



HERA Report No R5-93:2021

HERA's role in progressing the United Nations Sustainable Development Goals (SDGs)

HERA's role in progressing the United Nations Sustainable Development Goals (SDGs)

Chris Smallbone

IIW Fellow, IIW President 2005-2008

Dr Troy Coyle

CEO, HERA

Revision	Description	Date	Originator	Reviewer	Approver
0	First copy	1/12/2021	CS	TC	TC
1	v2	6/12/2021	CS / KN / MK / KA	TC / CS	TC

Publisher

New Zealand Heavy Engineering Research Association (HERA)

17-19 Gladding Place

P +64 9 262 2885

Manukau, 2104

F +64 9 262 2856

Auckland, New Zealand

E info@hera.org.nz

HERA ISBN 0112-1758

www.hera.org.nz

For information on publications, please contact HERA on +64 9 262 2885 or by email info@hera.org.nz.

About us

Securing tomorrow's industry by innovating today

HERA drives thought leadership for our industry in research and innovation.

We want our members to be employers of choice, and to be optimising cost effectiveness through productivity and efficiency. This includes providing support so that they follow global best practice, are evaluating and adopting new technologies for commercial success and are recognised for their outstanding commitment to quality.

Future-proofing our industry means making sure our members' metal solutions are recognised as the best choice because they're easy to use, are low risk and are the most sustainable, competitive, safest, and innovative option for Kiwis.

Disclaimer

All reasonable effort has been made and all reasonable care taken to ensure the accuracy and reliability of the material contained within this document. However, HERA, the authors and reviewers of this report make no warranty, guarantee or representation in relation to, or in connection with, this report and its accuracy or content of information. No representation, warranty, undertaking, or endorsement, is given in relation to or in connection with any aspect of this report including but not limited to any referenced products. No representation, warranty or undertaking is given in relation to the accuracy of any matter or fact contained in this report. HERA neither recommends nor endorses any product referenced in this report.

Users must make their own independent enquiries and investigations and obtain their own professional advice in relation to all material and content contained in this document and verify the same to their own satisfaction, including in relation to any referenced products. Users must not rely on the contents of this report in any manner or on any statement, representation, undertaking or warranty of any kind by HERA or by its personnel in connection with this report. HERA does not accept any responsibility or liability for any action taken in reliance on any content in this report.

HERA, the authors and reviewers, hereby disclaim any liability or responsibility for any loss or damage resulting from the use of this report and will not be held liable or responsible in any way to any user or any other person to the full and maximum extent permitted by law. In no circumstances will HERA or any other person be liable in any way to make any payment (whether by way of damages or otherwise) to any user of this document or any other person, for any direct or indirect, consequential, or special loss, howsoever arising.

This disclaimer governs the use of this report and by using this report, you accept this disclaimer in full.

Copyright

No part of this report may be reproduced in any way, or by any means without permission in writing from HERA.

Contents

Introduction 1
Recommendations 10
References..... 11

Introduction

HERA is an independent research association focused on heavy engineering. Typical components of the heavy engineering industry include:

- steel fabrication for hydroelectric projects, being penstocks, gates, and lifting gear;
- steel fabrication for buildings, bridges, and towers;
- storage tanks and containers, such as grain silos, and cement and petrol storage tanks;
- pressure vessels;
- firetube boilers and ancillary equipment;
- process machinery, such as cheese-making equipment, drying plants, heat exchangers, vats and vessels, and brewing plant;
- metalworking machinery, such as hydraulic guillotines, press brakes, and roll-formers;
- sawmilling and log-handling equipment;
- cranes, hoists, forklift trucks, rail wagons, and transporters;
- construction and mining equipment, such as crushing plant, concrete mixers, and loader buckets;
- equipment used in the energy industry, in fertiliser manufacture, and in pulp and paper manufacture; and
- ships.

Heavy engineering cuts across almost all sectors in New Zealand, including the primary sector, building and construction, the arts and manufacturing. It encompasses the total life cycle of products/structures including design, manufacture, conformity assessment, inspection and testing, operation, maintenance, repair, and decommissioning including recycling and other environmental conditions. It is a critical component of our national infrastructure.

Since its formation in 1978, HERA has worked, with its members and networks, to improve the nation's capability to support sustainable heavy engineering. For example, improving the National Welding Capability (NWC) [1]. HERA also has many examples of heavy engineering initiatives it has implemented to significantly progress the UN Sustainability Development Goals (SDGs) [2] and improve the quality of life of people and the environment in New Zealand and the Pacific Region.

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

HERA's excellent national and international network of individuals and organisations, such as 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.

For example, cooperating and collaborating with the Canadian Welding Bureau (CWB), Australian Steel Institute (ASI), ConstructSteel, Steel Construction Institute (SCI), Responsible Steel,

University of Michigan, Southern African Institute of Welding (SAIW) and the Indian Institute of Welding (IIW India), HERA is working to transfer the knowledge and experience of world experts into as many countries on a global basis.

Examples of such initiatives are shown below for each SDG.

SDG 1 – No poverty

Over the years, HERA has been able to show the value and benefits of its work and outcomes of that work to New Zealand. A good example was shown in its 2018 report on the return on investment of the HERA Welding Centre [3]. Many of the examples and initiatives developed by HERA over the years contribute to ending poverty and improving the quality of life.

HERA is also now focusing on the introduction of Industry 4.0, which is anticipated to give unprecedented transformation to New Zealand industry including a significant boost to GDP. 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 for the Small Island Developing States (SIDS).

HERA also commissioned Business and Economic Research Limited (BERL) in 2018 to assess the metals industry against the Living Standards Framework (LSF) including social, human, natural and physical/financial living standards and concluded that the metals industry contributed strongly to the economic performance and well-being of New Zealand [4]. In 2021, 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 [5].



SDG 2 – Zero hunger

HERA has many examples of how the technologies developed over the years in its networks have helped ensure the reliability of equipment for food processing as well as the reliability and integrity of the food itself.

It has also helped ensure a competent industry is available using appropriate technologies to be able to build, repair and maintain the relevant equipment for such food processing and food transportation as well as agricultural equipment and facilities.



SDG 3 – Good health and well-being

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 HERA network, for example, TWI related to medical devices. HERA also facilitates the design of safe and healthy buildings for people to live and work in.



HERA's work on assessing the steel industry's performance against the Living Standards Framework, identifies mechanisms to contribute to intergenerational wellbeing. This includes HERA's initiation of and commitment to the Aotearoa Steel Industry Transformation Agenda and Plan.

SDG 4 – Quality education

HERA has created and implemented numerous programmes and opportunities, both in its own right and within the 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.



Such initiatives taking place in New Zealand could also be offered to SIDS particularly with the upgrading of digital connections taking place at the University of South Pacific (USP).

HERA's CEO is also the Co-Chair of Hanga Aro Rau, the Workforce Development Council (WDC) for manufacturing, engineering and logistics. The WDC represents the industry voice in the reforms of vocational education.

The global welder shortage is a growing and well-known phenomenon. Is this a problem for New Zealand? To answer this question, HERA surveyed more than 200 companies involved in welding fabrication. The responses received are summarised in the infographic Report - The Future Needs Welders: <https://www.hera.org.nz/welder-shortage/>.

The fabrication industry will continue to be important for New Zealand. This is because businesses are likely to ensure their supply chain is more local to reduce the risks. There is great demand for Trade Qualified welders. The possibilities for continuous learning in welding are wide considering the advances in welding automation, processes, power sources and Welding 4.0 technologies.

Education and state-of-the-art training for local students are at the core of solving the welder/fabricator shortage. Over more than 30 years, HERA supported welding-education programmes by providing a range of Welders Training Modules, Welding Supervisor and Inspector courses. A range of expert seminars for professional engineers are also offered every year. HERA is also an International Institute of Welding (IIW) Nominated Authorised Body (HERA ANB) for the qualification of the welding personnel. HERA ANB complies with the highest standard for these organisations.

SDG 5 – Gender equality

HERA is involved in programmes in New Zealand enabling women and girls to enter STEMM (the last “M” standing for Mātauranga Māori, as coined by Pūhoro Charitable Trust) disciplines and engineering at various levels. This includes areas such as education, training, research, development and technology transfer accompanied by the appropriate career paths.

The implementation of HERA's Whanake Scholarship [6], founding membership of the “Diversity Agenda” and campaigns promoting women in engineering are all examples of how HERA is working towards gender equality and greater diversity to progress this SDG. HERA plays a key role in advocating for greater participation of women in STEMM, and heavy engineering, through its podcast (Stirring the Pot) and through its CEO sitting on panels and presenting to industry on this topic.



SDG 6 – Clean water and sanitation

HERA'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 wastewater treatment, less pollution, better water capture and increased water resources.

The continual transfer of such existing and new technologies into both New Zealand and the SIDS is paramount for achieving this SDG.

HERA also contributes indirectly through technical support for fabrication of water containment, storage and transport (vessels, pipes, tanks).



SDG 7 – Affordable and clean energy

Steel is critical to the development of the infrastructure required to transition to zero carbon energy. There are many examples of HERA's IIW Network 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.

Low carbon energies such as solar, wind, geothermal, hydro all require high quality steel design, manufacture, and maintenance to ensure their reliability.



SDG 8 – Decent work and economic growth

There are many factors that 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, HERA has had a great 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 heavy engineering capability can be easily shown.



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 HERA plays a significant role.

The establishment of the Fab4.0 Lab [8] to assist companies with new and appropriate technologies, implementation of post-graduate research scholarships [9] and excellent success of the Steel Fabricator Certification (SFC) programme [10], all contribute to improving this SDG. Alongside this, HERA is working to raise awareness of the productivity benefits of adopting industry 4.0 in the construction sector, with anticipated significant increases in GDP [5].

SDG 9 – Industry, innovation and infrastructure

HERA's vision is to secure tomorrow's industry by innovating today by building a passionate tribe of metal heads who innovate successfully.



To achieve this, HERA conducts a range of research activities to assist with the advancement of building and infrastructure resilience. This includes HERA's research programs in seismic, sustainability and fire engineering. Heavy engineering is a key requirement of all of our nation's critical infrastructure, including: road, rail, wind energy, solar energy, geothermal energy, hydro energy, and our building stock. HERA continually updates design guides, technical solutions to account for recent research and development, climate change, lessons learned from past natural hazards, and to improve structural resilience. HERA also significantly contributes to design standards development and amendment to provide a more reliable solution to assess, calculate the forces and deformations, and design of buildings and other structures. These advanced solutions will, in turn, assist design engineers to improve structural resilience.

Ever since its formation, HERA has supported an innovation culture both internally and within the heavy engineering industry, as well as more broadly across the manufacturing and construction sectors. This has been achieved in several ways, including:

- HERA's Innovation Ready, Set, Go program, which assists companies and individuals to build an innovation process and culture;
- Fab4.0Lab, which showcases latest industry 4.0 developments relevant to fabrication, and supports related research and training;
- HERA's Innovation Centre, which will be a purpose-built facility to showcase the latest developments in Construction 4.0;

- HERA's MetalMind app which is a key part of an innovation readiness and maturity tool and dashboard in development; HERA's innovation clusters for automation, defence, human resources and digital content to drive innovation thinking in these spaces;
- HERA's Industry 4.0 Cluster which is the forum for technology transfer and development linking end-users, technology providers and researchers.
- HERA's Future Forum conference which is focused on preparing industry for the future of work and potential disruptions. This is linked to industry awards, of which one is for innovation. It recognises major innovation being implemented through demonstrated product, manufacturing, information technology, process or service; and
- HERA commissioning BERL to explore the economic benefits of adopting Industry 4.0 into business and innovating work practices so they are more productive and efficient.

SDG 10 – Reduced inequalities

HERA supports this SDG by ensuring that these considerations are built into its industry-wide programs. For example, requirements for diversity, equity and not engaging in child labour in the Aotearoa Steel Transformation Agenda and Plan and the Sustainable Steel Council Certification Program. HERA has prepared a template Diversity and Inclusion Policy to assist companies to develop procedures and cultural changes required to support greater gender equality.



HERA has also launched a range of programs and projects aimed at improving diversity and inclusion. This includes:

- the Whanake Scholarship [6] which is aimed at Māori in Engineering, and where possible wahine (women);
- the current development of a Mātauranga Māori framework that can be adopted into business to meet Te Tiriti o Waitangi partnership and help businesses honour this partnership more genuinely [7].
- Thought leadership initiatives which challenge industry to consider their role to play in greater diversity and inclusion within their business model whether it be gender, culture, age, sexual orientation, disability or similar.

SDG 11 – Sustainable cities and communities

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, floods as well as failures due to shoddy quality.

In New Zealand, HERA 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.



HERA's work on seismic optimisation of welded structures [11] and on fire research [12] has made major impacts on this SDG for New Zealand. In addition, HERA is involved in a range of standards development and review Committees, which will ensure the safety and resilience of our building stock and infrastructure. These include:

- ME-001: Pressure Equipment
- MT-001: Iron and Steel
- BD-001: Steel Structures
- MT-029: Fasteners
- BD-006: General Design Requirements and Loading on Structures
- BD-032: Composite Construction
- BD-090: Bridge Design
- BD-023: Structural steel
- NZS 3404: Steel Structures
- WD-003: Welding of structures
- WD-002: Welding consumables
- MT-014: Corrosion of metals

SDG 12 – Responsible consumption and production

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

HERA has been heavily involved in the appropriate New Zealand organisations and IIW Commissions in these areas and the transfer of appropriate technologies into industry and the community at large.

Particular projects in this area include current research relating to:

- development of Australasia's first material passport, which will assist with the re-use and repurposing of structural steel;
- development of design guidance to extend steel structure lifetimes from 50 years to 100 years; and
- development of a world first comprehensive zero carbon steel offsetting program [13].



SDG 13 – Climate action

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.



HERA has 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. HERA has been particularly engaged in the development of Above Ground Geothermal Technologies.

HERA is a key member of the Sustainable Steel Council NZ Incorporated (SSC) working to show that steel is valued as a critical enabler to a low emission economy. The HERA CEO is the inaugural Chair of the Council. Recently, working with thinkstep-anz, HERA has introduced a zero-carbon steel program that uses carbon offsetting for steel used in New Zealand [13].

HERA itself has been certified as zero carbon for its business operations. HERA partnered with Ekos which offers certified carbon credits sourced from projects that grow and protect forests in Aotearoa and the Pacific Islands [14].

SDG 14 – Life below water

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 that will be used in water, the integrity of the welds becomes paramount.

Weld integrity is important for ships, boats, oil and gas carrying pipelines and tankers, where 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.



SDG 15 – Life on land

Heavy engineering is used in many critical applications on land, 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 heavy engineering, and HERA'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.



HERA has specifically chosen to partner with Ekos to deliver the zero carbon steel offset program because of the focus on planting and regeneration of indigenous forests. This has the advantage of creating greater biodiversity. As this offsetting program expands, it is likely to have a significant biodiversity impact too.

SDG 16 – Peace, justice and strong institutions

HERA honours Te Tiriti o Waitangi and is in the process of developing a program to assist the heavy engineering industry to increase its awareness of Te Tiriti obligations and appreciation for te āo Māori.

HERA also supports, through its certification processes, an increased focus on institutional transparency and accountability.



SDG 17 - Partnerships

An important component of achieving this SDG is the use of the formal networks that exist within the heavy engineering industry 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.

One only has to consider HERA's networks such as Responsible Steel, ConstructSteel, IIW, NZSO, ISO, ICNDT 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 [15] and [16].



Recommendations

For organisations, who wish to support and contribute to the achievement of the UN SDGs, a good guide is Reference 15 titled "Your Country's National Welding Capability (NWC) and its significance to the UN Sustainability Development Goals (SDGs)" by Chris Smallbone, IIW Past President.

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 HERA's initiatives, contact Dr Troy Coyle, CEO at HERA on troy.coyle@hera.org.nz.

References

- [1] SciELO - Brazil - Establishing and Implementing the Building Blocks of a Country's National Welding Capability (NWC)
<https://www.scielo.br/j/si/a/tDWHcwCpMB3tFYY4xTXWZWt/?lang=en>
- [2] https://en.wikipedia.org/wiki/Sustainable_Development_Goals
- [3] HERA calculates return on investment from welding centre
https://www.iranz.org.nz/news/2018/hera_welding_centre
- [4] Our NZ metals industry is the first to assess against Treasury's Living Standards Framework <https://www.hera.org.nz>
- [5] HERA report shows adoption of construction 4.0 worth \$8billion <https://www.hera.org.nz>
- [6] Whanake Scholarship <https://www.hera.org.nz/hera-whanake-scholarship/>
- [7] John Cole investigates the interface between Mataranga Maori and Construction 4.0
<https://www.hera.org.nz>
- [8] <https://nzmanufacturer.co.nz/2021/05/hera-sets-the-scene-for-heavy-engineerings-future-with-digital-home-for-the-tribe-and-fab4-0lab/>
- [9] Post-graduate Research Scholarships <https://www.hera.org.nz/post-graduate-scholarships/>
- [10] Assuring specifiers of steel construction through the SFC scheme
<http://steelfabcert.co.nz/>
- [11] Seismic research program improving optimisation of steel structures [Innovate@HERA](https://www.hera.org.nz/innovate@HERA)
- [12] HERA guide on performance-based fire design of multi-storey steel and composite (steel/concrete) structures [Innovate@HERA](https://www.hera.org.nz/innovate@HERA)
- [13] Zero carbon steel program <https://www.sustainablesteel.org.nz/heras-carbon-footprint/>
- [14] HERA's operations go zero carbon <https://www.hera.org.nz>
- [15] Your Country's National Welding Capability (NWC) and its significance to the UN Sustainability Development Goals by Chris Smallbone, IIW Past President.
<https://asr.ro/documents/C.Smallbone2021.pdf?t=1639211760>
- [16] WELD Canadian Welding & Lifestyle Magazine WINTER 2021 Vol 04 No 16.
<https://www.cwbgroup.org/association/publications>