



ANNUAL REPORT:
1 January – 31 December 2013
Johannes L van Niekerk & Alan C Brent
March 2014



CENTRE FOR RENEWABLE AND SUSTAINABLE ENERGY STUDIES



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Centre for Renewable and Sustainable Energy Studies

PROGRESS REPORT

Reporting period from 1 January 2013 to 31 December 2013

Identification

Name of Director :	Professor J.L. (Wikus) van Niekerk
Name of Centre :	“Centre for Renewable and Sustainable Energy Studies”
Abbreviated Name :	CRSES
Host institution :	Stellenbosch University
Date completed :	14 March 2014 (For Advisory Board)

1. Introduction

This is the eight annual report of the Centre for Renewable and Sustainable Energy Studies (CRSES) and the first while operating under the new contract between Stellenbosch University and the National Research Foundation (NRF). The new contract was signed on the 3rd of May 2013 for the period 1 January 2013 to the 2nd of May 2018. The report focuses on the deliverables and financials for the period 1 January 2013 to 31 December 2013.

2. Summary of Outputs

The outputs of the Centre are presented in tables – in the following sections – that correspond to the Service Level Agreement (SLA) that was part of the contract concluded between Stellenbosch University and the NRF.

2.1 SLA Objective: Building of human capital and institutional capacity

2.1.1 Outputs

SLA: 1. Human capital development						
OBJECTIVES	ACTIVITIES	SUB-ACTIVITIES	OUTPUTS/TARGETS	OVERALL	2013 TARGET	2013 ACTUAL
1. Human capital development	1.1 Coordinate and refine postgraduate degree programmes in Renewable and Sustainable Energy (RSE)	1.1.1 Manage and coordinate the postgraduate degree programmes	1.1.1.1 50 postgraduate degrees (Masters and PhD) are conferred over the five-year term, including coursework master programmes, research students supervised by Centre staff	50	10	14
		1.1.2 Academically coordinate coursework masters programmes – MPhil and MEng	1.1.2.1 Present at least six RSE courses at Stellenbosch University, which are not subsidised by the Department of Higher Education and Training, annually as part of the two coursework master programmes, which is available to postgraduate students from other institutions, as well as executive students – two of the courses will not be technology focussed but deal with social, policy and financial issues	30	6	7
		1.1.3 Scan the international landscape and establish a database of related programmes	1.1.3.1 Establish a database of related international programmes, and associated course contents, by the end of 2013; the database needs to be updated on an annual basis	1	1	1

		1.1.4 Develop databases of forecasted skills needed for the renewable energy industry	1.1.4.1 Databases of required skills for different technology systems – 1 per year	3		In progress
		1.1.5 Recruit and fund instructors and material for the RSE courses	1.1.5.1 Academic materials that are published to be used at other academic institutions and FET colleges	5	1	1 In progress
		1.1.6 Investigate the appropriateness of study material for cross cutting disciplines	1.1.6.1 A report on the outcome of the investigation will be prepared and shared with stakeholders	1	0	0
	1.2 Provide guidance for the establishment of postgraduate programmes at other universities	1.2.1 Support the NRF with the establishment of appropriate postgraduate programmes and core content for RSE at other institutions	1.2.1.1 Participate in national workshops with key stakeholders to discuss and agree on the core requirements/curriculum for RSE. Produce report of recommendations on a standard RSE programme and/or core modules that can be adopted and or adapted by South African institutions with two universities over the term of the contract and assist them to develop proposals for postgraduate training programmes	2	0	0
	1.3 Undertake an internship mentoring programme	1.3.1 Develop a mentoring programme and host DST/NRF funded interns, to be extended to the spokes	1.3.1.1 Accommodate at least two DST/NRF interns per annum in the Centre in a structured mentoring programme	10	2	1

			1.3.1.2 Interactions with researchers at other institutions to foster research capacity development (targets to be developed)			
	1.4 Training and educating government and NGO officials	1.4.1 Conduct workshops and training programmes with educators, government/local municipality officials and other relevant private sector personnel to capacitate them with knowledge and relevant intelligence to enable them to address issues of environment, climate change, mitigation, sanitation and nutrition	1.4.1.1 At least one workshop or training course for public officials per annum	5	1	3
	1.5 Institutional capacity development	1.5.1 Play a supportive role to identify, conceptualise, formalise and establish new RSE research and technology groups	1.5.1.1 New research groups established (targets to be developed in consultation with the DST and the NRF)			

2.1.2 Progress & Challenges

Academic Programmes

The academic programmes that the Centre currently coordinates consist of one postgraduate diploma in engineering (PDE), two coursework masters' degree programmes, and a variety of research masters' and doctoral degrees. The coursework masters' degrees are presented at Stellenbosch University, one in the Department of Mechanical and Mechatronic Engineering as an M.Eng. (Structured) in Mechanical Engineering with an emphasis on renewable and sustainable energy (RSE), and one in the School of Public Leadership as a postgraduate diploma PGD/M.Phil programme in Sustainable Development, with an option to specialise in RSE. More information on the structure of the PDE, M.Eng.(Structured) and PGD/M.Phil. programmes can be found at the following website:

<http://www.crses.sun.ac.za/studies-postgraduate-programmes.php>

The research masters' and doctoral degrees are available in various academic departments at Stellenbosch University as well as other universities, in particular the University of Cape Town, University of Pretoria, North West University, University of KwaZulu/Natal, University of Fort Hare, and Nelson Mandela Metropolitan University. Students enrol for the research degree in the relevant academic department and work in that research group while completing their studies. The research projects that are available, underway, and completed at the Stellenbosch University can be found at:

<http://www.crses.sun.ac.za/research-available-topics-solar.php>

Academic material that were developed for the different postgraduate modules at Stellenbosch are available to other institutions to assist them to present similar modules as part of their academic programmes. Discussions in this regard were held with NMMU and presently the University of Johannesburg will make use of this offer.

The students that are enrolled for the two coursework master degrees, as well as some of the research students, meet in a number of RSE postgraduate modules that are presented in a transdisciplinary manner at the Sustainability Institute, which is situated at the Lynedoch Eco-Village outside Stellenbosch. These modules are presented in a modular format where the students are required to do some preparatory reading, attend a week of contact sessions, consisting of five and half days at Lynedoch, which includes a group assignment and presentation on the Saturday morning, and then they have to complete a number of individual assignments and projects to complete the course. During the week of contact, students participate in lectures, tutorials, group discussions, projects and some site visits. The modules presented in 2013, with the number of students that attended, are listed in **Table1**.

Table 1: Attendance of RSE Modules for 2013

<u>Module</u>	<u>Presenters</u>	<u>Total</u>	<u>Coursework</u>	<u>Research</u>	<u>Staff</u>	<u>Exec Students</u>
Renewable Energy Systems	Dr Ben Sebitosi & Josh Reinecke	30	20	3	0	7
Renewable Energy Policy*	Prof Alan Brent	22	18	2	0	2
Thermal Energy Systems	Dr Jaap Hoffman	11	9	0	0	2
Introduction to Solar energy	Paul Gauche, Dr Johan Strauss, Riaan Meyer	18	9	0	2	7
Renewable Energy Finance*	Jako Volschenk	25	22	1	1	1
Wind & Hydro	Prof Theo von Backström, Alejandro Lupion Romero & Francis Jackson	18	16	0	0	2
Bio-Energy	Prof Johann Görgens & Team	21	15	6	0	0

* These courses are not technology focussed and are presented by the School of Public Leadership in the Faculty of Economic and Management Sciences.

The one-week contact period of the modules are also registered with the Engineering Council of South Africa (ECSA) as short-courses so that executive students who attend these modules will receive recognition towards their required continuous professional development (CPD points). The modules were also attended by some of the research students and staff members involved with the Programme to improve their background learning and understanding of RSE.

Two modules, *Renewable Energy Finance* and *Renewable Energy Policy* are focused on social, policy and financial issues related to renewable and sustainable energy use and are non-technical in content. These modules are registered in the School of Public Leadership of the Faculty of Economic and Management Sciences. Students in the PDE as well as both the coursework masters programmes are required to take the module Sustainable Development in the School of Public Leadership to further ensure that these students are well aware of the social and ecological issues driving RSE.

Training of Public Officials

Among the delegates attending the courses as executive students were an assistant director and a deputy director from the Department of Trade and Industry (DTI) who attended the Thermal Energy Systems course, and an engineer from the Western Cape Department of Agriculture who attended the Renewable Energy Systems module. Two staff members of the National Energy Regulator of South Africa (NERSA) also attended the Introduction to Solar Energy course. Personnel from Eskom attended various courses. As part of a training

contract with Eskom Ms Mtshali was seconded to the CRSES to be trained as a Renewable Energy Resource Analyst for Eskom and she also attended a number of courses as part of her training programme. Ms Mtshali registered as a part-time masters student in 2014.

The Centre also presented the results of a Rooftop PV study to officials and council members of the Hessequa Municipality where they were informed of both the technical and financial issues regarding rooftop photovoltaic installations in the town of Riversdale.

Postgraduate Students

The following 14 students graduated 2013, and copies of their completed theses, where available, can be found at: <http://crses.sun.ac.za/research-completed-research.php>.(where available):

March/April 2013

Mr Justin Beukes with a MCom (NMMU)
Ms Jessica Hosking with MCom (NMMU)
Mr Jacques Gerber with MCom (NMMU)
Mr Mario Benecke with MSc (NMMU)
Mr Sven du Clou with MScEng (UKZN)
Mr Zack Mouton with MScEng (*cum laude*) (US)
Mr Danie Diedericks with a PhD (SU)

December 2013

Mr James Joubert with a PhD (SU)
Mr Michael Owen with PhD (SU)
Mr Gregg Walker with MScEng (SU)
Mr Warrick Pierce with MEng (*cum laude*) (SU)
Mr Gerhard Hartwig with MScEng (SU)
Mr Johannes Bester with MEng (SU)
Mr Laurance Slann with MEng (SU)

The following students completed the Post Graduate Diploma in Engineering

Mr CL Sias
Mr AY Jimenez Torres
Mr JKJ Mokoena
Mr NA Snyders

Mr G Hull

Mr FA Asoba

The next graduation ceremony will take place in April 2014 where more postgraduate students are expected to graduate.

Some of these are students who were supported by bursaries from the Centre at Stellenbosch and other universities in South Africa or supervised by the staff supported by the NRF grant.

The database on other international postgraduate programmes in renewable energy studies has been compiled and is available on request. In due course this database will be published on the website of the Centre.

Only one intern was recruited and mentored in the Centre in 2013. Ms Sinovuyo Poni completed her experiential training in 2013 in the Centre and joined the University's spin-off company, GeoSUN Africa in 2014. The Centre has not been integrated in the Department of Science and Technology's internship programme and this will receive more attention in 2014.

The Centre's activities in developing human and institutional capacity have always progressed well.

2.2 SLA Objective: Deepening Knowledge/ Research and Technology Transfer

2.2.1 Outputs

OBJECTIVES	ACTIVITIES	SUB-ACTIVITIES	OUTPUTS/TARGETS	OVERALL	2013 TARGET	2013 ACTUAL
2. Deepening Knowledge / Research and Technology Transfer	2.1a Identify, prioritise, design and undertake research projects for knowledge production	2.1.1 Conduct basic and applied research and publish the results	2.1.1.1 Publish 45 papers in accredited journals and peer-reviewed conference proceedings, including papers from Centre staff, research students supervised by Centre staff, and all students who received a bursary from the Centre while conducting the research for the publication	45	7	17
	2.1b Undertake research that will enhance knowledge production, dissemination of knowledge and knowledge transfer and develop policy briefs to inform the move from a carbon intensive energy economy	2.1.2 Produce a report demonstrating the status quo of RSE in South Africa, and the impact of research conducted in the country	2.1.2.1 Maintain a continually-updated road-mapping mechanism to identify priority research areas; this will include refining scenarios based on policies that are updated, and the associated areas of specialisation that will be required, on an annual basis	1	0	0
		2.1.3 Manage and coordinate technology roadmaps to prioritise research				

		areas				
		2.1.4 Produce a report demonstrating the status quo of RSE in South Africa, and the impact of research conducted in the country	2.1.4.1 A report submitted to the NRF and DST which will be updated yearly	1	0	0
	2.2 Facilitate and inform the move from a carbon intensive energy economy by engaging with local government and NGOs	2.2.1 Develop a guideline for RSE technology transfer into different markets	2.2.1.1 Compile a guideline document on implementation to assist the public sector with evaluating renewable energy options and implementing projects successfully. A first version is to be developed by 2014, with a revised version in 2016.	1	0	0
		2.2.2 Provide forum platforms for dissemination of knowledge and assistance to public entities	2.2.2.1 Assist at least 3 local governments with RSE projects	3	1	2
			2.2.2.2 Publish five policy briefs (at least 1 per annum, priority being geothermal and ocean energy policy briefs) to inform the move from an energy intensive economy to one relying on RSE	5	1	1

	2.3 Develop and implement a programme in high schools to promote RSE among learners	2.3.1 Develop appropriate material for the Schools Programme	2.3.1.1 Develop material and make it available for roll-out to at least 2 provinces by end of December 2014	2	1	3
		2.3.2 Raise funds for the reproduction and distribution of the material				

2.2.2 Progress & Challenges

Publications:

The target of 7 peer-reviewed publications were easily met with 9 journal articles published by December 2013 while another 8 peer-reviewed conference papers by staff and students have already been accepted and presented at national and international conferences. Full details of these publications, as well as the conference papers presented, are available in Section 4 – Academic Outputs of this report.

Forums, Research Lectures and Awareness Programmes

The Centre arranged a number of forum discussions and research lectures over a wide range of topics, as listed in **Table 2** below. Students and lecturers from Stellenbosch University as well as UCT, CPUT and other institutions, as well as representatives from industry and the general public, are invited to attend these presentations. The presentations by visiting academics and researchers are also made available on our website at:

<http://crses.sun.ac.za/service-events-lectures.php>

Table 2: Attendance of RSE Forums, Special Lectures and Presentation Sessions in 2013

<u>Topic</u>	<u>Presenter(s)</u>	<u>Attendees</u>
<i>Is CSP a silver bullet for South Africa? A public debate on how concentrating solar power might benefit or hinder our economic and energy plans</i>	Saliem Fakir, WWF Paul Gauchè, STERG, US	23
<i>Sustainability of GM technologies in bio-energy production</i>	Prof A Brent, CRSES, US Dr Hennie Groenewald: Biosafety SA Prof Florian Bauer: Institute for Wine Biotechnology, Stellenbosch University Mr Glenn Ashton: Ekogaia Consulting, and widely published writer, freelancer, author Prof Johann Görgens: Department of Process Engineering, Stellenbosch University	45
<i>Applications of Low Temperature Solar Heat</i>	Billy de Lange	70
<i>Solar heat in industrial processes: It's applicability in South Africa</i>	Billy de Lange	72
<i>The SOLTRAIN programme and the South African Solar Thermal Technology Platform (SA-STTP)</i>	Karin Kritzinger	72
<i>Solar Thermal Power plants and their advantages</i>	Prof Frank Dinter, STERG, US	25
<i>Unlocking the Rooftop PV Market in South Africa – Case Study: Hessequa Municipality</i>	Karin Kritzinger, CRSES & Dr Bernard Bekker, Consultant	100

Note: Some of these events were not as well attended as in the past and this format will be reviewed in 2014.

School Outreach Programme

In addition to the forums a **School Outreach Project** was initiated in 2008 by the Centre. Therese Lambrechts, an experienced project manager with a passion for climate change and renewable energy, developed learning material on climate change and renewable energy suitable for grades 6 to 9. Thirty schools in the Western Cape, and 1800 learners in the Eden District, Eastern Cape, were reached. At the WESA Durban Eco School Conference in Kwazulu-Natal a further 23 schools and 1 400 learners were reached. The outputs for this project during 2013 are listed in **Table 3**.

Sustainable funding for the School Outreach Programme remains a challenge. Fundraising efforts for 2014 has been initiated.

Table 3: School Outreach Programme Outputs 2008-2013

Outreach	2008	2009	2010	2011	2012	2013
Total number of schools reached	3	18	119	72	30	99
Total number of educators reached	3	27	117	110	40	103
Total number of learners reached	0	0	23 600	14 400	500	6 044
Total number of students reached			376	257	25	

Technology Roadmapping

The Centre has taken the lead to develop a solar technology roadmap for the DST; to inform the strategy of the country pertaining to the R&D of solar technology systems. It is expected that this R&D roadmap will inform the larger solar energy roadmap that is underway; a collaboration between the DST and DoE with assistance of the IEA. In 2013 the Renewable Energy Policy postgraduate module was used to explore the different RE technologies with an emphasis on innovation 'pull' and 'push' mechanisms to enhance the national system of innovation. These outcomes will inform the development of a further R&D roadmap in 2014 pertaining to wind energy systems.

Assisting local and provincial governments

Stellenbosch University signed a Memorandum of Agreement with the Hessequa Municipality in the southern Cape. As part of this action, and in collaboration with the GreenCape initiative, a project was completed to study the effect that the introduction of rooftop PV systems will have in Riversdale, as an example of a typical mid-size rural town. The main aim of the study was to investigate both the technical and financial aspects of such a programme and in particular to investigate financial models that will ensure that the financial viability of the municipality is not adversely affected. This project was completed and the report is available at:

<http://crses.sun.ac.za/research-publications-tech-reports.php>

The findings of the report was presented at a SAPVIA meeting in Cape Town on 24 October 2013 and it is intended to present these results at an appropriate forum in Gauteng in the near future.



Figure 1: GIS Study results of Hessequa PV study (The yellow roofs were identified in Riversdale as suitable for the installation of a rooftop photovoltaic system.)

The Centre is also part of the Stellenbosch Infrastructure Task Team (SITT), which aims to prioritise the short and medium term actions to address the backlog of the Municipality and ensure local economic development and socio-economic growth. The Centre is responsible for the energy aspects of the SITT and it is envisaged that the learning of this participation will inform the implementations strategies of other municipalities. Prof Brent assisted Stellenbosch Municipality to develop a policy document on Rooftop PV.

Policy Briefs

Prof Wikus van Niekerk, while on sabbatical at the University of Edinburgh in Scotland, prepared the first policy brief on Ocean Energy for the Department of Science and Technology. During this period he consulted many of the wave and tidal energy technology developers based in Scotland and also visited the European Marine Energy Centre (EMEC) on the Orkney Islands. The policy brief was discussed with various stakeholders in South Africa, including Eskom and Sasol. The policy brief is available on request.

2.3 SLA Objective: Stimulating innovation and enterprise in the field of RSE

2.3.1 Outputs

OBJECTIVES	ACTIVITIES	SUB-ACTIVITIES	OUTPUTS/TARGETS	OVERALL	2013	2013
					TARGET	ACTUAL
3. Stimulating innovation and enterprise in the field of RSE	3.1 Undertake and manage teaching, research and market transformation projects with partners	3.1.1 Develop a database of local expertise that can undertake teaching, research and market transformation projects	3.1.1.1 A database of local expertise on market transformation by December 2014 which is annually updated	1	0	0
		3.1.2 Identify, contract, manage and participate in projects that are technology- and policy-oriented, such as resource assessment and informing the financing of renewable energy interventions; on a continual basis, namely, at least three a year	3.1.2.1 Lead (drive) and participate in at least 15 such projects over the five-year period, typically three per year	15	3	5
		3.1.3 Conduct feasibility studies on newly proposed technologies/ devices	3.1.3.1 A minimum of two newly investigated technologies/devices – as introduced by inventors and the like – and reported per annum	10	2	2

	3.2 Investigate, evaluate and facilitate the transfer of appropriate technology	3.2.1 Stimulate the transfer of at least 5 identified RSE technologies	3.2.1.1 Support the initiation of the process of transferring (at least 5) technologies to the market over the 5-years	5	1	2
	3.3 Engage with communities and NGOs to facilitate and establish developmental applications	3.3.1 Engage with rural and/or poor communities to establish their energy needs and identify relevant RSE technologies	3.3.1.1 Motivate for and demonstrate the process of transferring (at least 5) technologies to the market over the 5-years focussing on rural applications or energy for the poor	5	1	1
4. Coordinate national and international linkages and interactions in the RSE field	4.1 Build networks locally and internationally with synergistic programmes to maximise impact and leverage external funding	4.1.1 Arrange national workshops and conferences	4.1.1.1 At least 2 workshops/conferences per year to stimulate research collaboration and exchange - workshop/conference reports or proceedings, submitted to the NRF, should contain an outline of proceedings, and should detail event participation and highlight/ demonstrate the impact of the workshop/ conference	10	2	2
		4.1.2 Staff associated with the programme participate in international conferences to enhance collaboration with international research bodies	4.1.2.1 At least two international conference papers annually – also a report submitted to the NRF containing highlights and demonstrating the impact of the conferences	10	2	4
		4.1.3 Leverage external funding	4.1.3.1 External funding leveraged at least by the end of December 2014 but it will be an ongoing process			

2.3.2 Progress & Challenges

Projects

Table 4 indicates the scope of the completed projects while **Table 5** provides details of those projects that will continue in 2014.

Table 4: Completed Projects, 2013

	Project Description	Client	Project Leader	Contract Nr	Amount (incl VAT)
1	Soltrain I	AEE Intec	D Palmer	CRSES 2008/16	R 843 640.00
2	Continuation Lephale Measurements/ Exxro Contract amendment CRSES 2009/22	Exxaro	AJ Meyer	CRSES2009/22 CRSES2011/11	R 961 276.73
3	DNI measuring equipment procurement, installation, commissioning and reporting	SASOL New Energy	AJ Meyer	CRSES2010/31a&b CRSES2011/25	R 1 220 493.53
4	SI measurements Danielskuil en Kimberley	AfriDevo	AJ Meyer	CRSES2011/07	R 670 593.49
5	Rwanda Renewable Energy Strategy	UNEP	AC Brent	CRSES2012/4	R 199 200.00
6	Maintenance of Solar Measurement Stations in the Northern Cape	Aveng - (Vexicom (Pty) Ltd)	AJ Meyer	CRSES2012/10	R 110 248.23
7	Exxaro Botswana Measurements - Extention	Exxaro	AJ Meyer	CRSES2011/43b	R 273 076.74
8	Qatar Review Report	Qatar National Food Security Programme	AJ Meyer / C Leonard	CRSES2012/45	R 60 900.00
9	Mapping of current renewable energy EIA applications	CSIR	J Reinecke	CRSES2012/49	R 110 528.13
10	DEA Solar Maps	DEA	JL vNiekerk / J Reinecke	CRSES2013/08	R 1 093 984.38
11	Review of Ocean Energy Resource Data	TIA/SANEDI	J Reinecke	CRSES2013/09	R 200 000.00
12	Short Course - Wind Energy	NUMSA	T Lambrects	CRSES2013/10	R 5 415.00
13	De Beers On-vessel Technology Overview	De Beers Marine	J Reinecke	CRSES2012/18	R 162 810.35
14	PV Rooftop Study - Hessequa	GreenCape	C Leonard	CRSES2012/23	R 80 000.00
15	Peer review – Northern Cape Renewable Energy Strategy	Urban-Econ Development Economists	AC Brent	CRSES2012/48	R 62 300.00

	Project Description	Client	Project Leader	Contract Nr	Amount (incl VAT)
16	Installation and Measurements at Solar Station in Upington	SASOL New Energy	AJ Meyer	CRSES2012/05b	R 601 136.25
17	Extension - Solar Measurements - Noupoot	Terra Solar Energy	AJ Meyer / C Leonard	CRSES2012/6	R 93 227.04
18	Grid Planning Phase 3 - WASA data	Eskom	J Reinecke	CRSES2012/07	R 211 228.88
19	Broadbased RE Potential of South Africa	ESKOM	J Reinecke	CRSES2012/12	R 452 137.98
20	Eskom Solar Study: Effect of clouds on solar plants	ESKOM	J Reinecke	CRSES2012/14	R 1 667 054.15
21	CSP Today Markets Report (South Africa)	CSP Today	AC Brent	CRSES2013/14	R 32 000.00
22	OWS Scaling/testing device	Natural Energy Systems	I Meyer	CRSES2013/20	R 57 000.00
23	Solar and wind energy for rural water supply projects in Ethiopia	Ethiopian Ministry of Water and Energy	B de Lange	CRSES2013/17	R 2 421 284.94
24	SITT - Energy Working Group	Stellenbosch Municipality	C Leonard	CRSES2012/34	R 30 000.00

Table 5: On-Going Projects 2013/2014

	Project Description	Client	Project Leader	Contract Nr	Amount (incl VAT)
1	Energy Management	WineTech	AC Brent / B de Lange	CRSES2012/30	R 171 000.00
2	SETRM (Solar Energy Technology Roadmap)	CSIR	AC Brent	CRSES2012/47	R 182 400.00
3	Soltrain II	AEE Intec	JL van Niekerk/ C Leonard	CRSES2012/44	R 1 532 824.20
4	National SEA identification for the rollout of Wind and Solar PV Energy in South Africa.	CSIR	J Reinecke	CRSES2012/50	R 333 321.00
5	Technical Advice on Large (1MW) PV Installation	Lourensford Wine Estate	J Reinecke	CRSES2013/15	R 102 014.50
6	Eskom RE Chair Additional Funding	THRIP	JL van Niekerk / C Leonard	CRSES2013/05	R 1 300 000.00
7	eThekwini - Green Power Tariff Proposal	eThekwini	K Kritzingner	CRSES2013/07	R 198 413.33
8	South African-German Energy Programme - Installation and Monitoring of DNI Solar Stations and Updating of the South African DNI Solar Map	GIZ	JL van Niekerk / C Leonard	CRSES2013/11	R 4 949 896.52

9	KZN Renewable Energy Research Support	KZN Dept Econ Dev	AC Brent / J Reinecke	CRSES2013/21	R 1 500 000.00
	Project Description	Client	Project Leader	Contract Nr	Amount (incl VAT)
10	Desktop study on technologies to convert biomass to energy and electricity	Gaia Carbon Sciences	C Silinga	CRSES2013/23	R 45 600.00
11	Renewable Energy Advisor	Pepkor	J Reinecke	CRSES2013/24	R 92 832.25

On these projects both staff of the Centre, as well as other expert consultants in the University and private industry, combined to form strong, multi-disciplinary project teams to execute the technical work. A number of international partners also contacted the Centre to discuss cooperation; examples are the DLR, Fraunhofer ISE, GTZ and the German Development Bank who are interested to partner with the Centre on wind and CSP projects, and IIASA that wants to collaborate to develop regional-scale models to inform renewable energy oriented policy.

The projects undertaken by the Centre range from initial feasibility studies, for the deployment of renewable energy, to highly technical studies on specific technologies. The Centre is also regularly requested to assess the ideas of individual entrepreneurs that are referred to the Centre by SANERI, DST, DoE and others. The study of the resource in the Agulhas Ocean current is one of these that may lead to a significant future research project if the current application for funding to the Technology Innovation Agency is successful. A register of these ideas and the responses of the Centre are kept, as requested by SANERI and DST. The submissions that were received and reviewed in 2013 are listed in **Table 6**.

Database of Expertise

A database of local expertise in renewable energy was maintained in 2013. This database is available at: <http://www.crses.sun.ac.za/home-people-renewable.php>

Table 6: Proposed Patents and Ideas Investigated in 2013

Novel wave energy device	William Tommy Flusk
Natural Energy Systems – Floating buoy with a patented bi-directional air-turbine	Robbie Maartens

Transfer of RE Technologies to market

In 2012 the Centre submitted a proposal in response to the Open Innovation Challenge of the Technology Innovation Agency and Eskom to develop a device to harvest energy from the Agulhas Ocean current. In 2013 the Centre was informed that the proposal was of the only one submitted by a South African consortium that were invited to proceed to the next

step, a complete project proposal to the TIA. Unfortunately during the development of this proposal the international partner, Minesto AG, withdrew their support from the South African consortium and without their support it was decided not to pursue the TIA application any more.

In November 2012 a spin-out company from the Centre, GeoSUN Africa (Pty) Ltd, was formed. In 2013 the company increased their staff from two people to a total of five. The company seems to be successful in their area of business, measuring and assessing solar energy, and the Centre continue to collaborate with GeoSUN Africa on a number of projects.

RE in Rural Applications

A coursework master's project developed into a promising solution for rural electrification. The student came up with the concept of a SolarTurtle that consists of a container with solar panels that houses a battery charging station. The concept functions as a micro-utility where consumers would bring rechargeable batteries that will be charged during the day and then provide light, charging facilities and even power a television set in a rural dwelling. The student was awarded seed-funding from TIA and is currently being supported by the Centre and the University to commercialise the concept by developing a pilot plant that it can be deployed to the Eastern Cape.

National flagship projects

The Centre is also playing a coordinating and facilitating role in a number of flagship projects:

- South African Renewable Energy Technology Centre (SARETEC) project to establish a research, development and training facility in the Western Cape, primarily serving the wind energy sector.
- Southern African Solar Resource Database project, which will include 10 to 20 ground stations to accurately measure solar radiation, updating satellite derived solar data and establishing expertise in South Africa to interpret and assess the information.
- Small-Scale CSP Demonstration Plant and Research Station, which will be built as a public-private partnership.
- A national consortium to model the energy systems in South Africa to support the current groups in Eskom (IRP modelling) and Department of Energy.

Of these projects the one that gained the most momentum was the establishment of the South African Renewable Energy Training Centre (SARETC). This Centre will incorporate both wind and solar energy training and will be hosted at the Cape Peninsula University of Technology (CPUT). In 2012 a proposal was drafted in cooperation with the GreenCape initiative that was submitted to the Department of Higher Education and Training for a grant of R 80m to establish the physical infrastructure and R 25m for the first three years'

operating expenses of the Centre. This proposal was accepted by the DHET, the funding has been transferred to the CPUT, and planning and construction will continue in 2013/2014.

During 2013 the Centre started to work on the updated SA Solar Resource Database project, mainly funded by the German Federal Government through their agency the GIZ. As part of the GIZ project six solar resource measurement stations will be installed in South Africa and the data placed in the public domain. Five of these stations were installed in 2013 and the last will be installed early in 2014. In addition to the GIZ funded project another project funded by the US Government through their USAid programme will fund another four stations. Unfortunately this contract was not concluded in 2013 and this project will only start in 2014.

Conferences and Symposia

The **First Southern African Solar Energy Conference (SASEC)** was held in May 2012 in Stellenbosch with sponsorship from TIA and Eskom. The **second SASEC** will be hosted by Nelson Mandela Metropolitan University from 27 to 29 January 2014 in Port Elizabeth. Details are available on the website: www.sasec.org.za

The 2013 the **Energy Post-graduate Conference (EPC)** was organised by the NRF with support from the DST and Stellenbosch University, and took place from 11 to 14 August 2013 at iThemba Labs in Stellenbosch. This event was co-sponsored by the Centre and included an 'experience centre' to expose school learners (grades 11) to renewable energy in general. A list of the 69 Renewable Energy papers presented in the renewable energy stream will be listed on our website at <http://crses.sun.ac.za/service-conferences.php> and is included as **Annexure B**

RE Training Workshops/In-House Training Courses

During August 2013 a five-day RSE Technology training event was held in Stellenbosch, which was attended by 28 delegates from various industries, e.g. Eskom, Department of Energy, Aurecon, Unisa, MMI Holdings, Murray & Roberts, and Somoil SA in Angola. The workshop was presented as five one-day events covering various RE Technologies and participants could choose which technologies they wanted to attend. The programme is attached **Annexure C**

A group of 24 delegates from Ethiopia, sponsored by the Ethiopian Ministry of Water and Energy, attend a month long training workshop in August/September 2013 on the use of solar and water energy for rural water supply in Ethiopia. (**Figure 3**). The 24 delegates from Ethiopia also attended 4 days of the Renewable Energy Technology workshop as part of their training schedule. This also gave them exposure to a wide range of South African delegates in the RE field.

The training schedule for the month-long event is attached as **Annexure D**



Figure 3: Delegates attending the Training for Experts Working on Solar and Wind Energy for Rural Water Supply projects in Ethiopia

National and International Conferences Attended by Staff and Students:

Table 7: International Conferences Attended 2013

Name of Conference	Date and Place	Attendees
Funded from DST/NRF Funds		
SolarPaces 2013	September 2013, Las Vegas, USA	Prof Wikus van Niekerk
EWTEC 2013	September 2013, Aalborg, Denmark	Prof Wikus van Niekerk, Dr James Joubert
Funded from other funds		
SolarPaces2013	September 2013, Las Vegas, USA	Riaan Meyer, Cebo Silinga
IEA-SHC Task49 Experts Meeting	October 2013, Evora, Portugal	Billy de Lange
UNEP Green Economy workshop, Improving green economy related models to assist countries.	May 2013, Bergen, Norway	Prof Alan Brent
KwaZulu-Natal Green Economy Summit,: Renewable Energy – where should South Africa be heading?	February 2013, Durban, KwaZulu-Natal	Prof Alan Brent
South African Energy Modelling Network	January 2013, Pretoria	Prof Alan Brent

(SAEMN) colloquium, University of Pretoria,: Energy sector results from the South African Green Economy Model (SAGEM).		
AC21 International Graduate Summer School: Technology assessment in developing countries	May, 2013, Bangkok, Thailand	Prof Alan Brent
Green Economy National Youth Summit	June 2013, Cape Town	Imke Meyer & Sino Poni
Energy Post Graduate Conference (NRF)	August 2013, Stellenbosch	Imke Meyer, James van der Walt
ISES Solar World Congress	November 2013, Cancun, Mexico	Prof Wikus van Niekerk
Sponsored conferences		
Windaba 2013	September 2013, Cape Town, South Africa	Prof Wikus van Niekerk (Presenter) Alejandro Lupion Romero

The representatives from Stellenbosch University was the fourth largest group from a single organisation that attended the SolarPACES Conference in Las Vegas in September 2013. In total Stellenbosch students and researchers prepared seven papers that were presented at the conference. The SolarPACES Conference is the most important conference in the field of concentrating solar power. Stellenbosch University has increased our visibility at this conference over the last three years to the point that we are now seen as one of the leading institutions in the world doing research in CSP.

Staff also attended and presented at the following local conferences:

- CSP Today South Africa 2012, 7-8 February 2012, Johannesburg.
- TUT Centre for Energy and Electrical Power: Workshop on Energy and the Environment for Africa's Public Officials, October 2012, Pretoria, South Africa.

The Director attended the International Solar Energy Society (ISES) board meeting in November 2013 in Cancun Mexico as he represents South Africa on the Board of ISES.

In September the Director accompanied a delegation of the Western Cape Provincial Government and the Green Cape on a study tour to Denmark and the island, Bornholm. During this visit a number of renewable energy projects were visited and cooperation between the Copenhagen Clean Tech cluster the Western Cape was discussed.

The Director also visited the Northwest Marine Renewable Energy Centre based at Oregon State University and the Southeast Marine Renewable Energy Centre based at Florida Atlantic University to discuss collaboration on wave and ocean current technologies. At least one joint publication resulted from these interactions.

Johann Kotze, PhD student in renewable energy and bursary holder of the Centre received the **SANEA 2013 young researcher award** and presented a lecture to SANEA on 13 November 2013 in Cape Town.

CRSES hosted the **110% Green Innovation** tour where solar, ocean and bio-energy research projects were presented and discussed with the Premier's guests who included the Stellenbosch mayor on the 15th of July at Stellenbosch University.

Billy de Lange presented two presentations:

SESSA Breakfast, 24 May 2013, Cape Town, "Applications of Low Temperature Solar Heat"

SANEA Lecture, 8 October 2013, Durban, "Solar heat for industrial processes in South Africa"

Karin Kritzinger presented "The Soltrain Programme and the South African Solar Thermal Technology Platform (SA-STTP)" at a **SANEA lecture**, 8 October 2013 in Durban.

3 Human Resources

3.1 Centre Staff Complement

The following staff members' salaries were funded by the DST/NRF grant in 2013.

Table 8: Centre Staff Funded by DST/NRF Grant

Position	Incumbent	Gender	Race
Director and Professor in M&M*	Prof Wikus van Niekerk	M	W
Associate Director and Professor in the SPL [#]	Prof Alan Brent	M	W
Professor in M&M*	Prof Ben Sebitosi	M	B
Research Engineer	Josh Reinecke	M	W
Researcher Engineer	Corli Leonard	F	W
Admin/Finance Officer	Jos Liebenberg	F	W
Schools' Programme Coordinator	Therese Lambrechts	F	W
Intern	Sinovuoy Poni	F	B

* M&M: Department of Mechanical and Mechatronics Engineering

[#] SPL: School for Public Leadership

The following staff members' salaries were funded from other sources, mainly project income and the Eskom grant.

Table 9: Centre Staff Not Funded by DST/NRF Grant

Position	Incumbent	Gender	Race
Senior Lecturer	Alejandro Lupion-Romero	M	W
Research Engineer	Imke Meyer	F	W
Research Engineer	Cebo Silinga	M	B
Research Engineer	Billy de Lange*	M	W

Researcher	Karin Kritzinger	F	W
Research Technician	Athi Ntisana	M	B
Receptionist	Sandelize Heydenrycht	F	B

Note: * Mr De Lange resigned as of the end of October 2013

Excluding Mr De Lange the Centre now employs 14 staff members. Of these 5 are black, 36%, and 7 female, 50%, which means the Centre exceeded its 45% target for female employees but is still short of the target of 50% black representation.

A number of other staff members were associated with the Centre as supervisors, lecturers and specialists working on projects. These are listed in **Table 10**.

Table 10: Associated Staff

Position	Incumbent	Gender	Race
Lecturers & Supervisors	Prof Theo von Backström (M&M)	M	W
	Francis Jackson (Windlab Systems)	M	W
	Jako Volschenk (USB)	M	W
	Prof Johann Görgens (Process Engineering)	M	W
	Dr Jaap Hoffman (M&M)	M	W
	Prof Hanno Reuter (M&M)	M	W
	Dr Johan van der Spuy (M&M)	M	W
	Mr Paul Gauchè (STERG and M&M)	M	W
	Prof Johan Vermeulen (E&E)	M	W
	Dr Johan Beukes (E&E)	M	W
	Dr Johan Strauss (E&E)	M	W
	Prof Frank Dinter (STERG)	M	W
	Dr N Gule (E&E)	M	B

The Centre recruited three postdoctoral fellows in 2013. Two of them already joined Stellenbosch and the third is expected in February 2014.

Table 11 Postdoctoral Fellows

Position	Field of study	Gender	Race
Dr Eman Tora	Energy modelling and optimisation	F	B
Dr Sameer Hameer	Energy storage	M	B

3.2 Student Support

In 2011 the administration and disbursement of the bursaries, previously the responsibility of the Centre, was ceded to the NRF. In 2013 the Centre awarded 8 bursaries from own reserves and the NRF funding to the following eight students studying at Stellenbosch University.

- Grobbelaar Eben – MScEng White Male R80 000/year for 2 years
- Selinga, Cebo – MEng Black Male R80 000/year for one year

- Padi, Richard K - MScEng Black Male R40 000/year for 3 years
- Mokoena, Jazze KL -PDE Black Male R40 000 for one year
- Terblance, Johann P- MScEng White Male R120 000 over 2 years
- Landman, Willem - MScEng White Male R60 000 for one year
- Joubert, James R – PhD White Male R90 000 for one year
- Heller, Luke- PhD White Male R60 000/year for 3 years

Of this only R 90 000 was paid from the DST/NRF grant and the rest from other reserves of the Centre or the Eskom grant.

3.3 Staff Training

The following staff members attended training opportunities in 2013:

- Sinovuoy Poni attended a weeklong GIS course as well as the Renewable Energy Systems module.
- Athi Ntisana attended the Bio-Energy Technology workshop in August 2013. He also attended the Introduction to Solar Energy module.
- Cebo Silinga attended the Bio-Energy Technology workshop in August 2013.
- Karin Kritzinger attended the Renewable Energy Finance and Systems Dynamics modules. She also attended the Efficient Energy Use and Planning at Life Academy (<http://www.life.se/what-we-offer/training-programs/advanced-international-training-programs/efficient-energy-use-and>) in India.
- Jos Liebenberg attended an intermediate MS Excell course.
- Billy de Lange attended Soltrain II Solar thermal training workshop 11-12 March 2013, Stellenbosch.
- Josh Reinecke and Alejandro Lupion-Romero enrolled for the WASP- e-learning course at the Danish University of Technology

4. Publication Outputs

4.1 Articles in Peer Reviewed Journals

PEER-REVIEWED JOURNAL ARTICLES

	2013
1	Owen, M. , Kröger, DG, Contributors to increased fan inlet temperature at an air-cooled steam condenser, <i>Applied Thermal Engineering</i> , Vol. 50 pages 1149-1156, 2013
2	Allen, K.G., von Backström, T.W., Kröger, D.G., Packed bed pressure drop dependence on particle shape, size distribution, packing arrangement and roughness, <i>Power Technology</i> ???? Not yet accepted
3	Owen, M., Kröger, DG. Contributors to increased fan inlet temperature at an air-cooled steam condenser. <i>Applied Thermal Engineering, Vol50:1149-1156, 2013</i>
4	Pierce, W., Gauché, P., von Backström, T.W., Brent, A., Tadros, A., A comparison of solar aided power generation (SAPG) and stand-alone concentrating solar power (CSP): A South African case study. <i>Applied Thermal Engineering 61 (2013) 657-662</i>
5	Janse van Rensburg, P.J., Groenwold, A.A., Wood, D.W., Optimization of cylindrical composite

	flywheel rotors for energy storage. <i>Struct Multidisc Optim</i> (2013) 47:135-147
6	Heller, L., Gauché, P. , 2013., Modeling of the rock bed thermal energy storage system of a combined cycle solar thermal power plant in South Africa. <i>Solar Energy</i> 93 (2013) 345-356
7	Gauché, P., von Backström, T.W., Brent, A.C. , A concentrating solar power value proposition for South Africa. <i>Journal of Energy in Southern Africa</i> , Vol 24 No1, Feb 2013
8	Kotzé, J.P., von Backström, T.W. , Erens, P.J., 2013., High Temperature Thermal Energy Storage Utilizing Metallic Phase Change materials and Metallic Heat Transfer Fluids. <i>Journal of Solar Energy Engineering</i> , Vol 135, Issue 3, 2013
9	LE ROUX WG , BELLO-OCHEDE T and MEYER JP; A review on the optimisation and entropy generation minimisation of the solar thermal Brayton cycle, <i>Renewable and Sustainable Energy Reviews</i> , Vol. 28, pp. 677 - 690, 2013.

4.2 Published Conference Proceedings

CONFERENCE PROCEEDINGS

	2013
1	GARACH DV , DIRKER J and MEYER JP; Heat transfer and pressure drop in microchannels with different inlet conditions for water in the laminar and transitional flow regimes, Proceedings of the Ninth International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT2012), Malta, pp. 763 - 770, 16 – 18 July 2012.
2	MEYER JP, DIRKER J, OLIVIER JA and GARACH DV (keynote); The influence of different types of inlets on heat transfer of tubes in the transitional flow regime, Proceedings of the International Conference on Advances in Mechanical Engineering, 100 years of Energy, Strength and Precision, Mechanical Engineering Department, College of Engineering, Pune, Paper nr: ICAME-2013/K3, 29 – 31 May 2013.
3	SELINGA, C , Scenarios for peaking CSP system in South Africa in a short term. SolarPaces 2013, 17- 21 September, Las Vegas, USA.
4	KOTZE, J , Simulation and testing of a latent heat thermal energy storage unit with metallic phase change materials SolarPaces 2013, 17- 21 September, Las Vegas, USA.
5	HELLER, L , and GAUCHÉ, P . Dual-Pressure Air Receiver Cycle for Direct Storage Charging. SolarPaces 2013, 17- 21 September, Las Vegas, USA.
6	MALAN K , Model based open-loop correction of heliostat tracking errors. SolarPACES 2013, 17- 21 September, Las Vegas, USA.
7	LUTCHMAN, S , On Using a Gradient-based Method for Heliostat Field Optimisation,. SolarPACES 2013, 17- 21 September, Las Vegas, USA.
8	LUTCHMAN, S , A Comparison of Heliostat Field Optimisation Methods and a Simplified Heliostat Field Analysis Tool. SolarPACES 2013, 17- 21 September, Las Vegas, USA.
9	MUSANGO, JK, BRENT AC , 2013. Application of a new framework for energy technology sustainability assessment: Results from survey. International Association for Management of Technology (IAMOT), Porto Alegre, Brazil. (April)
10	MUNSANGO, JK, BRENT AC , BASSI, AM, 2013. Development of the South African Green Economy Model (SAGEM). International Conference of the System Dynamics Society, Cambridge, USA. (July)

11	MUSANGO, JK, BRENT AC , PRETORIUS, L, MÜLLER, H, 2013. Tutorial on the application of a systems approach to technology sustainability assessment (SATSA): the case of biodiesel production development. International Sustainable Development Research Conference (ISDRC), Stellenbosch, South Africa. (July)
12	MEYER, I, 2013 : Resource Assessment of the Agulhas Current to determine Feasibility for Marine Energy Extraction. Energy Post Graduate Conference (NRF), 11-14 Aug 2013 Stellenbosch, South Africa.
13	JOUBERT, J.R., and VAN NIEKERK, J.L. Design of a Novel Breakwater Wave Energy Converter for the South African Coast,” Proceedings of the 10th European Wave and Tidal Energy Conference , Aalborg, Denmark, 2013.
14	MEYER, A.J. and VAN NIEKERK, J.L. , “Towards a Verified DNI Map for South Africa,” Proceedings of the SolarPACES Conference, Las Vegas, USA, 17-20 September 2013
15	WANG R.-J., GERBER S. : Magnetically geared wind generator technologies: opportunities and challenges, The 5th International Conference on Applied Energy (ICAE), 9p, 1-4 July 2013, Pretoria, South Africa.
16	WANG R.-J., BRÖNN L., GERBER S. , TLALI P.M.: Design and evaluation of a disc type magnetically geared PM wind generator, IEEE Int’l Conf on Power Engineering, Energy and Electrical Drives, (POWERENG), (Paper-524), pp.1259-1264, 13-17 May, 2013, Istanbul, Turkey.
17	GERBER S. , WANG R.-J.: Design of a magnetically geared PM machine, Proc. of IEEE Int’l Conf on Power Engineering, Energy and Electrical Drives, (POWERENG), (Paper-359), pp.852-857, 13-17 May, 2013, Istanbul, Turkey.
18	GERBER S. , WANG R.-J.: Evaluation of a prototype magnetic gear, Proc of IEEE Int’l Conf on Industrial Technology, (ICIT), 25-27 Feb 2013, pp.319-324, Cape Town, South Africa.
19	GERBER S. , WANG R.-J.: Torque capability comparison of two magnetically geared PM machine topologies, Proc of IEEE Int’l Conf on Industrial Technology, (ICIT), 25-27 Feb 2013, pp.1915-1920, Cape Town, South Africa.
20	ROUX S , MEYER JP, MAHMOOD G and ALAM A; Heat transfer in a dimpled short pin-fin array, Proceedings of the 8th World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics, Lisbon, 16 – 20 June 2013.
21	Du Toit, L ; Incentives for sustainable energy measures in South Africa’, University of Groningen First European Environmental Law Forum Conference: Environmental Law and Energy and Climate Law as Instruments to Achieve Sustainable Energy 4-6 September 2013, Groningen, The Netherlands

4.3 Books & Book Chapters

BOOKS AND CHAPTERS IN BOOKS

1	Brent AC , Tredoux C, 2013. Integrating sustainability into technology-oriented project management: Cases from South Africa. In: Silvius G, Tharp J (Eds.): <i>Sustainability integration for effective project management</i> . IGI Global Business Science Reference, Hershey, PA.
2	L du Toit and J Glazewski ‘Energy Law and the Environment’ in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
3	J Glazewski and L du Toit ‘International Climate Change Law’ in J Glazewski and L du Toit (eds)

	Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
4	J Glazewski and L du Toit 'Atmospheric Pollution' in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
5	J Glazewski and L du Toit 'Noise Pollution' in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
6	J Glazewski and L du Toit 'Planning Law and the Environment' in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
7	J Glazewski and L du Toit 'Heritage Resources' in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013
8	L Feris and L du Toit 'Land Pollution' in J Glazewski and L du Toit (eds) Environmental Law in South Africa (Loose-Leaf Edition, Issue 1) LexisNexis 2013

4.4 Other Relevant Outputs

TECHNICAL REPORTS

	2013
1	Unlocking the Rooftop PV Market in South Africa , Josh Reinecke, Corli Leonard, Karin Kritzinger, Dr Bernard Bekker, Prof Johannes L van Niekerk, Joschka Thilo, CRSES, March 2013
2	South African Wave Energy Resource Data: A Case Study , Dr JR Joubert, Prof JL van Niekerk, CRSES, May 2013
3	Assessment of the Ocean Energy Resources off the South African Coast , Ms I Meyer, Mr J Reinecke, Prof M Roberts, Prof J L Van Niekerk, CRSES, April 2013.

4.5 Media Interaction

Solar capital growth, Alan Brent & Billy de Lange, Financial Mail 25-20 January 2013:14.,

Jou geld kan groei in 'n sonwatervhitter, Brent & de Lange, Die Burger, 22 Februarie 2013:45

<http://www.sake24.com/JouGeldsake/Bele-in-n-sonwatervhitter-en-slaan-munt-20130222c>

Sonkragbelegging: Ontsluit kleinskaalse hernubare krag. A Brent, K Kritzinger, J Reinecke, Die Burger, 20 April 2013:15

New centre to address skills shortage in renewable energy sector, Stellenbosch News, <http://www.sun.ac.za/english/Lists/news/DispForm.aspx?ID=105> 24 April 2013

SASEC- the Southern African Solar Energy Conference, Energy Management News, March 2013:3-4

Research Engineer: Renewable Energy. SA Career Focus Vol 7 No 7 2013:38

Forum: Sonskyn na kraglyn, Die Burger, 4 July 2013.

<http://www.dieburger.com/opinie/2013-07-04-forum-sonskyn-na-kraglyn>

A bright future for CSP – researchers, Engineering News, 19 July 2013.

http://www.engineeringnews.co.za/article/a-bright-future-for-csp-2013-07-18?utm_source=Creamer+Media+FDE+service&utm_medium=email&utm_campaign=EngineeringNews%3A+PetroSA+to+make+call+on+%24375m+to+%24510m+LNG+import+terminal+in+2014&utm_term=http%3A%2F%2Fwww.engineeringnews.co.za%2Farticle%2Fa-bright-future-for-csp-2013-07-18

New map offers visibility of all renewable-energy project applications, Engineering News online, 23 August 2013. <http://www.engineeringnews.co.za/article/new-map-offers-visibility-of-all-renewable-energy-project-applications-2013-08-23>

Só gaan SA se 27 sonkragaanlegte help, Die Burger, 12 September 2013.

<http://www.dieburger.com/sake/2013-09-11-sonkragplan-goed-op-dreef>

SA's solar future, Financial Mail, <http://www.fin24.com/Economy/SAs-solar-future-20130912>

The following article by Cebo Silinga, Paul Gauché and Alan Brent is being submitted for publication in Engineering News and Die Burger:

The peak power dilemma – invest in both conventional and concentrating solar power solutions.

5. Review of Progress

The Progress of the Centre in 2013 was in line with the expectations and the performance over the previous years. Some of the highlights of the year were:

- A new contract was concluded with the NRF and both tranches of funding for 2013 were received.
- Fourteen students graduated with postgraduate degrees. The Centre has a very good record of retaining contact with the students and supervisors of the students supported over the years.
- The number of projects completed for Eskom, other public and private sector parties, and international agencies, attest to the high regard the expertise in the Centre currently commands in South Africa. These projects will also contribute to the financial viability of the Centre in future.
- A large solar resource measurement project with the support of the German GIZ and the USAID has commenced.
- A group of 23 technicians and engineers from Ethiopia was successfully trained to use solar and wind energy to pump water.
- The Centre's income grew significantly in 2013, partly due to some large projects, which is an indication of the financial sustainability of the Centre.

The Centre was successful to meet, and in some cases exceed, the output targets set in the Service Level Agreement for 2013.

6. Conclusion

The Centre is well positioned to maintain, and in some cases expand, its activities and programmes in 2014 and beyond. The main assets of the Centre remain the excellent staff, both those employed by the Centre as well as the other academics and researchers associated with the Centre, the excellent facilities at Stellenbosch University, and the students at the different universities cooperating with the Centre.

7. Financial Information

The budget for the Programme from the NRF accepted by the Management Board for the Programme for 2013, came to R 4 378 500. A further amount of R 2 018 500 was approved for payment by the NRF for the outstanding grant & expenditure for 2012 as reported in the 2012 Annual Report and audited statements.

The total expenditure from the DST and NRF related cost points (28527, 11550 and 11565) until 31 December 2013 was R 7 918 254.98 (see **Appendix A**). These cost points are the cost points associated with the NRF grant (28527), the previous DST/SANERI funds (11550) and a new cost point (11565) used to make the expenditure of funds from the Centre's other reserves towards the core function of the Centre visible. The total amount received from the NRF in 2013 came to R 6 397 000 and therefore an amount of R 1 521 254.98 was **spend in addition to** the NRF grant in 2013 on the core functions of the Centre.

The total income of the Centre, for all cost points including the NRF and Eskom grants and THRIP funds, in 2013 was R 26 056 450.16 while the total expenditure and transfers came to R 19 815 420.15 which is considerably more than what it was in 2012. This significant increase in the income and expenditure of the Centre was mainly due to a number of large projects for Eskom, the GIZ and the Provincial Government of KwaZulu/Natal. The total funds available on 31 December 2013 were R 11 303 607.39 indicating that the Centre is in a very strong financial position at the start of 2014. It should be noted that as part of the expenditure new assets to the value of R 2 333 663.21 was purchased which is mainly equipment available for research projects at Stellenbosch University. The audited statements of all the cost points of the Centre are included as **Appendix B**.

Table 12 summarise the financial contribution the Centre made to the academic mission of the University. It is a substantial increase to what was invested in 2012, mainly due to the equipment purchased with the THRIP and GIZ funds, and the increase in the salaries with the appointment of Prof Dinter and Alejandro Lupion-Romero.

Table 12 Investment in the Academic Mission of Stellenbosch University

<u>Description</u>	<u>Amount</u>	
	2013	2012
Salaries for staff and academics at Stellenbosch University	R 6 559 401	R 3 427 864
Travel of students and staff	R 1 542 940	R 109 109
Conference attendance and hosting	R 720 316	R 164 483
Expenditure on furniture, equipment, software and facilities	R 3 572 766	R 61 465
Bursaries for students (not all at Stellenbosch University)	R 997 376	R 235 630
TOTAL	R 13 392 799	R 3 998 551

Appendix A: Financial Statement of All DST/NRF and CRSES linked cost points (28527, 11550, 11565)

CENTRE FOR RENEWABLE AND SUSTAINABLE ENERGY STUDIES

**STATEMENT OF COMPREHENSIVE INCOME FOR THE PERIOD ENDED 31 DECEMBER 2013
CONSOLIDATED**

	2013 R
INCOME	8 011 590.89
Interest received	65 693.96
National Research Foundation grant (2013)	4 378 500.00
National Research Foundation grant (2012)	2 018 500.00
Other income	98 896.93
Internal transfers	1 450 000.00
EXPENDITURE	7 918 254.98
Operational expenses	3 110 397.38
Advertisements and website	116 079.95
Affiliation and registration	48 825.17
Bursaries - post graduate	289 680.00
Conferences, workshops and courses	165 281.17
Community projects	162 027.30
Consumables & entertainment, forums	12 081.95
Floor space & electricity	41 594.89
Facilities and vehicle maintenance	17 386.90
Furniture and equipment less than R2 000	2 722.30
Furniture and equipment more than R2 000	75 852.51
Postage, telephone and fax	59 115.86
Prizes and medals	5 500.00
Stationary and printing	13 559.42
Travel and accommodation	78 289.06
Text books and research material	3 900.90
Expenses relating to 2012	2 018 500.00
Personnel expenses	4 807 857.60
SURPLUS FOR THE PERIOD	93 335.91


 Approved: Director Financial Services

25 February 2014
 Date

ANNEXURE B: AUDITED FINANCIAL STATEMENT OF ALL COST POINTS OF THE CENTRE



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Consolidated statement of income and expenditur CRSES cost centre 1155		
For the period ending :	31/12/2013	31/12/2012
TOTAL INCOME	-26 056 450.16	-9 789 322.19
CONFERENCE/CONGRESS (NO VAT)	-6 459 684.94	-518 229.75
CONTRACT RESEARCH (TAXABLE)	-3 810 448.78	-1 294 107.19
INCOME FOREIGN EXEMPT	-22 759.49	0.00
INCOME: BURSARY	-89 550.77	-65 000.00
INCOME: FOREIGN_ZERO RATE	-4 265 983.00	-651 539.39
INCOME: NRF APPORTIONED	-6 397 000.00	0.00
INCOME: NRF THRIP(ZERO RATE)	-1 166 667.00	0.00
INCOME: SPONSORSHIPS	0.00	-126 315.79
INCOME: SUNDRY TAXABLE	-3 450 291.84	-1 258 928.46
INTEREST RECEIVE: INTERNAL ALL	-375 083.56	-286 408.84
PROFIT/LOSS: EXCHANGE RATE DEB	-8 265.91	0.00
PROFIT: EXCHANGE RATE FOREIGN	-1 914.87	-3 778.77
SALES: TO INTERNAL ORG UNITS	-8 800.00	-16 514.00
SUNDRY INCOME: NON TAXABLE	0.00	-5 568 500.00
TOTAL EXPENDITURE	15 685 151.01	5 808 739.57
CURRENT EXPENDITURE		
ADVERTISEMENTS: GENERAL	62 106.00	62 901.66
ADVERTISEMENTS: POSTS	59 084.01	31 275.97
AFFILIATION & REGISTRATION EXP	167 265.97	72 584.11
BURSARY POST GRADUATE	688 756.91	225 000.00
BURSARY UNDERGRADUATE	98 620.00	10 630.00
CELL PHONE AIRTIME	2 840.72	9 795.79
CELL PHONE RENT	3 318.77	3 751.52
CLEANING COSTS - EXTERNAL FIRM	5 940.00	0.00
CLEANING MATERIALS	1 041.65	0.00
CLOTHING: OTHER	3 193.10	4 479.34
COMPUTER MATERIALS	1 001 006.90	289 821.63
CONSULTATION FEES	3 302 548.23	590 682.55
CONSUMABLE MATERIALS	113 473.69	95 957.56
COPY AND PRINTING	147 534.75	26 541.96
COURSES	10 500.00	5 926.65
ELECTRONIC COMPONENTS	1 301.43	0.00
ENTERTAINMENT: GENERAL	102 256.75	162 068.29
FENCING MATERIALS	100 842.38	0.00
FLOWERS, WREATHS, GIFTS	7 029.11	2 395.82
FOREIGN EXCHANGE LOSS	59 177.25	4 246.12
FOREIGN TRAVEL & SUBSISTENCE	225 908.89	82 393.79
FUEL, OIL, LUBRICANTS	1 132.40	0.00
GENERAL OFFICE COSTS	181.00	0.00
GENERAL VEHICLE EXPENDITURE	67 755.82	74 853.36
HANDBOOKS AND MANUALS	1 528.10	0.00
INS, LICENSES & 3RD PARTY	6 336.09	250.00
INTEREST PAID: INTERNAL APPOR	6 153.76	184.26
INTERNET NETWORK EMAIL LEVY	34 337.72	25 052.31
IP TRANSFER FEE	41 594.89	0.00
LEVY: ICRR (INDIRECT COST)	1 377 795.12	172 776.23
LEVY: SPACE AND FACILITY	29 049.82	19 979.12
MAINTENANCE OF APPARATUS	1 300.51	11 251.80
MEDICAL EXPENSES	12 032.67	0.00



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Consolidated statement of income and expenditur CRSES cost centre 1155		
For the period ending :	31/12/2013	31/12/2012
NON-CAPITALISED BOOKS	3 039.20	8 606.13
POSTAGE STAMPS AND TELEGRAMS	12 133.83	5 116.45
PRIZES AND MEDALS	5 500.00	4 800.00
REFRESHER COURSES AND SEMI	100.00	0.00
REFRESHMENTS: NON ACADEMIC	400.00	0.00
RENT OF EQUIPMENT GENERAL	28 039.24	0.00
RENT OF ROOMS	9 715.80	14 495.00
ROADS AND PARKING EXPENDITURE	371.69	0.00
SCW NON-CAPITALISED	0.00	33 538.46
SERVICES	16 630.56	18 767.08
SMALLER FURNITURE AND EQUIPMEN	24 603.44	55 305.13
SOFTWARE	43 061.65	5 914.98
SPONSORSHIP/DONATION OUT INSTI	7 400.00	0.00
STATIONERY	34 223.76	20 300.35
SUBSCRIPTION & MEMBERSHIP FEES	23 780.27	10 776.13
SUNDRY EXPENDITURE	29 713.53	0.00
SUNDRY EXPENSES	21 492.77	319.81
TELEPHONE INSTALLATION COSTS	750.00	5 702.12
TELEPHONE: CALLS	26 914.57	17 177.36
TELEPHONE: RENT	33 235.88	19 659.67
TOTAL REMUNERATION	3 527 536.41	2 390 448.39
TRAVEL: ACCOMMODATION VISUM PA	1 018 079.29	386 366.97
TRAVEL:DAILY ALLOWANCE AIR CAR	188 771.45	83 321.61
WORKSHOPS	553 050.05	232 793.75
ASSET TRANSACTIONS		
ASSET SCRAPPING/TRANSFERS	0.00	-719 725.95
DEPRECIATION	288 848.28	162 529.39
INCOME: INTERNAL ASSETS	-288 848.28	66 086.30
PROFIT/LOSS: ASSETS	0.00	491 110.26
ASSET ADJUSTMENTS	0.00	0.00
ASSET PURCHASES	2 333 663.21	510 530.34
OPERATING (SURPLUS) / SHORTFALL FOR PERIOD	-10 371 299.15	-3 980 582.62
FUNDS TRANSFERS	4 130 269.15	2 679 830.41
TRANSFERS FROM	10 787 527.42	4 113 789.55
TRANSFERS TO	-6 657 258.27	-1 433 959.14
NET (SURPLUS) / SHORTFALL FOR THE PERIOD	-6 241 030.00	-1 300 752.21
Plus: ACCUM (FUNDS) / SHORTFALL ON 01/01/2013	-6 568 187.41	-5 267 435.20
ACCUM (FUNDS) / SHORTFALL ON 31/12/2013	-12 809 217.41	-6 568 187.41
Min: BALANCE SHEET ITEMS	1 505 610.02	1 208 192.39
DEBTORS CONTROL ACCOUNT	2 281 617.29	1 301 720.05
ICRR CONTROL	-231 554.16	-83 725.91
SPACE AND FACILITY CONTROL ACC	-18 513.14	-9 801.75
SUNDRY CREDITORS	-525 939.97	0.00



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Consolidated statement of income and expenditur CRSES cost centre 1155

For the period ending :

31/12/2013

31/12/2012

FUNDS AVAILABLE ON 31/12/2013

-11 303 607.39

-5 359 995.02

F Majlet

Director: Financial Services



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ANNEXURE TO Consolidated statement of income and expenditur CRSES cost centre 1155

Consolidated according to CC table FOR THE PERIOD : 01/01/2013 - 31/12/2013

COST CENTRES INCLUDED IN THE FINANCIAL REPORT

11550 OSP SENTRUM VIR HERNUBARE EN VOLHOUBARE ENERGIE STUDIES
11551 HERNUBARE VOLHOUBARE ENERGIE STUDIES
11553 OSP SASOL SOLAR MEASUREMENTS S002172 S003049*GESLUIT*
11554 CSIR RENEWABLE ENERGY EIA APPLICATION MAPPING S003108
11557 SONMETING DANIELSKUIL EN KIMBERLEY S002342: JL VAN NIEKERK
11558 UNEP RWANDA S002835: PROF JL VAN NIEKERK*GESLUIT*
11562 SASOL UPINGTON CSP SITE S002781 *GESLUIT*
11563 SOLAR MAP KZN S002868 DEPT OF ECONOMIC DEVELOP*GESLUIT*
11564 ESKOM RESOURCE ANALYST MANAGER RENEWABLE ENERGY S002884
11565 CRSES PROGRAM BEFONDSING
11566 NATIONAL STRATEGIC ENVIRONMENTAL ASS FOR WIND&SOLAR S003141
11567 ESKOM: BROADBASED RE DATA S003160: PROF JL VAN NIEKERK
11568 ESKOM: CLOUD COVER STUDY S003161: PROF JL VAN NIEKERK
11570 ESKOM: WASSA DATA S003162: PROF JL VAN NIEKERK
11571 GIZ GRANT S003167: PROF JL VAN NIEKERK
11572 ETHEKWENI GREEN POWER TARIFF STUDY: PROF JL VAN NIEKERK
11573 KZN (JR) GIS KONTRAK S003416: PROF JL VAN NIEKERK
28527 NRF: DST CENTRE FOR REN&SUST ENERGY - PROF JL VAN NIEKERK
28593 NRF THRIP: PROF JL VAN NIEKERK TP1208025573 (MEG INGWESE)
R1111 KORT KURSUSSE: CENTRE FOR RENEWABLE & SUSTAINABLE ENERGY STU
R1651 KORT KURSUS: RENEWABLE ENERGY TRAINING
R1652 ESKOM CHAIR IN RENEWABLE ENERGY S002400: PROF JL VAN NIEKERK
R1654 ESKOM TESP GRANTS

ANNEXURE C: RENEWABLE ENERGY PAPERS PRESENTED AT EPC 2013

Energy Post-graduate conference 12- 14 August 2013

Monday 12 August 2013

TRACK 1

Ms. Mande, Livhuwani: Evaluations of six *Saccharomyces cerevisiae* promoters during growth on xylose.

Mr. Nkadimeng, Lefa: Intensification of methane production at SABMiller Newlands Brewery (SABNB) anaerobic Wastewater Treatment Plant (WTP)

Ms. Mulaudzi, Sophie: Evaluation of the solar irradiance in the selected location in the Vhembe District of the Limpopo Province of South Africa using different theoretical models.

Mr. Landman, Willem: Influence of Canting Mechanism and Facet Profile on Heliostat Field Performance

Ms. Mathevela, Langutani: Thermochromic nano-coatings for solar radiations heat regulation in small satellites

Mr. Apollo, Seth: Simultaneous biogas production and

Ms. Piyo, Nontembiso: Liquefaction of sunflower husks for biochar production

Mr. Bode, Sebastian-James: A novel approach to reduce ray tracing simulation times by reducing statistical noise

Mr. ZONGO, Sidiki: Gratzel dye solar cells with *bixa orellana* natural dye extract

TRACK 2

Mr. Tshehla, Maloba: A literature analysis of barriers and policy opportunities for the growth of renewable energy technologies at the

Mr. Swiegers, Cobus: Inlet and outlet shape-optimization of natural circulation building ventilation system

Mr. Thomas, Nathan: Development of a range of heat pipe heat recovery heat exchangers for the drying industry

Mr. Kopano, Mokhalodi: Development of a universal bidirectional galvanic isolated switch module for power converter applications

Tuesday 13 August 2013

TRACK 1

Ms. Crozier, Jacqui: Photovoltaic module characterisation using Electroluminescence

Mr. Allen, Kenneth: Thermal storage in packed beds: pressure drop and heat transfer characteristics

Mr. Kotzé, Johannes: High temperature thermal energy storage and heat transfer using eutectic metals in concentrating solar power

Ms. Thabezhe, Nokwethemba: Thermodynamic stability of VO₂ in contact with thin metal films

Ms. Thoresen, Mariska: An investigation into the synergistic action of exo-type and endo-type cellulases on the hydrolysis of complex substrates

Mr. Deetlefs, Ivan: Building of a free piston Stirling demonstrator engine

Mrs. Nuru, Zebib Yenus: Pt-Al₂O₃ ceramic nano-composites for high temperature solar absorbers applications

Mr. Mhlongo, Sizwe: Impact of inhibitors associated with ligno-cellulose hydrolyses on the expression level and activity of recombinant cellulolytic enzymes

Mr. Thema, Force Tefo: Chemical synthesis of graphene for dye solar cells electrodes.

Mr. Owen, Michael: A hybrid dephlegmator for incorporation into an air-cooled steam condenser.

Mr. Meyer, Rohan: Design, optimisation and construction of a solar reflector dish.

Mr. Prinsloo, Gerro: Design & construction of a self-tracking solar concentrator for power generation in rural Africa

---ooOoo---

TRACK 2

Mr. Du Preez, Jacques: Theoretical modelling and experimental verification of a passive downdraught evaporative cooling tower.

Wednesday 14 August 2013

TRACK 1

Mr. Sekoai, Patrick Thabang: Potential of using Organic Fraction of Solid Municipal Waste (OFSMW) for biohydrogen production in South Africa.

Mr. Ozemoya, Augustine: Factors influencing the conversion efficiency of a PV module.

Mr. Adams, Abdulghaliq: Low temperature deposition of silicon nitride thin films by hot-wire CVD.

Mr. Silinga, Cebo: Scenarios for a South African peaking CSP system in the short term.

Ms. Sibanda, Ntsako: Evaluating yeast hybridization to improve hydrolytic enzyme secretion for second generation bio-fuel production.

Ms. Nefdt, Taryn: The evaluation of macro-algae as a feedstock for bio-energy production within the South African context.

Mr. Muller, Christopher: The bio-energy potential of the South African sugarcane industry and its expected influence on sustainable development.

Mr. Smith, Michael Trevor: Exploring a systems approach for the economic assessment of small-scale anaerobic bioreactors for rural areas.

Ms. Kayofa, Lelo: Feasibility and business plan for manufacturing a 3 kw electrical solar Stirling engine and dish, for a stand-alone power supply unit.

Mr. Schultz, Ross: Concentrator photovoltaic module Design

Mr. Malan, Daniel: Integral solar water heating using heat pipes and phase change material (pcm) thermal storage

Ms. Brandt, Bianca: Yeast hardening for cellulosic ethanol production.

Dr. Kotsedi, Lebogang: Metal to metal-oxide transformation using ultra-fast laser on thin films for electromagnetic spectrum selection

---ooOoo---

Monday 12 August 2013

Mrs. Simo, Aline:
VO₂ nanostructures based chemiresistors for low power energy consumption hydrogen sensing

Mr. Jeggels, Dawood:
Theoretical and experimental

Mr. Solomon, Ramzi:
Scaling Machines for Renewable Energy IPP Applications

Mr. Loubser, Karl:
Geothermal heat recovery and utilisation using heat pipes

Ms. Van Der Bank, Marjone:
A Legal analysis on the regulation of renewable resources to promote energy efficiency in sustainable building

---ooOoo---

Tuesday 13 August 2013

Ms. Philander, Ghouwaa: Thermo-chromic doped vanadium dioxide coatings for smart windows

Mr. Tadadjeu Sokeng, Ifriky: Nanosatellites as energy efficiency facilitators in Africa

Ms. Fourie, Marna: Design of a subcritical and transcritical carbon dioxide refrigeration system

Mr. Manabile, Segaula Isaac: Production of nanofibers for technological application by electrospinning of polymer-graphene solution.

Mr. Barnard, Francois: Hybrid position sensorless control of a RSM in the entire speed range.

Mr. Stander, Johan: Split permanent magnet wind turbine generator topology comparison using optimisation

Mr. Craig, Rob: Thermodynamically driven gravity assisted water pump based on novelty dipping bird

Mr. Ndlangaman-Dla, Cebo: Synthesis of hematite nanorods for the study of its optical properties for the possible use in hydrogen production.

Ms. Meyer, Imke: Resource Assessment of the Agulhas Current to determine Feasibility for Marine Energy Extraction.

Mr. Lilla, Daleel: Comparison of Differential Evolution and Genetic Algorithm in the design of permanent magnet Generators.

Ms. Herbst, Lynette: The effect of climate change on wind resources in South Africa.

---ooOoo---

Wednesday 14 August 2013

Track 2

Mr. Van Der Walt, James: Micro-utilities using battery based distribution for rural electrification in South Africa

Mr. Poole, Sean: The development of a segmented variable pitch small-scale horizontal axis wind turbine with active pitch control.

Ms. DOBSON, Rose- Mary: The development of recombinant fungal enzyme cocktails for the hydrolysis of cellulosic waste products.

Mr. Stander, Johan: Pressure rigidised wind turbine blades - a novelty.

Mr. Kusakana, Kanzumba: Techno-economic analysis of an off-grid microhydrokinetic river system for remote rural electrification.

Mrs. Mayedwa, Noluthando: Development of platinum-iridium/ ruthenium telluride nanoalloy electrode systems for high performance ammonia fuel cell.

Mr. Hobbs, Kyle: Thermally driven natural circulation water pump

Mr. Kusakana, Kanzumba: Design and performance analysis of renewable energy powered electric TUK-TUK battery charging stations in South Africa

Mr. Stander, Johan: Mechanical design of a dual permanent magnet rotor generator

Mr. Gerber, Stiaan: Evaluation and design aspects of magnetically geared electrical machines.

Mrs. Thwaites, Tiffany: Bats (Chiroptera) and wind energy - can bat activity patterns make them vulnerable to wind turbine impacts?

Mr. Kuyula, Christian: Design of a high efficiency converter for fuel cell applications.

Mr. Fraser, Justin: Surface Tension Driven Water pumping

Mr. Kusakana, Kanzumba: Performance modeling of a hybrid diesel generator-Battery hybrid system

Annexure C: Programme for Renewable Energy Training Workshop 26 – 30 August 2013

	Day 1
Time	Overview of Renewable Energy Technologies
08:30 – 09:00	Registration , Tea and Coffee on arrival
09:00 - 10:30	Introduction to Renewable Energy Part 1 (Josh Reinecke)
	SA Grid, REIPPPP, Solar Resource, CSP, PV



continent, in terms of the regulatory, institutional and market settings for RE technology systems.

- The meaning of technology and the importance of National Systems of

	<p>Innovation to support emerging RE technology systems.</p> <ul style="list-style-type: none"> • How RE technology systems are embedded in national, continental and international energy and economic systems. How the sustainability of RE technology systems may be assessed and prioritised.
10:30 - 11:00	Tea break
11:00 - 12:30	Renewable Energy Policy Part 2
12:30 - 13:30	Lunch
13:30 - 15:00	Renewable Energy Finance Part 1 (Prof A Brent)
	<ul style="list-style-type: none"> • A brief overview of some financial metrics such as IRR, NPV or DSCR. • The background and drivers of environmental finance. • The nature of typical environmental projects with specific focus on energy-related projects. • The various financial instruments used in environmental projects and how these may impact on the feasibility of projects.
15:00 - 15:30	Tea break
15:30 – 17:00	Renewable Energy Finance Part 2
17:00 – 17:30	Additional time if required or time for Questions

	Day 3
Time	Solar Energy Technologies
08:30 – 09:00	Registration , Tea and Coffee on arrival
09:00 - 10:30	Solar Energy Part 1 (Riaan Meyer)
	The solar resource and resource assessment will be covered in detail – the difference in various solar components applicable to different solar technologies will be explained
10:30 - 11:00	Tea break
11:00 - 12:30	Solar Energy Part 2
	Concentrating solar power (CSP) plants: types, technology, cost, REIPPP awarded projects, CSP projects under development, the long term potential and viability of

	CSP
12:30 - 13:30	Lunch
13:30 - 15:00	Solar Energy Part 3
	Photovoltaic (PV) systems: types of cells and modules, cost, current developments in SA, tracking versus fixed tilt, etc.
15:00 - 15:30	Tea break
15:30 – 16:30	Solar Energy Part 2 (cont.)
	Other solar technologies. Solar water heating, solar process heat, sola cooling, solar cooking and drying, etc.
16:30 – 17:00	Additional time if required or time for Questions

	Day 4
Time	Wind and Hydro Technologies
08:30 – 09:00	Registration , Tea and Coffee on arrival
09:00 - 10:30	Hydro Power (Josh Reinecke)
10:30 - 11:00	Tea break
11:00 - 12:30	Wind : Intro and Technology part I
	<ul style="list-style-type: none"> • Global energy • Wind energy • South Africa • Potential • Turbine types
12:30 - 13:30	Lunch
13:30 - 15:00	Wind: Technology part I and II (Alex Lupion)
	<ul style="list-style-type: none"> • Aerodynamics • Control concept • Blades / rotor • Drive train, power curve, trends
15:00 - 15:30	Tea break

15:30 – 17:00	Wind : Resource, Wind Projects, Economics
	<ul style="list-style-type: none"> • Meteorology , Assessment, turbine selection • Project process, energy capture • Economics, employment, industry
17:00 – 17:30	Additional time if required or time for Questions

	Day 5
Time	Bio-Energy Technologies
08:30 – 09:00	Registration , Tea and Coffee on arrival
09:00 - 10:30	Course Introduction and Sustainability (Prof Johan Görgens)
	Bio-energy end-products and conversion technologies Sustainability assessment of bio-energy Sustainable biomass production
10:30 - 11:00	Tea break
11:00 - 12:30	Conversion Technologies Part 1
	Properties of plant biomass Thermochemical conversions of plant biomass
12:30 - 13:30	Lunch
13:30 - 15:00	Conversion Technologies Part 2
	Biodiesel production Introduction to biological conversions
15:00 - 15:30	Tea break
15:30 – 16:30	Conversion Technologies Part 3
	Biological conversions, including fermentation to alcohols and biogas production
16:30 – 17:00	Additional time if required or time for questions

Annexure D: Training for experts working on solar and wind energy for rural water supply projects in Ethiopia

Sat	Mon	Notes	Tues	Notes	Wed	Notes	Thurs	Notes	Fri		Sat	Sun	Mon	Notes	Tues	Notes	Wed		Thurs	Notes	Fri	
17-Aug	19-Aug		20-Aug		21-Aug		22-Aug		23-Aug		24-Aug	25-Aug	26-Aug		27-Aug		28-Aug		29-Aug		30-Aug	
	Orientat ion and general discussion	JLvN	Clim.ch ange and depl. Strat 1	ACB	PV Systems	Prof. B. Sebitosi	Theory on pumps	Johan dv Spuy	Prac on pumps		Tour Robin Island		Introdu ction to RE Tech		RE Policy and Finance		Solar Energy Tech		Wind & Hydro Tech		Site visits: Sunpower (Y)	
	H.M.		H.M.		H.M.				Fac. Eng.				Skilpadv lei		Skilpad vlei		Skilpad vlei		Skilpad vlei			
	Visit Bank & tour of Stellenbos ch	1st Cheque	Clim.ch ange and depl. Strat 1	ACB	PV Systems	Prof. B. Sebitosi	Solar resources	R. Meyer	Villie ra wine farm: PV system s				Introdu ction to RE Tech		RE Policy and Finance		Solar Energy Tech		Wind & Hydro Tech		Site visits: MLT, SetSolar, Tennesol, Villiera	
Sat	Sun	Mon	Notes	Tues	Notes	Wed	Notes	Thurs	Notes	Fri		Sat	Sun	Mon	Notes	Tues	Notes	Wed	Notes	Thurs	Notes	Fri
31- Aug	01- Sep	02-Sep		03-Sep		04-Sep		05-Sep		06-Sep		07-Sep	08- Sep	09-Sep		10-Sep		11-Sep		12-Sep		13-Sep
Outing to Somerset West	Under- ground water	TdW	Borehol e equipmen t and care	TdW	U.- ground water and borehole care	TdW	Operatio nal health and safety	Specialist	Site visit Palmiet			Centr ury City		Worksh op on finance	KK	Wind resources	A. Lupion	Designi ng a PV system	Dr J Strauss	Depl. Strat 3	ACB	Departure from Cape Town Internation al
	Under- ground water	TdW	Borehol e equipmen t and care	TdW	U.- ground water and borehole care	TdW	Stellenbo sch: Bank & shopping							Depl. Strat 2	ACB	Wind- electric systems	A. Lupion	PV systems	Dr van Randwijk	Present ing certificate s and formal dinner		

