# Interactive simulation of a Crowd Energy system

Dr. Christian Ritzel, Dr. Anton Sentic

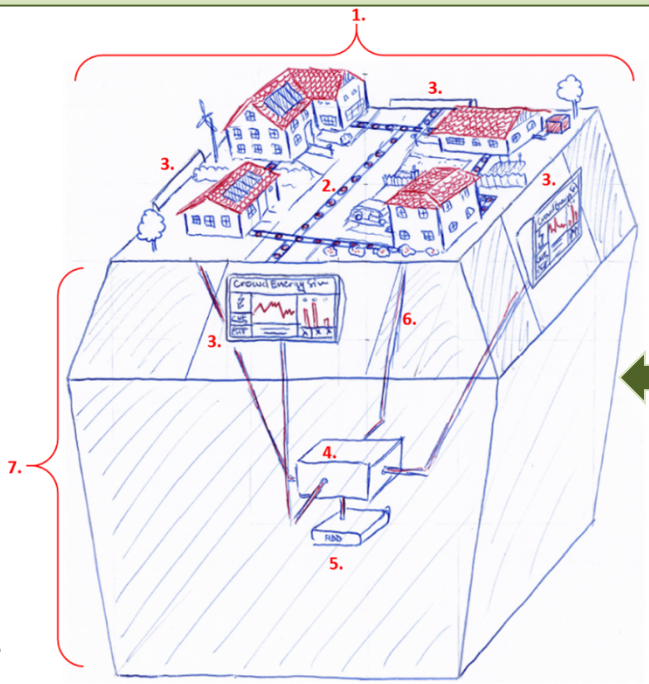
**Project idea:** Developing an interactive simulation of a Crowd Energy system; acting as a testbed for static and dynamic experiments on the sharing behaviour of energy prosumers within the crowd. The experiments will focus on i) investment decisions and ii) trade of energy/electricity within the crowd.

**Research question**

*What are the characteristics of cooperative and non-cooperative humans in the context of community-based energy production?*

## Approach:

- **Developing two software-based experiments**
- **Design and development of the physical model**
- **Implementation of experiments with UniFR actors and at selected exhibitions**




**Model legend**

1. A physical diorama showing 4 buildings, representing the 4 simulation participants
2. LED lighting strips showing energy flows in multiple colours dependent on flow characteristics
3. Four tablets with an interactive app simulating the crowd energy system
4. One central control unit operated by the researchers
5. One data storage unit
6. Necessary cables and connectors
7. Trapezoid-shaped base for the diorama

## What is Crowd Energy?

Crowd Energy is the collective effort of individuals or profit or non-profit organizations, or both, pooling their resources through online ICT-applications to help to implement the energy turnaround. This implies both, the concept of decentralization (production, storage and consumption of renewable electricity) and a substantial change in society, economy and politics (1).

## The experiments:

The model will focus on the following two elements of user (prosumer) behavior, represented as experiments through gamification:

1. An investment decision, depicted by an adapted public-good-game (2,3)
2. The trade of electricity /energy within the crowd (the market mechanism), depicted by variants of a dynamic double auction mechanism experiment (4,5)

After a given experiment, each participant will be asked on sociodemographic and other characteristics (e.g., political views). This strategy allows the researchers to identify individual characteristics of cooperative and non-cooperative humans in a realistic and strategic action situation.

## Outputs:

- ✓ **Database on prosumer behaviour**
- ✓ **Working paper detailing the theoretical concepts behind the simulation**
- ✓ **Journal paper based on the results of the experiments**
- ✓ **Physical Crowd Energy model**

**List of references**

(1) Teufel, S., Teufel, B., 2014. The Crowd Energy concept. Journal of electronic science and technology 12, 263–269.
(2) Holt, C.A., Laury, S.K., 1997. Classroom Games: Voluntary Provision of a Public Good. The Journal of Economic Perspectives 11, 209-215.
(3) Burlando, R., Guala, F., 2005. Heterogeneous Agents in Public Goods Experiments. Experimental Economics 8, 35-45.
(4) Smith, V.L., 1962. An Experimental Study of Competitive Market Behavior. Journal of Political Economy 70(2), 111-137.
(5) Smith, V.L., 1964. Effect of market organization on competitive equilibrium. The Quarterly Journal of Economics 78(2), 181-201.

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**University of Fribourg**

Dr. Christian Ritzel
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