Appendix:

Adenylate kinase catalyzes the following reaction:

$$ATP + AMP \underset{k_{-1}}{\overset{k_1}{\rightleftarrows}} 2ADP$$

Using mass action:

Dissociation rate constant = K = $\frac{k_{-1}}{k_1} = \frac{[ATP][AMP]}{[ADP]^2}$ (1)

Energy charge = EC = $\frac{[ATP] + \frac{[ADP]}{2}}{[ATP] + [ADP] + [AMP]}$ (2)

Assuming that [ATP] + [ADP] + [AMP] = α = 1 = constant, (3)

then using algebraic manipulation of equations (1-2), one could show that:

$$[ADP] = \frac{-0.5 + \sqrt{(0.5)^2 + 4\left(K - 0.25\right)\left(EC - EC^2\right)}}{2\left(K - 0.25\right)} \quad (4)$$

Thus, for a given EC and K values, equation (4) can used to determine [ADP]. Knowing [ADP], then [ATP] and [AMP] are determined from equation (2) and equation (3), respectively.