Evapotranspiration requires energy—it is an energy flow process as well as a water flow process. It takes about 2430 joules per gram (580 calories per gram) to convert liquid water to water vapor at a temperature of 30°C. For comparison, it takes 4.19 joules (1 calorie) to raise the temperature of 1 gram of water by 1°C. The energy balance is simply the partitioning into energy inflows and energy outflows. These inflow or outflow components at the surface include radiant energy flux, soil heat flux, sensible heat flux (convective heating or cooling of the air in contact with the surface), latent heat flux (evaporation), and energy flux stored as photochemical energy (photosynthesis).

The net radiant energy exchange at the earth's surface, called net radiation, R_n, can be expressed as

$$R_n = (1 - \alpha)\, R_s + R_d - R_u \tag{1}$$

where R_s = incoming solar radiation (direct and diffusive)
R_d = thermal radiation from the atmosphere (incoming)
R_u = thermal radiation from the earth's surface (outgoing)
α = albedo (reflectively of solar radiation)

These values are usually expressed in energy flux density units such as watts/m^2 or cal/$cm^2 \cdot$ min.

At night the radiation budget is made up of only thermal radiation. Normally, the earth's surface is warmer than the adjacent air, and it radiates energy upward at a greater rate than the atmosphere radiates energy downward. As a result, radiant energy is lost to space, and the earth's surface cools as it loses heat which was stored in the soil during the day.

The net radiation that is absorbed by the vegetation and soil at the earth's surface is the net energy inflow. For a vegetated surface which is well-watered, the largest part of the net radiation goes into evapotranspiration. This component is called "latent heat flux" because energy is used to evaporate water without raising the temperature. Usually a smaller part of the net radiation goes into heating the air through convection from vegetation and soil. This movement is called "sensible heat flux." During the daytime, a small fraction goes into heating the soil and is called the "soil heat flux." Finally, a small fraction, usually less than 5%, goes into photosynthesis when the ground has an active vegetative cover.

The energy outflows that balance the net radiation inflow can be expressed as

$$R_n = ET + H + G + P \tag{2}$$

where ET = evapotranspiration expressed as latent heat flux density
H = sensible heat flux density
G = soil heat flux density
P = flux density of solar radiation stored as photochemical energy in the process of photosynthesis.