From a thermodynamic point of view, it takes about 1220 BTU heat energy to vaporize a pound of snow. This energy remains virtually the same (within a difference of 2 BTU) for an ambient temperature between 0°F and 32°F. If the ten-to-one rule applies (i.e., 10" of snow is equivalent to 1" of water), a 1" (or 1/12') snowfall will translate to 52 lbs per 100 ft^2 of surface area as shown below.

$$\frac{0.1"}{12"/1'} \times 100\,ft^2 \times 62.4\,\frac{lb}{ft^3} = 52lb$$

where 62.4 lb/ft^3 = density of water

Hence, this amount of solid snow needs an energy input of 1220 × 52 = 63,440 BTU to evaporate. On an energy content basis, the table below presents some indicative costs to generate this quantity of heat using various fuels.

Though the operating cost to remove a 1" snowfall seems manageable, the cost to melt a 10" snowfall would be considerable! Depending upon the typical snowfall pattern and intensity in an area, the annual cost of operating a snow-melting system on electricity would be significant. Based on the table shown below, it is more expensive to operate a system on electricity than on natural gas.

It is very difficult, if not impossible, to determine the cost effectiveness of each system without a detailed analysis. The annual operating cost of a snow-melting system is dictated by the local climate and economic factors. In essence, the running cost varies in relation to the area treated, and other factors including:

- Prevailing air temperature
- Wind speed
- Snowfall intensity, duration and frequency
- How often the system will operate
- Cost of fuel whether be it electricity, natural gas or heating oil
- On- and off-peak (idling) rates
- Floor thermal mass

The 1995 ASHRAE Applications Handbook, Chapter 46, Snow Melting, provides better insight about these factors.

The Cost of Snow-melting

Fuel Type	Fuel Cost	Energy Equivalent	Efficiency (Assumed)	Cost to melt 1" snow on a 100 ft² area
Calgary, Alberta, Canada				
Electricity	10.5¢/kWh*	1 kWh = 3412 BTU	95%	$2.06
Natural gas	$6.60/GJ*	1 GJ = 947,817 BTU	80%	$0.55
Salt Lake City, Utah, USA				
Electricity	8.8¢/kWh**	1 kWh = 3412 BTU	95%	$1.55
Natural gas	$8.5/Dth**	1 Dth = 1,000,000 BTU	80%	$0.67
Propane	$2.8/gal**	1 gal = 91,500 BTU	80%	$2.44

*based on (2011) rates typical to Calgary, Alberta, Canada
**based on (2011) rates typical to Salt Lake City, Utah, USA
Note: The cost of electricity does not include any demand charges, which, if applicable, would greatly elevate the snow-melting cost shown. The assumed efficiency is conservative.

A Closer Look

In summary, the annual operating cost of a snow-melting system equals:

$$\frac{Energy\ Input}{Area\ Footage} \times \text{Size of Area} \times \text{Number of Hours per Season} \times \text{Rate of Local Fuel Charge}$$

Hypothetically, to calculate the annual energy input of a snow-melting application covering an area of 15,000 ft^2 in Calgary, the time duration (in terms of hours) and temperature range (when snow is likely to occur and accumulate over a year) are estimated. Factored in the calculations are the wind speed and the snow accumulation rate typical to the city. For comparison purpose, it is assumed that the weather data will remain the same over a year. Included in the calculations are the back and edge losses, which are assumed at 30% and 20% respectively for the hydronic and electrical system.

The average number of hours per year expected in a particular temperature range for the chosen city can be obtained from various sources. For the purpose of our calculations, the Bin Weather Data of Manual J (ACCA publication, 6th Edition) is followed.

The operating hours (Opr Hrs) correspond to the duration of the snowfall. (A constant 80% is assumed in the calculations.) This is the number of hours the system calls for snow melting action for the given temperature range.

The required heat input in the calculation is from our snow melting calculation which is based on a 0.75 snowmelt effective ratio, or the free area ratio in accordance to ASHRAE definition (see The 1995 ASHRAE Applications Handbook, Chapter 46, Snow Melting). Listed below are the results of the calculations.

The Annual Operating Cost of Snow-melting

Fuel Type	Annual operating cost $/ft^2	Annual operating cost $/15,000 ft^2
Calgary, Alberta, Canada		
Electricity (10.5¢/kWh)	7.92	118,800
Natural gas ($6.6/GJ)	2.13	31,950
Salt Lake City, Utah, USA		
Electricity (8.8¢/kWh)	3.38	50,700
Natural Gas ($8.5/Dth)	1.32	19,800
Propane ($2.8/gal)	4.77	71,550

Again, on a relative term, it is more expensive to operate an electrical system than a hydronic one on natural gas.

THE FIGURES SHOWN ABOVE ARE GOOD FOR INDICATION AND COMPARISON ONLY. LOCAL FACTORS, SUCH AS FUEL COSTS, HAVE TO BE ALLOWED FOR.