

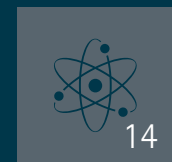
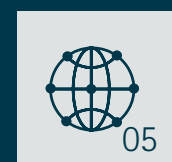
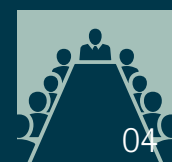


European
Copper Institute
Copper Alliance

2017 Annual Report



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Highlights

Welcome to the European Copper Institute (ECI) annual report. It provides an overview of who we are and how we operate and presents our main activities throughout 2017.

Our key activities included:

- Providing research and regulatory input to the European Commission to help ensure Europe's copper industry can continue delivering sustainable growth and jobs.
- Helping shape the debate on the Clean Energy Package and adding building automation to the Brussels agenda, paving the way to smarter buildings in Europe.
- Coordinating industry inputs on major EU building construction regulatory developments and technical issues, including building construction waste and recycling.
- Providing data and technical support to European industries looking to optimise products and services by making effective use of copper and its alloys.
- Developing a Public Affairs function to strengthen our narrative on copper as an enabler of a sustainable future for Europe.
- Continuing to work with the Copper Alliance, and alongside our members and the broader metals community, building strategic partnerships with companies and organisations throughout Europe and beyond.
- Continuously improving our ways of working, to create a European Copper Institute which is fit for the future and driven by focus, agility and expertise.

To find out more about our organisation, please visit www.copperalliance.eu. You can also connect with us on Twitter, [@ThinkCopperEU](https://twitter.com/ThinkCopperEU).

Growth Lies Ahead for the European Copper Industry

The year 2017 showed continued improvement for the worldwide copper market, with a 0.7% growth registered for the apparent usage of refined copper that reached 23.7 million tonnes at the end of the period. Even more positive news came from Europe, where demand grew by 1.6% over 2016 to reach 4.1 million tonnes. The share of the 28 EU countries in this demand was stable at 3.2 million tonnes.

Global refined production of copper grew by 0.6% in 2017 with a significant increase (4.5%) in secondary smelting and refining, due to better availability of scrap. Recovering from maintenance shutdowns in 2016 and driven by increased demand, European refined production enjoyed a healthy growth rate of 3.7% over last year.

Price recovery, observed in the fourth quarter of 2016, was confirmed in 2017, which saw the LME cash settlement price rise by 26.5% over the year, from 5,659 USD/tonne at the end of 2016 to 7,157 USD/tonne last December. Notwithstanding this evolution, copper substitution in 2017 reduced further from 1.0% to 0.8% of the total market, driven by strong demand for copper in power cable, mainly in China.

Besides market movements linked to growth in income and in population, the evolution of the European regulatory environment continues to present both challenges and opportunities for the copper industry.

The REACH regulation (Registration, Evaluation, Authorisation and restriction of Chemicals) is approaching its second phase (i.e. Evaluation), which will start in May 2018 after all chemical substances have been registered. This will bring the debate around hazard classification of copper products even higher on the regulatory agenda of the industry. We also need to take 'side-effects' into account, such as the registration of copper components entering into the manufacturing of niche biocidal products, or the potential inclusion of lead metal as a candidate for Substance of Very High Concern, which will impact the use of lead-containing copper alloys. On all these concerns, ECI needs to exercise due care in ensuring they are mitigated through fact-based, professional advocacy towards regulators.

A good example is the ongoing review of Occupational Exposure Limits (OEL) where the copper industry is engaging in a significant and comprehensive scientific research programme managed by ECI, with the aim of demonstrating to European lawmakers that a balanced approach to this highly sensitive issue is the right way forward.

The European copper industry is also actively engaged on global challenges. Driven by the growing concerns around responsible sourcing, the OECD has initiated the definition of strict guidelines for due diligence on suppliers with

specific focus on conflict-affected areas, human rights and environmental protection. Through the partnership between the International Copper Association (ICA) and the International Council on Mining and Metals (ICMM), ECI is closely engaged in providing constructive input to the OECD on these due diligence guidelines, so as to keep pragmatism high on the agenda. Also with ICMM, ECI is making good progress on developing adequate corrosion test procedures for the sea transport of bulk material like copper concentrates. Recent developments show that the International Maritime Organization (IMO) is willing to consider ECI's proposal for testing methodology, which will avoid significant increase in transport and handling costs for copper ore.

Regulations can also bring positive change. The issuance of the 'Clean Energy for All' package by the European Commission at the end of 2016 has triggered a significant string of opportunities for additional use of copper in areas including wind turbines, electric vehicles, grid balancing and building automation. Industry players are now actively taking initiatives, under the stewardship of ECI, to capture these opportunities.

The future of the copper industry in Europe thus remains bright. Thanks to the active role of ECI, our license to operate and our fair access to markets are maintained. I wish to take this opportunity to thank all member companies of ECI, the ECI staff and the International Copper Association for their continuous contribution to fulfilling this mission.



Gonzalo Cuadra
Chairman, European Copper Institute

Contributing to Building the Future of the European Copper Industry

Against the backdrop of a fast-changing environment that continuously creates both market and regulatory challenges and opportunities, it is key to keep our eyes and ears wide open in order to gain a good sense of the long-term perspective for the industry. In doing so, the copper sector will be able to prepare for new challenges and, equally importantly, proactively seize the chances coming our way.

Many such chances are appearing on the horizon of the European copper industry. The energy transition in which Europe has engaged confirms copper is the metal of choice to equip wind turbines, solar panels and heat pumps, to manufacture emission-free, high efficiency electric vehicles, to store energy and to interconnect power grids across the continent. The move towards a circular economy is another priority at EU level, which presents some challenges, but also a number of positives. The copper industry is well positioned: efforts deployed by European industry mean that around 50% of Europe's copper needs are already met with recycled material.

To strengthen our assistance to the copper industry in capturing these opportunities, ECI initiated the definition of a three-year plan in 2017. It will ensure all activities are guided by three key drivers: focus, agility and expertise.

Focus will be reached by developing an integrated approach to regulatory and market priorities, combining the efforts and knowledge of the market development programmes (Electricity and Energy, Building Construction Non-Electrical and Heat Exchange Systems) with the activities carried out in the field of Health, Environment and Sustainable Development. For this purpose, we created a Public Affairs function at ECI in 2017. It will ensure the data and analyses developed in the various programmes are leveraged into impactful advocacy positions that benefit the industry. Further, a broad action plan for reputation building has been launched to strengthen the mandate of ECI in its dealings with regulators—we aim to become a 'go-to' organisation, recognised by our stakeholders as a constructive contributor on key issues and a staunch, effective defender and promoter of the copper industry.

Agility is crucial in our fast-changing environment. This can only be achieved through close collaboration with ECI's members, which allows for a clear but flexible mandate on the battles to be fought, and the opportunities to be pursued. Collaboration mechanisms—such as steering committees—with our members are undergoing a thorough review with the aim of maximising the output, under the strict time and budget constraints we all face nowadays.

Expertise has been the backbone of ECI since its creation. We endeavour to further develop this expertise and leverage it across the full European footprint of ECI, through a revision of our work procedures and of our people development schemes that will ensure we optimise the use of skills present across our ten offices.

ECI's three-year plan has been developed with the participation of every member of its staff. Our ultimate goal is to have an organisation that is fit for the future. In this context, we are also strengthening the coordination between ECI and the International Copper Association in jointly addressing global challenges and exchanging best practices.

I wish to express my sincere thanks to our member companies, our partners and the ECI team for their strong support and their continued commitment to building a bright future for the European copper industry.



Bernard Respaut
Chief Executive, European Copper Institute

Who We Are



Bryony Samuel
Communications Manager, Europe

The European Copper Institute (ECI)—founded in 1996 and based in Brussels—coordinates a team of professionals based in offices across Europe, and works closely with its copper industry members on regulatory matters and market development programmes. ECI is part of the Copper Alliance™, which brings together the global copper industry to develop and defend markets for copper, and to make a positive contribution to society's sustainable development goals.

What we do



Provide valuable technical support and advice to the copper value chain



Lead industry efforts in human health and environmental science



Manage the REACH Copper Consortium to maximise industry's efficiency and cost-effective compliance with the regulation



Demonstrate the benefits of leading edge copper technologies to end-use sectors



Ensure copper's fair position in codes and standards at national and EU levels



Value Chain Representation

22 Companies

45,000 Direct employees in the European copper industry



Producers of copper



Leading manufacturers of semi-fabricated copper products



Downstream companies exploiting innovative copper-based products and technologies

Board of Directors

(at December 31st, 2017)

Gonzalo Cuadra (*Codelco Services*) - Chairman
Oriol Guixà (*La Farga*) - Vice Chairman
Joel Adams (*Glencore*)
Stefan Boel (*Aurubis*)
Augenija Di Bucci (*BHP Billiton*)
Jussi Helavirta (*Luvata*)

Sven Hjelmstedt (*Boliden*)
Krzysztof Kaczmarczyk (*KGHM*)
Evangelos Moustakas (*Halcon*)
Italo Romano (*KME Group*)
Javier Targhetta (*Freeport-McMoRan Copper & Gold*)
Werner Traa (*Wieland-Werke*)

Our Members and Funding



Catherine Mantell
Finance and Accounting Supervisor

ECI, plus its network of national Copper Alliance partners, operated with a 2017 budget of €9.5 million (\$10.6 million) to develop and carry out promotional and regulatory affairs activities.

While the International Copper Association—representing the world's leading mining companies, independent smelter/refiners (metal producers) and semi-fabricated product manufacturers—provided 80% of this budget, European members devoted significant time and contributed much-needed value chain intelligence to matters including programme design, regulatory issue management and national authority advocacy.

To a limited extent, member funding is leveraged with external funding sources to support ECI's activities in policy research, policy implementation, capacity building, market surveillance and in developing new technological solutions. In 2017, the IndustRE project successfully concluded, evaluating the flexibility potential of energy-intensive industries to facilitate grid integration of variable renewables, and the ReFreeDrive project was launched to develop rare-earth-free traction solutions for electric vehicles. Both projects obtained funding from the European Commission.

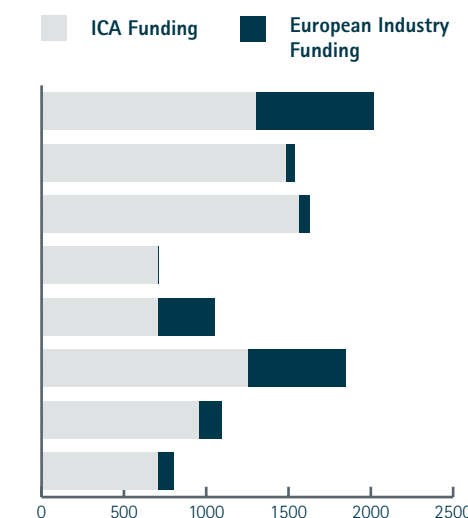
Copper Alliance Members Operating in Europe in 2017

Member companies listed here are those that have assets or operations, employ people and pay taxes within the EU. They include members of the International Copper Association. For the full list of members of the International Copper Association, please visit www.copperalliance.org.



Our Funding

Strategic Initiative	ICA Funding	European Industry Funding	Total
Building Construction Non-Electrical (BCNE)	\$1,300	\$720	\$2,020
Wire and Cable (W&C)	\$1,480	\$60	\$1,540
Energy Policies and Efficiency Standards (EPES)	\$1,560	\$70	\$1,630
Heat Exchange Systems (HXS)	\$700	\$10	\$710
Health, Environment, and Sustainable Development	\$700	\$350	\$1,050
Technical and Market Support	\$1,250	\$600	\$1,850
Communications and Public Affairs	\$950	\$140	\$1,090
Governance and Administration	\$700	\$100	\$800
GRAND TOTAL	\$8,640	\$2,050	\$10,690



Health, Environment and Sustainable Development



Katia Lacasse
Director of Health,
Environment & Sustainable
Development



Stijn Baken
Project Manager, Health
Environment & Sustainable
Development



Wendy Wellens
REACH Manager

In autumn 2017, the European Commission unveiled an Industrial Policy Strategy aimed at empowering European industries to continue delivering sustainable growth and jobs and acknowledging industry in Europe as the engine of innovation, productivity, growth and exports.

The work of the Health, Environment and Sustainable Development (HESD) team is to help ensure that the copper industry in Europe can continue to deliver on the above: to thrive and grow by making sure that the legislative framework conditions in place are appropriate and proportionate to the impact and overall benefits gained from the sector and the technologies we feed.

2017 brought an ever-growing number of regulatory pressures on various fronts, and also an increased regulatory debate on hazard classifications and safe limits of chemicals. Add to this a trend of the EU copper industry not only being directly impacted by regulatory discussions on copper, but also indirectly affected by regulatory actions on other substances which may have knock-on effects for our industry. Finally, we noted a high degree of 'proceduralisation' with limited opportunity for actual debate. All of the above means that the need for strengthened collaboration both between the various actors in the nonferrous metals industry and between industry and regulators has increased. It is essential that ECI finds alternative ways to make its voice heard in the right forum, and doing so has been a priority in 2017.

As an example, ECI led the way by contributing to the development of a forum for exchange: the Metals Inorganics Sectorial Approach (MISA), a platform initiated by Eurometaux and the European Chemicals Agency. The MISA will provide a forum for interaction and discussion, thereby allowing specific debates of relevance to the broader nonferrous metals sector to take place—exactly those debates which otherwise would not

happen due to the nature of today's regulatory processes. The harmonised hazard classification of granulated copper is another example of a regulatory discussion that took place in a forum that is poorly accessible for industry's argumentation. ECI therefore devised a plan for effective collaboration with regulators to ensure that the copper industry's approach was brought to the table.

A key strategy to achieve HESD's objectives and address regulatory pressures is to develop and solicit acceptance for novel or refined test methods. Such development typically requires intensive collaboration within the non-ferrous metals sector, and with scientists, test labs, and regulators. One such example from 2017 includes the development of a new methodology to help us understand how metals behave in lakes and rivers. When dissolved copper ends up in these waters, it is rapidly removed by natural processes. While this is a fundamental pillar of the environmental hazard classification, regulatory acceptance of this concept remains a challenge. ECI—working closely with other metals associations and a panel of scientists—has developed an extension of the existing transformation-dissolution test method. This test method will facilitate the regulatory debate, as it is a standardised way to assess the removal of metals from the water column. In 2018, a data package on this test method will be finalised and presented to regulators in the EU and at the global level.

The discussions around a modification of the copper occupational exposure limits (OEL) led to the establishment of a new, independent scientific expert peer review panel, overseen by ECI, the International Copper Association, the REACH Copper Consortium and the Copper Compound Consortium. The panel provided industry with guidance on developing a tiered research plan facilitating the derivation of a measured OEL for copper to be an indicative OEL at EU level. As an

outcome of the guidance, industry undertook in vitro tests to determine the solubilisation rate of copper from copper compounds in various simulated biological fluids.

In Scandinavia, we conducted a study on bioavailable background concentrations of copper, providing data for the Swedish Water Authority's national classification of lakes and waterways. Delivering this to the authority was a significant step towards ensuring a more reasonable assessment is achieved. Work is now ongoing to have background concentrations taken into consideration as part of the classification process.

Finally, as part of the European Commission's broader piece of work to facilitate the transition to a more Circular Economy, we're engaging with the European Commission on Life Cycle Assessment (LCA) and Product Environmental Footprint (PEF) to ensure we have the right data to properly assess the environmental impact of materials and products going forward.

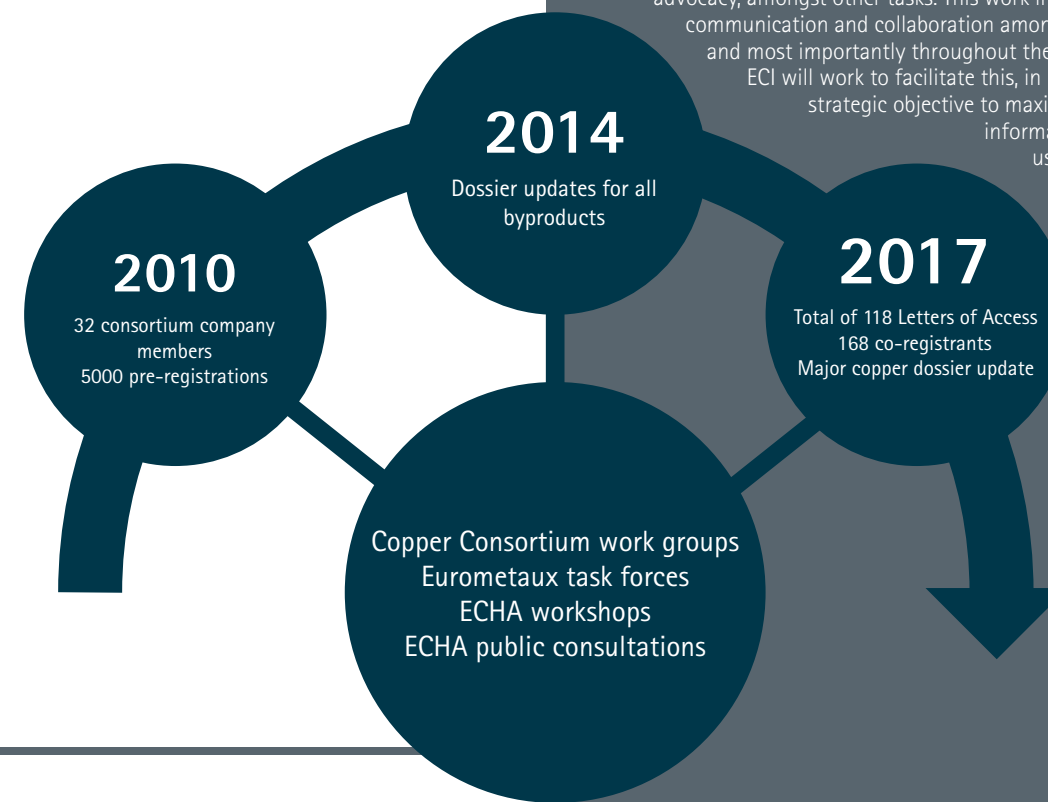
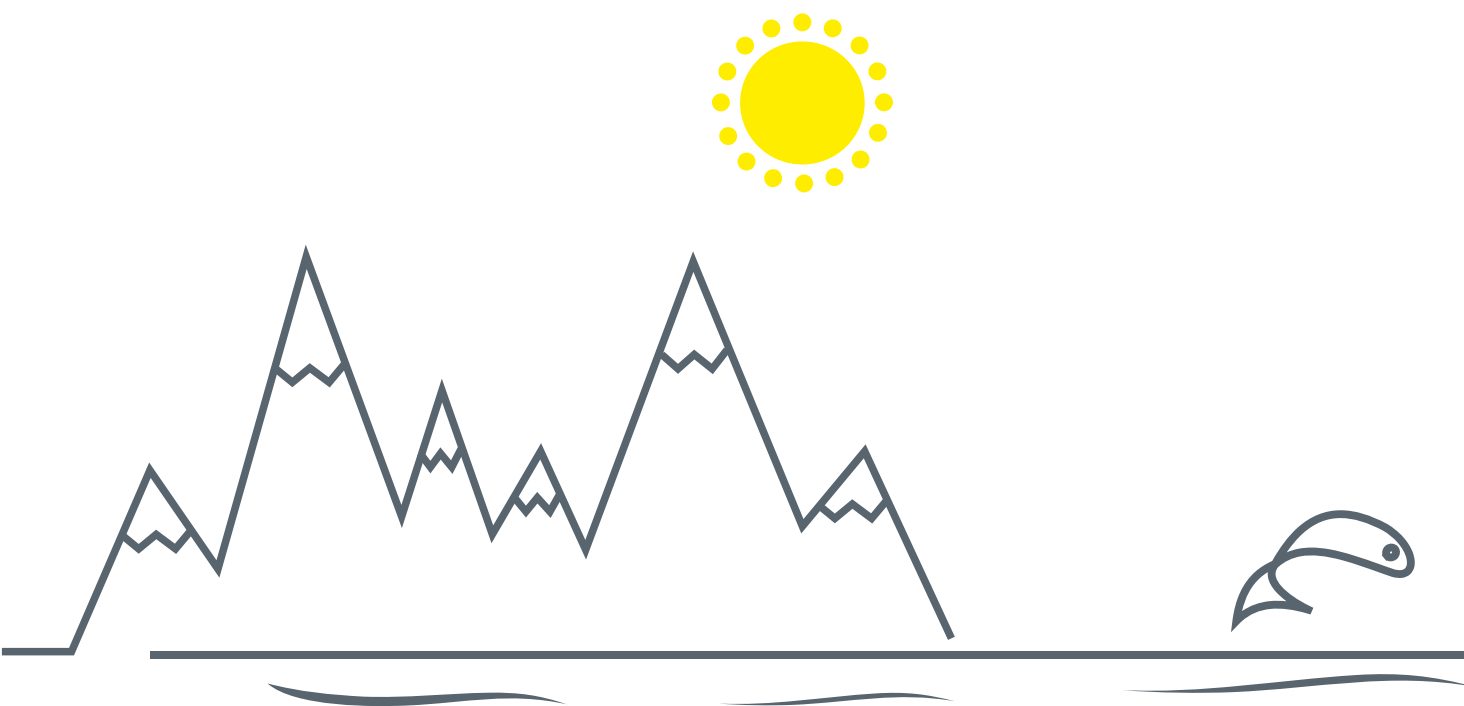
The LCA Task Force presented evidence to the European Commission and the Joint Research Centre demonstrating that it is premature to use natural resource assessment in the decision-making process for material choice in a comparative LCA study. A disclaimer was proposed to fix this, the outcome of which is that an expert team will work on a new method, better reflecting copper's contribution to resource conservation. The finalisation of the pilot projects, announced for the end of 2017, has been postponed several times, but has now finally been concluded for most PEF and OEF pilots, except the pilot on tubes.

REACH is a European Union regulation, adopted mid-2007 to improve protection of human health and the environment from the risks chemicals can pose, and enhance the competitiveness of the EU chemicals industry. Standing for Registration, Evaluation, Authorisation and restriction of Chemicals, it establishes procedures for collecting and assessing information on the properties and hazards of substances. ECI serves as Secretariat for the REACH Copper Consortium.

A major task in 2017 was the update of the copper REACH dossier to include the latest scientific knowledge, a task in which members of the REACH Copper Consortium invested significant time and effort.

Looking back on 10 years of the Copper Consortium, 14 dossier updates and many more tasks have been completed, and the amount of work on REACH-related issues is not slowing down. Again in 2017, for example, important advances in environmental science were considered to ensure up-to-date and compliant dossiers. 2017 also saw an increase in copper data access inquiries for regulatory submission outside Europe, which required the setting up of specific data sharing agreements and collaboration with the International Copper Association, the Copper Compounds Consortium and other stakeholders.

Looking forward to 2018, a growing number of substances are being screened by the European Chemical Agency (ECHA) to identify chemicals of potential concern. This means the number of substances advanced for the Candidate List—or proposals for harmonised classification or restrictions—will likely grow. For the consortia and companies impacted, this will bring increased work on public consultations, socio-economic analysis and advocacy, amongst other tasks. This work involves key communication and collaboration amongst registrants, and most importantly throughout the supply chain. ECI will work to facilitate this, in line with ECHA's strategic objective to maximise high quality information on the safe use of chemicals.



Electrical Innovation and Technology



Hans De Keulenaer
Director of Energy & Electricity

Copper has been a major actor in all four industrial revolutions, and now the energy transition—key to the growing renewables sector, and a fundamental vector of decarbonisation—also depends upon it.

Copper is central to the effectiveness of modern electric grids, connecting renewables to smart consumers. It also enables the many digital applications associated with smart buildings, and has an increasingly critical role in the electrification of transport and integration of energy storage.

Why is copper the metal of the energy transition? We produced a document outlining 80 reasons, but in short: copper is a fully-recyclable raw material that powers the technology and equipment driving the energy transition. So, what are we as the industry representatives doing to advance innovation and technology?



ACTIONS ON POLICY

ECI is shaping debate on the Clean Energy Package (CEP) through positions, amendments and direct engagements.

In January, we invited 27 representatives from progressive associations to a one-day CEP workshop. Transport electrification was identified as a major weakness, while market design—on which we strongly intervened in 2016—was deemed a strength. Our high-level messages were summarised in 11 points to fortify the CEP, providing a concrete framework to help Member States achieve energy targets. These were translated into five position papers and 31 amendment proposals, which were presented to around 20 key MEPs, including rapporteurs and shadows for the relevant topics. Consequently, some early wins are emerging on electromobility, the electrification of heat, building automation technology and ecodesign.

We're supporting the drive to clean up Europe's roads with cleaner vehicles and—ultimately—a move to electromobility.

ECI fed into the Zero-Emission Vehicle (ZEV) policy process, coordinating a letter to the European Commission (EC) in preparation for the Low Emission Mobility Package, proposing a mandate for ZEVs. 13 signatories from industry and industry associations co-signed the

letter, which takes a progressive stance. This action firmly established ECI as one of the top actors on electromobility in Brussels, helping us nurture partnerships within the value chain and utility sector while opening doors to relevant policy makers. To counter claims about cost implications, ECI developed a tool with Vrije Universiteit Brussel (VUB) to monitor total cost of ownership (TCO) of electric vehicles, demonstrating TCO parity is within reach, especially for small and medium vehicles.

In the transition to electromobility, the Clean Vehicles Directive—which governs the procurement of vehicles in the public sector—has so far lacked effect. We provided input into the EC's public consultation, proposing a clear definition for zero-emission rather than just clean vehicles for the public sector, with a rapid transition scenario over the coming years. This was our first communication on electromobility, and helped establish partnerships that enabled the ZEV letter.

TECHNICAL REGULATION

ECI successfully added building automation to the Brussels agenda, helping pave the way to smarter buildings in Europe.

In April, SEDC (now SmartEN) and ECI jointly convened the Smart Energy Summit—with over 100 delegates—to discuss advancing smart energy in Europe and beyond, contributions to demand-side flexibility from industry and consumers, developing an overview of Europe's demand-side landscape, and to consider the policy implications. ECI also participated in consultations for the smart readiness indicator, and jointly organised a workshop with BPIE to review progress on smart buildings. Building automation technology is now firmly on the regulatory agenda, so ECI's focus can shift from agenda setting to implementation.

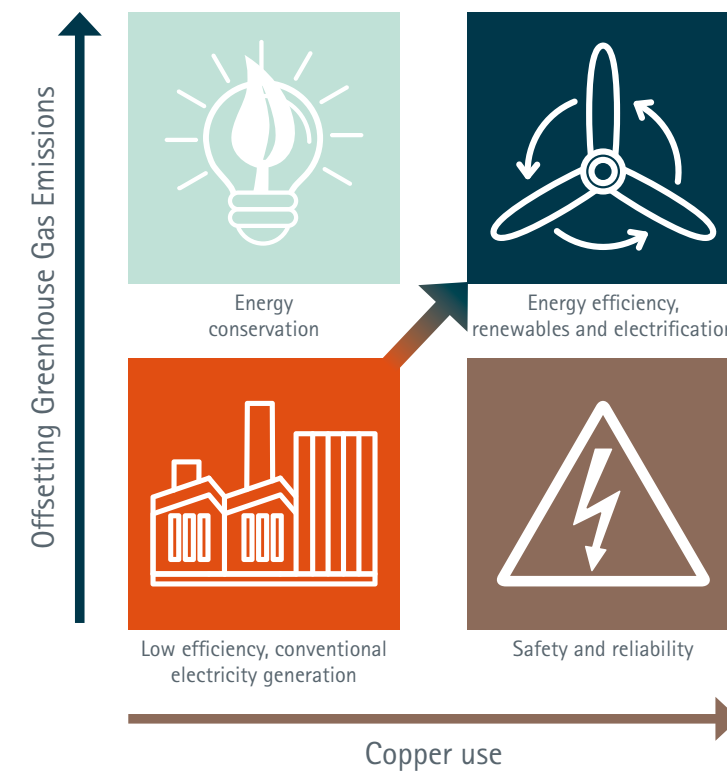
We engaged in the development of EU ecodesign regulations for power transformers that will lead to improved energy efficiency, saving millions of tonnes of CO2 emissions annually.

ECI analysed the review of Ecodesign Phase 2 (due 2021), countering arguments about design constraints, copper theft, availability and end-of-life value. We also participated in the review meeting, asking for limits on and reduction of the exemptions and loopholes in the directive, and advocating for the separate specification of load and no-load losses, which is favourable to copper. The regulatory process is ongoing.

We're driving the development of new energy efficiency and management standards that offer benefits to both industry and the environment.

ECI continued to develop, revise and publish standards in multiple areas. Progress was made on adding new components to the energy efficiency standard for building installations, and work on cable sizing continued. In motors, the focus was on positioning motor systems as an energy management solution into ISO 50001 and on market surveillance of motor efficiency standards. To support the development of a smart readiness indicator for buildings, we're providing input to stakeholder consultations.

There's a strong link between increased copper use and energy sustainability



LEADING INNOVATION

We launched an EC-funded project to make copper a viable alternative to rare-earth materials for motors in electric vehicles.

Late 2015, ECI launched an initiative to improve rare-earth-free motor technology for electric vehicles. Shortly after, an industrial consortium of 13 partners was formed, which—early 2017—submitted the ReFreeDrive proposal in response to Europe's Horizon 2020 call to optimise drivetrain components for fully electric vehicles. In May, the proposal was awarded six million euros to carry out the proposed activities, and the three-year project commenced in October. The project aims to improve two motor technologies beyond the current state-of-the-art, and address the design of power electronics and control systems, including battery charging functions.

The IndustRE consortium is highlighting how industrial energy demand management can facilitate further integration of renewable energy sources: better for business and the environment.

To meet the challenges of effective industry decarbonisation, ECI worked with seven partners for three years in the Horizon 2020-funded IndustRE consortium, comprising leading experts and companies across Europe. Business models have been created to enable electricity-intensive industries to save money and generate income by offering flexibility to the electricity grid. A number of IndustRE's policy recommendations have been introduced in the new market design rules proposed by the EC. With interest growing among corporations for green energy sourcing, ECI commissioned Ecofys to depict the various options for a company to go green, resulting in a report and a series of supporting webinars.

KEY PARTNERSHIPS

Placing electrical safety centre stage, we revised and relaunched a 2001 report from the Forum for European Electrical Domestic Safety (FEEDS).

In May, ECI released its revised report on ensuring progress in residential electrical safety, which highlights advances are happening too slowly and efforts must be scaled up. Its findings will be implemented via two stakeholder workshops. FEEDS was launched in October to further the case for electrical safety in Europe and its initial report was circulated by the EC to 25 Member States and 25 associations. The work will continue until spring 2019.

Our DecarbEurope initiative is connecting new technologies and key industry players to create a cleaner Europe-wide energy system.

To highlight the role of copper-dependent technologies in EU energy and climate policy, ECI launched DecarbEurope: a multi-channel marketing campaign targeting policymakers through events, publications, social media and direct contact, which will run until 2020. Engaging 12 partner organisations, the campaign identified 10 copper-based technologies to significantly reduce the EU's annual greenhouse gas emissions and decarbonise Europe, delivering them through value propositions, policy asks, case studies and thought leader interviews. The results to date indicate progress towards a copper-intensive energy transition, with over 10 million heat pumps installed, a million electric vehicles on the road, and a marked increase in photovoltaic and wind energy.

Building Construction and Heat and Cooling Technology



Nigel Cotton
Director of Building Construction
& Technology

2017 showed signs of improved activity in the European construction market. Pent up demand from underinvestment in buildings during the last decade continued to flow into the early stage of 2018.

The European construction sector report for 2017 is expected to show 3.5% growth and be strongest in smaller markets. This trend in growth rates is likely to continue for the next three years through 2020. In addition to state subsidies for residential construction, the more consistent use of EU funds—especially for construction—will play an important role here. ECI has coverage in the markets with the highest three-year growth projections (Hungary, Poland and the Czech Republic).

ECI continues to play a key role in coordinating industry inputs on EU building construction regulatory developments and technical issues, including building construction waste and recycling. We're a founding member of Metals for Buildings: an alliance dedicated to promoting the economic and sustainability benefits of metals in buildings to European institutions. We're also an active member of the Product Environmental Footprint Technical Secretariat for Hot and Cold Water Supply Pipes—led by the European Commission—and the working group of Construction Products Europe on Buildings Information Modelling (BIM).

In 2017, our Copper in the Built Environment campaign highlighted the role of copper products in green and healthy buildings, energy, resource use, design and functions. The campaign's benefit messages targeted private and public building owners, professionals and influencers through a range of focused online media relations, web-based outreach and events including technical seminars.

To showcase copper's incomparable performance capabilities and its sustainability credentials, we published two editions of the Copper Architecture Forum magazine in 14 languages, and our 17-language site www.copperconcept.org continued to provide architects with inspiration, featuring the finest examples of international copper architecture. New additions include examples of solar shading, award-winning green buildings and dynamic facades. 2017 also saw the return of our biennial European Copper in Architecture Awards. The overall winner was Copenhagen's Maersk Tower, which boasts an animated copper grid that moves with the sun to help maintain a comfortable interior temperature.

HEAT EXCHANGERS

The global air conditioning market is valued at \$100 billion, with Spain, France, Germany and Italy expected to experience a compound annual growth rate of 1–5% up to 2020. The increasing price of refrigerants resulting from increased regulation is driving change in the air conditioning and heat pump markets, with the biggest fast-moving goods companies pushing for more environmentally-friendly in-store display cases. This situation presents strong opportunities for copper.

The European Commission's Clean Energy for All Europeans proposal highlighted the need to concentrate efforts on the reduction of energy use and substitution of fossil fuels in the heating and cooling sector. Copper is key to many applications related to delivering useful heat to the market, including boilers, condensers, pumps and pipework, fin heat exchangers, building controls, compressors and renewable energy solutions. Heating and cooling account for 50% of final energy demand, and by 2050 emissions in this sector need to be cut by 95%, resulting

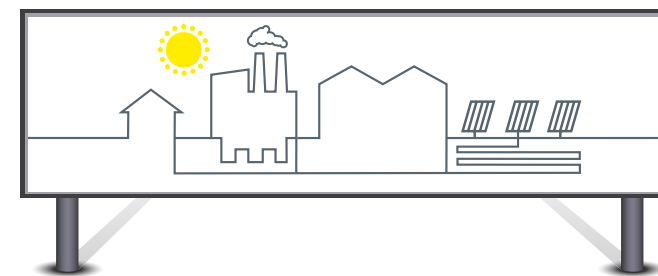
in the need to increase efficiency and introduce renewable heating and cooling technologies. ECI participates in dialogues with heating and cooling actors, institutional stakeholders and the research community.

The Kigali Amendment continues to have a major effect on the industry with its goal of limiting the use of harmful greenhouse gases and improving the energy efficiency of HVAC. The Kigali deal is perhaps more significant than the Paris Agreement since it's legally binding as an amendment to the Montreal Protocol. Implementation of the agreement is expected to prevent the equivalent of up to 80 billion tonnes of CO₂ emissions by 2050, which will make a significant contribution to the Paris Agreement objective of limiting the global temperature rise to well below 2°C.

Further benefits may be achieved by exploiting synergies with energy efficiency. The 30-year-old Montreal Protocol has been highly successful in protecting Earth's ozone layer, and the Kigali Amendment will allow it to make a wider contribution to global efforts to mitigate climate change.

The EU is leading global efforts to limit emissions of HFCs and other fluorinated greenhouse gases. Its 2014 regulation of these will ensure the EU can meet its obligations under the Kigali Amendment while also driving innovation in the field.

HFCs are synthetic substances used mainly in refrigeration and air conditioning equipment, as well as propellants in foams. Their global warming effect is up to 15,000 times greater than that of carbon dioxide, and their use is the fastest-growing source of greenhouse gas emissions worldwide, although the EU's own emissions recently fell for the first time in almost 15 years. Opportunities for small-diameter copper tubes exist through need for the reduction of refrigerant use and a need for increased energy performance associated with new refrigerants.



MICROGROOVE

MicroGroove is an umbrella brand for the promotion of small-diameter copper tube in the heating, ventilation, air conditioning and refrigeration (HVAC&R) market. The accompanying ECI campaign provides insights, manufacturing know-how and technical backup for the uptake and promotion of MicroGroove.

MicroGroove was exhibited at AHR Expo 2017, ACREX 2017 and ATMOSphere America, where it was accompanied by a well-received presentation of case studies demonstrating the use of copper heat exchangers for natural refrigerants. Further presentations at the IEA Heat Pump Conference explained how advanced round-tube, plate-fin (RTPF) heat exchanger coils contribute to the high efficiency of heat pumps.

We promote MicroGroove as a viable technology for large commercial-sized heat exchangers based on application case studies. Throughout the year, emphasis has been placed on how MicroGroove tubes facilitate adoption of refrigerants with low global warming potential, referencing research from the University of Padova, the University of Marine Science and Technology and Kyushu University, in addition to ongoing performance research from Shanghai Jiao Tong University.

HYGIENIC SURFACES

Copper touch surfaces and HVAC systems are effective measures for infection control and improving public health, offering particular benefits when deployed in healthcare facilities and other areas where people gather, such as schools and offices. The main focus of our promotion in 2017 has been supporting the supply chain with outreach, acting as a credible and neutral partner, maintaining and disseminating the scientific and economic evidence base, and advocating for official recognition to drive demand.

In Greece, our scientific team published a paper on the efficacy of copper surfaces in a hospital's intensive care unit, where antimicrobial resistance is endemic. Together with papers from other researchers—including the Polish Antybakter project that we partner—the expanded evidence base helped influence healthcare and hygiene guidance and rating schemes.

A field trial project, involving our Scandinavian centre, heavily influenced the Finnish Building Information Foundation's first ever indoor hygiene guidelines, which single copper out as the most effective and well-known hygienic material in addition to including it as an option for attaining the two highest hygiene levels.

In the UK, Health Protection Scotland—a division of NHS Scotland—reviewed the evidence base and published a Clinical Practice Recommendation for copper surfaces to be considered for high-touch sites as an additional measure to supplement existing procedures for routine cleaning.

MCZ Hospital in Poland switched to copper touch surfaces after the National Centre for Quality Assessment recognised their benefits in its hospital accreditation scheme. This helped MCZ achieve eighth place in the national hospital ranking scheme. A recent survey reported 20% of Polish hospitals now have copper surfaces.

As more schemes recognise hygienic materials, it's increasingly important for test standards to represent typical in use conditions, rather than the existing 'proof of principle' tests. We continue to support the development of new standards in France, Poland and the UK, tapping into the experience of our research network.

The number of companies offering copper touch surface and HVAC products is growing steadily, and we welcome these new partners to the global Cu+ supply chain, listing them in a comprehensive online directory of alloys, products and services on www.antimicrobialcopper.org. This site also serves as the international knowledge base for hygienic applications of copper.

Supply chains in Poland, Greece, Scandinavia and the UK continue to work closely with the Copper Alliance to exchange information to optimise approaches to the market and identify and develop significant opportunities.



Angela Vessey
Antimicrobial Copper Initiative Global
Team Leader

Technical Market Support



Michael Sander
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ECI's Technical Market Support helps European industries optimise products and services by making effective use of copper and its alloys, with centres of expertise in Germany and the UK. Activities include organising events, educational training—aimed at both students and professionals—and contributing to research and regulation.

In 2017, we intensified regulatory efforts supporting favourable European legislation on copper-based materials in contact with drinking water at the Brussels Congress on Materials in Contact with Drinking Water. Teaming up with EurEau, Plastics Europe and the European Drinking Water Consortium—supported by the 4 Member States (4MS) group—we organised a follow-up event in May to continue the dialogue. Regulators from the European Commission and most member states attended, and progress was made towards a Europe-wide approach to integrating hygienic and technical considerations with the free movement of goods. The work will feed into the revision of the EU Drinking Water Directive.

Our German centre held the 14th Copper Symposium on Material Sciences in November, facilitating discussion of new developments, trend and research outcomes from the world of copper and its alloys. The event is a significant technical platform for professional exchange for German-speaking industries and universities researching copper-based materials. Speakers were drawn from well-regarded research institutes including Fraunhofer ISI and Forschungsinstitut Edelmetalle, as well as from downstream industry. The event will run again in 2018.

The centre contributed to diverse, project-oriented research taking place at institutions including Ruhr University Bochum, the University of Munich, RWTH Aachen University and Fraunhofer, and also provided technical expertise and material science output to regulatory affairs working groups.

In addition to providing technical support and solutions, education and training are key activities. In Germany, a number of seminars took place and our technical expertise has been requested increasingly for engineering services directly offered at company level, or through technical inspections of copper applications. Support was given across fields including automotive, electrical, renewable energy and mechanical engineering.

Our UK centre is addressing copper alloy knowledge gaps in young engineers by promoting technical resources to universities offering marine undergraduate and post graduate engineering degrees, securing lectures at three universities in 2017. Two covered the corrosion and biofouling resistance of marine alloys for undergraduate and MSc students. The third additionally positioned copper alloys as contemporary materials to students on the University of Manchester's Centre for Doctoral Training (CDT) course 'Materials for Demanding Environments'.

The UK centre also continued to support professionals wishing to specify, manufacture from or optimise performance of copper and its alloys for both existing and new applications through a free-to-use online information service, staffed by a pool of experts across a range of disciplines including metallurgy, fabrication and engineering. A 2017 survey demonstrated the service is well-received, with users rating ease of access and speed of response at >80% satisfaction and the replies provided as 'good to excellent' (based on 288 responses). The survey also confirmed the importance of access to technical information and expertise for both existing and new applications. The service complements the technical content on the UK section of the European Copper Alliance website.



Public Affairs



Julie Kjestrup
Head of Public Affairs

Brussels is the heart of the European Union: a €14 trillion single market of over 500 million citizens. Decisions taken in Brussels are first and foremost implemented at member state level, but are also shaping global approaches to the environment, energy, industry and technology, amongst others, which in turn highly influence the copper market we operate in, both in terms of challenges and opportunities.

As the EU has grown—adding more member states in a number of enlargements—so has the size of the so-called 'Brussels bubble' in which an ever-growing number of stakeholders are trying to influence the political process, under increased scrutiny: the now-joint Commission and Parliament transparency register continues to grow every day. Add to this the growing role of social media—open 24/7, instantly reactive and enabling issues to travel the globe in a wink—and it is clear that to be an influencer in Brussels today, and stand out from the increasing 'noise', one requires a well-tailored approach, encompassing a number of activities both on- and offline.

ECI has been an effective operator in Brussels and beyond for the past decades thanks to established thematic programmes engaged with addressing specific concerns and opportunities. In 2017, a Public Affairs function was created to operate across those thematic programmes and further ECI's work on raising awareness and appreciation of the role of copper as an enabler of a sustainable future for Europe, adding value, boosting competitiveness and fostering jobs, sustainable economic growth and investment. This is done both through working closely with programme leaders to 'move the needle' on specific legislative issues for the copper industry, but also through a specific reputation building effort. Part of a global effort that kicked off in the second half of 2017, the aim is to ensure that copper messages meet our stakeholders where

we find them, in a format that appeals, and are adapted to the issues they currently care about.

The present College of Commissioners, headed by Jean-Claude Juncker, set 10 Commission priorities for their 2014–2019 mandate with the first—A New Boost for Jobs, Growth and Investment—overarching the rest. Two other priorities—A Resilient Energy Union with a Forward-Looking Climate Change Policy; and A Deeper and Fairer Internal Market with a Strengthened Industrial Base—are of particular relevance to ECI, and form the basis of much of the relevant legislation for the copper industry.

With the mandates of both the current European Parliament and European Commission coming to an end in spring 2019, 2018 will be a busy year in terms of wrapping up ongoing proposals, not least those of the Clean Energy for All package.

Copper is pivotal to powering Europe's sustainable future and a lot stands to be gained for the industry in terms of ensuring an ambitious but well-balanced sign-off to the different legislative elements of this package. On the one hand, the EU needs to create the right framework to unleash the potential of a clean energy revolution, while on the other hand sustaining an environment that allows the energy-intensive industries needed to power said revolution to thrive and grow in Europe. On the latter in particular, Public Affairs works closely with the Health, Environment and Sustainable Development team to tackle a number of ongoing challenges and ensure legislative outcomes that are proportionate to the issue at hand.



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