



EURYDICE

Collaborating towards a future in renewable energy

WP2.1: Analysis – Status Quo (MERGED)

D2.1.1: List of Renewable Energy Industry partners

D2.1.2: Status quo document for each SA University of Technologies

D2.1.3: Best practice document

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1. D 2.1.1 Local Renewable energy related industry stakeholders

The project strongly believes that bridging the gap between higher education institutions and the industry can be achieved by increasing industrial participation in UoT bachelor education through the integration of practical experience into the curriculum. A closer collaboration between university and industry automatically brings university staff closer to industry experts to carry out this mission. It is expected that real-world case study problems will be integrated into the lectures as well as practical laboratory experiments, without any formal curriculum changes.

1.1. Industrial partners

Identification of industry partners was on hold because of the legal aspects laid out in the project agreement. The agreement has been finalised and approved by the legal representatives from all South African partners. The following industry partners were identified and agreed to become partners in this project:

Table 1: list of industry partners

CUT	DUT	TUT
<ul style="list-style-type: none"> CENEC <p>CENEC is a dynamic zero emission energy company founded in 2014. We solve energy needs. We custom design, build, finance and manage solar and wind energy plants, green hydrogen production, energy storage solutions and artificial</p>	<ul style="list-style-type: none"> Eskom <p>Eskom is a South African electricity public utility, established in 1923 as the Electricity Supply Commission (ESCOM). Eskom represents South Africa in the Southern African Power Pool. The utility is the largest producer of electricity in Africa,[2][3] and was among the top utilities in the world in</p>	<ul style="list-style-type: none"> Department of Mineral Resources and Energy (DMRE) <p>The Department of Mineral Resources and Energy (DMRE) was established in June 2019 by the merger of the Department of Energy and the Department of Mineral Resources.</p>



<p>intelligence (AI) power management.</p> <p>Our Purpose</p> <p>We believe affordable clean energy and zero emissions mobility is essential for a healthy economy and society. South Africa has some of the best natural resources for solar and wind energy in the world. We are perfectly positioned to assist with the transition to a low carbon economy and help mitigate the devastating health and environmental effects of climate change. We create shared value through clean energy and zero emissions mobility solutions at scale.</p> <p>Web: www.cenec.com</p> <p>Confirmation is expected also from the following prospective industry partners:</p> <ul style="list-style-type: none"> • Karah Technologies • Jagertech 	<p>terms of generation capacity and sales, but has since slipped in both categories. It is the largest of South Africa's state owned enterprises. Eskom is a partner which could provide several topics on power supply....</p> <p>Web: www.eskom.co.za</p>	<p>The mission of the Department of Mineral Resources and Energy (DMRE) is to regulate and transform the sector for the provision of secure, sustainable and affordable energy and the promotion and regulation of minerals and mining.</p> <p>The Department's mandate is to ensure secure and sustainable provision of energy and mineral resources for socio-economic development. The strategic objective derives from the NDP, which envisages that, by 2030, South Africa will have a mineral resources and energy sector that promotes economic growth and development, social equity and environmental sustainability.</p> <p>Web: www.dmr.gov.za www.energy.gov.za</p> <ul style="list-style-type: none"> • Council for Scientific and Industrial Research (CSIR) Centre for Energy. <p>The Council for Scientific and Industrial Research, commonly</p>
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known as the CSIR, is a world-class African research and development organization established through an Act of Parliament in 1945. Its executive authority is the Minister of Science and Technology. The CSIR undertakes directed, multidisciplinary research and technological innovation that contribute to the improved quality of the life of South Africans.

The organization plays a key role in supporting government's programmes through directed research that is aligned with the country's priorities, the organization's mandate and its science, engineering and technology competences. The CSIR fosters partnerships with a network of partner organizations and clients, regionally and abroad, as part of a global sphere of influence on matters of technology.

Web: www.csir.co.za



		<p>Confirmation is expected also from the following prospective industry partners:</p> <ul style="list-style-type: none">• City of Tshwane <p>The City of Tshwane is the second largest municipality in Gauteng and is among the six biggest metropolitan municipalities in South Africa. The main economic sectors in the Municipality's area are community service followed by finance and manufacturing. The largest sub-sector within manufacturing is metal products, machinery and household appliances, followed by the manufacturing of transport equipment.</p> <p>Web: www.tshwane.gov.za</p> <ul style="list-style-type: none">• South African National Energy Development Institute (SANEDI) <p>The South African National Energy Development Institute (SANEDI) was established in 2011 under the National Energy Act, 2008 (Act No. 34 of 2008). The Act provides for SANEDI to direct, monitor and</p>
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		<p>conduct energy research and development, promote energy research and technology innovation as well as undertake measures to promote energy efficiency throughout the economy.</p> <p>SANEDI's energy development agenda is a key part of our country's energy journey. SANEDI's portfolio of initiatives are closely attuned to technology advancements, declining technology costs and continued innovation in the energy sector.</p> <p>Web: www.sanedi.org.za</p>
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1.2. Acquisition of new partners and Continuation

Identification of industry partners is an ongoing process and therefore, more invitation letters are sent out to get additional industry partners involved.

Letters have been sent to the following Companies:

- Jeka energy resources- (Partnership confirmed)
- Energy chambers- Waiting for response
- Madam waste-(still in discussion)

Acquisition of new industry partners will be done by university networks, personal contacts, chamber of commerce will be used. Fairs and conferences will be attended to get new partners, if possible. Online workshops and conference will be used to get new potential partners. Social media platforms such as LinkedIn will also be used to attract industry partners.



EURYDICE

Collaborating towards a future in renewable energy

D2.1.2 Status quo analysis

Foreword

This report provides some analysis on the state of energy education and industrial cooperation in South Africa. The study is part of the EURYDICE project – the status quo report – conducted within the South African context by South African partners namely, the Central University of Technology (CUT), the Durban University of Technology (DUT) and the Tshwane University of Technology (TUT). Given the importance of Renewable energy in promoting economic development and contributing towards an improved quality of life, a study on the state of energy education and industrial cooperation in South Africa is poised to make a vital contribution to the development of the Higher Education Sector and in society at large. In this report, the gaps in energy education within the Higher education sector have been identified, as well as the lack of close collaboration between universities and renewable energy industries. The study made use of the information, which is readily available to the public for the courses that are currently being offered by the University of Technologies (UoTs) in South Africa. The relevant partners also assisted with the information that was required to conclude on the self-assessment of Higher Education Institutions (HEI) concerning energy education and industrial cooperation (energy sector). The approach employed is non-biased, as a result, the findings and recommendations are relatively the best considered outcomes in the circumstances. This report can be considered as an important baseline assessment that may be used to improve the curriculum and also address the often received complaints from various industries about the lack of practical or applied experience from graduates and that it would take long to bring the young starters “on track”.

Acknowledgements

This work was achieved through the collaborative efforts of the Central University of Technology (CUT), the Durban University of Technology and the Tshwane University of Technology. We would like to acknowledge Prof Herman Vermaak, Mr Johan Raath, and Mr Rathi Sewsunker for their contribution. We also extend our gratitude to our European partners and Industry partners.



Executive Summary

There is a gap between the academic institutions and industry, which prompts the need to ensure that relevant curricula are taught and provide students with the opportunity for industrial exposure through internships and industrial placements. Cooperation is also one of the lacking components between the industry and higher education institutions regarding the utilisation of equipment and in particular research and development.

This gap can be bridged by increasing industrial experience in UoT bachelor education through the integration of practical experience into the curriculum. The closer collaboration between university and industry automatically brings university staff closer to industry experts to carry out this mission. It is expected that real-world case study problems will be integrated into the lectures as well as practical laboratory experiments, without any formal curriculum changes.

The general objective is to improve the quality of higher education in South Africa and enhance its relevance for the current labour market and society. The three university that are taking part in this project (TUT, DUT and CUT) have collaborated with some European intuitions whereas, each partner brings complementary and necessary experience in academic and technical expertise within engineering education as well as the renewable energy field.



2. Introduction

2.1. Background

South Africa's electricity generation capacity is dominated by coal-fired generation stations with a net output of 35.6 GWp, which represents over 85% of the country's total installed capacity of over 44 GWp. Nuclear generation capacity comprises 5% of generation capacity, and comes from the only nuclear generation facility on the African continent, Koeberg power station. As noted, Renewable Energy (RE) accounts for 5% of generation capacity after very rapid growth since 2011.

In Southern Africa many people, especially people in sparsely populated areas outside the national grids are forced to generate their own electricity using the popular sources of solar and wind generation. Given the rise in electricity prices from the national grid, there is also an increase in the number of solar heating devices supplying warm water to households who are connected to the national grid. Another barrier is the lack of technical expertise for the installation and maintenance of the solar heating systems is also an important barrier for the increase penetration of renewable energy sources (RES) in South African countries.

All the above have created the demand for graduates with renewable energy skills from HEIs and thus the priority for HEIs is to get involved in studies and skills' development within the renewable energy field. All the partner institutions have in one or another way got involved in answering this quest by introducing renewable energy programmes or modules within their offerings as well as skills' development activities. The education sector is not only under pressure to produce more technicians, technologists and engineers but to provide graduates and skilled workers for the renewable energy sector in particular.

This demand is highlighted by the number of renewable energy projects approved by the government within the Renewable Energy Independent Power Producers Procurement Programme as mentioned earlier. This has created a shortage of students/graduates/technical workforce with the relevant skills in the renewable energy field.



2.2. Objectives of the study

The overall objective of this project is to improve the quality of higher education in South Africa and enhance its relevance for the labour market and society. To improve the education curricula of diploma, bachelor and postgraduate qualifications, synergy with industry must be enhanced. This synergy is based on the findings and measures of the status-quo and gap analysis. This report provides a summary of findings on the status quo analysis, as well as the industry partnership.

2.3. Status Quo analysis

The objectives of the analysis are described as follows:

- To give an overview of the current energy education in South Africa and in particular those undertaken at UoTs.
- Identify common challenges and priorities on energy related modules.
- Identify possible gaps that are not being covered by the current curricula.

2.4. Study Methodology

South African partners were assigned to undertake the analysis of the current state of energy education, with TUT being the leader of this task. The following approach was used to gather information:

- Prospectus for each UoT was used to identify the energy related subjects or courses that are currently being offered. This was used because it is publicly available on the university website. There is no need to get ethics clearance unlike in a formal survey. A survey was not used in this case due to time constraints. Getting ethics clearance usually takes relatively a long time.
- Questions were also drafted and shared amongst the UoT partners to get the information that is not included in the prospectus.

2.5. Project Scope

The project has specific focus on gaps that present themselves between Technical and Vocational Education and Training (TVET) and UoTs, the vehicle that has been identified as core to the project is application of synergistic curriculum developments. The scope of this project is limited to Renewable energy due to the following:

- The vision of South Africa's energy strategy is to contribute to an affordable energy availability for all.
- To minimize the negative effects of energy supply and usage on human health and the environment.
- The promotion of energy efficiency technologies across all sectors.

This project linked to renewable energy addresses one of the Sustainable Development goals, which is "affordable and clean energy". Not only it is addressing the development goal but it will also increase the employability of the TVET, diploma, bachelor and post-graduate students.

2.6. Local Renewable energy related industry stakeholders

The project strongly believes that bridging the gap between higher education institutions and the industry can be achieved by increasing industrial participation in UoT bachelor education through the integration of practical experience into the curriculum. A closer collaboration between university and industry automatically brings university staff closer to industry experts to carry out this mission. It is expected that real-world case study problems will be integrated into the lectures as well as practical laboratory experiments, without any formal curriculum changes. The following industry partners were identified and agreed to become partners in this project:

- Department of Mineral Resources and Energy (DMRE)
- Eskom
- Council for Scientific and Industrial Research (CSIR) Centre for Energy
- CENEC
- Karah
- Jagertech

Confirmation is expected also from the following prospective industry partners:

- City of Tshwane
- South African National Energy Development Institute (SANEDI)

2.7. University of Technologies (UoTs) in South Africa

A University of Technology places emphasis on innovative problem-solving and career-directed courses, in addition to the basic educational responsibilities of a university. The courses are designed to be career-oriented and practical, with experiential learning forming part of the courses. All the UoTs are in a process of phasing out old qualifications, namely, National Diploma (N.Dip) and Bachelor of Technology (BTech), while phasing in new qualifications, namely BEng Tech, Diploma and Higher Certificate as well as a planned post graduate qualifications.



Table 2: Data from prospectus

University	BTech	National Diploma	BEng Tech	Diploma	Higher Cert
Central University of Technology	-	-	<ul style="list-style-type: none"> Energy Technologies III Energy Management III 	<ul style="list-style-type: none"> Energy Systems III 	<ul style="list-style-type: none"> Solar Energy Systems Small-wind Generation Solar Energy Systems II Power Generation and Storage
Cape Peninsula University of Technology	-	-	-	-	-
Durban University of Technology	-	-	<ul style="list-style-type: none"> Renewable Energy 	-	-
Tshwane University of Technology	-	-	<ul style="list-style-type: none"> Green Energy system 	<ul style="list-style-type: none"> Renewable Energy 	<ul style="list-style-type: none"> PV Solar
Mangosuthu University of Technology	-	-	-	-	-
Vaal University of Technology	-	-	-	<ul style="list-style-type: none"> Alternative Energy II Alternative Energy III Energy Management III 	-

It can be seen from the above table, that all the UoTs across South Africa have no energy related modules as part of the curriculum at the undergraduate level in the “old” qualifications. However, the “old” qualifications are being phased out and the “new” qualifications typically have a number of energy related modules, ranging from PV, wind, hydro as well as energy storage.

- CUT is currently offering a higher certificate in Renewable energy, the new qualification BEng Tech as well as Diploma include energy related modules.
- DUT is also offering BEng Tech, which is in line with Renewable energy.
- TUT also included energy related modules in BEng Tech, Diploma and Higher certificate.
- VUT has also included energy related modules at the Diploma level.

Table 3: Feedback from UoT Partners

Questions	CUT	DUT	TUT
<p>Section 1: Participant's Detail</p> <p>1. Please provide your details:</p>	<p>Title: Prof. / Mr. Name and Surname: Herman Vermaak / Johan Raath</p>	<p>Title: Mr. Name and Surname: Rathi Sewsunker</p>	<p>Title: Prof/Ms Name and Surname: Josiah Munda/ Memane N.P</p>
<p>Section 2: Participant's Institution</p> <p>2. Please complete the following regarding the organisation you work for:</p>	<p>The name of your institution: Central University of Technology Your position: Dean: Faculty for Engineering and Information Technology</p>	<p>The name of your institution: Durban University of Technology Your position: Lecturer: Faculty of Engineering and the Built Environment</p>	<p>The name of your institution: Tshwane University of Technology Your position: Lecturer: Faculty of Engineering and the Built Environment</p>
<p>3. Which category does your institution fall under?</p> <p>a. Technical and Vocational Education and Training (TVET) colleges</p> <p>b. Higher education (HE)/ University</p>	<p>Higher education (HE)/ University</p>	<p>Higher education (HE)/ University</p>	<p>Higher education (HE)/ University</p>
<p>Section 3: Courses</p> <p>4. Does your institution have a department that focuses on the energy sector education?</p> <p>a. Yes</p> <p>b. NO</p>	<p>Yes</p>	<p>Yes *</p> <p>* Within the Department of Electronic & Computer Engineering</p>	<p>Yes</p>

<p>If your response to question 4 is 'yes', then answer the questions below</p>			
<p>5. Which of the following aspects under the energy sector is your institution aligned to?</p> <ul style="list-style-type: none"> a. Solar PV b. Wind c. Biogas d. Energy management/Efficiency e. Fossil Fuel f. Small hydro g. Other (please specify) _____ 	<p>Solar PV Wind Small hydro</p>	<p>Solar PV Energy management/Efficiency Other: fuel cell, energy storage systems including supercapacitors</p>	<p>Solar PV Wind. Energy management/efficiency</p>
<p>6. Does your institution currently offer specific course(s) in renewable energy? Yes No If your response to question 6 is 'Yes', please answer the following:</p>	<p>Yes</p>	<p>Yes</p>	<p>Yes</p>
<p>6. Please specify the name of the course offered:</p>	<p>Higher Certificate in Renewable energies</p>	<p>BEng Tech BEng Tech Honours ** ** to be offered in 2021/2022</p>	<p>Higher Certificate Diploma- BEng Tech</p>
<p>7. Which NQF level does the course offered by your institution fall under?</p>	<p>5</p>	<p>BEng Tech: 7 BEng Tech Honours: 8</p>	<p>Higher Certificate: 5 Diploma: 6</p>

			BEng Tech :7
8. What is the duration of the course:	2X semesters	BEng Tech: 1 semester BEng Tech Honours: 2 semesters	1 semester
9. What is the estimated number of students that enrol for the course:	40	BEng Tech: 80 BEng Tech Honours: 40	Higher Certificate : 80 Diploma :80 BEng Tech: 40
10. What are the challenges that your organisation faces with the courses? a. Funding. b. Equipment/ Laboratories. c. Infrastructure. d. Other (please specify).	Funding Equipment/ laboratories	Funding Equipment/ laboratories	Funding Equipment/ laboratories
Section 4: Research 11. Does your organisation engage in research related projects in the field of renewable energy? a. Yes. b. NO If your response to question 10 is 'Yes', then please answer the following:	Yes	Yes	Yes
12. Please give a summary of the renewable energy research activities that your institution is currently involved in:	Solar PV Energy conversion/ Efficiency Small hydro	Optimizing Solar PV Energy management/Efficiency Hybrid systems: PV, fuel cell, supercapacitors, diesel generator	Solar PV Wind Small hydro

		Key focus area is DC microgrids	Energy management/Efficiency
13. Please give a summary of the renewable energy research activities that your institution has conducted in the past 5 years if different from question 12.	n/a	n/a	Distributed generation and microgrids
14. What are some of the challenges that your organisation faces with renewable energy related research. a. Lack of funding. b. Inadequate Equipment/Laboratories. c. Other (please specify).	Lack of funding Inadequate Equipment/ Laboratories	Lack of funding Inadequate Equipment/ Laboratories	Lack of funding Inadequate Equipment/ Laboratories
15. What is your perceived level of investment on renewable energy related research in your institution on a scale of 1 being low to 5 being high?	3	3	3
16. What are some of the key renewable energy infrastructure available at your institution? (E.g. Laboratories, Solar farms, etc...)	Laboratories and solar plant	Energy Lab fitted with 3 kW, +48V DC PV system	Solar plants
17. Does your institution have a centre for renewable energy research?	NO	Yes *** *** Within the Department of Electronic & Computer Engineering	Yes
18. Does your institution have any partnerships with industry/stakeholders in the renewable energy sector? Yes No	Yes	No	Yes
19. Please indicate some of the key stakeholders you know of:			City of Tshwane Website: www.tshwane.gov.za

			<p>South African National Energy Development Institute (SANEDI)</p> <p>Website: www.sanedi.org.za</p> <p>Department of Mineral Resources and Energy (DMRE)</p> <p>Website: www.dmr.gov.za</p>
<p>20. Are there any industry-related/sponsored projects for undergraduate students?</p> <p>Yes No</p>	No	No	No
<p>21. If yes, how many industry-related/sponsored projects are there for undergraduate students that you know of?</p>	n/a	n/a	n/a
<p>22. Does your institution use any infrastructure belonging to any renewable energy partner/company?</p> <p>Yes No</p> <p>If, yes please provide more details:</p>	<p>Yes</p> <p>Solar plant from Karah Industries</p>	No	No
<p>23. Are there any renewable energy industrial solutions that your institution has developed through research?</p> <p>Yes No</p> <p>If, yes please provide the details:</p>	No	No	Yes
<p>24. How would you describe cooperation and support your institution gets from the industry within the energy sector?</p>	Moderate	Needs to be driven	Moderate

Section 6: Student Enrolment	80%	Not yet known: to be run for the first time in 2 nd Semester of 2020	Not offered on the first year level
25. What is the percentage of students that successfully complete energy related courses in their first year or first semester?			
26. Based on your perception, are students who enrol for renewal energy related courses more likely to be employed than those who do not?	Currently Not	Some market opportunities do provide increased employability	Not really
27. Kindly provide us with a list of the Energy related fields within your organisation, including research projects.	Refer to question 11	Optimizing Solar PV Energy management/Efficiency Hybrid systems: PV, fuel cell, supercapacitors, diesel generator Key focus area is DC microgrids	Solar PV Wind Small hydro Energy management/Efficiency Distributed generation and microgrids
28. May we contact you again in future for similar surveys? Yes. No.	Yes	Yes	Yes

2.8. Findings

From the status quo analysis, it can be observed that most of the UoTs are changing curricula to include Renewable energy modules in the syllabus at both undergraduate and postgraduate levels. Common challenges around energy education within HEI have also been identified as follows:

- Lack of funding
- Lack of equipment in the laboratories
- Lack of human capital
- Lack of renewable energy project kits for students.

There is also lack of meaningful collaboration among UoTs in South Africa, as well as lack of close collaboration with industry stakeholders. Lack of laboratories and equipment affects the quality of learning, hence the emergence of various industries complaints about the lack of practical or applied experience of graduates.

According to a study that was conducted in August 2014 by ASSAF on the state of energy research in South Africa, Energy Research has been undertaken by almost all institutions [1]. The study also indicated that at least nine academic institutions conducted research in fossil fuel research.

2.9. Conclusion

Based on the findings above, more fundamental energy education and research on renewable energy need to be undertaken, as South Africa is still dependent on fossil fuels for energy generation. The fact that more energy-related modules are part of the curriculum shows that academic institutions are moving in the right direction. Further energy education and synergistic industry collaboration will result in production of clean energy, reduced greenhouse gas emissions, and a reduction in air pollution in the country. This will also assist with reduced energy costs, as well as job creation.

Most UoTs have included energy related modules at undergraduate level, however fuel cell fundamentals and application does not form part of the curriculum. It is suggested that shared fuel cell testbeds can be looked at as critically needed facilities, even at postgraduate level. Investment in

energy laboratories and student project kits are also needed, as lack of funding seems to be a major challenge across all the academic institutions.

2.10. Recommendations

In order to achieve the objectives of this project the following recommendations are made:

- Continued collaboration among academic institutions in South Africa.
- Maintain a synergistic relationship with industry partners.
- Participation in more renewable energy research, including hydrogen and fuel cells research.
- The right channels must be employed to increase the awareness of renewable energy in South Africa.

2.11. References

1. <https://www.assaf.org.za/files/2015/05/ASSAF-State-of-Energy-Research-Consensus-Report.pdf>, accessed in July 2020.
2. http://www.dmr.gov.za/LinkClick.aspx?fileticket=_RLK8Tx_648%3D&portalid=0, accessed in September 2020.
3. <https://www.renewableenergymagazine.com/emily-folk/the-many-economic-benefits-of-renewable-energy-20190312>, accessed September 2020.

D2.1.3: Best practise Document

3.1 Introduction

Summary of status quo analysis

Common challenges around energy education within UoTs in South Africa have been identified as follows:

- Lack of laboratory equipment and facilities.
- Quality and experience of educators.
- Collaboration with industry partners.
- Collaboration between Universities on a national level.
- Lack of funding.
- Lack of renewable energy project kits for students.

3.2 Best International practice

3.2.1 Lessons from the world's best performing systems.

A study was conducted by The Centre for Development and Enterprise focusing on vital national development issues and their relationship to economic growth and democratic consolidation. Through examining South African realities and international experience [1] the following practices were adopted from the study.

- ❖ The quality of an education system cannot exceed the quality of its teachers.
- ❖ Another way of improving outcomes is to improve infrastructure.
- ❖ To promote institutional Joint working.
- ❖ Research collaboration and Share infrastructure with both industry stakeholders and academic institutions.

3.3 Guidelines (Best practices)

Based on the identified deficiencies and lessons from the world's best performing systems, the following set of guidelines is proposed to address the deficiencies for all UoTs across South Africa.

- ❖ **Promote staff development**

- Quality and experience of educators plays a vital role for improving student outcomes. Top performing systems invest in their staff members, train them intensively.
- ❖ **Laboratory upgrades- introduce Virtual labs (E-learning)**
 - For UoTs, learning component comprises of both theory and practical, Laboratories upgrades will enhance efficiency.
- ❖ **Research collaboration and Share infrastructure with both industry stakeholders and academic institutions.**
 - These initiatives will allow researchers to build networks incorporating multidisciplinary approaches and solve real industry problems.
 - Promotion of active collaboration amongst universities on various levels of staff members will assist in finding a common ground for development of standardized courseware.
 - Collaborating on projects covers a broad range of research topics, ranging from equal opportunities, technology transfer and enhanced learning.

3.4 Conclusion

Continued collaboration among Industry partners and academic institutions.

Collaboration with industry partners needs to extend beyond curriculum development and postgraduate research work to include ongoing project collaboration with real problems in the industry poised as project tasks at all educational levels, based on complexity. Thus, enhanced collaboration would include project ideas and topics being jointly developed, project participation in common labs, and industry partners participating more actively in project assessment from the Bachelors level onwards. Testbeds and development hubs that are relevant to both the industry and education need to be set up for problem solving, training and demonstration.

Working closely with industry partners would be a good start for the university, the university staff will be informed with the current trends and new technologies. This will bring joint solutions to industry problems and it may also attract funding opportunities for students projects. This will also be an advantage for the university as it may have more resources to undertake research and to diversify our research areas.

Pooling of resources between UoTs and renewable energy practioners and educators at other universities is needed. Ideally, focus areas should be complementary so that resource and personnel sharing becomes mutually beneficial. The status quo analysis and best practice proposal highlighted the sub-optimal environment experienced at South African Universities.

3.5 References

1. https://media.africaportal.org/documents/International_best_practice_in_schooling_reform.pdf. Accessed in November 2020.

4. Contacts

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Work Package Leader

Partner Responsible for WP: P6 –Tshwane University of Technology

Name of the contact person, position: Memane N.P, Lecturer

Address: Staatsartillerie Rd, Pretoria West, Pretoria, 0183

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Phone: 012 382 2866

5. Appendix A – Invitation letter

To Whom It May Concern

I write this letter to extend to [Company] become a partner in our efforts to help with enhancing employability for our graduates in the field of Renewable Energies, on the basis of closer collaboration between university and industry. We have taken this project because South Africa has a high unemployment rate in general. The motive for this partnership is work collectively with the industry to address the often received complaints from various industries that practical or applied experience from the graduates is lacking and that it would take a long to bring the young starters “on track”. This lack of practical experience can be found on all the layers of the education system in South Africa.

We strongly believe that our aim can be achieved by increasing industrial experience in UoT first and higher qualification engineering education by the integration of practical experience into the curriculum. The closer collaboration between university and industry automatically brings university staff closer to industry experts to carry out this mission. It is expected, that then real-world case study problems will be integrated into the lectures as well as practical laboratory experiments, because curriculum changes are needed.

The general objective is to improve the quality of higher education in South Africa and enhance its relevance for the current labour market and society. We (TUT, DUT and CUT) have collaborated with European intuitions where, each partner brings complementary and necessary experience in academic and technical expertise within engineering education with a specific focus on the renewable energy field.

Should you be interested in this cooperation or have any questions in this regard, please feel free to contact me on the detail below.

Kind regards

Project manager contact details

6. Appendix B – Project agreement

COLLABORATION AGREEMENT

MADE AND ENTERED INTO BY AND AMONGST

South African industry partners

(hereinafter referred to as “the Company”)

and

TSHWANE UNIVERSITY OF TECHNOLOGY

A tertiary education institution, with address at Staatsartillerie Road, Pretoria West, Pretoria, (established in terms of the Higher Education Act, Act No 101 of 1997),

and

CENTRAL UNIVERSITY OF TECHNOLOGY

A tertiary education institution, with address at 20 President Brand Street, Bloemfontein, (established in terms of the Higher Education Act, Act No 101 of 1997)

and

DURBAN UNIVERSITY OF TECHNOLOGY

A tertiary education institution, with address at 41/43 ML Sultan Road, Grayville, Durban, 4000, (established in terms of the Higher Education Act, Act No 101 of 1997)

(hereinafter referred to as "TUT, CUT & DUT")

(Collectively referred to as “the Parties”)

WHEREAS

The Parties, are desirous of collaborating with each other to help with employability enhancement in the field of renewable energy, on the basis of closer collaboration between TUT, CUT & DUT and industry partners under the (EURYDICE) project, Grant Agreement No. 609689 concluded on 9 December 2020.

The Parties have agreed on the terms and conditions that will govern their collaboration on the Project.

NOW THEREFORE THE PARTIES HEREBY AGREE AS FOLLOWS:

1. **INTERPRETATION**

In this Agreement, unless the context indicates otherwise, the headings to clauses of this Agreement are inserted for reference purposes only and shall in no way govern or affect the interpretation thereof.

- 1.1. Any annexure to this Agreement form an integral part hereof and words and expressions defined herein shall bear, unless the context otherwise requires, the same meaning in such annexure.
- 1.2. Unless the context clearly indicates a contrary intention, words importing the singular shall include the plural and vice versa.
- 1.3. Reference to any one gender shall include the other gender and any reference to a natural person shall include a legal persona and vice versa.
- 1.4. Where the day on or by which anything is to be done is not a business day, it shall be done on or by the first business day thereafter.
- 1.5. If any number of days is prescribed in this Agreement, these shall be reckoned as calendar days, exclusively of the first, inclusively of the last day, unless the last day falls on a weekend or on a public holiday, in which case the last day shall be the next succeeding day which is not a weekend or a public holiday.

2. DEFINITIONS

In this Agreement, unless clearly inconsistent with or otherwise indicated by the context:

- 2.1. "This Agreement" means the agreement between the Parties captured in this document hereto which have been signed by all the Parties.
- 2.2. "Effective Date" means the official starting date with regards to participating in the logistical planning and implementation of the EURYDICE Grant Agreement No. 609689 concluded on 9 December 2020, notwithstanding the date of signature hereof by the Party signing last.
- 2.3. "Project" means the EURYDICE project, Agreement No. 609689, jointly undertaken between the PARTIES.
- 2.4. "Steering Committee" means the Committee established in terms of clause 5, which shall comprise of the representatives of the Parties.
- 2.5. "Intellectual Property" means the patents, know-how, copyright, designs, discoveries and trademarks, which relate to the Project.
- 2.6. "Patents" means the registered patents and patent applications.
- 2.7. "Know-how" means all Confidential Information of whatever nature relating to the Intellectual Property and its exploitation as well as all other Confidential Information generally relating to the manufacture, use and sale of the Project outcomes resulting from the execution of

this Agreement including technical information, manufacturing technique and designs, specifications, formulae, systems, processes, information concerning materials and marketing and business information generally.

2.8. "Trade-marks" means the registered trade-marks and trade mark applications.

2.9. "Copyright" means copyright in any copyrighted work, such as copyright in computer software programmes, computer databases, data messages, photographs, drawings, and/or reports.

2.10. "Designs" means the registered designs and design applications, and any other registerable inventions/trade.

2.11. "Confidential Information" means information that (i) relates to the Disclosing Party's past, present or future research, development, business activities, products, services and technical knowledge relating to the Project, (ii) either has been identified in writing as confidential, or is of such a nature, or has been disclosed in such a way that it is obvious to the other Party that it is claimed as confidential, including (iii) performance, financial, contractual, and special marketing information, ideas, technical data and concepts originated by the Disclosing Party, not previously published or otherwise disclosed to the general public, not previously available to the Receiving Party without restriction, not normally furnished to others without compensation, and which the Disclosing Party desires to protect against unrestricted disclosure or competitive use, and which is furnished pursuant to this Agreement. As used herein, the Party disclosing Confidential Information is referred to as the "Disclosing Party" and the Party receiving the Confidential Information is referred to as the "Recipient" or "the Receiving Party".

2.12. "Contribution" means each Party's contribution in terms of clause 7.

2.13. "Task" means any task approved by the Parties as contemplated by clause 6 of this agreement.

3. COMMENCEMENT AND DURATION

This Agreement will commence on the Effective Date and shall continue to remain in force, unless terminated earlier in accordance with the provisions of this Agreement, until 14 January 2023 or such alternative date as the Parties may agree to in writing.

4. COLLABORATION

4.1. The Parties hereto agree to jointly participate in the Project according to the terms and conditions provided for in this Agreement. In doing so, the Parties agree to co-operate with each other to supply information and to assist each other as may be necessary to gather all possible relevant information to perform the Project. The Parties agree to act in the utmost good faith, to reasonably give their approvals promptly, to do all those things necessary or desirable in order to meet the time constraints for the completion of the Project and their common goal in progressing the implementation of the Project.

4.2. The Parties undertake at all times to do all things, to perform all such actions and take all such steps and to procure the doing of all such things, the performance, taking or procuring of which may be necessary for or incidental to the putting into effect or maintenance of the terms, conditions and/or import of this Agreement.

4.3. Each of the Parties shall have specific responsibilities as outlined in Annexure “A” of this Agreement.

5. **STEERING COMMITTEE**

5.1. The Parties undertake to establish a Steering Committee for the purpose of any decision making process referred to in this clause 5 and management of the Project as provided for in clause 8.

5.2. The Steering Committee shall consist of a chairperson and at least 1 (one) representative from each Party.

5.3. Each Party shall be entitled to appoint alternates to the representatives appointed to the Steering Committee by them and the appointment of each Party's representatives (and their alternatives) shall endure until such time as that Party informs the other in writing of any change to its representative.

5.4. The Company shall be entitled to appoint the project manager and chairperson of the Steering Committee.

5.5. The Steering Committee will meet or be held by means of physical attendance or video/teleconference as and when deemed necessary by the representatives, but not less than once a month.

5.6. Only the members of Parties will, subject to the provisions of clause 5.9, have a vote each. The chairperson of the Steering Committee shall -

5.6.1. not have a second or casting vote; and

5.6.2. be appointed by the Company.

5.7. All decisions of the Steering Committee will be made by way of a unanimous vote.

5.8. If a unanimous decision cannot be achieved by the Steering Committee, the issue in question will be referred to the Chief Executive Officers / Senior Management of each of the Parties, or their duly designated representatives for resolution, which resolution shall be recorded in writing.

5.9. The quorum for a Steering Committee meeting shall be one representative from each of the Parties.

5.10. Should any member not be able to attend any meeting of the Steering Committee such member may appoint any other representative by proxy in writing to vote on behalf of such member.

5.11. Minutes of the Steering Committee meeting shall be prepared by a representative of the Company or his/her proxy, and such minutes shall be circulated to the members of the Steering Committee within 7 (seven) days after the conclusion of each meeting, and shall be tabled for approval at the next meeting.

5.12. Any representative of the Steering Committee may call a meeting of the Steering Committee by written notice to the other members. Unless there are circumstances of urgency, reasonable written notice shall be not less than 10 (ten) days, excluding Saturdays, Sundays or Public Holidays.

5.13. All meetings of the Steering Committee shall be held at the Company's offices or such other venue or by means of a video/telephone conference at such other venue/s as may be agreed upon.

5.14. The Steering Committee will have full power and authority over all aspects of, and pertaining to, the Project and will, without limiting the generality of the a foregoing, have the power and authority to:

5.14.1. Perform any act or do anything pertaining to the Project.

5.14.2. Consider all reports and recommendations and make all decisions relating thereto.

5.14.3. Appoint any consultant required for the preparation of the Project.

5.14.4. Prepare a business model for the Project.

5.14.5. Manage the Project on a day to day basis.

5.14.6. Do all things necessary to facilitate the Project.

6. TASK

Any work to be undertaken in terms of the Project shall be determined by the Steering Committee and shall be reduced to writing in the minutes of the Steering Committee.

7. COSTS AND PROCUREMENT

7.1. The Company will contribute towards the subsistence, transport and logistical needs associated with the Project.

7.2. The Project shall be conducted in accordance with the stipulations underlined by the Project document (Annexure A attached hereto) and time frames determined by the Steering Committee.

8. PROJECT MANAGEMENT

8.1. All components whether of an intellectual property nature or not as well as progress and information gathered attributable to the Project shall, subject to the provisions of the Intellectual Property Rights from Publicly Financed Research and Development Act, (Act 51 of 2008), from the date of inception until completion as referred to in clause 9 be the joint property of the Parties in equal undivided shares.

8.2. The management of the Project shall be performed by the Company representative, and, the TUT representative, reporting to the Steering Committee, and where necessary ad-hoc working groups (if required) will be established by the project manager in collaboration with the Steering Committee. and managed on a day-to-day basis by the Project Manager.

9. **COMPLETION OF THE PROJECT**

9.1. The Parties shall use their best endeavours to arrange for the completion of the Project within the timescales as determined by the Steering Committee.

9.2. The Project shall be deemed completed on 14 January 2023 or as at the date of submission of all documentation of the Project report to the Parties, whichever comes first, provided that, within a period of 21 (twenty-one) days thereafter the Parties may request supplementary research or clarification. In the latter event, the Project will be deemed to be completed as at the date of submission of the supplemental research or clarification.

10. **FORCE MAJEURE**

10.1. Should any of the Parties be rendered unable, wholly or in part, to carry out its obligations under this Agreement due to force majeure (including without limitation, acts of God, strikes, lockouts or other industrial disturbances, war or civil disturbance, unavoidable accident, fire, flood or explosion, laws, rules and regulations or orders of governmental authority, embargoes and unavailability of equipment or transport and other conditions not within the control of such Party whether or not similar to those enumerated), then that Party shall give the other Parties prompt written notice of the occurrence of such force majeure with reasonably full particulars concerning it.

10.2. Thereupon the obligations of that Party, insofar they are affected by the force majeure, shall be suspended and the non-performance of the suspended obligations shall be excused during the continuation of the intervention of such force majeure. The Party affected shall take all reasonable steps to eliminate the intervening event and shall resume performance as promptly as is practicable; provided, however, that nothing herein shall require such Party to settle or adjust any labour dispute on terms to which it does not agree.

10.3. So long as a dispute exists with respect to the fact of non-performance by any Party, and the dispute settlement procedure has been invoked, an event of force majeure shall be deemed to exist with respect to the obligations in dispute until such dispute is resolved pursuant to clause 16.

11. GOVERNING LAW

This Agreement is subject to the laws of the Republic of South Africa, which shall apply to the construction, interpretation, and execution of this Agreement.

12. CONFIDENTIAL INFORMATION AND ACCESS TO INFORMATION

12.1. The Parties and their authorised representatives shall at all times be entitled to and shall have access to the information concerning the Project.

12.2. The Parties shall keep confidential all Confidential Information and only use it in co-operation with each other and for the purpose expressly agreed upon and disclose same to their employees only on the basis of the need to know and provided that such employees bind themselves in writing to protect the secrecy and confidentiality of the Confidential Information. Any third party or employee to whom Confidential Information is disclosed shall, prior to such disclosure, sign a confidentiality undertaking.

13. WAIVERS

No favour, delay, relaxation or indulgence on the terms of this Agreement shall operate as a waiver of such power or right conferred on such Party in terms of this Agreement nor shall any single or partial exercise of any such power or right preclude any other or further exercises thereof or the exercise of any power or right under this Agreement.

14. SURVIVAL OF RIGHTS

14.1. The termination of this Agreement shall not prejudice the rights of any of Parties in respect of any antecedent breach or non-performance by the other Party of any of the terms and conditions thereof.

14.2. The commitment of the Parties to confidentiality as set out in clause 12 shall survive termination of this Agreement.

15. MODIFICATIONS TO BE IN WRITING

No variation, modification or waiver of any provision of this Agreement, or consent to any departure therefrom, shall in any event be of any force or effect unless confirmed in writing and signed by the Parties; and then such variation, modification, waiver or consent shall be effective only in the specific instance and for the purpose and to the extent for which it is made or given.

16. DISPUTE SETTLEMENT

16.1. Should any dispute or deadlock arise among the Parties in relation to any matter concerning the Project or the interpretation of this Agreement, with the exception of the members of the Steering Committee not being able to have a unanimous resolution referred to in clause 5.8, then the Parties shall endeavour to resolve their differences by a process of negotiation and in doing so shall be guided by the principle that the interests of the Project shall be paramount and given precedence above the interests of the Parties having due regard to the contractual rights and obligations of the Parties prevailing at the Commencement Date of this Agreement.

16.2. If, in the event of a dispute, the Parties are not able to reach agreement within 14 (fourteen) days from the date upon which any dispute or deadlock arose, then the dispute shall be submitted to such persons as designated by the Parties respectively by written notice from time to time for unanimous decision and failing such decision, within 90 (ninety) days from the date of expiry of the 14 (fourteen) day period referred to above, any of the Parties shall be entitled to serve written notice on the other to terminate this Agreement forthwith, and the provisions of clause 17.2 shall apply.

17. TERMINATION

17.1. This Agreement may be terminated by any Party for breach by any of the other Parties after failing to remedy such breach within 7 (seven) days of receipt of written notice by such Party or in terms of clause 16.2 or for any other reason as may be agreed upon by the Parties, in which event the Parties shall within 30 (thirty) days from the effective date of the termination make payment of any amount that may be due by a Party with regard to the Project costs or repay any money not incurred for the Project which has been paid.

17.2. In the event of a termination referred to in either clause 16.2 or 17.1 any of the Parties shall have the right to buy the work performed on the Project by paying to the other Party or Parties its or their Contribution up to that point. In the event that 2 (two) of the Parties are interested to buy the Project, the Party making the highest offer shall be entitled to such purchase in which event the proceeds shall be divided after accounting each one's obligation to contribute or else should none of the Parties make such an offer the Parties may, if agreed in writing sell it to a third party and to share the proceeds after accounting for each Party's unpaid Contributions.

18. WARRANTY OF AUTHORITY

Each Party warrants to the other Parties that it has power, authority and the legal right to sign and perform this Agreement and that this Agreement has been duly authorised by all necessary actions of its council or board, to the extent applicable, and all obligations contained herein constitute valid and binding obligations on it in accordance with the terms of this Agreement.

19. DOMICILIUM AND NOTICES

19.1. All notices and any other communications whatsoever (including, without limitation, any approval, consent, demand, query or request) by the Parties in terms of this Agreement or relating to it shall be given, in writing, and shall be sent by registered post, or delivered by hand, or transmitted by facsimile or electronic mail to the recipient Party at its relevant address set out below:

19.1.1. to the Company, at –

Address: _____

Postal address: _____

Electronic mail address: _____

Marked for the attention of: _____

19.1.2. to CUT, at –

Address: 20 President Brand Street, Bloemfontein, 9300

Postal address: Private Bag X20539, Bloemfontein, 9300

Electronic mail address: _____@cut.ac.za

Marked for the attention of: _____

19.1.3. to TUT, at –

Address: _____

Postal address: _____

Electronic mail address: _____

Marked for the attention of: _____

19.1.4. to DUT, at –

Address: _____

Postal address: _____

Electronic mail address: _____

Marked for the attention of: _____

19.2. Either Party may, by written notice to the other Parties, change any of the addresses at which, or the designated person for whose attention those notices or other communications are to be given.

19.3. Any notice required or permitted to be given in terms of this Agreement shall be valid and effective only if in writing.

19.4. Any notice or other communication given by one Party to another ("the addressee") which:

19.4.1. is sent by registered post to the addressee at its specified address shall be rebuttably presumed to have been received by the addressee on the 7th (SEVENTH) day after the date of posting;

19.4.2. is delivered by hand during the normal business hours of the addressee at its specified address shall be rebuttably presumed to have been received by the addressee at the time of delivery; or

19.4.3. is transmitted by electronic mail to the addressee at the addressee's specified electronic mail address shall be rebuttably presumed to have received by the addressee on the date of transmission as reflected on the sender's electronic mail records.

19.5. Notwithstanding anything to the contrary contained or implied in this Agreement, a written notice or communication actually received by one of the Parties from another, including by way of facsimile transmission or electronic mail, shall be adequate written notice or communication to such a Party.

19.6. The Parties choose their respective physical addresses in clause 19.1 as their respective domicilia citandi et executandi at which all documents relating to any legal proceedings to which

they are a party may be served. If that address is changed to another address which is not a physical address in the Republic of South Africa, then the original address shall remain the domicilium citandi et executandi of the relevant Party until it nominates a new physical address within the Republic of South Africa in writing, to be its new domicilium citandi et executandi.

19.7. Each of the Parties shall be entitled from time to time by written notice to the other to vary its domicilium to any other address within the Republic of South Africa.

20. NO AGENCY

The Parties understand and agree that no Party is an agent, employee, contractor, vendor, representative or partner of the other and that they shall not hold themselves out as such to third parties.

21. NON ASSIGNMENT

The Parties may not assign any of their respective rights or obligations in terms of this Agreement without the prior written consent of the other Parties.

22. COSTS

The Parties shall each bear their own in-house legal costs pertaining to the conclusion of this Agreement.

[THE NEXT PAGE IS THE SIGNATURE PAGE]

SIGNED at _____ on this the ____ day of _____ 2021

AS WITNESSES:

1. _____

For and on behalf of the COMPANY, he being duly authorized thereto

2. _____

SIGNED at _____ on this the ____ day of _____ 2021

AS WITNESSES:



1. _____

For and on behalf of TUT, he being duly authorized thereto

2. _____

SIGNED at _____ on this the _____ day of _____ 2021

AS WITNESSES:

1. _____

For and on behalf of CUT, he being duly authorized thereto

2. _____

SIGNED at _____ on this the _____ day of _____ 2021

AS WITNESSES:

1. _____

authorized thereto

For and on behalf of DUT, he being duly

2. _____