Magnetic Room Temperature Refrigeration Using Stacks of Gadolinium Plates

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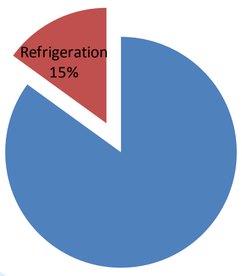
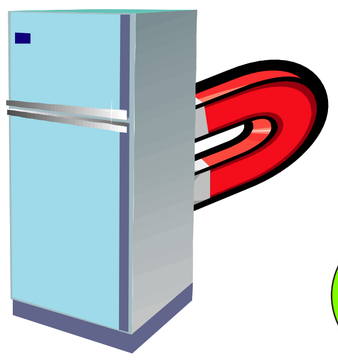
Motivation

World electricity comsumption



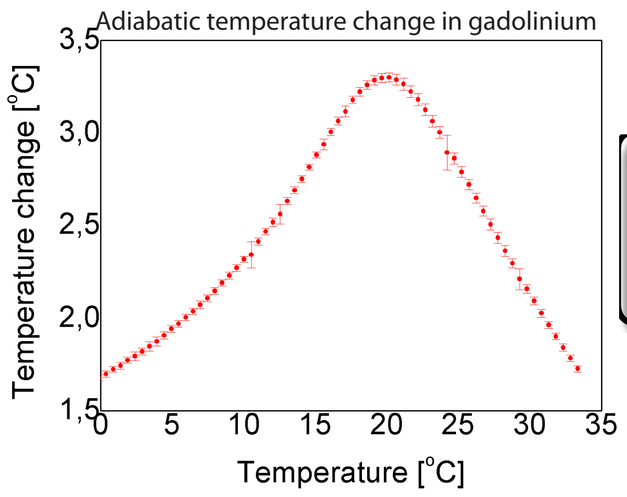


Reversible process: Airconditioning possible

20-40% higher energy effciency

No toxic greenhouse gasses

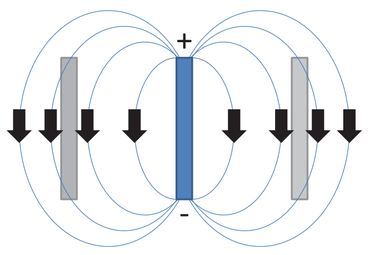
Thermodynamics of the magneto caloric effect



$$\Delta T_{ad} = -\mu_0 \int_{H_1}^{H_2} \frac{T}{C_{H,p}} \left(\frac{\partial M}{\partial T}\right)_H dH$$

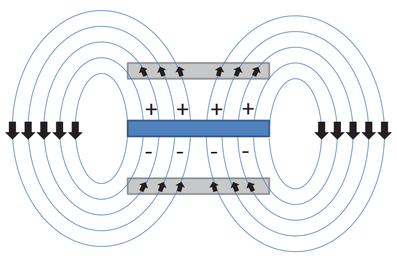
Plate geometry -Demagnetization

Plates arranged parallel to the magnetic field



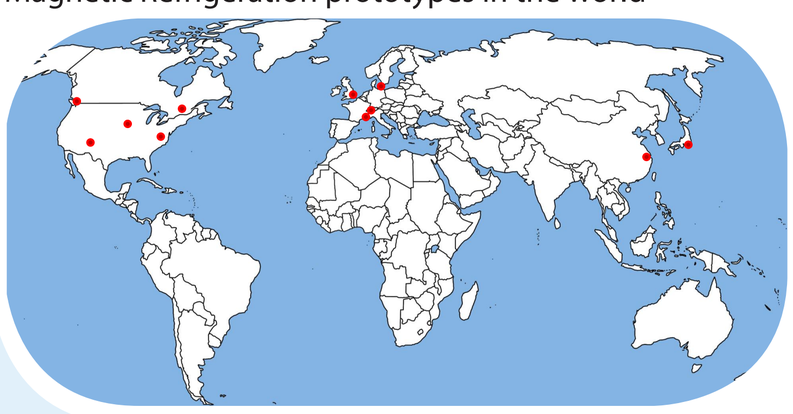
H_{appl}

Plates arranged orthorgonal to the magnetic field



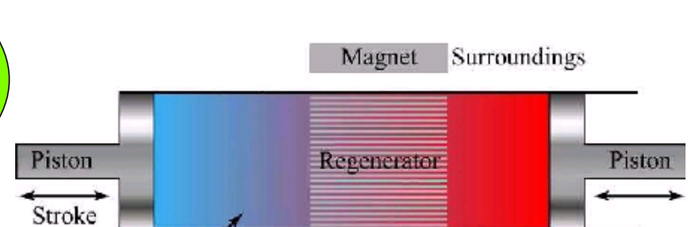
Perspectives

Magnetic Refrigeration prototypes in the world



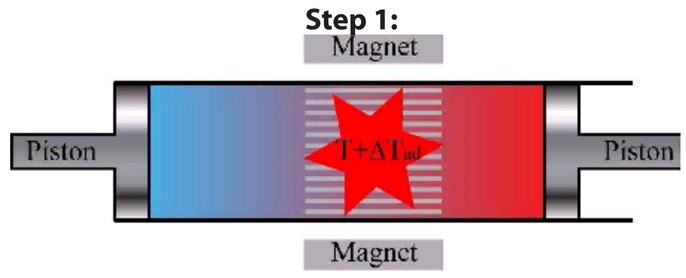
Prototype at Risø expected running in March 2011

The Active Refrigeration Device



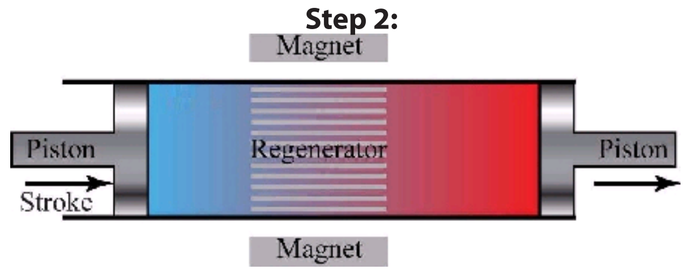
The device produce cooling through a four step regenerator cycle. This cycle is illustrated and documented below:

Step 1:



1) the magnetocaloric material is magnetized, thus decreasing the entropy and thereby increasing the temperature of the material.

Step 2:

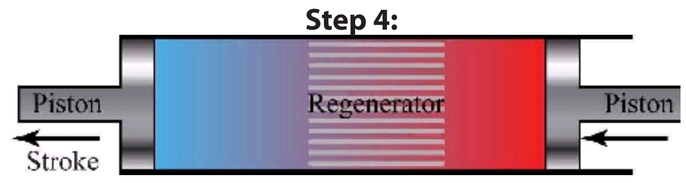


2) the water is pushed to the hot end of the device.

Step 3:

3) the magnetocaloric material is demagnetized, decreasing the temperature.

Step 4:



4) the water is pushed to the cold end of the AMR.

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