Welcome
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Head of Qatar Office
Midea Commercial Air Conditioner
• World AC Market by value in 2017, US$103 billion/ 5% growth rate

Source: The Building Services Research and Information Association (BSRIA)
### HVAC market - key countries

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Country</th>
<th>Trend</th>
<th>Market Value USD m</th>
<th>Market growth % 16-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>↑</td>
<td>34,000</td>
<td>+ 21%</td>
</tr>
<tr>
<td>2</td>
<td>USA</td>
<td>↑</td>
<td>16,650</td>
<td>+ 7%</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
<td>↑</td>
<td>13,904</td>
<td>+ 4%</td>
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<tr>
<td>4</td>
<td>S. Korea</td>
<td>↑</td>
<td>3,875</td>
<td>+ 44%</td>
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<tr>
<td>5</td>
<td>India</td>
<td>↑</td>
<td>2,600</td>
<td>+ 7%</td>
</tr>
<tr>
<td>6</td>
<td>Australia</td>
<td>↑</td>
<td>1,600</td>
<td>+ 28%</td>
</tr>
<tr>
<td>7</td>
<td>Italy</td>
<td>↓</td>
<td>1,395</td>
<td>- 7%</td>
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<tr>
<td>8</td>
<td>Saudi Arabia</td>
<td>↓</td>
<td>1,270</td>
<td>- 3%</td>
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<tr>
<td>9</td>
<td>Germany</td>
<td>↑</td>
<td>1,162</td>
<td>+ 3%</td>
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<tr>
<td>10</td>
<td>Turkey</td>
<td>↑</td>
<td>1,055</td>
<td>+ 17%</td>
</tr>
<tr>
<td>11</td>
<td>France</td>
<td>↑</td>
<td>1,015</td>
<td>+ 6%</td>
</tr>
<tr>
<td>12</td>
<td>Spain</td>
<td>↑</td>
<td>990</td>
<td>+ 10%</td>
</tr>
</tbody>
</table>

*Source: BSRIA*
• HVAC Market

• Global AC Sales Breakdown by Products 2017

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRF</td>
<td>11% (11 $bn)</td>
</tr>
<tr>
<td>Chiller</td>
<td>7% (7.5$bn)</td>
</tr>
<tr>
<td>AHU &amp; FCU</td>
<td>8% (8 $ bn)</td>
</tr>
<tr>
<td>Ducted Splits (Including US ducted)</td>
<td>11% (10 $bn)</td>
</tr>
<tr>
<td>Rooftops</td>
<td>4% (4 $bn)</td>
</tr>
<tr>
<td>Total CAC</td>
<td>30% - 40%, 40 US$ billion</td>
</tr>
</tbody>
</table>

Source: The Building Services Research and Information Association (BSRIA)
• HVAC Market

**World VRF Market by volume by region, 2016-2022**

- Total Americas: 1.5 mln
- Total Asia Pacific: 1.9 mln
- Total Europe: 2.3 mln
- Total Middle East, India, Africa: 2.7 mln
- Total Americas: 3.1 mln
- Total Asia Pacific: 3.4 mln
- Total Europe: 3.4 mln

By 2022:
- +11.4%
- 20 US$ billion VRF market

Vs.:
- +3%
- Global GDP
AC Global Trend—Sustainability

01: Life Cycle Costing
02: Improved tools for comparing environmental impact
03: Design for recovery/recycle/reuse
04: Reduced refrigerant charge and waste
05: Zero leak systems
07: Less/no packaging materials

Global Trend
Inverter is rising
Inverter and Split DX/Chiller

Inverters (single + multi) by volume, 2016 & 2020

Penetration in chillers in key countries by volume %, 2016-2021

50%+ of air conditioner are Inverter
PRIMARY COMPONENTS OF A VRF SYSTEM

Outdoor Unit
• Controls Compressor frequency and Fan speed
• Maintains Operational Mode

Branch pipe

Indoor Units
• Transfers Heating and Cooling to Space
• Allows for Optimal Zoning

Controls
• Controls Space Temperature and Indoor Unit Fan
• Remote and/or Central
VRF Systems = Low Maintenance

Generally, VRF systems only need filters changed and coils cleaned.

They are easier to install because they are modular, lightweight, and smaller.

Smaller piping, allowing the system to fit into standard size walls with more usable space.

They are ideal for new construction or retrofit.
VRF Advantages over Chiller

- VRF offers efficiency without requiring the space

- Chiller system require space for pumps, boilers, chillers, ducts, piping, heat exchangers
VRF Advantages over Split A/C

VRF has a great application for large buildings.
What are the benefits of VRF?

1. **Energy Saving.** The volume or flow rate of refrigerant is accurately matched to the required heating or cooling loads. It is estimated that the power consumption can be reduced up to 30%. As well VRF system has High Efficiency in part load. VRFs are predicted to provide 50% energy savings on average over the lifetime of the system.

2. **Heat Recovery.** Heat recovery VRF technology allows individual indoor units to heat or cool as required, while the compressor load benefits from the internal heat recovery.

3. **Modular design.** The modular design offers comfort on demand allowing the choice to use the system only in the zones where it is needed. Provides dehumidification and temperature control by rapidly adapting to changing loads.
What are the benefits of VRF?

4. **Quiet operation.** Sleep without noise. Indoor units may operate at 25dB(A) sound levels and outdoor units can operate at 50dB(A) and lower with night quiet operation.

5. **Smaller footprint.** Use less square footage in the facility. In theory is easier to install because they are lightweight and modular, which theoretically should reduce the installation costs. No central plant room.

6. **Centralized monitoring.** Feature that gives users control over the entire system from a single location or via the Web.
What are the benefits of VRF?

**Superior Aesthetics & Prestige.**
Most of the manufacturers are able to offer aesthetic design with a complete range of indoor units to fit into any application and any decorations.

**Ease of Design, installation & transportation.**
Selection software enables a fast method of laying out a VRF system. VRF is developed based on Split system, piping and wiring work are similar. Small size and light weight make it easy to transport.

**Ease of Service.**
Because of the scroll compressor, the quality and stability has been proven on field. Scroll compressor is easy to repair. And VRF as DX system the piping system and control part is easy to service also.
HVAC Industry Trend

- Inverter and VSD technology
- VRF is rising/VFD centrifugal chiller and Magnetic bearing
- Automation Production
- Smart Control and BACS for HVAC system
Key technologies—Large capacity EVI compressor

Enhanced Heating capacity—Vapor Injection Scroll Compressor

- Increase heating performance by 20% on average when outdoor temperature below 7℃.
- Thanks to Vapor Injection technology within the compressor increases the refrigerant flow rate by up to 20% compared to conventional products.
- As well, the EVI starts more efficiently Sub-cooling without loss during cooling.

@-15℃ refrigerant circulation volume is enhanced by more than 30%

-25℃ Starts as usual and work stably

-15℃ Heating capacity is improved by 20% than common types.
Key technologies—Large capacity EVI compressor

- EVI Large capacity, single compressor capacity up to 18HP
  *EVI (Enhanced Vapor Injection)
- Two-stage compression effect provides efficient heating operation in low temperature conditions
Key technologies - Optimized refrigerant circuit

2-stage sub cooling

The Plate Heat Exchanger boosting up refrigerant sub cooling:

- Refrigerant pressure loss reduce, Lower refrigerant flow noise
- Better refrigerant distribution in multi indoor units connection

Plate heat exchanger as a secondary intercooler improves 10%+ energy efficiency
Wider running frequency is from 15Hz to 140Hz

Extended Compressor Speed from 15 Hz
- Increase part load efficiency at all operation ranges
- Rapid operation response
- Capable of reaching required temperature quickly

Release Valve:
- Reduce the leakage loss and decrease discharge noise greatly, prevent over compression

Vapor injection technology:
- In heating mode, increase refrigerant circulation amount and heating capacity

Improved asymmetric scroll wrap:
- Improving compressor efficiency by reducing leakage and invalid suction superheat.

Non-contact oil membrane
- Adopted in both axial and radial chamber, oil film seal formed by lubricating oil, so friction reduced and reliability improved

Concentrated BLDC motor
- Compared with distributed type, it has lower height and higher efficiency in the mid-low speed area, better to improve part load EER

Advanced bearing design for high speed running:
- Cylindrical bearing + aligning ball bearing to support compressor running at 140rps perfectly

High pressure chamber structure:
- Achieve high volumetric efficiency, good performance, good lubrication effect, low operation sound and high stability

Internal oil circulation, positive displacement gear oil pump and dynamic oil balance
- Reduce the over-heat loss and oil discharge rate, as well ensure oil supply during high and low frequency operation; As well dynamic oil balance between compressors in parallel operation.
Key technologies - High reliability

Oil Control - 4 Stages Oil Vector Control

1st stage
Unique oil separation in compressor

2nd stage
High efficiency oil separator

3rd stage
balance between compressors in one outdoor unit

4th stage
balance controlled by smart procedure
Inverter and VRF

Before

6HP
36KG
502mm

Now

18HP
39KG
539mm

Before

32HP

Now

32HP

Inverter makes the VRF more powerful with smaller size
Unique Innovations - EMS (Energy Management System)

Floating Refrigerant Temperature for balancing comfort and efficiency

- With the integration of EMS (Energy Management System), V6 would be able to adjust evaporating temperature (in cooling) and condensing temperature (in heating) to maximize the comfort and energy efficiency automatically.
- Background knowledge:
  - For low ambient temperature, lower load and capacity are required
  - Lower load and capacity need, higher evaporating temperature can be
  - Higher evaporating temperature results in higher efficiency, especially for transition seasons

Evaporating temperature (floating) ° C

- Automatically adjust temperature
- Save Energy
- Comfortable cooling/heating

Temperature (indoor/outdoor)
Unique Innovations - EMS (Energy Management System)

Capacity Output Limitation for shortage of electricity

• With the integration of EMS (Energy Management System), For projects with limit electricity supply, V6 can be set to output 40-100% capacity.
• It’s also helpful for the buildings short of electricity.

- Limit the max. capacity output
- Reduce power consumption
- Ensure basic cooling/heating
Unique Innovations - Improved IPM reliability & performance

- MCLCS Refrigerant Cooling PCB

V6 – duplex U multi channel refrigerant cooling

IPM temperature range:

Double U-shape refrigerant pipe decrease the IPM temperature and enhance the reliability
Mr. Doctor – Refrigerant/Operation Pressure Auto Detecting Function

- When the level of refrigerant is too low or too high, it may cause damage and poor performance.
- The temperature and pressure of refrigerant can be real-time monitored by the outdoor unit.
- V6 outdoor unit can detect excessive amounts of refrigerant to ensure consistent performance.
Key technologies—Ease of installation

Automatic Charge Function (optional)

- System can be charged with the necessary amount of refrigerant automatically via a push button on the PCB.
- Automatic charging will stop once the appropriate amount of refrigerant has been transferred.
- Need to be customized.

Conventional manual charge:
1. Calculation of additional refrigerant charging volume
2. Measuring the weight of the cylinder
3. Charging the unit with additional refrigerant
Most Reliable Compressor-Compression ratio control

- Real-time monitoring the discharge and suction pressure of the system.
- The output of compressors and the EXV open degree can be regulated precisely to optimize the compression ratio.

The compression ratio can be always in the safety zone.
Key technologies—Ease of Service

Ease of Service——Refrigerant recycling function (optional)

- When outdoor or indoor units have malfunctions, this function can collect its refrigerant before servicing.

Case One: Refrigerant collect to outdoor units

Case Two: Refrigerant collect to indoor units

Case Three: Recycle to a tank
Key technologies – Various Operation Modes

- Various mode selections, provide more freedom and convenience to match the customer needs.

- With DIP switch setting

  * Operate according to ambient temp. (T4)
  - Heating if T4 < 13 °C
  - Cooling if T4 > 18 °C
  - Continue Last time operation if 13=<T4=<18

- Voting Priority (Majorities’ Requirement)
- Lock Cooling
- Cooling Priority
- Automatic Mode (default)
- Lock Heating Mode
- VIP Priority (default address #63.)
Key technologies—Continuous running when Indoor unit repair mode

- In case of one particular IDU needs to be repaired, it can be power off without any interruption to the system’s operation.
- In case of indoor unit disconnected (H7 display on ODU PCB), the system will keep running.

*Need to contact the Midea local distributor

The system can be repaired without interruption to normal operation.
Key technologies—Ease of installation

Non-polarity Communication Wiring (optional)

- Only one group of communication wire of 2-core, non-polarity, shield wire PQ, achieved communication for indoor & outdoor unit.
- Normal operation is possible even when communication cables are not connected properly.

If there's strong electromagnetic interference surrounded, please use 3-core shield cable in stead.
Unique Innovations - Pre-protection of the main components

Electrical Protections - Phase Sequence Detection Circuit

uses special internal protection circuitry to protect system from wrong power supply.

- In case of a wrong connection of the three-phase electricity wiring, it's capable to prevent the damage of electric control devices such as main PCB, Inverter Module, as well as the compressors.
The innovatively designed dust-clean function enables the outdoor unit to prevent the dust by itself.

To improve the reliability and maintain system operate efficiently

* This function needs to be customized
Key technologies—Optional Heavy Anti-corrosion

- In order to perform even in corrosive environments the V6 provides an option to customize stronger protection from various corrosive external environments such as seaside with high salt contamination.
Complete Solutions—Guaranteed comfort

- DC fan motor brings lower noise, less power consumption, more precise temperature control, as well as the anti-duct sealed DC fan motor is more durable.
- 7 speed adjustments of indoor fan design can maximum meet the needs of different conditions, providing control flexibility.
Key technologies—Triple Configurations

Local/Remote/Network configurations

Field local configuration Simplifies SERVICING
• The 7-segment indicator saves time with easy-to-read code.
• Indication of basic service parameters to quickly check basic functions.
• Clear menu indicating quick and easy on-site settings.
• Memory Chip can storage last 10 batches of operation/error/protection information and to check through a button on PCB.

4-digit 7-segment display makes the operation status and error code information easily inquired, convenient for management and service

Black box function
Helps the service person learn the historic record before failure
Key technologies—Ease of Access and Service

- **Compressors** are located near the front panel, which simplifies checks and enables valve or compressor parts to be replaced easily.

- **An additional auxiliary small PCB** is installed in the side columns, this design greatly help the installer or service man to set Auto-commissioning or CHECK the operation status without removing the front panel.
Complete Control Solutions – BMS Gateway

- BMS Gateways are compatible to multiple communication protocol of BACnet, LonWorks, RS485, Profibus, Modbus, KNX, etc.
- Connectible to BMS or Smart Home system
- Midea is one of member of these associations
Complete Solutions – Complete Control Solutions

Complete Control Solutions – Various controller and software

Individual  Group  PC/ Network  BMS
Network Service System

**Network** Control/Monitor all operating parameters and detailed information

- Through the Midea cloud server, it enable the IDU and ODU equipment to connect to our monitoring center over the internet (2G/3G/4G networks*).
- We continually monitor data in your equipment, so we know exactly how your systems are performing and we can even advise maintenance personnel in advance if service is required.

*Need to contact the Midea local distributor
Triple Configurations—Centralized setting

**PC Centralized** Control/Monitor all operating parameters and detailed information

**IMM Pro**

- One click installation wizard greatly streamlines system installation
- Database, IMM Server and IMM Client all automatically configured
All new diagnostic software

**Remote Control/Monitor all operating parameters and detailed information**

- When easily plug to the PCB from PC, technicians can review diagnostic information and graph data values to help troubleshoot any issue with ease.
- Real-time values are available for the outdoor and indoor units and can be graphed to evaluate operating trends.
High Efficiency - EER & COP
30%+ @ full load, 50%+ @ part load more efficient than split

EER (Energy Efficiency Ratio)

<table>
<thead>
<tr>
<th>HP</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>4.75</td>
</tr>
<tr>
<td>10</td>
<td>4.45</td>
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<tr>
<td>12</td>
<td>3.85</td>
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<td>18</td>
<td>4</td>
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<tr>
<td>20</td>
<td>3.7</td>
</tr>
<tr>
<td>22</td>
<td>3.35</td>
</tr>
</tbody>
</table>
Splits: Shift from R410A ——> R32
Or R290

VRF: Shift from R410A ——> ?  Flammability is a concern!
THANKS

Technology Inspires Possibilities