INSTITUT INTERNATIONAL DU FROID
INTERNATIONAL INSTITUTE OF REFRIGERATION

UK emissions from industrial, commercial and transport refrigeration in the UK

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Workshop Presentation

TICR Scope

Transport	Industrial	Commercial

Transport refrigeration units

Maritime shipping

Chemical Pharmaceutical

Food and drink

Data centres

Cold stores

Retail

Hospitals

A **data driven whole-systems approach to support decarbonisation** and **innovation strategies across all six sectors**

Refrigeration Energy & Emissions

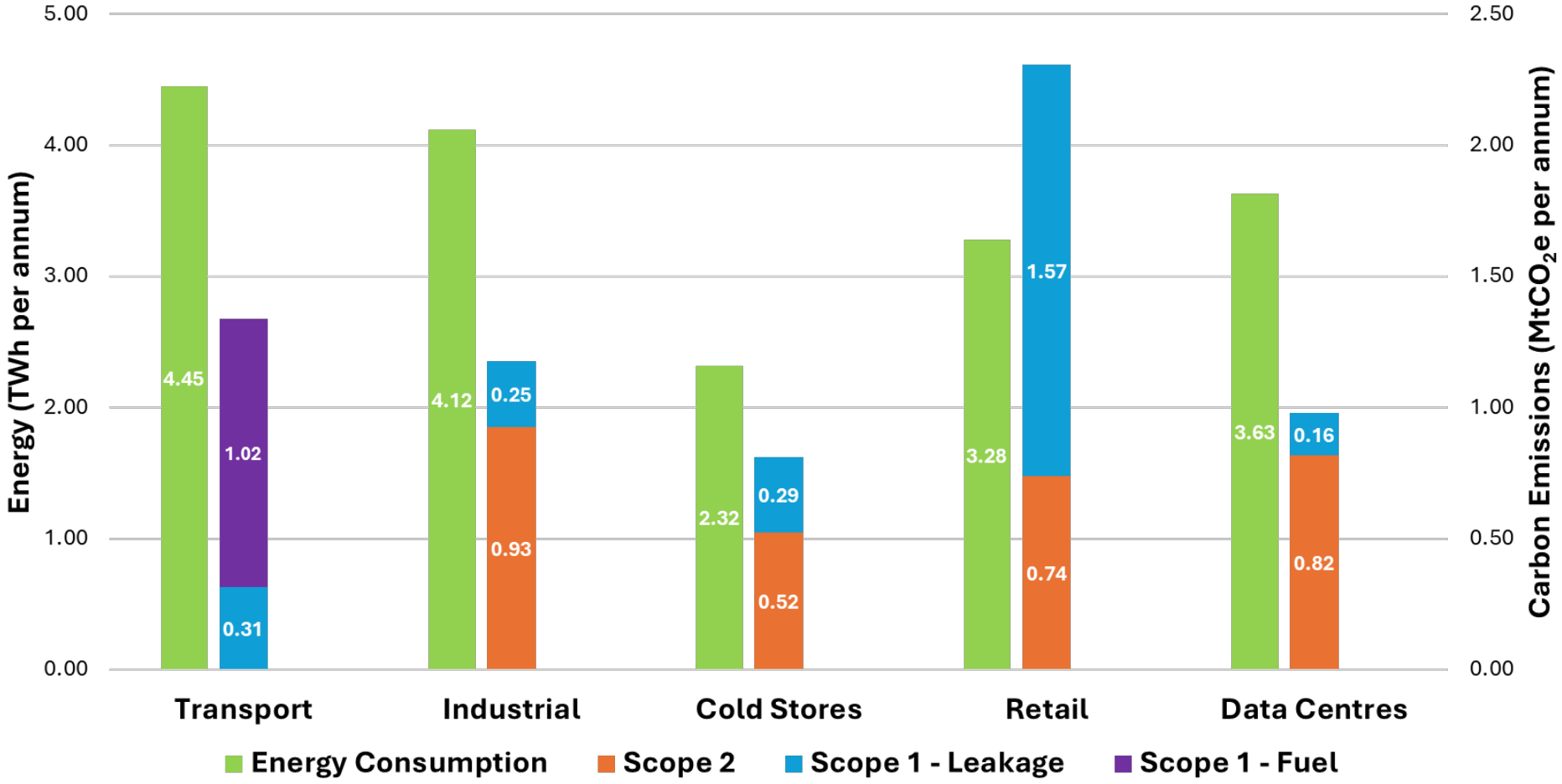
Surveys & Benchmarks

End user guidance

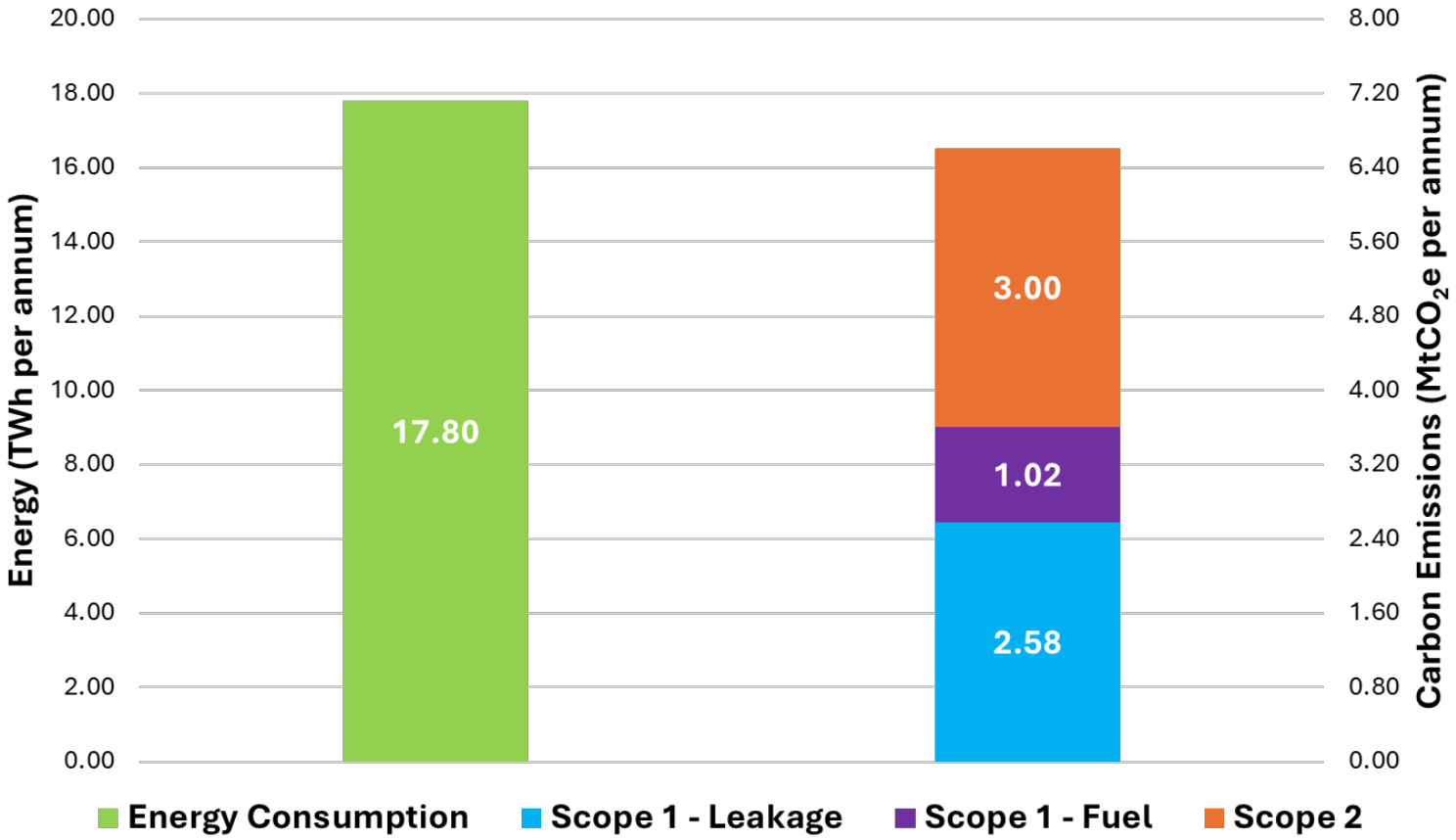
Models & Roadmaps

Policy opportunities

TICR Energy & Emissions per sector



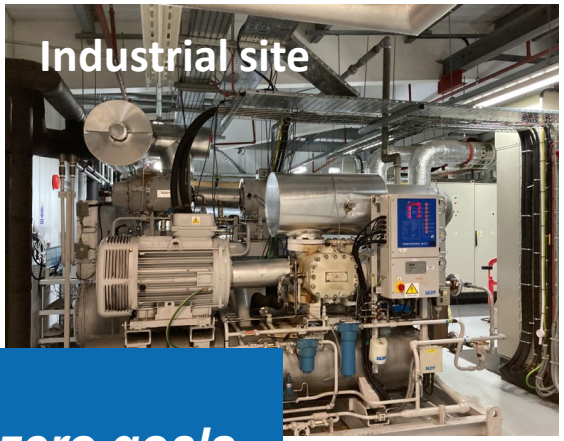
TICR Energy & Emissions



TICR represents ~6% of the UK total energy consumption and 1.7% of the emissions

Site surveys best practice

- **Sub-meter energy use** of refrigeration system & components
- **Pro-active refrigeration optimisation** (assess and rectify performance against a digital twin)
- **Reduce condensing temperatures**
- **Install variable speed evaporator fans/motors** that adjust speed to load
- **Increase evaporating temperature** (at design stage)
- **Ensure F-Gas logs are maintained** and available on site
- Implement a **Preventive Maintenance Plan** (regular condenser cleaning, refrigerant leak checking, etc.)



Industry Challenges:
Need for training, regulation, designer qualifications, and cultural change to meet net zero goals

Benchmarking tool

Self Assessment Survey at www.netzerorefrigeration.uk

TICR Net Zero Benchmarking Survey

1. Setting your net zero refrigeration benchmark

This self-assessment tool provides businesses in the transport, indust
a method to evaluate their current position and future opportunities t

5. What types of refrigerants are most commonly used in your refrigeration system(s)?

- ◯ Don't know
- ◯ HFC/HFC blends e.g. R410a/R407C / HFO blends such as R1234yf etc.
- ◯ Mix of systems some using using low GWP refrigerants (e.g. Carbon Dioxide/CO2 / Ammonia NH3) & HFC/HFC blends (e.g. R410a/R407C / HFO blends such as R1234yf etc.)

Each time it is completed a score sheet is available

Can be completed multiple times – to show progress or impact of different approaches

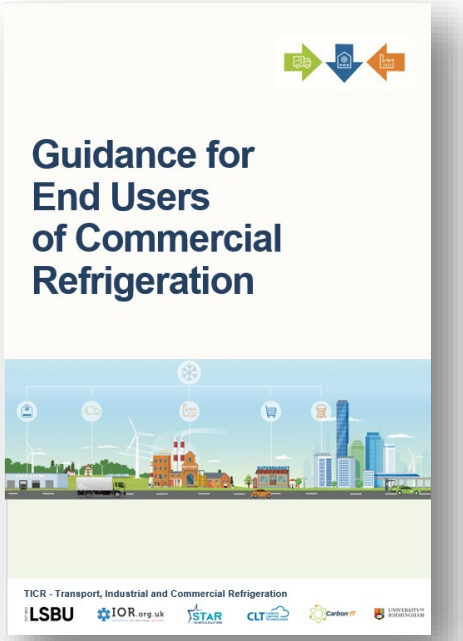
Can be by site or group

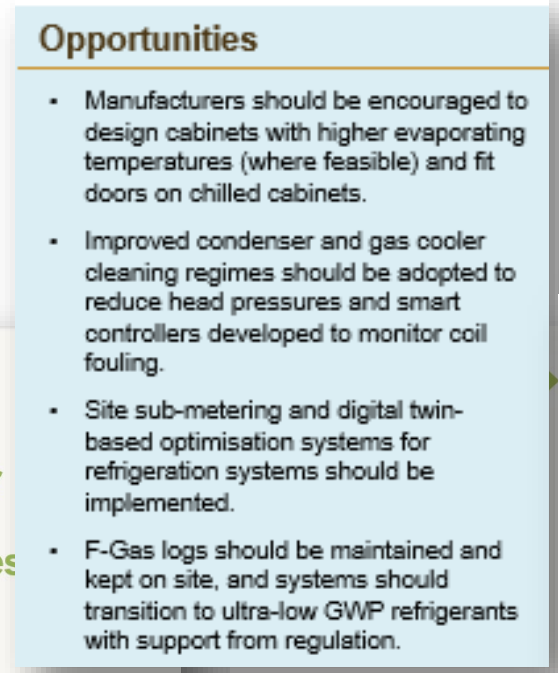
Can be completed anonymously

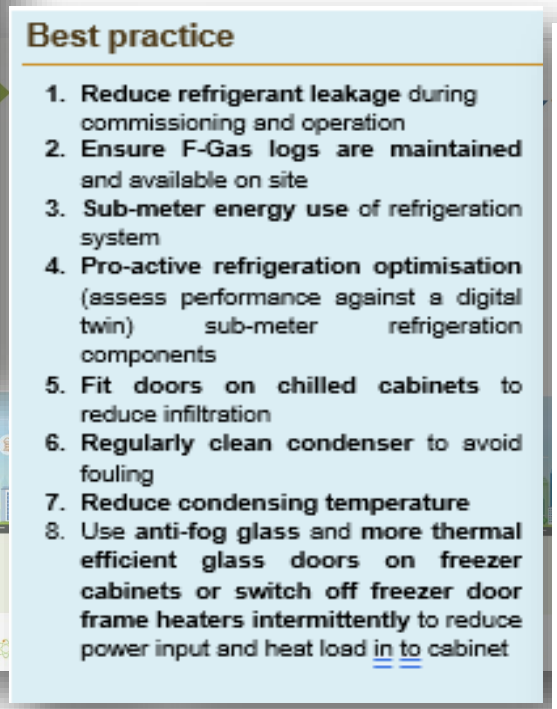
Additional data collection questions at end are optional

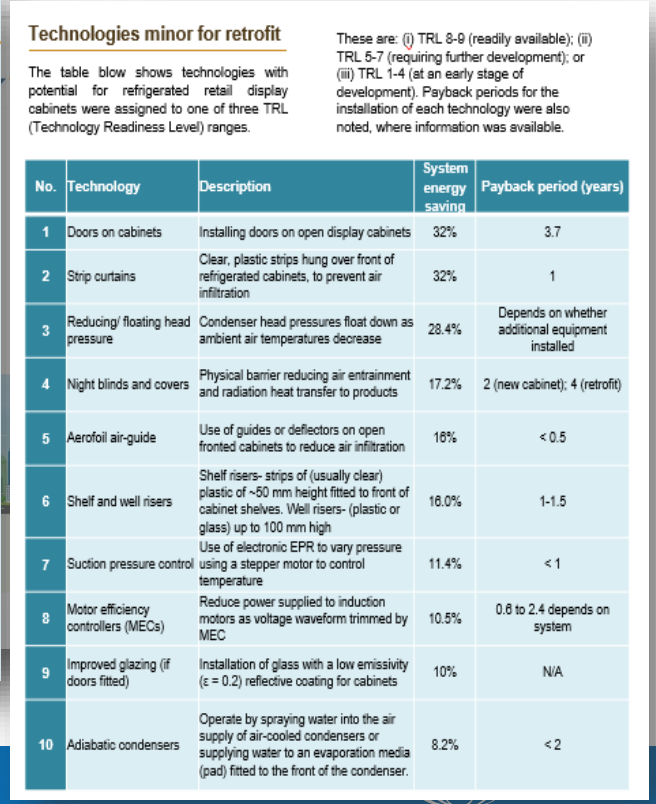
End User guidance

1. Prioritise efficiency
2. Address the information gap
3. Know your assets
4. Take a systems approach
5. Think long term
6. Make well informed decisions









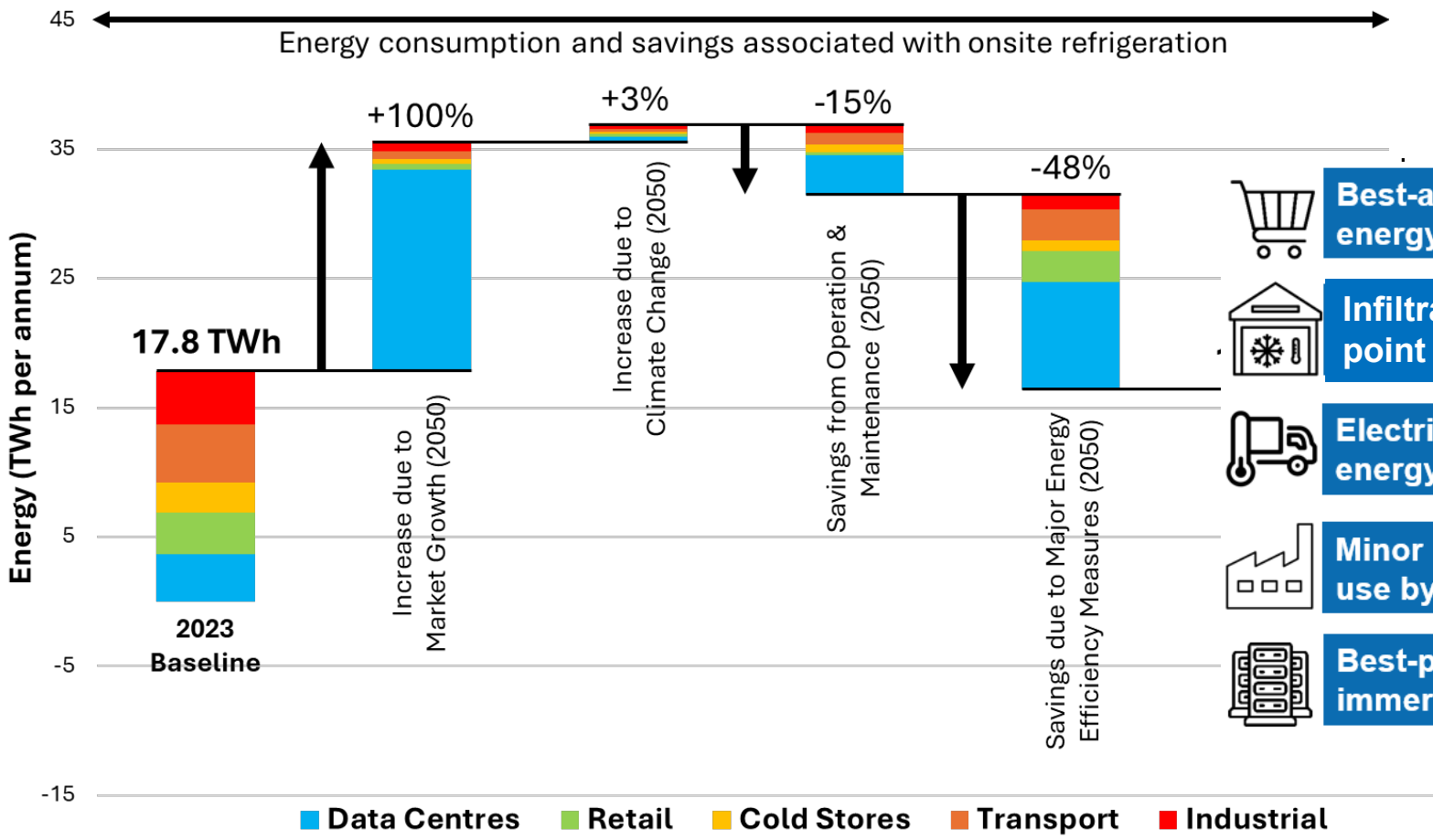
Technologies minor for retrofit

The table blow shows technologies with potential for refrigerated retail display cabinets were assigned to one of three TRL (Technology Readiness Level) ranges.

These are: (i) TRL 8-9 (readily available); (ii) TRL 5-7 (requiring further development); or (iii) TRL 1-4 (at an early stage of development). Payback periods for the installation of each technology were also noted, where information was available.

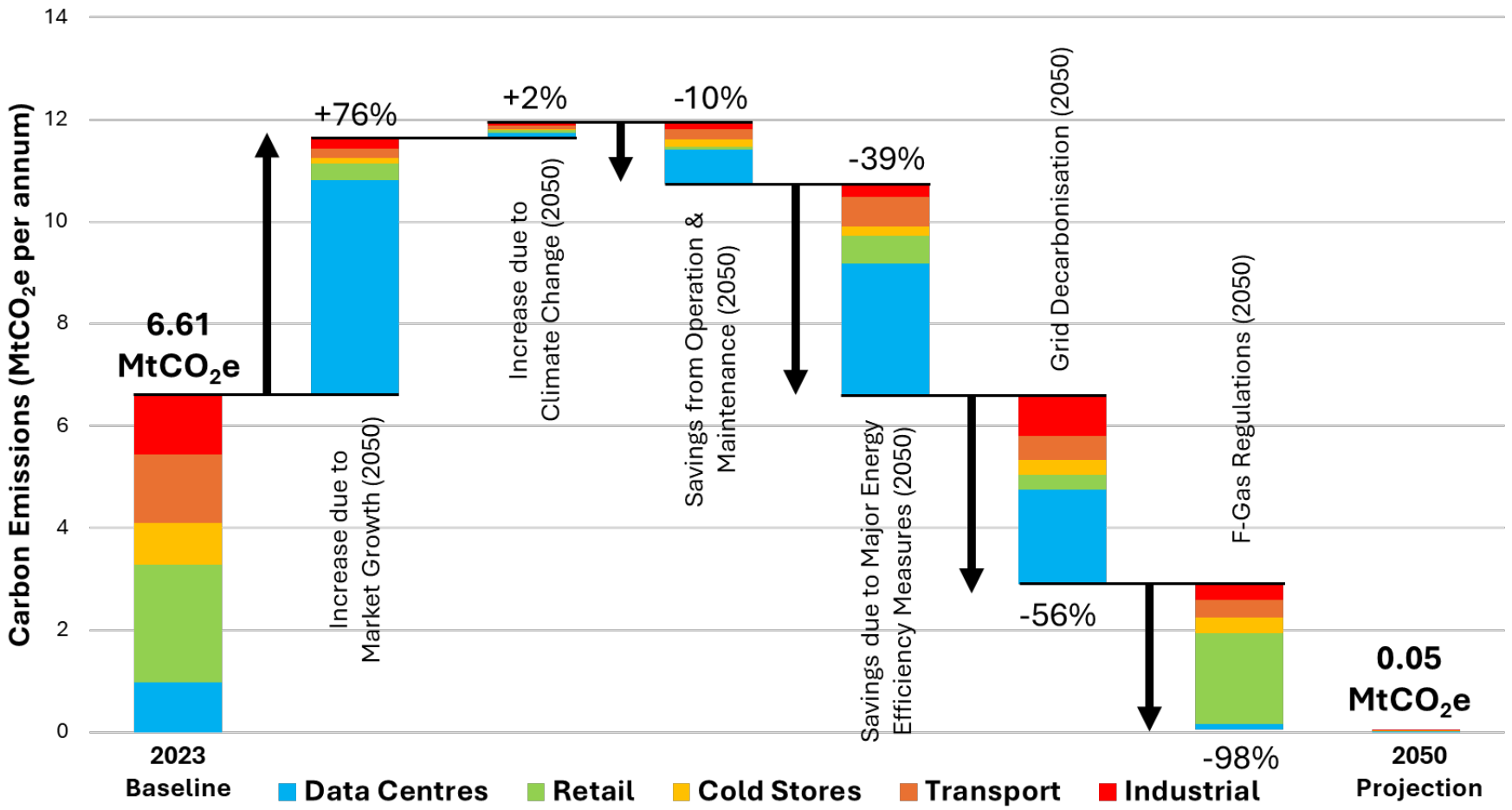
No.	Technology	Description	System energy saving	Payback period (years)
1	Doors on cabinets	Installing doors on open display cabinets	32%	3.7
2	Strip curtains	Clear, plastic strips hung over front of refrigerated cabinets, to prevent air infiltration	32%	1
3	Reducing/ floating head pressure	Condenser head pressures float down as ambient air temperatures decrease	28.4%	Depends on whether additional equipment installed
4	Night blinds and covers	Physical barrier reducing air entrainment and radiation heat transfer to products	17.2%	2 (new cabinet); 4 (retrofit)
5	Aerofoil air-guide	Use of guides or deflectors on open fronted cabinets to reduce air infiltration	16%	< 0.5
6	Shelf and well risers	Shelf risers- strips of (usually clear) plastic of ~50 mm height fitted to front of cabinet shelves. Well risers- (plastic or glass) up to 100 mm high	16.0%	1-1.5
7	Suction pressure control	Use of electronic EPR to vary pressure using a stepper motor to control temperature	11.4%	< 1
8	Motor efficiency controllers (MECs)	Reduce power supplied to induction motors as voltage waveform trimmed by MEC	10.5%	0.6 to 2.4 depends on system
9	Improved glazing (if doors fitted)	Installation of glass with a low emissivity (ε = 0.2) reflective coating for cabinets	10%	N/A
10	Adiabatic condensers	Operate by spraying water into the air supply of air-cooled condensers or supplying water to an evaporation media (pad) fitted to the front of the condenser.	8.2%	< 2

TICR decarbonisation pathways - Energy



- Best-available cabinets (EEI ≈20) cut energy by ~65% vs. current average
- Infiltration control and 3 K freezer set point increase save ~58% energy
- Electrification delivers 2.3 times lower energy use than Hydrogen
- Minor and major retrofits can low energy use by 25%
- Best-practice PUE (1.2) saves ~13%; immersion cooling saves ~49%

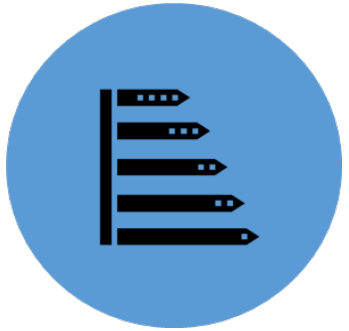
TICR decarbonisation pathways



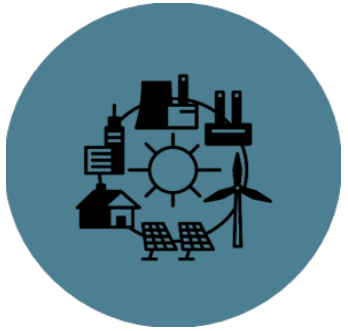
Policy opportunities

Demand Reduction & Behavioural Shifts

Refrigerant Transition



System Efficiency



Clean Energy Integration

- **Step change in skills** end users, designers, technicians & maintenance
- Granular data to measure & **monitor** current **emissions** & identify suitable **benchmarks**

- **Adoption of low GWP refrigerants and training**

- **Incentivisation of energy efficient technologies**

  (MEPS, guidance and tax rebates)

- **Capitalise on potential energy savings beyond refrigeration boundary**

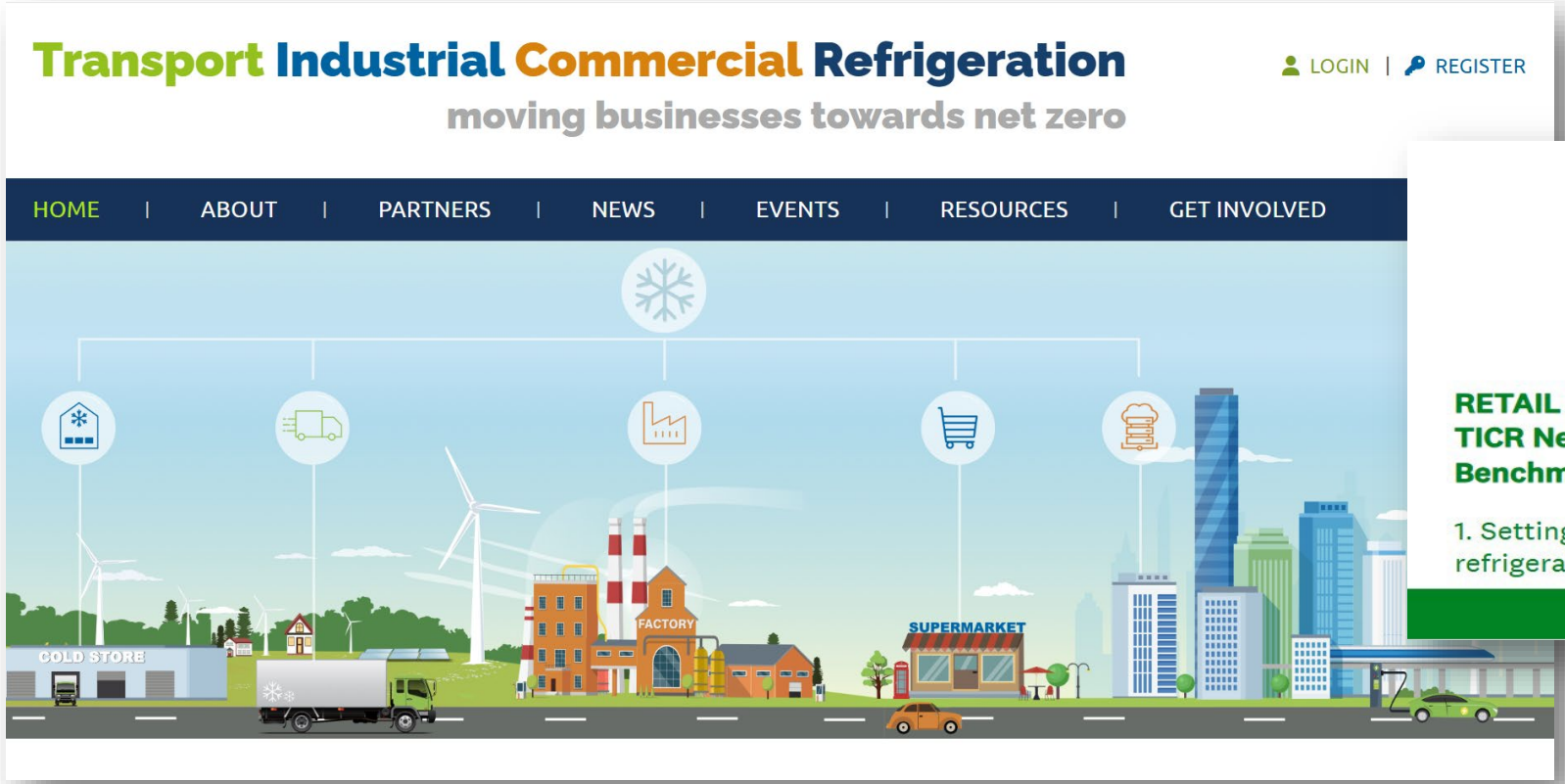
  (e.g. PV and Waste heat recovery)

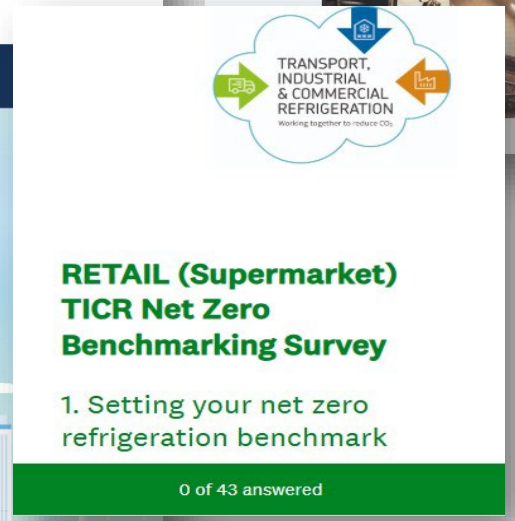
Conclusions

- TICR sectors in the UK emit 6.61 MtCO2e/year and consume 17.8 TWh annually
- **Operational inefficiencies and skills shortages drive high emissions**, highlighting the need for better maintenance, monitoring, controls, and refrigeration expertise
- **Ready and emerging technologies**: such as advanced controls, low-GWP refrigerants, and waste heat recovery offer potential to improve efficiency and cut emissions
- **Future decarbonisation pathways could reduce emissions to near zero** (0.05 MtCO2e) by 2050, leveraging technology adoption, renewable energy integration, and waste heat use
- Policy and industry must prioritize skills development, data transparency, refrigerant regulation, and collaborative innovation to enable the sector's net zero transition

Website

netzerorefrigeration.uk/





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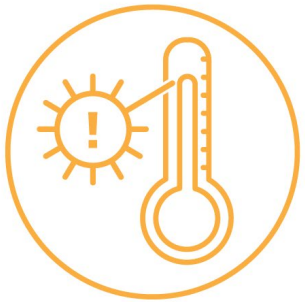

1st IIR International Conference on
Refrigeration Adapting to Rising Temperatures

Adaptation 2025

MANCHESTER - UK

AUGUST 10 -13

Thank you

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