



# Technical Seminar 2014

## Gas Absorption Heat Pumps

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# Contents

- History
- Absorption Technology
- Key features and benefits
- Other products
- Case studies

# Development of Gas Absorption Heat Pumps

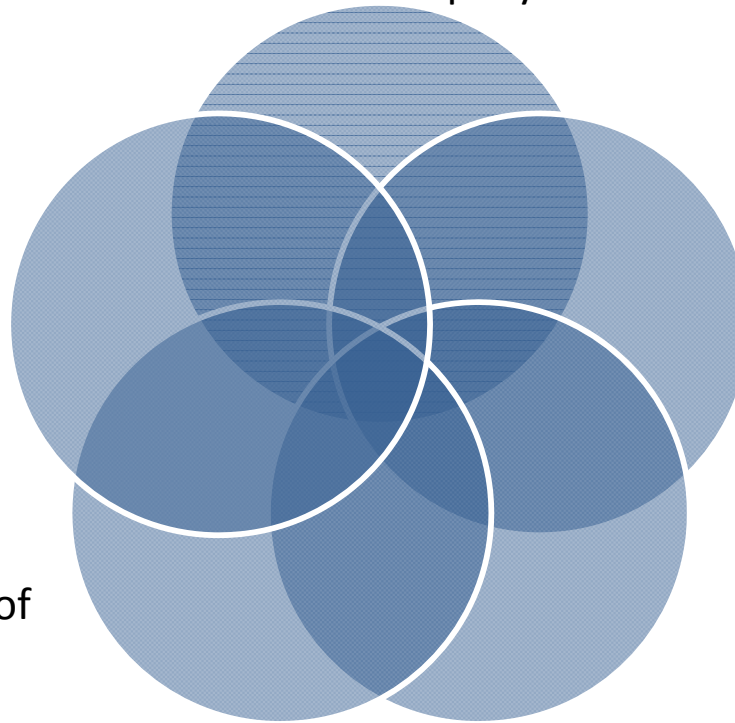
**1920s:** Albert Einstein does work on domestic refrigerators for the Servel company

**2004:** Launch of first gas powered heat pump

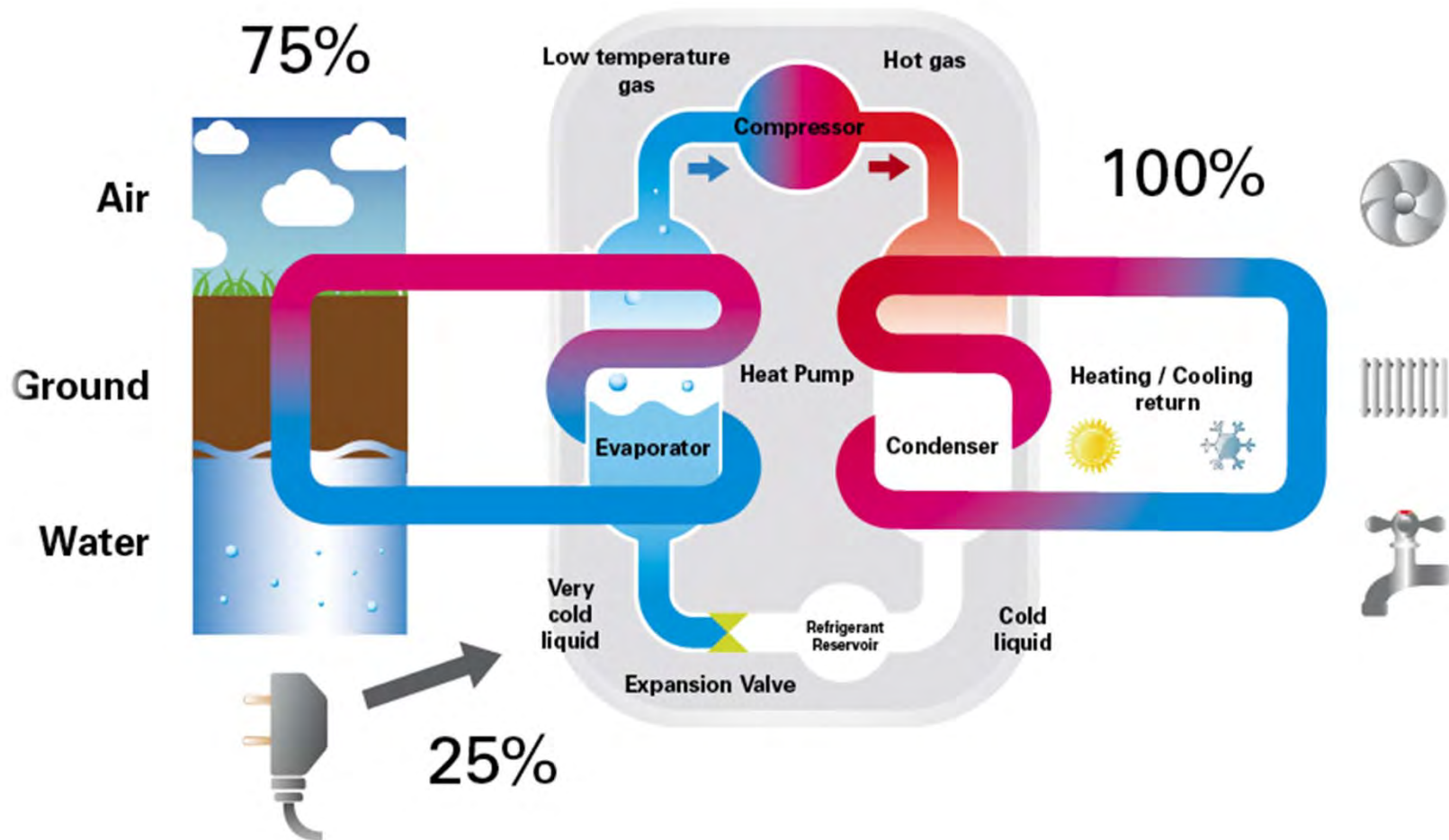
**1950s: and 60s**  
4 million refrigerators sold

**1991:** Development of first gas fired heat pump commenced

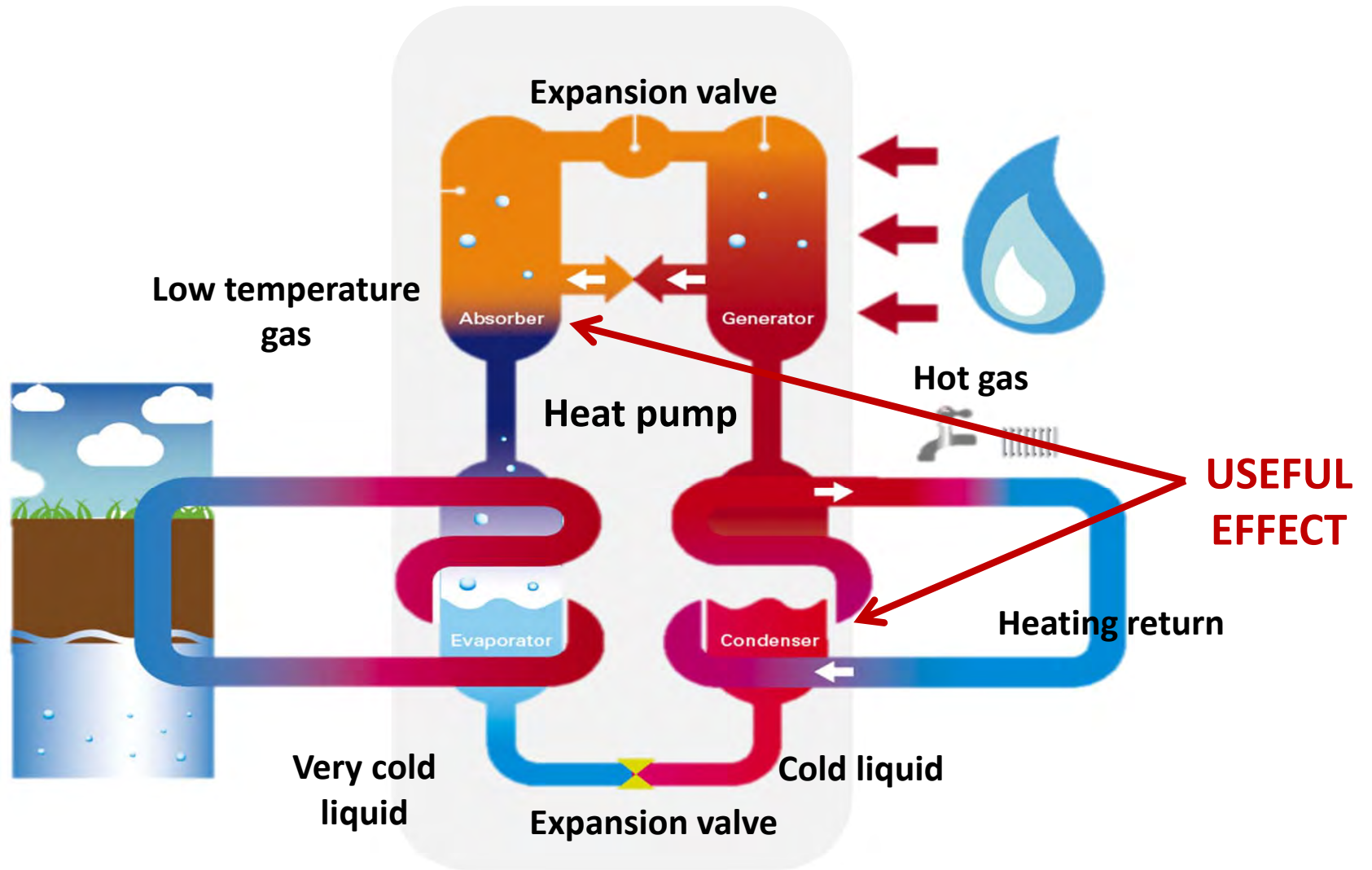
**1968:** First commercial gas-fired chiller was produced in the USA by the Arkansas & Louisiana Gas Company



# Principle of Compression Heat Pump



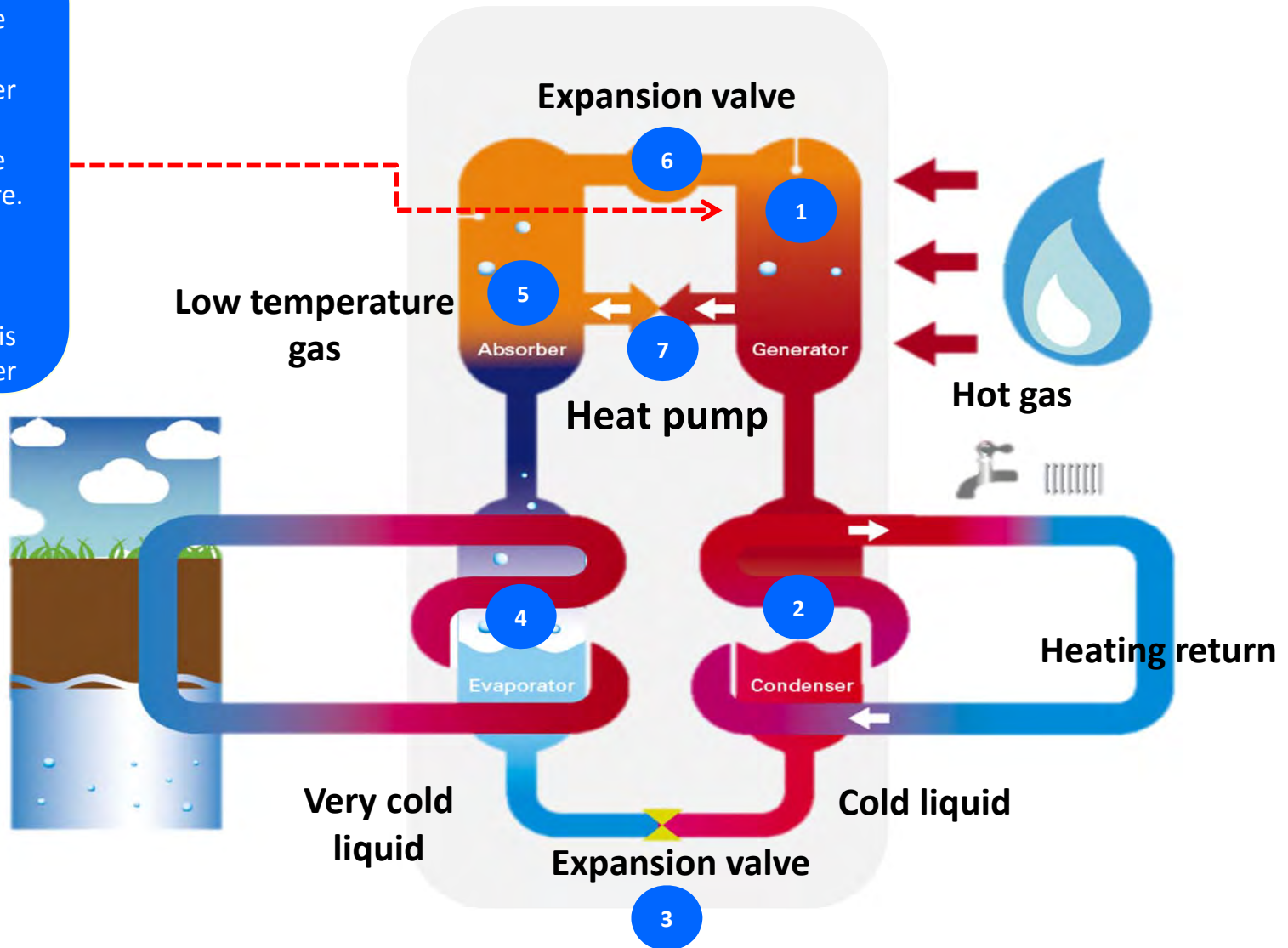
# Principle of gas absorption heat pump



# How does a GAHP work?

## 1. Generator

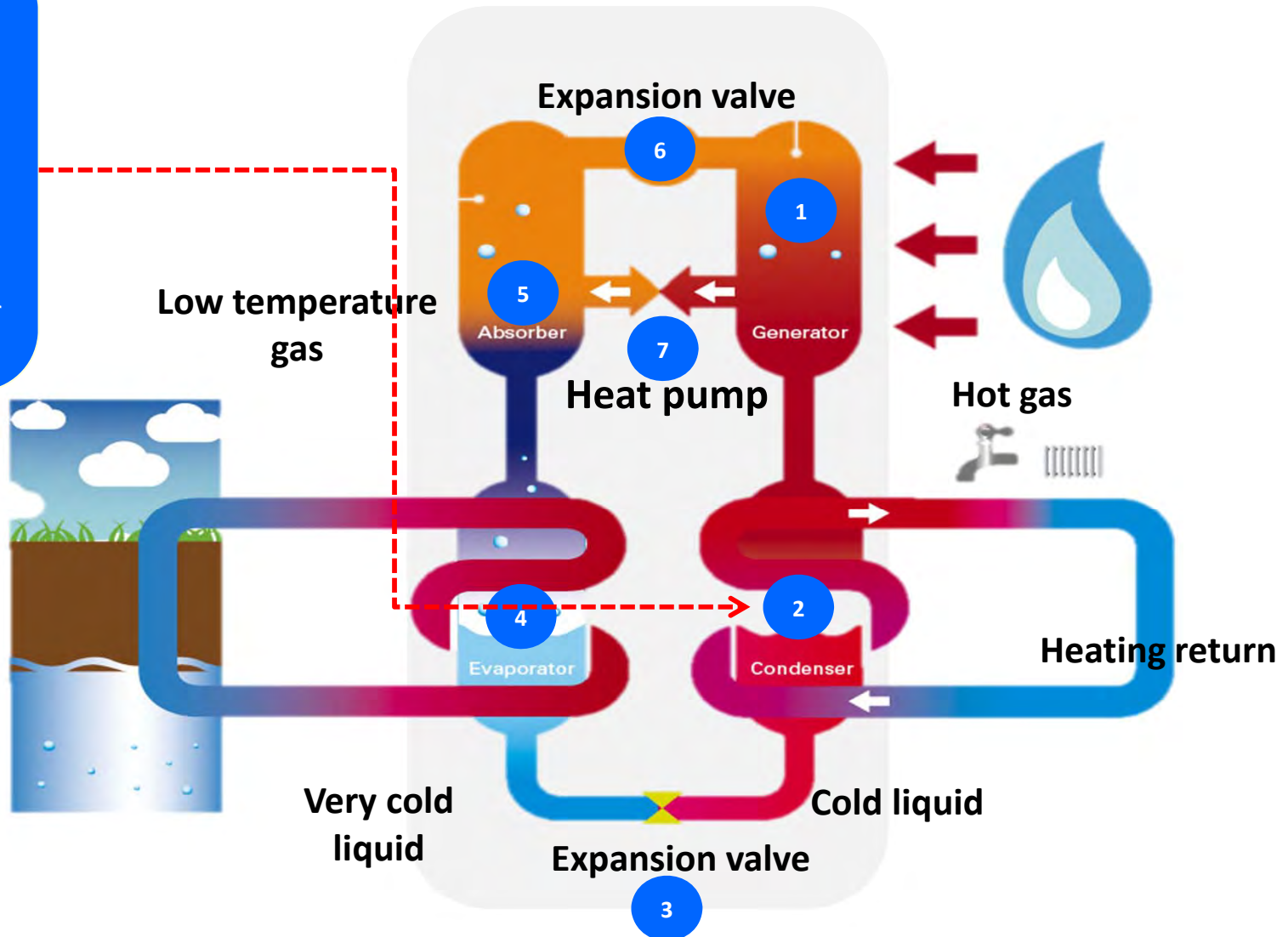
Within the generator, the low Nox gas-fired burner heats the ammonia/water solution via a heat exchanger, increasing the temperature and pressure. The strong ammonia vapour travels to the condenser (2) whilst the weak ammonia solution is circulated to the Absorber.



# How does a GAHP work?

## 2. Condenser

The high temperature, high pressure ammonia vapour releases its heat into the heating system in the condenser. The vapour becomes a liquid and travels to the expansion valve (3) on its way to the evaporator (4)

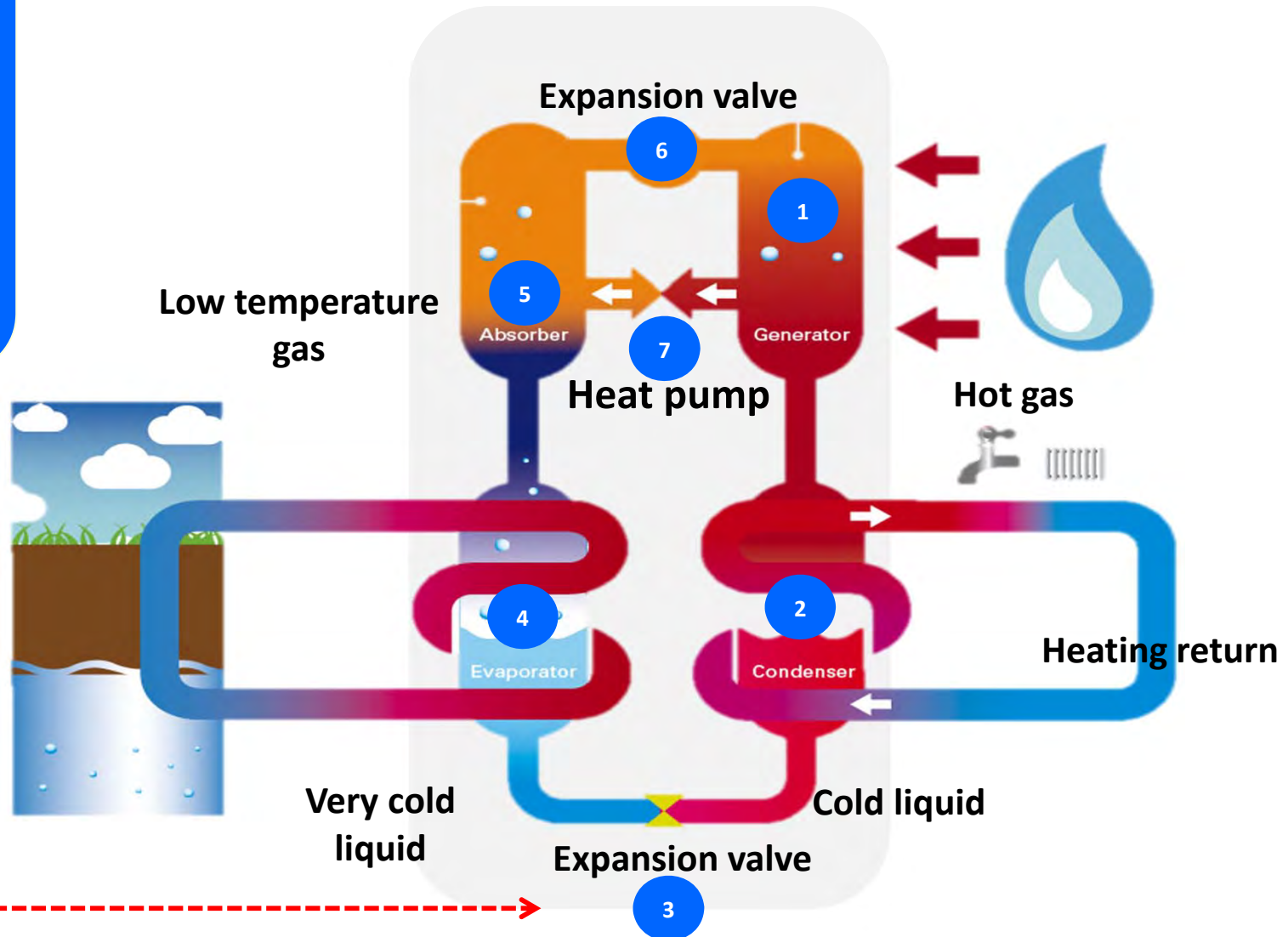




# How does a GAHP work?

## 3. Expansion valve

The high pressure ammonia passes through the expansion valve where the pressure falls. The ammonia now has a reduced boiling point and the liquid changes back to a vapour. This vapour passes on to the Evaporator (4)

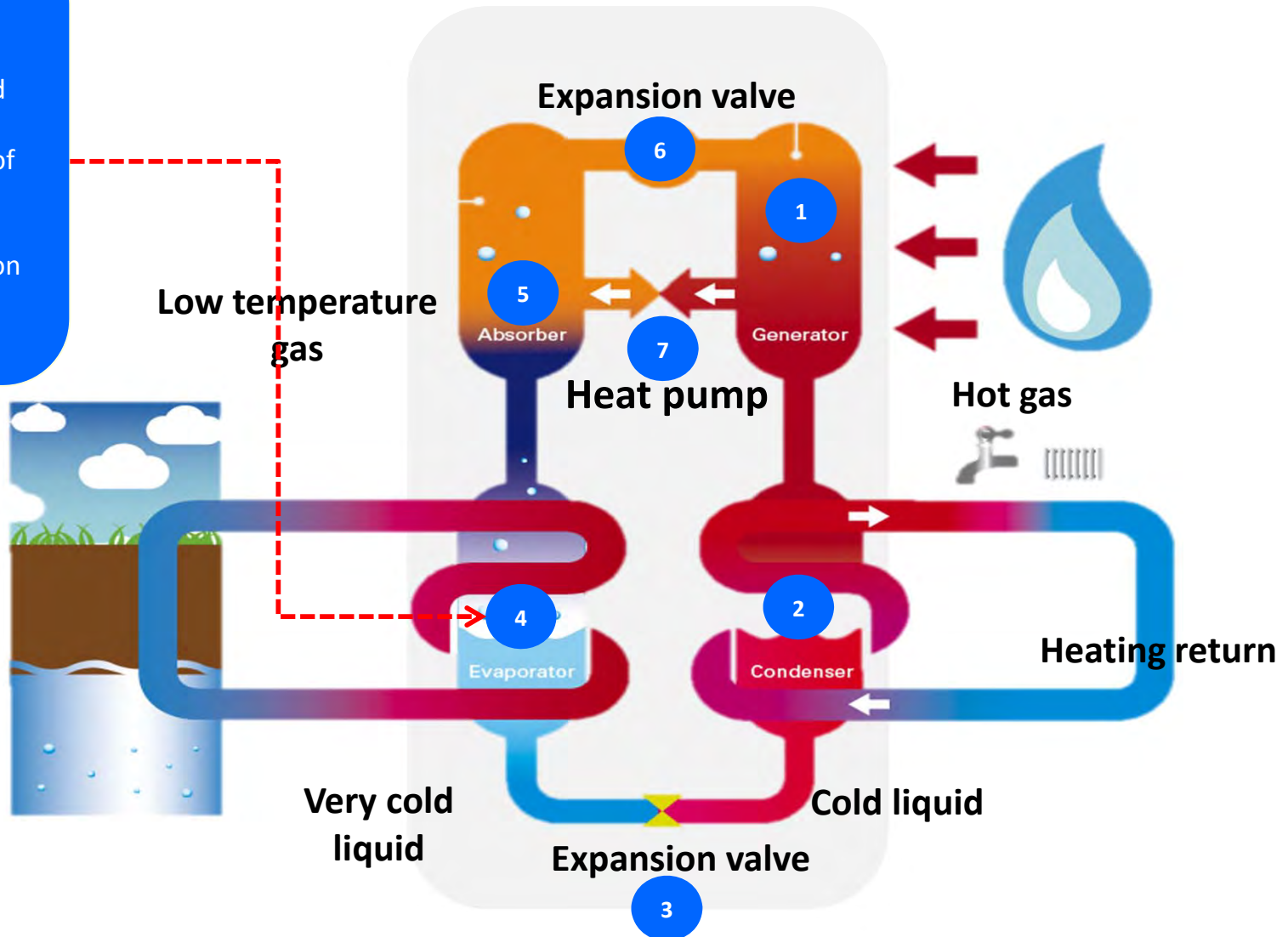




# How does a GAHP work?

## 4. Evaporator

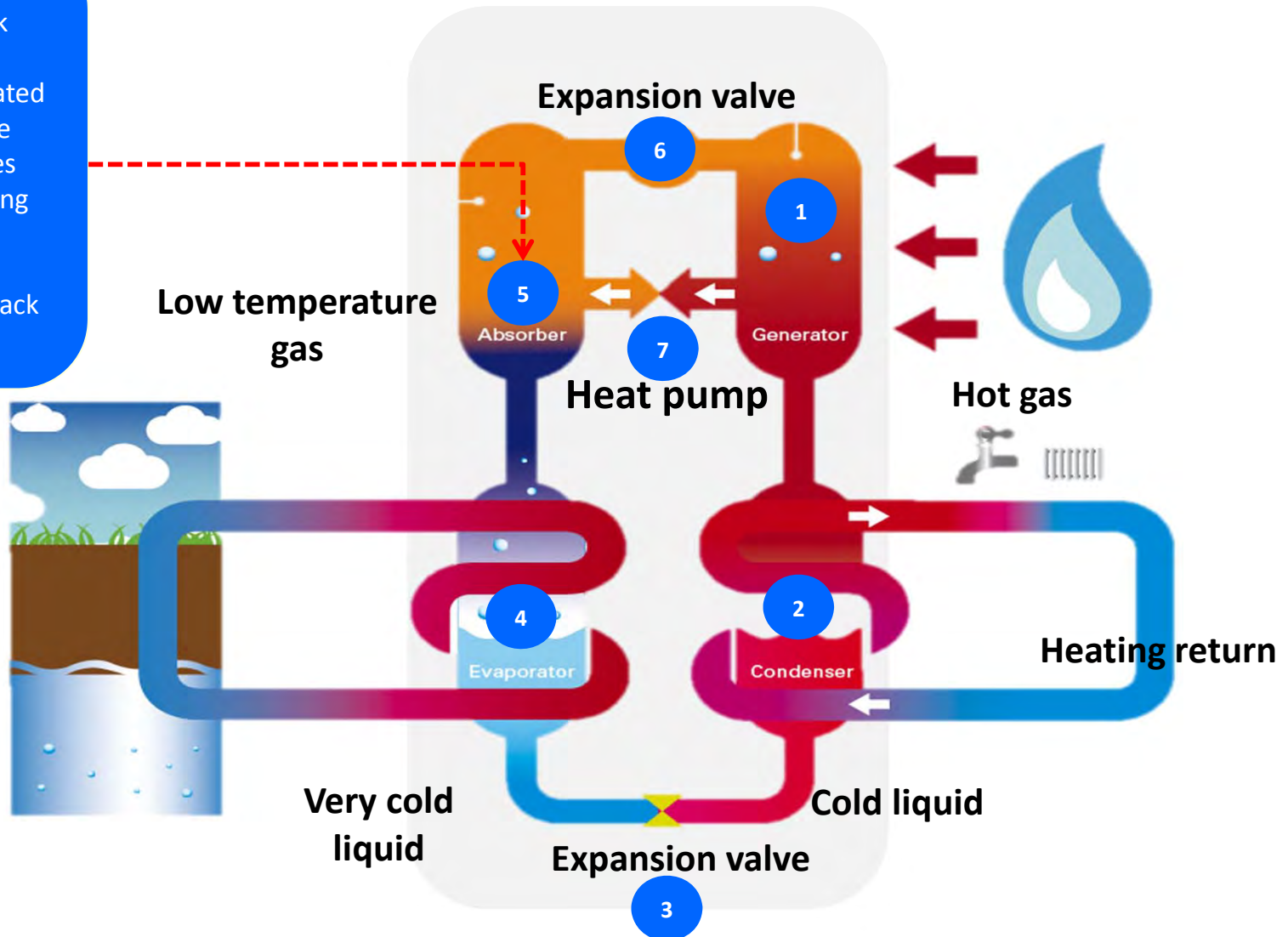
A fan draws ambient air through the evaporator. The ambient air captured by the ammonia vapour, contains a high amount of free, renewable energy. The now heated, low pressure vapour passes on to the Absorber (5)



# How does a GAHP work?

## 5. Absorber

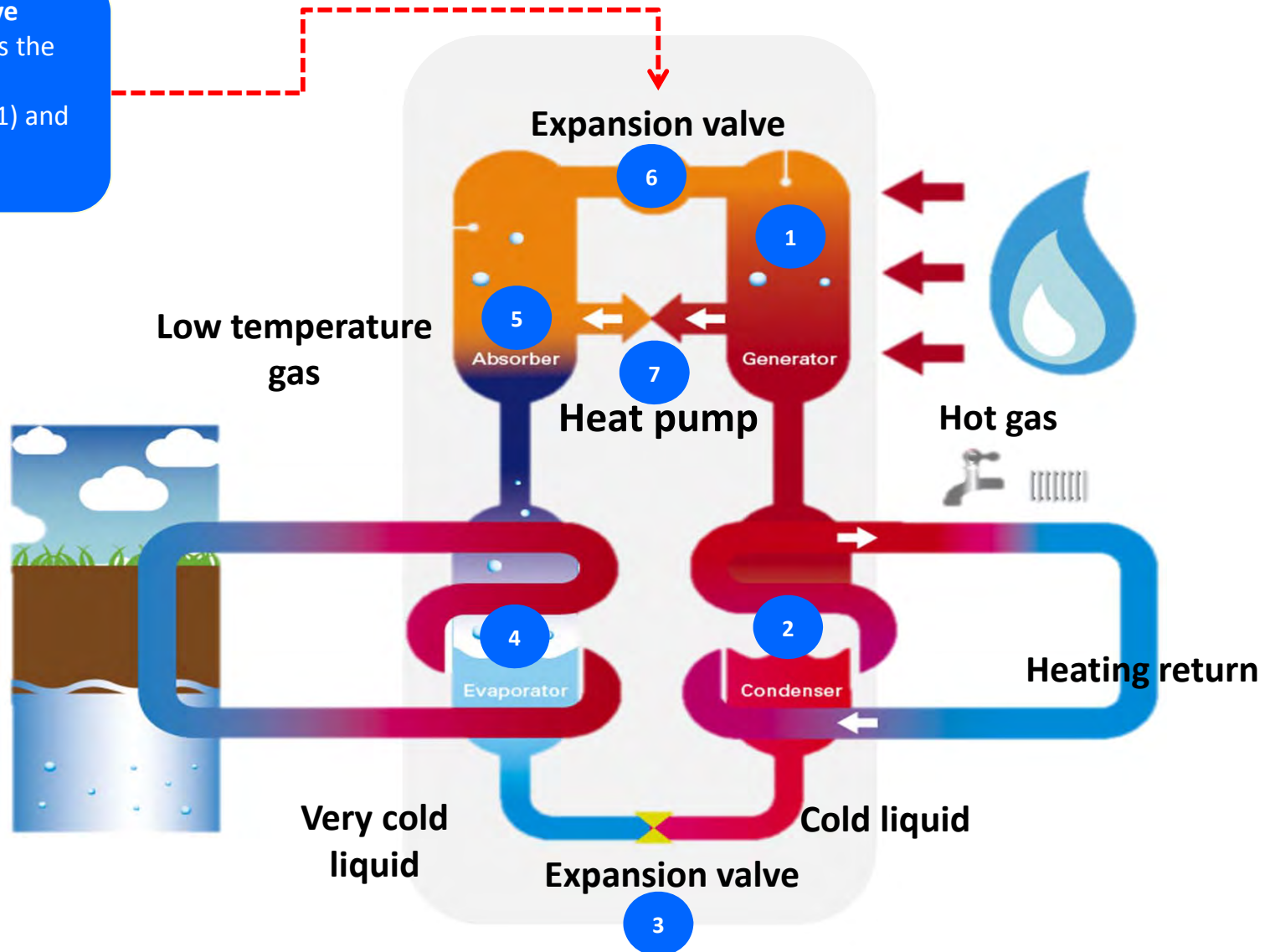
In the absorber the weak ammonia solution recombines with the heated vapour, changing its state into a liquid. This releases further heat to the heating system. The now recombined ammonia solution is pumped (7) back to the generator.



# How does a GAHP work?

## 6. Second expansion valve

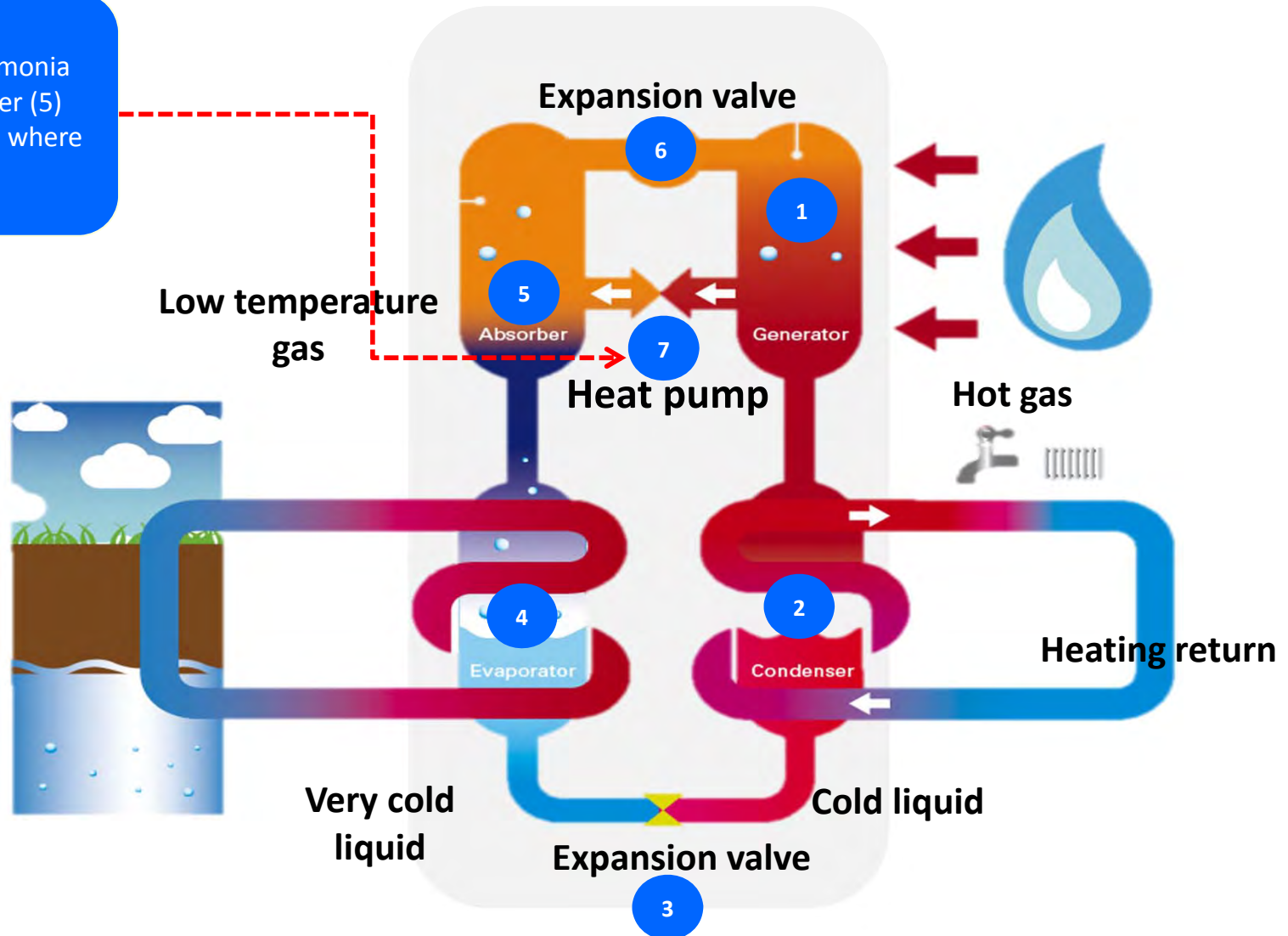
This second valve controls the flow of weak ammonia between the Generator (1) and the Absorber (5)



# How does a GAHP work?

## 7. Heat pump

The pump moves the ammonia solution from the Absorber (5) back to the Generator (1) where the process starts again.



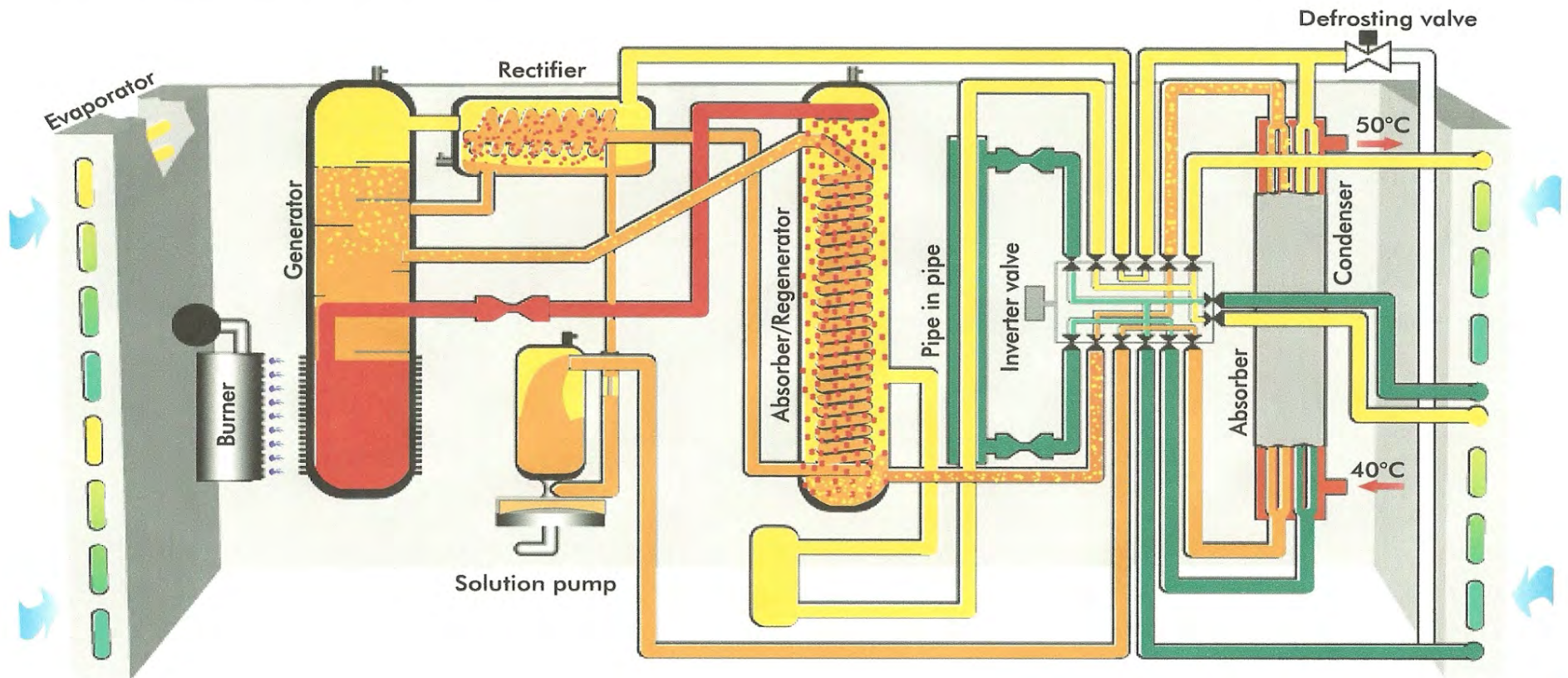


# How does a GAHP work?

GAHP-AR

THERMODYNAMIC CYCLE - HEATING OPERATION

**ROBUR**  
caring for the environment



● attiva defrosting



# Ground Source Heat Pump



- Ground source (closed loop)
- Internal installation
- Natural gas or LPG
- Water temperature 65oC \*
- Efficiency (GUE) up to 170%
- 60% less bore holes than electric heat pumps
- Simultaneous (GUE 244%)



# Ground Source Heat Pump



## Refrigerant

- Water-ammonia sealed circuit : no top-up, no drain, extremely simple maintenance;
- Natural refrigerant : no CFC, HCFC, HFC;
- Global warming potential of zero
- Ozone depletion potential of zero

# Ground Source Heat Pump



## Electrical supply

- Single phase power supply required
- Electrical consumption less than 0.5kW

# Ground Source Heat Pump

## Gas Utilisation Efficiency

- EN14511 Brine 0oC Water 35oC
- GUE 170%
- To equate this to COP, electricity from the grid 40% efficient therefore relative COP of 4.11

# Ground Source Heat Pump

## CO<sub>2</sub>

- Grid electricity 0.4455 kg/CO<sub>2</sub> kW/h
- Natural gas 0.1840 kg/CO<sub>2</sub> kW/h

# Ground Source Heat Pump

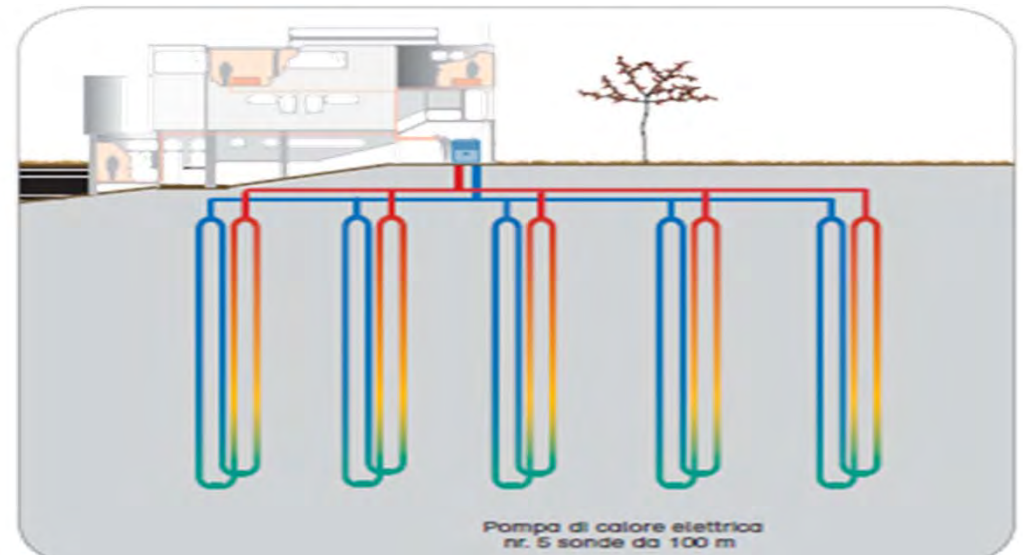
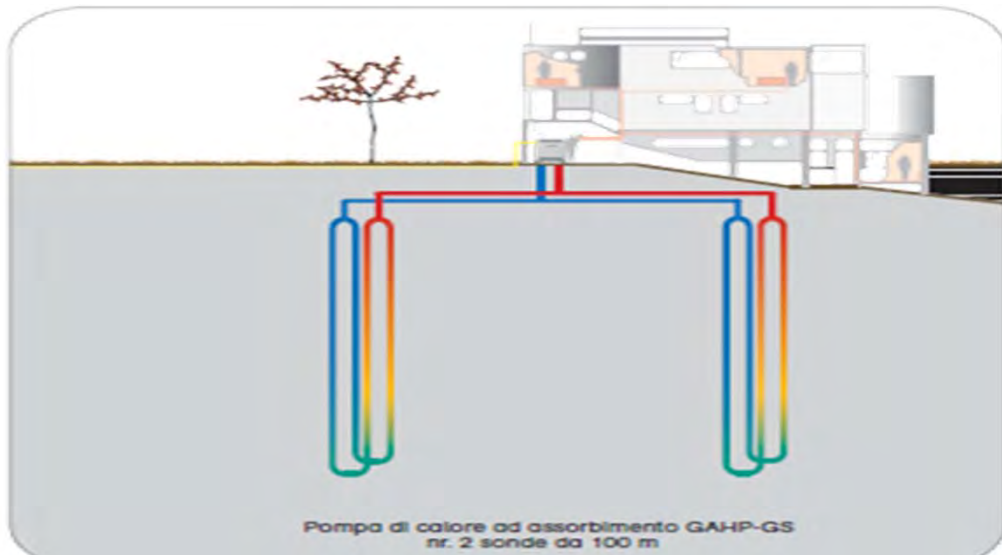
## Bore Holes

- Total output of 42.6kW
- Output from gas 25.6kW
- Output from the ground 17kW

# Ground Source Heat Pump

## Bore Holes

- Reduction in bore hole quantity of 60%
- Reduction in civils costs
- Reduction in area of bore field
- Unit cost?
- Bore hole cost?





# Ground Source Heat Pump

## **Benefits summed up**

Single phase low electrical consumption

Gas or LPG ( Remote sites )

Natural refrigerant, zero GWP and ODP

Lower civils costs

Less bore field area required

CO2 savings

A viable alternative to Electric ground source

# Air Source heat pump



- Air cooled
- Heat pump
- Natural gas or LPG
- Water temperature upto 65oC
- Seasonal efficiency 155%

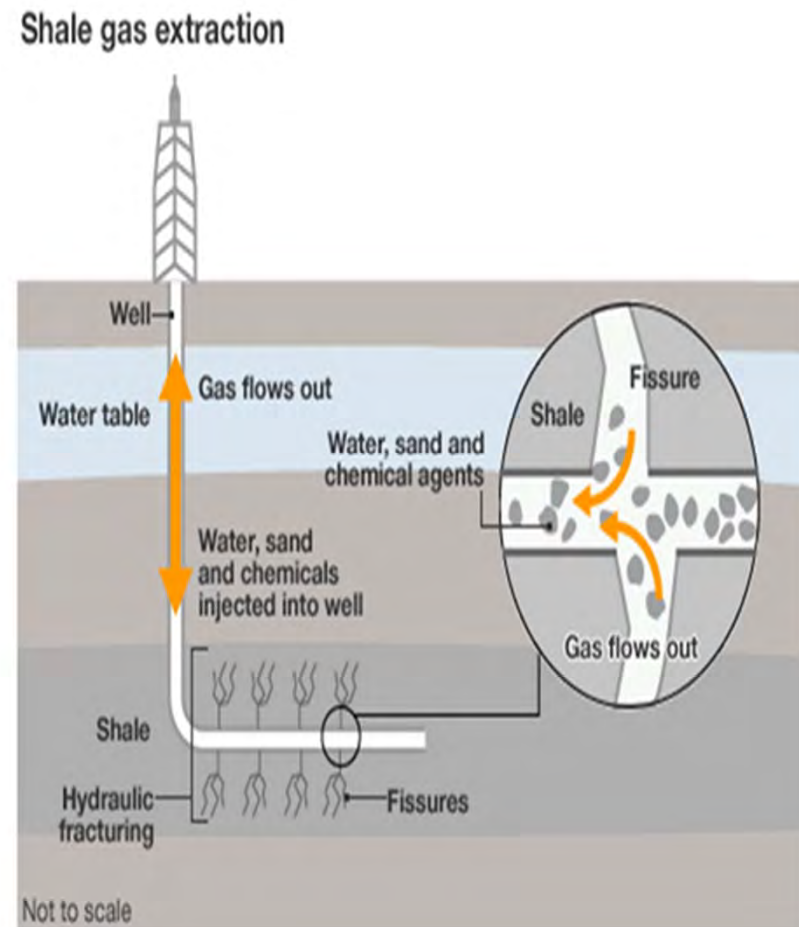
# Gas condensing boiler



- Gas condensing boiler heat Pump
- Used to supplement or be used as “back up”
- Hot water production
- 80oC water temperature
- 98 % Efficient

# UK Future Energy Source?

- Fracking-Shale Gas
- 1,300 Trillion ft<sup>3</sup>
- Mainly found in Lancashire
- Plans for West Sussex
- UK currently use about 3 trillion ft<sup>3</sup> a year
- 800 years of self sufficiency?



## Lowford Centre, Eastleigh



### **Community centre, Library and Doctors surgery**

9\* 100m closed loop boreholes

3\* GAHP-GS heat pumps in 2 plant rooms

130kW output

Single phase supply

50% running cost savings over traditional boilers

Small bore field under car park



## Open University, Milton Keynes



### Building 12 admin offices

- 140kW ground source ( 4 units)
- Exceeding peak efficiencies of 169%
- Saving 20.4 tons of CO2 (over condensing boilers)
- BREEAM outstanding as a result of low emissions
- 5<sup>th</sup> place in BREEAM highest scoring office buildings in 2012



## Brief Robur history

- Started in 1958 manufacturing gas burners still owned & operated by same family.
- HQ Bergamo Italy -220 staff
- 30 Million Euro turnover -7% is reinvested in R&D.
- 1991 bought the gas absorption technology from Electrolux
- 2004 launched the first gas absorption heat pump.
- 2005 started operating in UK
- To date have over 300 systems installed in the UK.

## Who Are ESS

- 2001 Appointed as the 1st National Distributor for Sanyo
- Promoting their electric & gas driven heat pumps predominately to Consultants and end users.
- 2010 Samsung range of heat pumps added to our portfolio.
- 2012 Appointed as Robur's UK Distributor due to our success offering heating & cooling solutions with our existing gas driven heat pump range.



# Thankyou



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