energy saving trust

Air-to-air heat pumps - how and where do they work?

Green Heat Installer Engagement Programme

6 September 2023

Net Zero Scotland
Scottish Government

LET'S DO NET ZERO

Presenters

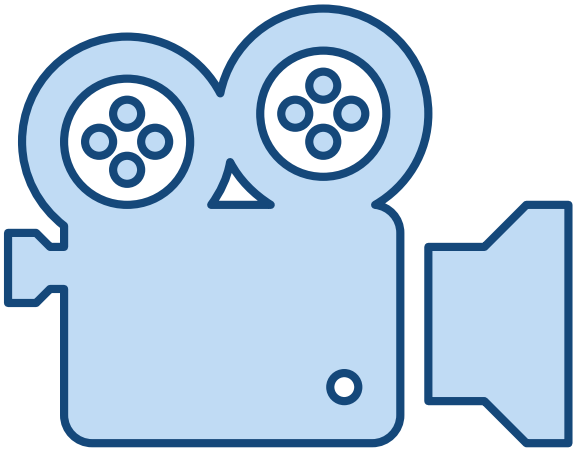
Pilar Rodriguez	Green Heat Installer Engagement Programme Manager, **Energy Saving Trust**	Presenter, Q&A Panel
Stephan Lang	Product Manager, Residential Air to Air Systems, **Daikin UK**	Presenter, Q&A Panel
Dean Blake	National Residential Air Conditioning Manager, **Daikin UK**	Q&A Panel

Questions

Type questions into the **Questions** pane of the control panel

You can send in your questions at any time during the presentation. These will be collected and addressed during the Q&A session at the end of the presentations.

Recording



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The Scottish Green Heat transition

Green Heat Installer Engagement Programme

Pilar Rodriguez 06 09 23

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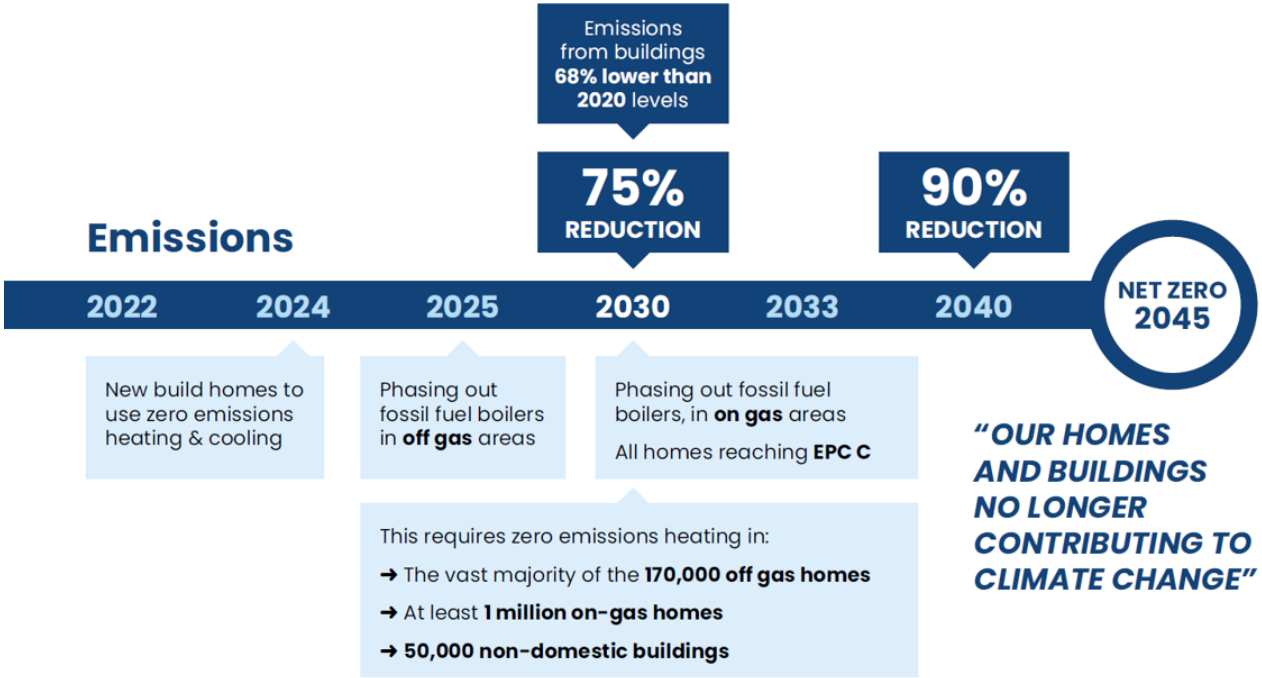
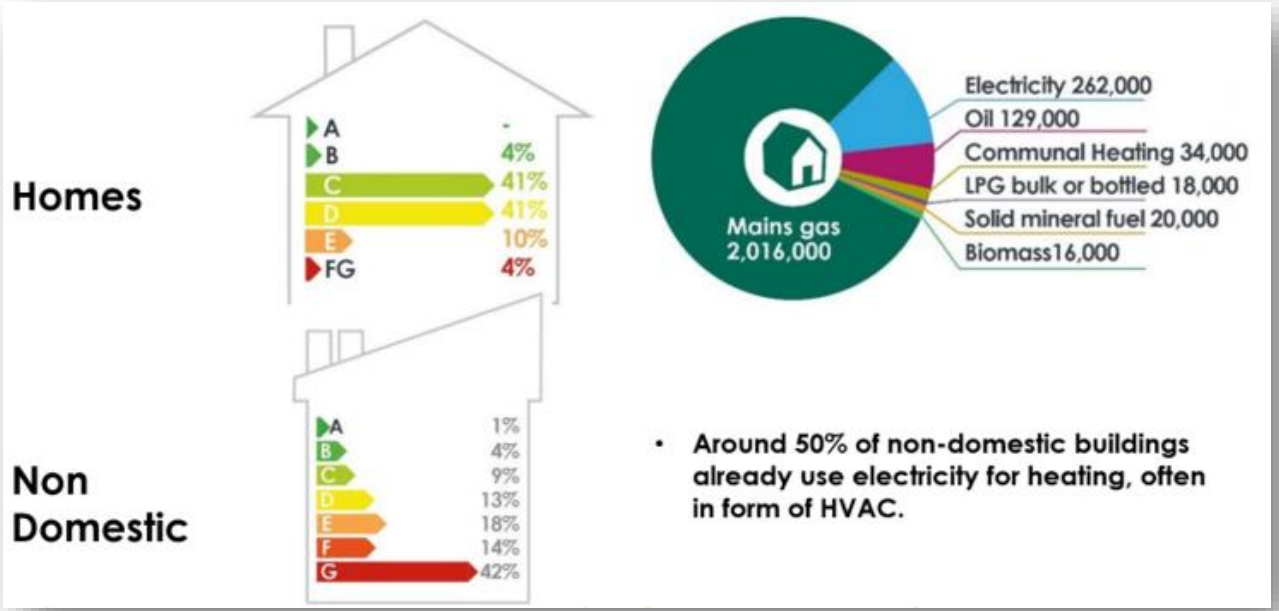
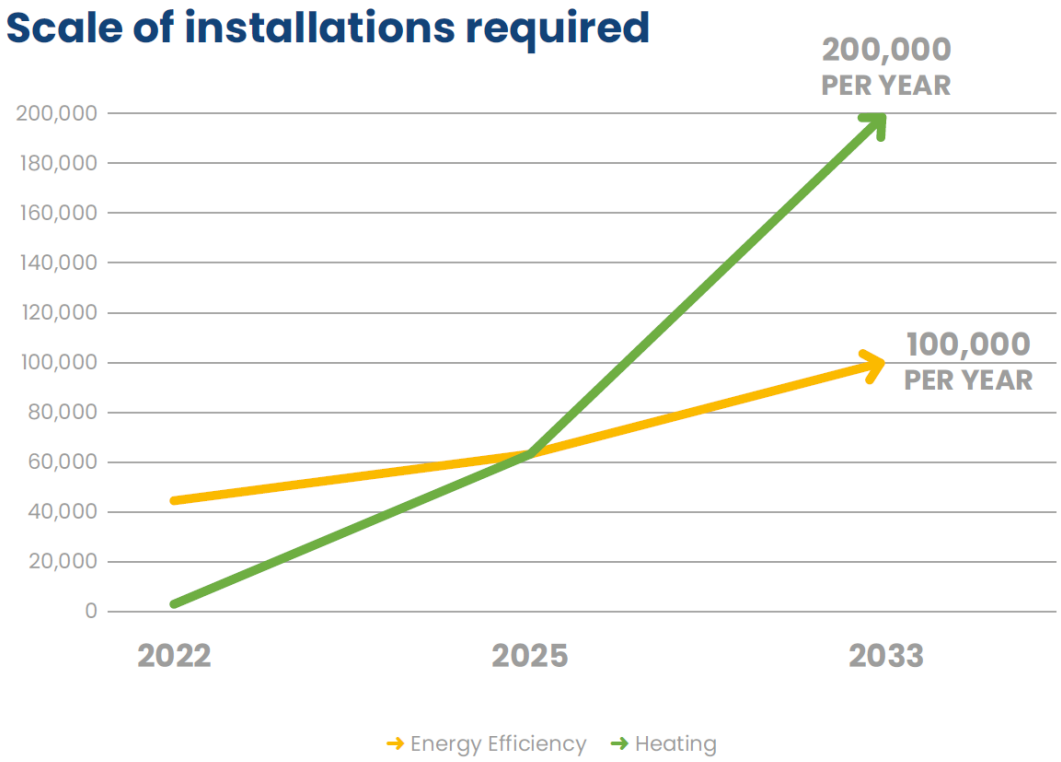
The challenge



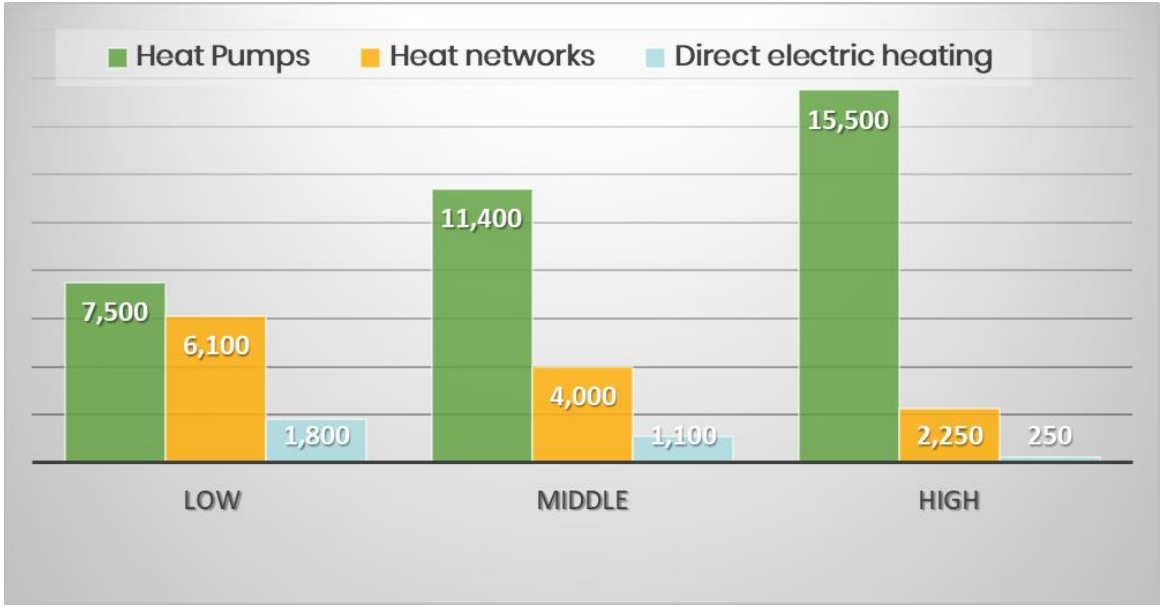
The opportunity



The scale – number of installations



The scale – workforce requirements



Green Heat Installer Engagement Programme – useful links

- Website: energysavingtrust.org.uk/green-installer
- Email updates and quarterly newsletter subscription – bit.ly/2PSatkL
- LinkedIn group: linkedin.com/groups/5139242
- Email: GreenInstallerScotland@est.org.uk

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Thank you

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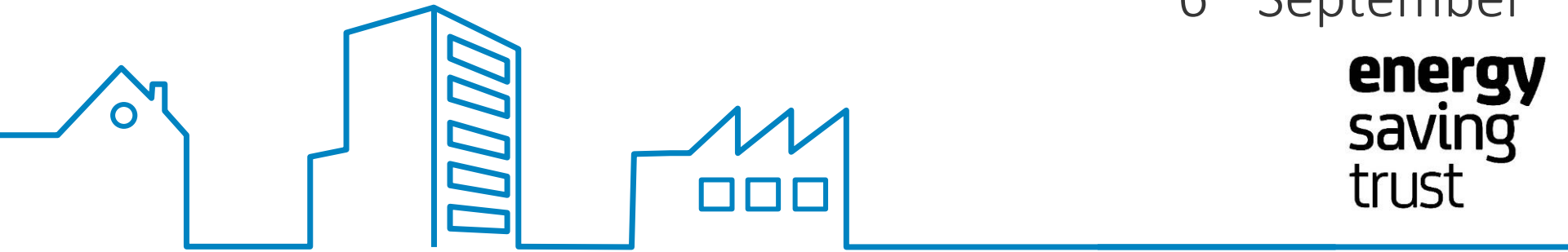
Air-to-Air Heat Pump Webinar

Energy Saving Trust

6th September



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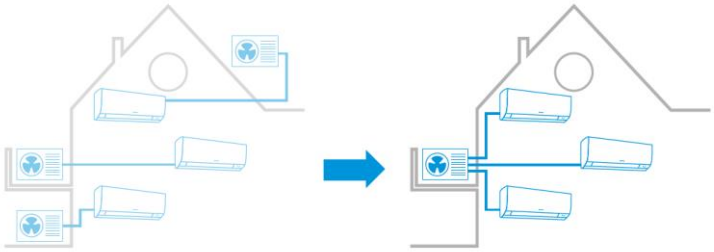
1. What is an A2A Heat Pump
2. Where to use A2A Heat Pumps
3. Efficiencies, Running Costs, Installation
4. Generating Hot Water
    A. Multi+ DHW
5. Skills Required
    A. F-Gas Training

What is an A2A Heat

1. Pump

1. What is an A2A Heat Pump

- Air-to-air heat pumps **transfer heat from the outside air to air inside your home**, increasing the temperature of the air in each room. This warm air enters your home through a series of fan coil units, or ‘blowers’.
- Air-to-air heat pumps are sometimes referred to as air conditioning. While many people think of air conditioning as a way of cooling buildings, it can **also be used for heating,** thus providing all-year comfort.
- Air-to-air heat pumps also **provide good indoor air quality** by filtering and cleaning the air within the habitable space.
- An air-to-air heat pump **does not heat water** delivered to the taps, so you will need to consider an alternative way of heating water for showering and bathing.
- Air-to-Air heat pumps are **highly efficient low carbon heating solutions**
- Air-to-Air heat pumps are available in **pair or multi split combinations**



Conventional pair split installation for air-conditioning three rooms

Solution for the same situation with only one multi split outdoor unit

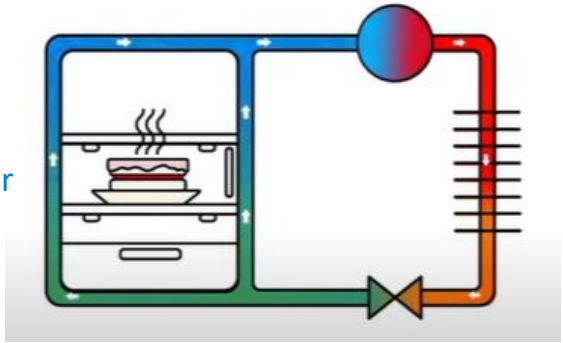
1. What is an A2A Heat Pump

A refrigerator is a heat pump

- The inside of the refrigerator is kept cool by extracting energy from inside the refrigerator.
- This energy is then rejected to the kitchen – if you put your hand behind the refrigerator, it feels warm.
- The refrigerator works based on the thermodynamic heat pump cycle (DX) which uses a compressor, condenser, expansion valve, evaporator and a refrigerant

Air-to-Air Heat Pump
is the like a refrigerator

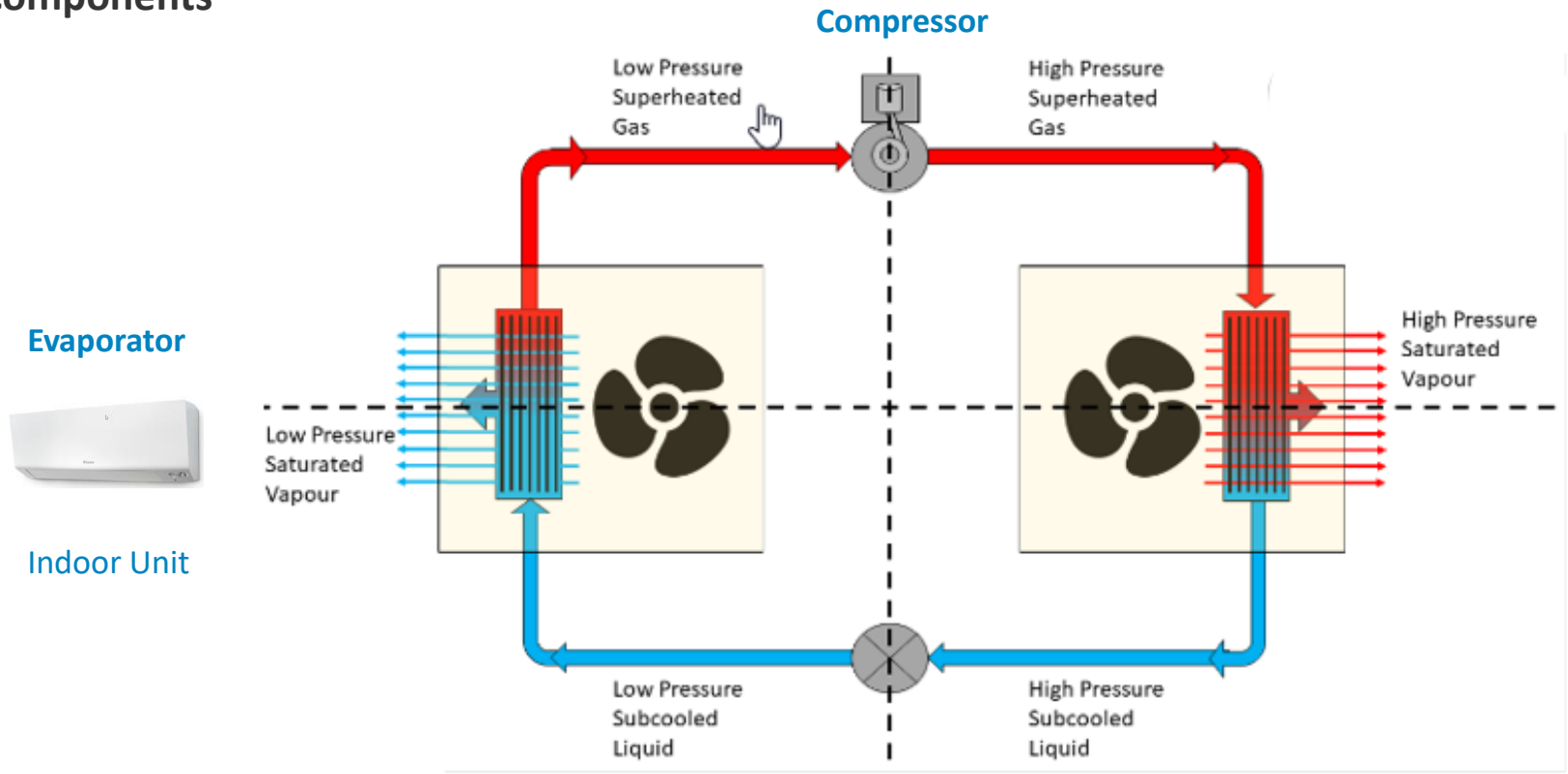
Evaporator



Condenser

1. What is an A2A Heat Pump

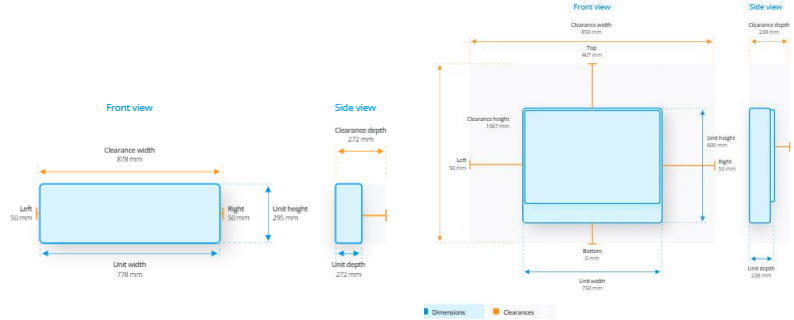
Components



3. Efficiencies, Running Costs, Installation

Installation Steps

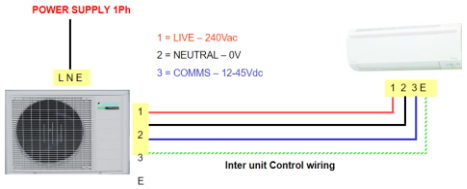
Step 1. Installation of the heat pump indoor unit(s). First, your contractor will install the wall-mounted, floor-standing or ceiling-concealed heat pump indoor units, which are designed to emit warm or cold air into your rooms.

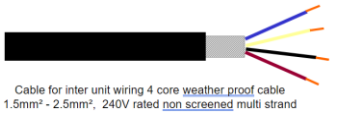


Step 2: Setting up access points inside your home. Next, they will create an access point(s) to connect the indoor unit(s) to the outdoor unit by drilling a hole in the wall for the electrical wiring and drain piping.

Step 3: Installation of the heat pump outdoor unit. Then they will install the heat pump outdoor unit, usually mounting it on the side of your home. In colder places, the unit must be off the ground, above where snow could settle.

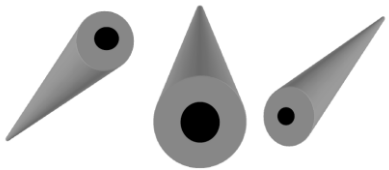
Step 4: Connection of electrical wiring. Afterwards, they will connect the electrical wiring. Wires should be insulated as necessary





Step 5: Connecting the piping. They will link up the refrigerant pipes that transport hot gas or cold liquid to the indoor units and the drainpipes that remove condensation. These should also be insulated as required.

Step 6: Quality testing phase. Finally, they will carry out thorough testing of the entire system to ensure it is working optimally before use.



Where to use A2A Heat

2. Pumps

2. Where to use A2A Heat Pumps

GAS BOILER – HEATING ONLY

- Instant heating
- Central heating system

- Different heat emitters:
  - Radiators
  - Under floor heating
- Performance independent from outdoor temperature

- ON/OFF system based on set point

- Limited airflow

- **Efficiency: max < 93%**

AIR TO AIR HEAT PUMP

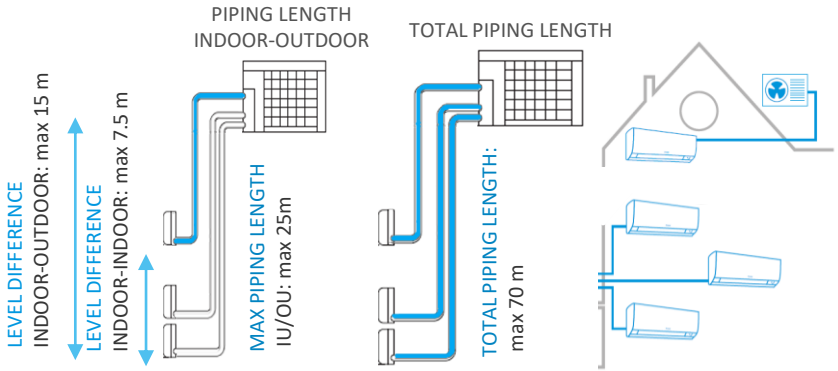
- Even quicker heating (powerful, heat boost)
- Central heating thanks to app & scheduled timer and still possible to individually control the set temperature per room
- Different heat emitters:
  - Floor standing > similar dimensions as radiators
  - Wall mounted unit > ideal to install above a door
- Guaranteed capacity
  - Down to -20°C for regular range
  - Down to -25°C for optimised heating range
- Inverter technology: small fluctuations between set temperature and room temperature
- Air flow features to provide best comfort: motion detection sensor, intelligent thermal sensor, coanda, heat plus, silent operation, IAQ features, etc.

- **Efficiency: up to 500%**

2. Where to use A2A Heat Pumps

CENTRAL HEATING vs AIR-TO-AIR

Important questions to reply to
- How many rooms
- Piping length (IU/OU installation)
- What is the best application when it exceeds 5 rooms?



UP TO 5 ROOMS
- Up to 5 indoors / one outdoor
- Max. piping length IU/OU
  - 20m (2 ports)
  - 25m (3,4,5 ports)
- Max. level difference
  - 15m
- TOTAL max. piping length
  - From 30 to 70m

UP TO 5 ROOMS
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- Max. piping length IU/OU
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  - 25m (3,4,5 ports)
- Max. level difference IU/OU
  - 15m
- TOTAL max. piping length
  - From 30 to 70m

MULTI + PAIR
- One room very far from the other rooms
- Total capacity exceeding 9kW

MULTI + MULTI
- More than 5 rooms
- Total capacity exceeding 9kW
- Easier to group into different zones

e.g. bedrooms with outdoor unit on top of the roof AND

2. Where to use A2A Heat Pumps

NIGH STORAGE HEATERS

- Instant heating -> Convection
- Low energy tariff (Economy 7 Energy Tariff)

- Different heat emitters:
  - Radiator types mainly
  - Smart, Fan assisted, On-Demand
  - Extra Heat Retention
- Performance independent from outdoor temperature

- Programmed, Room Thermostat, App Control

- Limited airflow direction -> Convection

- **Efficiency: max <100%**

AIR TO AIR HEAT PUMP

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- Central heating thanks to app & scheduled timer a still possible to individually control the set temperature per room
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- Inverter technology: small fluctuations between se temperature and room temperature
- Air flow features to provide best comfort: motion detection sensor, intelligent thermal sensor, Coand heat plus, silent operation, IAQ features, etc.

- **Efficiency: up to 500%**

2. Where to use A2A Heat Pumps

ELECTRIC HEATERS

- Instant heating -> Convection / Radiation (2/3 vs 1/3)
- Low energy tariff (Economy 7 Energy Tariff)

- Different heat emitters:
  - Radiator types mainly
  - Dry thermal, oil-filled, dry stone, mobile

- Performance independent from outdoor temperature

- Programmed, Precision Thermostat, 24/7 programming, App Control

- Limited airflow direction -> Convection / Radiation

- **Efficiency: max <100%**

Dry thermal | Oil-filled | Dry stone

AIR TO AIR HEAT PUMP

- Even quicker heating (powerful, heat boost)
- Central heating thanks to app & scheduled timer a still possible to individually control the set temperature per room
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Efficiency: up to 500%

2. Where to use A2A Heat Pumps

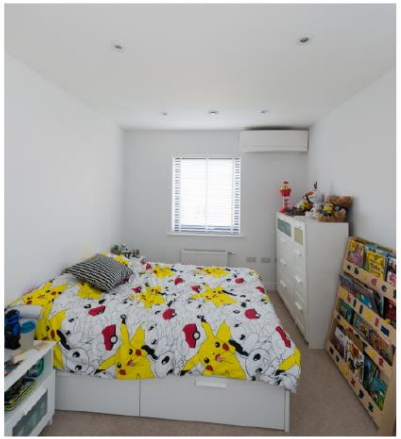
Application

- Residential (1200 sq ft)
- South facing new build
- 3 x Bedroom / 1 x Living Room

System

- 4 port multi 8.0kW Cooling / 9.6kW Heating
- 3 x 2kW / 2.5kW Emura Wall Mounted
- 1 x 3.5kW / 4.0kW Emura Wall Mounted
- Wifi Adaptor

"Daikin's R32 systems are straightforward to install and commission. The Emura indoor units have a sleek, contemporary appearance and in this installation, we were able to site them high on the walls so that even in the smallest bedroom they look good."
Technicool Contracts Manager Spencer Johnson, says:



3. Efficiencies, Running Costs, Installation

3. Efficiencies, Running Costs, Installation

FORMULA

NOMINAL

$$EER = \frac{\text{Cooling capacity at } 35°}{\text{Power input at } 35°}$$

SEASONAL

$$SEER = \frac{\text{Annual cooling demand}}{\text{Annual Power input during cooling + power input during auxiliary modes}}$$

FORMULA

NOMINAL

$$COP = \frac{\text{Heating capacity at } 7°C}{\text{Power input at } 7°C}$$

SEASONAL

$$SCOP = \frac{\text{Annual heating demand}}{\text{Power input during heating + power input during auxiliary modes}}$$

Nominal cooling
Ambient = 35°C
Internal = 27°C db 19°C wb

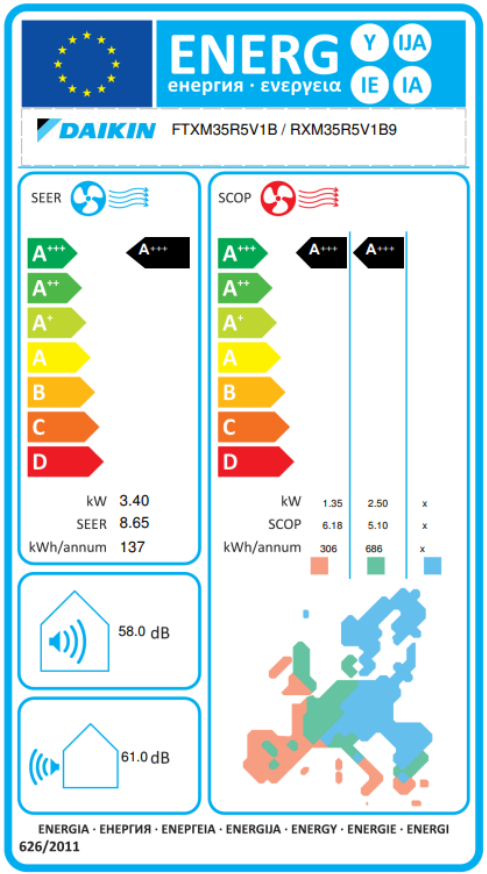
Nominal heating
Ambient = 7°C db 6°C wb
Internal = 20°C db

Example 3.5kW Split System with Perfera Wall
Nominal Cooling
3.40 kW / 0.80 kW = 4.25 EER

Seasonal Cooling Efficiency
8.65 SEER

Example 3.5kW Split System with Perfera Wall
Nominal Heating
4.00 kW / 0.99 kW = 4.04 COP

Seasonal Heating Efficiency
6.18 SCOP in hot climate
5.10 SCOP in moderate climate



3. Efficiencies, Running Costs, Installation

Running Operations

Hrs/Day	8
Day/Week	7
Cooling Weeks	30
Heating Weeks	22
Energy Price	£ 0.34
CO_2 Conversion	0.547

Time spent in Cooling

100% Load	5%
75% Load	10%
50% Load	34%
25% Load	51%
Total	100%

Time spent in Heating

100% Load	2%
75% Load	4%
50% Load	21%
25% Load	73%
Total	100%

Please Note: Do not change these values unless explicitly asked by the customer. These are the Part L default

Running Costs

3.5kW	Material				
Emura	RXJ35A/ FTXJ35AW	£302	=>	£0.83	per day
Stylish	RXA35A9 / FTXA35AW	£337	=>	£0.92	per day
Perfera	RXM35R9 / FTXM35R	£296	=>	£0.81	per day
Comfora	RXP35M / RXP35M	£356	=>	£0.98	per day

5kW	Material				
Emura	RXJ50A/ FTXJ50AW	£506	=>	£1.39	per day
Stylish	RXA50A9 / FTXA50AW	£479	=>	£1.31	per day
Perfera	RXM50R9 / FTXM50R	£428	=>	£1.17	per day
Comfora	RXP50M / RXP50M	£490	=>	£1.34	per day

Notes:

Running cost at UK condition
Cooling: Ambient 30°C, Internal 22°C db, 16°C db
Heating: Ambient 7°C db, 6°C wb, Internal 20°C db

Typical Room up to 35m²
4m x 8m = 32m²
100 W/m² thermal insulation
=> need 3200 W for cooling / heating

Typical Room up to 50m²
6m x 8m = 48m²
100 W/m² thermal insulation
=> need 4800 W for cooling / heating

4. Generating Hot Water

Multi+ DHW

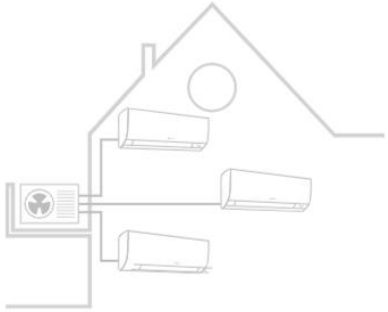
4. Generating Hot Water

Available soon

What does “Multi+” Series : Domestic hot water solution bring?

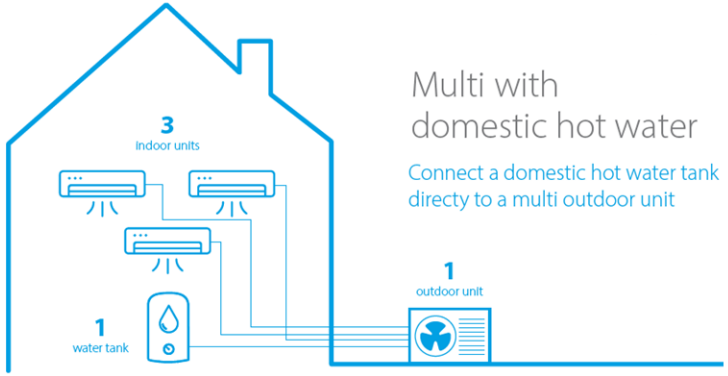
Conventional pair split installation for air-conditioning three rooms

Pair



Solution for the same situation with only one multi split outdoor unit

Multi



Production of hot water in combination with your multi system using *A/A heat pump technology*

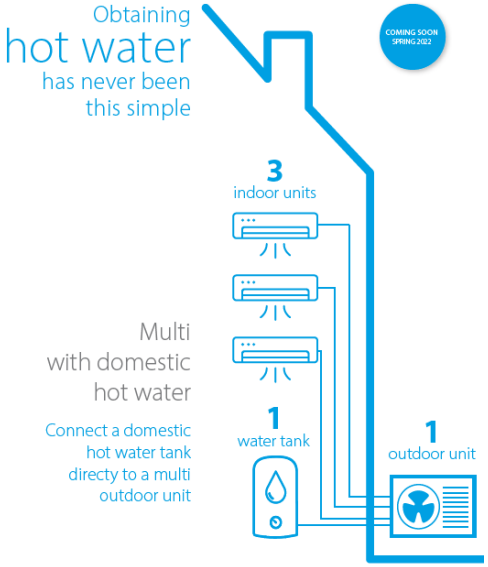
“Multi+” is clever enough to;

1. Combine a DHW tank directly to its multi+ outdoor unit
2. Provide hot water in a most economical / ecological way & cooling and heating in a most comfortable / efficient way
3. Create a solution for each customer’s preferences
4. Make scheduling daily, weekly and even monthly
5. Connect with Onecta

4. Generating Hot Water

What is the benefit ?

Multi+



1. Combine
   DHW tank directly to a multi+ outdoor unit
   Simply like an indoor unit, wall hung tank (120lt) is combined to multi outdoor unit developed for Multi+
   Simply replace the electrical water heater in your bathroom and easily install the tank.

2. Provide
   Hot water in a most economical / ecological way by *Air to Air Heat Pump* +
   Cooling and heating in a most comfortable / efficient way
   Daikin multi systems are known with their high efficiencies on the market (Up to A+++/A++)
   Hot water is prepared within this system with Energy Label B (120 ltr tank).
   Water is always hot; home is always comfortable.

3. Create solution for each *customer's preferences*
   How do you want to operate your system?
   Comfort in cooling & heating? Or economy in hot water preparation? Which season, what?
   Monthly scheduling on the priority selection is possible via MMI2 specifically developed for Multi+

   How economical & How fast & To Which Temperature do you want your hot water to be heated?
   Operation mode (QUICK, EFFICIENT) + Tank Set point (ECO, COMFORT)

   Customer has the liberty to choose own priority, own preferences

4. Schedule
   When do you want your hot water to be ready?
   Daily & weekly scheduling is possible via MMI2 specifically developed for Multi+

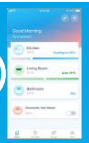
5. Connect Onecta : Connectivity is standard for Multi+
   Next to all indoor units operation via Onecta;
   - Set and monitor water temperature in the tank
   - Set On-Off & Powerful

4. Generating Hot Water

How does the system work?

Profile 1: Single Person
Habit: Shower twice a day
Time: Summer
Preferences:
- Comfort is priority
- Hot water ecologically & fast

1 Almost evening after a very hot day
A person on the way back home
checking the watch showing **18:30**

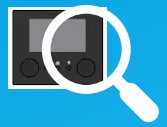


Via APP;
Checks the tank water temperature (45C OK)
Sets the living room(DX2) temperature to 22C

2 

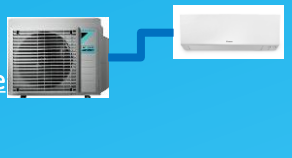
OU operates in cooling mode
DX2 blowing cool air
Living room temp. decreases

3 

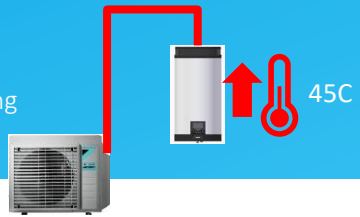
4 

- ✓ ECO setpoint [45C]
- ✓ QUICK mode
- ✓ QUICK Mode timer : ECONOMICAL
- ✓ SCHEDULED at 17p.m. & 6a.m.

5 It's 24:00. DX2 is turned off.
DX1 set temperature 27 C + night set mode
DX1 turns off eventually at night.



6 It's 06:00.
OU operates in heating mode.
Tank water is heated => Hot water ready by morning
(clock shows 07:30)

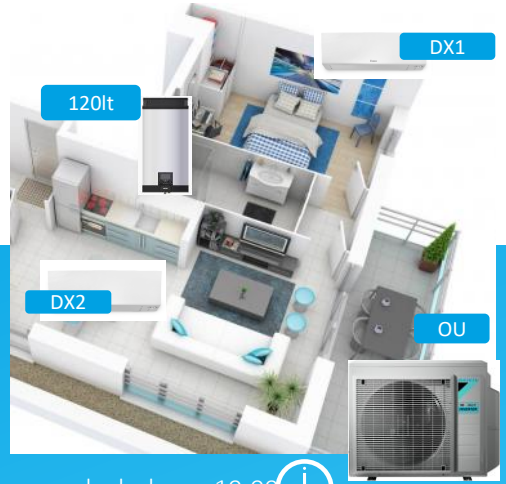


Shower at 07:30

DAIKIN

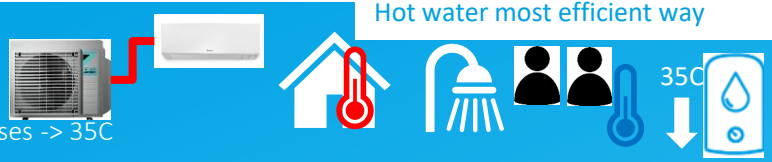
4. Generating Hot Water

Profile 2: Two People
Habit: Shower once a day / each
Time: Winter
Preferences:
Efficiency is priority
Hot water most efficient way



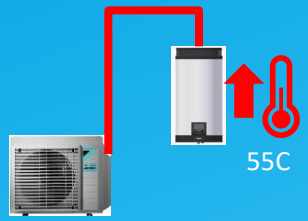
How does the system work?

1 Morning: clock on the wall shows 07:00
Warm environment (DX1 heating)
Person takes shower / then second person takes shower; Tank water temperature decreases -> 35C
People leave home

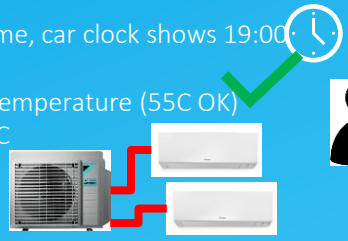


2
- ✓ COMFORT setpoint [55C]
- ✓ EFFICIENT mode
- ✓ SCHEDULED at 16p.m. & 4a.m.

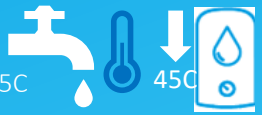
3 clock on the wall shows 16:00
OU starts to operate in heating mode
Tank water is heated => Hot water prepared for evening



4 People coming back home, car clock shows 19:00
Person via APP;
Checks the tank water temperature (55C OK)
Sets DX2 and DX1 to 24C



5 People arrive at warm home,
eat dinner, wash the dishes
Tank water temperature decreases -> 45C



6 People sleep, clock on the wall shows 04:00
OU operating in heating mode

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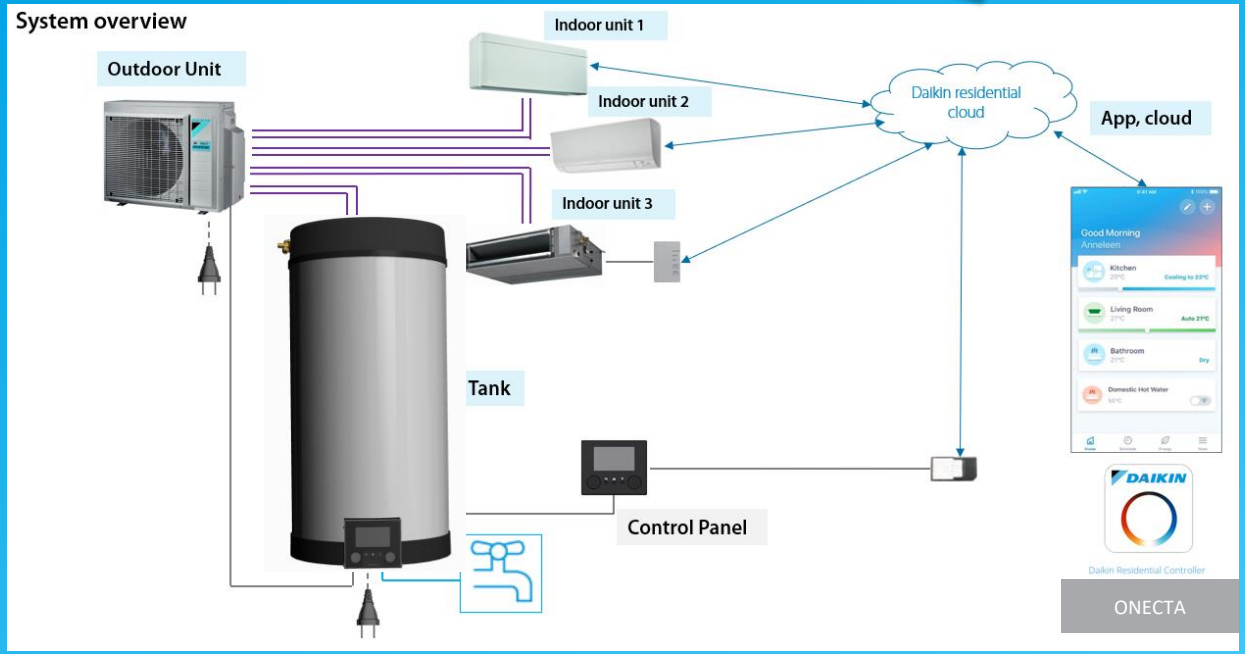
4. Generating Hot Water

Preliminary Information

System overview

	Material Name	Product Number
OU	4MWXM52A	4MWXM52A2V1B
Tank 120L	EKHWET120BV3	EKHWET120BAV3

Product Number	Dimensions (HxWxD)	Weight (Kg)
EKHWET120BAV3	1296 x 536 x 571	70



4. Generating Water

Combination table

Preliminary Information


stylish


perfera


emura


comfora




perfera




CONNECTABLE AIR CONDITIONING INDOOR UNITS	Wall mounted																								Concealed ceiling						Floor standing			Round flow		Fully flat			Ceiling suspended		Concealed floor standing		
	C/FTXA-AW/BS/BT/BB						C/FTXM-R						FTXJ-AW/S/B					FTXP-M9			FDXM-F9			FBA-A9				C/FVXM-A9			FCAG-B		FFA-A9			FHA-A9		FNA-A9		
	15	20	25	35	42	50	15	20	25	35	42	50	20	25	35	42	50	20	25	35	25	35	50	35	50	60	71	25	35	50	35	50	25	35	50	35	50	25	35	50
4MWXM52A	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●

○ = no combination with additional split indoor units possible

● = It is not allowed to install 1 indoor unit connection. Exception is 1 indoor unit connection of FBA60 or FBA71.

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5. Skills Required

F-Gas Training

5. Skills Required

F-Gas Training

What is it?

- All businesses that install, maintain or service stationary refrigeration, air conditioning and / or heat pump equipment containing or designed to contain F-gas refrigerants must have an accreditation by law since 2009.

What does it mean?

- Staff-wise, in practice this means that anyone must hold the relevant qualifications. If a company's staff members are qualified to the accepted standards set by Defra, the company itself is eligible to apply for FGAS Company Certification.

How is the accreditation checked?

- Businesses holding the accreditation are expected to undergo **regular auditing** to make sure that they are following all the correct procedures. There's an **annual risk-based desk-top audit** that is designed to check that the information provided by the 'named person' is accurate, and **on-site audits can also be triggered** if there has been a complaint about the company.

5. Skills Required

F-Gas Training

Safe-handling of Refrigerants

- Safety goggles to protect the yes
- Gloves made from non-absorbent material
- Clothing to cover the body
- Safety shoes
- Gas mask

Installation Competence

- Easy to upskill
- Daikin 1 day installation training course at the Sustainable Home Centre
  - Richmond's, 15 Carnoustie Place, Glasgow G5 8PA
  - Costs £150
- F-gas Level 1 Training Course
  - 5 days with HSS Training
  - Local Fgas training business, safe handling of refrigerants, brazing,
  - Company needs F-Gas

Thank you

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Q&A

You can ask questions by typing them into the **questions** box of the control panel

Panellists:

Pilar Rodriguez	Green Heat Installer Engagement Programme Manager, **Energy Saving Trust**
Stephen Lang	Product Manager, Residential Air to Air Systems, **Daikin**
Dean Blake	National Residential Air Conditioning Manager, **Daikin UK**

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- Email: GreenInstallerScotland@est.org.uk
- LinkedIn Group: https://www.linkedin.com/groups/5139242/
- Email updates and quarterly newsletter subscription: bit.ly/2PSatkL
- Website: https://energysavingtrust.org.uk/business/energy-efficiency/green-installer/

Please remember to complete the feedback survey after the webinar has finished

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Thank you for attending