

Deliverable D6.6: Second Field Testing

WP6: Development of the open Access TeaM Cables tool and
integration of models

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Description: Report on software testing (errors, experiences, feedback) and questionnaire completed by the end-user group.

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Glossary

Abbreviation/ acronym	Description
AO	Antioxidant
BWR	Boiling Water Reactor
COMSY	Condition Oriented Monitoring and Plant Management System (Software)
EDF	Électricité de France
FRA-G	Framatome GmbH
HW	Hardware
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
MS	Microsoft
NPP	Nuclear Power Plant
OS	Operating System
PE	Polyethylene
PH	Polymer substrate
PWR	Pressurized Water Reactor
SW	Software
VP	Virtual Polymer (Software)
WP	Work Package
XLPE	Cross-linked polyethylene

1 Executive Summary

This deliverable provides a summary of the WP6 activities organised in March 2022 in relation with the end users. A first end user workshop was held as a web meeting on 22nd September 2021 (see Deliverable [TMC-D7-6-End user first workshop](#) for more details). As this first session was held remotely due to the sanitary context instead of physically as initially planned, it consisted mainly in a demonstration of the TeaM Cables tool. The results summary of the follow-up questionnaire can be found in [TMC-D6.4-First Field Testing](#). Software testing took place when the second workshop was organised, on 1st-2nd March 2022 at Framatome in Erlangen, Germany (see [TMC-D7-7-End user second workshop](#)). A new survey was conducted after this workshop and a summary of the answers received is provided in this report.

The TeaM Cables Tool intends to combine COMSY (Condition Oriented Monitoring and Plant Management System), developed by Framatome GmbH, and VP (Virtual Polymer), developed by EDF.

A first specification of the TeaM Cables Tool was drafted in Deliverable D6.1, which was submitted in September 2019: [TMC-D6 1-First Revision of Specifications-F](#). The Deliverable D6.2 ([TMC-D6.2-Implementation of the software intermediate report](#)) presents the activities made and progress achieved in WP6 for the implementation of the TeaM Cables Tool in order to document the project evolution and decisions made in the course of the SW implementation works in order to achieve the TMC objectives. In D6.3 ([TMC-D6-3-Revision specification VP](#)), the progress achieved in WP6 for the implementation of the TeaM Cables (TMC) Tool is presented to document the project evolution and decisions taken in the course of the software (SW) implementation works in order to achieve the TeaM Cables objectives. The latest tool developments are presented in [TMC-D6.5-Software Improvements](#). All reports can be found at <https://www.team-cables.eu/media-centre/>.

2 Introduction

COMSY is the front-end software running on Windows OS platform at the customer; all data is stored in an MS Access or MS SQL Server database. For the TeaM Cables Tool, the electrical module of COMSY will be used. In the TeaM Cables Tool, the currently implemented ageing/degradation algorithms for assessment/management of the lifetime for XLPE insulated cables (as part of passive electrical systems) will be replaced/extended with the evaluation of calculation results from VP, using algorithms to be developed and validated within the framework of the TeaM Cables project.

VP is the back-end software running on Linux OS: it is a one-dimension modelling platform composed of a model data base and different calculation components. The chaining of the different parts makes it possible to develop a multi scale and multi physical modelling of the polymer ageing process. The further development and validation of the multi scale and multi physical modelling of the ageing process of XLPE in dependence of specific material properties and environmental conditions is the main objective of the TeaM Cables project.

The features required in the TeaM Cables Tool were identified in Deliverable D6.1 as the following:

- the graphical user interface (GUI) needed for cable data entry and display,
- generates the data needed for degradation calculations in VP,
- receives the calculation results (abacus/solver matrix) from VP,
- allocation/mapping of VP results to the individual cables,
- display of results, calculation of residual lifetime.

3 Survey to collect feedback from end users

A short survey was circulated among TeaM Cables end users to further clarify topics discussed during the second end user workshop and integrate feedback in preparation of the final version of the tool.

A summary of answers is provided hereafter.

Are you planning to use the tool from a R&D or NPP operator perspective?

9 responses



Figure 1: Perspective to use the tool

As expected, the end-user feedback to the first question reflects their affiliation to their communities; three working directly and one indirectly for organizations operating NPPs.

Have you managed to use the tool successfully?

9 responses

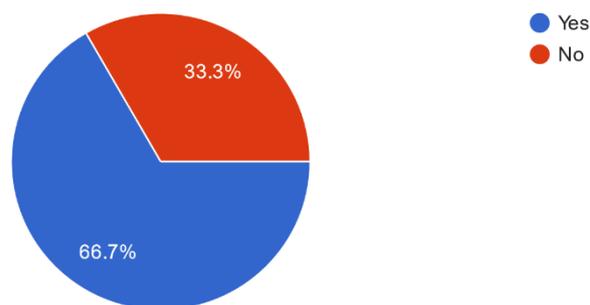


Figure 2: Successful usage of the tool

If no, please describe the issue(s) encountered:

- I have not enough time to test in detail
- Not tried yet. It is a partner in my company (also in team cables group) who is dealing successfully with the tool but not me
- We have some work to do before we can use this tool in our program.

Have you compared the results of the tool with results of an existing use case?

9 responses

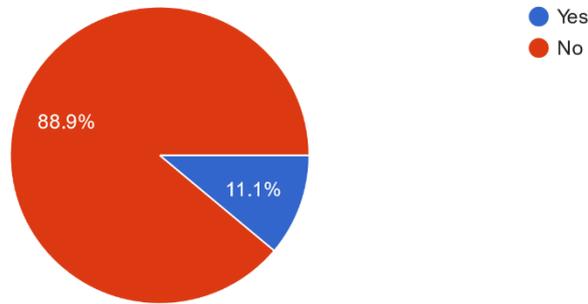


Figure 3: Comparison of results of the tool with results of an existing use case

Materials	Temperature	Dose rate	Life duration related to expertise
XLPE	30-130	0	All ageing time if possible
Fluoropolymer (FEP)	200°C	Not applicable	To be determined
Not yet, but planning to do	Not yet	Not yet	Not yet

The “YES” received is in context of the XLPE material.

Which criterion would you prefer to use: loss of antioxidant (AO), carbonyls content or permittivity?

9 responses

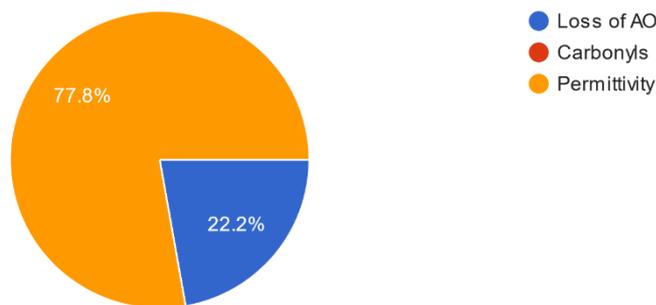


Figure 4: Preferred criterion to use

The “Loss of AO” criterion is in context with material sampling and investigation typically performed in laboratories (destructive testing). The “Permittivity” criterion is in context with electrical measurements performed on material samples and cables (non-destructive testing).

Do you think it would be interesting to compare the multiscale and empirical approach (activation energy and dose rate coefficient for XLPE and other model materials) in the TeaM Cables tool?

9 responses

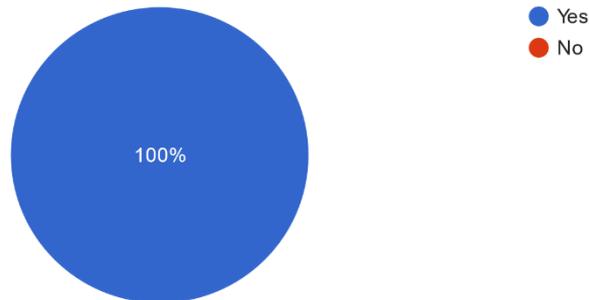


Figure 5: Opinion on comparison of the multiscale and empirical approach

The “YES” response of the end-user group for a comparison of the multiscale model and the empirical approach was expected as the use of the Arrhenius and the Power laws are established within the nuclear community in the context of qualification and of time limited ageing assessment of electrical equipment.

Would you be able to share measurements done on cables (permittivity, temperature, irradiation, ageing, life duration) in your plant?

9 responses

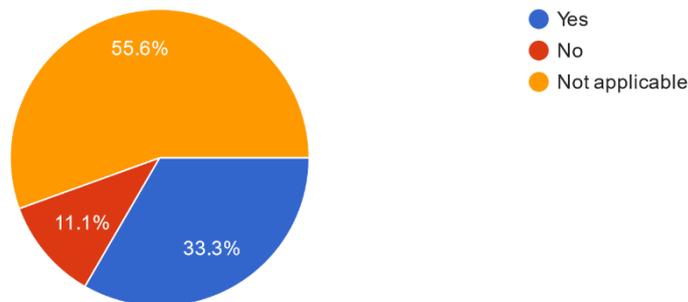


Figure 6: Sharing of measurements done on cables in plants

The “YES” responses were given by the end-users affiliated with NPP operating organisations. They have to be seen in context to the “Permittivity” criterion – non-destructive testing.

How big is your interest concerning this tool under development by the TeaM Cables consortium?

9 responses

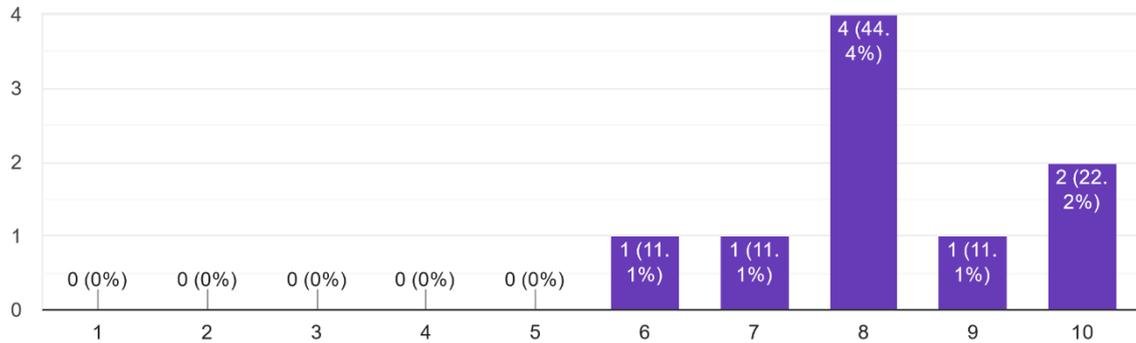


Figure 7: Interest in TeaM Cables tool

The TeaM Cables consortium is pleased to see that the end-user group is interested in the tool under development.

How likely do you think your company would be ready to use the TeaM Cables tool?

9 responses

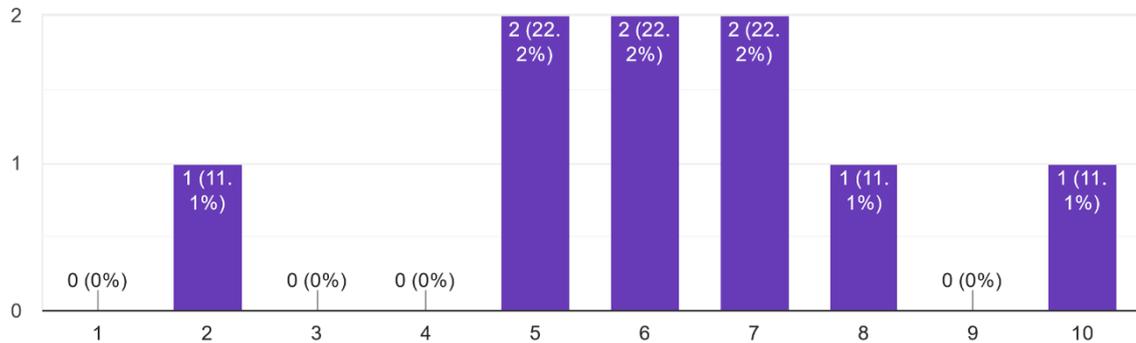


Figure 8: Probability to use the TeaM Cables tool in the company

Just as remark, the “2” score/response was received from a newly built NPP, the interest score/rating for the TeaM Cables tool received from the same end-user was “10”. The tool could become an integral part of the ageing management for this NPP.

How would you rate your satisfaction level of the second workshop? 1 to 10

9 responses

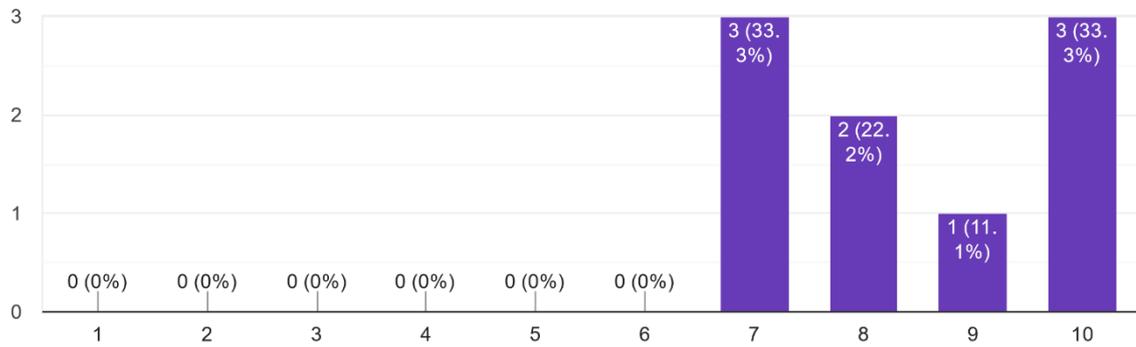


Figure 9: Satisfaction level of second workshop

Without rating and further comments, the satisfaction level ratings of the end-user workshop held in Erlangen are presented in the figure above.

4 Next steps

The final version of the TeaM Cables tool will be presented in the final WP6 report D6.7: Final version of the software including user guide, to be delivered in May 2022.

A Training Workshop about the tool and related Non-Destructive Techniques targeted to researchers will be held on 30th June 2022, following the TeaM Cables Final Symposium on 28-29th. Both events are planned in Paris, France. More details can be found at <https://www.team-cables.eu/team-cables-final-events-28-30-june-pre-registration-open-until-22nd-april/>.