D.T2.4.2 - KNOWLEDGE TOOL FOR PILOTS/ACTION PLANS IN THE FIELD OF ENERGY EFFICIENCY

Energy Efficiency

Final version
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1. Executive summary

Within the TalkNET project, five knowledge tools have been developed in order to make available a review of best practices and relevant knowledge in the two macro fields of action of the project, that is to say Multimodality and Eco-innovation, and the related five identified sub-topics:

1	LAST MILE CONNECTIONS OF MULTIMODAL NODES	MULTIMODALITY
2	NODE MANAGEMENT OPTIMIZATION	
3	ASSESSMENT OF MULTIMODAL SERVICES	
4	ALTERNATIVE FUELS DEPLOYMENT	ECO-INNOVATION
5	ENERGY EFFICIENCY SOLUTIONS	

The objective of the TalkNET project is to improve the coordination among freight transport stakeholders for increasing multimodal environmentally-friendly freight solutions. Within the project framework, stakeholders have been included in defined project clusters (five project clusters) that correspond to the five identified sub-topics and that allow to gathered actors with common interest for cooperation.
Within this goal TalkNET partners are involved in a continuous transnational consultation process with the stakeholders in order to define how to deal with the above mentioned fields of action.
The knowledge tools delivered are the results of this process: it deals with the collection of the relevant knowledge in these fields both from inside and outside the partnership. Therefore, the knowledge tools will include both the significant experiences of the project partners and those gathered outside at EU level from other actors and operators.

More in details, the use of the knowledge tool allows to focus on a specific issue considering the following logical steps:

1. needs identified as relevant for the partner or/and the stakeholders expressing an interest for the issue;
2. problems deriving from non-satisfaction of the needs preliminary identified, hampering the optimization of a specific process or/and situation;
3. identification (if any), of past attempts to remove, mitigate or solve the problems above-mentioned, offering suitable solutions;
4. identification of the weakness affecting the past attempts;
5. mapping of feasible good practices implemented in order to give answer to the same or similar needs in a comparable context. Good practices identified can refer not only to cases implemented within the Interreg CENTRAL EUROPE Programme area but in general,

provided that the needs and the context can be brought back and then compared to the punctual situation under analysis;

6. systematization in order to achieve a clear overview of the elements characterizing the good practices identified and their analysis in order to find out key elements or/and processes that can be adapted to the specific situation in order to provide feasible solutions.

For needs, it is meant the necessities identified internally or externally, by the stakeholders, to which it is not possible to provide a credible answer without implementing a series of actions aiming at solving weakness or/and obstacles.

A good practice can be seen as an example of someone with the same needs that was able to satisfy them. Accordingly, it is a method, model or technique that has been accepted as superior to several alternatives because it produces results that are superior to those achieved by other means or because it has become a standard way of acting.

The points mentioned above correspond to the approached adopted by the TalkNET project when dealing with knowledge management and review of best practices. This is demonstrated within the "Summary report of the inputs collected from the stakeholders and tools development" (D.T 1.4.4-2.4.4), that is strictly linked to the best practices collection as the step before to the development of the knowledge tools. In fact, stakeholders were involved in the preparation of the knowledge tools as partners took part in and/or organized meetings with relevant stakeholders to collect their inputs that are functional to the elaboration of these outputs. They allowed to investigate those best practices that can be possible answer to the stakeholder's needs.

Therefore a review of the current/up-to-date knowledge in the sub-topics identified by the project will be delivered and the knowledge available will help project partners in the implementation of the project activities. In particular, this benchmark will be useful and necessary to develop the project action plans (A.T1.5-2.5 – planning phase of the project activities) and the pilot actions (A.T 3.2 – testing phase of the project activities).

Anyway, TalkNET thematic knowledge tools will offer knowledge and best practices review that will be available not only to project partners but also to the operators acting in the fields of multimodality and eco-innovation. In particular, this knowledge tool is focused on the best practices gathered in the fifth field of energy efficiency solutions.

The structure of the document is the following: in chapter 2 it is given an overview of the TalkNET project; in chapter 3 it is given an introduction to the best practices that this documents propose, focusing on the EU and then the TalkNET approach about of energy efficiency; chapter 4 is the most relevant part of this document giving the collection of best practices and knowledge both from inside and outside the partnership; chapter 5 gives main conclusions of this work.

2. About TalkNET project

The aim of TalkNET is to improve the coordination among freight transport stakeholders for efficient and environmentally- friendly multimodal transport solutions in central Europe.

TalkNET involves sea and river ports, inland terminals, rail operators, logistic service providers, regional authorities and development agencies:

8 CORE PORTS	3 CE REGIONS	OPERATORS/PRIVATE
Port of Venice (IT) Port of Trieste (IT) Port of Koper (SI) Port of Budapest (HU) Public ports of Slovakia (SLO) Port of Rijeka (HR) Szczecin & Swinousce Seaports Authority (PL) Inland Port of Verona (IT)	Veneto Region/Veneto Strade (IT) West Pomeranian Region (PL) Usti Region dev. Agency (CZ)	Lokomotion (GER) Rail Cargo Hungaria (HU) Codognotto Poland (PL) Italian-German Chamber of Commerce, Munich (GER)

The project results will be achieved focusing on the following fields of action:

1: Last mile connections of multimodal nodes → INFRASTRUCTURES

It deals with the optimization of the links of the terminal/node with last mile connections. It is focused on the improvement of the links to the main transport networks node-to-node, in particular core and comprehensive TEN-T networks.

2: Improvement of multimodal terminals efficiency and optimization → MANAGEMENT EFFICIENCY

It deals with the optimization of the internal dimension of the terminal/node and it involves the improvement of its efficiency. It is focused on the improvement of the terminal operative and logistics management systems.

3: Market opportunities to reinforce or activate new multimodal services → SERVICES

It deals with market analyses to improve intermodal connections and existing/new logistics services and solutions. It is focused on the creation of new multimodal services to tackle bottlenecks affecting the several transport routes (rail, road, sea).

4: Alternative fuels deployment → ALTERNATIVE FUELS

It deals with the increasing use of transport means supplied by alternative fuels instead of fossil fuels. It is focused on the potential deployment of alternative fuels for ports/inland terminals and logistics operators (e.g. LNG demand analysis) to understand what is the real consumption of these type of fuels in the transport network.

5: Deployment of energy efficiency in transport operations → ENERGY EFFICIENCY
It deals with the research of the best tailor-made solutions to manage the partners' project logistics chains aiming to reduce the use of energy. It is focused on the creation of management solutions with a high level of efficiency to reduce the waste of energy during all transport/handling operations.

TalkNET project is developed in three macro Work Packages: WPT1 Multimodality, WPT2 Eco-Innovation and WPT3 Pilot Actions. Before implementing the pilot actions four main activities are implemented.
The first activity (AT1.2 - A.T2.2) includes the analysis phase focused at regional level. It aims to assess problems, needs and challenges of the identified project nodes' regions and measure the impacts of the stakeholders business activities on the five sub-topics previously defined. In this phase, the stakeholders are involved at a territorial level. The analysis will end with a further step that is the mapping of stakeholders.
The second activity (A.T1.3 - A.T 2.3) is about the identification of the clusters according to the results of the previous analysis. In this phase, the stakeholders are involved at cluster level.
The third activity (A.T1.4 - A.T2.4) develops the knowledge tools, which collect the knowledge from within and beyond the partnership on the five project sub-topics. The involvement of the stakeholders in this phase is at the transnational level. The thematic tools are developed and define the connection between the three work packages.
The fourth activity (A.T1.5 – A.T2.5) concerns the planning phase. Here the actions plans are implemented and they will be more suited to tackle problems and needs founded in the previous phases. Stakeholders are involved at node level.
The following step is to plan how to respond at problems/needs previously identified by the project: it is the testing phase, the core part of the TalkNET with the pilot actions (A.T3.2), with the cooperation of the stakeholders form the design to the evaluation of the final results of the pilot actions.

2.1 Overview of action plans and pilot actions

After the analysis phase, through the action plans project partners will implement the planning phase on the five project priorities: last mile connections, node management optimization, assessment of multimodal services, alternative fuels deployment and energy efficiency solutions. They are set up in cooperation with the relevant stakeholders.

The following partners focus their action plans on the field/cluster of energy efficiency:

D.T 2.5.2 – Action plans on eco-solutions deployment – VENICE (NAPA)	**NORTH ADRIATIC SEA PORT AUTHORITY**
D.T 2.5.3 – Action plans on eco-solutions deployment – TRIESTE (NAPA)	**PORT NETWORK AUTHORITY OF THE EASTERN ADRIATIC SEA**
D.T 2.5.4 – Action plans on eco-solutions deployment – LUKA KOPER (NAPA)	**LUKA KOPER**

D.T 2.5.5 – Action plans on eco-solutions deployment – RIJEKA (NAPA)	**PORT OF RIJEKA AUTHORITY**
D.T 2.5.6 – Action plans on eco-solutions deployment – VERONA FREIGHT VILLAGE	**ZAILOG**
D.T 2.5.7 – Action plans on eco-solutions deployment – BRATISLAVA	**PUBLIC PORTS**
D.T 2.5.8 – Action plans on eco-solutions deployment – BUDAPEST	**FREEPORT OF BUDAPEST**
D.T 2.5.11 – Action plans on eco-solutions deployment – USTI NAD LABEM	**REGIONAL DEVELOPMENT AGENCY OF USTI REGION**

Eleven pilot actions will test:

- the links to the main transport networks node-to-node;
- terminals' operative and logistics management systems;
- the creation of new multimodal services to tackle bottlenecks affecting the several transport routes (rail, road, sea);
- the potential deployment of alternative fuels for ports/inland terminals and logistics operators;
- the creation of management solutions with a high level of efficiency to reduce the waste of energy during all transport/handling operations.

The following partners focus carry out pilot actions in the field/cluster of energy efficiency:

PILOT ACTION ON ENERGY EFFICIENCY DEPLOYMENT

D.T 3.2.10 - Test of automation lighting system in port areas for cargo handling	**LUKA KOPER**
D.T 3.2.11 - Test for the optimization of locomotives energy efficiency	**LOKOMOTION**

In the field of energy efficiency, also two training are foreseen within the project activities:

TRAININGS

D.T 3.2.12/3.2.13 - Workshops on ECO-driving solutions for the rail sector	**RAIL CARGO HUNGARY & LOKOMOTION**

3. Introduction to best practices in the field of energy efficiency solutions

In accordance with its peculiarities and role (maritime ports, fluvial ports, inland interports, public administrations, …), each Project Partner involved in the TalkNET consortium has analysed in depth the current situation in its nodes of interest in order to identify, study and point out effective and feasible eco-innovative solutions to tackle the environmental impact of the transport and logistics operations managed.

In this section, the reader will be informed on the results of these analyses from the point of view of the energy efficiency solutions.

Proposed analyses' outcomes and relating solutions range from "soft" to "hard", where for "soft" is intended the re-thinking and progressive adaptation of the procedures and processes used by the Partners and their stakeholders in daily routinely operations, along with the awareness and behaviour.

On the other side, for "hard" is meant the investments in upgrading, re-thinking or building new infrastructures, so as to obtain a lower energy consumption and a better exploitation of the resources already in use.

Identified needs have to be analysed taking into account the nature of the Partner and its geographical context of reference. Nevertheless, main common points across the Central Europe macro-region can be pointed out. These needs are at the basis of the subsequent best practices' analysis and the detailed designing of the pilot actions. At large, the identification of best practices for each Partner as represented a useful benchmarking opportunity in order to became more aware of the current needs to be approached by further TalkNET activities.

Applying this methodology, three paramount outcomes have been identified:

- the possibility to operate retrofitting or upgrading interventions that are necessary to improve and decrease the energy consumption from the grid. A large part of these retrofitting and/upgrading measures does not require high investment or time to be put in place (e.g. installation of a light lighting system);
- a changing in the vision of key local and regional players, both public and private, towards the deployment of energy efficiency measures that must be accompanied by appropriate training and awareness raising activities on the topic
- the necessity to review a generally not fully-aligned public supporting policy measures, such as dedicated normative and incentives or grants.

Focusing on the first pivotal outcome pointed out above - Infrastructure Interventions, a set of common actions are shared by Partners, considering their nature. Accordingly, within this overview three different typologies have been addressed:

- costal ports;
- dry/inland ports;
- operators.

Costal ports involved, Port of Venice, Port of Trieste, Port of Koper, Port of Rijeka and Port of Szczecin expressed comparable requests, mainly related to the necessity to carry out a detailed analysis of the energy distribution and consumption within the area and inside each terminal. This analysis should be the basis for the drafting of guidelines and strategies to reduce the impact of port activities with specific KPIs and relating actions to improve the energy usage and to promote the use of renewable energy.

Along with the above-mentioned organisation initiatives, the majority of the partners highlighted the possibility to operate similar retrofitting measures, such as the installation of LED lighting system within terminals and port areas along with the dimming of certain areas which are not necessary to be lighted during night time operations, or the installation of specific components or machineries as photovoltaic systems and the substitution of diesel cranes with electrical ones.

Considering the Italian ports involved, Port of Venice and Port of Trieste, the analysis carried out through the project will support the Partners 'alignment to the Leg. Decree 169/2016 and subsequent Guidelines for Ports' Energy Masterplan issued on December 2018 by the Italian Ministry of Environment.

By way of example, the port of Rijeka, as the adjoining node of Koper, is facing the attempt to renationalize its energy consumption both via structural retrofitting or renewal of operational machineries and infrastructures or through the re-thinking and re-designing in a more sustainable way of the business routinely business processes, such as the reuse of waste materials and application of the circular economy principles.

Hence, the Port of Rijeka focused on potential solutions concerning the re-designing of the energy supply sources and tested the following: solar energy, biomass, hydrogen, wave energy, onshore supply energy.

The port of Venice carried out an in-depth analysis of the energy consumption of its 6 Terminal Operators, pointing out the weaknesses within the structures and operating methods of each, proposing possible solutions or alternatives to reduce energy consumption or to favour a better and more efficient distribution.

Another example of retrofitting and upgrading interventions have been presented by Port of Koper. Within its terminals, working processes require abundant use of diesel-fuelled machinery. The largest consumers include rubber-tired gantry cranes (RTG), terminal tugs, manipulators, vehicles used for rail traction, forklifts and tractors. In 2017, the container terminal was the largest consumer, accounting for 65.2% of all motor fuel consumption in the port. With new e-RTG and RMG cranes, motor fuel consumption on the container terminal will gradually decline. In purchasing new transport machinery, the Company satisfies to the latest technological and environmental requirements. Moreover, Existing boiler house for heating administrative buildings on fossil fuels that burden the environment, replaces the automated and environmentally friendly boiler room with the energy efficient biomass boiler. In addition to the active use of wood biomass for heating different objects of the Port of Koper, the challenge is to monitor the active use of wood biomass - wood chips and other waste materials that are collected in the port area in terms of energy savings.

Considering the Baltic Sea Region area (BSR), the Port of Szczecin reported the absence of shared indicators and parameters at node level for monitoring energy consumption and relative efficiency as one of the major factors hampering the application of a common and univocal

answer to the issue. The Partner propose the drafting of a specific plan for monitoring and improving energy consumption in the Zachodniopomorskie Region to be developed starting from statistical data from previous years (historical data), and concerning: fuel and energy consumption should be correlated with the nature of production, typical production indicators for the industry, and to be best associated with environmental indicators. As a result of monitoring the efficiency, a database based on policy assessments could be created, including the impact of technology on energy consumption

A second group of partners is represented by the dry/inland ports (i.e. Verona freight village, Freeport of Budapest and the Chamber of Commerce of Munich since it described the activities of the two German freight villages Nuremberg and Hof). The main outcomes and needs pointed out after the analysis are:

The needs identified are the following:

- the designing of a set of rules to implement an ICT system to improve the management of the loading units in the buffer area;
- the re-thinking of terminals layout to minimize the number of useless shunting operations. It must be done in two ways: hard and soft actions. The first can be represented by the new design of the terminal area where the distance from the railway station and terminals will be minimal;
- the establishment of clear rules for specific market sectors and products clusters to easy the handling operations;
- the re-designing of the operative processes related to transhipment of goods between rail and road transport modes in order to obtain a decrease of energy consumption through the application of new technologies and operational standards. The assessment of the transhipment of non-cranable semi-trailers is one of the possible directions of development.

By way of example, the Interport of Nuremberg has been included in the Rhine/Meuse-Main-Danube Masterplan for LNG to evaluate the feasibility to use this alternative fuel solution for cargos in inland waterways. LNG as fuel significantly reduce vessels pollutant emissions up to -20% of CO2 and -80% to -90% of NOX, with almost zero PM and SOx. The plan intends to promote a wide-scale development of LNG as a fuel and as an energy source.

Transport and Logistics operators, such as the Codognotto Group, Lokomotion or Rail Cargo Hungary expressed specific needs and expectations in relation to the complex increasing of energy efficiency of the nodes under review in the short/mid-term. Their pushing on port authorities and terminals, along with other market stakeholders consistently impact on the whole market context and evolutions. Their needs can be summed up in two main stream: infrastructure upgrading and technological development.

The interests and issues raised by Rail Cargo Hungary can be read in parallel with the ones identified by Lokomotion. The total transport performance in the examined region (rail network of the Hungarian State Railways) is approx. 100 million train kilometers per year. In 2016 more than 70% of this was performed by electric traction. The Hungarian overhead line is used by 34 railway companies, which needed 849 GWh electric energy in 2016. Given this huge nominal energy consumption values the development of an energy-efficient operation strategy has been in the focus of research and development centers, suppliers and industrial/rail users. The Partner identified three parts of the system on which intervene in order to obtain a positive effect in the short/mid-term:

- education;
- motivation;
- advisory system.

Other two aspects have to be taken into account looking at the operators' point of view. The dialogue with the public administrations and the customers. As previously highlighted for the ports, the sensitivity to the topic by the public decision makers is crucial in order to accelerate the market uptake of brand-new green technologies, along with the retrofitting of existing building with minor interventions able in any case to produce significant results in the short term.

4. Best practices collected in the field of energy efficiency solutions

The best practices presented in this document would like to offer good solutions tested and experienced in the field of energy efficiency solutions.

These good practices have been collected following the criteria of the project field of action and, when possible, of the pilot action foreseen in the related field (2.1 Overview of pilot actions).

Specifically, it deals with solutions tested and proposed by TalkNET project partners and other selected from external operators and actors that partners have deemed to be significant for their activities and business.

Nevertheless, not only good solutions are proposed, but in some cases also the relevant up-to-date knowledge in the thematic field of energy efficiency solutions, as guidelines to support activities in this specific field.

The selection of the best practices has been strictly influenced by the needs of partners' stakeholders that have been detected from the project activities and the various contacts that the partners had working with them.

Moreover, the variety of the TalkNET project partners has represented an added value for the knowledge management of the project, allowing to gather in turn different stakeholders good solutions adopted.

Title
ECO-solutions deployment in the Ports of Amsterdam
Players included and contacts (if available)
Port of Amsterdam: customers, suppliers, NGOs, start-ups, research and educational institutions
Location
Port of Amsterdam, Belgium - https://www.portofamsterdam.com/en
Summary
The Port of Amsterdam is the second largest in the Netherlands in terms of transshipment. It is ranked fourth among European ports and it 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. In this framework, from the most valuable solutions to be taken as best practice examples, the following solutions have been selected: 1. Energy Port Policy Adoption of a dedicated Programme for the transformation of the port to a sustainable 'Energy Port' 2. Installation of solar panels With the 100,000 m2 (17 MW) of solar panels installed on port's buildings, the port area is the largest solar farm in the region 3. "Sustainable energy means business" The Port seeks to become an innovative hub for strart-ups and companies working in the field of energy efficiency and circular and bio-based maritime economy 4. Cold ironing Implementing Cold Ironing solutions lessens the environmental impact on areas surrounding ports, particularly in densely populated areas. The Ports of Amsterdam is a great example where cold ironing has been successfully implemented using locally generated electricity
Overview
For many years the Port of Amsterdam committed itself to ensure energy efficiency by innovating its overall maritime and inland operation procedures, this including the efforts made in investing in energy optimization and testing new opportunities in energy generation and storage. On the basis of the results and achievements obtained in these implementation experiences, the following mesures have been selected: 1. **Energy Port Policy** The Port adopted a dedicated Programme titled 'Energy Port', in particular with reference the partnership with the Municipality for the detailed implementation framework of an innovative energy transmission systems through smart grids shared between the Port and the City. As energy provider of the smart grids the port, in alliance with the City, established the Waste and Energy Company, which produces

both electricity and heat from waste for the port area as well as for the city.
The Company is located in the port and intended as fully devoted to energy efficiency and recycling systems empowerment.

Currently the City of Amsterdam has a huge amount of residual heat, produced by two City' power stations and the Waste and Energy Company. Approximatly 45.000 houses have already been connected to the heating network and the Port is working in expanding this heating network ring to arrive approximately to 200.000 houses connected by 2040.

Furthermore, this implementation is also considered as valuable support in changing positively citizens and business behavior, strengthening the value of waste, leading to a more conscious consumption.

2. **Installation of solar panels**

Given their considerably lower cost and their relatively easier installatrion process, solar pannels have been more widly implemented in European Ports. With the 100,000 m2 (17 MW) of solar panels installed on port's buildings, the port area is the largest solar farm in the region.
The port is working to make it easier for businesses in the port area to go solar. For this purpose, a dedicated system is currently under implementation to ensure coordinated joint purchasing of port' solar panels as well as maintenance and monitoring of them.

One of the main objective currently under implementation is dedicated to accommodate new port's largest solar project with over 41,000 solar panels that will provide sustainable energy for one of the private companies operating as logistics services provider, the CWT.
In addition to transport and sea shipping operations, CWT is active in the Port of Amsterdam in fields including storage of cocoa and coffee. In order to carry out these activities in a sustainable manner, CWT has opted to use the roofs of its buildings to generate solar power. It is calculated that a combined total of 41,114 solar panels will generate more than 11,000,000 kWh of green electricity.

3. **Sustainable energy means business**

The Port of Amsterdam is an example of smart symbioses of different services and utilities which can reduce energy and costs. The Port Authority acts as an infrastrstructure manager for all industries located in the harbour.With this basis the port seeks to become an innovative hub for start-ups and companies working in energy efficiency, circular and bio-based maritime economy.

The vision is to promote sustainable energy transition as new opportunity for business development that will create jobs, new products, and economic progress thorought innovative companies (in the fields of recycling systems, biofuels, transshipment wind turbines) and green business in the port.

A valuable achivement in this direction is represented by the combination of proven technology with ground-breaking 'plastics-to-fuel' patents developed by Integrated Green Energy Solutions (IGES) in the Port of Amsterdam, which recently won the 2019 IAPH World Ports Sustainability Awards in the Climate and Energy category.

The facility has a permit to process 100 tonnes per day of end of life non-recyclable plastics to produce 35 million litres of fuel per annum that requires no further processing, blending, or refining – it is the first in the world.

IGES has the capacity to eventually process up to 400 tonnes of per day of end of life, non-recyclable plastic to produce 140 million litres of fuel (given the population of Amsterdam and its surrounding areas).

The plastic recycling plant at the Port of Amsterdam is a promising first step, and could be expanded with high-value approaches for waste streams with high environmental impacts, such as biomass, textiles, and e-waste.

4. **On-shore power supply**

The Port of Amsterdam, toghtether with AEB Amsterdam, Senfal and Energy eXchange are jointly supplying ship-to-shore power to vessels from locally generated power in the port. The project is intended to promote the use of sustainable, locally generated power in the port and to reduce costs.

This solution, tested from 2017, demonstrated that the use of sustainable, locally generated power in the Port of Amsterdam reduces costs improving efficiency and business-costs. Shore power stations are given to vessels the possibibilty to switch off their diesel generators at the quay and using the sustainable power grid. In this way no emissions will be released.

Port's of Amsterdam ambition in long term perspective is the production of locally generated energy without the interposition of a traditional electricity suppiers.

Furthermore, the Port intends to achieve its sustainability objectives formally signed with the agreement on 'Clean Shipping Vision 2030' thought concreate actions such as reduction of emission of ships at docks by 50%.

Results and experience collected

The Port of Amsterdam made record profits in 2018, while also further successfully developing its commitment to eco-innovation demonstrates that the approach in promoting the above described measures can represent an opportunity also for growing in competitiveness. The recently published annual report reveals that the Port made a net profit of 68.5 eu million in 2018, 12.5% higher than the 60.9 eu million profit made in 2017. Revenue also rose 5% to 157.4 eu million.

Further to this, a large portion of the revenues that the port made in 2018 from leasing land was earned from companies that are focused on sustainability and circular economy.

Added value for TalkNET project / Link to Pilot actions

The most promising solutions described above in the framework of energy efficiency at the Port of Amsterdam represent valuable references for all TalkNET project partners as well as for the Central Europe stakeholders.

More specifically, the above described best practices could be take into consideration while exploring eco-solutions and energy efficiency measures, such as:

- Energy Policy
- Solar panels installation and smart grids
- Sustainable energy and innovation start-ups
- On-shore power supply and generation of electricity from renewables.

Title
ECO-solutions deployment in the Port of Antwerp
Players included and contacts (if available)
Port of Antwerp: employees, neighbouring companies, customers, suppliers, the local community, local government, knowledge institutions[1]
Location
Ports of Antwerp, Belgium, https://www.portofantwerp.com/en
Summary
The port of Antwerp houses Europe's largest integrated fuel and chemicals cluster. This is associated with high energy intensity and emissions of greenhouse gases. Despite this chracteristics, the port community is considered worldwide as one of the most advanced in energy efficiency and has taken successfully energy optimization related measures in past years while investing in renewable energy. From the most relevant solutions implemented in this framework, the following measures have been selected: 1. Energy Plans and "The Blue Gate Antwerp project" The Port promoted a specific framework for energy plans dedicated to businesses operating in the port area. Furthermore, the Port of Antwerp itself is reinvesting its share of the income yielded by the generation of energy from renewables via dedicated fund for energy named "The Blue Gate Antwerp project". 2. ECLUSE Ecluse is a steam network created by the Port that supply the heat from six incinerator facilities in the form of steam to the nearby port companies. 3. PortXL and start-up Enervalis – smarter decisions about energy management With this project the Port of Antwerp aims to introduce and support innovative technologies on to the port sustainability platform, such as the case of Enervalis, a start-up offering a software that allows to make smarter decisions about energy management. 4. Mobility The promotion of sustainable transport methods within the port is one of the priority in which the Port is committed, including the promotion of a dedicated policy of promoting the use of sustainable transport methods and the reduction in the number of home/work trips by private cars.
Overview
Europe's second-largest port, in its relatively small area, the Port of Antwerp is home to the greatest concentration of major industrial energy consumers and electricity generation facilities with a capacity of 1.2 GW. Overall, the businesses on the site represent about 10% of national electricity consumption and 10% of national generating capacity. • Last year (2019), total maritime freight was up more than 5% on the year before, the sixth record year in a row managed while keeping the ecological footprint stable, despite larger freight volumes and industrial outputs, and the number of green energy production units

[1] https://www.sustainableportofantwerp.com/en/content/stakeholder-participation

is growing steadily.

- This is the result of the efforts that the port community has pursued in innovation in energy sectors and sustainability as a way of meeting the challenges posed by climate change.

From the most relevant solutions implemented in this direction, the following measures have been selected:

1. Energy Plans and The Blue Gate Antwerp initiative
   The Port promoted a specific framework dedicated to businesses operating in the port area, whose energy consumption exceeds the established parameters are required to design an energy plan every 4 years. This obligation equally applies to installations whose consumption varies between a specific lower range, when their environmental permit has to be renewed. The plan in question contains measures whose RoI (return on investment) is higher than 15%, and which must be put in place within 3 years. Moreover, the construction of any new installation requiring an environmental permit, and whose consumption exceeds a minimum standard, must be prefaced by an energy study, including in particular a comparison of the installation's energy efficiency solutions by reference to those already existing on the market (benchmarking). Lastly, businesses which are not SMEs and do not fall under the obligation to draw up an energy plan must undergo an audit (valid for 4 years).

   The Port of Antwerp itself is reinvesting its share of the income yielded by the generation of energy from renewables also via a dedicated fund for energy within "The Blue Gate Antwerp project" initiative, the objective of which is to facilitate investments in energy efficiency and to co-finance innovative energy initiatives in the port area. For example, the fund provides financial or practical help to businesses in carrying out their energy audits and setting up energy management plans. The projects proposed are evaluated by a steering committee made up of representatives from the port authority and experts.

2. ECLUSE
   Ecluse is a steam network created by the Port that supply the heat from six incinerator facilities in the form of steam to the nearby port companies. This enable them to heat their buildings sustainably. It also offers a host of benefits for the environment: over time, 100,000 tons of CO2 less will be discharged into the air each year.

   As first port' green heat distribution, ECLUSE, is fully operational as network comprising the overall port area. The installed renewable energy capacity has increased to 262.83 MWe in 2018.

3. PortXL and start-up Enervalis – smarter decisions about energy management
   PortXL is a start-up accelerator, a global hub for entrepreneurs in the logistics, maritime and energy sector. Its main objective is to put maritime start-ups in contact with companies at the port.
   Part of an international project, PortXL in the Port of Antwerp is working on scouting, matching and supporting businesses in the accelerated development of maritime and port-related start-ups. In this way, the Port of Antwerp aims to introduce innovative technologies on to the port faster than ever before. For the 2018, six start-ups convinced representatives from DEME, MSC and Port of Antwerp after an intensive day of pitching and conversations, proving their potential for closing energy and sustainability pilot projects.

Between them, Enervalis, a start-up offering a software that allows to make smarter decisions about energy management to successfully support the port community' vision for sustainability and energy economics.

- Throughout the three months period of preparatory phase, a clear action plan for implementing a common energy monitoring and reporting platform around the assets in the port have been identified, allowing standard definitions for measuring real-time energy usage.

4. Mobility

The promotion of sustainable transport methods within the port is one of the priority in which the Port is committed, including the promotion of a dedicated policy of promoting the use of sustainable transport methods and the reduction in the number of home/work trips by private cars. Accordingly, various incentives have been set up: the promotion of the use of bicycles, shuttles and car-shares (a database makes it easy to find a partner). Supplementary initiatives by private companies have also been rolled out. For example, workers at Bayer, Evonik, Ineos, Lanxess, Monsanto and Solvay enjoy a free I-Bus shuttle service.

In a medium term perspective, the Port Authority and its partners seek a sustainable commuter traffic policy and by 2030 target a 10% reduction in the number of employees-drivers driving alone. The Port is then working on initiatives and campaigns in different areas to stimulate public transport and promote alternative means of transport such as bicycles, collective transport, water mobility and initiatives such as carpooling.

Results and experience collected

Analyzing the above reported best practices and the relevant results achieved in energy efficiency combined with significant traffic growth achieved by the Port of Antwerp and detailed within the Sustainability Report - 2019, it is clear that successful implementation of eco-solutions can open new business opportunities ensuring a significant economic growth. Indeed, the growth of 2017 and 2018 has been reported without an increase in environmental emissions (NOx, SO2, 2 particulates and CO2) while energy consumption decreased of about 2.3%, despite the growth of the Port activities.

Not only did the Port's added value as an economic hub on a world scale and engine for the Flemish and Belgian economy significant success, but the results were also achieved under a long-term strategy for sustainable growth.

Added value for TalkNET project / Link to Pilot actions

The above described measures successfully implemented in the Port of Antwerp could be adapted and applied in the ports and business partners of TalkNET project, as well as in all the relevant transport stakeholders environments in Central Europe area.

More specifically, these best practices experiences could be take into consideration while exploring available eco-solutions and energy efficiency measures, such as:

- Energy Plans assessment
- Network of heating systems serving the port area
- Decision support systems for energy management
- Mobility

Title
Innovative technology for gantry cranes energy savings – Hupac, Busto Arsizio (Italy)
Contacts if available / Players included
▪ QUADRANTE SERVIZI as terminal manager ▪ AGSM as electricity supplier ▪ KÜNZ as gantry cranes producer ▪ TERMINALI ITALIA as terminal manager
Location
Busto Arsizio, Italy http://www.hupac.ch/IT/Home-page-d95c6b00 Verona, Italy http://www.quadranteeuropa.it/
Summary
a. In the Central Europe area, Hupac is one of the landmark in the terminal management field b. Following the example of this entity, Verona realized an innovative terminal in 2010 to get similar or even higher performance c. The innovative terminal of Verona (called Compact Terminal) has the same performance of the oldest in the freight village area but using the half of surface
Overview
In 1992, the Swiss company Hupac has built a new terminal close to the Busto Arsizio railway station. In 1993, the terminal was upgraded in order to activate the gateway service. This function allows to merge the goods of different trains, loading them in a unique train going to a specific destination. For instance, if there is a train going to Koln in Germany, it is possible to load it with the loading units coming by rail from the Italian ports. Using the gateway function, the trains are placed one next to each other. In this way, only the gantry cranes are used (avoiding the use of reach stackers), speeding up the entire process. There are not useless gantry crane lifts to place the loading units on the yard or on the buffer area because they are directly moved from the origin train to the destination one. This is one of the best organization available on the market because permits to increase the productivity, reducing the gantry cranes movements and enhancing the energy savings. Following this example, Verona built a new terminal in 2010 called “Compact Terminal”. It is managed by Terminali Italia and it has similar features to the Hupac one. In addition, Compact Terminal occupies the half of the surface of the traditional terminal working in Verona (as suggested by its name) and its performance are higher. It is due to its innovative technology that allows to grab the loading units quickly and to reduce the timings to move from one train to another, improving the overall handling process. Lastly, the gantry cranes can carry out a complete rotation (360 degrees) on itself when it is necessary to reverse the direction of the loading units if there are balancing problems. There is a sort dynamo that is able to recover energy during this rotation. This device permits to reduce the consumption of energy up to 25% compared to an old generation terminal like the first built in Verona. In conclusion, the good practice adopted in Hupac is a sort of guideline to follow in order to increase the level of efficiency of the nodes. In fact, all the useless gantry crane movements to put the loading units on the yard or on the buffer area are a waste of energy and time. However, it is important to remember that Hupac is a private terminal that manages only its trains so these conditions make easy to implement

the gateway system. Despite the deployment of the gateway system in other terminals can be difficult, following the example of Hupac it is possible to improve the inefficient management of some terminals operating in the Central Europe area.

Results and experience collected

- Thanks to the gateway service implemented in 1993, Hupac is one of the few players in the market able to reduce the useless gantry cranes lifts, preventing the congestion of the buffer areas
- Verona built a new terminal (called Compact Terminal) in 2010 to reach the same results of Hupac
- Compact Terminal uses the half of surface of the oldest terminal in Verona but has the same performance because are reduced the gantry crane movements. In addition, its cranes are able to save the 25% of energy compared to the obsolete ones operating in the area

Added value for the TalkNET project / Link to Pilot actions

The handling method implemented in Hupac thanks to its dedicated infrastructure represents an example of efficiency for the other European nodes (both ports and inland terminals). The accuracy and the speed of the gantry cranes movements allow to manage several trains per day. In addition, the reduced number of gantry crane lifts permits important energy savings. The environmental aspect has become more and more important in the last two decades. For this reason, the investments in eco-friendly solutions are raised. Moreover, the benefits achieved using these green technologies produce an increase of the revenues and an overall improvement of the management of the daily working activities. The example given by Hupac is important both for the TalkNET partners and for the all Central Europe players. In fact, Verona built a terminal with similar features to expand its business, reducing the waste of energy and of resources employed. Furthermore, inside the Verona freight village will be realized a new terminal with the last technologies available on the market (that will have a dedicated driveability) able to handle trains 750 meters long. The feasibility study to realize this new infrastructure will be included in the pilot action D.T3.2.1 (Pilot Action for last mile connectivity of multimodal nodes: Feasibility Study for a new rail terminal). The forecasts about this plant show a low consumption of energy despite the big volumes that will be managed inside this area. In conclusion, nowadays the use of green technologies is almost mandatory since they permit to reduce the environmental impact and also to get an advantage on the competitors.

Title
Eco-driving practice - Deutsche Bahn
Players included and contacts (if available)
▪ Deutsche Bahn
Location
Germany
Summary
Energy-efficient loco driving can enhance the environment friendliness and reduce the traction costs.
Overview
The importance of locomotive driving in an energy-efficient way is proven by practical experiences: two identical trains running on the same route could have a 40-50% difference in energy consumption, and half of the difference could be caused by non-appropriate driving style. Currently, eco-driving program is totally missing in the official, accredited training programs in Hungary as the Railway Authority does not obligate it. An optimal solution would be to put the eco-driving program into the standard train driver education organized by the National Railway Authority. However, the realization of this aim is not likely in the next few years. Therefore, it is a more reasonable goal to create eco-driving education for train drivers within the company frame. Although the legislation of the European Union makes the training in energy-efficient loco driving optional, a lot of railway undertakings in the member states pay attention to this topic (e.g. Germany, Austria) As an overview of the international practice the eco-driving activity of Deutsche Bahn was examined. DB is the largest energy consumer of Germany and very interested in energy saving. In 2002, a comprehensive energy efficiency management program was launched. During the program, all engine drivers (about 14,000 people) were trained in theoretical and practical training, all 3500 locomotive units were equipped with an energy consumption meter, established a database for the documentation of the energy consumption of locomotives, and trained 300 team leaders for data processing.
Results and experience collected
▪ Between 2002 and 2005, € 32 million was saved as a result of the measures introduced. In long-distance passenger transport 5% reduction in energy consumption was achieved in 2006 compared to 2002. It means 102,000 MWh of electricity and 63,343 tons CO2 emissions. Similarly, in the case of regional passenger transport, the decrease was 3% (but the base year was 2003), meaning 96,625 MWh and 60,694 tons CO2. ▪ Significant cost reduction (20-30% of the traction cost) can be achieved thanks to the proper driving behavior. ▪ The teaching methods are better appreciated if the loco drivers can place the theoretical knowledge to practical situations. The loco drivers have to experience the aha moment,

to realize the importance and the economic effect of their actions and behaviour.
Added value for TalkNET project / Link to Pilot actions (D.T 3.2.12)
2-days eco-driving workshop will be organized for 20 Hungarian loco drivers as a pilot project. The eco-driving workshop can help the loco drivers to experience the aha moment, to realize the importance and the economic effect of their actions and behavior. The importance of the simulator session has to be emphasized.

Title
LEADER process for eco-driving – DB Cargo germany
Players included and contacts (if available)
▪ Railway undertakings (e.g. Deutsche Bahn) ▪ Companies producing rail vehicle systems (e.g. Knorr Bremse)
Location
Germany
Summary
Two basic factors influence the traction energy consumption. Firstly the traffic circumstances, where the negative effects are caused by the delays and secondly the human factor, namely the driving-style. If the main goal is the improvement of the system, the traffic circumstances should be considered as an inevitable negative effect and it should be eliminated locally. Naturally the task is a multi-criteria optimization, since besides the minimal energy consumption the keeping of the journey time is the aim also. However such a system may not disturb the basic task of the engine-driver. These goals can be reached with the development of the following three parts of the system: • Education • Motivation • Advisory system
Overview
The first pillar of the efficient energy consumption is the education of the engine-drivers: the engine-driver should learn the effect of the deceleration and acceleration and energy demand of the chosen speed. The second pillar is the motivation of the engine-drivers, comparing their performance with a statically or dynamically (in a traffic-dependent way) calculated energy consumption norm. And thirdly: the motivated engine-drivers could be supported with a driver advisory system. A master thesis investigated energy efficient train control in the Netherlands. This research examined the performance of energy efficient train control on a network-level for a part of the rail network of the Netherlands, considering performance on energy

saving potential, punctuality and conflicts in order to gain insights on the behavior of energy efficient train control on a network level. The research strategy used in this study was experimenting by simulation with OpenTrack which is a micro-simulation tool in which both network and trains can be programmed to the smallest detail in order to accurately simulate running times. This study has shown that also on network-level, energy efficient train control significantly reduces the energy consumption of trains. An average saving of 11% was shown based on microsimulation analysis. In general application of energy efficient train control leads to an energy saving, but application of the strategy does not guarantee a saving in all cases. The research has also shown that punctuality is not affected negatively. Energy efficient train control causes the trains arrive more around the planned arrival time. Moreover, energy efficient train control contributes to safety. The red signal approaches and red stops at red signals are reduced by 10%.

As a practical example Metromiser system and Long-haul fuel conservation system can be mentioned. Although these systems were designed for diesel traction, it has similar analogue as in case of electric locomotives. Scheduling and Control Group of the University of South Australia grounded the theoretical basis with discrete control model for Metromiser system and Long-haul fuel conservation system, which provided driving advice for metros and long-haul rails, respectively. The Metromiser system has been successfully applied to urban rail transits in Australia, Melbourne, Toronto, etc. Metromiser system achieved a fuel saving of 15% and significant improvement in timetable keeping.

DB Cargo drivers in Germany are pioneering a new real time system aimed at making journeys as energy-saving as possible. The company is the first in Europe to utilize the Locomotive Engineer Assist Display and Event Recorder (LEADER) system, which has been designed to help deliver a sustainable transport system. From a dedicated digital display in the driver's cab, LEADER gives the driver live recommendations for maintaining speeds which are as energy-efficient as possible, based on calculations of the train's schedule and the altitude profile of the route. The technology ensures climate-friendly transport. LEADER is manufactured by Knorr-Bremse.

Results and experience collected

- There is significant potential for making savings within the environment of the driver's cab, with energy meters able to measure the vehicle's output.
- To help facilitate a wider public understanding of the LEADERS process and the energy-saving issues faced by a carrier like DB Cargo, it has also developed a train simulator app for smartphones and tablets. The 'DB Zug Simulator' shows how the energy-efficient system works on-board, and users can brake and roll the train in the right places, based on the type of recommendations that drivers receive.

http://kd5-lamp.systelserver.de/DB-Zug-Simulator/

Added value for TalkNET project / Link to Pilot actions (D.T 3.2.12)

Energy-reduction measures are also a vital part of training, which helps to keep the drivers informed of results and developments.

Title
Cranable mobile platform – Intermodal Terminal Dudelange, Luxembourg
Players included and contacts (if available)
CFL Terminal Intermodal Eurohub Sud http://www.cfl.lu/espaces/fret/en/group/structure/infrastructure/cfl-terminals
Location
Municipality of Dudelange, Luxembourg
Summary
The users and the transhipment volume of non-cranable semitrailers using the new mobile platform will gradually grow over the coming years.
Overview
Other logistics centres and transportation terminals gave various answers to the transition of road freight to railways and the linked services. Best practice found: CFL Intermodal terminal in Luxembourg, Dudenlange The CFL logistics centre lies on the TEN-T motorway line connecting the North-Sea and the Mediterranean, it is situated next to the marshalling yard of Bettembourg being the main freight terminal of Luxembourg. The logistics centre became saturated in 2014 and after a two and a half year long construction it has opened a new container and combined terminal of 33 hectares. It is open 24/7, provides intermodal connection mostly between road, rail, waterways (towards the North and the Baltic Sea) and air. It also provides regional last mile and industrial site rail services. The new terminal is directly connected to the Bettembourg marshalling yard on a side track that opens into a fan of six tracks within the terminal. Two of the tracks are used by the combined terminal. The other four tracks are used by the container terminal. The newly built container terminal has a capacity of 300.000 containers /year. It operates with 2 gantry cranes and 2 reach stackers. On the side of the container terminal is a parking place for 840 semi-trailers and also a storage unit with a capacity of 3.425 TEU. Both the container and the combined terminals are equipped with electronic weighing system and the latest security and surveillance systems. Each trailer entering the facility is photographed from all sides, the licence plates are read with an optical recognition system. CFL also provides warehousing cross docking and commissioning, customs services and further services in the logistics chain. The combined terminal operates two full pneumatic LOHR platforms of 700 meters. The core of the platform is a pneumatic system that lifts and turns the wagons by 30 degrees, containing the semi-trailers (detached from their carriers). The wagons are uploaded and downloaded in this rotated position with 6 jockey tractors simultaneously then secured by the

personnel of the terminal. One full loaded train takes 40 semi-trailers loaded on 20 wagons. The capacity of the combined terminal is 300.000 trailers/ year. The terminal offers train connections towards France, Italy and Belgium and Spain. The company has ambitious plans on the extension of the cowered routes in the future. Taking into consideration that combined transport has increased +41% between 2005 and 2013 it is reasonable to expect rapid further growth in this sector.

Combined transport in general is more efficient: rail freight transport emits 9 times less CO2 and uses 6 times less energy than road freight transport. Unfortunately no specific information or analysis is available on the operation of this specific terminal in terms of CO2 reduction and energy savings (rail vs road).

Through the implementation of the same system FBL could become a combined transport terminal within Central Eastern Europe. The Hungarian logistics terminal has the capacities and ideal geographical conditions for the implementation of this project.

Results and experience collected

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  - A significant modal shift from road to rail of the cargo transported in non-cranable semitrailers using an innovative cranable mobile platform.
-
  - After the successful market introduction, it is expected that the users and the transhipment volume of non-cranable semitrailers using the new mobile platform will gradually grow over the coming years.

Added value for TalkNET project / Link to Pilot actions (D.T 3.2.8)

After the successful market introduction, it is expected that the users and the transhipment volume of non-cranable semitrailers using the new mobile platform will gradually grow over the coming years. Through these achievements, a much better situation can be reached regarding the energy efficiency and consequently, the cost efficiency of the combined transportation system between the Freeport of Budapest and various destinations in the Central Europe region.

The main stakeholders are:

- Ministry of Innovation and Technology
- MAHART Freeport Plc.
- Freeport of Budapest Logistics Ltd. (FBL)
- ArcelorMittal Distribution Hungary Ltd.
- Ekol Logistics Szolgáltató Ltd.
- Ferroport Ltd.
- Ghibli Ltd.
- Kelet-Trans 2000 Ltd.
- MASPED Logisztika Ltd.
- MLSZKSZ (Hungarian Association of Logistic Service Centers)
- Varga Kreatív Mérnöki Iroda Kft.
- Brezovits Mérnökiroda Kft.
- Metallurgy manufacturing companies

- Waberers Intertrans Nyrt.
- RÉVÉSZ Trans Kft.
- Horváth Rudolf Intertransport Kft.
- Road freight transport companies

Title
Time-multiplex control unit system for (older) locomotives (TMC/ZMS) – BR 139 - Lokomotion
Players included and contacts (if available)
▪ EBA-German Railway Authority ▪ Rail Traction Company – Italy ▪ Various technical advisers
Location
Train Line: Munich /Germany) – Kufstein (Austria) – Brennero (Italy)
Summary
The trans-alpine combined loading traffic with only a temporary increase in locomotive demand thus clearly gains in attractiveness and performance. More efficient track use, higher loads and lower costs are clear arguments in favour of this approach.
Overview
Lokomotion and RTC operate a locomotive fleet which consists of several different types. Newer series (BR 185, BR 186, BR 187 BR 193, EU 43) from about year 2000 are largely compatible with each other, that is, several locomotives can be controlled by a locomotive driver from a driver cab. As there are older locomotives from the 1950s in the inventory (BR 139), it was natural to establish their compatibility with the rest of the fleet. In particular, the required investment level for vehicles that were around 60 years old was decisive. Not to be neglected, however, was the circumstance of the ever more difficult deployment possibilities without retrofitting taking place. Otherwise, these considerations could have ultimately led to the shutdown and scrapping of these locomotives. That is why the plans have been expanded to include energy efficiency and optimisation of human deployment. Criteria: The procedure to be considered with regard to the conversion must be co-ordinated by the authorities in advance. A phase-wise conversion or commissioning should be aimed at, so that the existing approval of the locomotive does not expire. A generally changed and quantitatively changed local service has to be co-ordinated in advance with all involved parties. Thus, the sum of the costs for expensive locomotive hours can be saved.

Results and experience collected

The procedure to be considered with regard to the conversion must be co-ordinated by the authorities in advance.

A generally changed and quantitatively changed local service has to be co-ordinated in advance with all involved parties. Thus, the sum of the costs for expensive locomotive hours can be saved.

Added value for TalkNET project / Link to Pilot action 3.2.13

The energy efficiency of transport operations will be increased.
Especially the trans-alpine combined loading traffic with only a temporary increase in locomotive demand thus clearly gains in attractiveness and performance. More efficient track use, higher loads and lower costs are clear arguments in favour of this approach.
Connected to the other TalkNET Pilot action (Interoperable use of drivers Verona – Kufstein)
Promotional and demonstrative actions need to be implemented in order to show the reliability of this technologies. Furthermore, public bodies need to be involved in order to understand how to react and delivered proper incentives.

5. Conclusions

Best practices collected in the field of energy efficiency solutions have highlighted different aspects about the approach and interventions in the field of the energy efficiency improvement.
The importance to study, test and put in place valuable actions and solutions to increase the energy efficiency in order to reduce the negative impact of the externalities related to the pollutant emissions increase and the economic costs related to an under-performing energy utilization is growing.
More in detail, as for the deployment of alternative fuels, the re-thinking and the upgrading of the energy management processes for day-to-day operations seems the most effective solution in the short-time, which appears able to produce concrete effects.

6. Index

6.1 Collection of best practices

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