

**SPARK OF NATURE
BY PLANT-E**
**ILLUMINATING
PLANTPOWER**



Introduction

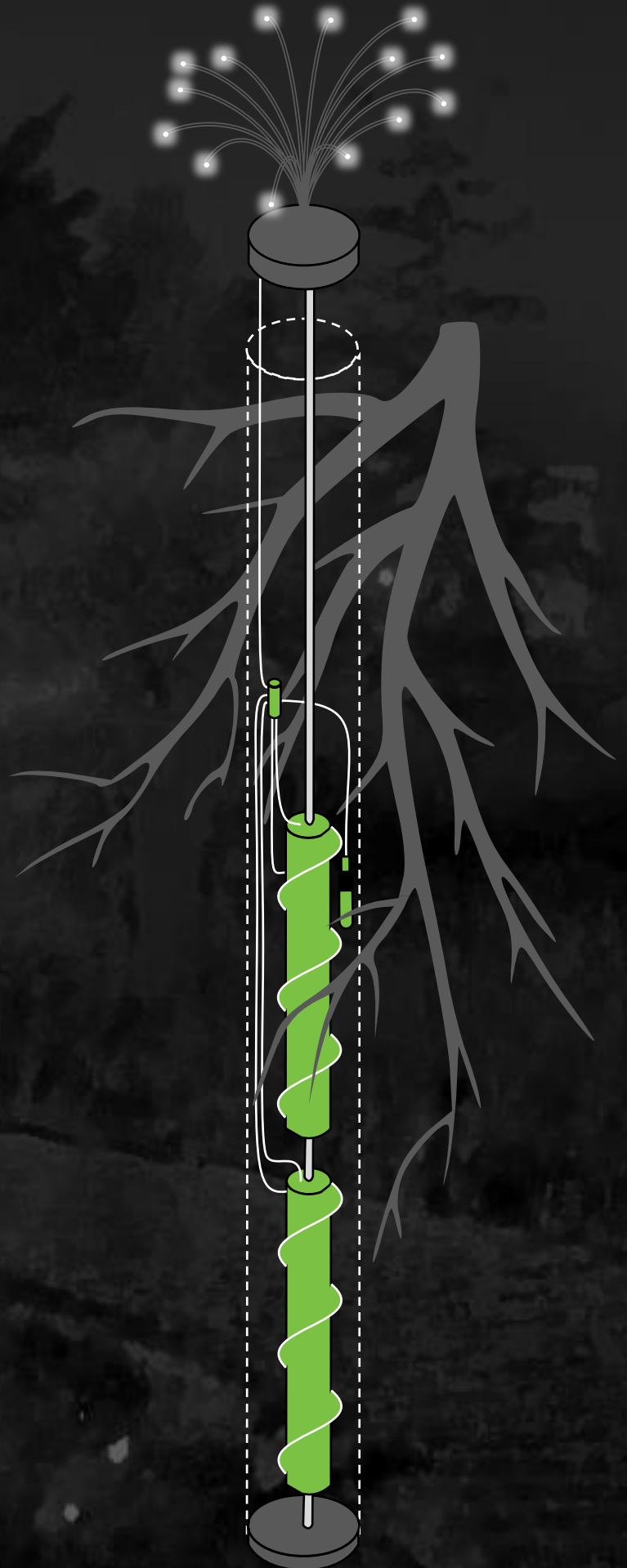
Spark of Nature by Plant-e is a low-power and year-long source of electricity. It harvests natural energy from plant-soil-microbial interactions, lighting up a chosen device.

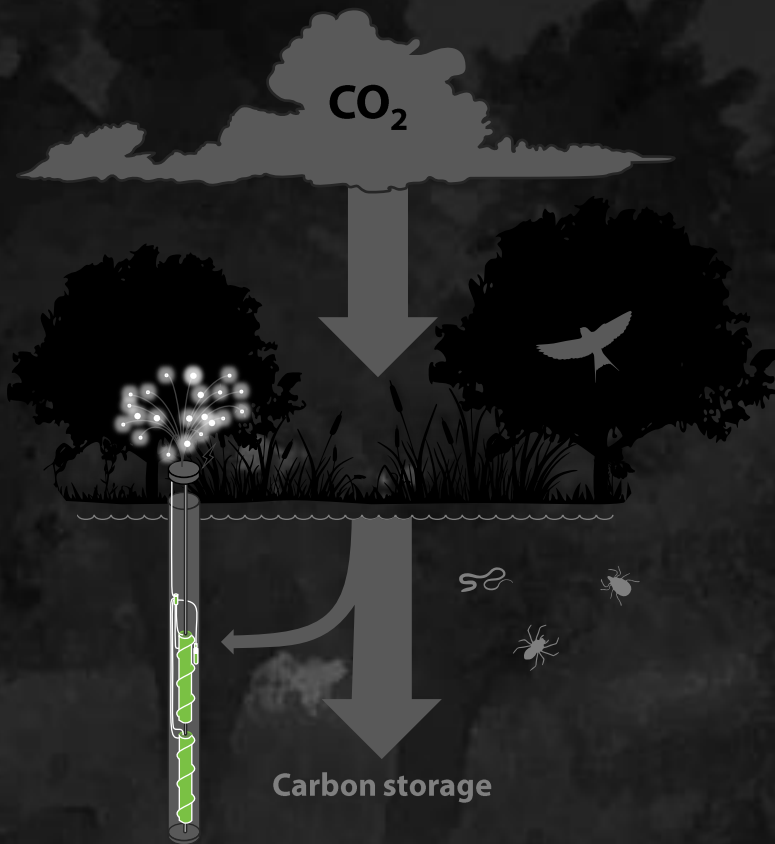
Lighting systems can be powered indefinitely by the Spark of Nature and outlast conventional photovoltaic- and alkaline battery-powered solutions. The Spark of Nature increases the reliability and reduces the cost, maintenance and environmental footprint of landscaping lighting projects.

The Spark of Nature is an innovative power source that harvests energy from microorganisms that decompose organic matter released by plant roots

Based on the Plant-Microbial Fuel Cell (P-MFC) technology, the Spark of Nature relies on natural electrochemically active bacteria (EAB) that thrive in wetlands, to generate electricity.

After quick and easy installation in waterlogged soil, the Spark of Nature is able to connect to a diverse portfolio of low-power lighting systems (LED lights, fairy lights, etc.), providing electricity for sustained operation.





Plant-powered lighting stimulates the greening of urban spaces and strengthens the bond between people and nature.

Spark of Nature by Plant-e thrives on healthy wetland ecosystems. This lighting solution supports the development of integrated green spaces in urban communities, putting Nature's cycles and rhythm at its core.

Plant-lighting projects multiply positive externalities with a stronger biodiversity, climate cooling, human-Nature bonding, and carbon capture, all the while producing an immersive landscaping experience.

Design

The Spark of Nature is designed with three key elements in mind: sustainability, practicality, and durability.

Continuous effort is made to ensure it is constructed from sustainably sourced, inert and long-lived raw materials.

The “all-in one” stick design allows for quick and easy installation of the Spark of Nature in wetlands using an earth auger drill

Energy harvester

The harvester enclosure contains the core of the Spark of Nature’s electronics. It **harvests electricity from the P-MFCs** in the soil and connects the Spark of Nature to a low-power lighting option of choice (LED lights, fairy lights, etc.).

P-MFCs

The **Plant-Microbial Fuel Cell** (P-MFC) is the essence of Plant-e’s technology. It is capable of **generating electricity from microbes** in the soil that feed on organic matter released by **plants**. Each Spark of Nature contains a pair of P-MFCs for robustness.

Soil node

It connects both P-MFCs with the harvester, as well as a set of sensors for **monitoring the Spark of Nature’s performance**.



A P-MFC consists of a **carbon anode** and a **carbon cathode**, separated by an electrical **insulator**. Oxygen is provided to the cathode by an **aeration tube**.

Plants to Power

Plant-Microbial Fuel Cells (P-MFCs) generate electricity from naturally-occurring microorganisms in the soil. These microorganisms thrive in wetlands and eat small organics deposited by plants in the soil.

#1 Rhizodeposits

Plants release organic matter in the soil through their roots and above-ground parts.



#2 Soil microbes

Microorganisms in the soil feed on this organic matter. In waterlogged environments, in the absence of oxygen, plant matter is decomposed into **small organic molecules**.



#3 Electrogens

Electrochemically active bacteria (EAB) are microorganisms that thrive in the absence of oxygen. In wetlands, they degrade organic molecules, **generating an electric potential**. The EAB donate their electrons to the anode electrode, to keep their metabolism going.



#4 Oxygen reduction

Electrons travel through a circuit from the $-$ to the $+$ electrode where they **react with oxygen and protons, to form water**.



#5 Power generation

The **harvester** electronics board is connected to the \ominus and \oplus electrodes and **harvests electricity** from the EAB. This electricity is stored in a storage element and used to power a lighting application.

Choosing the right environment for the Spark of Nature

Let the Spark of Nature breathe

Because the P-MFC's cathodes need oxygen, the air inlet of the Spark of Nature should always be above the water level.

Anaerobic conditions

Oxygen poisons the microorganisms on the anode. Make sure that the P-MFC part of the Spark of Nature sits below the root layer.

Organic-rich soil

P-MFCs feed on soil organic matter. Because of the length of the P-MFCs (80 cm), the layer of dark, organic-rich soil should be at least 1m deep.



High water level

P-MFCs only work in anaerobic soils and thus need to stay submerged.

P-MFCs are fit for:

- ✓ Natural or constructed wetlands
- ✓ Rice paddies
- ✓ Banks of ditches, canals, ponds, or lakes

Favorable temperatures

Below 7°C the microbial activity in the soil is very low. Thankfully, in temperate regions, most soils stay above this temperature in winter.



Installation

The Spark of Nature's "all-in one tube" design allows for quick and easy installation in wetlands using an earth auger drill. The booting and monitoring can be done via a wireless Bluetooth connection.

#1 Wetland assessment

The conditions of the chosen site are essential for P-MFCs to function properly. The main requirements are:

- ✓ High and stable water level year-round
- ✓ High organic content in the soil

See also Choosing the right environment for the Spark of Nature.

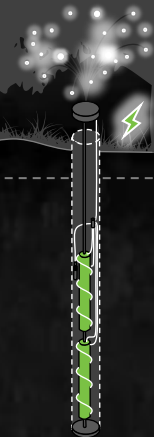


#2 Transport

The Spark of Nature is a lightweight handheld tube that is easy to ship and carry.

#3 Installation

Drill a hole at the chosen location and insert the Spark of Nature with the top about 30 cm above ground.



#4 Startup and operation

Connect your low-power lighting application of choice to the power outlet of the Spark of Nature. Performance of the Spark of Nature and soil conditions can be monitored via a bluetooth connection on your mobile phone from up to 100 m away.

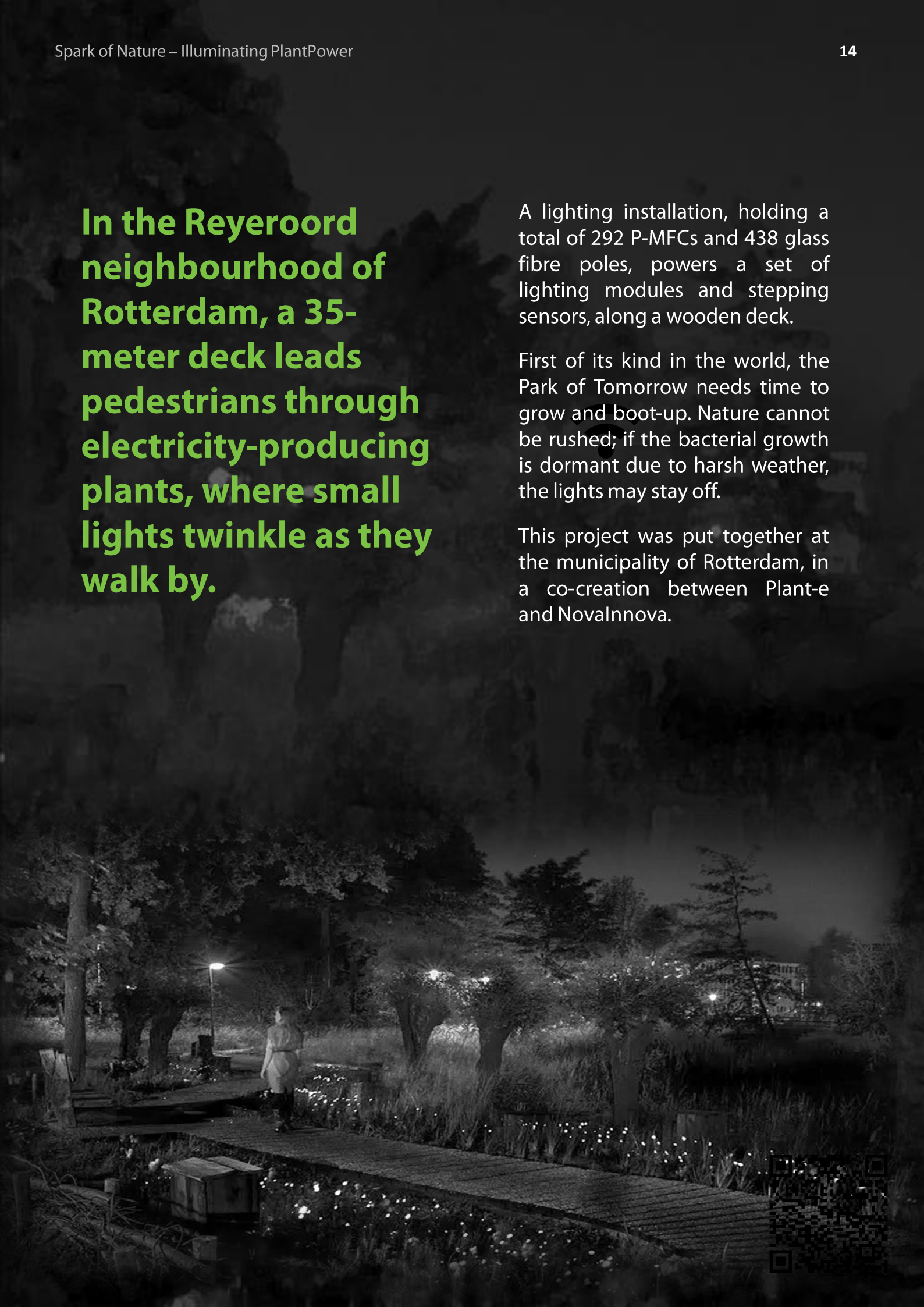
Example project

In the Reyeroord neighbourhood of Rotterdam, a 35-meter deck leads pedestrians through electricity-producing plants, where small lights twinkle as they walk by.

A lighting installation, holding a total of 292 P-MFCs and 438 glass fibre poles, powers a set of lighting modules and stepping sensors, along a wooden deck.

First of its kind in the world, the Park of Tomorrow needs time to grow and boot-up. Nature cannot be rushed; if the bacterial growth is dormant due to harsh weather, the lights may stay off.

This project was put together at the municipality of Rotterdam, in a co-creation between Plant-e and Novalnnova.



Spark of Nature powers a range of application from recreational and landscaping projects to signalling purposes.



Fairy tale lights



path signalling



Water body signalling



Interactive information boards



Get in touch

sales@plant-e.com

office@plant-e.com

