

ENVIRONMENT

The journey towards sustainability

Inaugural conference addresses production and consumption

THE inaugural International Sustainable Production and Consumption Conference (ISPCC) took place on 4–5 October, in Manchester, UK. Engineers, scientists, social scientists, and even lawyers from around the globe came together to discuss how to achieve more sustainable production and consumption.

The conference was launched in collaboration with *Sustainable Production and Consumption*, an IChemE journal published by Elsevier. Adisa Azapagic, professor of chemical engineering and analytical science at the University of Manchester, UK, acts as its editor-in-chief.

Conference chair Azapagic opened the proceedings. In her opening remarks she mentioned the diversity of the conference attendees' backgrounds and highlighted the importance of this multidisciplinary in dealing with sustainability challenges. This was very much in keeping with the conference aims.

The aims, Azapagic said, were: "To

stimulate dialogue between different disciplines, to facilitate interactions between technology consumption and policy perspectives, and to think about how we can help identify sustainable solutions for both production and consumption."

THE NEED FOR CHANGE

Many of Earth's natural resources, for example fossil fuels and minerals, are finite. They can therefore place limiting factors upon industrial processes, and production and consumption. But regardless of dwindling supplies, resource demand continues to rise as developed countries seek to maintain living standards, and developing countries move towards industrialisation. In addition to issues of supply and demand, current production and consumption practices have led to environmental degradation, air pollution and climate change, as well as increasing amounts of waste.

A milestone in the acceptance and

management of these issues was the 2015 Paris Agreement. Almost all of the world's nations signed the agreement which calls for signatories to take actions to combat climate change. These nations now aim to keep the increase in global temperature well below 2°C above pre-industrial levels. To achieve this, governments are instituting policies to limit greenhouse gas emissions, and technologies are being developed to remove greenhouse gases from the atmosphere.

If there was any doubt about the huge scale of the challenge facing society, the reality was made abundantly clear by UN climate scientists in October. They warned that limiting global warming to the stretch target of 1.5°C requires rapid and unprecedented changes to society (*see p8*).

IMPROVING RESOURCE EFFICIENCY

Raimund Bleischwitz, chair in sustainable global resources at the UCL Institute for Sustainable Resources, gave a plenary centred on sustainable use of resources.

"Industry will be a key player," Bleischwitz said. But also noted that policymakers and civil society could help to make the needed transformations more powerful in key areas such as mobility, housing, and food.

Referring to industry, he said: "They are the ones driving international supply chains, and better supply chain management. They are the ones carrying out all the footprint analysis, or at least being interested in the cost dimensions of using resources and the reputational implication it may have for their business."

"It starts with industry recognising

AZAPAGIC: MULTIDISCIPLINARITY IS IMPORTANT IN DEALING WITH SUSTAINABILITY CHALLENGES



NEWS IN DEPTH

how important the resources and materials it uses are, and then establishing ways of monitoring and tracking the supply and flow of resources.” He said that industry could then use the knowledge gained from such methodologies to “move towards a more circular type of economy.”

“IT STARTS WITH INDUSTRY RECOGNISING HOW IMPORTANT THE RESOURCES AND MATERIALS IT USES ARE, AND THEN ESTABLISHING WAYS OF MONITORING AND TRACKING THE SUPPLY AND FLOW OF RESOURCES.”

Circular economy is an alternative to traditional linear economy. The model seeks to keep resources in use for as long as possible in order to maximise value. This requires recovery and regeneration of products and materials at the end of each service life. A circular economy would address issues of waste and resource efficiency and help reduce the impacts of production and consumption.

Charalampos Michalakakis, a PhD student in the department of engineering at the University of Cambridge, UK, demonstrated how resource analysis could be utilised. He presented a poster of his research that went on to win the ISPC competition. Michalakakis combined analysis of material

and energy efficiency options in order to identify hotspots of resource use in chemical plants.

Michalakakis found that “use of network analysis (traditionally used in complex social systems) has the potential to reveal insightful information about the structures and relationships within a chemical site.” He added that this methodology could be applied to other industry systems, particularly those that are energy- and material-intensive, such as metals and cement.

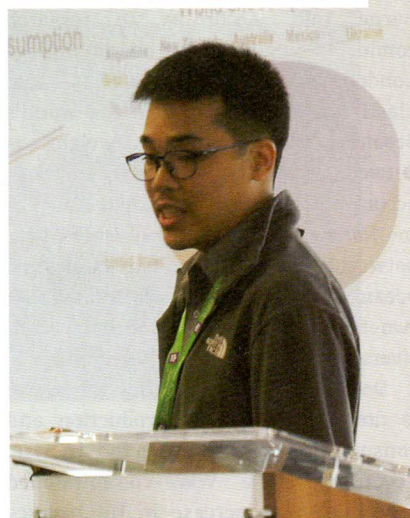
He said that the methodology could better allow for the identification of the “true location and magnitude of losses” within sites, compared to traditional energy and material flow analysis.

LIFECYCLE ASSESSMENT

Lifecycle assessment (LCA) was a major theme of discussion at ISPC. LCA is a technique used to analyse the environmental impacts of a product. The assessment considers everything from raw material extraction up until product disposal or recycling. Several speakers at ISPC demonstrated how LCA could be used to better understand impact, leading to informed decision making.

Piya Gosalvitr, a postgraduate research student in the school of chemical engineering and analytical science at the University of Manchester,

SAY CHEESE: GOSALVITR ON THE ENVIRONMENTAL IMPACTS OF PRODUCING CHEDDAR

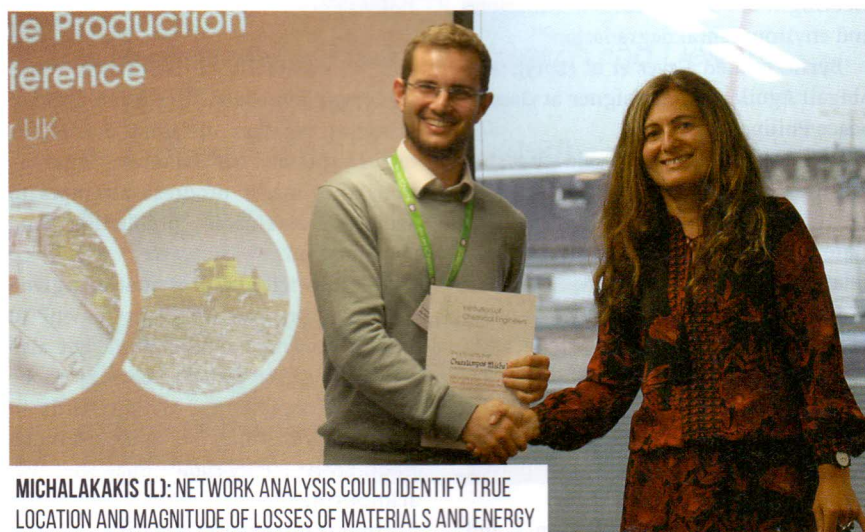


UK, was one such speaker. Gosalvitr presented research on the environmental impacts of cheddar cheese production. The effects of heat integration in the production process, as well as recovery of co-products from whey were also assessed. The assessments were then used to identify hotspots for global warming potential and primary energy demand, in order to make recommendations as to how these could be reduced.

The research found that the main contributors to global warming potential and primary energy demand throughout the cheese lifecycle were milk production and refrigeration at retailers. Heat integration allowed primary energy demand of the lifecycle to be reduced by around 5%. Recovery of co-products from whey reduced primary energy demand by 45%, though greenhouse gas emissions were only reduced by 1%. It was therefore concluded that milk production and retail storage should be targeted in order to reduce greenhouse gas emissions.

PLASTICS

Edmond Byrne, professor and chair of process and chemical engineering at University College Cork, Ireland, addressed consumption and production



MICHALAKAKIS (L): NETWORK ANALYSIS COULD IDENTIFY TRUE LOCATION AND MAGNITUDE OF LOSSES OF MATERIALS AND ENERGY

NEWS IN DEPTH

of plastics.

"The statistics are pretty daunting," Byrne said. According to research conducted by a team at Imperial College London there are an estimated 15–51trn plastic particles floating in the world's oceans. Their combined weight is between 93,000–236,000 t. In addition, according to a paper published last year in *Nature Communications*, each year between 1.2–2.4m t of plastic enters the oceans from rivers. It was calculated that two-thirds of this comes from just 20 rivers, mostly in Asia.

Despite the plastic crisis the world is now facing, plastic production and consumption is still expected to rise. According to a WWF-commissioned report, a 20% increase in UK plastics production is expected over the next 12 years.

"We are on the cusp of a plastics tipping point," Byrne said. Plastic waste is a long-recognised problem "but nobody's paid a blind bit of difference to it, until perhaps now." The world is becoming more aware of plastics as a major pollution issue through media coverage including documentaries such as *Blue Planet II*, which brought the issue to millions of TV screens.

This increased awareness has seen consumers put pressure on industry to

change. For example, the 2018 campaign which encouraged Walkers to create a recycling scheme for crisp packets. Members of the public believed that the 2025 deadline to eliminate single use plastics, set by parent company PepsiCo, was inadequate. A petition launched in response has so far received more than 330,000 signatures. In addition, protestors began sending unenveloped packets to the company's freepost address. The new recycling scheme, set to begin in December, will allow consumers to recycle their used crisp packets through the recycling company TerraCycle. People will be able to post enveloped packets for free or drop them off at public collection points. All crisp packets will be accepted.

Other companies have also begun to make positive changes. For example, Nestlé Waters, PepsiCo, and Danone have partnered up to create bio-based bottles. They aim to fully realise this goal by 2020. And Tetra Pak has a long-term ambition for all of its "chilled and ambient packages to be made from renewable alternatives to oil-based plastics."

However, Byrne questioned whether currently proposed "solutions" such as recyclable, bioplastic, biodegradable, or no packaging options, were really more sustainable.

"Or in the context of the dominant societal paradigm of consumerist growth will they ultimately just contribute to creating more waste, carbon emissions and environmental degradation?"

Byrne quoted *Geyer et al* (2015), and Abigail Aguilar, a campaigner at Greenpeace Philippines.

In *Geyer et al* it was said that "in the long run, recycling reduces waste generation only if it reduces primary material production; otherwise it merely delays it."

Aguilar said: "No amount of recycling can get us out of this global mess. Corporations may have conned us by providing so-called convenience but it's not convenient when your city, oceans, roads, and rivers are clogged by plastic garbage."

"Climate change, pollution, and

waste – including plastics...are all really symptoms of societal unsustainability," Byrne said. "And these symptoms are fed by unsustainable production and consumption. Which is driven by a market-driven consumerist paradigm."

"A key challenge is how and if the tipping point in plastics awareness can translate into transformative changes in consumption behaviours."

Byrne continued: "Chemical engineers, so long proud of our achievements in the realm of plastics, can play a huge and leading role in precipitating and delivering such change, which have wide ranging implications, both technical and socio-environmental."

KEY DRIVERS FOR INDUSTRY

Delegates at ISPC acknowledged that industry has a role to play in improving production and consumption. And, by making changes to transform its operations industry might actually benefit.

For example, as Raimund Bleischwitz said, more sustainable practices could result in reduced costs through increased efficiency. Business might also improve as consumers might view them as forward-moving and appreciate efforts to achieve sustainability.

In addition, governments can play a role in motivating industry behaviours through policies, and incentives such as subsidies.

MOVING FORWARD

ISPC was launched with the intention of bringing together different disciplines to facilitate constructive interactions that might progress attempts to achieve sustainable production and consumption.

The diversity of presentations given at the conference was a testament to ISPC's success in this regard, but also highlighted how much there is to be done. Azapagic stated with regards to the conference that "we achieved much more than I expected". But, she also acknowledged that "this is just the beginning of our journey" **AJ**

BLEISCHWITZ: REDUCED COSTS THROUGH EFFICIENCY



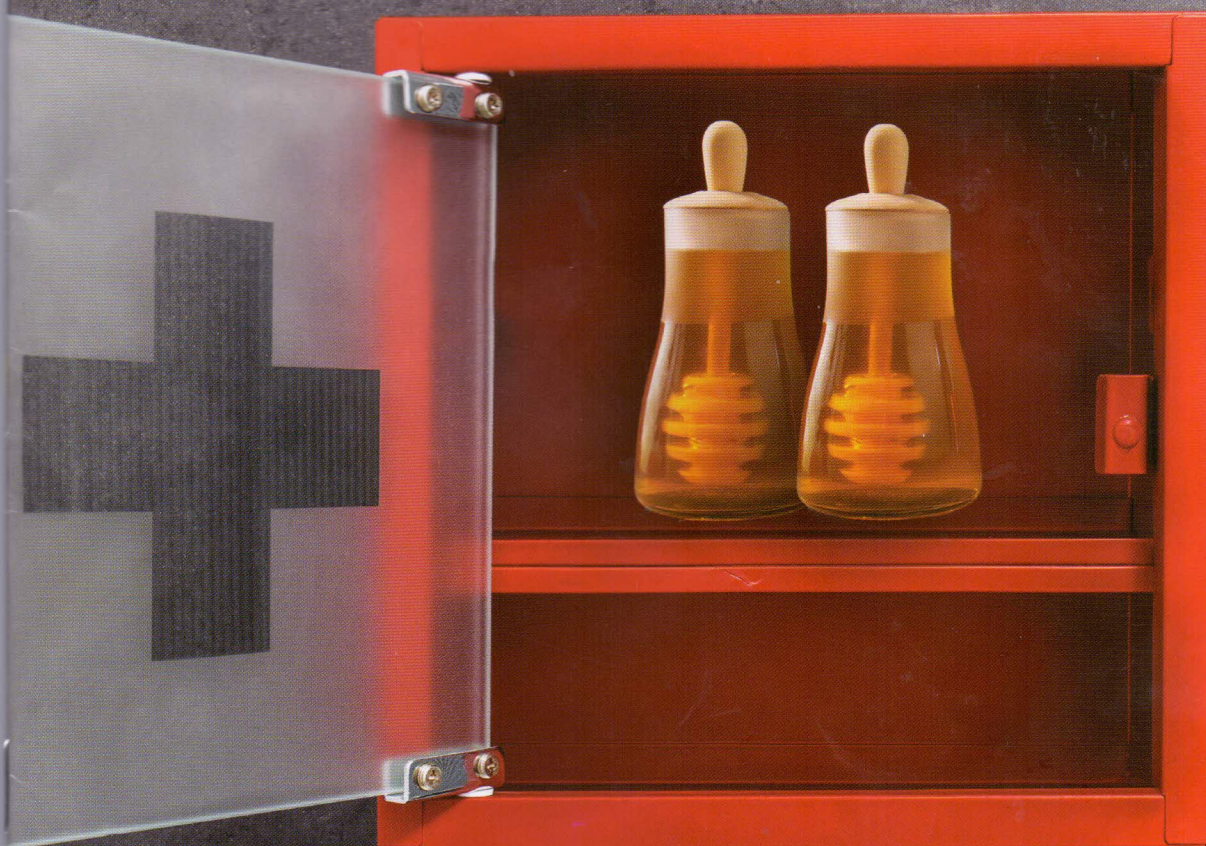
NOVEMBER 2018 ISSUE 929

The Chemical Engineer

NEWS AND VIEWS FROM THE PROCESS INDUSTRIES, BROUGHT TO YOU BY THE INSTITUTION OF CHEMICAL ENGINEERS

SWEET RELIEF

Engineers enlist honey in the fight against infection



WASTE MANAGEMENT

GOING GREEN
Working with algae to recover resources

PAGE 30

BUSINESS

READY FOR BREXIT?
Practical advice on preparing for no deal

PAGE 34

FILTRATION

DON'T COMPROMISE
Filtration needs more focus during development

PAGE 44

EDUCATION

VOCAL VOLUNTEERS
Practising engineers team up for lecture series

PAGE 55