HEAT SINK CAPACITY OF A SNOW DUMP SITE

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Summary

Prior to the advent of cheap energy lake ice was harvested, stored, and used for refrigeration and air conditioning.

Clearing snow from streets and parking lots is a modern form of ice harvesting and the accumulated snow could be utilized.

An old-fashioned ice house isn't needed over a snow mass to preserve it for summer use. Suitable insulation can be provided with a flexible foam plastic mat having a reflective surface. Pipes in a basin under the snow pile would serve as a heat exchange for the refrigeration equipment.

We have tested the melt-rate of snow protected by an insulating mat and have compared the heat sink capacities of the residues from various snow clearance operations with the air conditioning requirements of a large Postal Service building.

Rationale

A heat sink can be a valuable economic benefit if properly managed. The snow residues of a city, when plowed and stacked or trucked away, represent a formidable heat-absorbing capacity.

Air conditioning and refrigeration engineers have long used well water as a natural heat sink to cool the condenser coils of refrigeration equipment. Our objective has been to determine the economic feasibility of using snow in the same manner.

In our study, we have attempted to answer three questions as follows:

1. How much snow might be available, when compared with the requirements of a major commercial building.

2. How can snow be economically preserved for midsummer use?

3. What proportion of a building's air conditioning budget could be saved by a well-managed snow cooled air conditioning system?

The amount of snow available and being moved in the Manchester, NH, area was calculated for eleven city parking lots, the municipal airport, a large shopping mall, and the regional Postal Service center. The original plan was to survey the mass of the actual snow dump sites after snow removal.

Since snowfall in our area this past winter was unusually light, we have used US

Army Corps of Engineers data for the average snow accumulation on the ground as of March 15 as a basis for our estimates. The available snow far exceeds the cooling needs of our model, the US Postal Service building, but snow from the adjacent Postal Service parking lots would supply only 46% of the building's requirements.

Snow insulation and preservation were tested using a method that could be adapted to large scale commercial use.

A four inch thick mat of foam plastic with an insulation value of R11, covered on the top surface with reflectorized plastic, was used to cover part of a snow pile leveled off at six feet in height. The melt rate of the ten by ten foot covered area of the snow-pile was compared with an equal uncovered area. Our data show an average melt rate of twenty five inches per week for the uncovered control and five inches per week for the mat covered area of the snowpile.

Having available large quantities of snow for air conditioning purposes during the summer does not eliminate all air conditioning costs. Pumping a refrigerant and circulating cooled air would still be necessary. The Postal Service building expends approximately $8095 per year on air conditioning; snow use would save approximately $4562.

Our study has not considered the costs of installation and management, but the data suggests that a snow cooled system should, at present, be viewed as a possible alternative to reduce electric power consumption rather than a way to dramatically reduce costs.

SNOW MELT DATA

ELAPSED TIME (DAYS)	DATE	HEIGHT PROTECTED SECTION (INCHES)	HEIGHT UNPROTECTED SECTION (INCHES)
0	3/29/80	72	72
6	4/06/80	70	60
14	4/12/80	62	25
21	4/19/80	58	0
29	4/27/80	52	0
	APPROXIMATE REDUCTION RATE	5 IN./WEEK (13 CM./WK.)	25 IN./WEEK (64 CM./WK.)

REFRIGERATION AVAILABLE IN A TYPICAL YEAR

FROM A FEW MANCHESTER SITES

	(1) AREA (ACRES)	(2) ICE VOLUME (CU FT)	(3) WEIGHT (TONS)	(4) ADEQUACY (%)
Mall of NH (Parking lots)	31.9	602,000	18,800	209
US Post Office (Parking lots)	7.0	133,000	4,150	46
Manchester Airport (Runways, aprons, etc.)	168	3,160,000	98,600	1100
City of Manchester (Parking lots)	8.8	165,000	5,150	57
City of Manchester (City streets)	1.5	28,200	880	10

ELECTRICAL CONSUMPTION FIGURES - US POST OFFICE, MANCHESTER

MAY - SEPTEMBER 1978

Total electrical energy used during 5 month period	2,964,500 KWH	at a cost of	$87,298
Electrical energy used for refrigeration	274,900 KWH	at a cost of (estimated)	$ 8,095
Estimate of energy that would have been used had a large ice mass been in place and usable for refrigeration	120,000 KWH	at a cost of (estimated)	$ 3,533
Total estimated savings			$ 4,562