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OVERVIEW OF GEOTHERMAL TECHNOLOGY

Revised: 04NOV2009

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What is Geothermal Heat Pump Technology and How Does It Work?

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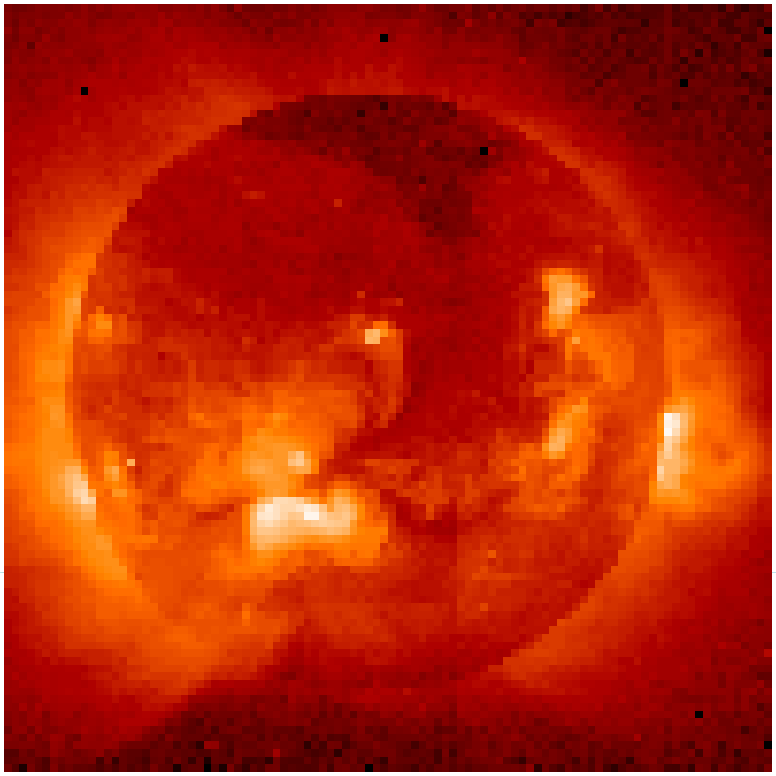
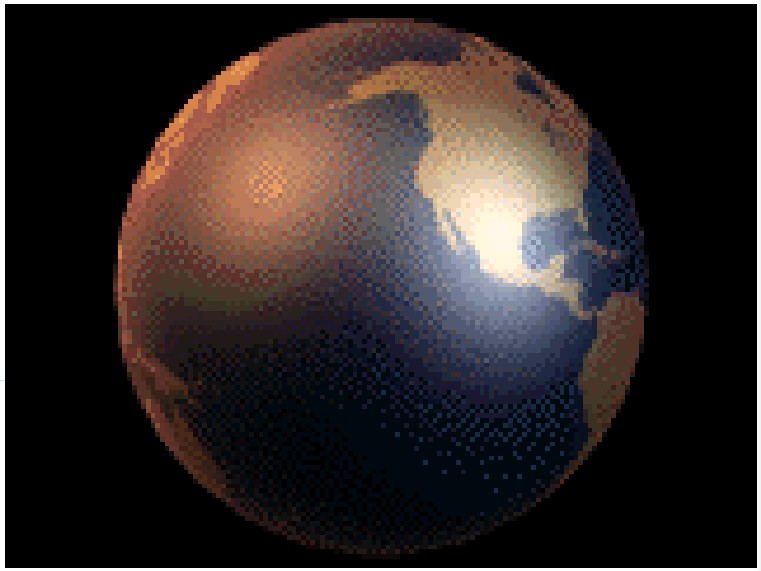
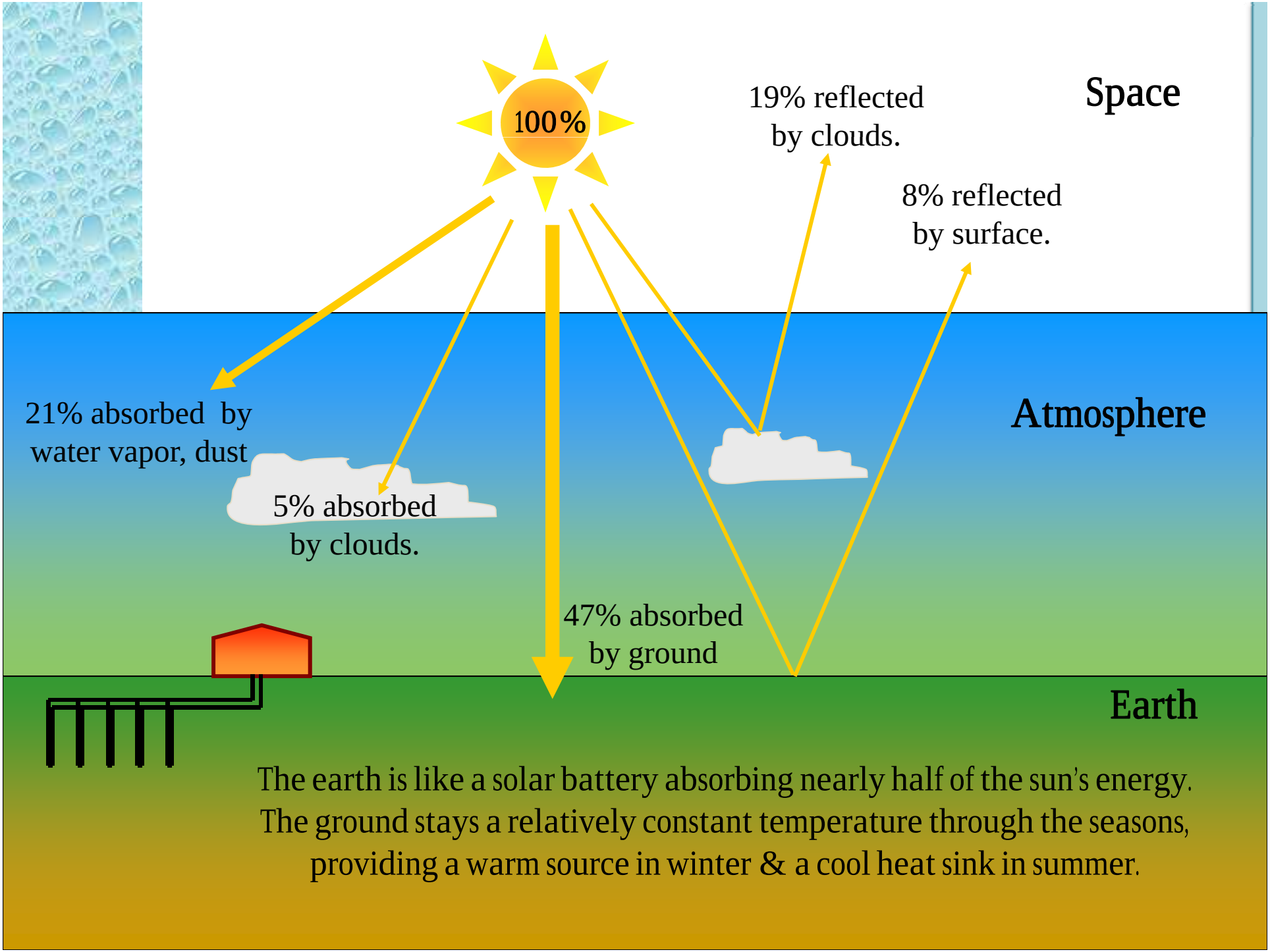
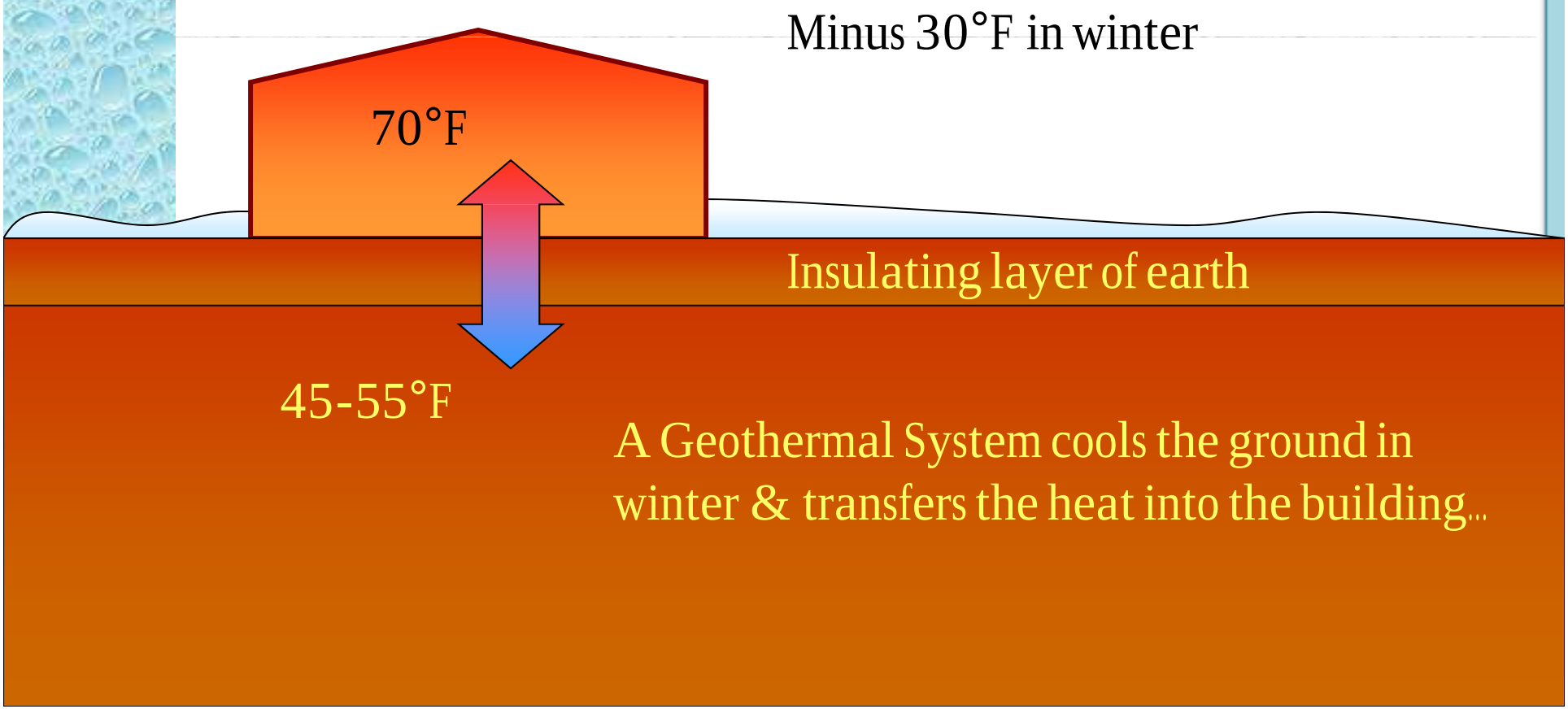




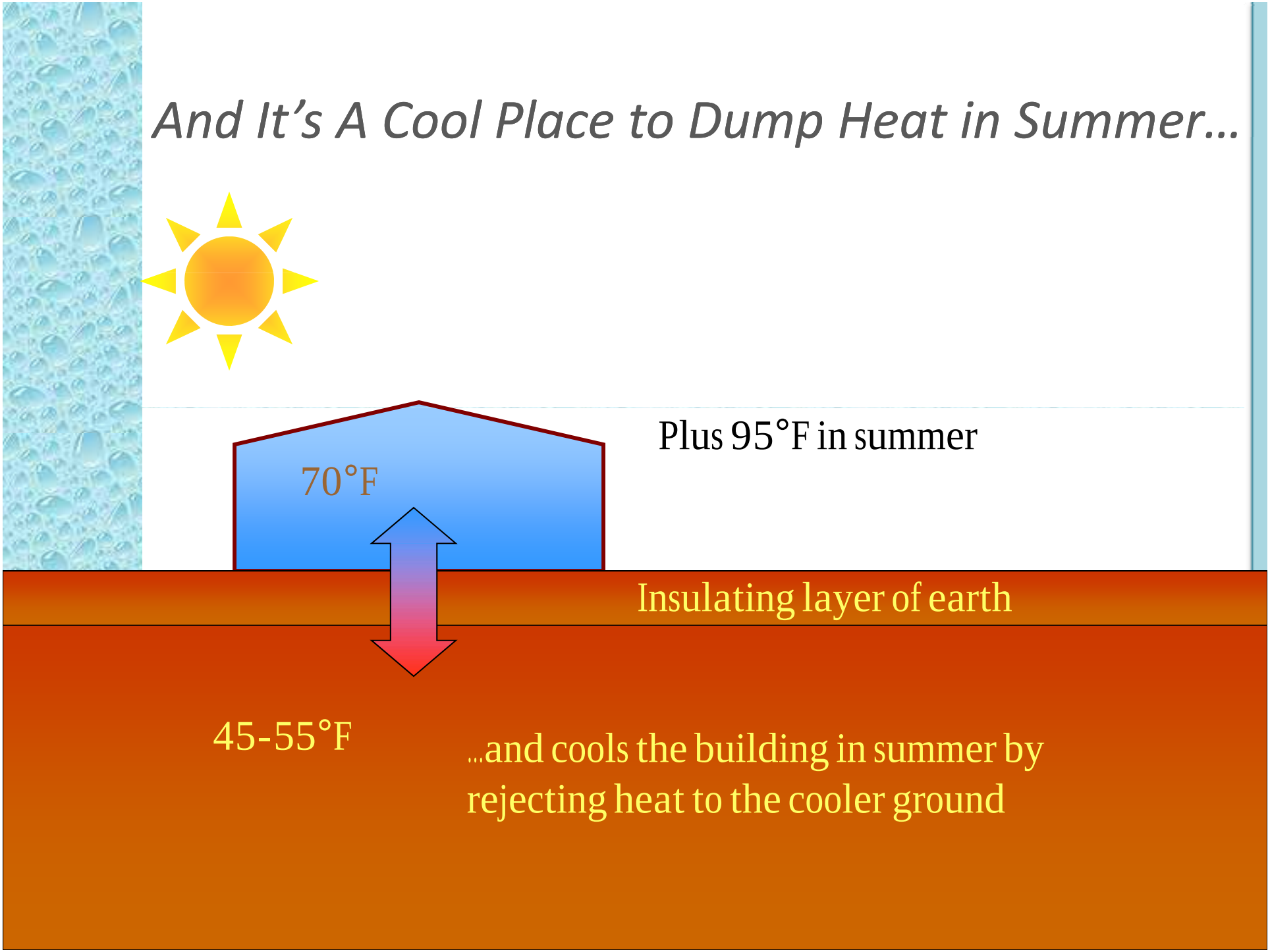
- *The Sun Is 100% Energy*


100%
19% reflected
by clouds.
Space
8% reflected
by surface.
21% absorbed by
water vapor, dust
Atmosphere
5% absorbed
by clouds.
47% absorbed
by ground
Earth
The earth is like a solar battery absorbing nearly half of the sun's energy.
The ground stays a relatively constant temperature through the seasons,
providing a warm source in winter & a cool heat sink in summer.

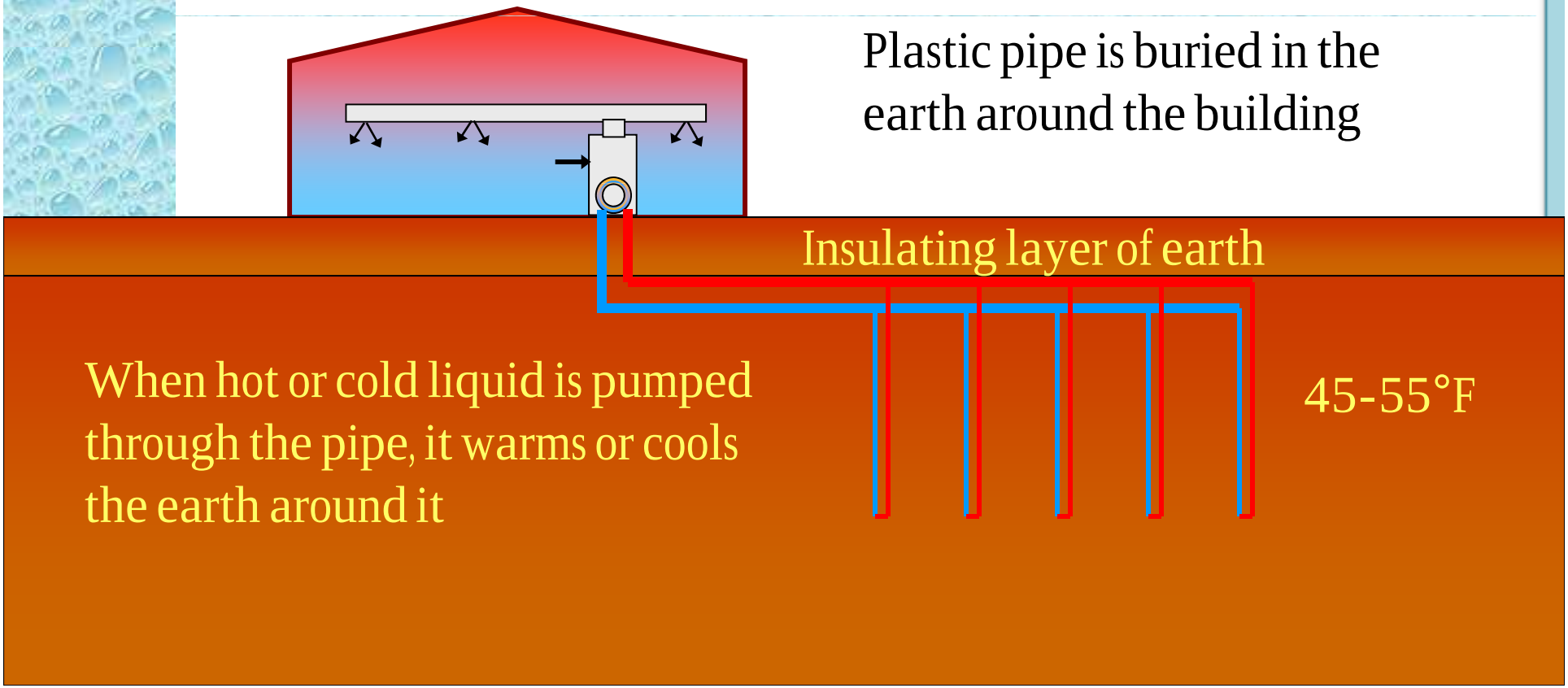
It's a Heat Source in Winter…



And It's A Cool Place to Dump Heat in Summer…

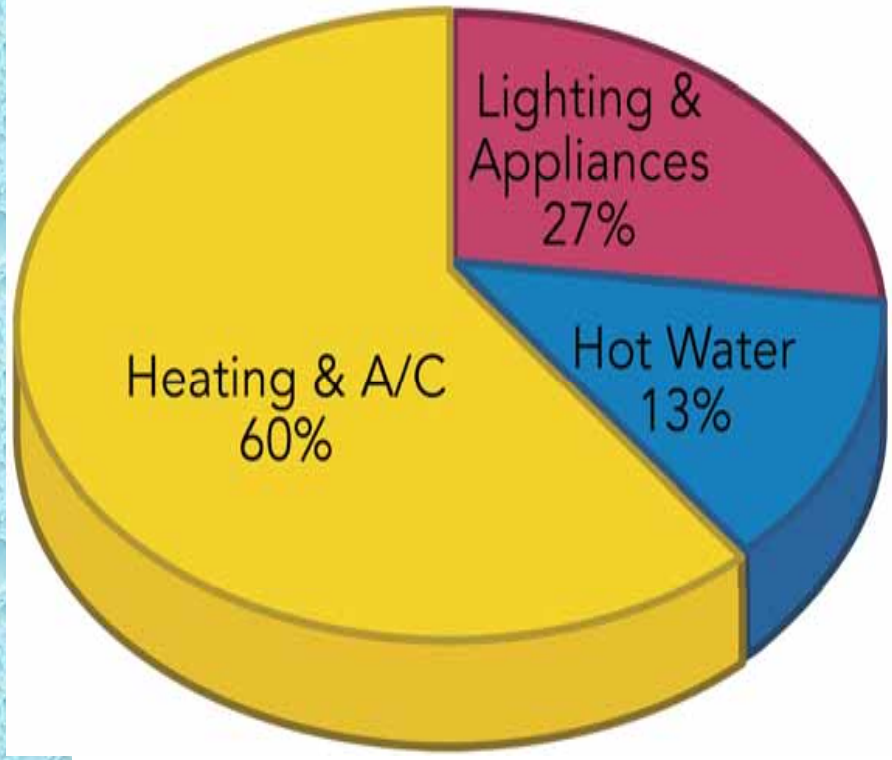


Heat Is Transferred Through an *Earth Loop*



Residential Site Energy

Conventional System



Over 70% of the energy consumed by a typical single-family home is used to meet thermal loads

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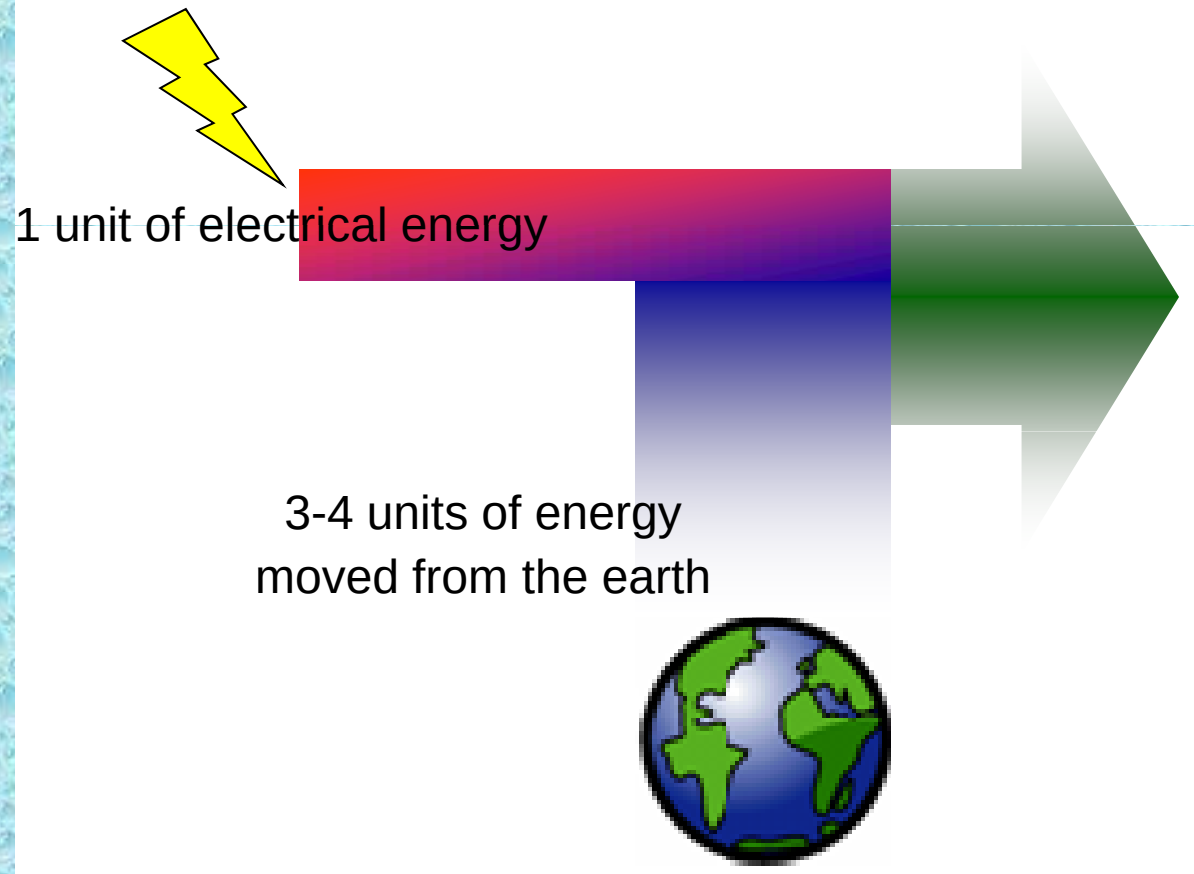
Geothermal – Output Energy



4-5 units delivered to the space

=

400-500% Efficient

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What are the Components of a Geothermal System?

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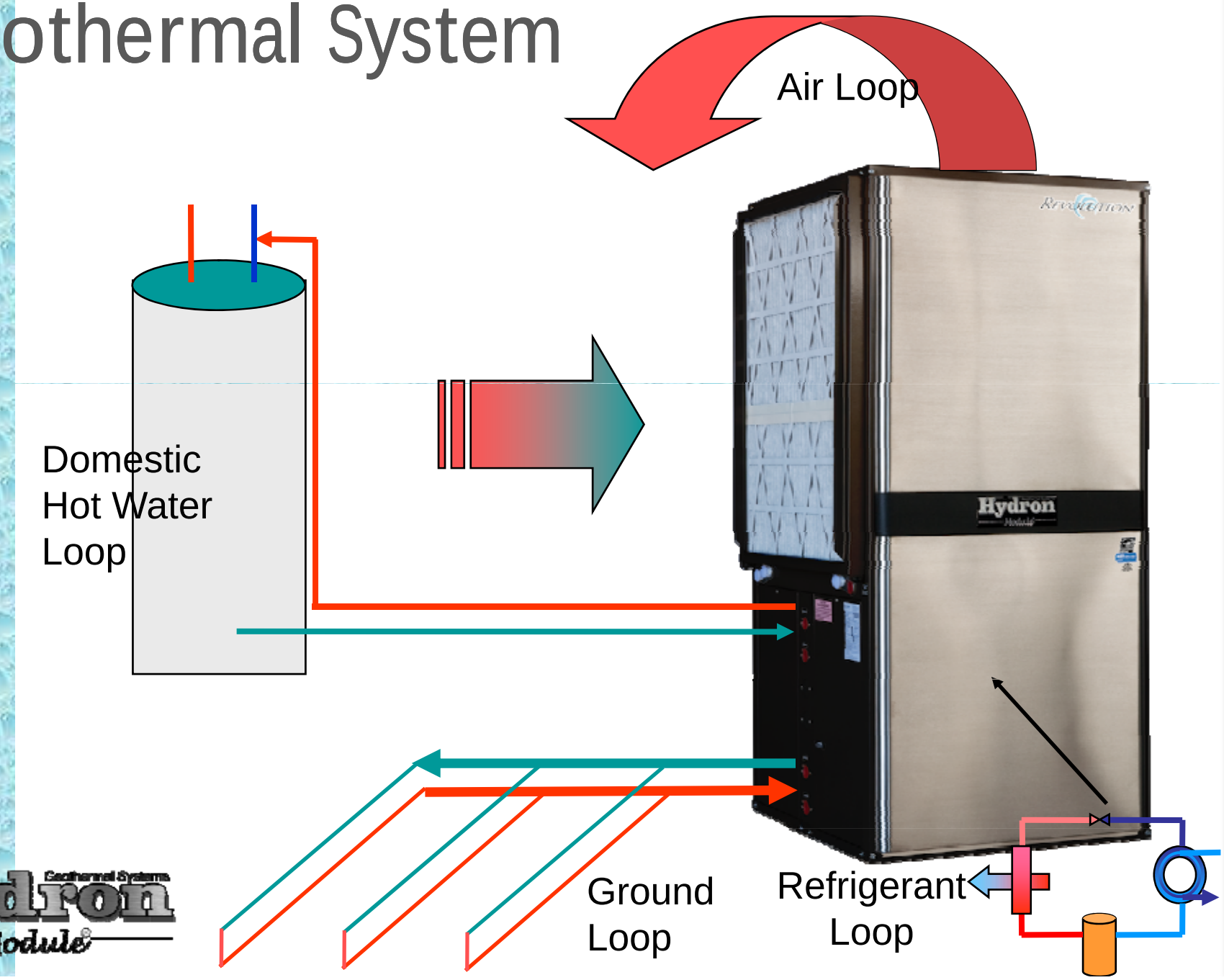
Geothermal System



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Vertical Closed-Loop Installation

Geothe

Drilling

Pipe Loop Insertion

Heat Fusing

Inside Connection

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What is a Heat Pump?

- Heat pumps are refrigeration devices
  - Refrigerators, freezers, AC units, dehumidifiers, and ice machines are all heat pumps
- Heat pumps use the refrigeration cycle
  - The refrigeration cycle can leverage and multiply input energy into additional Btu's. (Connected to the earth, performance can be as much as **5** times the input)

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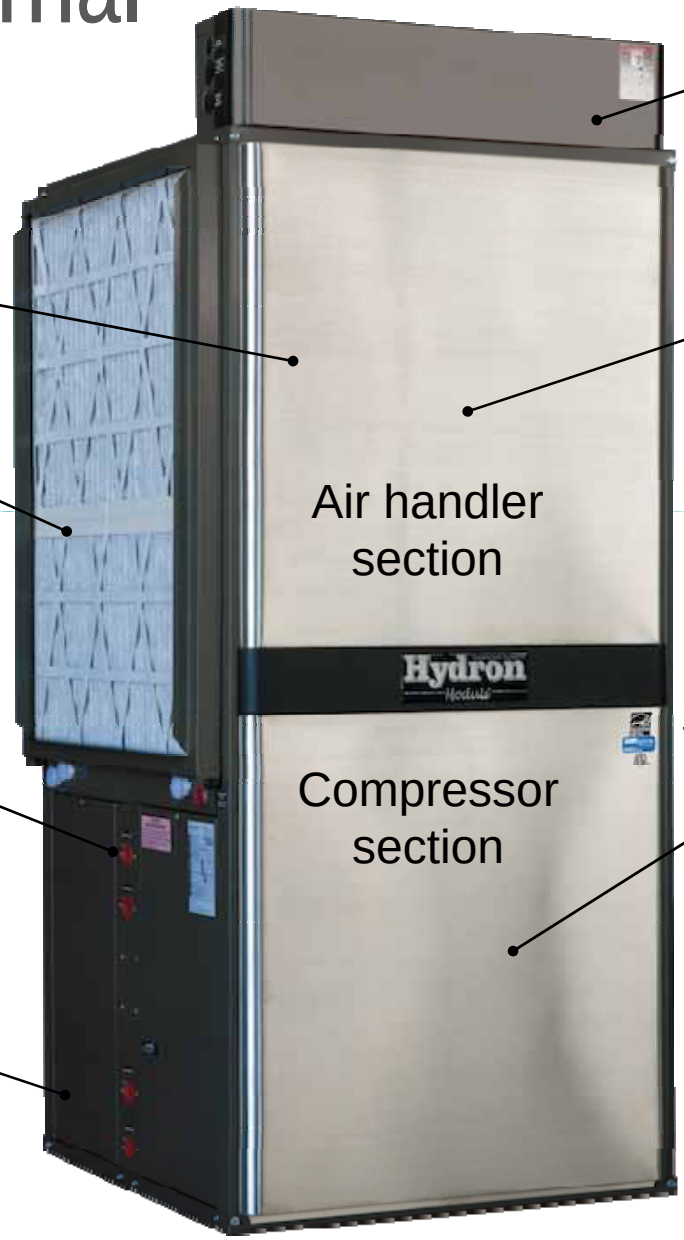
Typical Geothermal Unit



Unit controls

Internal Electric auxiliary

Fan & fan motor PSC or ECM

Air heat exchanger

Air handler section

Domestic hot water exchanger

High efficiency Scroll compressor

Compressor section

Coaxial loop heat exchanger

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How does the heat pump work?

- Heat pump systems **move** heat energy, which already exists, from one place to the other – do not create heat.
- Ground heat exchangers use the earth's stable temperature to help improve heating and cooling efficiency.
- Phase changes within the heat pump heat exchangers from liquid to gas and gas to liquid move energy.
- Refrigeration process can leverage and multiply input energy by as much as 5 times.

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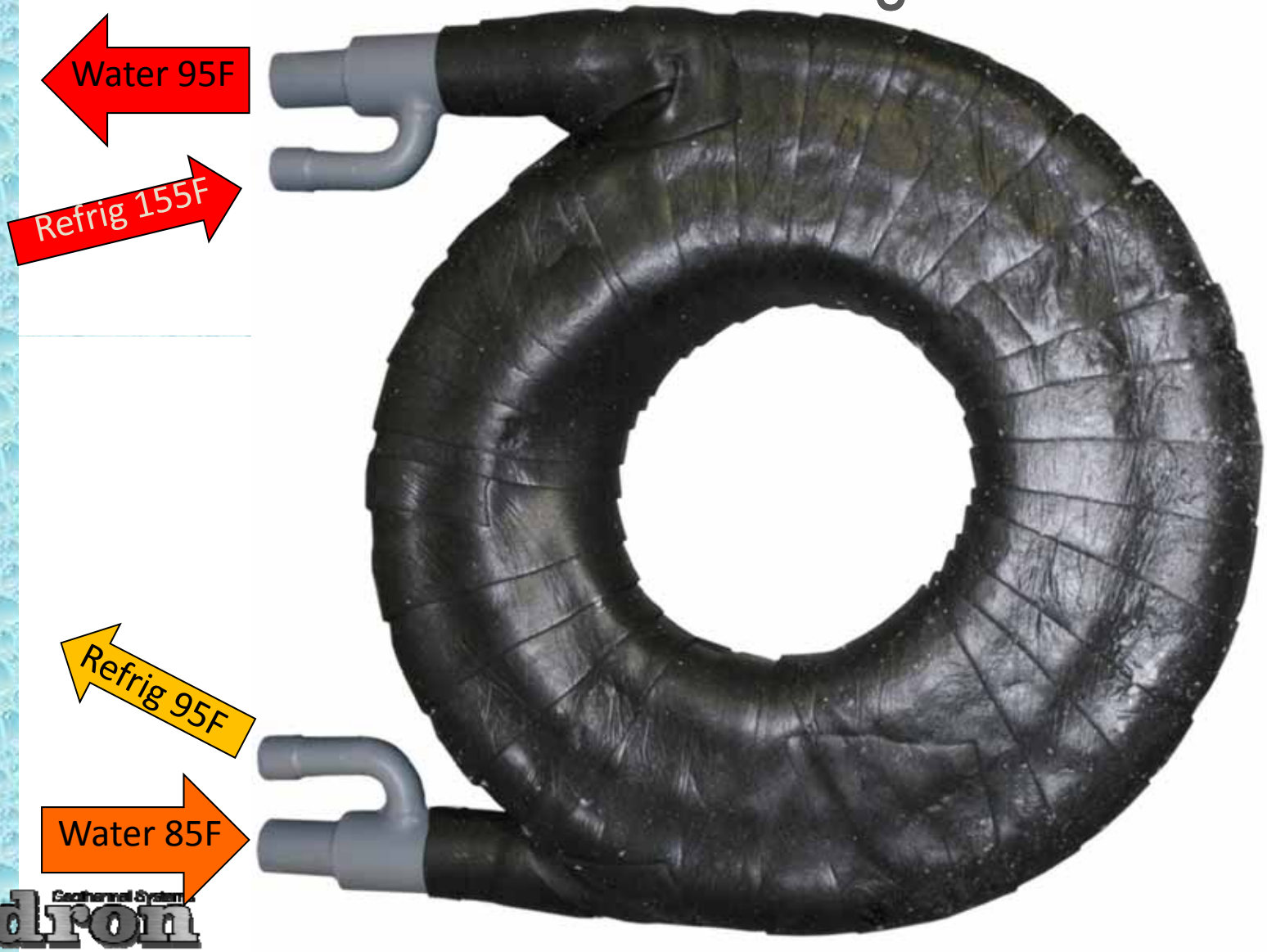
Water-to-Refrigerant (Coaxial) Heat Exchanger



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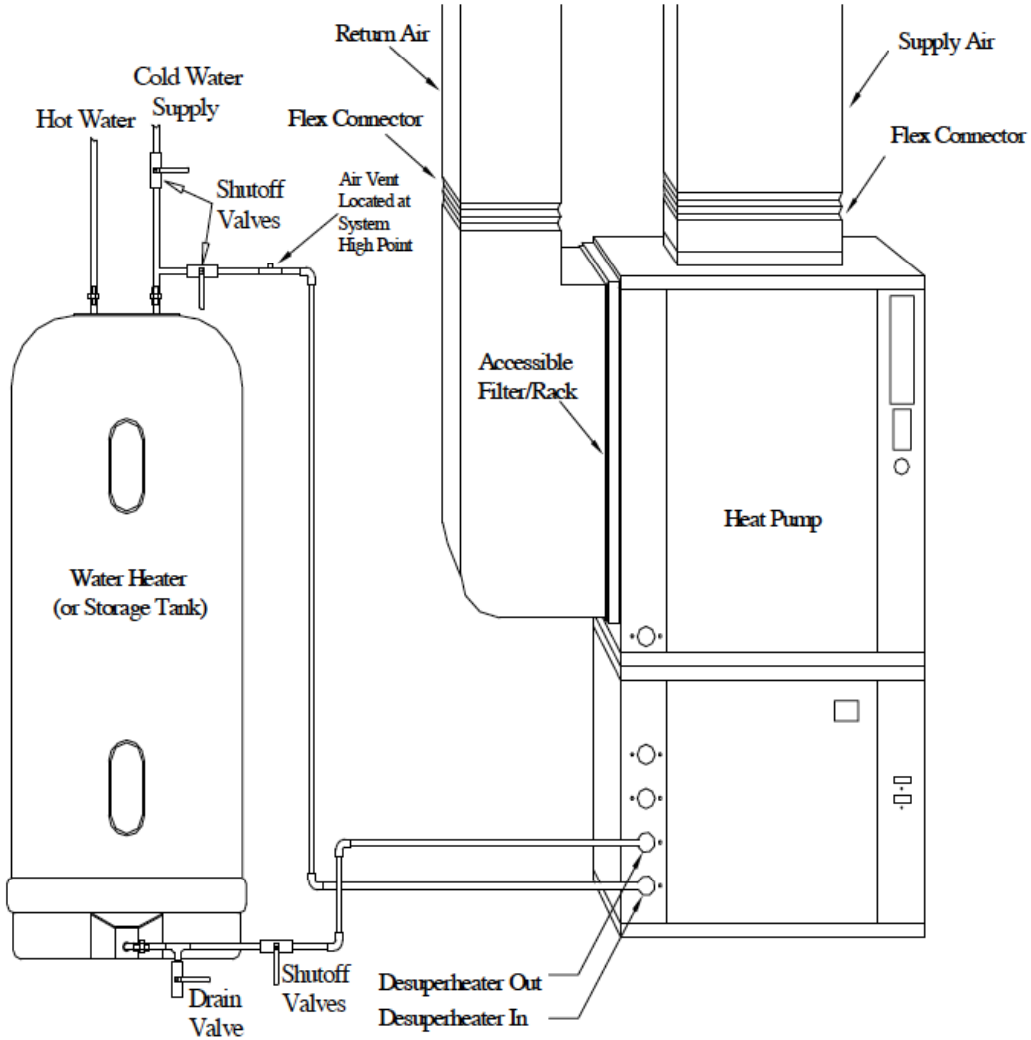
Domestic Hot Water Loop



Saves up to 25% on hot water costs annually!

Domestic Water Heater

Standard gas unit

Desuperheater

Generates hot water whenever compressor is in operation to cool the home

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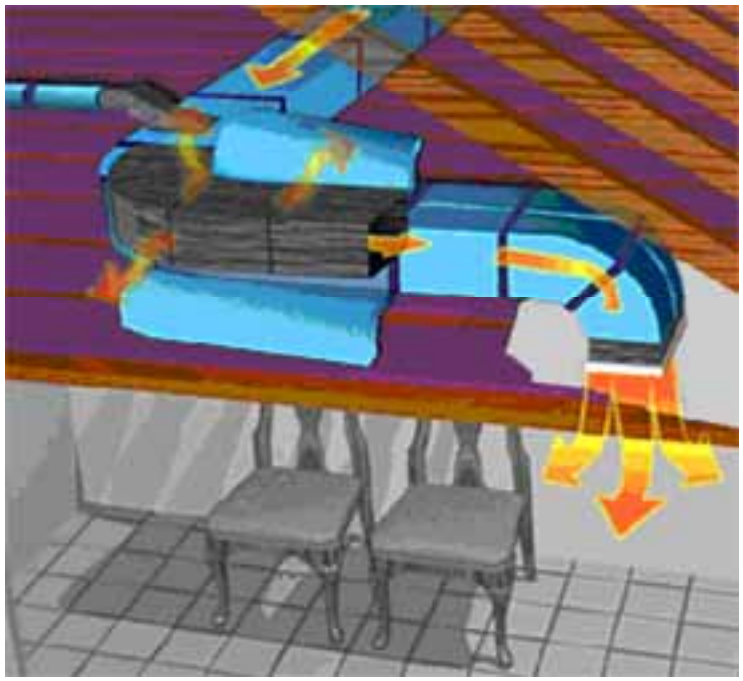
Distribution Systems-Air Loop

- Warm or cold air blown through ductwork
- Zone Control (optional)
- Excellent Comfort



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Applications for Geothermal

- Forced air heating and cooling
- New Construction or Retrofit
- Domestic hot water heating systems
- Radiant floor heating systems
- Pool/spa water heating systems
- Dual fuel heating systems
- Residential/Commercial/Industrial

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Geothermal Tax Credit

- Federal Income Tax Credit:
  - 30% of total GHP system cost
  - No cap on maximum credit
  - Can used to offset AMT tax
  - Can be combined with other tax credits
  - Can be used in more than one year
- State Tax Credit:
  - 25% of GHP system cost
  - $2,000 cap on maximum credit

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Questions?

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