

# University of Belgrade – Faculty of Mechanical Engineering

Invited Lecture at Thursday October 24<sup>th</sup>, 2024 at 12.00 in Reading room

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## **The Sustainable Campus**

The challenges faced by universities and industry in estimating their emissions for decarbonisation are similar, but the task of linking emissions to university operations, namely procurement, is complex and time-consuming due to the wide range and types of purchases. Here, participatory action research is used to address these challenges, with a group of Danish universities to investigate the functions and improve the completeness of university GHG inventories. The research enabled knowledge sharing and collaboration, leading to a better understanding of the complexities and possibilities of GHG inventories. The main conclusions drawn from discussions are that the GHG inventory should serve multiple functions; an inward-facing decision support material, and an externally-facing communication tool. EXIOBASE, an environmentally extended input-output model, was identified as a useful tool for future inventories, particularly in procurement, due to its comprehensive spend-based assessment of purchases also relevant to universities. With more universities adopting spend-based practices, the presented conclusions shed light on potential risks of this method that have not yet been discussed in this context. A consensus on methodological trade-offs, relevant activities, and data considerations for a GHG inventory are reached and reflected on. As suppliers can increasingly deliver product specific climate related information, a data ontology is needed to appropriately incorporate supplier-specific data into consistent inventories without conflicting with methodological principles and upholding proprietary requirements of suppliers. Addressing challenges identified through this collaborative investigation expands on the dialogue in the literature and helps to shape how universities conduct and use GHG inventories.

## **Carbon Footprinting of Universities Worldwide**

Universities, as innovation drivers in science and technology worldwide, should be leading the great transformation towards a carbon-neutral society and many have indeed picked up the challenge. However, only a small number of universities worldwide are collecting and publishing their carbon footprints, and some of them have defined zero emission targets. Unfortunately, there is limited consistency between the reported carbon footprints (CFs) because of different analysis methods, different impact measures, and different target definitions by the respective universities. Comprehensive CF data of 20 universities from around the globe were collected and analysed. Essential factors contributing to the university CF were identified. For the first time, CF data from universities were not only compared. The CF data were also evaluated, partly corrected, and augmented by missing contributions, to improve the consistency and comparability. The CF performance of each university in the respective year is thus homogenized, and measured by means of two metrics: CO<sub>2</sub>e emissions per capita and per m<sup>2</sup> of constructed area. Both metrics vary by one order of magnitude across the different universities in this study. However, we identified ten universities reaching a per capita carbon footprint of lower than or close to 1.0 Mt (metric tons) CO<sub>2</sub>e/person and year (normalized by the number of people associated with the university), independent from the university's size. In addition to the aforementioned two metrics, we suggested a new metric expressing the economic efficiency in terms of the CF per \$ expenditures and year. We next aggregated the results for all three impact measures, arriving at an overall carbon performance for the respective universities, which we found to be independent of geographical latitude. Instead the per capita measure correlates with the national per capita CFs, and it reaches on average 23% of the national impacts per capita. The three top performing universities are located in Switzerland, Chile, and Germany. The usual reporting of CO<sub>2</sub>

emissions is categorized into Scopes 1–3 following the GHG Protocol Corporate Accounting Standard which makes comparison across universities challenging. In this study, we attempted to standardize the CF metrics, allowing us to objectively compare the CF at several universities. From this study, we observed that, almost 30 years after the Earth Summit in Rio de Janeiro (1992), the results are still limited. Only one zero emission university was identified, and hence, the transformation should speed up globally.

**Brief Background:**

Prof. Dr. Eckard Helmers is Professor at Trier University of Applied Sciences since 1998. He is teaching in the field of environmental chemistry and is interested in pollution impact evaluation of all environmental matrices including toxicological aspects, having published over 80 scientific papers in the field. He is also co-editor of the scientific journal *Environmental Science & Pollution Research*, now *Environmental Sciences Europe*, since 1999. As well he is a member of the Boards for 'Sustainable Engineering and Science' of the journal *Sustainability*, of the boards for "Frontiers in Future Transportation – transportation emissions", and for "Highlights of Sustainability". He has been conducting research on automobile emissions for over 25 years and publishing on the environmental impact of the European diesel car boom since more than a decade. He is engaged in research projects in co-operation with the EU commission's Joint Research Center since a couple of years. As a director of IfaS (Institute for Applied Material Flow Research) he was co-heading the Department for Sustainable Mobility where he initiated the conversion of combustion engine cars to electric cars, accompanied by a life cycle assessment exhibiting that "eConversion" can ensure a minimum environmental impact of individual mobility by automobiles. At his university department, the Faculty for Environmental Technology and Planning, he is particularly engaged in internationalization, initiating exchanges with university partners abroad since 1998. He has been a visiting professor and scientist at universities in Singapore, USA, Abu Dhabi, Israel, Sri Lanka, Ireland, Luxembourg and Croatia.