

SUSTAINABLE LOUDOUN ENERGY SUMMIT

DESIGN FOR A RENEWABLE ENERGY SYSTEM

Presenter: Bruce E. Beddow, PE



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14-Nov-2008



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Design for a Renewable Energy System

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Minnie Howard School, Alexandria

SUSTAINABILITY STUDY: ARCHITECTURE HVAC / PLUMBING / ELECTRICAL



Sustainability Study for
Minnie Howard Ninth Grade Center
for the Alexandria City Public Schools

Date: April 24, 2008

Project No. 2008041

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SUSTAINABILITY STUDY: ARCHITECTURE



SUSTAINABILITY STUDY

Minnie Howard Ninth Grade Center



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SUSTAINABILITY STUDY: ARCHITECTURE



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SUSTAINABILITY STUDY

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SUSTAINABILITY STUDY: ARCHITECTURE



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SUSTAINABILITY STUDY: ARCHITECTURE



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SUSTAINABILITY STUDY: ARCHITECTURE



SD11

SUSTAINABILITY STUDY

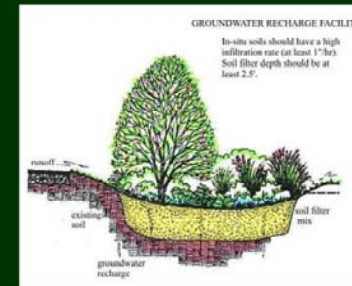
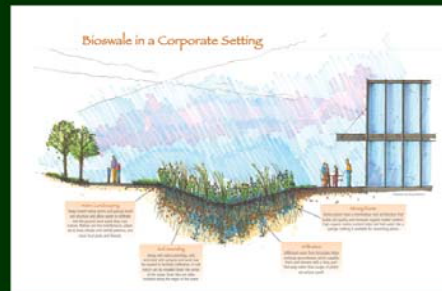
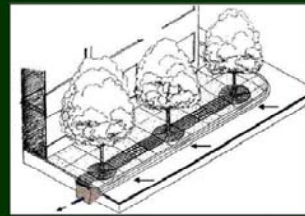
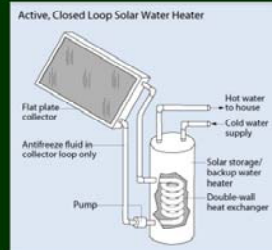
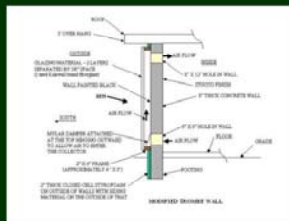
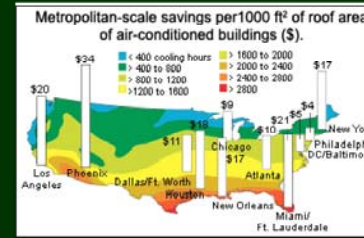
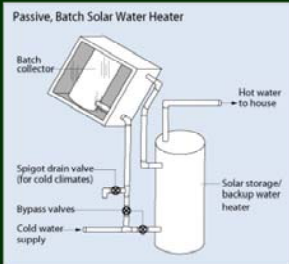
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SUSTAINABILITY STUDY: HVAC



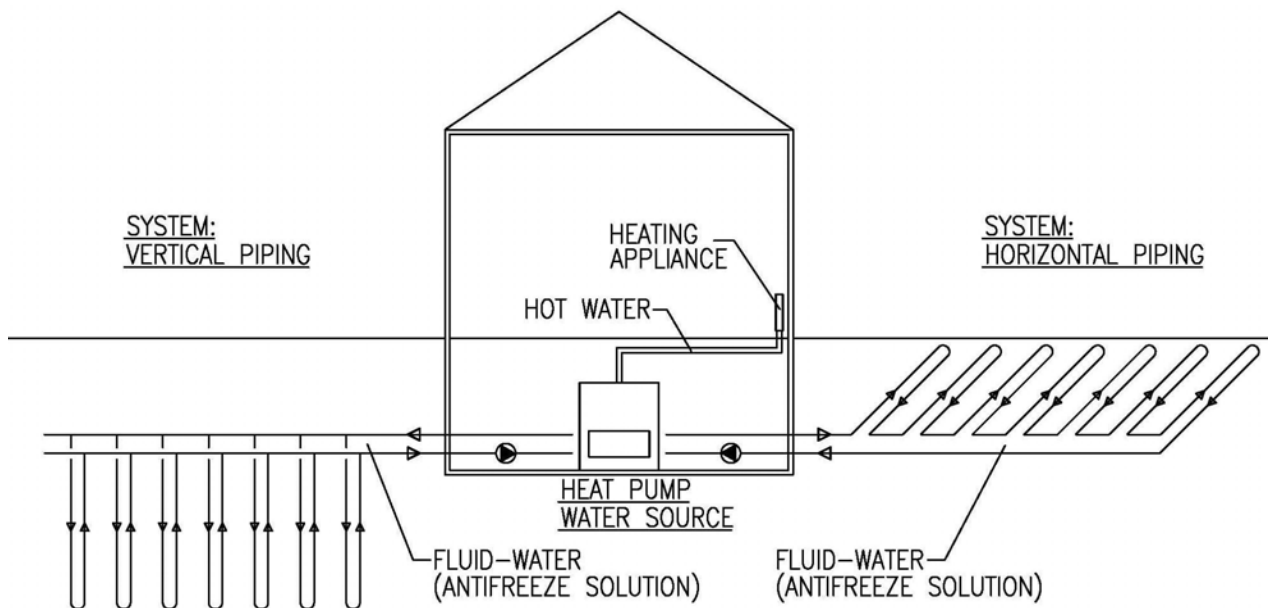
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SUSTAINABILITY STUDY: HVAC

HEAT PUMP

SOURCE: EARTH-COUPLED

COP: 4.0 – 7.0



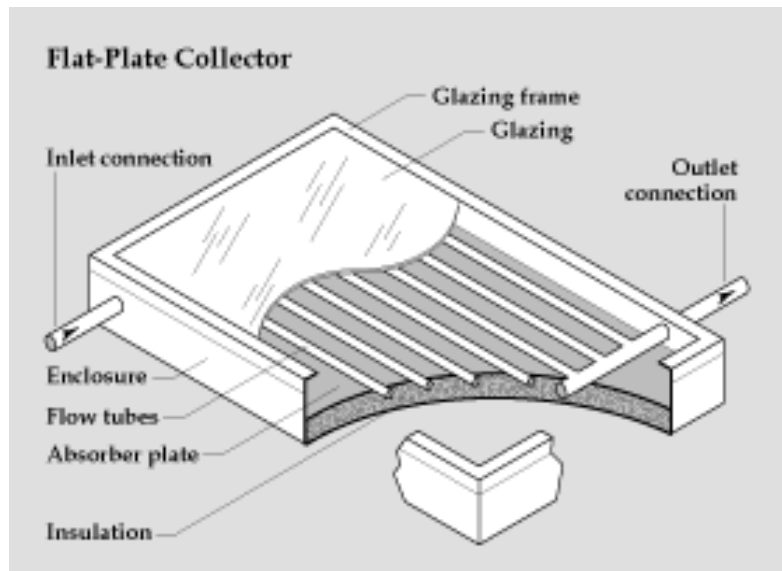
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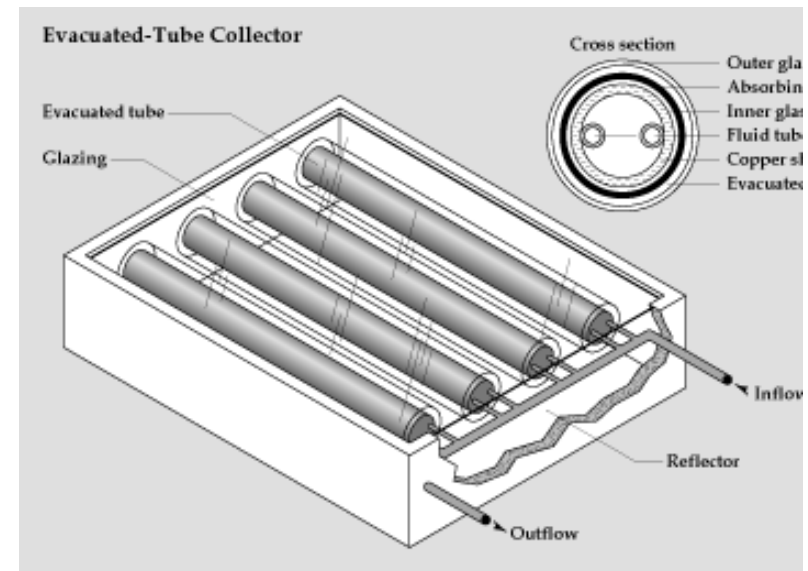
SUSTAINABILITY STUDY: HVAC

DIRECT SOLAR ENERGY
SOLAR COLLECTOR PANEL



FLAT-PLATE COLLECTOR

- Residential and Commercial
- Temperature below 200°F

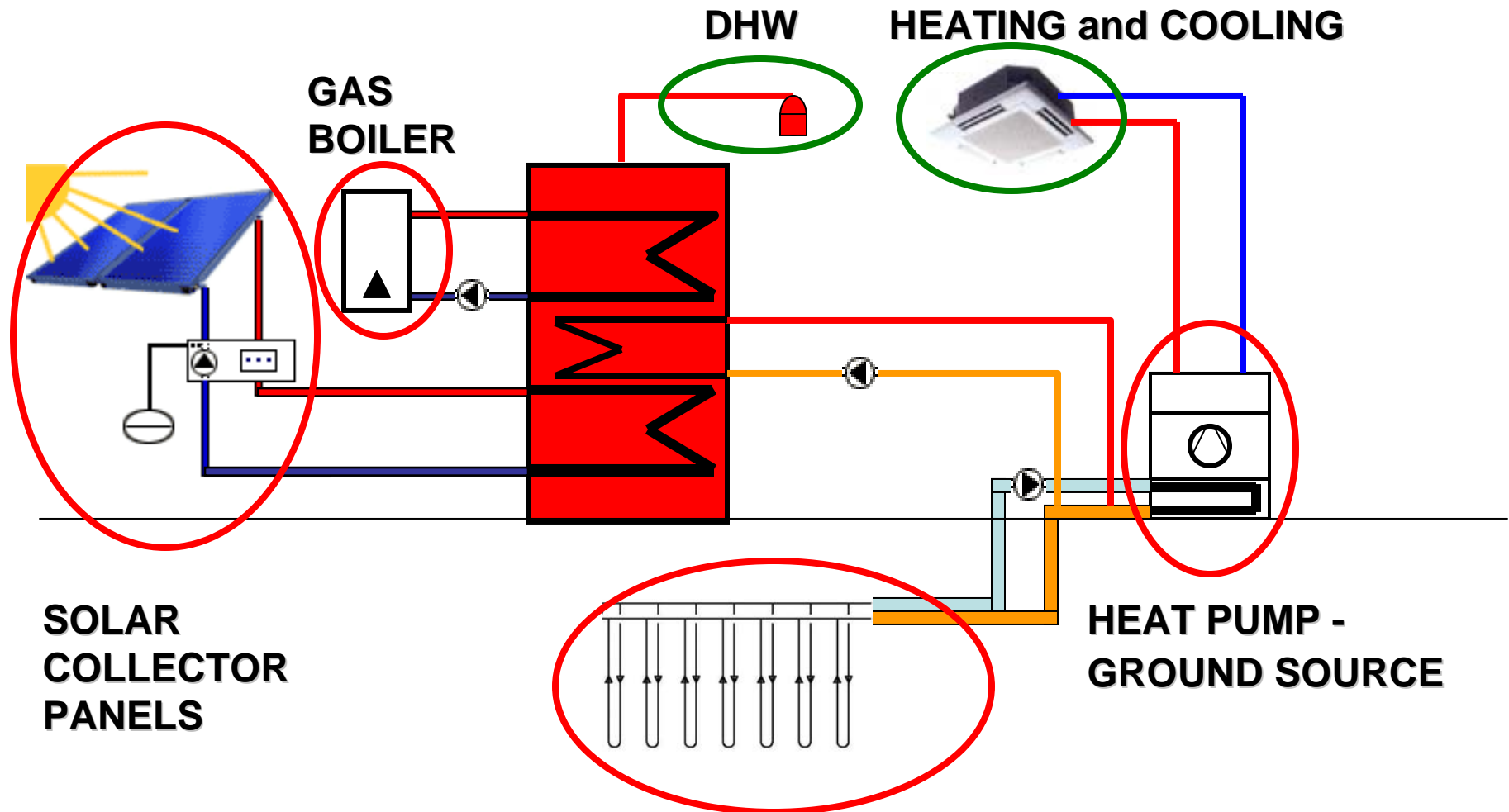


EVACUATED-TUBE COLLECTOR

- Temperature higher than 200°F

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APPROVED SOLUTION: SOLAR – GROUND SOURCE



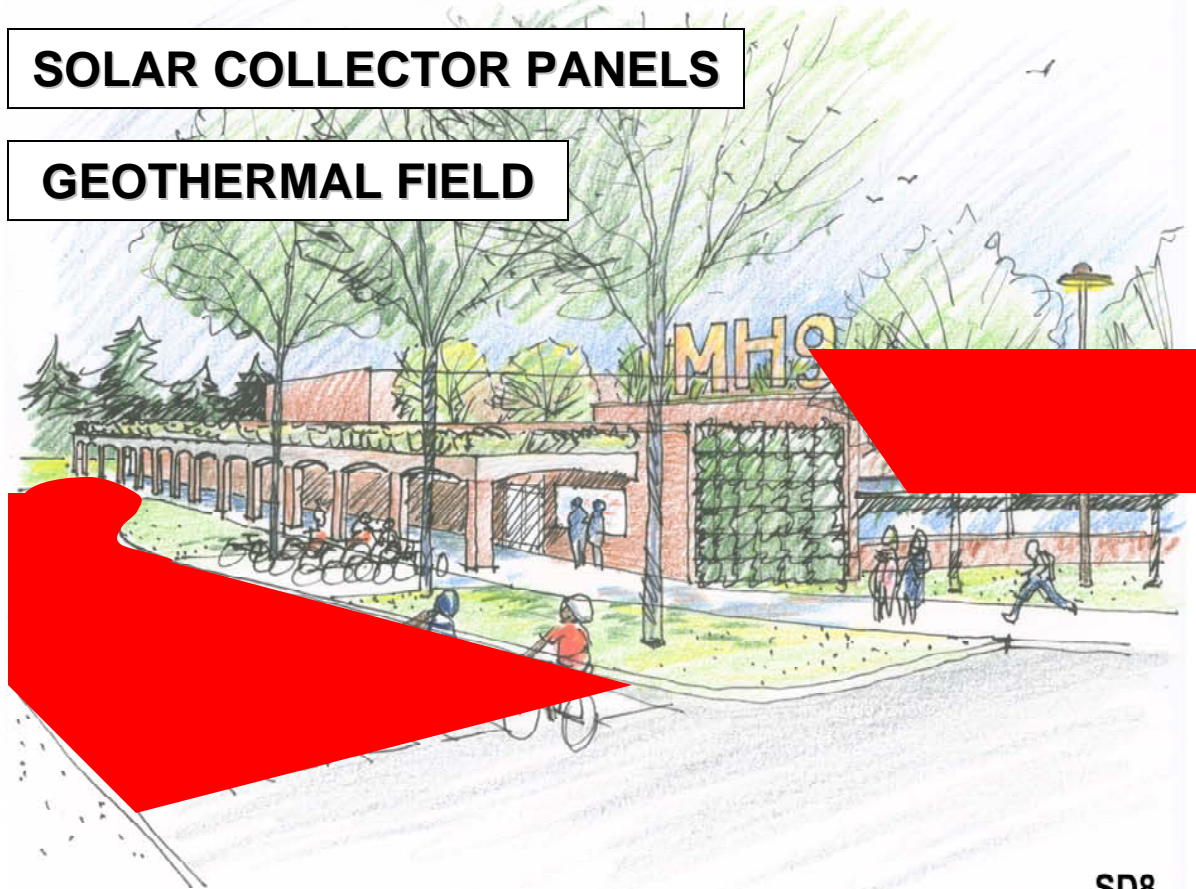
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APPROVED SOLUTION: SOLAR – GROUND SOURCE



SOLAR COLLECTOR PANELS

GEO THERMAL FIELD

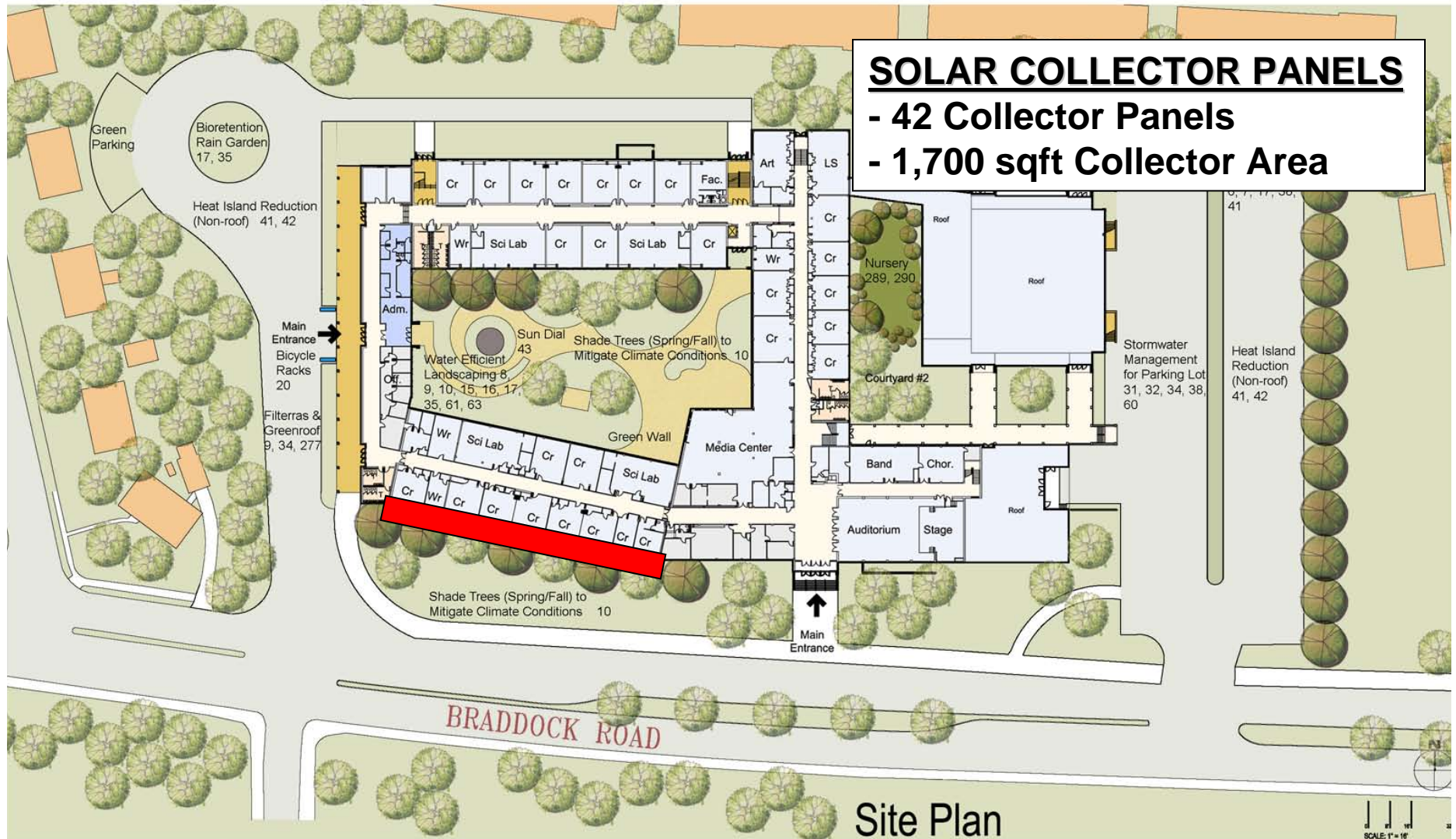


SUSTAINABILITY STUDY

Minnie Howard Ninth Grade Center



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SOLAR COLLECTOR PANELS
 - 42 Collector Panels
 - 1,700 sqft Collector Area

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Date: April 24, 2008

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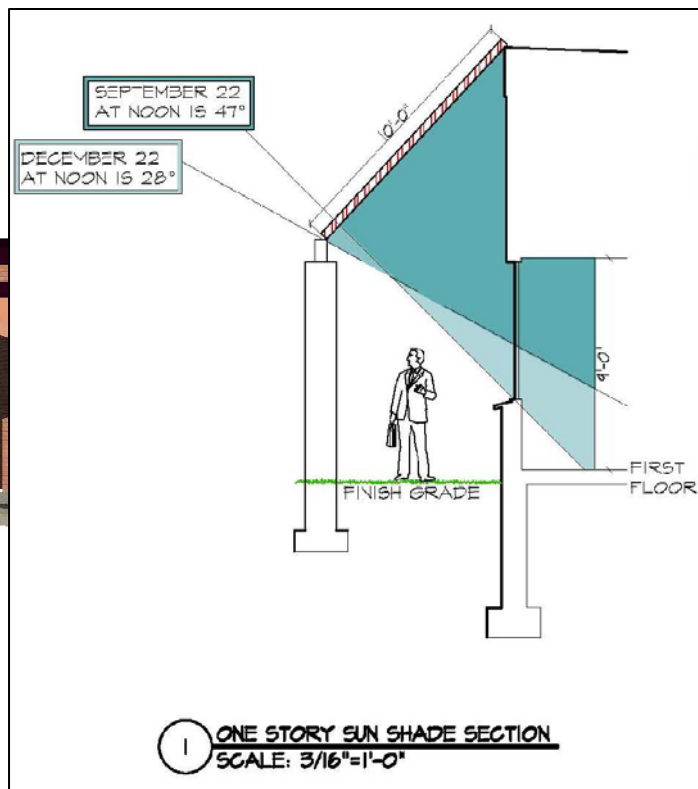


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Energy Flow Diagram

APPROVED SOLUTION: SOLAR – GROUND SOURCE

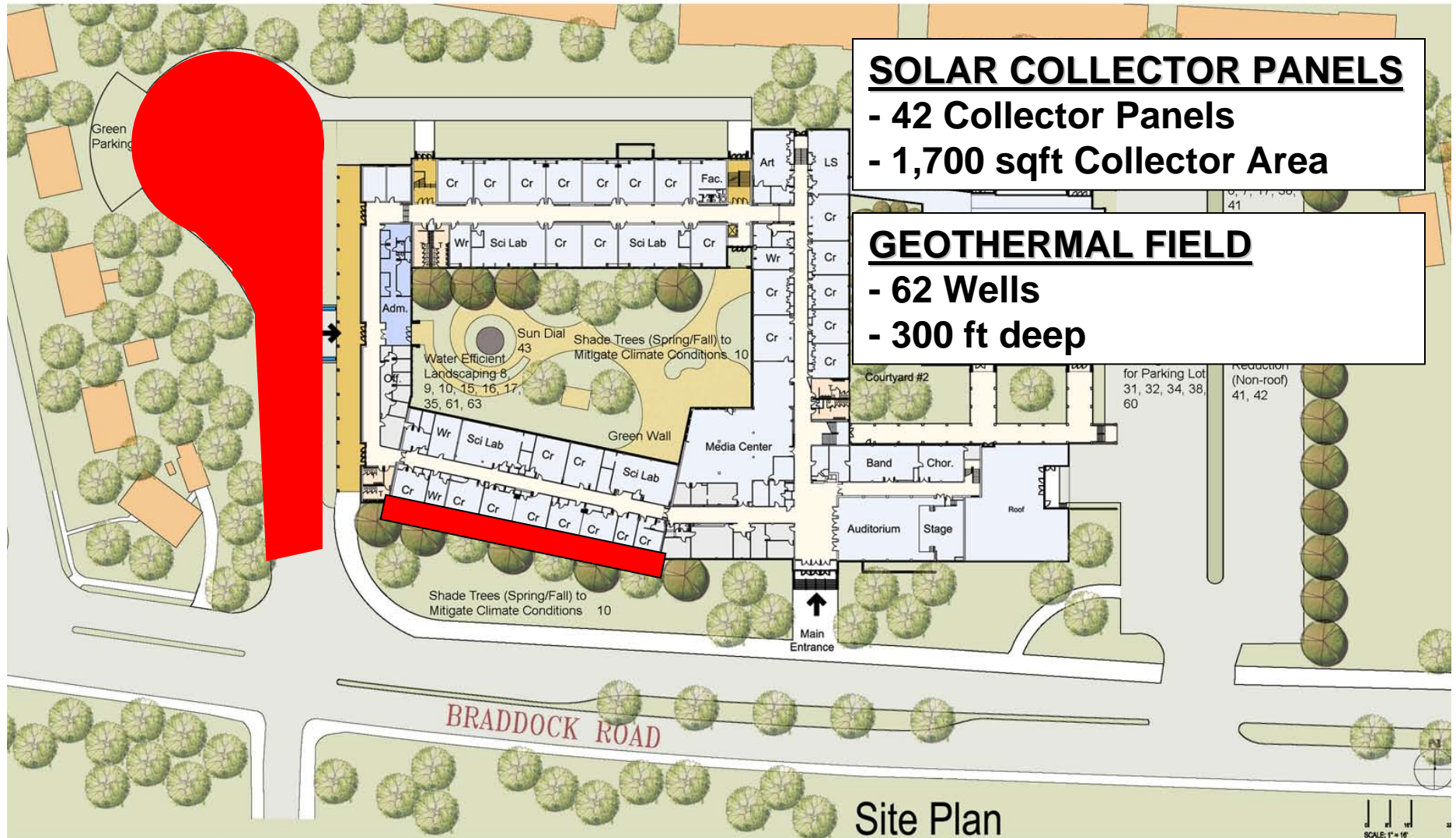
SOLAR COLLECTOR PANELS



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SOLAR COLLECTOR PANELS
 - 42 Collector Panels
 - 1,700 sqft Collector Area

GEOHERMAL FIELD
 - 62 Wells
 - 300 ft deep

Site Plan
 SCALE: 1" = 16'

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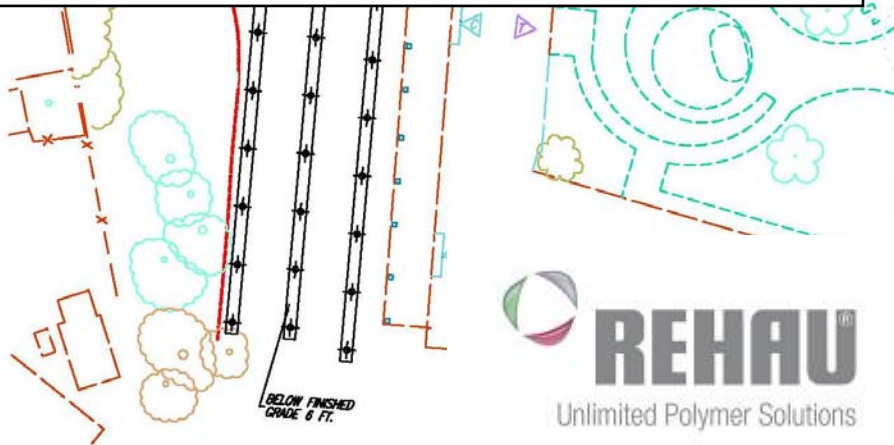
GEOTHERMAL FIELD

- 62 Wells
- 300 ft deep

APPROVED SOLUTION: SOLAR – GROUND SOURCE

RAUGEO™; DOUBLE U-BEND

- Less boreholes
- If one UBEND is compromised, the entire borehole is not lost
- Reduces borehole resistivity
- No fused joints in the borehole field



GEOTHERMAL FIELD

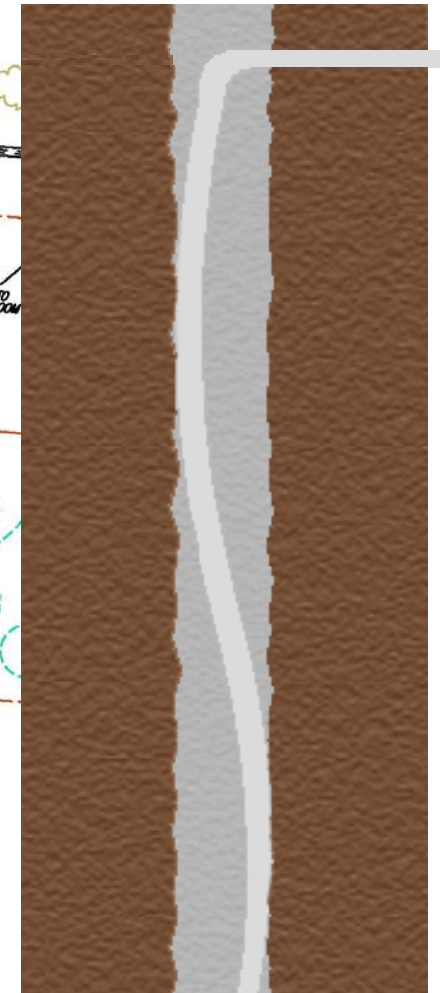
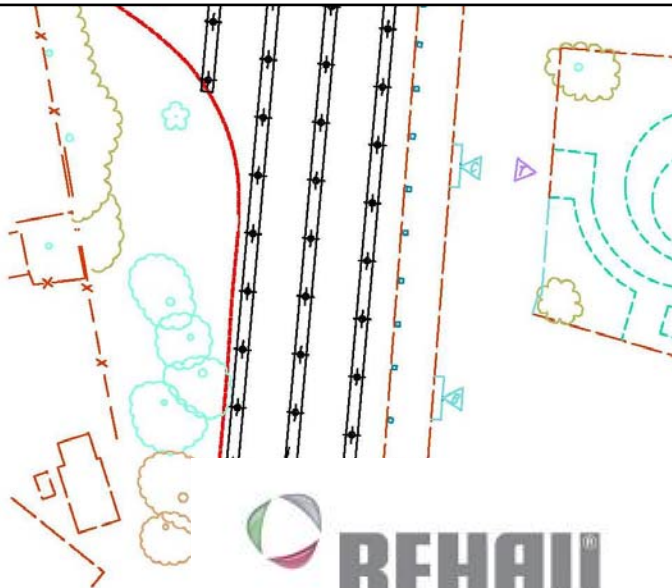
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- 62 Wells
- 300 ft deep

APPROVED SOLUTION: SOLAR – GROUND SOURCE

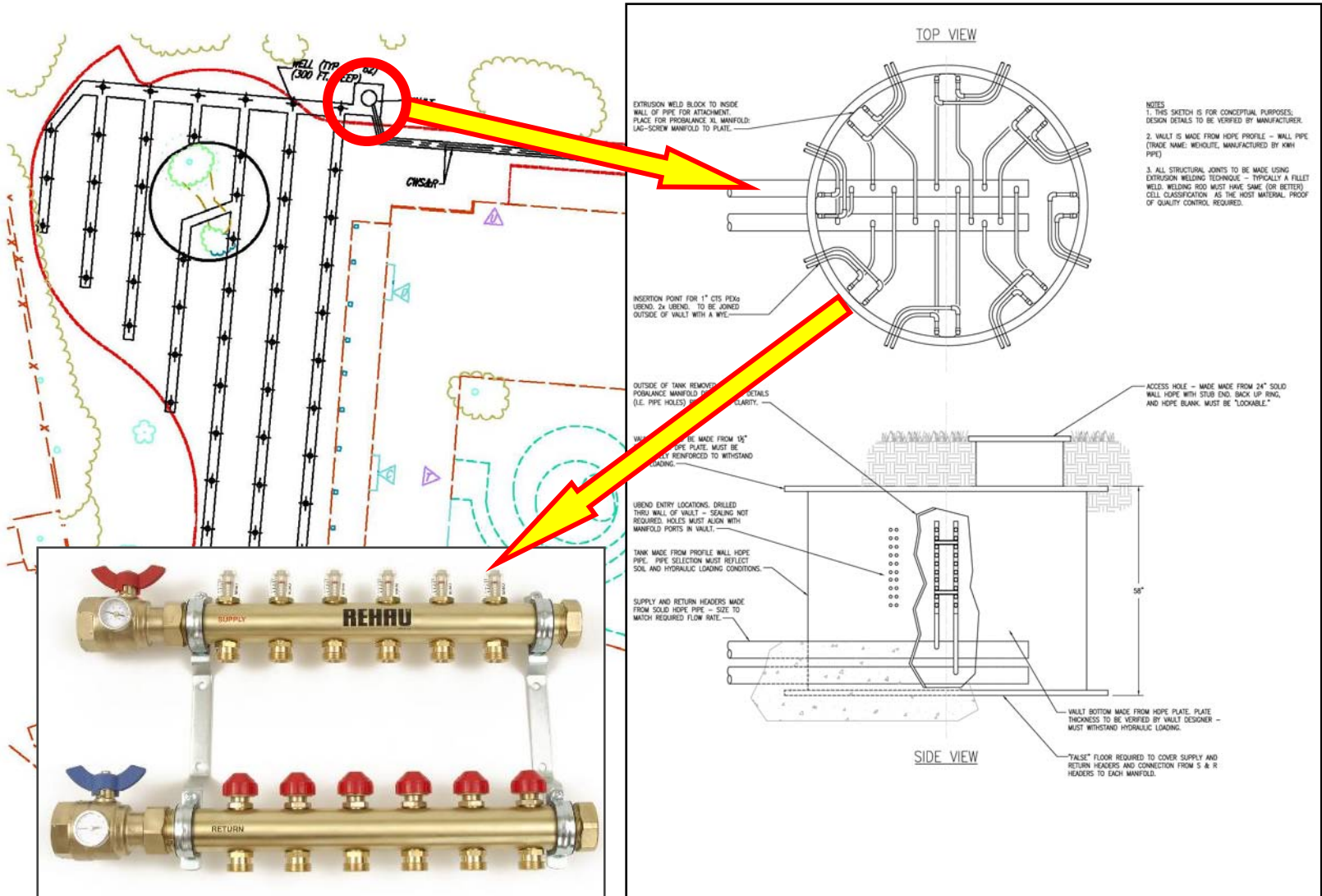
PIPE PEX-a

- PEX-a pipe has superior material properties vs. HDPE
 - resistance to crack growth
 - high impact load / notch resistance



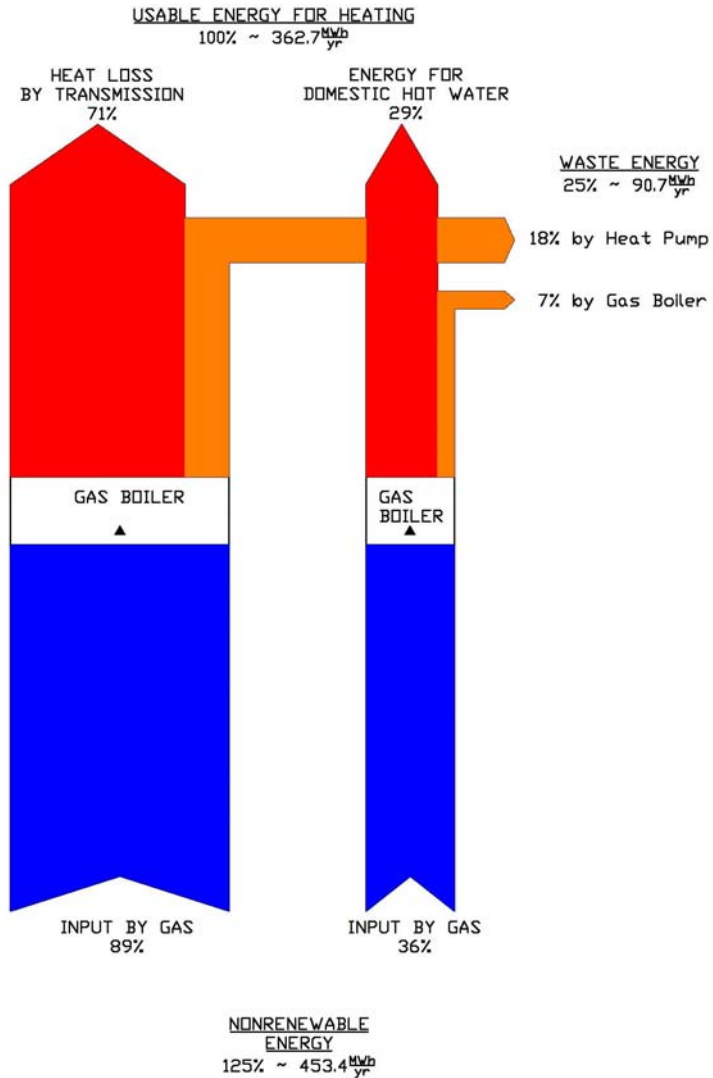
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APPROVED SOLUTION: SOLAR – GROUND SOURCE

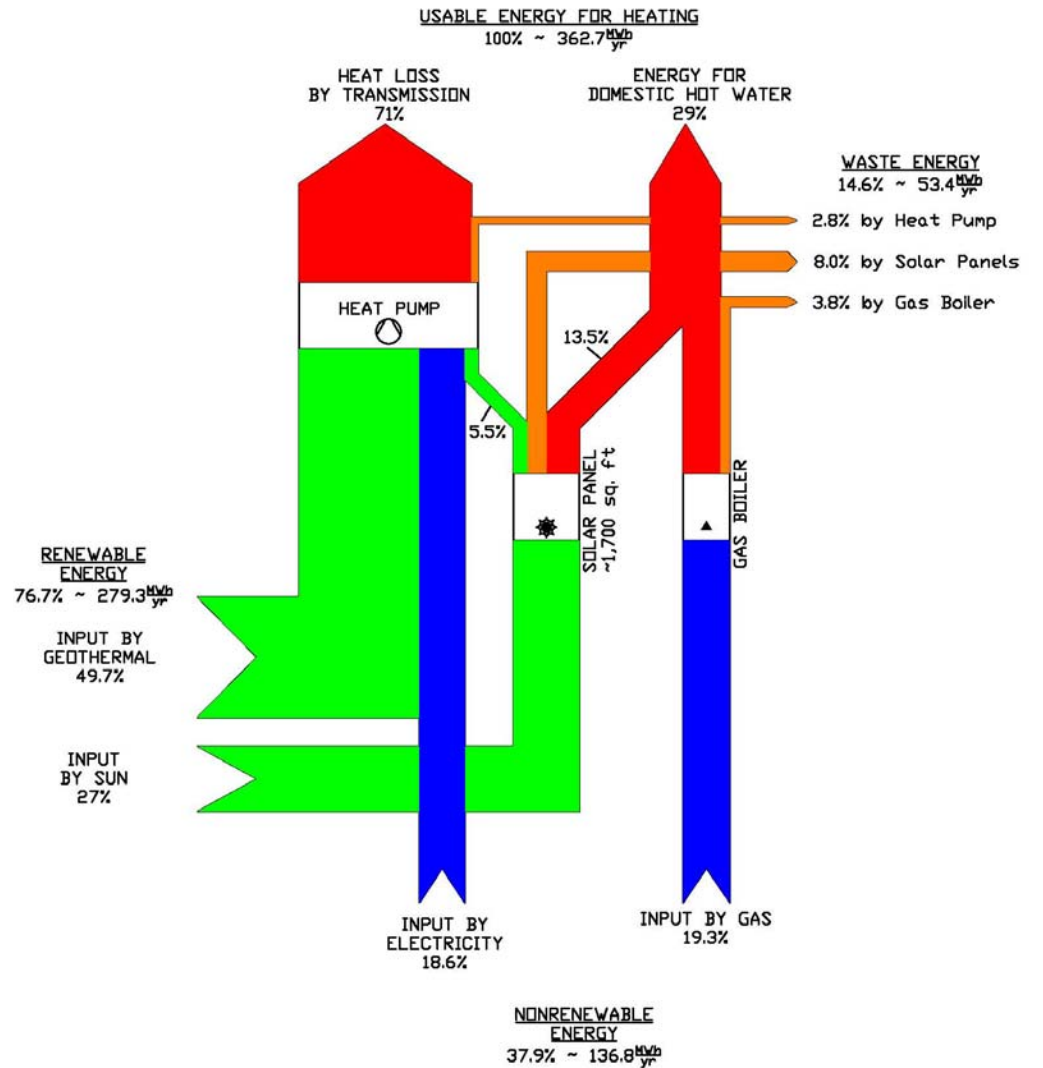


Energy Flow Diagram / HEATING

CONVENTIONAL



SOLAR – GROUND SOURCE



Energy Flow

COMPARISON

	INPUT	
	GAS	ELECTRICITY
CONVENTIONAL	78%	22%
SOLAR – GROUND SOURCE	12%	26%
SAVINGS	-66%	+4%

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Energy Flow

SUMMARY

CONVENTIONAL SOLUTION:

- needs 2.7 x more NON-RENEWABLE ENERGY

SOLAR – GROUND SOURCE

- PAYBACK ~8 years (LIFETIME from WELL FIELD is 50+ years)
- Life cycle COST SAVINGS \$430,000 over 20 years (in PV 2008 Dollars)
- Reduction of GREENHOUSE GASES 50,000 kg CO₂ per year

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THANK YOU FOR LISTENING



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