunication Base Transceiver Stations in Nigeria – Mr Babalola Samuel, Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES), Algeria

Language, Science and Translation within a Socio-Developmental Context in Lesotho – Dr Mosisili Sebotsa, National University of Lesotho

Harnessing Science and Technology towards achieving Sustainable Development Goals, 3, 8, 11, Professor Molibeli Taelo, Department of Physics and Electronics, National University of Lesotho



ROOM: MACHACHE 2

### **NULISTICE.III.2: ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT**

**Chair:** Dr Mosotho George, Head, Department of Chemistry and Chemical Technology, National University of Lesotho

#### **Presentations:**

Spatio-Temporal Climate Change Risk Assessment: Mangaung Metropolitan Municipality, South Africa – Mr Bernard Moeketsi, University of the Free State, Disaster Management Training and Education Centre for Africa, South Africa

Performance Evaluation of Grid-Connected Solar PV in the Tropical Conditions - a Case Study of Karume Institute of Science and Technology, Zanzibar – Mr Mohammed Haji, The Nelson Mandela African Institution of Science and Technology, Tanzania

Evaluation of Animal Manure as a Feedstock for the Production of Biogas in comparison with Sewage Water Microalgae – Ms Tebello Matlosa, Department of Biology and Biotechnology, Faculty of Science and Technology, National University of Lesotho

The VIP Latrine in Lesotho: Addressing Technical Flaws from the Qachas' Nek District Experience – Prof. Aiyuk Sunny, Department of Environmental Health, Faculty of Health Sciences, National University of Lesotho



ROOM: MOKOROTLO

### **SESSION N.III.3: MATERIALS SCIENCE & NANOTECHNOLOGY**

**Chair:** Prof. Heilmichael Alemu, Department of Chemistry and Chemical Technology, National University of Lesotho

#### **Presentations:**

Raman Spectroscopy and Imaging of Bernal-Stacked Bilayer Graphene Synthesised on Copper Foil by Chemical Vapour Deposition: Growth Dependence on Temperature – Dr Mopeli Fabiane, Department of Physics and Electronics, National University of Lesotho

Pore Size Enhancement in TiO<sub>2</sub> Thin Films and its Effects on Dye Sensitised Solar Cells – Mr Domtau Dinfa Luka, Department of Physics, University of Jos, Nigeria

Iminophosphine complexes of palladium and platinum: Application in cross-coupling and oligomerisation/polymerization, Dr Tebello Mahamo, Department of Chemistry and Chemical Technology, National University of Lesotho

Multiwalled Carbon Nanotubes Ag-Pt Composite Electrochemical Sensor for Nevirapine Antiviral Drug – Prof. 'Mangaka Matoetoe, Department of Chemistry, Cape Peninsula University of Technology, South Africa

# Conference Programme



**Thursday, 25 January 2018**

8.00 **SHUTTLE FROM HOTELS**

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9.00 **COOPERATION PITCH SESSION**

**ROOM: MACHACHE**

**Chair:** Dr Moeketsi Mpholo, NUL

Dr Timothy Thamae, NUL

Mr Niklas Hayek, RECP

Dr Ed Brown, LECDN

Ms Eva Kagiri, UniPID

Ms Ranisha Banset, Energypedia

Ms Noara Kebir, Microenergy Systems

Mr Kuda Ndhlukula, SACREEE

Prof. Abdellatif Zerga, PAUWES

Mr Saleem Ismail, Enigma

Mr Phelane Phomane, Tangerine

Mr Lebohang Ramaisa, Econet Telecom Lesotho

9.30 **TEA BREAK**

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10:00

**RERIS TRAINING WORKSHOP**

**ROOM:** MACHACHE

“From Energy Research to Bankable Power Practice”

**Chair:** Ms. Mariana Daykova, Consultant, Microenergy Systems

*More information on Page 28*

10:00

**NULISTICE ROUNDTABLE**

**ROOM:** MOKOROTLO

“Youth and Entreprenuership in Lesotho”

**Chair:** Prof. Spirit Tlali, Department of Physics and Electronics, National University of Lesotho

*More information on Page 29*

12.30

**LUNCH**

14.00

**OPEN POSTER SESSION AND VISIT TO NULISTICE EXPO AND INNOVATION MARKET**

14:00

**TELECONFERENCE WITH ENERGY CATALYST CONFERENCE LONDON**

**ROOM:** MACHACHE

18.00

**GALA DINNER**

**Closing remarks:** His Majesty, King Letsie III of Lesotho, Chancellor of the National University of Lesotho

# Conference Programme



**Friday, 26 January 2018**

## 8.00 **NULISTICE EXPO AND INNOVATION MARKET**

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All day (free entry for NULISTICE and RERIS participants)

*More information on Page 30*

## 9.00 **FIELD TRIP TO THE OUTSKIRTS OF MASERU**

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For international participants (registration required)

Pick-up from hotels at 9.00am

The Daytrip will be a one-day short trip around the outskirts of Maseru meant to give the international visitors a feel of this tiny Mountain Kingdom. Visitors will first go to the National University of Lesotho, situated some 30 km South East of Maseru. Then they will move to Metolong dam, not only to see the dam but enjoy the scenery of Lesotho's foothills. On the way back, they will stop at Thaba Bosiu Cultural Village, to enjoy a braai and then come back to Maseru.



# RERIS Training Workshop

## “From Energy Research to Bankable Power Practice”

*Thursday, 25 January 10.00, Room: Machache*

Research and practical implementation in the field of decentralised energy have a synergistic relationship, with each one more effective if and when informed by the other. Indeed, the work of practitioners is more effective if guided by established research findings. The work of researchers is more effective if hypotheses stem from practical experience, which betters research, and in turn, practice.

In reality, energy research and practice often run in parallel, with little knowledge exchange and consideration of the other. Energy practitioners, for example, rarely refer to research outputs, even if peer reviewed and reputable, often having discovered early on the irrelevance/unfit of research findings to the practical issues faced. Energy researchers, on the other hand, rarely prioritise engaging in actual practice / implementation, thereby generating research which by no surprise lacks apparent practical relevance.

### **OBJECTIVES OF THE WORKSHOP INCLUDE:**

- Provide international and local researchers/ academics and local practitioners in Lesotho with a platform for discussion on how to make research more relevant/fit for practice.
- Enable match-making and establishing paths for further joint work between local and international researchers/academics and local private sector actors in Lesotho.
- Inform participants about different product-service systems in the field of energy access in developing economies (e.g. mini grids, distribution models for decentralised RE & EE).
- Inform participants about different product-service systems in the field of energy access in developing economies (e.g. mini grids and distribution models).

# NULISTICE Roundtable

## “Youth and Entrepreneurship”

*Thursday, 25 January, 10.00, Room: Mokorotlo*

Never before has there been a time when Lesotho’s educated young people have faced a threat as bad as the threat of unemployment. Just a decade ago, higher education used to be viewed as a passport to a well-paying job, often a job at the public sector. Of course the public sector dominated economy, with little private-sector backup always being a time-bomb and everyone knowing it.

Times changed, the time-bomb went off in the upper half of the last decade: the number of graduating students ballooned and the public sector quickly became saturated. A new, slow national tragedy brewed: high level of unemployment among the educated youths. Of course local universities keep producing more graduates like never before and the problem is worsening.

However, it is not all doom and gloom in the Mountain Kingdom, there is a silver lining and, of course, a light at the end of the tunnel. The youth are not idly standing by. In fact, they are defying odds and, with little to no support, they are beginning to start innovative businesses. They have also developed innovative business ideas. Some of the youth’s work is highlighted on a weekly basis on the Facebook page platform “*NUL Research and Innovations*”.

This will be a session in which some of these young people will share the ups and downs of getting a business started with little to no funding, the support they have received along the way and the lessons they have learned. Discussions will also include lessons for the future.



# NULISTICE Expo & Innovation Market

2018 Expo will be the continuation of the first two (held in 2015 and 2016). This event is mainly targeting the local audience and it is meant to help society appreciate an important role that can be played by science, technology and innovation in daily life and to help attract funding and commercialisation of academic projects.

For the past two years, the event has generated an amazing interest in the country. While most people appreciate and communicate with the NUL through the media outreach platforms, the Expo is unique in the sense that it provides a means for members of society to get a feel of the projects. The result has been intensive networking and in some cases, emergence of new companies.

Traditionally, the main people who exhibit their products and projects in this Expo are NUL teachers, students and graduates. However, the following Expo will encourage the participation of innovators from all over the country.

Under this category, we are expecting more than 250 innovators to showcase their products and small businesses. Anyone can apply to this category and the fee charged is only 360 LSL (= 23 EUR) for four days from 23 January to 26 January. The only limit is that businesses should display only products they produce first-hand, not those that they buy and sell.

THE NULISTICE EXPO & INNOVATION MARKET  
WILL BE HELD AT:

Pioneer Mall  
Pioneer Rd.  
Maseru, Lesotho





# Information for International Participants\*

## VISA

Visitors can apply for an electronic visa online at <http://evisalesotho.com>. An overview of visa exemptions is available at <http://evisalesotho.com/visa-exemptions/>.

## MASERU, CAPITAL CITY OF LESOTHO

Maseru has always been one of Africa's quieter cities, but the capital of Lesotho has rapidly expanded in recent years. Today, the city is home to a decent selection of accommodations and restaurants, well-stocked shops, friendly people and a host of other modern amenities. Although there are very few traditional tourist attractions, the city is a great place to recharge and stock up before venturing further into Lesotho.

One of the most monumental buildings in the country stands near central Maseru. Called the Mokorotlo, the site is a traditional hut redesigned in a more modern and sophisticated style. The revamped hut houses a museum where visitors can learn more about the nation's history, culture and traditions.

Just south of Maseru is the village of Thetsane, where a cluster of factories produce clothing like jeans and T-shirts for American chain stores. While downtown Maseru has a slow, easy-going pace, Thetsane's industrial atmosphere creates a chaotic hustle and bustle.

There are many opportunities for outdoor adventures in and around Maseru. The city is home to some excellent gyms, tennis courts and golf courses, and canoeing down the Caledon River is a great way to explore the area's flora and fauna. Visitors can also ride horses in more off-the-beaten-trail parts of the capital and hike up the city's largest hill to catch great views of the capital.

Shopping is another popular activity in Maseru, and visitors can likely find everything they need before venturing further into the country, where Western-style shops are nearly nonexistent. In the capital, visitors can find shopping centers similar to European supermarkets, but there are also a number of cellphone and electronics stores. For local crafts, head to the Basotho Hat, a small shop run by the government. There, visitors can purchase beautiful hand-made items like ceramics, jewelry, toys and clothing.

\* Source: <http://www.visitcapitalcity.com/africa/maseru-lesotho>



Maseru is home to a number of outstanding restaurants, and it is easy to get a good meal within the city on any budget. Visitors can feast on a variety of cuisines, including Mediterranean, American, Chinese, Ethiopian, Italian and Indian.

At night, the city comes alive as locals get off work and want to relax. There are many popular bars and clubs in the area, most of which are filled with young expats or government workers. It is not too hard to find decent live music, and the drinks are cold and reasonably priced.

One of Lesotho's most remarkable sights is only about three hours away from the capital by car. The Semonkong Falls (picture below) drop over 200 meters, and visitors can swim in the pond below during the summer months. In the winter, the pond freezes and the falls become trapped in ice.

Thirty-five kilometers south of Maseru is the town of Morija. There, visitors can see well-preserved footprints of dinosaurs that once lived in Mozambique. Visitors to the town can also explore the Lesotho Evangelical Church and the Maeder House and Arts Center. There are also many opportunities for mountain climbing, hiking and pony-trekking in the town.

## MASERU GEOGRAPHICAL LOCATION

Maseru is located on the west central border between Lesotho and South Africa on the Caledon River. The approximate population of Maseru is 230,000.

## MASERU CLIMATE

Maseru experiences warm summers and mild, chilly winters. Rainfall is more common during the hotter months although it does rain throughout the year.

## LANGUAGES IN LESOTHO

Sesotho and English are the official languages of Lesotho.

## LESOTHO PREDOMINANT RELIGIONS

Christianity is the dominant religion in Lesotho, with approximately 90 percent of the population being Christian belonging to different denominations. The Lesotho Constitution provides freedom of religion.

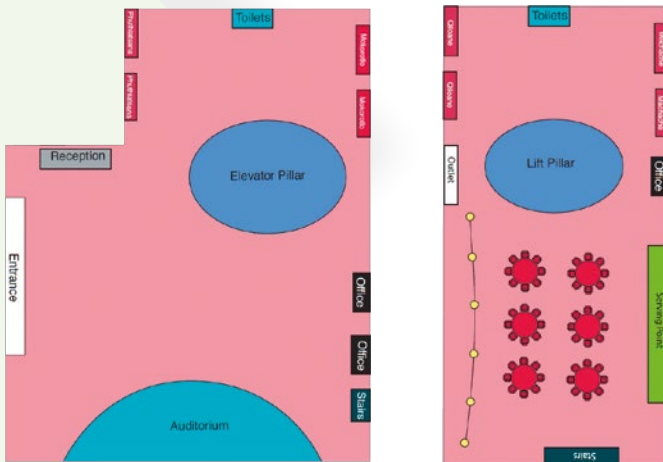
## LESOTHO CURRENCY

The Loti is the official currency of Lesotho. Current exchange rate: 1 LSL = 0.061 EUR (Nov. 2017)



# Venue

THE CONFERENCE WILL BE HELD AT:  
Manthabiseng National Convention Center  
Main South 1, Opp Iketsetseng Primary School,  
Maseru, Lesotho



THE NULISTICE EXPO & INNOVATION MARKET WILL BE HELD AT:  
Pioneer Mall  
Pioneer Rd.  
Maseru, Lesotho

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Cooperation Programme

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National University of Science and Technology Innovation Conference & Expo