



# SAIW and South Africa's National Welding Capability (NWC) and their significance to the UN Sustainable Development Goals (SDGs)

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## About Us

The Southern African Institute of Welding (SAIW) is a non-profit technical organisation dedicated to the implementation of standards and training in welded fabrication and related technologies to ensure the reliability and integrity of welded equipment for the safety of personnel and plant to furthering standards in welding-fabrication and related technologies. Established in 1948, it is a founder member of the International Institute of Welding (IIW).

SAIW provides training programmes, consultancy and industry support services. Based in Johannesburg, with branches in Cape Town and Durban, we are active throughout Africa and further afield, such as the Indian Ocean Islands and the Middle East.

SAIW has offered training courses for more than 40 years and SAIW qualifications and certifications have long been regarded as the industry standard in South Africa and also enjoy international recognition.

An IIW Authorised Nominated Body (ANB) since 2003, SAIW offers the full range of IIW qualifications - Engineer, Technologist, Specialist, Practitioner, Welder and Inspector. We also have strong affiliations with leading training organisations such as the Universities of the Witwatersrand and Pretoria.

SAIW also has an ISO 17025 accredited laboratory that is fully equipped to perform mechanical and non-destructive testing on welded samples to assess welder performance or procedure qualification. The materials testing laboratory also supports the consulting services offered by SAIW.

To ensure that it complies with the appropriate accreditations, SAIW Certification has also been approved as an IIW Authorised Nominated Body for Company Certification (ANBCC) and IIW Authorised Nominated Body (ANB) for the qualification of international welding engineers, technologists, specialists, practitioners, inspectors and international welders.

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# Introduction

The Southern African Institute of Welding (SAIW) and the South African Government are supporters of the United Nations (UN) project to continuously improve, both locally and globally, the 17 UN Sustainable Development Goals (SDGs) agreed to by world leaders in 2015. [https://en.wikipedia.org/wiki/Sustainable\\_Development\\_Goals](https://en.wikipedia.org/wiki/Sustainable_Development_Goals)

In 2012, South Africa had adopted The National Development Plan (NDP): Vision 2030-“Our future, make it work” as its development lodestar and roadmap. It predated the 2015 adoption of the UN's 2030 Agenda for Sustainable Development and the African Union (AU) Agenda 2063-“The Africa we want”.

The UN has 193 countries as members and the aim is to improve the quality of life particularly in low and medium income countries. Each UN country is encouraged to measure its progress on an annual basis against the targets and indicators set against each SDG. For example, South Africa's Voluntary National Review (VNR) Report 2019 Empowering People and Ensuring Inclusiveness and Equality [1].

South Africa had made progress in respect of some goals, but is confronted by major challenges on many fronts particularly with its economy being in a prolonged low-growth path of less than 1.5% since 2016 and having shrunk by 6.43% in 2020. The levels of poverty, inequality and unemployment are high (unemployment is currently at a staggering 45%) especially among the youth. Along with many countries, the Covid-19 Pandemic has had a negative effect on the 2020-2021 period [2]. It is ranked 107 out of 165 countries which have reported as shown in the Global SDG Index link below.

The progress does however reflect on the partnerships which have been built and strengthened and how collaborative initiatives can result in better outcomes and greater impacts.

Many of the South African Government's flagship programmes and key government departments are at the core of the SDGs.

The SDG South Africa Index report can be accessed with the full Sustainable Development Report 2021 giving the Global SDG Index and country reports on <https://dashboards.sdgindex.org/downloads> and [Sustainable Development Report 2021 \(sdgindex.org\)](https://sdgindex.org/Sustainable_Development_Report_2021)

The Southern African Institute of Welding (SAIW) is a not-for-profit organisation with 95 company members and 172 individual members. It is the South African Responsible Member of the 50 Member Country International Institute of Welding (IIW). SAIW is working in line with the South African Government's national initiatives, to help South Africa to achieve the United Nations Sustainable Development Goals (SDGs) by 2030.

SAIW's excellent national and international networks of individuals and organisations, including the International Institute of Welding (IIW), enables it to cooperate and collaborate with them and leverage many of the activities, including technologies, required to progress the various SDGs.

As part of the global community, SAIW also embraces collective international action, cooperating where applicable to apply global solutions to global challenges.

A key objective of this report is to act as a catalyst to create a quantum leap in the amount of projects within each SDG which SAIW and its welding Industry networks could undertake in cooperation and collaboration with South African Governments, industry and aid agencies to achieve the UN SDGs by 2030.

The link to a paper titled “Your Country's National Welding Capability (NWC) and its significance to the UN Sustainable Development Goals (SDGs)” by Chris Smallbone, International Institute of Welding (IIW) Past President, [allbones@iinet.net.au](mailto:allbones@iinet.net.au) contains many examples and references to various initiatives across welding-related fields which have been, or could be, introduced for all 17 UN SDGs [3].

If you wish to discuss such ideas further, including you and your organisation's possible contributions to SAIW's initiatives on the SDGs, contact John Tarboton, SAIW Executive Director, [john.tarboton@saiw.co.za](mailto:john.tarboton@saiw.co.za)



# The Importance of SAIW's work on South Africa's National Welding Capability (NWC) and Links to the UN SDGs

Welding technology is an enabling technology used across almost all industries in South Africa and a wide range of applications, from micro-joining of medical devices, electronics and photonics, to larger scale applications such as bridges, buildings, ships, rail and road transport, pressure equipment and pipelines. The importance of welding to national economic performance can be shown in numerous ways [4].

It encompasses the total life cycle of welded products/structures including design, manufacture, conformity assessment, inspection and testing, operation, maintenance, repair and decommissioning including recycling and other environmental conditions. It is critical to the infrastructure of any country and contributes to improving the quality of life.

The welding industry is defined as those organisations and people who are:

- involved with the total life cycle of welded products/structures including design, manufacture, conformity assessment, inspection and testing, operation, maintenance, repair and decommissioning including recycling and other environmental conditions
- engaged in, or employing, any of the organisations or people involved above;
- supplying welding equipment or consumables or materials to be welded; and /or
- involved with education, training, qualification, certification, research and development, work health and safety (WHS), standards and industrial relations aspects of welding.

SAIW, together with its members and networks, has worked for many years on improving the nation's National Welding Capability (NWC) [5]. SAIW also has many examples of NWC initiatives it has implemented to significantly progress the UN Sustainable Development Goals (SDGs) and improve the quality of life of people and the environment in South Africa and other African countries [6].

Such initiatives include amongst others, education, training, qualification and certification of personnel to both national and international standards, assisting companies to meet the exacting standards of customers, R&D and technology transfer. SAIW also assists in improving education and training to increase self-sufficiency and diversity in skilled personnel in South Africa and other African countries.

SAIW's excellent national and international networks of individuals and organisations, including the International Institute of Welding (IIW) and its members, enables it to cooperate and collaborate with them and leverage many of the activities, including technologies, required to progress the various SDGs.

SAIW has also been a great supporter of the International Institute of Welding (IIW) and its initiatives to improve the global quality of life [7].

Examples of some initiatives are shown below for each SDG although many SDGs are also interlinked. Hopefully, the examples given under each SDG will lead to mutually beneficial projects between SAIW, the different tiers of government in South Africa, the welding industry and aid agencies.



## SDG 1 End poverty in all its forms everywhere.

The challenges facing South Africa including from geo-political and socio-economic viewpoints are immense. More than half of South Africa's 60 million people live in abject poverty.

SAIW, its members, the welding industry and networks could assist in finding solutions to meet some of these challenges through the implementation of welding and related technologies.

The vast majority of people in South Africa simply want a decent job, food, education, health, safety and security and a roof over their heads for their family as well as a decent environment in which to bring up their children. The SAIW initiatives help to progress such aspirations.

Over the years, SAIW has been able to show the value and benefits of its work and the outcomes of that work to South Africa and Africa. Many of the examples and initiatives developed by SAIW over the years contribute to ending poverty and improving the quality of life.

Industrialisation through manufacturing and construction can lead to economic growth, and most importantly, with the creation of quality jobs with a high labour absorption rate. In metals manufacturing and construction, welding is the enabling technology that allows these activities to take place. Welding, as a career choice, is able to absorb unskilled, poorly educated people and give them in-demand, well-paid and high quality jobs as well as through further education and training, show them career paths to even better opportunities in the welding industry.

SAIW is also supporting the South African Steel and Metal Fabrication Master Plan 1.0 which aims to improve the long-term sustainability of the industry, guiding the stabilization and progress of the industry, thus opening up more career opportunities [8].

Although there are still problems with the adoption and impact of Industry 4.0 in South Africa [9]. SAIW is also now focusing on the introduction of Industry 4.0 which if successful is anticipated to give unprecedented transformation to South African industry. The introduction of new and appropriate technologies besides saving time, will boost productivity, reduce waste, expand business models and be more responsive to fast changing environmental and consumer demands which will all contribute to the improvement of the quality of life.



## **SDG 2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.**

SAIW has many examples of how the technologies developed over the years in its networks have helped ensure the reliability of plant and equipment for processing food as well as the reliability and integrity of the food itself thus contributing to food security.

This is critical for the country since astoundingly cheap investments made today in better nutrition for children can lead to better education and more productive adult lives.

Research in Ghana and Malawi has shown that with this approach, it can cost as little as \$US5 per mother and yet save lives and transform lifelong prospects so that each dollar spent delivers \$US36 of social returns [10].

Collaborating with organisations in its networks such as the Southern Africa Stainless Steel Development Association (Sassda) and the Aluminium Federation of South Africa (AFSA), SAIW has also helped ensure a competent industry is available using appropriate technologies to be able to build, repair and maintain the relevant plant and equipment for such food processing and food transportation as well as agricultural equipment and facilities.

With respect to food processing, the hygienic requirements of for example, the food and beverage industry, place high demands on the welds that hold tanks, pipes and vessels together.

The requirements specified in codes and standards for a high-quality weld and weld surface finish are paramount in the dairy and other food and beverage industries, as the consequences of poor surface and weld quality can be costly and dangerous.

South African fabricators make significant efforts to ensure that both the weld integrity is adequate and that the surface finish meets the specified requirement for hygiene.

South Africa has excellent opportunities for promoting “start-up initiatives” in many areas both urban and rural. In the welding field this could include youth acquiring basic skills in welding through to engineering personnel with degrees and diplomas. The resources required to train such people to operate an SMME (Small, Medium and Micro Enterprise) are readily available and can be incorporated into the welding training courses at the different levels.

SAIW’s members also supply significant support to farmers of all categories through the provision of facilities, equipment and consumables for the maintenance and repair of agricultural equipment and plant.

Even if one is in a region of subsistence farming, collective farming or individual large farms, access to skilled people and equipment is essential in order to make components and perform repair and maintenance using welding.

A key objective should be to train as many people as possible in the area in the appropriate welding skills and

knowledge for any eventuality which may arise. Such people can also use the skills and knowledge for non-agricultural purposes as well and develop other businesses in the rural areas as well as increase the opportunities for employment in various industries. There could be many opportunities at the micro-enterprise level to develop true entrepreneurial cultures.



### **SDG 3 Ensure healthy lives and promote well-being for all at all ages.**

To ensure the continuous well-being of people in a country and continued accessibility to health systems to increase life expectancy, welding and joining technology transfers are needed and contribute to meeting various medical objectives including examples such as those developed and implemented by IIW Members in the SAIW networks, for example, related to medical devices.

The integrity and reliability of the plant and equipment to produce pharmaceuticals, medical gases and medical radioisotopes rely on the availability of competent welding personnel and companies as well as appropriate welding related technologies. Medical radioisotopes are classified as essential products and the research reactor SAFARI-1 and South African Manufacturer NTP Radioisotopes produce them while a number of SAIW company members produce medical gases and are involved in installing them into the national networks of hospitals and medical facilities. The criticality of this industry was shown recently by the reported massive needs for oxygen during the Covid-19 crisis.

SAIW has also played a key role in ensuring that people involved in welding are protected from a health and safety viewpoint. Its involvement with many other organisations from industry, government, standards organisations and IIW among others, has enabled the appropriate standards, guidance notes and educational materials to be used throughout the country to continuously improve the well-being of people.



### **SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.**

South Africa has created and implemented numerous programmes and opportunities both in its own right and within the International Institute of Welding (IIW) for lifelong learning to take place. It has helped establish closer partnerships between higher education institutions and industry and the development of effective, affordable training systems to contribute to national economic development, international competitiveness and the attainment of social goals.

More and more people will therefore be able to access the opportunities in the welding related fields. SAIW has had a tremendous record and reputation for helping 1000s of disadvantaged people obtain training and qualifications over the past four decades to enable them to gain employment.

Persuading governments and industry to support the upliftment of disadvantaged people through improved skills and knowledge of welding and Non-Destructive testing (NDT) can also be a positive approach to be adopted in a NWC Project in a developing country.

For example, International Institute of Welding, IIW WGRA/COM, Success Story No 1 illustrates how the Canadian, Dutch and South African Governments were persuaded to provide the funding to train and qualify 65 disadvantaged people in NDT at SAIW. As the Success Story states "This wonderful team effort, between three national governments, industry bodies, national welding institutes and South African industry resulted in an outstanding outcome in improving the quality of life and ongoing opportunities for young people" [11].

Such a success story can lead to further support. For example, the Australian Federal Government later supported SAIW in the training of 20 disadvantaged people in South Africa as welders and through the South African Fabrication and Construction Training Trust Fund (SAFCTF) hundreds of disadvantaged people were also trained at SAIW as welding inspectors, welding supervisors and NDT personnel [12].

A major training project involving over 20 countries in Africa was initiated and supported by the International Atomic Energy Agency (IAEA) through the promotion of radiation based Non-Destructive Testing Techniques [13] with South

Africa and Tunisia playing very effective coordination and implementation roles in this very successful project. This project led to the formation of the African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA) established by African member states [14]. Projects still continue to this day.

Since 1994, SAIW has been involved with a number of initiatives with UNIDO [5] and this has continued even recently with UNIDO creating a video showcasing SAIW's capabilities and facilities in Johannesburg.

In 2014, SAIW formally established the SAIW Foundation to provide training to disadvantaged individuals across the broad spectrum of welding specialisations and allied technologies. It is intended to function as a joint effort between the Institute and industry giving as many young people as possible a chance in life, while at the same time doing as much as possible to alleviate the skills shortage in the country [6].

The development of the International Institute of Welding (IIW) Education, Training, Qualification and Certification programmes and their implementation including the IIW Manufacturers Certification Scheme According to ISO 3834 (IIW MCS ISO 3834) in 47 countries worldwide, illustrates the importance and need for world class personnel and companies to be available in the welding industry in a country.

To ensure that it complies with the appropriate accreditations, SAIW Certification has been approved as an IIW Authorised Nominated Body for Company Certification (ANBCC), an IIW Authorised Nominated Body (ANB) and a MerSETA (Manufacturing, Engineering and Related Services SETA) accredited training provider [6].

Since the introduction of the IIW programmes in 2003, 150 International Welding Engineers (IWEs) have been trained and qualified at the Universities of Pretoria and Witwatersrand, 171 International Welding Technologists (IWTs), 257 International Welding Specialists (IWSs), 117 International Welding Practitioners (IWPs) and 58 International Welders have been trained and qualified at SAIW [6].

These positive initiatives in South Africa have also been implemented by SAIW in other African countries such as Nigeria and Ethiopia.

In 2016, SAIW was selected by the Department of Higher Education Centres for Specialisation project to implement the QCTO (Quality Council for Trades and Occupations) National Artisan curriculum in TVET (Technical and Vocational Education and Training) colleges [6].

The SAIW has managed and administered the South African Qualification and Certification Committee for Inspectors of Pressurised Equipment (SAQCC IPE) and South African Qualification and Certification Committee for NDT personnel (SAQCC NDT) for over 30 years thus ensuring that South Africa has sufficient competent personnel in these fields leading to high integrity and reliability of welded components and structures including pressurised equipment [www.saiw.co.za](http://www.saiw.co.za)

SAIW's and IIW's welding inspector training, qualification and certification programmes have been so successful with over 5000 individuals being successful. Furthermore, 2300 certificates have been issued in the main non-destructive testing (NDT) methods during the past eight years as well as nearly 30000 days of welder training having successfully taken place on a variety of courses to meet the standards required for employment in industry.

To engage youth from elementary and secondary ages across the country, SAIW is working on introducing a new welding simulator program which will use virtual and augmented reality to allow students to try welding in a safe, controlled environment whilst learning about career opportunities in welding and related skilled trades. This may also be included in SAIW **Train-the-Trainer** programmes.

SAIW has also implemented many projects on a voluntary basis including improving the image of welding projects. Through the holding of welding skill competitions, welded art exhibitions and competitions, SAIW is encouraging as many people as possible to take up the art, trade or profession of welding.

SAIW is conducting national welding competitions to encourage young people in their welding careers as well as participating in international skill competitions and the IIW Welded Art Photographic Exhibition.

All this has contributed to improving SDG 4 in welding related fields in South Africa and Africa and with appropriate support can be expanded significantly in many regions.



## SDG 5 Achieve gender equality and empower all women and girls.

During the Second World War (WWII), in some countries such as the US, Canada, USSR and UK, due to sheer necessity, women and girls were employed in a wide range of employment situations normally fulfilled by men. Similarly, in many developed countries today, due to women and girls showing that they are competent to fulfil the employment roles, they are employed on an equal basis to men. Unfortunately, there may be countries where due to a variety of reasons, this does not apply. There may therefore be a need to change a number of cultures in a country to achieve equality and empowerment for women and girls.

One of the best ways to enable women and girls to show that they are competent to perform any type of work is to show that they have achieved the required qualification and certification criteria specified for a particular type of work or application. At the same time, if one can change the culture which might be having a negative effect on this approach, then it might achieve positive results.

This becomes easier to achieve when a country has developed and implemented a number of cultures including a skills respect culture [15].

SAIW has always been involved in programmes in South Africa promoting such cultures and enabling women and girls to enter the welding related fields at various levels and areas such as education, training, research, development and technology transfer accompanied by the appropriate career paths.

The implementation of scholarships and support for Science, Technology, Engineering and Mathematics (STEM) initiatives, are examples of how SAIW is working towards gender equality and greater diversity to progress this SDG.

The SAIW Foundation's recent collaboration with ArcelorMittal South Africa (AMSA), training six Grade 12 learners as IIW International Welders is an excellent example [6].



## SDG 6 Ensure availability and sustainability management of water and sanitation for all.

South Africa's water resources are at a critical point with challenges affecting the water including the amount available, the unequal distribution and access to clean water, the quality and state of water infrastructure, droughts causing towns to run dry and corruption that has affected municipal treatment plants, resulting in sewage flows into streets, rivers and groundwater [16]. It is anticipated that the country's water demand will outstrip supply by 2030.

Although South Africa has at least 10 desalination plants and around 2000 water treatment systems across its provinces (824 Waste Water Treatment Works and 1,036 Water Service Authority systems as of 2014), these treatment systems are extremely inefficient and poorly maintained [17].

SAIW's networks within IIW have developed and implemented over the years examples of technologies in applications which have led to cleaner, better quality drinking water; more efficient irrigation, less water wastage, more efficient waste water treatment, less pollution, better water capture and increased water resources.

The continual transfer of such existing and new technologies into both South Africa and regional countries, as well as training the people to apply them, is paramount for achieving this SDG.

South Africa also has highly variable rainfall patterns influenced by events such as El Nino and La Nina. The use and benefit of improved welding fabrication and construction technologies has been shown by numerous examples of plant required for climate-resilient water sources.

These are those on which climate variability, such as variations in rainfall, temperature and drought has little or no influence with two of the most significant being desalination and water recycling plants. The SAIW and the welding industry can truly assist the country in this regard.





## SDG 7 Ensure access to affordable, reliable, sustainable and modern energy for all.

ESKOM supplies 90% of South Africa's electricity with 80% of this being generated by coal fired power stations and the remainder from a nuclear power station with a handful of smaller pumped storage, hydroelectric stations but also with a growing number of wind farms and solar energy farms.

In the past, ESKOM and SAIW and its networks have worked very closely to ensure that there were industries competent to manufacture and maintain the appropriate equipment.

Unfortunately, the present coal fired power stations are reputed to now have major problems both on pollution and reliability aspects with major financial requirements to replace them.

In addition, a major challenge is the transition from a coal fired power station situation to one of "clean energy" as renewable energies such as solar, wind, hydro etc, and other types of energy sources require high quality design, manufacture, maintenance etc. to ensure their reliability and financing to ensure their implementation.

There are many examples of SAIW's networks being involved in aspects of helping the development of affordable, reliable, sustainable and clean modern energy for the country, including developing industries competent to manufacture and maintain the appropriate equipment.

In the foreseeable future up to 2030 therefore, even with a determined effort to move to cleaner energy sources, energy sources such as coal, oil, gas and nuclear will still be in existence and will require the same attention to reliability in service as provided by the technologies, personnel and companies existing in SAIW's networks.

As the implementation of newer energy sources grows, SAIW's support for the transfer of such technologies to the appropriate implementers is also growing.



## SDG 8 Promote sustained, inclusive and sustainable economic growth.

There are many factors which can have a positive effect on the growth of a country's economy. Some of these involve creating the correct cultures within the country. For example, SAIW has had a positive influence on cultures related to ethics, skills respect, productivity, quality, work, health and safety, environmental, innovation and service excellence amongst others in the welding related industries. Examples of how these can contribute to an excellent national welding capability can be easily shown.

SAIW and its members, being in the "welding industry", have a positive effect on economic growth. Innovation and the need to have competent people to play their part in innovation also places emphasis on the importance of education, training, qualification and certification of people as well as certification of companies in the country to improve this SDG. These are areas in which SAIW plays a significant role, its strategies to assist companies with new and appropriate technologies, links with education and training organisations and the excellent success of its ISO 3834 company certification programme with over 250 companies certified, all contribute to improving this SDG.



## SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

For successful industrialisation, a country needs a skilled workforce and one that includes welding and related qualified and certified personnel to ensure sustainable industrialisation and provide the ongoing innovation.

Ever since its formation in 1948, SAIW, its members and networks, have been involved in the building up of a vast array of resilient infrastructure in South Africa to world class standards. SAIW has inspired an innovation culture both in itself and in the country. An innovation culture is where everybody and every effort contributes to bringing in something new, to making changes (ideas, methods etc.)

whether in simple or complex forms and includes applying inventions and the adoption of R&D outcomes.

Implementation of innovative ideas and processes especially for smaller firms requires an effective link between the firms themselves and sources of technology. Research and development must therefore link in well with what technology diffusion provides but there must be market awareness of the R&D outcomes if technology diffusion mechanisms are to be effective and increase innovation. SAIW, its members and networks, have been at the forefront in this regard.

Companies themselves must recognise the importance of new technology to their business, and hence R&D, so that the market demand for new technologies continuously improves and the level of technology uptake at the individual company level increases.

The development of sufficient people as both technology deliverers and technology receptors is critical to ensure that innovation can take place. SAIW has also been at the forefront of this to world class standards.

The development of national and international standards are also essential to ensure the integrity and reliability of welded components and resilient infrastructure. South African industry has helped ensure this through its involvement through SAIW being a member of the South African Bureau of Standards (SABS).

SAIW representatives have been involved in many SABS Technical Committees related to welding and non-destructive examination, pressure equipment, health and safety amongst others and with the participation of a large number of SAIW members and allied industry associations.

SAIW has regularly over the years organized seminars for the industry, dedicated to the development and implementation of new standards and the SAIW Fusion Newsletters and posting of information via other traditional and social media often provide news on international, national and South African standards.



## **SDG 10 Reduce inequality within and among countries.**

It is important to conduct a needs analysis in a country to establish exactly what is required to improve the quality of life in the country and have solutions to improve equality. In the welding related field there are examples of how such needs analyses have been conducted by SAIW and then used to put in place appropriate strategies and action plans. SAIW has an excellent record of involving a wide range of organisations in its various needs analyses and strategic planning exercises over the years.

Key SAIW and welding industry initiatives have then involved growing opportunities in the manufacturing, maintenance and construction industries and creating the career pathways for people to improve and help reduce existing inequalities.

SAIW is probably in the ideal position to continually identify such needs, both in South Africa and African countries, and recommend and provide appropriate solutions and hence increased opportunities. The results which will be achieved will help improve the SDG.



## **SDG 11 Make cities and human settlements inclusive, safe, resilient, and sustainable.**

There has been an unprecedented growth of cities and settlements in South Africa over the past seven decades with the need to create safe and affordable buildings including housing as well as safe and efficient public transport. There has also been a growing trend to make such structures are resilient to disasters such as earthquakes, fires and floods, as well as failures due to shoddy quality and explosions due to faulty equipment.

In South Africa, SAIW has been heavily involved in developing and applying relevant technologies for use in many applications in human settlements as well as being involved in appropriate organisations related to the metals, pressure equipment and structural steel industry.

SAIW has always promoted the uniform rollout and implementation of the appropriate national and international standards across South Africa to ensure the reliability and integrity of welded structures/products.

Through the establishment of its SAIW Certification division, SAIW ensures that all personnel trained and qualified and companies certified under its auspices, meet the required national or international standards. Programmes such as SAQCC IPE help ensure competent inspectors maintain the safety of pressure equipment in a wide range of applications including major industrial installations, medical facilities, residential, domestic and personal usage.

Today, SAIW has more than 250 companies certified to the IIW Manufacturers Certification Scheme According to ISO 3834 thus helping cities and human settlements to be safe, resilient and sustainable [6].

Due to the Covid-19 pandemic, SAIW Certification introduced virtual audits which have proved to be very successful. With the “tyranny of distance” which exists in South Africa, technologies have been developed and implemented catering for the challenges of remoteness of both companies and individuals, and in particular disadvantaged communities, leading to more effective training, education, testing and auditing systems. This has naturally assisted good progress in a number of the SDGs.



## SDG 12 Ensure sustainable consumption and production patterns.

There are many examples of sound environmental and Work, Health and Safety (WHS) management practices around the world to assist in control of wastes related to welding.

An environmental culture of an organisation could be defined as the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's environmental management.

SAIW has been heavily involved in the appropriate South African and International organisations and IIW Commissions in these areas and the transfer of appropriate technologies into industry and the community at large.

Working with other organisations in its networks including SASSDA, AFSA and SAISC, the transfer of information on dealing with waste from the processes involved in the cutting, fabrication, construction of applications using metals is continually taking place via seminars, workshops, guidance notes, education and training courses.



## SDG 13 Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.

Energy resources power both domestic and industry needs, and are a key contributor to a country's economic prosperity. The demand for energy increases as a country's economy and population grow. Fossil fuels such as oil, natural gas and coal are examples of non-renewable resources and they cannot be replaced as quickly as they are being used. In contrast, resources that are referred to as renewable energy sources can be used again and again, without depletion, or can be replenished in a short time frame. The wind, sun (solar) and waves are all sources of renewable energy.

SAIW, and its networks, have been heavily involved in related work for many years in all these different types of energy ensuring their reliability and integrity and thus having a significant impact to combat climate change and regulating emissions.

Steel is at the core of a green economy, in which economic growth and environmental responsibility work hand in hand. Once steel is produced it becomes a permanent resource because it is 100% recyclable without loss of quality and has a potentially endless life cycle [18].

SAIW and the welding industry will collaborate with governments and the steel producing industry to meet the challenges ahead including the benefits to the SDGs through the significant growth in steel usage by 2030.



## SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

In terms of challenges below the water, there are many concerns about the whole range of pollution taking place which can have a major significant effect on the marine ecosystems. Since welding is used in numerous applications which will be used in water, the integrity of the welds becomes paramount.

If one considers the range of applications covering ships, boats, oil and gas carrying pipelines and tankers, failures can result for example in fires and oil pollution from small spills to catastrophic damage. The high integrity and reliability of welded structures in marine applications to this SDG is essential.

The expertise in SAIW's networks has been used to mitigate such problems particularly through the development work and involvement of its networks of world class experts, and will continue to do so.



## SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Welding is used in many critical applications which if failure occurs, varying degrees of contamination and destruction can take place. These can range from catastrophes similar to those mentioned above in SDG 14 through to issues such as sewage spillages onto land and into rivers which is prevalent in South Africa [17].

The great benefits of welding, and SAIW's and industry's efforts, can be realised however with the proper design, materials, procedures, manufacture, conformity assessment, operations including repair and maintenance as well as decommissioning leading to positive contributions to improving this SDG.

With the rapid development of welding technology and its links to steel as a 100% recyclable material, it is becoming cheaper and faster to make use of metal as a material, hence reducing the load on natural materials such as wood, hence reducing deforestation.



## SDG 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective accountable and inclusive institutions at all levels.

Often the word "sustainable" is understood by people to refer only to financial sustainability. It is important to realise that it refers to many other aspects of the SDGs, in particular including the environment and cultural behaviours.

A useful approach is to look for 'ethical leadership' in people at all levels. The most successful leaders inspire others to embrace a common goal through recognition of shared values. They build and maintain effective relationships by living and leading with integrity.

ISO (International Standardisation Organisation) has also introduced standards which involve ethical behaviour. ISO 19600:2014- Compliance Management Systems-Guidelines and ISO 26000 Social Responsibility Guidance Document.

ISO 19600:2014 covers establishing, developing, implementing, evaluating, maintaining and improving an effective and responsive compliance management system within an organisation. They are guidelines and the extent to which they are used depends on the size, structure, nature and complexity of the organisation. The Standard falls under ISO Technical Committee 309, Governance of organisations.

SAIW is an effective, accountable and inclusive institution. It is a member based organisation and is accountable to its members. Through its industry committees, it is accountable to the broader South African industry and being a not-for-profit organisation, it puts the needs of industry and communities first. To succeed in its objectives, it ensures



that the organisations in its networks are also effective, accountable and inclusive.

Through its technology transfer mechanisms, SAIW has the ability to significantly influence this SDG positively through the successful promotion and implementation of the above standards in industry.



## SDG 17 Strengthen the means of implementation and revitalise the global partnership for sustainable development.

An important component of achieving this SDG is the use of the formal networks which exist within the welding related industries both locally and globally.

Such networks help in producing a multitude of partnerships, both large and small, ready to work together on appropriate activities to assist in meeting SDG targets in a country.

A general definition of a network is that it consists of a variety of entities (e.g. organisations and people) which are largely autonomous, geographically distributed and heterogeneous in terms of their operating environment, culture, social capital and goals, but that cooperate and/or collaborate to better achieve common or compatible goals.

For example, cooperating and collaborating with the Canadian Welding Bureau (CWB), New Zealand's Heavy Engineering Research Association (HERA) and Indian Institute of Welding (IIW-India) in the Welding Innovations Network (WIN) to transfer the knowledge and experience of world experts into their countries on a regional basis.

One only has to consider SAIW's networks such as IIW, SASSDA, AFSA, South African Institute of Steel Construction (SAISC), South African Bureau of Standards (SABS), International Organisation for Standardization (ISO), IAEA, International Committee for Non-Destructive Testing (ICNDT) etc. to see the potential which can be harnessed. Two good examples of how such networks can assist with this SDG are shown in references [19] and [20]. Reference 19 shows how the Welding Technology Institute of Australia (WTIA) in Australia created a worldwide network of technological experts and organisations with remarkable success with technology transfer. Reference 20 shows how the CWB Group built up an Association from 1000 members to over 70000 members over a ten year period. When one considers the hundreds of thousands of people welding in South Africa, a quantum leap by the welding industry's involvement in progressing the SDGs will make an enormous contribution to the South African Government's endeavours.

In 2007, the SAIW and Nigerian Institute of Welding (NIW) started collaborating on education and training in the welding field and more recently in 2021, they were the catalysts for the formation of The Welding Federation (TWF) headquartered in Johannesburg with representatives from Nigeria, Kenya, Ethiopia, Uganda, Ghana, Mozambique, Egypt and South Africa as members [21].

The formation of TWF should result in many technology transfer activities being held in a cooperative and collaborative manner between the TWF Members and other African countries. These initiatives could result in outcomes such as funding support from governments and industry for technology support centres in African countries, as well as the transfer to the region of the knowledge and experiences of many world experts across a whole range of critical industrial applications.

## Recommendations and Future Actions

For those people, including their organisations, who wish to support and contribute to the achievement of the UN SDGs, please link to Reference 3 titled "Your Country's National Welding Capability (NWC) and its significance to the UN Sustainable Development Goals (SDGs)" by Chris Smallbone, IIW Past President, [allbones@iinet.net.au](mailto:allbones@iinet.net.au)

The paper contains many examples and references to various initiatives across welding-related fields which could be introduced for all 17 UN SDGs. If you wish to discuss such ideas further including you and your organisation's possible contributions to South Africa's welding industry initiatives, contact Mr John Tarboton, SAIW Executive Director, [john.tarboton@saiw.co.za](mailto:john.tarboton@saiw.co.za)

It is the intention of SAIW to draw up mutually beneficial strategies and action plans with the support of SA governments, industry and aid agencies for implementation to achieve significant progress in UN SDGs for which it has the expertise.

This report is to be a catalyst for such initiatives and create a quantum leap for SAIW and the welding industry to support the South African Government to succeed in this major objective by 2030.

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