Novel dual-fuel s**ys**tem for **m**odernisation of **a**ir-polluting diesel locomotives to clean and efficient gas ope**r**a**t**ion, NYSMART

Deliverable:

D7.2

Report on gender, societal, and ethical issue of exploitation

Date: 31.05.2019.

Version: 1.0

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Co-funded by the European Union

Introduction

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NYSMART is a project aimed at finalizing, certifying and piloting NYSMART dual-fuel system for different locomotive types and achieving ready to market product with the actual dual-fuel system proven in an operational environment. In order to achieve this objective, the work plan spans a duration of 30 months, consists of 8 working packages (WP), where 7 of them were introduced in project proposal and 8th "Ethics requirements" was introduced when was the Grant agreement was signed, and its overall structure follows a logical flow to take the NYSMART technology from TRL6 to TRL9 - compliance testing, field demonstration, and certification, the precursors for full market entry (TRL9).

The implementation of the project, led by DiGas SIA, is expected to result in increased competitiveness of the European railway, decreased greenhouse gas emissions from the rail operations, and significantly reduced health damage that is associated with emissions of particulate matter (PM), NO_x, and SO_x for European citizens. The project, while concentrated on the environmental dimensions, nevertheless shall be carried under the Responsible Research and Innovation principles to ensure that the whole research and innovation process and its outcomes are best aligned with the values, needs, and expectations of European society. Following the accepted Ethics principles is seen as pivotal for impactful and successful project implementation.

The present document is a deliverable of the NYSMART project, funded under the European Commission's Horizon 2020 framework programme SME Instrument Phase 2.

Deliverable D7.2 "Report on gender, societal, and ethical issue of exploitation" describes DiGas' approach to relevant gender, societal, and ethical issues. In this document, the issues are viewed in separate sections, describing the relation of each with the project in detail and providing explanations of how each is and will be addressed.

The internal guidelines administering the research and work of all involved parties under the NYSMART project are based on fundamental rights that govern the European Union such as the **Charter of Fundamental Rights of the European Union** and the **European Convention on Human Rights** and the national laws of the Republic of Latvia. Besides, H2020 specific guidelines on Gender, Ethical, Environmental, and Sustainable Development are prudently considered and strict compliance with them is assured.

Gender Issues

In line with the United Nations system's mandate to integrate a gender-perspective into work, DiGas is devoted to ensuring that no intervention or research contributes to gender inequality or aggravates existing gender inequality. NYSMART project does not directly involve actions or demonstrations that might affect the overall view on gender issues. Even more, in accordance with the Article 21 of the Charter of Fundamental Rights of the European Union on non-discrimination and Article 23 on equality between men and women, DiGas is committed to guaranteeing that all the actions undertaken by the entity and all its employees are not discriminatory to any gender, race, religion, culture or subject to any other unlawful discrimination and that men and women are ensured equal opportunities for employment, work, pay, and social security. In addition, all DiGas employees are expected and encouraged to act in accordance with the following principles:

- Opposing all forms of unlawful and unfair discrimination and promoting inclusiveness;
- Aiming at a gender balance of the team implementing the project;
- Promoting diversity of the local communities and involved parties;
- Providing equal and fair working conditions for both men and women;
- Prevent any form of sexism, prejudice or discrimination based on sex; implicit sexism; and sexual harassment or assault.

Moreover, DiGas is also dedicated to the European Commission Strategic Engagement for Gender Equality and is advocating its 5 priority areas[1]:

- Increasing female labor market participation and economic independence of women and men;
- Reducing the gender pay, earnings, and pension gaps and, thus, fighting poverty among women;
- Promoting equality between women and men in decision-making;
- Combating gender-based violence and protecting and supporting victims;
- Promoting gender equality and women's rights across the world;

To address the above-mentioned issues and promote gender equality, DiGas has already pursued many activities such as creating strict internal policies that ensure equal pay to both women and men; offering flexible working hours and an opportunity to work remotely to all employees; granting an extra day or two of for family necessities; and ensuring that all DiGas members are actively involved in decision-making and encouraged to express their views to challenge the conventional wisdom.
While DiGas is employing women during the implementation of the project, but the specific nature of the tasks that were carried out so far and unavailability of women specialists in the necessary areas of

[1] https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/gender-equality-strategy_en

expertise in the geographical proximity of DiGas have not yet allowed us to reach a complete gender balance. For further implementation of the project where less distinct tasks will be performed, however, DiGas is committed to ensuring that more women join the company and contribute to the realization of the project, eventually reaching the desired gender balance at all levels of the entity.

Societal Issues

The intent of NYSMART project is to significantly cut the greenhouse gas emissions of the railway industry and trough that curb climate change. The project is and will be executed ensuring sustainable development as defined by the European Commission - "development that meets the needs of the present without compromising the ability of future generations to meet their own needs within the planet's physical boundaries".[2] During the project, the following 5 Sustainable Development goals of the United Nations for 2030 will be directly addressed:

- Good health and well-being
- Decent work and economic growth
- Industry innovation and infrastructure
- Sustainable cities and communities
- Climate action

To understand the impact of NYSMART on all the goals stated above, let us consider them separately, starting from climate action and then sequentially progressing to others that are most related to the latter.

1.1 Climate action

It is the intention of DiGas SIA with its NYSMART technology to deliver environmental and economic step-change to the diesel locomotive market, thus, in turn, disrupting the existing dynamics. In this market, the most stringent emissions regulations are applied to only new locomotives, and new engines brought to the market. However, economic factors dictate that only a small proportion of new "units" are ever purchased by locomotive operators each year. From the total locomotive fleet worldwide, only 25% are produced after the year 2000 and only 2.5% are newly manufactured locomotives[3]. This shows just how slow the market moves and the current difficulties in changing the emissions profile for the sector. Globally, diesel locomotives cause 90 Billion kilograms of CO_2 every year[4] significantly facilitating ozone formation known as smog, acid rains, and overall global climate change.

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[2] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/climate-sustainable-development_en.htm

[3] SCI Diesel Locomotive market trends 2014

[4] The annual CO2 emissions calculation is based on 2.65 kg of CO2 per liter of diesel consumed

DiGas' NYSMART dual-fuel technology effectively reduces the pollution emitted from a locomotive and allows to achieve the desired impact significantly faster than would otherwise be possible. The effective decrease in CO_2 emissions per diesel locomotive that is achieved by installing NYSMART system is starting from 15-20% if compressed natural gas is used and up to 80% if renewable natural gas is applied for operations. Deployment of DiGas technology, therefore, directly tackles the UN Sustainable Development goal 13.1 "Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries"[5].

1.2 Health and well-being

Over the decades, rail transportation has proven to have a general environmental advantage compared to other means of transportation; a closer look at the industry, however, reveals a disturbing picture. Over 70% of all the world's railway locomotives are powered by diesel engines, consuming more than 34 billion liters[6] of diesel fuel annually. Diesel exhaust is known to be the third largest human-made source of small particles, known as fine particulate matter (PM), contributing significantly to local air pollution. Fine particles in the air pose a significant health risk because they can lodge themselves in the lungs. Such particles cause a serious risk to health and environment, increasing the likelihood of cancer; causing negative cardiovascular and respiratory health effects; pollution of air, water, and soil; soiling; and damages to vision. The World Health Organisation (WHO) reports that in 2012 around 7 million people died – one in eight of total global deaths – as a result of air pollution exposure. Besides emitting PM, rail transportation is also contributing greatly to the rising SO_2 and NO_x concentrations in the air.

Adaptation of DiGas dual-fuel technology to diesel locomotives allows for 80% reduction of PM and SO_2 emissions and 30% reduction of NO_x[7] discharged from locomotives, reducing the health risks imposed by the railway operations. This is especially important in the densely inhabited areas where shunting rail operations usually take place. The current tests of the technology in operations in Latvia and the data from CE Delft Report on external costs of transportation show that a single shunter locomotive[8] is responsible for around 112 000 EUR per year in external health costs to society[9]. The dual-fuel operations decrease the health costs imposed on society by around 62 000 EUR a year – a decrease by more than a half. In some European countries, the external health costs are even larger and the possible savings reach far beyond the amount above. For example, dual-fuel operations in France

[5] https://www.un.org/sustainabledevelopment/climate-change-2/
[6] www.biofuelstp.eu/rail-biofuels.html
[7] The emission reduction is based on tests performed on a demontration locomotive in operations as of TRL8.
[8] Shunter locomotive: a locomotive that is used for assembling trains ready for a Mainline locomotive to take over; disassembling a train that has been brought in; and generally moving railroad cars around
[9] The calculations of this number are based on source data of EUR/tonn of pulutant costs applied to the average annual exhaust emissions of shunter locomotives under regular workload conditions in Latvia

would result in annual savings in external health costs of almost 156 000 EUR per locomotive working in metropolitan area. By reducing the harmful emissions, DiGas directly addresses the UN Sustainable Development goal 3.9 “By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination”[10]. The impact of NYSMART system, however, reaches further than the environmental and health benefits.

1.3 Sustainable cities and development

The initial target locomotive segment for DiGas is shunter locomotives that are applied for assembling trains ready for a mainline locomotive to take over, disassembling a train that has been brought in, and generally moving railroad cars around. Majority of these tasks are performed in rural areas with high industrial activity, contributing to the negative impact on air quality and overall environment. The transition to dual-fuel operations will significantly reduce the environmental footprint of the shunter locomotives and ensure that the industrial activity becomes more sustainable and its further development does not pose any additional harm. Therefore, the UN Sustainable Development goal 11.6 “By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management”[11] is also an essential part of the objectives that shall be reached by DiGas upon successful implementation of NYSMART system.

1.4 Industry innovation and infrastructure

A crucial aspect of the railway industry in every country is the infrastructure maintenance and development companies that ensure that the rail network is constantly usable and that all the necessary advancements have taken place. All of the infrastructure companies rely on their own fleet of shunting locomotives that are applied for varying necessities. By providing the dual-fuel technology to these infrastructure companies, DiGas aims to not only raise their competitiveness but also reduce their fuel costs and allow for more efficient and less polluting operations. It is in line with the UN Sustainable Development goal 11.6 9.4 “By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities”[12]. Besides, the application of NYSMART shall also raise the competitiveness of the railway as such over other means of transportation where the operations cause greater risks to the environment, health, and wellbeing of people.

[10] https://www.un.org/sustainabledevelopment/health/
[11] https://www.un.org/sustainabledevelopment/cities/
[12] https://www.un.org/sustainabledevelopment/infrastructure-industrialization/

1.5 Decent work and economic growth

It is known that fuel costs constitute up to 60% of all the operational costs of railway operators[13] with diesel prices rising every year. Eurostat data show that, in the European Union, the natural gas is on average 63% cheaper than the energy equivalent amount of a liter of diesel. Substituting the largest proportion of diesel fuel for locomotive operations with natural gas, therefore, opens possibilities for a serious fuel cost savings to rail operators and other companies using locomotives in their operations. DiGas' current experience shows that the fuel costs can be curbed by up to 40%, presenting a serious competitiveness increase to companies that adapt NYSMART technology. The excess capital and greater competitiveness are, in turn, expected to stimulate further economic growth of the railway industry and result in more efficient use of the available resources. In addition, DiGas technology also involves revenue enhancement for locomotive repair plants that are performing the locomotive upgrades to dual-fuel operations and natural gas companies that are supplying the natural gas, resulting in new job creation also outside the direct rail industry. For these reasons, we are confident to say that the operations of DiGas are directly tackling the UN Sustainable Development goal 8.4 "Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead"[14].

Ethical issues

As viewed by DiGas, carefully addressing the ethical issues in the work under NYSMART project and beyond that is a critical element in ensuring sustainable development and best value from the business operations to the society. All the ethical issues are viewed in the light of Model Grant Agreement Article 34 of H2020 program and Regulations (EU) No 1291/2013 of the European Parliament and of the Council.

Besides strictly obeying the international, EU, and national law, DiGas guarantees that no activities under the project and beyond are aimed at human cloning for reproductive purposes, intended to modify the genetic heritage of human beings, intending to create human embryos for any purpose. In addition to these rules, DiGas also ensures the highest compliance with the European Code of Conduct for Research Integrity which implies ensuring reliability, honesty, respect, and accountability at all the steps of the action. All the research is done following the best research practices.

[13] DiGas analysis of BNSF (US), PKP Cargo (PL), LDz Cargo (LV) annual reports for 2015
[14] https://www.un.org/sustainabledevelopment/economic-growth/

In line with the Article 19 of Regulation (EU) No 1291/2013 of the European Parliament and of the Council, particular attention is paid to “the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity
of a person, the right to non-discrimination and the need to ensure high levels of human health protection”. The technology of DiGas is, in fact, aimed at fostering the fundamental ethical principles and the team members of DiGas recognize the importance of promoting these principles with their activities.

Conclusions

The overall project objective is to finalize, certify and pilot dual-fuel system for 5 locomotive types and achieve ready for a market product with the actual dual-fuel system proven in an operational environment. In order to achieve this objective, the work plan spans a duration of 30 months, consists of 8 working packages (WP), where 7 of them were introduced in project proposal and 8th “Ethics requirements” was introduced when was the Grant agreement was signed, and its overall structure follows a logical flow to take the NYSMART technology from TRL6 to TRL9 - compliance testing, field demonstration, and certification, the precursors for full market entry (TRL9). .

This deliverable is designed to assess and improve the current approach of DiGas to gender, societal, and ethical issues. Careful consideration of the current and planned actions of DiGas under NYSMART project does not reveal the presence of any gender, societal, or ethical issues. Following the guidelines of the European Commission and generally accepted principles has been the key element of the project implementation process. The project is foreseen to result in a gender balanced workplace at DiGas and shall directly address 5 of goals for Sustainable Development of the United Nations for 2030 - good health and well-being; decent work and economic growth; industry innovation and infrastructure; sustainable cities and communities; and climate action.

Overall, NYSMART project shall lead to decreased greenhouse gas emissions and harmful pollutants such as PM, SO_x, NO_x. This will result in lower health risks to people that leave in the proximity of any railway activities and decreased external health costs that are faced by governments, insurance companies, and society at large. In addition, the implementation of the project shall be followed by more sustainable industrial activities and enhanced growth among European locomotive repair and natural gas companies. Furthermore, an increased competitiveness of the rail industry due to curbed operational costs is expected.

Above all, the research carried out by DiGas is currently posing no ethical issues and is anticipated to continue in the following manner.