**S3 File. Cost of CCM on *Trichodesmium* growth.**

Raven et al. [[1](#_ENREF_1)] calculated the minimum photon cost for operating cyanobacterial CCMs where CO2 enters the cells by passive diffusion across the plasma membrane through selective protein channels. The CO2 is then converted into HCO3- by a specific NAD(P)H–PQ oxidoreductase located in the thylakoid membrane thus allowing intracellular concentrations of HCO3- to increase above those in the surrounding bulk medium. The HCO3- then enters the carboxysome, where it is converted back to CO2 by carbonic anhydrase prior to fixation by Rubisco. Depending on the assumptions made regarding the photon efficiency of the PSI driven NAD(P)H–PQ oxidoreductase and the magnitude of the leakage of CO2 away from Rubisco, the calculated photon requirement ranged from 0.5 to 2 photons per CO2. This represents 5-20% of the cost of CO2 fixation. Perhaps more informative is a comparison of the photon cost of the CCM with the photon cost of N2 fixation. Based on a Redfield C:N of 106:16, and the ATP and reductant requirements for nitrogen fixation, the minimum photon requirement of 1.7-3 photons per CO2 fixed into biomass is obtained (S2 Table). This suggests that there may be some room for an energetic trade-off between the costs of CCM and N2 fixation. However, the effect on growth rate is likely to be small since the photon requirement for operating the CCM accounts for only 5-15% of the photon requirement for growth (S2 Table).

**References.**

1. Raven JA, Beardall J, Giordano M (2014) Energy costs of carbon dioxide concentrating mechanisms in aquatic organisms. Photosynthesis Research 121: 111-124.