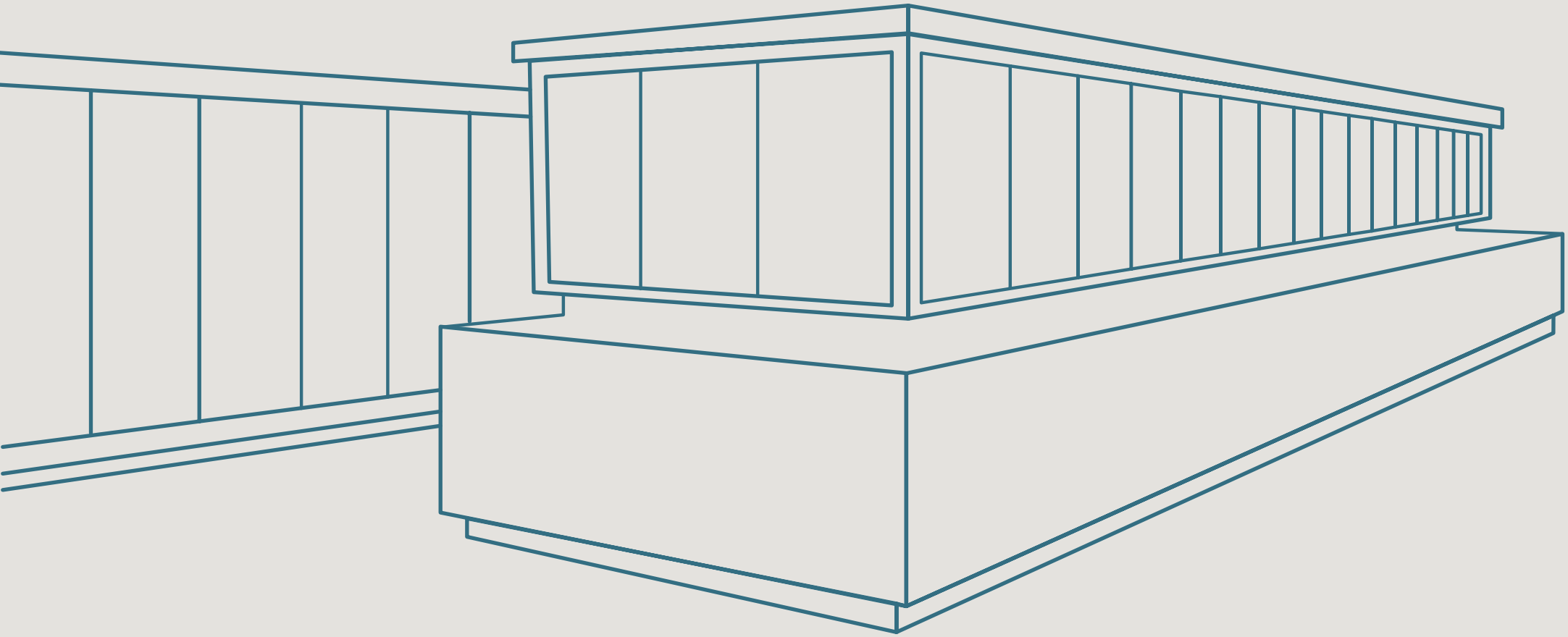
Cool Up

Catalogue of sustainable cooling solutions for

Commercial refrigeration



The four pillars of sustainable cooling

- **Lowering cooling demand**
- **High efficiency equipment**
- **Utilising natural refrigerants**
- **Renewable energy supply**

Lowering refrigeration energy demand

High efficiency equipment

Modern, high-efficiency refrigeration units have better energy ratings and performance

Proper commissioning

Particularly for larger systems, ensuring systems have been installed properly, tested & regularly inspected can optimize efficiency.

LED lighting

Modern LED lights have only very low heat emission. Using them in displays reduces both lighting and cooling energy.

Insulation

High performance insulation materials, on units and distribution systems, reduces heat losses and better maintains internal temperatures.

Door seals

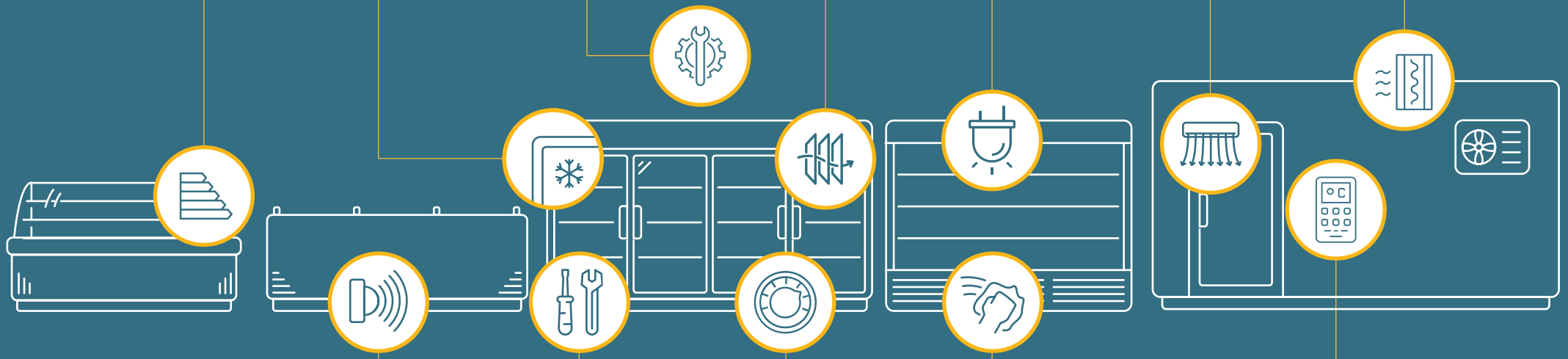
Effective door seals prevents air and moisture entering the unit, resulting in fewer on-off cycles and less strain on components.

Display glass & night covers

Multi-pane (inert gassed) display glass and removable covers for open refrigerated cases during off hours can reduce energy losses.

Air curtains & door flaps

Use of a constant air stream to separate cold air inside an always open unit from warmer ambient air. Flaps can also be used on doors.



Sensors & alarms

Sensors can directly turn off lights or fans or, via alarms, alert staff to issues such as high operating temperatures or open doors.

Advanced controls

Systems that can sense conditions and adjust operation of floating head pressure, anti-sweat heaters, defrost on demand, etc.

Energy management system

EMS can help monitor, control, and optimize the entire refrigeration system, identifying inefficiencies and areas needing maintenance.

Inspection & maintenance

Ensure seals are intact, coils are clean, and there are no refrigerant leaks to maintain optimum system efficiency.

Regular cleaning

Over time, dirt can accumulate on coils, fans, vents, door seals, drain lines and over sensors, all reducing system efficiency.

High efficiency refrigeration equipment

Stand-alone units



Plug in refrigerators & freezers

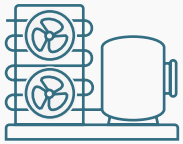
EXISTING HFC REFRIGERANT SYSTEMS

Size Typical capacity range	**0.1 – 1 kW**
Refrigerant leakage rates Estimated annual losses	**1 – 15 %**
Typical efficiency range Low to high	**170 – 20** EEI Energy Efficiency Index Lower is better with 100 = a defined standard depending on product category

NATURAL REFRIGERANT SYSTEMS

R744 Carbon dioxide	! Efficient but relatively costly technology
R290 Propane	✓ Established, simple, efficient and cost effective technology
R600a Isobutane	✓ Established, simple, efficient and cost effective technology
R717 Ammonia	

Condensing units

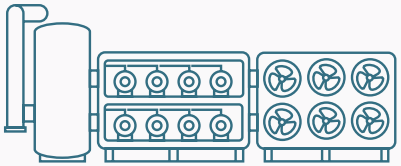


Condensing units

2 – 20 kW
10 – 35 %
Low temp: 0.8 – 2.5 **Med temp: 1.5 – 2.5** COP - Coefficient of Performance

! Efficient but relatively costly technology
✓ Established, simple, efficient and cost effective technology

Central systems



Central direct systems

Central indirect systems

Central direct systems	Central indirect systems
40 – 200 kW	**40 – 200 kW**
10 – 35 %	**10 – 35 %**
1.7 – 4.4 COP - Coefficient of Performance	**1.7 – 4.4** COP - Coefficient of Performance
✓ Trans-critical & sub-critical operation (often in a cascade system)	✓ Sub-critical operation (often in a cascade system)
✓ Part of cascade system to keep R744 system in sub-critical state	✓ Established, simple and cost effective technology
✓ Part of cascade system to keep R744 system in sub-critical state	✓ Established, simple and cost effective technology

Utilising natural refrigerants

Banned refrigerants

First generation refrigerants are usually CFC or HCFC chlorofluorocarbons that are highly environmentally harmful as they are synthetic, toxic, impact the ozone layer and have high global warming potentials. These ozone depleting substances (ODS) were targeted for phase-out under the 1987 Montreal Protocol.

	SC	ODP	GWP
R12 CFC - CF_2Cl	A1	1	10900
R22 HCFC - CHF_2Cl	A1	0.055	1810

Safety Class

Ozone Depletion Potential

Global Warming Potential (100 years)

Commonly used in air conditioning

Commonly used in refrigeration

(Full colour = used / partial colour = not used)

Commonly used refrigerants

Hydro-fluorocarbon based refrigerants entered the market as replacements for their ozone damaging HCFC cousins. However, these HFCs have high global warming potentials and have since been targeted for phase down under the 2016 Kigali Amendment to the Montreal Protocol.

	SC	GWP
R134a HFC - CH_2FCF_3	A1	1430
R404A HFC - Zeotropic blend	A1	3922
R407A HFC - Zeotropic blend	A1	2107
R407C HFC - Zeotropic blend	A1	1774
R407F HFC - Zeotropic blend	A1	1825
R410A HFC - Zeotropic blend	A1	2088

Natural refrigerants

Natural refrigerants are non-synthetic substances that occur in nature's biochemical process and thus do not lead to persistent and toxic emissions and decomposition products. In addition, natural refrigerants have only a negligible climate effect, if any.

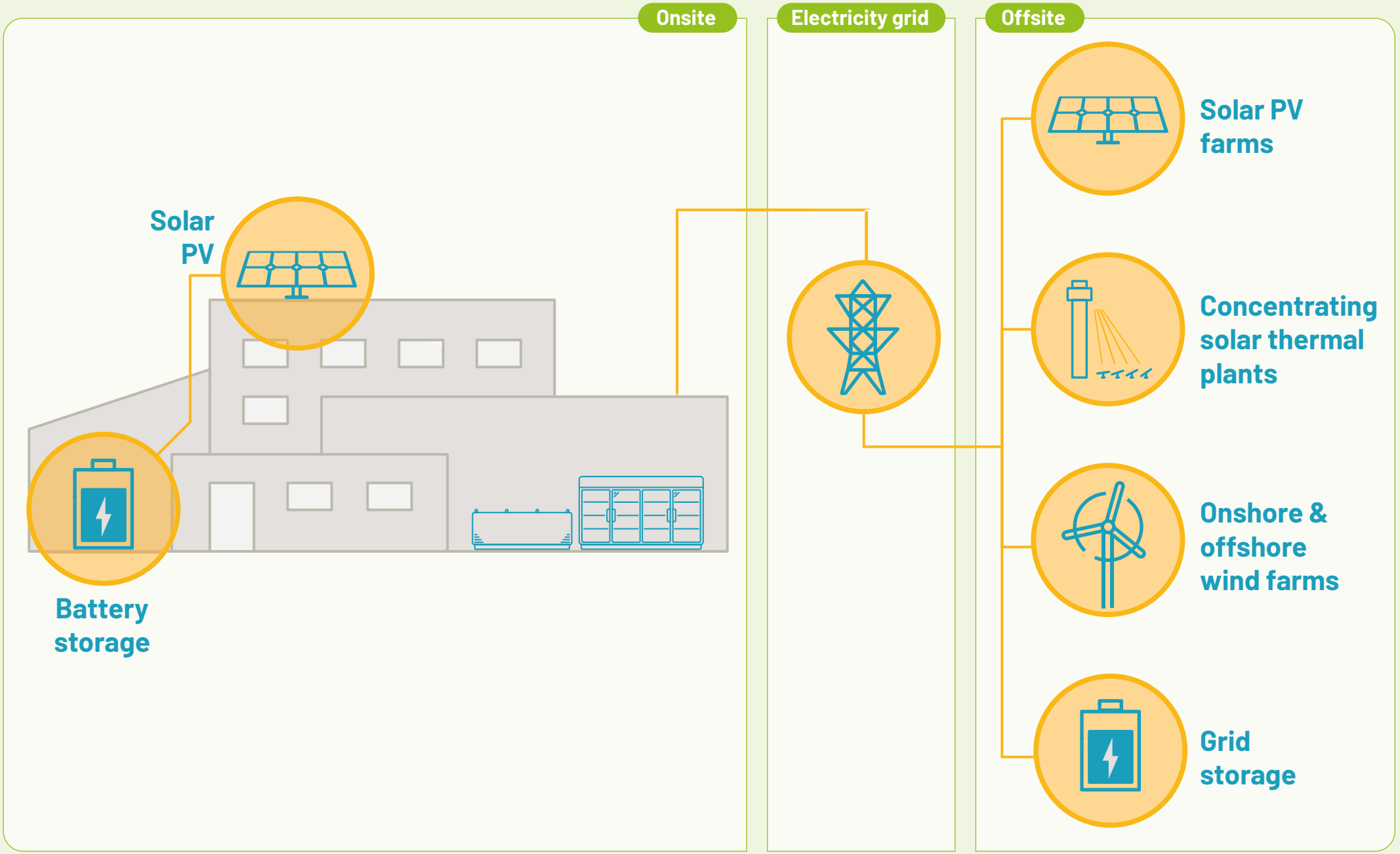
	SC	GWP
R744 Carbon dioxide - CO_2	A1	1
R290 Hydrocarbon - Propane C_3H_8	A3	0
R600a Hydrocarbon - Isobutane C_4H_{10}	A3	3
R717 Ammonia - NH_3	B2L	0
R718 Water - H_2O	A1	0

Newer alternatives

These refrigerants are considered modern alternatives for applications where they are replacing refrigerants with a higher global warming potential. However, they are largely HFOs or blends of synthetic HFCs and HFOs where the GWP is still sufficiently high. Nearly all of the new synthetic refrigerants are per- and polyfluoroalkyl substances (PFAS), which a suspected of being carcinogenic, that's why they may be banned in the EU due to a new PFAS regulation.

	SC	GWP
R32 HFC - CH_2F_2	A2L	675
R449A HFC + HFO - Zeotropic blend	A1	1396
R450A HFC + HFO - Zeotropic blend	A1	601
R454A HFC + HFO - Zeotropic blend	A2L	237
R513A HFC + HFO - Azetropic blend	A1	631
R1234ze HFO - $C_3H_2F_4$	A2L	1
R1234yf HFO - $C_3H_2F_4$	A2L	1

Increasing renewable energy supply





More information

Full reports

This snapshot is based on the 2022 series of reports entitled:

Catalogue of Technical Solutions for Sustainable Cooling in:

- **Egypt**
- **Jordan**
- **Lebanon**
- **Türkiye**

Refrigeration technologies

- **Commercial refrigeration:** cooltechnologies.org/sector/commercial-refrigeration

Cool Up Upscaling Sustainable Cooling

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