



CO-DESIGN APPROACHES TO REDUCE LIGHT POLLUTION

Holwerd, The Netherlands

Holwerd (Frisian: Holwert) is one of the Dutch demonstrator sites within DARKER SKY. Coordinated by Landmakers Coöperatie (LM), the pilot applies a **bottom-up, community driven approach** to nature-friendly lighting, biodiversity awareness and behavioural change. Following discussions with the DARKER SKY lead partner, the original ambitions for multiple intervention areas were consolidated into one realised demonstrator location in the village centre. This adapted streetlight represents the completed physical intervention within the project.

Rather than focusing on large-scale technical deployment, the demonstrator functions as a learning and activation site that stimulates **reflection, dialogue and locally initiated follow-up actions**.

A distinctive element of the approach was the exploratory use of Extended Reality (XR), including Virtual Reality (VR) and Augmented Reality (AR), during early co-design phases. These tools supported visualisation and dialogue but were not used as core implementation instruments.

CO-DESIGN APPROACH

The Holwerd pilot combines technical experimentation with social learning. Residents, entrepreneurs, young people and local authorities jointly explored nature-friendly lighting solutions through meetings, workshops and surveys organised since 2023.

Rather than co-designing multiple physical interventions, the process focused on awareness raising, behavioural reflection and local ownership.

The adapted streetlight serves as a demonstrator where stakeholders can experience and discuss alternative lighting principles and consider their own actions.



Governance Context

The Municipality of Noardeast-Fryslân is responsible for public lighting and collaborates with a regional lighting provider. Additional coordination takes place with Rijkswaterstaat and local stakeholders where lighting intersects with infrastructure, safety and spatial planning.

Governance is characterised by a multi-level, multi-actor structure requiring continuous coordination between public authorities, residents and technical experts. Landmakers acts as a bridging organisation facilitating dialogue and supporting bottom-up initiatives.

Stakeholder Involvement

Stakeholder engagement evolved gradually from awareness raising to activation. Over time, stakeholder involvement shifted from consultation towards empowerment, encouraging residents and organisations to initiate their own nature-friendly lighting measures.

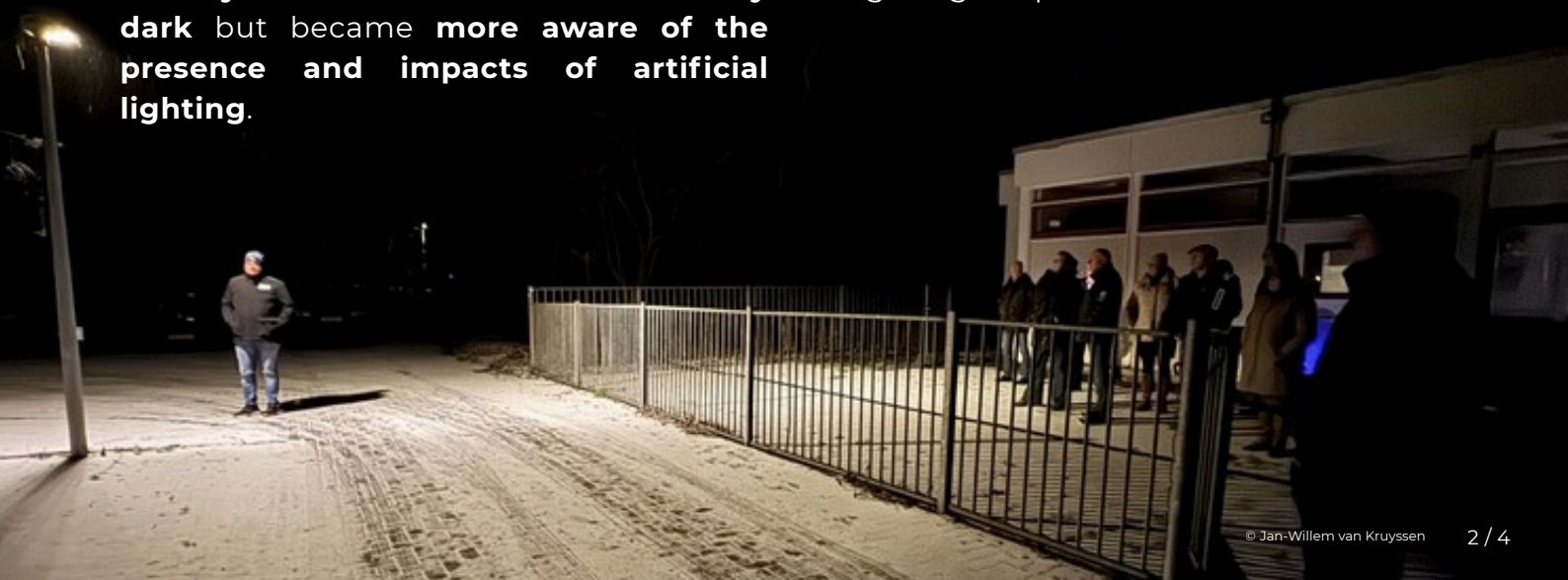
Engagement & Awareness

- **Initial engagement** started with entrepreneurs from the Lands Welvaren industrial estate during a **kick-off meeting on 2 October 2023**, where safety and interest in nature-friendly lighting emerged as key themes.
- **Young people** became **involved through the Holwerd Youth Sounding Board Group (4 November 2023)**, where DARKER SKY was introduced and discussed in relation to biodiversity and the future of the village.
- **A community workshop on 13 May 2024**, supported by a baseline survey, explored perceptions of artificial light at night, well-being and biodiversity. Participants **initially** considered Holwerd **relatively dark** but became **more aware of the presence and impacts of artificial lighting**.

Increased Awareness & Activation

- The national **“Nacht van de Nacht” event on 26 October 2024** further **increased awareness** through light measurements, observations and discussions on darkness, biodiversity and landscape experience.
- A **public workshop on 26 January 2026** marked the transition from **awareness to activation**. Participants were introduced to the realised demonstrator, biodiversity impacts of artificial light and the broader objectives of DARKER SKY.

The programme included a **livedemonstration** of the smart streetlight, a follow-up **sociological survey** and the launch of a **local idea competition** encouraging citizen-led lighting adaptations.



SCIENTIFIC MONITORING

Monitoring combines technical measurements, ecological observations and participatory learning.

Activities are carried out by the University of Groningen (RUG), Van Hall Larenstein University of Applied Sciences (VHL) and PolyCiviel. Together they contribute to light measurements, Sky Quality Meter (SQM) monitoring and methodological reflection.

Baseline measurements were conducted before the lighting adaptation. Follow-up measurements focus on light levels, spectral characteristics and operational scenarios of the demonstrator.

Due to the limited scale of the intervention, monitoring is not intended as a statistically comparative biodiversity study. Instead, the demonstrator functions as an experimental learning environment that provides indicative ecological insights while supporting awareness, reflection and informed decision-making.

Monitoring results are shared during workshops and demonstrations, linking scientific evidence to stakeholder dialogue and supporting both evaluation (A2.8) and broader project learning objectives.

SWOT ANALYSIS

STRENGTHS

- Strong bottom-up engagement of residents, entrepreneurs, young people and local authorities.
- Increased awareness and dialogue on light pollution, biodiversity and night-time quality.
- Demonstrator-based approach combining practical experience with learning.
- Collaboration with knowledge institutions and technical partners.
- Flexible implementation capacity suited to a community-driven context.

WEAKNESSES

- Limited resources for physical lighting modifications.
- Slow and complex public decision-making.
- Fragmented governance structure.

HOLWERD BOTTOM-UP CO-DESIGN APPROACH

OPPORTUNITIES

- Transferability of XR-supported co-creation methods.
- Strong links with biodiversity, liveability, energy awareness and community ownership.
- Further cooperation with knowledge institutions and pilot sites on monitoring, evaluation and policy transfer.

THREATS

- Dependence on political priorities and external funding.
- Expectations regarding technical or ecological outcomes may exceed what is feasible in a small-scale demonstrator.
- Administrative complexity may reduce long-term engagement capacity.

RECOMMENDATIONS

- Use **immersive tools** such as XR to make lighting scenarios **understandable for non-experts** and improve participation.
- Start with **small, visible interventions** that create tangible **results** and build **trust**.
- **Invest** in long-term **relationships** and **local ownership**, particularly in small communities.
- **Remain flexible**, as governance processes and infrastructure developments can influence implementation timelines and opportunities.

Next Steps for Holwerd

The final project phase focuses on **consolidation, reflection** and **knowledge transfer**.

- In 2026, a follow-up meeting with Dorpsbelang Holwerd will present the **results of the local idea competition** and **encourage** additional residents, entrepreneurs and stakeholders to initiate nature-friendly lighting measures.
- **Monitoring activities will complete** the post-installation phase **and integrate** light measurements and sociological survey results into the A2.8 evaluation. The **emphasis** will be on **learning effects, perception change** and **behavioural intention**.
- The pilot has **already generated wider impact**. Several **residents have adjusted** their own **lighting**, while the approach has **inspired a citizen-led initiative** on light pollution in the Nijlân district of Leeuwarden.
- **Interest** has also **emerged beyond the consortium**. Organisations such as Torrão LAB (Foundation DaST, Portugal) have expressed interest in applying the participatory methods developed within DARKER SKY.
- The **remaining project period** will **focus on supporting** locally driven follow-up actions, **strengthening** knowledge transfer and **positioning Holwerd as a transferable example** of a small-scale, community-based approach to light reduction and awareness



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