



SUSTAINABLE SYSTEMS

Fields of Expertise TU Graz

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Martin Fellendorf,
Sustainable Systems

Source: Lunghammer – TU Graz

Against the background of world-wide, controversially discussed measures against climate change, our Field of Expertise Sustainable Systems wanted to address this epochal question. In the public lecture series of the four universities in Graz (sustainability4u.uni-graz.at), scientists from different disciplines such as technologists, physicians and social

scientists had planned to discuss proposed solutions from their respective perspectives. Due to the measures against the novel coronavirus, this initiative regarding the public communication of research results had to be cancelled. Like all other courses, workshops and congresses, the lecture series was discontinued or switched to virtual teaching and learning. This sudden change is a hitherto unknown social experiment, which, in addition to the fatal effects on economic life, has positive effects on the climate in that industry and transport emit fewer pollutants. The extent to which the initial restrictions lead to reduced mobility is shown by calculations currently being carried out by the Institute of Highway Engineering and Transport Planning together with the Graz-based start-up company Invenium Data Insights on the basis of anonymized mobile phone data

from A1. Whereas before the crisis about a quarter of Austrians moved less than 1 km away from their homes on an average day, this share increased to 53% and 56%, respectively, in the two weeks after the initial restrictions were imposed. At the same time, the share of highly mobile persons with travel distances over 10 km per day decreased from 38% to 15%. After Easter, an increase in mobility could already be observed again, with the proportion of the less mobile falling to 47% and the highly mobile rising again to 22%. Nevertheless, we are still far from the original degree of mobility. Interestingly, the short and medium distances travelled on Sundays show less change, but long distance trips have decreased from 25% before the restrictions to about 10% as of April 19th. The coming months will show whether mobility behavior will remain or return to normal.

Wolfgang Sanz:

Contributions to a Future Energy System Based on Renewable Energy and Hydrogen

A modern energy system based on renewable energy like wind and solar power inevitably needs a storage system to provide energy on demand. Hydrogen is a promising candidate for this task. For the re-conversion of the valuable fuel hydrogen to electricity a power plant of highest efficiency is needed. In order to support the transition to a renewable energy system the Institute for Thermal Turbomachinery and Machine Dynamics has been working on innovative highly-efficient power cycles fuelled with hydrogen and oxygen as well as on the modelling and improvement of solar and wind technology.

In order to counteract the threatening climate change most countries regard it as virtually self-evident that they must concentrate on the development of renewable energy resources as wind and solar power. Due to the fluctuating nature of solar and wind power a storage system is also inevitable for land-based electricity generation by renewable energy in order to provide energy at the times of demand.

For this application hydrogen is currently being investigated as a large-scale storage medium with several pilot plants having already been installed.

Figure 1 shows how such a future renewable energy system based on hydrogen could look like. All kinds of renewable energy sources, such as wind, solar or tidal power, use their electricity excess which cannot be used immediately, to gener-

ate hydrogen and oxygen by local electrolyzers. Hydrogen and oxygen is then delivered to highly efficient power plants for the re-conversion to electricity on demand. In this sense we proposed a hydrogen/oxygen-fuelled steam power plant using fuel cells and gas turbine cycle components in 2010. The concept is based on the assumption that oxygen is provided “freely” together with hydrogen >