FACT SHEET 7
Small Self Contained Air-Conditioning

1. Description of market sector

This market sector includes small hermetically sealed air-conditioning units used for cooling small rooms in residential and commercial buildings.

Market sub-sectors

The sector includes portable units, window units, through-the-wall units and packaged terminal units. This Fact Sheet has not been split into sub-sectors as the HFC alternative options are similar for all types of small self-contained air-conditioning. Window units and through-the-wall units used to dominate the market for small air-conditioning equipment, but in most countries they have become less popular and largely displaced by small split air-conditioning (see Fact Sheet 8). In some countries package terminal units are still very popular in the hotel sector.

Typical system design

All systems use a direct expansion (DX) vapour compression cycle. They are self-contained, with a compressor, evaporator and condenser all located in a single unit. The equipment is factory built and uses hermetically sealed compressors and pipework. Portable units use flexible ductwork to supply outside air to the condenser and to return the heated air to the outside of the room. Window and through-the-wall units have their condenser located outside the room and an evaporator located in the room.

Alternative technologies

There is currently no use of alternative technologies.

Changes driven by ODS phase out

Prior to 1990 this sector used CFC-12 and HCFC-22. From the mid-1990s non-Article 5 countries started using R-407C and more recently have moved to R-410A. There is still widespread use of HCFC-22 in Article 5 countries.

Table 1: Self-contained air-conditioning: Summary of characteristics for HFC units

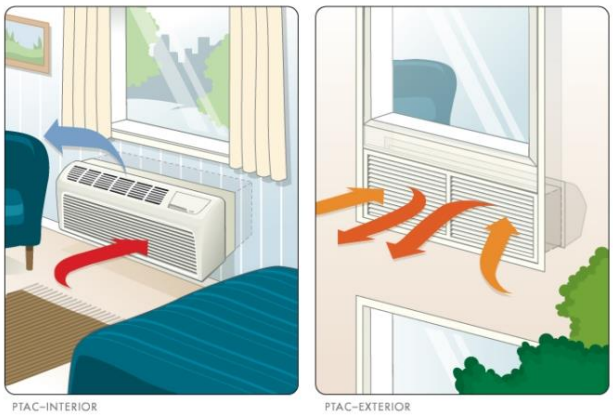
Typical refrigerant charge	0.2 to 2 kg
Typical cooling duty	2 to 7 kW
HFC refrigerants used	R-407C (GWP 1774[1]) R-410A (GWP 2088)
Refrigeration circuit design	Hermetically sealed vapour compression
Manufacture / installation	Factory built
Typical location of equipment	Class A (access by persons not acquainted with safety precautions)
Typical annual leakage rate	< 1%
Main source of HFC emissions	Losses at end-of-life
Approximate split of annual refrigerant demand	New equipment: 90% Maintenance: 10%

[1] All GWP values are based on the IPCC 4th Assessment Report

Portable air-conditioning unit

Window mounted air-conditioning unit

Through-the-wall air-conditioning unit



Packaged terminal unit air-conditioning (PTAC) internal and external views

2. Alternatives to currently used HFC refrigerants

Table 2: Lower GWP alternatives for small self-contained air-conditioning

Refrigerant	GWP	Flammability[2]	Comments
HC-290 R-441A	3 6	3 3	Hydrocarbons are being used in this sector as in most cases the refrigerant charge is low.
HFC-32	675	2L	Lower flammability refrigerant with characteristics similar to R-410A and much lower GWP.
R-446A R-447A	460 582	2L 2L	Newly developed lower flammability blends with characteristics similar to HFC-410A.

R-410A is currently the dominant HFC refrigerant in new systems.

HC-290 can be used with good efficiency. HFC-32 and the new blends R-446A and R-447A provide a lower flammability option with performance expected to be equal or better than R-410A.

In the EU there will be a ban on the use of an HFC with a GWP above 150 in portable self-contained air-conditioning from 2020. For manufacturers with exports to the EU, this creates a strong driver to introduce HC-290 instead of the lower flammability refrigerants listed in Table 2. The US EPA listed recently HC-290, R-441A and HFC-32 as acceptable for use in self-contained air-conditioning.

3. Discussion of key issues

Safety and practicality

The required refrigerant charge is higher than for domestic refrigerators but is low enough for the use of either hydrocarbons or lower flammability fluorocarbons, provided established safety requirements are followed.

Commercial availability

Some models using HC-290 are already available in some regions. It is expected that further HC-290 and HFC-32 models will become available during the next 3 to 5 years. There is currently little commercial activity related to R-446A and R-447A in this market sector

Cost

The price of HFC-32 units are expected to be the same or below the price of R-410A units. R-446A and R-447A unit costs are not yet known.

[2] Flammability classes based on ISO 817 and ISO 5149
3 = higher flammability; 2 = flammable; 2L = lower flammability; 1 = no flame propagation

Energy efficiency

HC-290 and HFC-32 units are expected to have equal or better efficiency than R-410A.

Efficiency of R-446A and R-447A units is not yet known, but it is expected to be equal or better than R-410A.

Applicability in high ambient

There are no extra design issues to produce HC-290 or HFC-32 equipment for high ambient conditions, compared to R-410A. Both these refrigerants have a higher critical temperature than R-410A, so are easier to use at high ambient. The position for the new blends R-446A and R-447A is not yet clear although these also have a higher critical temperature than R-410A which is beneficial in high ambient.

The main challenge for high ambient conditions is the balance between energy efficiency and maximum refrigerant charge limits for safety. The heat load per m^2 is higher than in cooler climates which leads to higher refrigerant charges per m^2 of occupied space. Several countries in the high ambient region increase the minimum energy efficiency requirements, leading to even higher refrigerant charges. This could create a constraint for HC-290 in larger units.

Opportunities to retrofit existing equipment

It is not appropriate to retrofit existing HFC equipment in this market sector.

Technician training

HCs: Technicians doing maintenance need training that addresses handling of higher flammability refrigerants. There are established training courses available for domestic refrigerator technicians and such training can be adapted to include self-contained air-conditioning.

Lower flammability HFCs/ HFOs: Training will be essential for maintenance of systems with lower flammability refrigerants. As these are not yet used in this market, training is not available.

Minimising HFC emissions from existing equipment

The majority of HFC emissions from self-contained air-conditioning occur at end-of-life and recovery facilities must be available to minimise these emissions.