Saving energy is only part of the benefit, the real benefit of the Snowmelt comes with the savings. The following equations were used to calculate just how much savings could be made for a solar panel located in Denver Colorado. Denver was chosen as it receives 16 snowfalls a year with more than 1 inch of snow. This makes it an ideal location to initially implement the Snowmelt system.

First to calculate the energy required to melt the snow the mass of ice on top of the solar panel had to be calculated, via equation (1) below,

$$(1)\quad A\rho_I\rho_w B = Mass\ of\ Ice$$

- *A = Area of Solar Panels [m^2]*
- ρ_I *= Density of Snow [%]*
- ρ_w *= Density of Water [kg/m^3]*
- $B = Boundary\ Layer\ of\ snow\ needed\ to\ melt\ [m]$

After calculating required ice to melt, equation (2) below can be used to calculate the amount of energy required to melt the ice,

$$(2)\quad Required\ Energy = \left(mc_p\Delta T + mH_{fusion}\right) * \frac{2.78 * 10^{-7}\ [kWh]}{1\ [J]}$$

- *m = Mass of ice [g]*
- c_p *= Specific Heat of Ice [J/g°C]*
- ΔT *= Change in temperature between the Ice and the surrounding air*
- H_{fusion} *= Heat of fusion for water [J/g]*
- $Required\ Energy$ *= [kWh]*

After calculating the energy required to melt the snow, the energy saved from melting the snow must also be calculated. This was calculated via equation (3) below,

$$(3)\quad Energy\ Gained = \frac{(\eta AIt)}{1000}$$

- η *= Efficiency of the solar panels [%]*
- A *= Area [m^2]*
- I *= Sun's Intensity [W/m^2]*
- t *= Time exposed to sunshine gained [hr]*
- $Energy\ Gained$ *= [kWh]*

On average it was found that a kWh costs 15 cents in Colorado. So to calculate the net profit per snowfall equation (4) below was used,

$$(4)\quad 0.15(Energy\ Gained - Energy\ Lost) = Net\ Profit$$

- *0.15 [$/kWh]*
- *Net Profit [$/snowfall]*

After arriving at a net profit per snowfall, equation (5) below was used to calculate the savings over the lifetime of the solar panel,

$$(5)\quad LfN - 4s = Total\ Profit$$

- *L = Lifespan of the solar panels [yr]*
- *f = # of snow falls per year [snowfall]*
- *N = Net profit snowfall [$/snowfall]*
- *s = Cost of weight sensor [$]*

The following assumptions were made to find the net total profit of the lifespan of a solar panel in Denver, CO.

- Area: 1.65 m^2
- % Ice: 30%
- Density of Ice: 0.9187 kg/m^3
- Air Temperature: -5 ^oC
- Panel Efficiency: 21%
- Snowfalls/year: 16
- Lifespan of Solar Panel: 20 yr
- Solar Intensity: 1000 W/m^2
- Boundary Melted: 0.01 m
- Sunshine Gained: 7 hours
- Weight Sensor Cost: $4.91
- # Sensors: 4

Based on these assumptions it was found that each solar panel would generate $96.76 of profit over its 20 year lifespan. The average house will have anywhere from 15 to 45 solar panels. This indicates that over the lifetime of a solar panel system the savings will be from $1,400 to $4,000 for a residential home. For solar farms, Colorado's largest solar farm has around 500,000 panels, indicating savings over the lifespan of this solar farm would total to 48 million dollars.