**MKH’s Approach as outlined in the Lighting Paper 2020**

In equations 15 and 16 in the Lighting Paper 2020 draft MKH gives the following definitions for the exergy efficiency and valuable exergy efficiency of a lamp.

To calculate L3, the valuable light, you first calculate the total radiant flux of a lamp.

To calculate the proportion of light that a lamp emits which is deemed ‘useful’ a luminosity function, or weighting function is applied. For illumination this is usually the photopic luminosity function. The useful light in this instance is termed the photopically weighted radiant power, and is given by:

The photopic luminosity function is the function which forms the basis of th defintion of the SI base unit the Lumen, and is given by applying a constant of 683 lumens per watt.

The luminous efficacy is a measure of the efficiency of a lamp and is equal to the qoutient of the luminous power and the electricity input to the lamp.

Having established that the useful light is equal to the weighted radiant flux (in this example by the photopic luminosity function) the luminous efficacy of a lamp can also be defined as follows.

By simply dividing the luminous efficacy of a lamp by 683 lumens per watt, we can calculate the useful light over the power consumption of a lamp.

**Societal Exergy Analysis Approach to Date**

The luminous (or second law) efficiency has previously been calculated in SEA by taking the quotient of the theoretical minimum quantity of energy necessary to emit 1 lumen, and the actual energy used to produce 1 lumen by the device, values which are produced by taking the inverse of luminous efficacy values. This is equivalent to the quotient of the luminous efficacy of the device being assessed, and the maximum luminous efficacy.

When considering the above definitions this equation can be simplified to

This equivalency facilities the conversion of published luminous efficacy values to the valuable exergy efficiency if the energy:exergy factor is known. However, this only works if we take the photopic luminosity function to be the correct determinant of the useful portion of the light emitted by the lamp. To calculate the useful portion of a lamps light according to different criteria different weighting functions must be used. This calculation can be generalised in the following equation: