**Goal**  
To create a sustainable biological light source based on genetically engineered cyanobacteria.

**Background**  
**Bioluminescence**  
Bioluminescence is light produced by a chemical reaction and subsequently emitted from a living organism. In nature, it is used to e.g. scare off enemies, as camouflage or even to attract mates.  

The LuxCDABE operon consists of the luxc, luxD, luxA, luxB, luxE genes from *V. fischeri* (bacteria) has the full-package for light production with luciferase (luxA and luxB) as the major enzyme.

Luciferase (encoded by A and B) catalyzes oxidation of substrates under emission of light. CDE are accessory proteins needed for substrate regeneration.

**Cyanobacteria**  
As host organism for the bioluminescence we choose the cyanobacteria due to its capabilities of performing photosynthesis and removing waste CO2 while providing the chemical energy for the bioluminescence.

**Light sensitive promotors**  
The idea is that the cyanobacteria will gather energy during the day through photosynthesis and then use this energy for bioluminescence during night, and for this we need light sensitive promotors.

In this project we utilize two different light sensitive promotors:  
- *lrtA* which is a night inducible from the cyanobacteria *Synechocystis sp*. PCC6803 involved in its circadian rhythm.  
- *YF1* and *FixJ* light sensitive promotors system added to the registry of standard biological parts by the 2011 Uppsala iGEM team.

All three in combination: **Bioluminescent cyanobacteria only in darkness**.

**Strategy**  
**Cloning**  
For assembling our biological part we use the Plug’n’Play system promoted by the iGEM 2011 team DTU2 – Denmark which is based on USER cloning. This system could potentially speed up the cloning work of the since several biological part can be assembled in one step, but the method seems to have limitation with regards to combining small large DNA fragments. which would potentially

Experimental construct 1 - using *YF1* and *FixJ* as light sensitive promotors

In darkness *YF1* is autophosphorylated and it leads to phosphorylation of *FixJ* which in turn leads to transcription of the Lux cassette and light emission.

Experimental construct 2 – using *lrtA* as a light sensitive promotor

The *lrtA* promoter is associated with the electron transport chain of photosynthesis in *Synechocystis sp*. When it is dark and photosynthesis is shut off the electron acceptors of the electron transport chain are in their reduced state and the *lrtA* promoter is active, thus transcription of LuxCDABE operon occurs.

**Perspectives - Biological neon**  
Biological neon is a possible platform for companies to appear environmentally responsible in urban settings.

**Submitted parts**  
BBa_K770001: Reporter gene - the luxCDABE gene cassette in pSB1C3  
BBa_K770000: Composite part – ProC-YF1 – in pSB1C3

**Modeling**  
A model describing light emission from the Lux operon as a function of K1 and K2 (see lux operon figure)