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Low charge ammonia packaged systems

Delivering a sustainable future for the cold chain

Dr Rob Lamb

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QUESTION

25% TO 30%

Energy used for RACHP in developed countries (UNEP 2018) and increasing!

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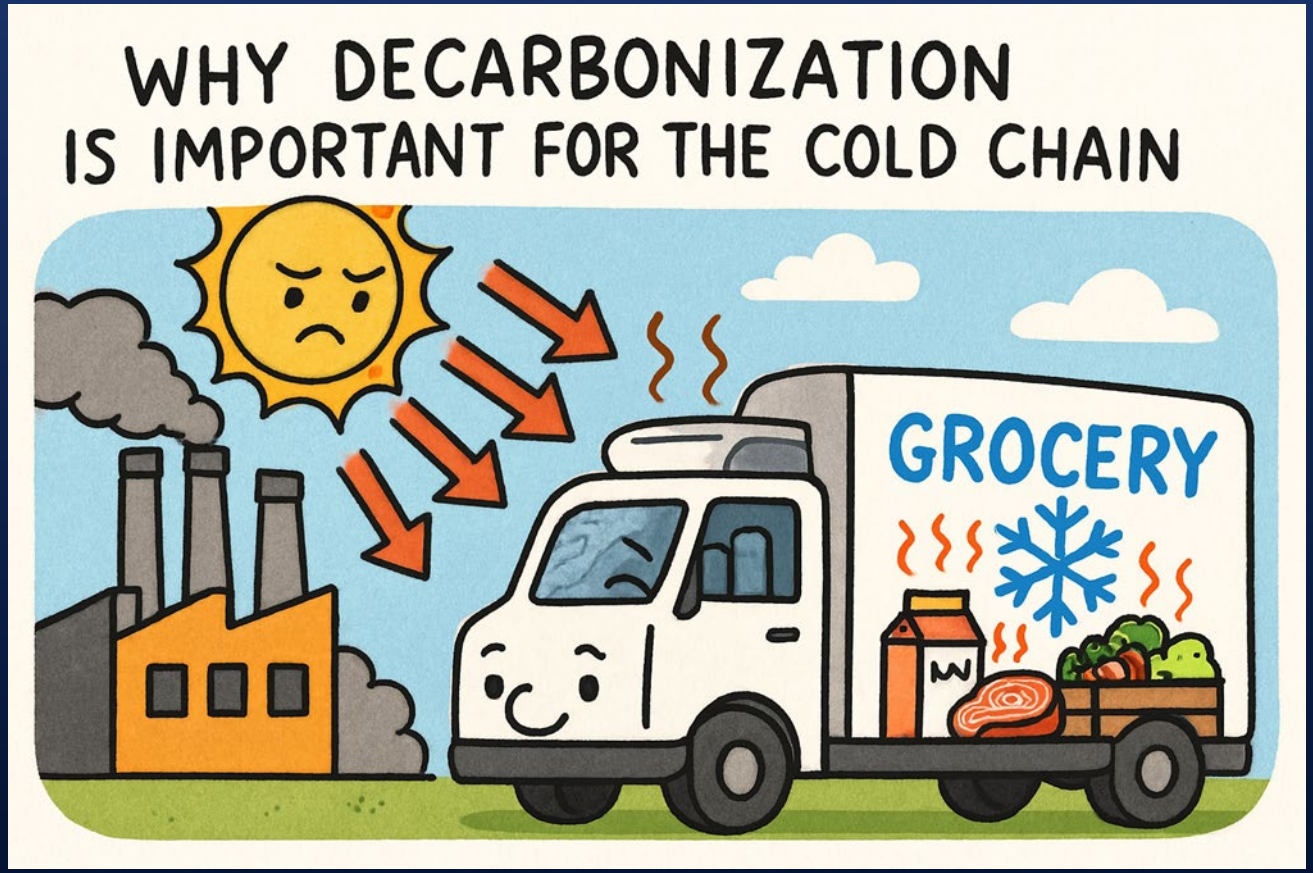
WHY IS DECARBONISATION IMPORTANT?

- Responsible for approx. 4%* of global green house gas emissions
- This will grow with population
  - Need for more food
  - Use of cooling to reduce food loss
- Emissions associated with:
  - Food waste/loss
  - Refrigerant loss
  - Equipment manufacture
  - Energy production



* UNEP (2022)

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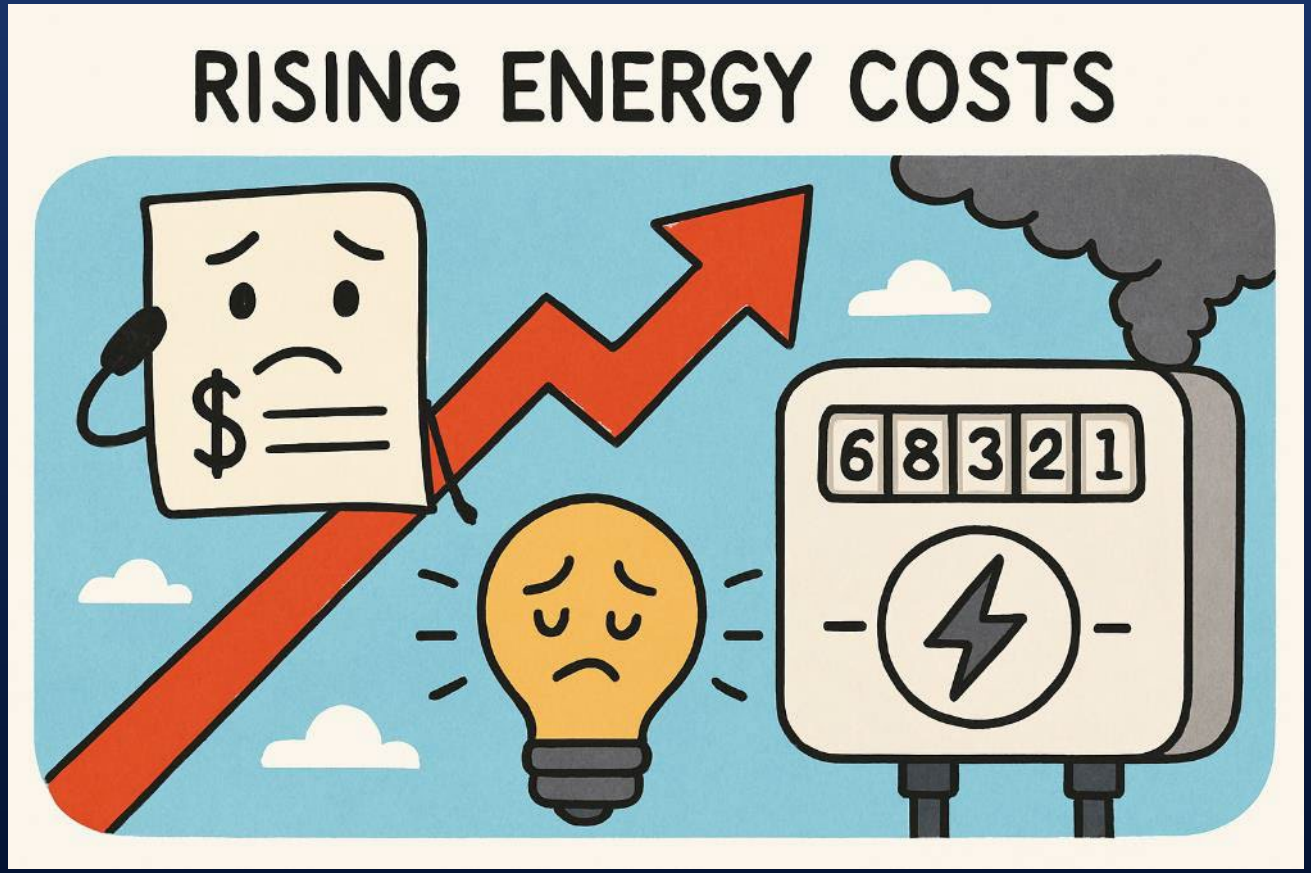
WHY IS DECARBONISATION IMPORTANT?

- Rising energy costs
  - Cost increased 3 or 4 time in 10 years
  - Price uncertainty remains
  - These costs hit the bottom line



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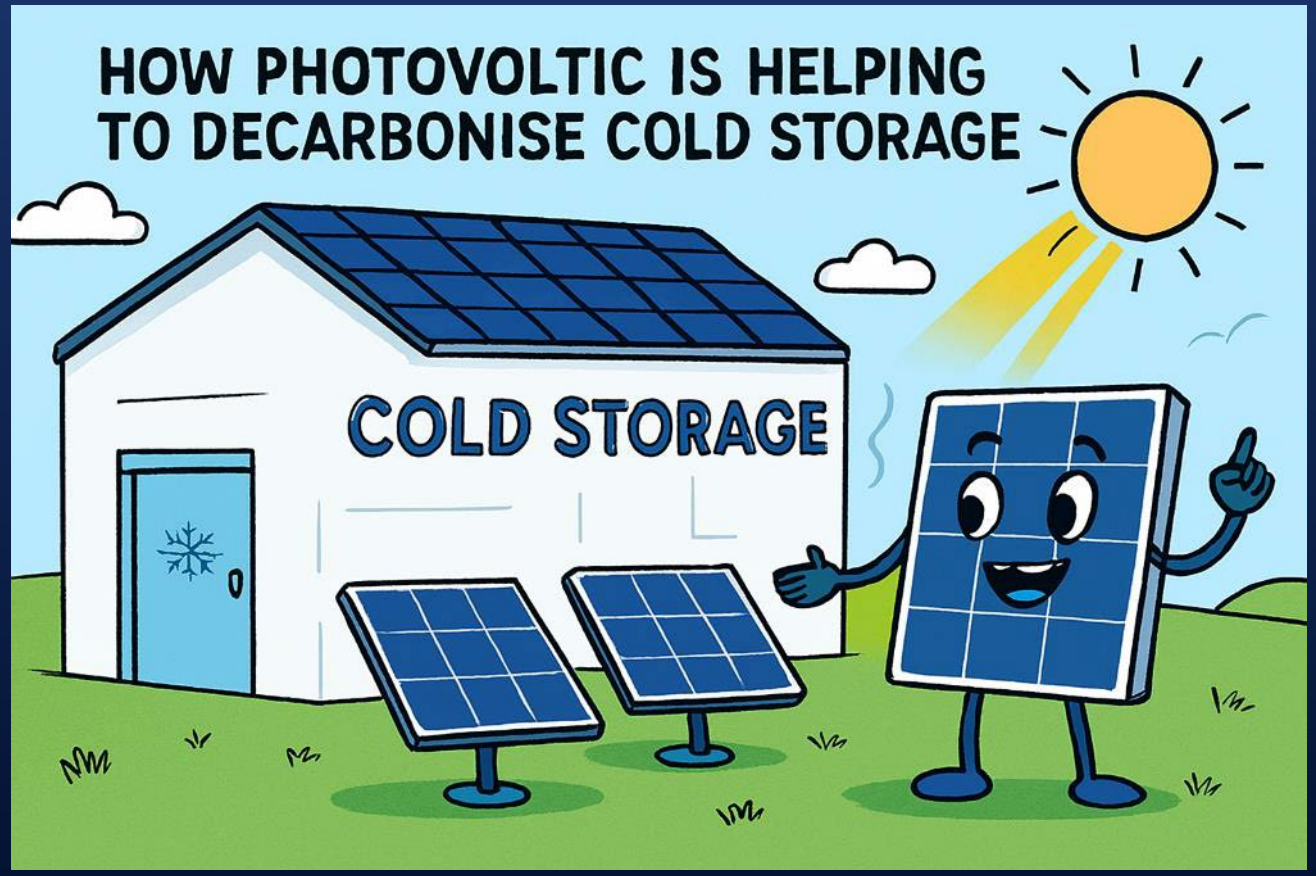
RENEWABLE ENERGY – A STEP IN THE RIGHT DIRECTION

- Move to clean energy is helping
  - Large space available for PV energy generation
  - PV produces peak energy when cooling demand is at its highest
  - PV and wind enable overcooling when available
  - Storage would be even better



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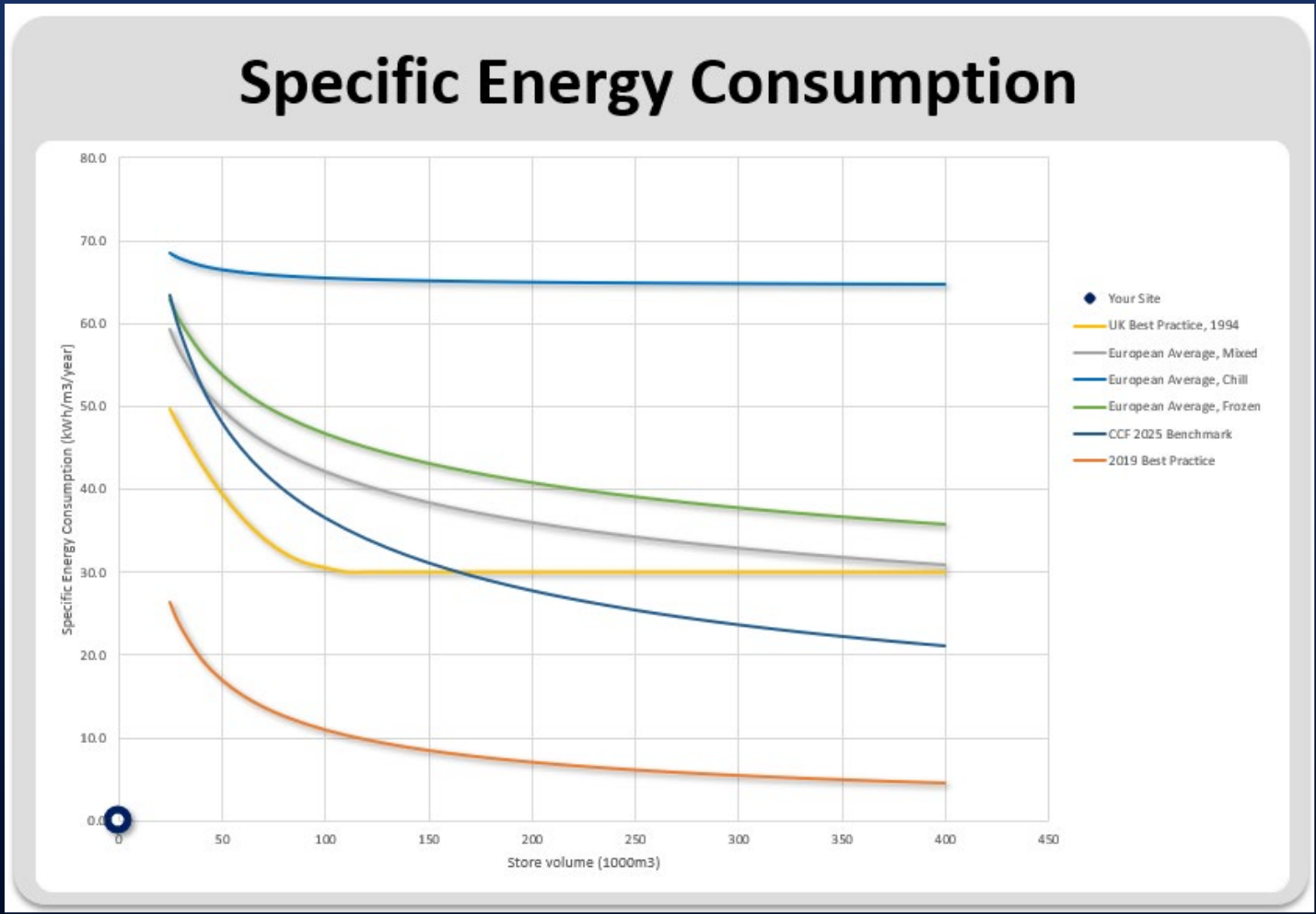
BUT WE CAN DO MORE….

- European consumption exceeds 1994 UK best practice
- UK systems fair better at larger volumes
- Plenty of room for improvement



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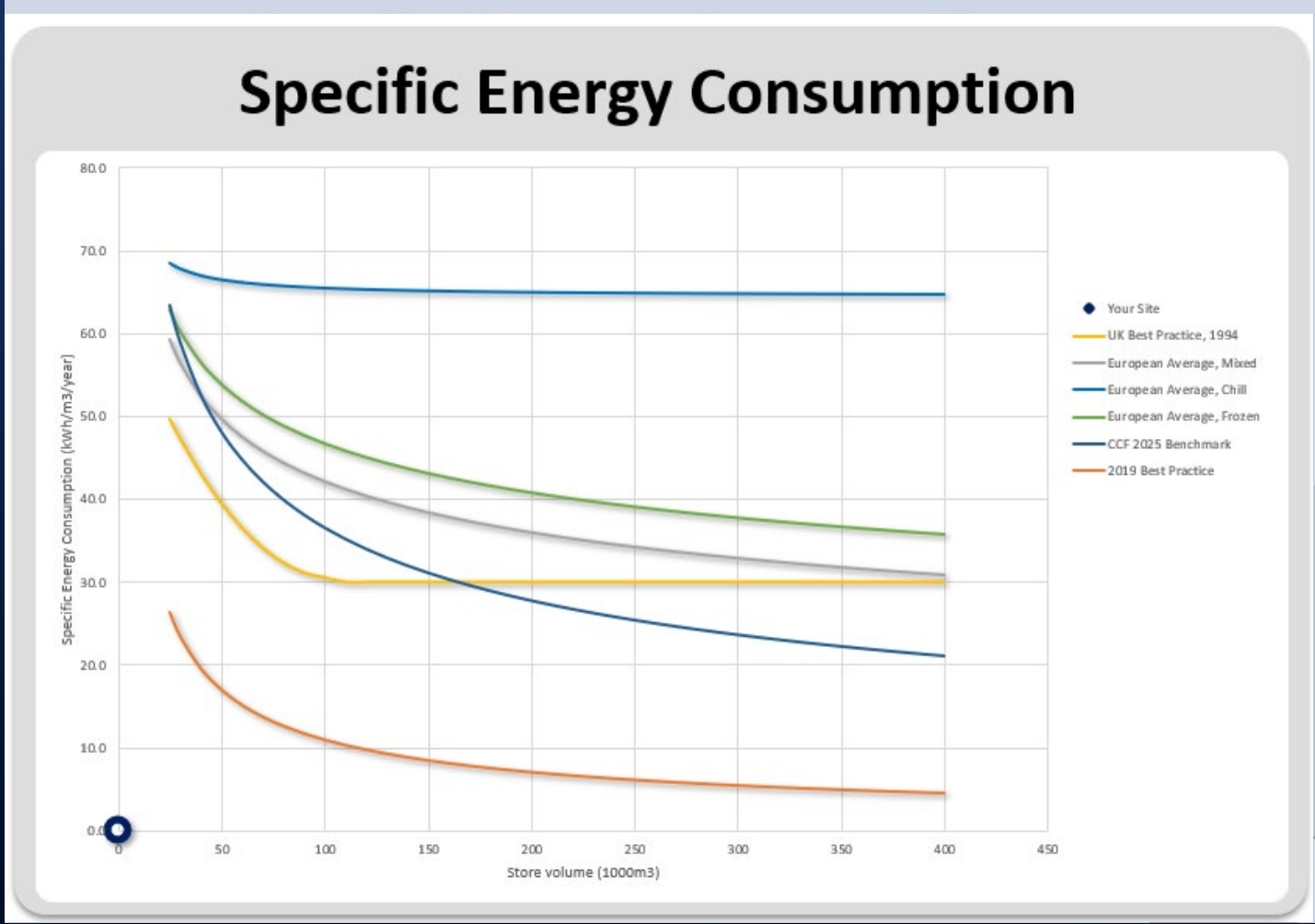
BUT HOW?

- Focus on energy performance
  - Benchmark against best practice
  - Measure in real time
  - Optimise quickly
    - Plan
    - Do
    - Check
    - Act



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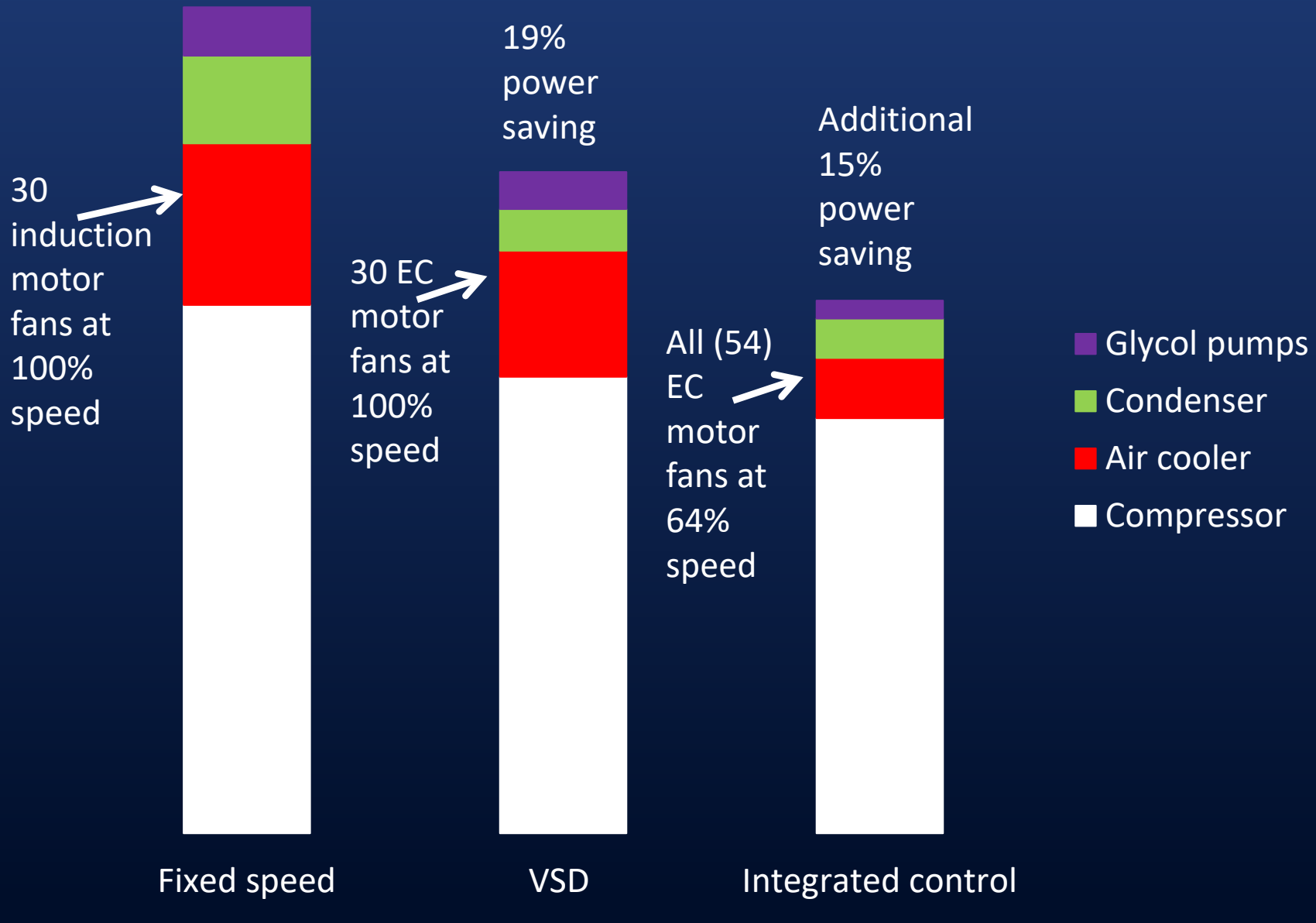
OPTIMISE CONTROL



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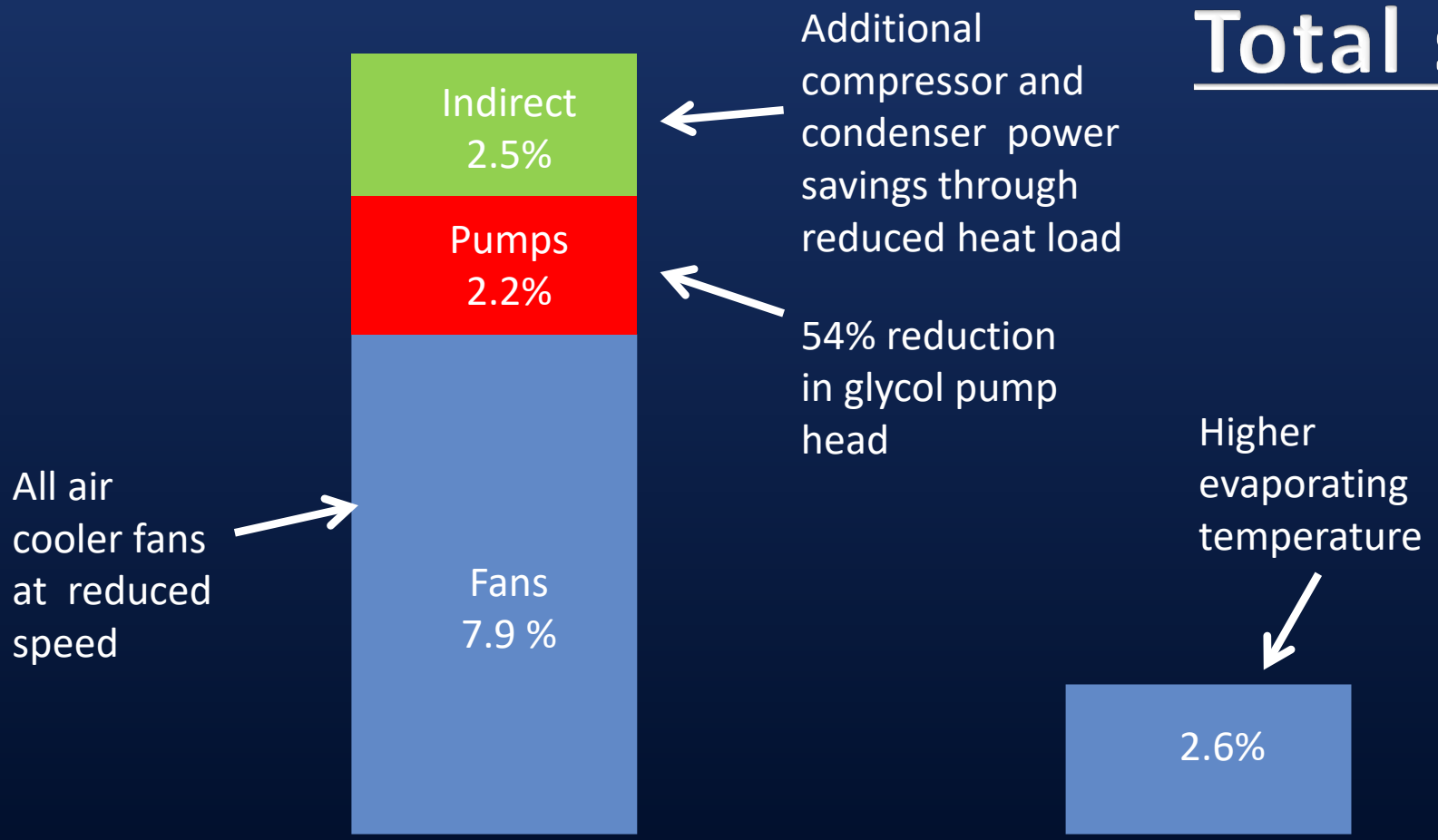
OPTIMISE CONTROL

Total saving >15%



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Case Study
Modular Low Charge Ammonia Chiller Installation

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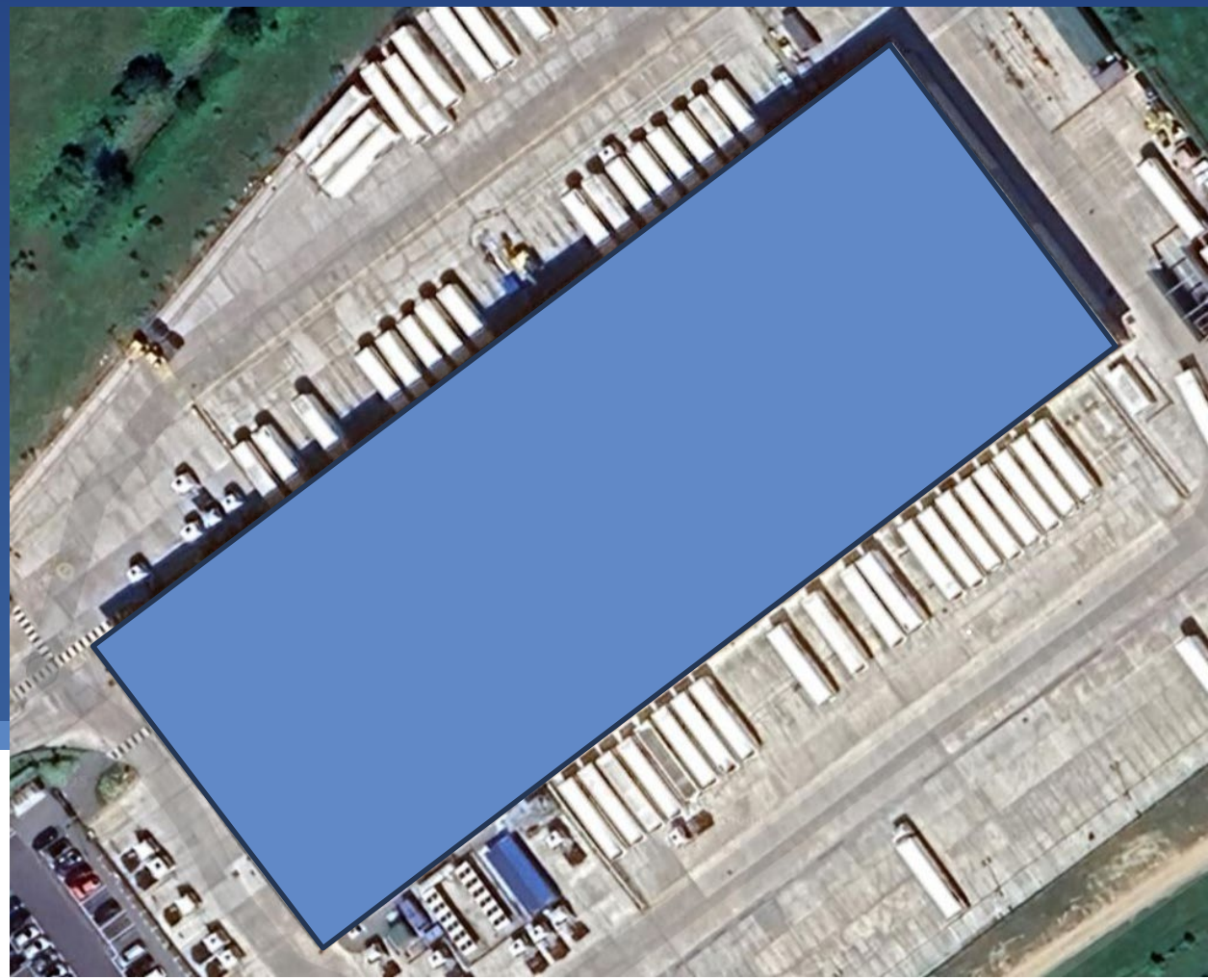
Chillstore Details

- 50,000 m^3 volume
- Installed 2017
- Operational 2017
- +2°C design temperature
- 2 x modular low charge ammonia chillers
- 830kW chiller capacity
- 11 x 69 kW air coolers



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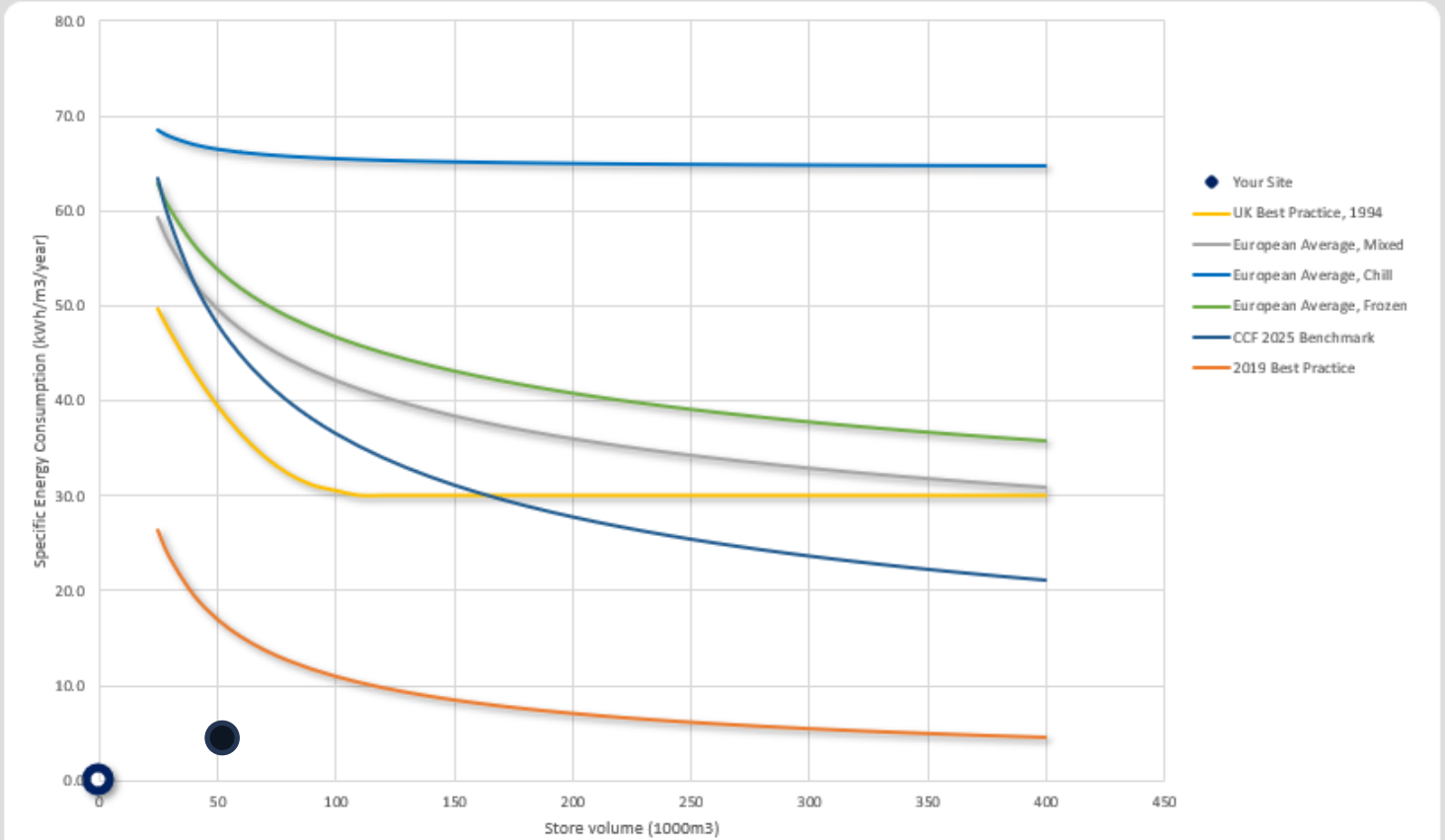
A New Benchmark In Efficiency

- SEC = 5 kWhr/m3/yr
- 92% reduction in energy vs European average
- 87% reduction vs previous UK best practice
- 89% reduction vs current UK average

Specific Energy Consumption



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Case Study
Modular Low Charge Ammonia Freezer Installation

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Phase 1

- 74,000 m^3 freezer
- Installed 2018
- Operational 2019
- -24°C design temperature
- 600kW cooling capacity
- 2 x modular low charge ammonia packages
- 4 x 150kW evaporators
- Ambient loading bay

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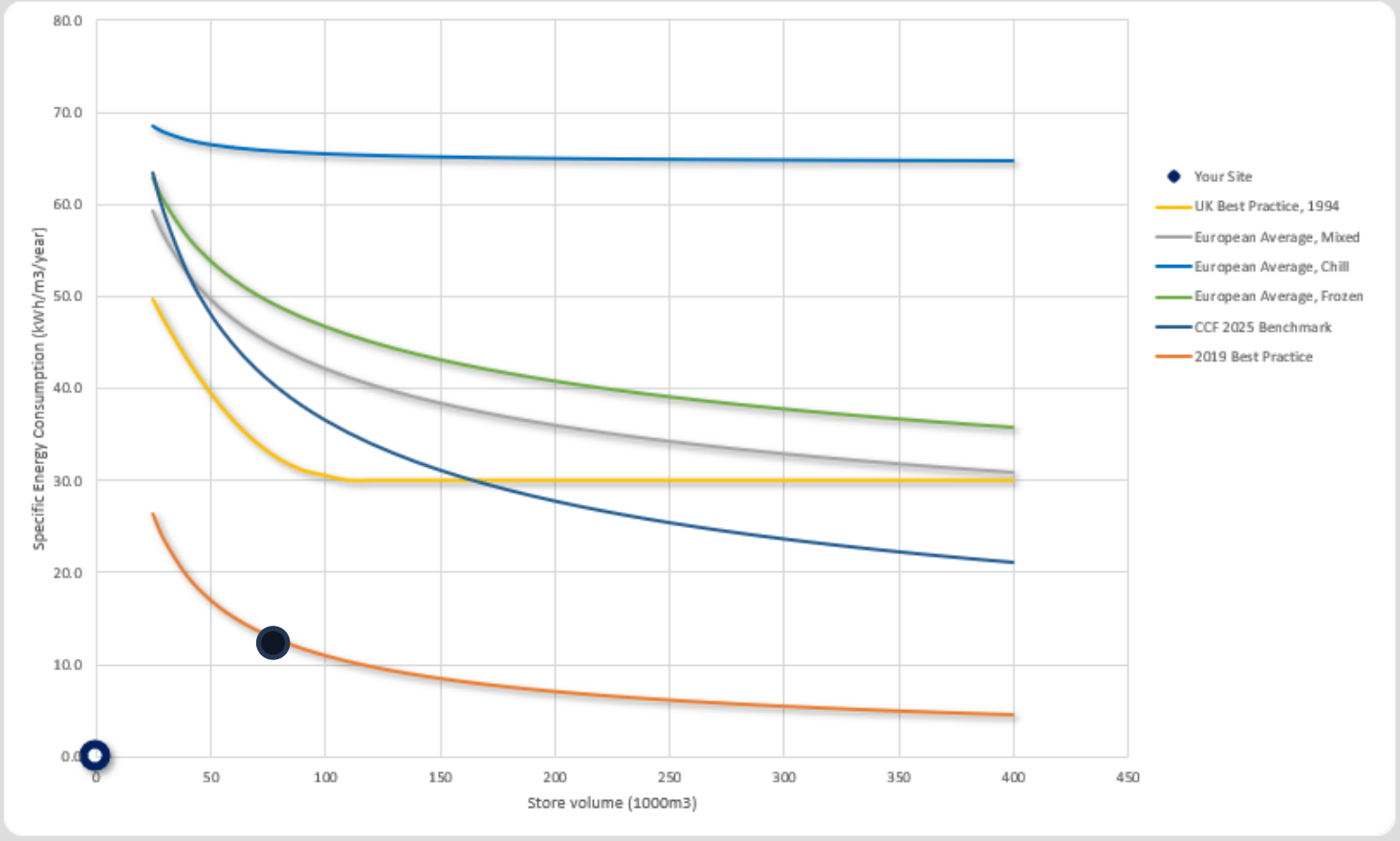
A New Benchmark In Efficiency

- SEC = 12 kWhr/m3/yr
- 75% reduction in energy vs European average
- 63% reduction vs previous UK best practice
- 70% reduction vs current UK average

Specific Energy Consumption



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Phase 2

- 81,000 m^3 freezer
- Installed 2020
- Operational 2020
- -22°C design temperature
- 552kW cooling capacity
- 2 x modular low charge ammonia packages
- 4 x 138kW evaporators
- Access from Phase 1

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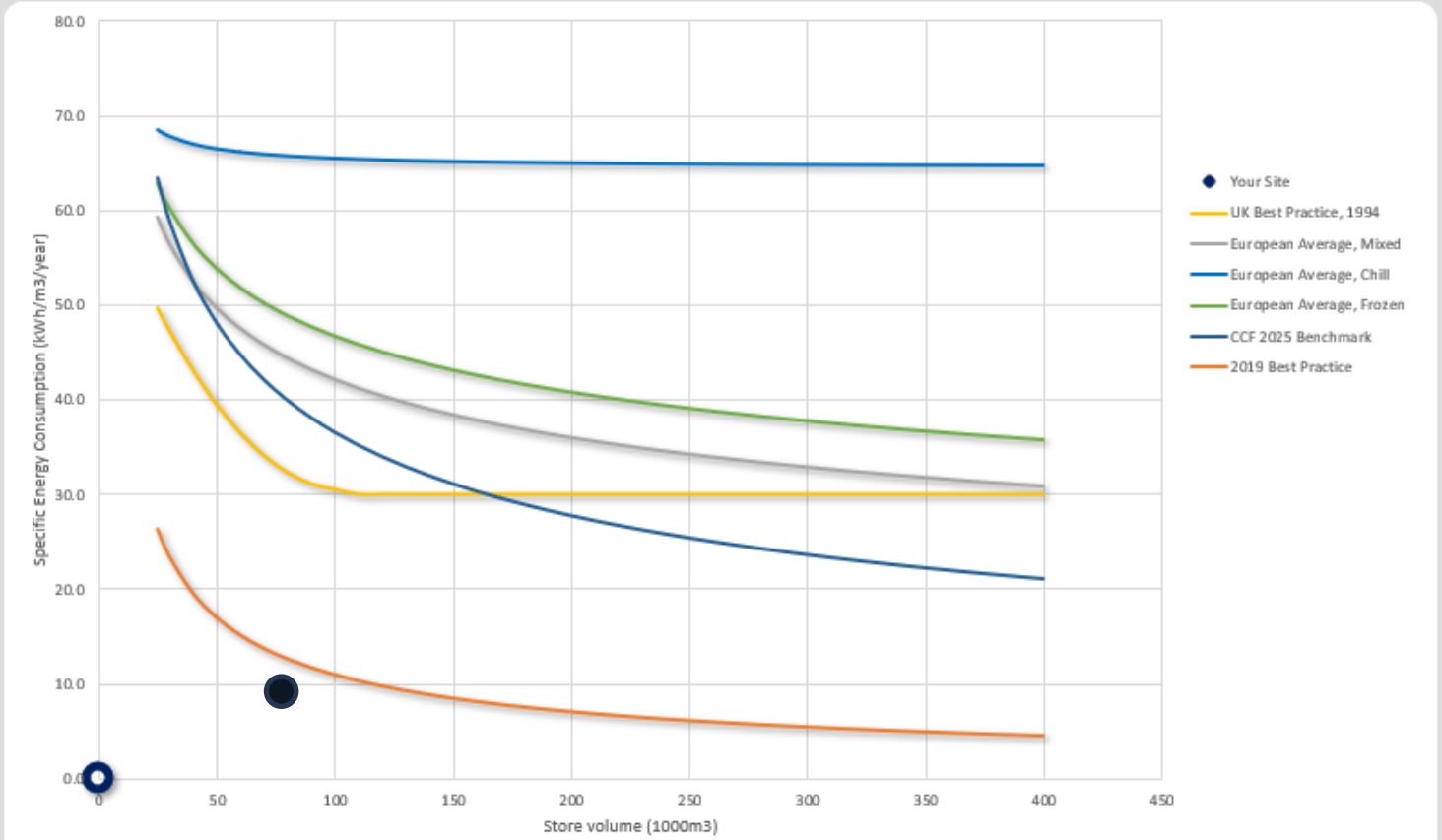
Further Efficiency Improvement

- SEC = 9 kWhr/m3/yr
- 81% reduction in energy vs European average
- 72% reduction vs previous UK best practice
- 78% reduction vs current UK average

Specific Energy Consumption



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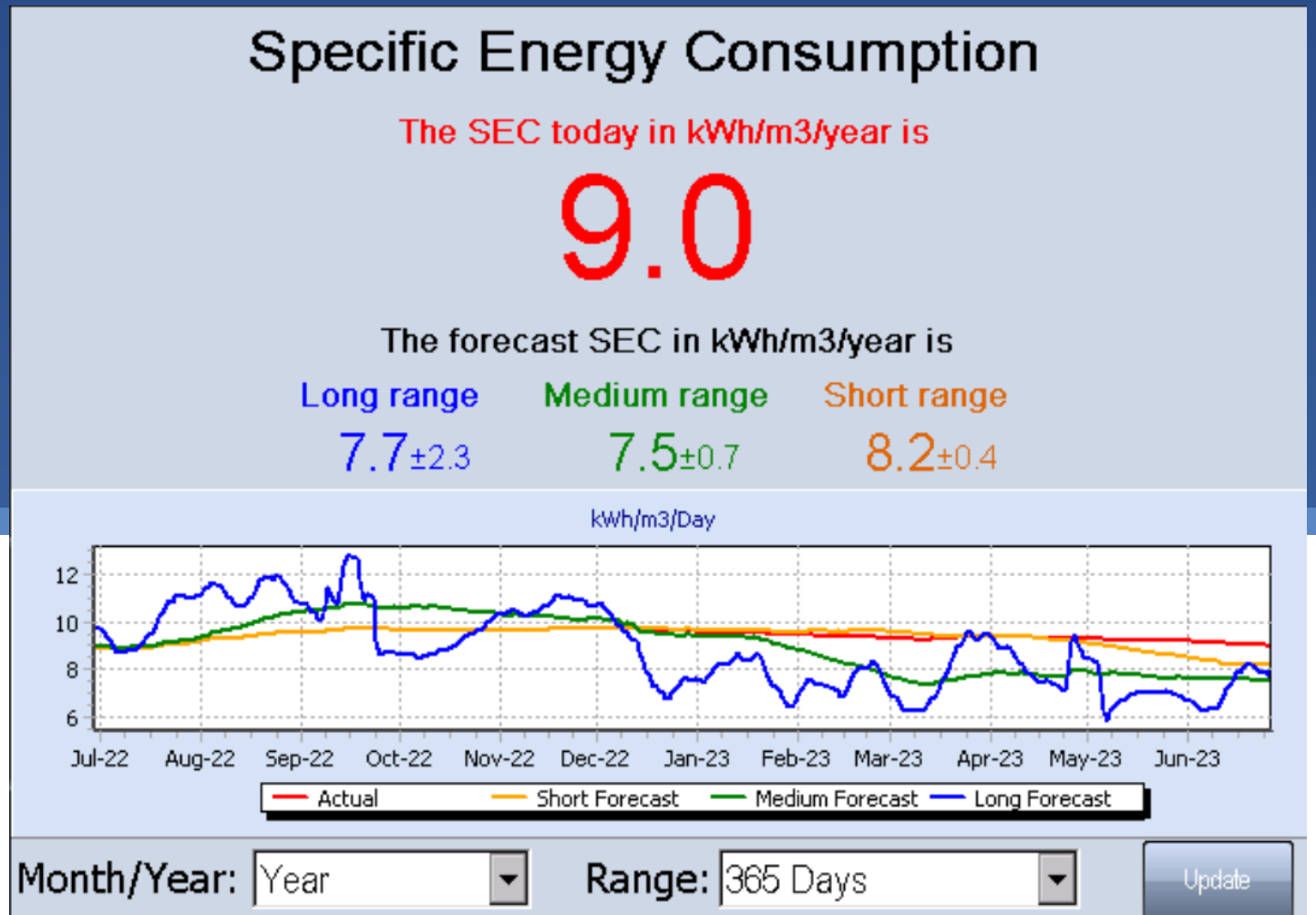
Real Time Energy Monitoring and SEC Prediction



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Phase 3 - Freezer

- 304,000 m^3 high bay
- -22°C design temperature
- 1320kW cooling capacity
- 2 x modular low charge ammonia packages
- 12 x 110kW evaporators
- 60 m air throw

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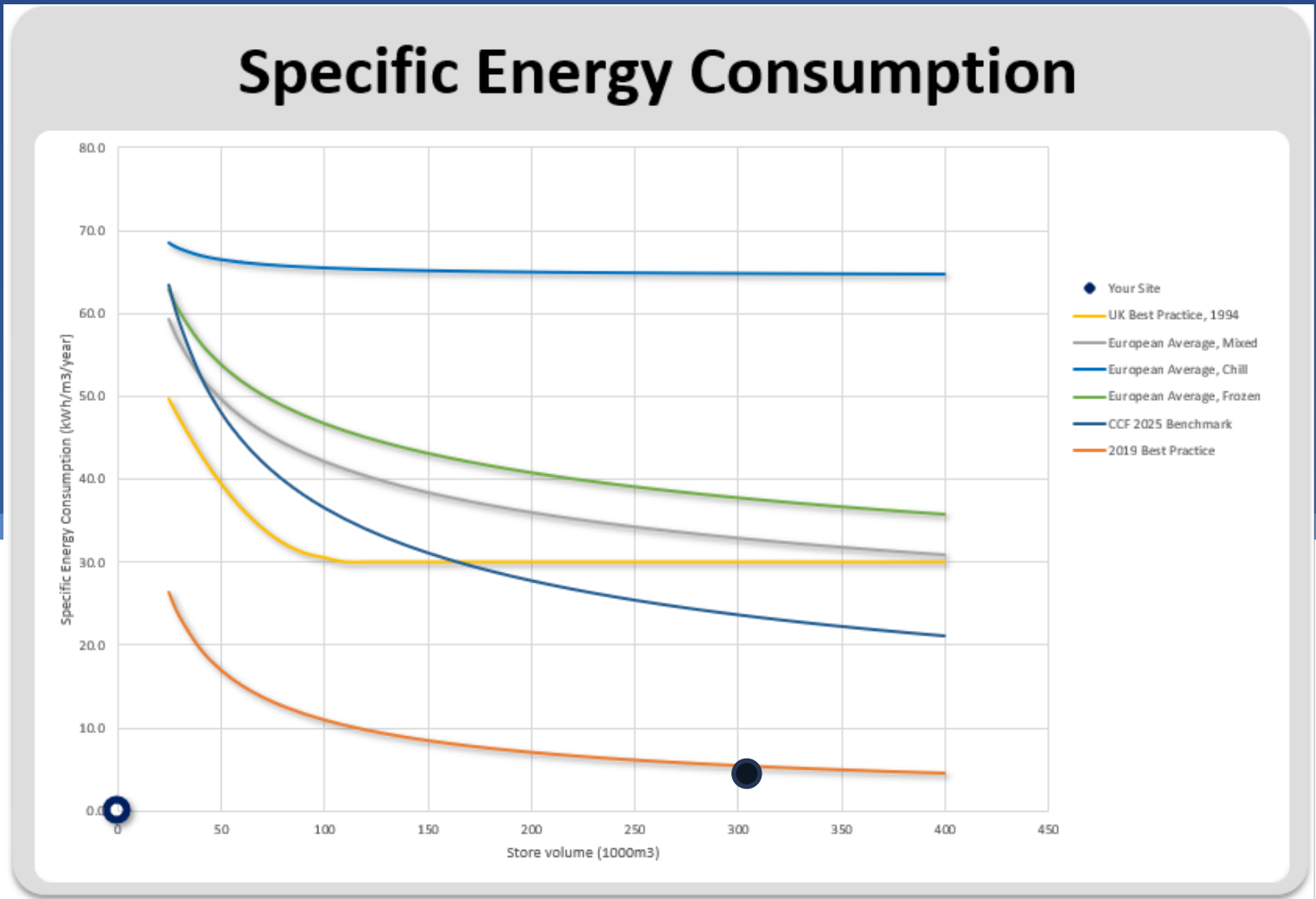
Benchmark Efficiency

- SEC = 4.2 kWhr/m3/yr
- 89% reduction in energy vs European average
- 86% reduction vs previous UK best practice
- 82% reduction vs current UK average



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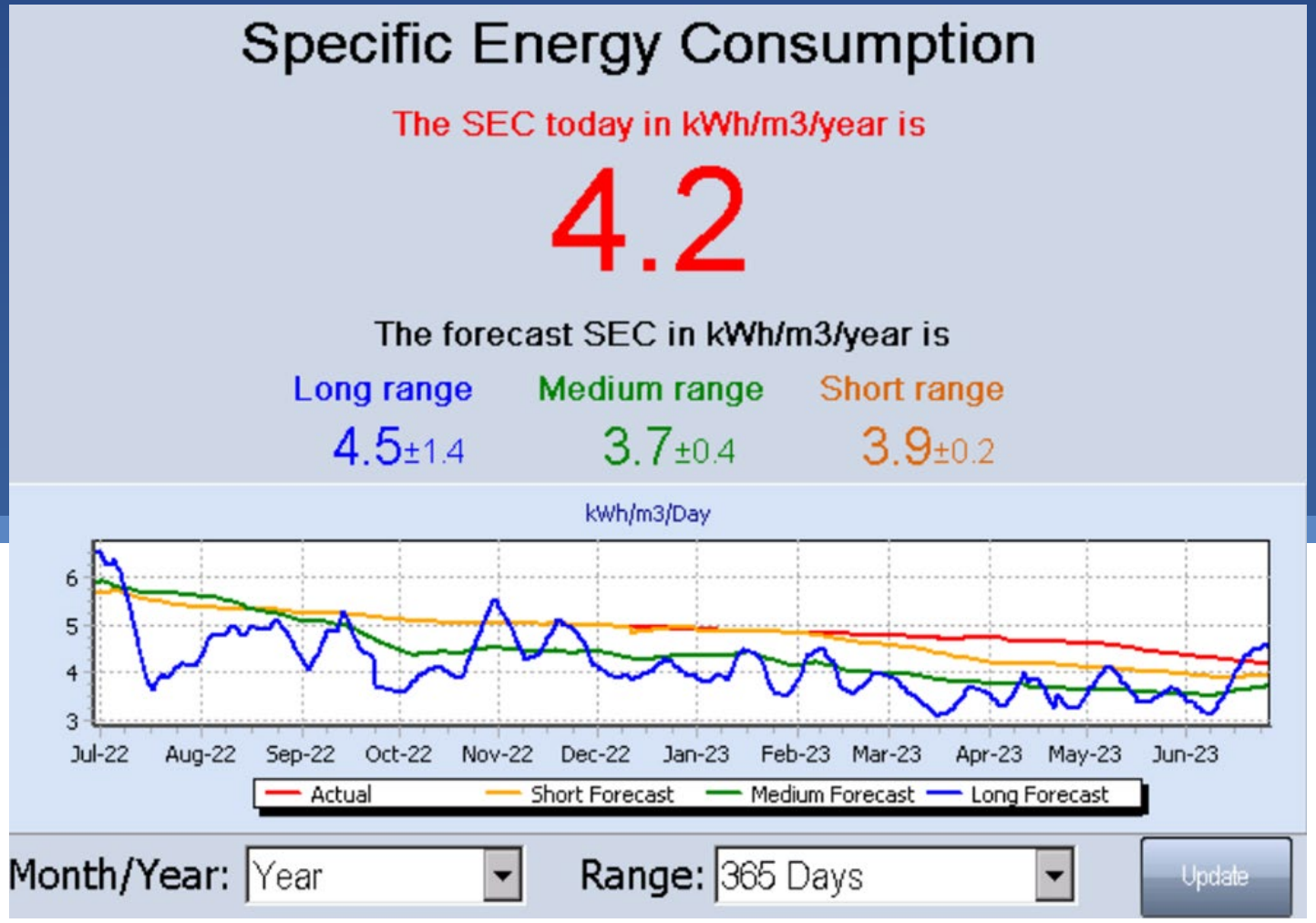
Real Time Energy Monitoring and SEC Prediction



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Conclusions

- Improvements in existing cold chain energy performance will contribute to decarbonisation
- Benckmarking is key to understanding what is possible
- Energy reductions of >50% are possible in temperature controlled storage using modern technology
- Total system optimisation delivers further savings when using variable speed motors
- Continuous monitoring of performance ensures ongoing efficiency

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Thank you for listening

I look forward to your questions

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