Reducing CO₂ Emissions
MAKING BETTER BATTERIES
MAKING CROP PROTECTION SAFER
FEEDING THE GROWING HUMAN POPULATION
IMPROVING THE SUSTAINABILITY OF WATER TREATMENT
CREATING RENEWABLE ENERGY
REDUCING CO₂ EMISSIONS
MAKING BETTER BATTERIES
With global climate, energy, and sustainability issues set to intensify, Calix has identified some key challenges that have emerged in the last decade and are increasingly putting our planet at risk.

This series will dive deeper into each of these challenges in a dedicated special feature.
Why Reducing CO$_2$ Emissions?

It is broadly accepted that reducing man-made carbon dioxide (CO$_2$) emissions is crucial for the future of the planet. In this sustainability trend series issue, we look at the pressures the cement industry, marine shipping, and energy generation face as their CO$_2$ emissions come increasingly under the spotlight. The Calix Process is aiming to help industries and energy producers reduce their CO$_2$ emissions with minimal energy or operating efficiency penalty.
THE EUROPEAN UNION – LEADING THE WORLD IN CO₂ REDUCTION

The European Union is targeting an 80% reduction in CO₂ emissions by 2050. To help drive CO₂ emissions reductions, in 2005 the EU introduced and began operating the largest emissions trading scheme in the world. The European Union Emissions Trading Scheme (EU ETS) involves a process of allocating and auctioning tradable permits that can be used to offset actual emissions. The scheme is currently in its third phase which will run until 2020.

If a particular CO₂ emitter has taken steps to reduce emissions and ends up with a surplus of permits, they can sell them to another emitter who has not taken such steps, and needs the permits due to having high emissions.

The “cap and trade” system involves an open market price for CO₂, which has become a benchmark for the costs of emitting CO₂ in Europe.

The European economic slowdown over the last decade or so reduced CO₂ emissions below planned targets, resulting in a reduction in the price of these traded CO₂ permits since around 2011. However, the imminent ending of the third phase of the EU ETS in 2020, and the commencement of a fourth phase where the overall emissions cap will be progressively reduced by 2.2% each year until 2030, has seen dramatically renewed interest in the purchasing of CO₂ permits, as industry starts to face real and significant costs for CO₂ emissions. CO₂ prices have consequently shot up from a low of around €5 per tonne in 2017, to over €20 per tonne today. These real costs are generating renewed interest from industry in CO₂ abatement technologies. The Calix Process is being developed in several different programs in the EU targeting CO₂ emissions reduction.

Refinitiv (formerly known as the Financial and Risk business of Thomson Reuters)
Calix is a leader in Project LEILAC (Low Emissions Intensity Lime and Cement) due to be completed in 2020.

Alongside HeidelbergCement, Cemex, Lhoist and Tarmac, Project LEILAC utilises Calix technology – changing the way the limestone is heated – to enable direct capture of the limestone-produced carbon dioxide.
Reducing emissions from the cement industry

Cement is the second most consumed substance on Earth after water – over 4.5 billion* tonnes per year! The cement industry also accounts for around 5% of global CO₂ emissions. About two thirds of those emissions come from the processing of limestone used when the cement is made and as such are unavoidable. To meet the European Union target for reduced CO₂ emissions, around 60% of European cement plant capacity will need to deploy some form of carbon capture by 2050. Given the pressures from the EU ETS, and also to assist with R&D funds being made available from the EU Horizon 2020 programme, some cement and lime companies are taking real steps to help develop technologies to deal with their emissions.

For example, Project LEILAC (Low Emissions Intensity Lime And Cement) is supported with €12 million from EU research funds, and involves a consortium, lead by Calix, that includes industrial heavyweights HeidelbergCement, Cemex, Lhoist and Tarmac. Project LEILAC utilises the Calix Process - a world first, patented technology that changes the way the limestone is heated, to enable direct capture of the limestone-produced CO₂. It requires no additional chemicals or processes, and is targeting no additional capital or operating penalty for the cement industry. The technology could also be developed with alternative or waste fuels or renewable energy, to ultimately achieve a zero-emissions cement.

* Follow CO₂ European emission allowances price:
  https://markets.businessinsider.com/commodities/CO2-emissions/rechte

Reference:
A Calix Process is being developed to capture sulphur and CO₂ emissions in ships with a system called RECAST, which could absorb more than 85% of the CO₂.
Maritime transport emits around one billion tonnes of CO₂ annually – about 2.5% of global CO₂ emissions – and these emissions are set to grow by between 50% and 250% by 2050*. In line with the European Union’s drive to reduce CO₂ emissions, it is calling for a global approach to curbing maritime CO₂ emissions and has commenced mandatory emission reporting for all large ships using EU ports from 2018. A 2011 Transport White Paper by the EU (http://www.transforum-project.eu/-en/transforum/white-paper-on-transport.html), calls for CO₂ emissions reductions of 40% from 2005 levels to 2050, and if feasible, 50%. The peak maritime industry body, the International Maritime Organization (IMO) has responded with several greenhouse gas studies, and major shipping manufacturers such as Maersk are leading initiatives to reduce maritime emissions.

The Calix Process is being developed to capture sulphur and CO₂ emissions in ships with a system called RECAST. RECAST involves using a dry exhaust gas scrubber - essentially a Calix Process reactor “in reverse” using lime - which would absorb more than 85% of the CO₂ and most of the sulphur, and recover the heat of absorption to add around 50% to the ship’s range. If RECAST technology were applied to the 25% of high-mileage ships, which use 80% of global bunker fuel, the theoretical reduction in emissions would make the total world maritime fleet carbon negative. To achieve this, the lime used in a RECAST scrubber must be manufactured in a (shore-based) Calix Process lime producer, which captures the CO₂ from the raw limestone. This technology now being demonstrated at scale in Belgium in the LEILAC Project. Initial estimates suggest RECAST could cost less than $40 per tonne of CO₂ emissions saved, making it cost-effective as well as safe and reliable.

Reference:

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REDUCING CO₂ EMISSIONS
Much has been written about the “hydrogen economy”. Hydrogen is a gas that, when burned, produces only water as an emission. Sounds perfect! – but how do you produce enough hydrogen in the first place, to power global energy requirements?

Hydrogen can be produced by “splitting” water into its components - hydrogen and oxygen - but this takes a very large amount of energy. Unless such energy could be provided by vast amounts of renewable power, producing hydrogen for energy could result in more CO₂ emissions than simply burning fossil fuels. Another way to produce hydrogen is from fossil fuels such as natural gas, by splitting methane into carbon and hydrogen. This is a lower energy pathway, and if the carbon could be captured and either utilised or sequestered, is a lower emissions pathway also.

Major oil companies, sitting on millions of barrels of fossil fuel assets, are thus naturally interested in such production pathways – for example see https://www.shell.com/energy-and-innovation/the-energy-future/future-transport/hydrogen.html

The Calix Process is being developed to enable hydrogen production with carbon capture. As far back as 2012, Calix started working on the concept after receiving a grant of £5.8m from the UK Department of Energy and Climate Change (DECC).

In 2013, the Advanced Solid Cycles with Efficient Novel Technologies (ASCENT) project also commenced, looking at specific carbon sorbents which could be used in the process.

Recent developments in Australia, including the production of the National Hydrogen Roadmap (https://www.csiro.au/en/Do-business/Futures/Reports/Hydrogen-Roadmap) while focusing on mature technologies, nonetheless that indicates a potential development pathway could also be available for the technology in Australia. Calix will thus continue to look for funding to develop the concept both in Europe and Australia.

Introducing Dr. Brian Sweeney

Brian spent 20 years working with Shell around the world, and eight years with the Rolls-Royce Industrial Power Group. Brian’s current role is in business development at Calix Europe, and he has been instrumental in helping develop the Calix Process into several CO₂ emissions reduction initiatives.

He has been a key Calix team member on numerous successful CO₂ reduction applications grants, including DECC, the LEILAC Project and ASCENT, and he also leads the RECAST initiative. Brian studied engineering at Cambridge University and Columbia University, New York.
Our passion is to find innovative ways to apply our technology to solve pressing global challenges. This innovation drive is at the heart of that we do as we continue to seek new ways to apply our technology and know-how in new markets, on a global scale.

Calix is a leading global innovator of award-winning environmental solutions for industry. Through developing unique processes and materials, we work with businesses and governments to help them minimise their impact on the environment whilst still achieving performance levels that they require.

Innovating for the Earth.

With global climate, energy, and sustainability challenges set to intensify, Calix has identified some key challenges that have emerged in the last decade and are increasingly putting our planet at risk. These Global Challenges are at the heart of everything we do.