System vs Surroundings:

The system is the matter that is undergoing a change in state or chemical makeup. The system is the matter that is experiencing a change in potential energy. The surroundings is the matter that is in thermal contact with the system. For example, the reactants in a beaker are the system. The surroundings are the beaker itself and the air and surfaces that the beaker is in contact with.

The arguments made below are based on adding heat to a substance (the system). All arguments can be reversed for the removal of heat (i.e. cooling). Also the change of state used is liquid to gas. Different arguments can be made for other changes of state!!!!

The first method of measureing heat ($Q = mc\Delta T$) is fairly obvious. Because heat is being absorbed (or added), the temperature increases. A postive ΔT gives a positive Q etc.

In the second method ($Q = Lm$), it is not as obvious. Heat energy is convert to potential energy. The gas is in a higher potential state than the liquid from which it forms. This means that ΔH for the system has increased for the change of state liquid to gas. Because heat energy appears to be swallowed up in this process (remember temperature remains constants) the heat is said to go into hiding. This is referred to as latent heat. This latent heat will reappear should the reverse change of state occur. This is a major implication in meterology and steam burns.

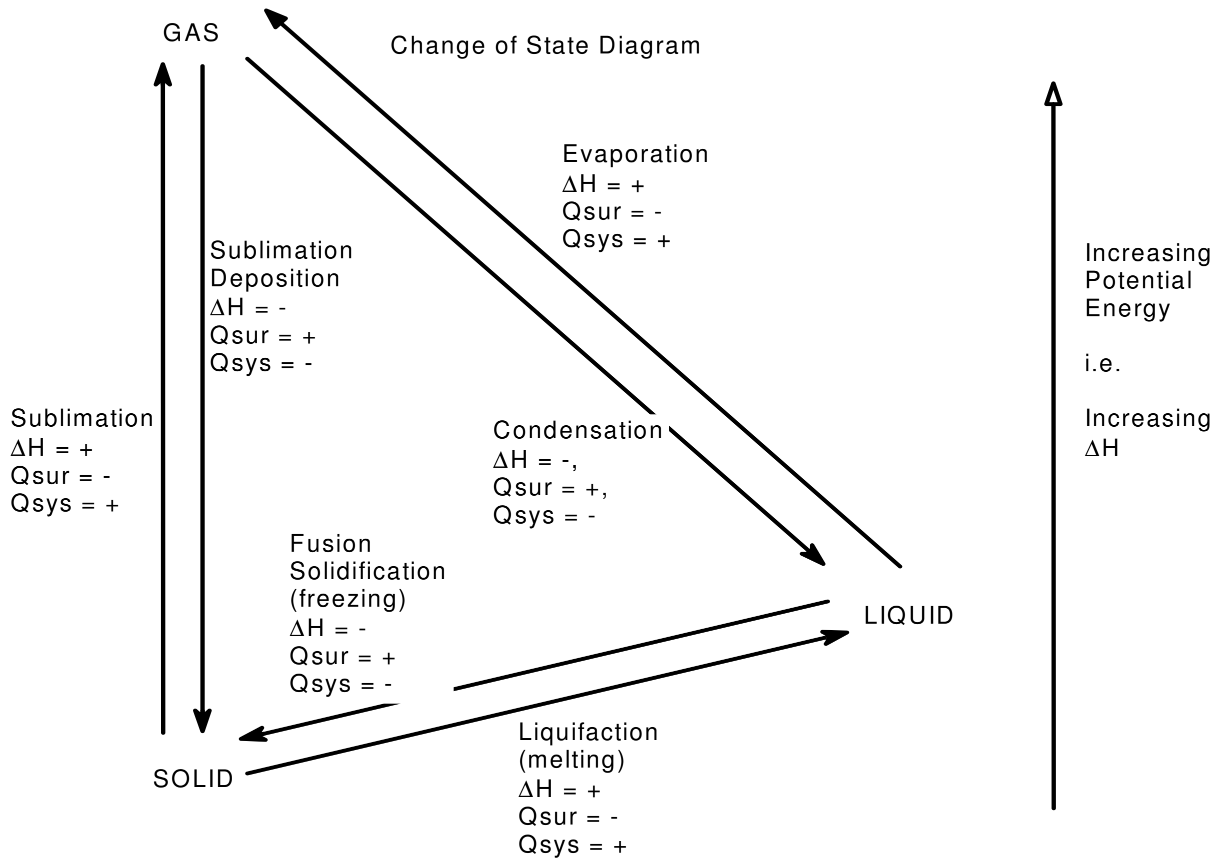
One must consider that the heat for the change of state comes from the surroundings. This means that heat is surrender by the surroundings to make possible the (g) to (l) change of state. $Q_{surroundings}$ therefore has a negative value. Given the heat transfer concept:

$$Q_{system} = -Q_{surroundings}$$

Heat lost by the surroundings (-Q) shows up as heat gained by the system (+Q). And in this case the Q_{system} is coverted to potential energy and hence, according to the first law of thermodynamics:

$$\Delta H_{system} = -Q_{surroundings}$$

This will give the correct sign for an increase in potential energy at the expense of a loss of heat from the surroundings. The confusing point is that the Q in Q = Lm is Q_{system} not $Q_{surroundings}$. What the equation Q = Lm measures in the amount of latent heat which is the same as the increase in potential energy.


Change of State Diagram
GAS
LIQUID
SOLID
Evaporation
ΔH = +
Qsur = -
Qsys = +
Sublimation
Deposition
ΔH = -
Qsur = +
Qsys = -
Sublimation
ΔH = +
Qsur = -
Qsys = +
Condensation
ΔH = -,
Qsur = +,
Qsys = -
Fusion
Solidification
(freezing)
ΔH = -
Qsur = +
Qsys = -
Liquifaction
(melting)
ΔH = +
Qsur = -
Qsys = +
Increasing
Potential
Energy
i.e.
Increasing
ΔH