MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA NX-N SERIES
REVERSIBLE AIR-TO-WATER HEAT PUMPS

www.Climaveneta.ca

CLIMAVENETA®
SUSTAINABLE COMFORT

TOPICS

- **AIR-TO-WATER HEAT PUMP CENTRAL PLANT**

- **LOW AMBIENT DESIGN CONSIDERATIONS**
  - Operating Envelope
  - Capacity According to Outside Air Temperature
  - COP According to Outside Air Temperature
  - Defrosting Cycles

- **APPLICATIONS & EXAMPLES:**
  - 2-Pipe, 4-pipe & Heat Recovery Solutions
  - Cascade Systems
  - Energy Modelling Study: Energy Savings & Emission Reduction with Hybrid 4-Pipe System

- **CLIMAVENETA NX-N SERIES:**
  - Product Overview, Features & Options

- **Q & A PERIOD**

TIMELINE OF MEHITS' KEY TECHNOLOGIES

RC IT COOLING

CLIMAVENETA

1963

RC is Established

Climaveneta is Established

1971

Energy Raiser: FIRST MULTI-PURPOSE UNIT FOR COMBINED HEATING AND COOLING in 4-pipe systems.

1980

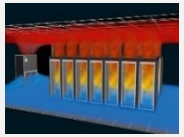
UA / UH: the first complete series of close control air conditioners for Computer rooms application.

1990

FREE COOLING

The "free cooling liquid chillers" are introduced for process cooling.

1997



Displacement Air Flow:
Close Control Air Conditioners with displacement air flow.

EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com

EUROVENT Certification
Climaveneta is **among the initiators** aligning Europe with the USA.

1999

TECS chillers with oil-free technology
Pioneering high-efficiency liquid chillers equipped with **magnetic levitation compressors**.

2005

2008

RC CLOUD PLATFORM
RC Ai Artificial Intelligence

RC CLOUD:
Web service for remote monitoring and management of air conditioning plants

full inverter CONCEPT

FIRST 'FULL INVERTER' CHILLER
Pioneering high-efficiency liquid chillers equipped with inverter on screw compressors, fans and pumps.

2011

clima PRO
PERFORMANCE RELIABILITY OPTIMISATION

INNOVATIVE HVAC PLANT ROOM CONTROL AND OPTIMIZING SYSTEM for top energy performance.

2012

INVERTER
RC Hi-Tech

FULL INVERTER
Full inverter technology applied to Close Control
Air Conditioners for data center application.

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TIMELINE OF MEHITS' KEY TECHNOLOGIES

RC IT COOLING

CLIMAVENETA

2013

COOLNET
RC AI Artificial Intelligence

COOLNET
Software for the Load Sharing in data center application for maximization of energy savings.

i-FX(1+i)

i-FX(1+i): New inverter chiller with **1 FIXED SPEED +1 VARIABLE SPEED COMPRESSOR** for highest efficiency **both at full and partial loads.**

2014

XCOILS
RC Hi-Tech

X TYPE
the unique precision air conditioner with innovative **X coils** for operation with ΔT 10°C or higher.

MITSUBISHI ELECTRIC

Acquisition by Mitsubishi Electric Corporation

2015

TX-W

TX-W: INNOVATIVE OIL-FREE CHILLER

- More than **60 configuration**
- Efficiency **ESEER over 10,2** .
- **From 246 to 4191 kW** CC

2016

SIVIS
Innovative indirect adiabatic cooling system for Data Center

2017

INTEGRA i-FX-Q2

FIRST multi-purpose heat pump for simultaneous production of hot and cold water with **FULL INVERTER TECHNOLOGY.**

MEHITS is Established

MITSUBISHI ELECTRIC | MITSUBISHI ELECTRIC HYDRONICS & IT COOLING SYSTEMS S.p.A.

i-FX

S-MEXT

S-MEXT
The first MEHITS "**3-diamond**" branded product

2018

NEW PRODUCT RANGES WITH ECO-FRIENDLY R513A AND HFO 1234ze REFRIGERANTS.

r1234ze r R513A

NX-N-G02-U Reversible Heat Pump Launched in Canada
The First of many **High-Efficiency** Hydronic **Technologies** and **Solutions** to be introduced in Canada

2020

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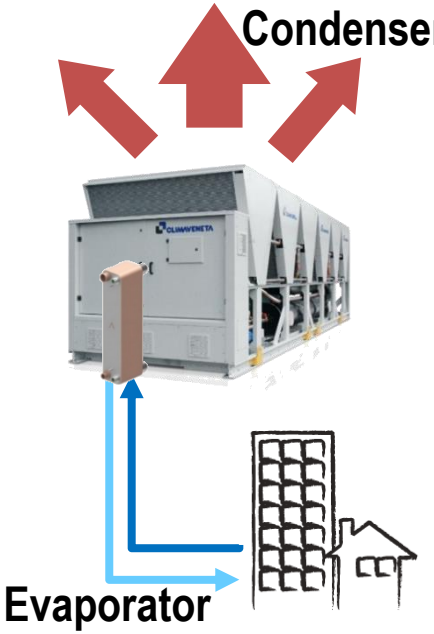
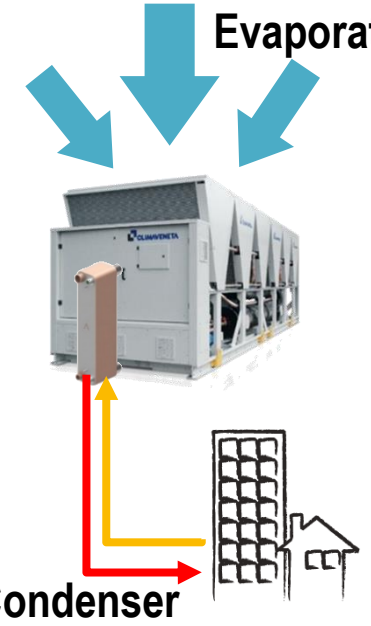
REVERSIBLE AIR-TO-WATER HEAT PUMP: OPERATING PRINCIPLE

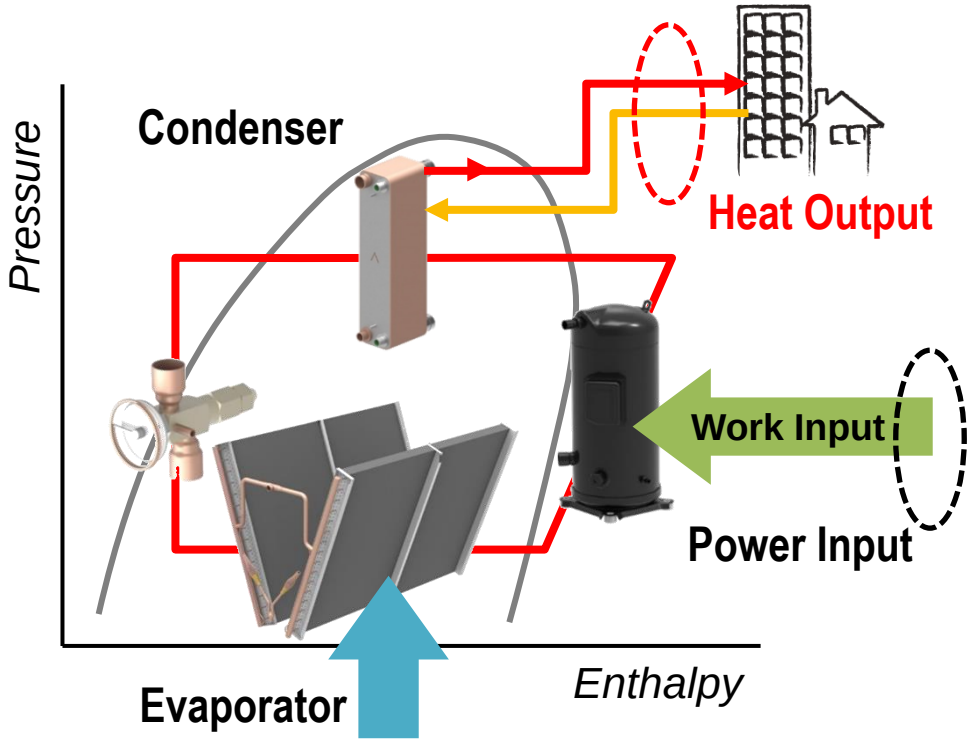
COOLING MODE



HEATING MODE



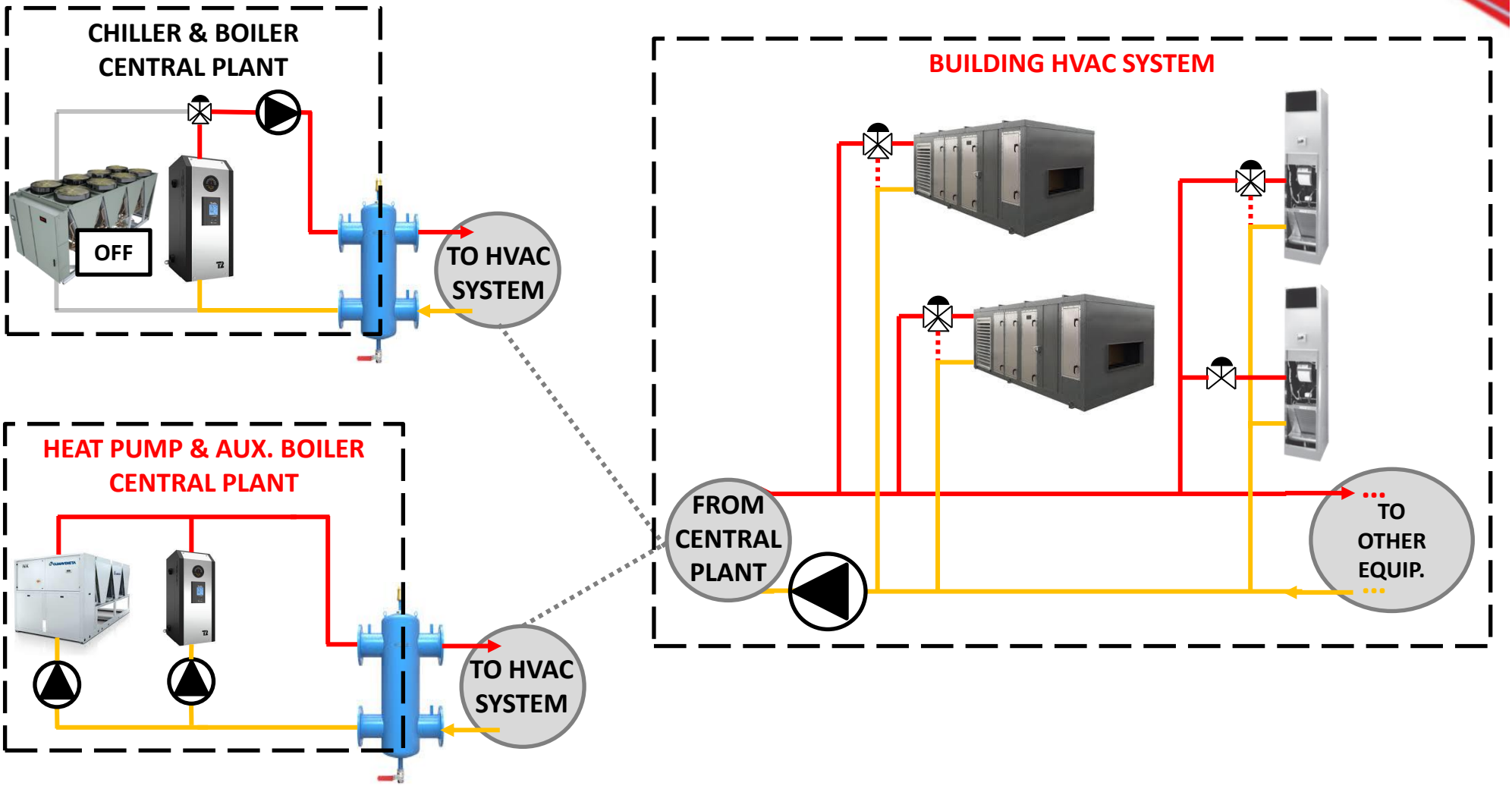
VAPOR-COMPRESSION REFRIGERATION CYCLE (HEATING MODE)



Coefficient of Performance:

$$COP = \frac{Heat\ Output\ (\frac{BTU}{h}\ or\ Watts)}{Power\ Input\ (Watts)}$$

CENTRAL HYBRID HEAT PUMP PLANT



WHY AIR-TO-WATER HEAT PUMPS?
ONTARIO EMISSIONS COMPARISON

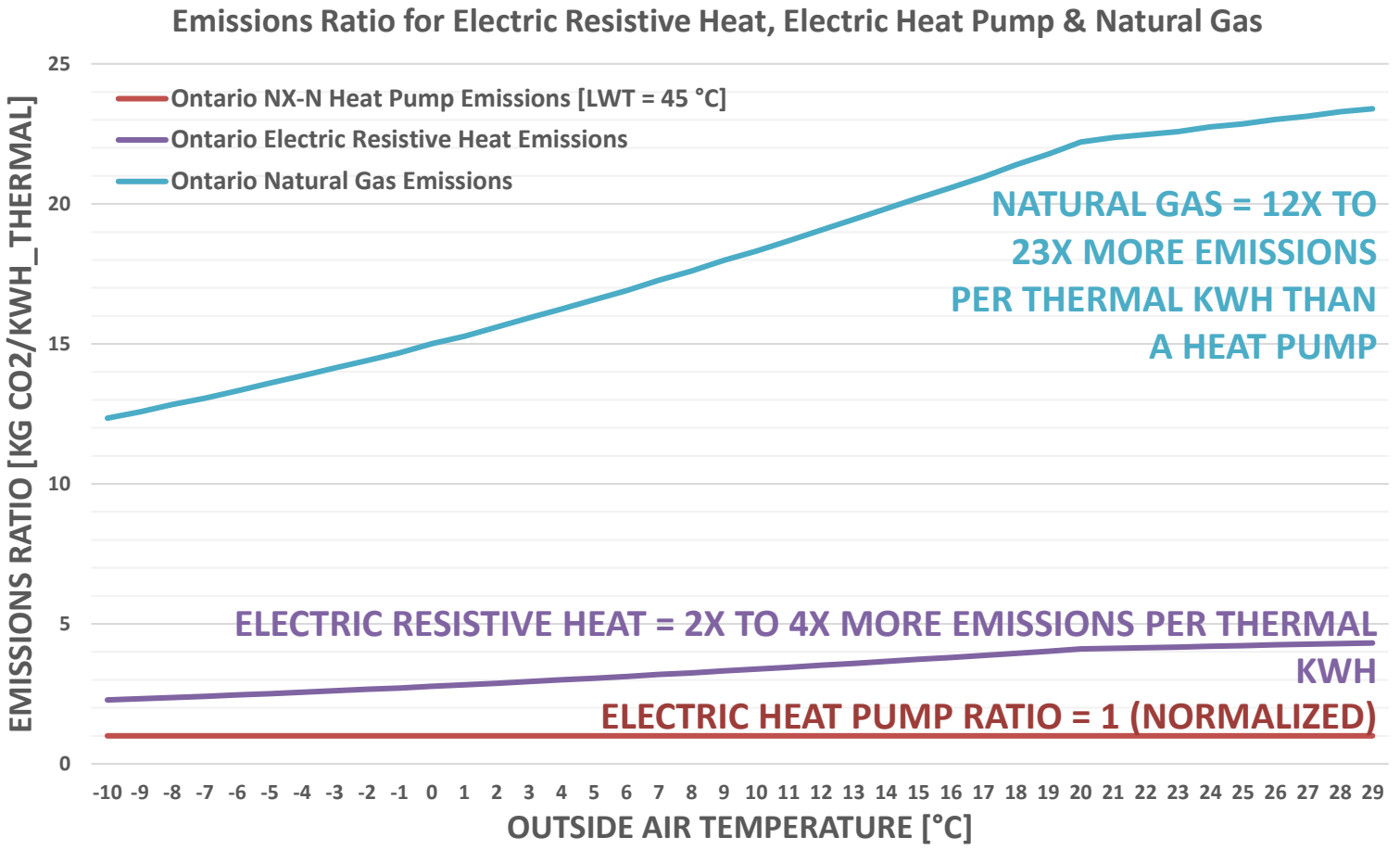
ONTARIO ELECTRICITY GENERATION:
0.031 kg CO_2e /kWh

SOURCE: TAF 2018 AEF: HTTPS://TAF.CA/WP-CONTENT/UPLOADS/2019/06/A-CLEARER-VIEW-ON-ONTARIOS-EMISSIONS-JUNE-2019.PDF

ONTARIO NATURAL GAS EMISSION INTENSITY:
1.888 kg CO_2e/m^3
= 0.18693 kg CO_2e/kWh

[1 m^3 Natural Gas = 10.1 kWh]

SOURCE: ONTARIO MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE'S "GUIDELINE FOR QUANTIFICATION, REPORTING AND VERIFICATION FOR GHG EMISSIONS - JULY 2017", TABLE 400-2



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WHY AIR-TO-WATER HEAT PUMPS?
BRITISH COLUMBIA EMISSIONS COMPARISON

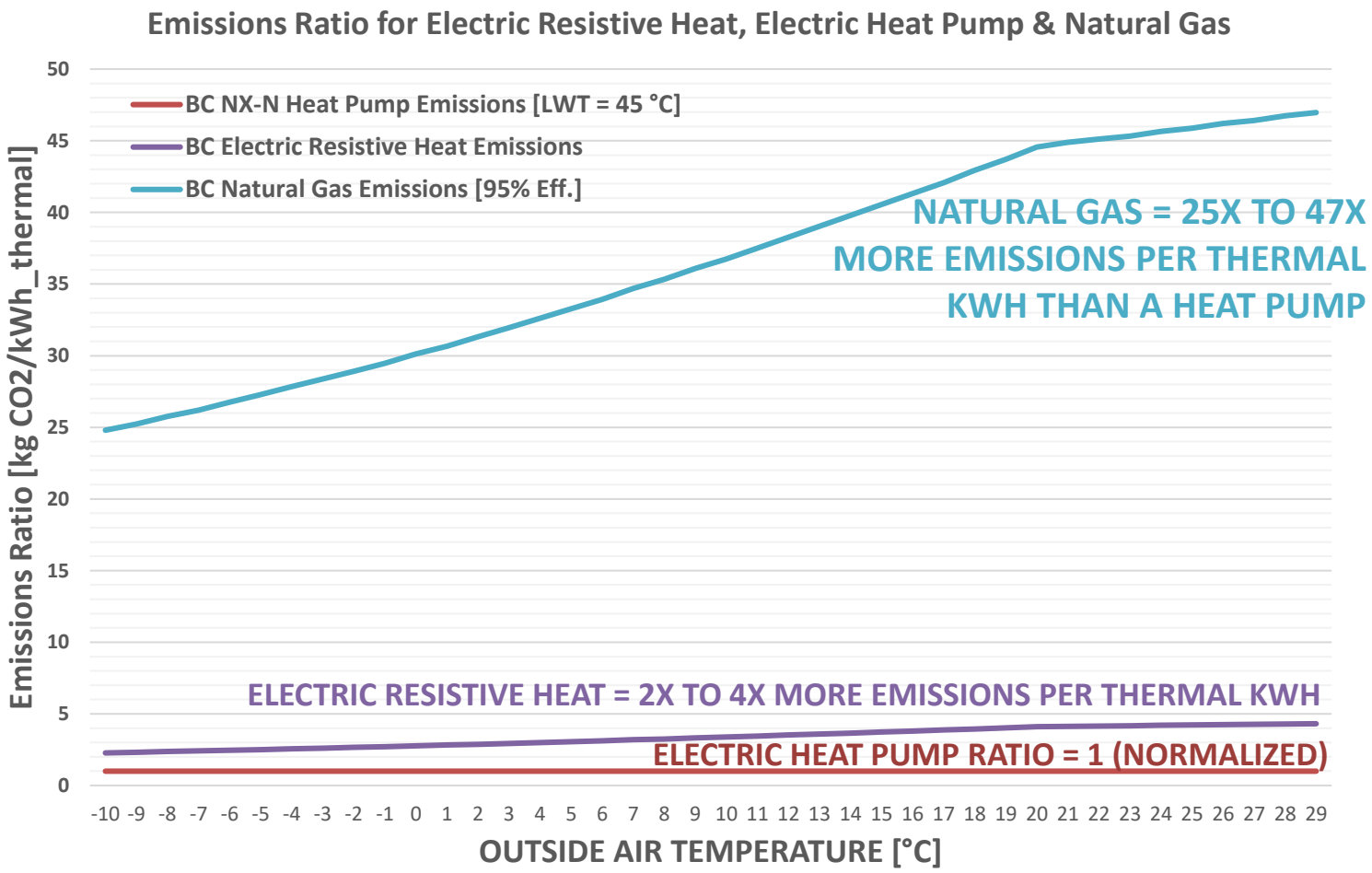
BRITISH COLUMBIA ELECTRICITY GENERATION:
0.0186 kg CO_2e /kWh

SOURCE: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS IN CANADA, TABLE A13-11. AVAILABLE: En81-4-2019-3-eng.pdf (publications.gc.ca)

BRITISH COLUMBIA NATURAL GAS EMISSION INTENSITY:
1.940 kg CO_2e/m^3
= 0.1921 kg CO_2e/kWh

[1 m^3 Natural Gas = 10.1 kWh]

SOURCE: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS IN CANADA, TABLE A13-11. AVAILABLE: En81-4-2019-3-eng.pdf (publications.gc.ca)



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WHY AIR-TO-WATER FOR HYDRONIC SYSTEMS? EMISSIONS COMPARISON

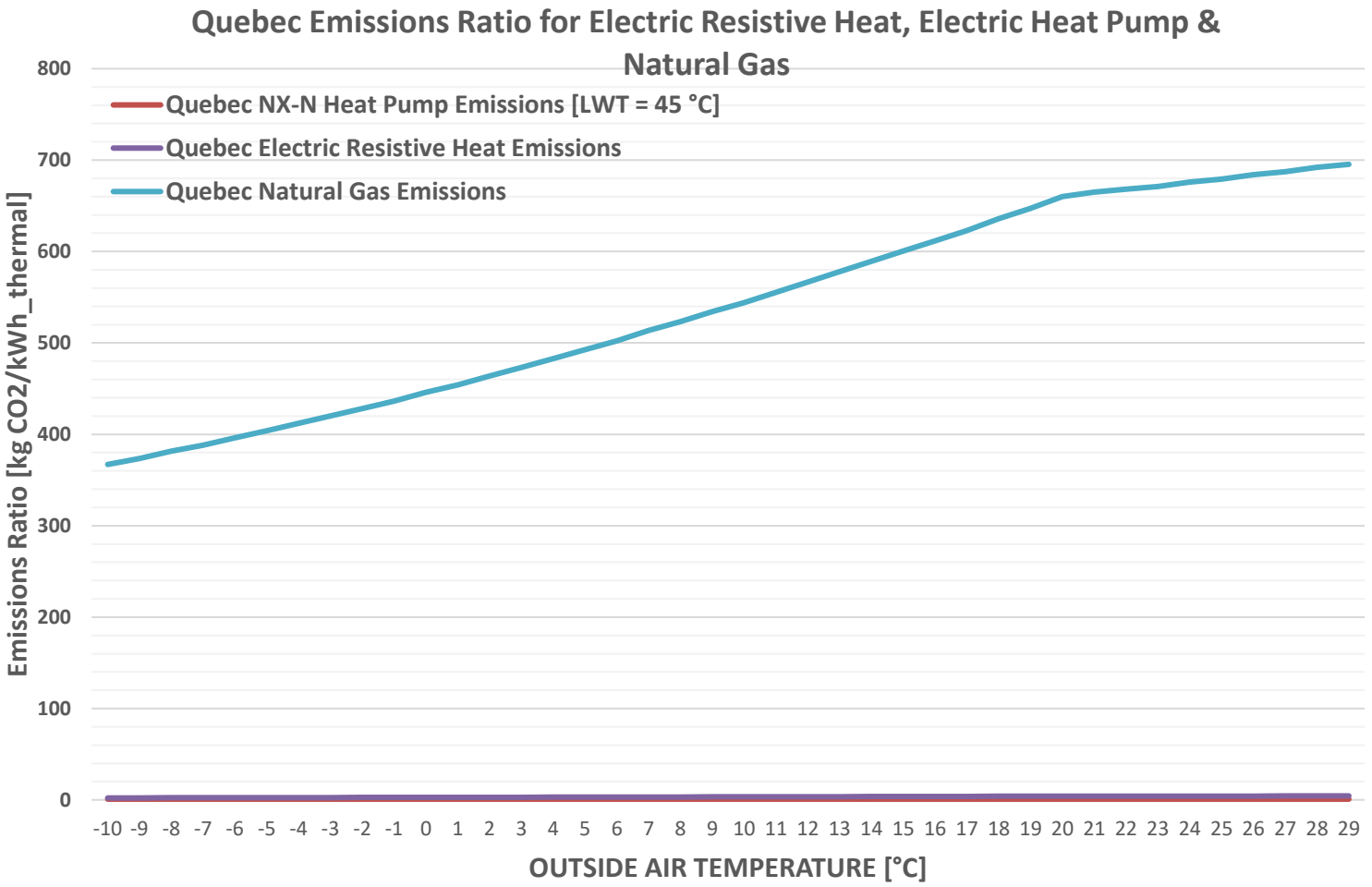
QUEBEC AVERAGE ELECTRICITY GENERATION:
0.0012 kg CO_2e /kWh

SOURCE: CANADA ENERGY REGULATOR
CER – Canada's Renewable Power Landscape 2017 - Energy Market Analysis - Greenhouse Gas Emissions (cer-rec.gc.ca)

NATURAL GAS EMISSION INTENSITY:
1.888 kg CO_2e/m^3
= 0.18693 kg CO_2e/kWh

[1 m^3 Natural Gas = 10.1 kWh]

SOURCE: ONTARIO MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE'S "GUIDELINE FOR QUANTIFICATION, REPORTING AND VERIFICATION FOR GHG EMISSIONS - JULY 2017", TABLE 400-2



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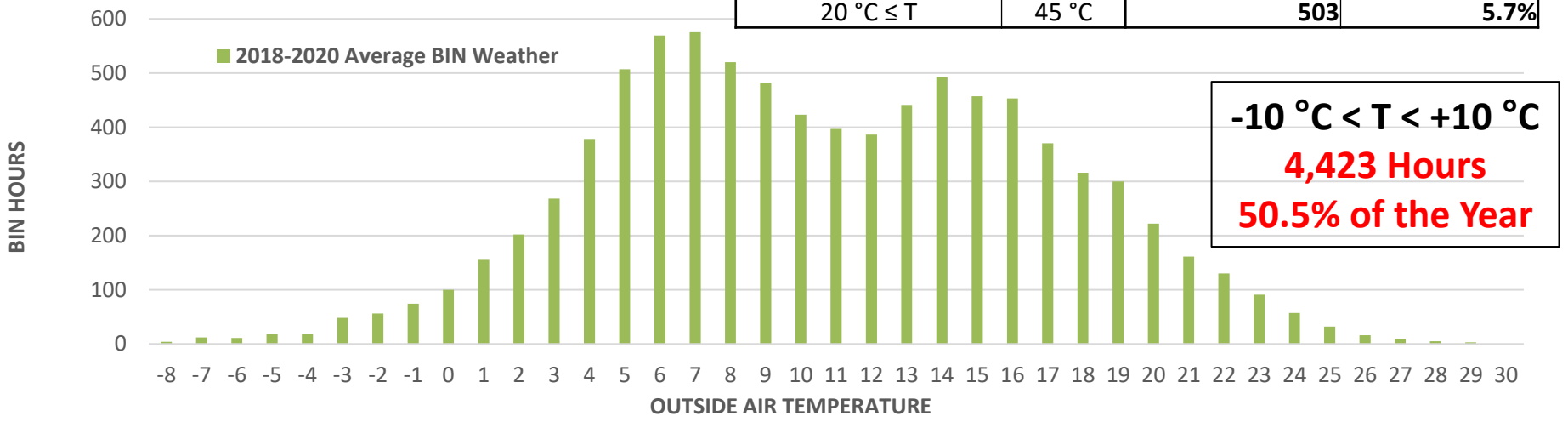
VANCOUVER WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: VANCOUVER, BC
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	-	0.0%
-15 °C ≤ T < -10 °C	35 °C	-	0.0%
-10 °C ≤ T < -5 °C	45 °C	27	0.3%
-5 °C ≤ T < 3 °C	50 °C	673	7.7%
3 °C ≤ T ≤ 10 °C	55 °C	3,723	42.5%
10 °C < T < 20 °C	52 °C	3,834	43.8%
20 °C ≤ T	45 °C	503	5.7%

VANCOUVER 3-YEAR AVERAGE BIN WEATHER DATA

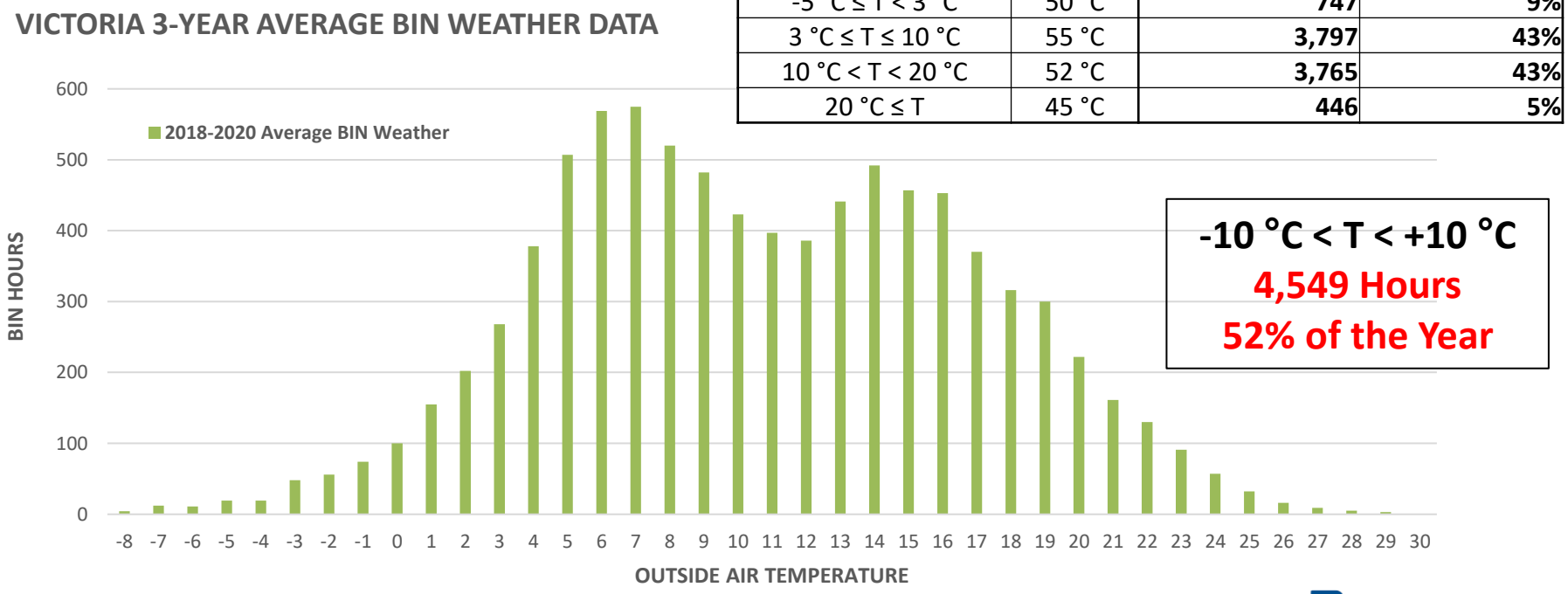


-10 °C < T < +10 °C
4,423 Hours
50.5% of the Year

VICTORIA WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: VICTORIA, BC
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	-	0%
-15 °C ≤ T < -10 °C	35 °C	-	0%
-10 °C ≤ T < -5 °C	45 °C	5	0%
-5 °C ≤ T < 3 °C	50 °C	747	9%
3 °C ≤ T ≤ 10 °C	55 °C	3,797	43%
10 °C < T < 20 °C	52 °C	3,765	43%
20 °C ≤ T	45 °C	446	5%



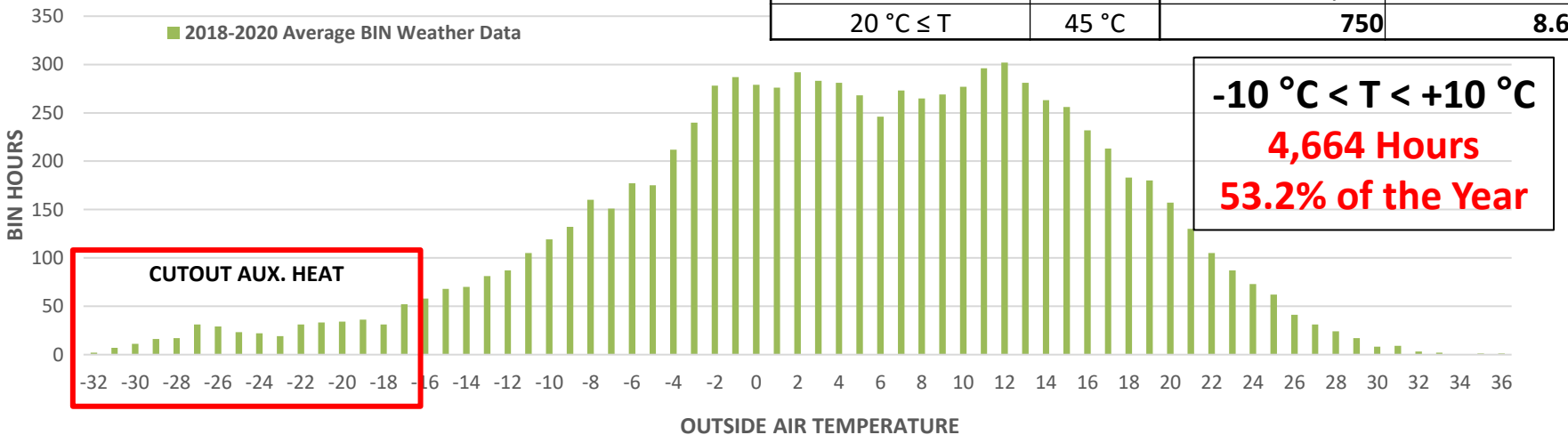
-10 °C < T < +10 °C
4,549 Hours
52% of the Year

CALGARY WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: CALGARY,AB
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**453**	**5.2%**
-15 °C ≤ T < -10 °C	35 °C	**411**	**4.7%**
-10 °C ≤ T < -5 °C	45 °C	**740**	**8.4%**
-5 °C ≤ T < 3 °C	50 °C	**2,040**	**23.3%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,884**	**21.5%**
10 °C < T < 20 °C	52 °C	**2,490**	**28.4%**
20 °C ≤ T	45 °C	**750**	**8.6%**

CALGARY 3-YEAR AVERAGE BIN WEATHER DATA



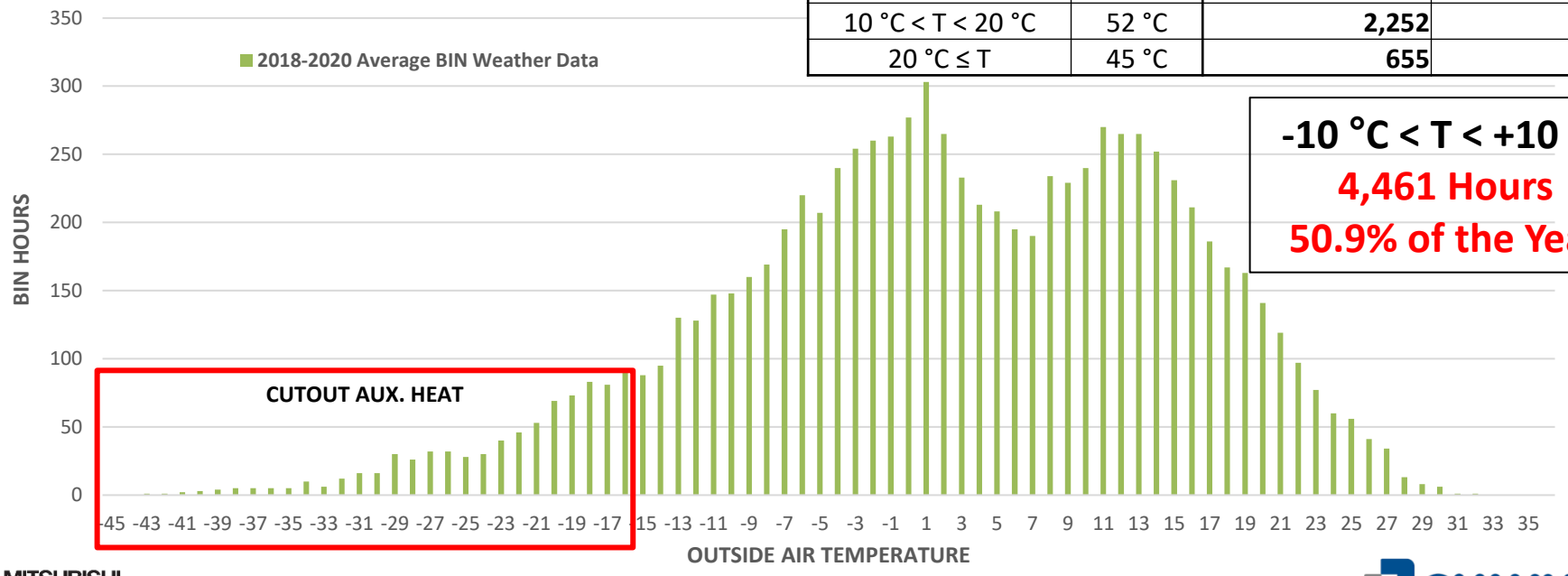
-10 °C < T < +10 °C
4,664 Hours
53.2% of the Year

EDMONTON WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: EDMONTON,AB
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**806**	**9%**
-15 °C ≤ T < -10 °C	35 °C	**588**	**7%**
-10 °C ≤ T < -5 °C	45 °C	**893**	**10%**
-5 °C ≤ T < 3 °C	50 °C	**2,069**	**24%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,499**	**17%**
10 °C < T < 20 °C	52 °C	**2,252**	**26%**
20 °C ≤ T	45 °C	**655**	**7%**

EDMONTON 3- YEAR AVERAGE BIN WEATHER DATA



-10 °C < T < +10 °C
4,461 Hours
50.9% of the Year

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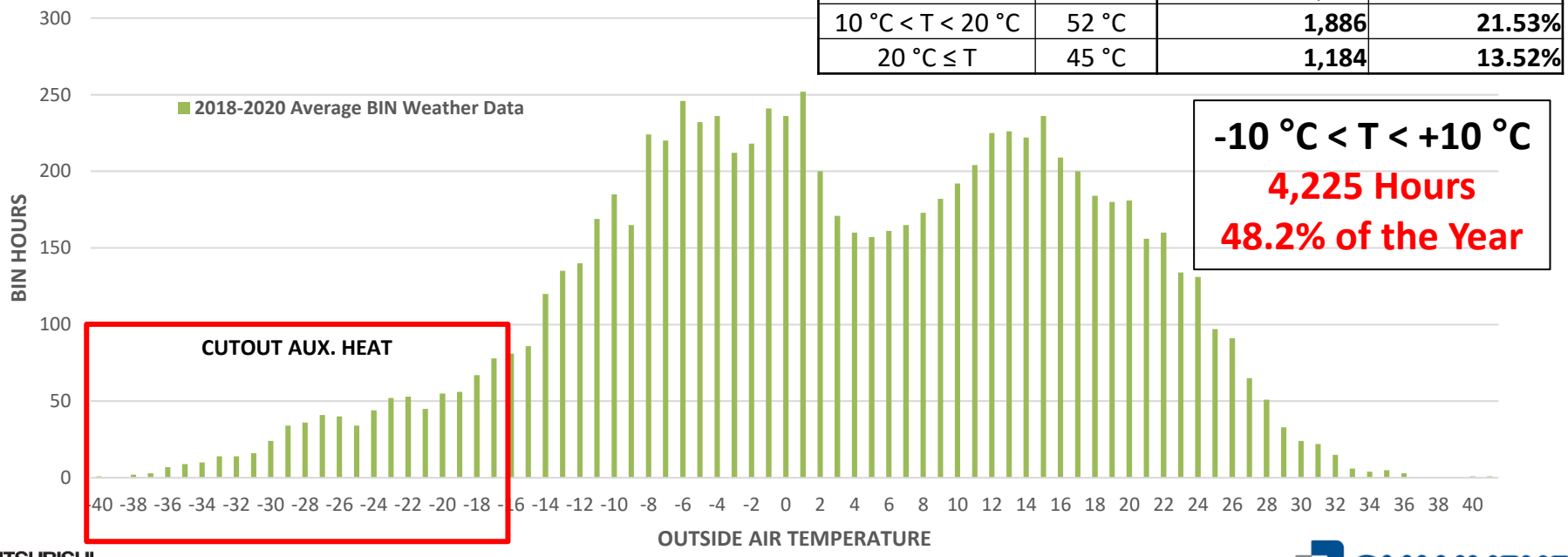
REGINA WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: REGINA, SK
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**815**	**9.30%**
-15 °C ≤ T < -10 °C	35 °C	**650**	**7.42%**
-10 °C ≤ T < -5 °C	45 °C	**1,038**	**11.85%**
-5 °C ≤ T < 3 °C	50 °C	**1,827**	**20.86%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,360**	**15.53%**
10 °C < T < 20 °C	52 °C	**1,886**	**21.53%**
20 °C ≤ T	45 °C	**1,184**	**13.52%**

REGINA 3-YEAR AVERAGE WEATHER BIN DATA



-10 °C < T < +10 °C
4,225 Hours
48.2% of the Year

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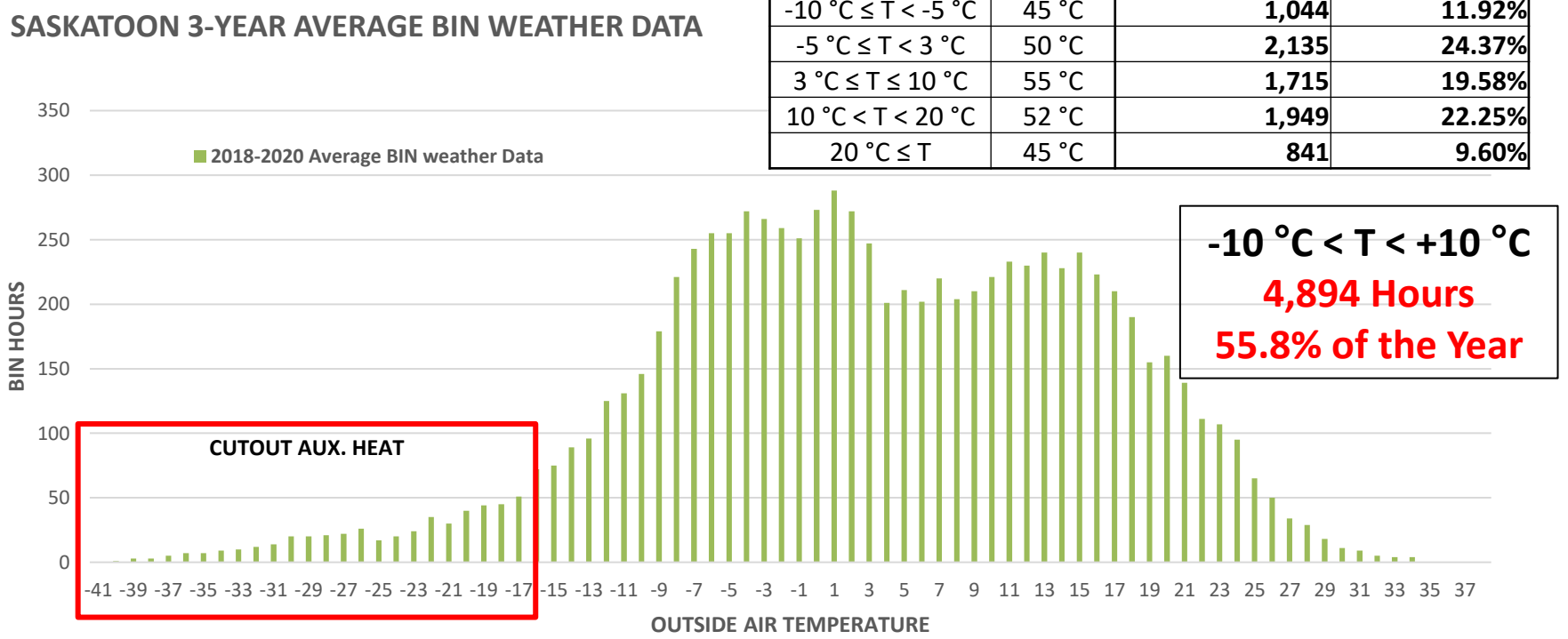
SASKATOON WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: SASKATOON,SK
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**560**	**6.39%**
-15 °C ≤ T < -10 °C	35 °C	**516**	**5.89%**
-10 °C ≤ T < -5 °C	45 °C	**1,044**	**11.92%**
-5 °C ≤ T < 3 °C	50 °C	**2,135**	**24.37%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,715**	**19.58%**
10 °C < T < 20 °C	52 °C	**1,949**	**22.25%**
20 °C ≤ T	45 °C	**841**	**9.60%**



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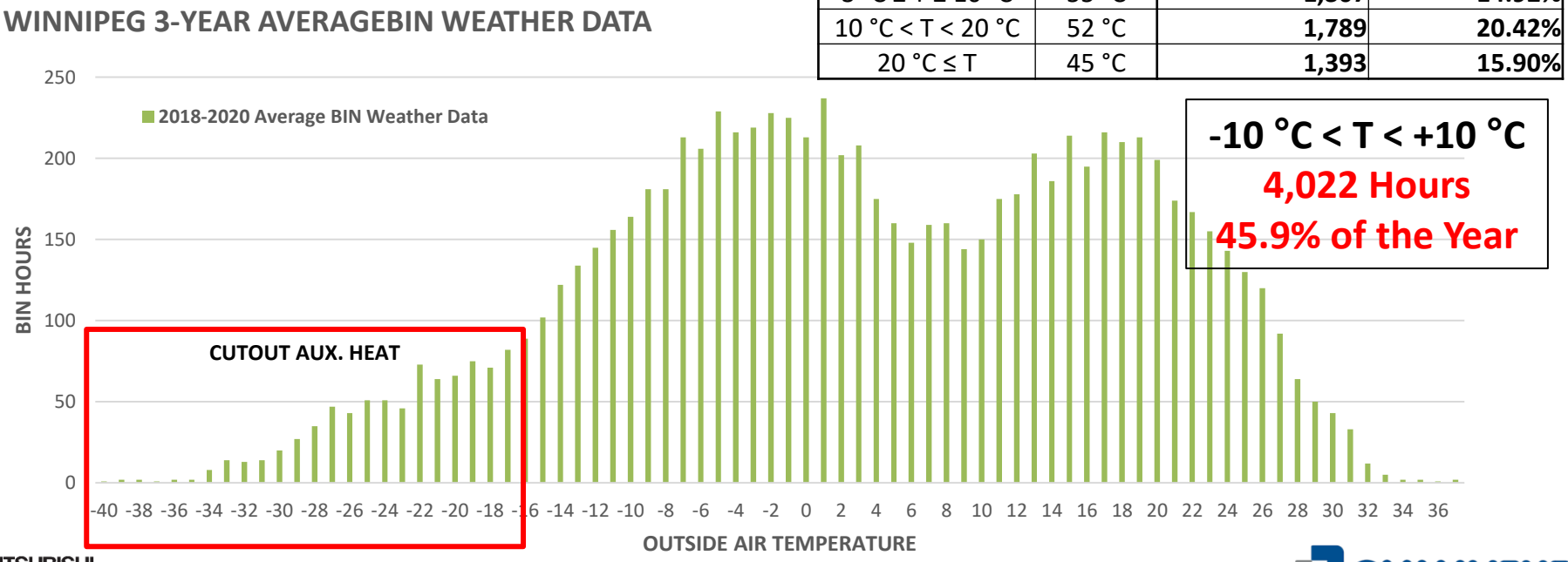
WINNIPEG WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: WINNIPEG, MB
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

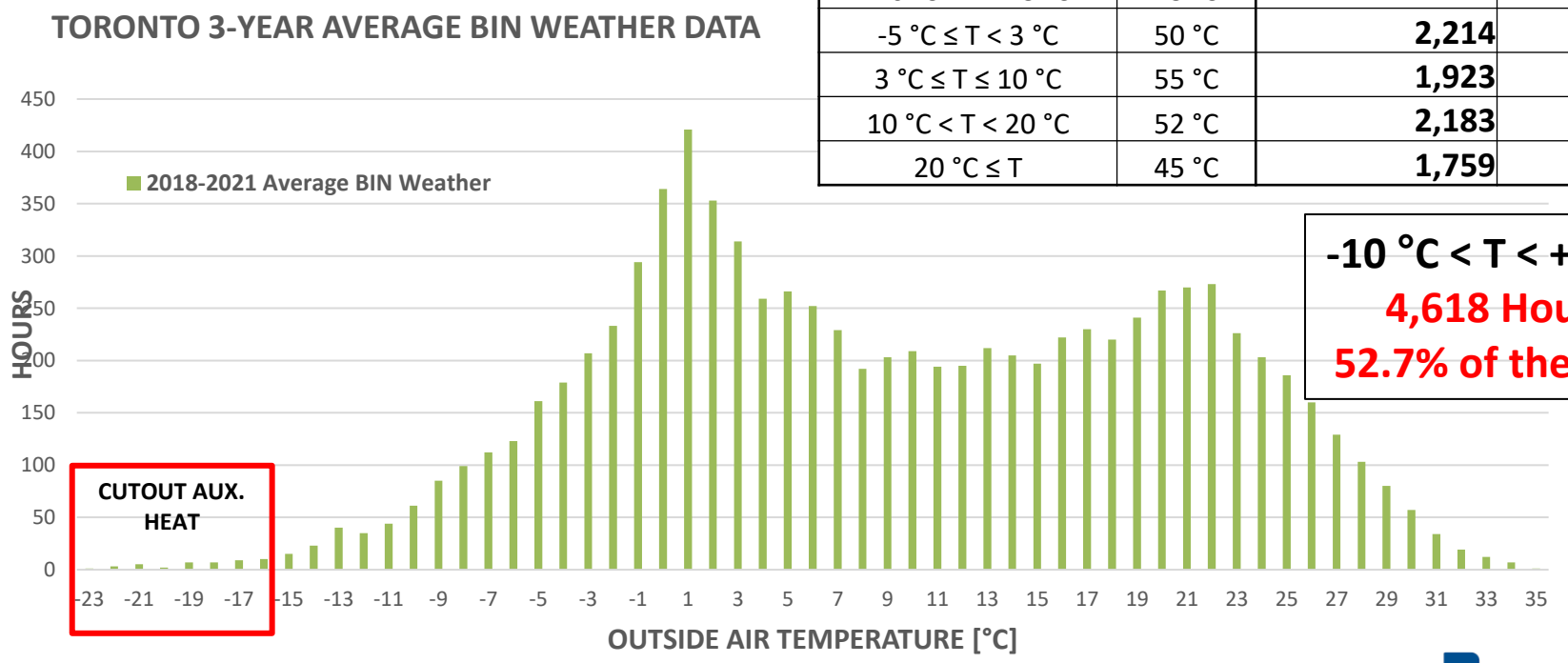
TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**897**	**10.24%**
-15 °C ≤ T < -10 °C	35 °C	**659**	**7.52%**
-10 °C ≤ T < -5 °C	45 °C	**945**	**10.79%**
-5 °C ≤ T < 3 °C	50 °C	**1,770**	**20.21%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,307**	**14.92%**
10 °C < T < 20 °C	52 °C	**1,789**	**20.42%**
20 °C ≤ T	45 °C	**1,393**	**15.90%**



TORONTO WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: TORONTO, ON
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**44**	**0.5%**
-15 °C ≤ T < -10 °C	35 °C	**157**	**1.8%**
-10 °C ≤ T < -5 °C	45 °C	**481**	**5.5%**
-5 °C ≤ T < 3 °C	50 °C	**2,214**	**25.3%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,923**	**21.9%**
10 °C < T < 20 °C	52 °C	**2,183**	**24.9%**
20 °C ≤ T	45 °C	**1,759**	**20.1%**



-10 °C < T < +10 °C
4,618 Hours
52.7% of the Year

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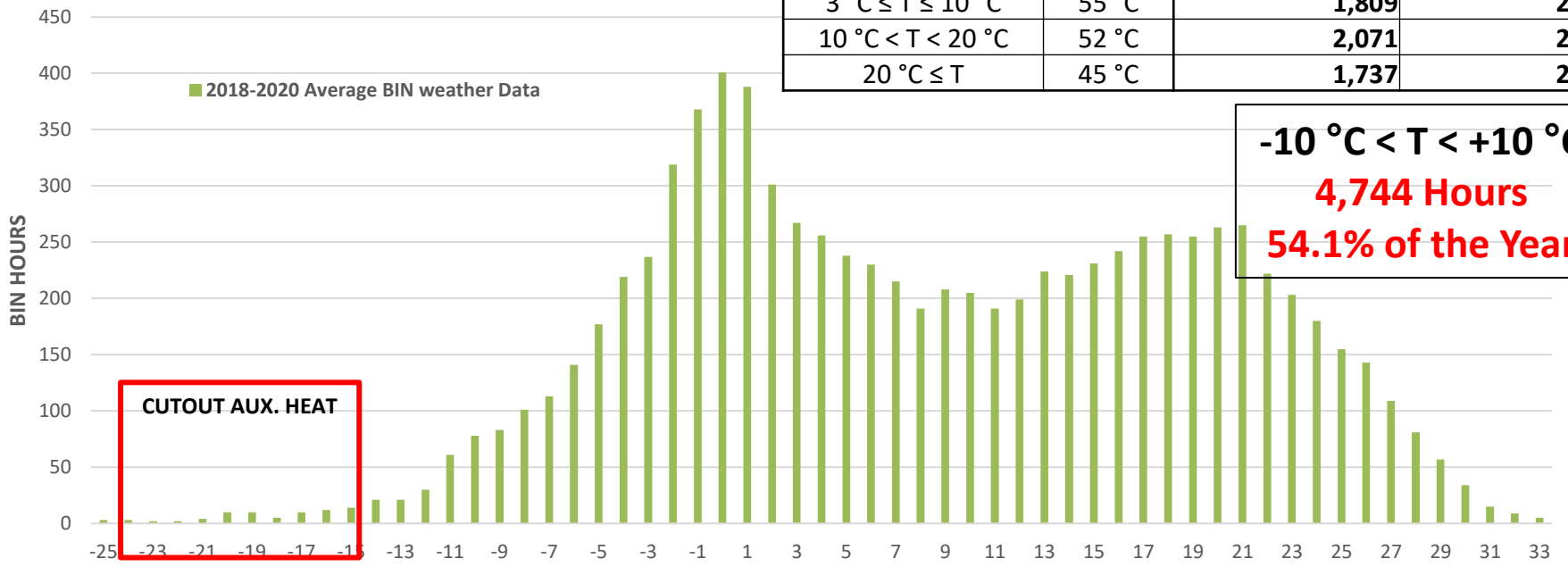
LONDON WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: LONDON,ON
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**61**	**1%**
-15 °C ≤ T < -10 °C	35 °C	**147**	**2%**
-10 °C ≤ T < -5 °C	45 °C	**522**	**6%**
-5 °C ≤ T < 3 °C	50 °C	**2,413**	**28%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,809**	**21%**
10 °C < T < 20 °C	52 °C	**2,071**	**24%**
20 °C ≤ T	45 °C	**1,737**	**20%**

-10 °C < T < +10 °C
4,744 Hours
54.1% of the Year

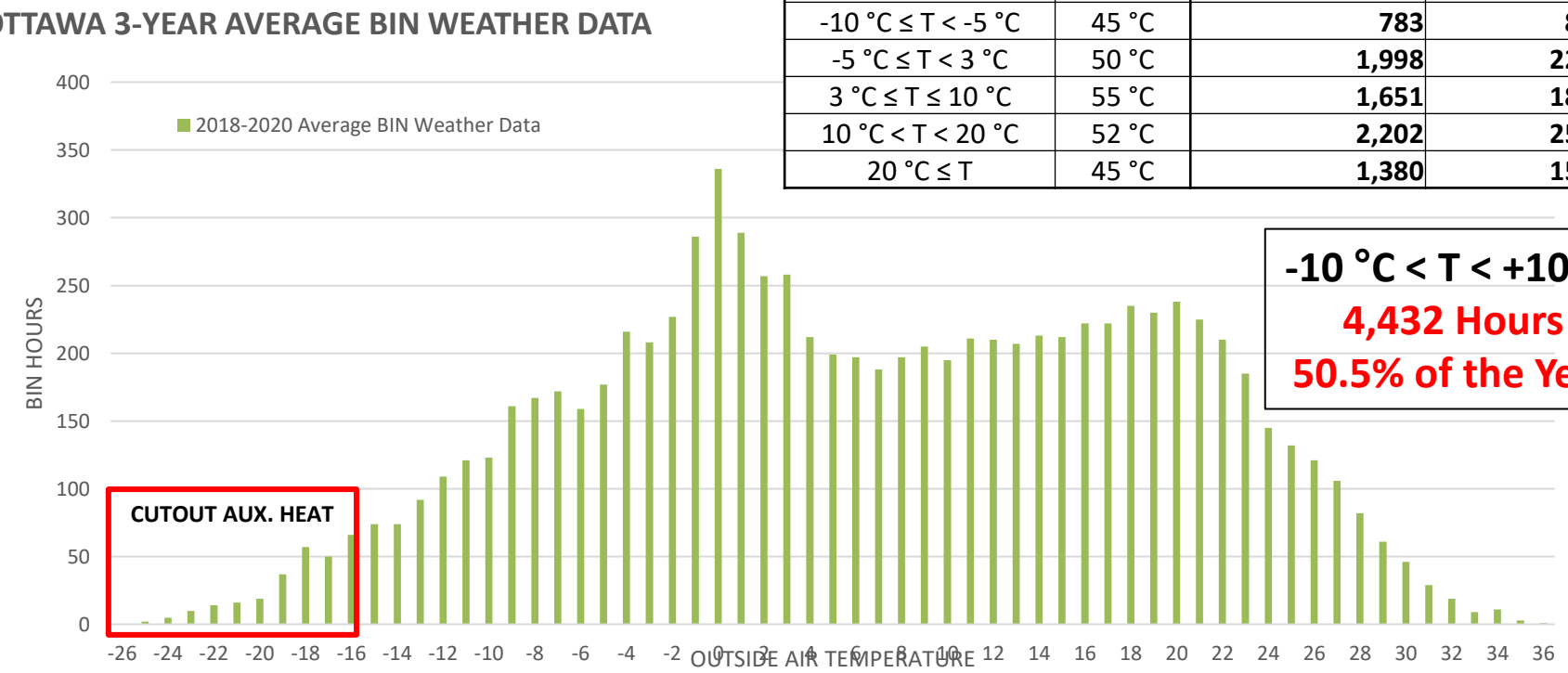
LONDON 3-YEAR AVERAGE BIN WEATHER DATA



OTTAWA WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: OTTAWA,ON
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**277**	**3.16%**
-15 °C ≤ T < -10 °C	35 °C	**469**	**5.35%**
-10 °C ≤ T < -5 °C	45 °C	**783**	**8.94%**
-5 °C ≤ T < 3 °C	50 °C	**1,998**	**22.81%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,651**	**18.85%**
10 °C < T < 20 °C	52 °C	**2,202**	**25.14%**
20 °C ≤ T	45 °C	**1,380**	**15.75%**



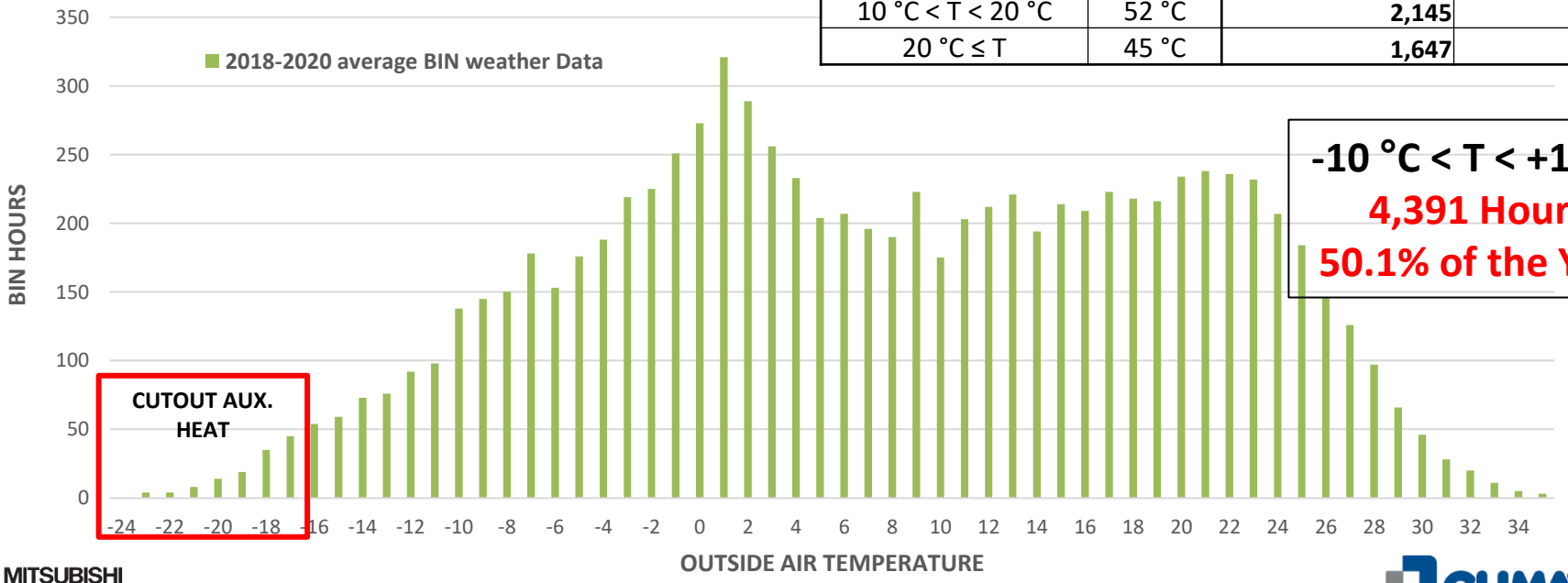
-10 °C < T < +10 °C
4,432 Hours
50.5% of the Year

MONTREAL WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: MONTREAL,QC
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	185	2%
-15 °C ≤ T < -10 °C	35 °C	401	5%
-10 °C ≤ T < -5 °C	45 °C	765	9%
-5 °C ≤ T < 3 °C	50 °C	1,942	22%
3 °C ≤ T ≤ 10 °C	55 °C	1,684	19%
10 °C < T < 20 °C	52 °C	2,145	24%
20 °C ≤ T	45 °C	1,647	19%

MONTREAL 3-YEAR AVERAGE BIN WEATHER DATA

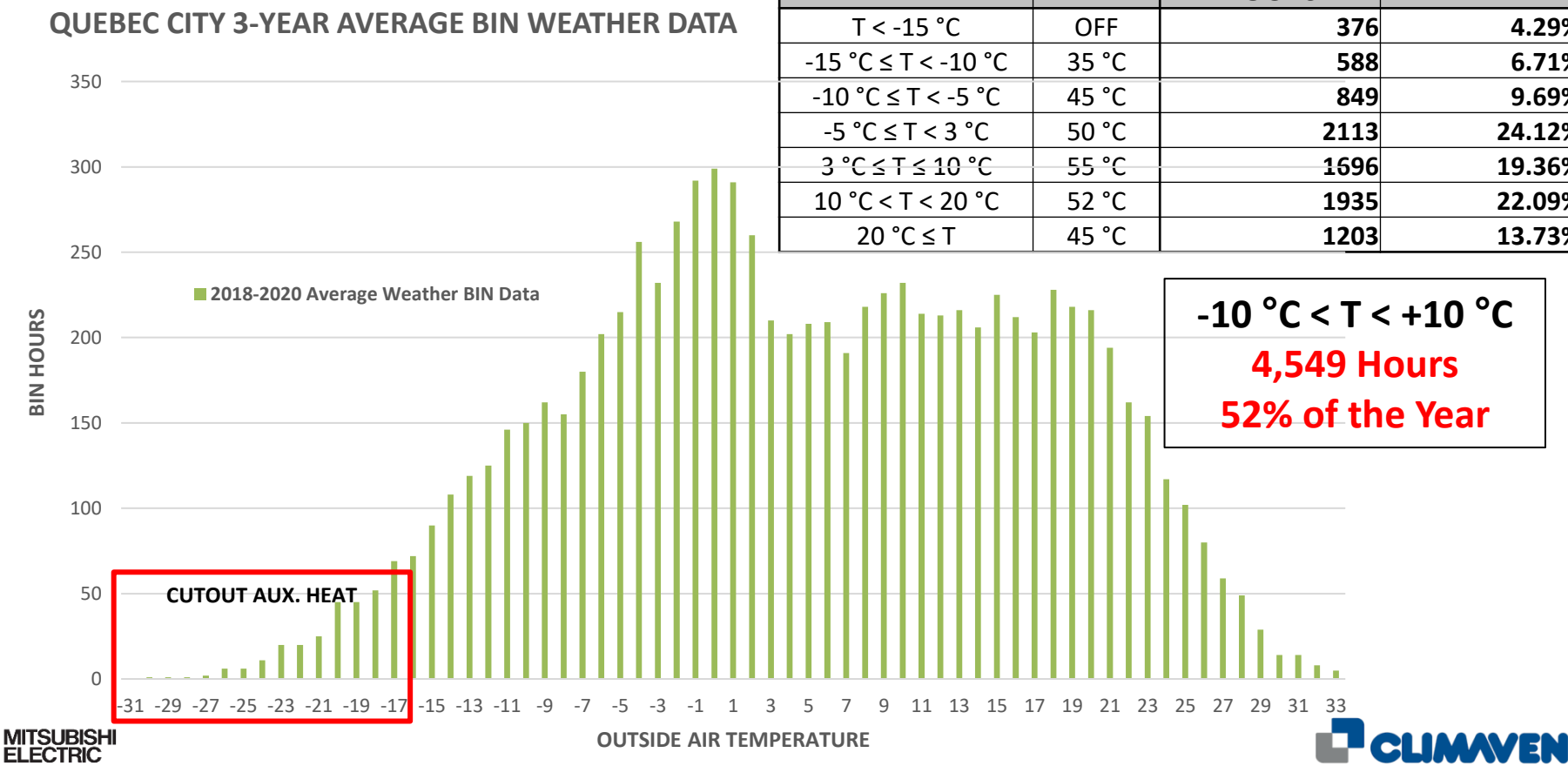


-10 °C < T < +10 °C
4,391 Hours
50.1% of the Year

QUEBEC CITY WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: QUEBEC CITY,QC
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**376**	**4.29%**
-15 °C ≤ T < -10 °C	35 °C	**588**	**6.71%**
-10 °C ≤ T < -5 °C	45 °C	**849**	**9.69%**
-5 °C ≤ T < 3 °C	50 °C	**2113**	**24.12%**
3 °C ≤ T ≤ 10 °C	55 °C	**1696**	**19.36%**
10 °C < T < 20 °C	52 °C	**1935**	**22.09%**
20 °C ≤ T	45 °C	**1203**	**13.73%**

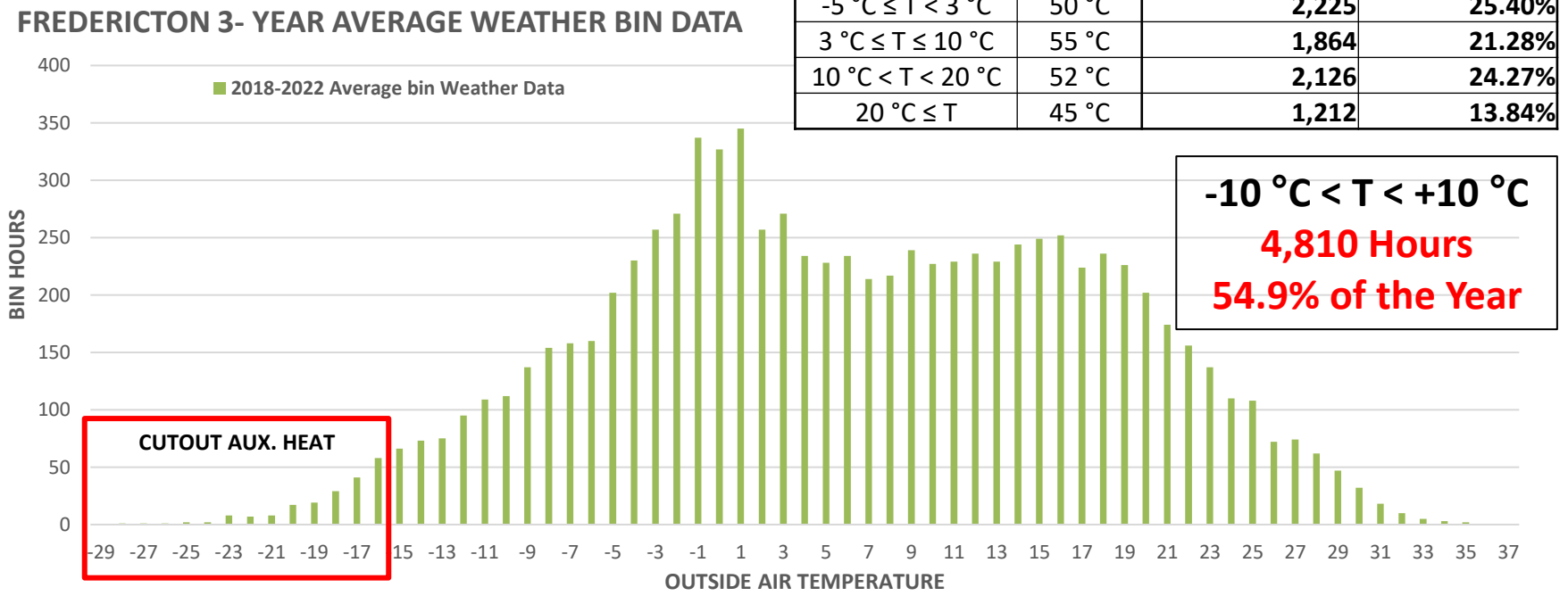


-10 °C < T < +10 °C
4,549 Hours
52% of the Year

FREDERICTON WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: FREDERICTON, NS
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**194**	**2.21%**
-15 °C ≤ T < -10 °C	35 °C	**418**	**4.77%**
-10 °C ≤ T < -5 °C	45 °C	**721**	**8.23%**
-5 °C ≤ T < 3 °C	50 °C	**2,225**	**25.40%**
3 °C ≤ T ≤ 10 °C	55 °C	**1,864**	**21.28%**
10 °C < T < 20 °C	52 °C	**2,126**	**24.27%**
20 °C ≤ T	45 °C	**1,212**	**13.84%**

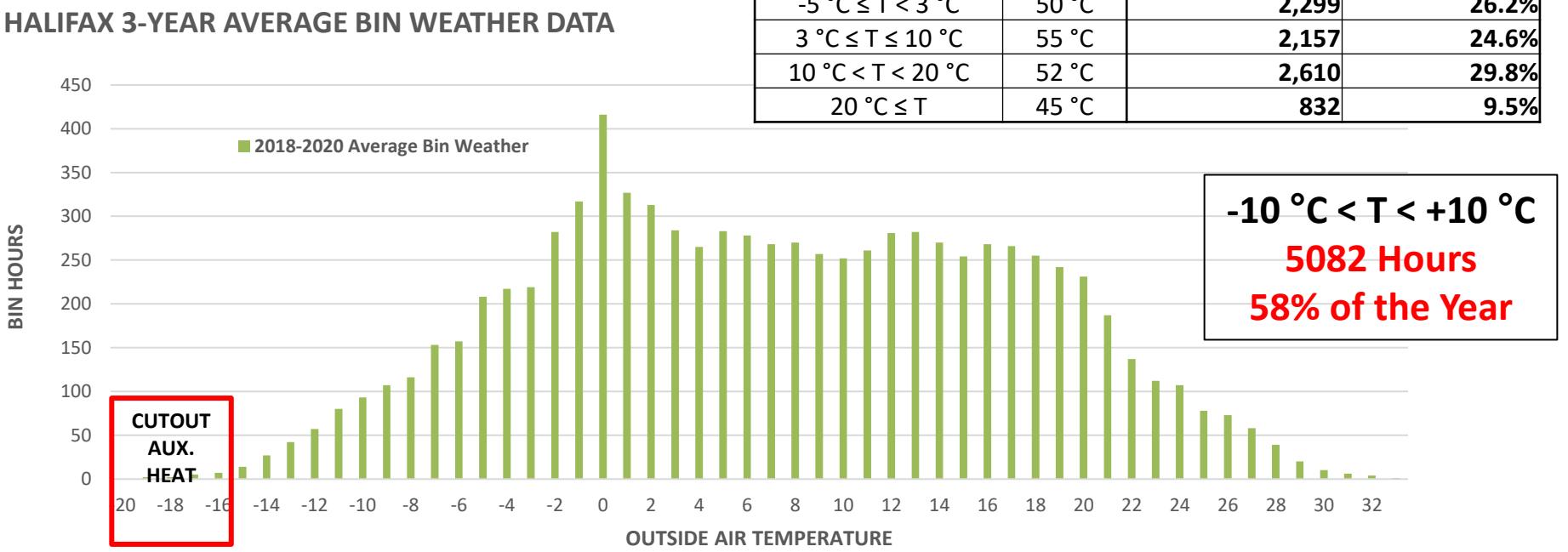


-10 °C < T < +10 °C
4,810 Hours
54.9% of the Year

HALIFAX WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: HALIFAX,NS
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

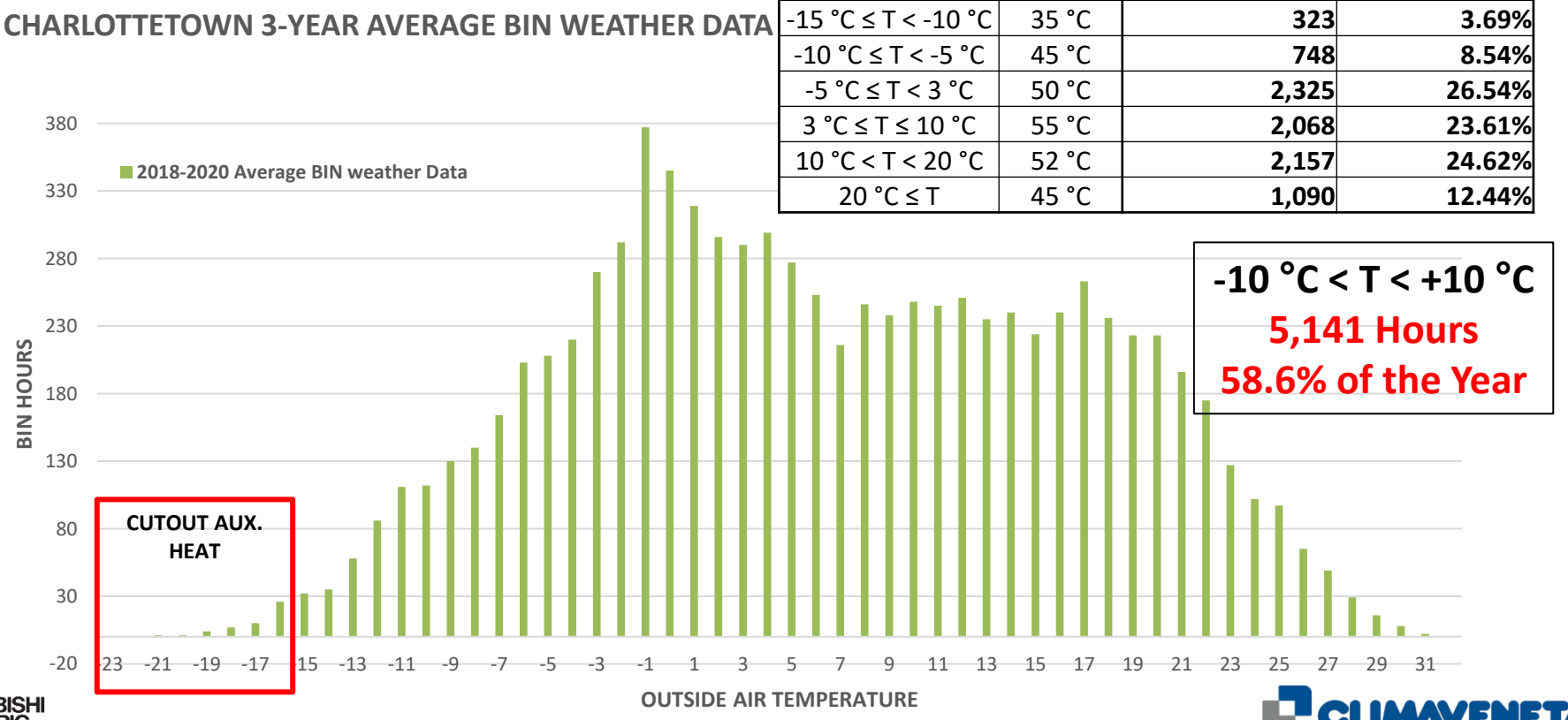
TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**17**	**0.2%**
-15 °C ≤ T < -10 °C	35 °C	**220**	**2.5%**
-10 °C ≤ T < -5 °C	45 °C	**626**	**7.1%**
-5 °C ≤ T < 3 °C	50 °C	**2,299**	**26.2%**
3 °C ≤ T ≤ 10 °C	55 °C	**2,157**	**24.6%**
10 °C < T < 20 °C	52 °C	**2,610**	**29.8%**
20 °C ≤ T	45 °C	**832**	**9.5%**



CHARLOTTETOWN WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: CHARLOTTETOWN, PEI
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**49**	**0.56%**
-15 °C ≤ T < -10 °C	35 °C	**323**	**3.69%**
-10 °C ≤ T < -5 °C	45 °C	**748**	**8.54%**
-5 °C ≤ T < 3 °C	50 °C	**2,325**	**26.54%**
3 °C ≤ T ≤ 10 °C	55 °C	**2,068**	**23.61%**
10 °C < T < 20 °C	52 °C	**2,157**	**24.62%**
20 °C ≤ T	45 °C	**1,090**	**12.44%**



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Heating and Cooling

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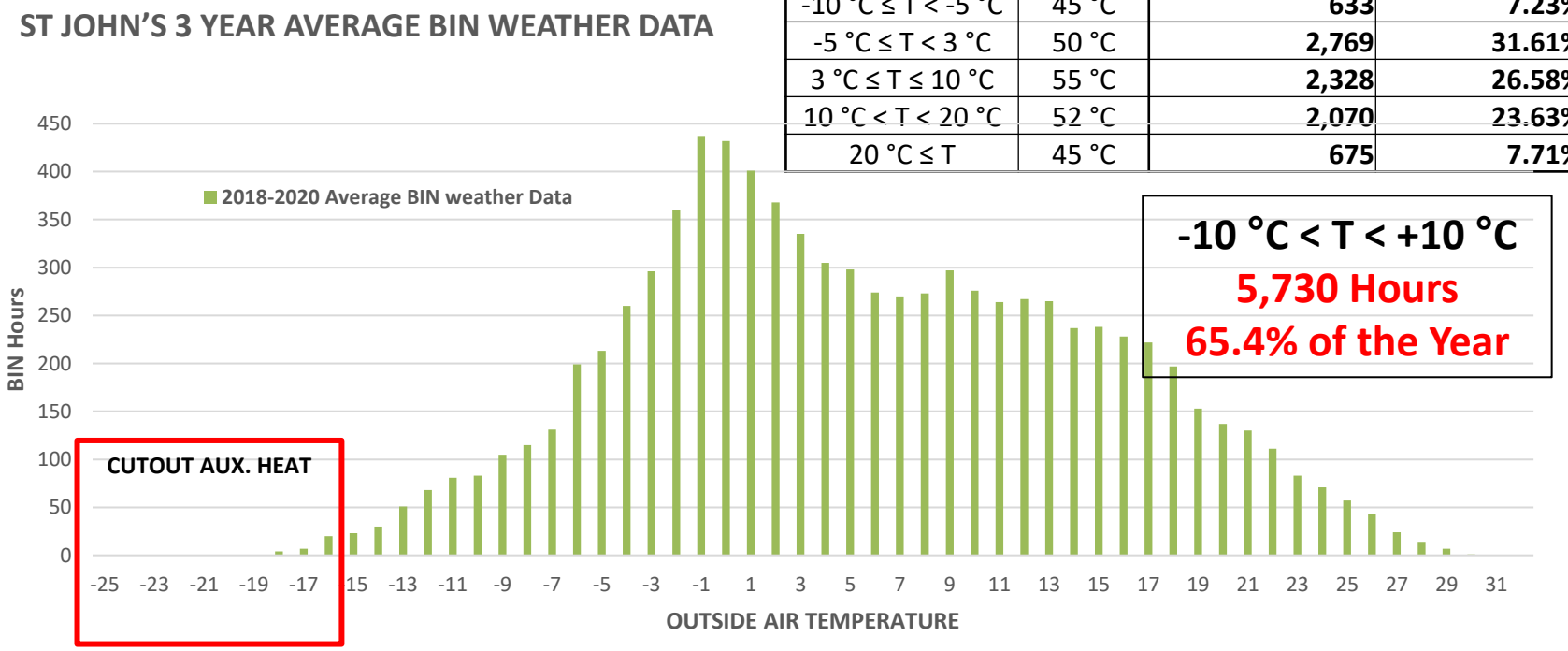
ST JOHN'S WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: ST JOHN'S, NFLD
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

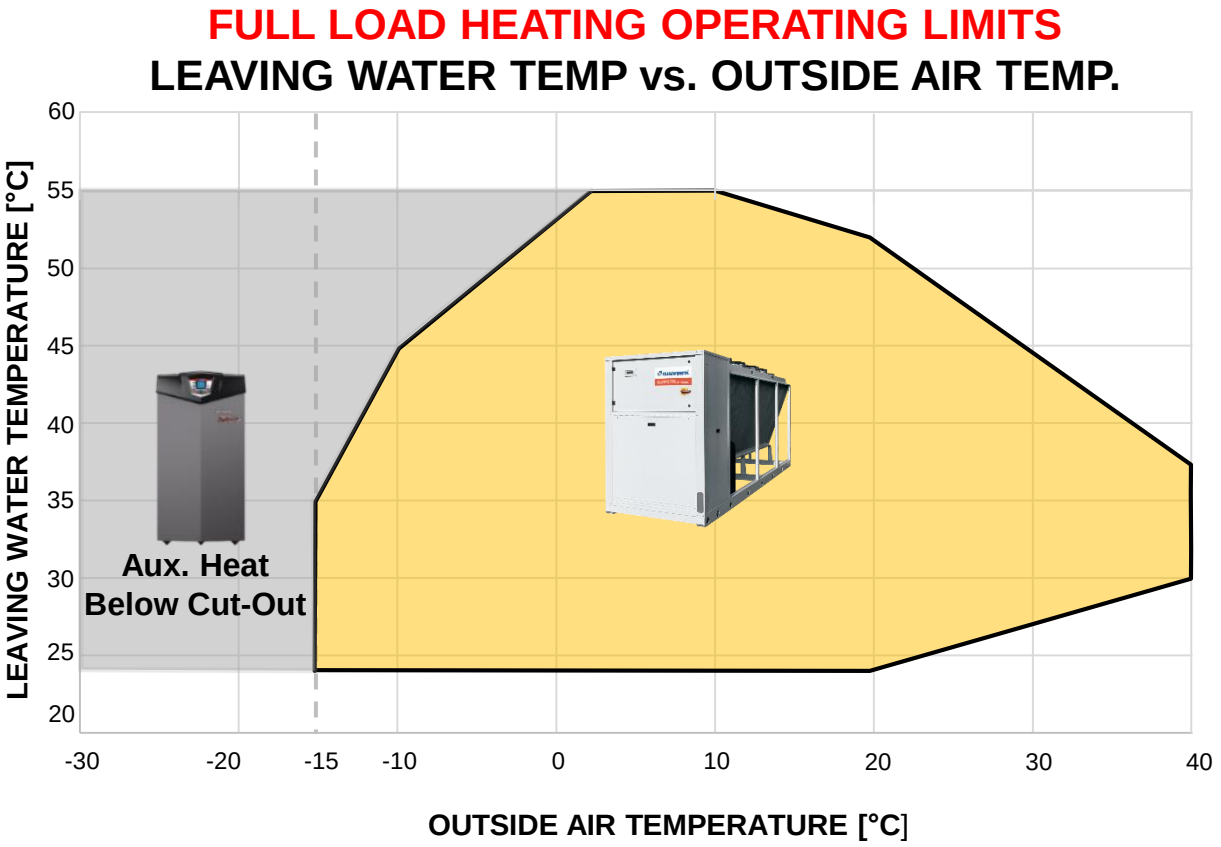
TEMPERATURE RANGE	MAX LWT IN RANGE	3-YEAR AVERAGE ANNUAL HOURS	3-YEAR AVERAGE % OF HOURS
T < -15 °C	OFF	**31**	**0.35%**
-15 °C ≤ T < -10 °C	35 °C	**254**	**2.90%**
-10 °C ≤ T < -5 °C	45 °C	**633**	**7.23%**
-5 °C ≤ T < 3 °C	50 °C	**2,769**	**31.61%**
3 °C ≤ T ≤ 10 °C	55 °C	**2,328**	**26.58%**
10 °C < T < 20 °C	52 °C	**2,070**	**23.63%**
20 °C ≤ T	45 °C	**675**	**7.71%**



AIR-TO-WATER HEAT PUMP: DESIGN CONSIDERATIONS

- UNDERSTAND THE INFLUENCE OF OUTSIDE AIR TEMPERATURE
- DESIGN HYDRONIC SYSTEM BASED ON HEAT PUMP CAPABILITIES INSTEAD OF FITTING INTO EXISTING DESIGN PRACTICES
- HEAT PUMP PERFORMANCE VARIES WITH OUTSIDE AIR TEMPERATURE:
  1. SUPPLY TEMPERATURE REDUCTION (OPERATING ENVELOPE)
  2. CAPACITY REDUCTION
  3. COEFFICIENT OF PERFORMANCE REDUCTION
  4. DEFROSTING CYCLES

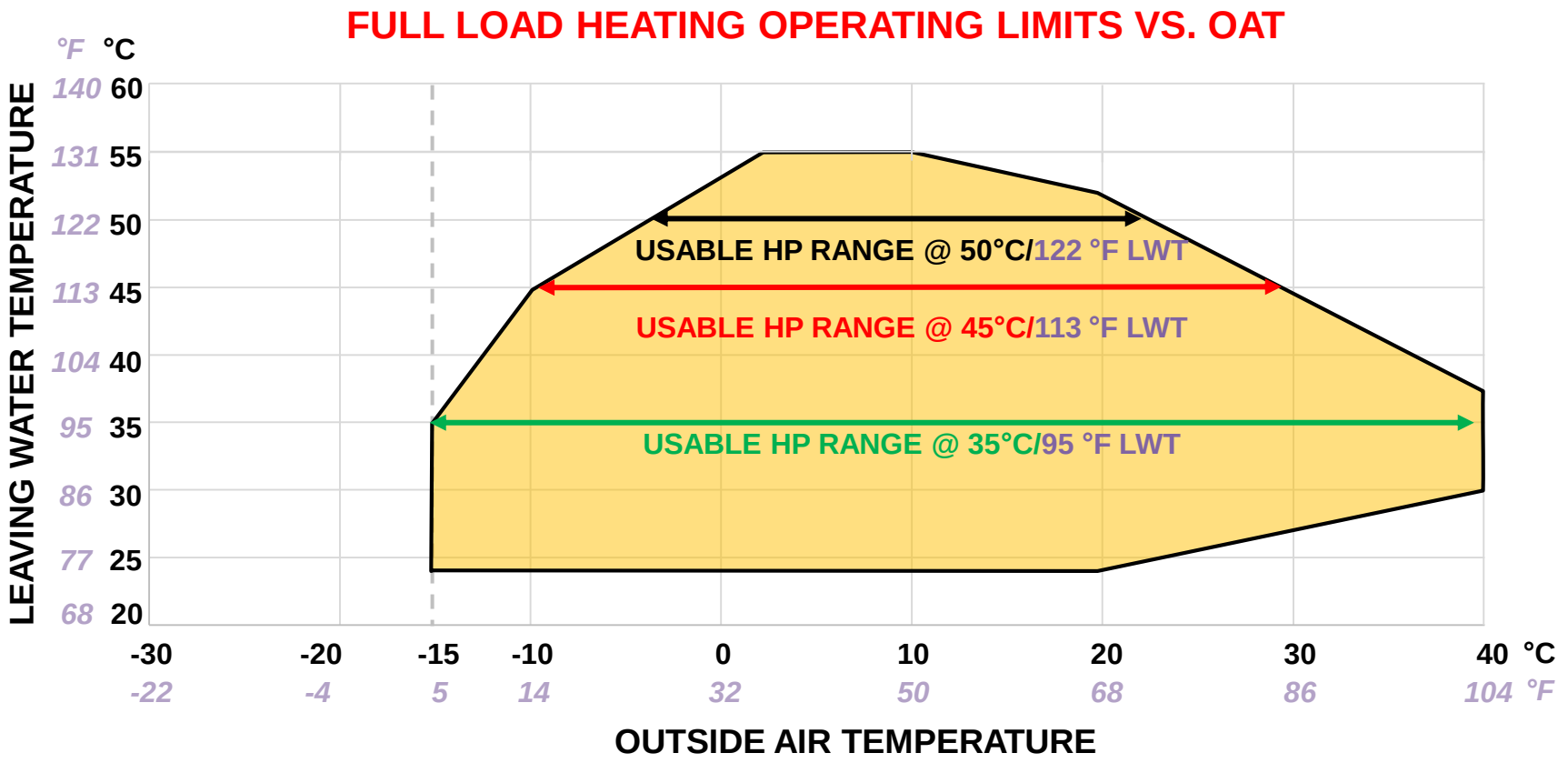
AIR-TO-WATER HEAT PUMP: OPERATING ENVELOPE



DESIGN POINT SELECTION:

- Relationship Between **OUTSIDE AIR TEMPERATURE** & **SUPPLY TEMPERATURE**
- **CAPACITY** Reduction As **OUTSIDE AIR TEMPERATURE** Decreases
- **AUXILIARY BOILER WHEN NEEDED:**
  - **NATURAL GAS** (Operating Cost)
  - **ELECTRIC** (Zero-Carbon)
- **BOILER OPERATION:**
  - **SUPPLEMENT** ATW HP Capacity
  - **REPLACE** ATW HP As Heat Source (BIVALENCE Change-Over)

AIR-TO-WATER HEAT PUMP OPERATING ENVELOPE: SUPPLY TEMPERATURE SELECTION

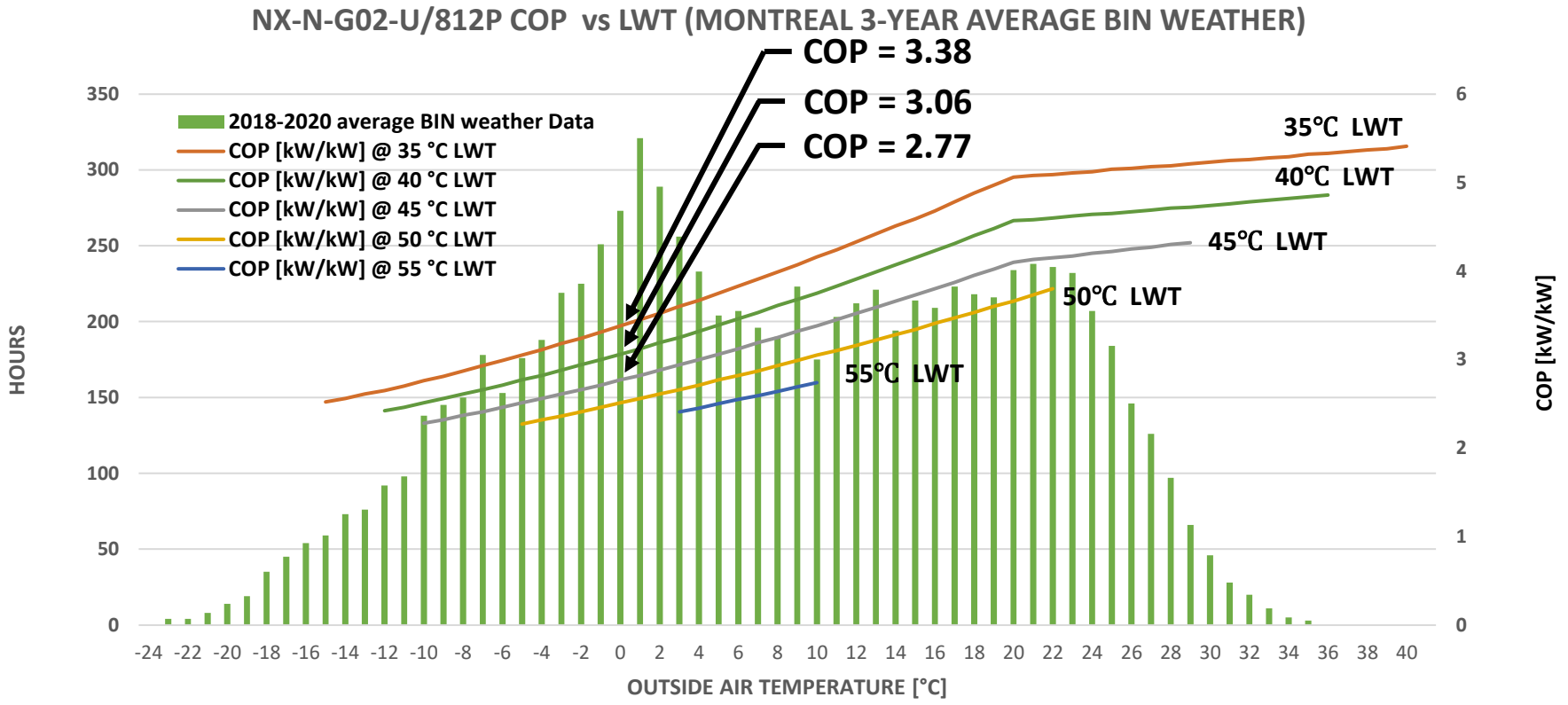


MONTREAL WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: MONTREAL,QC

PERIOD ANALYZED: APRIL 2018 - APRIL 2020

2020 s/b 2021



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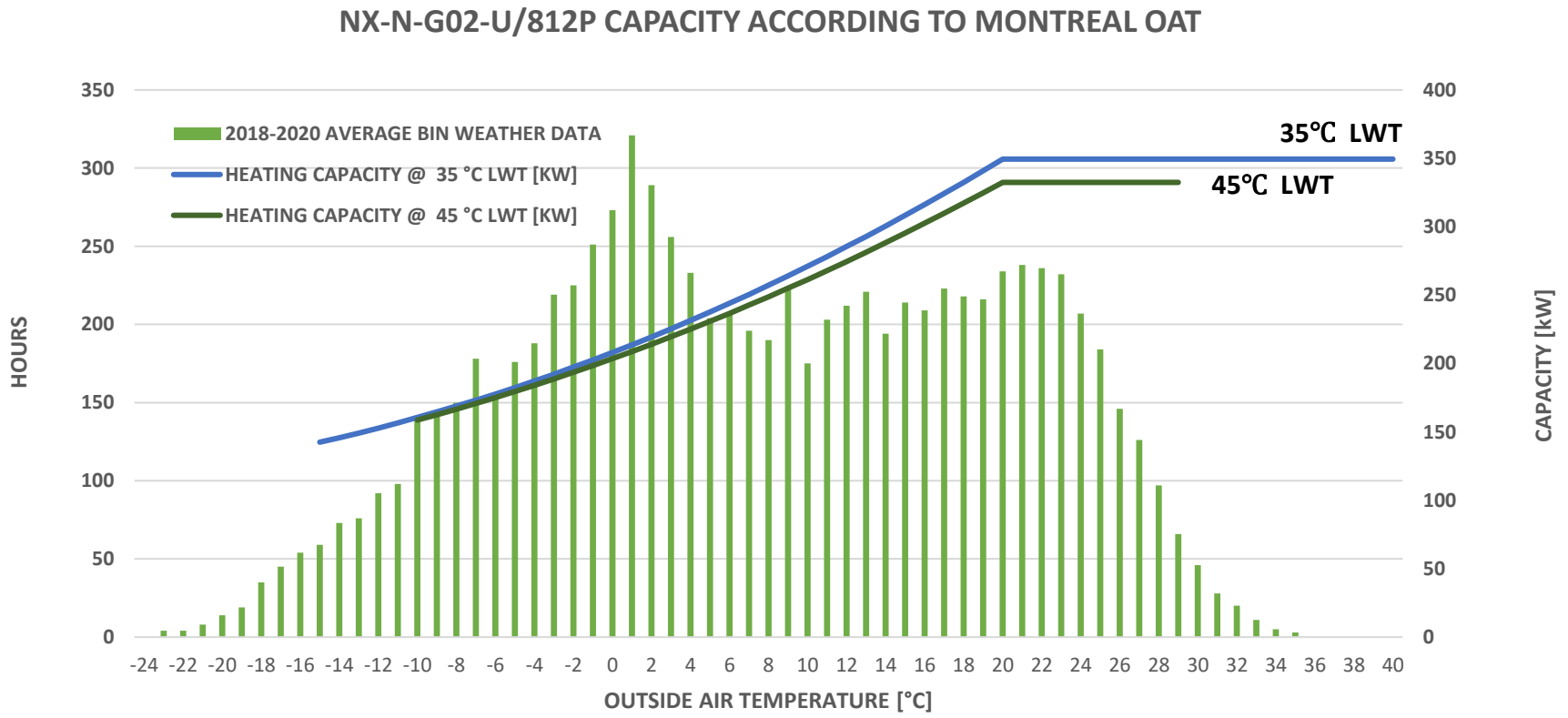
MONTREAL WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: MONTREAL,QC
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

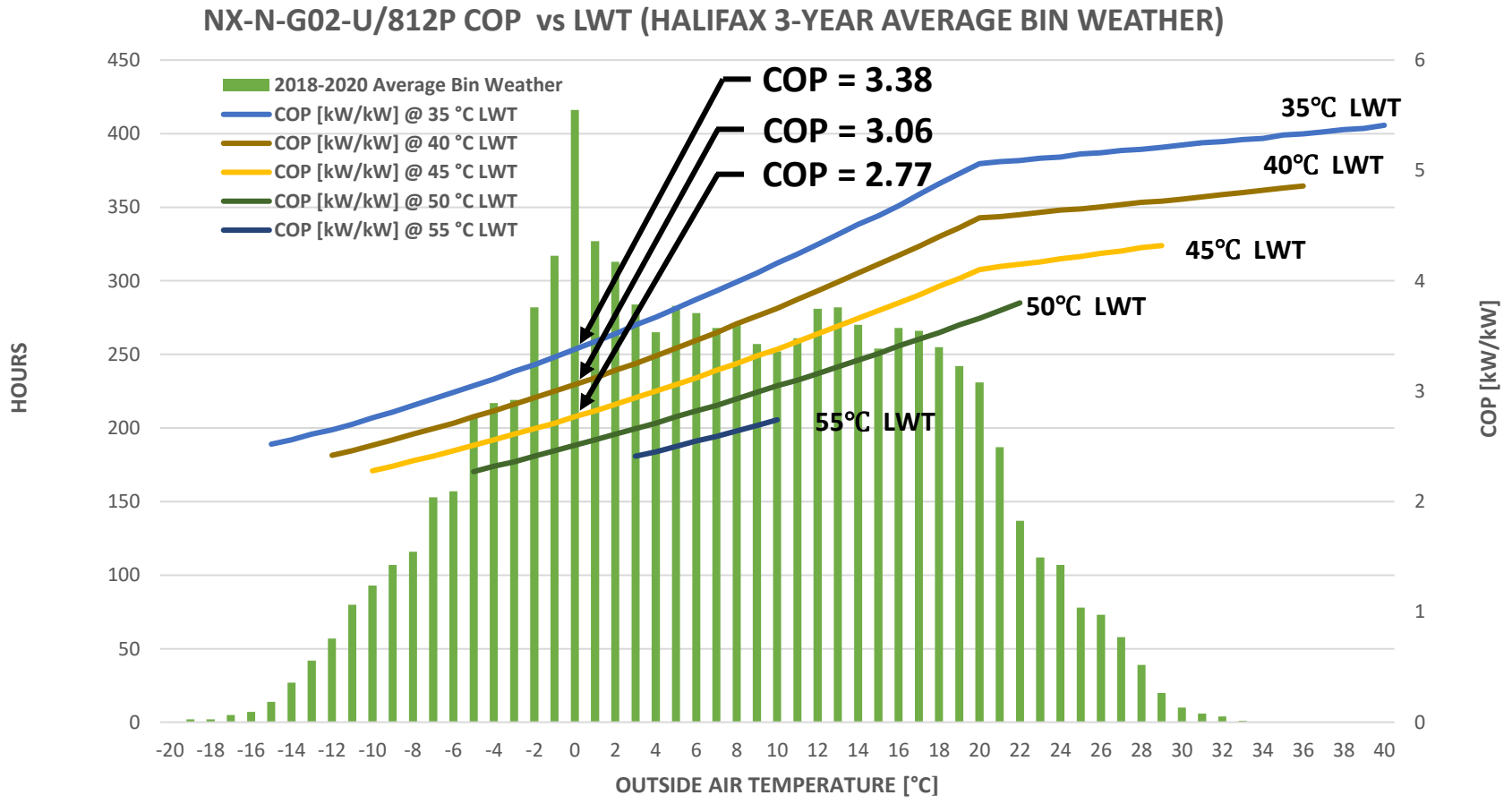
2020 s/b 2021



HALIFAX WEATHER DATA: ENVIRONMENT CANADA

BIN TEMPERATURE PROFILE: HALIFAX,NS
PERIOD ANALYZED: APRIL 2018 - APRIL 2020

2020 s/b 2021



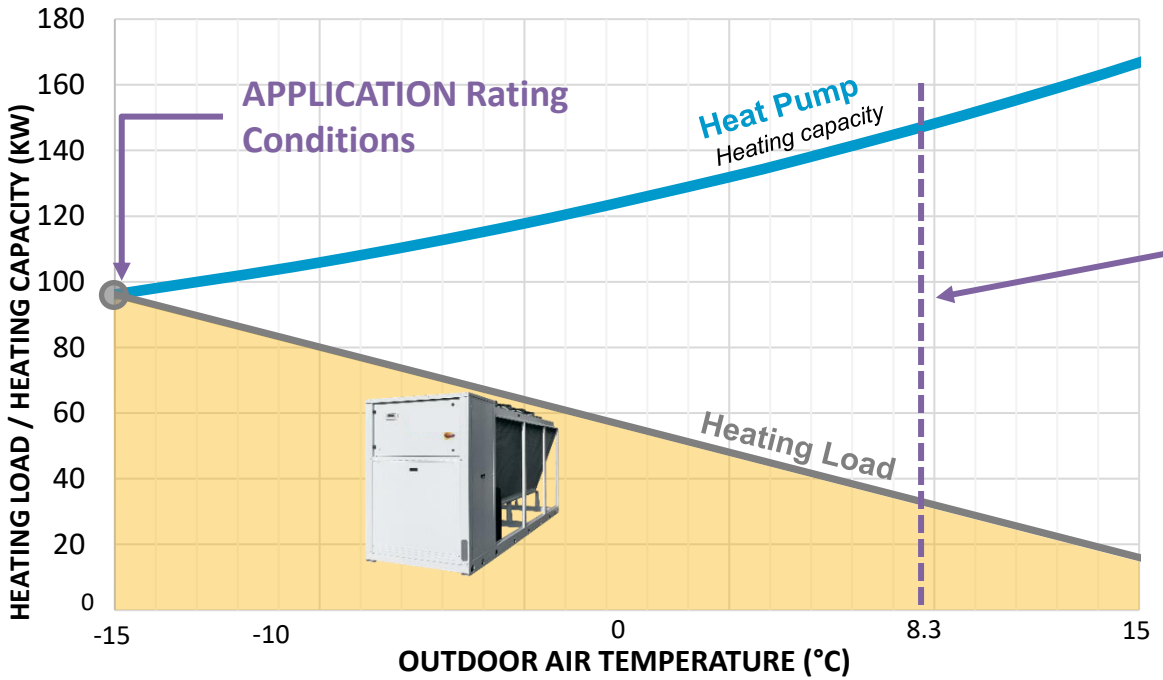
AIR-TO-WATER HEAT PUMP: SIZING FOR HEATING

NX-N /502P

138 kW ATW HP (NOMINAL)

REVERSIBLE UNIT, AIR SOURCE FOR OUTDOOR INSTALLATION

HEATING CAPACITY VS. HEATING LOAD



1 139 kW 502P

AHRI 550 Standard Rating Conditions = 8.3 °C OAT

Heat Pump 100%

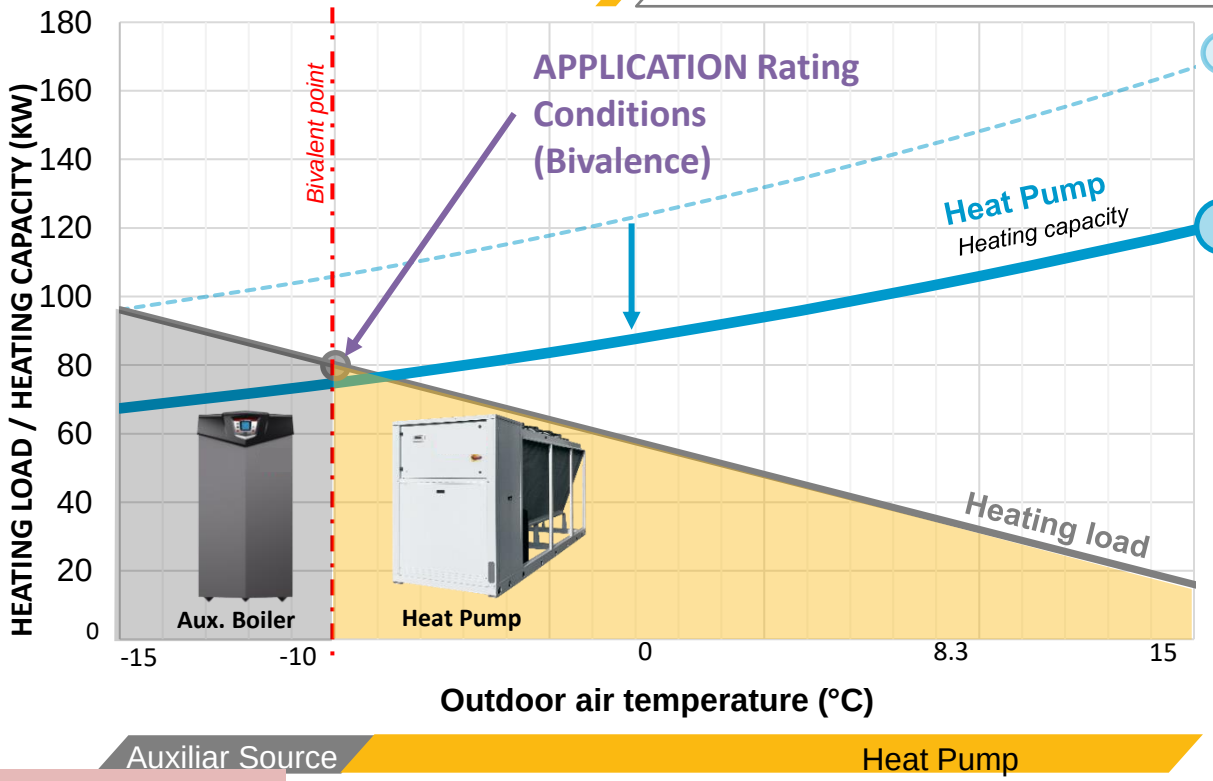
AIR-TO-WATER HEAT PUMP: SIZING FOR HEATING

HEATING CAPACITY VS. HEATING LOAD

NX-N /352P

99 kW ATW HP (NOMINAL)

REVERSIBLE UNIT, AIR SOURCE FOR OUTDOOR INSTALLATION



1	139 kW	502P
	120 kW	452P
	108 kW	402P
2	**99 kW**	**352P**

PRICE

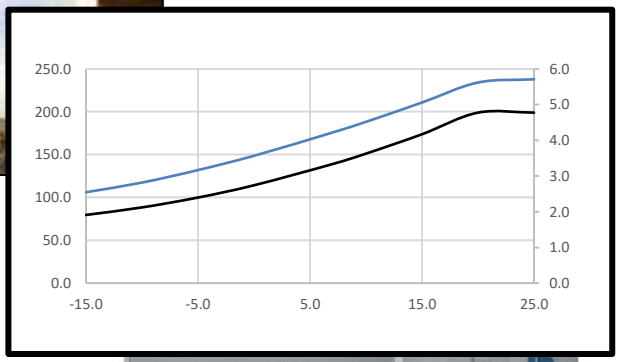
FOOTPRINT

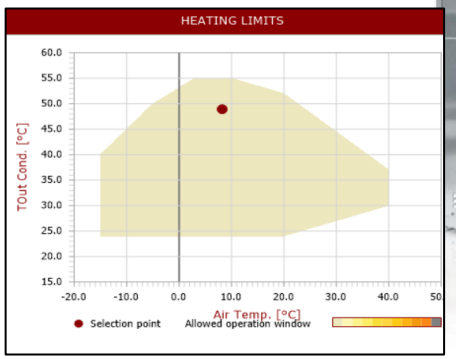
Auxiliar s/b Auxiliary

NX-N STANDARD FREEZE PROTECTION FEATURES

NX-N Series Standard Low Ambient Features:

- ✓ Outdoor Coil Heater + Drain Pan Heaters
- ✓ Indoor Heat Exchanger Freeze Protection:
  - ✓ Heat Exchanger Immersion Heater
  - ✓ Differential Pressure Switch across Indoor HX
  - ✓ Pump “Sniffer” Function
  - ✓ Double Layer Insulation on HX
  - ✓ Heat Tracing + Insulation (Hydronic Module)
- ✓ Auto-Adaptive Defrost Control





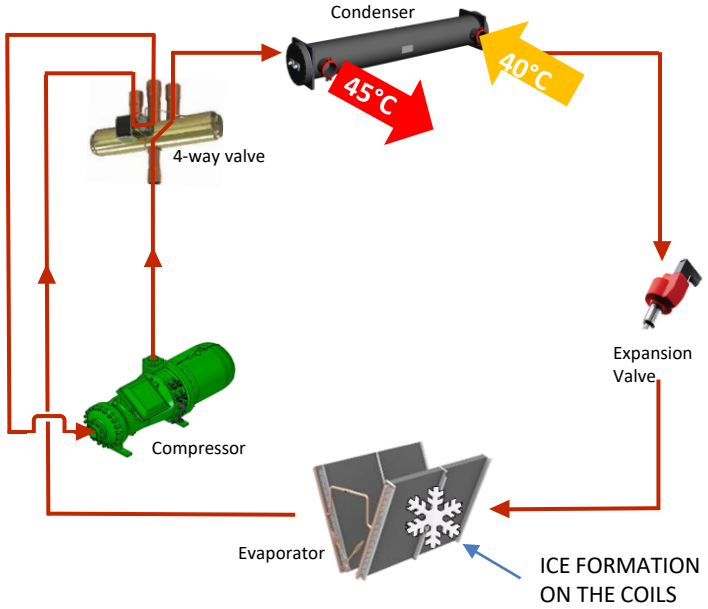
DEFROSTING CYCLES

The ice formation on the coils leads to **an increase in thermal resistance of the tubes and increasing pressure drops on the air side**. This phenomenon **compounds** itself, allowing the **formation of more ice**.

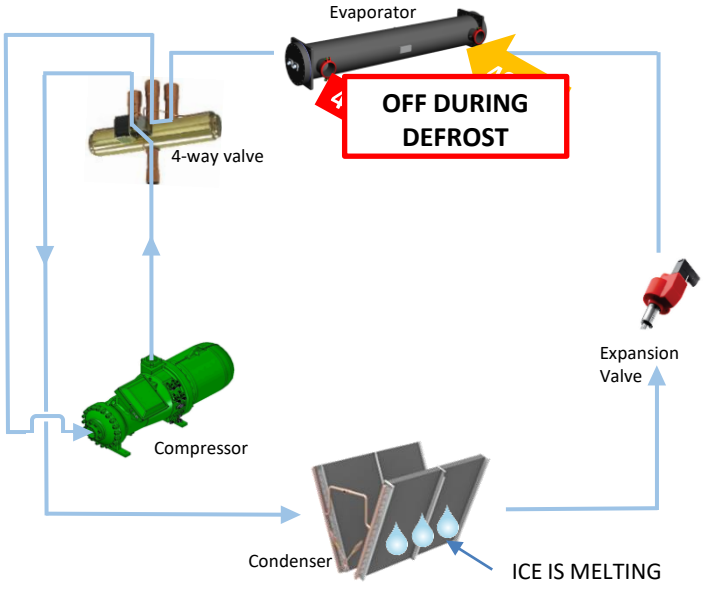
DE-FROSTING CYCLES ARE NEEDEED:

The refrigerant cycle is Reversed and high-pressure hot refrigerant is sent to the finned coil, fans are stopped to allow the ice to melt.

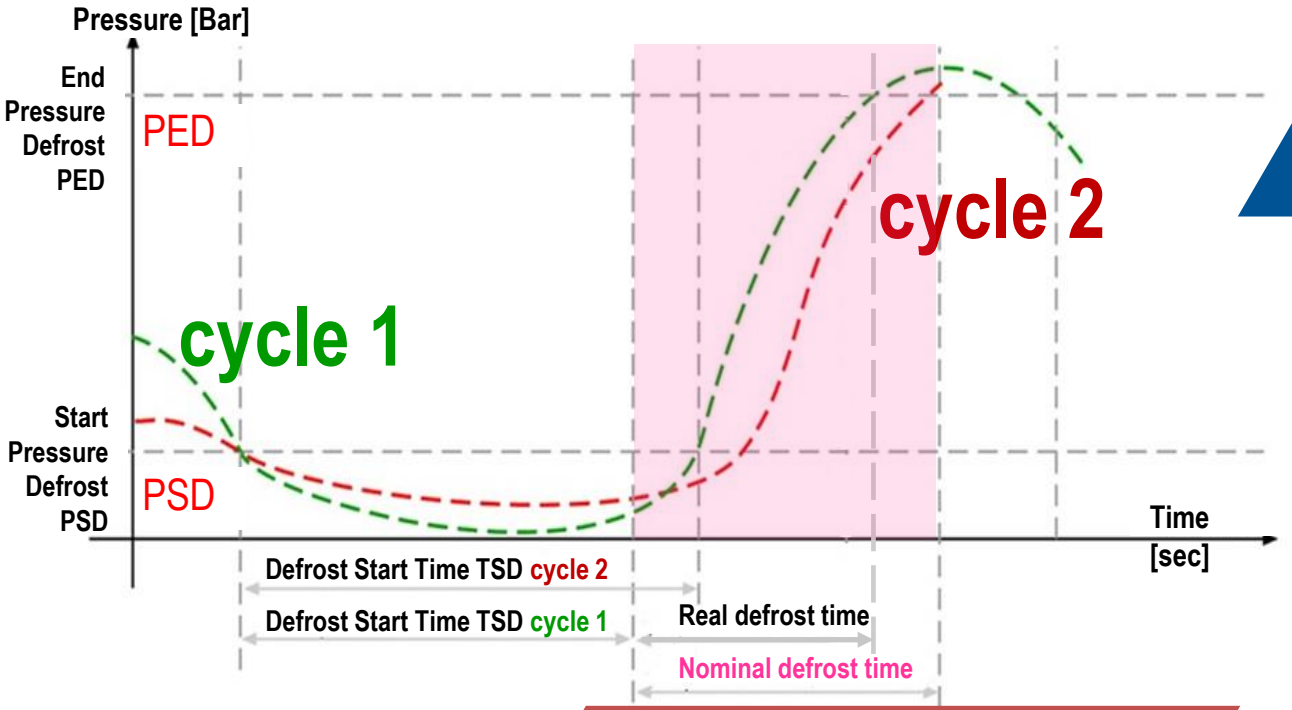
Heat pump in **HEATING MODE**



Heat pump in **DEFROST MODE**



AUTO-ADAPTIVE DEFROSTING



AUTO-ADAPTIVE DEFROSTING BENEFITS

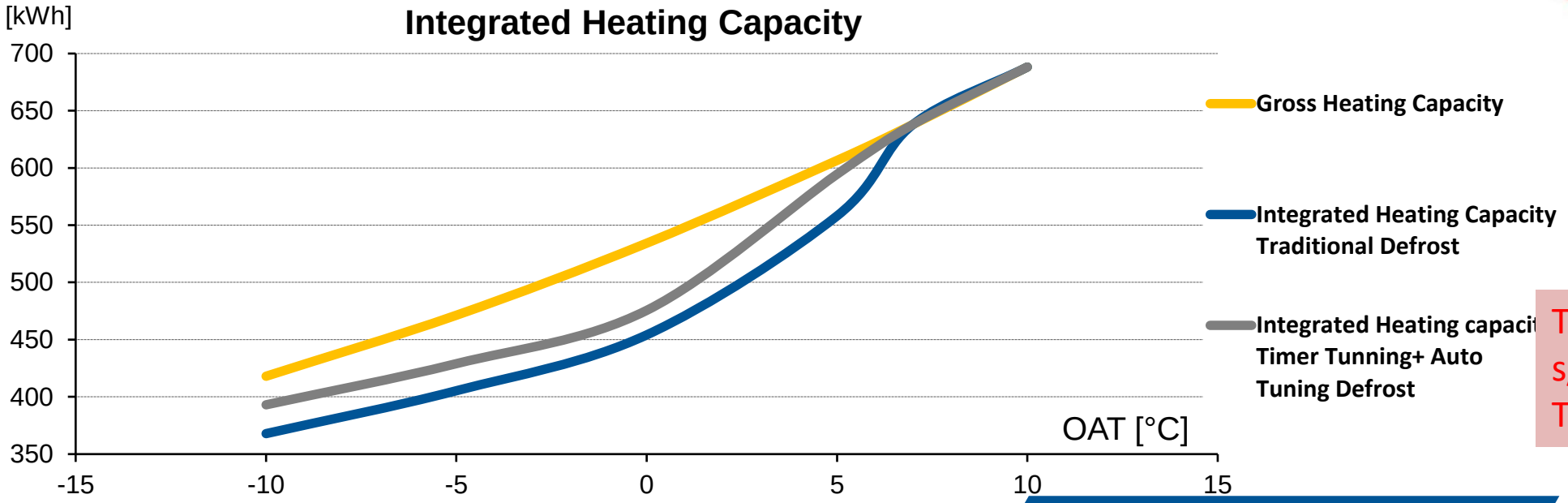
- Reduction in defrosting time
- Minimum impact on leaving water temperature
- Reduction of energy used for defrosting
- COP Improved

AUTO-ADAPTIVE DEFROSTING

PATENTED Auto-Adaptive Defrost Logic ensures each defrost cycle is better than the previous cycle.

All parameters are monitored and modulated between subsequent cycles to ensure the heat pump is always operating as efficiently as possible

TRADITIONAL VS. AUTO-ADAPTIVE DEFROSTING



Tunr
s/b
Tuni

+9.6% of NET HEATING CAPACITY

+6.3% of INTEGRATED COP

Higher stability of Condenser leaving water temperature

AUTO-ADAPTIVE DEFROSTING

- ✓ Higher Efficiency than Traditional Defrost Strategy
- ✓ Increase in Net Heating Capacity
- ✓ No block for low evaporating pressure due to permanent layer of ice on the coils

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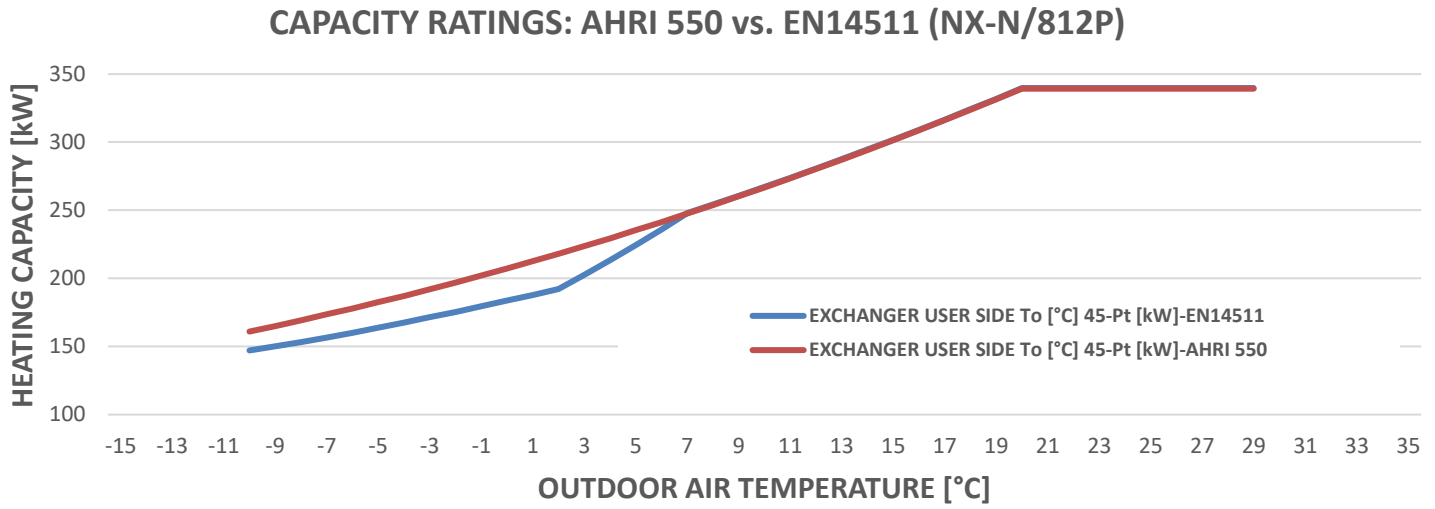
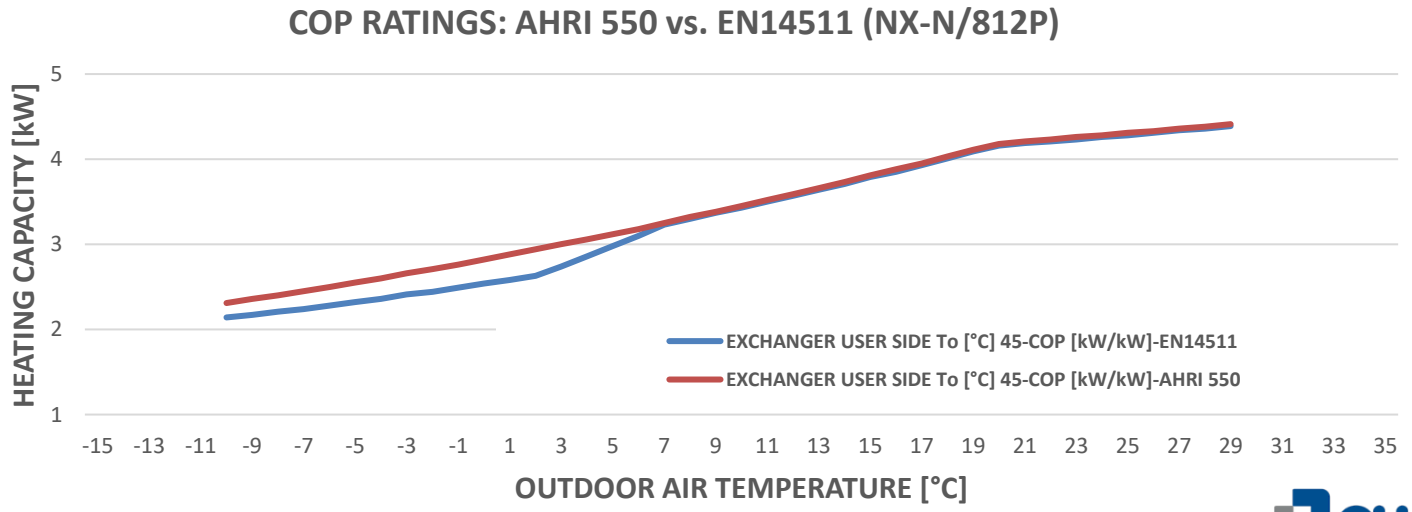
AHRI 550/590 VS. EN14511 PERFORMANCE RATINGS





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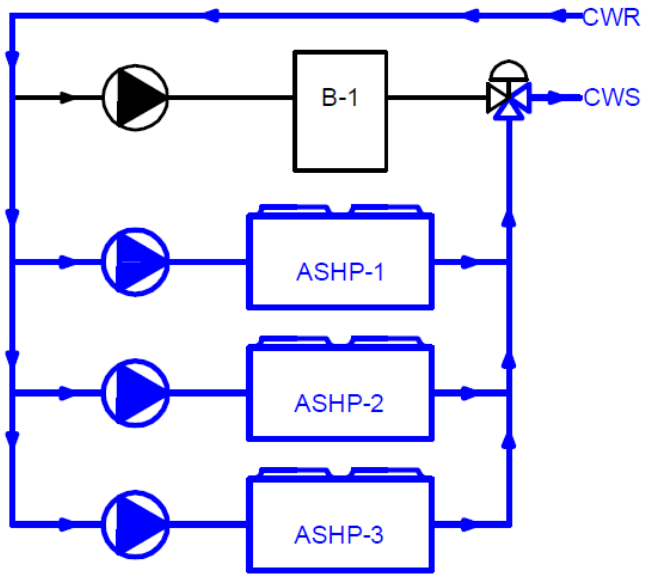
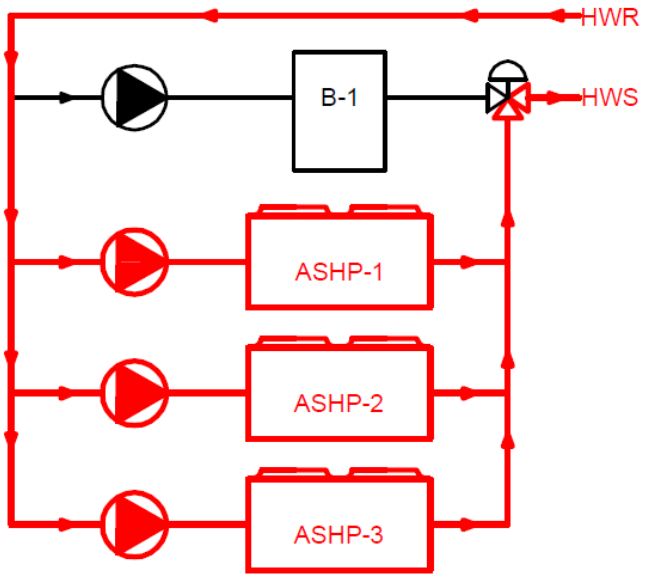
SUSTAINABLE COMFORT

HYBRID CENTRAL HEAT PUMP PLANT: 2-PIPE CHANGEOVER COMMERCIAL SYSTEM

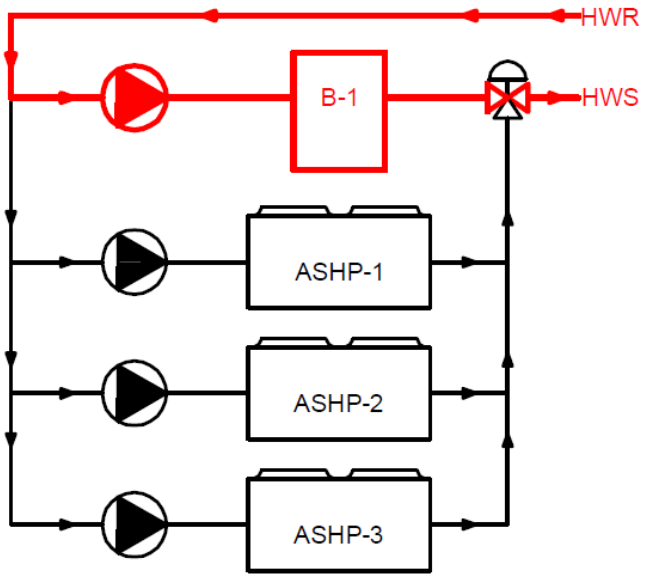
SUMMER COOLING



WINTER HEATING AIR-TO-WATER HEAT PUMP



WINTER HEATING AUXILIARY BOILER

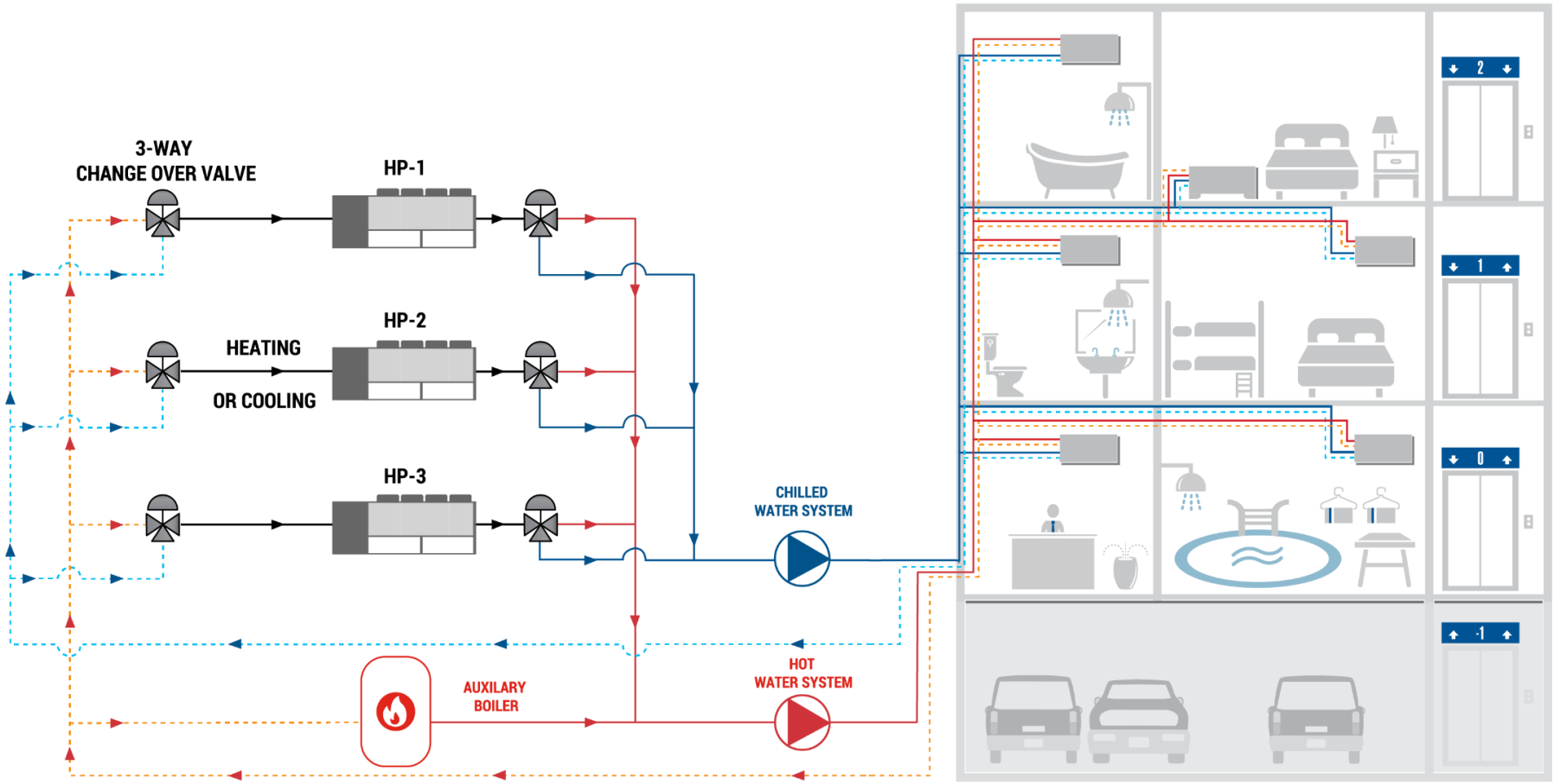


MITSUBISHI ELECTRIC Heating and Cooling

CLIMAVENETA SUSTAINABLE COMFORT

CENTRAL PLANT APPLICATIONS: HYBRID 4-PIPE SYSTEM

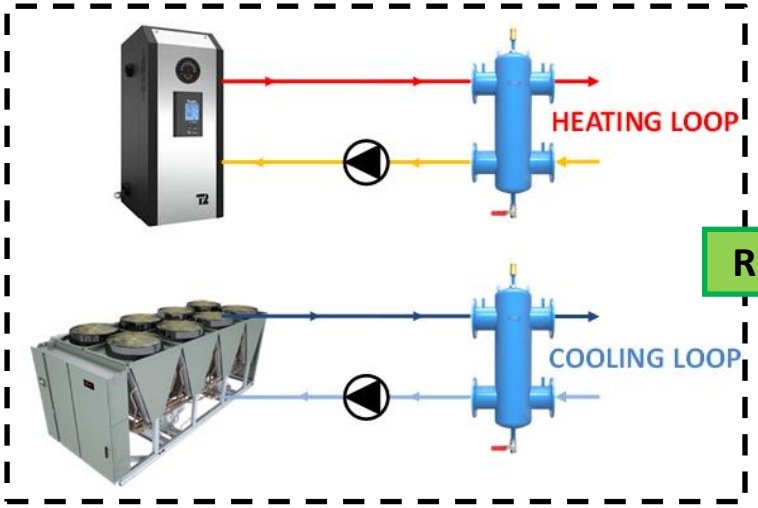
CENTRAL 4-PIPE PLANT USING 2-PIPE ASHP UNITS INDEPENDENTLY IN LARGE HOTEL APPLICATION:



ENERGY MODELLING: HYBRID 4-PIPE SYSTEM

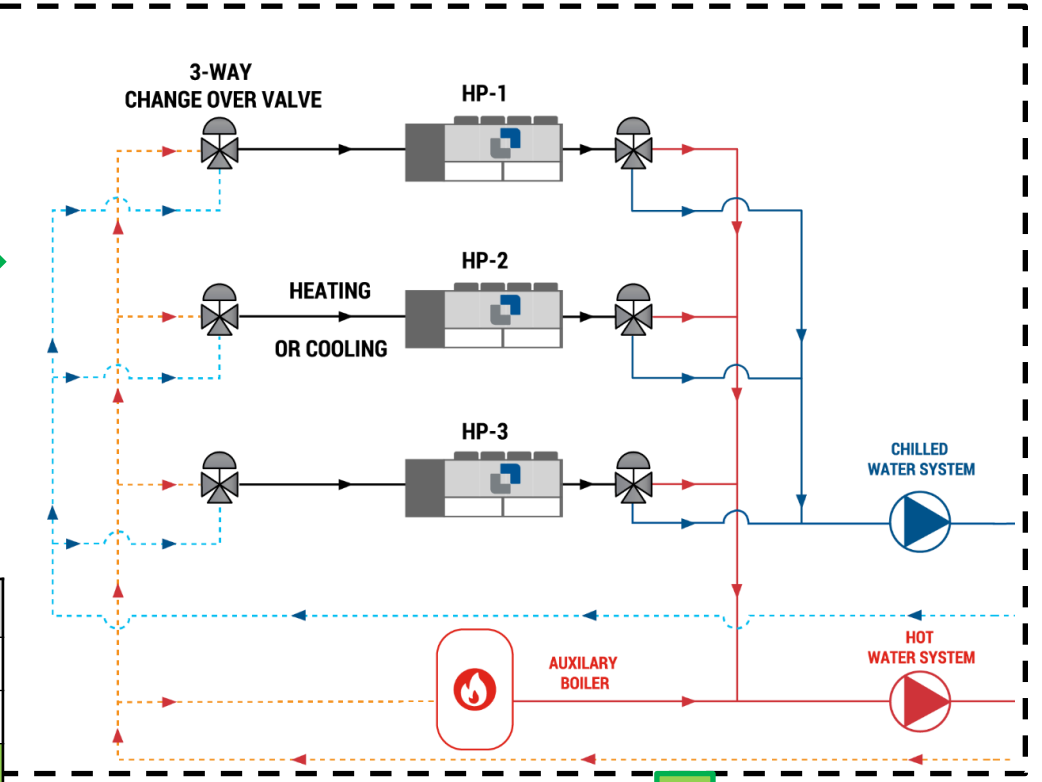
LARGE HOTEL APPLICATION IN VANCOUVER, TORONTO & MONTREAL CLIMATE ZONES

4-PIPE CHILLER + BOILER



RETROFIT

4-PIPE HYBRID CENTRAL PLANT W/ AUX BOILER



Montreal Fuel Switch Retrofit Energy Modelling Results	
System Heating S/R Temp [°C]	45 / 40
Bivalence Point Selected [°C]	-10
EUI REDUCTION [kWh/m²]	20.75%
Increase in Electricity [kWh/m²]	6.09%
Reduction in Natural Gas (kWh NG)	42.22%

SAVINGS/RESULTS

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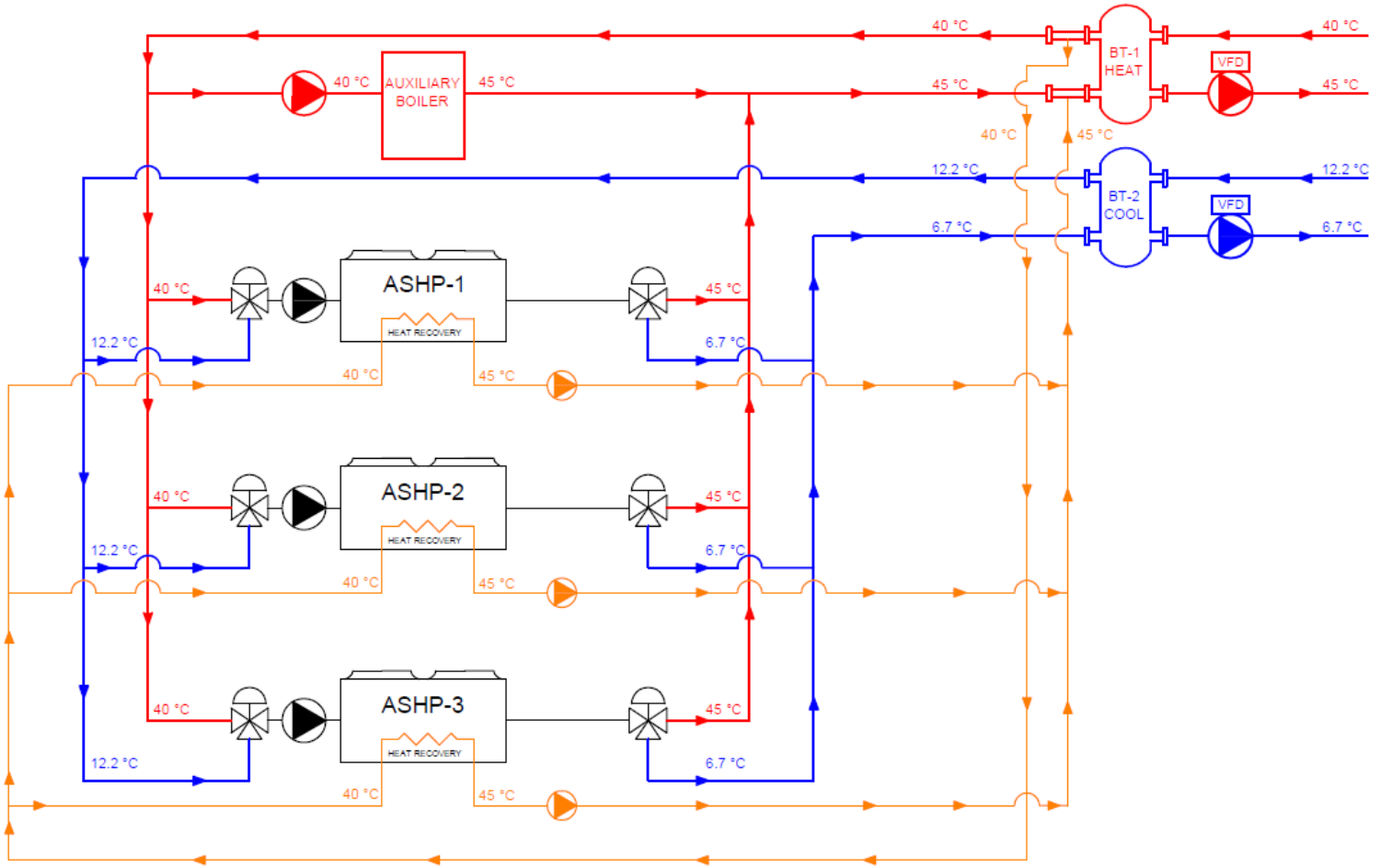
SUSTAINABLE COMFORT

CENTRAL PLANT APPLICATIONS: HYBRID 4-PIPE SYSTEM WITH HEAT RECOVERY

CENTRAL 4-PIPE PLANT USING 2-PIPE ASHP UNITS WITH HEAT RECOVERY:



AIR-TO-WATER CASCADE SYSTEM: VRF HYBRID

LOW-CARBON SOLUTION, LOWER COST COMPARED TO GEOTHERMAL

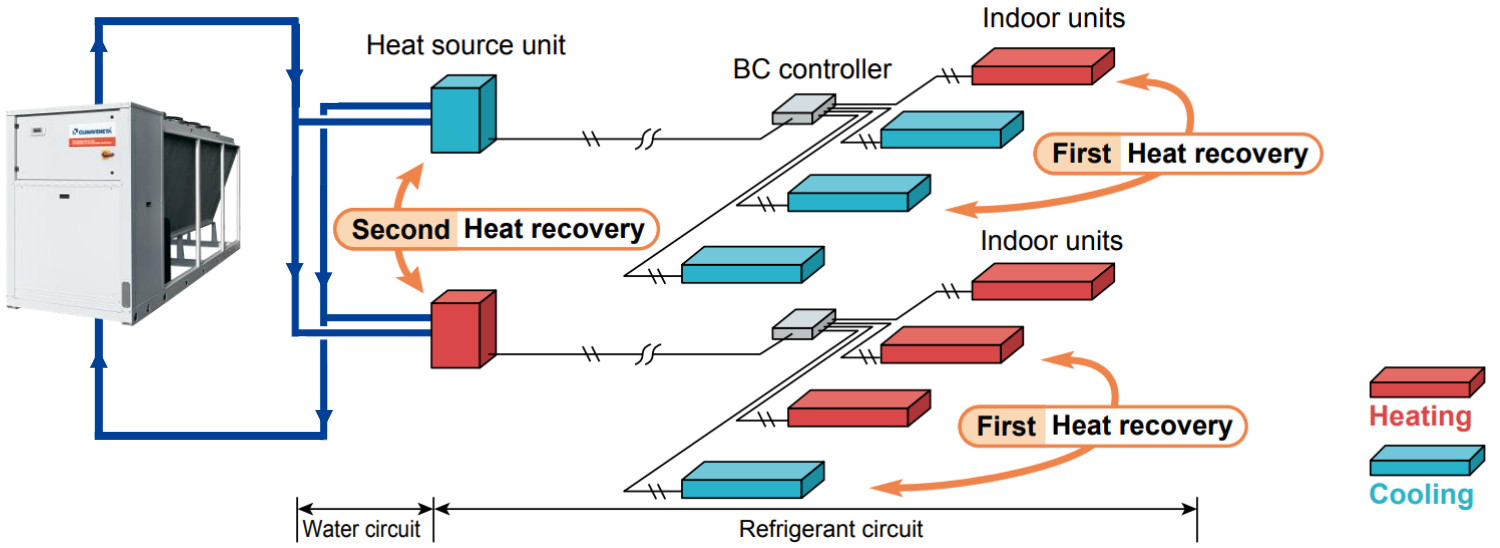
AIR-TO-WATER HEAT PUMP + WATER-COOLED VRF CENTRAL PLANT BENEFITS:

- Eliminates the **"Operating Envelope"** Constraint → Perfect comfort at indoor VRF units

- Supplement with Auxiliary Boiler as Required
  - Replacement: Below -15 °C **Bivalence**
  - Air-to-Water Heat Pump + Boiler **Load Sharing** provides sizing flexibility

- **Optimized COP/EER** of overall system for in both Heating & Cooling

Heat Injector
OR
Heat Rejector



MITSUBISHI CLIMAVENETA: NX-N SERIES

ASHRAE 90.1 compliant

Best In-Class Efficiency

NX-N Series is Perfect for Chiller Retrofits:
Exceeds ASHRAE 90.1-2019 in Cooling Mode

14 Sizes to Suit Projects of All Sizes

Available with Desuperheater for Heat Recovery

Cooling Capacities:
41 kW – 225 kW
11 Tons – 65 Tons

Heating Capacities:
50 kW – 250 kW
170 MBH – 850 MBH

AXIAL

SCROLL

HFC R-410A

PLATES

Wide Operating Limits

Cooling Mode:
Ambient Temperatures from -10 °C to +46 °C
Fluid Temperatures as low as -8 °C to +15 °C

Heating Mode:
Ambient Temperatures from -15 °C to +40 °C
Fluid Temperatures up to 55 °C

MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA
SUSTAINABLE COMFORT

NX-N: ELECTRICAL FEATURES & CONTROL

Standard Electrical Configuration

- General door lock isolator
- Automatic circuit breakers
- Numbered cables
- Terminals for cumulative alarm

Set-point control

- **Double set-point** (digital input)
- **4-20 mA** (analog input)
- Remote Summer/Winter Switch
- Set point compensation for outdoor temperature in heating & cooling

Other Optional Features

- Demand limit
- Night mode
- User Limit Control
- BMS Serial Cards (BacNET, Modbus, etc.)
- Soft Starters
- Power Factor Correction
- Energy Metering
- Remote probe for buffer Tank/Decoupler
- Auxiliary Heat Source Management
- DHW Mode Management

CONSTRUCTION: LONGITUDINAL V-SHAPE

Electrical Board

- W3000+ Controller is standard.

- A cover is also available as option to protect the controller against:
  - UV rays
  - Rain and snow
  - Dust and pollution

Axial fans

- Draw through Condenser Fans
  - Diameter/Qty matched to specific size

Air Coils

- V-Coil Structure
- Cu/Al Fin-tube coils standard
  - Coil Coating Options Available

Hydronic Group (**Consult Factory**)

- Factory fitted Pump(s) & Piping:
  - Vertical in-line single or parallel pumps with low or high head [Constant Speed]
  - Insulation & Heat Tracing

Refrigerant Section

- 1 circuit with 2 scroll in tandem configuration
- **Electronic Expansion Valve Standard**

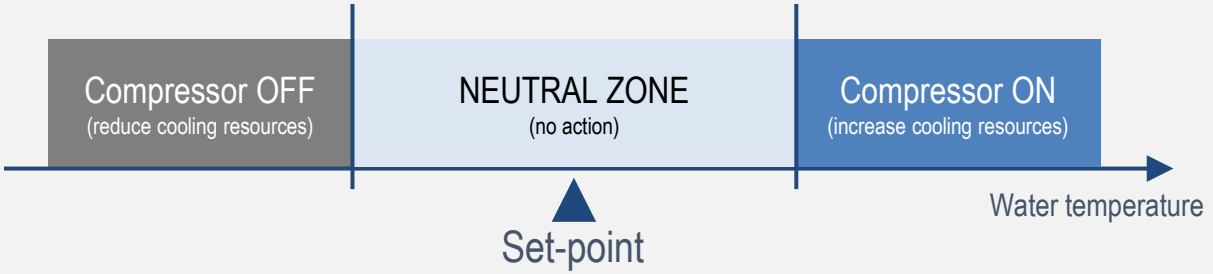
Heat exchanger

- Brazed plate heat exchanger

NX-N-G02-U: CONTROLS

Water temperature control

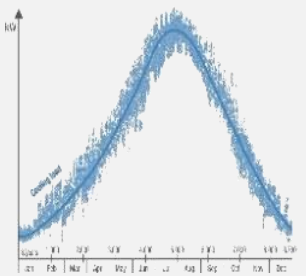
QUICK MIND



The width of the neutral zone is **dynamic** and automatically calculated on the basis of:

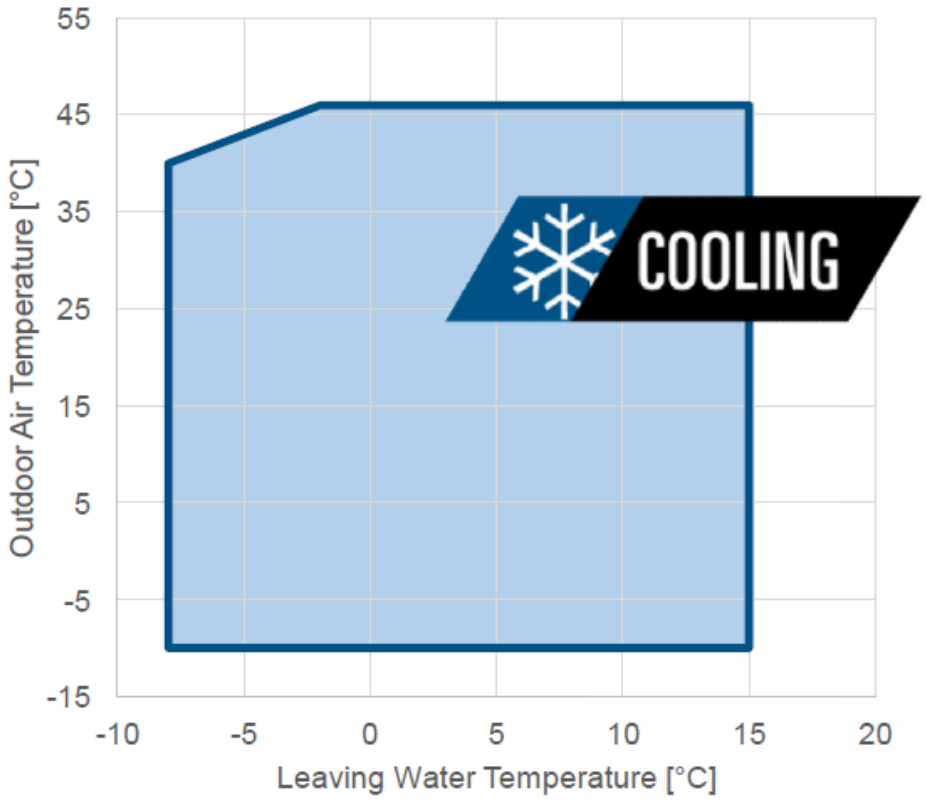
Maximum start-ups per hour

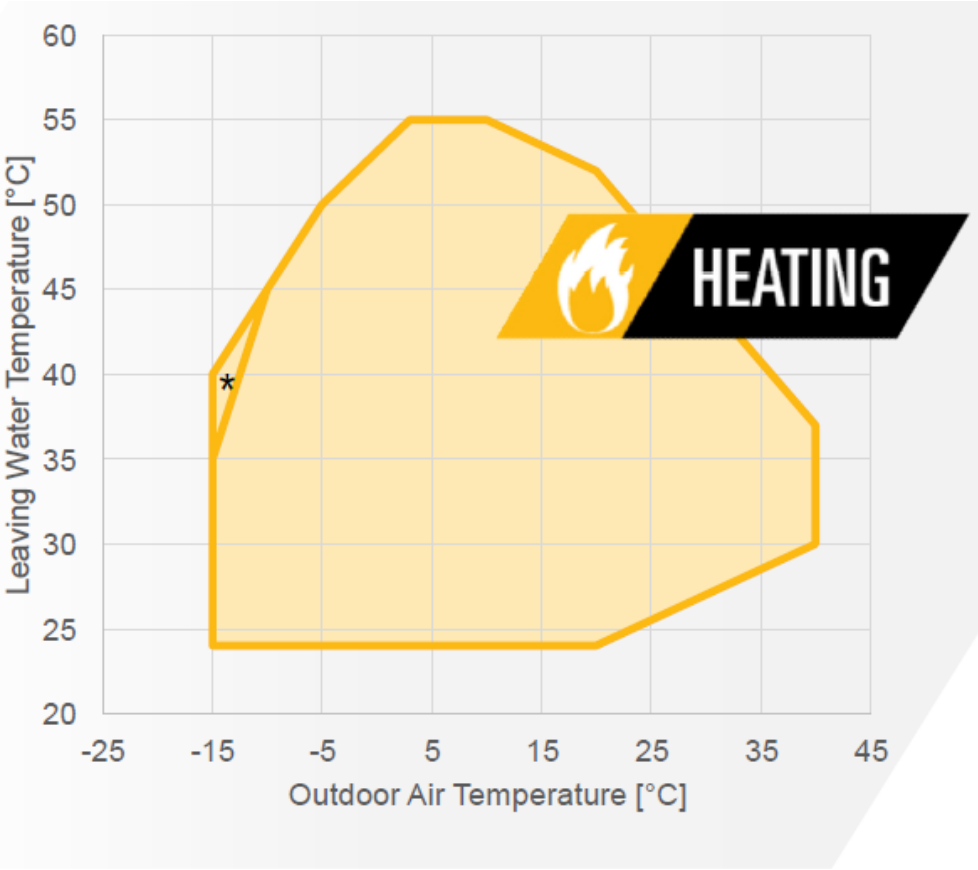
Water content of the plant



Demand vs Capacity

NX-N SERIES: HEATING & COOLING LIMITS





* Sizes with nominal capacity up to 100 kW

MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA
SUSTAINABLE COMFORT

NX-N SERIES PERFORMANCE DATA: SI

AXIAL

SCROLL

HFC R-410A

PLATES

V-shape module

Intertek

AHRI CERTIFIED® www.ahridirectory.org
Air-Cooled Chillers
AHRI Standards 550/590 and 551/591

ASHRAE 90.1 compliant

Dual Coil-shape module*

	NX-N SERIES PERFORMANCE RATINGS - AHRI 550/590 & 551/591 - SI UNITS													
Unit Size	152	182	202	252	262	302	402	452	502	562*	612*	662*	712*	812*
Cooling Cap. [kW]	41.2	45.5	53.5	61.3	68.4	76.8	91.7	106	119	135	154	180	206	226
Cooling COP_R [W/W]	2.88	2.88	2.92	2.92	2.87	2.87	3.01	2.94	2.87	2.90	3.03	3.01	3.12	2.95
IPLV [W/W]	4.74	4.70	4.68	4.69	4.74	4.80	4.70	4.74	4.71	4.69	4.69	4.68	4.70	4.70
Heating Cap. [kW]	48.8	53.7	60.8	70.8	76.8	89.8	106	120	134	152	169	192	222	248
Heating COP_H [W/W]	**2.94**	**3.09**	**3.01**	**2.99**	**3.02**	**3.09**	**3.05**	**3.13**	**3.16**	**3.09**	**3.09**	**3.00**	**3.03**	**3.02**
Footprint [m^2]	2.86	2.86	2.86	2.86	2.86	4.02	4.76	4.76	4.76	9.12	9.12	9.12	11.3	11.3

Rated in Accordance with AHRI Standard 550/590:
Cooling Water (out/in): 6.7 / 12.2 °C – Air (in): 35 °C
Heating Water (out/in): 48.9 / 43.3 °C – Air (in): 8.3 °C

MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA®
SUSTAINABLE COMFORT

NX-N SERIES PERFORMANCE DATA: IP

AXIAL

SCROLL

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PLATES

V-shape module

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ASHRAE 90.1 compliant

Dual Coil-shape module*

	NX-N SERIES PERFORMANCE RATINGS - AHRI 550/590 & 551/591 - IP UNITS													
Unit Size	**152**	**182**	**202**	**252**	**262**	**302**	**402**	**452**	**502**	**562***	**612***	**662***	**712***	**812***
Cooling Cap. [Tons]	11.7	12.9	15.2	17.4	19.5	21.8	26.1	30.1	33.9	38.4	43.8	51.3	58.5	64.1
Cooling COP_R [BTU/hW]	9.83	9.82	9.97	9.96	9.80	9.77	10.26	10.03	9.78	9.88	10.32	10.26	10.63	10.08
IPLV [BTU/hW]	16.17	16.04	15.97	16.00	16.17	16.38	16.04	16.17	16.07	16.00	16.00	15.97	16.04	16.04
Heating Cap. [MBTU/H]	166.7	183.2	207.4	241.5	261.9	306.3	362.2	408.2	455.7	519.5	576.9	653.8	758.0	845.0
Heating COP_H [BTU/hW]	**10.03**	**10.53**	**10.20**	**10.19**	**10.32**	**10.53**	**10.40**	**10.68**	**10.78**	**10.53**	**10.55**	**10.23**	**10.35**	**10.29**
Footprint [ft^2]	30.8	30.8	30.8	30.8	30.8	43.3	51.2	51.2	51.2	98.2	98.2	98.2	122.1	122.1

Rated in Accordance with AHRI Standard 550/590:
Cooling Water (out/in): 44 / 54 °F – Air (in): 95 °F
Heating Water (out/in): 120 / 110 °F – Air (in): 47 °F

MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA® SUSTAINABLE COMFORT

NX-N /D SERIES PERFORMANCE DATA: SI

AXIAL · SCROLL · HFC R-410A · PLATES

V-shape module

Intertek

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ASHRAE 90.1 compliant

Dual Coil-shape module*

NX-N SERIES PERFORMANCE RATINGS - AHRI 550/590 & 551/591 - SI UNITS															
Unit Family	Unit Size	152	182	202	252	262	302	402	452	502	562*	612*	662*	712*	812*
All Series	Footprint [m^2]	2.86	2.86	2.86	2.86	2.86	4.02	226	4.76	4.76	9.12	9.12	9.12	11.3	11.3
NX-N Series	Cooling Cap. [kW]	41.2	45.5	53.5	61.3	68.4	76.8	91.7	105.8	119.3	135.0	154.0	180.2	205.6	225.6
	Cooling COP_R [W/W]	**2.88**	**2.88**	**2.92**	**2.92**	**2.87**	**2.87**	**3.01**	**2.94**	**2.87**	**2.90**	**3.03**	**3.01**	**3.12**	**2.95**
	Heating Cap. [kW]	48.84	53.71	60.78	70.76	76.77	89.76	106.1	119.6	133.6	152.2	169.1	191.6	222.1	247.6
	Heating COP_H [W/W]	**2.94**	**3.09**	**3.01**	**2.99**	**3.02**	**3.09**	**3.05**	**3.13**	**3.16**	**3.09**	**3.09**	**3.00**	**3.03**	**3.02**
NX-N /D Series Heat Recovery	Cooling Cap. [kW]	42.7	47.2	55.6	63.6	71.0	79.7	95.1	109.8	123.8	140.0	159.8	187.0	213.3	234.1
	Rec. Heating Cap [kW]	11.6	13.0	14.8	17.0	19.6	22.0	24.4	29.3	34.4	37.8	41.7	49.0	53.3	62.6
	% Recovered [Full Load]	27%	28%	27%	27%	28%	28%	26%	27%	28%	27%	26%	26%	25%	27%
	HR Mode Power Input [kW]	13.8	15.3	17.7	20.3	23.0	25.9	29.6	34.9	40.3	45.1	49.3	58.0	64.0	73.9
	Cooling + Heat Rec. TER [W/W]	**3.93**	**3.94**	**3.97**	**3.97**	**3.93**	**3.93**	**4.04**	**3.99**	**3.93**	**3.94**	**4.09**	**4.07**	**4.17**	**4.01**

Rated in Accordance with AHRI Standard 550/590:
Cooling Water (out/in): 6.7 / 12.2 °C – Air (in): 35 °C
Heating Water (out/in): 48.9 / 43.3 °C – Air (in): 8.3 °C

Cooling + Heat Recovery Mode:
Cooling Water (out/in): 6.7 / 12.2 °C – Air (in): 35 °C
Recovery Exchanger: 45 / 40 °C

MITSUBISHI ELECTRIC Heating and Cooling

CLIMAVENETA® SUSTAINABLE COMFORT

NX-N /D SERIES PERFORMANCE DATA: IP

AXIAL

SCROLL

HFC R-410A

PLATES

V-shape module

Intertek

AHRI CERTIFIED® www.ahridirectory.org
Air-Cooled Chillers
AHRI Standards 550/590 and 551/591

ASHRAE 90.1 compliant

Dual Coil-shape module*

Unit Family	Unit Size	152	182	202	252	262	302	402	452	502	562*	612*	662*	712*	812*
		NX-N SERIES PERFORMANCE RATINGS - AHRI 550/590 & 551/591 - IP UNITS													
All Series	Footprint [ft²]	30.8	30.8	30.8	30.8	30.8	43.3	2432.6	51.2	51.2	98.2	98.2	98.2	121.6	121.6
NX-N Series	Cooling Cap. [Tons]	11.7	12.9	15.2	17.4	19.5	21.8	26.1	30.1	33.9	38.4	43.8	51.3	58.5	64.1
	Cooling COP_R [BTU/hW]	**2.88**	**2.88**	**2.92**	**2.92**	**2.87**	**2.89**	**3.01**	**2.94**	**2.87**	**2.9**	**3.03**	**3.01**	**3.12**	**2.95**
	Heating Cap. [MBTU/h]	166.7	183.2	207.4	241.5	261.9	306.3	362.2	408.2	455.7	519.5	576.9	653.8	758.0	845.0
	Heating COP_H [BTU/hW]	**10.03**	**10.53**	**10.27**	**10.19**	**10.32**	**10.53**	**10.40**	**10.68**	**10.78**	**10.53**	**10.55**	**10.23**	**10.35**	**10.29**
NX-N /D Series Heat Recovery	Cooling Cap. [Tons]	12.1	13.4	15.8	18.1	20.2	22.7	27.1	31.2	35.2	39.8	45.4	53.2	60.7	66.6
	Rec. Heating Cap [MBTU/h]	39.7	44.2	50.4	58.2	66.8	75.1	83.4	100.1	117.2	129.1	142.4	167.2	182.0	213.5
	% Recovered [Full Load]	27%	27%	27%	27%	28%	28%	26%	27%	28%	27%	26%	26%	25%	27%
	HR Mode Power Input [kW]	13.8	15.3	17.7	20.3	23	25.9	29.6	34.9	40.3	45.1	49.3	58	64	73.9
	Cooling + Heat Rec. TER [BTU/hW]	**13.41**	**13.44**	**13.55**	**13.55**	**13.41**	**13.41**	**13.79**	**13.61**	**13.41**	**13.44**	**13.96**	**13.89**	**14.23**	**13.68**

Rated in Accordance with AHRI Standard 550/590:
Cooling Water (out/in): 44 / 54 °F – Air (in): 95 °F
Heating Water (out/in): 120 / 110 °F – Air (in): 47 °C

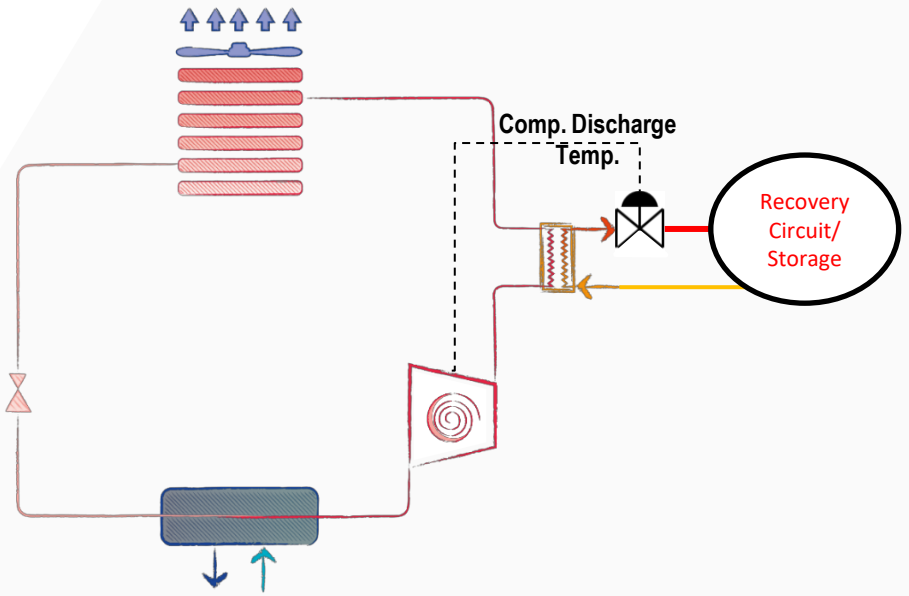
Cooling + Heat Recovery Mode:
Cooling Water (out/in): 44 / 54 °F – Air (in): 95 °C
Recovery Exchanger: 113 / 104 °F

MITSUBISHI ELECTRIC
Heating and Cooling

CLIMAVENETA® SUSTAINABLE COMFORT

HEAT RECOVERY IN 2-PIPE CHANGEOVER SYSTEM

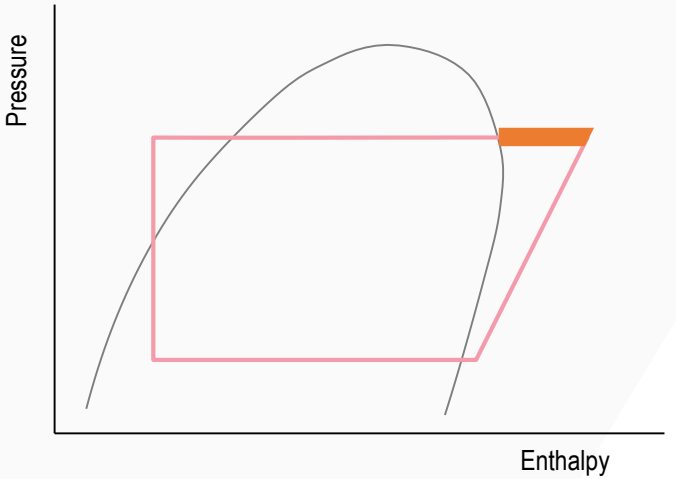
Partial heat recovery



The refrigerant circuit is fitted with a **desuperheater** in series with the condenser coils.

Approximately **20%** of the chiller's capacity (*)

Up to **60 °C** Leaving Water Temperature



(*) The heat recovery and its amount depend on the unit's operating conditions, in particular the outdoor air temperature and the load percentage.

NX-N/D SERIES: DESUPERHEATER

HEAT RECOVERY TO DOMESTIC HOT WATER SYSTEM (2-PIPE SYSTEM)

*REFER TO LOCAL AND NATIONAL BUILDING/PLUMBING CODES TO ENSURE COMPLIANCE WITH LEGIONELLA MITIGATION

HEAT RECOVERY TO BOILER PRE-HEAT (2-PIPE SYSTEM)

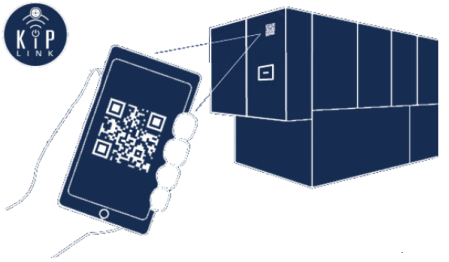
NX-N-G02-U: USER INTERFACE

Compact Keypad Display

Standard interface. It features a complete LCD display with backlight and ergonomic keys for viewing data and navigating the multilevel menu with multiple access types according to password level

KIPlink: the Keyboard is In your Pocket *

Based on the **Wi-Fi technology**, KIPlink gets rid of the standard keyboard and allows one to operate on the unit directly from a **mobile device** (smartphone, tablet, notebook using the **MEHITS Mobile App** (iOS/Android).



NX-N-G02-U: USER INTERFACE

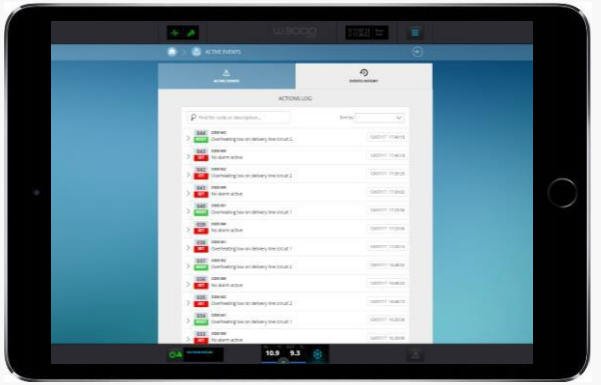
KIPlink: the Keyboard is In your Pocket

Easier on-site operation

- **Monitor** each component **while moving** around the unit for maintenance.
- View and change all parameters with **easy-to-understand screenshots** and dedicated tooltips.
- Get devoted “help” message for alarm reset and trouble shooting.

Real-time graphs and trends

- Monitor the **immediate labor status** of the compressors, heat exchangers, cooling circuits and pumps.
- View the real-time graphs of the key **operating variable trends**.



Data logger function

- View history of events and use the **filter for a simple search**.
- Enhance diagnostics with data and graphs of **10 minutes before and after** each alarm.
- **Download** all the data for detailed analysis.

FACTORY TESTING & WITNESS TESTING

FACTORY TESTING OVERVIEW:

AHRI CERTIFIED®
www.ahridirectory.org
Air-Cooled Chillers
AHRI Standards 550/590 and 551/591

PRODUCTION TESTING

- **Subassembly & Final Assembly Tests**
- **Alarm Testing**
- **Full Performance Testing at Design Selection Points**

WITNESS TESTING

- **Possibility to include additional test conditions:**
  - Different Temperatures, ΔT, Load Conditions & Variations, etc.

NX-N SERIES: PRODUCT ADVANTAGES

The Climaveneta Benefit: NX-N Series

- **NX-N SERIES:** 10-65 Tons Nominal Cooling Capacity
- Optimized Design for the Canadian Climate
- Low-Ambient Reliability & Protection
- Standard 5-Year Extended PARTS & COMPRESSOR Warranty*
- ASHRAE 90.1-2019 Compliant in Cooling Mode
- High COP_H Efficiencies in Heating Mode
- Performance Optimization Integrated into Controls to suit every Project's Needs
- KIPLink Enhanced Connectivity & Management

5 YEAR EXTENDED PARTS & COMPRESSOR WARRANTY INCLUDED*

*Conditions Apply. For details, See the warranty terms at www.Climaveneta.ca

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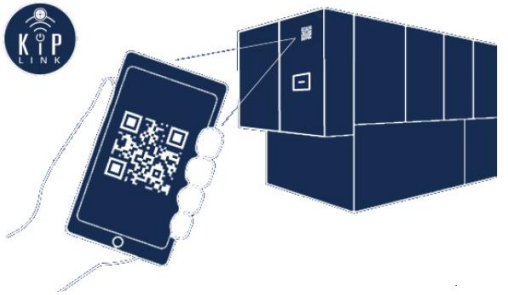

ASHRAE® 90.1 compliant