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Interview summary:

Promoting low-emission machinery traffic in the companies at Vuosaari Harbour

Helsinki

6Aika Avoimet ja älykkäät palvelut Kuutoskaupunkien yhteistyöstrategia

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Photo: Port of Helsinki / Suomen ilmakuva Oy

Background

This summary presents the current actions, challenges and areas for development related in particular to the green house gas emissions reductions of the machinery in the companies at Vuosaari Harbour.

The summary is based on seven interviews with companies carried out between 31 November 2019 and 31 January 2020. The interviewees selected included persons who are in charge of quality-related and environmental matters and/or machinery technology at companies that use heavy machinery and tugboats. The opinions of the interviewees do not represent the official stances of the companies. In addition to machinery emissions, the interviews also dealt more broadly with the environmental work of companies and the policy instruments of the Port of Helsinki Ltd. The interview outline is presented in Appendix 1.

The interviewees work at companies that have 20–850 employees and that focus on one or several of the following sectors:

- stowage services (such as loading and unloading cargo vessels, cargo unit handling in the port area)
- forwarding and terminal operations (such as cargo handling, storage, distribution, cargo documentation)
- container maintenance and repairs; storage of empty container
- tugging.

The interviews and the summary have been produced as a part of the shared 6Aika: Carbon-neutral and Resource-wise Business Parks (HNRY) project. The project partners include the Cities of Helsinki, Espoo, Vantaa and Turku, Technical Research Centre of Finland VTT Oy, Turku Science Park Oy and the University of Turku. The Helsinki-Uusimaa Regional Council has granted funding for the project from the European Regional Development Fund. The project's website and Twitter.

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Introduction

Being a pioneer in climate work and achieving carbon neutrality are the strategic focuses of the Port of Helsinki and City of Helsinki. They serve as a response to one of the most significant global challenges of our time – climate change. To achieve the climate goals, the entire city needs to commit to climate work – residents and companies included.

Port of Helsinki Ltd, which maintains the Port, has set an objective of being carbon-neutral in terms of its own emissions, but also reducing the carbon dioxide emissions of the entire Port by at least 32% by 2035. The latter goal means that the Port aims to encourage and support the emissions reductions of the companies operating in the port areas.

The Port's goals are connected to the City of Helsinki aiming to achieve carbon neutrality by 2035. This means that, within 15 years from now, the operations in the City's area will no longer contribute to global warming, and 80% of the City's direct emissions will have been reduced. The remaining 20% will have been compensated for, calculated based on the level of 1990. The Climate Watch service of Helsinki, launched in 2018, provides transparent information on the progress of the 147 emissions reduction actions included in the City's carbon neutrality plan. In 2018, the emissions of the City of Helsinki amounted to 2,560 thousand tonnes of carbon dioxide equivalent, approximately.

Machinery traffic accounted for 9% of the CO_2 emissions in the Helsinki harbour areas managed by the Port of Helsinki (Vuosaari Harbour, West Harbour, South Harbour and Katajanokka Harbour) in 2018. Emissions from ship traffic accounted for 79%, other wheeled traffic accounted for 7% and the Port of Helsinki Ltd's own emissions accounted for 5% of the emissions. Vuosaari Harbour is a nationally significant cargo harbour, which specialises in the import of consumer goods for the needs of the metropolitan area. The Harbour's operations mainly involve processing sea containers and truck trailers and serving container and roro (roll on, roll off) vessels, but the Harbour also serves Finland's export traffic and small-scale passenger traffic.

1. Harbour machinery

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1.1 Current climate actions

Vuosaari Harbour uses heavy machinery for processing, storing and moving cargo – particularly containers and truck trailers. Wheeled types of machinery include straddle carriers, terminal tractors, reach stackers, empty container handlers and counterweight forklifts. There are a little over 200 pieces of machinery in the closed harbour area. Other machinery includes terminal roof cranes and large ship-to-shore cranes.

Interviewees mentioned machinery renewals and efficient operation as current ways to reduce emissions:

Machinery renewals and choices

Renewing the machinery was seen as a significant climate action. Both newer and older equipment seem to be used at the Harbour. Some companies raised the point that the new diesel machinery purchased consumes less fuel and produces fewer local emissions (such as NOx, fine particles) than the previous machinery. Some port companies have also procured individual electric forklift trucks. Stowage and container storage can also be implemented with various types of machinery and different storage methods, which may also affect fuel efficiency. One of the examples included the fact that straddle carrier and reach stacker operating methods differ from each other in terms of mileage and the number of pieces of machinery needed.

Using machinery more efficiently

Measures such as route optimisation, economical operation, and avoiding cold-starts and idling were considered important simply to minimise fuel costs and accelerate customer service. The interviewees stated that the development of storage techniques and IT systems, automatisation, and employee training are factors that improve the efficiency of machinery. As for idling, there may be room for development, particularly in the evenings and during breaks. By contrast, route optimisation could not always be influenced as it is restricted by the area divisions within the Harbour.

1.2 Fuels (1/2)

The machinery in the Harbour uses fossil-based diesel oil. Companies monitor the fuel consumption to varying degrees, and many of them have machine-specific monitoring data, including operating hours and litre volumes. Companies also aim to ensure consumption is adjusted to be proportionate to the work quality and weather conditions, among other things, which also affect the consumption levels of machinery.

Lower-emission fuels had not yet been tested in machinery, but there was interest in second-generation biofuels (such as Neste MY renewable diesel currently on the market). As for diesel, wood-based solutions were also discussed as a potential future alternative.

Respondents highlighted the following challenges related to biofuels:

1. Financial reasons

The price of the renewable diesel available on the market is currently higher than that of oil used in machinery, which is taxed more lightly. The price difference is a probable challenge, particularly in the companies where fuel costs make up a significant portion of the expense structure.

1.2 Fuels (2/2)

2. Suitability

Respondents wanted more research information regarding the suitability of biofuels, particularly for older machinery. Proof of functionality was considered desirable concerning the advanced HVO diesel, for example. With older machinery, the lack of manufacturers' warranty approval for a fuel may pose a challenge. These views were based on both the interviewees' own suspicions and discussions with machinery manufacturers.

3. Infrastructure and practical implementation

Simultaneous use of different fuels was mentioned as a potential challenge in a harbour environment. However, it was also felt that moving to renewable diesel could be relatively easy if a new distribution tank were installed next to the old tank and the two tanks were both used.

4. Fuel sufficiency

Discussions about the limited raw material base for biofuels and the sufficiency of the fuels for extensive and long-term use were also raised in the interviews.

1.3 Electrification (1/3)

The interviewees were enthusiastic about electric machinery, and many were of the opinion that it would be a likely development direction in the Port. The benefits seen in electrification involved the lack of emissions, including carbon dioxide, local emissions that worsen air quality and noise disturbances, as well as the lower operating costs compared to diesel fuels. The electrification of machinery can be seen as a solution that reduces carbon dioxide emissions when the electricity is produced from zero-emission or low-emission energy sources. At the time, the wheeled machinery being used was fully electric forklift trucks.

Some interviewees were monitoring the development of the machinery market and/or in discussions with machinery manufacturers. Preliminary studies on electrification had been conducted at a few companies. Based on these, it is possible that electrification could start in the next few years with individual pieces of small machinery, but no detailed schedules for the change were given. This will be affected by both investment opportunities and the technological development, price development and availability of electric machinery. Companies may also keep the plans secret until they are completed.

1.3 Electrification (2/3)

Respondents highlighted the following challenges related to electrification:

1. Infrastructure and practical implementation

The constant need to charge batteries, the high number of charging stations and switching batteries were seen as challenges in the limited and dynamic harbour environment. For example, the battery durability of the forklifts in a forklift pilot project was not sufficient for an entire working day; the batteries needed to be switched in the middle of the day. Switching batteries was seen as a time-consuming activity that could not be done in narrow spaces. In addition to this, it was felt that charging the batteries took too long.

Extensive electrification would require changes to both the terminals and the outer areas. Charging should be quick and available along the normal route, without disturbing the machinery that still uses diesel. The interviewees thought that the potential of electrification could improve rapidly as technology develops. For example, hydrogen-based fuel cell technology could reduce the need to charge large machinery.

Vuosaari's starting point was seen as fairly good in terms of the size of the electrical grid, at least for early electrification projects. Respondents would like the Port of Helsinki to create the conditions for a more extensive change in means of power, for example by providing sufficient cabling. The robustness of the grid was seen as insufficient for the simultaneous quick-charging of large machinery.

1.3 Electrification (3/3)

2. Financial reasons

Respondents considered the purchase price of fully electric or hybrid machinery to be higher than that of equivalent diesel machinery. However, the final prices are also affected by the models of various manufacturers and the deals between sellers and buyers. There was also uncertainty about the repayment times, related to aspects such as the intervals at which batteries need to be renewed. These matters will only be clarified after prolonged use. Similarly, establishing the new distribution infrastructure required by the change of type of power was seen as a significant investment (e.g. charging stations).

3. Selection

The selection of fully electric and hybrid machinery on the market was considered weak (particularly for high-transmission machinery types), or the current models were considered unsuitable for the company's operations and/or northern weather conditions (in terms of battery durability, for instance). However, the market was also seen as developing.

4. Safety and emissions

The occupational safety of electric machinery (e.g. risk of fire in collisions, silent movement, batteries obstructing visibility), batteries' lifecycle emissions, and the challenges related to recyclability were highlighted as potential problems.

2. Tugboats

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2. Tugboats

The technological requirements of tugboats are different from those of other vessels. They need to have both small frames and high power to agilely steer large ships in narrow harbour waters. The power to weight ratio of a tugboat is higher than that of commercial ships, for example, which are designed to travel long distances on the open sea. Additionally, the winter conditions in Finnish ports place additional requirements on tugboats' power profile, since high-power use is common due to icebreaking needs. The lifecycle of the boats is often long (ca. 50 years) and their utilisation rate is usually low (ca. 1,000 hours/year). The following measures were suggested to reduce emissions:

- **Engine development:** The technological development of conventional diesel tugboats, in terms of engine efficiency, heat recovery and filtering, reduces the emissions in itself when replacing the equipment.
- **Biofuels:** As for tugboats' mechanisms, moving to second-generation liquid biofuels would be possible. Nonetheless, questions about finances and fuel sufficiency were raised.
- **New technology:** As for tugboats, the adoption of new technology, such as electric, gas-fuelled or hybrid solutions, was seen as needing further research and development. Alternative modes of powers involve the challenge of packing sufficient energy into a small vessel. On a global scale, there have been tugboat pilot projects, but their focus has been on open-water port solutions and they were considered to be ill-suited for the winter conditions in Finland. Studies are called for to establish the potential for optimising the emissions of various technologies, with the power profile in winter conditions also considered, lifecycle emissions of various technologies, and the feasibility of the solutions in relation to their emissions reduction potential.

3. Other environmental work of the companies

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3.1 Environmental programmes and emissions calculations

Some companies are using or working on a (certified or uncertified) environmental programme that directs their environmental work. The companies that did not yet have an environmental management system were interested in the idea.

The interviewees were interested in establishing out their emissions and emissions reduction potential. A few companies had calculated their emissions by means such as charting their emissions sources or studying the emissions impact of new machinery purchases, or were planning to calculate the emissions. Interviewees had also had positive experiences of software that can calculate the climate impact of machinery and monitor the energy consumption of the company.

The carbon footprint and carbon neutrality were seen as partially unfamiliar concepts, but the respondents were interested in understanding them more deeply.

3.2 Electricity and heating

In the companies interviewed, electricity is needed for indoor and outdoor lighting, temperature-adjusted containers and machinery, whereas heat energy is used for heating properties. As for electricity and heating, energy efficiency has been improved by installing LED lights in terminals and using heat recovery technologies. Vuosaari is within the distribution area of energy company Helen's district heating, which means that the emissions reductions planned by Helen also indirectly reduce the carbon footprint of the companies.

The average emissions of electricity production are also on the decrease in Finland, and they are expected to decrease further because of the EU's emissions trading. Some companies hold competitive tendering processes and sign their own electricity contracts with energy companies, which means that moving to eco-electricity is a potential emissions reduction measure for these companies. Eco-electricity refers to electricity produced with renewable energy (such as wind power, hydroelectric power, biomass and solar energy). The electricity has been granted a guarantee of origin or the EKOenergy label. However, eco-electricity's higher price per kWh may become an obstacle, particularly for the companies where electricity makes up a significant portion of the expense structure.

Solar power production

Using roof areas to produce solar power, for example on the terminal halls, was mentioned as a potential emissions reduction measure. The idea of producing solar power as back-up power for electric machinery was also presented. The interviewees would like to see the Port of Helsinki install panels on the scale of the entire Harbour through collaboration with energy companies. This would be more efficient than the actions of an individual company. Some companies have surveyed the installation of solar panels, but they have not taken action due to the weak benefits, for example. Some companies are tenants, which is why installing solar panels would require negotiations with the property owner.

3.3 Waste management

The Harbour area produces wooden, cardboard, metal and plastic waste. The interviewees highlighted the idea of centralising and unifying the area's waste collection: the current waste management was considered inefficient, as each company holds competitive tendering for its respective waste management and several collection vehicles move about in the area, causing unnecessary emissions. Through joint collection, the waste flows could also be directed to be re-used more efficiently. The respondents expressed a need for experiences and examples of joint collection systems in Finnish or foreign industrial areas. The interviewees also wanted to hear the views of the property owners, since many companies operate in rented facilities.

Plastic

As for plastic, the companies seem to produce plastic wraps, protective panels and plastic pallets. The sorting practices for this type of waste varied. The interviewees mentioned that the challenges in plastic recycling include waste containers that fill up quickly, the difficulty of setting suitable recycling targets due to small amounts, and the high price of recycling.

4. Policy instruments of the Port of Helsinki

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4. Policy instruments of the Port of Helsinki

The Port of Helsinki Ltd was seen as the party that creates the framework for the operations in the harbour. The promotion and direction of environmental matters were also considered an increasingly important part of sustainable business. The Port's profile in climate work and its ambitious climate goals may be potential competitive advantages over other ports. Regardless, the interviewees expressed concerns over ship traffic moving to rival ports if the costs of the climate actions fall on the users of the port.

The maintenance and development of the port area infrastructure were considered a part of the Port's direction. As for electric machinery, securing sufficient electricity distribution was a recurring topic in the interviews. The impact of the Port's area distribution on the length of transport routes also evoked discussion.

Of the Port's policy instruments, the interviewees saw the use of incentives as an important measure. Financial incentives, in particular, could steer companies in the desired direction. The various shared projects coordinated by the Port were also seen as positive steering that could bring the needed profitability and leverage to achieve changes. This could include a solar power project implemented in co-operation between the Port and energy companies, or a more extensive EU-funded project for promoting the electrification of machinery or finding new technological solutions.

Due to intense competition, the level of co-operation between companies in the Port was seen as relatively low. Joint forums have been held by the Port of Helsinki, and the Port was also seen as a natural host for shared events. The Port was seen as a suitable umbrella organisation for environmental co-operation, as environmental solutions concern the entire Port. Respondents felt that it would be possible to activate co-operation by promoting information and experience sharing between companies, for example.

5. Conclusions and suggestions for improvement

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5.1 Conclusions (1/2)

The climate work of Vuosaari Harbour is still in the early stages in terms of machinery. However, emissions have been reduced by means such as optimising transport and making it more efficient, and by purchasing newer equipment. It seems companies are willing to reduce emissions. This will to act is influenced by the operators' personal motivations for preventing climate change, brand benefits for companies, and customers' and shareholders' increased demands of proven environmental work.

It is still too early to say which alternative types of power the Harbour's machinery will use in the future. Second-generation biofuels, such as renewable diesel, could be a partial and interim solution on the way toward zero-emission machinery. However, the high price of the fuel and the questions about suitability are a challenge when considering moving to new fuels. The limited raw material base and the increasing demand are also raising questions on the supply's long-term development. It remains to be seen if the development of renewable fuels will also bring long-term solutions with it.

The electrification of machinery is seen as a long-term zero-emission solution that would advance gradually as the machinery is renewed. It is possible that companies will pilot individual fully electric or hybrid machinery in the next few years, but extensive adoption of electric machinery is still a distant goal, and its schedule cannot be predicted from the interviews. The topic involves many uncertainties, such as the suitability of machinery for a harbour environment, the technological development of machinery and batteries, price development and availability of the machinery, the economic situation and the development of other alternative fuels. Other future fuel solutions suitable for harbour machinery may be methane (LNG, CNG, biogas) and hydrogen.

5.1 Conclusions (2/2)

Based on the interviews, emissions reductions and withdrawing from fossil fuels in port operations, as well as in machinery, is a likely trend. However, the price competition within the Harbour and between harbours was seen as a challenge in adopting new solutions; this means the solutions need to be grounded in cost efficiency.

Of the Port's policy instruments, financial incentives, in particular, were seen in positive light, and they may accelerate the adoption of cleaner solutions. Climate work could be boosted by nationalising the carbon neutrality goals of harbours, making information sharing more efficient and allowing tests and development through shared projects, for example.

5.2 Suggestions for improvement (1/3)

Biofuels

- Providing Harbour companies with expert information on the use and suitability of biofuels, particularly of the renewable diesel on the market, for machinery. Information on the potential of biofuels as a long-term climate solution seems to be interesting to companies (in terms of raw material base, price and technological development, among other things).
- Discussing the warranty matters of advanced biofuels, such as renewable diesel, with various parties, particularly regarding older machinery.
- Piloting renewable diesel in the Harbour's machinery. Warranty matters may not concern all machinery (particularly the newer pieces) or machinery manufacturers, therefore, it may be possible to test the fuels, at least partially. In addition to the pilot, it would also be possible to survey the necessary changes to the Harbour's infrastructure, distribution and practical implementation in preparation to extensive use of new fuels.
- Surveying which policy instruments the Port can use to encourage companies to use renewable diesel. Financial incentives, in particular, may lower the threshold for moving to renewable diesel.

Other fuels

- Identifying other future fuels at the harbour and their potential for use in machinery. Potential fuels include methane and hydrogen.

5.2 Suggestions for improvement (2/3)

Electric machinery

- Surveying the potential to support the test use of electric machinery, and possibly other alternative types of powers, in the harbour area. Electrification involved uncertainty related to charging needs, battery switching, maintenance, performance and safety, amongst other elements. The companies' investment decisions could be accelerated by testing the machinery in a harbour environment. It seems it is difficult for companies to get machinery from providers for free test use. Leasing agreements could be one way of allowing testing.
- Increasing companies' theoretical understanding of electric machinery and existing pilot projects. For example, the INTOPORT project studied the potential of alternative fuels and electric forklifts in HaminaKotka Harbour (final report).
- Preparing a preliminary schedule for using electric machinery in Vuosaari, led by the Harbour companies. To prepare for infrastructural changes in advance, it would be useful to have an idea of the schedule, particularly for an extensive change, for example at five-year intervals.
- Surveying the capacity of the Harbour's current infrastructure for electrification, as well as the needs for change for more extensive electrification. Based on the interviews, the infrastructure of Vuosaari Harbour is estimated to be sufficient for early electrification measures.

5.2 Suggestions for improvement (3/3)

Companies' work for the climate and environment

- Surveying the emissions sources of companies, calculating the carbon footprint and surveying reduction actions support the consistent climate work of the companies. Examples of support:
  - The Central Chamber of Commerce offers the Climate Commitment label to companies that calculate their carbon footprint and prepare a roadmap towards carbon neutrality (subject to a fee).
  - The Climate Partners network is intended for companies that want to take part in making Helsinki a carbon-neutral city. The companies that join Climate Partners sign an environmental commitment with the City, and each company specifies its own environmental goals in this commitment.
- Extensive environmental work is carried out through the environmental programmes or systems of companies. SMEs in particular that are only beginning their environmental work benefit from lighter environmental systems that help them advance in environmental work in a practical manner.
  - EcoCompass is certified environmental management system that offers a light tool particularly to SMEs (subject to a fee).
  - Stiia Solutions, a part of Satamatieto Ltd, offers visual and web-based SeeS software for smart environmental reporting, energy management, emissions monitoring and prevention (subject to a fee).

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APPENDIX 1. INTERVIEW OUTLINE

Lower-emission machinery and logistics solutions in Vuosaari Harbour

Introduction
- Carbon neutrality goals of the City of Helsinki and Port of Helsinki for 2035

Company background
- Company and its operations in Vuosaari Harbour; tasks

Customers/business
- Customers, subcontractors and partners in Vuosaari (potential case example)
- Business prospects and future development

Co-operation
- Current co-operation between companies in Vuosaari; related needs; co-operation in climate/environmental matters
- Role of the Port/City of Helsinki in the Harbour's development
- Co-operation with the Port; Port's policy instruments

Machinery/logistics
- Machinery and fuels used
- Current methods of reducing emissions of machinery/making fuel consumption more efficient
- Future machinery and fuels/motive powers
- Methods of promoting cleaner solutions; obstacles/hindrances of development
- Incentives and policy instruments

Environmental values
- Current status of monitoring and measuring the climate impact of the company; current status of emissions reductions
- Environmental programmes used
- Areas for improvement

Waste/resource-wise operations
- Key waste flows; current status of monitoring of waste volumes and reducing waste (especially plastic)
- Areas for improvement

Future Vuosaari Harbour
- Vuosaari Harbour in 5 and 15 years
- Carbon-neutral Vuosaari Harbour

Co-operation with the HNRY project
- Project progress; participation opportunities; wishes