

Heat exchangers and their impact on condensing units

Kelvion, Research Laboratory, 8th March 2018



Heat exchangers and their impact on condensing units

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- Factors affecting condensing unit design.
- Affect of the Ecodesign directive
- Efficiency v Cost
- Potential for heat exchangers in condensing units

Factors affecting condensing unit design.



Factors affecting condensing unit design.

There were 3 major contributors to condensing unit design

- 1 Cost
- 2 Size
- 3 Reliability

There is now a 4th

Eco-Design directive

This defines Minimum Efficiency Performance Standards (MEPS) for varied products, including the condensing units, sold in the European market

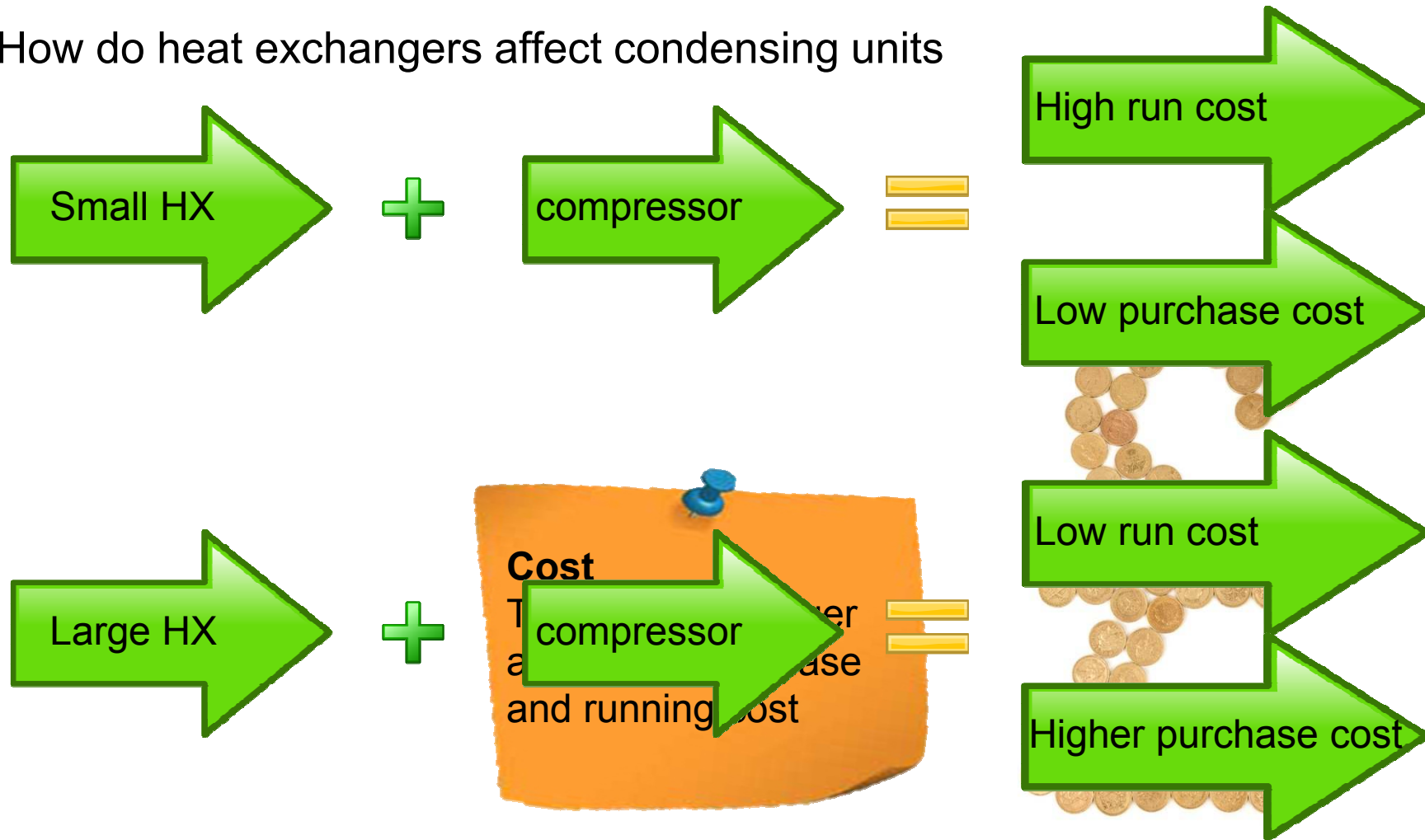
Factors affecting condensing unit design.

How do heat exchangers affect condensing units



Factors affecting condensing unit design.

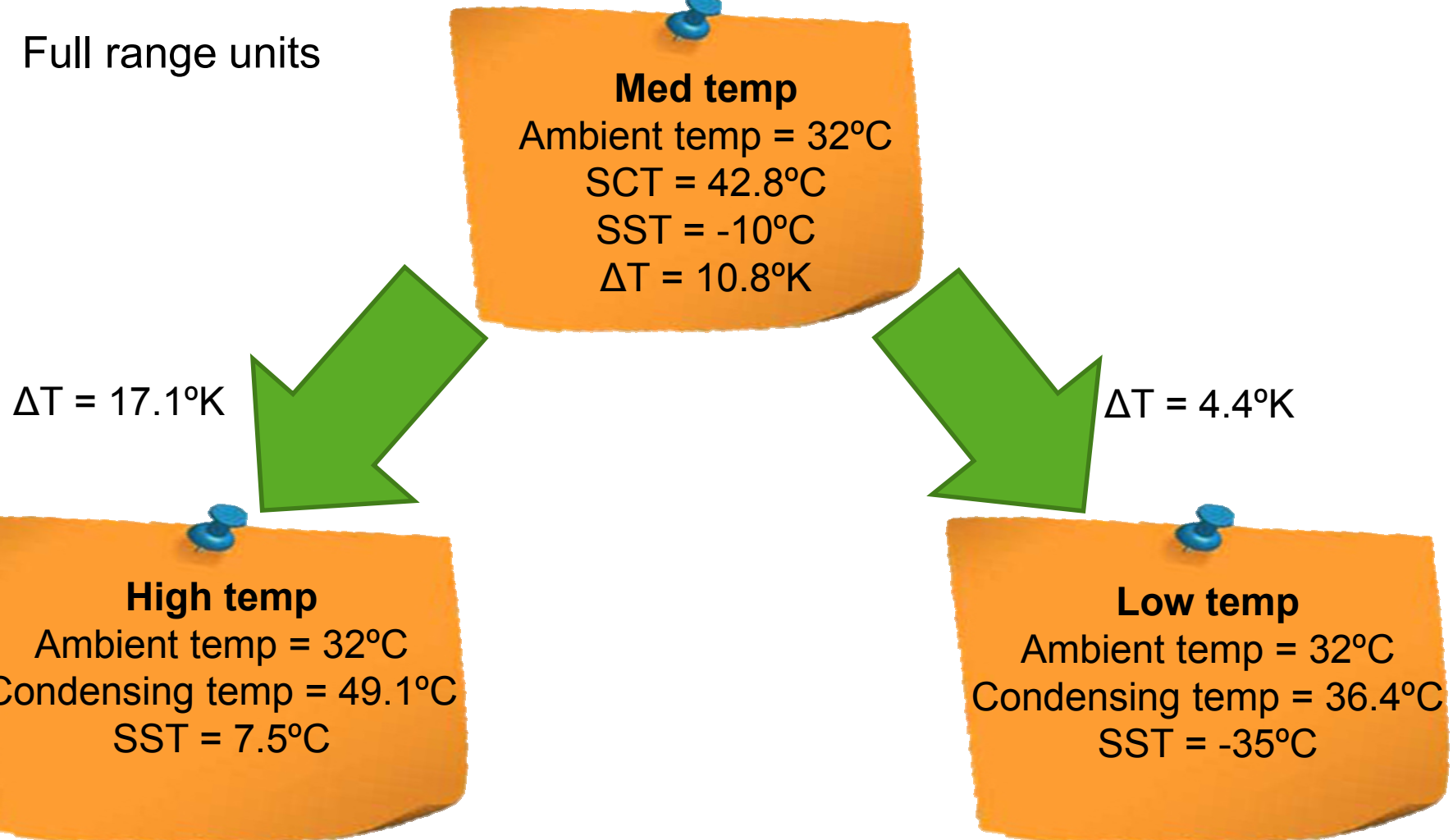
How do heat exchangers affect condensing units



Factors affecting condensing unit design.

Condensing unit design conditions

Full range units



Factors affecting condensing unit design.

Condensing unit design conditions

Med to Low units

Med temp

Ambient temp = 32°C

SCT = 46.5°C

SST = -10°C

$\Delta T = 14.5^\circ\text{K}$

$\Delta T = 5.9^\circ\text{K}$

Low temp

Ambient temp = 32°C

Condensing temp = 37.9°C

SST = -35°C

Factors affecting condensing unit design.

Heat exchangers influence overall unit dimensions

Surface area has to increase with

Air flow will increase along with su

Sound will often increase with abo



Factors affecting condensing unit design.

Heat exchangers influence overall unit dimensions



Coil capacity = 100kw @15°K ΔT
= 72 kw of refrigeration cop = 2.32
Coil capacity = 133kw @20°K ΔT + 33%
= 90 kw of refrigeration cop = 2.01
Coil capacity = 67kw @10°K ΔT – 33%
Coil capacity = 53kw @ 8°K ΔT – 47%
Coil capacity = 33kw @ 5°K ΔT – 67%
= 25 kw of refrigeration cop = 2.42

Air flow remains the same
Sound level remains the same
(compressor sound may reduce)

Factors affecting condensing unit design.

Advances in heat exchanger technology reduce cost impact

High efficiency fans increase airflow

Mini / Micro channel reduce refrigerant
than previous versions)

Fin geometry increase heat transfer to



Factors affecting condensing unit design.

However air cooled condenser hx's still dictate the actual size of units



Affect of the Ecodesign directive

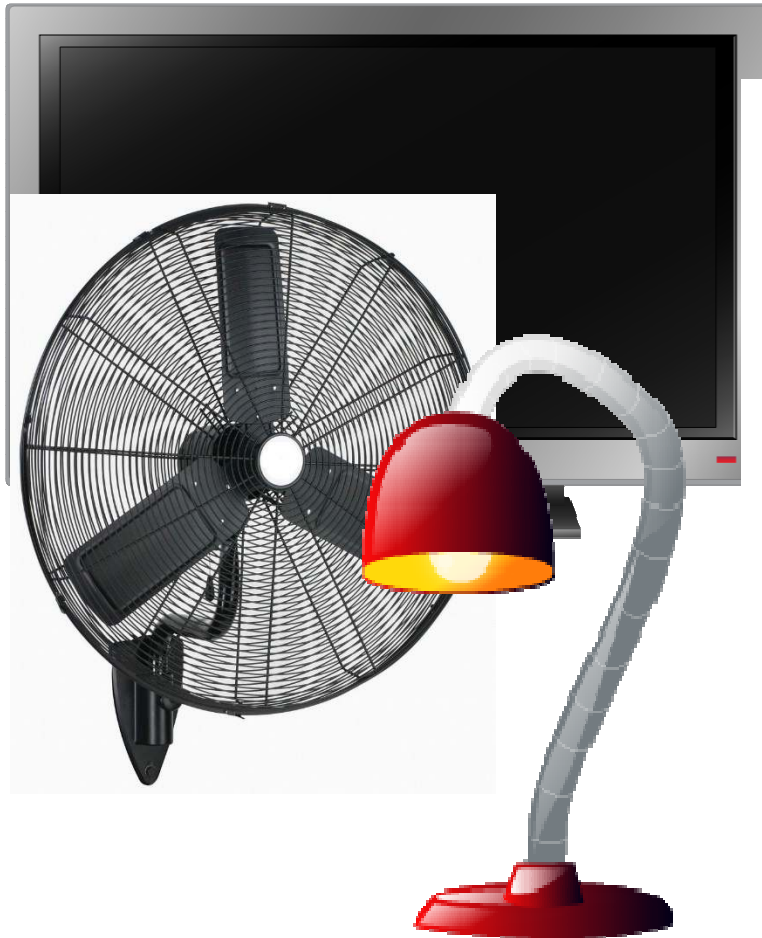
Affect of the Ecodesign directive

Aim of the directive



Affect of the Ecodesign directive

The directive covers a wide range of products



Affect of the Ecodesign directive

The directive also covers our industry



Affect of the Ecodesign directive

Manufacturers have to comply with so called

MEPS

Affect of the Ecodesign directive

The MEPS for condensing units are

MEPS – COP Analysis

	Refrigerating capacity	MEPS Tier-1	MEPS Tier-2
Medium Temperature	0,2 kW... ≤ 1 kW	1,2	1,4
	1 kW... ≤ 5 kW	1,4	1,6
Low Temperature	0,1 kW... ≤ 0,4 kW	0,75	0,85
	0,4 kW... ≤ 2 kW	0,8	0,95

MEPS – SEPR Analysis

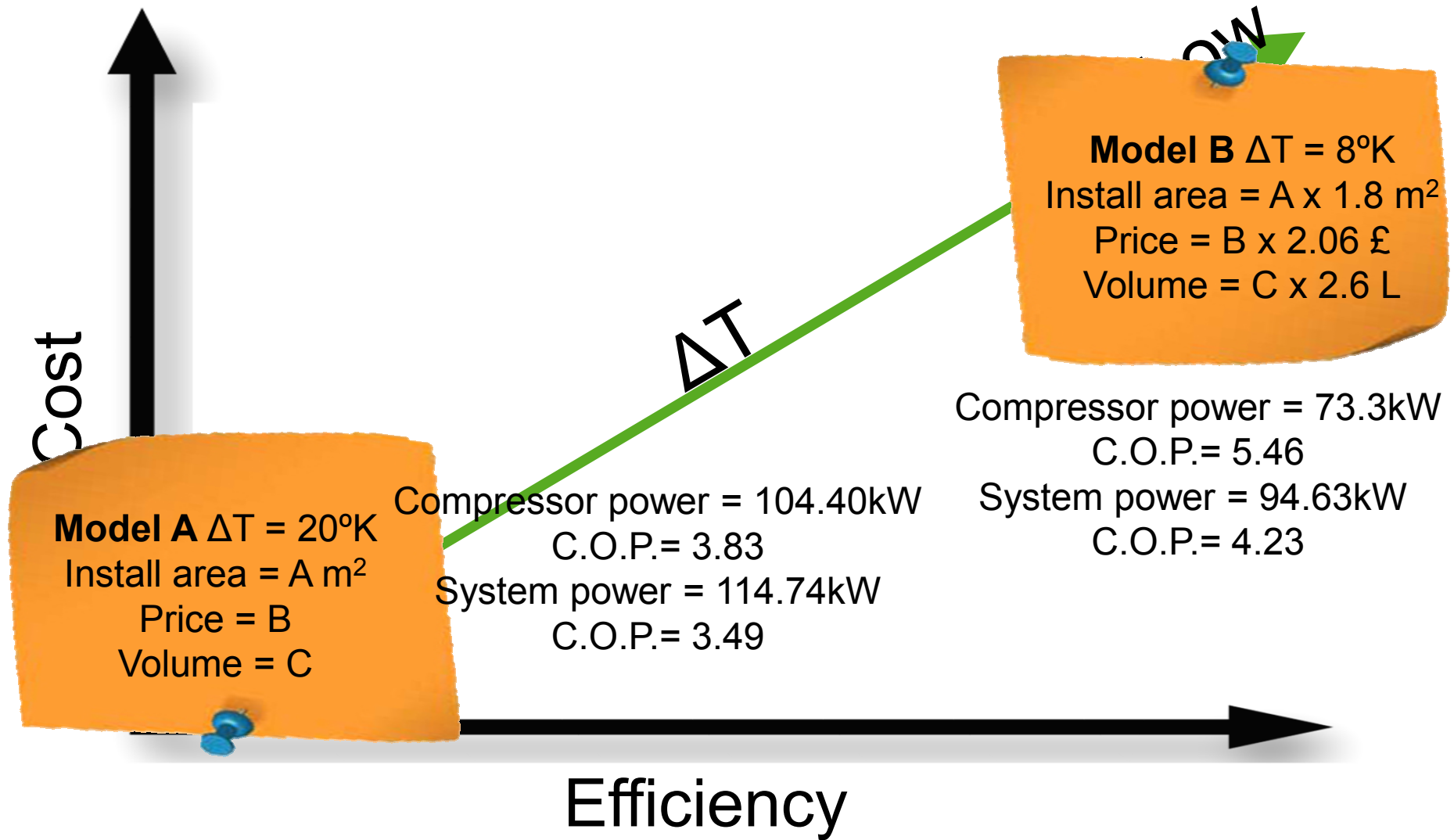
	Refrigerating capacity	MEPS Tier-1	MEPS Tier-2
Medium Temperature	5 kW... ≤ 20 kW	2,25	2,55
	20 kW... ≤ 50 kW	2,35	2,65
Low Temperature	2 kW... ≤ 6 kW	1,5	1,6
	8 kW... ≤ 20 kW	1,6	1,7

Bonus GWP < 150 ⇒ Tier-1: 15% // Tier-2: 10%

Efficiency v Cost.



Efficiency v Cost.



Efficiency v Cost.

Model B

Cost factor of 2.06 so total additional cost to end user £11,400.00

Kw used assuming run for 1 year 8,760 hrs (24/7)

Model A = 1,005,122.4Kw

Model B = 828,958.8Kw Diff = 176,163.6Kw

Cost per Kwh = £0.12608

176,163.6Kw = £22,210.71

Climate change levy = £1,000.61

Total energy saving for 1 year =

£23,211.32

Potential for heat exchangers in condensing units.



Potential for heat exchangers in condensing units.

Increase heat
transfer rates

Decrease internal
volumes

Improve air
flow

Questions?



THE HEART OF FRESHNESS