LCA of sand aggregates production from a quarry in Cyprus

Marinos Stylianou^{1*}, Marina Stefanou¹, Iliana Papamichael¹, Agapios Agapiou², Antonis Zorpas¹

¹Laboratory of Chemical Engineering and Engineering Sustainability, Faculty of Pure and Applied Sciences, Open University of Cyprus, Giannou Kranidioti 89, Nicosia 2231, Cyprus ²Volatolomics Research Lab, Department of Chemistry, University of Cyprus, P.O. Box 20537, Nicosia, 1678, Cyprus

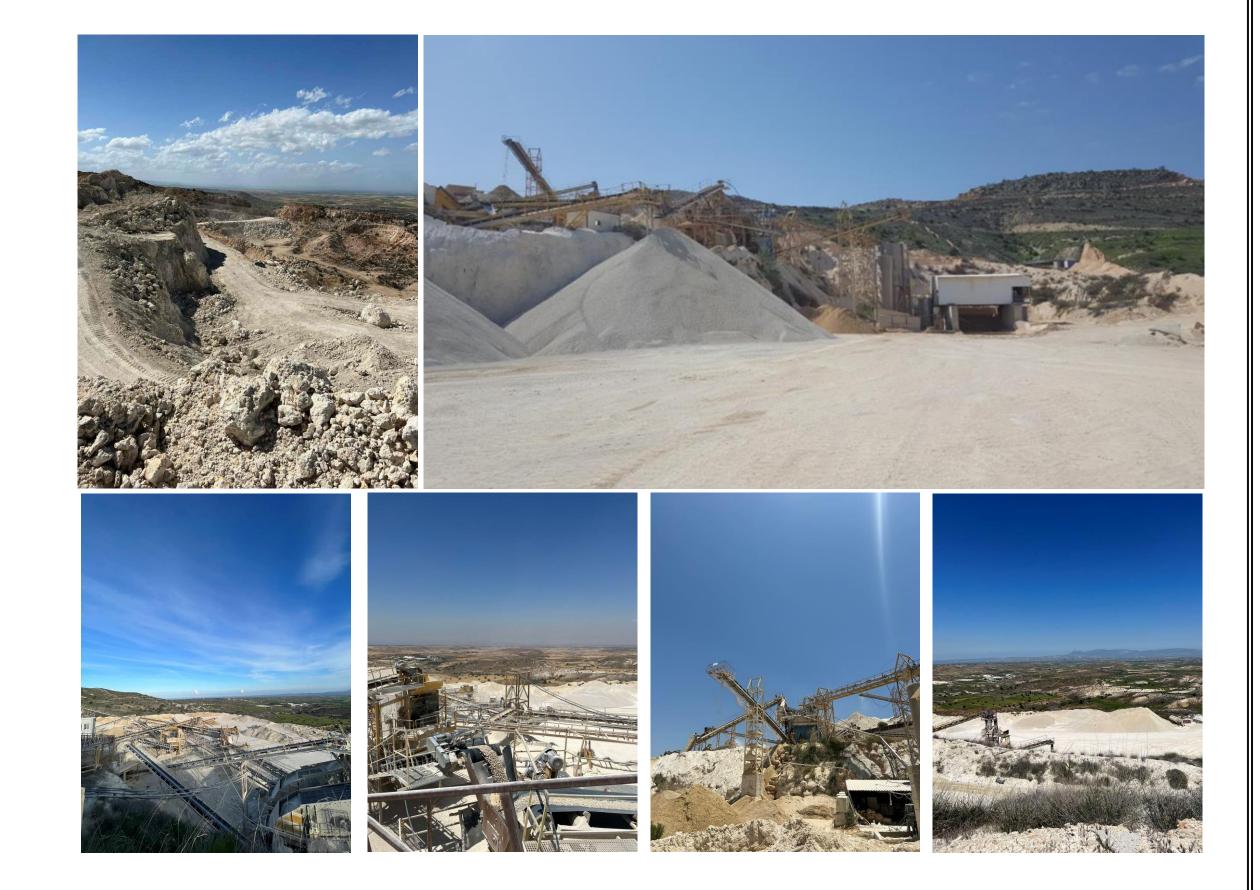


**Corresponding author:* e-mail address: marinos.stylianou@ouc.ac.cy



Research area

- > The present research study provides an overview of a Life Cycle Assessment (LCA) conducted to evaluate the environmental impacts associated with the production of sand aggregates from a quarry located in Cyprus.
- > The LCA aims to provide environmental experts with valuable insights into the sustainability



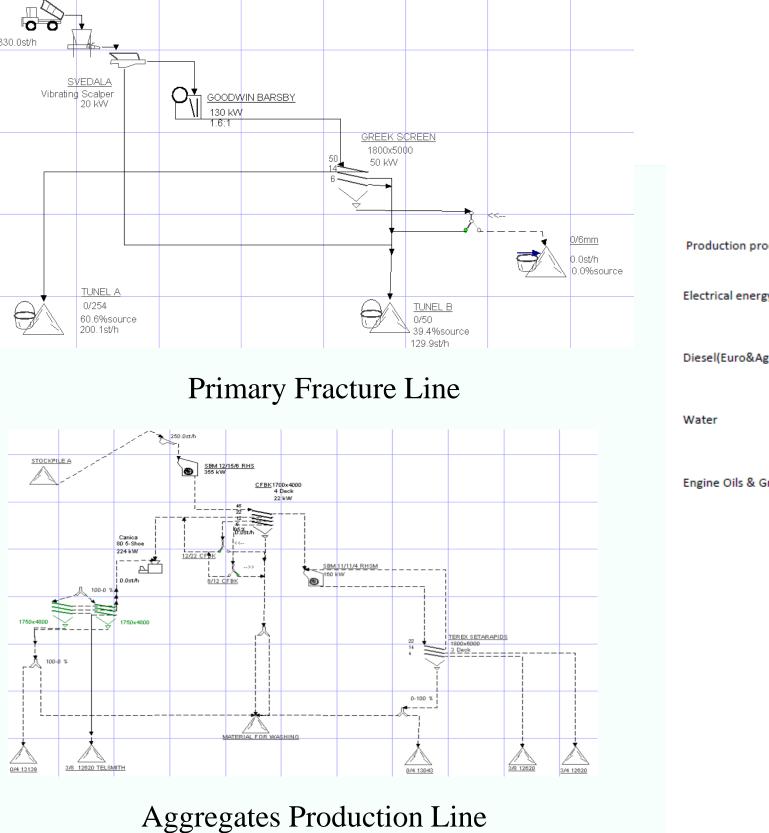
aspects of sand aggregate production and identify potential areas for improvement.

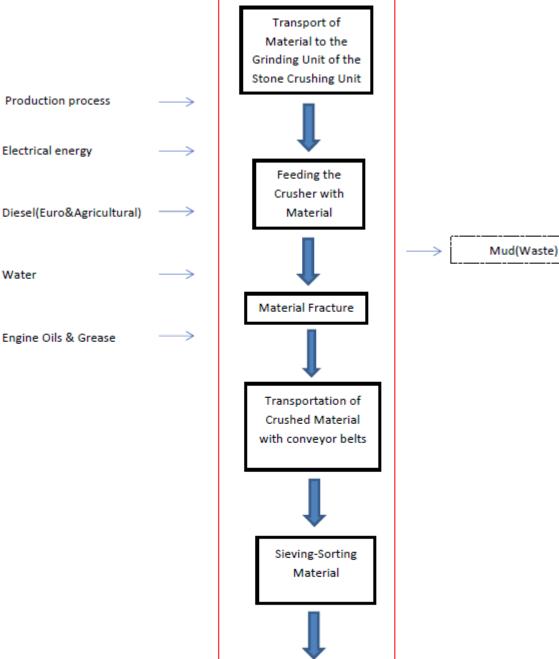
> The study investigates the gate to gate approach of sand aggregates, including raw processing and production.

Methodology

- ➤ The functional unit (FU) used in the current LCA for the data collection and inventory formulation was 1t of sand aggregate production.
- ➢ Initial data collection involved acquiring detailed information on the quarry's operational processes, energy consumption, water usage, emissions, and waste generation.
- > Primary data was supplemented with secondary data from databases to ensure comprehensive coverage (OpenLCA software).
- > Three environmental impact categories were calculated in the LCIA including: (i) acidification potential (AP) in kg SO₂-eq·FU⁻¹, (ii) global warming potential (100 years) (GWP) measured in kg CO₂- Eq·FU⁻¹, and (ui) terrestrial ecotoxicity (TAETP) measured in kg 1,4-DCB-Eq·FU⁻¹.

Results:

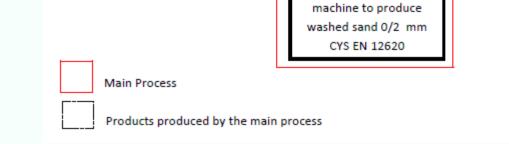




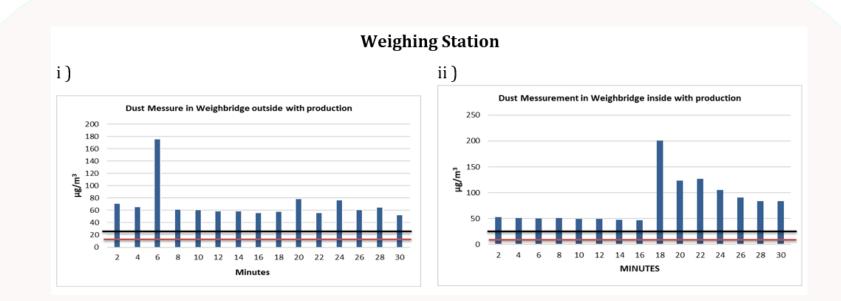
Washing in the washing

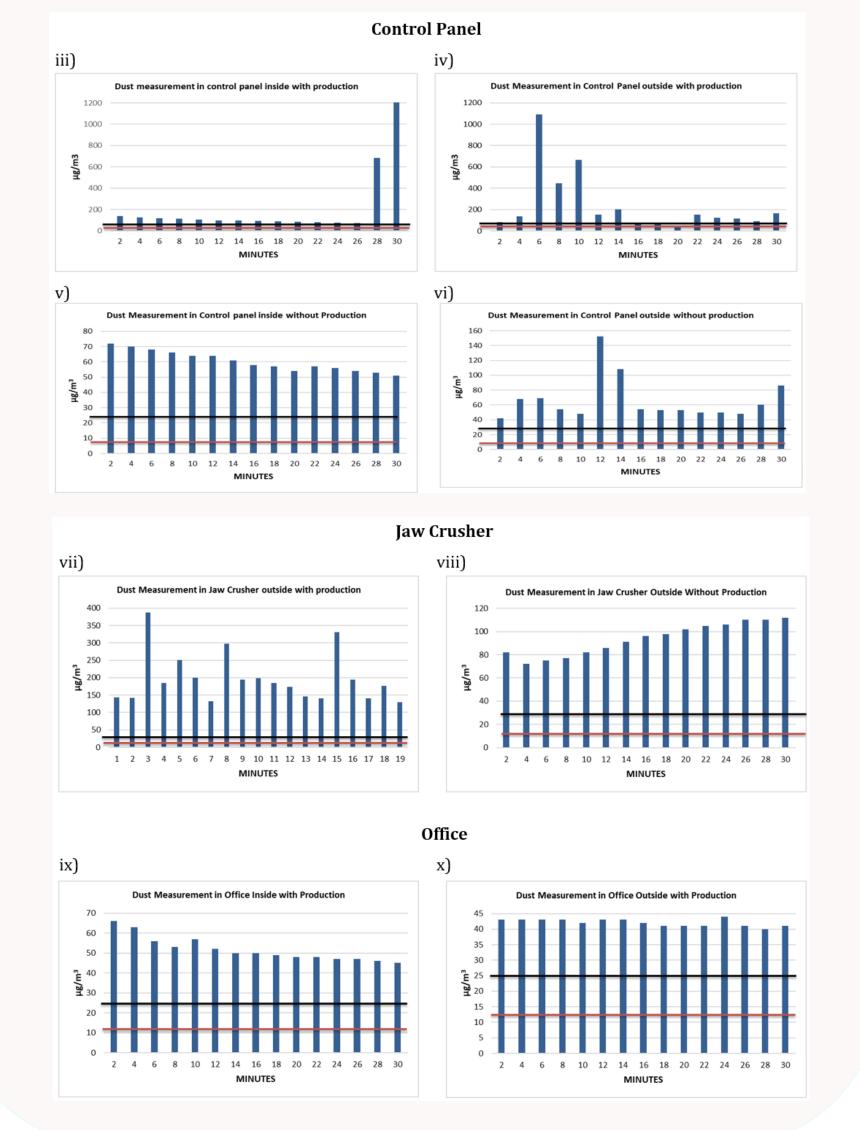
ngine oils	Use
ubricant Libra 46 HIDR	Hydraulic Oil - Movable machinery
ubricant Libra 68 HIDR	Hydraulic Oil - Movable machinery
ubricant Superturbo 15/40	Engeer oil- Diesel engines, Mobile machinery, Generators
ubricant Cartago 80/90	Gear Oil- In drive systems (chainrings)
ubricant ATF 3	Automatic π.χ. Dumber(Volvo, Aveling)
ubricant Antifreeze 100%	Radiator movable and stationary machines
ubricant Serie 3 10W	Transmission- Hydraulic oil in movable machinery
ubricant Super Tauro 220	Gear Oil- In factory sieves Hydraulic systems
ubricant Super Tauro 150	Gear Oil- In factory sieves Hydraulic systems
ubricant EP2 Special Grease	Grease - Sieves
ubricant EP2/3 General Grease	Grease - In sieves and movable machinery
ubricant EP00 Special Grease	Grease - In automatic systems pumps

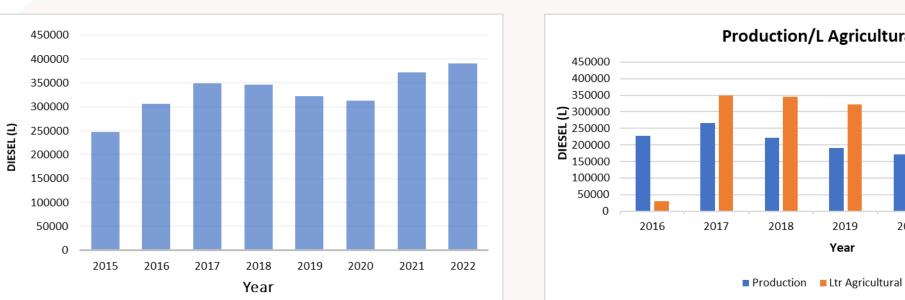


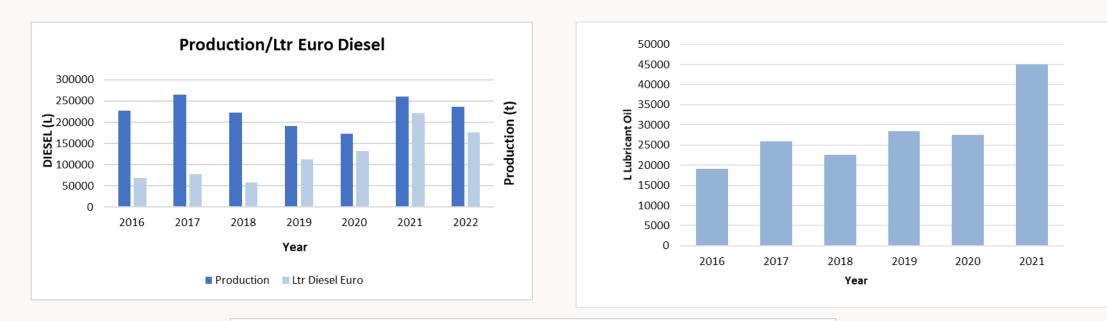


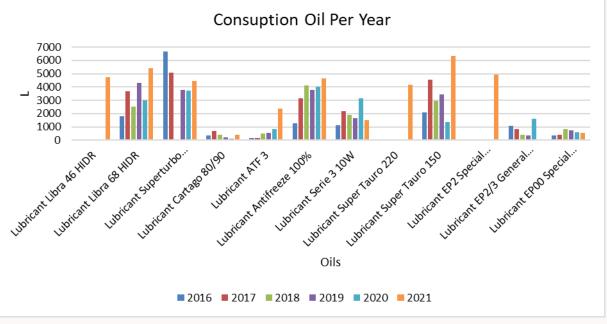
> Furthermore, in order to estimate the impacts associated with specific processes such as crushing, sieving and washing of aggregates a sampling campaign was performed to measure the concentration of particulate matter $(PM_{2,5})$.

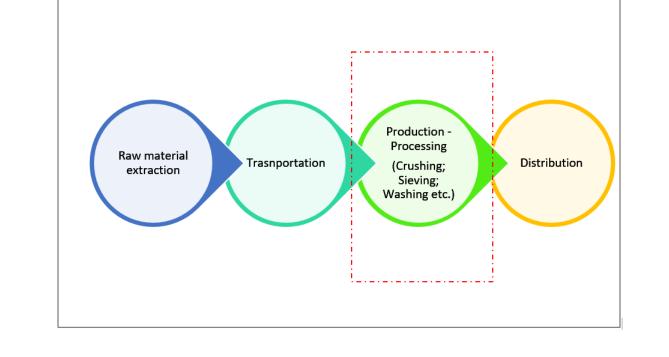


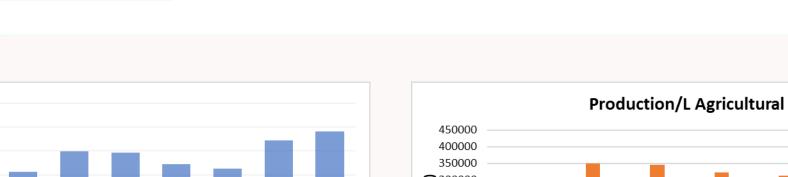












Category	Impact Results	Unit
Acidification Potential-Generic	2.64E+04	Kg SO₂-Eq
Climate Change- GWP 100a	2.81E+06	Kg CO ₂ -Eq
Terrestrial ecotoxicity- TAETP 100a	4475.536	Kg 1,4 -DCB-Eq

- > Preliminary results indicate that the extraction and processing of sand aggregates have significant environmental impacts.
- > Key findings highlight the substantial energy consumption and associated greenhouse gas emissions during the processing stages.
- > Through LCA potential mitigation measures and sustainable alternatives to minimize the environmental footprint of sand aggregate production are proposed.
- > Strategies such as energy-efficient processing technologies, water recycling, and responsible land reclamation are discussed, along with their potential benefits and challenges.

Chania 2023 ^{10th} International Conference on Sustainable Solid Waste Management, 21-24 June 2023