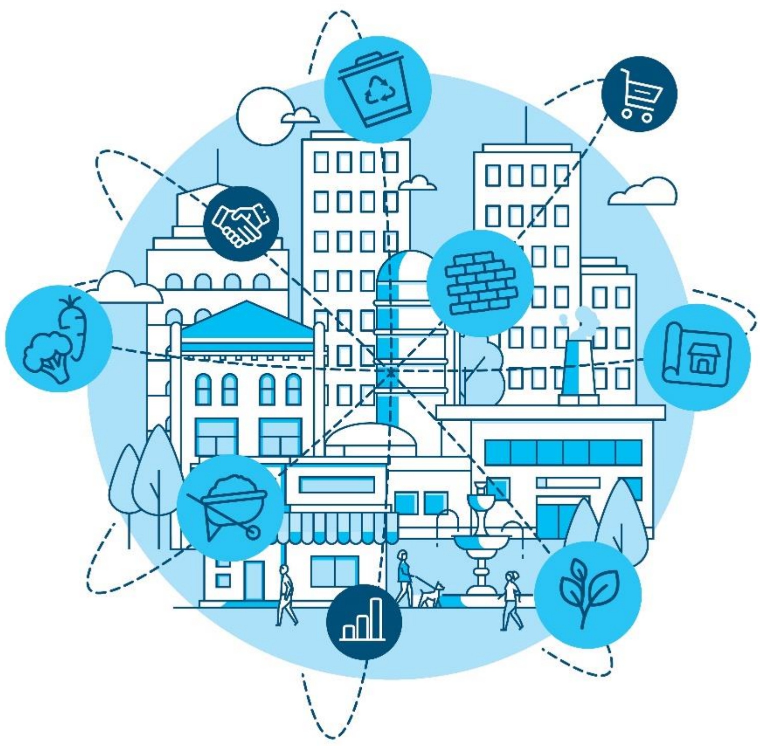
Business case in Bodø

Description

Municipality of Bodø, Norway and Danish Association of Construction Clients, Denmark



Contents

This text describes Bodø’s business case in the mass treatment and transport at a road development project in Sjøgata, in midtown Bodø. The sections come from Bodø’s CityLoops demonstration report available here.

Business cases – Sjøgata, Bodø

Mass treatment and transport at a road development project

Photo: Bodø Muncipality

National market conditions

A national strategy for a green circular economy is manifested in 2021 [Link], which may strengthen the national conditions for CE-business cases. Furthermore, regulations, taxes and guidelines evolving in a direction that might lead to an increase of circular economic practise (TEK17 building regulations, EU taxonomy, mass treatment regulations). This increased practise of circular economy might be an opportunity to explore how circular business cases can be built.

There might also be barriers regarding circular treatment of CDW. National regulations states that all materials that is part of a demolition process, shall be treated at a waste management facility [Link]. This might complicate the process of directly reusing masses and materials at nearby projects. However, regulations state that if the quality of the resources is satisfying, and nearby projects are already planned (and not planned because of the freed resources), they can be reused directly.

In CityLoops in Bodø several stakeholder involvement activities have been arranged. In these arrangements it has been asked what the stakeholders believes is necessary to establish a digital and physical market for reused materials. Findings from these workshops suggest that there is a market for reused resources, but that the market has insecurities and risk aversion related to e.g., pricing, insurance, and quality of the materials.

The business case in a brief

This business case will explore different alternatives for mass treatment and transport at a road development project in midtown Bodø. This is localized close to the CityLoops demonstration site (Bodø Airport) and will function as a pilot. This means that the lessons learned from this business case will be applied to mass treatment processes in the demonstration project.

Different options for mass treatment and transportation are assessed, and pros and cons of the alternatives are evaluated. Factors of significance are financial, environmental, and social impacts.

Lessons learned

From a monetary perspective, the business case analysis favours the solutions where reuse is practiced, either it is practiced at an intermediate storage facility or at the waste management facility. In the best-case scenario, reuse at the intermediate storage at Langstranda is preferred, while in the worst-case scenario (with less reusable masses), reuse at Iris is preferred. Given the fact that IRIS is in possession of more competence and equipment to handle the masses, the business case analysis in general suggests Option 2 that entails reuse at Iris. In terms of social values, the solutions with the shorter distance and workplace generation are preferred. From an environmental perspective, Option 3 is preferred for the "best case", while option 2 is preferred for the "worst case".

The business case in details

To get an understanding of the price for disposing masses, data from IRIS (local waste management company) is gathered. This data show that in total, the sum of clean and polluted masses ending up in the landfill, amounts to 27 155 tonnes in 2022, allocated like this:

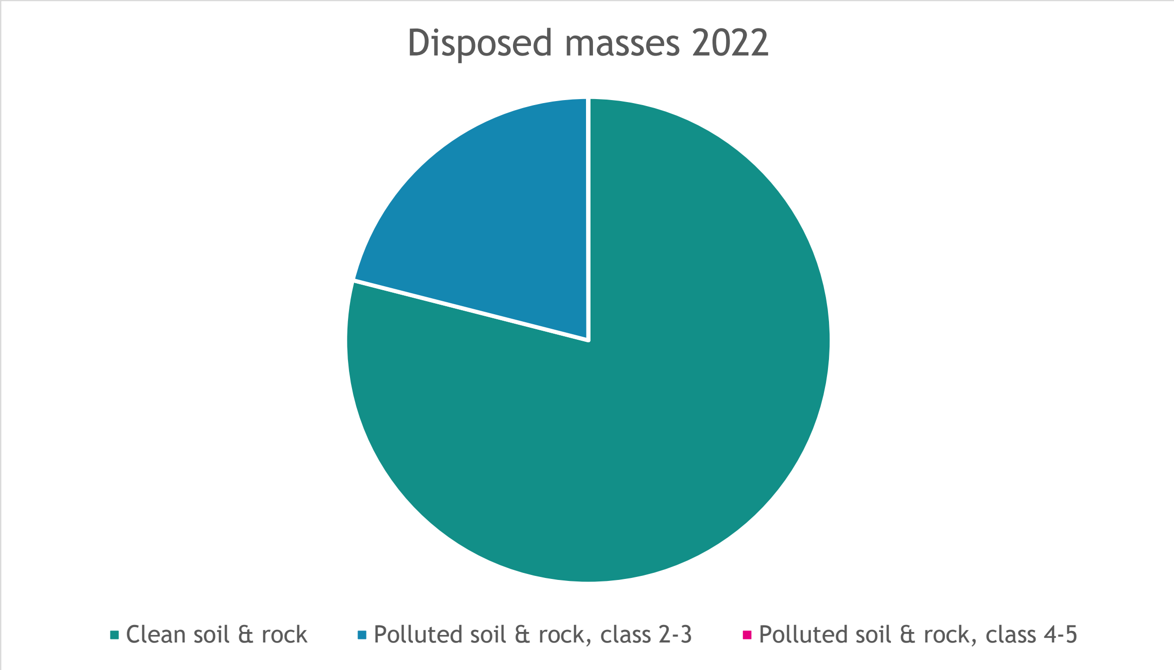


Illustration 1: allocation of municipal disposed masses 2022

Clean soil & rock	21 445	Tonnes
Polluted soil & rock, class 2-3	5 705	Tonnes
Polluted soil & rock, class 4-5	5	Tonnes
Sum	**27 155**	Tonnes

With this pricing model pr ton

Clean soil & rock	NKR 87	€ 7,70
Polluted soil & rock, class 2-3	NKR 378	€ 33,35
Polluted soil & rock, class 4-5	NKR 594	€ 52,40

Meaning that the total cost for disposed masses in 2022 is:

Cost 2022		
Clean soil & rock	NKR 1 865 715	€ 164 647
Polluted soil & rock, class 2-3	NKR 2 156 490	€ 190 308
Polluted soil & rock, class 4-5	NKR 2 970	€ 262
Sum	**NKR 4 025 175**	**€ 355 217**

Based on this information, we see that even though the amount of (mainly lightly) polluted masses are significantly lower than clean masses, the price of treating them is higher:

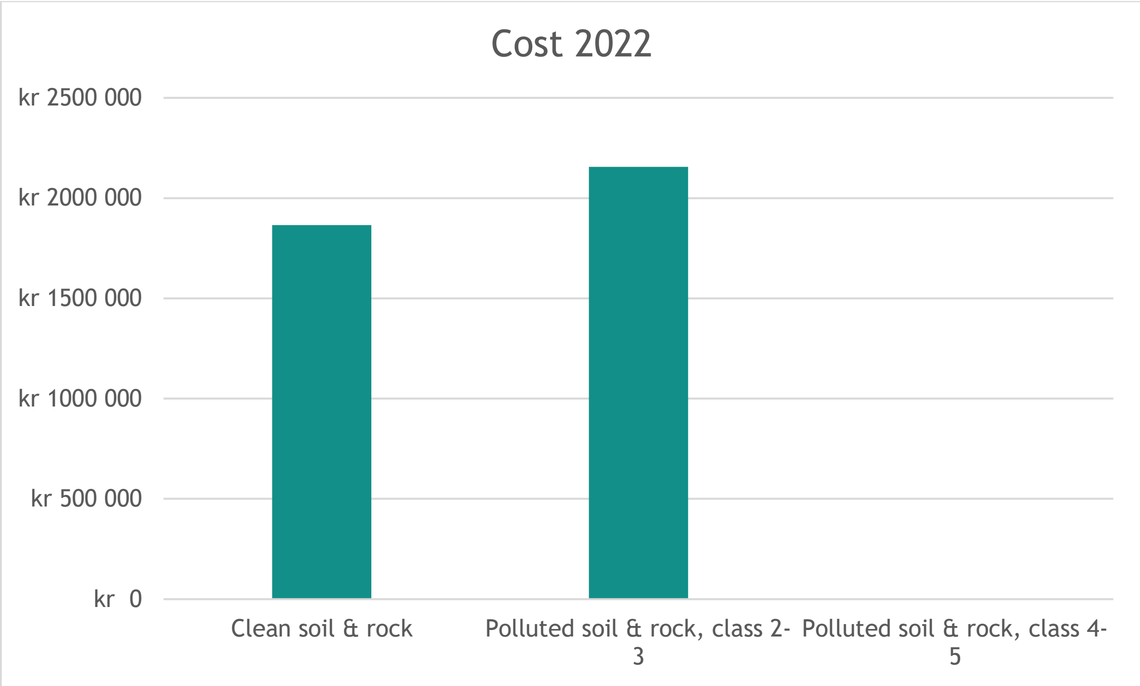


Figure 1 shows the price level of treating masses of different contents.

Alternative routes for mass transport

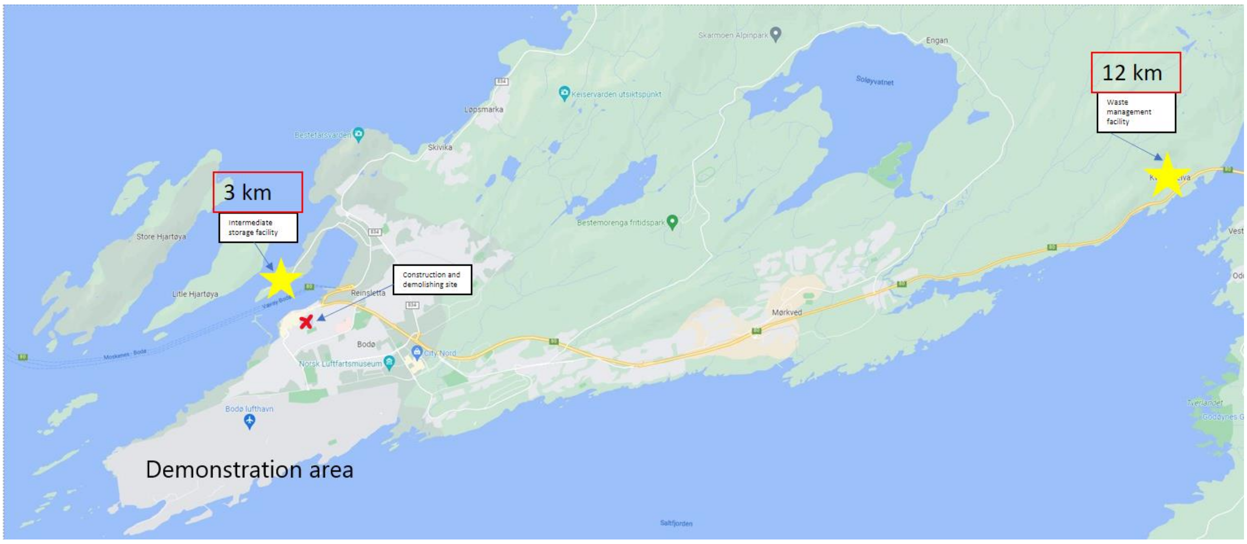


Illustration 2: Map with construction site and current mass treatment sites

The star that is marked as 3 kms from the construction site (red X) is the location of the intermediate storage facility (Langskjæret). The star marked as 12 kms from the construction site is the waste management facility. This business case evaluates where the different masses should be transported and how they should be treated.

In the business case, it is discussed whether the masses should be transported to the intermediate storage facility, or to the waste management facility. Or a combination. In discussing where masses should be transported, these are the most important advantages and disadvantages that have been described:

Waste management facility, advantages:

- Approved landfill
- Crew and equipment for e.g., waste sieving

Waste management facility, disadvantages:

- Longer transport distance than alternative
- Expensive waste treatment

Intermediate storage facility advantages:

- Shorter transport distance
- Free, and municipal ownership

Intermediate storage facility disadvantages:

- Not approved as landfill
- Investments of new equipment for sieving is necessary.

Scenarios

To build different scenarios, we must look at IRIS' price model. The fact that Bodø Municipality in order to treat masses in a circular way, has to buy back its own disposed masses to IRIS, has to be taken into consideration in the trade-off analysis. In the scenario building financial values will be of significance. However, a CityLoops-developed LCA-calculator will also be used to help us quantify co2-emissions from the different alternatives that will also be of significance. Furthermore, reflections around social values on the different alternatives are made, making sure triple bottom line [Link] are taken into consideration.

Clean masses pr ton		
Disposal	NKR 87	€ 7,70
Treatment	NKR 60	€ 5,25
Polluted masses pr ton		
Disposal	NKR 78	€ 33,35
Treatment	NKR 78	€ 24,50

Procurement of cleaned masses (originally disposed) pr ton.	NKR 100	€ 8,80
Collection of stored massed pr ton	NKR 40	€ 3,50

Illustration 3: price model for mass disposal IRIS Waste Management Facility

Two different scenarios are evaluated. One scenario described as a “best case” where the masses have a greater degree of reusability than the second scenario described as a “worst case”. Based on information that already has been gathered about the masses, chances are that the quality of the masses is characterized somewhere in between the two scenarios. To these two scenarios, three different ways of treating the masses are evaluated.

The calculations that lay the foundation for the analyses are attached in an Excel-sheet.

Scenario 1 – “Best case”

- 1 year of digging
- 5,000 tonnes of soil/stone masses
- 40% contaminated.
  - 10% to landfill
  - 30% is cleaned and reused.
- 60% pure
  - 30% is sieved and reused.
  - 30% is reused without sifting.
- 20% disappears when sifting.

Mass treatment option 1

- Case 1
  - Everything is deposited.

Mass treatment option 2

- 90% is sent for reuse on IRIS.
  - 30 % polluted and reused.
  - 30 % clean, sieved and reused.
- 20 % disappears.

- 30 % clean and directly reused.

Mass treatment option 3

- 30% is temporarily stored at Langskjæret.
- 60% treatment and reuse at IRIS.
- 10% to landfill.

The cost of these three options is visualized in this model:

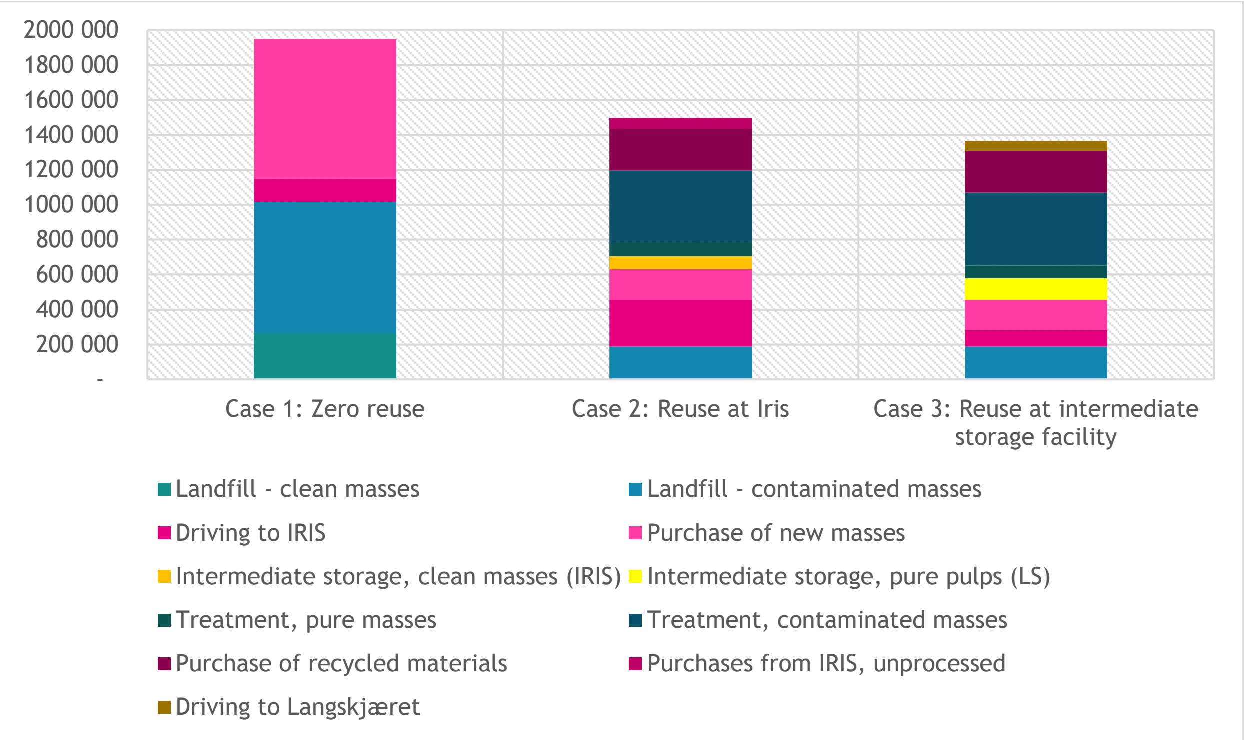


Figure 2 shows visualize the costs in the three options in Scenario 1.

With this scenario, the analysis suggests that the most inexpensive way of treating the masses is at the intermediate storage facility but that that this might lead to more requirements to how masses are treated at site. The complexity of mass treatment should be considered at a cost/benefit analysis.

Scenario 2 – "Worst case"

- 1 year of digging
- 5,000 tonnes of soil/stone masses

- 40% contaminated.
    - 10% can be cleaned and reused.
    - 30% is deposited.
- 60% pure
    - 30% is deposited.
    - 20% can be reused after sieving.
    - 10% can be reused without sifting.
- 20% disappears when sifting.

Mass treatment option 1

- Everything is deposited.

Mass treatment option 2

- 60% is deposited at IRIS.
- 30% is processed and reused at IRIS.
- 10% is temporarily stored and reused at IRIS.

Mass treatment option 3

- 10% is temporarily stored at Langskjæret
- 30% treatment and reuse at IRIS
- 60% to landfill

The cost of these three options is visualized in this model - see next page:

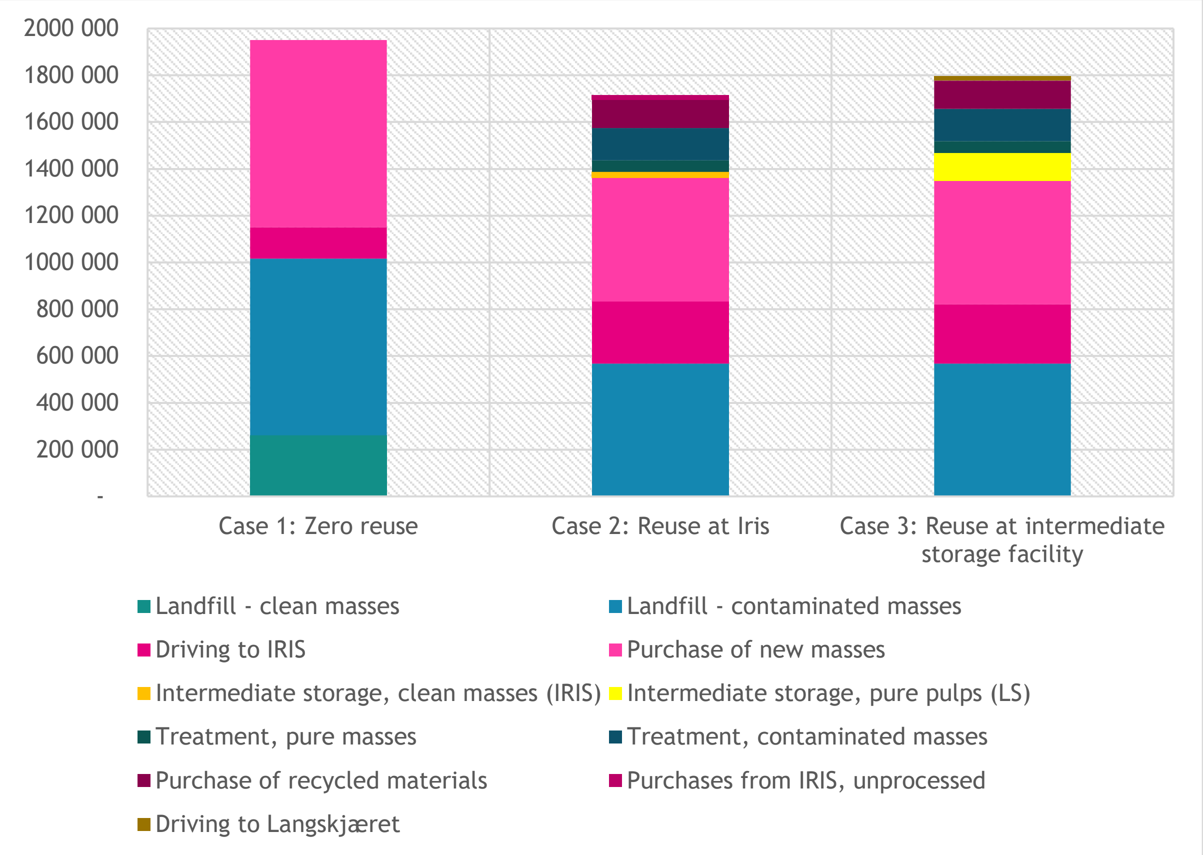


Figure 3 shows visualize the costs in the three options in Scenario 2.

At a scenario where the reusability of the masses is lower than in the best-case scenario, the analysis suggests that sending the masses to the waste management facility in the most inexpensive way of doing it. This complexity of treating the masses will then accrue IRIS that has more competence in this than Bodø Municipality.

Environmental considerations

In this discussion, emission will from the different alternatives will be evaluated. To quantify the amount of CO2 the different alternatives will lead to, a CityLoops-developed LCA-tool is applied [Link].

The results of these analyses are summarized in this matrix:

Options	CO2 spend "best case"	CO2 spend "worst case"
Option 1	**4 878 tonnes**	**4 878 tonnes**
Option 2	**3 735 tonnes**	**4 327 tonnes**
Option 3	**3 678 tonnes**	**4 461 tonnes**

This suggests that Option 2 in both scenarios are the least CO2-emission intensive solutions to handle and transport the masses.

Find calculations behind the results in the matrix in Appendix 1.

Social values

Social values are something that should be taken into consideration in the business case. In this specific case it is believed that it would not benefit the inhabitants of Bodø if infrastructure is affected by heavy load of industrial transport. Particulate matter, traffic load, noise, wear on roads and safety are factors that are believed to influence the quality of life of Bodø's inhabitants.

As a result of an informal workshop with employees at the Business & Society Department in Bodø Municipality, this matrix that that discusses social factors were made.

The result of this suggests that the most socially sustainable way of transporting masses in general, when the two alternatives are compared, is the shorter route on 3 km to Langskjæret. This is because it will be exposing a shorter road stretch to noise, pollution, wear and tear and will pass a lower number of people.

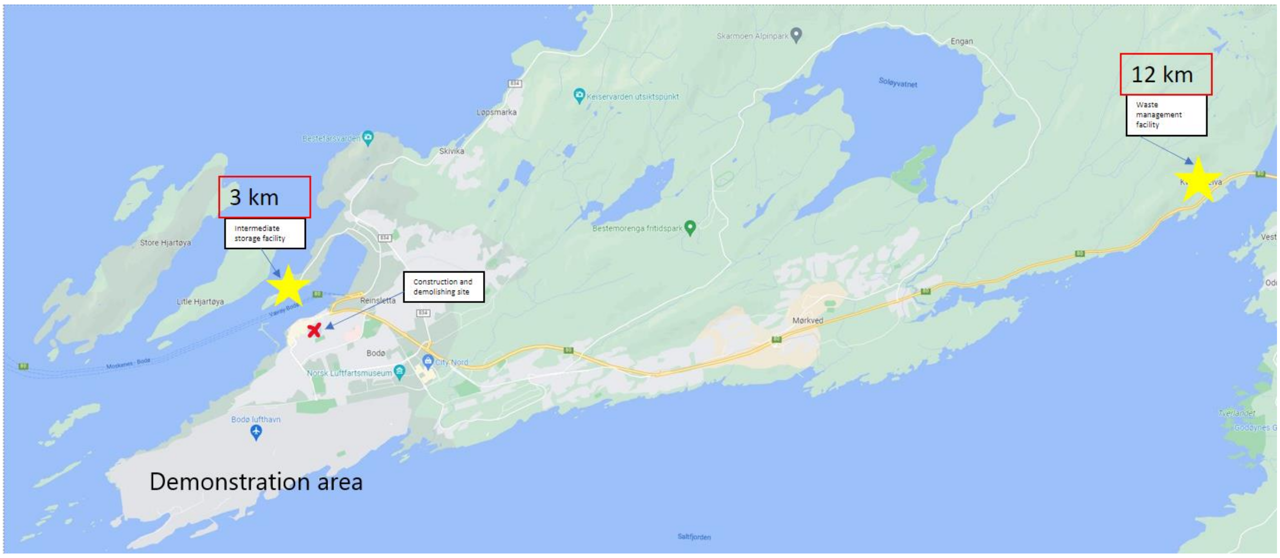


Illustration 2: Map with construction site and current mass treatment sites

Increasing the mass treatment activities at the intermediate storage facility will possibly lead to increased degree business activities and workplaces. From a social perspective this is probably considered as a beneficial effect.

Even though case 3 come out as the best option, the social impact of all the cases can be considered low, as the roads are built for heavy transport and go through areas with low population. The first section has a more significant impact, but because this is the same for all cases and hard to avoid, it is therefore not considered in detail. The analysis of social factors can be found in Appendix 2.

Conclusion

To evaluate alternatives, one must determine whether outcomes, selections, values, or strategies are superior in a given scenario. One can make intelligent choices on the relative advantages and disadvantages of several options. It's important to make a substantial difference as many items advance to be more energy efficient. Electric machines eliminate the need to monitor fuel purity or replace leaking engine oil. The higher efficiency of electric solutions compared to conventional technologies allows it to reduce the total energy demand and emissions. Reusing masses entails the need of having a physical place that can function as intermediate storage, some masses must be cleaned before they can be reused in other projects, but environmental trade-offs have proven that it is possible to work towards a low emission society. This case has exemplified how even in small communities with limited budgetary options, it is often possible to find and choose environmentally friendly solutions. This might be just the start of a set of other actions that might follow this positive case in Northern Norway.

Appendices

1. CO2 analysis – available here
2. Qualitative assessment – available here
3. Reuse calculator – available here

CityLoops is an EU-funded project focusing on construction and demolition waste (CDW), including soil, and bio-waste, where seven European cities are piloting solutions to be more circular.

Høje-Taastrup and Roskilde (Denmark), Mikkeli (Finland), Apeldoorn (the Netherlands), Bodø (Norway), Porto (Portugal) and Seville (Spain) are the seven cities implementing a series of demonstration actions on CDW and soil, and bio-waste, and developing and testing over 30 new tools and processes.

Alongside these, a sector-wide circularity assessment and an urban circularity assessment are to be carried out in each of the cities. The former, to optimise the demonstration activities, whereas the latter to enable cities to effectively integrate circularity into planning and decision making. Another two key aspects of CityLoops are stakeholder engagement and circular procurement.

CityLoops started in October 2019 and will run until September 2023.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 821033.