Annual Report
2005/06
The Engineering Professions Association of Namibia (EPA) is a non-profit, voluntary membership association of qualified engineers, engineering technicians and others engaged in engineering related professions. The association strives to uphold excellence in the field of engineering by promoting the image, continuing education and common interest of its members. The EPA pursues its aims and promotes the engineering profession with modest means through its involvement in various activities, such as the management of engineering bursary funds and the annual “Young Engineers’ Construction Project” and engineering careers exhibitions.

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**President’s Report**

**International Forum on Engineering and Technology for Poverty Reduction**

Upon invitation, I attended this international forum organized by UNESCO in February this year at SAICE in Midrand, Johannesburg. More in-depth information you will find in the annual report publication.

**Presentation: “Small is Beautiful”**

For the purpose of sharing information on the mentioned UNESCO Forum, the EPA arranged a presentation that was held on 28 March at Hotel Thule in Windhoek. Members unfortunately very poorly attended this presentation.

**The Young Engineers Construction Project**

The bridge building competition for secondary schools in Namibia was again very well received and turned out to be a great success. It took place on the 17 June at the Windhoek Technical High School. A record number of 50 teams from schools all over Namibia, consisting of three scholars in each team participated. The DHPS again took the first place but also third place, while the team from Walvis Bay High School took second place. Unlike last year, we did not receive a sponsorship from Air Namibia to fly the winning team to Johannesburg for participation in SAICE’s international bridge building competition.

**Coastal Careers Exhibition for the Erongo region**

During June, this exhibition was held in Swakopmund over 2 days. Our former secretary, Mrs. Chantel Kutz, who now lives in Swakopmund represented the EPA at that exhibition and reported that it was well received and well attended.

**Annual Golf Day**

This event took place on Friday 25 August 2006. Altogether 34 players participated and enjoyed a super day in the sun. The day was concluded with the prize giving and a social dinner.

**Roads Authority Bursary Fund Scheme**

The Roads Authority Bursary scheme continued in 2006 with initially 5 students at the Polytechnic of Namibia and 4 students at the University of Cape Town. In January this year, the Roads Authority reinstated one of the UCT students and awarded bursaries to a further 6 civil engineering students, 3 of which attend UCT and one the Polytechnic, one at the Stellenbosch University and one at UNAM. This brings the total number of students, whose bursaries are administered by the EPA to 16.

**General EPA matters**

The EPA membership is shrinking, partially due to retirements and/or resignations, but also due to terminations of membership for non-payment of membership fees over several years. This state of affairs will undoubtedly have a negative affect on the financial situation of the EPA.

Concerted efforts should be made to recruit new members, especially younger engineers and technicians. At the same time though, consideration should be given to ways and means to make membership of the EPA more attractive and worthwhile for prospective new and old members.

Thank you all for attending this AGM. I trust that the year ahead will bring new challenges to us all.

S Tekie Pr.Eng. (Mrs)

President
The EPA Council for 2005/06

The management of the EPA’s affairs is vested in a member-elected Council that comprises a President, a Vice-President, an Honorary Secretary, an Honorary Treasurer, and several members representing the various engineering disciplines. The EPA Council employs a part-time secretary for the general administration of the association.

President: Mrs Sophia Tekie Pr. Eng.

Sophia, a professional civil engineer, is the Road Management System Manager of the Roads Authority of Namibia. During EPA’s last Annual General Meeting in November 2005, she was re-elected by Council to serve a further year as President of the Association.

Vice President: Mr Fritz Jeske Pr. Eng.

Fritz is an electrical engineer and director of Bicon Namibia Consulting Engineers. He has been a stalwart of EPA since its early beginnings, and has served on Council in several positions, including several terms as President.

Honorary Secretary: Mr Günter Seydack Pr. Eng.

Günter has been a roads engineer for 30 years, starting with the SWA Administration Roads Branch, doing a stint of research work with the CSIR in Pretoria, and eventually settling in Namibia as an independent consultant. In this capacity, he was involved with the road sector reform and the establishment of the Roads Authority and Road Fund Administration. Having worked for the latter from 2002 as Manager for Policy, Programme Management and Advice, he opted for early retirement in 2005, to split his time between consulting work, philosophy and arts.

Electrical Engineering Discipline: Mr Helmut Weinert Pr. Eng.

Helmut studied for electrical engineering at the University of Natal (Durban) and was first employed at South African Railways in the seventies. Later he went to the Directorate of Civil Aviation for ten years. After this did a spell consulting for about two years and then joined the project engineers at Telecom Namibia. He retired in 2004.

Incorporated Engineers and Technicians: Mr Erich Albrecht Eng. Tech.

Erich began his career with the SWA Administration Roads Branch in 1968, obtained the National Diploma in Materials Testing in 1971, and has managed materials laboratories on numerous roads construction sites during his long career dedicated to Namibia’s roads. He is currently the manager of the Roads Authority’s Central Laboratory.

Associated Body – NAMIT: Mr Jürgen Hennes I. Eng.

Jürgen started as a learner technician with the Department of Water Affairs, South West Africa, which supported him with a bursary to obtain a 3-year diploma in Pretoria. Returning to Windhoek, he specialized in water retaining structures. To gain more knowledge on bitumen road construction, he moved to the City of Windhoek for 5 years and moved back to the "water business". He was eventually promoted to Superintendent of Water and Sewerage Reticulation of the City of Windhoek. Ever seeking to manage his own business, he left the public service and joined the insurance industry, where he has been engaged in loss adjusting on buildings, structures and construction sites on a free lance base for the past 10 years.
Administrative Secretary: Mrs Ricki Wilson

Qualified as a draughtswoman, Ricki has worked in that field for altogether 22 years for several architectural firms in Windhoek and freelance from home, with an interruption of a few years to raise a family. During that time she also expanded her skills into bookkeeping and secretarial work. Since July 1998, she has been the Executive Secretary of the Construction Industries Federation (CIF), managing this office in the mornings. To fill the afternoons - no more Mom’s Taxi - she took over the EPA office administration in January 2004 and moved it into her office at home.

The following permanent posts on Council were vacant during the year:

- Honorary Treasurer
- Civil Engineering Discipline
- Mechanical Engineering Discipline

As EPA currently has no active Branches, Engineering Divisions and Student Chapters, none of the posts for representatives of these on the Council were filled.

Acknowledgment:
The Council gratefully acknowledges the support received from Mr O’Brien Ekandjo in the course of the Council’s year of office.

From the Editor’s Desk

Your Council started its year of office with the ideal to once again produce even just one annual issue of the “EPA Magazine”. In the “good ol’ days” this had been published quarterly, and then ever more erratically. Alas, in our attempts, we again became painfully aware of our lack of capacity for such an undertaking. The contributions received were not sufficient to support a magazine. It seems that we are all too busy making money to be able to spare time for anything else. Ironically, after all our money-making, time and again we have just made enough to pay the banks, our bills, and what’s left – to the tax-man.

And so we decided to use whatever contributions we had received to publish an annual report, and the result is in your hands. I wish to thank those contributors who have made it possible to achieve this.

We have included in this annual report EPA’s audited financial statements for the period ending February 2006, but due to the Honorary Treasurer’s post being vacant, there is no Treasurer’s Report.

EPA’s financial situation is still sound. To a significant extent, this may be attributed to EPA’s management of the EPA Bursary Fund Trust for engineering study bursaries, first for the Ministry of Works, Transport and Communication, and subsequently for the Roads Authority. Occasionally, but mainly in the past, EPA has also been able to make small profits on the seminars and workshops it has arranged. All of these significantly boosted EPA’s revenue, making it less dependent on membership fees, and this has allowed EPA a record run of unchanged membership fees for so many years that we probably have already lost count of when the last increase was (1990?).

However, our expenses have exceeded our revenues for several years now, and we have therefore been gradually diminishing our reserves. Added to this, unfortunately, a large portion of EPA’s assets is tied up in a debtor’s account, being the Young Professionals Programme Bursary Fund. This still owes EPA more than N$79,000 in administrative fees. The money “is there”, but can only be released to EPA with the Ministry of Works, Transport and Communication’s approval, which EPA is still awaiting.

EPA members’ way of ploughing back something into their professions has been EPA’s support of activities that promote engineering as a career to school children. Most notable among these are the Young Engineers’ Construction Project and several careers exhibitions. Some feedback about these has been included in this annual report, and EPA is deeply grateful to those who have volunteered their time to keep these activities on the go. The Young Engineers’ Construction Project is costly, and EPA would have been severely challenged to continue with this project, had it not been for the generous support of various donors. EPA is indebted to these donors and has given recognition to them in some of the articles below.

In addition, EPA hopes to plough back into the professions by eventually awarding its own bursaries, and EPA’s bursary fund has been increasing gradually. Unfortunately, inflation in education costs is catching up with this fund. Once EPA has (hopefully) received its dues from the Young Professionals Programme Bursary Fund, this would give another boost to EPA’s own bursary fund.

Ensuring the sustainability of EPA and of the aforementioned projects that constitute its core activities is a challenge that the new Council will have to face.
Young Engineers’ Construction Project: Bridge Building Competition

The Bridge Building Competition is an annual event hosted by the EPA to promote engineering as a career. Senior Secondary schools throughout Namibia offering Mathematics and Physical Science are invited to partake in the Bridge Building Competition. This year’s event took place on Saturday 17 June 2006 at the Windhoek Technical High School in Academia. The EPA Vice-President Mr. Fritz Jeske officially opened the event, welcoming students and teachers and wishing them all success in the competition.

A record number of fifty teams from all corners of Namibia consisting mostly of three members each participated in this competition. The rules together with the material and tool kits are handed to each team on the day of the competition, the kit consisting of wooden dowels, a hacksaw, a cutter, glue and string. The teams commence planning and building at 9:00 in the morning. Cut-off time is 15:00. A panel of judges weighs and evaluates the bridges on workmanship and ingenuity, before the bridges eventually are being put to the test as to much load they can carry before breaking.

This year’s winning bridge weighed 153.8g and carried a load of 98.9kg. The winning team, made up of Charlotte Rechholtz, Oliver Pieters and Felix Fleissner, was from the Deutsche Höhere Privatschule in Windhoek. The team from Walvis Bay High School took the second place and another team from the DHPS in Windhoek took third place. The first three teams received cash money for each team member and a cheque for their school, the prizes amounting to N$750.00 per team and school for the first prize together with a floating trophy, N$600.00 for the second prize and N$450.00 for third prize respectively.

In his closing remarks the EPA Vice-President Mr. Fritz Jeske encouraged students to consider engineering as a career. Some of these pupils are our country’s future engineers. Competitions such as this help to stimulate additional interest in those, who may consider engineering as a profession besides promoting the industry as a whole to pupils, laymen and current engineers alike.

Our congratulations go to all participants in the competition for their enthusiasm and camaraderie, but in particular to the winning teams and respective schools. A special word of thanks goes to the EPA judges, Mr. K Detering, Mr. J Leicher and Mr. F le Roux, as well as Mrs. Retha Landsberg, Mrs. C Langeveldt and Mr. T du Toit of the WTHS for their kind assistance and technical support on the load testing of the bridges.

The Engineering Professions Association is a non-profit organisation that amongst other aims and functions promotes engineering as a career at schools, career exhibitions and projects of this nature. The EPA relies on sponsorships from consulting firms and related businesses to make such event possible. We would like to take this opportunity to thank the following firms for their kind and generous sponsorships:

- Windhoek Consulting Engineers
- V K E (Namibia) Inc. Consulting Engineers
- Africon Namibia Consulting Engineers
- Lund Consulting Engineers
- Seelenbinder Consulting Engineers
- Penny Pinchers and Timber City
- Democratic Media Holdings.

The day ended with a small cocktail function to which the participating teams, accompanying teachers, parents, sponsors, guests and members of the EPA were invited.

Whereas the winners of the competition in previous years were sponsored to participate in the SADC regional bridge building competition held annually in South Africa, this was regretfully not possible in this year, due to both insufficient sponsorship and conflicting school examinations schedules.
The Young Professionals Programme Bursary Fund

The Ministry of Works, Transport and Communication (MWTC) in the early 90’s embarked on a reform of the road sector with a view to achieving improved efficiency in the sector with regard to both the management and funding of the national road network. The reform was substantially executed through a project of the MWTC, named “the MWTC2000 Project”, which by April 2000 had achieved the establishment of the Roads Authority and the Roads Contractor Company out of the operational components of the Department of Transport in the MWTC, and the Road Fund Administration as an entirely new institution for securing funding mainly for the national road network.

The MWTC had been experiencing a chronic shortage of engineers and technicians and it was foreseen that for a successful reform of the road sector, the shortage in these professions would have to be alleviated. As part of the strategy towards this end, the Young Professionals’ Programme (YPP) was established under the auspices of the MWTC2000 Project, with funding for engineering study bursaries provided by the Swedish International Development Cooperation Agency, Sida, under the Namibian – Swedish Specific Agreement on Transport and Communication Sector Support.

The MWTC on 1997-02-11 concluded an agreement with the Engineering Professions Association of Namibia (EPA) for the management of the YPP Bursary Scheme, which EPA then managed during the financial years from 1996/97 to 2004/05 as part of EPA’s Bursary Fund Trust, into which the Swedish funds were paid directly.

The total intakes of students from 1997 to 2000 resulted in bursaries being awarded as follows, with regard to affirmative action criteria:

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Namibian women</td>
<td>5</td>
</tr>
<tr>
<td>Brown Namibian women</td>
<td>2</td>
</tr>
<tr>
<td>White Namibian women</td>
<td>3</td>
</tr>
<tr>
<td>Black Namibian men</td>
<td>13</td>
</tr>
<tr>
<td>Brown Namibian men</td>
<td>2</td>
</tr>
<tr>
<td>White Namibian men</td>
<td>11</td>
</tr>
<tr>
<td>Subtotal Women</td>
<td>10</td>
</tr>
<tr>
<td>Subtotal Men</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

The above figures include one student who was awarded a bursary for post-graduate studies in transportation economics. Therefore, 35 bursaries were awarded for engineering studies.

With the aforementioned intakes of students, the Scheme has substantially succeeded in alleviating the shortage of young civil engineers in Namibia, by producing 23 graduate civil engineers in the course of seven years between 1997 and 2004. The total cost amounted to N$ 5 295 971, which averages to about N$ 230 000 per graduate. This cost includes the irrecoverable losses incurred on students that dropped out of the Scheme.

Not taking into account a number of students who were awarded a bursary but who for various reasons never commenced their studies under the Scheme, drop-outs numbered only six. Considering the difficulty of engineering study, and the under-privileged background of many of the students, a ratio of 6 drop-outs to 23 successful students is regarded a remarkable success.

In April 2006, EPA produced a closing report on this bursary scheme, which has been accepted by the Ministry of Works, Transport and Communication and by Sida. Those who are interested in reading about the challenges met and lessons learnt in the operation of the scheme, may obtain an electronic copy from EPA’s secretary.

EPA Annual General Meeting

On Thursday evening 27 October 2005 the Annual General Meeting of the association was held at the Bauernstube Restaurant in Windhoek. With not as many members in attendance as wished for the meeting nonetheless concluded the business of the day and engaged in interesting discussions. While most council members had agreed to continue serving on the EPA council in their respective positions, only one additional nomination was received, i.e. Mr. G Seydack re-joined council. The following persons make up the EPA council: Mrs. S Tekie (President), Mr. F Jeske (Vice-President), Mr. G Seydack (Honorary Secretary), Mr. J Hennes (NAMIT), Mr. J H Weinert (Electrical) and Mr. E Albrecht (Technical).

EPA Workshops

Two workshops were presented during the month of November, namely “Small Scale Treatment Plants for Drinking Water” (3 & 4 November) and “Basic Principles and Concepts of Preventative Maintenance” (15 & 16 November). Identified as priorities for training during the African Engineering Forum in March 2005 the workshops formed part of SADC’s rollout programme on capacity building in the water and sanitation sector and were coordinated by SAICE. Unfortunately attendance at both workshops
was not as plentiful as hoped for, mainly due to relatively short notice received from SAICE to host the courses, but participants expressed that the workshops proved interesting, informative and beneficial for their line of work.

**EPA Participation: International Forum on Engineering and Technology for Poverty Reduction**

The International Forum on Engineering and Technology for Poverty Reduction was convened at the South African Institution of Civil Engineering (SAICE) in Midrand from 22 to 24 February 2006. Participants and speakers from various African and other countries were involved, including the Engineering Professions Association’s President, Mrs Sophia Tekie.

The forum hosted by SAICE and organized by UNESCO (United Nations Educational, Scientific and Cultural Organisation), SAICE, the Engineering Council of South Africa (ECSA) and Ordem dos Engenheiros de Mozambique, has as immediate goal:

Discussing, developing, promoting and initiating a programme of action promoting the role, contribution and awareness of the importance of engineering and technology to poverty eradication. The overall challenge is to improve the access of people living in poverty to the technology that will help change their lives and livelihoods.

This forum is of particular interest as engineering and technology are of vital importance in addressing basic needs, poverty reduction, emergency and post-conflict relief and reconstruction. This relates particularly to the UN Millennium Development Goals (MDG), especially in the eradication of poverty, primary education, gender equality and empowerment of women and health issues. Improved infant and maternal health, sustainable development and global partnership are high on the MDG agenda. Some of the topics discussed were:

- Poverty reduction and the role of engineering and technology: rural and urban; needs, barriers and challenges; gender issues, advocacy, communication, policy, planning – a multi-country case study perspective;
- Enterprise development: SMEs, income generation, manufacturing, micro-finance; and
- Perspectives on technology for poverty reduction from government, intergovernmental organisations and NGOs.

Poverty relates primarily to the limited access of people living in poverty to the knowledge and resources with which to address their basic human needs and livelihood development. Such areas of need include water supply, sanitation, food production and processing, housing, energy, transportation, communication, income generation and employment creation.

Addressing basic needs in these areas consists essentially of the application of technology, as knowledge, tools and skills, appropriate to the context of poor people – in terms of the social, economic, educational and knowledge situations of the poor. Technology empowers the poor and access to knowledge and technology is therefore a central component of a rights-based approach to poverty eradication.

Activities in engineering, technology and poverty reduction include human and institutional capacity building, applied research, information and advocacy, technology choice, transfer, adaptation, development, innovation and dissemination.

Plans and Programmes of action were in place by the end of the Conference that mainly focused on networking, information dissemination, communication and commitment that engineers must get involved in government plans and policy making by being proactive.

**Coastal Careers Exhibition**

EPA was once again represented at a Careers Exhibition held in Walvis Bay on 14 and 15 June 2006. This exhibition was organised by the Life Skills teachers of Swakopmund and Walvis Bay for all the schools at the coast and the Erongo region. EPA is grateful to Mrs. Chantel Kutz for representing the EPA at this event. She reported that it was well attended and approximately 1500 learners visited the exhibition.

**EPA Golf Day – 25 August 2006**

The EPA Golf Day has become a popular annual event to bring together engineers, architects and quantity surveyors, as well as builders, suppliers and clients. For those participating, golfers and non-golfers alike, it has proven to be a day filled with fun in the sun, a day away from the pressures in the workplace.

This year’s golf day took place on Friday 25 August, weather wise a perfect day for outdoors. 34 players entered the competition, mostly in teams of four. T-off started at 11h00 and by sunset the last team had completed 18 holes.

As a non-profit, voluntary organisation the EPA has to rely on donations and/or sponsorships to a great extent to make such an event possible. It is with much appreciation that the following companies have to be thanked for their generous sponsorships in the form of money and/or prizes:

- Lafarge Roofing SA
The day was concluded with the prize giving during a social gathering in the lapa at the Golf Club where all golfers and their partners could enjoy drinks and a scrumptious barbecue.

Report: International Forum on Engineering and Technology for Poverty Reduction

Sophia Tekie; President, Engineering Professions Association

This forum was held from 22-24 February, 2006 at South African Institution of Civil Engineering (SAICE) Office at Midrand, Johannesburg, South Africa. The forum was organised by UNESCO (UN Educational, Scientific and Cultural Organisation), SAICE, Engineering Council of South Africa (ECSA), Ministry of Science and Technology, South Africa (MST), Ordem dos Engenheiros de Mozambique and Ministra da Ciência e Tecnologia, Mozambique (MCT).

The Poverty environment

Poverty relates primarily to the limited access of people living in poverty to the knowledge and resources with which to address their basic human needs and livelihood development. Such areas of need include water supply, sanitation, food production and processing, housing, energy, transportation, communication, income generation and employment creation.

Addressing basic needs in these areas consists essentially of the application of technology, as knowledge, tools and skills, appropriate to the context of poor people – in terms of the social, economic, educational and knowledge situations of the poor. Technology empowers the poor and access to knowledge and technology is therefore a central component of a rights-based approach to poverty eradication.

Engineering and technology are of vital importance in addressing basic needs, poverty reduction, emergency and post-conflict relief and reconstruction, and relate particularly to the UN Millennium Development Goals – especially the eradication of poverty, primary education, gender equality and empowerment of women, health issues – particularly improved infant and maternal health, sustainable development and global partnership. Activities in engineering, technology and poverty reduction include human and institutional capacity building, applied research, information and advocacy, technology choice, transfer, adaptation, development, innovation and dissemination.

Goals of International Forum on Engineering and Technology for Poverty Reduction

This Forum had the immediate goal of discussing, developing, promoting and initiating a programme of action promoting the role, contribution and awareness of the importance of engineering and technology to poverty eradication. The overall challenge is to improve the access of people living in poverty to the technology that will help change their lives and livelihoods. This Forum follows a preparatory “Focus on Engineering and Technology for Poverty Eradication”, held in Washington in March 2004.

The Forum had plenary sessions and parallel workshop sessions with presentations from leading speakers and associated discussions on specific themes. The Focus commenced with a welcome and official opening session, followed by keynote addresses on poverty and the role of engineering and technology in poverty reduction. The afternoon sessions consisted of two workshop sessions on infrastructure and enterprise development. The second day began a review of the first day, followed by two workshop sessions on capacity building in engineering and technology for poverty reduction, information and communication, policy and planning issues.

A field trip was organised to visit a community multimedia centre to explore issues relating to information and communication for technology and poverty reduction. The Centre is called Sci-Bono and is in the heart of Johannesburg where the whole area used to be abandoned because of crime. The city of Johannesburg using proper town planning is making the area liveable again and this Centre was one of the outcomes of the project. The Centre attracts many visitors per year: in 2004-2005 24 628 visitors visited the centre further 8 000 people participated in the various outreach programmes at schools, libraries and community centres. The Centre is developed in such a way that learners will discover science through see-
ing and feeling the scientific gadgets that are in the Centre. The Centre was even interesting to many en-
gineers who have forgotten basic concepts of science, bring laughter and excitement to the attendants of
the forum. Sci-Bono discovery Centre was initiated
by the Gauteng Department Education in 2002 and
positions itself to contribute to economic develop-
ment and job creation objectives as defined by the
national skills development policy. Perhaps Namibia
can also think of putting such a centre in the future to
assist learners and to make them enthusiastic to study
science.

The third day began with a workshop session on per-
spectives from governmental, intergovernmental or-
organisation and NGO perspectives on engineering,
technology and poverty eradication. This was fol-
lowed by a panel discussion on needs, barriers and
challenges for engineering and technology for pov-
erty reduction. A final workshop session discussed
and then presented conclusions and recommendations
of the Workshop, and a proposed plan of action. This
summary will still be compiled and e-mailed to the
participants. In general the recommendations con-
sisted in the six areas that were discussed.

It is intended to invite 50 - 70 participants to the Fo-
rum. These will include senior policy makers and
planners, commentators and specialists in engineering
and technology, economic and social development
and specific areas such as gender dimensions of pov-
erty and poverty eradication. These will be invited
from government and the public sector, intergovern-
mental organisations, NGOs, academia, the private
sector and potential sponsors from around the world.
It is hoped also to include an exhibition and poster show.

The participants were from Ghana, Kenya, Lesotho,
Malawi, Mauritius, Mozambique, Namibia, South
Africa and Zimbabwe although others were invited
but did not participate.

Lessons Gained

1. That Science and Technology should include
Engineering, Science and Technology (ES&T)
– the Engineering part should not be forgotten.
“Scientists discover the world that exists; en-
gineers create the world that never was...”
Theodore Van Karman, Aerospace Engineer.

2. That countries that have a Ministry dedicated
to Science and Technology are advancing
well, and those African countries do not have
such a Ministry of Department in their Minis-
tries of Education, or Culture should seriously
look into this aspect as there will be no devel-
opment in any country if emphasis is not given
to Engineering, Science and Technology to al-
leviate poverty by making technology accessible
to those remote areas.

3. Governments in Africa need to have policies
to make ES&T accessible to the poor. Not
only policies but concrete plans. Policies are
not enough they should be practical and im-
plemented on the ground, people must see dif-
fences in the day to day living.

4. Practical and meaningful action plans were
finalised by end of the forum to have adv oc-
cy and talk to our governments so that those
action plans will be supported. One aspect was
to have a special Ministry to address ES&T; to
have engineers being involved in policies of
the government so that they will be practical.

5. The sister organisation SAICE is doing a lot
of work by talking to government when it
comes to engineering matters to assist them in
making the right decisions. One such effort
was by publishing a book called Numbers and
Needs by Allyson Lawless where instead of
having thumb suck figures a well researched
book was published to show the needs in
South Africa of Engineers and where the chal-
lenges lie ahead.

a) One important aspect of the book was the
age gap. There are late 40s and 50s and
above mainly white male that are retiring
and young black engineers are coming to
the market climbing up the ladder too fast
that the quality of engineers is suffering
bringing a lot of damage on the profession
and society. This gap the middle part En-
gineers from 35-45 (more or less) are vir-
tually non existent – and hence there is no
work force as such to produce. Such initia-
tives were encouraged to be implemented
by other countries such as Namibia. Per-
haps EPA can be instrumental to such a
study.

b) Population and no of Engineers

South Africa, with a population of nearly
47 million, has 14 806 registered engi-
neers. The population per engineer is
3 166, and the population per doctor is
1 493. Namibia, in comparison, with a
population of 2,030,692, has 320 registered engineers. The population per engineer is 6,346, and 4,545 per doctor. Some additional comparisons are tabulated below.

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>No of Engineers</th>
<th>Pop. per Engineer</th>
<th>Pop. per Doctor</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>46 888 200</td>
<td>14 806</td>
<td>3 166</td>
<td>1 493</td>
</tr>
<tr>
<td>Namibia</td>
<td>2 030 692</td>
<td>320</td>
<td>6 346</td>
<td>4 545</td>
</tr>
<tr>
<td>UK</td>
<td>58 821 000</td>
<td>189 406</td>
<td>311</td>
<td>492</td>
</tr>
<tr>
<td>USA</td>
<td>296 771 226</td>
<td>762 000</td>
<td>389</td>
<td>361</td>
</tr>
<tr>
<td>Swaziland</td>
<td>979 000</td>
<td>80</td>
<td>12 238</td>
<td>9 100</td>
</tr>
<tr>
<td>Zambia</td>
<td>11 261 795</td>
<td>881</td>
<td>12 783</td>
<td>11 100</td>
</tr>
</tbody>
</table>

This shows clearly that the number of our Engineers is not enough for the population.

c) This is a quote from the Abstract of the book: “A great deal has been said about the lack of capacity in relation to civil engineering professionals. The nation’s economy and the quality of life of its citizens depend heavily on the supply and efficient operation of infrastructure. Yet the civil engineering industry faces unprecedented challenges in attracting, recruiting and retaining the staff needed to design, manage and deliver this infrastructure, without which poverty alleviation, and ultimately its eradication, is not possible. Transportation is also a major challenge, and concerns have been raised at national level about the limited numbers of black people in senior positions. For South Africa to be 3 globally and technologically competitive, positive steps must be taken to create diverse, well-trained and multicultural workforce.

Fast tracking of young graduates has been suggested, but herein lies a conundrum: it is only possible to develop capacity if there is sufficient capacity to develop this capacity! Fast tracking can only be a solution if it does not mean reduced experience and, consequently, a reduced level of competence. Alternatively, placing non-engineering staff in engineering management roles results in an inadequate understanding of levels of service, maintenance, systems and finances required.

This document presents statistics and bottlenecks identified from 24 months of detailed research. It seeks to make practical recommendations in terms of education, leaderships, training, coaching and mentoring, as well as suggesting how to attract and retain professionals to develop sufficient civil engineering capacity to unblock bottlenecks”.

6. That the problem in South Africa, in Africa and in the whole world is that we have a decline in the number of civil engineering professionals since the infrastructure development were mostly in the sixties and seventies. The students entering civil engineering field has reduced drastically while the demand is higher in the industry for engineers because they are not being replaced. Hence the education system from primary and then secondary and tertiary levels have to be looked at critically as the rate it is going not enough civil engineers are produced.

7. When projects are looked at to alleviate poverty there are some criteria that needs to be looked at.

a) The amount of money that goes to consultants is about 95% compared to the rest of 5% that is left on the ground, what is done for the people. Therefore new look is needed to see the percentage of funds ends in the community.

b) Sustainability is the other factor. Projects should not be implemented for shorter period and when the experts leave everything collapses. There is a need to include the community, the leaders of the community and the government so that the project is sustainable.

c) Poverty reduction for Small and Medium Enterprises (SME) has proven that there is no skill, no finance and some areas do not even get the daily newspapers so are totally cut off from the rest of the world. Therefore the key is to help the SME’s by transferring skills and finances so that they can stand on their won two feet. It is by bringing technology to the people that situation in the world will change. ES&T is not there only for the rich but also for the poor.

d) Life cycle cost of a project should be looked at and not only capital costs; many projects fail because the maintenance is not catered for in the design of the project.

e) Ask what communities want to do instead of donors or NGO’s or government imposing in what they need. If a community needs roads then they should get a road and not a well for water. This has happened in many projects, and those projects have failed because in the first instance the community did not need them.
8. Communication has improved the lives of our rural community. Pay as you go concept of cell phone in South Africa has reached 34% penetration. Hence it is not the affordability only that should be looked at but the accessibility. Cell phones are accessible everywhere.

9. The cell phone technology has flourished because government was not part of it. Usually government projects tend to be full of policies, regulations and rules tying up creativity. Perhaps government needs to let go on some of the projects so that the industry can compete bringing new ideas to the market. Cell phone technology is demand responsive and not imposed on people. People see it as a fashion as a brand and everyone wants it.

10. Improvement of technology and management systems is important. Without proper management systems technology will fail.

11. Some of the specifications of engineering standards are not applicable to poor people as they are expensive and hence alternative ways of technology should be used which is still safe but less costly. The Engineering Council and the industry is busy to revise some of those specifications, say for example for sanitation.

12. Appropriate Technology – appropriate technology does not mean less quality or 2nd hand. The poor should also be consulted in what their needs are because they are human beings they have feelings like the rich. What is appropriate for the rich is equally appropriate and useful for the poor. Appropriate means fit to the people and the environment. Develop technology for the people not for the “poor”. Market to the poor is the same market to the rich. The poor are the best economists as they know how to manage money. Therefore the attitude people have towards the poor has to change.

13. Lessons learnt from China was that if Engineers are part and parcel of policy making in government there is a lot of development. There are villages being transformed after villages where people’s lives on the ground are changed by using ES&T.

14. There is tendency to think that nobody affords anything – people still buy dry cell batteries for their radios, they buy kerosene for their lamps…. If there is electricity in the rural areas people will be willing to pay as long as it is affordable.

15. Engineers need to collaborate with others such as sociologists, politicians etc. Because of globalization all fields are interrelated and engineers need to be more outgoing and get involved in communities. Technical work is good but it is not anymore enough.

16. Corruption was also mentioned in the forum that if money is used in the right projects then there would be sufficient to fund many projects for the poor. Corruption is everywhere in the NGO’s, in governments, in the private sector etc…. “UK Anti Corruption forum” was introduced.

17. Capacity building – we should start from the early days of childhood to train people to like math and science so that they can become civil engineers in the future. Once students finish university it is good that they go back to their communities this way they can help to alleviate poverty. This process though needs to be managed.

18. Renewable energy was also discussed in depth and that needs to be introduced to rural communities on a bigger scale. Once people have energy power then they can do welding, sewing etc…. bringing economic development.

19. There is a huge gap between research and practical standards. Although research is good but needs to also be done on practical solutions on the ground that are beneficent to the grass roots at the end. Networking and communications was also emphasized that reports, new ideas, etc…should be accessible to engineers in Africa though the Engineers Forum. In 2001 EPA had signed the AEF Protocol. The vision and the Mission of the AEF describe the function of this institution.

Vision: “AEF strives to ensure an appropriate level of efficient human resource capacity in the built environment professions but in particular engineering, to enable Africa to ultimately achieve sustainable development for all the people of Africa”.

Mission: “AEF contributes resources and expertise in partnership with key stakeholders to accomplish the transfer and assimilation of the value of the best practice principles of sustainable development to identified communities at all levels”.

20. ECSA also gave a small presentation, in which the CPD – Continuous Professional Development – was of interest. Now, in South Africa, Engineers must re-register every five years. Namibia is contemplating in introducing this aspect because it is good for the industry and engineers will always keep themselves updated with latest developments in the field.
Conclusion

The Forum was very informative and many lessons were gained. A DVD titled “small is working” was shown that emphasized Technology for Poverty Reduction. UNESCO is willing to fund projects that are viable and can be contacted for those related to alleviation of poverty.

We Engineers have a challenge to advise and assist our governments with policies and planning and to be involved instead of living in our own technical worlds. Globalization and inter relationship of various fields are inevitable and we need to change our thinking with the times.

The outcome of the recommendations and the action plan will be forwarded to us soon, which we will share in due course and will also be published on UNESCO web page.

I thank the Roads Authority and the EPA for sending me to this important forum to represent Namibia and hence I thought to at least contribute to our industry by sharing this information to the EPA members and others so that we Engineers can start making a difference in our society.

References and Quotes: SAICE announcement of the Forum; Numbers and Needs Book.

In this Annual Report, we have hereafter included a copy of a project report written by a promising young engineering entrepreneur, and which was kindly availed to EPA. This project typically represents the engineering spirit that EPA strives to promote among the young generation.
PORTFOLIO

Temperature Control

Windhoek Technical High School
Electricity Project by Craig Anderson 12B
October 2004
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1. Introduction
2. Temperature Control Applications
3. Design Brief and Required Operation
4. Possible Solutions
5. Chosen Solution
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7. Planning
8. Materials List
9. Drawings and Diagrams
10. Building of Project
11. Testing
1 Introduction

All living creatures, plants and organisms have certain temperature ranges in which they thrive and perform best. Take humans, for example: all over the world people perform best in an environment where the ambient temperature is between 20 and 25 °C. Most reptiles can hardly move when the temperature is below 5 °C, while many plants wilt if exposed to temperatures above 30 °C. Life on earth would cease if the sun's warmth did not prevent it from freezing, but in contrast, almost no life is to be found in the areas on earth that receive too much sun.

Even synthetic materials, such as vinyl and plastic, have “temperature windows” in which they can be manufactured and applied, but for living organisms this window is usually much narrower. For some flora and fauna the window can be as narrow as 5 or 10 °C. e.g. moss, lichen and certain fish species.

Most processes occurring on earth have an optimum temperature range of about 2 - 5 °C in which they will perform or occur best. Sometimes the process will happen many times faster at this optimum temperature than at any other temperature. Often, if the temperature is either lower or higher than the optimum, then the process will go wrong or will change into a different process. e.g. some crops will wilt and die instead of ripening.

Therefore, if we want to be more successful in our enterprises, be it farming, manufacturing, medical treatment or many other fields, we must be able to control the temperature accurately and reliably.

2 Temperature Control Applications

Temperature control systems are used extensively throughout the world in numerous different places ranging from farms, factories and supermarkets to hospitals, museums and national archives. Just a few of these applications are discussed below.

CROP HANDLING AND STORAGE

Almost all grains, fruit and vegetables will spoil very soon after harvesting if the temperature is not carefully controlled during handling and storage.
TOBACCO CURING
The drying process for newly harvested tobacco. Various NATURAL CURING methods are performed in widely ventilated barns under natural atmospheric conditions, but require a dry environment (no rain) and plenty of heat from the sun. It takes 6-12 weeks.

FLUE CURING is performed in small, tightly constructed barns with artificial heat beginning at 90 °F and ending round 170 °F; Temperature control is very important. It takes 5-7 days. The name comes from the metal flues used in the heating apparatus.

DAIRY FARMING
Cows produce more milk when the milking barns are temperature controlled. Better quality butter and cheese is also produced when the cows are "happy".

Temperature controlled dryers are used during cheese and butter manufacture.
POULTRY FARMING

The survival rate for newly-hatched chickens is much higher when the temperature of the brooding houses is controlled. Hens also lay more eggs in a temperature controlled environment.

GREENHOUSE PRODUCE

Production of certain vegetables and fruit such as lettuce and tomato can be greatly enhanced when the temperature is controlled in special “hot-houses”.

COTTON/YARN DRYING

The cotton seeds must be carefully dried at temperatures between 300 and 350 ° F. A lower temperature will allow too much moisture to remain, which will result in the ginning machines not being able to remove all the waste material from the seeds. A higher temperature will cause the cotton fibres to lose strength and will ultimately result in a weaker fabric.
INDUSTRIAL MANUFACTURING PROCESSES

During plastic and polystyrene manufacture a reaction occurs, which is a batch process where accurate control of temperature is critical. A deviation of 2 °C can cause the batch to be lost. The optimum deviation for good product quality is less than 0.5 °C. Polystyrene is then extracted from the fluid phase and dried.

PRESERVATION

Important documents, maps, photos, picture films and magnetic tape media must be preserved in archives e.g. The National Archives of Namibia.

Objects, such as dried flowers, plants and stuffed animals must be preserved where they are displayed e.g. museums.

Preservation is best accomplished in a temperature-controlled environment.
3 Design Brief and Required Operation

There are a number of technologies that can be used in temperature control, but one of the most common is electrical engineering. Many different electrical devices are available nowadays for regulating temperature. Common examples are heaters, fans and air conditioners.

However, for many specialised applications, these devices need to be more accurately controlled or linked into a system that can be programmed to operate according to certain conditions.

I think the ideal project would be a device that can be programmed and then connected to a power source, so that it can switch on/off either a heating or cooling device according to the temperature.

The device should be able to measure temperature in a particular location and control heating or cooling equipment in order to maintain a desired temperature range. This control should be accomplished automatically by means of some type of electrical system that incorporates an adjustable thermostat.

It must be able to operate unattended and in all sorts of different locations. It must therefore be portable, reliable and accurate.

The device would be much more versatile if it could be programmed and controlled remotely, perhaps by connection to a computer via cable, modem/telephone line or even a wireless network link.

4 Possible Solutions

As is always the case with technology, there are a number of ways to achieve the required operation. Each possible solution will have pros and cons involving factors such as cost, operational features, availability of spare parts, ease of servicing, adaptability, etc.

Compromises are usually inevitable, but most importantly, the chosen solution must have the versatility to meet the needs of many different temperature control applications without modification or replacement of the hardware.
Possible Solution 1:
Heating/cooling airconditioner

Many different airconditioners that have built-in heating and cooling capability are available today. Most of them even come with infra-red remote control units and can be programmed to maintain a room at a specific temperature.

ADVANTAGES:
- Freely available, commercial “off-the-shelf” product
- Relatively inexpensive
- Easy to maintain and service

DISADVANTAGES:
- Combined heater/cooler that cannot be separated
- Heat generation is only by heater element within main unit and the hot air is blown into the room by fan. It is not possible to generate static heat e.g. by means of energy from an incandescent light bulb situated at the specific location where the heat must be concentrated
- Cooling is only by compressed refrigerator gas within main unit and the cold air is blown into the room by fan. It is not possible to provide cooling by any other means. e.g. water spray
- The temperature measurement/thermostat system is not sufficiently accurate for some applications
- The temperature cannot be measured at a specific sensing location
- The precise points at which the heater is switched on/off and at which the cooler is switched on/off cannot be programmed independently
Possible Solution 2:
Analogue temperature control system
A control unit using analogue electronic circuitry to control separate heating and cooling devices.

ADVANTAGES:
- Relatively simple
- Highly accurate and reliable
- Can be configured to control different heating and cooling devices separately
- Can have external temperature sensor for measurement at a precise location
- Provides independent adjustment for the points at which the heater and cooler will switch on/off

Response curve for a typical analogue or digital temperature control system set for high of 15.1°C and low of 14.9°C

DISADVANTAGES:
- Relatively high cost
- Lacks versatility – hardware has to be modified or replaced in order to satisfy different operational applications
- Programmability is limited to switch settings and adjustable hardware components
- Remote control is much more difficult
- No data display functions
- Repair/servicing can be difficult
Possible Solution 3:
Digital temperature control system

A control unit using digital electronic circuitry to control separate heating and cooling devices.

ADVANTAGES:

- Highly accurate and reliable
- Extremely versatile
- Can be configured to control different heating and cooling devices separately
- Can have external temperature sensor for measurement at a precise location
- Provides independent adjustment for the points at which the heater and cooler will switch on/off
- Fully programmable by PC and appropriate software
- Easy to accomplish remote control via different methods
- Data can be displayed on a digital readout panel

DISADVANTAGES:

- Quite complex circuitry
- Relatively high cost
- Repair/servicing can be difficult and costly

5 Chosen Solution

For my project I chose to build a digital temperature control system because I wanted the unit to be as versatile as possible and I liked the idea of being able to program and control everything from a PC.

The system is designed around the DS1620 chip manufactured by Dallas Semiconductors. This is an 8-pin DIL-package integrated circuit that has built-in temperature sensing, data processing and output control circuitry. It also has some on-board memory so that it can be programmed to function according to certain parameters.

I also chose to use a PIC 16F84 microcontroller that had been pre-programmed to display data from the DS1620 on a 16-character x 2-line LCD panel. This allows the current temperature and humidity to be displayed.

I decided not to use any specific heating and cooling devices, but just to provide standard 3-pin electrical
sockets, so that any device that works with 230VAC can be plugged in and controlled.

6 Specifications

- The device shall operate unattended and automatically
- It shall be small, compact and easily transportable when it is required to be reprogrammed or reconfigured
- It must be easy to use and not have any complicated controls
- It should be cost-effective and affordable
- It should display a sign that warns people that connected 230V devices will start automatically
- Power supply shall be 230VAC via socket on rear panel
- Protection from internal short circuit shall be by 10A fuse located on front panel
- There shall be a power-on indication on the front panel
- A temperature sensor unit shall be connected to the front panel via a flexible cable so that it can measure the temperature in a required location
- The actual temperature at the sensor shall be displayed on the front panel
- The temperature sensor shall operate in the range –55 to +125 °C
- The device shall be programmable by means of a cable connected to a standard IBM-compatible PC
- Remote control, if required for a specific application, shall be possible by means of standard PC hardware
- There shall be two 15A switch sockets accessible at the front, where heating and cooling devices can be plugged in
- Each of the above sockets shall be controlled by a relay with contact rating of at least 15A 230VAC

7 Planning

I planned to start off with the portfolio first and then move over to the practical part later. But, once I started with the portfolio, I soon realised that I needed to test some of the electrical circuitry before continuing with the portfolio. So I proceeded to immediately evaluate my possible solutions. For this, I needed to do a lot of research on the internet.

Once I had decided on the final solution I would set about gathering all the electrical components and all the required tools. I would then solder all the components onto the Veroboard, do some more testing and complete the design.

At this stage I could probably prepare some of the diagrams, such as the overall block diagram, the circuit diagram and the wiring diagram.

After that I would finally ensure that there are no electrical faults and that the device operates correctly in prototype form. Once this was successfully completed, I planned to build the casing, including the front panel plate.

The final stage of practical construction would be to install all the components, boards, modules, etc. into the casing and complete all the interconnection wiring, after which I would do the final testing.

I would then take some photos of the finished unit and be able to concentrate on preparing all the documentation for the portfolio.
8 Materials list
1 x230Vprim 9Vsec transformer (T1)
1 xswitch with built-in NEON indicator (S1)
1 xpanel-mount fuse holder with 10A fuse (F1)
1 x3-pin 230V power socket
4 xdiode 1N4007 (D1; D2; D3; D4)
1 x10µF capacitor (C1)
3 x2.2KΩ resistor (R2; R4; R6)
3 x1KΩ resistor (R1; R3; R5)
3 x100Ω resistor (R7; R8; R9)
3 xLED green, red, yellow (DL1; DL2; DL3)
3 xNPN transistor 3N3053B (TR1; TR2; TR3)
2 x12VDC relay with contacts rated 250VAC 10A (RL1; RL2;)
2 x8-pin relay socket
2 x15A 230VAC 3-pin switch-socket
4 xDB 25-pin connector
2 xDB 9-pin connector
1 xDS1620 IC (IC1)
1 xPIC 16F84 microcontroller board
1 xLCD 16x2 display module
1 xveroboard
1 xcustom PC board for power supply
1 xcustom wooden casing
1 xcustom metal front panel
1 xplastic box for remote temperature sensing
miscellaneous wires, ribbon cables and data cables
miscellaneous screws, nuts, washers, lugs, etc.

9 Drawings and Diagrams
The following drawings indicate basically how the DS1620 chip works.

In the example above, the Th and TI outputs are used to drive transistors, which in turn switch relays that are controlling a fan and a heater according to the program-med temperature thresholds in the DS1620. The supply voltage can even be 230VAC as long as the relays are suitable for switching mains power.
In this example, the Tcom output is being used to switch on a fan when the temperature exceeds the programmed Th level and keep the fan running until the temperature drops below the Tl level.

This is the circuit needed for programming the DS1620 from the parallel port of a PC.

Photo of the chip installed on the PC board.

**Digital Temperature Control System Block Diagram**

1. **POWER SUPPLY** (230VAC)
2. **CONTROL UNIT**
   - Relay outputs
3. **HEATING DEVICE**
4. **COOLING DEVICE**
5. **TEMPERATURE SENSOR**
6. **PC running special software**

Cable connected to PC parallel port
This is the user interface of the software that can be used for programming and monitoring

Digital Temperature Control System Circuit Diagram
10 Building of Project

I started off by first gathering all the required components and placing them temporarily on the veroboard to see if it was of sufficient size. After this, I set about soldering all the components into place and cut the required tracks by using a small drill bit. When this was complete, I did a static test, checked if everything was soldered properly and that there were no short circuits or dry joints. Then I mounted the IC temperature sensing board inside a small plastic box with a vented metal cover and attached the connecting cable. After that, I made up the programming cable with a DB25 connector and a DB9 connector.

Once I was pleased with everything, I connected the power supply and applied power. The circuit operated correctly. I then connected the LCD module and processor board, after which I tested again to make sure that the temperature indication worked.

Next, I had to decide on the size of the casing. I could have built an entirely new box, bought a ready-built unit or just modified an existing casing. After a lot of thinking and looking around at the available options, I chose to modify an existing casing. I found an old faulty guitar amplifier, but the box seemed a bit too big. However, I decided that it would work with some modification. I stripped it and immediately set about measuring the required size. I cut sections out of the sides to shorten the height. I then had to cut new front and rear panels.

It was then time to construct the metal plate on which the connecting sockets, fuse holder, power switch and all the other front panel components would be mounted. The plate was cut from the side of an old computer casing, bent, filed and drilled. After that, I spray-painted the front plate silver and covered the box using black vinyl.

Once I had cut holes for the switch socket out of the front panel and the power socket out of the rear panel, I covered the panels with carpet. Then I put the whole box together and drilled the required holes for mounting the PC boards, relays, transformer, etc. Later, I gathered screws, nuts and spacers and mounted all the internal components. When this was complete, I did several tests to ensure that everything was still working properly. Finally, I used a number of cable ties to fasten all the wires together so that they looked neat and were held safely in place.

Once satisfied, I closed the box to see that everything was neat and again checked that the system still worked. Then I took several photographs to use in my portfolio. Lastly, I printed some labels out and placed them on the box using
sellotape and perspex for those that needed to be attached to the carpeted front panel. After that, the practical part of my project was complete.

11 Testing

First of all I tested to see if my power supply would be capable of supplying enough current to switch the relays. It did, so I knew that my power supply would be sufficient. I then constructed the prototype and carried out a static test without power being connected to see that there were no short circuits, dry joints and that the current would reach its destination. After that, all components were joined together and final tests were done to ensure that all circuits were safe. Once that was complete, I applied power and everything worked as planned.

Once the practical part of the project was complete, I connected it to a PC and did some tests with the software.

It was easy to programme the device and it worked correctly.

After that, I connected a reading lamp to simulate the cooling device and a hairdryer to simulate the heating device. During this test, one of the relays did not switch. After some testing with a multimeter I found that the relay was not faulty, but the problem was as follows:

The relays were rated at 12V and my supply was only 9V. During the first test, when I tested to see if the relays would switch, I used the power supply to power the relays only with no other circuitry being connected, but now the power supply had to power other circuitry. The resistance of the coils in each relay differs slightly, therefore the coil with the most resistance only switched. To counteract this problem, I exchanged the relay for a different one that had slightly more resistance in the coil and the problem was solved.

Everything worked smoothly from then on, so my testing was complete.

Below are some pictures of the unit in operation with the T-low threshold set at 24°C and the T-high threshold set at 25°C. I chose these thresholds because the room temperature was at that time around 22°C and it was easier to warm up the sensor for testing than to cool it down.

Here, the yellow LED has just switched on, indicating that the temperature at the sensor has dropped to the T-low threshold. At the same time the heating device (hairdryer) switched on.
I then used the hairdryer to warm up the sensor and the temperature immediately increased above the T-high threshold. This caused the red and green LEDs to come on, indicating that the temperature was above normal. The cooling device (reading lamp) then switched on, while the hairdryer stopped.

After that, I just waited for the room temperature to cool the sensor down. At exactly 25°C the red LED and the reading lamp switched off, while the green LED remained on to indicate that the temperature was within the normal range.
Appendix: Financial Statements ending February 2006
THE ENGINEERING PROFESSIONS
ASSOCIATION OF NAMIBIA

ANNUAL FINANCIAL STATEMENTS

28 FEBRUARY 2006

Grant Thornton Neuhaus
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Auditor's report to the members 3
Balance sheet 4
Income statement 5
Cash-flow statement 6
Notes to the financial statements 7–8
COUNCIL MEMBERS
S Tekie - President
F Jeske - Vice-President

REGISTERED AND BUSINESS ADDRESS
P O Box 21885
Windhoek
Namibia

COUNCIL’S APPROVAL OF FINANCIAL STATEMENTS

Management is responsible for the preparation, integrity and objectivity of the financial statements and other information contained in this annual report. In order to discharge this responsibility, the association maintains internal accounting and administrative control systems designed to provide reasonable assurance that assets are safeguarded and that transactions are executed and recorded in accordance with the association’s policies and procedures.

The annual financial statements, which appear on pages 4 to 8, were approved by the council members on 6 September 2006 and are signed on their behalf by:

[Signatures]

PRESIDENT

VICE-PRESIDENT

WINDHOEK
REPORT OF THE INDEPENDENT AUDITORS

To the members of

THE ENGINEERING PROFESSIONS ASSOCIATION OF NAMIBIA

We have audited the accompanying balance sheet of The Engineering Professions Association of Namibia at 28 February 2006, and the related statements of income and cash flows for the year then ended. These financial statements are the responsibility of the association's management. Our responsibility is to express an opinion on these financial statements, based on our audit.

Scope

We conducted our audit in accordance with statements of Namibian Auditing Standards. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes:

- examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements,
- assessing the accounting principles used and significant estimates made by management, as well as
- evaluating the overall financial statement presentation.

We believe that our audit provides a reasonable basis for our opinion.

Audit opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of the association at 28 February 2006 and the results of its operations and cashflows for the year then ended in accordance with Namibian generally accepted accounting practice.

GRANT THORNTON NEUHAUS
Registered Accountants and Auditors
Chartered Accountants (Namibia)

WINDHOEK
6 September 2006
THE ENGINEERING PROFESSIONS ASSOCIATION OF NAMIBIA

BALANCE SHEET

AT 28 FEBRUARY

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**ASSETS**

**Non-current assets**

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- Roads Authority Bursary Fund

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**Total assets**

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**FUNDS AND LIABILITIES**

**Funds and reserves**

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**Current liabilities**

**Payables**

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**Total assets**

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<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N$</td>
<td>N$</td>
</tr>
<tr>
<td></td>
<td>225 018</td>
<td>248 375</td>
</tr>
</tbody>
</table>

4
### Income Statement

#### For the Year Ended 28 February

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCOME</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration fees - Roads Authority Bursary Fund</td>
<td>26 039</td>
<td>12 317</td>
</tr>
<tr>
<td>MWTC - Sida Bursary refund</td>
<td>-</td>
<td>491</td>
</tr>
<tr>
<td>Courses and seminars</td>
<td>22 000</td>
<td>360</td>
</tr>
<tr>
<td>Donations</td>
<td>14 000</td>
<td>5 020</td>
</tr>
<tr>
<td>Functions</td>
<td>4 470</td>
<td>5 560</td>
</tr>
<tr>
<td>Interest received</td>
<td>8 718</td>
<td>9 879</td>
</tr>
<tr>
<td>Subscriptions and membership fees</td>
<td>31 125</td>
<td>38 210</td>
</tr>
<tr>
<td><strong>Total Income</strong></td>
<td>106 352</td>
<td>71 837</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(129 709)</th>
<th>(105 779)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXPENDITURE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advertising</td>
<td>990</td>
<td>-</td>
</tr>
<tr>
<td>Audit fees</td>
<td>5 957</td>
<td>4 698</td>
</tr>
<tr>
<td>Bank charges</td>
<td>1 019</td>
<td>174</td>
</tr>
<tr>
<td>Career guidance</td>
<td>2 150</td>
<td>-</td>
</tr>
<tr>
<td>Competition and prizes</td>
<td>10 029</td>
<td>6 338</td>
</tr>
<tr>
<td>Course and seminar expenses</td>
<td>7 240</td>
<td>1 800</td>
</tr>
<tr>
<td>Equipment rental</td>
<td>1 400</td>
<td>400</td>
</tr>
<tr>
<td>Functions</td>
<td>12 896</td>
<td>10 707</td>
</tr>
<tr>
<td>Membership fees written off</td>
<td>8 160</td>
<td>1 600</td>
</tr>
<tr>
<td>Postal expenses</td>
<td>1 021</td>
<td>620</td>
</tr>
<tr>
<td>Printing and stationery</td>
<td>1 281</td>
<td>-</td>
</tr>
<tr>
<td>Secretarial services and salaries</td>
<td>73 200</td>
<td>75 050</td>
</tr>
<tr>
<td>Telephone expenses</td>
<td>4 366</td>
<td>4 392</td>
</tr>
<tr>
<td><strong>Total Expenditure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(23 357)</td>
<td>(33 942)</td>
</tr>
</tbody>
</table>

**DEFICIT** for the year

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACCUMULATED FUNDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- at beginning of the year</td>
<td>224 806</td>
<td>258 748</td>
</tr>
<tr>
<td><strong>ACCUMULATED FUNDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- at end of the year</td>
<td>201 449</td>
<td>224 806</td>
</tr>
</tbody>
</table>
THE ENGINEERING PROFESSIONS ASSOCIATION OF NAMIBIA

CASH-FLOW STATEMENT

FOR THE YEAR ENDED 28 FEBRUARY

<table>
<thead>
<tr>
<th></th>
<th>2006 N$</th>
<th>2005 N$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flows from operating activities:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash receipts from members and customers</td>
<td>112 892</td>
<td>42 601</td>
</tr>
<tr>
<td>Cash paid to suppliers and employees</td>
<td>(129 709)</td>
<td>(105 779)</td>
</tr>
<tr>
<td>Cash (utilised by) operations</td>
<td>(16 817)</td>
<td>(63 178)</td>
</tr>
<tr>
<td>Interest received</td>
<td>8 718</td>
<td>9 879</td>
</tr>
<tr>
<td>Net cash (outflow) from operating activities</td>
<td>(8 099)</td>
<td>(53 299)</td>
</tr>
<tr>
<td>Net movement in cash and cash equivalents</td>
<td>(8 099)</td>
<td>(53 299)</td>
</tr>
</tbody>
</table>

Change in cash and cash equivalents

<table>
<thead>
<tr>
<th></th>
<th>2006 N$</th>
<th>2005 N$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance at beginning of the year</td>
<td>117 209</td>
<td>170 508</td>
</tr>
<tr>
<td>Net movement</td>
<td>(8 099)</td>
<td>(53 299)</td>
</tr>
<tr>
<td>Balance at end of the year</td>
<td>109 110</td>
<td>117 209</td>
</tr>
</tbody>
</table>

The balance comprises:

<table>
<thead>
<tr>
<th></th>
<th>2006 N$</th>
<th>2005 N$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash on hand and at bank</td>
<td>109 110</td>
<td>117 209</td>
</tr>
</tbody>
</table>

NOTE TO THE CASH-FLOW STATEMENT

A. RECONCILIATION OF (DEFICIT) FOR THE YEAR TO CASH (UTILISED BY) OPERATIONS

(Deficit) for the year | (23 357) | (33 942) |

Adjusted for:

• Interest received | (8 718) | (9 879) |

Operating (deficit) before working capital changes | (32 075) | (43 821) |

Working capital changes:

• Decrease/(increase) in receivables | 15 258 | (19 357) |

Cash (utilised by) operations | (16 817) | (63 178) |
1. **ACCOUNTING POLICIES**

The financial statements have been prepared in accordance with Namibian generally accepted accounting practice. The following are the principal accounting policies of the association, which are consistent in all material respects with those applied in the previous year. The financial statements have been prepared on the historical cost basis.

1.1 **Property, plant and equipment**

Property, plant and equipment is depreciated on the straight-line basis at a rate considered appropriate to reduce the book value to estimated residual value over the anticipated useful life of the asset. The rate of depreciation is as follows:

- Furniture and fittings 10 years

1.2 **Financial instruments**

- Initial recognition and measurement:

Financial instruments are recognised when the association becomes a party to the transaction. Initial measurement is at cost, which includes transaction cost. Subsequent to initial recognition, these instruments are measured as follows:

- Financial assets

  The association's principal financial assets are receivables and cash resources.

  Trade and other receivables originated by the association, are stated at fair value of consideration received less provision for doubtful debts.

  Bank balances and cash are measured at fair value.

- Financial liabilities

  Financial liabilities are classified according to the substance of the contractual arrangements entered into.

  Significant financial liabilities consist of trade and other payables, which are stated at their nominal value.

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>N$</td>
<td></td>
<td>N$</td>
</tr>
<tr>
<td>At cost</td>
<td>6 982</td>
<td>6 982</td>
</tr>
<tr>
<td>Accumulated depreciation</td>
<td>(6 981)</td>
<td>(6 981)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### THE ENGINEERING PROFESSIONS ASSOCIATION OF NAMIBIA

### NOTES TO THE FINANCIAL STATEMENTS (Contd)

#### 28 FEBRUARY

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. SUBSCRIPTION FEES IN ARREARS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Membership fees receivable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 1999/2000</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>• 2000/2001</td>
<td>470</td>
<td>1 190</td>
</tr>
<tr>
<td>• 2001/2002</td>
<td>1 080</td>
<td>1 680</td>
</tr>
<tr>
<td>• 2002/2003</td>
<td>710</td>
<td>2 870</td>
</tr>
<tr>
<td>• 2003/2004</td>
<td>1 870</td>
<td>5 230</td>
</tr>
<tr>
<td>• 2004/2005</td>
<td>3 600</td>
<td>7 440</td>
</tr>
<tr>
<td>• 2005/2006</td>
<td>2 545</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>10 435</td>
<td>18 570</td>
</tr>
</tbody>
</table>

#### 4. TRADE RECEIVABLES

**MWTC - Sida Bursary Trust Fund**

<table>
<thead>
<tr>
<th></th>
<th>79 433</th>
<th>79 433</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2002</td>
<td>42 446</td>
<td>42 446</td>
</tr>
<tr>
<td>• 2003</td>
<td>30 827</td>
<td>30 827</td>
</tr>
<tr>
<td>• 2004</td>
<td>6 160</td>
<td>6 160</td>
</tr>
</tbody>
</table>

**Roads Authority Bursary Fund**

<table>
<thead>
<tr>
<th></th>
<th>26 039</th>
<th>33 162</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration fees receivable from the Roads Authority Bursary Fund, calculated at 6.5% of bursary expenses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2003</td>
<td>-</td>
<td>2 140</td>
</tr>
<tr>
<td>• 2004</td>
<td>-</td>
<td>18 705</td>
</tr>
<tr>
<td>• 2005</td>
<td>-</td>
<td>12 317</td>
</tr>
<tr>
<td>• 2006</td>
<td>26 039</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>105 472</td>
<td>112 595</td>
</tr>
</tbody>
</table>

#### 5. PAYABLES

**EPA Bursary Fund Trust**

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 2003</td>
<td>20 814</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2004</td>
<td>8 286</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2005</td>
<td>(5 531)</td>
<td></td>
<td>(5 531)</td>
</tr>
<tr>
<td></td>
<td>23 569</td>
<td>23 569</td>
<td></td>
</tr>
</tbody>
</table>
The Engineering Professions Association of Namibia

The Engineering Professions Association of Namibia is a non-profit, voluntary membership association of engineering and related professionals in Namibia. Since September 1992, EPA has been a member of the Commonwealth Engineering Council, and has since 1995 been associated with the Namibian Institute of Technology (NAMIT).

EPA was originally established by engineers and engineering technicians to ensure both a high degree of professional competence in the engineering profession and protection of the interests of the public. To this end, EPA was instrumental in the promulgation of the Engineering Professions Act of 1986. The Act provides for professional registration in the categories of professional engineer, engineer in training, incorporated engineer and engineering technician in the various disciplines.

The aims of EPA

The Association strives to uphold excellence in the field of engineering by promoting the image, continuing education and common interests of its members.

Engineers, engineering technologists and technicians have traditionally played a major role in Namibia. The excellent infrastructure relating to, among others, transport, power supply, telecommunications and water supply bears ample witness to this statement. With the independence of Namibia, a greater emphasis has been placed on the effective utilisation of scarce resources, the maintenance of existing infrastructure, and sustainable development with due regard to the protection of the environment. The engineering profession has a crucial role to play in this regard.

What has EPA to offer?

EPA promotes the engineering profession through its involvement in activities such as the following:

- promoting technical awareness at school level
- providing study loans/bursaries to engineering students
- maintaining an input into the tertiary education of engineers and technicians
- arranging continuing education courses
- promoting environmental awareness
- maintaining a positive image for the profession
- encouraging awareness of current events in the country
- promoting the common interests of its members through activities such as seminars, conferences, lectures, and others.

Circulars are issued throughout the year to inform members on matters of interest, such as luncheons, seminars, etc.

A highly popular project with a link to international competitions is the annual EPA Young Engineers’ Construction Project. This competition is open to Grade 11 and 12 students of secondary schools throughout Namibia. Students are challenged to build simple but effective model engineering structures according to broad specifications, which allow students’ to exercise their ingenuity in finding the best compliant engineering solution. Apart from sponsored prizes for the best teams and their schools, the winning team is sponsored to participate in the annual Bridge-building Competition of the South African Institution of Civil Engineering, where they compete internationally against winning teams from similar competitions in various countries in Southern Africa.

Membership of EPA

Any engineer, incorporated engineer or engineering technician, who is registered with the Engineering Council of Namibia, is eligible for corporate membership, for which the annual fee currently stands at N$240. An associate membership grade exists for foreign members, graduate members and persons closely involved with the engineering professions who don’t qualify for corporate membership.