Measures

EVISA
ENERGIAVIISAS SATAMA

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METERS:

1. ship environmental monitoring system
2. additional meters by port area and building
3. meters by port consumption: heating (electric and other) / water (hot and cold) / lighting / electric ventilation / fuel (benzine, diesel, gas)
4. installation of online metering system

HEATING:

1. district heating / cooling
2. seawater source heat pumps

LIGHTING:

1. LED lighting
2. adaptive lighting system
3. LED floodlights and walkway lights

BUILDINGS:

1. painting walls white / add windows and skylights
2. install air curtain
3. optimization of HVAC system
4. insulation
5. nearly zero energy building
6. demand controlled ventilation (DCV) system
7. adjusting air temperature
8. green roof

Programme for Sustainable Growth and Jobs

Leverage from the EU 2014–2020

European Union
European Regional Development Fund

ALTERNATIVE FUELS:

1. onshore power supply (OPS)
2. LNG PowerPac
3. mobile LNG barge

4. LNG bunkering: truck to ship (TTS)
5. LNG bunkering: shore to ship
6. LNG bunkering: ship to ship (STS)

7. LNG bunkering: local liquefaction plant
8. alternative fuels
9. automated mooring systems

10. hybrid power train
11. hybrid power train (plug in hybrid)
12. electrification of power train (battery or fuel cell)

RENEWABLE ENERGY SOLUTIONS:

1. obtain “green” energy
2. solar photovoltaics (PV)
3. wind power

4. hydropower
5. biogas
6. geothermal
7. microturbine

Programme for Sustainable Growth and Jobs

Leverage from the EU 2014–2020

European Union
European Regional Development Fund

EFFICIENCY:

1. energy / emission target
2. energy management system (EMS)
3. energy audits

4. smart grid applications
5. employee suggestion system
6. employee environment training

7. employee bus shuttle services
8. provision of bikes for commuting
9. bundling of power

10. cross company use of waste heat
11. heavy duty vehicle (HDV) emission control zone
12. alternative HDV cooling: DTRU
13. alternative HDV cooling: grid feed
14. green port fees
15. slow steaming

16. electrification of power train
17. energy saving tires
18. tire pressure control

19. regenerative drives
20. emission control technologies (ECTs)
21. eco driving lessons

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European Union
European Regional Development Fund

METERS:

❶ **ship environmental monitoring system**

Description:

It is a port system with available data on the most important environmental parameters: e.g. fuel consumption and air emissions of individual ships.

The system helps to centralize environmental data collection and define energy or emission reduction objectives for vessels in the port area and track progress around those objectives. This system can also be used to estimate the environmental impact of the port: e.g. carbon footprint assessment.

The data could additionally be used for port benchmarking and certification programs as well as give good grounds for organizing green discounts for visiting vessels.

← BACK

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European Union
European Regional Development Fund

METERS:

❷ **additional meters by port area and building**

Description:

This measure is about the installation of additional meters which specify certain consumption flows (electricity, hot water, other energy sources) for separate port areas and/or individual buildings. This is mostly about improving the availability and precision of data on energy. The generated data are important and serve as input for further improvements in port energy management.

❸ **meters by port consumption:** heating (electric and other)/water (hot and cold)/lighting/electric ventilation/fuel (benzine, diesel, gas)

Description:

This measure is also about installation of meters, but the focus is on specific energy streams: heating (electric and other) / water (hot and cold) / lighting / electric ventilation / fuel (benzine, diesel, gas). If the previous measure was about getting energy data for port locations, this improvement is rather about separate energy flows. This can also be used for further advancement in port energy management. For instance, if there is overconsumption in port lighting and it is possible to see it on a separate meter, betterment can be done here. If old light bulbs consume a lot in comparison with LED technology, precise numbers can support decision-making and justification of change. The same could be used for the addition of an adaptive lighting system when it is possible to predict the difference in certain numbers of consumed electricity.

← BACK

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European Union
European Regional Development Fund

METERS:

❹ **installation of online metering system**

Description:

This measure can improve the quality of available data due to its properties. It is an online system that shows real-time and archived measurements of electricity consumption by port area and building as well as by separate electricity streams such as lighting, heating and other electricity uses. An existing example is already in operation in the Port of Oulu, Finland.

← BACK

HEATING:

1 district heating / cooling

Description:

It is built on the well-utilized idea that instead of each building having its own heating or cooling system, the energy can be delivered to several buildings in a larger area from a central plant. A change of the heating system from its own fossil fuel-based system to district heating can reduce carbon footprint significantly. Usually, district heating is more energy efficient, due to the simultaneous production of heat and electricity in combined heat and power generation plants. Options for district heating (and cooling) are gas, biomass, central solar heating, heat pumps and geothermal heating. In the Port of Stockholm, for example, the CO2 emissions could be decreased from 5,500 to 0.7 tons, mainly because of the switch from an oil-based generator to district heat. *Carbon footprint reduction potential, %: from 5 to 16.*

2 seawater source heat pumps

Description:

The idea is about heating and cooling the port premises with seawater heat pumps. The system is very efficient; however, high investments must be made, and they are much higher compared to district heating and cooling solutions. *Carbon footprint reduction potential, %: from 7 to 20.*

← BACK

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European Union
European Regional Development Fund

LIGHTING:

1 LED lighting

Description:

This solution is mostly about replacing conventional light bulbs with LED lights. While the initial cost of installing LEDs is typically higher than conventional lighting options, energy savings and reduced maintenance can result in a fast return on investments. Real case studies suggest that energy savings can amount to between 55-60%. Ports that have introduced newer lighting technologies often report other operational benefits. For example, improved lighting tends to improve safety and result in reduced operator fatigue. New lighting technologies also allow operators to have greater control over how light sources affect the surrounding environment in terms of light pollution, light spill, and glare. Finally, LED lights can be programmed and dimmed to reduce energy consumption and light pollution. It is a common solution in Finnish ports. *Carbon footprint reduction potential, %: less than 1.*

2 adaptive lighting system

Description:

It has to do with the installation of a lighting system that automatically adjusts its light output and operation. The adjustment is done to provide targeted light levels based on environmental conditions, user schedules, or other application-specific criteria. Such a system may include various types of products: e.g. dimmable lamps and luminaires, occupancy sensors, photocontrols, time clocks, communication panels, and wireless communication nodes.

← BACK

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European Union
European Regional Development Fund

LIGHTING:

3 LED floodlights and walkway lights

Description:

This measure is about local lighting solutions for walkways and similar purposes. Such lights can, for instance, be installed on port cranes. This can reduce energy usage, reduce crane maintenance costs and increase operator safety. Due to fewer moving parts in LED technology, there will be a significant decrease in service costs. Plus, it adds to port safety, sustainability and profitability.

← BACK

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European Union
European Regional Development Fund

BUILDINGS:

1 painting walls white / add windows and skylights

Description:

It has to do with the inclusion of natural lighting. Painting walls in white helps to reflect the light. It is a simple and cost-effective measure to brighten up the port warehouse and/or workshop. Adding windows on the walls or the roof (skylights) enables penetration of natural light in the room and provides the best use of daylight. The most energy-intensive parts in warehouses and workshops are lighting, heating and cooling. Adoption of a more efficient lighting system where a photo-controlled energy-efficient lighting system (e.g., auto-adjusting LED technology according to the daylight intensity) is coupled with natural light can lead to energy savings of up to 80%. *Carbon footprint reduction potential, %: less than 1.*

2 install air curtain

Description:

This measure includes the installation of well-insulated, high-speed doors to prevent energy escape. Usually, open doors provide the largest portal for energy loss in port warehouses. The same idea applies to cold storage which consumes considerable amounts of energy. Studies have shown that a large part of the cooling is generally lost each time the doors of the cooling section are opened. This increases the energy consumption and operational costs of the refrigeration unit. As a simple measure, the doors are fitted with transparent PVC curtains strips; this decreases the average energy consumption by nearly 20%, while all other factors (number, time and duration of door openings) have remained the same.

← BACK

BUILDINGS:

3 optimization of HVAC system

Description:

It deals with indoor air temperature, which is regulated by heating, ventilation, and air conditioning (HVAC) systems. The components of HVAC systems can degrade over time and drop their energy performance by 30 to 60 %. A well-maintained HVAC system can significantly cut energy costs and extend equipment life. Maintenance can keep the system's original efficiency at 95%. Retrofitting old HVAC systems with thermostats can lead to further energy savings of up to 10 % for heating and cooling. *Carbon footprint reduction potential, %: up to 2.*

4 insulation

Description:

The building envelope is the thermal and mass barrier between the interior and outdoor environment and is one of the primary determinants of how much energy the building consumes and how comfort and indoor air quality are maintained. Approximately 35% of the energy consumed in commercial and residential buildings is used to maintain a comfortable and safe interior environment. Improving insulation is a proven way to reduce both heating and cooling costs. Proper sealants are also a good way to improve the energy efficiency of a warehouse. This measure can, for example, help to reduce the refrigeration load in warehouses. It is about sufficient perimeter insulation, specifically meaning the spaces between refrigerated and adjacent unrefrigerated area (including the roof).

← BACK

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European Union
European Regional Development Fund

BUILDINGS:

5 nearly zero energy building

Description:

It is a building that is constructed under the best possible building practices: with a focus on energy efficiency and renewable energy. It has to do with control over indoor climate, heating of household water and utilization of appliances and other electrical equipment. Due to high energy savings in such buildings typically payback time is rather short. *Carbon footprint reduction potential, %: up to 21.*

6 demand controlled ventilation (DCV) system

Description:

It has to do with the division of buildings into thermal zones. The zones are controlled separately based on space functions. For example, the radiant heaters should be controlled by timers or occupancy sensors to minimize their operation when areas are unoccupied.

7 adjusting air temperature

Description:

It deals with adjusting the desired air temperature closer to the ambient air temperature. This measure will save significant amounts of energy consumption. For instance, reducing the indoor temperature in summer from 26° to 22° had been shown to reduce energy consumption by up to 40% on average. This can easily be achieved by retrofitting the heating system with thermostats and outdoor sensors. *Carbon footprint reduction potential, %: up to 8.*

← BACK

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Leverage from the EU 2014–2020
European Union
European Regional Development Fund

BUILDINGS:

8 green roof

Description:

It is about installing a special layer on the rooftop. The layer consists of a specialized growing medium and specifically selected plants. Green roofs can be installed on flat roofs as well as on porch roofs. The advantages include a high degree of insulation, dust prevention, cleaning of the air, CO2-sink and O2-generation by photosynthesis, increased biodiversity in the area, improved aesthetic views for neighbours, improved worker productivity and creativity, extended durability of the roof energy efficiency and minimization of heat loss in winter. Furthermore, they reduce the “urban heat island effect” by absorption (not reflection) of UV radiation. In addition, stormwater run-off is cleaned by the roof and the water amount is reduced to up to 50%.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

1 onshore power supply (OPS)

Description:

This solution helps to avoid air emissions as well as noise pollution from a vessel located at berth. Instead, vessels rely on shore power rather than electricity generated by their auxiliary engines that emit greenhouse gas emissions, reducing local air quality and ultimately the health of people in and around the port. OPS can eliminate generated emissions in port but the carbon footprint of the technology highly depends on the type of electricity supplied to the grid: if it is renewable energy based or not. Expected noise reduction in the port ranges from 0 to 10 dB. Each OPS installation includes transformer stations, frequency converters, cable management systems and grid extension – hence, its substantial initial investment. Additionally, visiting ships have to have a suitable connection to such a system. However, there are visible trends and expectations from ports to apply the OPS system already in the 2030s. *Carbon footprint reduction potential, %: from 30 to 70.*

2 LNG PowerPac

Description:

Similar to the onshore power supply (OPS) system, this measure also deals with electricity supply for visiting vessels at berth. The idea is to produce electricity from LNG using a generator placed in a mobile container. Same as with the OPS system, the main advantage is the reduction of the ship's emissions and noise from working auxiliary engines. The container or LNG PowerPac can be located on the ship or onshore. The expected power supply is up to 30 MW.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

3 mobile LNG barge

Description:

It represents one more solution that is closely related to onshore power supply or LNG PowerPac alternatives. Mobile LNG barges look like floating power plants that produce electricity for vessels at berth. The power is generated by burning LNG. The mobile barge can provide power to more than one ship at a time. The noise levels of the LNG generator are lower than in the case of a diesel-based generator. Carbon emissions from the barge are 20% lower than when the ship uses the auxiliary engines.

4 LNG bunkering: truck-to-ship (TTS)

Description:

This measure is about LNG supply for vessels as fuel. This usually requires building a certain infrastructure around it. But one of the simplest approaches is just to fuel ships directly from LNG carrying trucks. The truck connects to the vessel via special hoses. The trucks can also be used for LNG distribution for other purposes. The main disadvantage of TTS LNG bunkering is limited gas carrying capacity – which is important for large consumers. The speed of gas flow is also relatively small. On the other hand, the cost of such a solution would be at a level of 200 000 euros per truck.

NOTE: According to often shared EU Parliament representatives' opinion, LNG is considered an unsustainable fuel for vessels but rather a transition fuel towards synthetic fuels – which recommends avoiding planning long-term investments (10-15 years) in developing such port infrastructures.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

5 LNG bunkering: shore to ship

Description:

This measure is about LNG supply for vessels as fuel. This usually requires building a certain infrastructure around it. But this rather local solution allows doing it from a small LNG station in port. Few fixed hoses and cranes are used to handle the operation. The main advantages of the approach are available large bunkering capacity and large speed of gas flow. The mobile station can be customized for automatic fuelling and is ready for shore-to-ship bunkering when required. The solution needs high investments (e.g., tanks and bunker stations) and some port space.

6 LNG bunkering: ship-to-ship (STS)

Description:

Similar to the previously mentioned truck-to-ship and shore-to-ship alternatives, this measure is also about LNG supply for vessels as fuel. Bunkering usually requires building certain infrastructure around it. However, in the case of ship-to-ship bunkering, there is only a need for offshore space in port to accommodate the bunkering vessel. The advantages are availability and flexibility of gas fuelling in different port locations and outside of it, large bunkering capacity and high flow rates. The disadvantages are in turn required space in the port water area and high initial costs.

NOTE: According to often shared EU Parliament representatives' opinion, LNG is considered an unsustainable fuel for vessels but rather a transition fuel towards synthetic fuels – which recommends avoiding planning long-term investments (10-15 years) in developing such port infrastructures.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

7 LNG bunkering: local liquefaction plant

Description:

This measure is also about LNG supply for vessels as fuel. This requires building a certain infrastructure around it. In this case, the LNG production plant is considered on port premises. The advantages are the security of supply, reduced space for gas storage tanks and certain value on the market with respectful additional revenue channels for the port. The disadvantage is the high investment needed for building the plant.

NOTE: According to often shared EU Parliament representatives' opinion, LNG is considered an unsustainable fuel for vessels but rather a transition fuel towards synthetic fuels – which recommends avoiding planning long-term investments (10-15 years) in developing such port infrastructures.

8 alternative fuels

Description:

It is about substituting traditional fuels (e.g., diesel) for cargo handling equipment with alternative and low-emission fuels. The carbon load levels are lower than for normal diesel, but the disadvantages of alternative fuels are that they are more expensive and their organization (e.g., LNG, LPG, CNG) require special infrastructure within the port area.

← BACK

ALTERNATIVE FUELS:

9 automated mooring systems

Description:

This measure or system helps to moor quicker and with fewer operators involved. The air emissions are reduced due to the shortness of mooring operation time. Besides, engines are shut off much earlier. Usually, ocean-going vessels represent the largest contribution to the port's carbon footprint calculation. However, the carbon footprint of the port is reduced only slightly with this measure because air emissions from manoeuvring have just a small share of vessel total air emissions in ports.

10 hybrid power train

Description:

This solution is about the substitution of the main engine power of port vehicles for a newer version – a hybrid with the possibility to operate on electricity together with traditional fossil fuels. The battery is charged during vehicle operation. The advantage is the reduction of air emissions due to the inclusion, for example, of the "stop & go" mode in engine operation. This can be seen in port forklifts. In addition, there is a fuel economy of up to 15%. The disadvantage at the moment is that not all types of port vehicles can yet be available on the market.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

11 hybrid power train (plug in hybrid)

Description:

It is similar to a hybrid power train solution, but the difference is in the charging system. If the power train vehicle is charged during operation, the plug-in hybrid is charged with a cable connection to the power grid. The vehicle can still operate both on electricity and diesel. The advantage is the reduction of air emissions due to less use of diesel as well as fuel economy. The disadvantage at the moment is that not all types of port vehicles can yet be available on the market.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

ALTERNATIVE FUELS:

⑫ **electrification of power train (battery or fuel cell)**

Description:

It has to do with the full substitution of diesel motors in port vehicles for electric ones. Full electrification is achieved either with the use of a battery or fuel cell. Battery-based electric vehicles require charging: via electricity generation during operation or via a plug-in connection to the electric grid. In turn, fuel cell vehicles have their own inbuilt power plant that supplies electric energy to the motor. No battery is required here. Fuel – normally hydrogen – is transferred to electric energy. If we compare the two types, by far battery electric vehicles seem to perform better: having higher energy efficiency. Fuel cell-based vehicles can consume two times more energy than battery-driven vehicles. The advantages are carbon and noise reduction as well as the additional possibility to operate indoors. The drawback is a higher cost in comparison with common port vehicles, possible short driving distances and the need to be charged (battery case, plug-in hybrid) – it affects both, the practical use of vehicles as well as requires having a charging station. In the case of a fuel cell, which is based on hydrogen, enhanced safety is required for operation. *Carbon footprint reduction potential, %: from 11 to 20.*

← BACK

RENEWABLE ENERGY SOLUTIONS:

1 obtain "green" energy

Description:

This measure does not require any installation of wind turbines or solar panels in the port area. Instead, it is only about purchasing renewable energy from a local energy company. This is a simple and fast way to reduce carbon footprint in ports (under 5%). It is a comfortable solution for small ports. *Carbon footprint reduction potential, %: from 0,8 to 3,5.*

2 solar photovoltaics (PV)

Description:

This measure has to do with solar energy production in the port area. Many such projects have already been implemented in Finnish ports. EVISA offers an easy-to-use tool to estimate local solar energy potential and assess how fast a solar energy project can pay back the initial investments. After several tests in real-life conditions, feasible projects usually return the investment in under 5 years. Usual places for solar panel installations are rooftops and walls: e.g., warehouses. *Carbon footprint reduction potential, %: under 1.*

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

RENEWABLE ENERGY SOLUTIONS:

3 wind power

Description:

This solution is about the conversion of available local windy conditions into a useful renewable energy source. The traditional way to do it is via the installation of a wind turbine in an offshore or onshore port area. Usually, wind-rich places are located in coastal or highland areas. The disadvantage is the required space for placing the turbine or several of them. In addition, the usual downsides of wind energy use are noise pollution and danger for seabird migration routes. On the other side, the benefit of using wind power is its zero air emissions. This can lower the carbon footprint to some degree (up to 5%). *Carbon footprint reduction potential, %: under 1.*

4 hydropower

Description:

This solution, if possible locally, enables utilization of available flowing water potential with subsequent production of electricity. Examples of flowing water can be river flow, tides and wave power. The last two may be troublesome since they require a large area for implementation, which can disturb port operations. The obvious advantage is emission-free energy production and betterment of port image in terms of its sustainability and energy management. *Carbon footprint reduction potential, %: up to 4.*

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

RENEWABLE ENERGY SOLUTIONS:

5 biogas

Description:

This measure utilizes biogas for renewable energy production. If there are prerequisites in terms of available feedstock (wastewater, food waste or other organic waste), this solution can be included in the port energy system. The energy is produced by the fermentation of organic material in a closed environment. The disadvantages are specific disagreeable odour, space and temperature requirements. Fermentation requires keeping the temperature at about 37oC all year round. This might be energy intensive in winter. In addition, fermentation leftovers have to be transported at the end of the process. The advantage is the utilization of existing potential into yearly available sustainable energy. *Carbon footprint reduction potential, %: up to 4.*

6 geothermal

Description:

It deals with the transformation of available thermal energy under the port into electricity. In addition to electric power supply, geothermal energy can be used for heating. The advantage compared to other renewable energy sources is the permanent access to the energy source. The Swedish port of Stockholm, for instance, partly uses geothermal energy. *Carbon footprint reduction potential, %: from 7 to 20.*

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

RENEWABLE ENERGY SOLUTIONS:

7 microturbine

Description:

This has to do with the utilization of produced biogas (also natural gas) in energy-generating turbines or microturbines. They look like containers and can be of different sizes: from 30 kW to 10 MW of electric power. Microturbines are a type of combustion turbine, therefore in addition to electricity, they can also produce heat. The advantages are secure power, energy efficiency, fewer air emissions, compact size and mobility. The disadvantage is the availability of certain types of gas (biogas, landfill gas or similar) to be able to place this solution in the renewable energy category. *Carbon footprint reduction potential, %: under 1.*

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

1 energy/emission target

Description:

This little measure is done as part of the port's energy strategy. EVISA offers an energy mapping as well as a carbon footprint calculator, which both help to define the baseline of how energy is used in port and what carbon emissions are behind it. Once these are completed, the port target on emission reduction or energy improvement is set. Both are usually related to the baseline conditions. Achievement of emission target is assessed in percentage from it: e.g., several per cents from baseline carbon load.

2 energy management system (EMS)

Description:

This holistic measure is about organizing, controlling and managing different energy flows in a port (electricity, lighting, heating). It all starts by making a port energy map, for which the EVISA project developed a tool. Once an energy map is created, there are several steps towards a successful energy management system in the port. Step 1 is building a port energy vision. Step 2 is defining gaps in current energy management using the energy map. Step 3 is choosing measures to implement in order to cover those existing gaps. Step 4 is to put those measures on the timeline: when each of those selected measures is going to be implemented in port. Having an EMS helps to control overall energy consumption, reduce it and at the same time decrease the port's carbon footprint.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

3 energy audits

Description:

It has to do with the assessment of current energy consumption in the port. EVISA suggests using the energy mapping tool to complete this measure. The tool lists the full spectrum of energy flows to consider: Annual port consumption of electricity, heating, fuel and water; incoming and outgoing electricity flows; heating budget: incoming and outgoing flows; port vehicles and their fuel consumption; indoor and outdoor lighting inventory; energy performance of buildings; use of biofuels and other types of alternative fuels; utilized renewable energy sources; and applied energy efficiency measures. Knowing and having the data available will help to define the existing gaps in energy management and formulate energy goals as well as the port's long-term energy strategy.

4 smart grid applications

Description:

This measure is about a thorough rethinking of port energy distribution infrastructure and management: instead of one-way energy communication from energy producer to consumer towards two-way dialogue when all energy system components communicate with each other. Usually, a smart grid system includes the following parts: energy production site (e.g., solar panels or wind turbine), electricity usage management systems (e.g., smart meters, communication devices, automation algorithms) and onsite energy storage batteries (including plug-in hybrid vehicles). The normal grid connection is still in operation – for the case when renewables cannot supply enough energy for port use.

The advantage of a smart grid system is the efficiency, reliability and security of the energy grid.
The disadvantage is the requirement of large resources to implement such a system.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

5 employee suggestion system

Description:

It deals with the involvement of employees in the process of striving towards energy sustainability. Examples can be the introduction of voluntary local green initiatives coming from employees and encouragement for those workers who participate in and support those green projects or practices. In other words, this measure is about adding a practice or system through which employees can bring in their ideas.

6 employee environment training

Description:

This solution includes small seminars or training sessions with invited guests (if the administration does have the resources to organize it by itself), where there is a proper environment for learning about new green or sustainable port practices. It helps employees to start thinking greener. This may result in savings: electricity, fuel, or other resources.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

7 employee bus shuttle services

Description:

This measure suits better for large-scale or industrial ports, where the area of operation is too large to move around. Staff shuttle bus delivers people from one port area to another, which as a measure helps to decrease traffic and improve safety in port. This is, for example, implemented in the industrial Port of Tornio.

8 provision of bikes for commuting

Description:

It has to do with the introduction of bike use in and outside the port for employees. If applicable, this measure can help port workers stay fit and reduce their annual carbon footprint. There are existing examples when employees bike to work and also when they bike within the port.

← BACK

EFFICIENCY:

9 bundling of power

Description:

This measure is about negotiation with port operators to agree on joint purchasing of electricity from the energy provider. The idea is to get a discount on green energy: buy energy from renewable energy sources for the same price as one usually buys regular energy from conventional sources. This would make sense for the energy provider because it will get multiple customers as a single package. Before bundling, all port operators and the port authority could be connected to different energy companies. But after bundling they all go to one “shop”, which makes a better deal for the power supplier.

10 cross-company use of waste heat

Description:

This measure is usually applied to larger (industrial) ports but not exclusively. If the port has operators who produce large amounts of waste heat, it can be recuperated and sent forward to other buildings or port operators where it could be utilized. This is a good sustainable practice, which makes environmental and economic sense. *Carbon footprint reduction potential, %: from 7 to 20.*

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

11 heavy duty vehicle (HDV) emission control zone

Description:

This is a port initiative that is related to stricter air emissions standards for vehicles within the port area. This can helps reduce the carbon footprint in the port and put the port authority in the leading role in the greenification process. Examples of such standards could be taken from general European vehicle requirements like EURO V or VI standards.

12 alternative HDV cooling: DTRU

Description:

This measure represents an alternative option for cooling units in the port. It has to do with DTRU or “Dearman Transport Refrigeration Unit”. It has a generator run on liquid nitrogen which produces both cold and power. The advantage is carbon footprint reduction. The disadvantage is the relatively high investment need.

13 alternative HDV cooling: grid connection

Description:

This measure also deals with an alternative option for cooling units in the port. But this particular option is about getting them connected to the local grid if this has not been done yet. The solution also contributes to carbon footprint reduction but only in case, the grid supplies renewable energy-based electricity.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

14 green port fees

Description:

It is a market-based tool addressing the environmental impact of the shipping industry. The idea of this environmental initiative is to differentiate port fees for vessel owners based on vessels' environmental performance. The better it is or the less negative impacts it has, the less one pays – for pilotage fee, security fee, harbour fee, quay due and others. The advantage of the measure is that desired environmental behaviour is being incentivized and as a result, the air emission level is lower. The port has the initiative in its hands. But the system should be transparent, the size of the fee rebate should be sufficiently large to support green upgrades in the shipping sector, and the fee rebate should always target relevant parameters.

15 slow steaming

Description:

This is similar to the green port fees initiative. This measure (which can be stand-alone or be part of the aforementioned approach) has to do with a reward system for those vessels which voluntary reduce speed once reaching the port area. This helps to decrease air emission levels as well as improve the vessel's fuel economy. As a reward there can be slow steaming discounts on port dues. An example of low speed can be 12 knots when the distance from the port is 20-40 nm.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

16 electrification of power train

Description:

It has to do with the full substitution of diesel motors in port vehicles for electric ones. Full electrification is achieved either with the use of a battery or fuel cell. Battery-based electric vehicles require charging: via electricity generation during operation or via a plug-in connection to the electric grid. In turn, fuel cell vehicles have their own inbuilt power plant that supplies electric energy to the motor. No battery is required here. Fuel – normally hydrogen – is transferred to electric energy. If we compare the two types, battery electric vehicles seem to perform better: having higher energy efficiency. Fuel cell-based vehicles can consume two times more energy than battery-driven vehicles. The advantages are carbon and noise reduction as well as the additional possibility to operate indoors. The drawback is a higher cost in comparison with common port vehicles, possible short driving distances and the need to be charged (battery case, plug-in hybrid) – it affects both, the practical use of vehicles as well as requires having a charging station. In the case of a fuel cell, which is based on hydrogen, enhanced safety is required for operation. Both options improve operational efficiency.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

17 energy-saving tires

Description:

This is a simple yet effective measure that can improve fuel economy (by up to 10%). It is about the application of state-of-the-art “low rolling resistance” tires on port vehicles. The advantage is less fuel used; the main drawback is a higher price per tire.

18 tire pressure control

Description:

Another simple measure related to tires has to do with their pressure control. The appropriately inflated tires improve fuel economy, reduce braking distance, improve vehicle handling, and increase tyre service life. Examples of such systems are devices built into tires, which tell the pressure. Manual pressure control practices can be also a solution.

← BACK

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Leverage from the EU 2014–2020
European Union
European Regional Development Fund

EFFICIENCY:

19 regenerative drives

Description:

This measure is suitable for electrified (including hybrid solutions) vehicles and equipment. An example can be a crane, where regenerative drives recover energy from the cranes lowering and braking motions. The recovered energy is sent to the battery for later use, which makes the technology more energy efficient than the conventional one.

20 emission control technologies

Description:

This measure is about improving currently used port cranes. The idea is to upgrade it with certain devices which will lower its emissions. Examples of such devices can be diesel oxidation catalysts; diesel particulate filters; exhaust gas recirculation, exhaust gas after-treatment systems, and others.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund

21 eco driving lessons

Description:

This measure relates also to personnel training programmes. This one is about learning to operate vehicles with the least possible fuel or energy consumption (by up to 10%): e.g. via special driving, lifting techniques, speed controlling and speed switching. By the way, speed control alone can reduce energy consumption by 50%. The idea is to be able to operate the vehicle or equipment with optimal (lowest possible) speed, without losing control over the operation. With speed switching, which idea is to switch or reduce the engine speed to idle (neutral position in a mechanical gearbox) when equipment is not moving, fuel/electricity savings can be up to 25% on average, depending on the operation and utilization of the crane or vehicle. All these lessons can be organized as computer-simulated exercises or real-life practices. This is applicable for cargo handling equipment, cranes and other vehicles in port. The advantage is noise and air pollution level reductions.

← BACK

Programme for Sustainable Growth and Jobs
Leverage from the EU 2014–2020
European Union
European Regional Development Fund