ACTIVITY 3.2 Pilot actions implementation

PILOT ACTION FINAL REPORT

Draft Version
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1. BACKGROUND

<u>Introduction</u>

Technical Work Package 3 includes pilot actions and trainings for cooperation in multimodal transport chains and business activation. Within this WP, activity 3.2 involves the implementation of the pilot actions.

Each partner shall carry out its pilot (as it is specified in the application form) and prepare its pilot report. In all cases other partners are involved, too (assessment, capitalization etc).

<u>Purpose of this document</u>

In order to have a same quality level of pilot report, PP8 Freeport of Budapest as WP leader provides a series of reporting templates, including:

- the pilot action inception report,
- the pilot action mid-term report,
- and the pilot action final report.

This document – the template of the pilot action final report - is the third and last element of this series. The aim of this document is to provide methodological support to be used to summarise the implementation of each pilot action.

<u>Which project partners are involved?</u>

Each project partner who has a pilot is involved. The following table summarises the pilot actions and the responsible PPs.

Topic	Pilot action - Deliverable	Partner responsible
Last mile connections of multimodal nodes	D 3.2.1. PA for last mile connectivity of multimodal nodes: Feasibility Study for a new rail terminal	PP4 - ZAILOG
Multimodal terminals efficiency and optimisation	D 3.2.2. PA for multimodal nodes/terminals efficiency and optimization: innovative control shunting system	LP - NASPA

Topic	Pilot action - Deliverable	Partner responsible
Multimodal terminals efficiency and optimisation	D 3.2.3. PA for multimodal nodes/terminals efficiency and optimization: ICT/ITS tools for rail traffic	LP - NASPA
Multimodal terminals efficiency and optimisation	D 3.2.4. PA for multimodal nodes/terminals efficiency and optimization: ICT/ITS tools for rail traffic	PP6 – Port of Rijeka
Multimodal terminals efficiency and optimisation	D 3.2.5. PA for multimodal nodes/terminals efficiency and optimization: new WMS (warehouse management system) model	PP16 - CODOGNOTTO POLAND
Assessment of market opportunities to reinforce or activate new multimodal services	D 3.2.6. PA for activation/optimization of multimodal services: new services port gateway/freight village	PP4 – ZAILOG AND LP - NASPA
Assessment of market opportunities to reinforce or activate new multimodal services	D 3.2.7. PA for activation/optimization of multimodal services: modal shift form road to rail	PP16 - CODOGNOTTO POLAND AND LP - NASPA
Alternative fuels deployment	D 3.2.8. PA for ECO-innovations on alternative fuels deployment: development of new e-mobility	PP8 – FREEPORT OF BUDAPEST (WITH PP9 – PUBLIC PORTS JSC INVOLVEMENT)
Alternative fuels deployment	D 3.2.9. PA for ECO-innovations on LNG deployment as alternative fuels: logistic model for LNG	PP16- CODOGNOTTO POLAND
Energy efficiency solutions	D 3.2.10.	PP5 – LUKA KOPER

Topic	Pilot action - Deliverable	Partner responsible
	PA for ECO-innovations on energy efficiency deployment: test of energy efficiency in cargo handling	
Energy efficiency solutions	D 3.2.11. PA for ECO-innovations on energy efficiency deployment: tests on transport operations	PP14- LOKOMOTION (assessment by PP7 – RCH)
Trainings	D 3.2.12. Testing of training pathways for energy efficiency deployment in the rail sector – RCH (report is not needed)	PP7 – RAIL CARGO HUNGARY
Trainings	D 3.2.13. Testing of training pathways for energy efficiency deployment in the rail sector – Lokomotion (report is not needed)	PP14- LOKOMOTION

Why do you have to do it?

The main important findings of the pilot actions are recorded and organized in specific documents in order to support the transferability process. It means that we have to prepare a summary assessment report of all pilot actions – which is the responsibility of WP responsible partner (Freeport of Budapest – PP8). The summary report will be based on the inputs you provide in your inception, mid-term and final reports about your pilot actions. Inputs from you are provided for the final report in the format specified by this document.

2. PILOT ACTION IMPLEMENTATION

PROJECT PARTNER	Luka Koper
PILOT PROJECT NAME:	TalkNET Thematic work package 3
PILOT PROJECT ID:	PA for ECO-innovations on energy efficiency deployment: test of energy efficiency in cargo handling

3. DESCRIPTION OF THE PILOT ACTION

NEEDS AND CHALLENGES ADDRESSED BY THE PILOT ACTION (max. 2000 characters)

One of the main goals in the port regarding the operational costs is the rationalization of the costs for energy. Luka Koper will achieve this goal also with the use of high-efficiency lighting technologies, like solutions based on LED (light emitting diode) and automated solutions. These solutions can offer significant improvement in energy efficiency compared with installed conventional metal-halide lighting system, while maintaining equal or providing even better quality of light and improved illumination. The upgrade of indoor lighting may require a significant modification of the existing electrical installations, which can be very expensive.

Energy consumption for lighting can also be reduced with a lighting controls system (powerful monitoring and control capabilities). Market analysis and consultations with potential technology providers proved that a combination of a lighting controls system with occupancy sensors and energy-efficient lamps and luminaires produces the best possible outcome in terms of lighting performance in a selected general cargo warehouse.

BEST PRACTICES AND ACTION PLANS SUPPORTING THE PILOT ACTION (max. 2000 characters)

The upgrading of the energy management processes for everyday operations seems the most effective solution in the short time. Some cases of energy efficiency solutions were presented in best practice examples, for example the case of Port of Antwerp that is considered worldwide as one of the most advanced in energy efficiency and has successfully implemented energy-optimization related measures in past years; and Port of Amsterdam that is considered to be one of the world's most advanced and committed ports in terms of energy efficiency solutions, sustainable energy generation and storage. These best practice cases of investing in energy optimization and testing new opportunities in energy generation and storage and energy consumption reduction were the basis to consider whether the solution is viable to implement as pilot action in the Port of Koper and how to do it as well. Described best practices were taken into consideration while exploring eco-solutions and energy efficiency measures and the possibilities to implement them in our environments.

Within the action plan for the detailed analysis for the implementation of the pilot action was performed. The analysis contains chapters addressing the following topics:

- Description of addressed processes and current energy and environmental footprint,
- Evaluation of energy efficiency potentials, design constrains and replicability potential
- SWOT analysis, implementation approach and identified challenges.

After the performed analysis it was clear that upgrade of indoor electrical lighting has a potential to unlock significant energy and environmental benefits which presents a growing challenge for port infrastructure. The action plan defined tasks to be performed, financial and human resources, involvement of stakeholders and expected results.

Our pilot action was planned based on research of the best tailor-made solutions aiming to reduce the use of energy. The Port of Koper has recognized energy efficiency as one of the key measures to improve company performance and enhance its competitiveness. The port acknowledges that energy efficiency improvements make a significant contribution to security of supply, lower environmental impacts, and more cost-effective business operations. Pilot action focused on the creation of management solutions with a high level of efficiency to reduce the waste of energy during all transport/handling operations.

PURPOSE OF THE PILOT ACTION (max. 1000 characters)

After the as-is analysis and the evaluation of energy efficiency potentials in the selected general cargo warehouse was made to enable proper identification of opportunities for reducing cost for energy and environmental compliance and for future energy savings. The electricity consumption is mainly used for indoor and outdoor lighting (the lighting is active during cargo operations). The results from this analysis were used during the implementation phase. After the analysis of the energy efficiency of the warehouse the technical solution for the improvement of electrical lighting at the selected general cargo warehouse was defined and the technical documentation was prepared. Based on the technical documentation the renovation of the lighting system was implemented. With the new LED lightning system also monitoring was established in order to calculate the energy savings. The testing of the pilot action was carried out in order to confirm expected results and to justify the renovation of the lighting systems in other warehouses of the port. With this report of the testing phase and justification the solution will be transferable to other logistic nodes and transport connections.

CONTENT AND OUTPUT OF THE PILOT ACTION – DESCRIPTION OF THE DELIVERABLE (max. 15000 characters)

In the selected general cargo warehouse no.33 the new LED lighting system with a powerful monitoring and control capabilities was implemented. It provides a flexible and open concept for upgrading electrical lighting installations and it must be capable to operate in a standalone mode or integrated in a future smart grid. The documentation/project design of electrical installations and electrical equipment for reconstruction of the electrical installations in the warehouse 33A, B, C, D in the port of Koper was prepared on the basis of the project task of the investor (Implementation of alternative solutions for electrical installations in the warehouses 33A, B, C, D, in Luka Koper).

This project has high replicability potential since there are around 2,200 similar lamps installed in other warehouses in the port of Koper that can be replaced with new and energy efficient lamps. The proposed solution can operate fully automatic with remote control or in a standalone mode. Additionally, proposed solution has a potential to reduce a peak power on the port level.

Existing metering system was upgraded and additional sub-meters for direct measuring of electricity consumption for indoor and outdoor lighting were installed. The proposed solution upgraded existing light level/illuminance and consequently improve working conditions in the selected general cargo warehouse no. 33 in the port of Koper. It is positive that proposed LED based solution will require less maintenance than existing, conventional high-pressure metal halide lamps and it is desired that the electricity for port operations come from renewable or at least low carbon energy sources.

SITUATION BEFORE THE PILOT ACTION

Addressed warehouse no. 33 is used for the storage of general cargo and it is in constant operation since 1995. Building has a typical warehouse design where the main construction material is the reinforced concrete. Total useful surface of the warehouse is around 7,032 m^2 and the height is around 8 m. Warehouse is divided by walls in four equal storage units (no. 33A, 33B, 33C and 33D) with the surface of 1,758 m^2 each. Each storage unit has its own entrance.

Figure 2: Typical situation in the general cargo warehouse no. 33

Cargo handling operations are managed by several warehouse workers which are responsible for all aspects of warehouse functions including the receiving, storing, handling, shipping and preparing of materials and goods for delivery while maintaining the warehouse in a safe and orderly fashion.

The main environmental impact that can be attributed to the processes related with the addressed general cargo warehouse no. 33 can be attributed to the electricity consumption which is mainly used for indoor and outdoor lighting. Working hours of electrical lighting system (indoor and outdoor) are in close connection with the associated cargo operations. The electricity consumption of the entire general cargo warehouse no. 33 is metered, and available data represents solid background for the monitoring and verification of future energy savings. Example of metered data is given in Figure 3.

The meter is installed at the main supply cable in the transformer station. On the annual level electricity consumption of the addressed general cargo warehouse is around 60 MWh of which 74% is for indoor and 23% for outdoor lighting. Around 3% of annual electricity consumption can be attributed to other systems (office and other small cargo handling equipment, etc.). This graph shows the electric energy consumption for the lightning system in the warehouse no. 33 when operating. With reduction of power by 51% for interior lighting and establishing a control system, the warehouse 33’s electricity consumption is reduced from 44,400 kWh to 22,500 kWh per year, which is an approximate consumption of one RMG crane per month.

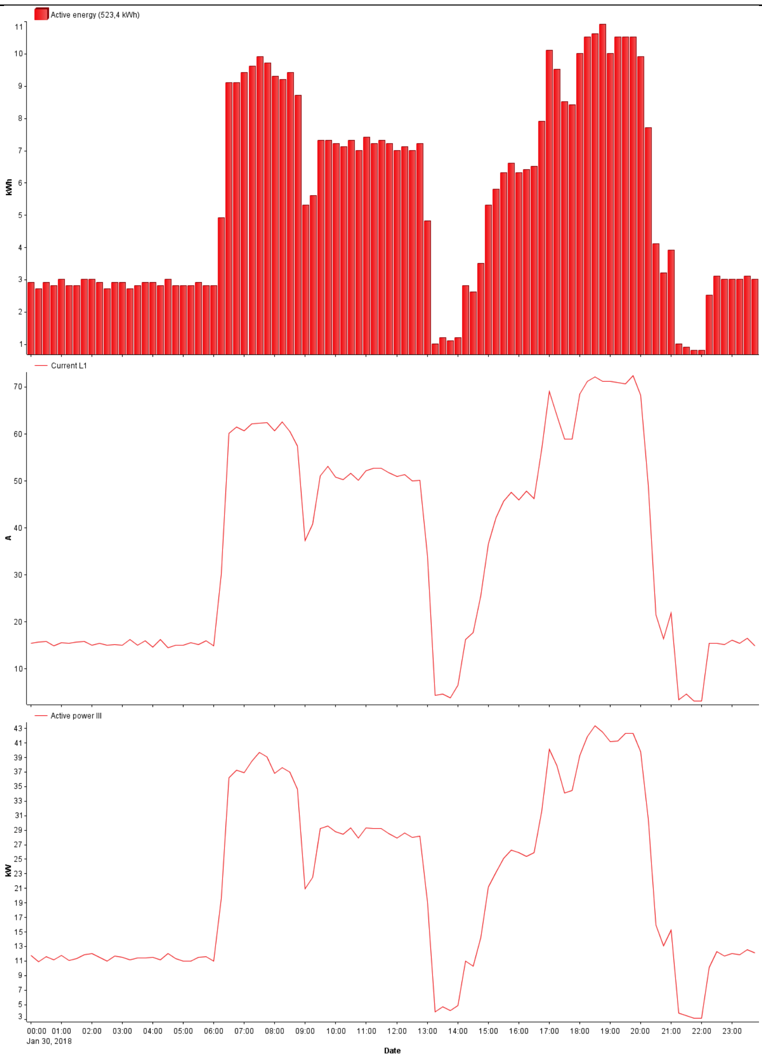

Figure 3: Example of monitored electricity consumption in the general cargo warehouse no. 33

Sankey diagram of electricity consumption in general cargo warehouse no. 33 is given in Figure 4. Flows are in kWh per year (reference year is 2017).

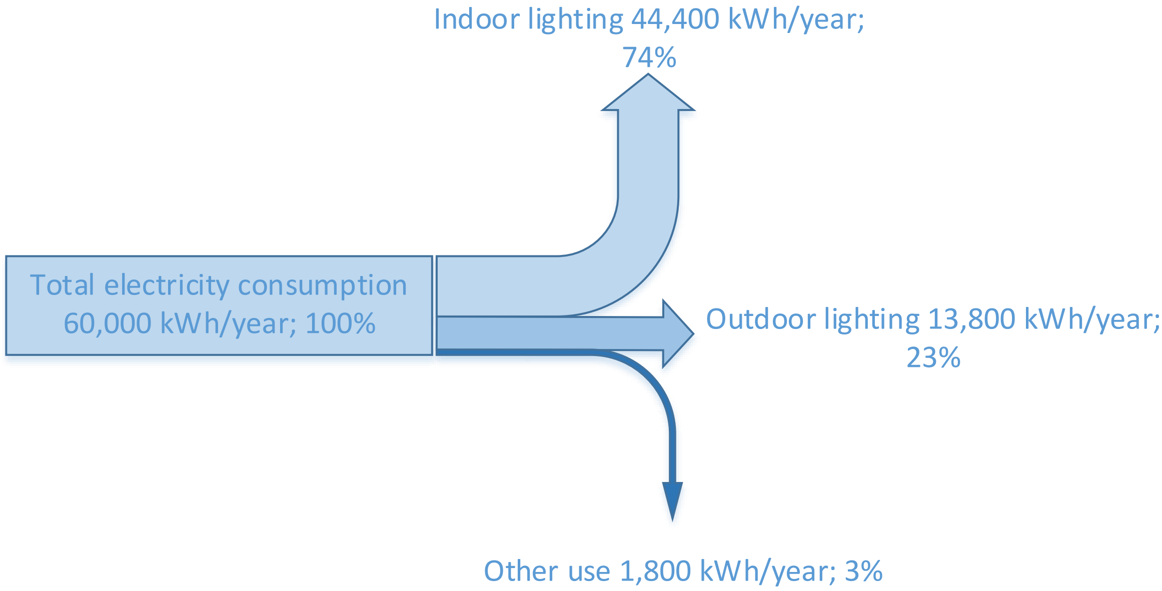

Figure 4: Sankey diagram for electricity consumption in the general cargo warehouse no. 33

Before the pilot action implementation, seventy-two (72) Osram 400 W high pressure metal-halide lamps are used for indoor lighting in the addressed warehouse no. 33. Total installed power of the indoor lighting system, including ballasts and control gear, in addressed warehouse amounts to 31.68 kW. Additionally, it needs to be clarified that metal-halide lamps cannot immediately begin producing their full light capacity because the temperature and pressure in the inner arc chamber require time to reach full operating levels. This is the reason why in many cases metal-halide fixtures have more operating hours than actually needed since the shop-floor workers tend not to turn off the lighting system due to the safety reasons. Average illuminance in the addressed warehouse amounts to 189 lux (before the pilot action).

PRELIMINARY SIMULATION RESULTS

According to results of simulations the total installed power of new system amounts to 16.06 kW (before the realization of the pilot action was 31.68 kW). Also, according to results of simulation new lighting system in addressed warehouse no. 33 provides average illuminance of 236 lux which represents upgrade of existing illuminance level for 25%.

TEST RESULTS - KEY PERFORMANCE INDICATORS

Measurements of electricity consumption for indoor lighting show that about 4,300 kWh is consumed per quarter of year, which amounts to 17,200 kWh annually, which means that electricity consumption is decreased by 26,800 kWh or 60.1% compared to the estimations of electricity consumption.

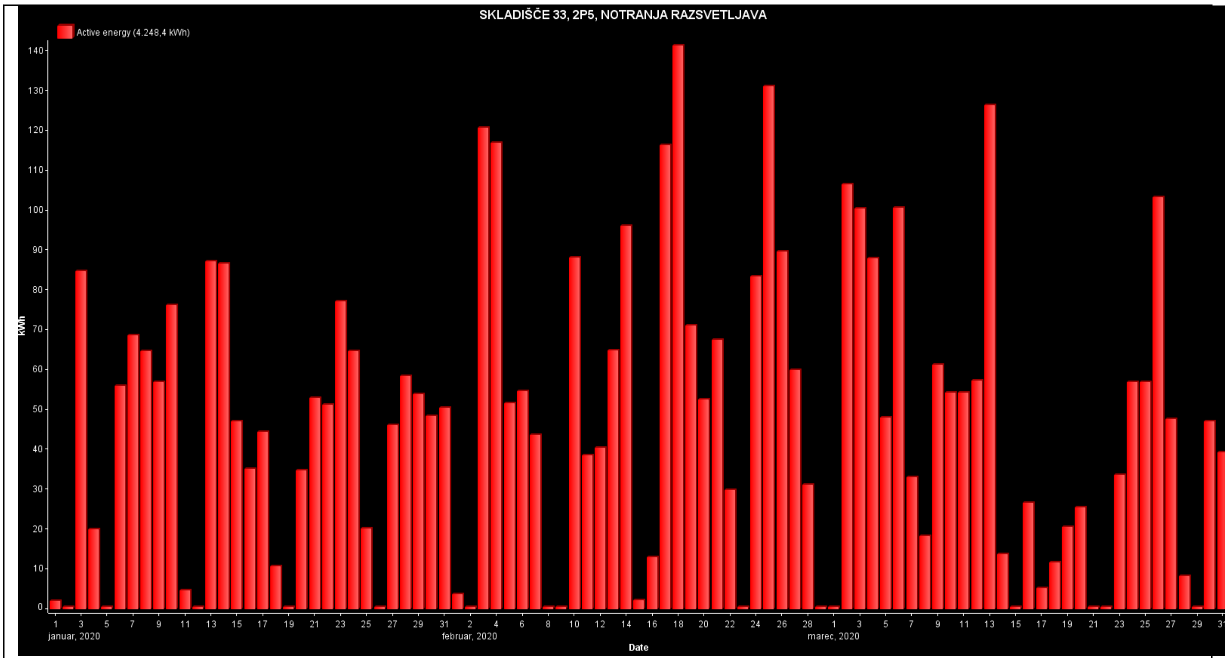

Figure 5: Graph of electric energy for interior lightning

	BEFORE PA	AFTER PA
Ratio between total electricity consumption for indoor lighting and total number of cargo handling operational hours	11,89 kWh/op. h.	4,63 kWh/op. h.
Ratio between electricity consumption for indoor lighting and total mass of cargo stored in the warehouse	1,81 kWh/t	1,37 kWh/t
Ratio of electricity consumption for indoor lighting and total number of cargo units stored in the warehouse	12,43 kWh/TEU	6,88 kWh/TEU

The following Figure 5 shows the user-friendly remote-control system for LED-lightning system in the warehouse no. 33. It can be easily used on PC or tablets.

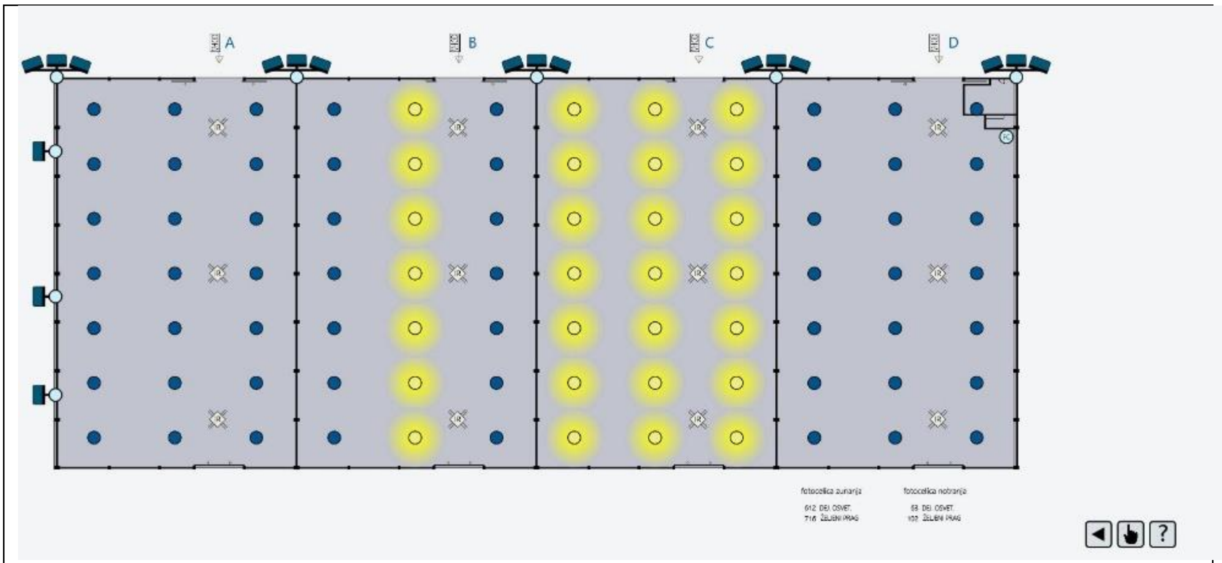

Figure 5: Remote-control system for LED-lightning system in the warehouse no. 33

The following Figure 6 shows the difference before and after the installation of the LED-lightning system in the warehouse no. 33. The illumination before the LED-lightning system installation was 189 lx on average. After the installation of LED-lightning system the illumination in the warehouse no. 33 was 236 lx on average.

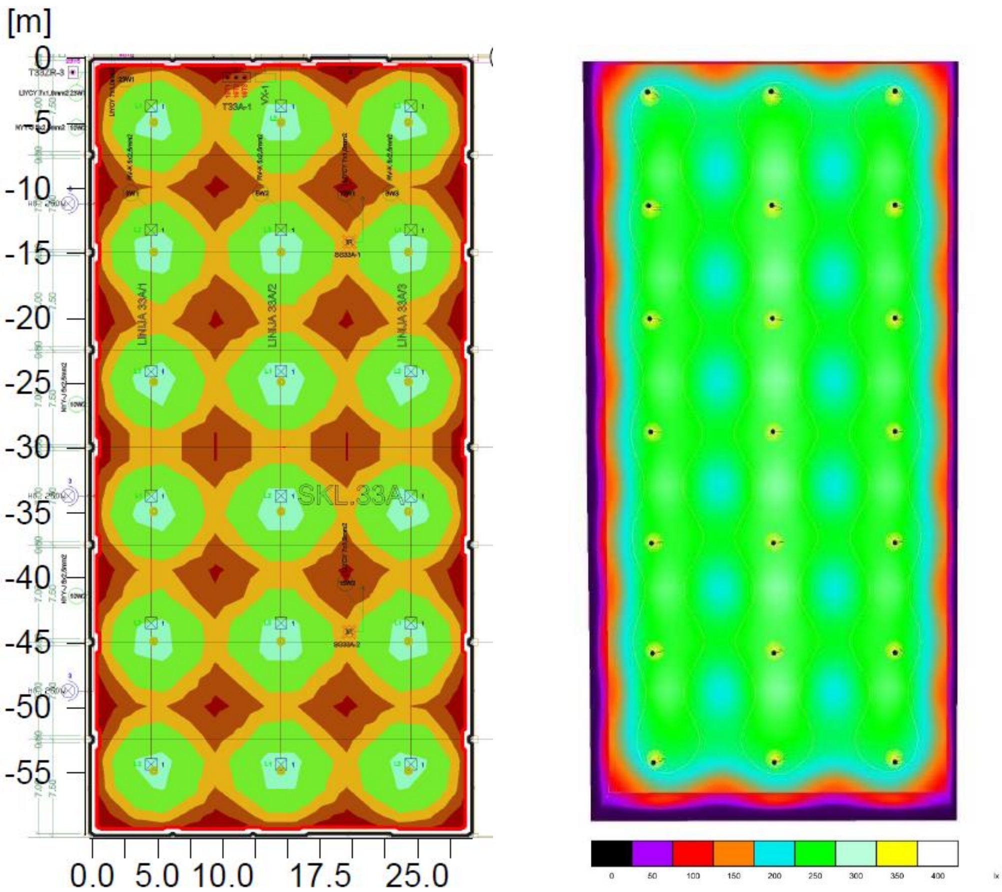

Figure 6: Illumination in the warehouse before and after the new LED-lightning system

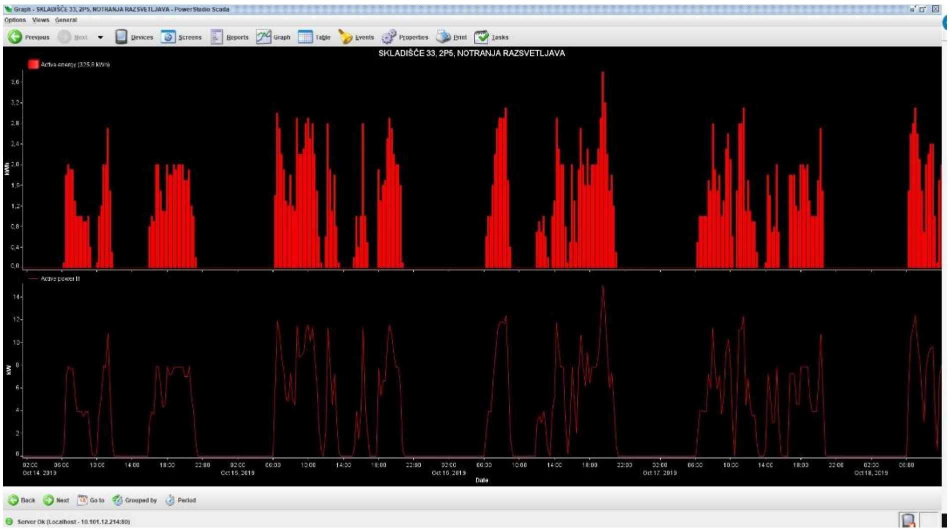

Figure 7: Graph of electric power for interior lightning

Sankey diagram of electricity consumption in general cargo warehouse no. 33 is given in Figure 8. Flows are in kWh per year (reference year is 2020).

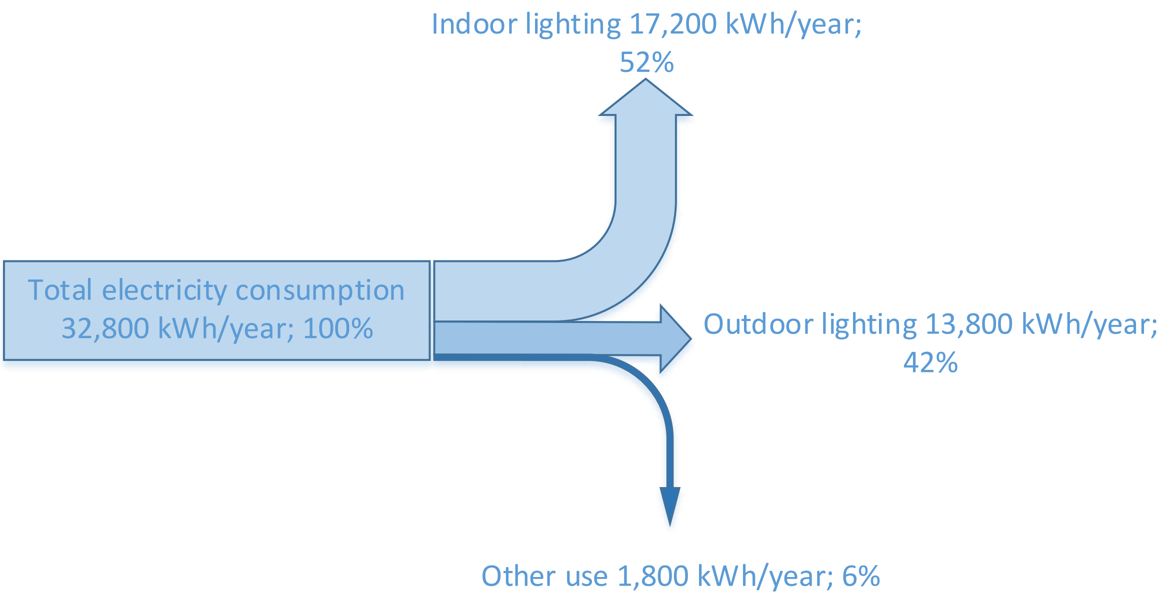

Figure 8: Sankey diagram for electricity consumption in the general cargo warehouse no. 33 (2020)

WERE THERE ANY DEVIATIONS IN TERMS OF THE CONTENT OR PURPOSE OR ANY PART OF THE PILOT ACTION – IF YES, PLEASE DESCRIBE THE REASONS (max. 2000 characters)

No deviations.

4. STAKEHOLDER'S INVOLVEMENT

HOW THE STAKEHOLDERS WERE INVOLVED (max 2000 characters)

The transport and logistic players included in the operations before and after the implementation of the investment:

- Forwarding agents (Port community - 46 members)
- Shipping agents (Port community – 20 members)
- Shipping companies

These players daily express their satisfaction with the solutions of the investments and the satisfaction with the realization of the ordered service.

The players:

- Ministry of infrastructure (Slovenian Maritime Administration, 2 Municipalities)
- Institutes, companies – logistic area, traffic and transport

are involved in the preparation of the investment documentation.

5. TRANSFEREBILITY OF PILOT ACTION RESULTS

TRANSFERABILITY OF THE PILOT ACTION RESULTS (max. 2000 characters)

The solution of improvement of energy efficiency in the selected cargo warehouse (Luka Koper pilot action) has been developed to the point that can be adapted/exchanged in this case in all kinds of warehouses/warehouses on other terminals - nodes by all project partners and other stakeholders in the logistic area throughout the CE region. Certainly, Luka Koper will continue with usage of the lightning system also after the project implementation and will in the future transfer this solution onto other warehouses.

The advantages of the new lighting system are mainly energy and environmental savings and lower operating costs, which can be even greater after the replication and transferring of the tested solution to other warehouses in the port. With the installation of the new LED-lightning system, there is reduced energy consumption in the warehouse for up to 50% and reduced costs of energy in the warehouse for up to 50%.