

The Cold Economy “doing cold smarter”

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2015

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Why Cold Matters?

The world needs cooling; it is the backbone of our society - food, health, data and comfort

but

Refrigeration and air conditioning cause 7% of global CO₂ emissions



Emerging Markets – Two Extremes

40% of food is lost post-harvest!

If developing countries had same level of cold chain as UK, could save 200M tonnes of perishable food.

Asian Pacific 'middle class' could grow six-fold to 3.2 billion in 2030, two thirds of the global total, and its spending power could rise from \$5 trillion to \$33 trillion.

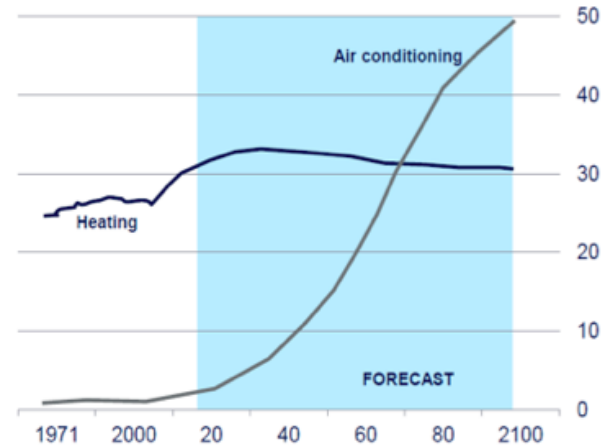


Built Environment - challenge

Global space cooling to consume more energy than global space heating by 2060 and 60% more by end of century – heat remains flat.

Global aircon energy consumption to rise from 300TWh in 2008 to 10,000TWh in 2100.

Figure 5: World forecast energy demand for space heating and space cooling
World energy demand, exajoules



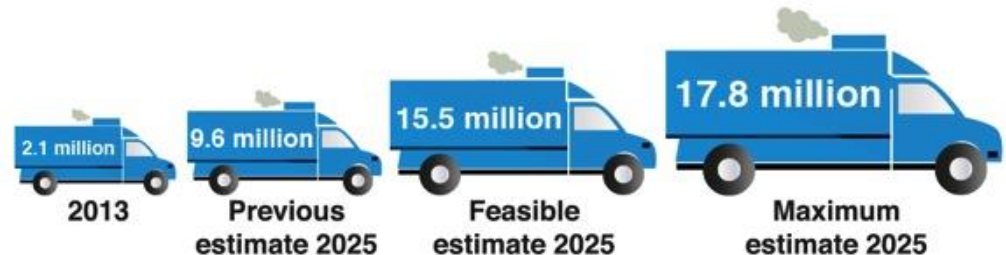
Transport - challenge

A transport refrigeration unit consumes up to 20% of a refrigerated vehicle's diesel and can emit up to 6x as much NO_x and 29x as much PM of Euro VI engine



To meet growing demand, the number of refrigerated trucks on the road is going to increase

= >600 million diesel cars.



Cold Economy – a Systems Approach to Cooling

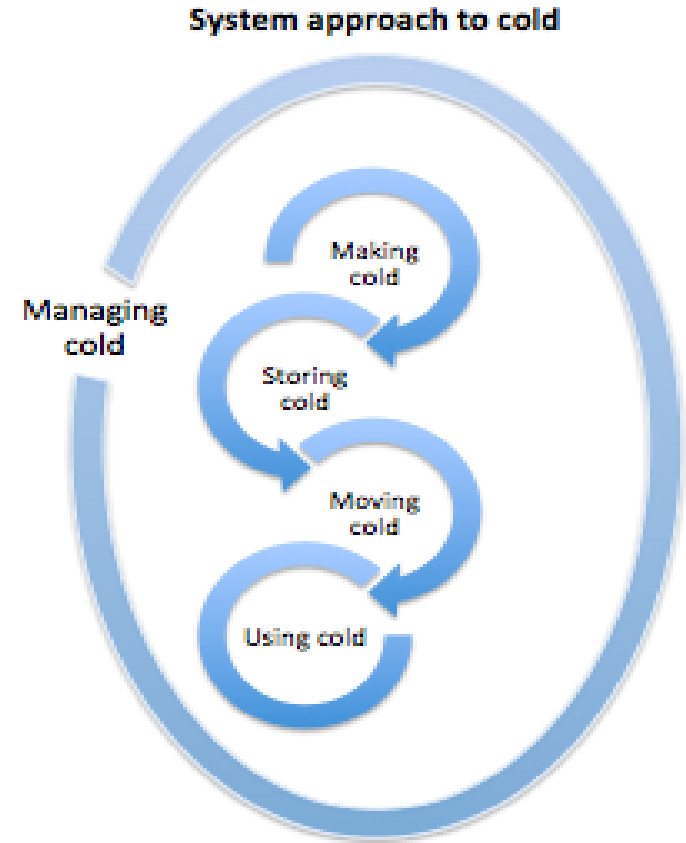
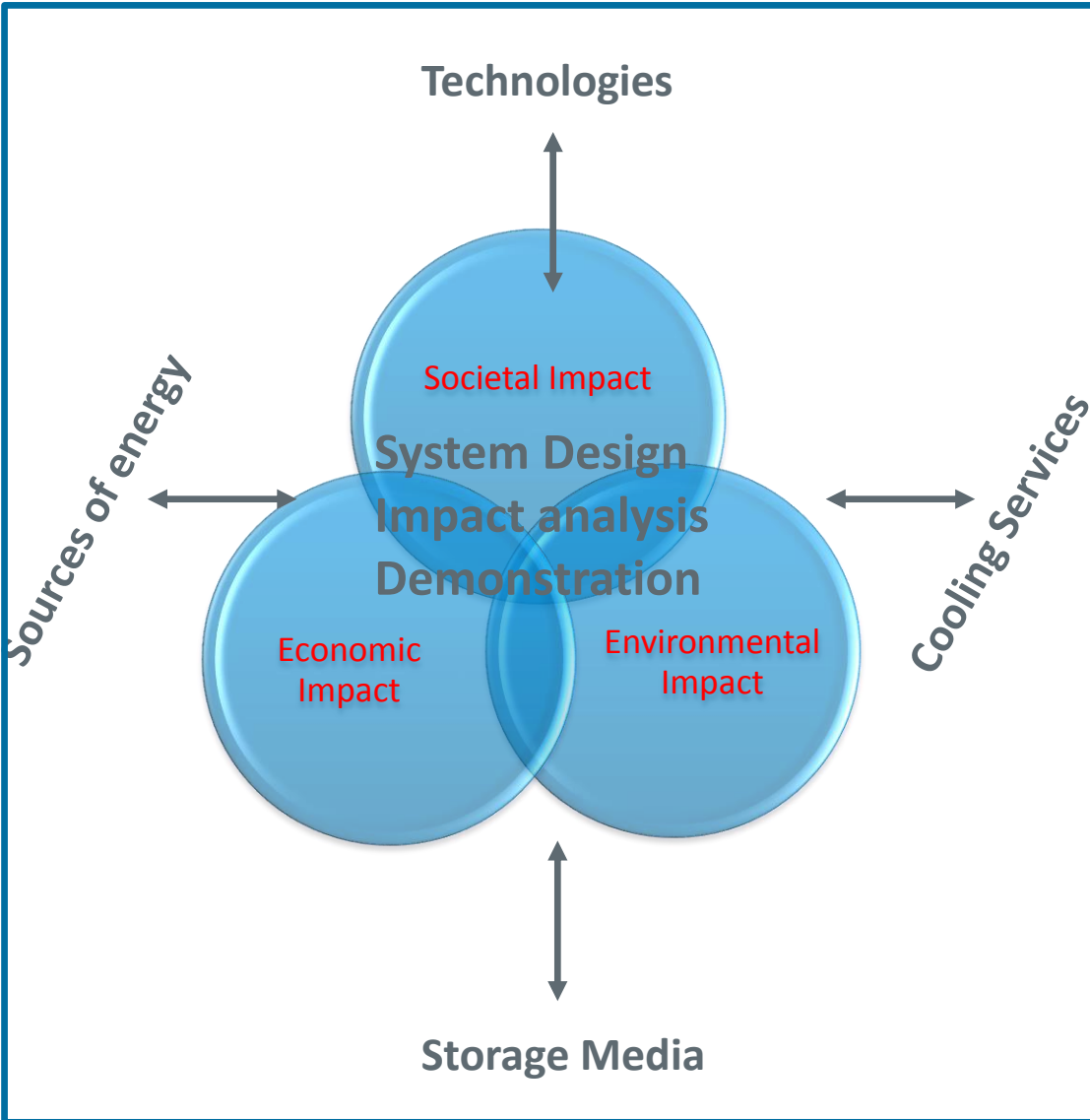
It is crucial that the primary energy demand for providing cold does not grow at the same rate as cold demand itself.

We need to start with the **services** required, not simply the electrical demand

We then must think about how to make, harness, transport and access cold to meet these cooling loads

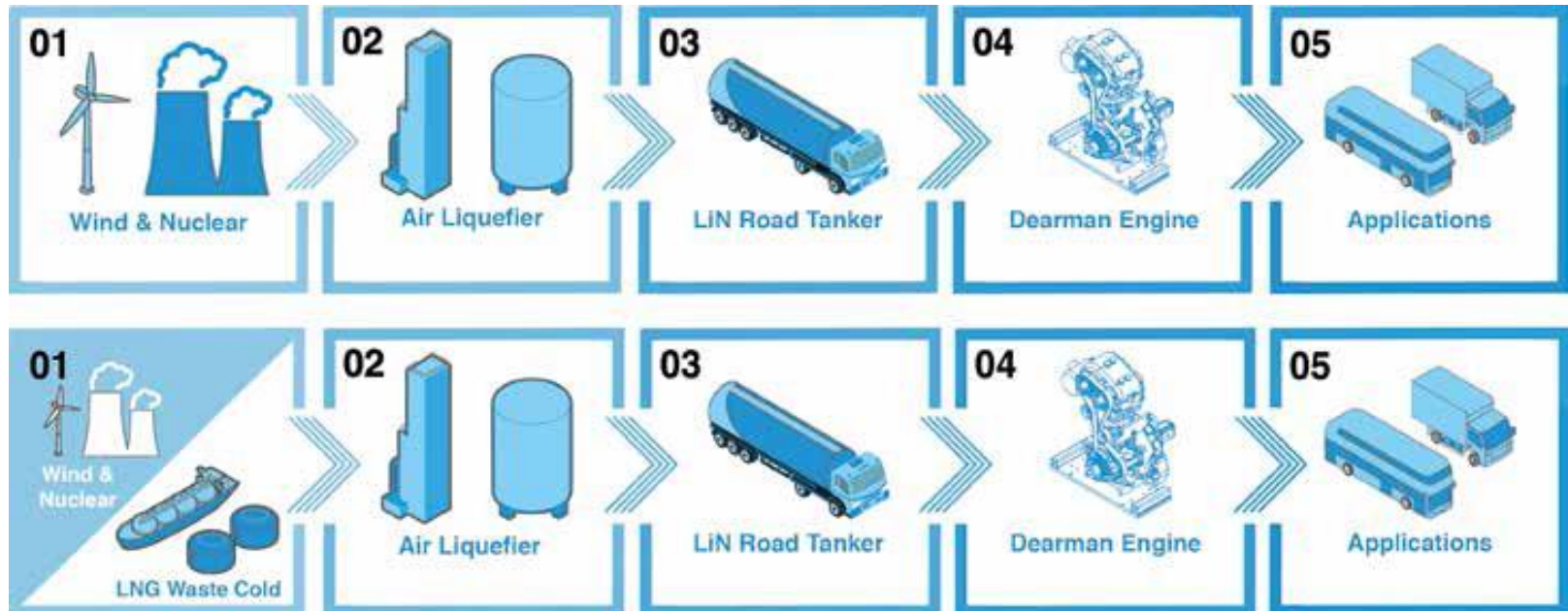


Doing Cold Smarter



What is “waste cold”?

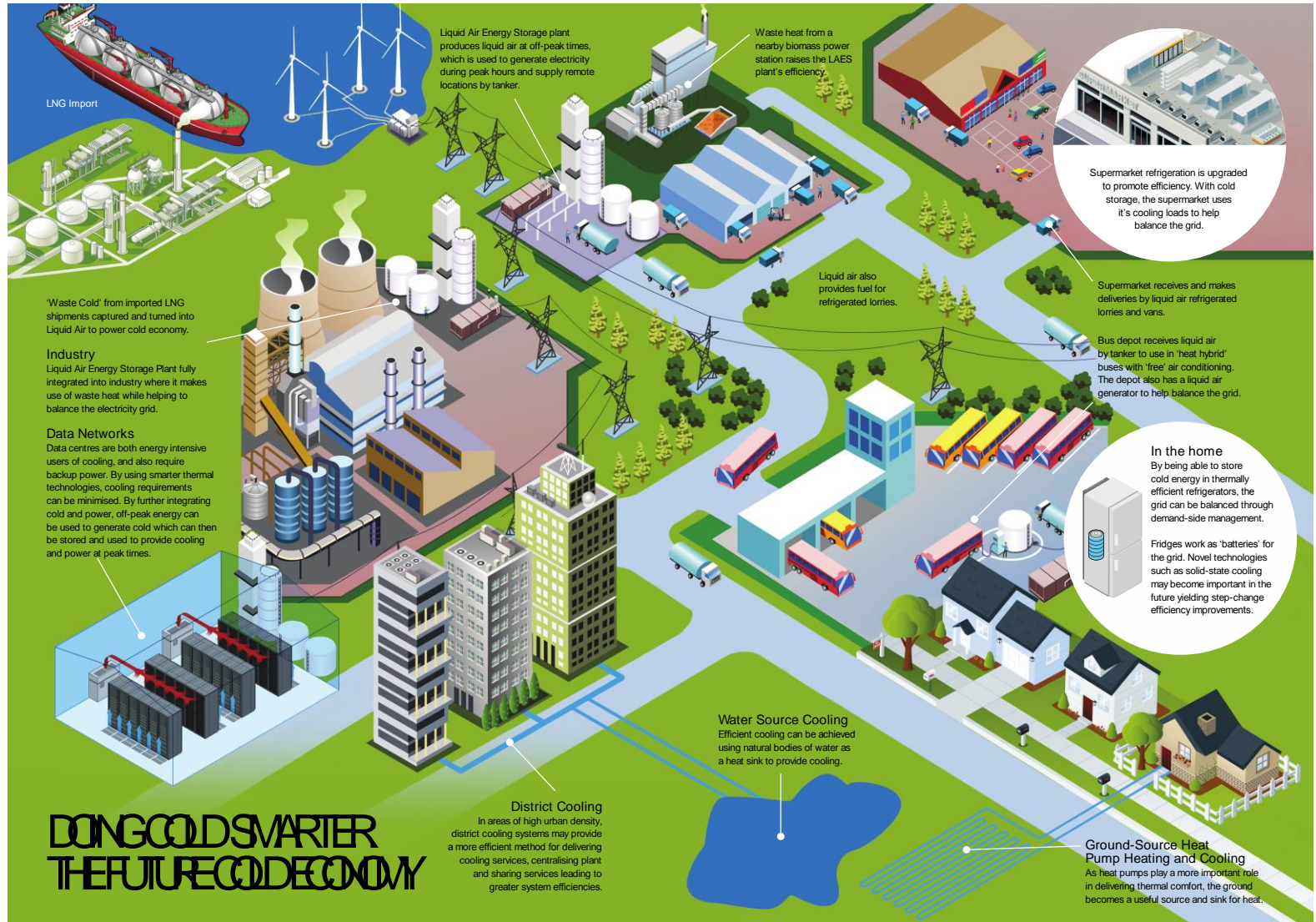
Of the **111** LNG import terminals worldwide, only **23** undertake any form of cold recovery.



Impacts of harnessing the 'packaging' of LNG

- ✓ Sales of cold – <10% of chemical value of LNG
- ✓ CO2 reductions
- ✓ Environmental and social benefits
- ✓ Energy resilience
- ✓ New business opportunities and jobs





Conclusions

- Energy storage is a key technology for society
- More radical innovations are needed beyond batteries
- Energy-water-food require a wholly systems approach and more innovative thinking
 - E.g. provision of power and cold without using electrical energy and using wasted cold
- “Resource/service thinking” leads to new technological solutions
- Outcomes may be disruptive to current business models and require some business rewiring – major opportunity