PIESA

THE POWER INSTITUTE FOR
EAST & SOUTHERN AFRICA

PIESA 2019

ANNUAL REPORT

The Power Institute for East and Southern Africa (PIESA) is a voluntary regional power utility association established on 28 February 1998. We aim to improve electrification in East and Southern Africa through sharing information, research, technology, skills and experiences for the benefit of customers and suppliers in the electricity distribution industry. The main focus is on technical rationalisation to achieve economies of scale with local manufacturers in an effort to enhance electrification in the region.

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ABOUT THE POWER INSTITUTE FOR EAST AND SOUTHERN AFRICA (PIESA)

The Power Institute for East and Southern Africa (PIESA) is a voluntary regional electricity industry association established in 1998 to facilitate and coordinate the sharing of information and technology in the specialised areas of:

- Technology and engineering support;
- Applied research;
- Standardisation;
- Environmental management; and
- Technical development and training

PIESA aims to be the catalyst for sustainable regional technological cooperation in expanding the electricity distribution industry for regional growth and development by:

- Encouraging participation by all regional electricity distributors and supporting industries;
- Compiling, optimising and maintaining integrated information systems for technology related to the distribution of electricity including technical equipment specifications and codes of practice that are appropriate for the regional environment;
- Providing a mechanism for continuously capturing the experiences of members in order to improve efficiency;
- Encouraging the use of local resources and manufacture of equipment for use in the distribution industry;
- Promoting applied research in areas that are relevant to the effective performance of members;
- Fostering a culture of technology transfer and skills development among the members;
- Developing strategic alliances and partnerships with other related organisations involved in or with the electricity distribution industry.

In a nutshell, PIESA aims to improve electrification in East and Southern Africa through sharing information, research,

technology, skills and experiences for the benefit of customers and suppliers in the electricity distribution industry. The main focus is on technical rationalisation to achieve economies of scale with local manufacturers in an effort to enhance electrification in the region.

Membership is open to electric power utilities in East and Southern Africa, manufacturers, suppliers of equipment, researchers, academic institutions, investors, financiers and other associations who wish to participate in PIESA's activities.

PIESA is governed by a Board of Directors with representatives from each participating utility. The prime responsibility of the Board is to determine the objectives and direction of PIESA.

PIESA's core activities are conducted through its four Board Advisory Committees:

- Electrification
- Non-Technical Loss Reduction
- Environmental and Safety Management
- Standardisation

Members currently include electricity distributors from the following countries: DRCongo, Kenya, Lesotho, Malawi, South Africa, Tanzania, Uganda, Zambia and Zimbabwe.

VISION AND OBJECTIVES

Vision

PIESA's Vision is to be the catalyst for sustainable regional technological cooperation in expanding the Electricity Distribution Industry and stimulating the electrification for regional growth and development.

Principal Objectives

To stimulate the electrification of the region by:

- Broadening Membership - Participation from all regional electricity distributors and supporting industries
- Maintaining a centralised integrated information system for technology related to the distribution of electricity
- Developing mechanisms for the continuous capture of experiences of members to improve efficiencies (feedback loop)
- Encouraging the use of local resources and the manufacture of equipment for use in the distribution industry
- Optimising and harmonising technical equipment specifications and codes of practice for the regional environment
- Promoting applied research in areas that are relevant for the effective performance of the members
- Developing a culture of technology transfer and skills development among members
- Developing strategic alliances and partnerships in research, industry and manufacture and other similar organisations
- Compilation of standards and guidelines with the objective of minimising the impact on the natural environment
- Being flexible to the needs of an evolving Electricity Distribution Industry
- Facilitating dialogue relating to the Electricity Distribution Industry
- Promoting energy efficiency
- Operating, maintaining upgrading and refurbishment of assets cost effectively.
- Promoting occupational health and safety.

MEMBERS OF THE PIESA BOARD

Bukhosi Siso
PIESA board chairman

Vally Padayachee
Executive Officer PIESA Board

Alfred Kaponda
ESCOM – Malawi

Mohlomi Seitlheko
LEC – Lesotho

Refilwe Mokgosi
AMEU - Southern Africa

Simbiso Chimbima
UMEME – Uganda

> PIESA AIMS TO BE THE CATALYST FOR SUSTAINABLE REGIONAL TECHNOLOGICAL COOPERATION IN EXPANDING THE ELECTRICITY DISTRIBUTION INDUSTRY

Benson Muriithi
KPLC – Kenya

Patrick Mwila
Zambia - ZESCO

Greg Tosen
IERE - Chairman

Sophia Mgonja
Tanesco – Tanzania

Sumaya Nassiep
Eskom - South Africa

CHAIRMAN'S REVIEW

Engineer Bukhosi Siso

BSc (Elect), MSc, MBA, CEng, FzweIE, MIET, MistLM
Chairperson of The PIESA Board

The 2018-19 period for me personally marks the end of my term as PIESA chairman. My heartfelt thanks for the support that I received during my term as Board Chairman, from my colleagues in the Board, the working groups and the secretariat. I will officially vacate my office at the PIESA Board meeting to be held this year at Sun City, South Africa in October 2019.

The Power Institute for East and Southern Africa (PIESA) is delighted and excited to co-host with IERE the 2019 General Meeting and PIESA-IERE South Africa Forum (Forum) to be held at the magnificent Sun City Resort located in the North West Province in the Republic of South Africa from October 28-31 October 2019.

We note that the theme of the Sun City joint PIESA IERE conference, "Electricity & the 4th Industrial Revolution – an Africa perspective" chosen for the Forum will generate excellent papers, presentations and discussions that will contribute to addressing the challenges as alluded to in the aforementioned.

The electricity utility sector in particular is also being and still going to be impacted by the fourth industrial revolution ("4IR") in the years ahead so much so that the majority of them will have to rethink their business models to remain inter alia viable. Unlike the first (1IR), second (2IR) and third (3IR) industrial revolutions the impact of the fourth industrial revolution (4IR) is going to be astronomical to say the least. PIESA will be focusing on 4IR emerging technologies especially to stimulate and accelerate electrification in PIESA member countries for growth and development.

As PIESA moves into a new cycle of events, I note the expectation for several exciting and very relevant activities, such as:

- Renewable Energy project
- Asset management
- Closer liaison and cooperation with the academic community for introducing innovations for Electrification planning, and distributed generation, as well as continuing with the identification of appropriate standards for electrification.

> THE ELECTRICITY UTILITY SECTOR IN PARTICULAR IS ALSO BEING AND STILL GOING TO BE IMPACTED BY THE FOURTH INDUSTRIAL REVOLUTION ("4IR") IN THE YEARS AHEAD SO MUCH SO THAT THE MAJORITY OF THEM WILL HAVE TO RETHINK THEIR BUSINESS MODELS TO REMAIN INTER ALIA VIABLE.

The challenge of electrification is a pan-African one, and I am sure the work being done in PIESA to identify and promote appropriate standards will be a valuable input to the work of AFSEC. Through such cooperation maybe some of us will see that day when we achieve universal access to electricity of all people in Africa. We know it is a huge challenge, but do not give up!

PIESA's aim to facilitate and promote electrification in the regions has not changed. It's common knowledge that access to electricity has been a serious challenge in Africa and still continues to be a serious challenge. As previously reported, 600 million Africans are not connected to an electrical network. Businesses in most countries in Africa cite access to electricity amongst the two most severe constraints on their operations and business.

The ability and capability of PIESA member countries to raise adequate funding to rollout new and much needed infrastructure is still a serious problem. Backlogs in respect of maintenance and refurbishment of essential power supply and power delivery infrastructure still continue to plague the sector that PIESA operates in.

We also want to acknowledge and recognise the Top 20 "emerging technologies" and Top 5 "fringe technologies" as identified by IERE in its excellent "IERE TECHNOLOGY FORESIGHT 2020 REPORT". We will factor the findings of this Report into PIESA's strategies and planning where possible.

I now hand over the baton to the incoming Board chairman and trust that he will receive the same level of cooperation and commitment as I did from the PIESA membership. I would also like to take this opportunity to express my sincere thanks and appreciation to the PIESA Secretariat team for all their support and assistance to me in particular during my term as Chairman.

FROM THE DESK OF THE EXECUTIVE OFFICER

Vally Padayachee

CD (SA); FInstD; FIRMSA; MBA; MSc (Eng);
PIESA Executive Officer

THE POWER INSTITUTE FOR EAST AND SOUTHERN AFRICA (PIESA) EXECUTIVE OFFICER'S REPORT 2019

It gives me great pleasure to once again write my third report as the Executive Officer of PIESA. The year 2019 flew by for PIESA in a flurry of activity.

Looking back on the year under review, the working groups were reasonably active right from the outset with meetings that took place in Cape Town, South Africa to coincide with the African Utility Week conferences, followed by a Board meeting in Cape Town.

The review period has been one of numerous challenges that continue to impact on power service delivery and expanding electrification.

PIESA is still working very hard at maintaining external stakeholder relationships, which include executive membership of The International Electricity Research Exchange (IERE) and affiliate membership.

We are pleased that PIESA will be delighted and excited to co-host with IERE the 2019 General Meeting and PIESA-IERE South Africa Forum (Forum) to be held at the magnificent Sun City Resort located in the North West Province in the Republic of South Africa from 28-31 October 2019. The theme of the joint PIESA-IERE conference, is "Electricity & the 4th Industrial Revolution – an Africa perspective."

The electricity utility sector is still being and still going to be impacted by the fourth industrial revolution in the years ahead so much so that the majority of them will have to rethink their business models to remain inter alia viable.

PIESA will, going forward, focus on 4IR emerging technologies to stimulate and accelerate electrification in PIESA member countries for growth and development.

It is common knowledge that the sector that we as a PIESA operate in has been plagued by several challenges and problems, including the provision and increasing access to electrical energy to the entire population, eventually. The focus on further electrification will still be a priority; increases in technical and non-technical losses; increasing ingress of renewables, especially distributed energy in the energy mix, theft and vandalism.

> PIESA WILL CONTINUE TO EXPLORE THE POSSIBILITY OF INSTITUTING NATIONAL FRAMEWORK CONTRACTS FOR PROCURING RELEVANT EQUIPMENT AND SERVICE SIMILAR TO THE RECENTLY INTRODUCED SOUTH AFRICAN MISA NATIONAL FRAMEWORK CONTRACTS.

As the PIESA, we will still continue to focus our strategies, projects, etc including the following:

1. Training and development
2. Cost effective renewable technologies
3. Block chains (NOT bitcoins) but focus on smart contracts, etc
4. Microgrids

We still continue to be grateful to IERE for continuing to provide PIESA with much needed funding for key projects and initiatives. In this regard plans are afoot to utilise IERE funding to sponsor relevant training and development for PIESA delegates.

In furtherance a successful joint two-day PIESA-IERE utility management course was held in Johannesburg in February 2019.

PIESA will continue to focus on sharing case studies, knowledge and information among its members and to explore and investigate ways of introducing eLearning in respect of training, development and mentoring of especially technical and engineering professionals and other resources at its member utilities.

PIESA will continue to explore the possibility of instituting national framework contracts for procuring relevant equipment and service similar to the recently introduced South African MISA national framework contracts.

Standardisation continues to also be a key focus for PIESA especially from a perspective of improving service delivery and fast-tracking electrification rollout.

As reported previously, a major challenge that is looming is the TID 2024 rollover challenges associated with STS type prepayment meters. Just to recap a unique token identifier (TID) is calculated and coded into the token every time a token is created at the POS. The meter records the TID when the token is entered into the meter - this prevents token replay. The TID is currently calculated as the number of minutes that have elapsed since a base date of 1993. The TID has a limited range of 31.9 years. In November 2024 the TID will reset (roll over) to zero. Any new tokens after this date will not be accepted by the meter as the meter will consider these as being “OLD”. The remedy is to clear the meter’s memory of previously accepted TIDs and to change the meter’s cryptographic key at the same time in order to prevent token replay.

There is an appreciation that the existing and traditional business model by utilities of selling energy (kWh) is no longer proving to be a viable business model - PIESA is also looking in a very prudent manner at other more viable business models. The latter approach is gaining reasonable acceleration given the increasing ingress of distributed generation for self-generation or own use by certain customers.

PIESA has been and will also be giving increased focus to increasing its membership base especially the affiliate’s membership.

I also want to take this opportunity of thanking the members of the Board of Directors for their continued leadership and stewardship of PIESA, the PIESA Secretariat and all the other members of PIESA and especially those that have assisted in keeping the PIESA ship afloat during the past year under review. I want to also say a very special thank you to our outgoing Chairman Eng. Bukhosi Siso for his superb leadership and stewardship of PIESA during his term as Chairman.

ADVISORY GROUP REVIEWS

PIESA Advisory Groups are to function as forums where members and technology partners can meet and discuss pertinent issues and agree on regional strategies and actions. Each Advisory Group will have a Chairperson to act as the convener, and be responsible, in conjunction with the PIESA Secretariat to call the meetings and set the agenda. A Deputy Chair is to provide continuity in the event of absence of the Chair from a meeting and a Secretary to provide an administration service for the Advisory Group such as agenda and minutes of meetings.

Each Advisory Group will also have a 'sponsor member' who will have a particular interest in the terms of reference of the particular Advisory Committee. This 'Sponsor' shall be a member of the PIESA Board, and will be responsible to liaise between the Board and the Advisory Group and convey specific requests for agenda items from the board.

Pursuant to giving effect to the above four advisory groups have been established as follows:

1. Standardisation
2. Electrification
3. Revenue Protection (Non-technical loss reduction)
4. Environmental and Safety management

The participants are mandated by their corresponding utilities and a chairman is appointed to each Advisory Committees by the PIESA Board. The Advisory Committees delegate strategies and executable projects to any or all of the four services secretariats. Information flow and committee administration conducted by an operations manager situated in the general administration secretariat.

In particular, terms of reference for the Advisory Committees would be to inter alia:

1. Meet on a regular basis,
2. Identify pertinent subjects,
3. Debate and exchange information,
4. Network with each other,
5. Develop regional plans, strategies and initiatives,
6. Share experiences and best practices,

The following reflects some of the major achievements of each of the aforementioned Advisory Groups during the ensuing financial year:

1. ELECTRIFICATION ADVISORY GROUP

a. Attendance of members to meetings of this Group was also poor

b. A major achievement was the approval by the PIESA Board of the definition of access to electrical energy

c. The definition that was approved by the PIESA Board was the following;

i. "Access to electrical energy is the ability to avail energy that is adequate, available when needed, reliable, of good quality, affordable, legal, convenient, healthy & safe, for all required energy services across household, productive and community uses inclusive of a minimum 20 Amps energised power supply in every household (based on WORLD BANK (ESMAP) (latest version)"

ii. Noting also that energy services includes lighting, cooking, space heating, water heating, cell phone charging, etc

iii. 20 Amps power supply covers the following typical appliances i.e. radio + lights + television + fridge and one of the following at any one time : (iron + double hotplate) or (kettle + single bar heater) or (iron + two bar heater) or small geyser

d. This Advisory Group is also investigating the pros and cons of strategic purchasing and group sourcing of material, for the benefit of PIESA member countries based on value adding experience from other countries

e. The PIESA member Utilities are encouraged to implement the electrification related projects in their respective countries, which have been tried and tested by the other PIESA countries

f The Electrification Advisory Group also coordinates the sharing of electrification statistics of member countries among the member countries

g. The Electrification Advisory Group will continue with the following initiatives;

i. To share the strategies of other advisory or working groups on the document portal.

ii. To survey members on their electrification %, based on the Board's acceptance of the revised access to electrical energy definition

iii. To explore ways and means to assist member countries to rollout electrification infrastructure much quicker

iv. To assist member countries to raise much needed funding to rollout electrification infrastructure

v. To explore alternative business models given that the current model of selling electrical energy (kWh) is proving to be no longer viable for most member utilities

vi. To investigate the further incorporation of cost effective renewable energy technologies in the energy mix.

vii. Formalising an electrification partnership with POWER AFRICA

viii. To investigate and rollout smart technologies, smart grids, etc with a view to improving service delivery

ix. Significant attention is being paid to training, development and mentoring initiatives especially with respect to the upskilling of personnel especially technical, engineering and leadership personnel

2. THE ENVIRONMENTAL AND SAFETY MANAGEMENT ADVISORY GROUP

a. Attendance of members to meetings of this Group was also poor

b. There was a need to raise the profile of environmental and safety in the various utilities

c. The Advisory Group resolved that to improve the safety and environment culture in utilities, it is also important to briefly discuss important and relevant safety and environmental issues that would benefit the attendees

d. A wayleave guideline has been prepared and circulated to members – still to be finalised

e. The aspect of encroachments was still a cause for concern and requires further investigation to provide relief

f. With respect to Practical Environmental & Social Impact Assessment (ESIA)

Eskom will arrange ESIA presentation and site visit.

g. Training:

i. ZESA will put together a 3 day safety training programme for supervisors. It was also agreed that there should be a site visit and a competency test on the third day of the training.

ii. The relevant local legislative requirement must be included in the training

> THE PARTICIPANTS ARE MANDATED BY THEIR CORRESPONDING UTILITIES AND A CHAIRMAN IS APPOINTED TO EACH ADVISORY COMMITTEES BY THE PIESA BOARD.

iii. The cost of the trainer's travel, accommodation and meals will be funded by PIESA.

iv. The pilot utility will be ESCOM (Malawi) who will host and arrange the local logistics.

h. The Advisory Group suggested that each utility should submit a PCB inventory and provided a template to be used which was circulated to all members. The PCB template was workshopped and forwarded to all to populate

i. The Endangered Wildlife Trust (EWT) did a presentation on animal interactions with electricity infrastructure and the various solutions implemented at Eskom and tested to minimise the injury or mortalities of especially birds. Utilities were invited to contact EWT for advice and training relating to animal interactions with powerlines.

3. THE REVENUE PROTECTION ADVISORY GROUP

a. The Advisory Group suggested that the Electrification Advisory Group address the issue about the IPP matters

b. Investigating the construction of a 400kV line from Mozambique

c. The Advisory Group noted that various utilities in South Africa are busy with smart meter pilot projects

d. eThekwini Municipality in SA agreed to forward information regarding their smart metering projects successes and challenges to the committee before the next meeting.

e. Landis & Gyr (Mr Lawrence Juku) to draft a white paper on MD prepaid metering technology

f. NRS 049/2 completed and circulated and to commission standards committee to localise. Issues of prepayment is key. Utilities to study and adopt.

g. Landis & Gyr (Mr Lawrence Juku) to prepare and circulate a white paper on the MD meter technology

h. The Advisory Group resolved to create a PIESA user group for sharing pilot programme information

4. THE STANDARDISATION ADVISORY GROUP

a. To survey members for their standards used for common procurements using the updated list of procurement items drafted in Malawi end October 2016,

b. AFSEC members have the opportunity to comment on new IEC standards and/or comment on proposed changes to existing standards. In order to do so member countries in Africa must organize themselves effectively to be able to have meaningful influence to changes in IEC documents.

c. Technical cooperation agreement between SADCSTAN and PIESA - the agreement is still in place and binding between the two organizations

d. All member countries are to present a list of commonly used PIESA standards for the purposes of Procurement

e. A catalogue of all PIESA standards to be published and made available

MEMBERSHIP CATEGORIES AND ELIGIBILITY

Membership of PIESA is open to the electricity industry. The number of members from time to time shall not be limited, but shall at no time be less than five (5). Membership may not be assigned or transferred to any other person, company or concern.

Membership of PIESA is open to the electricity industry. The number of members from time to time shall not be limited, but shall at no time be less than five (5). Membership may not be assigned or transferred to any other person, company or concern.

Membership is obtained by paying the prescribed contributions as stipulated in Article 14.2 following the acceptance by the PIESA Board of the applicationfor membership.

PIESA has the following categories of membership: Full Members are organisations that:

(a) Generate, transmit, distribute or buy and sell electricity; or

(b) Represent an organisation contemplated in (a).

Coordinate with like-minded organisations e.g. SADCSTAN, UPDEA towards the common goal of harmonised standards;

Participate in training activities, exchange programmes and development projects;

Participate in regional workshops and conferences, and network with strategic decision-makers in the electricity industry;

Provide opportunities for market growth and economies of scale for regional manufacturers and suppliers of equipment and services.

Affiliate Members are organisations or individuals with an allied interest to PIESA, and would include, inter alia, manufacturers and suppliers of services or equipment to the electricity distribution industry, researchers, consultants and financiers.

BENEFITS TO MEMBERS INCLUDE:

Access to and participation in the development of standards for the electricity distribution sector;

Sharing of information, technology and skills and, in particular, experiences gained from pilot projects and implementation of new technologies, and local solutions to recurrent problems experienced in the region;

Network with like-minded organisations, joint research activities and access to information from international research organisations e.g. IERE, EPRI, SAPURAB;

Influence the development of standard specifications appropriate for the region through active involvement in the Advisory Commitee;

MEMBERS

- AMEU - Association of Municipal Electricity Utilities (Southern Africa)
- ESCOM - Electricity Supply Commission of Malawi
- KPLC - Kenya Power and Lighting Company
- ESKOM - South African electricity supply company
- LEC - Lesotho Electricity Company
- SNEL - Société Nationale d'Électricité
- TANESCO - Tanzania Electric Supply Company Limited
- UMEME - Umeme Company Limited
- ZESA – Zimbabwe Electricity Supply Authority
- ZESCO - Zambia Electricity Supply Corporation Limited

AFFILIATE MEMBERS

- Aberdare Cables
- Circuit Breaker Industries
- Hi-Tech Transformers Maintenance
- Linegear
- Landis + Gyr (Pty) Ltd
- Lucy Electric South Africa
- Metal Frabicators - Zambia PLC
- Powertech Transformers
- Reinhausen South Africa
- Schneider Electric
- Siemens Southern Africa
- TE Connectivity
- ZEST WEG Group

FINANCIAL STATEMENTS

APPROVAL OF THE BOARD

The financial statements set out on the following two pages.

The Board are responsible for the preparation and fair presentation of the financial statements of The Power Institute for East and Southern Africa, comprising the statement of financial position at 28 February 2017, and the statement of comprehensive income for the year then ended, and the notes to the financial statements which include the basis of accounting and other explanatory notes, as set out in the audited statements.

The Board are also responsible for such internal control as the Board determines in necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error, and for maintaining adequate accounting records and an efficient system of risk management.

The Board have made an assessment of the ability of the association to continue as a going concern and have no reason to believe that the business will not be a going concern in the year ahead.

The auditor is responsible for reporting on whether the financial statements are fairly presented in accordance with the basis of accounting described in the financial statements.

Approval of financial statements

The financial statements of the Power Institute for East and Southern Africa, as identified in the first paragraph, were approved by the Board and signed by

_____

Chairperson

STATEMENT OF FINANCIAL POSITION

Balance Sheet as at 28 February 2019

	Notes	2019 R	2018 R
Assets			
Current assets			
Trade and other receivable	1	880 997	248 435
Cash and cash equivalents	2	238 097	1 205 241
Total assets		**1 119 094**	**1 453 676**
Equity and liabilities			
Equity			
Retained income		878 350	1 131 901
Current liabilities			
Trade and other payables	3	241 840	322 871
Total accumulated surplus and liabilities		**1 120 190**	**1 454 722**

STATEMENT OF COMPREHENSIVE INCOME

Balance Sheet as at 28 February 2019

	Note(s)	2018 R	2018 R
Revenue			
Sponsorships		-	130 944
Membership dues		1 167 360	1 447 842
		1 167 360	**1 578 786**
Other income			
Interest received		48 740	24 328
Total income		1 216 100	1 603 114
Expenditure			
Annual report		11 313	12 586
Auditors' remuneration		21 700	31 320
Auditors' remuneration - prior year		-	7 180
Bank charges		6 548	8 499
Conference venue and meeting costs		21 978	8 938
Secretariat - International travel		22 465	-
Secretariat fees - local travel and venue costs		148 787	-
Training Workshop		102 630	-
Printing and stationery		3 828	4 460
Secretariat fees		1 043 844	1 092 825
Subscriptions		73 937	81 681
Travel and accommodation		-	-
Website and communication costs		12 621	11 204
		1 469 651	1 258 693
Net (loss)/ profit for the year		**(253 551)**	344 421
Retained income from prior year		**1 131 901**	787 480
Retained income at the end of the year		**878 350**	1 131 901

STATEMENT OF COMPREHENSIVE INCOME

Notes to the Annual Financial Statements

	2019 R	2018 R
1. Trade and other receivables		
IERE Membership	27 656	73 937
Accrued membership dues	674 116	-
VAT	179 225	174 498
	880 997	**248 435**
2. Cash and cash equivalents		
Cash and cash equivalents consist of:		
ABSA Call account	158 107	727 095
ABSA Money Market account	79 990	478 146
	238 097	**1 205 241**

The Money Market account is interest bearing and carries interest at 7.25% (2018; 7.56%

3. Trade and other payables		
Harris Dowden & Fontaine	26 350	31 000
Refund due to Eskom	-	62 019
Education fund	32 804	32 804
Membership fees received in advance	182 686	197 048
	241 840	**322 871**

4. Taxation

No taxation is provided as the Association is at present exempt from tax in terms of Section 10(1)(d)(iv)(bb) of the Income Tax Act.

IERE TECHNOLOGY FORESIGHT 2020

TOP 20 EMERGING TECHNOLOGIES & TOP 5 FRINGE TECHNOLOGIES

We want and need to acknowledge at the very outset that the information contained in this article has been fully extracted from The International Electric Research Exchange ("IERE") Technology Foresight 2020 Report that was compiled by FROST & SULLIVAN on behalf of IERE (and its membership).

The International Electric Research Exchange ("IERE"), was established in October 1968. With the leadership of the 4 founding members (EPRI, UNIPEDE, CEA and Japan IERE Council), IERE has been promoting information exchange on R&D and cooperative activities among the leading electric utilities of the world for mutual benefit.

PIESA has been the recipient of grant funding from IERE for a number of projects undertaken by PIESA in the last few years. PIESA is indeed grateful to IERE for so kindly making this funding accessible to PIESA to execute the said projects

For the purpose of this Technology Foresight 2020, the following definitions for "Emerging Technologies" and "Fringe Technologies" were adopted.

Emerging Technologies are new or alternative technologies increasingly adopted by the energy industry, where only emerging technologies that have been commercialized were considered.

Fringe Technologies are technologies considered to have remote possibilities, but could potentially disrupt the energy industry. "BLACK SWAN" technologies are acknowledged as being of increasing importance.

The selection of the Top 20 Emerging Technologies was selected based on the highest votes as received during the IERE Member Survey. However, the sequence of the Top 20 Emerging Technologies and Top 5 Fringe were primarily influenced by two factors; a) Potential for Market Transformation, and b) Likelihood to Impact Industry in 3 to 5 Years (for Top 20 Emerging Technologies), OR 10 years (for Top 5 Fringe).

"The power system is changing at an exponential pace into a highly interconnected, complex, and interactive network of power systems, telecommunications, the Internet, and electronic commerce applications. Virtually every element of the power system will need to incorporate sensors, communications and computational ability.

No longer will society depend primarily on central station power and one-way flow on the grid, since the use of distributed generation, distributed energy storage and smart cities will proliferate. At the same time, the move towards competitive electricity markets requires a much more sophisticated infrastructure for supporting the myriad of informational, financial, and physical transactions between the several members of the electricity value chain that supplements or replaces the vertically integrated utility. Thus the rise of the "utility of the future" is upon us and thus requires a fundamental shift in our current thinking.

The IERE, a non-profit organization, serving the electricity industry across the world as a "global platform" of information exchange and collaboration in electricity technology research, development, demonstration, and deployment (RDD&D).

In particular, IERE has three organizational missions:

- Evaluate innovative and emerging technologies and their implementation
- Help establish corporate strategy related to R&D under changing business climate
- Facilitate technology transfer from developed economies to developing economies

There are many factors driving the rapid changes in the worldwide electric industry today. Increased presence of nonconventional energy sources, advancement

of utility grid operations technologies, and further penetration of enabling technologies that support demand-side resources are just few such examples. As an industry-leading organization with global and world-class expertise in supporting and promoting technology innovations in the global electric industry, IERE is in a strong position to provide thought leadership on technology solutions that could shape the future trajectory of the industry.

To this end, the IERE has undertaken a study in which a complete market survey and developed profiles of critical technologies that formed the foundation for our Technology Foresight 2020 report. The objectives for this report include:

- Present the groups of technologies that IERE members identify as critical for the coming decades and addressing climate change
- Provide background information on the selected technologies (costs, development status, etc.)
- Provide information on IERE members' experts and projects related to these technologies" [Greg Tosen, Chairman IERE and PIESA Board Member]

TOP 20 EMERGING TECHNOLOGIES

1. Prosumer Technologies

Prosumer technologies are technologies that enable end users to become both consumers and producers of energy. Prosumerism enables consumers to have greater control to choose where, how, and when energy is generated for their consumption.

2. Energy Storage Devices

Energy storage systems store electrical energy in the form of chemical, mechanical, or electrical energy.

3. Big Data Applications

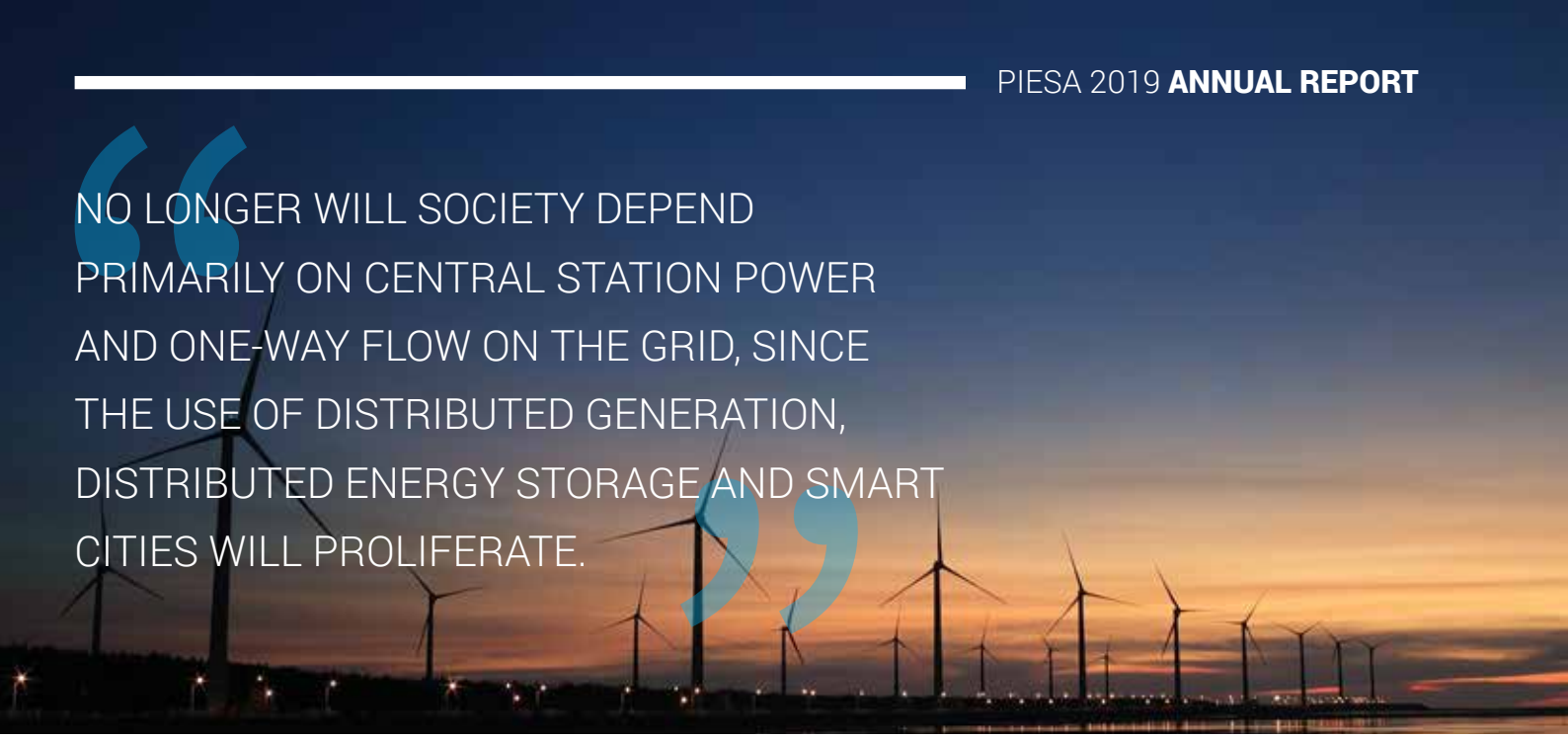
Big Data analytics refers to a set of data management tools, applications, and techniques for effective analysis of big datasets so as to derive intelligence on business operations and customer interactions.

4. Renewable and Distributed Generation

In distributed generation ("DG"), power is generated using small-scale systems sited close to the point of use. DG depends mostly on renewable sources, such as solar, and cogeneration technology, to provide secure and reliable power supply. However, the size of the DG unit is not clearly defined. All generation units installed privately in home and private premises, with the maximum generation capability ranging from 50 to 100 MW, are called DG by the International Council on Large Electric Systems ("CIGRE")

5. Climate Modelling

Climate modelling involves computer-based tools to predict climate behaviour, for instance, possibilities of extreme climate (drought and monsoon), or response of clouds and circulation systems to changes in temperature.



6. Smart Grid

A smart grid is an intelligent grid that can be monitored and controlled by combining automation, communication, and data processing technologies.

7. Wireless Sensors

Wireless sensors are spatially distributed autonomous sensors, mostly battery operated, which are used to monitor three core aspects of the power industry, that is, generation, distribution, and consumption. They play a significant role in increasing the efficiency of the grid by monitoring large areas at low range and low cost.

8. Internet of Things ("IoT")

The Internet-of-Things ("IoT") describes technologies that facilitate the linking of sensors, controllers, sensors, and persons over the Internet. An important criterion for a device to become a part of IoT is that it should be assigned an IP address.

9. Electric, Hybrid & Fuel Cell Vehicles

An electric vehicle (EV) is a type of vehicle that utilizes electricity to drive a motor to propel it forward. Electricity is generated either from a battery or fuel cell, most likely operated with hydrogen

10. Lithium-ion Battery

Lithium-ion batteries store electrical energy in the chemical form for later use through electrochemical reactions. They are tremendously popular as power sources for many electronic devices, as they are compact and deliver high power density and high energy density.

11. Smart X

Smart and connected devices play a dominant role in a myriad of applications and technical developments, such as smart grids, connected health, Internet of Things (IoT), and smart homes. They help in collecting data, monitoring, and automating any environment in a seamless way. The Smart X solutions, which include smart cities, smart energy, smart meters, and utilities like thermostats, help to collect and transmit information to a central control unit.

12. Water Resource Planning

Integrated Water Resource Planning (IWRP) is defined as a holistic approach to the management of water systems, which combines water supply, water demand, water quality, environmental protection and enhancement, rate structures, financial planning, and public participation

13. Water Recovery and Reuse

Power plants consume significant amounts of water. The various types of wastewater released from a thermal power plant are cooling tower make-up, boiler feed water, condensate polishing and filtration, cooling tower side stream, cooling tower blowdown, flue gas desulfurization (FGD) wastewater, and dry ash pond effluent.

14. Grid and Home Cybersecurity

Electrical systems are evolving to be more cyber physical in nature. Even the traditional grid has industrial control systems installed for remote monitoring and data collection, where this feature is getting more sophisticated by the day. Hence the need for a better system to secure the data and information generated is also growing.

15. Offshore Wind Energy

Offshore wind energy is preferred for more continuous and higher power generation, compared to conventional land-based systems. The presence of stronger and more reliable winds and flow patterns makes them a better choice and helps in achieving more annual full load hours compared to onshore wind farms.

16. Carbon Capture, Utilization & Storage

The carbon capture, utilization, and storage (CCUS) process involves the capture of anthropogenic carbon emissions from the waste gas released from large stationary point sources before the gas is released back into the atmosphere. The carbon dioxide (CO2) can subsequently be stored or converted later into valuable products such as chemicals or fuels. This method is part of the CO2 point removal process

17. Hydrogen Energy Storage

Hydrogen energy storage is intended to store surplus electricity either from renewable or non-renewable power generation in the form of hydrogen gas, which can be used directly either in a fuel cell or in a hydrogen gas turbine, when the need for electricity arises.

18. Hybrid Energy Systems

Hybrid renewable energy systems combine more than one renewable energy resource, such as biomass, geothermal, hydropower, solar, and wind to balance energy generation, articularly for areas that are far away from electrical grids. These systems can then be augmented by fossil fuelled generators to ensure electrical production. Another important component for hybrid renewable energy is energy storage, in order to balance out intermittency of the generation.

19. Nuclear Power Gen III+

Generation III reactors have improvements over Generation II reactors in terms of thermal efficiency, modularization, and fuel technologies. The main differentiation in terms of function design and operation between the previous generations and the Generation III+ reactors include better design in terms of simplicity and ruggedness, better safety measures that require minimal active control and manual intervention, and reduced chances of reactor core melting.

20. Virtual Power Plant

A Virtual Power Plant (VPP) brings together a number of power sources, distributed, storage and conventional, and also communication and control technologies together to ensure reliable power supply. The major differences between distributed power generation and Virtual Power Plants (VPPs) are the interlinking of sources and better demand management in the latter case.

TOP 5 FRINGE TECHNOLOGIES

1. Artificial Intelligence

Artificial Intelligence (AI) is focused on developing humanlike cognitive capabilities such as learning, reasoning, problem solving, planning, and self-correction for machines to enable them to perform cognitive functions efficiently.

2. DC Grid

The three main components of DC (direct current) grids in the future would be solar panels and solar farms, energy storage systems, and the integration of electric vehicles (EVs). The output for the first two components would be DC power while the power required to charge EVs would be DC. The main function of the DC grid is to enable the deployment of solar solutions such as rooftop, building integrated photovoltaics (BIPV), and solar farms. This infrastructure would also come handy in regions where the adoption of EVs is high.

3. Advanced PV

Development of advanced photovoltaic (PV) is taking two different routes, either 1) the low-cost, lightweight, transparent, and flexible route, mainly by using different materials or increasing the efficiency, or via 2) advanced silicon-based solar cells.

4. Advanced Nuclear

For the purpose of this review, advanced nuclear technology refers to Generation IV (Gen IV) reactors, small modular reactors (considered to be Generation III+, and typically below 300 MW) and nuclear fusion. The first two systems refer to nuclear fission processes while the latter refers to the nuclear fusion process. All three technologies refer to generation of electricity from a controlled thermonuclear process, where the released energy from the thermonuclear process is used to generate electricity.

5. Artificial Photosynthesis

Artificial photosynthesis is a process, which mimics natural photosynthesis, where fuels and chemicals are produced using carbon dioxide, water, and sunlight. It is used to refer any process that captures and stores energy from sunlight in chemical bonds of a fuel.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