eit InnoEnergy
Knowledge Innovation Community

LUMEN

Game-based learning to teach electricity

Lumen is a **free Minecraft modification** that aims to demystify energy to youngsters and general learners who want to understand **how** (sustainable) **energy works**. Lumen plays into the rising trend of **gamification in education** and offers a fun way of learning the fundamental concepts of electricity. In this modification of the popular computer game Minecraft, **electrical components** are implemented, which allow the player to **experiment in a fun and safe environment**. On top of that and as opposed to other energy modifications, the world of Lumen follows the **physical laws of electricity**. **Lumen can be played in a classroom, at home or online** and is sure to enthuse teachers and students alike.

Lumen is


A multilingual solution


Physically and technically correct


Based on fundamental energy concepts


An ideal setting to experiment with electricity


Free and easy to install

Youngsters

By using gameplay, Lumen raises interest in STEM topics among children and young adults. Through the game, youngsters are able to absorb key knowledge about specific laws of electricity but also about world challenges such as sustainability. The simplicity that Lumen offers in explaining how everything works means youngsters previously unfamiliar with the game can learn how to play in maximum fifteen minutes. With plenty of features implemented, Lumen is sure to be a very compelling way to study.

Teachers

Lumen can be employed as an educational tool to motivate and engage students into the learning process of STEM courses (Science, Technology, Engineering and Mathematics). Lumen demystifies topics like energy and electricity for young students, providing a harmless environment to experience the properties and outcomes of specific processes. With an extensive manual and a tutorial world with preprogrammed scenarios, a competitive, easy to understand and challenging environment is created, benefiting both students and teachers.

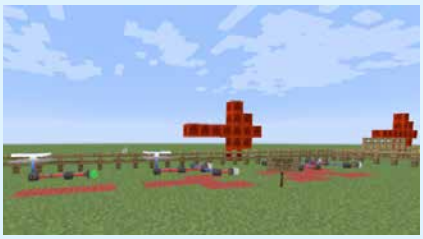
Life-long learning

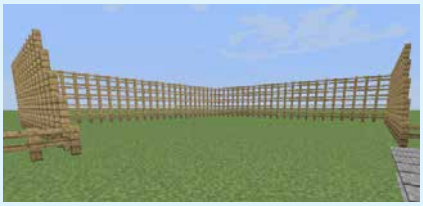
Lumen employs gamification as an educational trend which can contribute in to a continuous learning process in two different ways: Firstly, by engaging students in a resilient learning experience, where they can progress in a safe environment without avoiding failure and secondly by introducing a digital platform with a physically correct design and content, teaching properly the physical laws related to electric systems, which develop in-depth technical skills.

Learning objectives

- Understanding the **Law of Ohm**: e.g. a load with a lower resistance will draw more current for the same voltage.
- Understanding the **Law of Joule**: e.g. cables have a resistance, thus power is dissipated in them; promoting the use of shorter cables.
- Identification and **comprehension of parallel and series connections**: e.g. connecting cables in parallel will decrease the resistance and hence let more current through for the same voltage drop.
- Understanding the **Law of Kirchhoff**: e.g. for any node, the sum of the current equals zero; what goes in, must come out.
- Reminding that **electricity is harmful**: e.g. touching a non-isolated cable or interaction with systems with high voltage can harm your character or other Minecraft mobs.
- Understanding that **solar and wind power are intermittent**: e.g. solar power depends on the position of the sun and shading, while wind power depends on the location of the wind turbine, as well as, the speed and direction of the wind. In this extent, Lumen introduces the battery as a buffer of energy; the battery automatically charges and discharges to balance the voltage, as long as it is not full or empty.
- Understanding that a **primary energy source is needed to produce electricity**: e.g. the combustion engine burns coal or wood to produce electricity.





Lumen is continuously under development with a lot of interesting features being added. Other forms of energy are being added as well, such as pressurized water and heat. The interaction between the different energy flows could be implemented to expand the capabilities of Lumen as a true energy mod.

Gameplay versions of Lumen

Stand-Alone:

When played as a stand-alone version, the player can find their own learning pace without restrictions. At the same time they can release their creativity while the physics which Lumen has been based on show the player if what they are building really works.

Multiplayer:

When joining others in a world, Lumen can stimulate two abilities: collaborative work and acknowledgment of the energy ecosystem. In an implicit way, the players assume roles and try to build something together in a sustainable way. In contrast, a competition could also be organized in order to test and probe which creation works best. Lumen can reproduce how energy systems work in the real world.

Where to get Lumen

1. Go to www.innoenergy.com
   > Education
   > Lumen – Energy for kids
   > Lumen
2. Download the LumenLauncher for Windows, Mac or Linux
3. Start the launcher by executing the LumenLauncher.exe file
4. Fill in the email address and password of your Mojang account
5. Press 'play'
6. All necessary files will automatically be downloaded and installed
7. You can now play Lumen! Join our online server at lumen.esat.kuleuven.be for the multiplayer experience.

Remark: to play Lumen you need to create a Mojang account and buy a Minecraft license!
For more information please visit www.minecraft.net

Contact

- Scarlett Nadir Tokunaga Contreras

  Project Manager Lumen
  scarlett.tokunaga@innoenergy.com

- Prof.dr.ir. Johan Driesen

  Creator and Supervisor of Lumen
  johan.driesen@innoenergy.com

eit | European Institute of Innovation & Technology

InnoEnergy is supported by the EIT, a body of the European Union