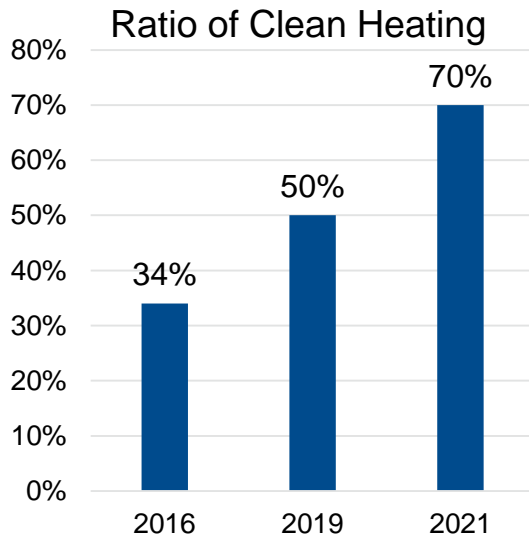
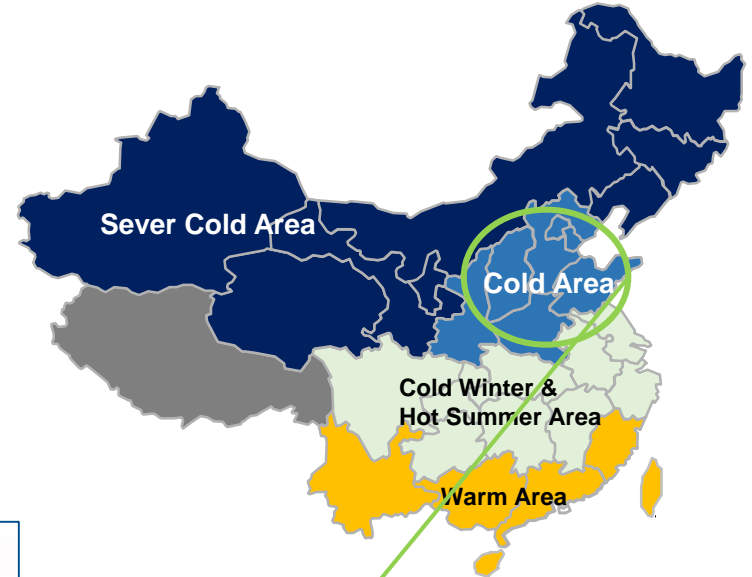


District Heating Solutions

Clean Energy Heating Policy

Winter Clean Heating Plan for the Northern Region (2017-2021)

- Issued on Dec.27,2017
- Jointly issued by 10 ministries and commissions
- The clean heating rate in the northern region will reach 50% in 2019, and 70% by 2021, replacing 150 million tons of loose-burning coal
- For “2 + 26” urban areas, by 2021, realize clean heating and remove all coal boilers below 35 tons in urban areas; in county towns, the clean heating rate reach 80% and remove all coal boilers below 20 tons; In rural areas, the rate of clean heating reaches more than 60%.



国家发展和改革委员会
国家能源局
财政部
环境保护部
住房和城乡建设部
国务院国有资产监督管理委员会
国家质量监督检验检疫总局
中国银行业监督管理委员会
中国证券监督管理委员会
中央军委后勤保障部

文件

发改能源〔2017〕2100号

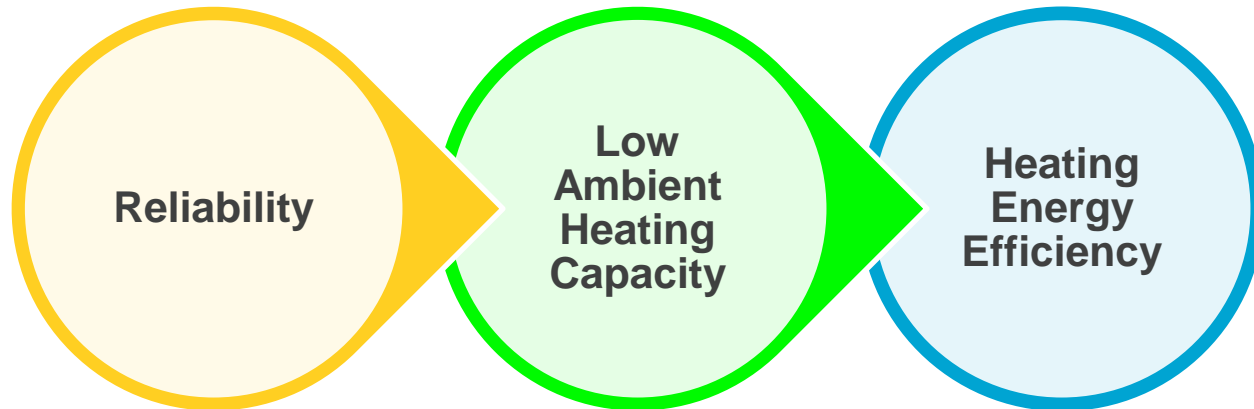
关于印发北方地区冬季清洁取暖规划
(2017-2021年)的通知

为深入贯彻党的十九大精神，落实习近平总书记在中央财经领导小组第14次会议上的重要指示，以习近平新时代中国特色社会主义思想为指导，按照党中央、国务院决策部署，发展改革委、能源局、财政部、环境保护部、住房和城乡建设部、国资委、质检总局、银监会、证监会、军委后勤保障部制定了《北方地区

— 1 —



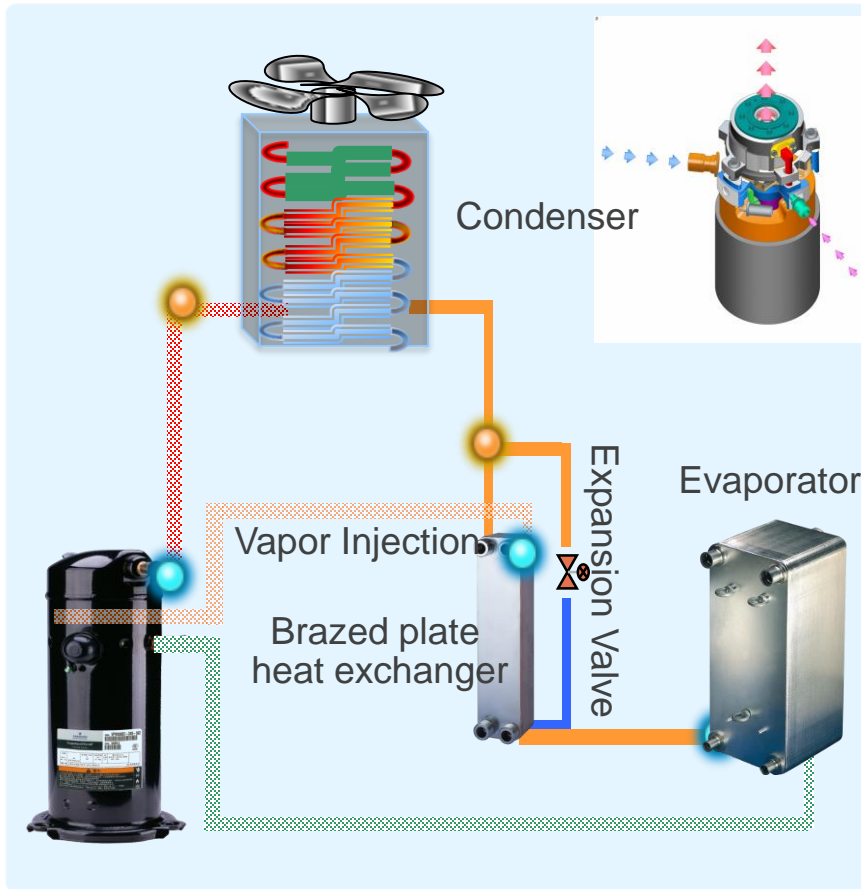
The Challenges of Low Ambient Heating With Air Source Heat Pump



Emerson Low Ambient Temperature ASHP Solutions

EVI Scroll Heating Technology

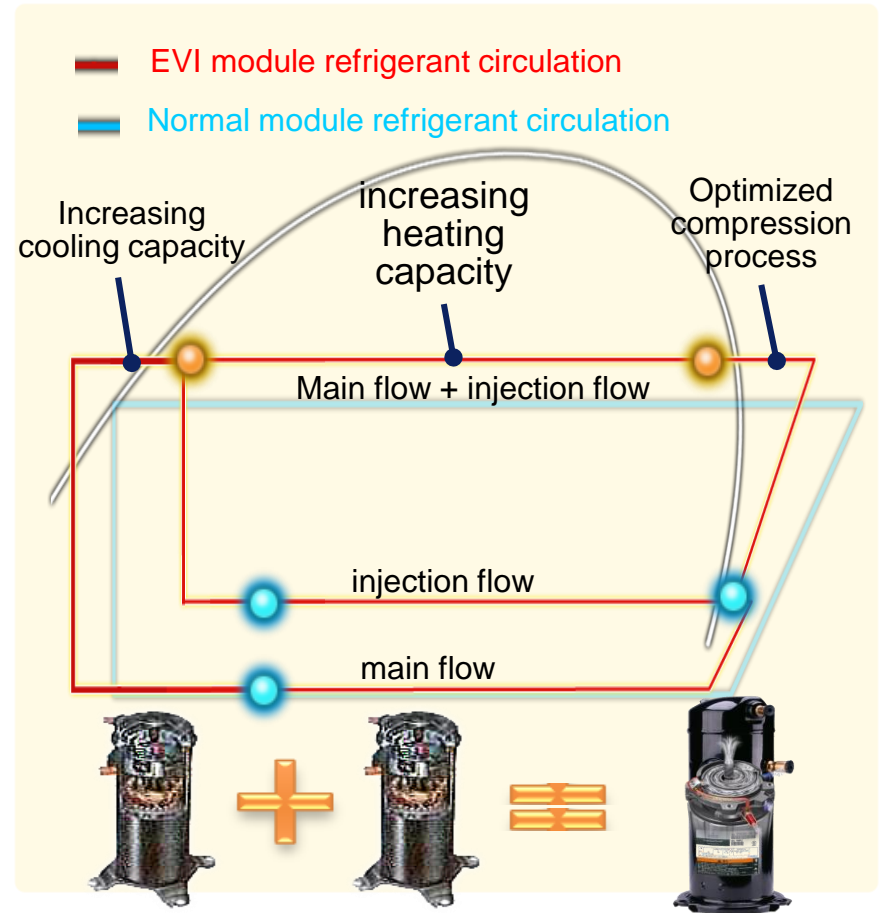
EVI Cycle Schematic Diagram



EVI Compressor

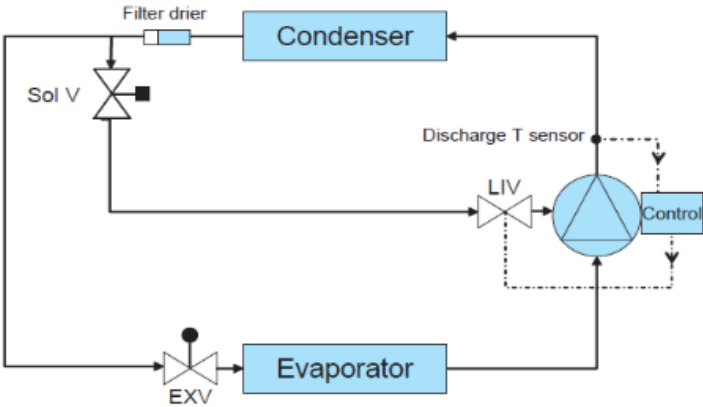
- Create a second suction port in the scroll
- Through the second suction circuit, increase the refrigerant flow and enlarge the enthalpy difference of the main refrigerant circuit

EVI Cycle Pressure-enthalpy Diagram

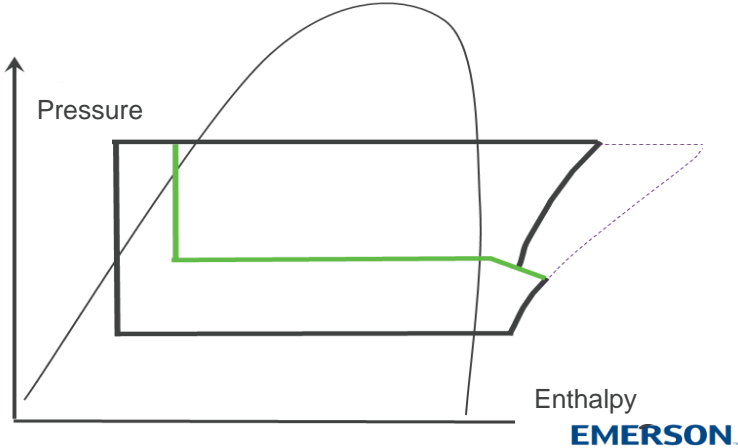
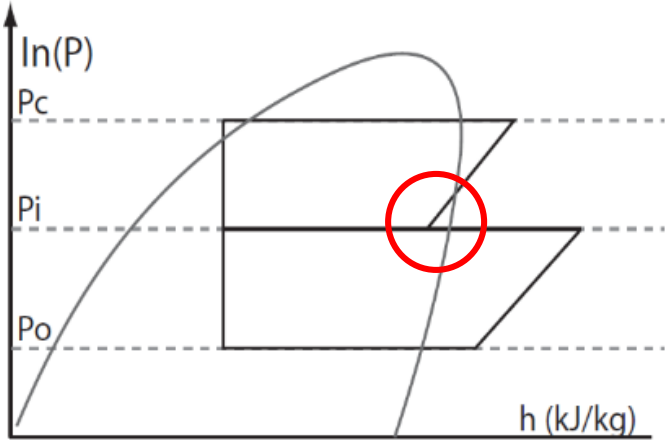
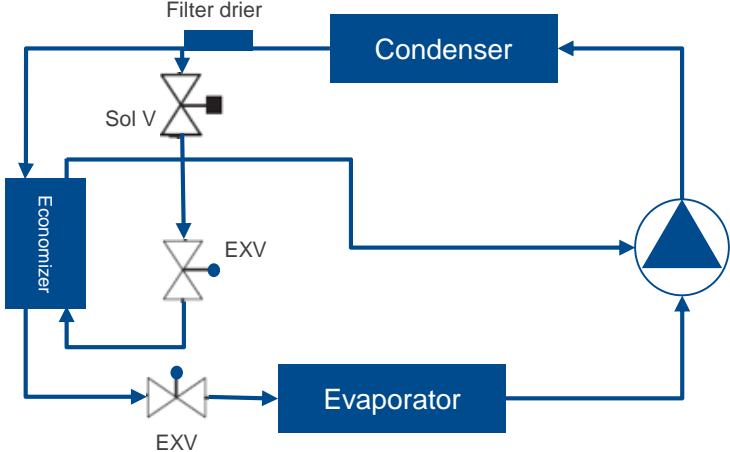


EVI and Liquid Injection System Schematic Diagram

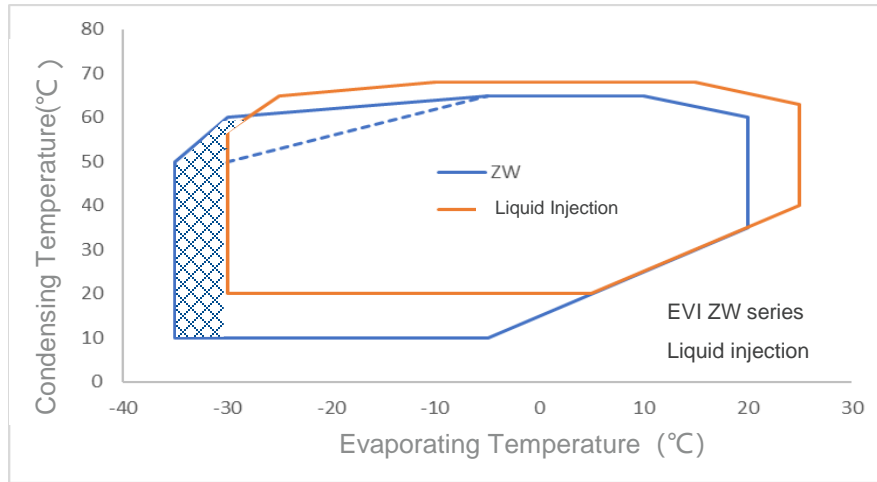
Liquid Injection



EVI



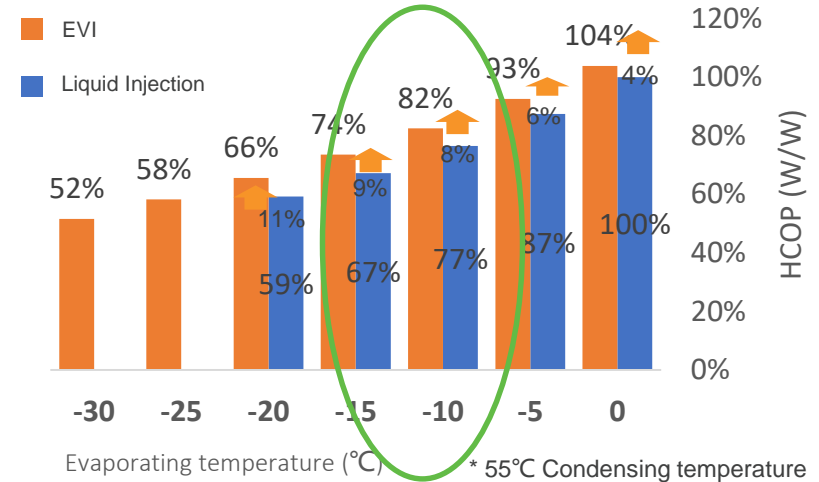
Operating Range Comparison Between EVI and Liquid Injection Compressor



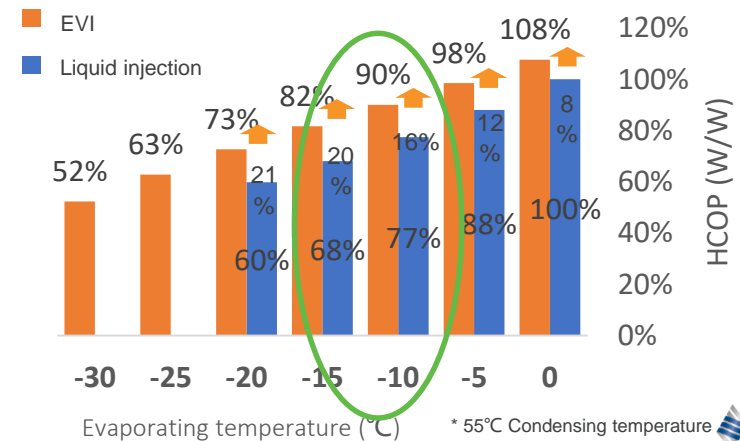
- The minimum evaporating temperature of Copeland Scroll™ ZW series EVI compressor is as low as -35 °C. It can meet the heating requirements at lower ambient temperature. This is helpful for the application of ultra-low temperature air source heat pumps in severe cold areas such as Xinjiang province.
- The wide envelope also ensures the reliability of heat pump systems equipped with EVI compressors in low ambient temperature applications.

	EVI VS Liquid	System Advantages	Project Advantages
Heating Capacity	↑ 8-10%	↓ Number of units ↓ Electrical heating	↓ Initial investment
Heating COP	↑ 15-20%	↓ Running cost	↓ Payback period

Heating Capacity Comparison

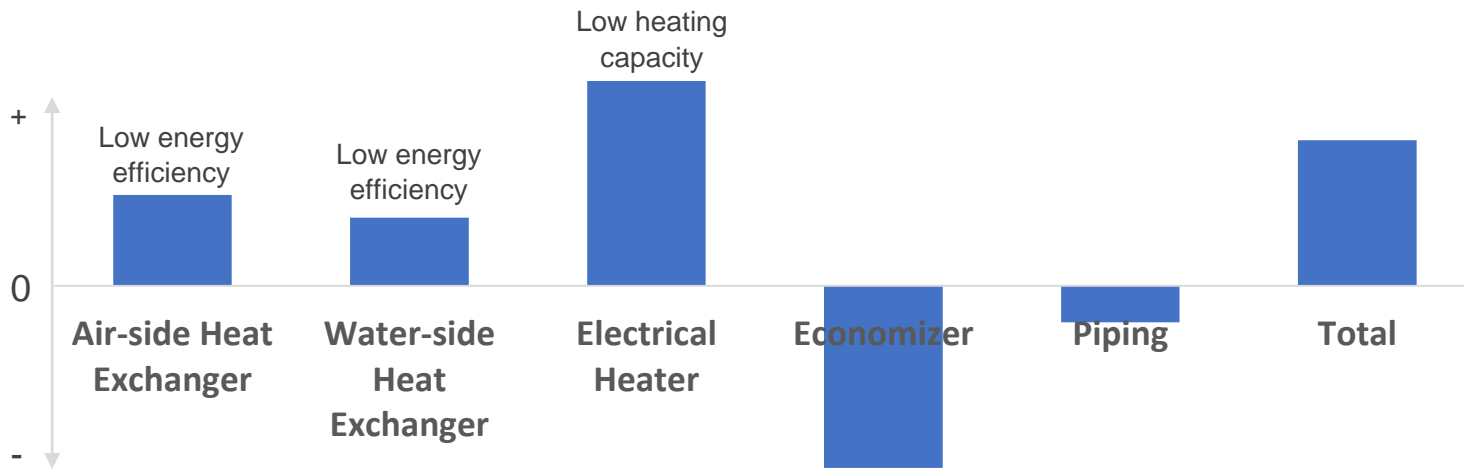


Heating COP Comparison

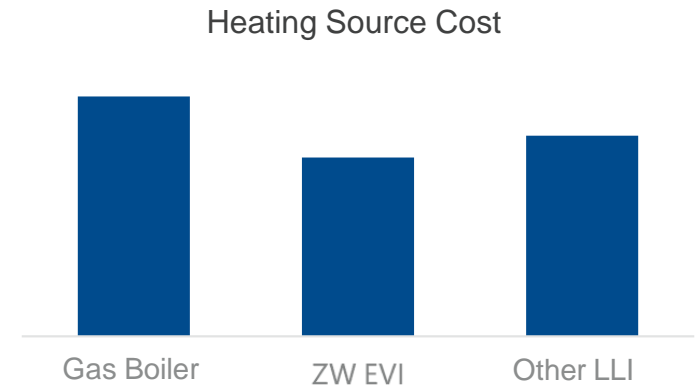


Excellent Heating Performance Effectively Shortens Payback Period

The liquid injection system has higher applied cost than EVI system (base).

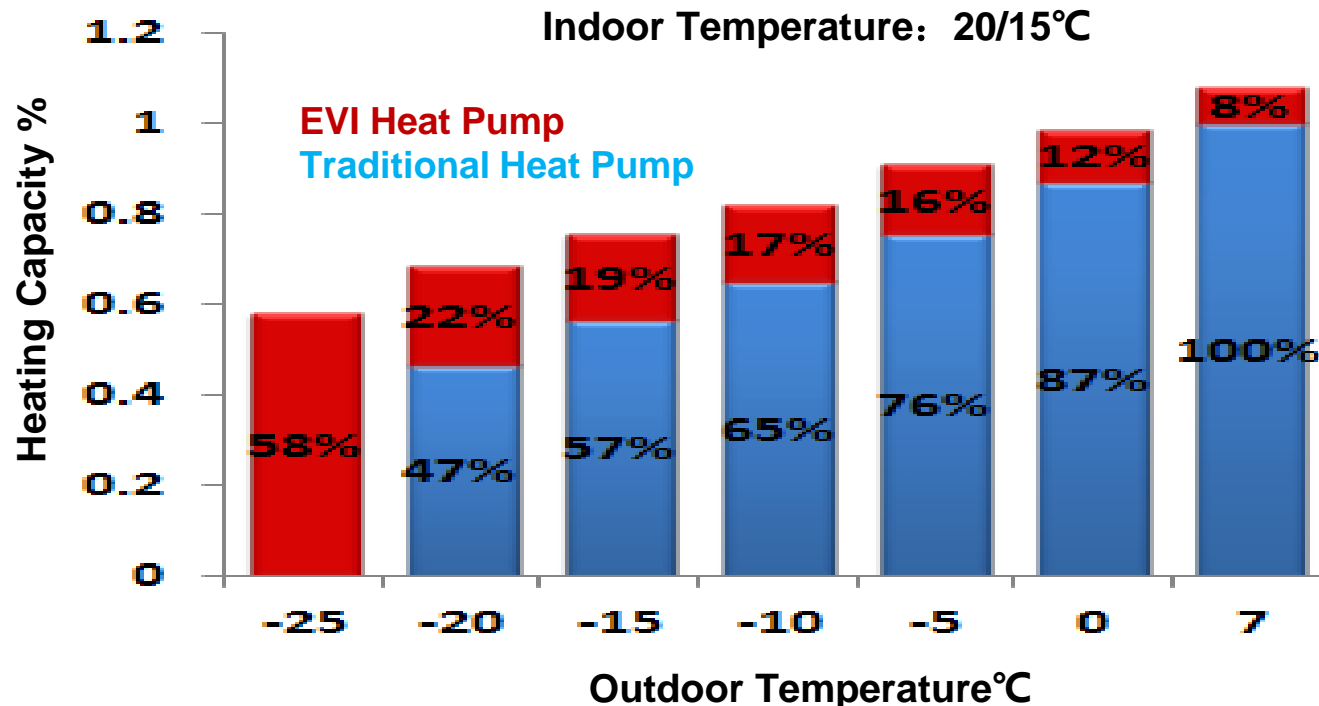


	Emerson EVI	Liquid Injection
Reduce discharge temperature	Yes	Yes
Increase heating capacity	Increase	No
Improve heating efficiency	Improve	Decrease



EVI Advantages in Low Ambient ASHP System

- Greatly improve **the reliability of heating in low ambient temperature**
 - Expand the operating range of the unit, and it can still provide high-temperature hot water stably at an ambient temperature of -30 °C
- Improve **the heating capacity of the unit at low temperature**
 - Increased heating capacity by 10-20% at low ambient temperature
- Improve the **energy efficiency of system**, save running costs, and shorten the payback period
 - Using economizer circulation to improve cooling EER 7 ~ 10%
 - Improve heating COP by 20% at low ambient temperature



Industry Standard Upgrade to Improve Energy Efficiency Guidance

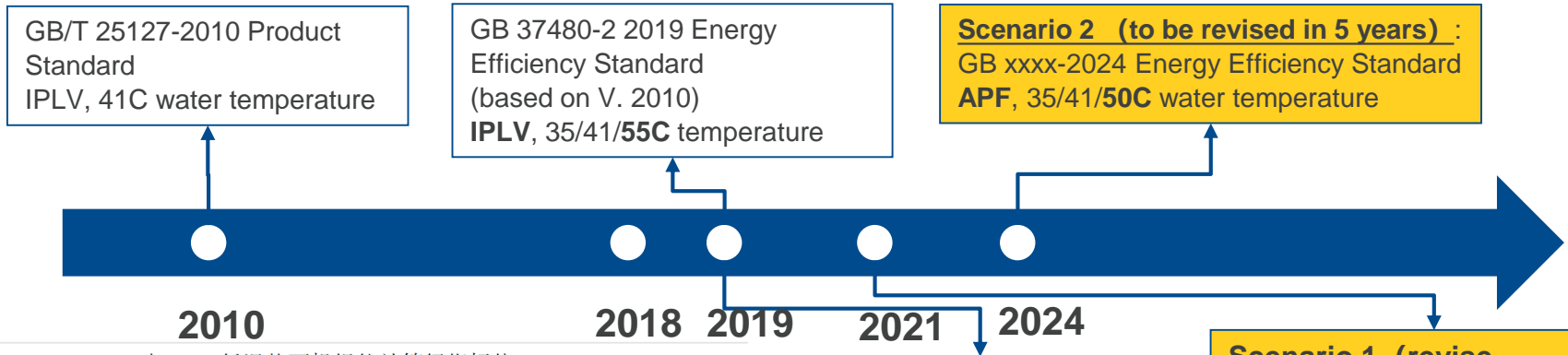


表 1 低温热泵机组能效等级指标值

名义制热量 kW	额定出水 温度	1		2		3	
		综合部分 负荷 性能系数 (IPLV (H), W/W)	综合部分 负荷 性能系数 (IPLV (H), W/W)	综合部分 负荷性能 系数 (IPLV (H), W/W)	制热性能系数 (COP _h , W/W)	综合部分 负荷性能 系数 (IPLV (H), W/W)	制热性能系数 (COP _h , W/W)
H ≤ 35 (或CC ≤ 50)	35°C ^a	3.40	3.20	3.00	2.40		
	41°C ^b	3.20	2.80	2.60	2.10		
	55°C ^c	2.30	1.90	1.70	1.60		
H > 35 (或CC > 50)	35°C	3.40	3.20	3.00	2.40		
	41°C	3.00	2.80	2.60	2.30		
	55°C	2.10	1.90	1.70	1.60		

注: a) 主要适用于低温辐射采暖末端, 如地板采暖等;
 b) 主要适用于强制对流采暖末端, 如风机盘管、强制对流低温散热器等;
 c) 主要适用于自然对流和辐射结合的采暖末端, 如风机盘管、低温散热器等。

GB/T 25127-2019 Product Standard
APF, 35/41/50°C water temperature

IPLVH Level GB37480-2019
 Released on Apr 4, 2019 and to be effect on May 1st 2020

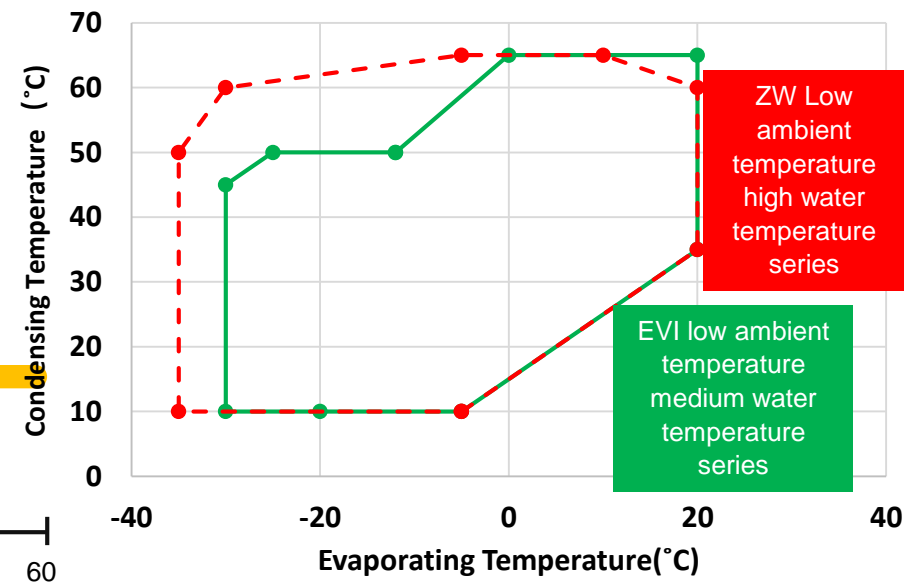
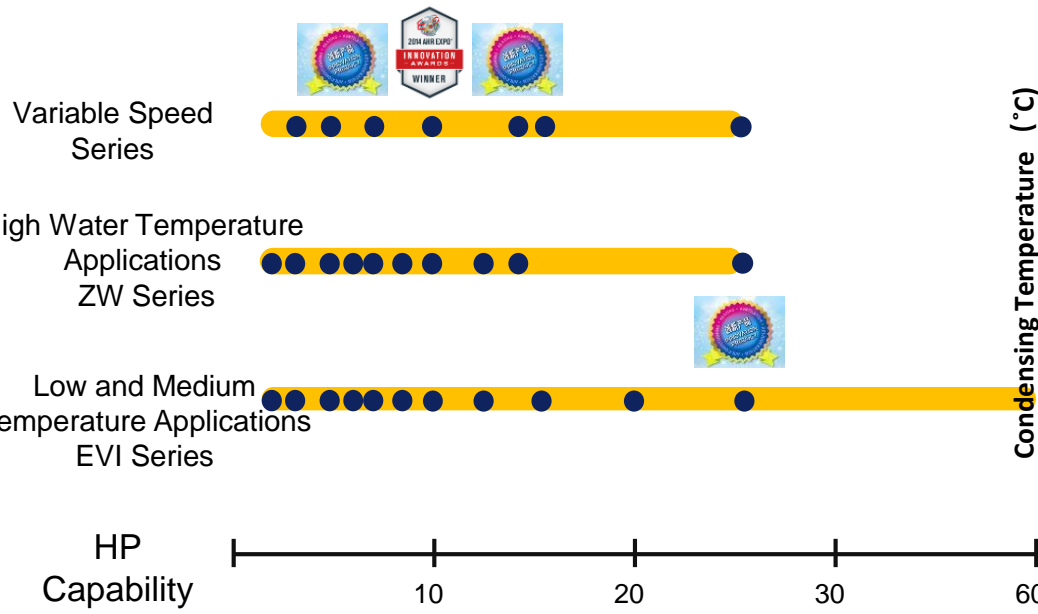
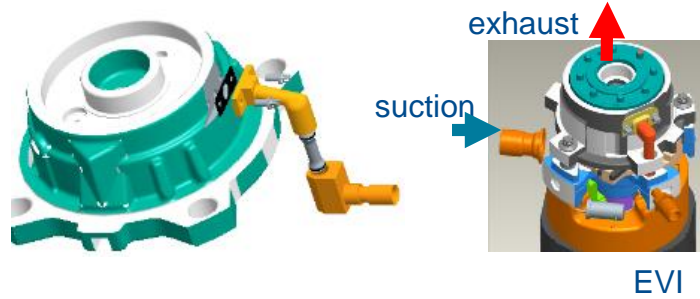
Scenario 1 (revise immediately) :
 GB xxxx-2021 Energy Efficiency Standard
APF, 35/41/50°C water temperature

For long-term, should revise to 50°C and corresponding energy efficiency.

In 3-5 years, HSPF(APF) Will Be The Metrics of Low Ambient Temperature Heat Pump Units. Firstly to Release IPLV(H) Evaluation System, Then to Synchronously Evaluate The Revised High Water Temperature and APF(CSPF&HSPF).

Emerson Low Ambient Application Product Profile

- Patented EVI technology
- The continuously expanding EVI product line
- Rich EVI application experience



Emerson's Decades of EVI Design, Manufacturing and System Application Experience Guarantee The Reliable Design and Stable System Operation for Our Customers

Emerson EVI Scroll Heating Technology Summary

Perfect Solution for Heat Pump Heating System

Reliable

- Stable heating capacity under ultra-low ambient enables the application of air-source heat pump units in north regions
- Meet the heating needs of non-central heating area

Energy Saving

- Save operating costs by up to 70%

Environment Friendly

- Replace coal boiler for heating, improve air quality
- From the perspective of primary energy efficiency, CO2 emissions can be reduced

Intellectual Property and Expert Assessment



上海交通大学
SHANGHAI JIAOTONG UNIVERSITY

户式空气源热泵热水供热系统
冬季性能测试

汇报人：陈晓宁
陈江平 教授课题组

上海交通大学 机械与动力工程学院
2015.08.06

EVI涡旋强热变频多联机应用测试案例

- 2套完全相同的住宅建筑，每套125m²
- 各装有一套1拖4的风冷多联机组
 - 采用制冷剂喷射技术的低温多联机（1级能效）
 - 普通多联机（1级能效）
- 测试时间：2014/2/10~2014/3/5

专利审查受理通知书
发明专利申请号：201410263471.9
受理日期：2014年11月11日

发明专利申请号：201410263471.9
受理日期：2014年11月11日

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中华人民共和国国家知识产权局
266071
发明专利申请号：201410263471.9
受理日期：2014年11月11日

Copeland Scroll™ Variable Speed Compressor
Won Innovation Product Award

智汇·冷暖
低温空气源热泵在寒冷地区的应用



哈尔滨工业大学

20180328

家用多联式空调(热泵)
超低环温供暖效果分

倪龙 博士, 教授,
13204500382@163.com

EVI涡旋强热热泵热水器应用测试案例

- 快捷酒店, 5层建筑, 70+ 房间
- 空气源热泵热水器
- 测试时间：2014/1/18~2014/2/17

记录参数：
- 进水 / 出水温度：11/12
- 进风 / 出风温度、湿度：1a1, d1 / 1a2, d2
- 水流量：6m³
- 空气流量：6m³

EVI涡旋强热冷水机组应用测试案例

项目城市：北京
建筑概况：11层楼，建筑面积7000m²
设备状况：12台55KW CVI风冷模块冷水机组
为康筑物提供制冷采暖

运行模式：6台机组运行+3台机组待机
定频风机变频压缩机+变频风机
测试周期：2013年11月15日~2014年3月15日

测试设备：
- 路声级谱仪、功率电表、风速仪
- 温度传感器
- 远程数据监控系统

Variable Speed Scroll Compressor
专利号201420634719

Tsinghua University, Shanghai Jiaotong University and Harbin Institute of Technology Have Highly Praised The Systems Using Emerson EVI and Variable Speed Technology

Emerson's Successful Case



A district heating project in Beijing



R32 heating project in a shopping mall in Yining, Xinjiang



Heat pump heating project of a ski resort in Jilin



R32 project in a scenic spot in Beijing



Heating project in a residential building in Shandong



District heating project of a community in Shandong



A poverty alleviation industrial base in Yining



A district heating project in Tianjin



A heating project in Ningyang, Ningxia

**EMERSON
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SOLVED™**