

Diffusion of off-grid electricity systems

The electricity systems around the world are currently in a state of transition. The climate crisis drives a shift from fossil to wind and solar electricity as well as an increasing demand for electricity for transportation and industry. In industrialised countries change is multi-faceted including different trends. From a starting point of centralised generation and national distribution, solar and wind electricity now enables local generation and local use in small off-grid systems or distribution in various smart grid configurations. At the same time, the varying production of solar and wind power stimulate sharing of electricity in larger networks, super-grids, crossing national borders creating continent wide configurations. In countries with low penetration of electricity network, such as in many African countries, the competition has a different starting point, but basically involves the same alternatives: off-grid and micro-grid solutions or large grids.

The final outcome is far from a given. Decreasing costs of mass-produced modular small-scale technologies such as batteries and solar cells could result in a process of grid defection and an ever-increasing cost for those remaining on the grid leading more consumers to leave the grid, sometimes referred to as a “spiral of death” for grids. On the other hand, some huge investments in long-distance cables could shift the balance in favour of grid extension. The process is highly dynamical and will depend on numerous technical, economic, political, and social factors. The stakes are high for many actors and there is a multitude of environmental and social implications of the outcome. A first step in trying to understand the process is to monitor what is actually going on.

This master thesis aims at investigating the speed and scope of diffusion of off-grid and micro-grid systems in different parts of the world and possibly to develop a metrics for relative independence.

The master’s thesis is conducted in cooperation with Svea Solar, one of Sweden’s largest solar cell installation companies. The project is also linked to the National research program Resistance and power – on smart grids for the many people with collaborators from four Swedish universities and a multitude of connections to Swedish electricity industry and energy authorities.

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Time: January – May 2021

Suitable background: Industrial ecology, Sustainable Energy Systems or Management and Economics of innovation