



UKRENERGY



TRAINING COURSE 16TH – 20TH SEPTEMBER 2024

Energy Efficient Buildings

Calculation of Environmental Parameters Using the LCA Method

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Innovative Master Courses Supporting the Improvement of the Energy and Carbon

Footprint of the Ukrainian Building Stock



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the European Union**

Challenges and limitations in the building construction sector

- Data Availability and Quality
- Complexity of Building Systems
- Subjectivity in Impact Assessment
- Boundaries and System Limitations
- Uncertainties and Future Projections



Case study in the field of Wastewater treatment



Wastewater treatment plant Dunajská Streda

| | | |
|-----------------------------------|---------------|----------------|
| p. e. | 46 387 | - |
| Amount of wastewater/year | 6675306 | m ³ |
| Amount of dissolved solids | 1214.9 | mg/l |
| BOD₅ | 1018 | mg/l |
| Q_a | 211.1 | l/s |
| Elektricity/ year | 1516733 | kWh |

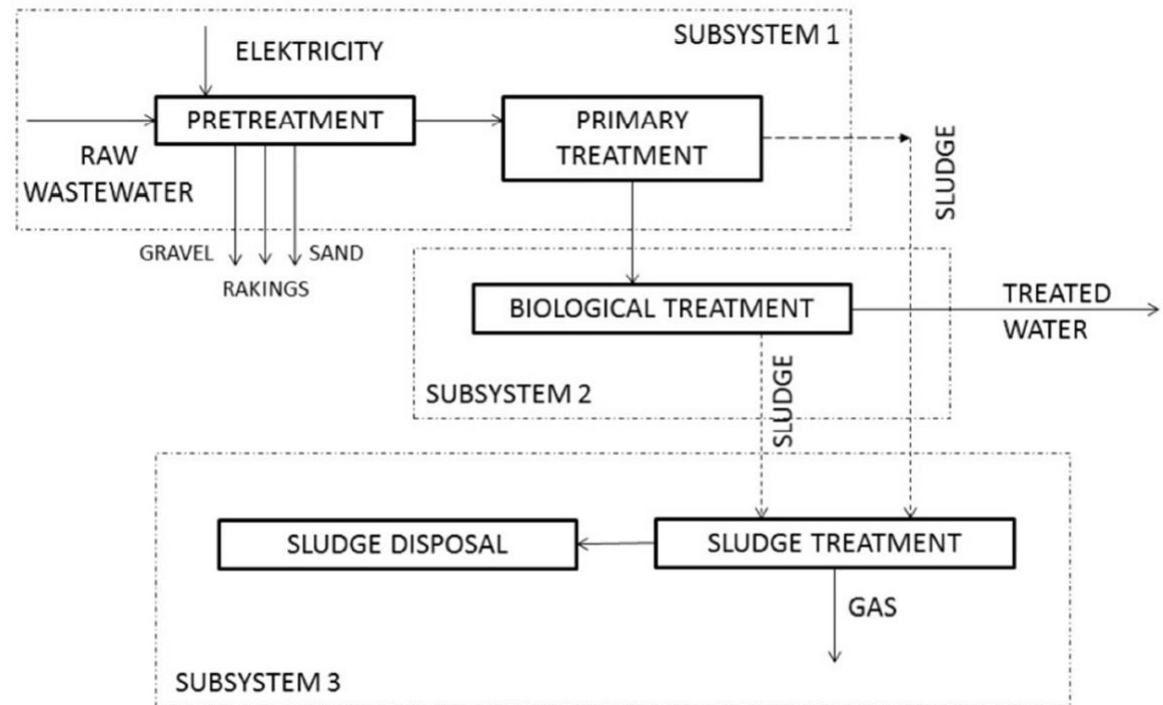


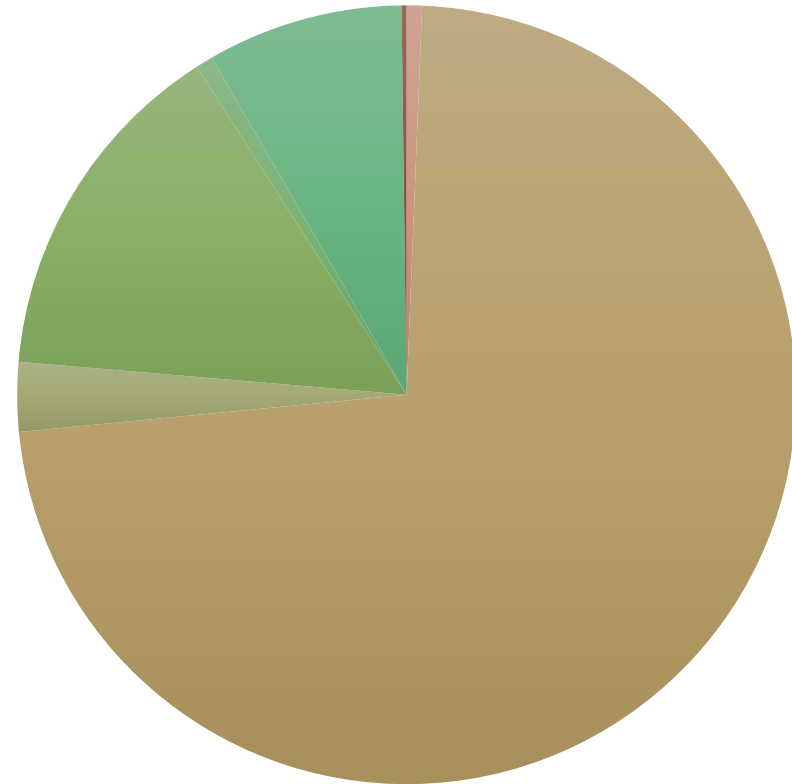
Fig. 2. Model of product system and subsystem defining

| | pH (-) | KNK 4,5 (mmol/l) | COD (Cr) (mg/l) | BOD5 atm (mg/l) | DS 105 (mg/l) | N-NH4 (mg/l) | N-NO3 (mg/l) | Ntotal (mg/l) | Ptotal (mg/l) | PP-PO4 3- (mg/l) |
|-----------------------------|--------|------------------|-----------------|-----------------|---------------|--------------|--------------|---------------|---------------|------------------|
| Untreated wastewater | | | | | | | | | | |
| Minimum | 6.63 | 6.80 | 128.15 | 69.28 | 67.50 | 10.40 | 0.23 | 18.88 | 1.03 | 0.62 |
| Maximum | 7.23 | 8.58 | 547.75 | 320.25 | 603.00 | 44.80 | 0.62 | 27.78 | 5.13 | 2.15 |
| Average | 6.94 | 8.04 | 267.19 | 154.25 | 185.09 | 16.47 | 0.29 | 22.17 | 2.46 | 1.36 |
| Treated wastewater | | | | | | | | | | |
| Minimum | 6.99 | 3.83 | 8.22 | 4.36 | 10.00 | 0.35 | 5.60 | 9.30 | 0.12 | 0.04 |
| Maximum | 7.53 | 6.10 | 13.13 | 7.50 | 12.50 | 0.92 | 9.48 | 11.95 | 0.78 | 0.64 |
| Average | 7.26 | 4.83 | 11.09 | 5.63 | 11.14 | 0.66 | 7.67 | 10.16 | 0.44 | 0.24 |

- OpenLCA,
- Free databases,
- several impact methods,
- ILCD 2011 for EU.

Global Environmental Impact of WWTP

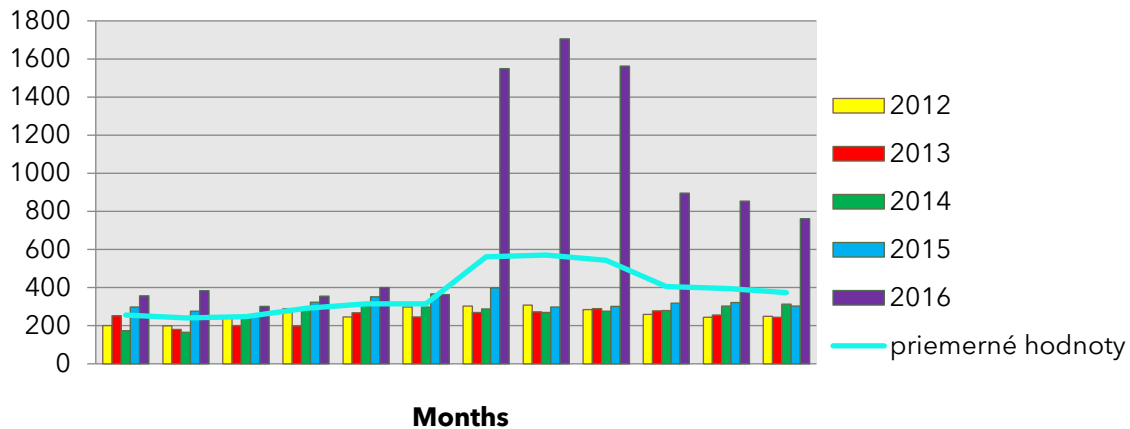
- Acidification
0,6 %
- Climate change
72,8%
- Freshwater ecotoxicity
3,9%
- Resource depletion
14,6%
- Terrestrial eutrophication
0,7%
- Ionizing radiaton
8,1%
- Photochemical ozone formation
0,2%



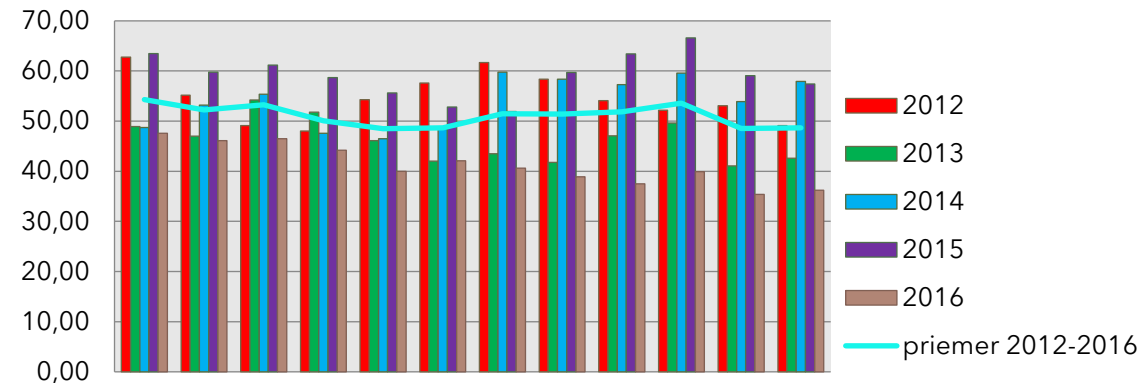
Wastewater treatment plan „B“

- Input data: (2013-2016)
- Description of the WW source and the WWTP
- 22 300 p.e.
- Characteristic wastewater flow
- Electricity consumption
- Volumes of sludge, biogas, waste, sand
- Concentration of pollutants in raw wastewater and treated wastewater

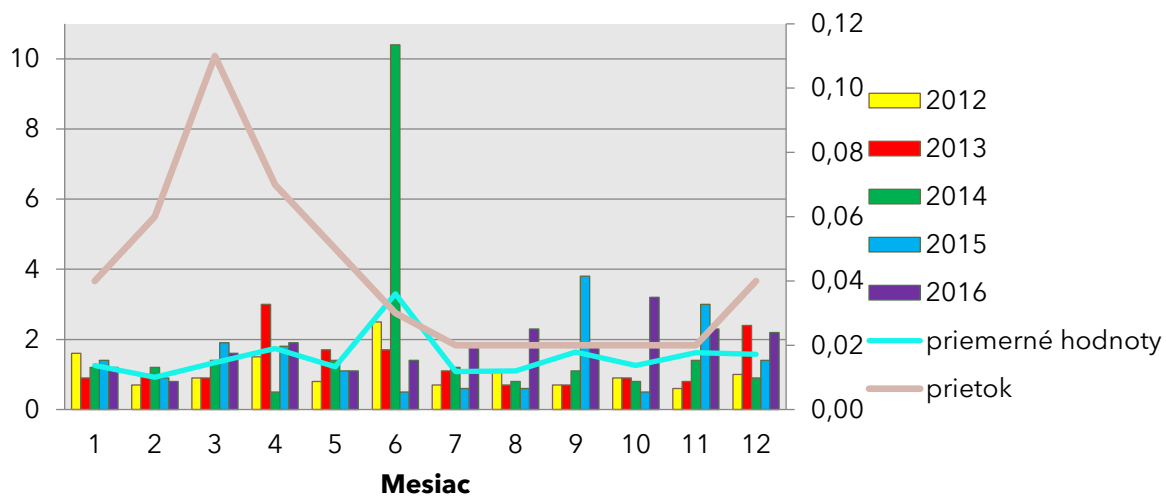
Concentration of BOD₅



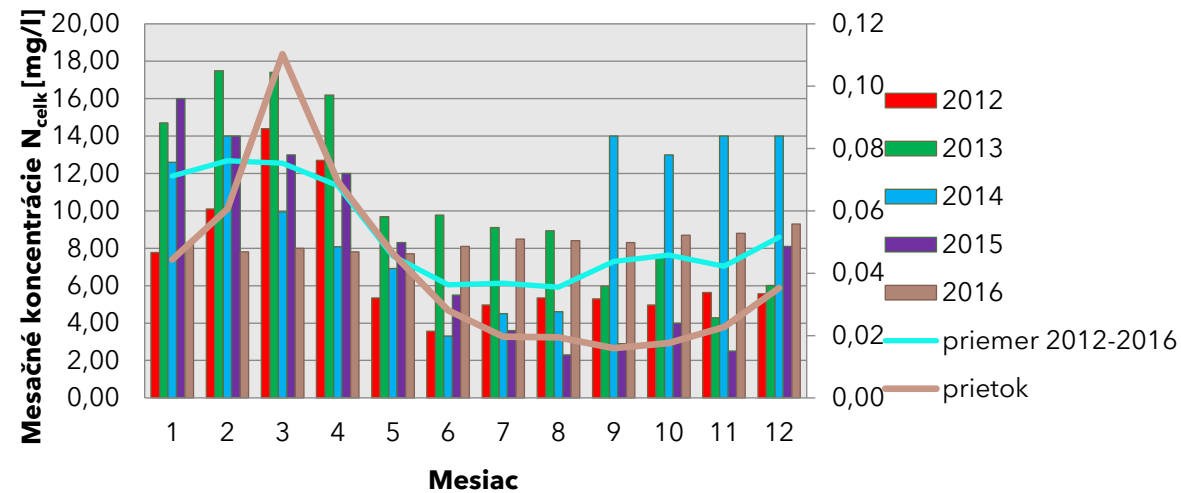
Concentration of N_{tot}



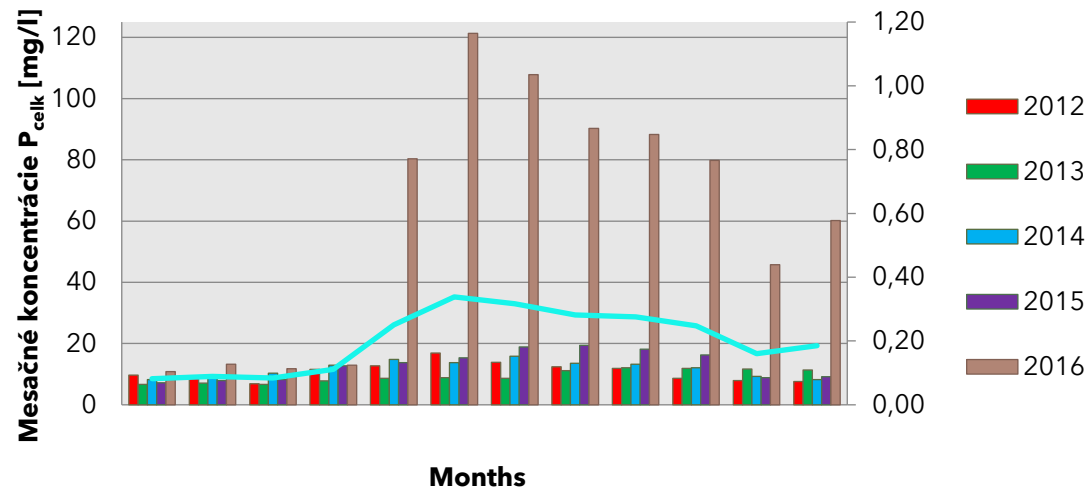
Mesačné koncentrácie BSK₅ na odtoku



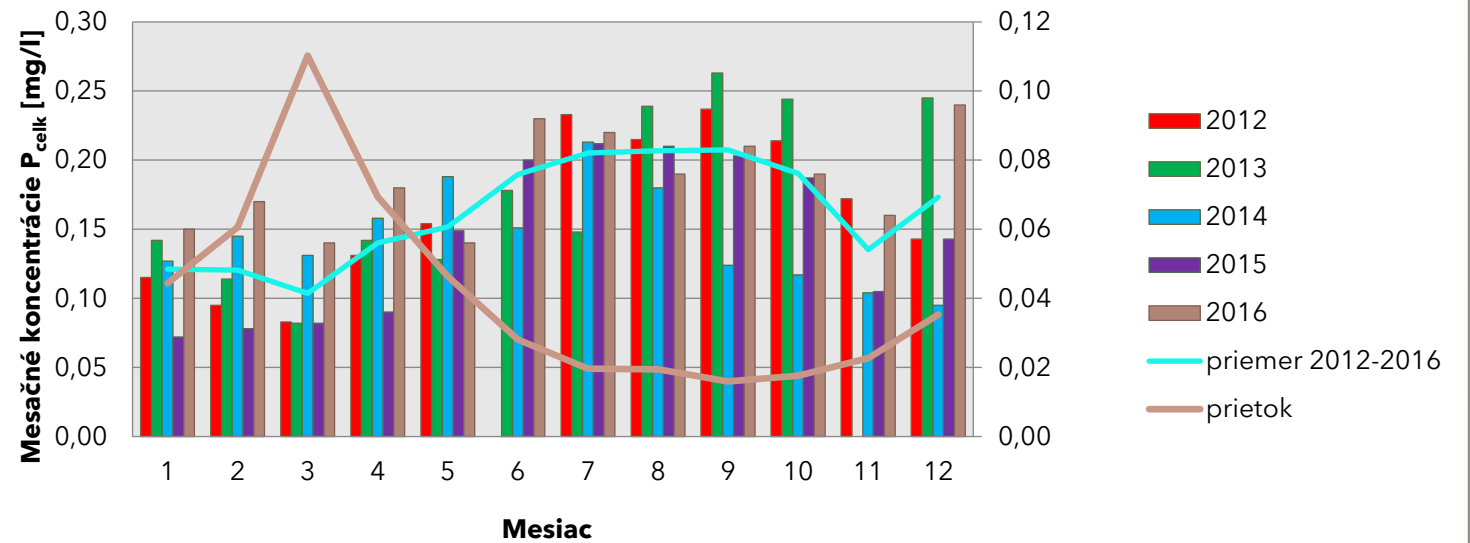
Mesačné koncentrácie N_{celk} na odtoku



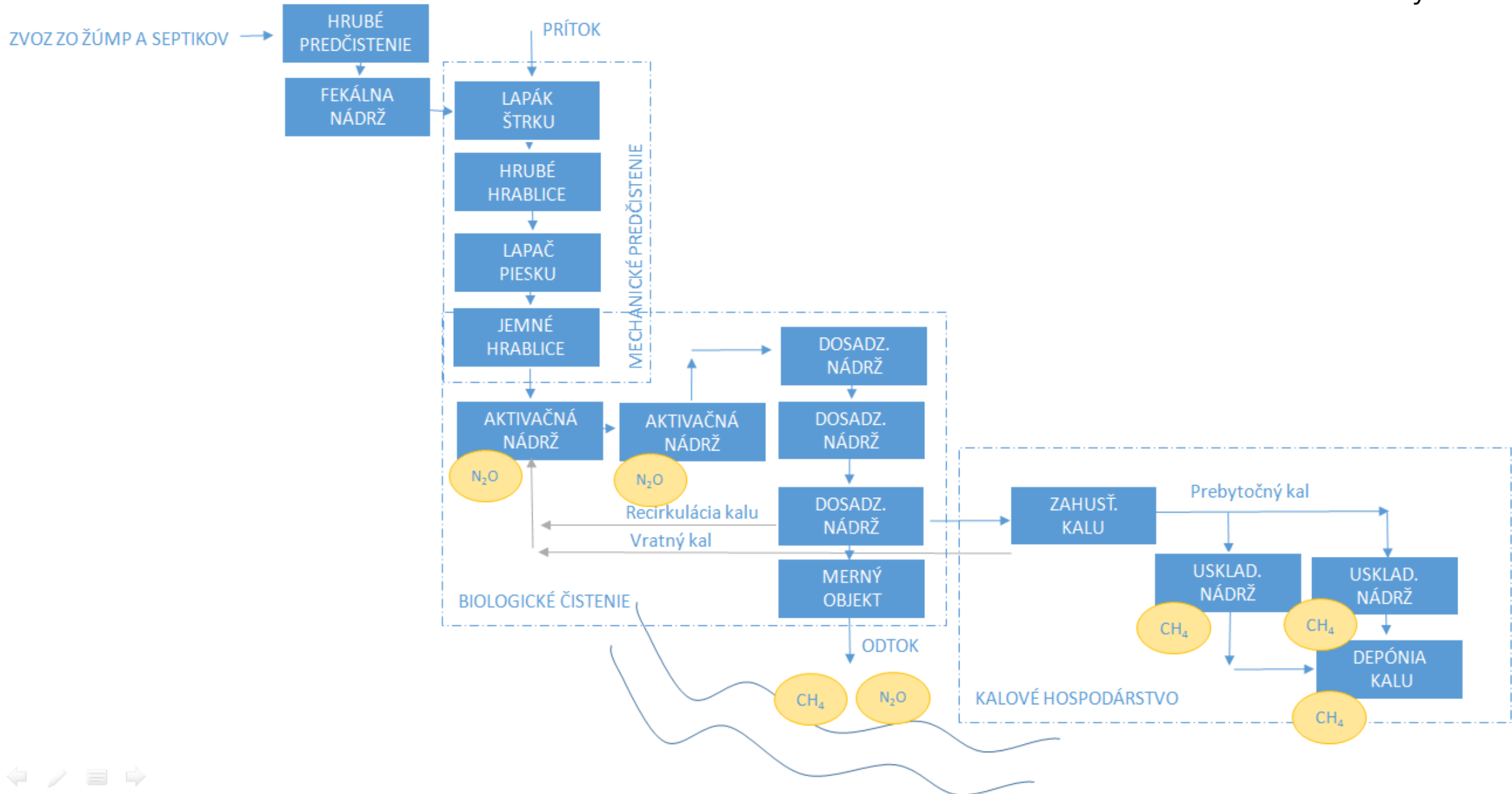
Concentration P_{tot}



Mesačné koncentrácie P_{celk} na odtoku

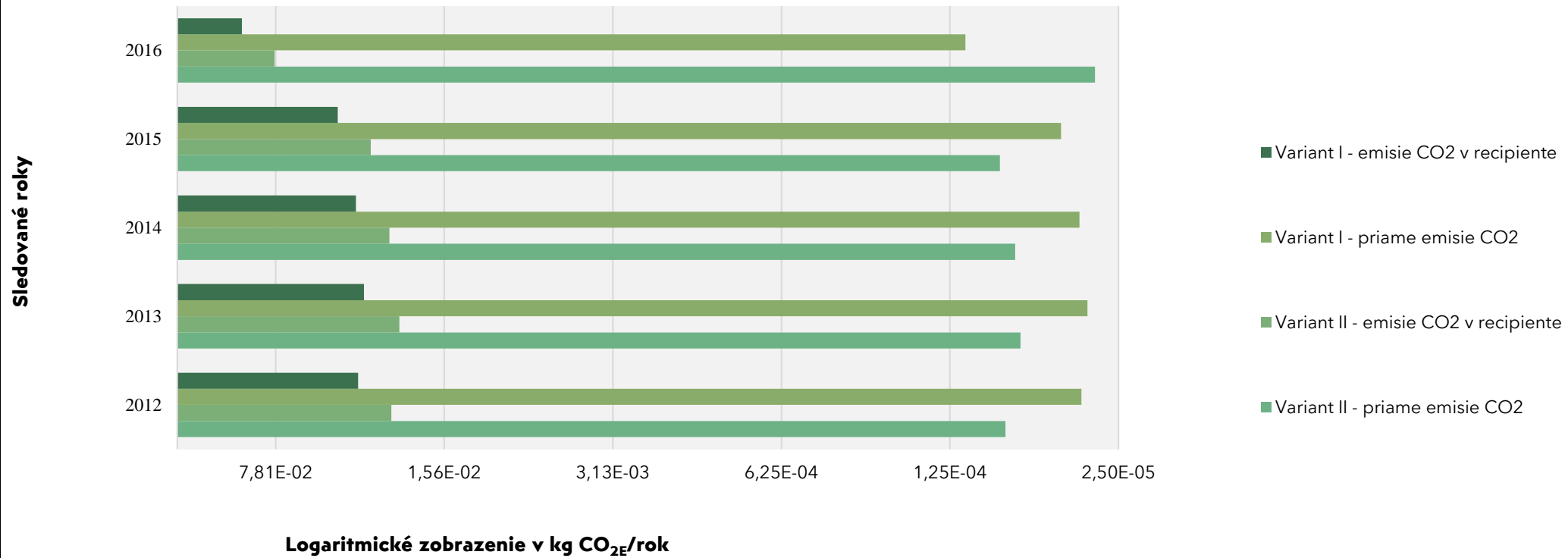


Subsystems



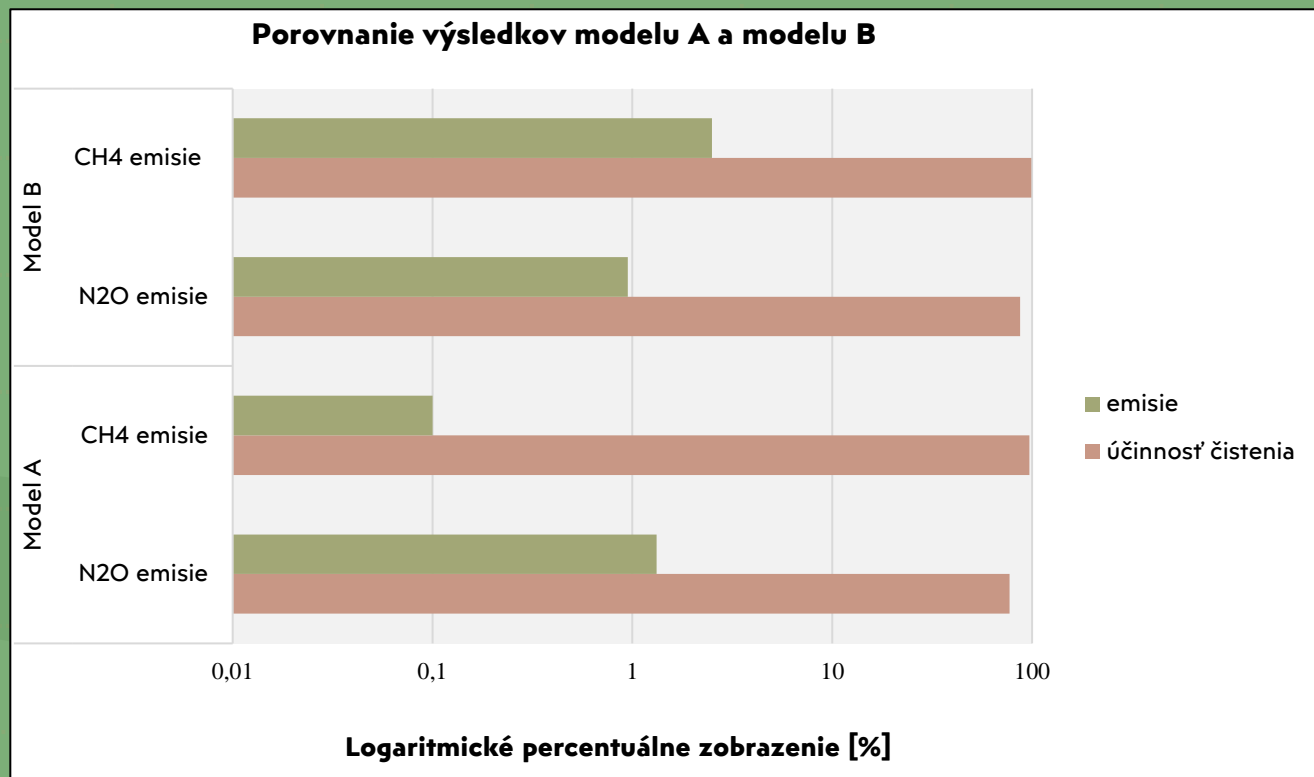
CO₂ production

Porovnanie variantov vyčíslenia emisií CO_{2E}/rok

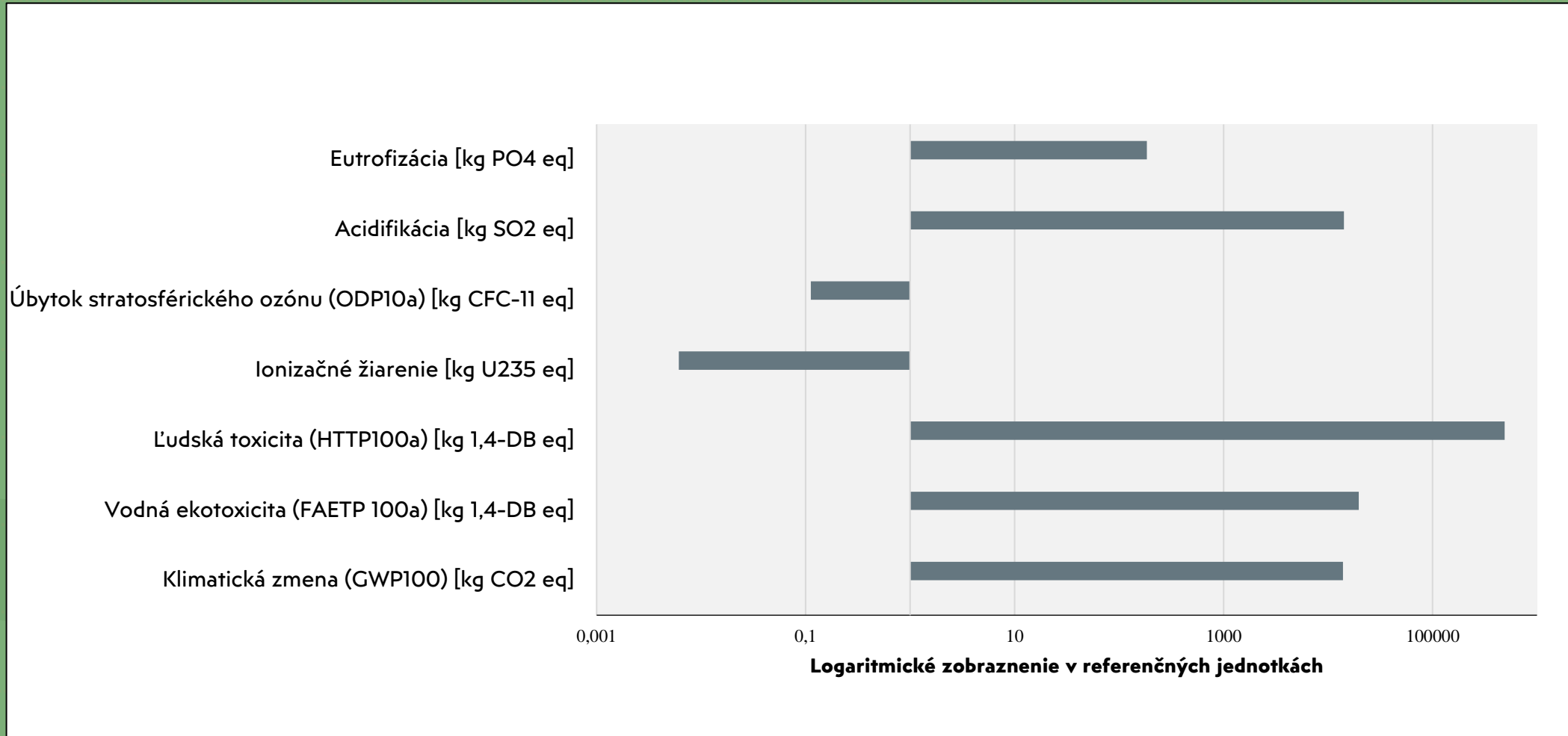


Comparisom of 2 different variants of sludge digestion

- Anaerobic and Aerobic

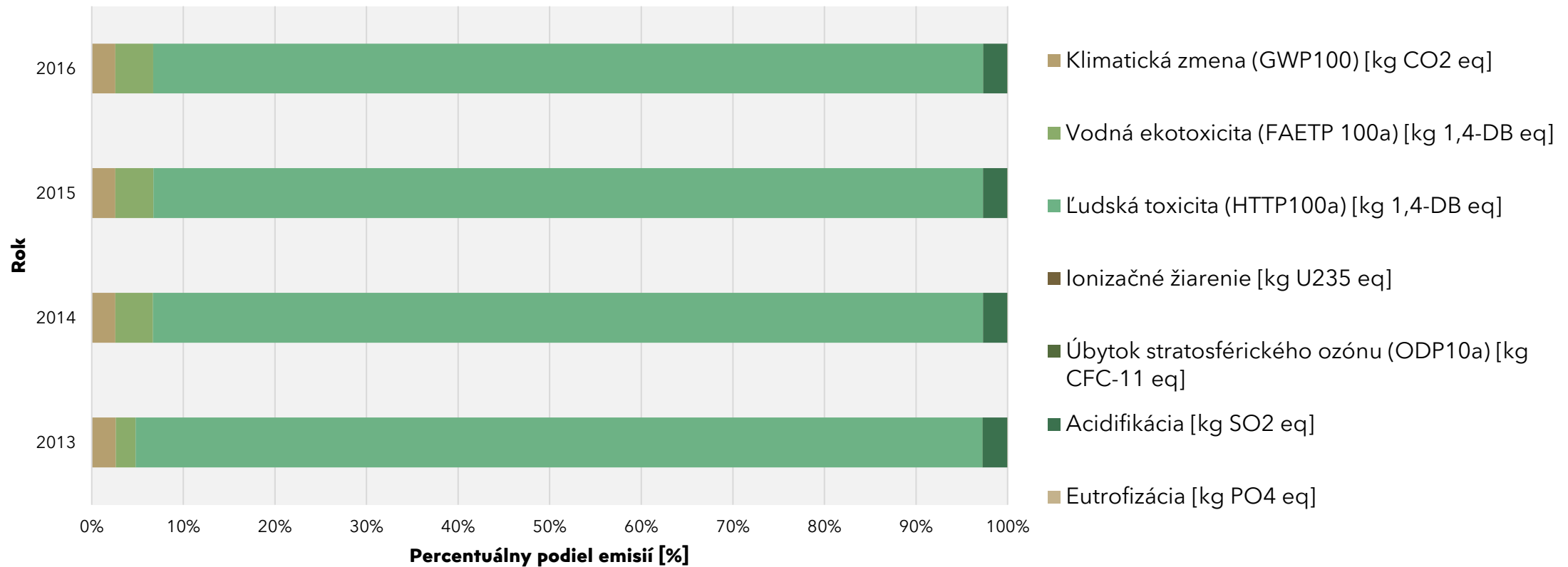


Average emissions from sludge management for the years 2013-2016 via OpenLCA



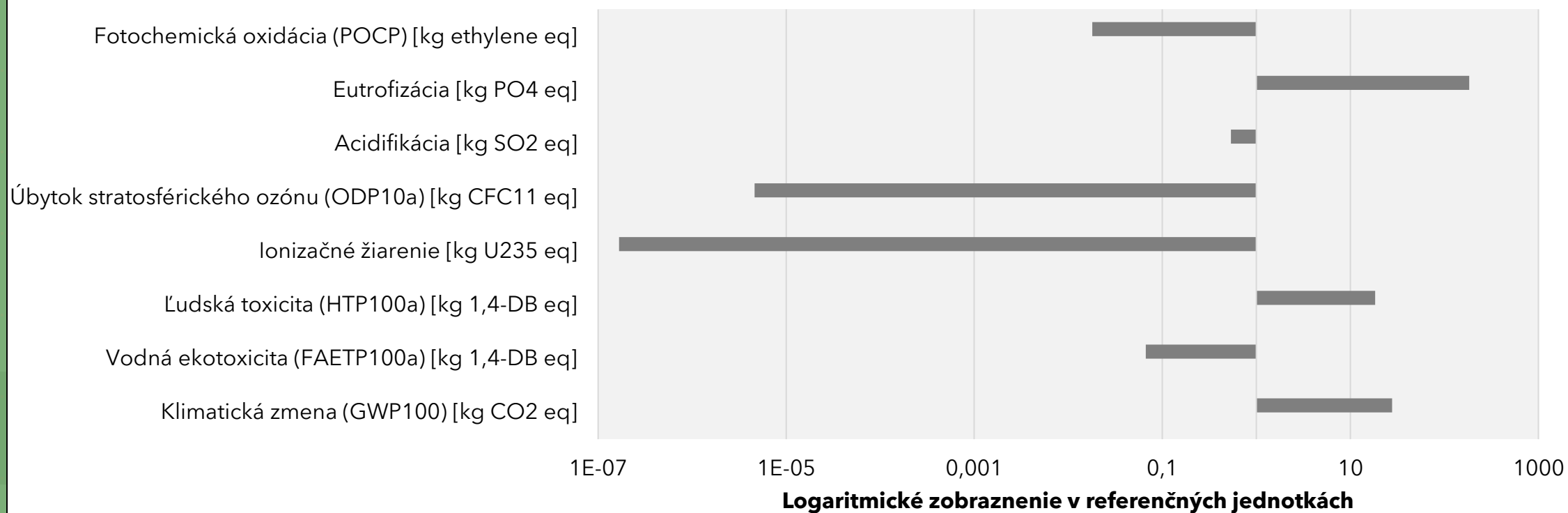
Percentage distribution of emissions from Sludge management for the years 2013 - 2016 via OpenLCA

Percentuálne rozloženie emisií z kalového hospodárstva za roky 2013 - 2016 prostredníctvom OpenLCA



Analysis of wider relations

Average emissions from WWTPs for the years 2012-2016 via OpenLC



Conclusion

- By utilizing LCA in water management, stakeholders can make informed decisions, optimize resource use, and prioritize sustainable practices. LCA helps drive innovation, encourages collaboration, and supports the transition to more environmentally responsible water management systems, ultimately contributing to long-term water security and the preservation of vital water resources.

Thank you for you
attention!