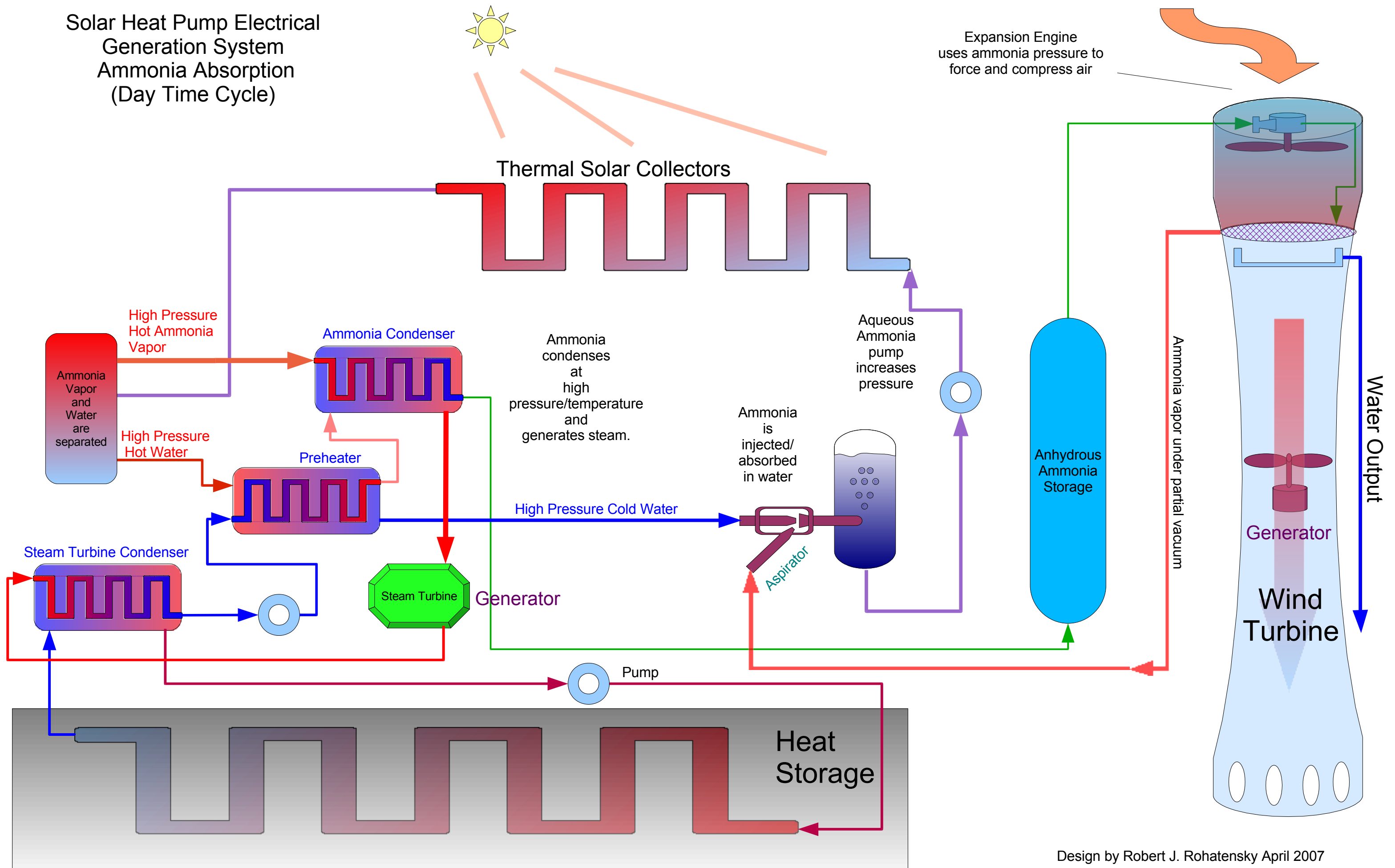


Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



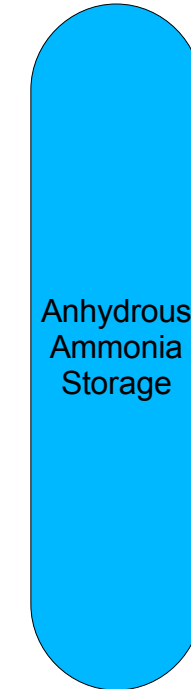
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

The target location in this example is
Western Canada.

For the summer daytime cycle, assume
that the ambient air temperature is 20°C
and the shallow earth is 3°C.

The solar collectors would be concentrated
solar trough or similar system capable of
temperatures >400°C.

Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

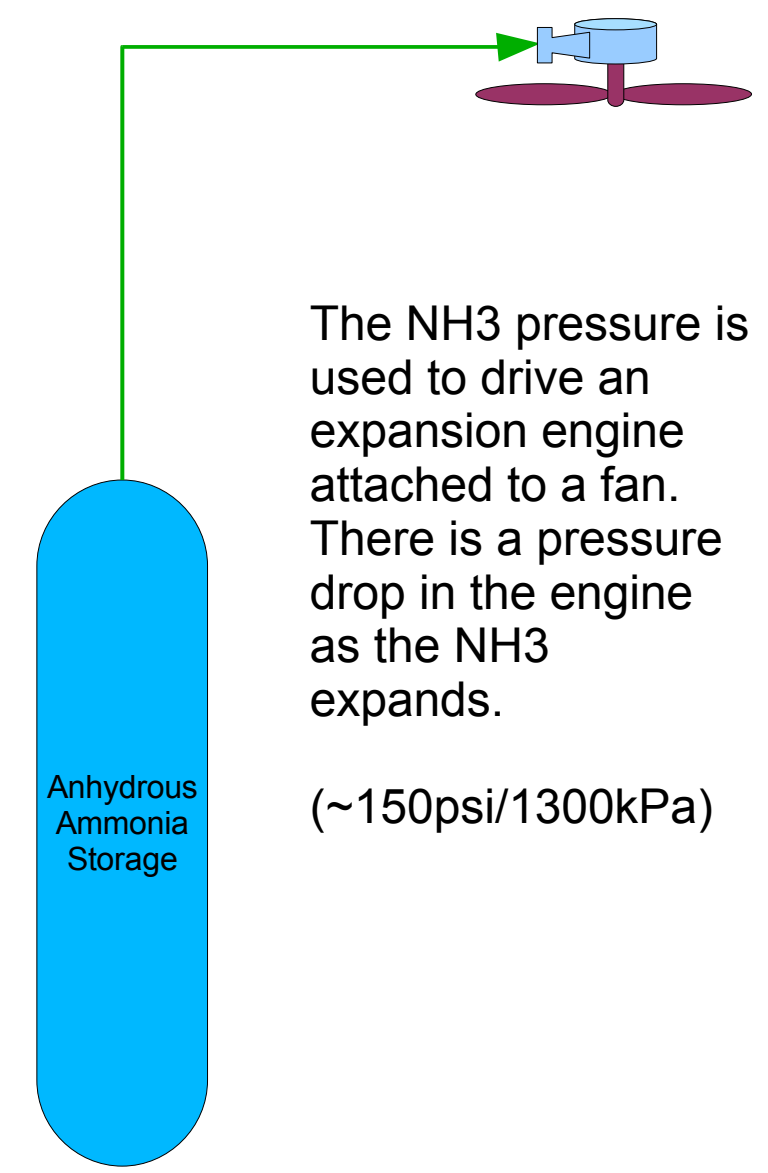


Anhydrous
Ammonia
Storage

Anhydrous Ammonia
(NH₃) is stored as a
liquid under pressure
at ambient
temperature.

(400psi/2700kPa)

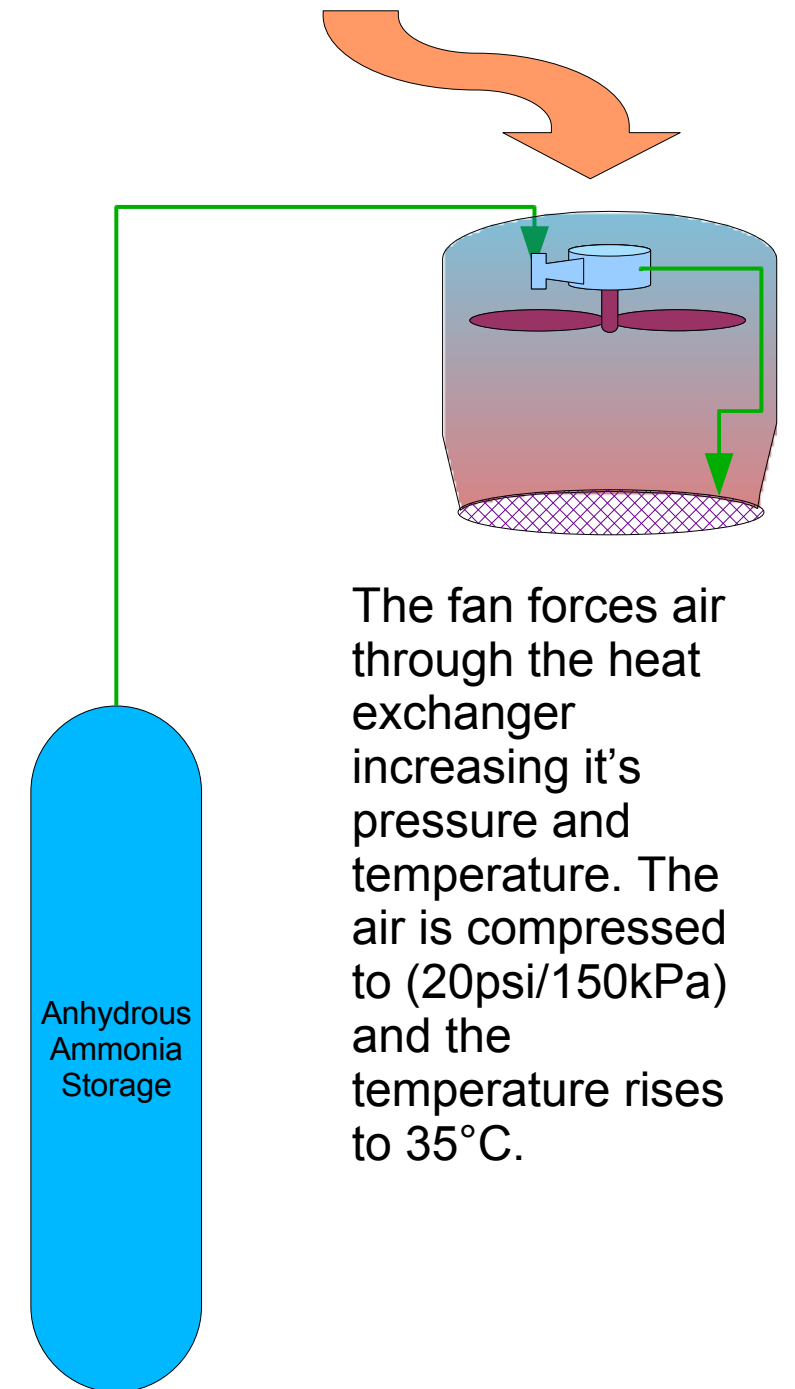
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



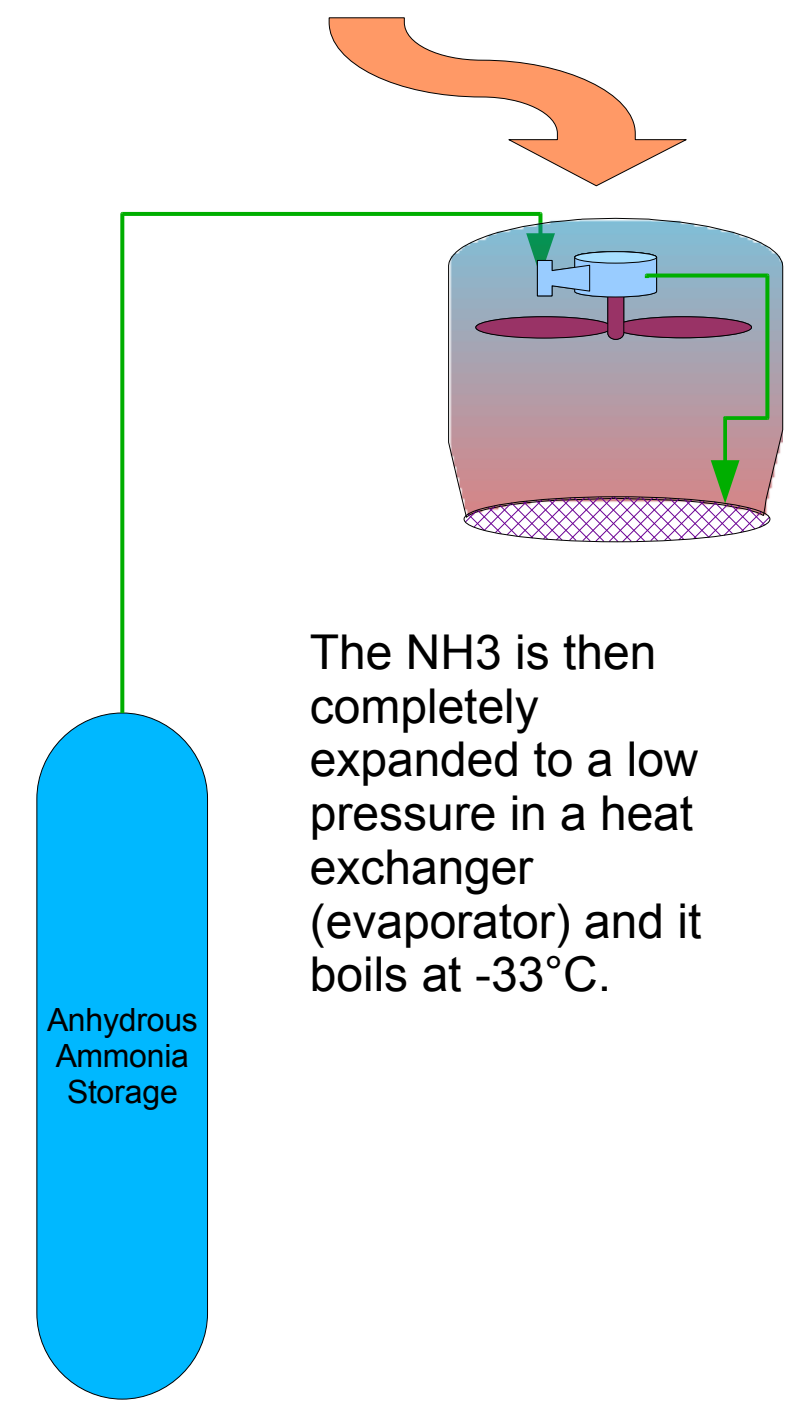
The NH₃ pressure is used to drive an expansion engine attached to a fan. There is a pressure drop in the engine as the NH₃ expands.

(~150psi/1300kPa)

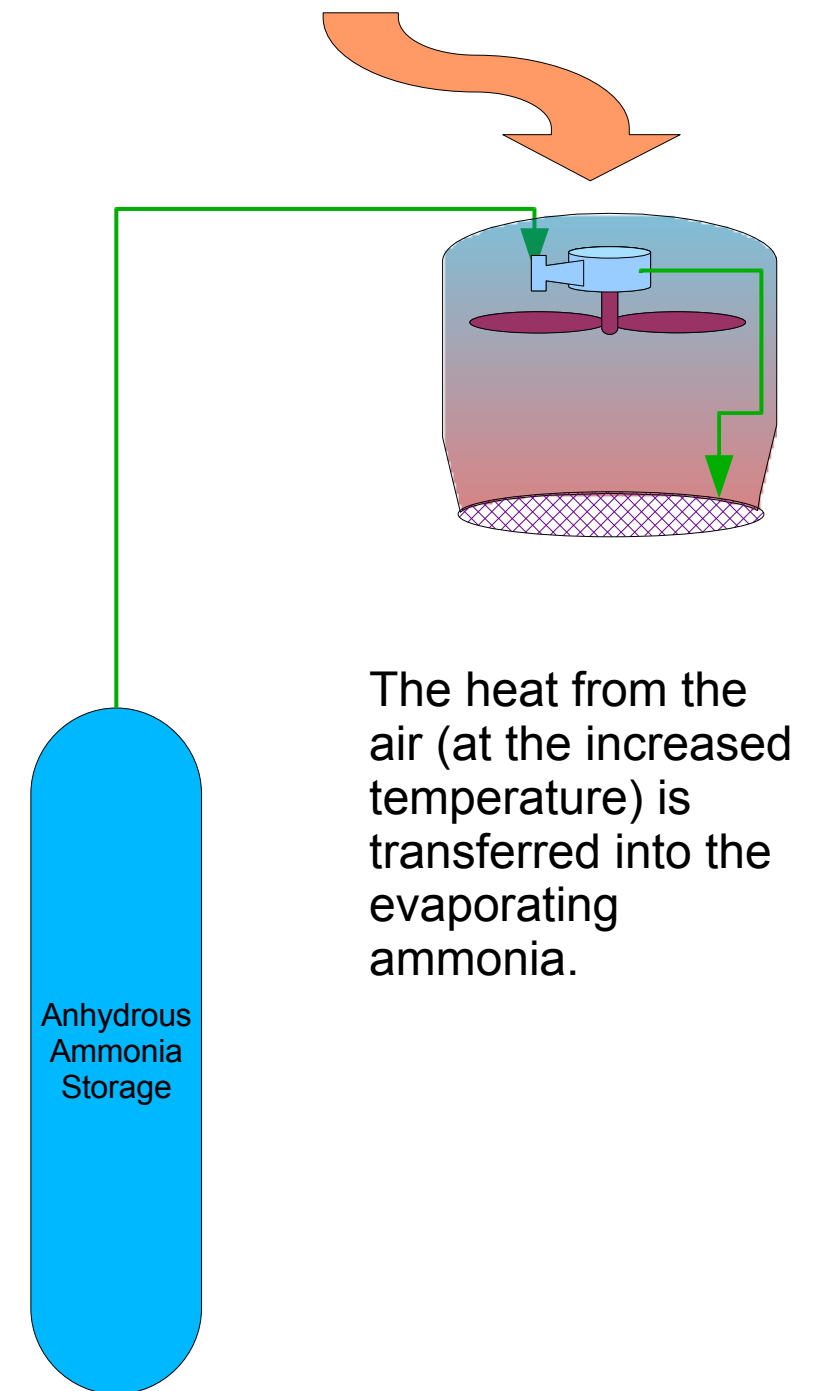
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



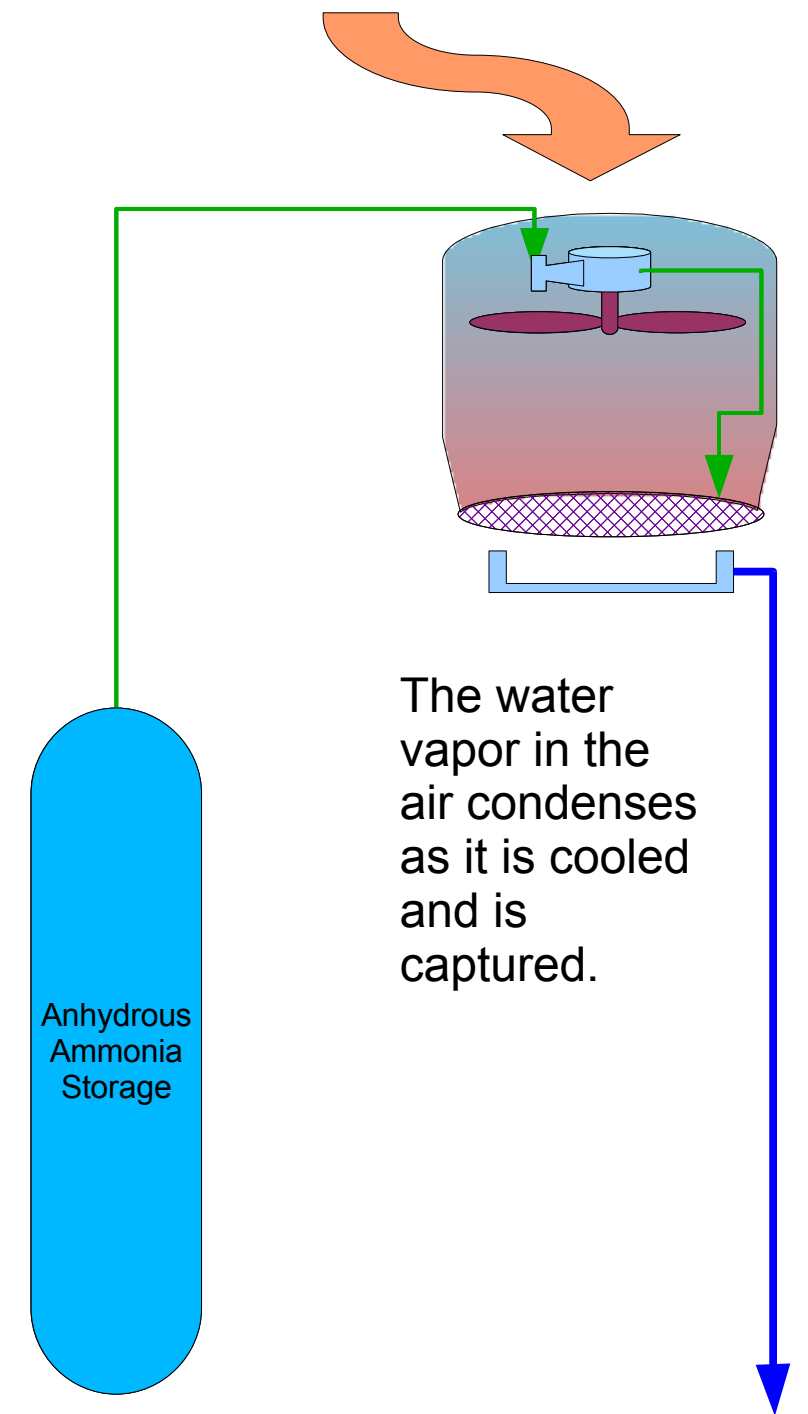
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



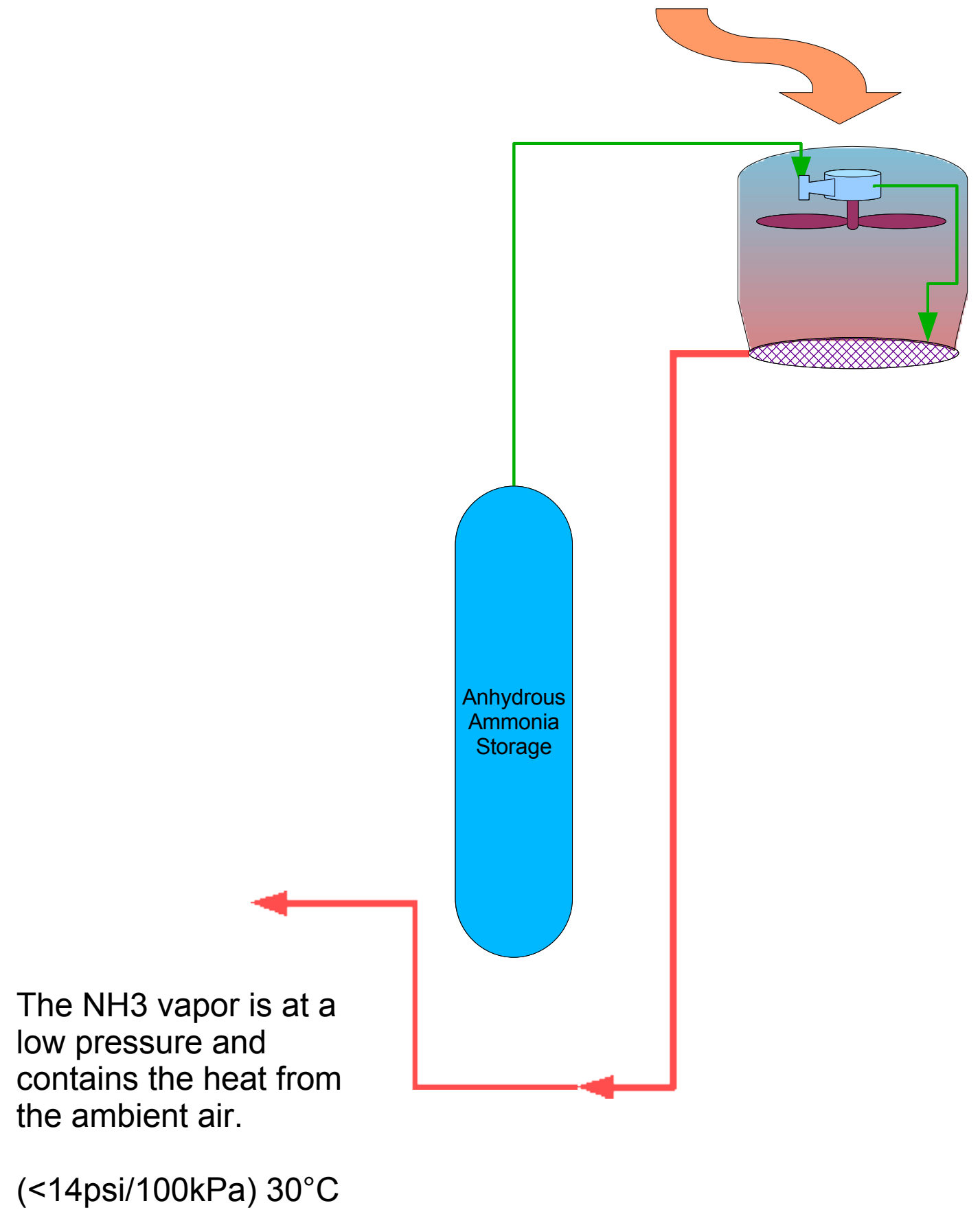
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

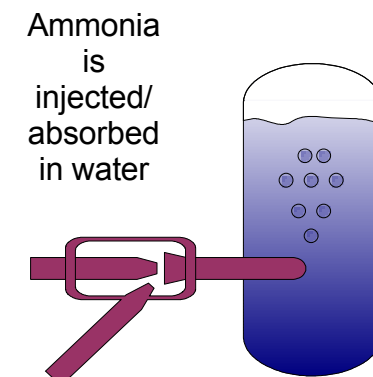


Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

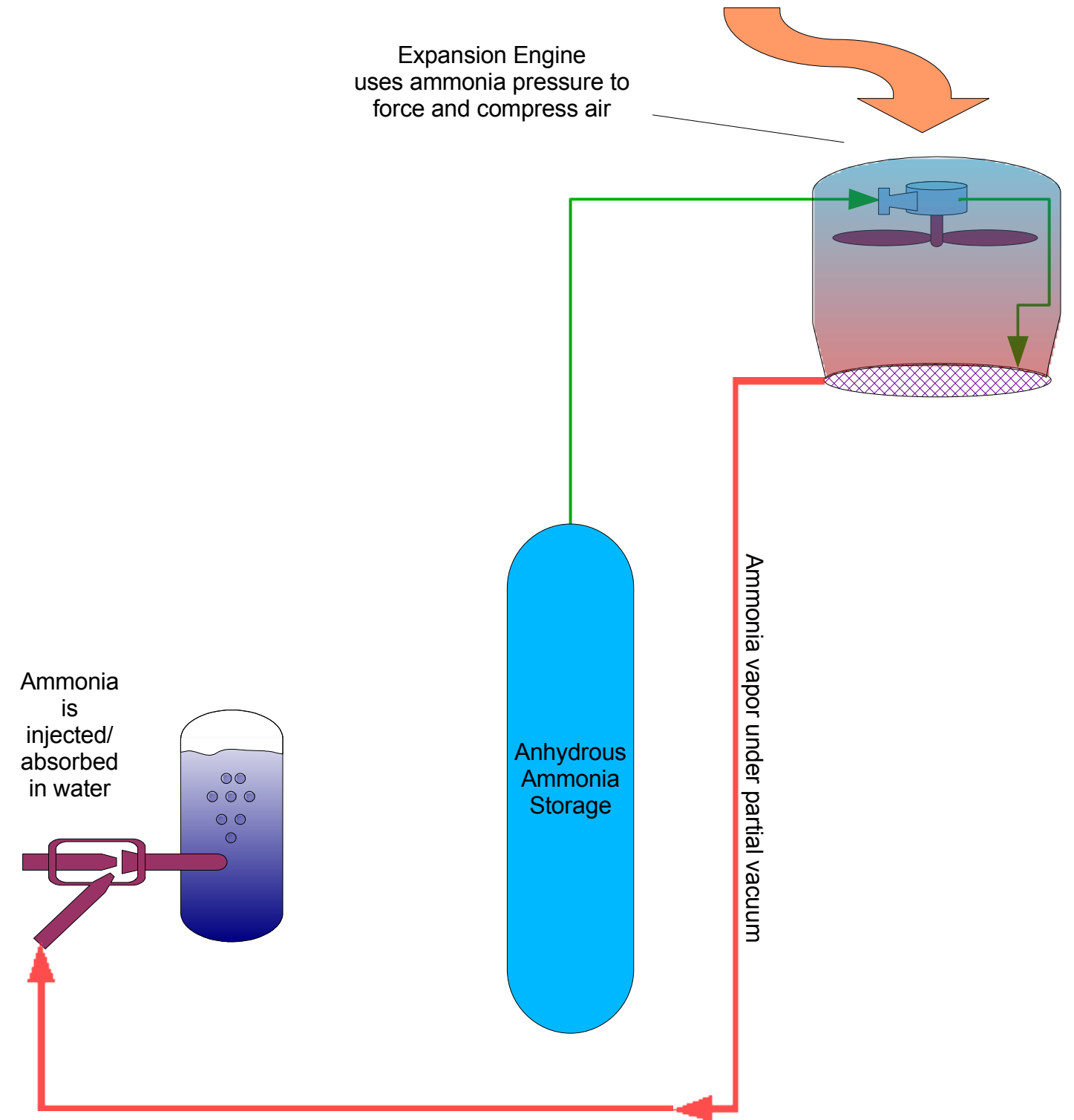


Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

It is then absorbed into
cool water. The
absorption is
exothermic and the
resulting aqueous
ammonia liquid
contains the heat from
the ambient air.



Expansion Engine
uses ammonia pressure to
force and compress air



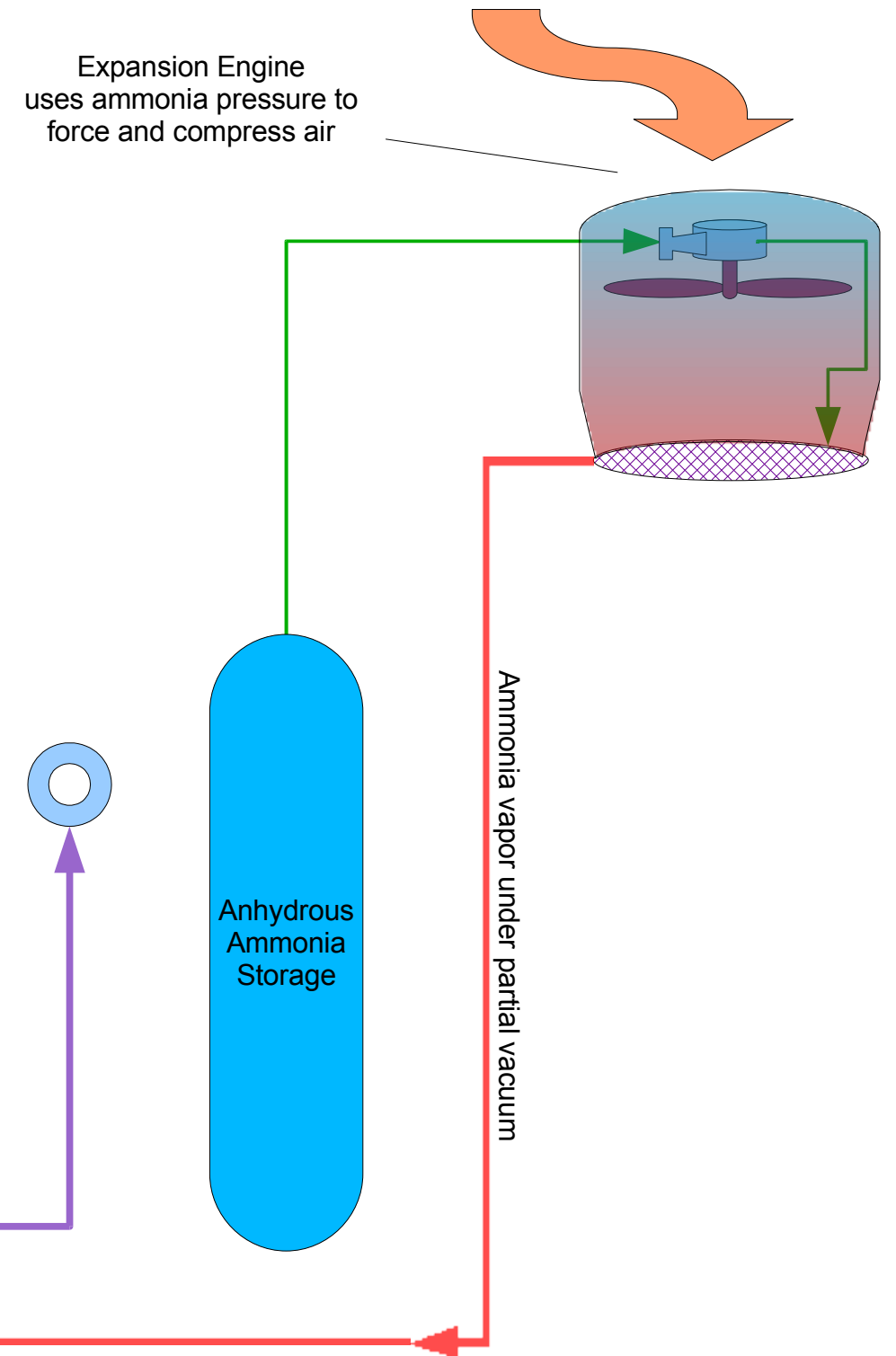
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

A pump pressurizes
the aqueous ammonia
liquid to
400psi(2700kPa)

Ammonia
is
injected/
absorbed
in water

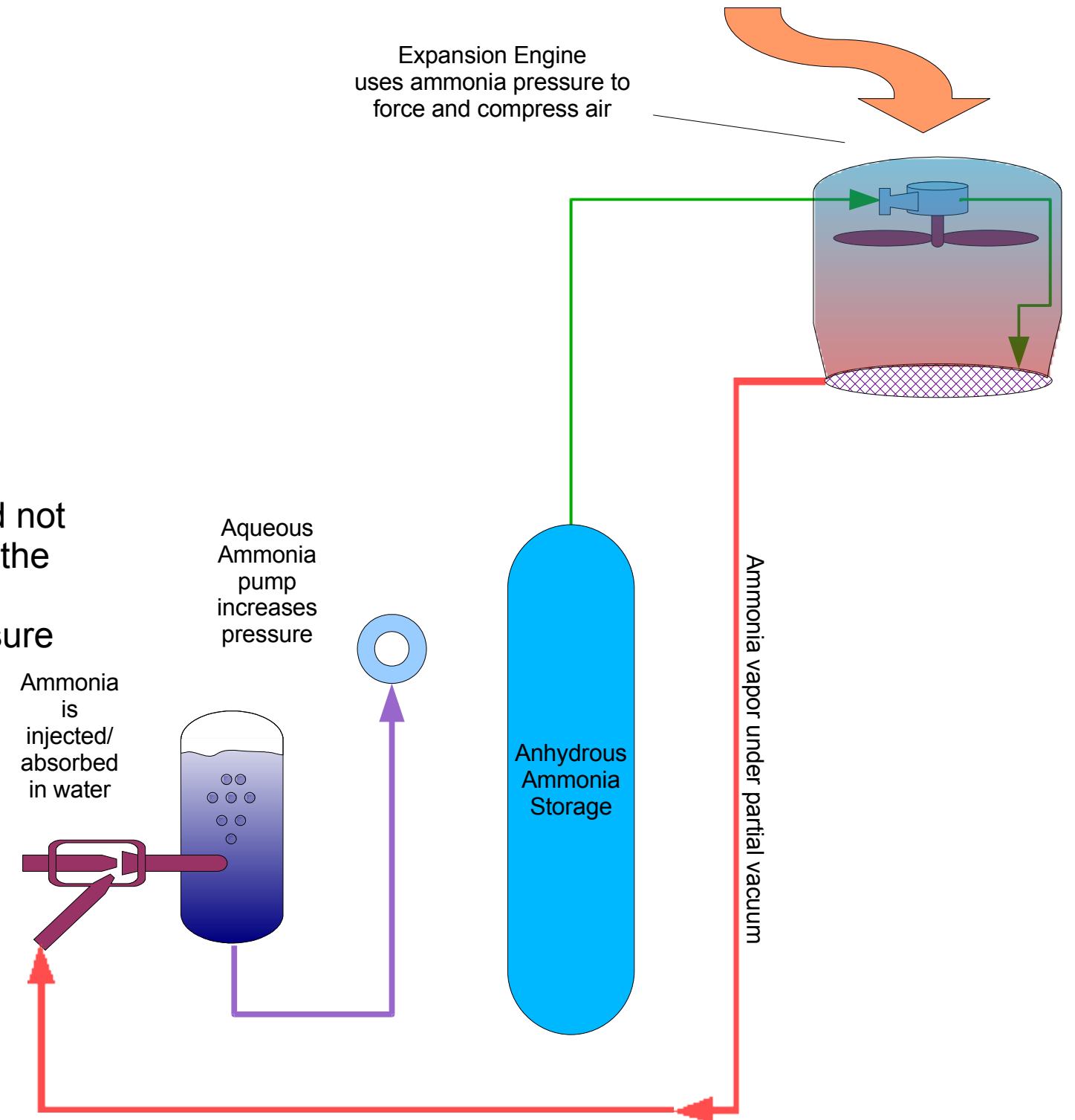
Aqueous
Ammonia
pump
increases
pressure

Anhydrous
Ammonia
Storage



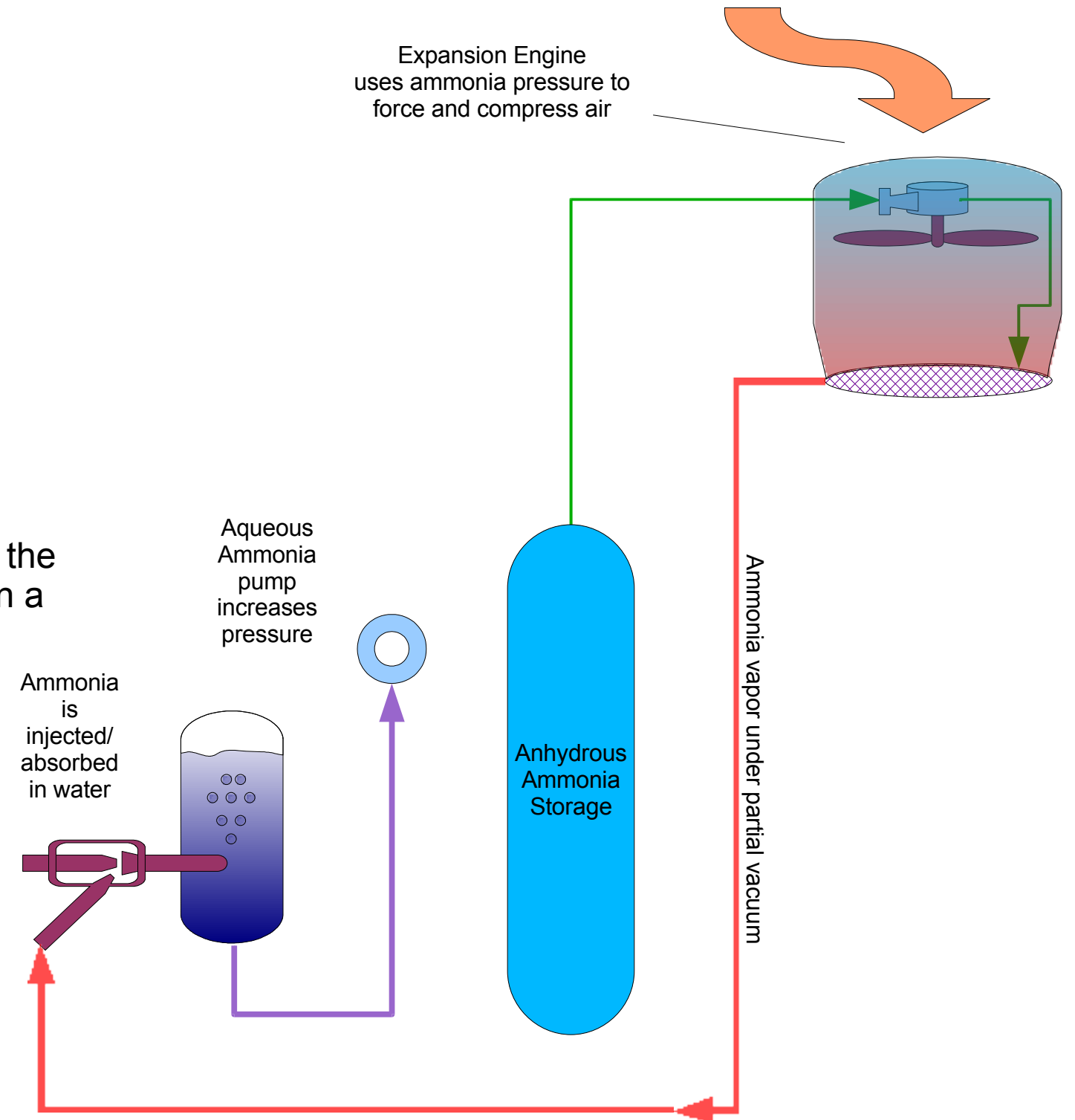
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

This is a liquid and not
compressible and the
required power to
increase the pressure
is relatively low.



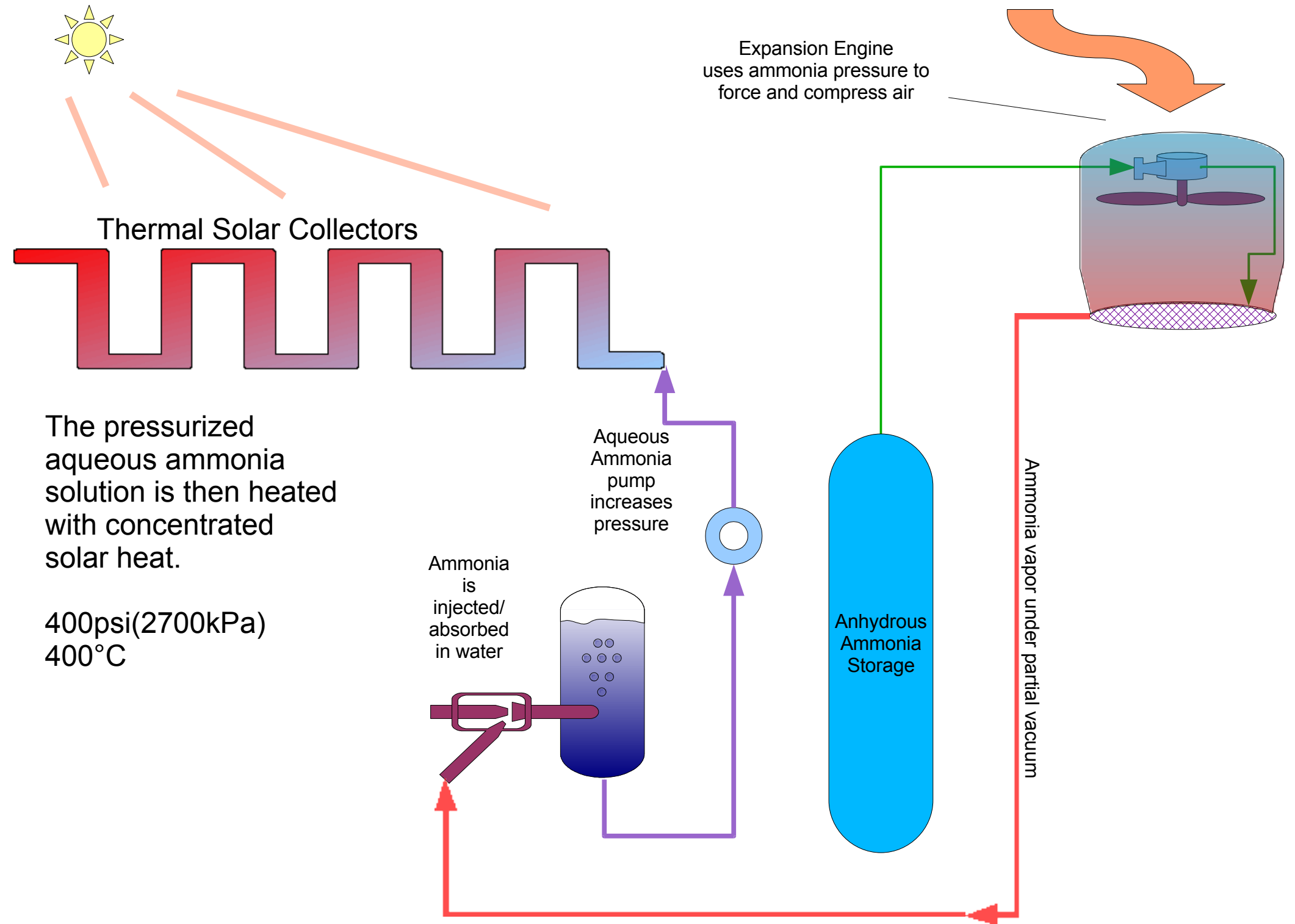
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

This pump is very
similar in action to the
feed water pump in a
Rankine cycle.



Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

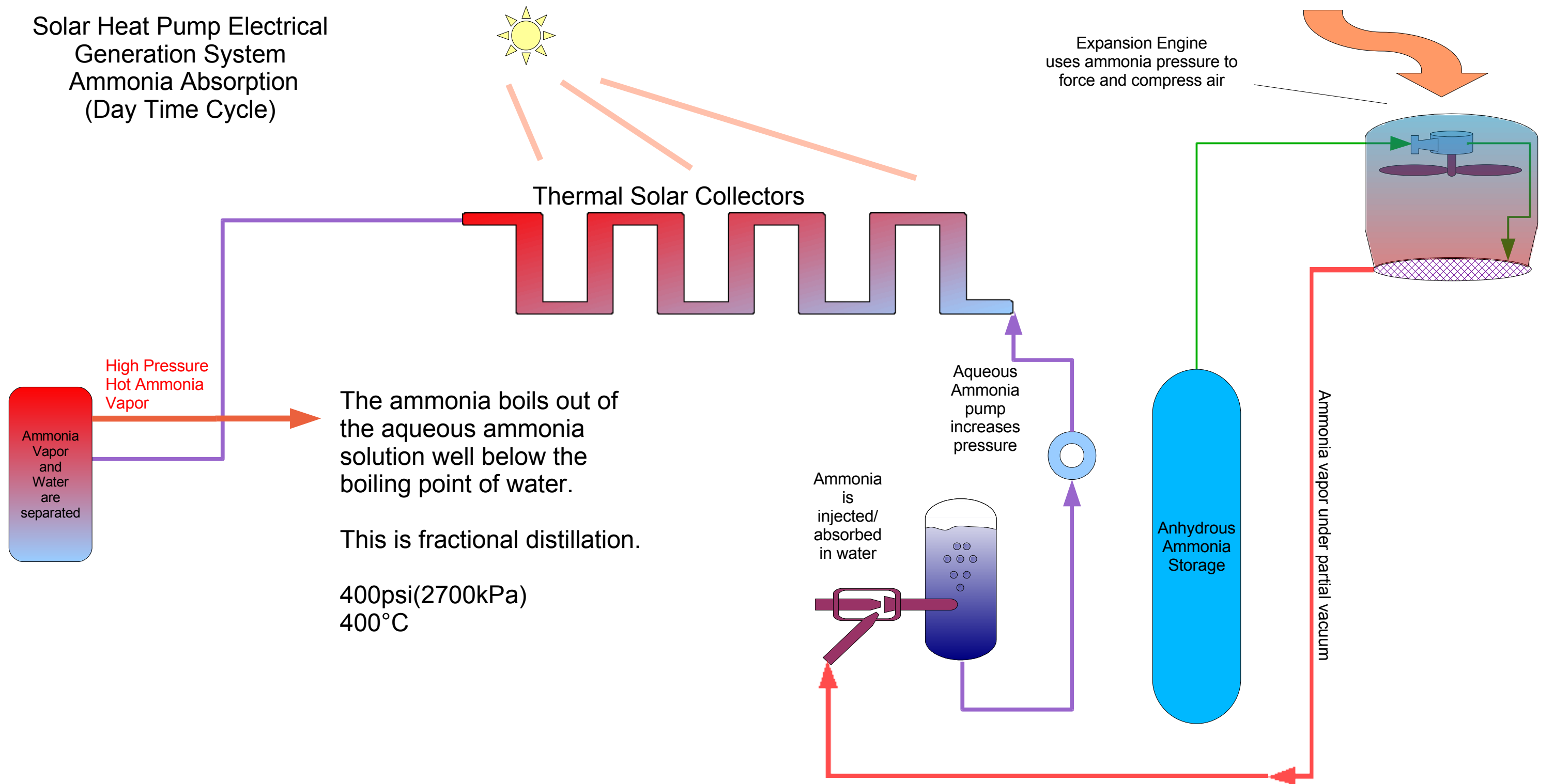
*A thermal oil and
secondary heat
exchanger would be used
and is removed for
simplification.*



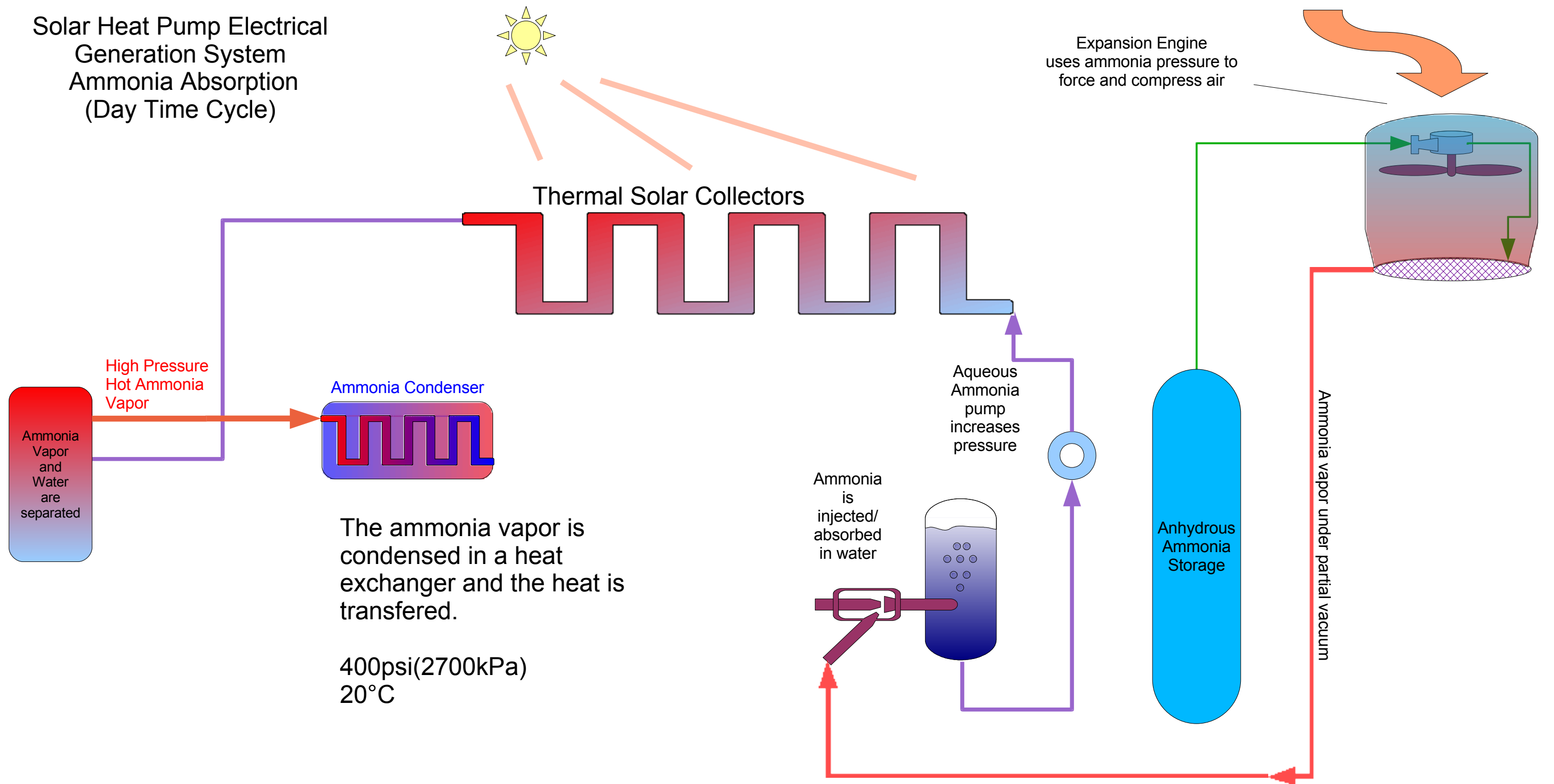
The pressurized
aqueous ammonia
solution is then heated
with concentrated
solar heat.

400psi(2700kPa)
400°C

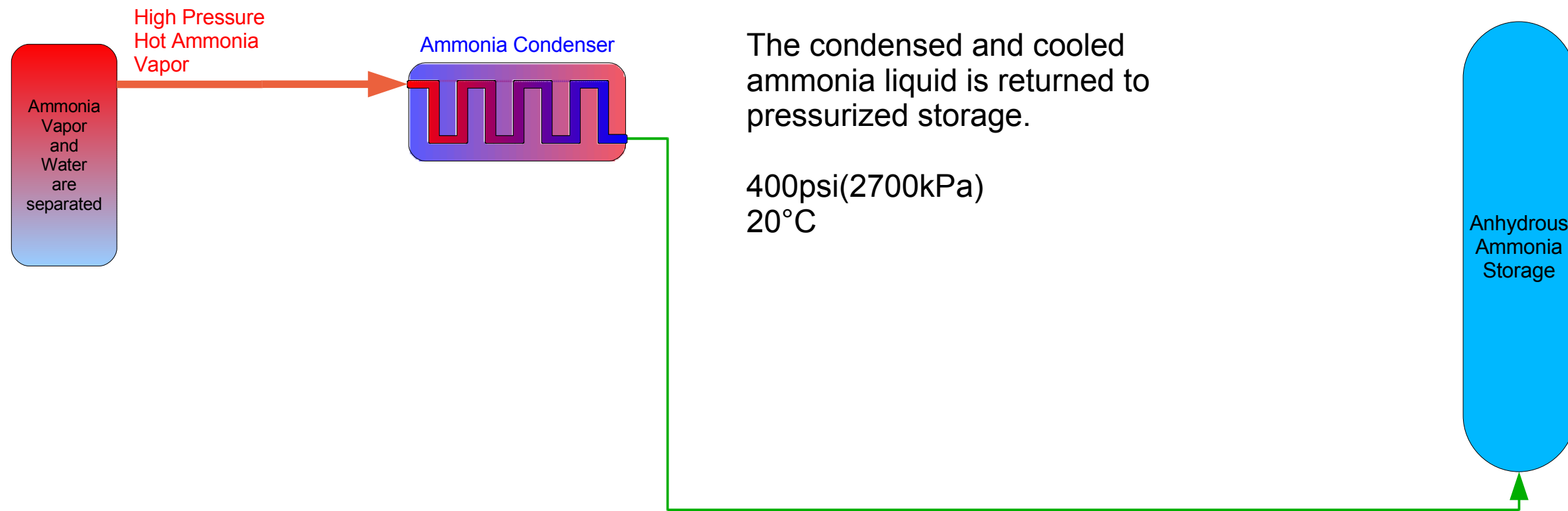
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



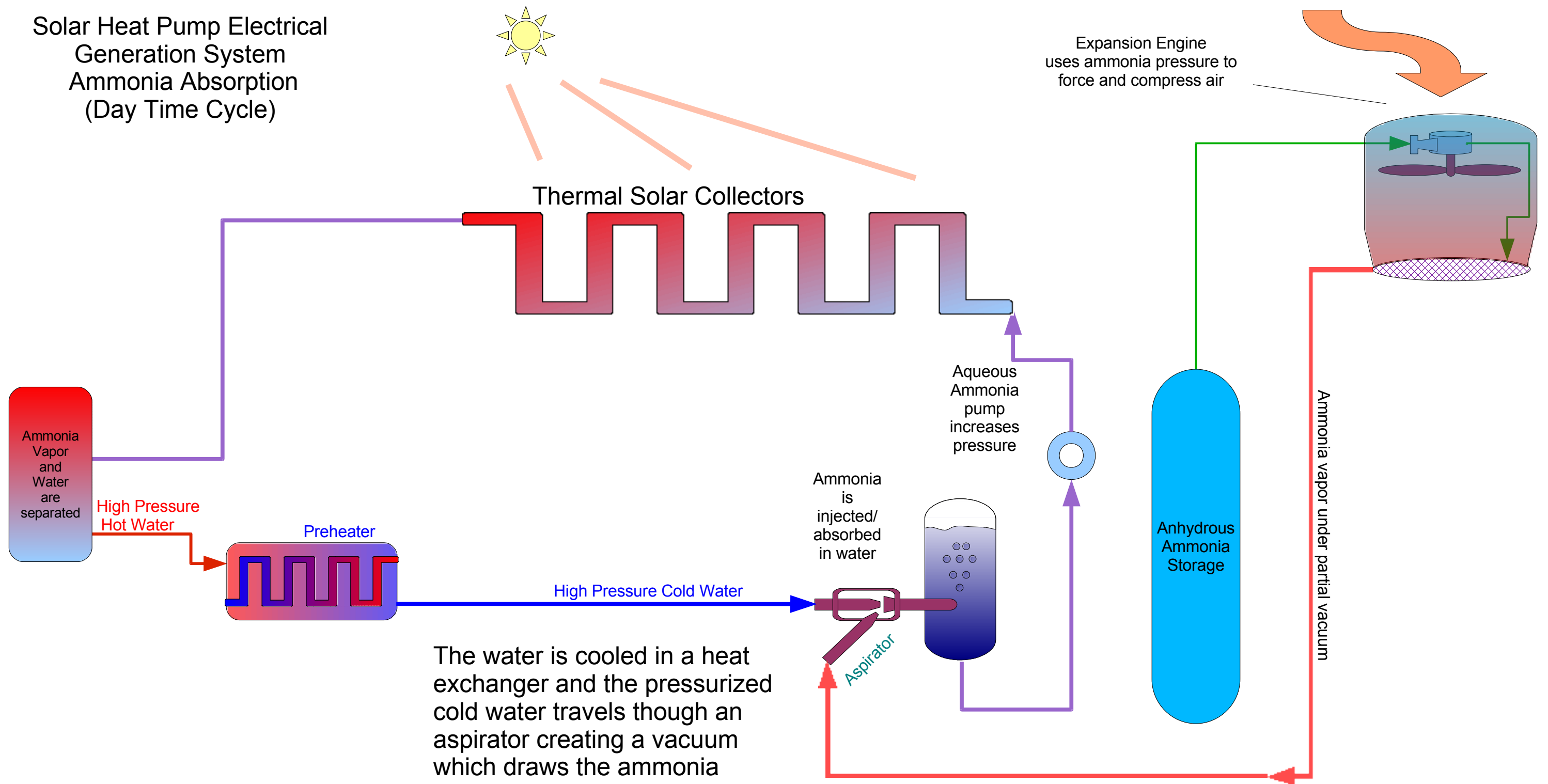
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



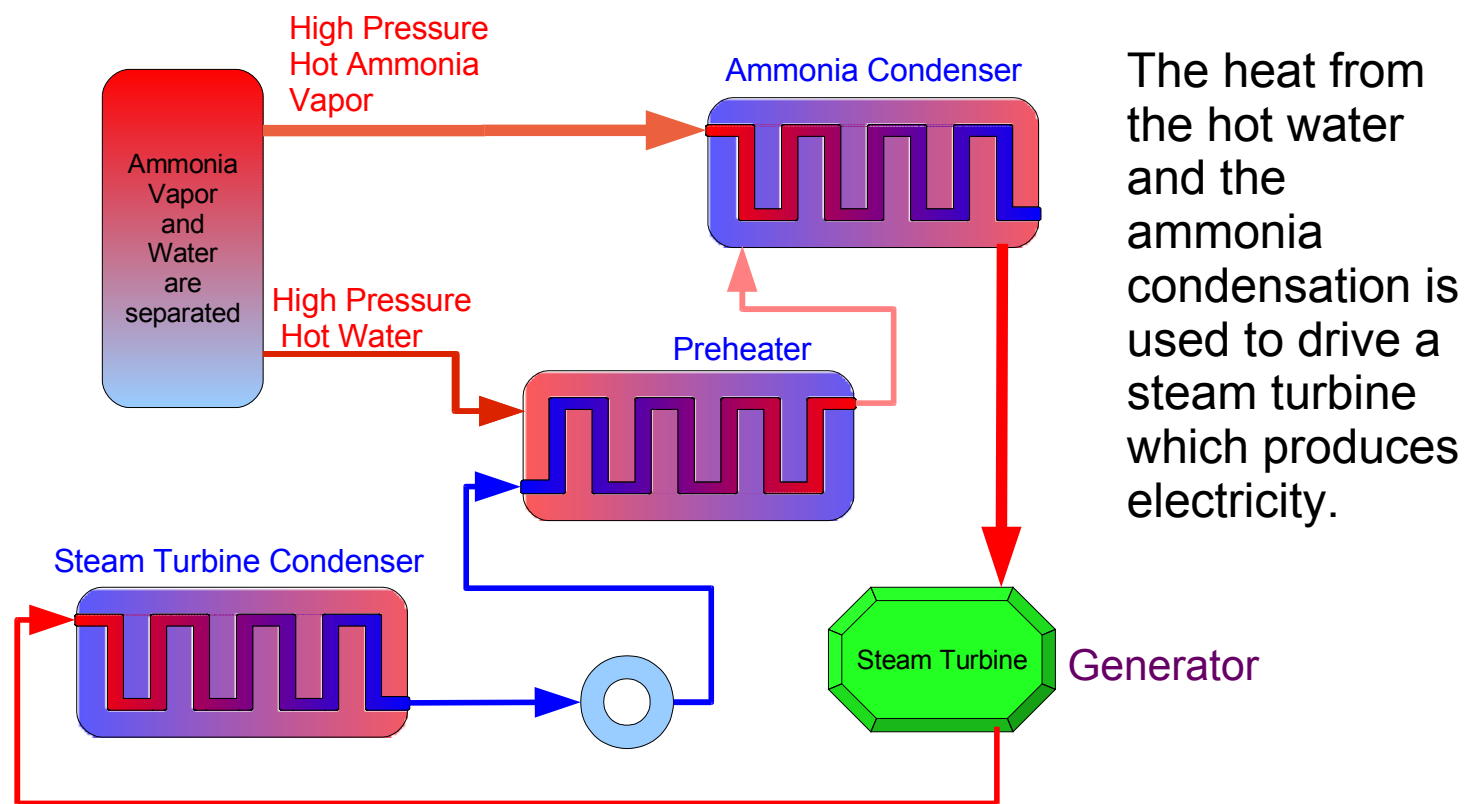
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



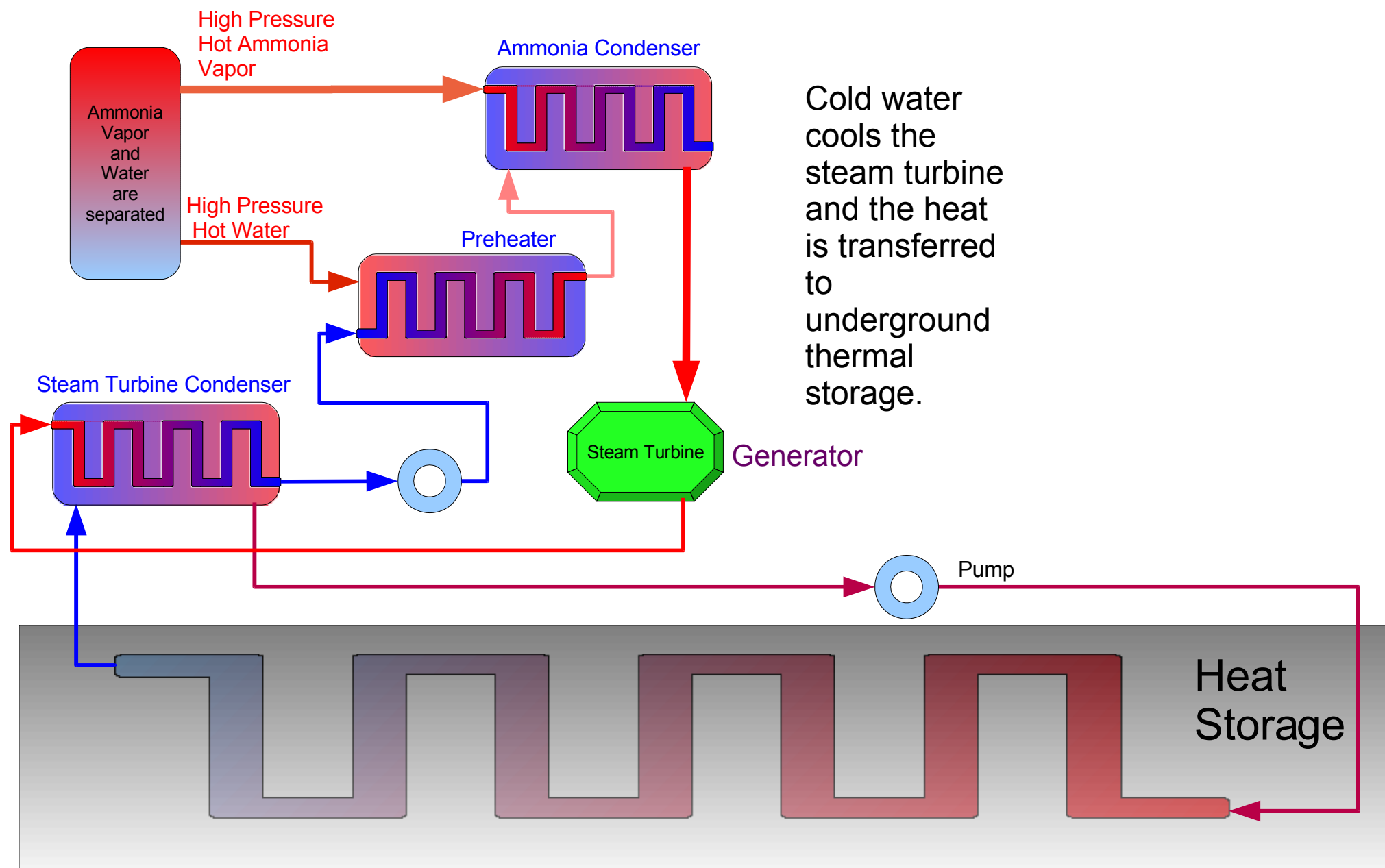
The water is cooled in a heat exchanger and the pressurized cold water travels through an aspirator creating a vacuum which draws the ammonia vapor.

The pressure drops to 200psi through the aspirator, this pressure drop is maintained by the aqueous ammonia pump intake.

Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



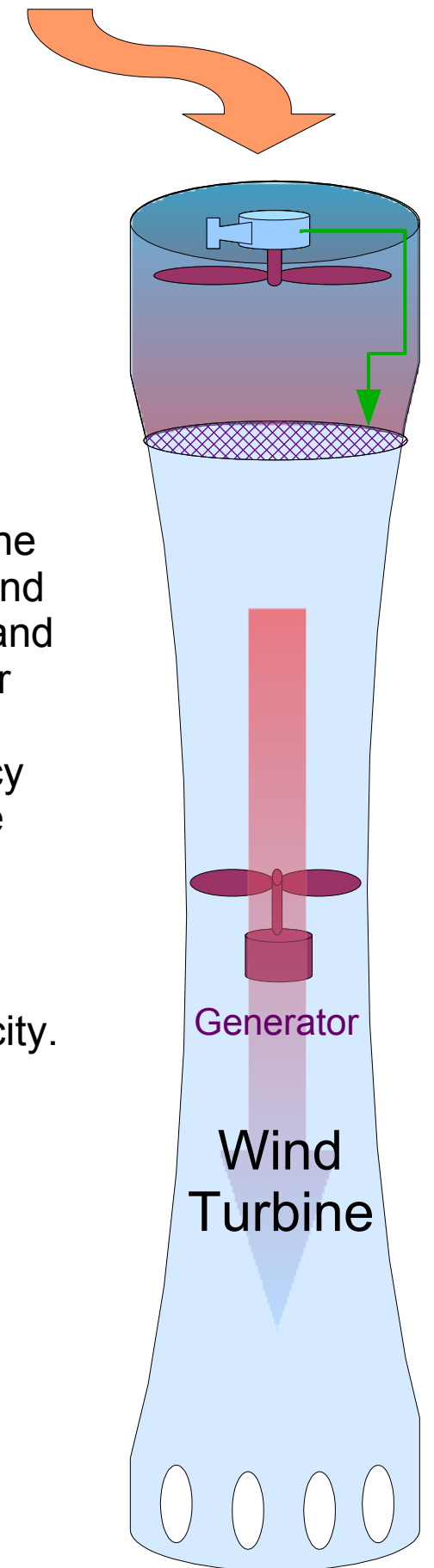
Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)



Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

The air pressure
drops as it exits the
heat exchanger and
the much colder and
drier air is denser
than ambient and
negative buoyancy
forces it down the
convection tower.

A wind turbine
generates electricity.



Solar Heat Pump Electrical
Generation System
Ammonia Absorption
(Day Time Cycle)

