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# Food Wastage and Global Food Security

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## • Talk Overview

- Increasing demand
- Food security
- Wastage opportunity
- Perishable priority
- Engineering sustainable cold
- What needs to be done?
- Conclusions



# Increased global demand

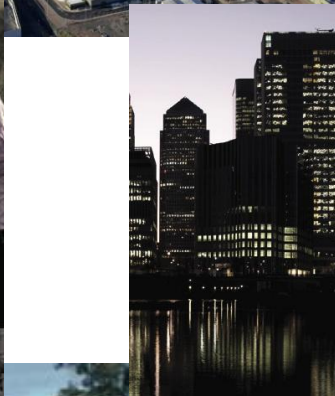
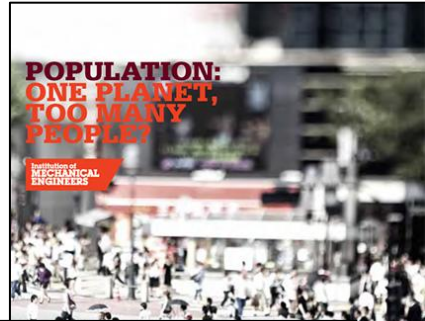
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- Population growth and demographic change
  - Food – more than double agricultural demand by 2050
  - Water – global consumption up 30% by 2030
  - Shelter – 75% of people urban by 2050 (3 billion more)
  - Energy – 40% demand increase by 2035 (90% non-OECD)
- Changing tastes
  - Most populous region becoming more affluent, fuelling unprecedented demand for goods and dietary changes
- Stresses from climate change & geopolitical tensions
  - Extreme weather, droughts, floods, sea level rise
  - Finite resources and finite usable land

# Why engineers? Why IMechE?

## Food-Water-Energy-Land relationship

A defining challenge for the 21<sup>st</sup> century



# Food security

- About more than having enough nutritious food
- Access, human development and stability
  - Individual and Community: key enabler for route out of poverty and mechanism to increase human well-being
  - National: well-being of citizens and stability of state
  - International: reduction of geopolitical tensions
- Sustainable food security
  - Enhances water and energy security, reduces land-use tensions as well as environmental degradation and risk



# Food wastage opportunity

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## Increased production and/or wastage control?

- Total tonnage of around 4 billion (bn) produced today
- Estimated 30-50% is wastage (1.2 – 2 bn tonnes)
- Basic maths:
  - Feeding 6 bn people on 2 – 2.8 bn tonnes
  - Feed 9 - 10 bn on a little more than 4 bn tonnes

## Opportunity – reduce and help feed future population

- Improve food security and sustainability of food system
- Radically reduce pressure on water, energy, land-use

# Food wastage – where?

- **Loss – developing and emerging economies**
  - Poor harvesting techniques, inadequately engineered storage and transportation infrastructure
- **Waste – mature developed economies**
  - Retailer practices encouraging over purchasing
  - Supermarket crop rejections at supply chain source
  - Consumer behaviour in the home and marketplace
  - Hospitality industry procurement practices



# Food loss

- **Poor harvesting and inadequate infrastructure**
  - India/Sub-Saharan Africa 35% - 50% fruit & veg
  - SE Asia typically 35 – 80% rice (China 45%)
  - Eastern Europe 25 – 50% grain (Australia 0.75%)
  - $\approx$ 20 million tonnes of wheat lost annually in India
  - Solutions include; mechanical handling in field, gutters on buildings, sealing cracks and holes, installing temperature control, standardised transport crates





# Perishable priority – why?

- **Population growth and demographic change**
  - Asia and sub-Saharan Africa projected to experience biggest growth in absolute numbers
  - Increased urbanisation demanding more and longer rural-urban supply chains
  - Dietary preference changes to food based on perishable produce with increasing affluence
  - Increased demand for convenience foods; largely based on perishable produce
- **Global warming**
  - Tropical and sub-tropical regions already warm; anticipated to experience most severe climate change
  - Productivity yields projected to reduce so critical to ensure as much produce as possible reaches market

# India and Tanzania

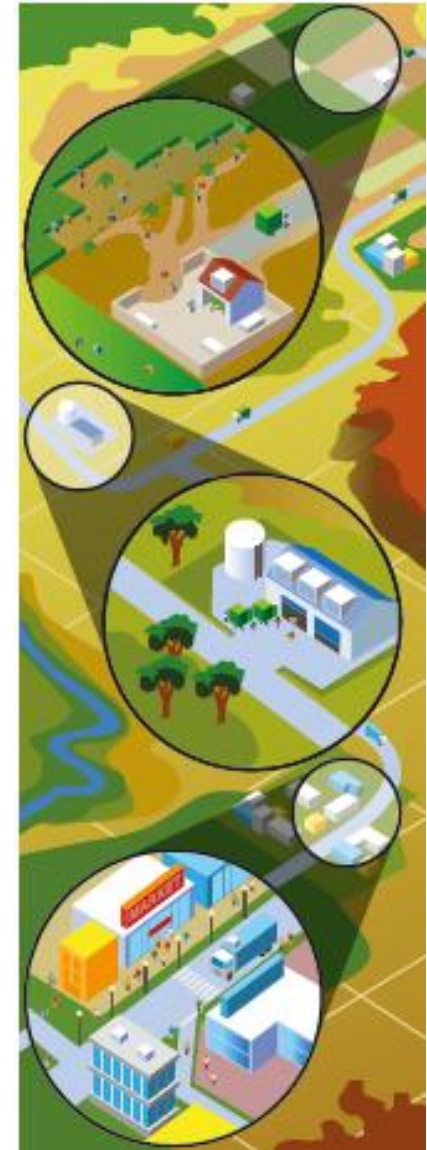
## ● Perishable product loss

- India & Tanzania lose up to 50% of perishables (fruit, vegetables, fish & meat) between field – market
- 97% Tanzanian meat not refrigerated and 16-25% dairy lost (seasonal)
- Indian and Tanzanian farmers often receive just 30 – 20% of potential produce value
- Indian perishable food losses worth  $\approx$  US\$4.5 billion annual lost revenue



# Cold is the need

- Cold is key to tackling perishable loss
  - Estimated that around a quarter of total food wastage in developing countries could be eliminated if these countries adopted same level of refrigeration as in developed economies
  - Establishing a continuous temperature controlled environment is what is required – farm to home

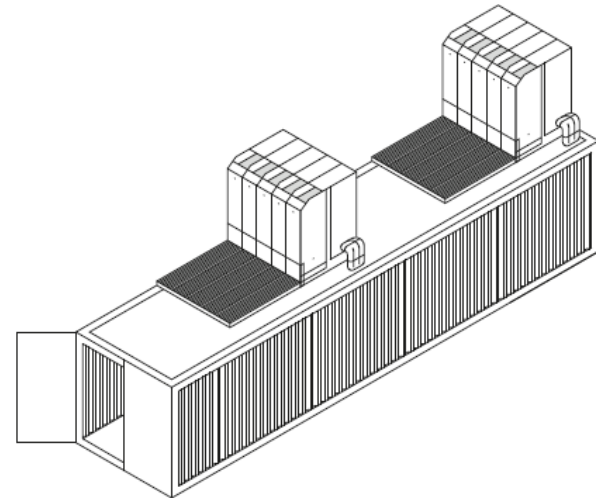
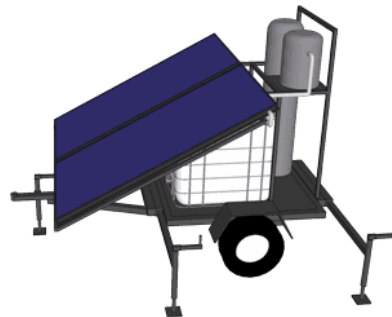


- The primary challenge

- Nearly all cold chain technologies require reliable, continuous and affordable source of electricity (pre-cooling/chilling/freezing & storage) or diesel (transport)
- 400 million people in India are not connected to grid and 350 million of those are located in rural villages
- Less than 14% of Tanzanians have access to electricity and in rural areas the figure reduces to 2%
- Farmers resort to diesel generator sets; energy security issue – often expensive and in short supply
- Energy security will become more challenging as global competition increases and diesel subsidies withdrawn

# Renewable energy for cold

- Direct use of renewable energy
  - Refrigeration based on absorption process driven by solar thermal (e.g. SunChill, Solar-Polar)
  
- Small scale power use
  - Solar (e.g. SunDanzer, Promethean)
  - Biogas (e.g. UGARF)



# A Tank of Cold - power & cold

- Enables scaleable holistic systems level approach
  - Not only reliable electricity, but also direct cooling
  - Avoids traditional refrigerants and uses benign feedstock (air) and working fluid (liquid air)
  - Established mechanical engineering with embedded global supply chain in place
  - Enables provision of 'fuel' for transport refrigeration units



# What needs to change?

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- **International**

- Enable, facilitate and broker transfer of sustainable engineering practice knowledge and localised technology

- **National**

- Reclaim national food policy
- Raise public awareness of food waste issues
- Deploy sustainable infrastructure, training and management

- **Retailers**

- Reform procurement contracts and promotional practices
- Audit supply chains for food loss reduction and elimination
- Assist public reconnect with culinary and food skills

- **Citizens**

- Put pressure on politicians to change retail practices
- Actively re-engage with food and food value

- Reducing food waste and losses could significantly help meet the challenges of food security for the 9.5bn people on the planet in second half of 21<sup>st</sup> Century.
- Unique opportunity exists to 'leapfrog' the resource-hungry unsustainable phase of industrialisation; avoid our failures and mistakes of the developed world.
- Finance, politics, regulation, ethics, access and ownership are the key barriers to meeting the challenge.



# Thank you



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