

The purpose of this presentation is to guide ICA programs and provide members information to make independent business decisions.

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A Regulatory Roadmap for Copper

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International Copper Association, August 2017

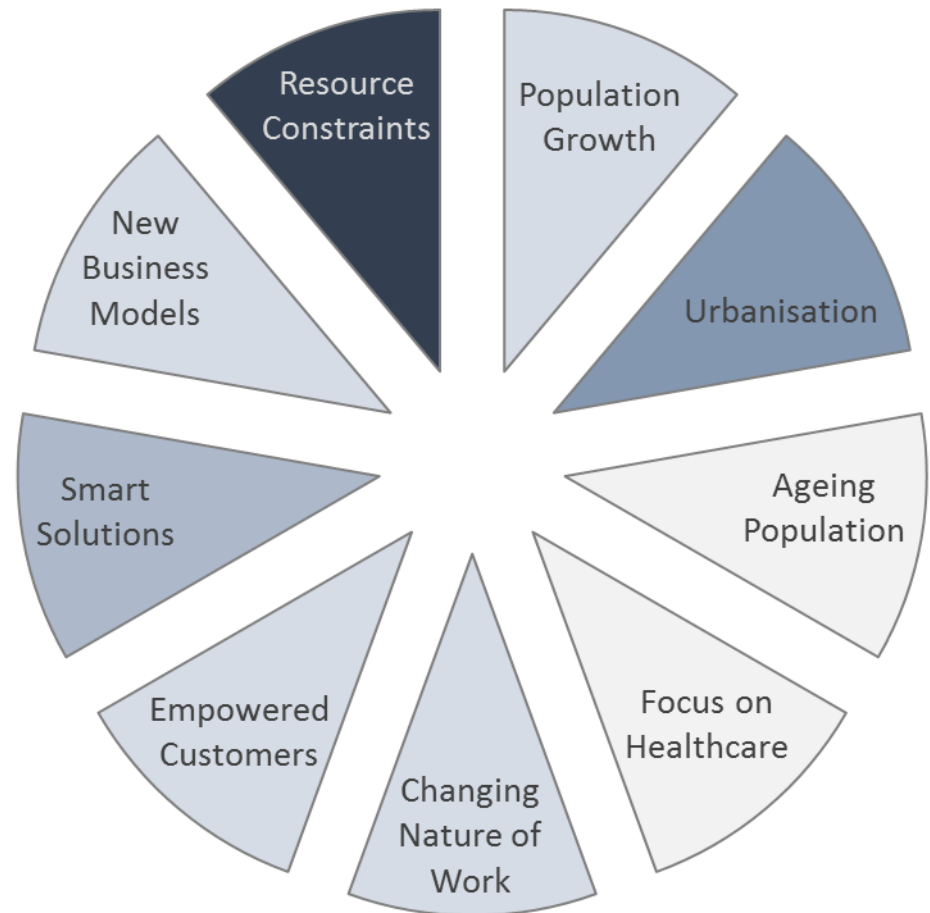


MEGATRENDS & COPPER MARKETS AFFECTED

Population Growth	Growing markets, all segments
Urbanisation	Boost to infrastructure
	Boost to building construction
	Higher per capita purchase of goods
Ageing Population / Focus on Healthcare	Boost to home electrics
	Care home / hospital solutions
Changing Nature of Work	Manufacturing in new locations
	Automation in the workplace
	Boost to commercial floorspace
Smart Solutions	Build out of data infrastructure
	Smart elements in physical infrastructure
	Smart elements in the home
Empowered Customers	More goods at lower prices
	Sanction against low quality
New Business Models	Ability to supply volume at low cost
Resource Constraints	Boost to clean energy generation
	Boost to low energy use solutions
	Boost to low toxicity solutions
	Boost to water management solutions
	Boost to food production solutions

SPECIFIC GROWTH OPPORTUNITIES FOR COPPER

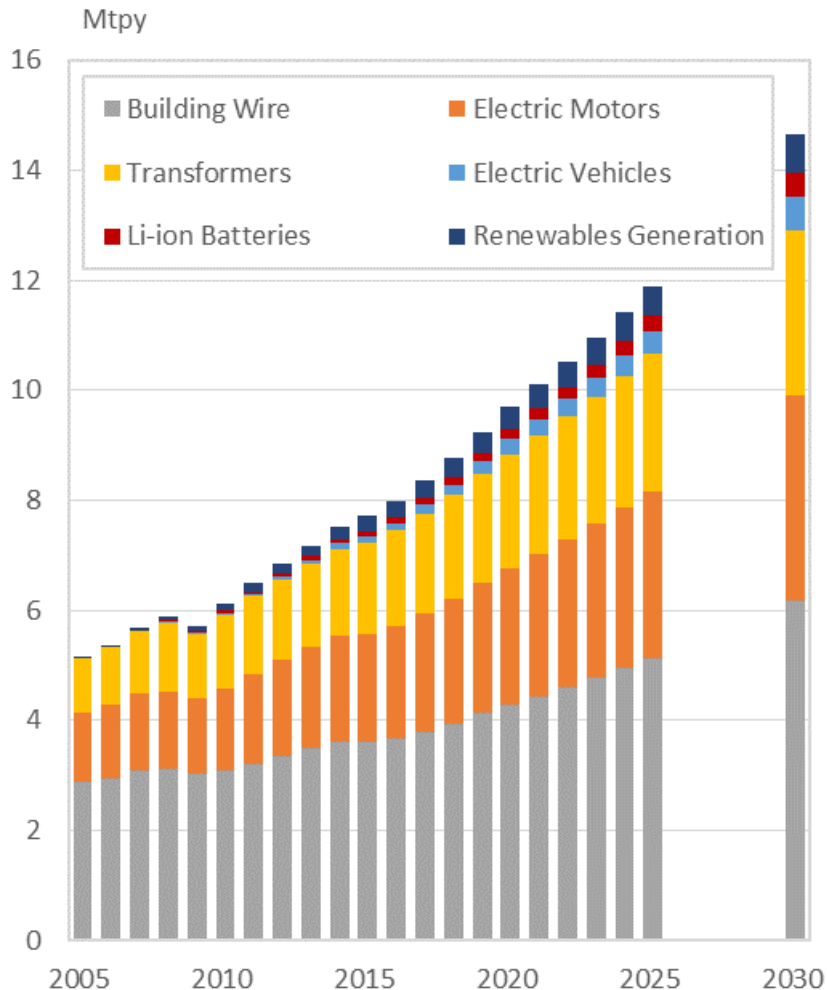
<i>Infrastructure Build Out: Focus in infrastructure-dense urban areas</i>
<i>Building Construction: Focus high electrical density urban needs</i>
<i>Urban & Infrastructure Renewal: Needs of mature markets</i>
<i>Electrical / Other Goods: Rising penetration with growing middle class</i>
<i>Electricity Generation: Focus on renewables</i>
<i>Electricity Transmission & Distribution: In particular undergrounding</i>
<i>Efficient Electrical Equipment: Motors, transformers & other</i>
<i>Other Low Energy Solutions: Carbon neutral construction / installation</i>
<i>Low Emissions Products: Electric vehicles</i>
<i>Distributed Solutions: Energy & water. Battery storage etc.</i>
<i>Food & Water: Desalination, irrigation, aquaculture etc.</i>
<i>Enhanced 'Smart' Content: Networks, buildings, appliances, healthcare</i>



Shading intensity indicates relevance to copper

Adding substantially to copper use over time

Select Key Cu Markets Integral to Megatrends

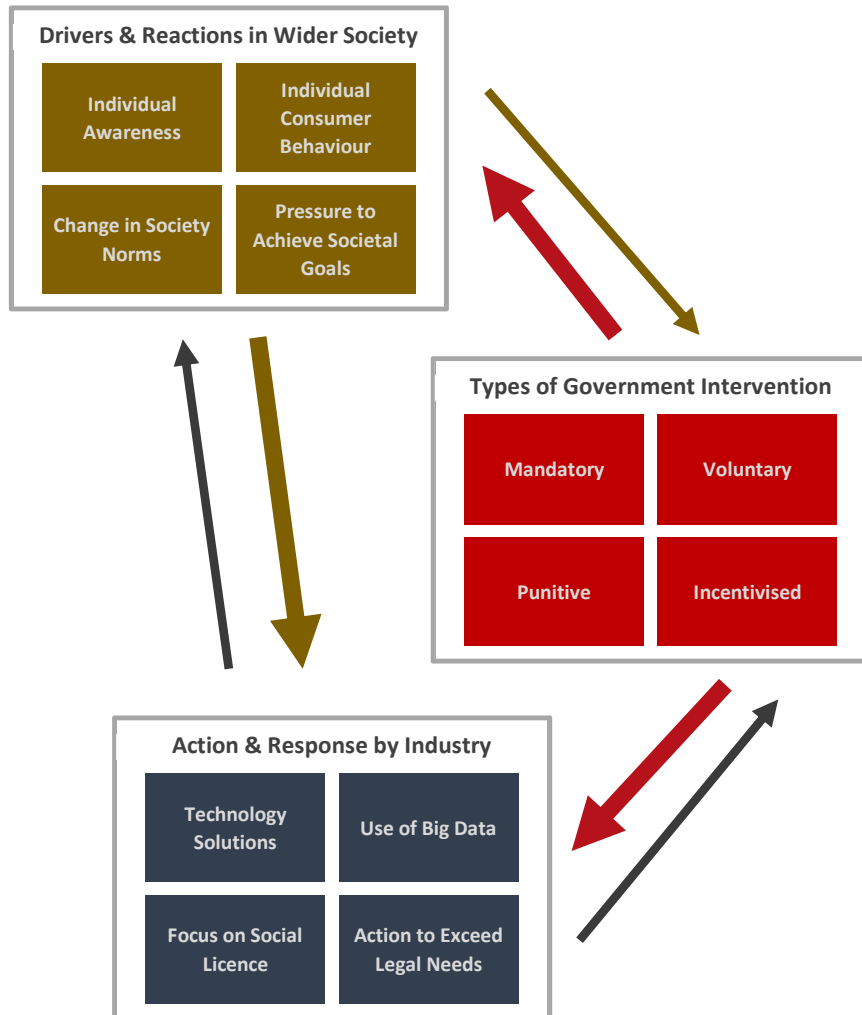


- Population growth, urbanisation and increased wealth means more building construction and greater building density – building wire is a key part of this
- Growth in infrastructure and electrification are good for electrical equipment sales in general – here we show growth in key electric motor and transformer sectors
- Then there are the markets that specifically benefit from society megatrends – here we show electric vehicles, li-ion batteries and renewables generation
- Taken together, growth in these markets is accelerating, adding over 4 Mt of copper use 2015-2030

Accelerating Market Segment Growth

Mtpy	2005	2010	2015	2020	2025	2030
Building Wire	2.88	3.10	3.60	4.29	5.14	6.17
Electric Motors	1.27	1.49	1.97	2.48	3.03	3.72
Transformers	0.98	1.33	1.66	2.07	2.50	3.03
Electric Vehicles	0.01	0.03	0.11	0.27	0.41	0.60
Li-ion Batteries	0.00	0.04	0.09	0.19	0.27	0.45
Renewables Generation	0.02	0.12	0.27	0.41	0.54	0.68
Sum of the Above	2.28	3.01	4.11	5.41	6.75	8.48
Additional Copper	-	0.73	1.10	1.30	1.34	1.73

Types of intervention for sustainable development



- Behavioural economics will tell us that individual behaviour has biases, in particular a tendency to discount the future in favour of current gratification
- En masse, though, people can act to sustain and improve society in general, forming a context within which laws favouring sustainability are passed and accepted, even at the expense of current gratification
- This forms a context within which consumers and investors will favour companies that fit what come to be accepted as societal goals, by granting 'social licence'
- Manufacturers can respond by actively developing clean technology, good manufacturing practice and the integrity of their supply chain. The options offered help to determine the terms of government intervention, and also mould the expectations of consumers and investors
- Ideally, once the seeds of change have been sown by government action, a virtuous cycle between industry and consumers / investors should help to ensure that both individual and society goals are met
- In practice, continued government action is always necessary. This may be in the form of mandatory and sometimes punitive legal requirement. Voluntary and incentivised control also features, helping to turn what might seem onerous into 'current gratification'

Resource Conservation

- Applying Life Cycle Analysis (LCA) to materials used from source (mine) to end of life (recycling)
- Minimising material use by design, considering longevity, repairability, recyclability

Carbon Footprint / Climate Change

- Reducing energy consumption of products in use (e.g. motors, transformers)
- Using low / zero carbon emission products (e.g. electric vehicles)
- Low / zero carbon emission energy generation (e.g. wind & solar power)
- Carbon neutral – low carbon building construction and fittings

Toxicity

- Ensuring that products in use pose no toxicity risk (or hazard) to human health
- Ensuring that products in the supply chain pose no toxicity risk (or hazard) to human health
- Ensuring that products in use pose no toxicity risk (or hazard) to the environment
- Ensuring that products in the supply chain pose no toxicity risk (or hazard) to the environment
- Ensuring that industrial process along the supply chain poses no toxicity risk, including carbon

Product Integrity

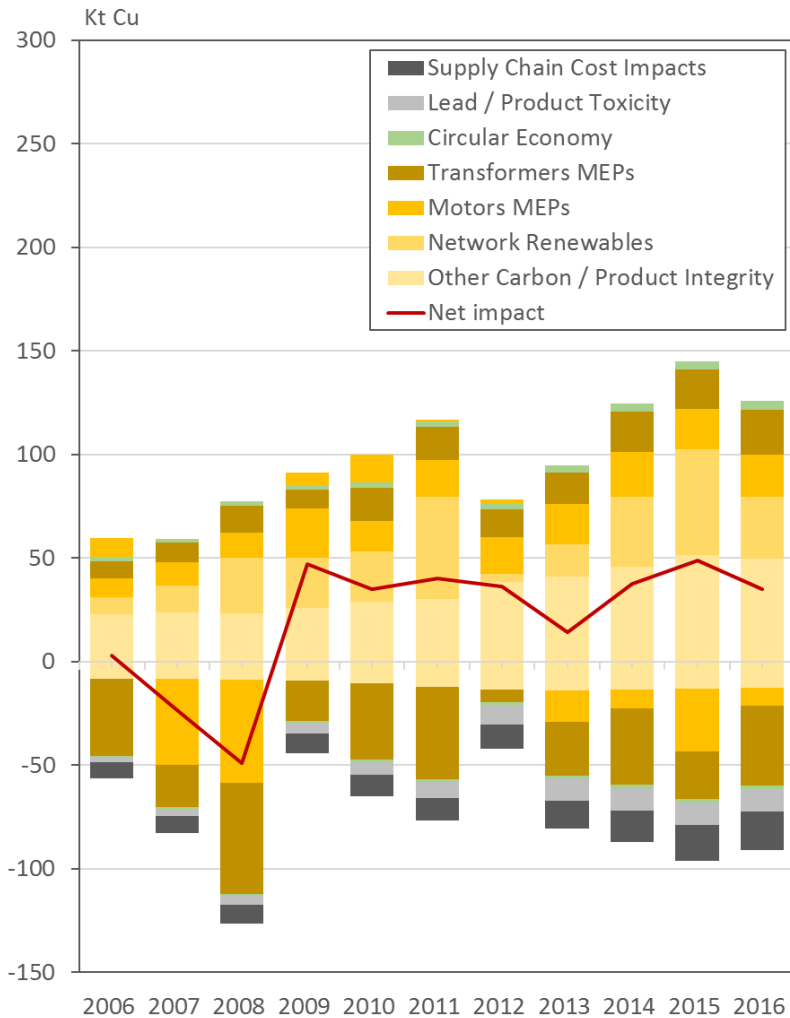
- Products required to be safe, and fit for purpose
- Local product standards based on other objectives (e.g. low toxicity) specified to ensure product integrity

Social Licence to Operate (SLO)

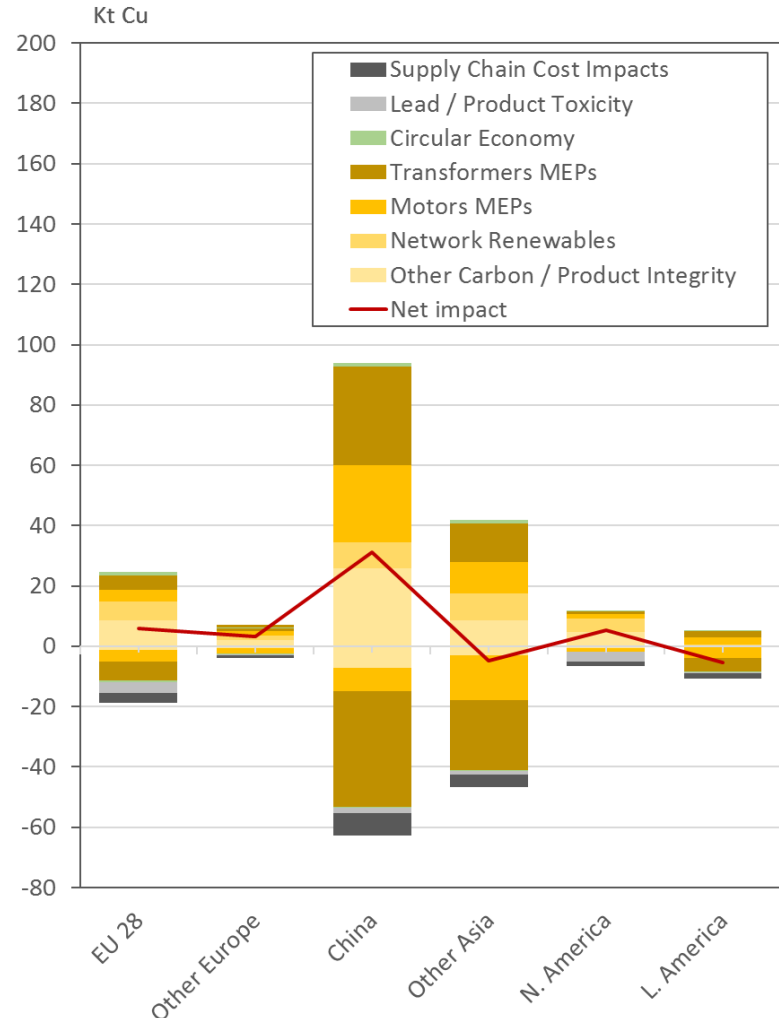
- Achieving SLO from holders of key resource by compliance with social and other socially relevant objectives
- Compliance in law may be required, although SLO is essentially non-legal but may be needed for legal permit
- For manufacturers, the grant of SLO is by customers, able to withhold sales, and investors holding capital

Heavy emphasis on lowering carbon footprint

Annual Trend



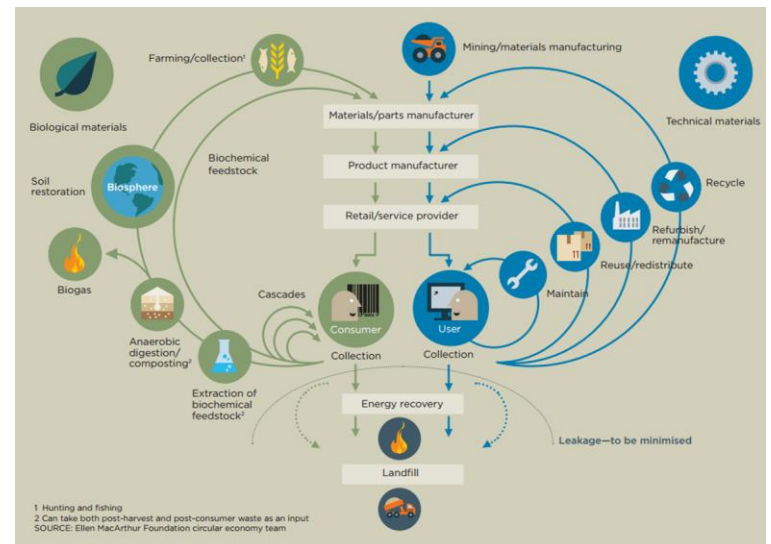
Regional Shares in 2016



- Sustainable resource use is at the core of resource conservation policy and legislation
- Circular Economy (CE) concepts reflect this, defined by The Ellen MacArthur Foundation as an:

“industrial system that is restorative or regenerative by intention and design”
- This is achieved by the elimination of waste through the better design of materials, products, systems and, within this, business models. It replaces end-of-life concepts with restoration, seeing each input of new material as ‘leakage’ from what should be a closed system
- Sustainable economic growth long term depends on us learning how to use finite resources efficiently and safely, thus saving scarce raw materials (including minerals and fossil fuels). Further, correct economic management can avert climate change and toxicity in the environment
- To date, resource conservation law has focussed on recycling at end of life by imposing obligation on manufacturers and imposing restrictions on disposal. Going forward, CE concepts should become more integral to product design
- The fact that copper is fully recyclable and stands up well in Life Cycle Analysis (LCA) should ensure that it does better than some competing materials, and to this extent it should gain in share

Circular Economy Concept – Ellen MacArthur



- The world's climate as a whole is getting warmer, for which Greenhouse Gas (GHG) emissions as a by-product of human activity are held largely to blame
- Climate change matters, in particular in rising sea levels, extreme climatic events and drought
- Carbon Dioxide (CO₂) is the most common GHG, arising in the atmosphere mainly as a result of fossil fuel burning for energy. Others include HFCs, used as a refrigerant in air conditioners
- Means of tackling climate change include clean electricity generation through renewables or avoiding direct fossil fuel burning - especially in autos
- It can also be tackled by reducing energy use in general by using efficient machinery, design or behaviour to reduce energy using machine use, or addressing other non-CO₂ emission sources
- Climate change is the focus international effort. The accord was embodied in the COP21 agreement coordinated by the UN in Paris in 2015
- In legislation and standards the Issue is most clearly reflected in raising equipment efficiency, especially for transformers, motors and HVAC
- Targets, incentives and penalties also apply to the use of renewables, and to electric vehicles
- The major climate change initiatives are intrinsically positive for copper. The challenge is to ensure that copper achieves the full benefit that seems to exist

Emissions Control to Ensure a Green World

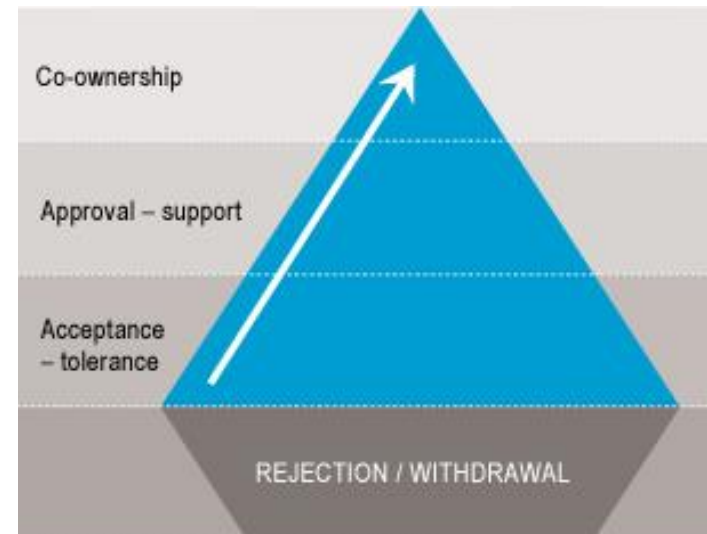


- Toxicity to human health and the environment is tackled by general or specific legislation tackling:
 - Chemicals content of products and systems
 - Chemicals in the supply chain
 - Chemicals in the environment
- Chemicals content of products and systems rules address copper as used in final product form, affecting copper directly or materials used alongside it in alloys
- Chemicals in the supply chain rules affect raw materials as well as final products, and their transit. This group applies mainly to direct impacts on human health
- Chemicals in the environment refers explicitly to rules affecting pollution / contamination
- Discharge into water and into air is the main focus of much of the environment-based toxicity legislation

- Much legislation is passed to achieve key social / environmental objectives. In order for the objective to be realised in practice, individual design criteria for specific products are embodied in standards and regulations (usually mandatory, but sometimes advisory) at national or regional level
- Such standards not only ensure that the key objective is realised, but also that the product itself functions and is safe. We therefore consider the Issue as separate from the headline Issue, and refer to this as 'Product Integrity'
- Also under the label 'Product Integrity', we consider standards introduced or altered relating to specific products where there is no overriding objective other than specifying details of the product itself, often introduced as new technical or materials options are introduced
- Individually, most Local Product Standards have little impact on copper market performance, but there are exceptions
- Though individually most Local Product Standards have little impact on copper, as a whole we see them as the largest contributor to regulatory impact on the market, and amongst the most addressable. They can be positive for copper, by providing a minimum specification benchmark. Also, the introduction of new standards can be a driver of product replacement
- A risk aspect for copper is development of performance criteria for alternative (cheaper) materials or employing suitable less materials-intensive designs

- The term ‘Social Licence to Operate’ (SLO) is familiar to the mining industry, applied to the acceptance earned from the local community of its mining activity. This is additional to any legal permit, though social elements do appear in the legal framework
- In its wider context, social licence may be seen as the right to operate earned from those able to withhold a key resource. For industry, unlike mining, the resource is usually not ‘land’, but more often sales (which can be withheld by consumers) or capital (which can be withheld by investors)
- SLO is not just a present / absent calculation. It can be graded, and grade can relate back directly to profitability. Generic grades are 1) Rejection, 2) Acceptance, 3) Approval, in theory at least going on to 4) Co-ownership. The grade of SLO in turn influences access to the key resources
- So, active management of SLO by going beyond legal requirement can have huge business merit
- For copper beyond mining, SLO management has two aspects, first the integrity of own business on social & environmental grounds, secondly the integrity of the entire supply chain, from mine through to recycling
- Increasingly, legal requirements are imposed that require supply chain audit, very notably in REACH and in Conflict Minerals. Complex data systems to enable this are now commonplace. Ensuring integrity and leveraging big data to publicise it are also becoming more common, and increasingly necessary

Social Licence – Earned by Going Beyond the Law?



Adapted from Boutilier and Thomson