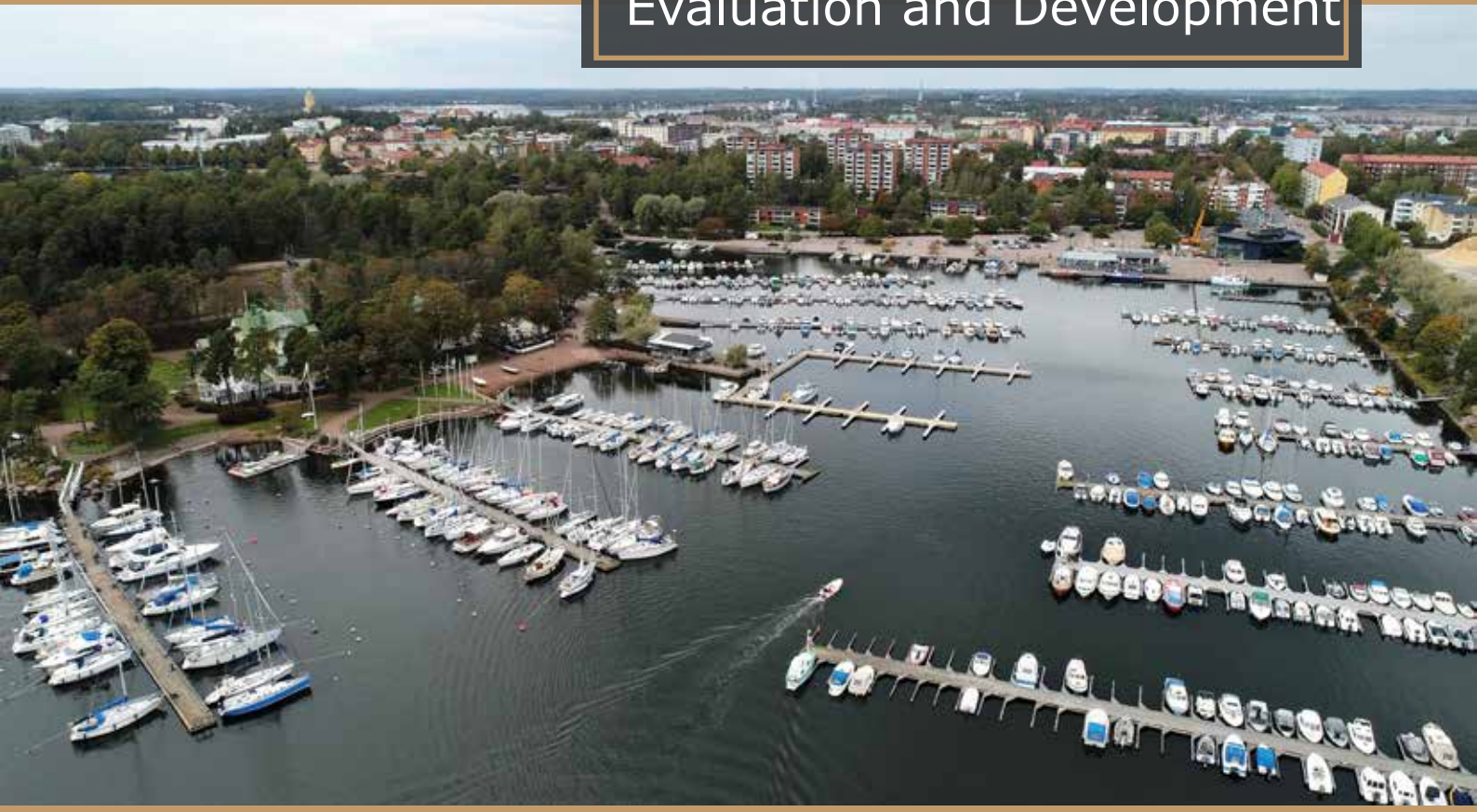
Energy Efficiency in the Small Ports

Evaluation and Development



EUROPEAN UNION
European Regional Development Fund

Interreg
Central Baltic

CB SMALL PORTS

CBSmallPorts - Energetic Small Ports in the Central Baltic Region -

Satakunta University of Applied Sciences

2022

Pori

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Project: CBSmallPorts CB845: Energetic small ports in the Central Baltic region

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1. Purpose of this document

This document gathered experiences and technical information about environmentally friendly and energy efficiency related investments done in small ports within different Central Baltic (later CB) projects of CB programme period 2014-2020. As one outcome A4 type evaluation form (attachment 1) was created for small ports for helping them to analyse their current energy efficiency (EE) situation and for future development tips. The work presented in this report was done in CBSmallPorts activity T1.1.

Moreover, based on the collected information and the information and experience gained in the CBSmallPorts project, best practices on energy efficiency investments were derived for the use of all small ports interested in developing their energy efficiency. In other words, this document is especially for those small ports who want to save energy and cut energy costs.

2. Data collection methods of the report

2.1. Previous CB projects, web pages and publications

In addition to the ongoing CBSmallPorts project, the data collection and best practices for the report are based on the previous projects funded from Interreg Central Baltic and Estonia-Latvia Programmes (2014-2020). More specifically twelve projects were included to Central Baltic program priority P3 'Well-connected regions' and specific objective 3.2 'Improved services of existing small ports to improve local and regional mobility and contribute to tourism development' (http://database.centralbaltic.eu/). In addition, two projects from the ongoing Interreg Estonia-Latvia program have been included in the review. All 14 projects are listed in table 1. Table indicates if the project has included energy efficiency or environmentally friendly investments and lists shortly the other relevant project results that were found. More detailed project information can be found in the project descriptions and tables on the following pages.

Table 1. Small port projects in Interreg Central Baltic and Estonia-Latvia Programmes 2014-2020

Project name	**Energy efficiency (EE) / environmental friendly (EF) related investments**	**Other relevant results**
Interreg Central Baltic projects		
30MILES - Smallport every 30 miles apart Development of services for lively water tourism in the Eastern Gulf of Finland	NO	Investment planning tool for sustainable small ports
Arc Gate - Innovative Service Points for Maritime Tourists	YES 8 flexible modules	
BATSECO-BOAT - Best Available Technologies of Sewage Collecting for Boat Tourism	YES Sewage collecting solutions	Practical guide

FamilyPorts - Green and Family-friendly gArchipelago Ports	YES	
INTROSERV - Development of Integrated Trossi Service in Baltic Sea Region	NO	
MASAPO - Development of Maritime Safety in the Small Ports in the Baltic Sea Region	NO	
PortMate - Safely connected and sustainable small ports in Central Baltic region	YES (EE and EF)	Practical guide
SEASTOP - Modern ports in historic waters	YES Upgraded environmentally sustainable facilities	
Smart Marina - Contemporary harbours with soft energy technology	YES (EE and EF)	
SmartPorts - Modern and attractive small ports network through cross-border interactive information system, joint marketing and improved port services	NO	
Sustainable Gateways - Small ports - sustainable gateways to coastal national parks	YES (EF)	
Interreg Estonia-Latvia projects (ongoing)		
ESTLAT harbours	YES (EF)	
EASTBALTIC HARBOURS	YES (EF)	

For previous Central Baltic projects, information was gathered e.g. through their websites and publications. The basic idea was to go through the information the CB projects has produced on the themes of the energy efficient and green investments. Below is a brief summary of the projects reviewed. The Euro amounts mentioned under Total budget are divided into the total project budget and the ERDF (European Regional Development Fund) amount in brackets, which means the share of the funding program.

30MILES - Small port every 30 miles apart (Development of services for lively water tourism in the Eastern Gulf of Finland)

The project 30MILES (table 2) aimed at improving the overall service level and safety in small ports and waterfront. In practice the project established a ring of ports around the Eastern Gulf of Finland to focus on joint development of sustainable port

services and marketing activities. As a result of the project service level increased in 12 small ports in the Eastern Gulf of Finland.

The result was achieved with several infrastructure investments in the ports, by creating a network for the small ports and a route risk analysis related to boating in the Gulf of Finland. 12 different ports and 12 project partners from Finland and Estonia were involved in the project. The project increased the safety and accessibility of the ports in collaboration with relevant sailing and port safety officials.

30MILES also created an investment planning tool for sustainable small ports. The tool is based on the gained understanding and collected data, concerning the aspects of sustainability in the small port context. A user manual and the model code are published on the project web page and are free for anyone to use.

Table 2. 30MILES project basics

Project name	30MILES - Small port every 30 miles apart Development of services for lively water tourism in the Eastern Gulf of Finland
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Southern Finland - Estonia
Duration	01.09.2015 - 30.11.2018
Total budget (ERDF)	€ 3 301 746 (€ 2 601 314)
Project database / web pages	http://database.centralbaltic.eu/project/17 http://www.30miles.info/

Arc Gate - Innovative Service Points for Maritime Tourists

The aim of this project (table 3) was to open the "gates" to maritime tourists who don't have a boat or knowledge about the peculiar travel conditions that apply each day. The project aimed at increasing the service at these "gates" and to get the infrastructure in place so that tourists can find their destination without worrying about how to return home. In the framework of the Arc Gate project 13 travel hubs "Service Points" in the Stockholm and Finnish Archipelago were identified. These service points are all connected to public transport.

The main results at 13 service points in the archipelago was better digital information about timetables and tourist information including maps. The project results contribute to a more local, "green" tourist economy. All Arc Gate small ports (Dalsbruk, Kasnäs, Nagu, Pärnäs, Heponiemi, Galtby, Baggö, Sommaröstrand, Ekenäs, Sollenkroka, Möja, Årsta Brygga, Utö (Sweden)) will have digital information screens. Additionally, 8 solar powered flexible modules will be installed in the ports.

Table 3. Arc Gate project basics

Project name	Arc Gate - Innovative Service Points for Maritime Tourists
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.05.2020 - 31.12.2022
Total budget (ERDF)	€ 1 109 782 (€ 832 337)
Project database / web pages	http://database.centralbaltic.eu/project/127 https://www.regionstockholm.se/verksamhet/Regional-utveckling/landsbygd-och-skargard/arc-gate/

BATSECO-BOAT - Best Available Technologies of Sewage Collecting for Boat Tourism

To provide tourists with better sewage services for boats, BATSECO-BOAT (table 4) aimed to improve the capacity and service level of latrine sewage collection in small boat ports in Estonia, Finland, Sweden and Åland. The BATSECO-BOAT project's main result was an actual upgrade of the sewage collecting services in a number of small boat ports (altogether 18 ports) in Estonia, in Finland and in Sweden. Investments were made in the best available technology of sewage collecting, both new and renovated pump-out stations.

Table 4. 3BATSECO-BOAT project basics

Project name	BATSECO-BOAT - Best Available Technologies of Sewage Collecting for Boat Tourism
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.12.2017 - 31.05.2021
Total budget (ERDF)	€ 1 479 085 (€ 1 140 184)
Project database / web pages	http://database.centralbaltic.eu/project/87 https://www.batseco-boat.eu/

CB FamilyPorts (Green and Family-friendly Archipelago Ports)

Four small ports (two in south-west Finland and two on Gotland island in Sweden) made investments into service buildings and green technology. The new/improved service buildings also provide the companies running the ports an opportunity to boost the marketing of the ports. The project (table 5) made a joint architectural vision for small ports in Nagu, Dalsbruk, Lickershamn and Ronehamn, to address the need for high-quality, green, functional and accessible services. The concrete results of the project were:

- In Nagu (Finland): A service building with a family sauna and a separate dish washing station were constructed, and boat chargers were bought.
- In Dalsbruk (Finland): Service building, electricity system, solar panels and boat charger.
- In Ronehamn (Sweden): A new service building was built, including solar panels.
- In Lickershamn (Sweden): The service building was renewed, and a sanitation building was built. Solar panels were installed and a module for automatic check-in was installed.

Table 5. CB Family Ports project basics

Project name	CB FamilyPorts Green and Family-friendly Archipelago Ports
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.07.2016 - 31.03.2020
Total budget (ERDF)	€ 1 045 633 (€ 784 224)
Project database / web pages	http://database.centralbaltic.eu/project/50

INTROSERV - Development of Integrated Trossi Service in Baltic Sea Region

The main objective of the project (table 6) was to create the Trossi Service – a common maritime assistance service tool based on the experience of all Nordic countries and aimed at small boats. This service will provide primary technical assistance to amatorial boaters – small repairs on location, the possibility to tow in the nearest harbor, and information about available facilities for larger repairs as required. The model was initially established in 10 Estonian and Finnish small ports and implemented by regional coordination centers in which local voluntary maritime rescue organizations will offer the technical assistance service in cooperation with the port operators.

Table 6. INTROSERV project basics

Project name	INTROSERV - Development of Integrated Trossi Service in Baltic Sea Region
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Southern Finland - Estonia
Duration	01.04.2020 - 31.03.2022
Total budget (ERDF)	€ 518 816 (€4 20 083)
Project database / web pages	http://database.centralbaltic.eu/project/123

CB MASAPO (Development of Maritime Safety in the Small Ports in the Baltic Sea Region)

The project MASAPO (table 7) aimed at developing maritime safety in small ports in the Baltic Sea Region. The project tackled the lack of information about small ports and safety services in Estonia and Åland. MASAPO raised maritime safety in coastal areas and small ports. The targeted areas include western Estonia and the Åland archipelago. Increased maritime safety was achieved through training and increased capacity of voluntary maritime rescue organizations. Additionally, infrastructure development took place and rescue equipment (rescue boats, personal safety equipment and so on) was purchased in selected small ports. In total, conditions, rescue capacity and service level were improved in eight small ports on Estonian islands (Kõrgessaare, Kärdla, Lõunaranna, Kuressaare, Soela, Suaru) and on Åland islands (Rödhamn, Kastelholm).

Table 7. CB MASAPO project basics

Project name	CB MASAPO Development of Maritime Safety in the Small Ports in the Baltic Sea Region
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.10.2015 - 31.03.2018
Total budget (ERDF)	€ 1 178 136 (€ 953 597)
Project database / web pages	http://database.centralbaltic.eu/project/41

PortMate - Safely connected and sustainable small ports in Central Baltic region

Project (table 8) worked during end 2016 - end 2019 to improve services in 19 small ports in Finland, Sweden, and Åland (Rauma, Gävle, Söderhamn, Kökar, Sottunga and other small ports nearby). A considerable part of the project budget and resources was devoted to the upgrade of investments – service houses, waste management solutions, drinking water, lighting, renewable energy by solar panels, etc, which is a valuable achievement that is used by boaters and other small port users today and during coming years. The project also worked on resource efficiency in the small ports. As a result, a practical guide on technology, purchasing & installation, and perfect small port within resource efficiency: best practices and sustainability were developed. In addition, guidance videos on resource efficiency solutions and installations were released. The resource efficiency was considered also as much as possible when upgrading investments in the small ports (using led lights, placing solar panels).

Table 8. PortMate project basics

Project name	PortMate - Safely connected and sustainable small ports in Central Baltic region
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.11.2016 - 31.12.2019
Total budget (ERDF)	€ 2 725 455 (€ 2 044 091)
Project database / web pages	http://database.centralbaltic.eu/project/66 https://www.portmate.eu/

SEASTOP - Modern ports in historic waters

SEASTOP (table 9) enabled infrastructure investments in 18 small ports in the Stockholm, Åland and Turku archipelago. The main common challenge was to develop and broaden tourism and overnight stays by upgrading the service levels in the ports. SEASTOP engaged 5 experienced and financially strong project partners and 21 existing small ports in Sweden, Finland and the Åland islands. The planned investments lead to around 550 meters of new floating jetties, upgraded environmentally sustainable facilities, such as water, toilets, electricity, showers, saunas, boat toilet discharge systems and waste recycling. The project, amongst other things, led to the development of 300 new mooring places and new water and sewage systems. The investments transformed the participating ports into attractive stops, as well as enhancing regional economy and mobility.

Table 9. SEASTOP project basics

Project name	SEASTOP - Modern ports in historic waters
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.12.2017 - 28.02.2021
Total budget (ERDF)	€ 3 779 336 (€ 2 834 502)
Project database / web pages	http://database.centralbaltic.eu/project/77 https://seastop.se/

CB Smart Marina (Contemporary harbors with soft energy technology)

The aim of the project (table 10) was to help harbors transform into attractive and modern ports by connecting harbors & other relevant actors across CB borders to jointly enhance the level of services. The motto of the entire project was: "Opening the door to a destination". As a result of the project, a visitor-friendly harbor was opened not only for (boat)tourists but also for hikers, cyclists, families from the village nearby/beyond. As a result of the project there are 32 harbors in the Archipelago with increased number of services and improved service level; dockside pedestals with drinking & non-potable water, laundry possibilities, modern mooring, ship logs, BerthMaster online etc. are a definite part of available services in invested harbors.

Table 10. CB Smart Marina project basics

Project name	CB Smart Marina Contemporary harbors with soft energy technology
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.02.2018 - 30.04.2021
Total budget (ERDF)	€ 8 205 287 (€ 6 243 202)
Project database / web pages	http://database.centralbaltic.eu/project/84 https://www.smartmarina.eu/

SmartPorts - Modern and attractive small ports network through cross-border interactive information system, joint marketing and improved port services

The project SmartPort (table 11) aimed at improving and integrating the network of small ports via modern information and communication technology. The project increased the service quality of small ports in the Central Baltic region and helped to create better awareness about marina networks to double the number of visitors by the sea.

In the project 16 small guest harbors were improved with better infrastructure and safety in four countries (most ports in Estonia and Latvia). Ports invested in new safety and environment protection equipment to make ports more secure, sustainable, comfortable and to provide better services in harbors. Ports purchased navigation marks, buoys, meteorological stations, directional lights, and improved port facilities.

Table 11. SmartPorts project basics

Project name	SmartPorts - Modern and attractive small ports network through cross-border interactive information system, joint marketing and improved port services
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Central Baltic
Duration	01.10.2015 - 30.09.2017
Total budget (ERDF)	€ 1 455 658 (€ 1 225 260)
Project database / web pages	http://database.centralbaltic.eu/project/32

Sustainable Gateways - Small ports - sustainable gateways to coastal national parks

The Sustainable Gateways project (table 12) developed small boat harbors located in national parks and nature reserves in the Finnish (4 harbors) and Swedish (3 harbors) outer archipelagos. With the project´s support, these harbors became more sustainable and attractive gateways destinations for boaters. The project focus was on increasing environmental sustainability, customer satisfaction and harbor operators' business knowledge. Environmental sustainability in the ports concerned mostly preserving nature and providing better opportunities for environmental protection. Investments implemented at ports were directly related to environmental protection, such as wastewater treatment, waste collection and improved sanitation or indirectly contributed to it.

Table 12. Sustainable Gateways project basics

Project name	Sustainable Gateways Small ports - sustainable gateways to coastal national parks
Programme Priority	P3 Well-connected region
Programme Specific Objective	3.2. Improved services of existing small ports to improve local and regional mobility and contribute to tourism development
Sub-programme	Archipelago and Islands
Duration	01.02.2018 - 31.10.2020
Total budget (ERDF)	€ 1 730 631 (€ 1 297 973)
Project database / web pages	http://database.centralbaltic.eu/project/94

ESTLAT harbours (Improvement of sailing infrastructure and yacht harbors network building in Estonia and Latvia)

The project (table 13) objective was to improve sailing infrastructure and build a network of harbors in Estonia and Latvia to promote East Baltic as a sailing destination. Purpose of the project investment in Estonia and Latvia were aimed to create standardized and harmonized service levels in harbors along the coastline of Latvia and Estonia (altogether 20 small harbors), which includes safe navigation conditions into harbors, secure environment, and good quality level services in the harbor, easy to access and understand information – while planning the trip, as well during the sailing holiday.

Table 13. ESTLAT harbours project basics

Project name	ESTLAT harbours Improvement of sailing infrastructure and yacht harbors network building in Estonia and Latvia
Duration	15.6.2020 - 30.9.2022
Total budget (ERDF)	€ 3 304 285,93 (€ 2 808 643,01)
Project database / web pages	https://estlat.eu/en/estlat-results/estlat-harbours.html http://www.evak.ee/est-lat-harbours.html

EASTBALTIC Harbours

The project (table 14) objective was to improve, strengthen and expand the sailing infrastructure of the network of harbors in Estonia and Latvia and to promote the East Baltic as a sailing destination. The project will implement activities in two

main directions – investments in harbors and marketing activities of the network. Investment activities will complement the investment activities implemented in EST-LAT Harbours project to avoid overlap and will contribute to the creation of equal safety and service standard level in the East Baltic network.

Table 14. EASTBALTIC Harbours project basics

Project name	EASTBALTIC Harbours Improvement and promotion of the East Baltic Coast harbours network
Duration	1.6.2017 - 31.5.2022
Total budget (ERDF)	€ 10 811 188,53 (€ 9 189 510,21)
Project database / web pages	https://estlat.eu/en/estlat-results/eastbaltic-harbours.html

2.2. Current CBSmallPorts project

The Central Baltic area of CBSmallPorts project was formed by areas in Finland (incl. Åland), Sweden, Estonia and Latvia. The area is known as a boating and sailing region with various types of small ports. E.g. some of the ports are located next to large cities, others in the areas of natural parks. The small ports provide services to boaters and other user groups. In the Central Baltic area, several small ports have already performed a lot of activities and investments both in safety and resource efficiency services during the previous Central Baltic projects (see 2.1. and 4.1.)

In the CBSmallPorts project activities, the main theme was a climate friendly leisure time in small ports, with a focus on energy supply and use — especially on the efficient use of energy by boaters and other small port users. The objectives of the project were achieved through strengthened cooperation. The main reason for collaboration is that despite being located in different areas, the small ports all face the same issues: short sailing season, competition of people's time and limited financial and skills resources for the port development.

In an earlier project report Practical approach to energy efficiency investments in small ports (https://www.theseus.fi/handle/10024/703509) the investments for 14 small ports implemented during the project were described in detail. This report gathers the highlights of that report and additionally uses the survey of 'Energy efficient and environmentally friendly small ports' (attachment 2), interviews and data gathered during 2021 and 2022 for describing best practices on conducting energy efficiency and green investments in small ports. Finally, an A4 type evaluation form (attachment 1) was presented for small ports to self-evaluate their current energy efficiency status and options for future enhancements. Goal in all was that different kinds of small ports could use this report in future development of their own small ports and their energy efficiency.

2.3. Survey to small ports

A '*Energy efficient and environmentally friendly small ports*' (attachment 2) survey was conducted in summer/autumn 2021 to obtain more information. The target group for this survey consisted of two different port groups:

Group 1: The port in this group invested in energy or resource efficiency in the CBSmallPorts project.

Group 2: The port in this group had been involved in previous CB or other projects and the energy efficiency investments made were explored in the CBSmallPorts project.

There were a total of 46 ports in these groups and a total of 28 ports responded to the survey. Table 15 shows the responding ports and their relationship to previous projects. In addition, responses were also received from a few ports that have not been involved in previous projects, but were nevertheless found to be interesting from an energy efficiency point of view.

Table 15. Ports that responded to the survey

Port group	Port name	Country/ Region	Project
1	Lennusadam	Estonia/Tallinn	CBSmallPorts 30MILES
1	Lõunaranna	Estonia/Muhu	CBSmallPorts MASAPO SmartPorts ESTLAT harbours
1	Roograhu	Estonia/ Hiiumaa	CBSmallPorts Smart Marina
1	Kärdla	Estonia/ Hiiumaa	CBSmallPorts Smart Marina SmartPorts MASAPO
1	Orjaku	Estonia/ Hiiumaa	CBSmallPorts Smart Marina
1	Sõru	Estonia/ Hiiumaa	CBSmallPorts ESTLAT harbours EastBaltic Harbours
1	Seili	Finland/Turku Archipelago	CBSmallPorts
1	Sapokka	Finland/Kotka	CBSmallPorts 30MILES
1	Tervasaari	Finland/Hamina	CBSmallPorts

2	Nauvo	Finland/Turku Archipelago	Arc Gate FamilyPorts
2	Taalintehdas	Finland/Turku Archipelago	Arc Gate FamilyPorts
2	Lootholma	Finland/Kustavi	
2	Turku	Finland/Turku	
1	Bläse Kalkbruk	Sweden/ Gotland	CBSmallPorts PortMate
1	Klacksörarna	Sweden/ Söderhamn	CBSmallPorts PortMate
2	Söderhamn city	Sweden/ Söderhamn	PortMate
2	Storjungfrun (Fyrhamn)	Sweden/ Söderhamn	PortMate
2	Pāvilosta port	Latvia/Pavilosta	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Ventspils Marina	Latvia/Ventspils	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Roja port	Latvia/Roja	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Engure Marina	Latvia/Engure	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Jūrmala Yachtclub	Latvia/Jūrmala	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Rīga City Yacht Club	Latvia/Rīga	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Salacgrīva port	Latvia/ Salacgrīva	ESTLAT harbours SmartPorts EastBaltic Harbours
2	Sottunga port	Åland/Sottunga	PortMate SmartPorts
2	Kökar Havspaviljongen	Åland/Kökar	PortMate
2	Käringsund	Åland/Eckerö	Smart Marina
2	Lappo	Åland/Lappo	Seastop

2.4. Interviews and energy audits to selected ports

Based on the results of the survey and the answers of the small ports, two ports were selected for further examination. These ports were Pavilosta Marina in Latvia and Lootholma in Finland. They were interviewed during the winter and spring of 2022 and the responses received were used to compile this report and the energy efficiency evaluation form.

A more detailed study of these two ports was performed using three different parts, as applicable:

1. A written request for additional information by email was made on the basis of the survey responses received by the ports
2. A face-to-face interview deepened the answers already received and provided a more effective and in-depth understanding of the port's resource and energy efficiency.
3. During the port visits, the site was explored in more detail and the necessary measurements and interviews were conducted

Additionally, for Pavilosta Marina more structured energy audit was performed as it was seen as a good way to deepen the understanding of the energy consumption profile of a small port. Audit procedure was based on the energy auditing principles used in Finland in Motiva type energy audits. Motiva is a state funded expertise company related to sustainable use of energy and materials (www.motiva.fi/en/motiva). Motiva trains e.g. energy auditors in Finland.
The Motiva type energy audit constitute generally of following three steps:

1. Analyzing current level and distribution of energy and water consumption (how much?, what time of day/week/year?, where?)
2. Identifying economically viable savings potential with financial calculations (calculations require data on energy/water consumption, costs and tariffs, hourly data, possible in situ measurements)
3. Reporting of proposed actions and further activities (based on the calculations and site visit findings and measurements)

In short, the mission of the Motiva energy auditor is to find economically viable measures that bring savings in energy and water consumption and decrease the CO_2-emissions caused by the energy consumption of the target site. Within the framework of this project and with the limited resources, we focused on the most economically viable electricity saving potential and activities of a single small port.

3. Results of the data collection

3.1. Findings from previous CB projects

Previous projects related to the development of small ports are listed and presented in section 2.1. These projects have been implemented between 2015 and 2022, first completed in 2017. The Central Baltic Program database was used as the main data collection source. This database also provided access to project websites, partners, results, publications, visibility, stories and interviews. Unfortunately, the websites of all the projects were no longer available. In addition, there were challenges in the availability of publications and other written material. Of the thirteen previous projects examined, nine included some form of investment in themes of energy efficiency or environmental friendliness (table 16).

Table 16. Summary of previous energy efficiency and environmental projects

PROJECT	INVESTMENTS INCLUDED	IN-DEPTH INFORMATION AVAILABLE (e.g. reports, publications)
Arc Gate	Investments include 8 flexible modules installed in the vicinity of the service points to develop cycle tourism and give shelter for travelers. The modules are powered by solar energy and have solar panels located on the roof of the module. The users can charge their electronic appliances for free at these modules by locking them into lockers with USB ports and lockable doors.	At the time of the reference, the project was still in progress and no materials had been published
BATSECO-BOAT	Altogether 11 new sewage pump-out stations were installed, of which five are located in Finland, four in Estonia and two in Sweden.	Practical guide: Investing in sewage pump-out stations at leisure craft guest harbors

FamilyPorts	Four small ports; two in south-west Finland (Nagu, Dalsbruk) and two on Gotland (Lickershamn, Ronehamn) island in Sweden made investments into service buildings and green technology. Investments in green technology included boat chargers and solar power plants.	NO
PortMate	Project partnership worked during end 2016 - end 2019 to improve services in 19 small ports in Finland, Sweden, and Åland. A considerable part of the project budget was devoted to the investments and resource efficiency was considered as much as possible when upgrading investments in the small ports (using led lights, placing solar panels).	Practical guide: Best resource efficient technologies in small ports (technology, purchasing & installation) Report: Perfect small port within resource efficiency
SEASTOP	The project led to the development of 300 new mooring places and new water and sewage systems. The investments included 550 meters of new floating jetties, upgraded environmentally sustainable facilities, such as water, toilets, electricity, showers, saunas, boat toilet discharge systems and waste recycling.	NO
Smart Marina	As a result low or renewable energy solutions (e.g. solar panels, combined electricity and water systems) were taken in use in 25 harbors. Smart Marina was the biggest project in the Central Baltic Programme (specific objective 3.2); the total budget for the project was EUR 8.4 million, of which 73% went directly to tangible port investments.	NO
Sustainable Gateways	Investments implemented at ports were directly related to environmental protection (such as wastewater treatment, waste collection and improved sanitation) or indirectly contributed to it.	Publication: Guidelines for Sustainable Harbour Development

ESTLAT harbours	Project investments in Estonia and Latvia were aimed to create standardized and harmonized service levels in harbors along the coastline of Latvia and Estonia (altogether 20 small harbors).	Project is still ongoing at the time of writing this report
EASTBALTIC HARBOURS	Investments include e.g. navigation signs, increasing marina capacity, installing floating piers (with electricity and water equipment), waste and wastewater management, electricity and drinking water improvements, greywater disposal and bilge water facilities.	Project is still ongoing at the time of writing this report

With regard to previous CB projects, it can be said that material related to energy efficiency and the implementation of investments was rather difficult to find or did not even exist at all. Within the framework of the available material, this report delved deeper into projects involving investment in resource efficiency and especially trying to find out more information on the four-step investment process model formed in the CBSmallPorts project:

1. Plans and drawings
2. Decision making/selection of products
3. Public procurement
4. Purchasing, installation, initialization

The best related material was found in the BATSECO-BOAT, Sustainable Gateways and PortMate projects. Also the 30MILES project (which did not include energy or resource efficiency investments) published material related to this topic, however.

STEP 1: Plans and drawings

Going forward into the future, small ports need to use the experiences of other small ports in the region to streamline and enhance their own purchasing processes. Small ports are encouraged to collaborate and openly communicate and share, at a minimum, technical specifications, tendering details, supplier information, and matters of pricing.

Planning the project involves analyzing and planning needs and possibilities in a simplified way. Needs and possibilities are identified in the course of planning, e.g., the location and logistic position of the port, possible connections to utilities such as electricity, water supply and sewerage networks, requirements for the technical systems of the station, amount of investment, etc. The outcome of the planning stage should be the terms of reference of the investment project. This is the most important and the most affordable stage of the investment project. In other words – this is the moment when the desired outcome of the investment project, as well as

the ratio of cost to quality, is formulated. (BATSECO-BOAT project 2021)

A key lesson learned in the PortMate project was that more effort and time is needed in the beginning of the investment process to assess technical requirements of all procurement, including costs and time scheduling. (PortMate project 2019)

When examining previous CB project materials, one essential point goes unnoticed; investment financing. The investments involved in previous projects have been naturally funded by various EU funding programs. It is often thought that by providing the necessary infrastructure for boaters use, for example, a proper waste disposal, recreational ports simultaneously invest in good customer service and support sustainable boating. Furthermore, investing in such environmental protection likely strengthens the competitiveness of recreational port business. With this in mind, investments can also be self-financed to improve the business conditions and economic productivity of ports. (30MILES project 2018)

Setting up a small boat port business in remote coastal or archipelago location and environment is challenging. The investments made into a port infrastructure are expensive in relation to the income those can generate and quite seldom just the guest pier business itself and harbor fees from visiting boats are enough to make the whole business profitable. The financial calculations based on the life cycle of a small boat port just do not support the investment being profitable. A small boat port needs to be looked at as a larger entity, including the whole destination or service portfolio with restaurant or cafeteria and leisure time activities. All these form different sizes of additional income flows, and support thus the economic sustainability of the small boat port. (Sustainable Gateways project 2020)

Archipelago tourism is also strongly a seasonal business where the high season is very short and intensive, only 6-7 weeks from Midsummer till mid-August. Sometimes this high season might be even shorter than 6-7 weeks and it contains several risks, most important being the weather risk. Number of sunny days correlates strongly with turnover of a small boat port operator. Seasonality makes the small boat port business very challenging, especially when the weather risk hits the high season. Most of the yearly turnover is collected in June-August and thus it is crucial how successful the high season is. Because of the seasonality, larger investments in particular are quite rare in small ports.This alone underlines the importance of quality planning and calculations. When operating a remote small boat port of any size and especially in archipelagos, it is quite common that the turnover generated from visiting boats (in the form of port fee) is not enough to cover the operative costs of the small boat port and the service portfolio it provides. Operator companies are usually micro size companies and their resources are commonly very limited. Key issue is that these entrepreneurs try to make a living with their tourism business and they should also have an economic incentive and reward for taking the risks of the archipelago tourism business they operate. Otherwise this business could be called as an "expensive hobby". That is, investment calculations, reasonable payback times, and the return on investment (which can be financial, but also marketing value, for example) require very careful consideration and planning of financing options. (Sustainable Gateways project 2020)

The 30MILES project surveyed boaters 'preferences for small ports and their services in the summer of 2016 with an online survey. As part of the query, the respondents were asked to describe the guest harbor of their dreams. Generally, a so-called good harbor is easily accessible, safe and tidy, regardless of the size or range of services provided in the port. The 30MILES query data also repeatedly mentions water faucets, power sources, pump-outs for sewage holding tanks and waste containers, emphasizing their location and functionality. In relation to the guest harbor of the respondents' dreams, when asked to describe a sustainable small port, the respondents of the 30MILES query notably voice again the importance of decent waste disposal. This partly indicates the respondents' preferences for a dream guest harbor are in line with what they consider sustainable. A waste disposal system, including pump-outs for sewage holding tanks is the main issue for respondents regarding a sustainable small port. Other important elements mentioned include an emphasis on safety and the use of solar power or other renewable sources of energy, along with the possibility of purchasing environmentally friendly products, such as detergents. Interestingly, responses rarely consider ecolabel certifications important. (30MILES project 2018)

The 30MILES project also identified the seasonal nature of boating and the challenges it poses to the small port's year-round turnover. In addition, a few year-round services that are significant for guest ports outside the short boating season are mentioned by respondents. These include a restaurant or café, a public sauna by the pool, a gym, massage, marked nature trails and rental of bicycles or other outdoor equipment. It is worth noting that small ports cannot live only on the income brought by boaters, local people must also use the services in the ports. Guest harbors can enable sea recreation in both summer and winter. However, the ice cover sets limits on possible activities. From a port operator's perspective, the results of the 30MILES query disclose a link between economic investments, customer satisfaction and positive contribution to the state of the surrounding environment. By providing the infrastructure that enables boaters to act in an environmentally responsible manner, a guest harbor promotes its own business and competitiveness in the long run. Port actors in 30MILES project suggested improvements to the economy by networking, cooperating more actively, providing a variety of different services, organizing events, increasing marketing, and trying to lengthen the season with different services and events. (30MILES project 2018)

Considering the national and local government rules and legislation that regulates the construction, the harbor owner and/or the person who carries out the investment project must plan and fill the following duties with the appropriate specialists:

- Connecting the different parts of the construction project and coordinating the solutions (logistics and location plan, structural part, electricity, water supply and other solutions)
- Monitoring deadlines and adherence to the budget
- Technical supervision of construction
- Implementation documentation and applying for possible authorisations and approvals from the authorities.

Depending on the specifics and complexity of the project (which means, above all, the desired technical solution), either one or several specialists can manage to perform the functions listed above. This means that employing a whole team of specialists and service providers isn't always necessary. It may happen that the harbor operator themselves has the required skills and competencies in the case of a simpler solution and suitable preconditions, so they can procure and install e.g. the pump-out device and manage the entire investment project. However, if the scope of the investment project includes the design and construction of new utility systems, it would be reasonable to consider involving an external consultant who oversees the process. (BATSECO-BOAT project 2021)

STEP 2: Decision making/selection of products

In terms of Central Baltic funding, flexibility in transferring allocated funds from one investment procurement item to another (which may incur higher than estimated costs during the installation) is absolutely necessary. Some purchases end up requiring more resources than others, despite the initial investment planning. (PortMate project 2019)

Utilizing the experience gained from the investment procedures of the Portmate project, guidance was created for small ports in decision-making, implementation and maintenance of resource efficiency investments. According to the project conclusions before taking the first step to invest in resource efficiency, the port operator should go through the following list of things to consider when planning resource efficiency investments in a port.

Making resource efficiency investments in a port:

1. Recognize the strengths and opportunities of your port. Define the reasons why visitors come to your port. Emphasize the special features of the port to stand out from the other similar small ports.
2. Be realistic of the weaknesses of your port and the threats you might have to encounter. Provide services that fit to your small port's characteristics. Consider the resource efficiency of the services to minimize their environmental impact.
3. Put an effort on the investments that your visitors highly value. Make sure that water and wastewater and recycling is well managed. Tell about the values and act according to them. Make sure that seasonal employees are also committed to them.
4. Remember maintenance and upkeeping. Make sure that all the equipment works properly, and both the property and the outdoor areas are clean and tidy during the whole operating season.
5. Expand operations outside the boating season by providing other services. All-year operation ensures the viability of resource efficient investments.
6. Cooperate with other small ports and other service providers. There is no need for all the same services in all ports, if some of the ports nearby are already providing the service. Let the visitors of your port know about the services nearby.
7. Support the local know-how of resource efficient investments. Tell about your

needs. Local service suppliers with local workforce, equipment and knowledge enables the profitable realization of the investments.

(PortMate project 2018)

STEP 3: Public procurement

Depending on the method and source for financing the investment object (public or private sector, personal funds or financing with support from public funds), the person who carries out the investment project must consider whether, to what extent and in which form it is necessary to prepare and carry out one or more procurements for equipment and services. The purpose of the procurement is to ensure the transparency of the investment, sustainable use of funds and equal treatment of tenderers, and to find a supplier of the equipment with the best price to quality ratio for the contracting entity. An invitation to tender, which specifies the following, must be prepared in order to carry out the tenders:

- terms and conditions of the contract (technical specifications of the object of procurement technical requirements for the devices, composition and volume of the construction and installation work, estimated value of the devices and work, deadlines for completion of the supply or construction work, possible sanctions in the event of breaches of the contract, warranty period, etc.)
- tender forms, which set out which information and in which format the tender must contain so that the submitted tenders are comparable
- additional information to be submitted by the tenderers for the qualification of tenderers, and for the evaluation and comparison of tenders (e.g., prior references, documents certifying the professional qualification of the tenderer's employees in charge, information about the tenderer's economic indicators, etc.).

Based on the submitted tenders, it is possible to assess which tenderer has offered the best price to quality ratio, i.e., with whom the supply, construction and/or installation contract(s) should be entered into. (BATSECO-BOAT project 2021)

3.2. Findings from CBSmallPorts project

During the planning phase of the CBSmallPorts project, the following aspects were identified as the main risks in the implementation of energy efficient investments:

1. Schedule tightness – Staying on project schedule requires good planning and quality implementation.
2. Official paperwork and approval of small port owners – Succeeding in this operating environment emphasizes the importance of smooth cooperation between the stakeholders.
3. Finding the best solutions to small ports with their environmental conditions – The products and materials need to be selected so that they are suitable to sea weather conditions and need minimum maintenance.

4. Maintenance – No investment is eternal without proper maintenance. The agreements guarantee the continuity of maintenance of the investment made by the project also in the future.

During the implementation of the investments, the project partners responsible for the investments made their own observations, which are compiled in the earlier project report 'Practical approach to energy efficiency investments in small ports' (https://www.theseus.fi/handle/10024/703509). In addition, the report brought together the practical work done within investments in small ports and the best practices for energy efficiency in small ports, such as technical specifications, tenders and new technologies used.

The findings are summarized under the following steps, which were also used in the CBSmallPorts project. A new component was added to these steps, named as Communication and cooperation, which connects all steps of the investment process.

STEP 1: Plans and drawings

1. Port operations and investment planning before the implementation (outdated technical solutions can also be found in newly built ports)

In the daily life of port operations, it is good to be precise (relevant documentation and drawings, auditing, decisions and reflections on the necessary investments) and to take the development actions like electrical installations of the port gradually forward. If and when the opportunity comes to implement the planned investments with the help of external funding, e.g. by participating in an EU project, there is no need to waste time on all of this. Plans made in haste are usually not the best ones and may neglect the holistic view. For example, is the current electric network of the port strong enough for the load brought by the new PV system.

2. The importance of planning and scheduling the investment

Projects must always be prepared for possible delays since there are almost always some and their impact on the implementation of the whole project should be considered. In addition, it should be taken into account that the need for special permits is very common when building something new or making bigger changes to existing buildings of infrastructure. These permits and actions could include building permit, hearing of neighbors, permits for changes to historic buildings, water work permit, etc. As one of the partners rightly said, the old phrase "well planned is half done" really holds true.

STEP 2: Decision making/selection of products

As for the selected products, it should be noted that they should operate in a harsher environment than in normal inland conditions. The salty marine environment combined with possible storms, water level fluctuations, intense sunlight and harsh winters places special demands on the durability of the selected equipment. As a

rule of thumb, it can be generalized that the selected products should be kept as simple as possible, because the investments must be maintained for a long time. A simple and durable construction also means simpler maintenance.

Additionally, energy efficiency related technology and equipment mature and get better year by year so it is good to stay up-to-date on this development when selecting products. A good example from this project is the PV system installed in Bläse Kalkbruk offering novel features in increasing the self-consumption share of the produced solar energy and thus increasing the profitability of the investment.

STEP 3: Public procurement

The importance of planning is emphasized at the latest in the tendering stage. The plans and possible drawings must be sufficiently detailed to enable the invitation for tenders to be drawn up with precision. The absence of some relevant information can significantly delay schedules due to supplementation requests or even re-tenders. It is also important to note that all necessary plans and annexes must be attached to the tender documents. Quality invitation for tenders makes it much easier to compare and select from the received offers.

A few CBSmallPorts project sites encountered the problem of obtaining little responses to calls for tenders. The unifying factor in these cases was the location of the site in the archipelago, to which transport connections and access in general is more difficult and time-consuming compared to mainland sites. In general, it can be said that it can be difficult to find contractors, especially for sites in the archipelago. And if they are found, the budgeting and planning should be prepared for higher pricing than in the mainland. During the investment in this project, the impact of the Covid-19 pandemic was also noticed; the rise in the price of raw materials and components, as well as problems with their availability, were reflected in the overheating of the construction market and the rise in the price level of offers.

One of the issues raised concerned tendering methods. In the investments made in the CBSmallPorts project, the selection of offers was almost in every case based on the lowest price. In a project with a tight budget fixed already at the planning stage, this poses certain challenges in the context of tendering. If the port owner making an invitation for tenders does not have very accurate information on market prices, the bids received may come as a big surprise compared to the budget in use. Especially if the investment budgets are drawn up quickly and with low planning. This can easily cause unwanted over or under spending that requires additional management work.

One option could be to use reverse bidding. In this tendering model, the call for tenders is based on the available budget, i.e. the maximum price to be paid has been decided in advance. Here instead of price, bidders compete with other factors like equipment quality and service level. Reverse bidding could produce a higher quality result faster and re-tendering due to high price levels could be avoided. In addition, the money budgeted for the investment could be used more efficiently. This would again ease the work from the project management and modification point of view.

For some of the investments made, it was also possible to use existing and previously tendered framework contracts of the site owner. These should be taken into account already at the investment planning stage. Otherwise, extra work is needed during the tendering process in confirming there are no restrictions for using these existing framework contracts.

STEP 4: Purchasing, installation, initialization

Regarding the implementation of the investments, it became clear that construction work carried out in the archipelago takes longer time and becomes more expensive than the corresponding work on the mainland. In these cases, the importance of logistics and its management is further emphasized. In addition, in the climate and operating environment of the archipelago, weather, wind and water level variations can have an impact on the implementation.

The implementation of the CBSmallPorts project investments also showed that when a site is contracted by several separate contractors, the importance of coordination is significant. It can even be said that it is difficult to coordinate several suppliers in an archipelago environment. Guidance on this challenge could be planning schedules in collaboration with everyone involved.

STEP 5: Communication and cooperation

The importance of communication and quality cooperation can never be overemphasized. Good communication skills are needed and relations between the contractor and customer are very important. As mentioned earlier, also the number of contracted suppliers affects how smoothly the work and communication proceeds. For a few investments, the initial difficulties were due to a lack of real contacts or that they were not immediately found. Especially with investments in municipality owned small ports, finding the right people from the beginning of the project makes the process easier and on schedule. Once the right stakeholders are found and networks created, collaboration and communication must be also maintained during the whole project.

3.3. Survey results and outcomes

The survey was conducted during the summer and fall of 2021 and the last day of the survey was 31.12.2021. The survey was sent to a total of 46 ports, selected on the basis of the criteria set out in section 2.2. The survey was answered at 28 small ports, with a total response rate of 61%. This section reviews the responses based on the survey found in attachment 2 to this report.

General information of the ports

The location of the responding ports was divided according to figure 1. The highest number of responses was received from Finnish ports (27,6% of all respondents) and the lowest from ports of Sweden and Åland (both 13,8% of all respondents).

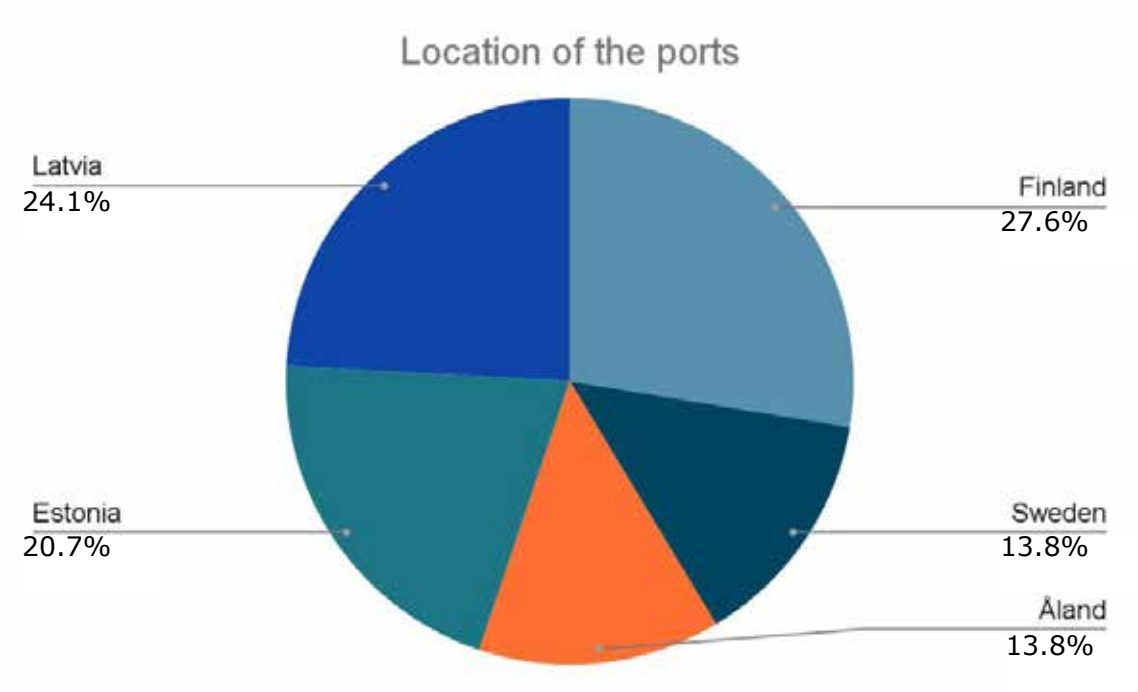


Figure 1. Location of the ports

Ownership of the responding ports is distributed according to figure 2. About 65% of the ports are publicly/municipally owned, 17% privately owned and 17% of the ports falls into the category of some other form of ownership.

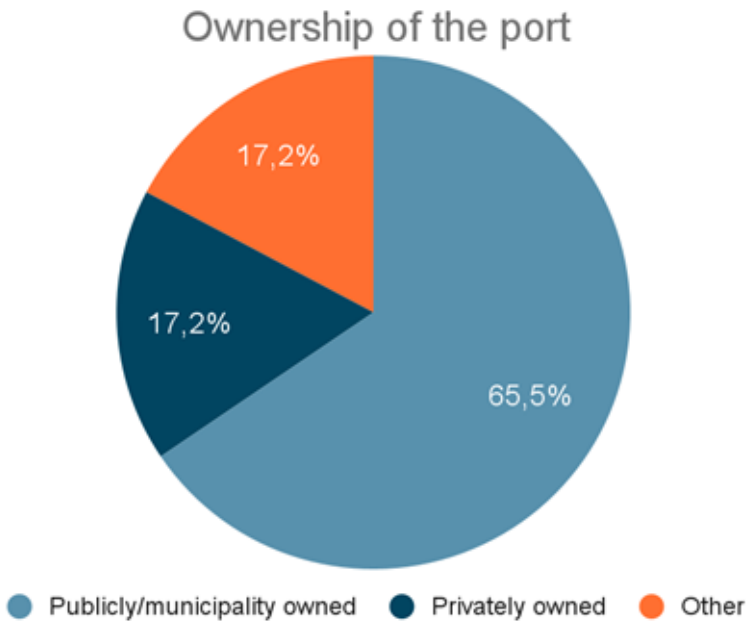
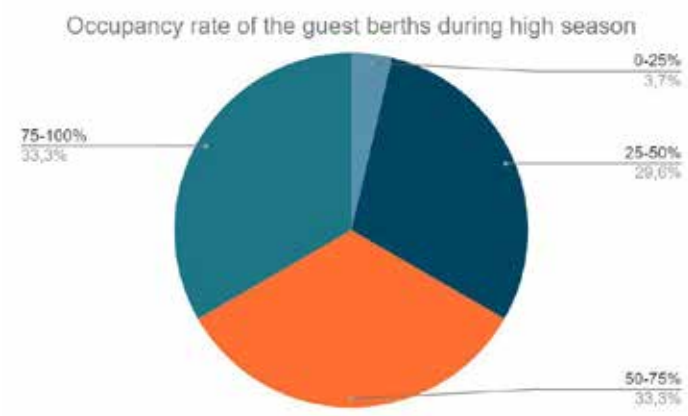
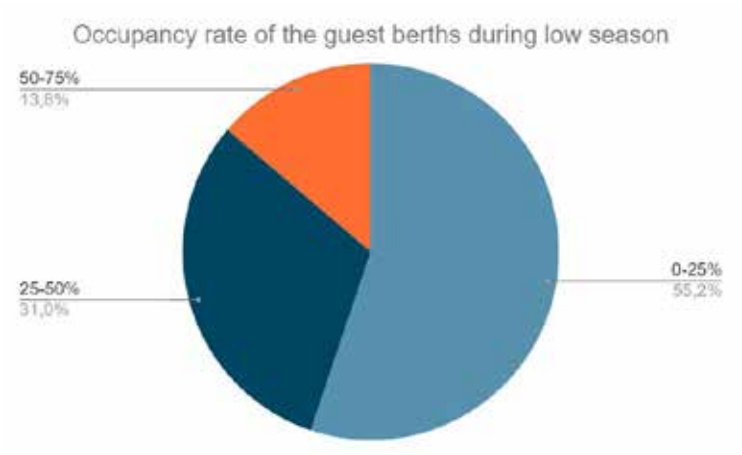


Figure 2. Ownership of the port

The average depth of the responding ports was 3,6 meters, with a range between 2,0 and 8,0 meters. The amount of berth places was asked for both guest boats and those for who call the port as their home port. In addition, the occupancy rate of the guest berths during high and low season was asked (high season meant time in between midsummer to school start).

Amount of guest berth places varied between 5 to 250, being the average of 49. Number of seasonal berth places ranged from 0 to 100 and the average was 27. The occupancy rate answering options of the guest berths during high and low season were divided into four levels in the survey: 0-25%, 25-50%, 50-75% and 75-100%. Figures 3 and 4 show the distribution of responses between these options during both the high and low seasons.





Figures 3 and 4. Occupancy rates of the guest berths

During the high season, at least half of the guest berths are reserved in 66 percent of the responding ports. In addition, almost every third port has a reservation rate between 25-50%. During the low season, the ports are clearly calmer; more than half of the ports reported occupancy rates between 0-25%. Still, 14% of ports said their occupancy rate was between 50-75% and every third port had an occupancy rate between 25-50%, despite the low season.

Energy efficiency and environmental friendliness of ports

The total annual energy consumption of the ports was asked on a six-point scale (figure 5). The majority of the responding ports (approximately 83%) consumed 0-60,000 kWh of electricity annually. About 17% of ports consumed more than 60,000 kWh per year and there were only two ports consuming more than 100,000 kWh; these were Kärdla Marina and Seaplane Harbor Marina in Estonia.

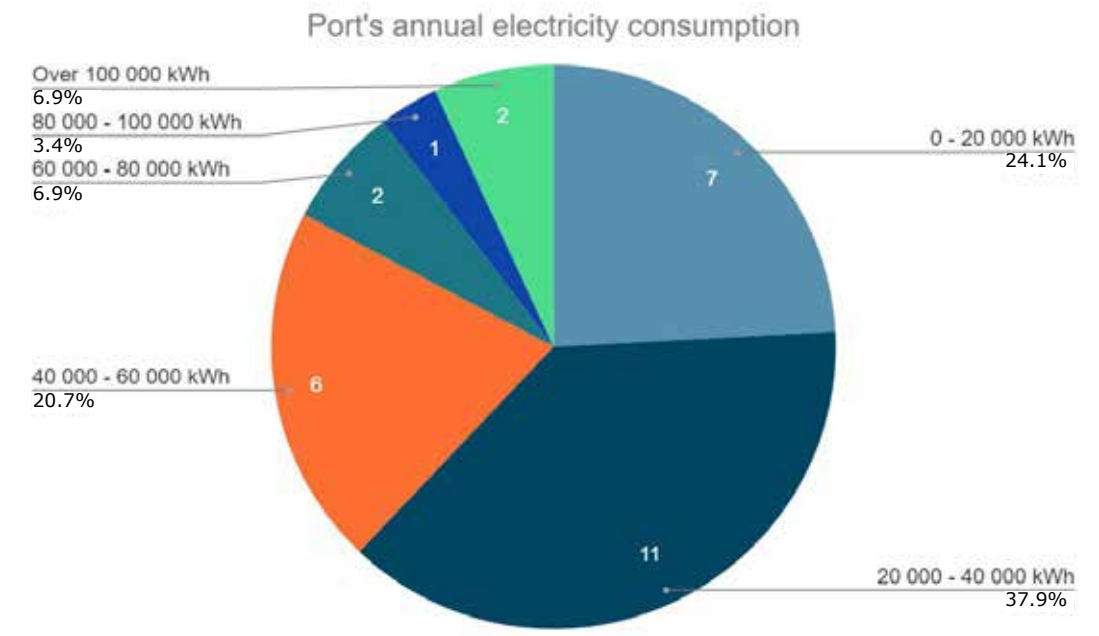


Figure 5. Port's annual electricity consumption

The most significant energy consumption objects in ports were asked on the basis of predefined services (figure 6). The figure shows numerically on how many ports the service is in. Almost every port has service building, outdoor/area lighting and electricity for boats. About two-thirds of the respondents have a sauna, restaurant and other buildings in their service network. The section other buildings included e.g. rentable cabins, recycling station and summer concert hall. Less common services include year-round services (e.g. winter storage for boats) and camping areas. In the section Other was mentioned several times e.g. pump out facilities for boat sewage systems.

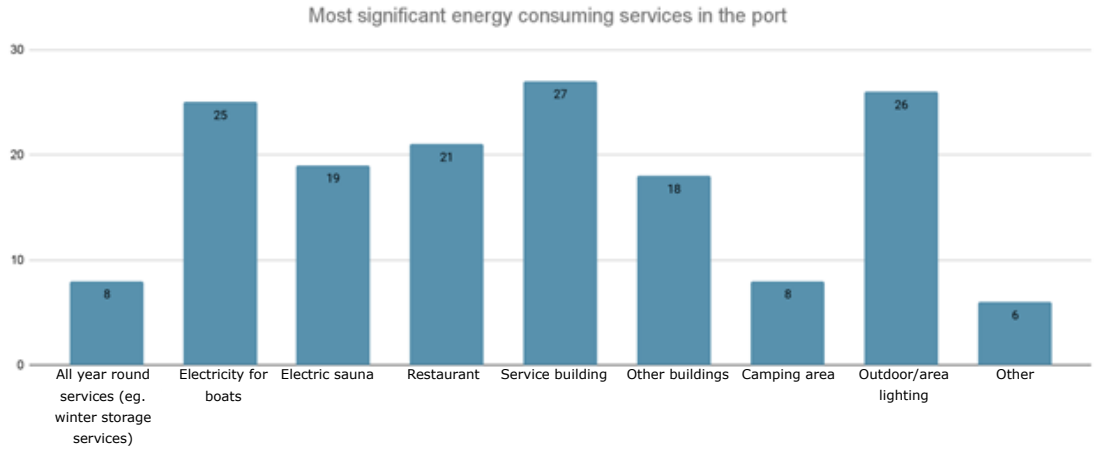


Figure 6. Most significant energy consuming services in the port

The original assumption of the survey was, that the best way to improve the energy efficiency of ports is to produce it with renewable energy sources (eg. wind power, hydro power) and to produce it yourself (eg. solar or wind power). In addition, electricity consumption must be monitored and the largest energy consumers must be identified. Figure 7 shows how many percent of the ports that responded to the survey have taken these issues into account. 41% of the responding ports utilize renewable energy sources in their own electricity management. 83% of ports monitor their own electricity consumption and 93% know where the electricity they buy is used for.

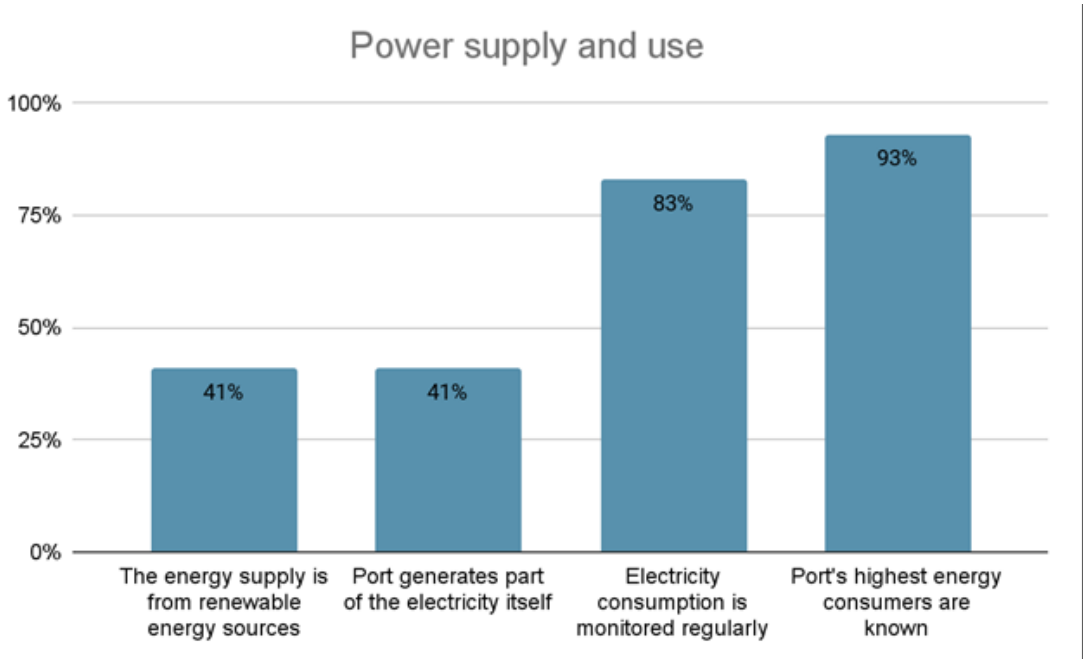


Figure 7. Power supply and use

Ports were also asked about the energy efficiency technologies that have already been implemented. Majority of the respondents (figure 8) had LED lighting (79%) and lighting automation (86%) in use. Almost half of the respondents had a heat pump in use while heat recovery systems were used in only a third of the ports.

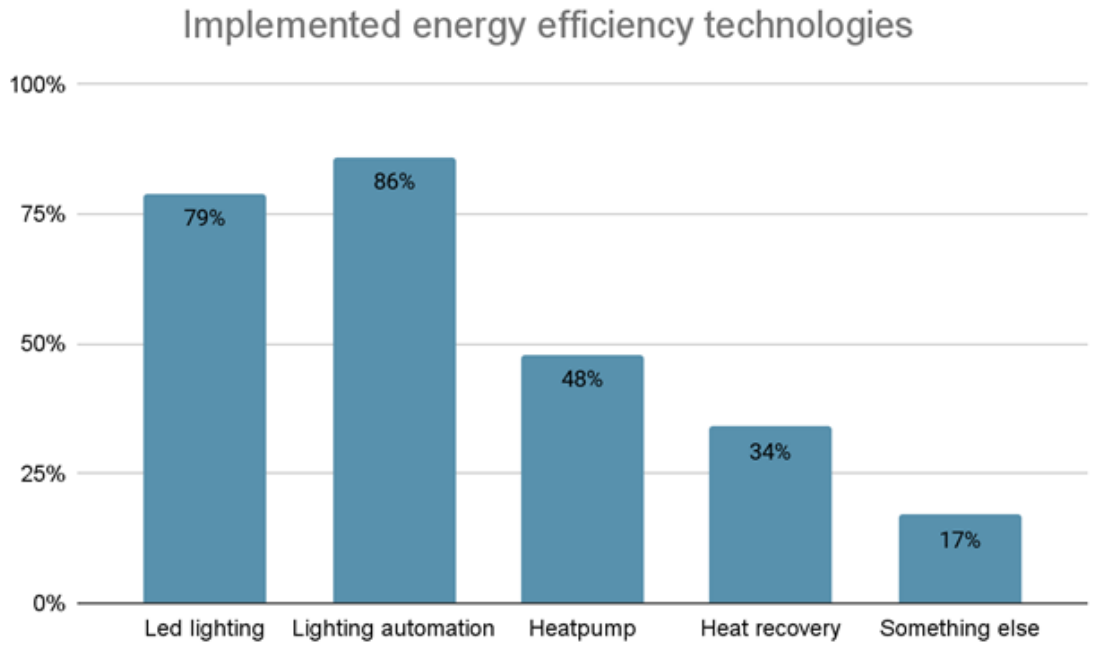


Figure 8. Implemented energy efficiency technologies

Heating and cooling of buildings is an important factor in terms of energy efficiency. This set was addressed in the survey through four YES/NO questions (table 17). 76% of the respondents had heated/cooled buildings in their port. Based on the responses, these buildings were inspected and systems were regularly maintained in almost all ports. Only the annual inspections of the tightness of the doors and windows had some shortcomings in every fourth port.

Table 17. Heating and cooling of buildings

QUESTION	YES (%)	NO (%)
Are there heated/cooled buildings in the port?	76	24
If there are heated/cooled buildings…		
These buildings are regularly checked for adjustments and operation of the heating system	91	9
These buildings have been checked for tightness of the doors and windows during past year	77	23
The mechanical ventilation system of these buildings is regularly cleaned and maintained	95	5

There are many ways to save water and the energy used to heat it. The easiest measures related to usage habits can be implemented immediately and without investment. An example of this is influencing the consumption behavior of users by informing and advising. Some measures, in turn, require more detailed planning

and investment, in which case they must be designed separately. Figure 9 presents the questions related to water consumption in the survey and the ports' responses to them. In the majority of ports, water consumption is monitored, checked and adjusted regularly, but still only just over half of the ports have taken measures to reduce water consumption.

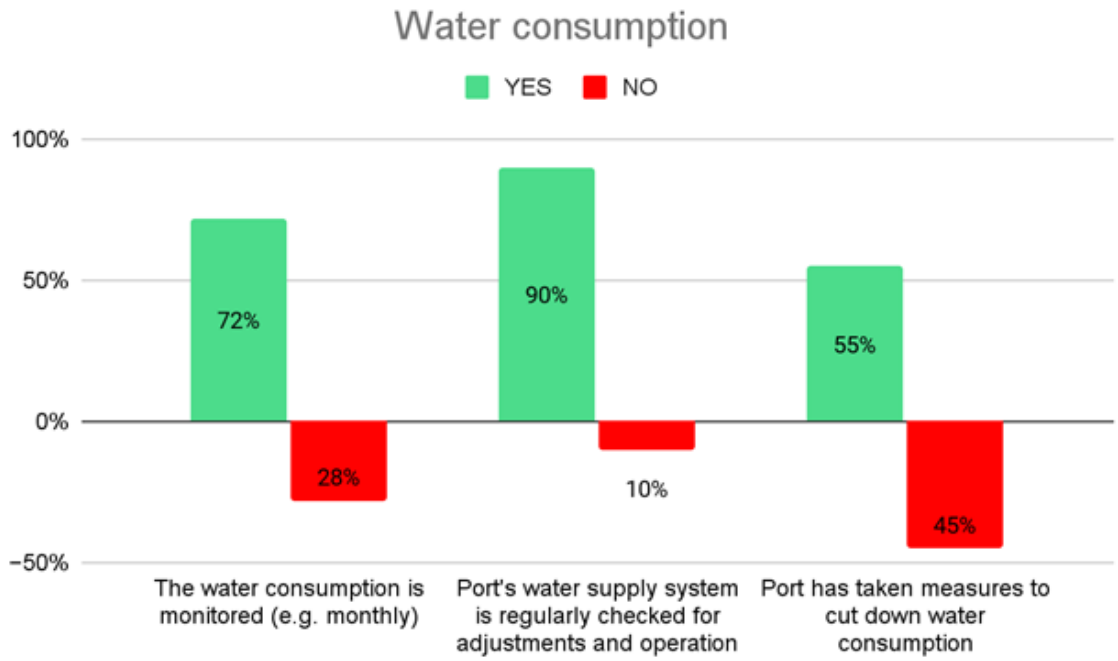


Figure 9. Water consumption

Why do we need sewage disposal and collection facilities at small harbors? The sewage generated on boats is rich in nutrients, such as nitrogen and phosphorous compounds. There are three terms which are commonly used to distinguish the different types of waste water created on boats: black water, greywater and bilge water.

- Black water is toilet waste i.e., waste which will often contain harmful bacteria and viruses
- Greywater is waste water from sinks, showers and washing machines
- Bilge water is self-explanatory but is often contaminated with oil.

(The BATSECO-BOAT project 2021)

As a part of the water consumption, ports were also asked about their possibilities to handle septic/greywater, oily (bilge) water and dishwashing facilities (figure 10). 86% of ports were able to handle greywater. Oily (bilge) water was able to handle almost half of the ports and the dishwashing facilities were available in about 60% of the responding ports.

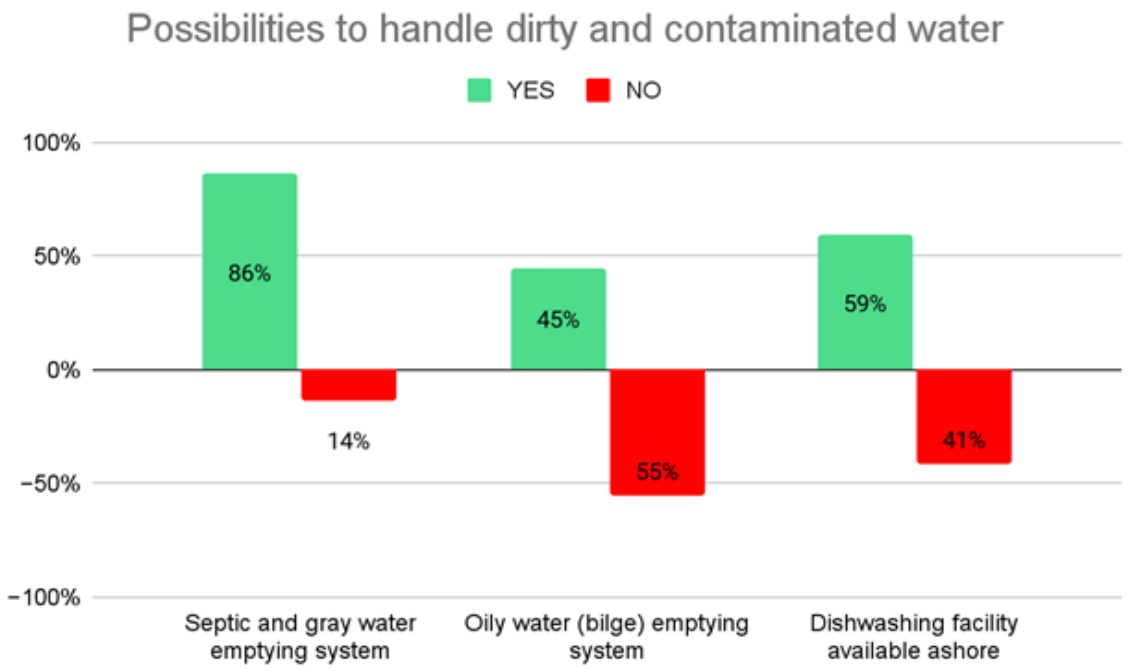


Figure 10. Possibilities to handle dirty and contaminated water

Water consumption and various wastewaters are also essentially associated with their treatment. The most common responding port was connected to the municipal wastewater network (59%) and a few ports (24%) had a local wastewater system (figure 11).

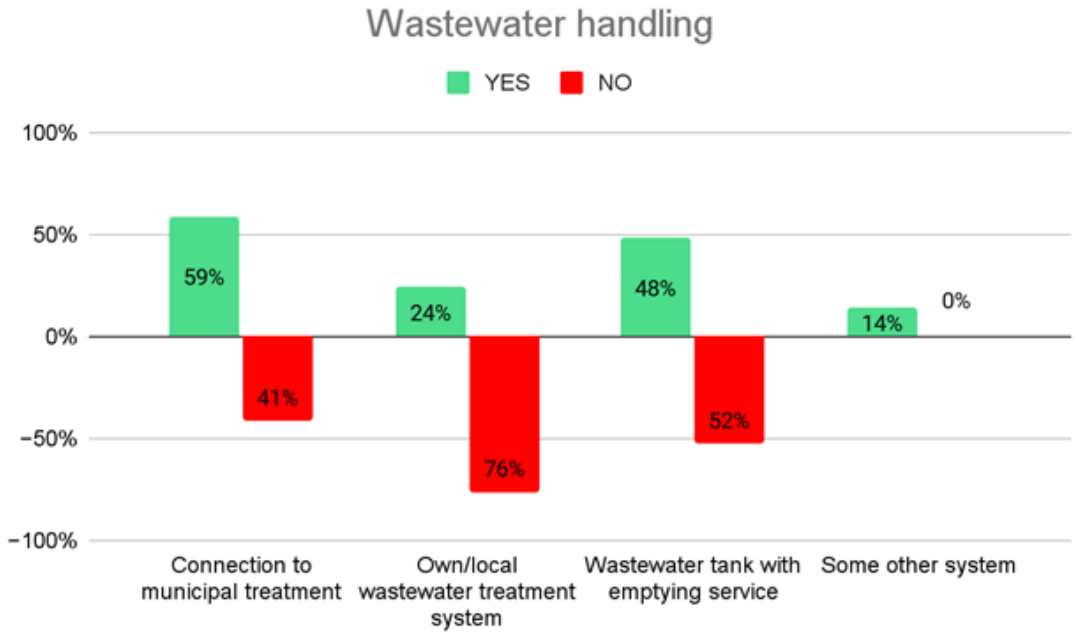


Figure 11. Wastewater handling

Regular and timely boat bottom washing has undeniable benefits that benefit both the boat owner and the environment. Boat performance and fuel economy are improved, antifouling paint dissolves in the water from the boat bottom during the boating season, which damages nature and especially water environment. 31% of the ports included in the survey provided boat bottom washing services (figure 12). By providing this service, ports can demonstrate their environmental friendliness and offer direct savings to their customers.

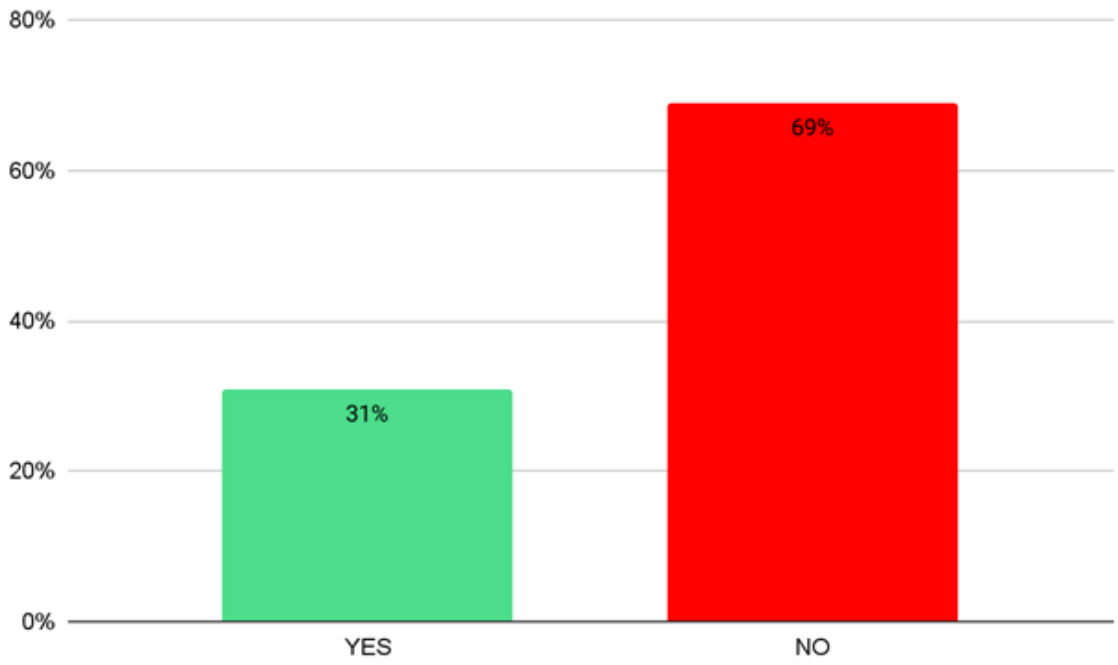


Figure 12. Boat bottom washing service

The survey also asked about the port's waste management (figure 13). Based on the answers, guests will be able to leave their waste in all ports. In addition, almost all ports had recycling points for various waste fractions.

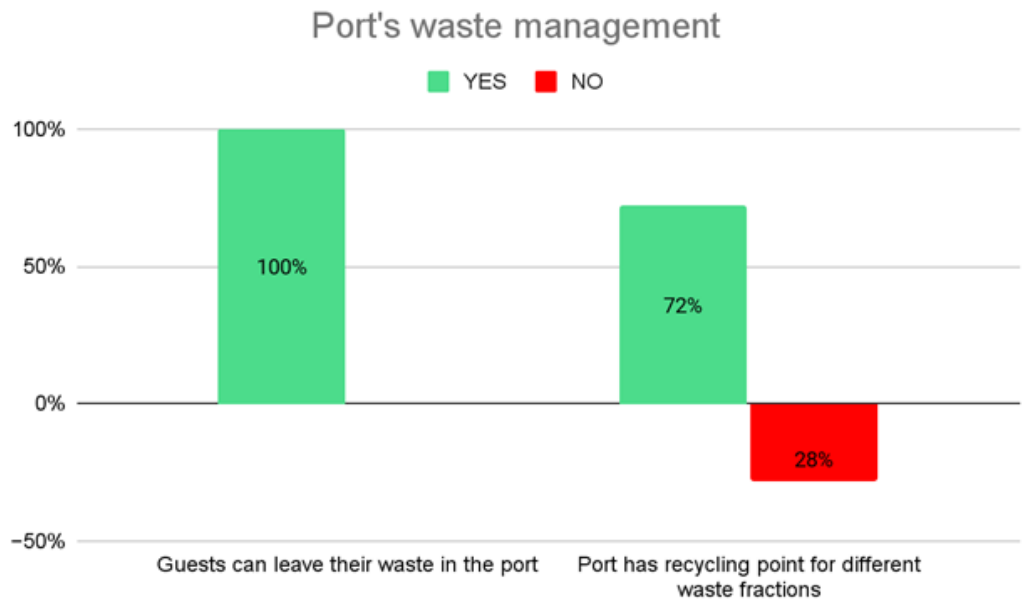


Figure 13. Port's waste management

Open questions

There were also two open questions in the survey for which there were no predefined answer options. Respondents were asked;

1. Have any measures been taken in the port to improve energy efficiency or environmental friendliness?
2. And are there these measures planned for the port?

The energy efficiency and environmental friendliness of ports had already been improved in many ways; the most common improvements were lighting and solar energy. In addition, improvements had been made e.g. wastewater treatment and general waste management. In the future, many respondents also had plans to invest in solar energy.

3.4. Results of Interviews and energy audit in Pavilosta Marina

Pavilosta Marina was selected for special review because of its survey responses, but also on the recommendation of local partners in the CBSmallPorts project (Riga Planning Region and Kurzeme Planning Region).

Pāvilosta Marina is a recreation center that, in addition to boat moorings and services, offers relaxation in holiday homes and camping rooms as well as petrol station services (picture 1). Pavilosta Marina is located in the west coast of Latvia about 200 kilometers from the capital Riga.

Picture 1. Map of Pavilosta Marina © www.pavilostamarina.lv

Pavilosta Marina offers berth places for 20-25 boats and has an average depth of 2,5-3,5m. The occupancy rates of the guest berths are 50-75% in high season and 25-50% in low season. Annual electricity consumption of the small port is 20 000 - 40 000 kWh.

The port offers the following services

- Yacht harbor + electricity (berth fee 20€ - 25€)
- Winter storage (operated by another company)
- Holiday houses / Camping area
- Fuel station
- Playground for childrens / Sports field
- Motorboat rental
- Boat slip
- Shower, toilet, laundry
- Garbage collection
- Internet access
- Fresh water (from well)

The following buildings can be found in the port:

- Harbor service building, area 39.7 m², without heaters, built in 2019
- White big camping building with 7 separate rooms, total area 111,2m², with air recuperator system, build in 2006, reconstruction 2018 (picture 2)
- Four separate holiday houses, small houses 19,35m² each and bigger houses 33/93m² each, with electrical heaters, build in 2008 (picture 3)
- Service building for boaters
- Fuel station

Picture 2. White camping building with seven rooms and roof terraces.

Picture 3. One of the four Pavilosta Marinas separate holiday houses.

Most significant energy consuming services in Pavilosta Marina are:

- Hot water production/consumption (many hot water boilers, in every house)
- Sauna (in one holiday house) with 8kW electric stove
- Electricity for boats
- Other buildings facilities (heating, cooling, cooking stove, fridge, lighting)
- Camping area (electricity available)
- Outdoor/area lighting
- Fuel station (space heating, lighting)

Extensive contacts were held with representatives of the Pavilosta Marina, which culminated in a port visit in late April 2022. Before that preliminary questions were asked in February, a Teams meeting was held in March and additional questions were asked in early April. The communication and port visit resulted in a report: Pavilosta Marina and Gas station Energy Audit - Energy Efficiency Action Proposals (attachment 3).

3.5. Findings from the port of Lootholma

Lootholma in Kustavi Finland is a marina, camping and vacation center with a variety of services. The site is rather new. Nearly all the buildings of Lootholma have been built since 2015 including over 20 different kinds of rental cabins and yurts, a restaurant, separate service facilities for boaters and campers, event hall and grill places, separate saunas etc. And of course, fully equipped harbor with several piers and berth places for about hundred guest boats. Cabins are well-equipped, many of them with their own outdoor hot tub on the terrace, and available year-round, but are rented during low season mostly on weekends (picture 4).

Picture 4. Rentable cabins in Lootholma, Finland

All used energy for running the place is in practice in the form of electricity. Along with the number of heated and well-equipped cabins, other buildings and a broad variety of services, also the electricity consumption of Lootholma is big, about 950 MWh per year. Moreover, everything is under a single billing meter. Actually, different buildings do have some separate sub meters which have been used earlier for some rough general follow-up but they are not online and require more manual work to gather the data needed for better analysis of the energy consumption.

First and key finding from Lootholma is clearly the absence of proper energy consumption data and its monitoring. It is very difficult to identify the consumption hot spots and to validate the made energy efficiency actions if you have just one proper meter for such a big consumption figure and area. Here a control system with separate automatic online meters and optionally a real-time metering would make a big difference. Naturally, in order for the solution to work it requires an interested and motivated person to actually use the data gathered to analyze, plan and validate the possible energy efficiency actions.

Second finding is the energy inefficiency of luxury. In Lootholma case, the warm water for the Jacuzzis are changed for every guest and during low season there is additionally a lot of idle time during weekdays when Jacuzzis are kept warm just in case new guests arrive on short notice. As reference, just heating up a $1m^3$ of water from 5 to 40°C requires about 41 kWh of energy. If e.g. 10 cabins would have $1m^3$ jacuzzi and they would have their water changed and heated 50 times per year it would make about 20 MWh of energy use solely. And this does not even take into account the energy needed for keeping the water warm when heated. There is surely something that could be done for better energy efficiency. Maybe cut down idle times and communicate this well to customers. Secondly, is there a need to change the water between every visitor if there is a water purification system within the Jacuzzi or couldn't the water be checked or tested for purity before refilling.

As a third finding, the energy efficiency of the restaurant kitchen could be studied a bit more carefully. When in active use, there is a lot of energy used for heating, cooking, cooling and freezing. One good source for more information on restaurant or professional kitchens' energy efficiency is a report published by Finnish Environment Institute (in Finnish only): Ilmastoystävälliset ammattikeittiöt.

4. Best practices for ensuring the energy efficiency of a small port

Small ports may not be the worst energy consumers and CO^2 emitters but like said in fighting climate change "every non-emitted CO^2 ton counts". Therefore, it is worthwhile to turn every stone and see what could be done for small ports' energy efficiency.

Generally, it can be said that in small ports most energy is consumed in the form of electricity. This is because ports are closed during the heating season and other forms of energy like oil, wood or district heating are mostly for heating. For the port services, with relatively small off-season maintenance heating and domestic hot water, electricity is the most common form of energy.

Depending on the size, service level and occupancy rate there can be high variation in electricity usage between different small ports. According to the survey results (chapter 3.3.) e.g. electricity consumption varied between the small ports from less than 20 000 kWh/a to more than 100 000 kWh/a. The energy consumption in small ports is concentrated to high-season time and during winter there is only the minimum necessary consumption. This type of energy consumption profile makes it very potential for solar energy utilization.

4.1. Importance of the consumption data

If you can't measure it, you can't improve it. – Peter Drucker

Same goes for energy efficiency actions. You can't know if your actions were successful if you don't know the 'before' and 'after' situations. From electricity consumption data offered by your electricity supplier you can (should) get hourly kWh figures for each billing meter you are charged for. District heating or gas suppliers should be able to provide similar info. Water consumption data is also important since heating of water consumes lots of energy (1kWh = 9L can be heated from 5°C to 100°C). There are many ways to save on energy and water consumption but first you need to know the distribution (how much, when and where).

4.2. Energy efficiency does not always require large investments

Much of the energy savings can be achieved with proper energy efficiency management. In practice, this means regular checking and maintenance of energy consuming buildings, devices and activities. One good option would be to derive or update a checklist for the port's regular maintenance work that would also include the work affecting energy efficiency.

For helping with the detailed contents of this list check the self-evaluation A4 from the attachments.

4.3. Investments in solar energy

Due to a good timely match between solar energy production and small port energy consumption, both at maximum during summer days, it is worthwhile to check the solar energy utilization potential of your port. The solar power (PV) system is already a rather profitable investment. The system prices have been continuously decreasing and recent electricity prices have made their payback times even more reasonable. Depending on the consumption and physical possibilities of your port, by installing solar you may be able to cover a significant part of your port energy consumption with the energy from your own roof (picture 5). See example PV system feasibility study from Pavilosta energy audit report (attachment 3).

Picture 5. New solar olar power plant in Sapokka small port in Kotka, Finland.

Along with solar PV system there is usually possibility for production online monitoring for free, which is worthwhile to take into use. You should ask this from the supplier and include the monitoring system setup as part of the total system commissioning. Inverter manufacturers provides also mobile app for easy system follow-up. Via the app you can easily follow your system production in real-time and see the historic data. This way you can get an idea of the production and optimize the production-consumption match.

Often systems have additionally options for battery and consumption monitoring when needed. With this type of complete setup, you can see in real time how much you produce, consume and store and which part comes from the roof and which from the network or from batteries. See figure 14 for example view of one monitoring tool. From left side box of the view it can be seen that from the momentary electricity consumption of 15.4KW big part (12.3KW) comes from the own solar production, the rest (3.6KW) is bought from the grid. Right side shows electric phase based current distribution of produced solar energy (~16.7A for each phase) and phase based consumption and grid transfer. Clearly phase 1 (green line) has the highest load which suggests changes to equalize the load distribution and thus enhance the solar power self-construction share.

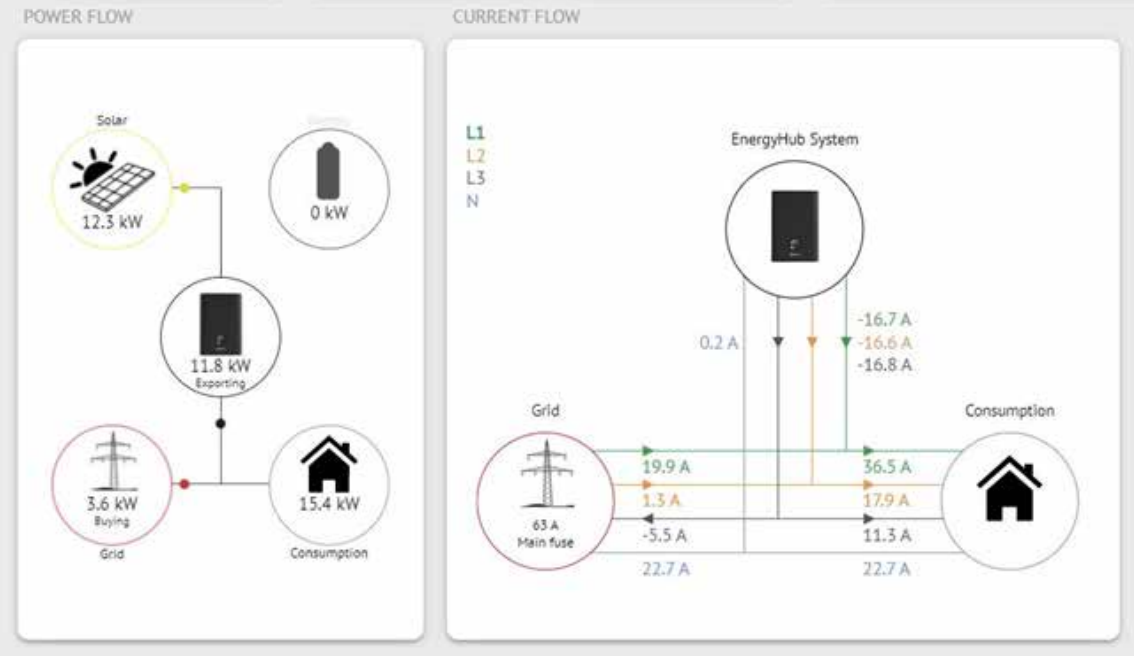


Figure 14. Monitoring dashboard view of Bläse Kalkbruk PV system. No batteries installed.

4.4. Best practices for energy efficient investments

During the CBSmallPorts project, a report Practical approach to energy efficiency investments in small ports was prepared (https://www.theseus.fi/handle/10024/703509). The report gathered the information of practical work done and knowledge gained during the CBSmallPorts project's small port investments. The idea was to summarize the best practices suitable for small port's energy efficiency development.

The report included technical information and tendering process data on energy efficiency related investments done in small ports within the CBSmallPorts project i.e., products and services purchased from the budget of the CBSmallPorts project. The report also discussed possible new technologies and their use in the investments made. Based on the collected information, best practices on energy efficiency investments were summarized for the use of all small ports interested in developing their own energy efficiency. These best practices can be found in the chapter 3.2. of this report.

5. Energy efficiency self-evaluation form

Based on the data collected for this report and during the project, a self-evaluation form for energy efficiency of small ports was created. See attachment 1. The purpose of the form is to work a checklist and introduction to energy efficiency activities related to small ports development. Motivate small port owners and operators to think about energy efficiency issues. To start "thinking energy efficiently".

Form is short, double sided A4 with energy efficiency tips and a couple of flowchart examples on how to proceed with energy efficiency development.

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7. Attachment 1

Check list for small port energy efficiency status evaluation and tips for future actions

In your port, have the following actions been done (**OK**), are not done (**NOK**) or are not applicable for the port (**N/A**)?

OK	NOK	N/A	
			Action list 1
☐	☐	☐	Ability to monitor energy consumption (necessary monitoring tools/systems, know-how).
☐	☐	☐	Energy supplier online service is used for regular, hour level consumption follow-up (Not real time data).
			Action list 2
☐	☐	☐	Real time energy meters have been used or installed for practical and better consumption measurements.
☐	☐	☐	The electricity profile and biggest consuption points have been identified (What?, When?, How much?).
			Action list 3 (easy and inexpensive actions)
			Water
☐	☐	☐	Hot water boilers are well insulated.
☐	☐	☐	Hot water boiler temperatures have been adjusted to proper temperature (good range is 55–60°C).
☐	☐	☐	Hot water pipelines are well insulated for heat leaks.
☐	☐	☐	Water pressure has been adjusted for proper water flow of faucets (shower, kitchen: 12 L/min, other: 6 L/min).
☐	☐	☐	Hot water usage is controlled (5 min shower consumes c. 2.5 kWh of energy).
			Cooling & heating
☐	☐	☐	Heating settings of the buildings are adjusted for season/off-season times
☐	☐	☐	Excess cooling of spaces is avoided. Note. In summer comfortable indoor temp. can be even 25°C.
☐	☐	☐	Different shading solutions are used for blocking the excess heat load of the sun.
			Maintenance works
☐	☐	☐	Refrigeration equipment are installed with good air circulation and checked for working temperatures .
☐	☐	☐	Back cooling units of refrigeration equipment have been cleaned regularly. Noting also the fire risk.
☐	☐	☐	Mechanical ventilation has been checked for seasonal setups and new filters.
☐	☐	☐	Tightness of windows and doors has been checked for leaks before heating (and cooling) season.
☐	☐	☐	Unnecessary (seasonal) devices (defrosting cables, heaters etc.) has been checked and switched off.
			Guidance & planning
☐	☐	☐	Educating and motivating staff and customers about energy efficiency has been planned and implemented.
☐	☐	☐	Planning for the future energy efficiency investments has been done.
☐	☐	☐	Different options for financing energy efficiency investments have been checked (e.g. EU development funds).
☐	☐	☐	Different port fees have been checked and inline with the energy consumption, services and their costs.
☐	☐	☐	The potential for solar energy use has been clarified (production-consumption match, payback time).
☐	☐	☐	The idle use of saunas and kitchens (as big consumers) has been minized with planning.

Action list 3 (potential bigger investments)

Lighting

- ☐ ☐ ☐ All indoor and outdoor lighting has been updated to more durable and energy efficient LED solutions.
- ☐ ☐ ☐ Lighting is combined with presence/twilight sensor and 'partial power use' automation.

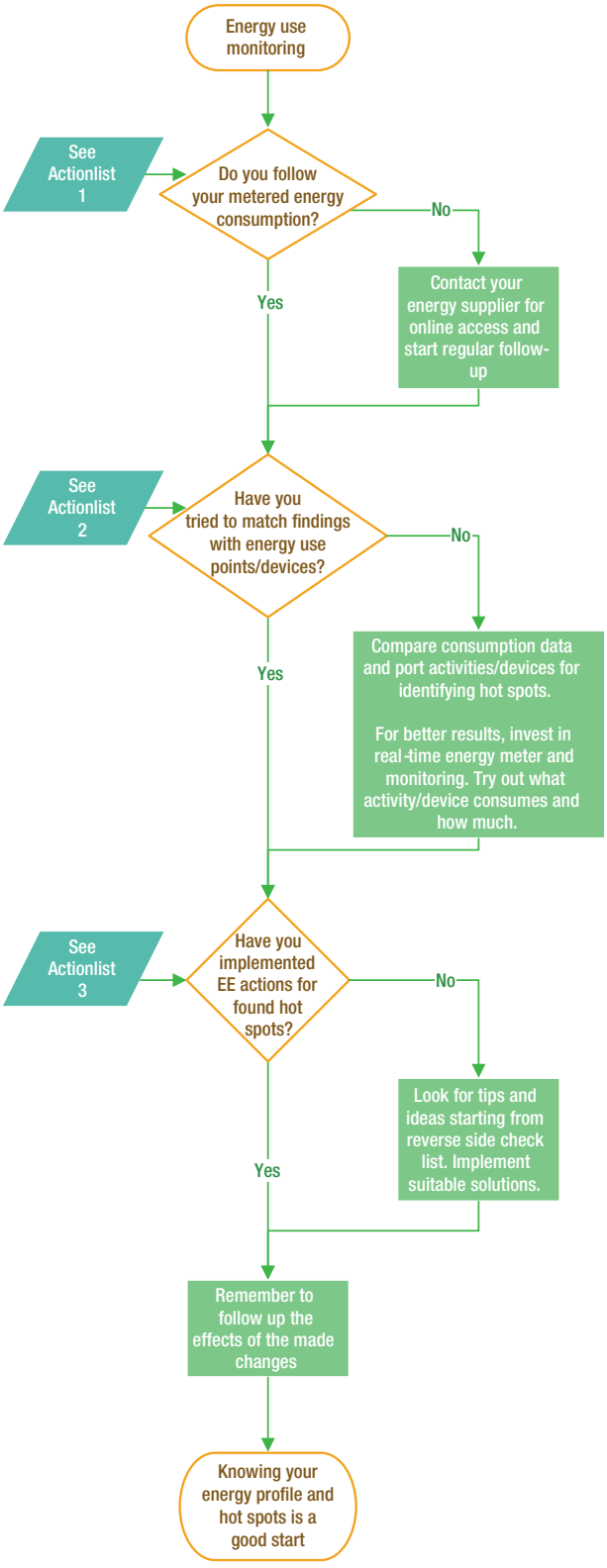
Solar energy

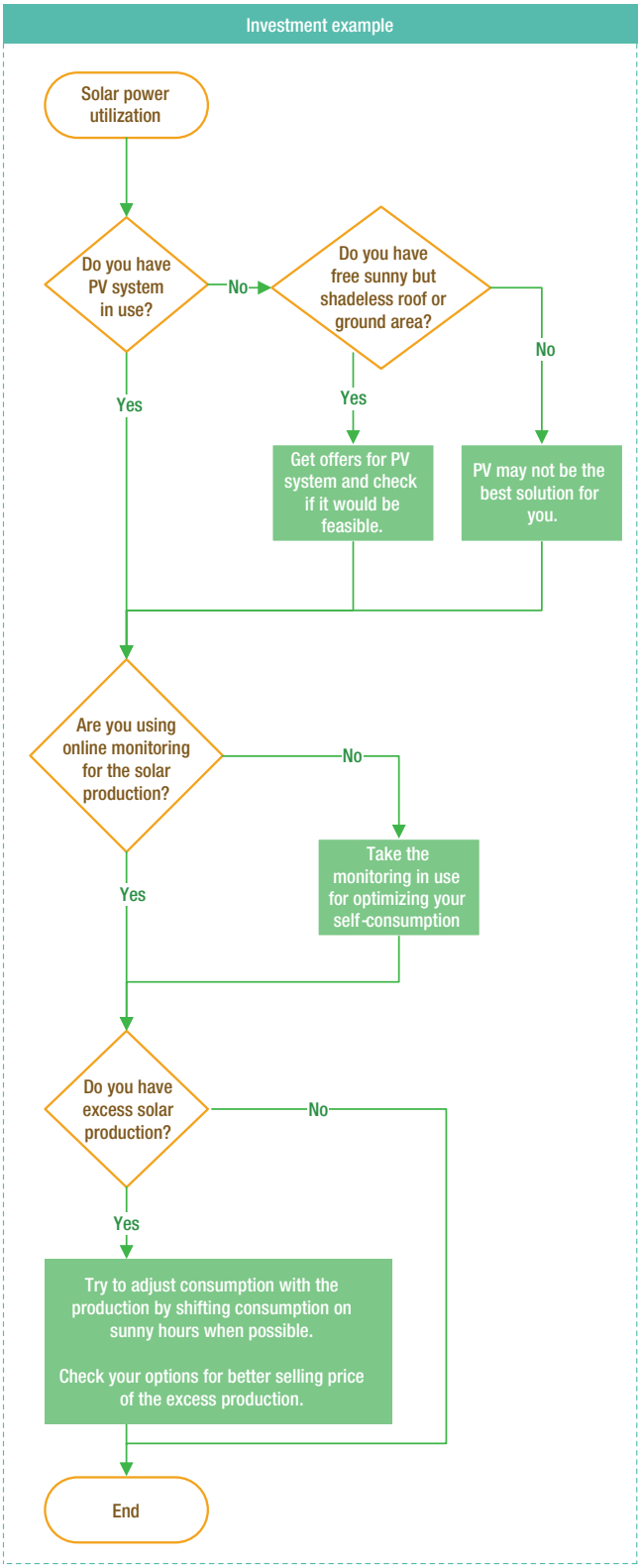
- ☐ ☐ ☐ Solar power has been installed to compensate high season electricity consumption (see reverse side example)
- ☐ ☐ ☐ In case of high hot water use, solar thermal system has been installed for heating hot water (and space).

Heating & cooling

- ☐ ☐ ☐ Heat pump(s) has been installed for space heating and cooling.
- ☐ ☐ ☐ Good insulation has been implemented when building new heated space, esp. for saunas.
- ☐ ☐ ☐ Household appliances & equipment
- ☐ ☐ ☐ The best energy class equipment has been bought when updating old equipment.

Developing Small Port's Energy Efficiency





8. Attachment 2

Form is scheduled: publicity starts 3.6.2021 12.10 and ends 31.12.2021 23.59

Energy efficient and environmentally friendly small port

Dear small port manager

We are making a survey on energy efficiency and environmental friendliness of small ports as part of an EU project. We ask if you could take a moment to answer the questionnaire from the small port owner/operator point of view. If you have more than one small port under your management, you can fill out own form for each small port. By answering the survey you will get maybe already some ideas on how to save energy in your own small port.

The questions marked with a red star are mandatory to fill in.

The survey is part of the CBSmallPorts project, in which the goal is to improve the energy efficiency, sustainable services and joint marketing of small ports in the Central Baltic region.

For more information on the CBSmallPorts project: https://sub.samk.fi/projects/cb-small-ports/

Thank you for your valuable input.

General information of the marina

Name of the small port *

Location of the port *

- ☐ Finland
- ☐ Sweden
- ☐ Åland
- ☐ Estonia
- ☐ Latvia
- ☐ other

Ownership of the port *

- ☐ Port is publicly/municipality owned
- ☐ Port is privately owned
- ☐ Other

Amount of guest berth places *

Amount of home berth places *

Depth of the port (meters) *

Occupancy rate of the guest berths during high season (from midsummer to school start) * Select

Occupancy rate of the guest berths during low season * Select

Most significant energy consuming services in the port

	Yes	No	Possible clarification
* All year round services (e.g. winter storage for boats)	○	○	
* Electricity for boats	○	○	
* Electric sauna	○	○	
* Restaurant	○	○	
* Service building	○	○	
* Other buildings	○	○	
* Camping area	○	○	
* Outdoor/area lighting	○	○	
* Other	○	○	

Energy efficiency and environmental friendliness of the port

Power supply and use

	Yes	No
* The energy supply is from renewable energy sources (eg. wind power, hydro power)	○	○
* Port generates part of the electricity itself (eg. solar or wind power)	○	○
* Electricity consumption is monitored regularly	○	○
* Port's highest energy consumers are known	○	○

Port's annual electricity consumption *

- ☐ 0-20 000 kWh
- ☐ 20 000 - 40 000 kWh
- ☐ 40 000 - 60 000 kWh
- ☐ 60 000 - 80 000 kWh
- ☐ 80 000 - 100 000 kWh
- ☐ Over 100 000 kWh

Implemented energy efficiency technologies

	Yes	No	Possible clar
* Led lighting	○	○	

	Yes	No	Possible clar
* Lighting automation (presence detector, light-sensitive switch, etc.)	○	○	
* Heatpump	○	○	
* Heat recovery (ventilation, sewage, exhaust gases)	○	○	
* Something else, what?	○	○	

Heating and cooling of buildings

	Yes
* Are there heated/cooled buildings in the port?	○
* These buildings are regularly checked for adjustments and operation of the heating system	○
* These buildings has been checked for tightness of the doors and windows during past year	○
* The mechanical ventilation system of these buildings are regularly cleaned and maintained	○

Water consumption ?

	Yes	No	P
* The water consumption is monitored (e.g. monthly)	○	○	
* Port's water supply system is regularly checked for adjustments and operation	○	○	
* Port has taken measures to cut down water consumption	○	○	

Port has ...

	Yes	No
* septic and grey water emptying system	○	○
* oily water (bilge) emptying system	○	○
* dish washing facility available ashore	○	○

Boat bottom washing

	Yes	No	Possible clarification
* Does port offer service for boat bottom washing?	○	○	

Wastewater handling. Port has ...

	Yes	No	Possible clarification
* connection to municipal treatment	○	○	
* own/local wastewater treatment system	○	○	
* wastewater tank with emptying service	○	○	
* some other system, what?	○	○	

Port's waste management

	Yes	No	Possible clarification
* Guests can leave their waste in the port	☐	☐	
* Port has recycling point for different waste fractions	○	○	

Have any measures been taken in the port to improve energy efficiency or environmental friendliness?

And are there these measures planned for the port?

Your feedback

Comments and feedback of the survey

Respondents contact information

Contact

Name

Email or phone number

Proceed

Save

If you have questions related to the survey or subject contact us:
teemu.heikkinen@samk.fi or
jussi.sutela@xamk.fi