European Commission

Horizon 2020
European Union funding
for Research & Innovation

ESFR-SMART
sodium fast reactor safety

Action	Research and Innovation Action NFRP-2016-2017-1
Grant Agreement #	754501
Project name	European Sodium Fast Reactor Safety Measures Assessment and Research Tools
Project Acronym	ESFR-SMART
Project start date	01.09.2017
Deliverable #	D3.1.7
Title	Report on Content and Delivery of Video
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Version	1
Related WP	WP3.1. Dissemination, education and training
Related Task	T3.1.7. Communication with general public and project website (LGI)
Lead organization	LGI
Submission date	25.09.2020
Dissemination level	PU

This project has received funding from the Euratom research and training programme 2014-2018 under the grant agreement n°754501

History

Date	Submitted by	Reviewed by	Version (Notes)
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Abbreviations

KPI	Key Performance Indicator

Summary

This deliverable presents the ESFR-SMART video which was released at M12 in order to promote the project and highlight its main goals. In addition to the video script, a special attention was given to the selection of animated visuals and images. This report also outlines the channels and tools chosen to promote and share the video to the targeted audiences defined in deliverable D3.1.6 – Communication Action Plan, and the KPIs reached.

Key words
Video, script, dissemination, communication, Twitter, LinkedIn, YouTube, audience, views, likes.

1. INTRODUCTION

Presented in this deliverable and released at M12, the ESFR-SMART video contributes to reach the following key objectives of ESFR-SMART in terms of public communication:

- to promote the project's activities, objectives and the uptake of its results;
- to engage in a two-way dialogue with stakeholders and civil society;
- to raise public awareness and contribute to the public acceptance of nuclear energy via demonstrating a significantly higher safety level of ESFR compared to traditional reactors.

1.1 Script of the video

The ESFR-SMART video is **5'30 minutes long** and directly accessible on the homepage of the official ESFR-SMART website:

Figure 1. ESFR-SMART homepage

The main goal of this video was to present the ESFR-SMART project, its expected goals and impacts, as well as the nuclear technology in the heart of this project: Sodium Fast Reactors (SFRs). Moving images and animations were selected to illustrate and show live the ESFR technology, its features and how the system will operate. In addition, key data are provided in the script.

The ESFR-SMART video targets the different audiences defined previously in deliverable D3.1.6 – Communication Action Plan:

- Nuclear research & scientific community
- European & international SFR stakeholders
- Nuclear industry & designers
- Universities & higher education, PhD students, post-docs
- National & European policymakers
- General public

PART I. INTRODUCTION

A new Horizon-2020 project, called ESFR-SMART, was launched in September 2017, to continue the conceptual development of the European Sodium Fast Reactor – a machine generating an electric power of 1500 MW.

In this reactor, the fission chain reaction is sustained by neutrons of high energy allowing effective breeding of fissile material. Breeding and enhanced utilization of natural uranium are essential requirements for nuclear energy which is considered as a key contributor of the sustainable energy supply of the future.
The main goal of the ESFR-SMART project is to introduce new safety measures and assess their performance, using all the positive features of the Sodium Fast Reactors, among which are low coolant pressure; efficiency of natural convection; possibility of decay heat removal by atmospheric air; high thermal inertia. All safety improvements are envisaged in tandem with a simplification of the ESFR design developed in the EU in the past.

The ESFR reactor core produces 3600 MW of thermal power, which is removed by liquid sodium circulating in the large primary pool by means of three mechanical pumps. Power is transferred through six intermediate heat exchangers to the secondary sodium loops, each of which has six steam generators. The produced steam drives the turbines, generating electricity.

PART II. THE REACTOR CORE

Control of the chain reaction is one of the key objectives of the reactor safety system. In ESFR the control of the reactor power or shutdown are guaranteed by inserting neutron absorbing rods in the core. In addition, absorption rods of a special type are introduced in the design to ensure plant shutdown without any operator intervention. The actuation of these rods is based on passive principles. Should the coolant temperature at the core outlet exceed a certain value, namely the Curie point, the locks of these rods lose their magnetic properties and release the absorber rods, thus their insertion is driven only by variation of physical parameters.

Undesired perturbations during reactor operation must not lead to an increase of reactor power. A refined design of the core allows improving the neutronic reactivity feedbacks in both nominal and accidental operation conditions.

For the very low-probability accidental scenarios in which all these safety measures fail and the core melts down, dedicated channels in the core are designed to facilitate core melt relocation towards a special structure called core catcher. There the molten materials are localized and can be efficiently cooled down.

PART III. THE PRIMARY SODIUM CONFINEMENT

Confinement of radioactive isotopes is another key objective for safe operation. To avoid the primary sodium leakages and sodium-air interactions, the design of the reactor pit and roof has been simplified and improved. In particular, the second vessel used in the former Sodium Fast Reactor designs has been replaced by a metallic liner on the surface of the reactor pit. The reactor roof is designed as a solid and heavy metallic structure with a minimum number of penetrations. The leak tightness of these penetrations is given either by freezing seals or by temporary welding. All these measures allow to suppress the reactor dome above the roof ensuring mitigation of a severe accident and improve the economics.

PART IV. DECAY HEAT REMOVAL

Heat removal constitutes the third key objective of reactor safety. Even in shutdown conditions, the residual energy called Decay Heat releases due to the decay of radioactive nuclides. Dedicated Decay Heat Removal systems designed for the ESFR aim to practically eliminate accidents of the Fukushima type.

The main path of decay heat removal is the same as heat removal in normal operation: through intermediate heat exchangers and the secondary circuit to the feedwater in steam generators. This path works under both forced and natural convection. To assist the natural convection of the secondary sodium each loop is equipped with a passive electromagnetic pump. It's driven by thermoelectricity generated by the temperature difference between the sodium and the environment.

In case the feed water supply to steam generators should fail, the decay heat is removed from the surfaces of the modular steam generators by natural convection of atmospheric air through the inlet and outlet windows of the steam generator casings.

In addition, six small secondary loops are dedicated to decay heat removal in accidental conditions when the main secondary loops are lost or drained. These small loops operate based on passive principles under natural convection of secondary sodium assisted by thermal pumps and by natural convection of atmospheric air assisted by the tall air stack.

Finally, an independent decay heat removal path through the reactor vessel is foreseen through cooling systems installed in the reactor pit and used during normal operation for cooling the concrete. This system allows also an effective heat removal from the core in case of severe accident management and mitigation of its consequences.

PART V. CONCLUSIONS

Having assessed the new safety measures proposed for ESFR, we aim to fulfil the goals set by the Generation-IV International Forum for future nuclear reactors, on one hand by controlling sensitive points such as the core neutronic reactivity and the sodium chemical reactivity and, on the other hand, by relying upon favourable characteristics of Sodium Fast Reactors such as the passivity facilitated by coolant efficiency, the grace and autonomy periods and especially diversification of the safety systems.

1.2 YouTube: the platform to host the ESFR-SMART video

YouTube was selected to host the ESFR-SMART video as it is a popular video-sharing platform with high visibility when using searching tools (Search Engine Optimisation), and which can easily be embedded in a webpage.

Additionally, a dedicated account for the project was created on YouTube and followed now by **27 subscribers.**

Since the online availability of the ESFR-SMART video on 24 September 2018, the video reached **1 514 views and 55 likes.**

1.3 Promotion of the video

The official website, Twitter and LinkedIn were selected to promote and communicate on the ESFR-SMART video. In addition to the homepage, the video is also accessible under the “Resources” section:

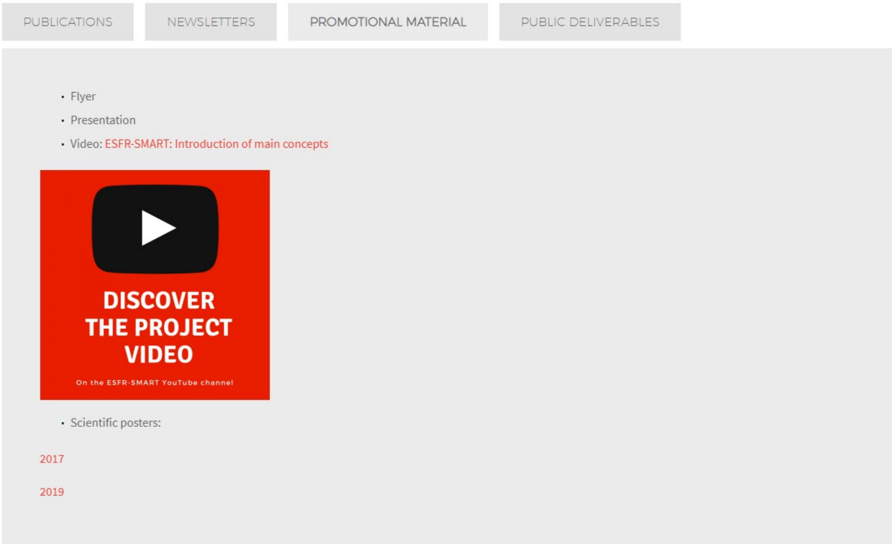

Figure 2. Screenshot of the “Resources” webpage

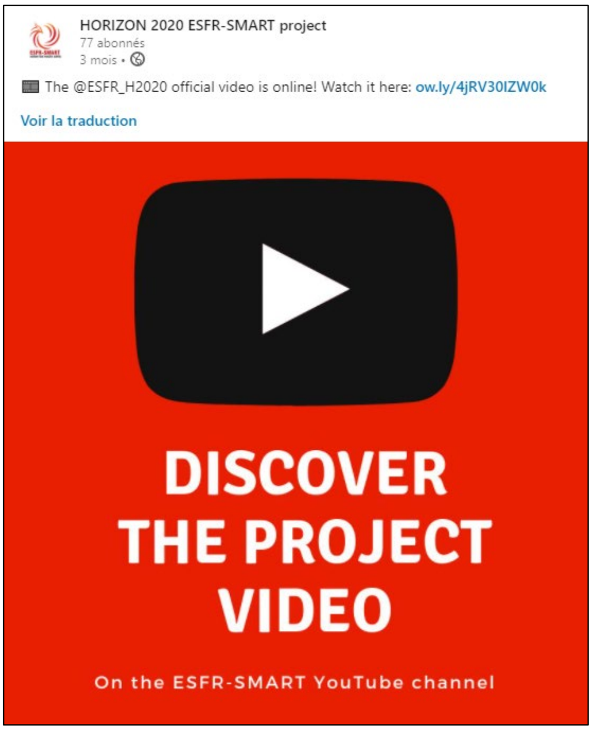

Figure 3. Example of message and visual published on LinkedIn

In addition, the ESFR-SMART video was promoted in the two newsletters distributed until now:

- Newsletter n°1:in a form of banner (2 direct clicks)
- Newsletter n°2: via the YouTube icon in the footer

2. CONCLUSION

The ESFR-SMART video is one of the key communication tool to promote and boost awareness of the project, and highlight its main goals to targeted audiences. Moreover, it is an interactive material easily usable by partners when attending an event or a conference.