GREENHOUSE GAS ACCOUNTING OF GRAZ UNIVERSITY OF TECHNOLOGY

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Introduction

The implementation of international climate goals needs clearly-defined climate strategies on a national level. Academic institutions take an integral and responsible part to support these climate strategies in the pioneering quest for ideal measure settings in front of the climate change challenges [1]. Being the first academic institution in Austria which voluntarily implemented a certified energy management system (EnMS) following the EN ISO 50001 standards in the year 2016, TU Graz is also member of Austrian Universities in the Alliance of Sustainable Universities in Austria (ANU), a voluntary cooperative work platform that promotes sustainability issues [2].

Amongst other actions, the ANU working group for "CO_2-e neutral universities" initiated an accounting of greenhouse gas emissions (GHG) to monitor the impact of universities on the environment. For this purpose, a tool named "ClimCalc" was developed which allows universities to calculate their GHGs [3].

In the paper, the TU Graz GHG emissions in 2017 will be presented in detail. This accounting serves the university to identify the main in-house GHG emitters and define goals and priorities to reduce them.

Methodology

The accounting includes all parts of TU Graz campus, including embodied impacts of buildings, operational energy, mobility and food. The accounting is based on the inventory data of the year 2017. The evaluation is carried by the ClimCalc_edu tool, which is based on the emission data of the Austrian Environmental Agency [4]. For 2017 they were calculated with the current UBA emission factors for the year 2017 (UBA Air Pollutant Inventory OLI 2016, [5]). The life cycle accounting (LCA) for buildings was carried out following the European standard EN15978 [6]. The environmental impacts are estimated on the case of the EBS building (Energy Based Systems) as proxy to estimate yearly GHG-emissions. The functional unit is 1 m² net floor area per year, the reference study period is 50 years, and the indicators assessed are the global warming potential (GWP) [7] and primary energy demand [8].

Results

The results of the GHG accounting 2017 show total emissions of about 21,800 (excluding buildings) or 27,000 t CO2-e (CO2-equivalents) for the year 2017. The results can be seen in Figure 1.

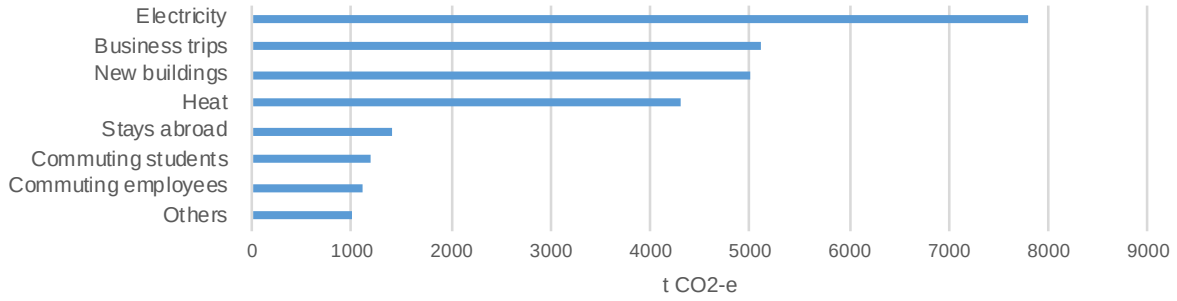

Figure 1: TU Graz's GHG accounting for 2017

The categories with the biggest GHG impacts are electricity incl. heat pumps (29%), business trips (19%), the construction of new buildings (19%), and heat (mainly district heating, 19%).

Discussion and Conclusion

The GHG accounting of TU Graz helps to identify hot spots and potentials for the reduction of GHG emissions. TU Graz plans to reduce emissions firstly by the decarbonization of the used electricity mix, which is the biggest GHG contributor. In the current accounting, the large share of GHG results is based on the provided dataset of Austria's electricity mix to allow comparability with other Austrian universities. The reduction of electricity impacts can be done by choosing a different electricity mix and providing a part of the electricity through photovoltaics. A change to UZ46 certified electricity [9], which guarantees sustainable electricity supply in Austria, can drastically reduce the GHG emissions of electricity by 89%.

The second largest contributor to GHG emissions is business trips, which often include air travels. To reduce the impact of business trips, a comprehensive strategy will have to be developed by TU Graz.

The construction of new buildings has surprisingly high impact on GHG emissions. Due to the high demand for new buildings, i.e. 75,000 m^2 until 2030, overall emissions of 75,000 t CO2-e need to be addressed. Measures to reduce the embodied impacts of buildings are therefore crucial to reducing the university's GHG emissions. One proposed measure is the implementation of LCA in early planning stages of new buildings to optimize and reduce the GHG emissions.

Heating, which currently is the fourth largest contributor to emissions, is mainly based on district heating. TU Graz does not have the means to directly influence its impacts, since the district heating is managed by the service providers Energie Graz and Energie Steiermark. At present, about 25% renewable energy sources are used for the provision of district heating. Therefore, the university's strategy is to provide heat by geothermal heating and heat pumps instead of district heating in new buildings. The shift from district heating to heat pumps using electricity further increases the relevance of the electricity decarbonization.

The sustainability board of TU Graz is currently supporting the strategy development in order to achieve climate neutrality as early as possible and the authors thank them for their support.

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