The goal of this study is to apply the primary resource classification framework UNFC-2009 to a landfill-mining project, to identify it as a ‘reserve’ (current economic extraction by a defined project and sale confirmed) or a ‘resource’ (reasonable prospects for economic extraction by a defined project and sale in the foreseeable future) or none of both, and to reveal critical factors for the classification of the project. Three crucial points need to be considered (cf. Figure 1):

1) Knowledge on composition, size and quality of the extractable resource stock (G-axis)
2) Project and technical feasibility: Under what technical conditions can materials be extracted and valorized? (F-axis)
3) Socioeconomic viability (E-axis)

Materials & Methods

The UNFC-2009 framework identifies four different levels of resource classification: ‘non-resource’, ‘resource’, ‘reserve’ and ‘resource or reserve’.

The NVPs for the 4 landfill-mining scenarios, calculated based on a range of estimates regarding potentially recoverable and salable quantities (Table 2), turned out to be negative, ranging between -197 million € in the best and -284 million € in the worst case. This implies that none of the project’s variations is currently economically viable, and thus the landfill cannot be classified as ‘resource’. Optimistic forecasts assume metal prices to double by 2035 and operating cost of sorting plants to decrease by 20 % due to the use of more energy efficient technologies (Table 3). In addition, operators of incinerators will pay, due to overcapacities, at least 10 € per ton RDF made from the landfill’s combustible materials. Therefore the macro-perspective scenarios are classified as potentially feasible (E3) (2015: Pay in average €40 million for the scenario “On-Site Micro” and €40 million for the scenario “On-Site Macro”). For the on-site incineration scenarios, with 20 % lower sorting costs, doubling metal prices and feed-in tariffs for electricity assuming to double by 2035, the scenario “On-Site Micro” would yield a negative NPV of -54 million € and the scenario “On-Site Macro” would result in a positive NPV of 88 million €.

Combining those three criteria, the macro-perspective scenarios are categorized as E3F2G1 (‘resources’) and the micro-perspective scenarios are evaluated as E3F2G0 (‘non-resources’) (Figure 5).

Although the applicability of UNFC-2009 to landfill mining has been proven successfully, further research is needed to define specific, quantifiable criteria for categorizing various kinds of anthropogenic resources under UNFC-2009. This will improve the estimates of global total resource inventories and their extractable fractions by considering various boundary conditions, allowing for fair comparisons between naturally occurring and anthropogenic resource deposits.