MAGPIE

SMART GREEN PORTS

CONTINUOUS MONITORING AND CROSS-DEMONSTRATION SYNERGIES

contact@magpie.eu +33 2 35 42 76 12 www.magpie-ports.eu

Funded by the European Union

This project has received funding from the European Union's Horizon 2020 (MFF 2014-2020) research and innovation programme under Grant Agreement 101036594

GRANT AGREEMENT NO.	101036594
START DATE OF PROJECT	October 1, 2021
DURATION OF THE PROJECT	60 months
DELIVERABLE NUMBER	D8.3
DELIVERABLE LEADER	EUR
DISSEMINATION LEVEL	PU
STATUS	First Version
SUBMISSION DATE	8 December 2023
AUTHORS	van Houwelingen R. (EUR) Streng M. (EUR) Hein C. (AIVP) Pruyn J. (TUD) Jansen M. (EUR) Backers R. (PoR) Harmsen, J. (TNO) Ghisolfi, V. (TNO)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036594.

PU=Public, CO=Confidential, only the members of the consortium (including the Commission Services), CI=Classified, as referred to in Commission Decision 2001/844/EC.

Modification Control

VERSION #	DATE	AUTHORS	ORGANISATION
V0.1	30-11-2023	Houwelingen R.	EUR
		Streng M.	EUR
		Hein C.	AIVP
		Pruyn J.	TUD
		Jansen, M.	EUR
		Backers, R.	PoR
		Harmsen, J.	TNO
		Ghisolfi, V.	TNO

Release Approval

NAME	ROLE	DATE
Martijn Streng	WP Leader	28-11-2023
Alexandra Nitsche	Peer reviewer	10-11-2023
Dingena Schott	Peer reviewer	17-11-2023
Maarten Flikkema	Scientific coordinator	8-12-2023
Arne-Jan Polman	Project coordinator	11-12-2023

History of Changes

SECTION, PAGE NUMBER	CHANGE MADE	DATE
		DD-MM-YYYY
		DD-MM-YYYY
		DD-MM-YYYY
		DD-MM-YYYY

Table of contents

Executive summary

This deliverable D8.3 Baseline comparison report based on measurements 2 years into the project provides an overview of the continuous monitoring process and will display the initial methods, results, issues and lessons learned from the task 8.3 continuous monitoring and cross-demonstration synergies. This deliverable consists of various components:

- Methodological descriptions for specific elements within the monitoring and impact evaluation workpackage: abatement costs, spatial impact and social acceptance
- Monitoring results for the different demonstrators
- An analysis of cross demo synergies
- An overview of lessons learned and conclusions so far in the continuous monitoring process

Methodological descriptions for specific elements within the monitoring and impact evaluation workpackage: abatement costs, spatial impact and social acceptance

The main methodological components of WP8 have been described in D8.1 Measurement requirements, method and KPIs framework. Besides the methods and elements elaborated in D8.1, two elements require a slightly different methodology. The continuous monitoring process provides a good opportunity due to its nature to develop and elaborate these methods now more in detail. This is the case for 1. the abatement costs and 2. the spatial impact and social acceptance.
Both these elements are important to consider in determining the impact and effects of the demonstrators within MAGPIE.

Monitoring results for the different demonstrators

The progress and developments of the different demonstrators have been monitored. The demonstrators have been monitored with regards to the different 'tracks' within WP8:

- The continuous monitoring with regards to the KPI framework (D8.1)
- The baseline measurement and continuous monitoring of the spatial impact and social acceptance as specific element within the KPI framework (D8.1)

An analysis of cross-demo synergies

By means of various workshops, meetings and discussions with the different stakeholders around the demonstrators, the cross-demo synergies are analysed. What are the lessons learned in the one demonstrator that can be helpful for another demonstrator? Besides sharing information about the lessons learned, it can also be beneficial to share other elements such as findings and/or methods between the demonstrators.

An overview of lessons learned and conclusions so far in the continuous monitoring process

The work and process carried out so far has taught us valuable lessons. These lessons are taken into account whilst elaborating the baseline measurements, the continuous monitoring and the impact evaluation and lead to adjustments in the process where necessary. The major lessons learned so far are:

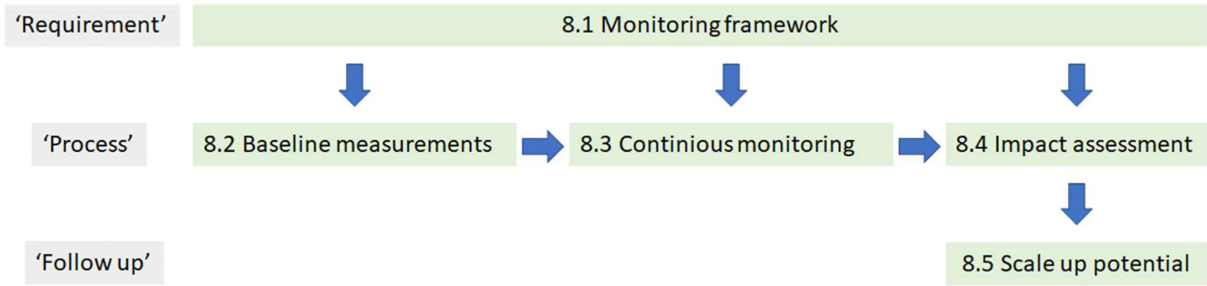
- **Timeline for the baseline measurement.** Different demonstrators have different timelines and pace of making progress. The timeline of the monitoring and impact evaluation process needs to be adjusted to the timeline of the demonstrator, rather than the initial idea that all baseline measurements, continuous monitoring measurements and all 'after implementation' measurements are carried out at the same time.

- **Scope of the demos and measurements is only partially defined.** Not all the demonstrators have been clearly defined and determining the scope is sometimes part of the process. This also applies to the determination of the baseline and its corresponding measurement. To a certain extent, this has also to do with the fact that not all the required input for the demonstrators was available.
- **Comparability of results sometimes difficult.** Direct comparison between the different demonstrators is applicable only to a certain extent. Only a part of the identified indicators are applicable to all demonstrators and there are also indicators that apply only to part of the demonstrators.
- **Gap between descriptions and actual values.** It is relatively easy for most demonstrators to supply the baseline descriptions. However, most demonstrators have more difficulties with supplying the actual values of the baselines.

1 Introduction

Work package 8 is responsible for monitoring the baseline and the results of the demonstrators. The figure below provides an overview of the monitoring and impact evaluation process of WP8.

Figure 1: Overview monitoring and impact evaluation process of WP8



This deliverable 8.3 Baseline comparison report based on measurements 2 years into the project will display the initial methods, results, issues and lessons learned from the task 8.3 continuous monitoring and cross-demonstration synergies. This task will collect data and monitor developments related to the key performance indicators (KPIs) throughout the course of the project.

This deliverable is therefore a combination between the two different 'tracks' in WP8:

1. the continuous monitoring process of the demonstrators by means of the KPI framework and
2. the baseline and continuous monitoring of the social acceptance and spatial impact.

These two 'tracks' form a combined approach to determine the impact and effects of the demonstrators.

In earlier stages of the project, in the first deliverable of WP8, D8.1 Measurement requirements, method and KPIs framework we have identified the result areas and indicators that will be used in the monitoring and impact evaluation process. We have set three results areas for the KPIs: Environmental, operational, and socio-economic. Besides those three areas, there are the demo specific indicators. Most of the KPIs have a quantitative approach, such as CO_2 emissions and the costs. Within the socio-economic result area, we have defined two themes that are not purely quantitative, namely social acceptance and spatial impact. These themes require a qualitative approach, because both the impact and acceptance cannot be expressed only in numbers. As WP8, we believe that these themes are relevant for the demonstrators within MAGPIE, because they can affect the implementation of the new technologies on a large scale.

Along the process of the baseline measurements and the continuous monitoring, the WP8 team found out that the social acceptance and spatial impact analyses require a partially different methodology from the methodology and approach for the other indicators that has been defined in D8.1. The continuous monitoring process provides the opportunity and time to develop this methodology now. The continuous monitoring process consists of the validation and regular checks for updates of the baseline measurement and the progress of the demonstrators. This provides the WP8 team with the opportunity to define the right approach and context to analyse the social acceptance and spatial impact of the demonstrators properly. Therefore, the WP8 team has taken the approach to further elaborate on this specific theme in this deliverable.

This report consists of the following chapters:

- A methodological description of the two tracks in the monitoring process

- The results of the monitoring process for the two tracks
- A description of the process for the cross-demo synergies
- The lessons learned from the monitoring process in general and the cross-demo synergy process in particular

2 Continuous monitoring process

This chapter will explain the methodologies applied for both tracks of the continuous monitoring process. The methodology for the quantitative continuous monitoring process is relatively straightforward and follows from the methods and measurements described in D8.1 Measurement requirements, method and KPIs framework and D8.2 Baseline evaluation and prioritization of demo-specific scenarios. The methodology for social acceptance and spatial impact requires more explanation and context. Therefore, section 2.2 starts with the theoretic context and explanation of the principles behind the methodology.

2.1 Methodology quantitative continuous monitoring

This methodology of the quantitative continuous monitoring process consists of two parts:

- The methodology of the works carried out with regards to the monitoring of the defined KPIs
- The elaboration of the methodology for abatement costs.

2.1.1 Methodology of the works for monitoring the defined KPIs

The methodology for the works with regards to the monitoring of the defined KPIs have been described in the D8.1 Measurement requirements, method and KPIs framework and D8.2 Baseline evaluation and prioritisation of demo-specific scenarios. In this deliverable we will explain the methods which WP8 used to continuously monitor the demos. During the continuous monitoring process WP8 has been in frequent contact with the demonstrators to keep up to date with the developments, work on the completions of the baseline measurements and carry out the continuous monitoring. In order to do so, WP8 liaised with the demonstrators by means of:

- Session with all the demonstrators to discuss the monitoring process and facilitate a discussion between the different demonstrators to find cross demo synergies.
- Individual meetings with all different demonstrators to discuss individual progress and specific issues with regards to the KPIs.
- General demo leaders meeting with the demonstrators and workpackage leaders to discuss various monitoring components with the relevant stakeholders.

This way the WP8 experts keep up to date with the progress of the demonstrators. Besides the aforementioned methods to continuously monitor the demonstrators, one specific element will be added to the methodology, which is the explicit update of the baseline measurements before the start of the implementation of the demonstrators. Some demonstrators already submitted their baseline values way before the actual implementation of the demos. To validate that the baseline situation is still applicable after a (relatively) extended period of time, an additional check will be carried out with all the demonstrators to validate the baseline measurement.

2.1.2 Methodology for abatement costs

Abatement costs is a topic that was specifically addressed in the periodic review meeting with CINEA and the experts that provided a review. The overall goal of the inclusion of abatement costs is to find out which measure is most cost effective. We have developed a methodology that is complementary to, but build upon, the measurement requirements, method and KPIs framework. This section provides the explanation of the methodology that we will apply for the abatement costs.

As the reduction of GHG emissions is for a large extend societal driven and not the direct result of significant economic benefits, a comparison between demos based on impact and associated costs should be made. When consulting literature there are roughly several methods to this. The first would be a **full life cycle analysis**[1]**.** This is an extensive and detailed method, translating a variety of impacts into one measure. Each system would require a full rather time-consuming study. As MAGPIE and its demos focus on GHG reduction as a priority, this method is deemed too costly for our purpose.

Another method which considers various impacts of operations and materials is **Cost to Society**[2]**.** The idea behind this is to translate any impact ultimately into its costs to us as a society. This includes healthcare, impact on food production etc. These costs have already been established but are also updated regularly. The latter means that results may differ in the future based on new insights. Another issue with this method is that although the final expression is in a monetary value, they should not be directly compared to e.g., actual costs as companies will never be charged these costs, or only to a limited extend. This means that this helps in the comparison of various emissions but is less straightforward when considering both costs and emissions.

This leads to a third option, **costs** that are actually charged to owners **based on GHG emissions**. Legislation will be implemented to either tax GHG emissions or limit the amount and force companies to trade if they exceed this limit, the Emission Trading System (ETS). The latter is the most likely to include also shipping in the near future. The difficulty with especially ETS, but to a large extend also with taxes, is that the price is not known. Right now, prices are around 50-100 Euro per ton CO_2 (€83 in September 2023), but it is expected that this will rise in the future. We can deal with this effectively by reversing the equation. Instead of determining profitability at a predetermined tax or ETS level, we can use the cost difference (TCO, **total costs of ownership**[3]) between the current situation and the situation after the demo and divide this by the impact reduction of the demo.

This way we are able to establish a required ETS or tax-level for the proposed solution to become feasible to implement. Of course, some solutions are beneficial already, these would lead to a negative required ETS or tax. A major downside of this method is the fact that the absolute impact is lost in this way as it is not represented in the ETS value.

[1] Heijungs, R., Huppes, G., & Guinée, J. B. (2010). Life cycle assessment and sustainability analysis of products, materials and technologies. Toward a scientific framework for sustainability life cycle analysis. *Polymer degradation and stability*, *95*(3), 422-428.
Heijungs, R., Suh, S., & Kleijn, R. (2005). Numerical approaches to life cycle interpretation-the case of the Ecoinvent'96 database (10 pp). *The International Journal of Life Cycle Assessment*, *10*, 103-112.

[2] Maibach, M., Schreyer, C., Sutter, D., Van Essen, H. P., Boon, B. H., Smokers, R., ... & Bak, M. (2008). Handbook on estimation of external costs in the transport sector. *Ce Delft*, *336*.

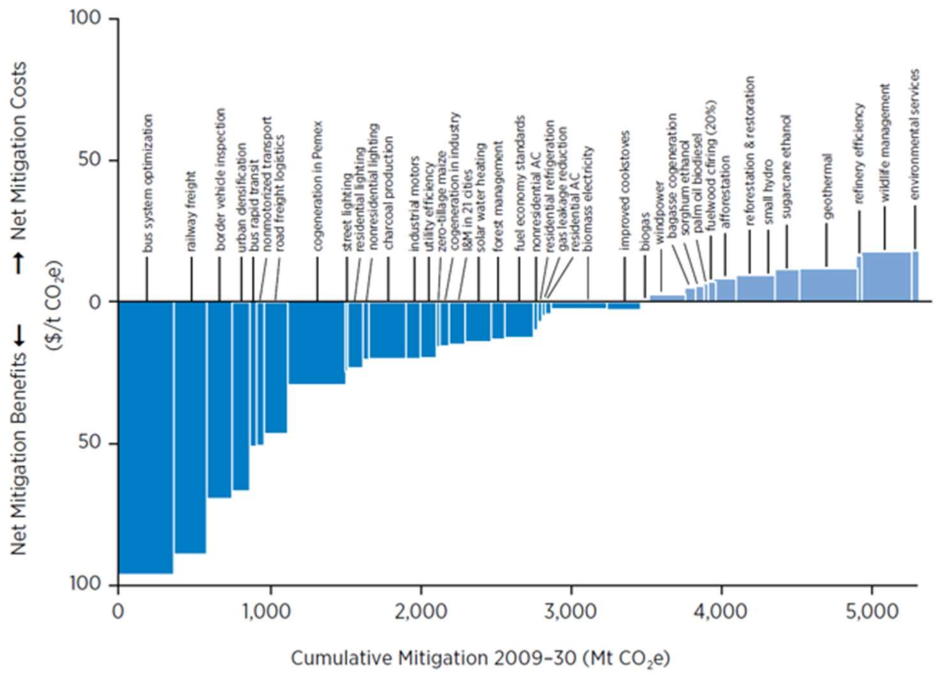
[3] Ellram, L. M. (1995). Total cost of ownership: an analysis approach for purchasing. *International Journal of Physical Distribution & Logistics Management*, *25*(8), 4-23.

Table 1: Overview methodologies abatement costs

	LCA	CTS	ETS-required
Inputs	All emissions, downstream activities impacts, use of energy and water, use of rare materials, access to an impact database.	CAPEX, OPEX, CO2-emissions, access to an impact database.	CAPEX, OPEX, CO2-emissions.
Outputs	A value for impact that can be compared to other values.	A total cost to us which includes internal and external costs.	ETS-Required, a value paid per ton of CO2 reduction.
Challenges	Detailed data required, database is incomplete for downstream activities. No indication of costs per impact reduction.	External costs are not paid by the owner, hence difficult to accept as equal to internal costs.	Total impact reduction is lost in this single value.

The discussion above is summarised in table 1 and based on the discussion the required ETS is selected as the preferred comparison basis for the abatement costs. In consultation with the defined KPIs, the data required is available from the demos, providing a good baseline. To deal with the missing total impact as discussed above, an extension is proposed. DNV has in an earlier project called GLOMEEP made an overview of abatement options, their impact on operations for various vessels and their total reduction potential. This is presented in an overview called Marginal Abatement Cost Curve (MACC). An example of which is presented below in figure 2. This one is applied to solutions for Mexico City, one of the most polluted cities in the world.

Figure 2: Marginal Abatement Cost Curve (DNV)



Source: Marginal Abatement Cost Curve (LEAP)

As can be seen in the example figure, the measures are ordered by their mitigation benefits, or in our case required ETS from small to large for each demo in one overview. This is represented on the y-axis. On the x-axis the cumulative impact of the measures is provided.

Of course, such a tool is not valuable at the level of the demo itself, but makes more sense on the level of e.g., a port or a region. Take for example shore power and ammonia as a bunker fuel. These two measures will both have different costs, e.g., due to the grid composition, but also due to vessels visiting, as e.g., tankers are much more expensive to convert to shore power than bulkers, while container vessels are somewhere in between. This means that costs and impacts can differ due to different vessels visiting a port. The same would be the case for ammonia, for which some ports already have production capacity (albeit not green), while others do not have this advantage. This again could impact the costs of ammonia bunkers offered as well as the time needed to implement such an infrastructure.

Such investigations will be performed in task 8.4 and task 8.5 and are thus crucial for the application of the MACC curves based on these investigations. Only in that way we will be able to study and compare the effect of different demos on a larger scale.

2.2 Methodology for social acceptance and spatial impact

2.2.1 Introduction

Work package 8 is responsible for monitoring the baseline and the results of the demonstrators. We have set three results areas for the key performance indicators (KPIs): Environmental, operational, and socio-economic. Most of the KPIs have a quantitative approach, such as CO_2 emissions and the costs. Within the socio-economic result area we have defined two themes that are not purely quantitative, namely social acceptance and spatial impact. These themes require a qualitative approach, because both the impact and acceptance cannot be expressed only in numbers. As WP8, we believe that these themes are relevant for the demonstrators within MAGPIE, because they can affect the implementation of the new technologies on a large scale. During the energy transition, most communities are in favour of new greening technologies. However, the discussion changes when the technology should be placed in 'somebody's backyard' (see figure 3: social acceptance). Additionally, the license to operate in ports is heavily influenced by the new technology's spatial impact. For example, what space is needed for the new technology and how does it impact the surrounding space or environment? (see figure 4: spatial impact)

Figure 3: Social acceptance in relation to MAGPIE

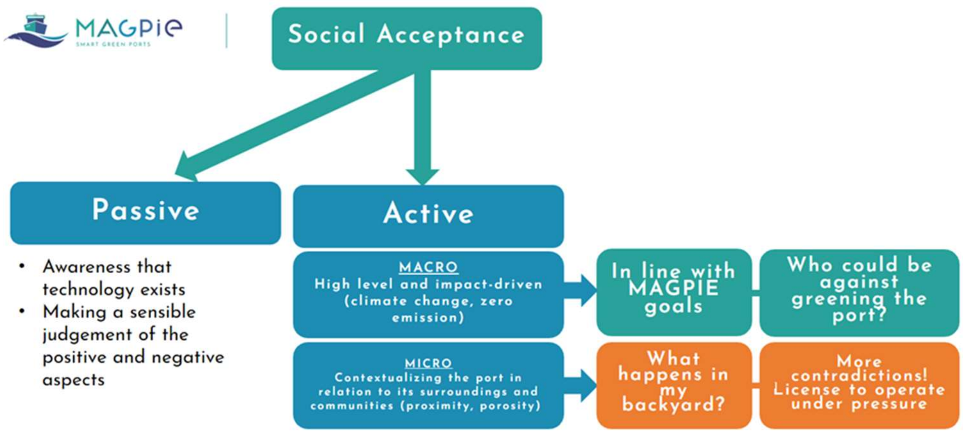
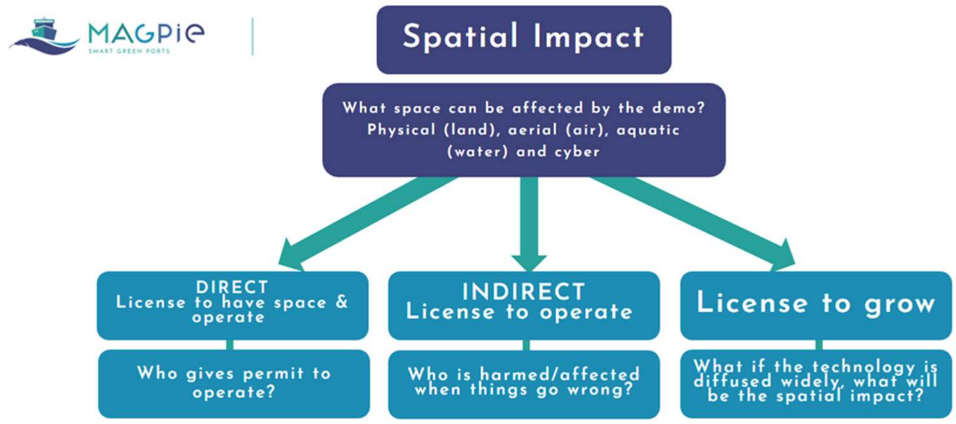


Figure 4: Spatial impact in relation to MAGPIE



Considering that WP8 has decided that social acceptance and spatial impact are important KPIs for the monitoring framework (D8.1), we designed a survey about these KPIs in 2022. One of the lessons learned was that not all the elements were applicable to every demonstrator. Another important lesson learned was that the definitions of social acceptance and spatial impact were not clear for every demonstrator. Therefore, the questions could be interpreted in different ways. We took the feedback into account and decided to redesign the research methodology for these KPIs.

The overview of the research methodology is shown in figure 5. The objective of this research design is to deepen out the socio-economic indicators of social acceptance and spatial impact. First, the definitions of these concepts are elaborated (see the above sections). Interviews were conducted to address relevant themes for port-city stakeholders. Both direct as well as indirect stakeholders can relate to these themes, which will result in a non-exhaustive list of attributes for social acceptance and spatial impact scale. Direct stakeholders refer to actors who interact directly with the demonstrators and indirect stakeholders refer to all other actors who otherwise are affected by the demonstrator. Considering that the first step of the research design is defining social acceptance and spatial impact, the next two sections are dedicated to these definitions. In the section 'Research design social acceptance and spatial impact' the thematic approach is elaborated and the process of the research design is described.

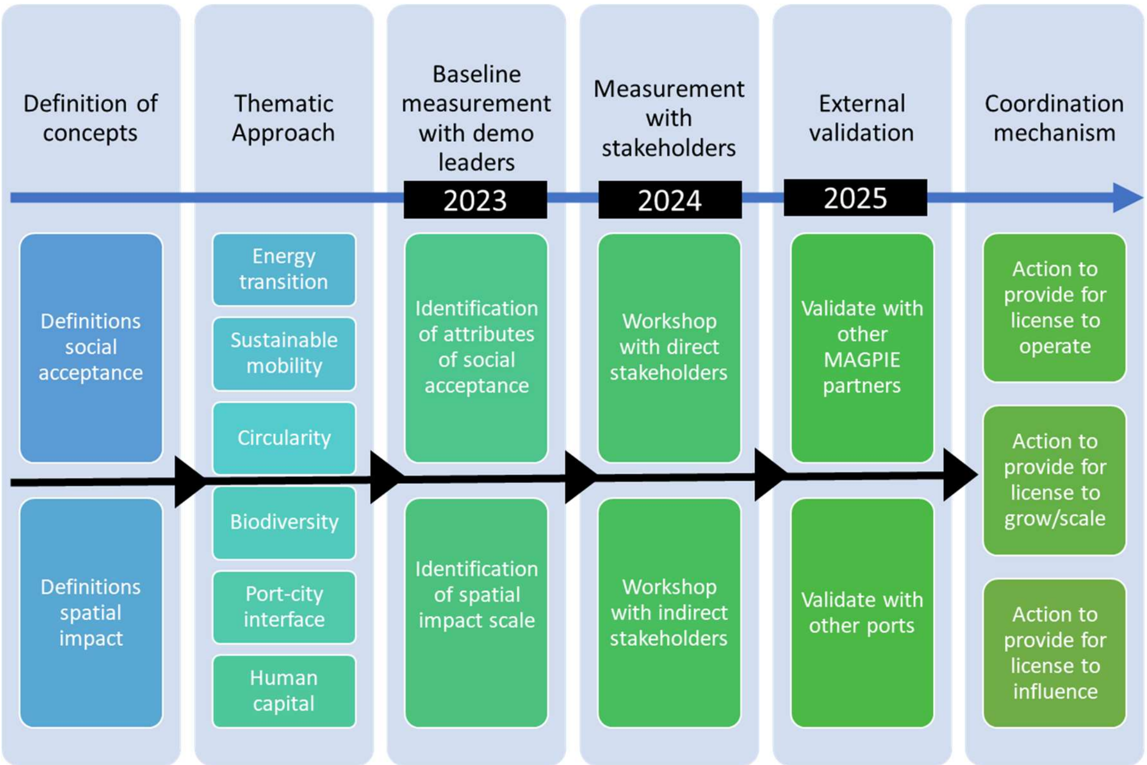
2.2.2 Research methodology spatial impact and social acceptance

As described in the introduction, social acceptance and spatial impact require a qualitative analysis. The main research questions of the analysis are as follows:

1. How will the implementation of the new technology within MAGPIE be influenced by social acceptance?
2. How will the new technology demonstrated within MAGPIE impact its spatial surrounding of the port-city interface?

The aim of this qualitative analysis is to develop a list of attributes of social acceptance as well as on spatial impact. The diagram in figure 5 depicts the research set-up that starts with a definition of the two concepts: social acceptance and spatial impact in the context of sustainable port development. Subsequently there is an interview round before or during the implementation of the demonstrator. The interviews are structured along 6 themes. The objective is to establish a baseline for what can be measured in subsequent monitoring assessments. The research related to the baseline measurement with demo leaders will be conducted in 2023. The next step is to organise a workshop with relevant indirect stakeholders in the port community in 2024. After constructing the qualitative baseline measurements and the workshop, the results will be validated with other MAPGIE partners and the fellow port. The last step is to construct the coordination mechanisms related to social acceptance and spatial impact.

Figure 5: Research methodology social acceptance and spatial impact



2.2.3 Definition of social acceptance

Social acceptance in a port context relates to both a passive notion of accepting a technology and a more active notion of support and adoption of technology[4]. Acceptance is a reaction to something that is imposed on actors in a social space, which either means an engagement with a certain new technology or an acceptance of the potential hazards and risks that may arise from using a technology. Contextualising this definition of acceptance in a port and port-city context, where community engagement with emerging green energy technologies and infrastructure is at stake, we notice that such energy technologies are often being proposed by authorities or multinationals who assume these technologies will be accepted by the general public without contestation[4]. Why would citizens be against renewable energy technology and infrastructure? But this top-down perspective is criticized in social acceptance literature because the unit of analysis is different. Indeed, on a macro-scale, one would expect individuals and communities to be in favour of renewable energy technology when that is good for society. However, on a micro-level scale -when it affects people's personal space and spheres- opposition and protests can be fierce, e.g., when it concerns windmills or large-scale solar panel fields in their 'backyards'. People are inclined to accept such energy infrastructures if they do not harm the landscape or local environment.[5]

2.2.4 Definition of spatial impact

Spatial impact concerns the extent to which the territory is affected, altered, harmed, temporarily or permanently. Ports are often situated in densely populated coastal areas, which means scarce space will have to be shared with other users. One of the major challenges for ports is how to co-exist with their societies while preserving the natural ecosystem[6]. The Sustainable Development Goals are at the heart of gaining a better understanding of the interactions between the human use of space for port development and growth in coastal ecosystems. We argue that impact needs to be measured with the sustainable development goals in mind. Inevitably port development activities – their construction, operations, redevelopment – impacts the port's surrounding ecosystem. For ports to develop and prosper, more and more emphasis is given to sustainable development, which includes the acceptance from society. AIVP launched the 2030 Agenda by AIVP as the world's initiative to adapt the UN's 17 SDGs for the specific context of port-city relations. Embedded in this agenda are 10 Commitments[7] where Action 4 focuses on Renewed Governance, defined as the 'promotion of a City Port dialogue within a renewed governance aimed at associating the search for economic and environmental performance with the well-being and aspirations of the inhabitants.

Spatial issues arise from different perspectives on how the surroundings are valued by a variety of users in the port city space. Port industrial companies value the port as a favourable location and occupy vast areas of land for production, storage and transportation over land and water, whereas residents value the space to live close by their work often enjoying the waterfront for its views. Their liveability is affected by neighbouring port activities in the sense of noise, air pollution, water surface pollution, light pollution, horizon pollution.

---

[4] Batel S., Devine-Wright, P. & Tangel, T. (2013) Social Acceptance on low carbon energy and associated infrastructure: A critical discussion. *Energy Policy,* 58 (1-5). https://doi.org/10.1016/j.enpol.2013.03.018.

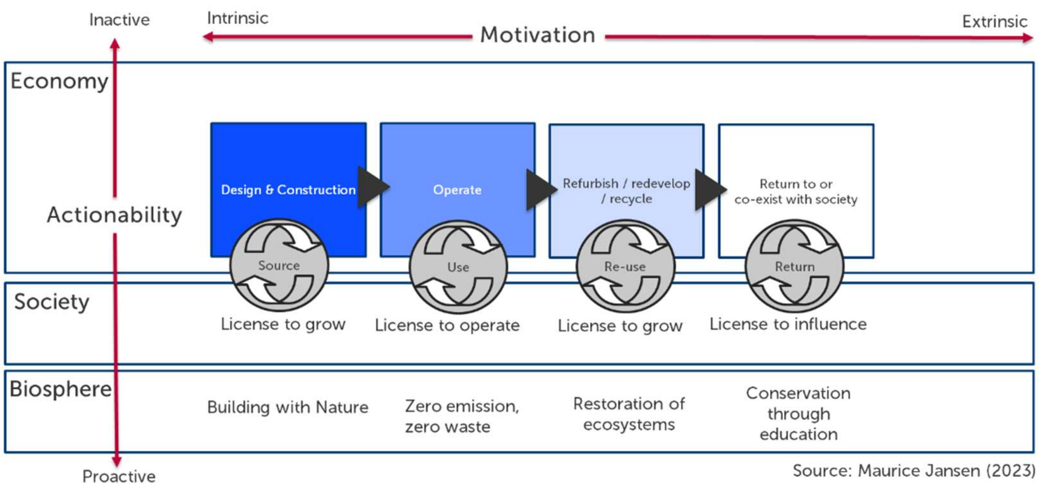
[5] Horbaty, R. & Huber, S. (n.d.) "Social Acceptance of Wind Energy Projects; winning hearts and minds", Conference Proceeding: The International Energy Agency Implementing Agreement for Co-operation in the research, development and deployment of wind energy systems. www.socialacceptance.ch.

[6] Jansen (2023) Ports and the Sustainable Development Goals: an Ecosystems Approach, in International Business and Sustainable Development Goals (31 July 2023), DOI: 10.1108/S1745-886220230000017014

[7] https://www.aivp.org/engagement/

The following diagram (figure 6) explains how port development impacts society and environment. From this diagram it shows that port authorities require a so-called 'license' from civil society for each stage of port development. In the design and construction stage, a license to grow is required. Often spatial impact assessments and environmental impact assessments are obligatory trajectories for port developers, which eventually result in a permit for the construction of a port expansion project.

Figure 6: Impact port development on society and environment



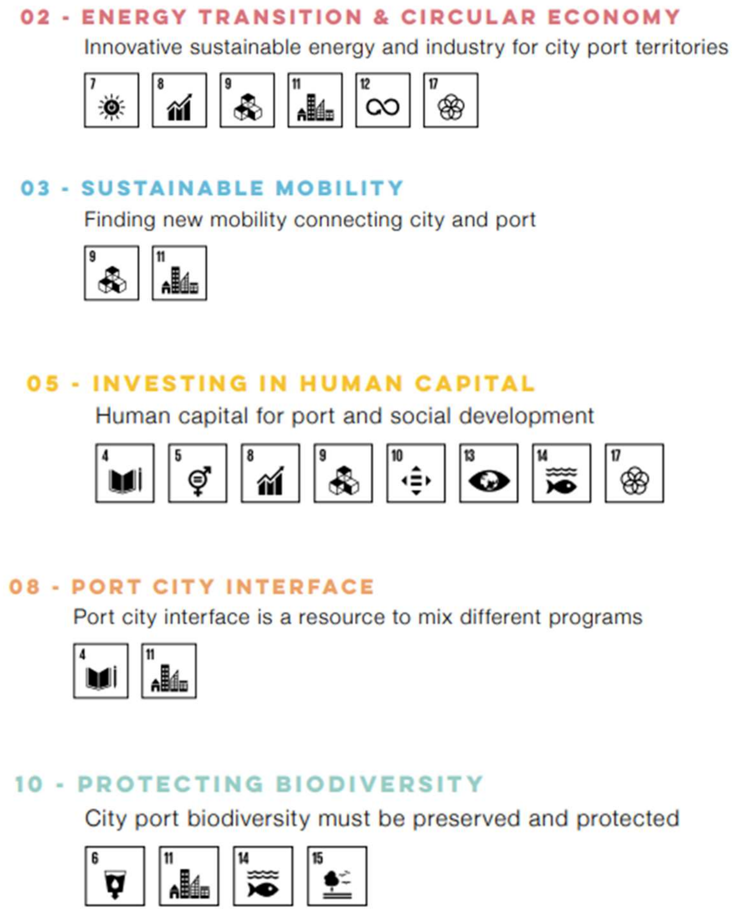
In the operation phase, port industries get a license to operate only when they keep the harmful effects of their business practices (noise, pollution, nuisance, congestion) within acceptable boundaries. More and more it requires companies to embed business practices within a framework of corporate social responsibility. The third stage of port development is when disused port areas are refurbished and redeveloped for new purposes, such as for waterfront redevelopment, re-establishing links between the port and city or rewilding. As with new port development such projects also require a societal license to grow, because it could mean a loss of economic value. The fourth phase when port functions co-exist with society, or where port areas are given back to the city, e.g., for residential or educational purposes. The question then arises how much influence a port development company exerts on future development of such areas adjacent to existing port activities, e.g., shipping activities over water in the vicinity of residential areas on the waterfront.

2.2.5 Thematic approach

The main objective of the first interview round is gathering the first insights and perspectives of the demonstrators on social acceptance and spatial impact. To assess social acceptance and spatial impact during the first interview round, we address them in relation to the AIVP 2030 goals[8]. These goals are related to the Sustainable Development Goals (SDGs) and describe 10 commitments for a more sustainable development of the port-city interface. According to the descriptions of social acceptance and spatial impact, the SDGs are strongly related to these KPIs. Based on the scope of MAGPIE, the selection of five goals is made to assess the social acceptability of the demonstrators and the spatial impact (see figure 6).

[8] The AIVP Agenda 2030 includes 10 goals indicating the main challenges for sustainable port cities, and 46 measures for action. Each one of AIVP's 10 goals connect to several SDGs, responding to the holistic approach we need for sustainable development.

Figure 7: AIVP 2030 goals in relation to social acceptability and spatial impact.



We apply a thematic approach during the first interview round based on these AIVP goals. The following keywords per goal are considered during the interviews itself:

1. **Energy transition:** Supply of renewable electricity, providing services and products in the field of green energy.
2. **Circular economy:** Recycling, exchange of gases and materials, modular design, industrial ecology.
3. **Sustainable mobility:** Urban traffic and congestion, waterways, non-fossil modalities, smart mobility applications, local mobility authorities.
4. **Port-City Interface:** Nuisances (e.g., dust, noise, lights, and smoke), communities, new technologies.
5. **Biodiversity:** Rivers and basins linked to the city, local urban spaces, animal and vegetal species living on the port jurisdiction and city area.
6. **Human capital:** Education, job creation and loss, new skills and job profiles.

3 Monitoring results

This chapter will elaborate the monitoring results of the continuous monitoring process until November 2023. Similar to chapter 2, the two tracks will be explained per demonstrator, first discussing the monitoring results for the quantitative KPIs, followed by the results for the social acceptance/spatial impact analyses.

3.1 Demonstrator 1: on-site bio LNG production

No monitoring updates about demonstrator 1 since exact scope, content and partnerships are not fixed yet.

3.2 Demonstrator 2: smart energy systems

Monitoring update

The set-up and scope of demonstrator 2 are changing due to the unavailability of the required data to develop the tool. The ideally required data in the port of Rotterdam is not available and will not become available for the demonstrator. The reason for this is that it was difficult to share the data because private companies are operating in the port area. Receiving permission for sharing information about the energy use of customers was not possible. Therefore, the demonstrator explored the data availability of energy systems with other fellow ports within the MAGPIE project. The outcome of the discussions with the other fellow ports is that the Port of Sines is able and willing to share the data regarding their energy system. They are able to share their data because the Port of Sines is also responsible for these activities in their port area, unlike the Port of Rotterdam. This has a large potential impact on the measurements and monitoring process within WP8. Therefore, the experts from WP8 and demonstrator 2 will remain in good contact to keep track of the progress and developments.

Social acceptance / spatial impact

The interview about social acceptance and spatial impact was conducted on Thursday 5 October 2023 with demo leader Pedro Vergara Barrios and Neda Vahabzad (TUDelft). The following summarises the interview.

The Smart Energy System contributes to the long-term energy scenario planning of ports. The tool simulates the energy supply and demand in the port. Energy congestion on the electricity grid can be made visible and solutions can be implemented. Therefore, energy sources will be used more efficiently than before the implementation of the smart energy system. The better management of the energy system leads to less energy losses. Consequently, less energy infrastructure needs to be built to answer the increasing (renewable) energy demand in the ports. As a port going through an **energy transition**, less investments need to be made as a port authority in the expansion of the energy infrastructure to answer the energy demand. The supply of energy is increased by using the available energy sources more efficiently instead of expanding the energy infrastructure which requires resources and construction resources. The expansion of the energy infrastructure consists of cables, substations, transformers and more. The construction of these facilities require space. Considering that the indirect objective of the tool is decreasing the energy losses on the grid and using less resources for an increase in energy supply, the tool contributes to the **circular economy**.

Additionally, construction and maintaining energy infrastructure has an impact on biodiversity and vegetation. Animals, such as birds, cannot touch the cables and the area needs to be kept clean from vegetation in order not to interfere with the energy system. The implementation of the smart energy system has indirectly a smaller spatial impact and therefore less impact on the **biodiversity**. Areas of the port – which could have been used for the expansion of energy infrastructure to answer the energy demand – can be preserved for nature with the benefits for biodiversity. Additionally, less construction activities lead to less construction nuisances (such as noise) which benefits the relationship between the port and the cities.

The implementation and use of the smart energy system requires analytical skills to be able to understand the output for the energy management. The output of the smart energy system needs to be analysed and decisions must be made based on the output. The tool will not necessarily lead to job creation or loss. The required skills for system operators and energy managers might change and has an impact on **human capital**. During the development of the smart energy system opensource papers are shared and therefore the scientific community can benefit from the knowledge of the developments of the demonstrator.

The demonstrator contributes to the energy transition, circular economy, biodiversity, port-city interface and development of human capital. These themes are defined as sub themes for social acceptance. Based on these themes and the current provided information, no setbacks in terms of social acceptance are expected. However, the only downside is data acceptance and willingness to share data. The impact of the smart energy system depends on the available data regarding the electricity grid and the energy management. In the Port of Rotterdam, it was difficult to share the data because private companies are operating in the port area. Receiving permission for sharing information about the energy use of customers was not possible. On the contrary, the Port of Sines is also responsible for the activities in their port area. Therefore, the Port of Sines is able and willing to share data about the energy data use.

In terms of spatial impact, the implementation of the smart energy system has an impact on the required amount of space for energy infrastructure to meet the (increasing) renewable energy demand. Considering that less expansion and construction is required for the energy infrastructure, the tool has a positive impact in spatial terms.

3.3 Demonstrator 3: shore power peak shaving

Monitoring update

The scope of demonstrator 3 is changing, due to the fact that one of the partners withdrew from the project. The demonstrator will now feature a vessel of Heerema with battery on board of a vessel instead of a battery on land. This way the peak shaving of shore power grid will be carried out with the help of a battery on board of the vessel. A meeting is planned between all stakeholders in demonstrator 3, where WP8 experts will also join to discuss (in amongst) the measurements of the KPIs and the monitoring process. The baseline measurement is not completed yet (values are still missing), which is part of the discussion during the meeting.

Besides the developments within the scope of the demonstrator, there are also developments with regards to mock-up testing which is done in a field lab by TNO. This is an energy management system with batteries, small wind turbines, electrolysis, where various scenarios will be tested, simulated and analysed. WP8 has kept track of these developments and will remain in close contact to see what this (simulated) data might mean for the monitoring process and impact evaluation.

Social acceptance / spatial impact

An interview has not been conducted with Demonstrator 3 at this time but will be planned as soon as possible.

3.4 Demonstrator 4: ammonia bunkering and storage

Monitoring update

The monitoring process with regards to the ammonia bunkering is constant. The baseline measurements have been completed as much as possible. The developments within the demo do not allow the impact measurements yet. The demonstrator has conducted the gas dispersion study and hazardous study. These studies are almost finished, and the final step is sharing these studies across the MAGPIE partners. These studies are relevant for the monitoring impact of the demonstrator because it provides information about the safety measurements and spatial requirements. Additionally, the developments with regards to the ammonia storage terminal are a point of attention within the monitoring process. The initial concept of the ammonia storage terminal has been assigned. WP8 will remain in contact to discuss the possibilities to include these elements in the monitoring process of WP8.

Social acceptance / spatial impact

The interview about social acceptance and spatial impact was conducted on Tuesday 26 September 2023 with demo leader Peter Lystrup Christensen, technology manager at Zero Carbon Shipping (ZCS). The following summarises the interview.

The main objective of the ammonia bunkering and storage demonstrator within MAGPIE is building the safety framework for ammonia. The framework will be next step in the use of the alternative fuel ammonia. Ammonia is considered as a green alternative fuel and ports can be an enabler for the use of ammonia. During the interview it was suggested that ammonia has better scalability opportunities than alternative fuels that are reliable on bio-waste.

As a port going through the **energy transition,** ammonia can contribute to a cleaner energy mix. The ports have different roles in enabling the use of ammonia in transport, such as import, production, bunkering, infrastructure, and storage. These functions of enabling ammonia requires space and therefore the use of ammonia has a spatial impact on the port activities and communities in the **port-city interface**. The airborne emissions of ammonia are considered as dangerous due to the toxicity levels. Animals and the communities near the port can be directly impacted by an accident with ammonia. The societal risks of the use of ammonia should be considered. Therefore, during the demonstrator a gas dispersion and hazardous study are executed. The first results of the studies present that safety zones as a spatial requirement are necessary in the port-city interface. Various factors should be considered before placing a bunkering location of ammonia, such as residential areas and other social spaces. If ammonia disperse into air the toxicity levels are high, spraying the ammonia down decreases the impact. Therefore, water spraying installations should be considered. Additionally, a possible nuisance of the use of ammonia can be the smell and should be considered within the demonstrator.

The use of ammonia affects the shipping industry. During the interview is suggested that the application of ammonia is most efficient for large vessels on the seaside and not for the inland vessels. The demonstrator considers that the dispersion effects are larger when the ship is larger. Two different uses of ammonia for shipping were discussed during the interview. The use of refrigerated ammonia is considered as less dangerous and more efficient for shipping than pressurised ammonia. The use of refrigerated ammonia requires completely new vessels and retrofitting is not a possibility. Considering that retrofitting is not a possibility, the demonstrator does not contribute to **circular economy** in this way. However, the new ship designs can be modular and be considered as circular. In addition, the use of ammonia for shipping can have an impact on the **biodiversity** when a leakage occurs. In comparison to the use of heavy oil in shipping, ammonia has the advantage that it dissolves in water and does not have such a large impact on marine life as a leakage of heavy oil. However, the direct consequences of a leakage of ammonia are not clear yet.

New fuels and energy sources have an impact on the **human capital** in the port area. Additional training for those handling ammonia and those on the cranes due to risks associated to ammonia. Also, the work environment for the employees at the bunkering location will change in comparison to the bunkering activities of traditional activities. The employees will not be near the bunkering point but be in a saferoom and more systems need to be in place near the points of bunkering.

Considering toxicity levels of ammonia, the developments of ammonia can receive resistance from a **social acceptance** perspective. If an accident happens while using ammonia and it impacts the biodiversity and communities in the port-city interface, the use of ammonia will be less acceptable. Therefore, the safety measurements are highly relevant for this demonstrator. Partnerships between port and city stakeholders (e.g., municipalities) are necessary for the implementation of the use of ammonia. As mentioned above the port has different roles as an enabler of ammonia and constructing the required facilities have a large spatial impact which can be a bottleneck.

3.5 Demonstrator 5: offshore charging buoy

Monitoring update

The monitoring process for demonstrator 5 is constant. The baseline measurements are already submitted. The testing of the buoy was/is not planned during the timespan for this deliverable. There have been changes in the design of the buoy due to the business case. The continuous monitoring process consisted of keeping up to date with the demonstrator to keep informed of deviations. In May 2024 the first test session for the offshore e-buoy is planned. We expect the first monitoring results after May 2024.

Social acceptance / spatial impact

The interview about social acceptance and spatial impact was conducted on Friday 6 October 2023 with demo leader Govert Wagenaar, manager at Bluewater energy services. The following summarises the interview.

The e-buoy demonstrator consists of two sub-demonstrators: Charging buoy for the offshore industry and the charging buoy for ships at anchorage. One of the objectives of the demonstrator is to make (green) electricity available for vessels for the offshore (maintenance) vessels and vessels at anchorage. The use of electricity as an energy source for shipping instead of fuels contributes to the **energy transition** in port areas and the shipping industry. The aim for e-buoys in the offshore area is that the buoy is connected to the wind parks at sea. Therefore, the electricity provided by the e-buoy is generated by wind energy and is considered as green. The e-buoys in the anchorage areas will be connected to the electricity grid on land. Whether the used electricity is considered as green, depends on the used energy sources for the supply of electricity on the grid in the port area.

The life cycle of the e-buoy is highly relevant for the business case. The objective is to develop e-buoys with a life cycle of approximately 30 years. The design will consider a cradle-to-cradle method which means that the raw materials that are used can be fully reused without losing their value. Another criterion of the design of the e-buoy is that while detaching the e-buoy the seabed and marine life cannot be harmed. These design considerations are in favour of the **circular economy** and the **biodiversity** on the seabed.

During the interview was shared that outside the scope of MAGPIE research is conducted about the effect of the e-buoy on biodiversity. We need to wait on these exact results to be more detailed about this subtheme. Nevertheless, during the interview we discussed some relevant elements regarding biodiversity. While the vessels are at anchorage, the (diesel) generators can be shut down while connected to an e-buoy. Consequently, the vessels do not need to burn fossil fuels for their energy supply. Hence, the vessels are less pollutive in the port area. Another advantage is that the ship is generating less vibrations, noise and smell which has a positive impact on the marine life, crew members and the port-city interface.

Other important aspects in relation to the **port-city interface** were also discussed. One of the aspects that was raised was tourism. If the vessels are less pollutive in the port areas, it will be more pleasant to visit the port areas as a tourist. Another aspect were the safety zones in the port area. Mainly existing anchorage areas will be used for this demonstrator and safety zones around the e-buoy will be required. Besides that, the e-buoy requires more space on sea for the rotation of the ship around a fixed point of the e-buoy than an anchorage location. The demonstrator leader mentioned they already organised a stakeholder meeting with the wind industry including Shell, Daamen, IHC and other wind park operators. This is mainly important for the application of the e-buoy in the offshore industry. The demonstrator is considering the stakeholder field which is relevant for the implementation of the e-buoy.

Besides organising a stakeholder meeting, the demonstrator organised interviews with captains about the use of the e-buoy. The outcome of the interviews about the implementation of the e-buoy was positive because of the reduction of nuisances on the ship, such as noise, smell and vibrations for the crew members. Due to the reduction of these factors, the comfort of the crew will be improved and has a positive impact on the **human capital**. To be able to use the e-buoy additional training is required for the crew members. Additionally, system operators might need training for the use of the e-buoy.

Considering the positive impact on the energy transition, circular economy, biodiversity and human capital, not much resistance is expected from a social acceptance perspective. One of the aspects that can change this point of view is the biodiversity. If the use of the e-buoy has a negative impact on the seabed and the marine life, more resistance is expected. Besides that, the e-buoy has a spatial impact. Safety zones should be implemented, and space should be considered for the dwelling of the ship. This should not lead to a setback for the implementation of the buoy but should be considered as a port authority for making the space available.

3.6 Demonstrator 6: autonomous e-barge and transhipment

Monitoring update

The monitoring process for demonstrator 6 has made no progress. The partners in demonstrator 6 are still working on the scope, details and content of the demonstrator. The baseline measurements have not been carried out. There is a new leader for demonstrator 6. There have been two meetings between this new demo leader and WP8, but only high level. There hasn’t been a follow up meeting between WP8 and demonstrator 6 to discuss the measurement and monitoring process.

Social acceptance / spatial impact

An interview has not been conducted with demonstrator 6 at this time but will be planned as soon as possible.

3.7 Demonstrator 7: green energy container

Monitoring update

The monitoring process for demonstrator 7 is constant. The partners in demonstrator 7 are still working on the scope, details and content of the demonstrator. The baseline measurements have not been carried out.

Social acceptance / spatial impact

An interview has not been conducted with demonstrator 7 at this time but will be planned as soon as possible.

3.8 Demonstrator 8: hybrid shunting locomotive

Monitoring update

The monitoring process for demonstrator 8 is constant. The vast majority of the baseline measurements is already submitted; only the socio-economic indicators are still under discussion. The delivery of the hybrid shunting locomotive was/is not planned during the timespan for this deliverable. The continuous monitoring process consisted of keeping up to date with the demonstrator to keep informed of deviations, particularly in the delivery time of the locomotive. The test of the hybrid shunting locomotive is planned in 2025. In that year we expect the monitoring results.

Social acceptance / spatial impact

The interview was conducted on 21 September 2023 with Maurits van Schuylenburg, Demo leader and Programme Manager at the Port of Rotterdam. The following summarises the interview.

The aim of the demonstrator is to replace the old diesel engines of shunting locomotives with a battery. With this installation, the train no longer will have to switch between overhead power and diesel power for the last mile, saving on time and reducing emissions. Regarding the spatial impact of this technology, it would be minimal. For the **energy transition**, the same infrastructure is used with regards to rail lines and overhead lines and there is no need for an additional charging space as the battery is charged while the train is running on the overhead lines. If it is used well, it can even reduce the necessary amount of space as the switch between the shunting and diesel locomotive will not have to be done. The need for less space for switching of operations and charging the battery on the track can be seen as reducing the spatial impact on the **port-city interface**. The lack of need to shift from shunting to diesel will also reduce the time needed to deliver goods. The faster turnaround time may lead to an increase in the number of trains travelling daily.

In terms of social acceptability in general, the demo addresses various issues that made shunting locomotives bothersome to users, people living in the vicinity, and to the biodiversity. Through the electrification of the entire process, the hybrid shunting locomotive reduces nuisances, specifically linked to pollution, odours, and noise making it more socially acceptable in the port-city interface. The amount of light pollution will remain the same. Indirectly, the reduction in pollution and other sources of nuisances will benefit the local **biodiversity**. The only danger to biodiversity is if new infrastructure would have to be built during upscaling. In terms of acceptability by the direct stakeholders (e.g., the workers and clients), the demo does not seem to face any major issues in the case of the Port of Rotterdam. In regard to **circular economy**, the lifecycle of the battery is longer than that of a diesel engine – 10 to 15 years versus 7 years respectively – and the hybrid shunting locomotive has a modular design so that the battery pack can be easily switched out. Less nuisances from emissions and noise would also be beneficial to the workers linked to **human capital**. Furthermore, the technology requires only a short training for drivers to best understand how to use the battery pack to its fullest capacity. There is also no job loss or job creation expected but rather a more efficient use of the current workforce as they will not have to switch the train from overhead charging to diesel.

The roll-out issue that is posed with this demo is that the simplicity of the roll-out depends entirely on the status of the infrastructure in place to host the demonstrator. The Port of Rotterdam is one of the most electrified ports in EU, according to Mr. Van Schuylenburg, while other ports have a much bigger surface that is not electrified. For example, the Port of Hamburg does not have overhead lines in most rail lines in the port. Therefore, it may be necessary to consider another source of renewable energy rather than batteries in these cases. For now, TNO considers the opportunities for roll-out limited. However, as the battery pack is modular, other forms of renewable power could be considered.

3.9 Demonstrator 9: green connected trucking

Monitoring update

The demonstration has started, and first trucks are driving. There are also developments with regards to partners that are (getting) involved in the demonstrator. The continuous monitoring process consisted of keeping up to date with the demonstrator and address issues. The baseline measurements are also still work in progress, which is something that receives the utmost attention for WP8 experts.

Social acceptance / spatial impact

The interview regarding social acceptance and spatial impact was conducted with Jaco van Meijeren from TNO on the 5th of October 2023. The following summarises the interview.

Regarding both social acceptance and the spatial impact there were mixed views for the implementation of the tool. The social acceptance of the business model by the direct stakeholders, namely the port community and the acceptance by workers is unclear. Mr. Van Meijeren indicated that the implementation of the demo would require a specific **energy transition** governance and collaboration by a variety of actors – the Port Authority to create the infrastructure, the transport company to organize the drivers, manufacturers of the trucks to roll out the demo, and electricity providers – and a large amount of initial investments. There are various questions to which the demo leader did not have specific answers as they would be case dependent: is the infrastructure public or private? In which ports will the infrastructure be built? Does a reservation system for a charging slot need to be developed? Furthermore, considering the **circular economy** model, as the batteries are not modular, a big question needs to be asked regarding the battery health versus fast charging, requiring further planning for the governance of this tool. There is also a big question about the funding of the new trucking system as the electric trucks cost circa 3.5 times the amount of regular trucks and there are additional costs depending on the energy prices. Will there be subsidies in place to support the shift to the electrified trucks?

In terms of social acceptance there are also issues of the location of charging stations in the **port-city interface**. Depending on the chosen location, indirect stakeholders including citizens may have more trucks passing by and thus more congestion and light nuisance in specific areas. However, the electric trucks would emit less pollution and make less noise. The understanding is that generally, electric trucks are well accepted by indirect stakeholders as they are less emitting but if something does go wrong, it garners more attention. It may also increase social acceptance that, as the trucks are electric, there will be fewer fuel leaks and thus less ground pollution and impact on **biodiversity**.

Regarding the social acceptance of the direct stakeholders, the **human capital** thematic discussion has highlighted inconsistencies. DFDS drivers – who have been asked to test the demo – are sceptical about driving these new trucks. This is largely because they do not know the new technology and are afraid to run empty on battery power. On a more global perspective, Mr. Van Meijeren has indicated that drivers who do have the experience of driving electric vehicles seem to prefer it. It is planned to have more demonstrations of the tool in order to encourage the drivers to use the new trucks. However, as the current drivers of DFDS are reticent to drive the electric vehicles, there is a shortage of drivers with whom to test the demo which may be addressed by autonomous driving. Regarding the autonomous driving aspect, the acceptance by workers may be negatively impacted by the need to film for the purpose of sensors and to monitor. There are ongoing discussions with the workers union regarding what is being recorded and how it may be used. The acceptance of the demo by the port community may also be limited as certain goods, specifically dangerous or chemical goods, may not be transported via electric trucks. Lastly, a new job may be created in the long-term to bring the trucks to the charging station.

With regards to the spatial impact of this demonstrator, it depends greatly on the choices made by the users. It is clear that new infrastructure will have to be built in several ports or port-city interface zones to accommodate the electric trucks but how many charging stations and decoupling points will be built also depends on the choice to make these points public or private. There may also be a spatial impact on the surrounding urban areas through congestion depending on the location that is chosen to place these stations. The size of the location to house the charging station and decoupling points is estimated to be the size of a distribution centre for now.

3.10 Demonstrator 10: spreading road traffic

Monitoring update

The continuous monitoring process with demonstrator 10 consisted of a series of meetings with the experts from demonstrator 10 to keep up to date with the progress of the demonstrator. The five pilots within demonstrator 10 progress on various paces. Some of the pilots are already (almost) finalised, while others are only in the initial phase. The experts from demonstrator 10 use the KPI templates from WP8 in their discussions with the respective stakeholders in the various pilots. TNO as one of the core team partners from WP8 will actively explore the possibilities to work closely with stakeholders in demonstrator 10 in analysing onboard computer data.

Social acceptance / spatial impact

The interview was conducted on 3 October 2023 with Celeste Muilwijk and Liselotte Lorenzo from the Port of Rotterdam. The following summarises the interview.

Overall, the spreading of road traffic aims to diminish the spatial impacts of port activities on the traffic within the port area and in the **port-city interface** zone around it. In the case of Rotterdam, there is no questions regarding the route that will be taken changing if the port traffic is spread to night times. When the demo is rolled out, there may be a spatial impact in regard to which route is chosen by the drivers: the fastest, the most direct one, or the one that circumnavigates the urban areas. Another spatial impact related question that is yet to be addressed is where the cargo will be placed during the night if there is no one in the facilities to accept the deliveries. Is a distribution centre necessary? Another question to consider in the process is where will the trucks park?

Regarding the social acceptance of the demonstrator, it was expected by the demo leaders that it would be welcomed by society as there would be less traffic during the day. A question that was brought up was concerning the increased traffic at night and if this may be perceived as an increase in nuisances for citizens as they will be home and trying to sleep during the time in which port vehicles are driving around. However, by spreading road traffic to the night hours, less emissions are expected to be created, supporting **sustainable mobility**. Apart from this, **biodiversity** could perhaps also be impacted by the night driving due to interruptions to animals who hunt or are active at night. There is also a greater risk of accidents during wildlife crossings at night as the visibility is diminished.

From the direct stakeholders, social acceptance is not expected to be negatively affected when considering **human capital**. There is no additional training expected for truck drivers and there is no decrease in jobs expected. There is a plan in place to first send experienced drivers before with less experienced drivers doing a drive along, so that they may learn and be informed of the technicalities for each location they visit. It is also noted by the demo leaders that it is important to have continuous flow of information at night between the drivers and with the people at the companies where they deliver the goods. Apart from the drivers, it is also important to include other parties in order to triangulate the trips of the drivers to increase efficiency and discuss the procedure of delivering goods during non-business hours. This touches on the thematic of **circular economy** as it would reduce the distances travelled without cargo or to deposit containers from deep sea terminals that cannot be reused.

3.11 Analysis of the monitoring results

The first round of interviews with demo leaders resulted in descriptions and considerations for the implementation and/or deployment of demonstrator projects in the public space, e.g. on the interface between port and city or region. The qualitative approach resulted in a long list of concerns and potential issues that may hamper an effective implementation.

Social acceptance has two dimensions. The first one is whether stakeholders (citizens, companies, NGOs) actively or passively accept a change in policy or embrace new technology. The other dimension is whether it affects people on a macro or micro level, in other words: to what extent does the change / new technology affect people personally. From the demos we have learned these dilemmas also exist with demonstrator technologies in the MAGPIE project. An example is when talking about the green deal, which is a rather passive macro-concept, whereas a company's green port strategy is the active-based application of the same principles in a specific port. Another example on the macro level: decarbonisation policies translate into decarbonisation pathways for active stakeholders, which are dependent on the acceptance of individual companies/consumers to accept a higher upfront investment.

Table 2: Stakeholder groups mentioned in the interviews with demo leaders

Demo	Direct port stakeholders	Indirect city / region stakeholders	Entities beyond city/region, such as
Smart energy system (2)	Port, Customers, System operators	Municipalities	Birdlife
Ammonia bunkering and storage (4)	Port authorities, ship operators, tank terminals	Municipalities, citizens,	Marine life
E-buoy (5)	Captains, crew, Shell, Damen, IHC and other wind park operators, fishermen	Sailing tourism	Marine life
Hybrid shunting locomotive (8)	Port authorities, train operators, port industrial companies	Train drivers / students	Nesting birds
Autonomous trucking (9)	Truck drivers, truck manufacturers, port authorities	Local citizens	Wildlife
Spreading road traffic (10)	Transport companies, shipping companies, warehouses	Exporters, importers	Nocturnal animals, wildlife

3.11.1 Social acceptance

The monitoring framework (see table 8) that we put forward relates to the stakeholders' perception on a micro-level. In other words, whether the stakeholder accepts the implementation in their direct sphere of influence. The scale can either be positive or negative, depending on the perception of a stakeholder group. During the interviews we found that demo leaders were not clear whether the stakeholders have a positive or negative perception on the specific technology. The reason for this ambiguity is that social acceptance is a multi-dimensional concept. Social acceptance has to do with the innovative nature of the technology and the level of awareness of this new technology in people's minds. Stakeholders may have a passive stance on energy transition technology.

Table 3: Output of the baseline measurement with demo leaders - identified social acceptance attributes

Social acceptance	Active opposition	Negative awareness	Passive	Positive awareness	Active support
Safety hazards					
Road congestion					
Horizon pollution					
Light pollution					
Employment					
Productivity gains					
Working conditions (less noise, less nuisances in the workplace, mental health)					
Emissions reduction					
Noise nuisance during the day					
Noise nuisance during the night					
Biodiversity on land (quality of life for flora/fauna)					
Biodiversity in water					
Spills on land					
Spills in water					
Use of new materials / resources					
Use of energy					
Land use (e.g. reclamation)					
Maritime space (i.e. demarcation areas)					

The more aware the stakeholders are of the technology, the better their perception, which then could either be negative or positive. Subsequently this perception may result in either active support or active opposition, depending on how the technology is felt in a personal sphere of influence of the stakeholder. At this stage of the monitoring process, we were able to describe attributes of social acceptance based the synthesis of the literature and the interview results. The presented attributes in the first column are perceived relevant by the demonstrators. The attributes that were presented in literature, but were not perceived as relevant, are not included in de list. The other columns will be filled in a later stage of the research design. Therefore, we conclude with table 8 as the output of the baseline measurement with demo leaders.

The table above can serve as a monitoring overview while monitoring the results about social acceptance. Over time the results and/or perceptions relating to social acceptance can change. Therefore, this monitoring overview can change over time for the specific demonstrators. For example, when an interviewee indicates she/he has not thought of an attribute, but after consideration believes it may have an effect – positively or negatively – the attribute can be placed in the passive column.

3.11.2 Spatial impact

Some demos are likely to have a bigger impact than others. For spatial impact we distinguish this dimension on a geographical scale: spatial impact within the port, in the port-city and region and on national scale. The following table summarises the impact which were mentioned during the interviews with demo leaders.

Table 4: Output of the baseline measurement with demonstrators - identified spatial impact

Spatial impact	Port	City/Region	National
New transport infrastructure			
New storage facilities (e.g. batteries)			
New energy infrastructure (e.g. charging space)			
Scalability (e.g. bigger ships, bigger zones)			
Spreading road traffic over time, e.g. into night hours			
Land reclamation for purpose of transition space			
Contaminated land from leakage, spills			
Light pollution			
Disturbance of nocturnal species (e.g. from night traffic)			
Connections with national energy infrastructure			
Contamination of drinking/ industrial water			
Air pollution (e.g. because of wind / wind directions)			

3.11.3 Coordination mechanisms

When using the space and expanding the port beyond its boundaries, port development companies are confronted with stakeholders who also put a claim on this space in the port-city ecosystem. The interplay between these stakeholders is determined by community dialogues, both with direct as well as with indirect stakeholders. The outcome of these dialogues is the license to operate (1), license to grow (2), also referred to as license to scale, and (3) license to influence. When social acceptance is negative, there are several coordination mechanisms which could be considered. These mechanisms were also mentioned during the interviews with the demo leaders: collaborative governance, new business models, subsidies/incentives, resources management, supply chain collaboration, modular design, scenario planning, life cycle assessments, cradle to cradle design, modular design (WP7, financing, governance).

The last step in the research methodology will be to discuss with demo leaders the coordination mechanisms to accommodate potential conflicts with stakeholders. The following table contains the mechanisms that were mentioned in the baseline measurement.

Table 5: Output of the baseline measurement with demo leaders – coordination mechanisms

	Coordination mechanisms that	
Outcome of social acceptance and spatial impact	reduce negative externalities	generate positive externalities
License to operate	Subsidies Compensation schemes Nuisance reduction measures	Create better working conditions Training programmes
License to grow / scale	Safety zones, safety frameworks Cradle-to-cradle design Modular design / modular production Life cycle assessments	New business models
License to influence		Supply chain collaboration Set up training programmes

4 Cross-demo synergies

This chapter describes the cross-demo synergies and the work that has been carried out to identify these synergies. This leads to the lessons learned and conclusions in the next chapter.

4.1 Workshops 2022

In 2022, WP8 organised a session with all the demonstrators about the baseline measurement. The idea was that all the demonstrators could interact and discuss several monitoring issues with each other. The discussion between the various stakeholders enables demonstrators to learn from each other and enables WP8 experts to facilitate the monitoring process. This could for example be synergies and similarities between the various monitoring processes, but also to share lessons learned and similar findings and results. However, discussing the actual monitoring and measurement issues between each other, turned out to be difficult and we did not achieve the detailed discussion that we anticipated. We took these lessons into account for the general demonstration leader meetings that we organised in 2023, in which the discussion was more between WP8 experts and the demonstrator leaders, rather than between the demonstrator leaders directly.

4.2 General demonstrator leader meeting

As indicated in section 2.4, WP8 organised in cooperation with WP1 (Maarten Flikkema) demonstrator leader meetings. In 2023, three meetings were organised (11 January 2023, 23 June 2023 and 17 November 2023). These workshops were/are used to:

- **discuss the demonstrator's progress.** During these meetings, the demonstrators were provided with the possibility to present their progress and status of their respective demos. This allowed WP8 to remain up to date with the demonstrators.
- **discuss the baseline measurements.** Besides the general update the demonstrators provided an update of the monitoring measurements that the demonstrators carry out in close cooperation with WP8. Eventual questions and issues could be discussed and the discussion between the WP8 experts and the demonstrators, as well as the demonstrators in between each other was carried out centralised.
- **discuss the methods and various components of the WP8 impact monitoring process.** Within these demonstrator leader meetings, WP8 experts have been able to highlight or explain certain elements of the monitoring process. Specific example is the social acceptance approach during the meeting in June 2023, but also more in general about the baseline and continuous monitoring process.
- **discuss the lessons learned.** Different demonstrators encountered different issues during the monitoring process. The demonstrator leader meetings provided an opportunity to discuss these issues. The WP8 experts have shared their lessons learned and other elements that were useful to the different demos. The meetings have also been used to further standardise the input that is provided to the different demonstrators.

The discussion between the various stakeholders enables demonstrators to learn from each other and enables WP8 experts to facilitate the monitoring process. This could for example be synergies and similarities between the various monitoring processes, but also to share lessons learned and similar findings and results.

4.3 Milestones elaboration

Part of the continuous monitoring process is the dissemination and facilitation of discussion between the various stakeholders and partners within the MAGPIE project on the monitoring results. In cooperation with WP1 (Maarten Flikkema), WP8 organised demo leader meetings, in which all the demo leaders, workpackage leaders and other stakeholders in the project could interact and exchange ideas, visions and results. These demo leader meetings are the practical implementation of the milestones that are defined in the proposal (only MS6 so far, MS9 and MS12 later on). The content of these meetings is further elaborated in section 4.2 of this deliverable in the context of cross demo synergies.

5 Lessons learned and conclusions

So far along the monitoring and impact evaluation process we have learned a couple of lessons. The major ones will be discussed here. This chapter will be updated, and new lessons learned will be included in the next deliverables. The major lessons learned so far in the monitoring and impact evaluation are:

- **Timeline for the baseline measurement.** Different demonstrators have different timelines and pace of making progress. Some demonstrators are already in progress or actively preparing, while other demonstrators have not been defined or started yet. For example, the hybrid shunting locomotive has been ordered, but it still takes a couple of years before the locomotive can actually be delivered and the demonstration will begin. The timeline of the monitoring and impact evaluation process needs to be adjusted to the timeline of the demonstrator, rather than the initial idea that all baseline measurements, continuous monitoring measurements and all 'after implementation' measurements are carried out at the same time.
- **Scope of the demos and measurements is only partially defined.** Not all the demonstrators have been clearly defined and determining the scope is sometimes part of the process. This also applies to the determination of the baseline and its corresponding measurement. To a certain extent, this has also to do with the fact that not all the required input for the demonstrators was available.
- **Comparability of results sometimes difficult.** Direct comparison between the different demonstrators is applicable only to a certain extent. Part of the identified indicators are applicable to all demonstrators, however there are also indicators that apply only to part of the demonstrators. Besides that, there are also indicators that are demonstrator specific. With regard to these indicators, there is not really a possibility to compare the results of the demonstrators.
- **Gap between descriptions and actual values.** It is relatively easy for most demonstrators to supply the baseline descriptions. However, most demonstrators have more difficulties with supplying the actual values of the baselines. Describing what the baseline situation looks like is for the majority of demonstrators possible. Providing the actual values of the baseline measurements is proving to be more difficult for some of the demonstrators. This has earlier been explained in the deliverable 8.2 more in detail.

Annex 1: Contribution to the Knowledge Portfolio

According to the requirements set by the European Commission, an annex with the contribution to the knowledge portfolio should be included in the deliverable. Guidelines state that is standard access conditions apply; this section can be skipped. Since D8.2 – Baseline evaluation and prioritization of demo-specific scenarios is of public access, not confidential, does not contain any patent or any other rights subject to embargo, the contribution to the knowledge portfolio is not applicable.

Table A1 – Contribution to the knowledge portfolio: Background

BACKGROUND – BASELINE EVALUATION AND PRIORITIZATION OF DEMO-SPECIFIC SCENARIOS	
Owner(s)	EUR
Nature	Report
Registration/Protection	Not applicable
Description	This report provides a description of the baseline measurement process, including methodologies, values and other characteristics of the current, 'as is' situation.
Access conditions for research in the project / Limitations	Not applicable
Access conditions for use / Limitations	Not applicable
Licensees in the project	Not applicable
Licensees for use	Not applicable

Table A2 – Contribution to the knowledge portfolio: Exploitable Foreground

EXPLOITABLE FOREGROUND	
Type of exploitable foreground	General advancement of knowledge
Exploitable foreground (description)	Not applicable
Confidential	No
Foreseen embargo date	Not applicable
Exploitable product(s) or measure(s)	Not applicable
Sector(s) of application	Not applicable
Timetable for commercial use or any other use	Not applicable
Patents or other IPR exploitation (licenses)	Not applicable
Owner & other beneficiary(s) involved	Not applicable

Table A3 – Contribution to the knowledge portfolio: Patents, Trademarks, Registered designs, etc.

PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.	
Type of IP rights*	Public access
Application reference(s) (e.g. EP123456)*	Not applicable
Subject or title of application*	Not applicable
Confidential*	Not applicable
Foreseen embargo date	Not applicable
Applicant(s) as on the application*	Not applicable
URL of application	Not applicable

Annex 2: Interview guidelines spatial impact and social acceptance

INTERVIEW – DEMONSTRATORS & WP8 SOCIAL ACCEPTANCE AND SPATIAL IMPACT

Introduction

Introduction

- **WP8 (qualitative)**
- **Recording**
- **Introduction**

Set-up

- **Main topics**
- **Main research questions**
- *How will the implementation of the new technology within MAGPIE be influenced by social acceptance?*
- *How will the new technology demonstrated within MAGPIE impact the spatial surrounding of the port-city interface?*

Themes

The main two themes of the interview are Social Acceptance and Spatial Impact. These themes consist of sub-themes we would like to discuss with the demonstrators. The overview of sub themes with corresponding key words is as follows:

- **Energy transition:** Supply of renewable electricity, providing services and products in the field of green energy.
- **Circular economy:** Recycling, exchange of gases and materials, industrial ecology.
- **Sustainable mobility:** Urban traffic and congestion, waterways, non-fossil modalities, smart mobility applications, local mobility authorities.
- **Port-City Interface:** Nuisances (e.g., dust, noise, lights, and smoke), communities, new technologies.
- **Biodiversity:** Rivers and basins linked to the city, local urban spaces, animal and vegetal species living on the port jurisdiction and city area.
- **Human capital:** Education, job creation and loss, new skills and job profiles.

Contact credentials WP8-members

The research is conducted by Maurice Jansen, Caya Hein and Rosanne van Houwelingen

- Maurice Jansen T. 06 81016678 / E. m.jansen@ese.eur.nl
- Caya Hein, chein@aivp.org
- Rosanne van Houwelingen, T. 06 21651513 / E. vanhouwelingen@ese.eur.nl

Figure A1: Social acceptance in relation to MAGPIE

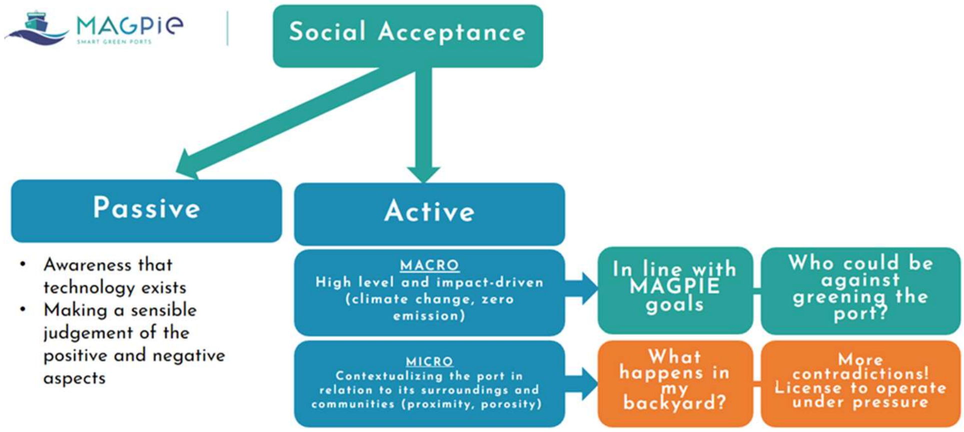
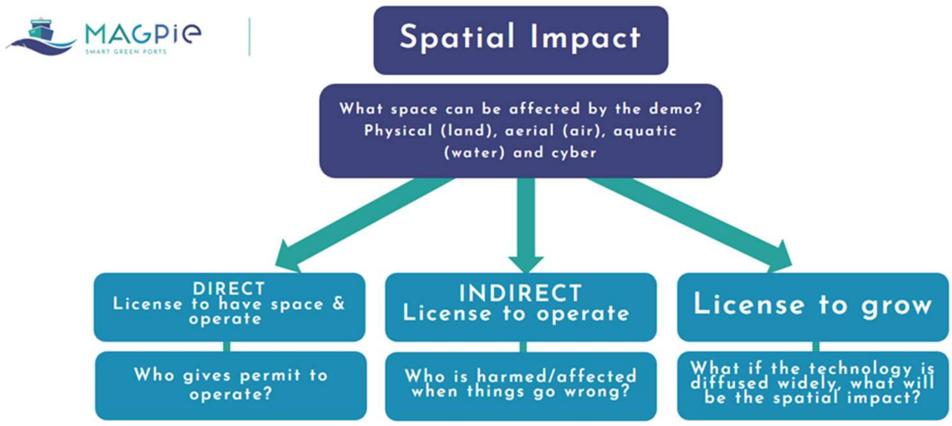


Figure A2: Spatial Impact in relation to MAGPIE



Specific questions per theme Demo

1. Energy transition / Sustainable mobility

Supply of renewable electricity, providing services and products in the field of green energy.

Urban traffic and congestion, waterways, non-fossil modalities, smart mobility applications, local mobility authorities.

- Will the demo be part of already **supply chains/boats**? Are there specific customers involved? Will the bunkering time influence the operations? Comparison LNG

@:

- Size of **production plants? In comparison?**

@:

- Will the zero-emission storage/bunkering use local supply of **renewable electricity**?

@:

- How, where and **what kind of ships** will be bunkered?

@:

- What kind of **partnerships** are required for the functionality of the demo?

@:

2. Circular economy

Recycling, exchange of gases and materials, industrial ecology.

- While designing the storage/bunkering, is the circular economy considered? E.g., modular approaches, life assessment cycle, recycling of parts?

@:

4. Port-City Interface

Nuisances (e.g., dust, noise, lights, and smoke), communities, new technologies.

- In comparison to the current situation (diesel shunting locomotive), will there be changes in noise, light and smoke?

@:

- What type and extent of measures will you implement to **reduce nuisances**?

@:

- Does this demo require a specialized **safety framework**?

@:

- What type of spaces will you plan to welcome school or general public visits on the demo site? How does the demo interact with **citizens**?

@:

- What is the **social acceptability** level for this demo? Have you already experienced set-backs?

@:

5. Biodiversity

Rivers and basins linked to the city, local urban spaces, animal, and vegetal species living on the port jurisdiction and city area.

Is biodiversity a topic within your demo?

6. Human capital

Education, job creation and loss, new skills, and job profiles.

- Does the demo require additional training and safety measures for workers?

@:

- Are new skills required and/or job profiles required and do these require specialized skills?

@:

- How many jobs will be created/lost due to the demo?

@: