BENCHMARKING OF SUPERMARKET ENERGY CONSUMPTION

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PERFORMANCE INDICATORS FOR ENERGY EFFICIENT SUPERMARKET BUILDINGS

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Annex 44 has been performed by:
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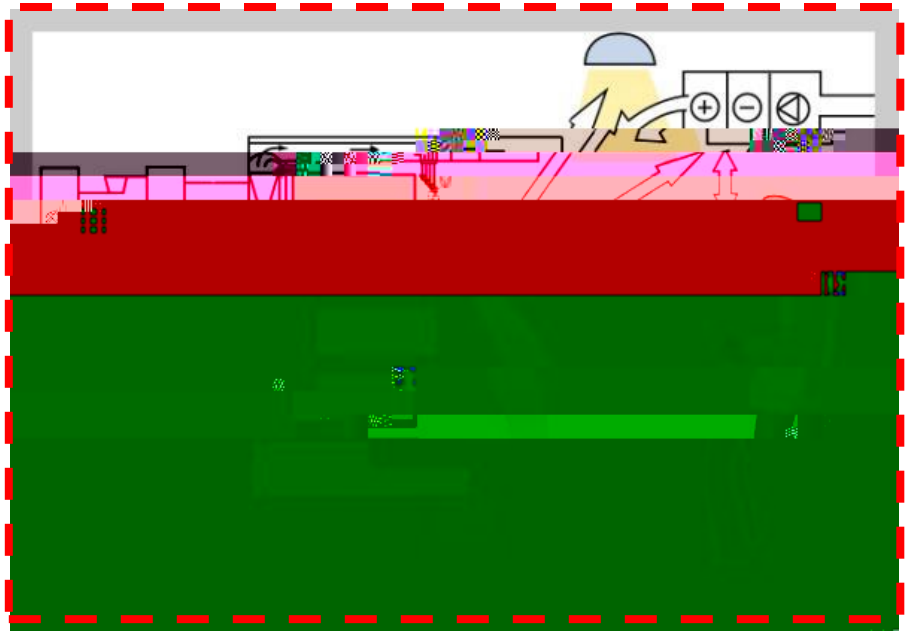
SYSTEM BOUNDARY



(from Lindberg, Axell and Rolfsman 2011, ICR2011)

The system boundary in Annex 44 is the whole supermarket, which includes all energy systems (HVAC, refrigeration, lighting and other uses).
Proposed in Annex 44
kWh/(m².year)
- Total Energy Consumption (Electricity and Heat/Gas/Oil)
- Sales Area.

MONITORING AND MEASUREMENTS

Primary aim of these systems is control and regulation

Separate systems i.e. energy meters

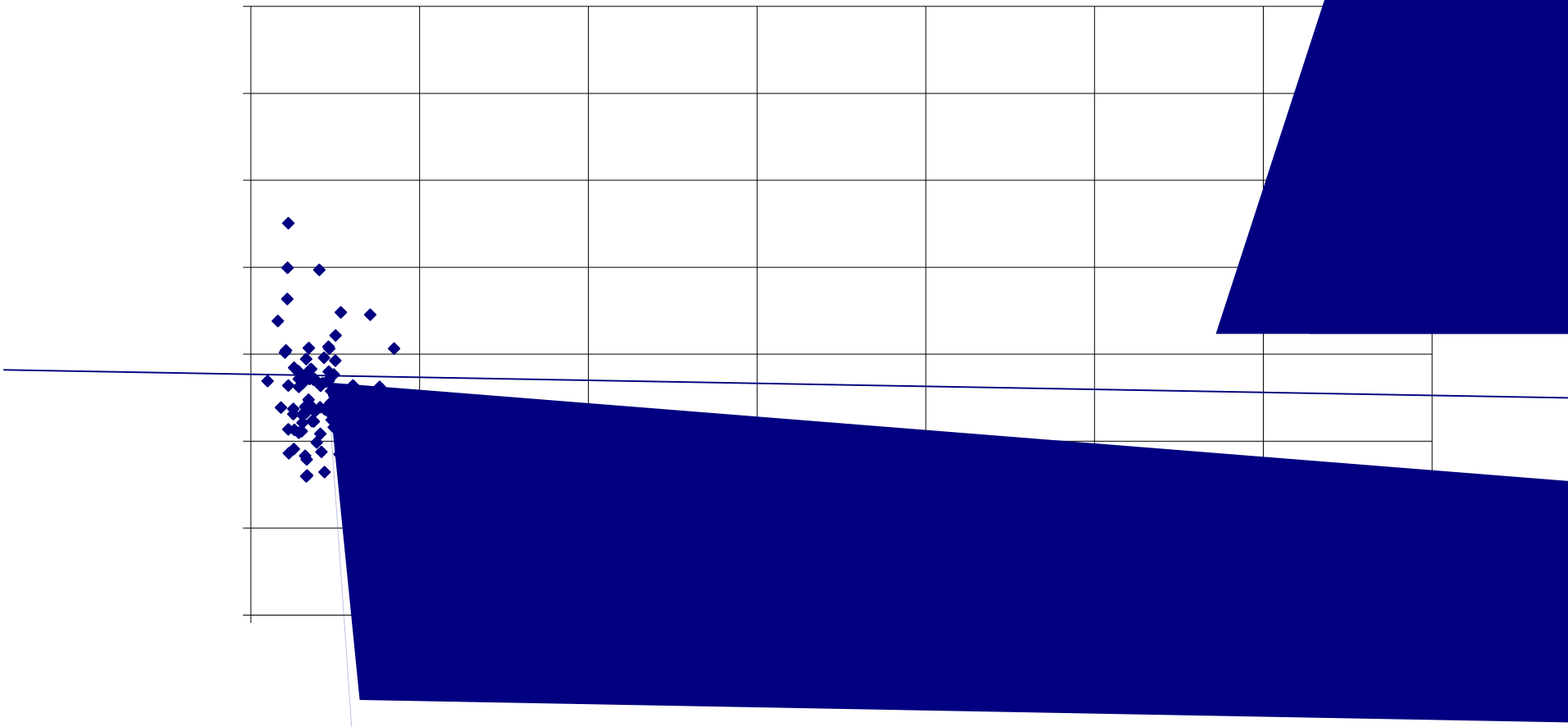
Supermarkets require

Efficient handling of alarm monitoring, data structure, HACCP[1] procedures, HACCP policies, refrigeration energy consumption, service calls and refrigeration maintenance management.

[1]Hazard analysis and critical control point here specifically related to safe handling of food

(IEA-HPT Annex 3

Related (earlier) work.



Related (earlier) work.

(Tassou *et al*. - UK)

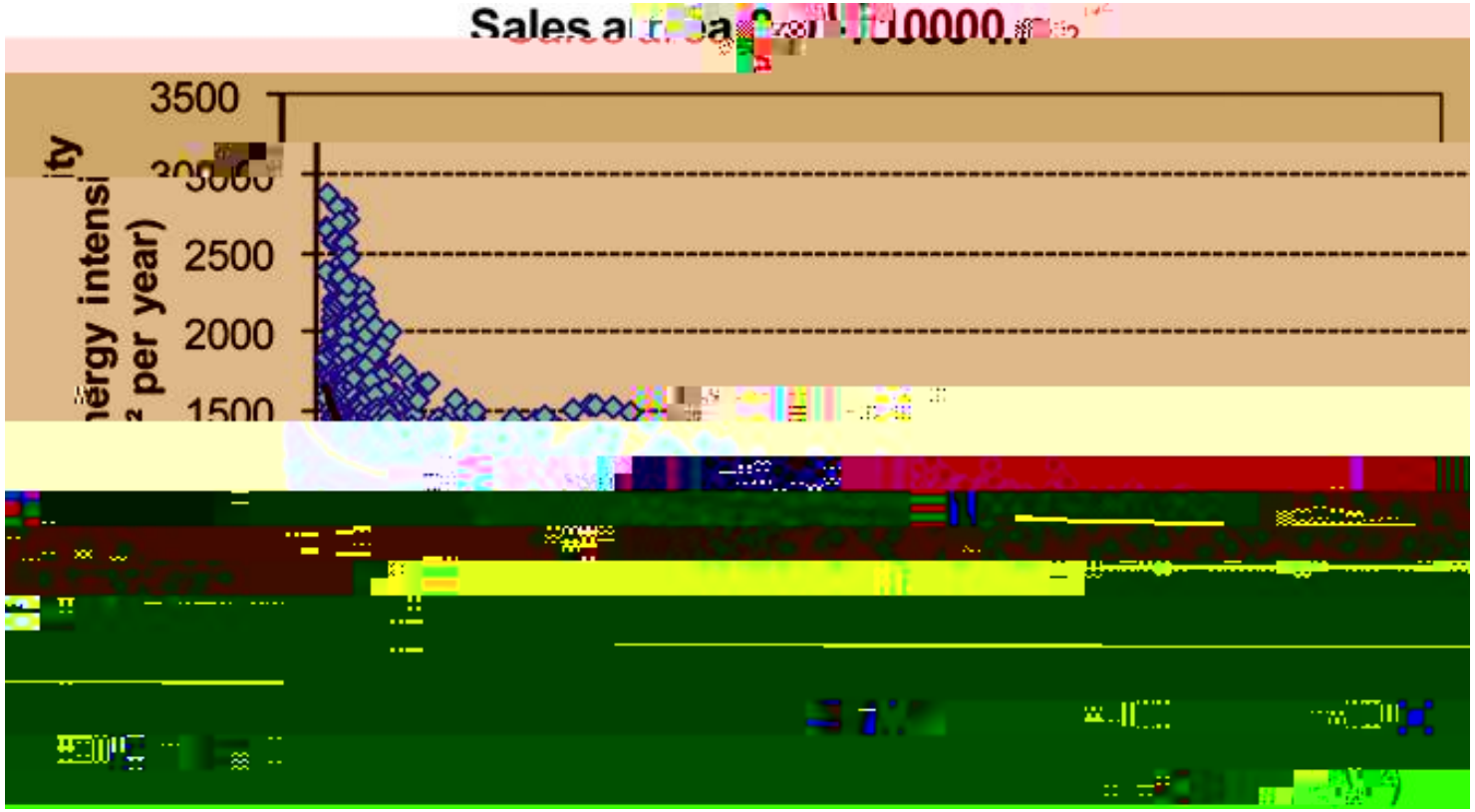
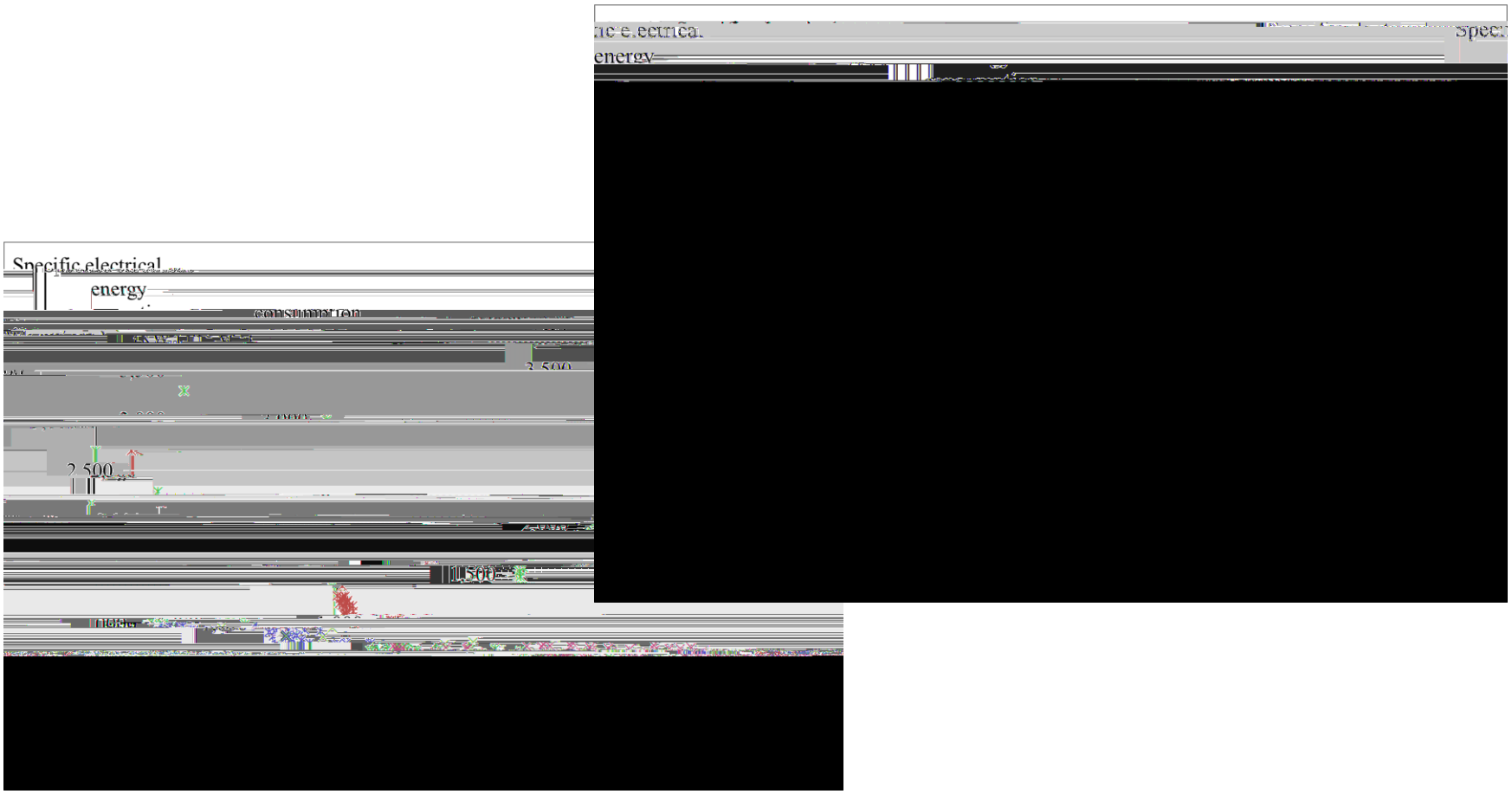


illustration of the decrease in energy intensity as the supermarket size increases (with permission, from Tassou, 2010).

New study **Electrical energy consumption vs Sales area** (Foster *et al.* - UK)



Issues arising from (earlier) work

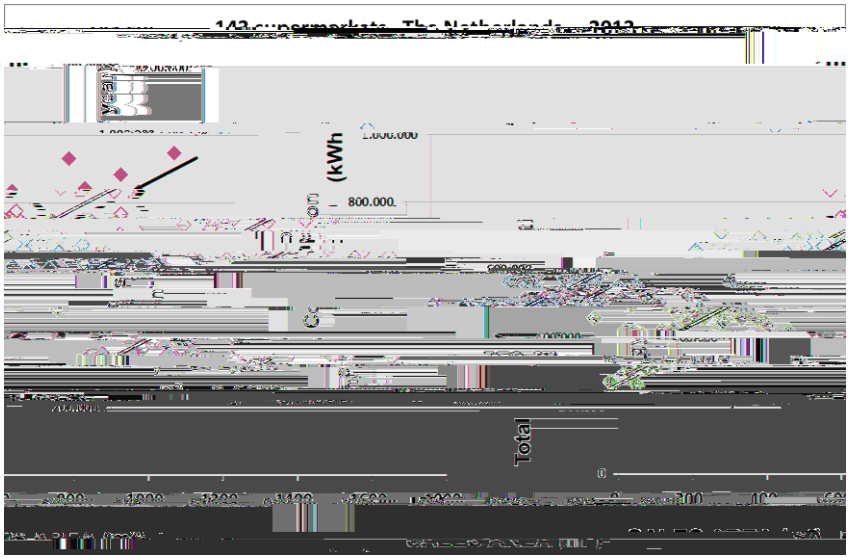
Comparison basis:

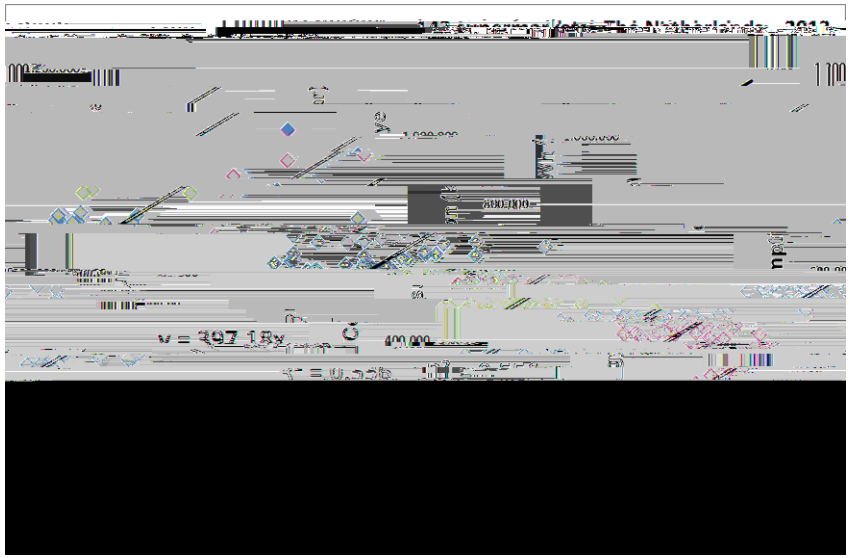
- Supermarket Size:
  - * First source (Annex 31) uses TOTAL Supermarket Area
  - * Second source (Tassou) uses Supermarket SALES Area
- Energy consumption:
  - * First source (Annex 31) uses TOTAL energy consumption / m^2.year
  - * Second source (Tassou) uses ELECRICAL energy consumption / m^2.year
- What is the preferential choice?
- How do data from these sources relate?

- $SEC_{EE/SFA}$

Analysis of Dutch data.

- SALES area relates better to energy consumption than TOTAL area, therefore <u>SALES Area must be considered</u>.

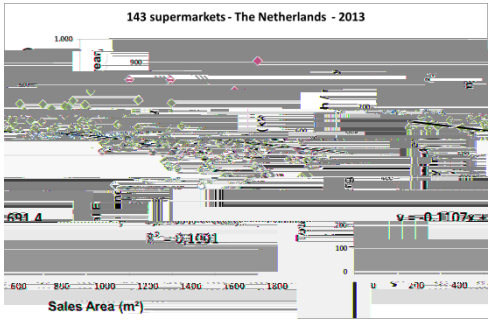


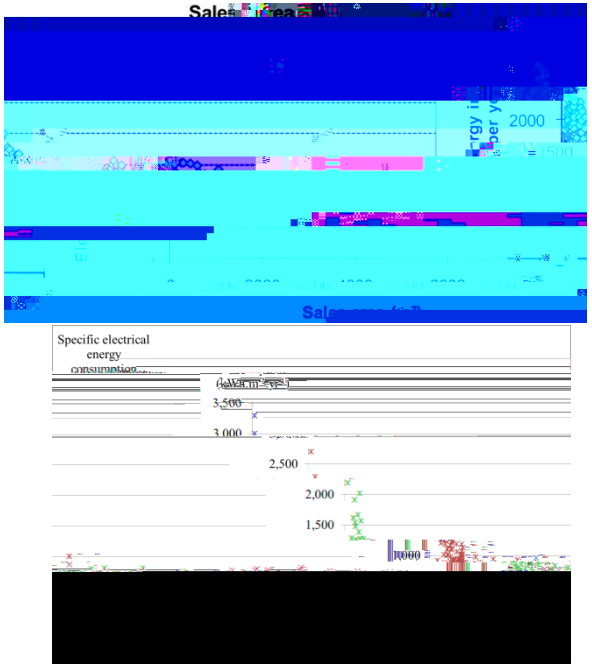


(Average TOTAL Area / SALES Area = 1,4)

Energy intensity: total energy use / sales area

- NL 2013: Average Energy Intensity = 585 kWh/m².year (@ 957 m²)
- NL 2014: Average Energy intensity = 539 kWh/m².year (@ 970 m²)
- Energy intensity decreases with increasing supermarket size.
  (- 2 % for each 100 m² sales area increase)





RESULTS

Annex 44
Supermarket size as primary performance indicator

Discussions to include non conventional indicators, to fully explain observed energy use and efficiency in practice, i.e.

the maintenance and dynamics of the systems
sales volume or customer density
the indoor temperature & humidity
the cleaning and loading procedures
the training of personnel

Results 1(4)
Supermarket comparison

Data from Denmark, Sweden, The Netherlands:

- Total energy consumption below 400 kWh/m^2/year - energy efficient supermarkets with referred data to total supermarket area.
- 400 kWh/m^2/year the average energy intensity.

Average total area 1 360 m^2 and 73 openings hours per week.

- No relation between total energy consumptions (heat & electricity) and the geographic region
- Developments, i.e. refrigeration systems and lighting, increased energy efficiency ranging 1-10% per year.

Results 2(4)

UK Data

- SEC different conclusions with different data sets
- SEC reduces with increasing area
  - Very small stores very large SEC

Results 3(4)

Reduction in SEC with time

Sullivan and Gouldson (2013)

Six UK supermarket chains

2.5 to 5.5% reduction p.a. relative to 2007

Up to 10 years, 2 to 3% reduction

Savings often outstripped by business growth

Results 4(4)

Reduction in SEC with time

New data - 1 UK store

2013 to 2017 - 3.3% reduction p.a.

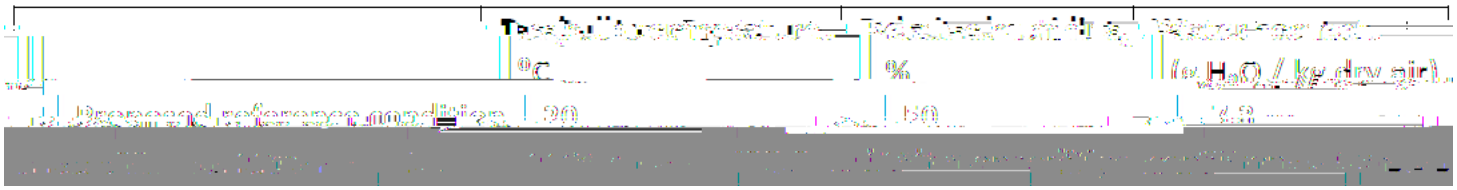
Over 5 years

- 32% reduction in lighting
- 20% reduction in refrigeration
- 8% reduction in HVAC

Future work and for discussion

Other secondary performance indicators?

In relation to indoor conditions, Annex 44 propose:



Other indicators/ calculations in relation to other parameters that influence

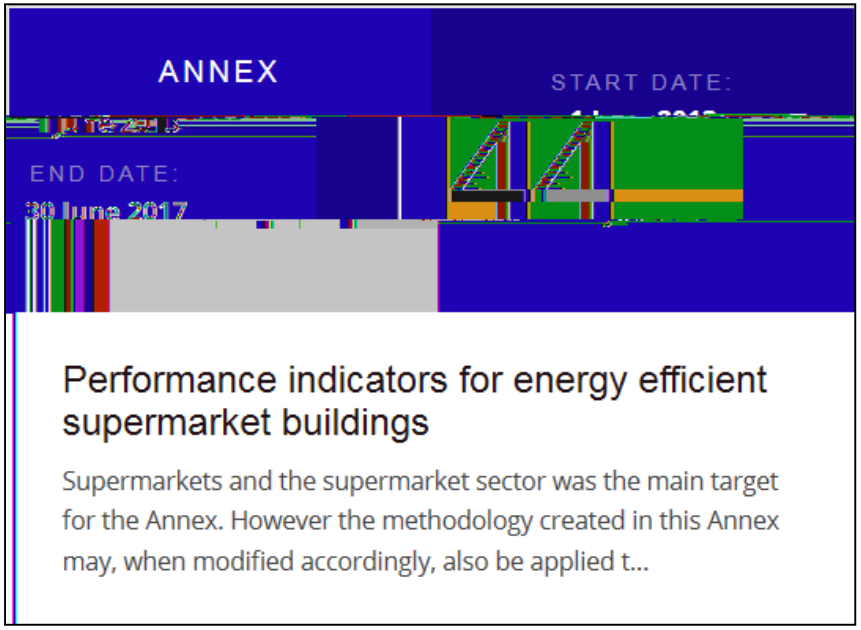
energy consumption?
costs?
heat recovery?
parking area?

How to display the indicators, different detailed levels depending on interest.

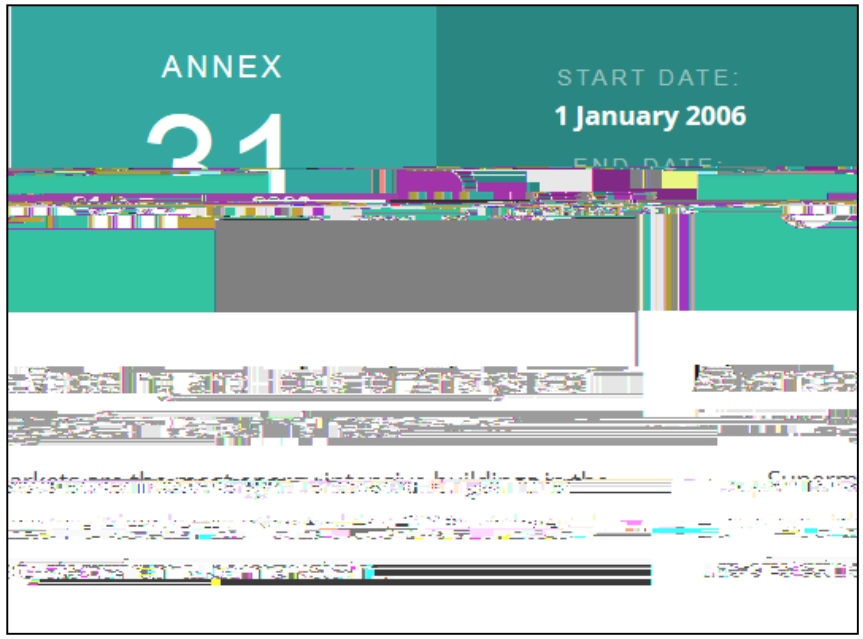
HOW TO START OR JOIN AN ANNEX

Any party working in any of the programme's member countries can participate in annexes. **HPT welcomes ideas and topics for new international collaborations!**

http://heatpumpingtechnologies.org



Read more Visit annex



Read more Visit annex

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