



IIW-India and India's National Welding Capability
and
their significance to the UN Sustainable Development Goals



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About us

The Indian Institute of Welding (IIW-India) was incorporated on 22nd April 1966 at erstwhile Calcutta to foster the development of welding science, technology, and engineering in India and since then has been serving the cause of the welding industry through its 13 Branches, 2 Centres and several Students' Chapters throughout India. The Institute is a not-for-profit organization registered under Section 25 of the Companies Act 1956 (presently Section 8 of the Companies Act 2013) and is also registered under section 12A of the Income Tax Act 1961, as an Institution for charitable purposes.

Through its various activities and programmes, IIW-India is now recognised as the premier professional Institute related to welding in the country, with around 4200 Individual and Corporate Members. Furthermore, as a member society of the International Institute of Welding (IIW), it is helping to project the importance and achievements of the Indian Welding Industry to the global community. IIW-India is also a member of the Asian Welding Federation (AWF) since its inception. The Institute has completed 55 glorious years towards serving the welding fraternity in India.

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1 Introduction



India has successfully lifted more than 271 million people out of multidimensional poverty through economic growth and empowerment, enhanced access to nutrition, child health, education, sanitation, drinking water, electricity and housing. This has led to reduced inequalities especially among people in vulnerable situations [1].

The Indian Institute of Welding (IIW-India) and the Indian 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

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, the Indian Government was part of the **2020 Voluntary National Review** of the High-Level Political Forum on Sustainable Development [1].

India has made steady progress towards achieving the UN SDGs in areas of health, energy and infrastructure, as per the latest **SDG India Index** which shows the strides taken by the country in social, economic and environmental development over the past year.

The index also reflects on the partnerships which have been built and strengthened and how collaborative initiatives can result in better outcomes and greater impacts.

Using environmental, social and economic indicators, India aims to produce a productive, sustainable and inclusive economy linked to a cleaner, greener, carbon neutral country.

Many of the Government's flagship programmes such as **Make in India**, **Skill India** and **Digital India** are at the core of the SDGs.

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

The Indian Institute of Welding (IIW-India) is a not-for-profit organisation with 134 company members and 4043 individual members as at 31st December 2021. It is the Indian Responsible Member of the 50 Member Country International Institute of Welding (IIW). IIW-India is working in line with the Indian Government's national initiatives to help India to achieve the United Nations Sustainable Development Goals (SDGs) by 2030.

IIW-India's excellent national and international network 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, IIW-India 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 IIW-India and its welding Industry networks could undertake in cooperation and collaboration with Indian Governments, industry and aid agencies to achieve the UN SDGs by 2030.

For those people, including their organisations, who wish to support and contribute to the achievement of the UN SDGs, please 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, IIW Past President, allbones@iinet.net.au [2].

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 IIW-India’s initiatives, contact Mr Rituraj Bose, Honorary Secretary General at IIW-India on rituraj.bose@iiwindia.com.

2 The Importance of IIW-India’s work on India’s National Welding Capability (NWC) and Links to the UN SDGs



Welding technology is an enabling technology used across almost all industries in India 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 [3].

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.

IIW-India, together with its members and industry networks, has worked for many years on improving the nation’s National Welding Capability (NWC) [4]. IIW-India 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 India.

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. IIW-India also assists in improving education and training to increase self-sufficiency and diversity in skilled personnel in the country.

IIW-India has also been a great supporter of the International Institute of Welding (IIW) and its initiatives to improve the global quality of life [5].

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 IIW-India, the different tiers of government in India, the welding industry and aid agencies.

3 SDG 1 End poverty in all its forms everywhere



The vast majority of people in India 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. IIW-India, its members and welding industry initiatives help to progress such aspirations through the implementation of welding and related technologies.

Over the years, the welding industry has been able to show the value and benefits of its work and the outcomes of that work to progress the SDGs. Many of the examples and initiatives developed contribute to ending poverty and improving the quality of life.

India is experiencing a massive industrialisation phase and through manufacturing and construction this can lead to economic growth, and very 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 in the welding industry as well as through further education and training, show them career paths to even better opportunities.

India is also promoting “start-up initiatives” in many areas. In the welding field this could include rural youth acquiring basic skills in welding through to engineering personnel with degrees and diplomas. The resources required to train such people to operate an MSME (Micro, Small & Medium Enterprises) are readily available and could be incorporated into the welding training courses at the different levels.

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. In particular, a true entrepreneurial culture could be developed at the micro-enterprise level.

Assessments of the importance of the metals industry's effects on social, human, natural and physical/financial living standards have concluded that the metals industry contributes strongly to the economic performance and well-being of countries [6]. In 2021, Business and Economic Research Limited (BERL) conducted an assessment of the potential economic impact of Industry 4.0 technologies in Construction on New Zealand and concluded an increase of 0.5 to 1.0% in GDP could result over the next five year period [7].

IIW-India and the Indian welding industry are also now focusing on the introduction of Industry 4.0 which is anticipated to give unprecedented transformation to 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. Similar approaches can be used to assist associated developing countries in the SAARC region.

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



IIW-India and its members have many examples of how the technologies developed over the years in its networks have helped ensure the reliability of plant for processing food as well as the reliability and integrity of the food itself, thus contributing to food security and Indian Government programmes.

Through a nationwide initiative triggered by the **Clean India Campaign** and the **National Nutrition Mission**, India achieved 100% rural sanitation and a sharp reduction in stunting and child and maternal mortality rates [1].

These efforts are 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.

India is an agricultural based economy and is facing some significant challenges which the welding industry can contribute solutions to. Production of agricultural goods and point-of-use is a big problem because of poor infrastructure and road connectivity and efforts are being made to improve the logistics by way of improving the road, rail and waterways networks.

For grain storage, sufficient storage space and appropriate environmental conditions are not available leading to wastage of food grain. Efforts are being made to store the food grain in large stainless steel silos with proper nitrogen purging and humidity control.

Metro rail links are planned from rural to larger cities and coaches will be reserved for perishable goods such as fruits, vegetables etc. Refrigerated vans/containers will be provided for exotic vegetables, dairy products and sea food.

It is therefore critical to ensure a competent welding industry is available using appropriate technologies to be able to build, repair and maintain the relevant plant and infrastructure for such food processing, storage and food transportation as well as agricultural equipment and facilities.

5 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 IIW-India network, for example, related to medical devices.

The integrity and reliability of the plant and equipment to produce pharmaceuticals, medical gases and medical radioisotopes relies on the availability of competent welding personnel and companies as well as appropriate welding-related technologies.

Medical radioisotopes are classified as essential products and production of these has taken place in India since the 1950s at a number of research reactors starting with the APSARA reactor in 1956. Expansion of such facilities continues to take place to meet ever-growing demand with the Department of Atomic Energy preparing to build India's first reactor on a public-private partnership (PPP) model. It is understood that 17 companies from around the world across the nuclear medicine value chain such as nuclear medicine, pharmaceutical,

healthcare, medical devices and nuclear equipment suppliers, have expressed interest in joining hands for the project.

A number of IIW-India company members produce medical gases and are involved in installing them into the national network of hospitals and medical facilities. The criticality of this industry was shown recently by the reported massive shortages of oxygen during the Covid-19 crisis. The inter-relationship between the Indian Government's initiatives and the welding industry can also be shown by a few examples shown below.

The Government of India, through the Ayushman Bharat Scheme is providing medical health services and facilities to the poor and needy. The medicines provided are manufactured with special machinery which involves special welding techniques. Pharmaceutical products are also distributed through the Jan Aushadhi Kendra scheme whereby generic medicines are supplied at nominal rates.

For children, the very important mid-day meals provided are cooked in automatic machinery manufactured out of stainless steel which involves welding.

IIW-India 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 the International Institute of Welding (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.

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



The Indian Government has promoted social inclusion through universalising access to nutrition, health, education, social protection and developing capabilities for entrepreneurship and employment [1].

IIW-India 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 are therefore able to access the opportunities in the welding related fields. Such initiatives taking place in India could also be offered to developing SAARC countries particularly with the upgrading of satellite connections taking place to such countries.

In 2009, IIW-India formally established the **IIW-India 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.

To engage youth from elementary and secondary ages across the country, the Foundation is working on 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 will also be included in its **Train-the-Trainer** programmes.

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 India.

To ensure that it complies with the appropriate accreditations, IIW-India has been approved as an IIW Authorised Nominated Body (ANB) in 2007 and an IIW Authorised Nominated Body for Company Certification (ANBCC) in 2011 as well as by the Government of India, DGE&T (Directorate General of Employment and Training) as an Assessing Body for all Fabrication sector courses under their MES-SDI (Modular Employment Skills-Skill Development Initiative Scheme).

Since the introduction of the IIW programmes in 2007, 522 International Welding Engineers (IWEs), 510 International Welding Technologists (IWTs), 117 International Welding Specialists (IWSs), 16 International Welding Practitioners (IWPs) and 219 International Welders have been trained and qualified at IIW-India as at 31st December 2021.

IIW-India 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, IIW-India is encouraging as many people as possible to take up the art, trade or profession of welding.

IIW India is conducting national and international welding competitions for boys and girls in the field of welding to encourage them into welding careers.

Welded art provides a number of benefits to people. As a hobby it may help improve the mental health of people, it is a wonderful tool to improve the image of welding and in some cases provides an income for people with the appropriate artistic skills.

The **Welded Marvels** competition is conducted by IIW-India for creating welded sculptures from waste/scrap material. This is giving lots of encouragement to turn scrap into artistic sculptures. The competitions are supported by the Association of Welded Products Manufacturers (AWPM).

Through the Government initiative Skill India, skills development and welding excellence centers have been established in the majority of states in India to provide quality education in the field of welding.

IIW India, through its **National Welding Training and Certification Scheme (NWTCS)** for the certification of welders, is training and certifying welders in rural and small towns and skilling them to be employed in the industry.

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



IIW-India has become involved in programmes in India 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 IIW-India is working towards gender equality and greater diversity to progress this SDG.

The Indian government has enabled new avenues of credit, insurance and Direct Benefit Transfers to the poor, including to over 200 million women, thereby accelerating their economic empowerment which can lead to pursuing opportunities in welding related fields [1].

It has also introduced programmes of reserving specific jobs for women both in private and government organisations and is continually requesting industries to recruit more women and girls.

Because women and girls have shown that they are competent to fulfil the employment roles, they are employed on an equal basis to men at IIW-India Member companies which have implemented training programmes to achieve this objective. Unfortunately, there may be places where due to a variety of reasons, this does not apply. There may therefore be a need to change certain cultures 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 [8].

IIW India is promoting welding through student chapters in diploma and degree colleges and encouraging female students to participate in such programs in a big way. Similarly, by IIW India encouraging women welders and engineers in a big way to join the mainstream in welding, this will help to achieve gender equality.

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



IIW-India's network within IIW has 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 India and developing SAARC countries is paramount for achieving this SDG and available through IIW-India Members and the welding industry.

India has only about 4% of the world's renewable water resources but is home to nearly 18% of the world's population.

India's water resources are at a critical point with significant challenges, including the amount of water available to meet ever-increasing demand, the unequal distribution and access to clean water, the quality and state of water infrastructure (nearly a third of the country's geographical area is drought-prone whereas 12% of the area is prone to floods), and industrial pollution and untreated sewage flowing into streets, rivers and groundwater.

With India facing the situation of flood in many areas and drought in other areas, the Government of India has taken initiatives including connecting the major rivers with the help of welded pipelines so that water can be supplied to areas where there is drought from areas where water is in abundance.

India also has highly variable rainfall patterns influenced by events such as El Nino and La Nina as well as the negative effects of climate change. The use and benefit of improved

welding fabrication and construction technologies has been shown by numerous examples to be highly beneficial for 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. IIW-India and the welding industry can truly assist the country in this regard.

In desert areas and cities near the sea, desalination plants are installed and water is made available to people. Water treatment plants are installed in all cities to ensure a good quality of potable water is available through pipelines.

IIW-India and the welding industry can truly assist the country in this regard as the continual expansion of such plants takes place to meet the ever-increasing challenges.

As more and more “smart cities” are being built, sweet water lakes are connected by welded pipelines to ensure water is available in all lakes and is stored during the monsoons and distributed to households. Emphasis on efficient drainage and water harvesting is given during construction of smart cities.

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



Globally, India stands third in renewable power, fourth in wind power and fifth in solar power. India launched the **Coalition for Disaster Resilient Infrastructure** and the **International Solar Alliance** to leverage partnerships for climate action and disaster resilience [1].

The Government of India is giving lots of concessions to companies in industry if they use solar/ wind energy for their power consumption. The wind energy equipment manufacturers making wind towers use advanced welding processes to produce such equipment.

With India being a solar abundant country, emphasis is given by government to use solar energy. Compressed natural gas, piped natural gas and liquefied natural gas are also used for vehicles and domestic consumption and power generation.

There are many examples of IIW-India’s networks and the welding industry 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.

When one thinks of “clean energy” as renewable energies such as solar, wind, hydro etc, these and other types of energy sources require high quality design, manufacture, maintenance etc.to ensure their reliability.

In the foreseeable future up to 2030, 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 in IIW-India’s networks and the welding industry.

As the implementation of newer energy sources grows, IIW-India’s support for the transfer of such technologies to the appropriate implementers is also growing. For example, there is also growing interest in the use of hydrogen by industry and as fuel in cars.

This is leading to greater cooperation and collaboration between various countries. Some strategies focus on developing so-called “green hydrogen”, hydrogen produced from

renewable energy sources whilst others use the broader term “clean hydrogen” that includes both green and blue hydrogen (hydrogen produced from natural gas which captures emissions using carbon capture and storage).

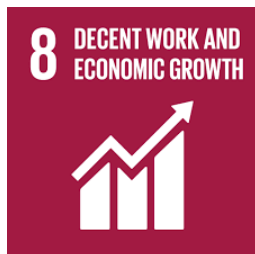
In addition to other energy-related activities such as energy efficiency measures and the expansion of renewable energy production, “clean hydrogen” (including green and blue) offers significant opportunities to decarbonise industry and a potentially massive new export industry can be developed, either in the form of hydrogen or ammonia as this is easier to store and transport. Through hydrogen, there is also the possibility to produce Green Steel for which there are also large regional markets in countries like Japan, South Korea, or Singapore.

Irrespective of the type of energy source used either now or in the future, welding and joining will be employed to varying degrees in the manufacture, repair and maintenance of the structures producing the energy or components using the energy source. Coal, gas and nuclear power stations will still function for many years ahead so it is important that the appropriate welding related technologies are available in India to ensure the optimum life cycle is obtained; similarly with oil and gas pipelines and structures, both on and off-shore. With renewables such as wind and solar energy, the components have their own challenges not just in manufacture but also in-service ensuring that premature failures do not occur.

With the advent of transport vehicles fuelled by energy sources such as electricity and hydrogen, the efficiencies of manufacture, repair and maintenance by welding and joining will still be required. E-vehicles are becoming more popular by the day in India, ranging from “two wheelers” to heavy vehicles such as passenger buses.

Promoting the developments in renewable energy, will still require all the benefits of an improving national welding capability. A goal of development will be to reduce life cycle costs to achieve a cost per kilowatt hour of electricity which is attractive to consumers. Lowering fabrication costs, increasing production rates, enhancing durability and reducing maintenance will all contribute to this.

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



India is one of the fastest growing emerging economies with a young population and burgeoning innovation and business ecosystem. With a GDP of US\$2.72 trillion in 2018-2019, India is striving to become a US\$5 trillion economy by 2025, and pursue an inclusive and sustainable growth trajectory by stimulating manufacturing, building infrastructure, spurring investments, fostering technological innovation and boosting entrepreneurship [1].

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, IIW-India 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.

IIW-India, being in the “welding industry”, has 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 IIW-India plays a significant role.

Its strategies to assist companies with new and appropriate technologies, implementation of post-graduate research scholarships and introduction of its ISO 3834 company certification programme with 33 companies now certified, all contribute to improving this SDG.

A benefit of this is shown by the number of Indian companies specializing in manufacturing various critical pharmaceutical equipment which meet the high standards of the US Food and Drug Administration (FDA) and the Indian FDA high standards. These companies employ a very high quality level of welding and IIW-India and the welding industry have pioneered the techniques to meet these exacting requirements.

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



Ever since its formation in 1966, IIW-India has inspired an innovation culture both in itself and in the country and together with its members and welding industry networks has been involved in building up a vast array of resilient infrastructure in India to world class standards. 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. IIW-India, its members and networks have been at the forefront in this regard.

The Government of India is also giving greater emphasis for R&D efforts to industries and providing benefits to promote more R&D work.

Companies themselves, however, 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. The Indian Government is increasingly providing scholarships to needy and intelligent students to promote their involvement in R& D work. To encourage this approach, IIW India conducts a best welding engineer competition each year which also helps the students to present their innovation case studies.

12 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 in a number of countries and then used to put in place appropriate strategies and action plans [9],[10],[11].

Since 2000, IIW-India has held workshops and congresses on technology innovation and national welding capabilities involving Indian and international experts to identify such needs and implement solutions which all contribute to reducing inequality.

IIW-India is probably in the ideal position to continue to identify such needs, both in India and associated developing SAARC countries, and provide appropriate solutions. The results which will be achieved will help improve the SDG significantly.

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



There has been an unprecedented growth of cities 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 resilient to disasters such as earthquakes, fires and floods as well as failures due to shoddy quality and explosions due to faulty equipment.

India has a major challenge with the rate of urbanisation increasing rapidly in the country and slum proliferation increasing. Developments are taking place to create pre-fabricated affordable housing stock made available by clean and fast welding techniques.

Under the “smart cities” programme, the need for bridges, flyovers and metro tracks is increasing, which also increases the scope of welding in the cities of India.

IIW-India 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 structural steel industry.

IIW-India has always promoted the uniform rollout and implementation of the appropriate national and international standards across India to ensure the reliability and integrity of welded structures/products. IIW-India regularly organises seminars for the industry, in particular for welding personnel, dedicated to the implementation of the new standards and the posting of information via traditional and social media provides ongoing news on international, national and regional standards.

The certification of fabricators and construction companies to national, regional and international standards to build such products as bridges, flyovers and ‘fast train’ networks is one method the welding industry uses to ensure the reliability and integrity of the wide range of welded products and structures.

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

14 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 waste 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.

IIW-India has been heavily involved in the appropriate Indian organisations and IIW Commissions in these areas and the transfer of appropriate technologies into industry and the community at large.

15 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.

India is putting its best foot forward by reducing the consumption of fossil fuels in heavy duty trucks and buses and commercial vehicles by the use of compressed natural gas and liquefied natural gas by reducing the SO_x and NO_x levels.

Solar and wind energy is being given preference over thermal energy to reduce the pollution as well as the road transport industry in India putting stringent norms of emission for vehicles.

IIW-India, 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 [12].

It is reported that the Indian steel industry will play an integral role in steering India towards a \$5 trillion economy by 2025[13]. India is the world's second largest steel producer with 102.5 MT production, an installed capacity of 142.2 MT and the third largest consumer in the world with a finished steel consumption of 94.9 MT in the 2021 financial year said to increase to 230MT by 2030/31.

IIW-India 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.

16 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 IIW-India's networks and the welding industry has been used to mitigate such problems particularly through its development work and involvement of its network of world class experts.

Examples include, amongst others, IIW-India members developing products for the marine industry using LNG as the fuel for heavy duty ship engines which reduces the pollution in the sea as well as waterways being developed and constructed for ships and barges thus avoiding surface transport on roads

Perhaps the biggest challenge facing this SDG is the massive pollution of waterways, including major rivers, which takes place daily in India.

17 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.

The great benefits of welding, and IIW-India'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.

18 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.



IIW-India 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 Indian 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.

A successful approach has been 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.

Through its information and technology transfer mechanisms, IIW-India has the ability to significantly influence this SDG positively.

It is also important to note that often the word “sustainable” could be 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.

19 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), Southern African Institute of Welding (SAIW) and the Heavy Engineering Research Association (HERA) in New Zealand, the Indian Institute of Welding (IIW India) is part of the **Welding Innovations Network (WIN)** working to transfer the knowledge and experience of world experts into as many countries on a global basis.

One only has to consider IIW-India's networks such as IIW, AWPM, Bureau of Indian Standards (BIS), International Organisation for Standardization (ISO), International Committee for Non-destructive Testing (ICNDT), Indian Society for Non-destructive Testing (ISNT), Indian Institute of Metals (IIM), Indian Stainless Steel Development Association (ISSDA) etc to see the potential which can be harnessed. A good example of how such networks can assist with this SDG is shown in references [14] and [15]. Reference 14 shows how the Welding Technology Institute of Australia (WTIA), created a worldwide network of technological experts and organisations with remarkable success with technology transfer to Australian industry. Reference 15 shows how the CWB Group built up an Association from 1000 members to over 70000 members over a ten year period. When one considers that there are over 2m welders in India, a quantum leap by the welding industry's involvement in progressing the SDGs will make an enormous contribution to the Government of India's endeavours.

In the spirit of South-South Cooperation for realizing the 2030 Agenda, India also supports developing countries through the US\$ 150 million **India-UN Development Partnership Fund**. In this spirit of regional and global partnerships, and the country's commitment to leave nobody behind, India has stepped into the Decade of Action [1].

IIW-India has been making great strides in working with the SAARC countries including planning to assist them with its SDG initiatives.

20 Recommendations



For those people, including their organisations, who wish to support and contribute to the achievement of the UN SDGs, please link to Reference 2 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.

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 IIW-India’s initiatives, contact Mr Rituraj Bose, Honorary Secretary General at IIW-India on rituraj.bose@iiwindia.com.

It is the intention of IIW-India to draw up mutually beneficial strategies and action plans with the support of the Indian government, industry and aid agencies for implementation to achieve significant progress in UN SDGs for which it and the welding industry has the expertise.

This report is to be a catalyst for such initiatives and create a quantum leap for IIW-India and the welding industry to support the Indian Government to succeed in this major objective by 2030.

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