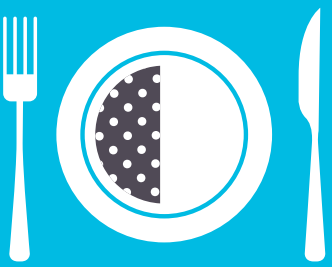
UNIVERSITY OF BIRMINGHAM

# THE COLD TIME BOMB

UP TO 50% OF GLOBAL FOOD IS WASTED BECAUSE FOOD PERISHES WHILE 1 IN 8 GO HUNGRY



GLOBAL URBAN POPULATION WILL GROW TO 6 BILLION BY 2050

AIR POLLUTION CURRENTLY CAUSES 1.2 MILLION PREMATURE DEATHS IN CHINA EACH YEAR AND 600,000 IN INDIA

DEMAND FOR COOLING IN ALL ITS FORMS IS ACCELERATING. THESE ARE THE PROBLEMS, WE HAVE THE SUSTAINABLE SOLUTIONS... WWW.BIRMINGHAM.AC.UK/DOINGCOLDSMARTER

# TIME TO RETHINK COLD ENERGY

BIRMINGHAM ENERGY INSTITUTE

BIRMINGHAM POLICY COMMISSIONS

# THE COLD TIME BOMB

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**800 million people in the world are under nourished and the UN Food and Agriculture Organization estimates that by 2050 feeding the global population will require a 70% increase in food production.**

The supply chain is under pressure. Currently up to 50% of food perishes or is thrown away, when it could be used to feed the one in eight going to bed hungry every night. In emerging and developing economies, this is largely because produce cannot be kept at sufficient temperature en route to market.

From field to fork, the cold chain – the movement of fruit, vegetables and meat via a 'chain' of refrigerated transport and storage – is extensive and complex. The journey is problematic and fleets are challenged, particularly in developing countries where reaching rural communities without adequate infrastructure is complicated.

Closer to home, the increase in 'doorstep delivery' services has extended the chain and seen a surge in smaller refrigerated transport vehicles and cold storage facilities.

The provision of cold energy, or cooling, is integral to modern society; without it, the supply of medicine and data, as well as food, would simply break down. It is also essential to domestic and retail comfort through air conditioning solutions and modern server space for rapid and widespread internet provision.


A rapid growth in new middle classes across the world, including an anticipated increase to 3 billion in Asia in the next five years, means the demand for cold energy to provide the luxury comforts of air conditioning, modern technology and healthcare is soaring, from Starbucks to the latest Apple i-product.

If this ever-increasing need is met using existing fossil fuelled technologies then that would add to the pressure upon the environment, both adding to dangerous air pollution and contributing to climate change.

## HEATING THE PLANET

The rapid growth in urban populations is having a dramatically worsening impact on the environment. As urban populations grow and people become more affluent, so their patterns of consumption change and their demand for cold in particular will increase.

This has the potential to have a very significant impact upon the local environment and upon climate change. The energy required to deliver cooling is significant and highly polluting. If refrigerant usage trends continue, for example, Hydrofluorocarbons (HFCs) will be responsible for nearly half of all global greenhouse gas emissions by 2050.

Furthermore, an estimated 200 million tonnes of perishable food is wasted in developing countries each year, the production for which contributes around 3.3 billion tonnes of carbon emissions. The delivery vehicles and storage facilities are also significant polluters with refrigeration units consuming up to 20% of a refrigerated vehicle's diesel but emitting up to six times as much Nitrogen oxides (NO and $NO_2$) as a modern truck engine.

While ambitious targets to reduce carbon emissions by 80% in the UK and the new US Climate Change plan announced by President Obama earlier this year show that developed countries are taking sustainability seriously, statistics around cold show this area cannot be ignored.

## OUT OF CONTROL

The need for cooling provision in many forms will rise with the growth of global populations and the escalating demands of the new middle classes.

70% of food consumed in the UK is chilled or frozen to store and the demand for commodities is expected to rise by around 30% over the coming decade. Food security is a problem in the developing world now but if cold is not addressed properly the food crisis will come to Britain's door too. This puts huge pressure on energy provision and could have ruinous effects on the environment.

**AIR POLLUTION CURRENTLY CAUSES 1.2 MILLION PREMATURE DEATHS IN CHINA EACH YEAR AND 600,000 IN INDIA**

While current technologies are capable of improving the cold chain and overcoming some of the challenges, the environmental impact would be severe. Air pollution currently causes nearly 1.2 million premature deaths in China and 600,000 in India. The impacts of climate change are familiar but the role of cold and cooling is, as yet, still ignored.

## A COLD ECONOMY

Experts at the University of Birmingham say addressing cold demand and energy consumption is essential to delivering on carbon reduction targets and planning energy systems for the future.

Furthermore they have recognised that the process of 'doing cold smarter', including providing new clean cold technologies and providing the expertise required to integrate them could lead to the foundation of a 'cold economy'. The UK has a unique opportunity to lead this emerging global sector.

The Cold Economy has the potential to include far more than just a collection of energy efficient technologies. Importantly, it could involve a systems analysis and cover many aspects of efficiency, including the recycling of waste cold and utilisation of 'wrong time' energy – such as excess wind power generated at night when demand is low – to provide, through novel forms of energy storage and low-carbon, zero-emission cooling and power.

Professor Martin Freer, Director of the Birmingham Energy Institute, said: *'A systems approach to energy that looks at integrating the different aspects of generation, storage and use is vital to future-proofing our lifestyles – from food to data and modern technology.'*

New technologies for sustainable cooling, including alternatives to refrigerators, delivery vehicles and storage options are gaining traction with a number of SMEs developing innovative new products and prototypes. For example, creative entrepreneurs are pioneering new technology for utilising the most simple power of water for cooling with extensive medical, food and domestic applications as well as the properties of liquid air to pave the way for zero-emission transport refrigeration and other liquid coolants which could revolutionise data cooling.

Professor Freer said: *'The UK has enormous talent and expertise in energy solutions manufacturing and technology innovation but it is being stifled. We can achieve the country's ambitious carbon reduction targets but only if we invest in these sustainable innovations – the government must take cold seriously instead of focusing solely on heating.*

*'There is significant opportunity for the UK to grow new business and generate jobs but time is ticking and if we don't act now, economic giants such as China and India will get there before us.'*

## SOLUTIONS

A policy commission titled 'Doing Cold Smarter' led by the Birmingham Energy Institute at the University of Birmingham and independently chaired by Lord Teverson, Liberal Democrat Spokesperson for Transport and former Member of the European Parliament, was launched earlier this year to produce a roadmap for the UK to navigate the complexity of cold energy provision and provide direction for investment in sustainable solutions. The commission, which is made up of academic researchers and industry experts, is researching new ways of providing cold in a sustainable way, specifically through a system level approach, as well as exploring the economic opportunities this new clean cold industry could present.

This commission will also demonstrate ways the UK could become a global leader in the development of new cold energy systems and the technical, economic, research and skills issues around 'cold'.

Lord Teverson said: *'Cold is a vital part of energy policy for the future, but has been little explored. The demand for cooling is rising globally, and if we fill this urgent need with existing technologies it would have a detrimental effect, not only on the environment, but also for our energy supply.*

*'There's significant opportunity in the UK to develop a new economic hub of innovative manufacturing and technology, as well as positioning ourselves as leaders in this field on the world stage. This will generate jobs and important economic benefits for our country as well as essential carbon reductions.'*

The global energy storage market is set to grow by 8% per annum, rising to be worth £35 billion by 2020. For cooling and refrigeration this means £14.6 billion. Anticipated growth of the global energy demand over the next 25 years presents significant opportunity for innovation in the field and export of technology and knowledge.

Around 14% (almost £5.2billion each year) of Britain's electricity goes to cooling, yet compared with transport and heat, cold and cooling has received little attention in the international energy debate.

Toby Peters, Visiting Professor of Power and Cold Economy at the University of Birmingham and CEO of the Dearman Engine Company said: *'The next 10 years of development in the reconfiguration of the UK's energy landscape and the rapid building out of the energy infrastructure in emerging markets requires an accelerated adoption of a variety of novel energy technologies. These technologies will be a radical departure from the traditional methodologies and could provide sustainable solutions to cooling. There is an exciting opportunity for the UK to embrace these new business and export opportunities spurring innovation and generating tens of thousands of jobs.'*

With urban populations growing at pace and the increased demands of new middle classes for energy intensive luxuries, this is a critical time for transformation of the global energy system. Time is running out for changing the course of food security and environmental crises, as well as the UK opportunity to boost economic growth in this area.

### 28 OCTOBER 2015

The commission will report on its findings at a launch event on 28 October 2015 and present a roadmap for policy. For further information about the commission and to get involved, visit www.birmingham.ac.uk/doingcoldsmarter