

# Using Sunlight to Light Up Buildings – Learning from Developing Countries

**K.S. Luck<sup>1,4</sup>, A. Sharma<sup>2,4</sup> and T. Weßels<sup>3,4</sup>**

<sup>1</sup>Technische Universität Darmstadt, Germany

<sup>2</sup>IIT Bombay, India

<sup>3</sup>RWTH Aachen University, Germany

<sup>4</sup>Aalto University, Finland

## INTRODUCTION

Looking at developing countries, several million people are living without any access to electricity. The initiative *Liter of Light* has the aim to light up their homes by using the sunlight. This initiative recycles PET bottles by filling them with water and installing them in the roofs, s.t. they act like light bulbs and distribute the sunlight inside the homes. Inspired from this idea, we want to use the sunlight to illuminate buildings all over the world.

## USING SUNLIGHT – LEARNING FROM DEVELOPING COUNTRIES

In many buildings, there is no possibility to install external windows in hallways. This poster is proposing a system which can be compared to the above described idea of light bottles to illuminate hallways in an energy efficient way.

Mirrors on the roof of the buildings are used to concentrate the sunlight and to focus it on the end of optical fibers. The fibers transport the sunlight from the roof to the hallways. To improve the overall environmental impact, recycled optical fibers might be used. However, the optical fibers can only act as point source of light. Therefore, pipes filled with water are installed at the ceiling of the hallways. The water inside the pipes will distribute and diffract the light from the optical fibers, s.t. they will act like luminescent tubes. In order to illuminate the complete hallway from the beginning to the end, refractive coatings are used to control the amount of light distributed along the whole distance. As refractive coatings, superhydrophobic surfaces can be applied as they establish an air film between the water and the walls of the pipes. With this air film, total internal reflection occurs minimizing the total loss of light.

When the sun is not shining bright enough or not at all, LEDs embedded in the pipes can be turned on to achieve the desired illumination of the hallways. This can be controlled by sensors adjusting the brightness of the LEDs automatically and according to whether someone is in the hallway or not. Since LEDs are also point sources, the water is used again to spread the light.

## Conclusion

We presented an already implemented solution to illuminate houses in developing countries and a novel concept for illumination. Both concepts are based on natural sunlight.

The most outstanding advantage of the presented system is that it reduces the demand of energy needed for lighting significantly. As long as the sun is shining outside, there will be less need to use artificial light.