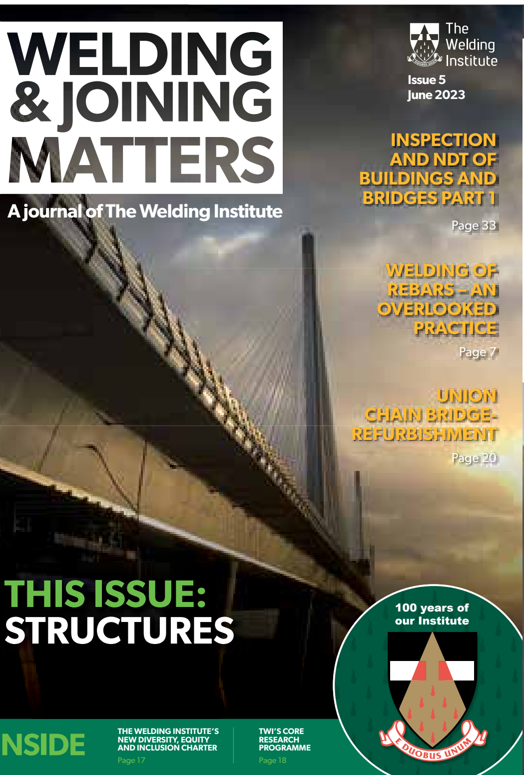
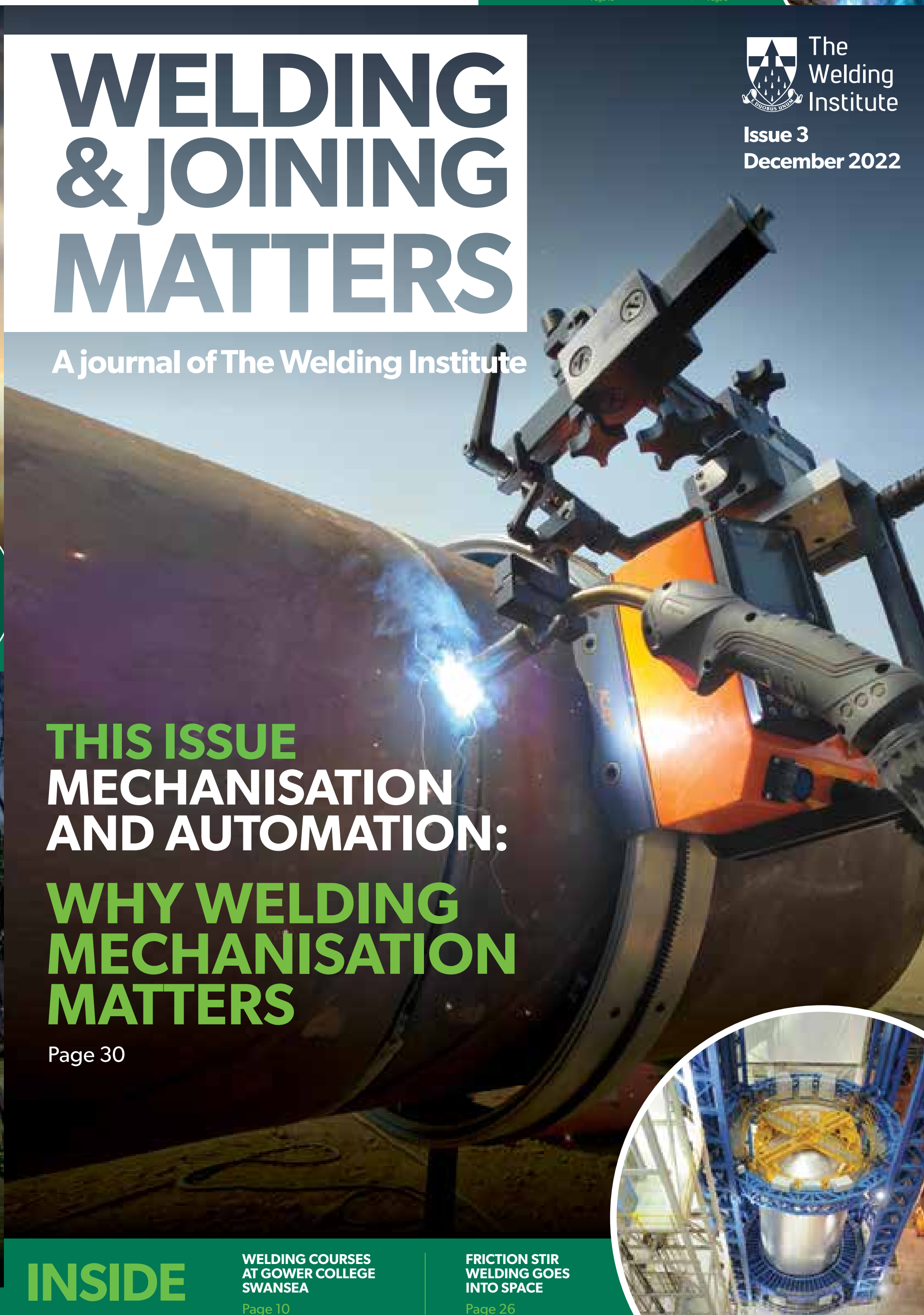
WELDING & JOINING MATTERS
MEDIA PACK
2024





WELDING & JOINING MATTERS

www.theweldinginstitute.com

'Welding and Joining Matters is the UK journal for all of those working in the fields of welding and joining as well as the related fields of surface coatings, inspection and non-destructive testing which is now two years old. It is published quarterly by The Welding Institute and has an international readership through the individual and industrial company memberships of the Institute. The circulation is to more than 5000 specialists. The articles are written to be educational and informative and consequently each issue has great appeal for retention and recirculation. Hence it provides an attractive and readable publication for advertisers. We look forward to receiving your enquiries for advertising space in our great new journal.

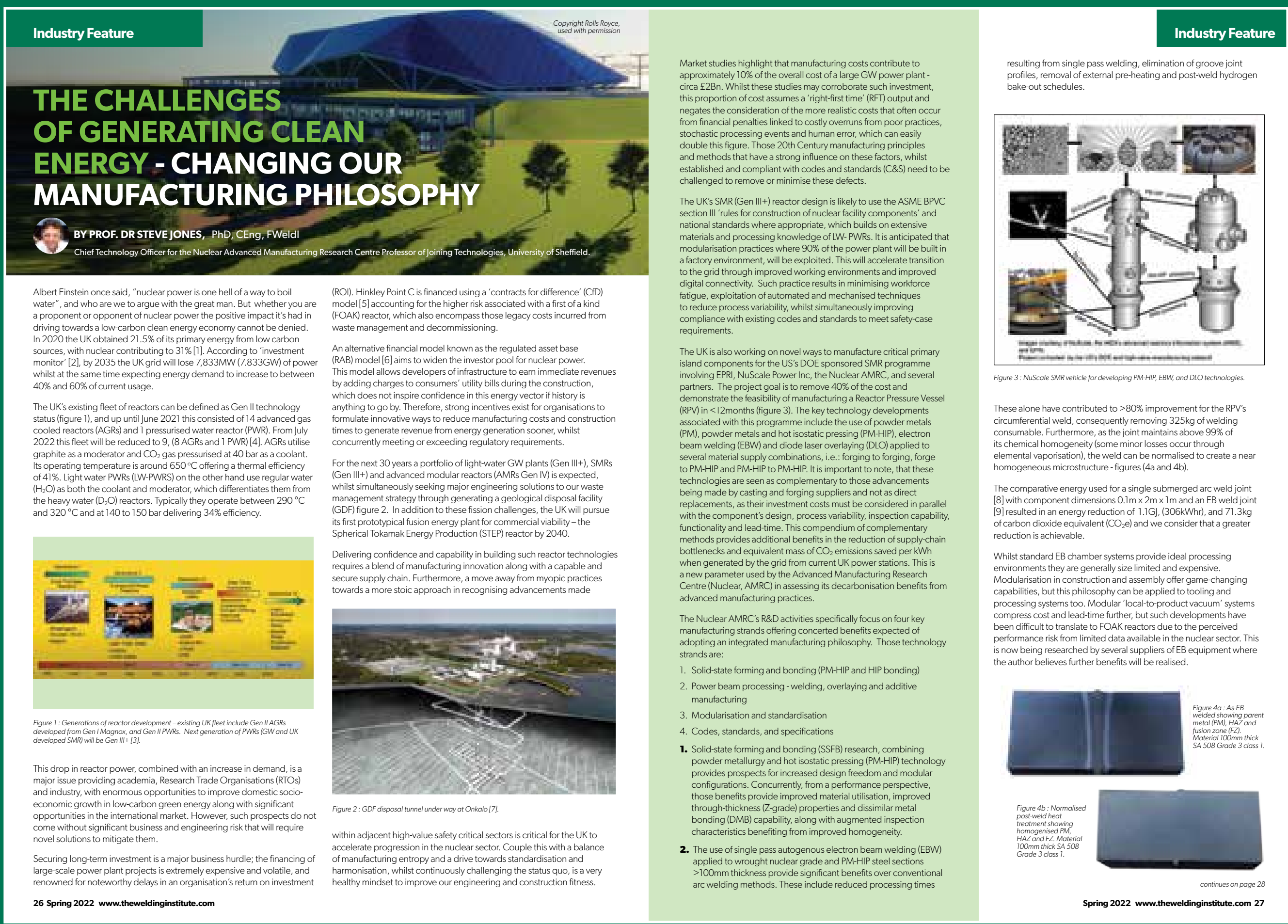
Claire Kimpton, Chair, Professional Board, The Welding Institute

Key Facts

Welding & Joining Matters

- Circulation of over 5000 subscribers.
- 75% of subscribers UK-based and 25% around the world notably in Malaysia, India, the Middle East and Australia.
- Readers include those at senior levels in companies responsible for sourcing, specifying and purchasing equipment, systems, services and finished fabricated products.
- Each issue is themed with articles and features on that theme. Themes for the 2024 issues are shown on the back page.
- In addition to the themed articles the editorial includes regular features on Industry News, Product Innovation, 'Job Knowledge', 'Ask the Expert', 'Inspection and Non-destructive testing' and 'Equipment and systems'. There will also be Branch News, International News and updates on codes and standards.

Facsimile Page of Welding & Joining Matters, showing example content only.



Industry Feature

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THE CHALLENGES OF GENERATING CLEAN ENERGY - CHANGING OUR MANUFACTURING PHILOSOPHY

BY PROF. DR STEVE JONES, PhD, CEng, FWeldI

Chief Technology Officer for the Nuclear Advanced Manufacturing Research Centre Professor of Joining Technologies, University of Sheffield.

Albert Einstein once said, "nuclear power is one hell of a way to boil water", and who are we to argue with the great man. But whether you are a proponent or opponent of nuclear power the positive impact it's had in driving towards a low-carbon clean energy economy cannot be denied. In 2020 the UK obtained 21.5% of its primary energy from low carbon sources, with nuclear contributing to 31% [1]. According to 'investment monitor' [2], by 2035 the UK grid will lose 7,833MW (7.833GW) of power whilst at the same time expecting energy demand to increase to between 40% and 60% of current usage.

The UK's existing fleet of reactors can be defined as Gen II technology status (figure 1), and up until June 2021 this consisted of 14 advanced gas cooled reactors (AGRs) and 1 pressurised water reactor (PWR). From July 2022 this fleet will be reduced to 9, (8 AGRs and 1 PWR) [4]. AGRs utilise graphite as a moderator and CO_2 gas pressurised at 40 bar as a coolant. Its operating temperature is around 650 °C offering a thermal efficiency of 41%. Light water PWRs (LW-PWRS) on the other hand use regular water (H_2O) as both the coolant and moderator, which differentiates them from the heavy water (D_2O) reactors. Typically they operate between 290 °C and 320 °C and at 140 to 150 bar delivering 34% efficiency.

Figure 1 : Generations of reactor development – existing UK fleet include Gen II AGRs developed from Gen I Magnox, and Gen II PWRs. Next generation of PWRs (GW and UK developed SMR) will be Gen III+ [3].

This drop in reactor power, combined with an increase in demand, is a major issue providing academia, Research Trade Organisations (RTOs) and industry, with enormous opportunities to improve domestic socio-economic growth in low-carbon green energy along with significant opportunities in the international market. However, such prospects do not come without significant business and engineering risk that will require novel solutions to mitigate them.

Securing long-term investment is a major business hurdle; the financing of large-scale power plant projects is extremely expensive and volatile, and renowned for noteworthy delays in an organisation's return on investment (ROI). Hinkley Point C is financed using a 'contracts for difference' (CfD) model [5] accounting for the higher risk associated with a first of a kind (FOAK) reactor, which also encompass those legacy costs incurred from waste management and decommissioning.

An alternative financial model known as the regulated asset base (RAB) model [6] aims to widen the investor pool for nuclear power. This model allows developers of infrastructure to earn immediate revenues by adding charges to consumers' utility bills during the construction, which does not inspire confidence in this energy vector if history is anything to go by. Therefore, strong incentives exist for organisations to formulate innovative ways to reduce manufacturing costs and construction times to generate revenue from energy generation sooner, whilst concurrently meeting or exceeding regulatory requirements.

For the next 30 years a portfolio of light-water GW plants (Gen III+), SMRs (Gen III+) and advanced modular reactors (AMRs Gen IV) is expected, whilst simultaneously seeking major engineering solutions to our waste management strategy through generating a geological disposal facility (GDF) figure 2. In addition to these fission challenges, the UK will pursue its first prototypical fusion energy plant for commercial viability – the Spherical Tokamak Energy Production (STEP) reactor by 2040.

Delivering confidence and capability in building such reactor technologies requires a blend of manufacturing innovation along with a capable and secure supply chain. Furthermore, a move away from myopic practices towards a more stoic approach in recognising advancements made

Figure 2 : GDF disposal tunnel under way at Onkalo [7].

within adjacent high-value safety critical sectors is critical for the UK to accelerate progression in the nuclear sector. Couple this with a balance of manufacturing entropy and a drive towards standardisation and harmonisation, whilst continuously challenging the status quo, is a very healthy mindset to improve our engineering and construction fitness.

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Market studies highlight that manufacturing costs contribute to approximately 10% of the overall cost of a large GW power plant - circa £2Bn. Whilst these studies may corroborate such investment, this proportion of cost assumes a 'right-first time' (RFT) output and negates the consideration of the more realistic costs that often occur from financial penalties linked to costly overruns from poor practices, stochastic processing events and human error, which can easily double this figure. Those 20th Century manufacturing principles and methods that have a strong influence on these factors, whilst established and compliant with codes and standards (C&S) need to be challenged to remove or minimise these defects.

The UK's SMR (Gen III+) reactor design is likely to use the ASME BPVC section III 'rules for construction of nuclear facility components' and national standards where appropriate, which builds on extensive materials and processing knowledge of LW- PWRs. It is anticipated that modularisation practices where 90% of the power plant will be built in a factory environment, will be exploited. This will accelerate transition to the grid through improved working environments and improved digital connectivity. Such practice results in minimising workforce fatigue, exploitation of automated and mechanised techniques to reduce process variability, whilst simultaneously improving compliance with existing codes and standards to meet safety-case requirements.

The UK is also working on novel ways to manufacture critical primary island components for the US's DOE sponsored SMR programme involving EPRI, NuScale Power Inc, the Nuclear AMRC, and several partners. The project goal is to remove 40% of the cost and demonstrate the feasibility of manufacturing a Reactor Pressure Vessel (RPV) in <12months (figure 3). The key technology developments associated with this programme include the use of powder metals (PM), powder metals and hot isostatic pressing (PM-HIP), electron beam welding (EBW) and diode laser overlaying (DLO) applied to several material supply combinations, i.e.: forging to forging, forge to PM-HIP and PM-HIP to PM-HIP. It is important to note, that these technologies are seen as complementary to those advancements being made by casting and forging suppliers and not as direct replacements, as their investment costs must be considered in parallel with the component's design, process variability, inspection capability, functionality and lead-time. This compendium of complementary methods provides additional benefits in the reduction of supply-chain bottlenecks and equivalent mass of CO_2 emissions saved per kWh when generated by the grid from current UK power stations. This is a new parameter used by the Advanced Manufacturing Research Centre (Nuclear, AMRC) in assessing its decarbonisation benefits from advanced manufacturing practices.

The Nuclear AMRC's R&D activities specifically focus on four key manufacturing strands offering concerted benefits expected of adopting an integrated manufacturing philosophy. Those technology strands are:

1. Solid-state forming and bonding (PM-HIP and HIP bonding)
2. Power beam processing - welding, overlaying and additive manufacturing
3. Modularisation and standardisation
4. Codes, standards, and specifications

1. Solid-state forming and bonding (SSFB) research, combining powder metallurgy and hot isostatic pressing (PM-HIP) technology provides prospects for increased design freedom and modular configurations. Concurrently, from a performance perspective, those benefits provide improved material utilisation, improved through-thickness (Z-grade) properties and dissimilar metal bonding (DMB) capability, along with augmented inspection characteristics benefiting from improved homogeneity.

2. The use of single pass autogenous electron beam welding (EBW) applied to wrought nuclear grade and PM-HIP steel sections >100mm thickness provide significant benefits over conventional arc welding methods. These include reduced processing times

Industry Feature

resulting from single pass welding, elimination of groove joint profiles, removal of external pre-heating and post-weld hydrogen bake-out schedules.

Figure 3 : NuScale SMR vehicle for developing PM-HIP, EBW, and DLO technologies.

These alone have contributed to >80% improvement for the RPV's circumferential weld, consequently removing 325kg of welding consumable. Furthermore, as the joint maintains above 99% of its chemical homogeneity (some minor losses occur through elemental vaporisation), the weld can be normalised to create a near homogeneous microstructure - figures (4a and 4b).

The comparative energy used for a single submerged arc weld joint [8] with component dimensions 0.1m x 2m x 1m and an EB weld joint [9] resulted in an energy reduction of 1.1GJ, (306kWhr), and 71.3kg of carbon dioxide equivalent (CO_2e) and we consider that a greater reduction is achievable.

Whilst standard EB chamber systems provide ideal processing environments they are generally size limited and expensive. Modularisation in construction and assembly offer game-changing capabilities, but this philosophy can be applied to tooling and processing systems too. Modular 'local-to-product vacuum' systems compress cost and lead-time further, but such developments have been difficult to translate to FOAK reactors due to the perceived performance risk from limited data available in the nuclear sector. This is now being researched by several suppliers of EB equipment where the author believes further benefits will be realised.

Figure 4a : As-EB welded showing parent metal (PM), HAZ and fusion zone (FZ). Material 100mm thick SA 508 Grade 3 class 1.

Figure 4b : Normalised post-weld heat treatment showing homogenised PM, HAZ and FZ. Material 100mm thick SA 508 Grade 3 class 1.

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ADVERTISING OPPORTUNITIES

We have a range of advertising opportunities in Welding & Joining Matters. However because this is a technical journal, space is limited and is booked on a first come first served basis.

DISPLAY ADVERTISING

We have a number of display advertising slots available throughout the magazine which can be booked at the following rates:

Full page (w)210mm x (h)297mm

£1200.00

Half Page (w)190mm x (h)130mm

£700.00

Quarter page (w)90mm x (h)130mm

£450.00

PRIME POSITIONS

The inside front cover and inside back cover are our prime advertising positions. These prime positions attract a 25% loading charge and are available on a first come first served basis.

RECRUITMENT ADVERTISING

Advertising your vacancy in Welding & Joining Matters is an extremely effective way of reaching industry related practitioners, professionals and academics.

Full Page – £1800.00

Half Page – £1050.00

Quarter page – £675.00

LEAFLET INSERTS

We can design, print and insert your leaflets into Welding & Joining Matters or if you prefer to supply your own leaflets, we will insert them in the magazine.

Design, print and insert an A5 double sided leaflet – £595.00

Design, print and insert an A5 four page or A4 two page leaflet – £945.00

Insertion of you own leaflets (Maximum A4 sheet) – £395.00

DISCOUNT FOR INDUSTRIAL OR PROFESSIONAL MEMBERS OF THE WELDING INSTITUTE

All members enjoy a 15% discount in addition to our standard discount structure.

SERIES DISCOUNT

We are pleased to offer a range of series discounts to advertisers. Series bookings are billed in full after the first insertion.

2 insertions – 10% discount

3 insertions – 15% discount

4 insertions – 25% discount

CLASSIFIED ADVERTISING

Place your classified advertisement in Welding and Joining Matters under one of the following headings – or propose your own category:

metal suppliers and stockholders; welding, joining and surface processing equipment and systems; plant and equipment – general; welding consumables; gases; welding shop supplies and accessories; brazing equipment and supplies; plastic and composite supplies; cutting and preparation equipment; measurement equipment and sensors; fume extraction and air filtration systems; structural fabrication services; pressure vessels fabrication; piping and process system fabrication; additive manufacture services; specialist subcontractors; heat treatment specialist; inspection and non- destructive testing services; laboratory testing services; consultants and specialists.

Basic Listing – 25 words max. £50
Bronze Listing – £150
Silver Listing – £250
Gold listing – £350

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