SEALING IN THE HEAT

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PROBLEM A cold bedroom.

PURPOSE To find an easy and cheap solution for improving the bedroom's heat retention.

HYPOTHESIS Caulking cracks in the exterior masonry wall will reduce infiltration through the cracks, increasing wintertime room temperatures by an average of three degrees Fahrenheit through a week.

THE HOUSE: A mid-century rental house full of ECS blunders. The study room is located on the lower story of the home.

THE ROOM: A concrete masonry unit (CMU) wall is the coldest element in the room. Low insulation and large cracks let a large amount of heat escape from the room.

THE PROBLEM: The large cracks pictured let a considerable amount of heat out of the room. When a hand is placed over the cracks, cold air movement can be easily detected.

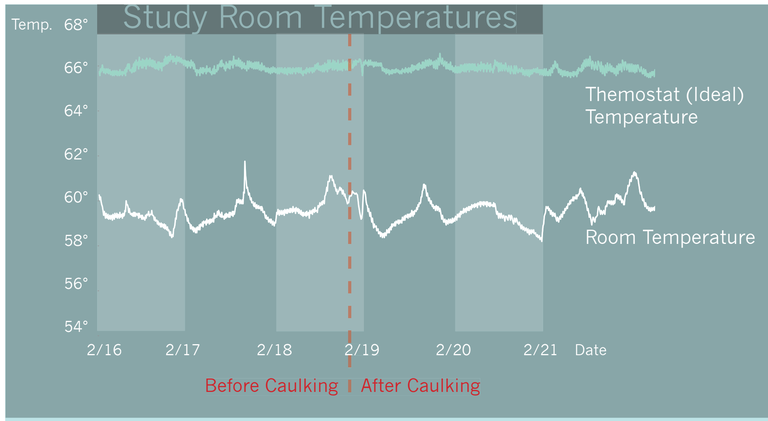
PROCESS

A blower door test was performed before and after caulking the CMU wall in order to find the caulk's effect on infiltration levels.

CAULKING

BLOWER DOOR

SEALED



Average temperature in the study room did not increase as a result of caulking. This disproves the hypothesis, but leads the study in a new direction to examine the other benefits the caulk had on the thermal performance of the wall.

	Interior	Exterior
Average Before	59.52°	38.75°
Average After	59.57°	39.00°

BLOWER DOOR TEST RESULTS:
CAULKING REDUCED INFILTRATION BY **4.4 CFM**

REDUCTION IN HEAT LOSS

$q = (CFM) \times 1.1 \times (\Delta T \text{ in } °F)$
$q = (4.4) \times 1.1 \times (65° - 25.6°)$

$q = 190.69$ Btu/hr Reduction

REDUCTION IN AIR CHANGES/HOUR

$$ACH = \frac{(CFM \times 60 \text{ min/hr})}{\text{room volume in ft}^3} = \frac{(4.4 \text{ CFM} \times 60 \text{ min/hr})}{1488 \text{ ft}^3}$$

ACH = 0.18 Reduction

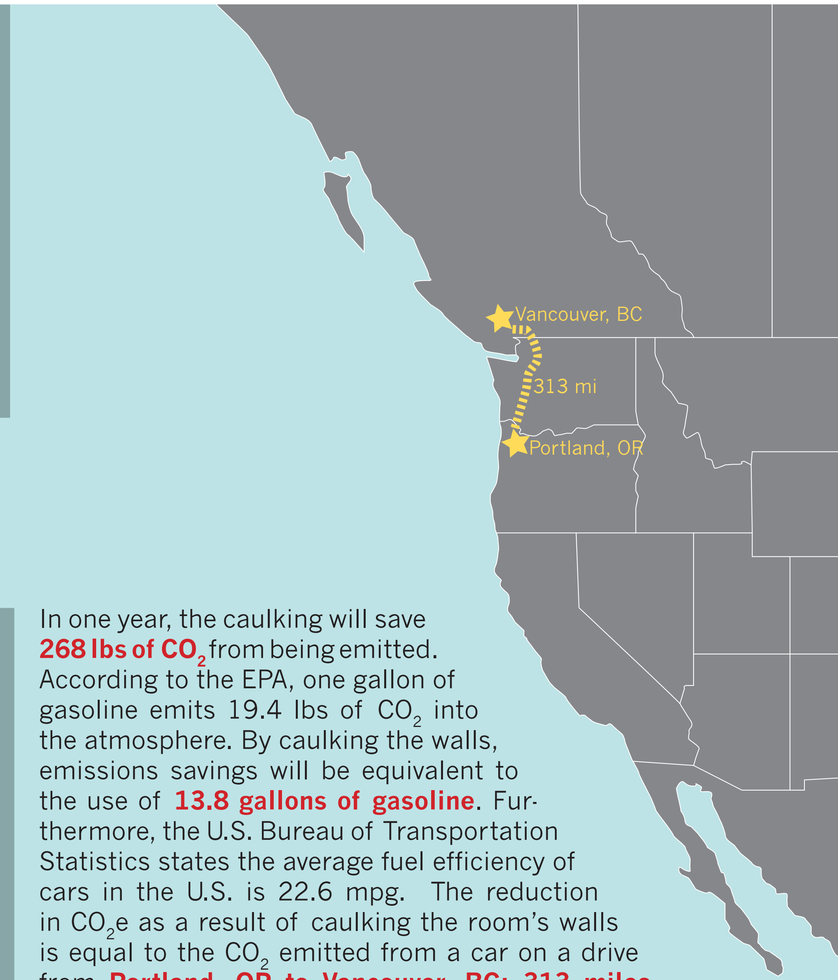
REDUCTION IN ENERGY USE INTENSITY (EUI)

1.368 kWh/day × 120 heating days = 164.14 kWh/year
164.16 kWh/year ÷ 186 ft^2 = 0.883 kWh/ft^2/year
0.883 kWh/ft^2/year × 3412 Btu/kWh = EUI
EUI = 3011.36 Btu/ft^2/year Reduction

REDUCTION IN CO_2 EMITTANCE

$CO_2e = (1.670 \text{ lbs/kWh}) \times (0.883 \text{ kWh/ft}^2\text{/year})$

CO_2e = 1.475 lbs/ft^2/year Reduction



In one year, the caulking will save **268 lbs of CO_2** from being emitted. According to the EPA, one gallon of gasoline emits 19.4 lbs of CO_2 into the atmosphere. By caulking the walls, emissions savings will be equivalent to the use of **13.8 gallons of gasoline**. Furthermore, the U.S. Bureau of Transportation Statistics states the average fuel efficiency of cars in the U.S. is 22.6 mpg. The reduction in CO_2e as a result of caulking the room's walls is equal to the CO_2 emitted from a car on a drive from **Portland, OR to Vancouver, BC: 313 miles.**