EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)

REA.A – Marie Skłodowska-Curie Actions & Support to Experts
A.3 – MSCA Staff Exchanges

GRANT AGREEMENT

Project 101182948 — RETROTRAFO

PREAMBLE

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and

on the other part,

1. 'the coordinator':

UNIVERSIDAD DE CANTABRIA (UC), PIC 999880075, established in AVENIDA DE LOS CASTROS S/N, SANTANDER 39005, Spain,

and the following other beneficiaries, if they sign their 'accession form' (see Annex 3 and Article 40):

2. **UNIVERSIDAD CARLOS III DE MADRID (UC3M)**, PIC 999899572, established in CALLE MADRID 126, GETAFE (MADRID) 28903, Spain,

3. **ZAPADOCESKA UNIVERZITA V PLZNI (UWB)**, PIC 999843894, established in UNIVERZITNI 8, PILSEN 301 00, Czechia,

4. **ZILINSKA UNIVERZITA V ZILINE (UNIZA)**, PIC 999969606, established in UNIVERZITNA 8215/1, ZILINA 010 26, Slovakia,

5. **BALIKESIR ELEKTROMEKANIK SANAYI TESISLERI ANONIM SIRKETI (BEST)**, PIC 906675200, established in GUMUSCESME MAHALLESI 252 SOKAK 1-13/A ALTIEYLUL, BALIKESIR 10100, Türkiye,

6. **SEA MARCONI TECHNOLOGIES DI VANDERTUMIATTI SAS (SMT)**, PIC 986834060, established in VIA PRINCIPI D ACAJA 11, TORINO 10143, Italy,

7. **POLITECHNIKA SLASKA (SUT)**, PIC 999899087, established in AKADEMICKA STREET 2A, GLIWICE 44-100, Poland,

8. **TECHNICKA UNIVERZITA V KOSICIACH (TUKE)**, PIC 999839238, established in LETNA 9, KOSICE 042 00, Slovakia,

9. **USTAV EXPERIMENTALNEJ FYZIKY SLOVENSKEJ AKADEMIE VIED (UEF SAV)**, PIC 999604983, established in WATSONOVA 47, KOSICE 04001, Slovakia,

10. **FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES (BCMATERIALS)**, PIC 928273511, established in BARRIO SARIENA S/N, LEIOA 48940, Spain,

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator and affiliated entities (if any).

If only one beneficiary signs the grant agreement ('mono-beneficiary grant'), all provisions referring to the 'coordinator' or the 'beneficiaries' will be considered — mutatis mutandis — as referring to the beneficiary.

The parties referred to above have agreed to enter into the Agreement.

By signing the Agreement and the accession forms, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

The Agreement is composed of:

Preamble

Terms and Conditions (including Data Sheet)

Annex 1 Description of the action[1]

Annex 2 Estimated budget for the action

Annex 2a Additional information on unit costs and contributions (if applicable)

Annex 3 Accession forms (if applicable)[2]

Annex 3a Declaration on joint and several liability of affiliated entities (if applicable)[3]

Annex 4 Model for the financial statements

Annex 5 Specific rules (if applicable)

[1] Template published on Portal Reference Documents.
[2] Template published on Portal Reference Documents.
[3] Template published on Portal Reference Documents.

TERMS AND CONDITIONS

TABLE OF CONTENTS

DATA SHEET

1. General data

Project summary:

Project summary
Power transformers play a crucial role in electric power transmission and distribution systems, being both expensive and strategically important. Their prolonged efficient operation is essential to prevent long-term power outages. With tens of thousands of transformers worldwide approaching the end of their typical 30-40 year lifespan, the question of recycling becomes significant. Remarkably, around 95% of a power transformer's materials could potentially be recycled. Recognizing the importance of a circular economy, the European Commission adopted a Circular Economy plan in 2020, aiming to shift from a linear "take, make, dispose" model to a circular one where waste becomes a new resource. While the initial focus was on energy efficiency in transformers, the impact of materials is not negligible. The upcoming revision of the eco-design regulation for transformers in 2023 will introduce new requirements on material efficiency. The proposed project will develop research on transformer retrofilling with alternative or recycled insulating liquids. This technique is based on the replacement of the mineral oil of a transformer in service with a biodegradable and less-flammable fluid. The procedure would lead to safer and more environmentally friendly transformers and could allow the application of higher loads, deferring the replacement of equipment in service. However, the technique has not been sufficiently studied, it is needed to evaluate the impact of retrofilling on the operation of the transformer and to assess its economic and technical feasibility. Project's researchers have applied the circular economy concept to power transformers in various ways during project definition: a) Evaluating the efficient use of materials throughout a transformer's life cycle (renewable or re-refined oils instead of conventional oils); b) Lifetime extension through dielectric and thermal design review and guidance on operation and maintenance.

Keywords:

- Electrical and electronic engineering: semiconductors, components, systems
- Energy systems, smart energy, smart grids, wireless energy transfer
- Sustainable design (for recycling, for environment, eco-design)
- Transformers, retrofilling, natural ester, synthetic ester, recycled oils, biodegradabile insulating liquids, life extension, fire safety, increased loadability, circular economy

Project number: 101182948

Project name: Development of knowledge and technology to implement retrofilling in power transformers using biodegradable or recycled fluids and fostering circular economy

Project acronym: RETROTRAFO

Call: HORIZON-MSCA-2023-SE-01

Topic: HORIZON-MSCA-2023-SE-01-01

Type of action: HORIZON TMA MSCA Staff Exchanges

Granting authority: European Research Executive Agency

Grant managed through EU Funding & Tenders Portal: Yes (eGrants)

Project starting date: fixed date: 1 January 2025

Project end date: 31 December 2028

Project duration: 48 months

Consortium agreement: Yes

2. Participants

List of participants:

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible contrib.	Max grant amount
1	COO	UC	UNIVERSIDAD DE CANTABRIA	ES	999880075	501 400.00	501 400.00

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible contrib.	Max grant amount
2	BEN	UC3M	UNIVERSIDAD CARLOS III DE MADRID	ES	999899572	253 000.00	253 000.00
3	BEN	UWB	ZAPADOCESKA UNIVERZITA V PLZNI	CZ	999843894	69 000.00	69 000.00
4	BEN	UNIZA	ZILINSKA UNIVERZITA V ZILINE	SK	999969606	36 800.00	36 800.00
5	BEN	BEST	BALIKESIR ELEKTROMEKANIK SANAYI TESISLERI ANONIM SIRKETI	TR	906675200	46 000.00	46 000.00
6	BEN	SMT	SEA MARCONI TECHNOLOGIES DI VANDERTUMIATTI SAS	IT	986834060	27 600.00	27 600.00
7	BEN	SUT	POLITECHNIKA SLASKA	PL	999899087	128 800.00	128 800.00
8	BEN	TUKE	TECHNICKA UNIVERZITA V KOSICIACH	SK	999839238	59 800.00	59 800.00
9	BEN	UEF SAV	USTAV EXPERIMENTALNEJ FYZIKY SLOVENSKEJ AKADEMIE VIED	SK	999604983	73 600.00	73 600.00
10	BEN	BCMATERIALS	FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES	ES	928273511	64 400.00	64 400.00
11	AP	UNL	UNIVERSIDAD NACIONAL DEL LITORAL	AR	998777476	0.00	0.00
12	AP	UPM	UNIVERSITI PUTRA MALAYSIA	MY	999650282	0.00	0.00
13	AP	UBO	UNIVERSIDAD BERNARDO O'HIGGINS	CL	884603432	0.00	0.00
14	AP	USACH	UNIVERSIDAD DE SANTIAGO DE CHILE	CL	986427436	0.00	0.00
15	AP	UVALLE	UNIVERSIDAD DEL VALLE	CO	974162271	0.00	0.00
16	AP	Kyutech	KOKURITSU DAIGAKU HOJIN KYUSHU KOGYO DAIGAKU	JP	954274167	0.00	0.00
17	AP	NYU	NEW YORK UNIVERSITY	US	999437561	0.00	0.00
18	AP	UW	UNIVERSITY OF WATERLOO	CA	996231614	0.00	0.00
19	AP	UTFSM	UNIVERSIDAD TECNICA FEDERICO SANTA MARIA	CL	999633792	0.00	0.00
20	AP	UNSJ	UNIVERSIDAD NACIONAL DE SAN JUAN	AR	972856457	0.00	0.00
21	AP	UNIMAN	THE UNIVERSITY OF MANCHESTER	UK	999903840	0.00	0.00
22	AP	TU	Tanta University	EG	930247849	0.00	0.00
23	AP	WMU	Western Michigan University	US	899854160	0.00	0.00
24	AP	UQ	THE UNIVERSITY OF QUEENSLAND	AU	999881724	0.00	0.00
25	AP	CELSIA	CELSIA COLOMBIA S.A E.S.P	CO	878312885	0.00	0.00
26	AP	Diveg	Diveg s.a.s.	CO	878317929	0.00	0.00
27	AP	STOEN	RWE STOEN OPERATOR SP ZOO	PL	951920268	0.00	0.00
28	AP	EGI	E.ON GROUP INNOVATION GMBH	DE	893549548	0.00	0.00
Total						1 260 400.00	1 260 400.00

Coordinator:

– UNIVERSIDAD DE CANTABRIA (UC)

3. Grant

Maximum grant amount, total estimated eligible costs and contributions and funding rate:

Total eligible contributions (unit, flat-rate and lump sum contributions and financing not linked to costs)	Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
1 260 400.00	1 260 400.00	1 260 400.00

Grant form: Unit

Grant mode: Action grant

Budget categories/activity types:

- A. Contributions for seconded staff
  - A.1 Top-up allowance
  - A.5 Special needs allowance

- B. Institutional contributions
  - B.1 Research, training and networking contribution
  - B.2 Management and indirect contribution

Cost eligibility options:

- In-kind contributions eligible costs

Budget flexibility: Yes (flexibility with conditions)

4. Reporting, payments and recoveries

4.1 Continuous reporting (art 21)

Deliverables: see Funding & Tenders Portal Continuous Reporting tool

4.2 Periodic reporting and payments

Reporting and payment schedule (art 21, 22):

Reporting					Payments	
Reporting periods			Type	Deadline	Type	Deadline (time to pay)
RP No	Month from	Month to				
					Initial prefinancing	30 days from entry into force/10 days before starting date – whichever is the latest
1	1	24	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
2	25	48	Periodic report	60 days after end of reporting period	Final payment	90 days from receiving periodic report

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	819 260.00

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (63 020.00), retained from the initial prefinancing

Restrictions on distribution of initial prefinancing: The prefinancing may be distributed only if the minimum number of

beneficiaries set out in the call condititions (if any) have acceded to the Agreement and only to beneficiaries that have acceded.

Interim payment ceiling (if any): 90% of the maximum grant amount

No-profit rule: n/a

Late payment interest: ECB + 3.5%

Bank account for payments:

ES7321038557130030004922 UCJAES2M

Conversion into euros: n/a

Reporting language: Language of the Agreement

4.3 Certificates (art 24): n/a

4.4 Recoveries (art 22)

First-line liability for recoveries:

Beneficiary termination: Beneficiary concerned

Final payment: Each beneficiary for their own debt

After final payment: Beneficiary concerned

Joint and several liability for enforced recoveries (in case of non-payment):

Individual financial responsibility: Each beneficiary is liable only for its own debts (and those of its affiliated entities, if any)

Joint and several liability of affiliated entities — n/a

5. Consequences of non-compliance, applicable law & dispute settlement forum

Suspension and termination:

Additional suspension grounds (art 31)

Additional termination grounds (art 32)

Applicable law (art 43):

Standard applicable law regime: EU law + law of Belgium

Dispute settlement forum (art 43):

Standard dispute settlement forum:

EU beneficiaries: EU General Court + EU Court of Justice (on appeal)

Non-EU beneficiaries: Courts of Brussels, Belgium (unless an international agreement provides for the enforceability of EU court judgements)

6. Other

Specific rules (Annex 5): Yes

Standard time-limits after project end:

Confidentiality (for X years after final payment): 5

Record-keeping (for X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

Reviews (up to X years after final payment): 2

Audits (up to X years after final payment): 2

Extension of findings from other grants to this grant (no later than X years after final payment): 2

Impact evaluation (up to X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and terms and conditions applicable to the grant awarded for the implementation of the action set out in Chapter 2.

ARTICLE 2 — DEFINITIONS

For the purpose of this Agreement, the following definitions apply:

Actions — The project which is being funded in the context of this Agreement.

Grant — The grant awarded in the context of this Agreement.

EU grants — Grants awarded by EU institutions, bodies, offices or agencies (including EU executive agencies, EU regulatory agencies, EDA, joint undertakings, etc.).

Participants — Entities participating in the action as beneficiaries, affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties.

Beneficiaries (BEN) — The signatories of this Agreement (either directly or through an accession form).

Affiliated entities (AE) — Entities affiliated to a beneficiary within the meaning of Article 187 of EU Financial Regulation 2018/1046[4] which participate in the action with similar rights and obligations as the beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions).

Associated partners (AP) — Entities which participate in the action, but without the right to charge costs or claim contributions.

Purchases — Contracts for goods, works or services needed to carry out the action (e.g. equipment, consumables and supplies) but which are not part of the action tasks (see Annex 1).

Subcontracting — Contracts for goods, works or services that are part of the action tasks (see Annex 1).

In-kind contributions — In-kind contributions within the meaning of Article 2(36) of EU Financial

[4] For the definition, see Article 187 Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 ('EU Financial Regulation') (OJ L 193, 30.7.2018, p. 1): "**affiliated entities** [are]:
(a) entities that form a sole beneficiary [(i.e. where an entity is formed of several entities that satisfy the criteria for being awarded a grant, including where the entity is specifically established for the purpose of implementing an action to be financed by a grant)];
(b) entities that satisfy the eligibility criteria and that do not fall within one of the situations referred to in Article 136(1) and 141(1) and that have a link with the beneficiary, in particular a legal or capital link, which is neither limited to the action nor established for the sole purpose of its implementation".

Regulation 2018/1046, i.e. non-financial resources made available free of charge by third parties to a beneficiary.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371[5] and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995[6], as well as any other wrongful or criminal deception intended to result in financial or personal gain.

Irregularities — Any type of breach (regulatory or contractual) which could impact the EU financial interests, including irregularities within the meaning of Article 1(2) of EU Regulation 2988/95[7].

Grave professional misconduct — Any type of unacceptable or improper behaviour in exercising one's profession, especially by employees, including grave professional misconduct within the meaning of Article 136(1)(c) of EU Financial Regulation 2018/1046.

Applicable EU, international and national law — Any legal acts or other (binding or non-binding) rules and guidance in the area concerned.

Portal — EU Funding & Tenders Portal; electronic portal and exchange system managed by the European Commission and used by itself and other EU institutions, bodies, offices or agencies for the management of their funding programmes (grants, procurements, prizes, etc.).

CHAPTER 2 ACTION

ARTICLE 3 — ACTION

The grant is awarded for the action **101182948** — **RETROTRAFO** ('action'), as described in Annex 1.

ARTICLE 4 — DURATION AND STARTING DATE

The duration and the starting date of the action are set out in the Data Sheet (see Point 1).

CHAPTER 3 GRANT

ARTICLE 5 — GRANT

5.1 Form of grant

[5] Directive (EU) 2017/1371 of the European Parliament and of the Council of 5 July 2017 on the fight against fraud to the Union's financial interests by means of criminal law (OJ L 198, 28.7.2017, p. 29).
[6] OJ C 316, 27.11.1995, p. 48.
[7] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

The grant is an action grant[8] which takes the form of a unit grant.

5.2 Maximum grant amount

The maximum grant amount is set out in the Data Sheet (see Point 3) and in the estimated budget (Annex 2).

5.3 Funding rate

Not applicable

5.4 Estimated budget, budget categories and forms of funding

The estimated budget for the action is set out in Annex 2.

It contains the estimated eligible contributions for the action (unit contributions), broken down by participant and budget category.

Annex 2 also shows the types of contributions (forms of funding)[9] to be used for each budget category.

The details on the calculation of the unit contributions will be explained in Annex 2a.

5.5 Budget flexibility

The budget breakdown may be adjusted — without an amendment (see Article 39) — by transfers of units between participants, as long as this does not imply any substantive or important change to the description of the action in Annex 1. Transfers between budget categories are not allowed.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE CONTRIBUTIONS

6.1 General eligibility conditions

The **general eligibility conditions** for the unit contributions are the following:

(a) the units must:

- be actually used or produced by the beneficiary in the period set out in Article 4 (with the exception of units relating to the submission of the final periodic report, which may be used or produced afterwards; see Article 21)

- be necessary for the implementation of the action and

(b) the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 20).

6.2 Specific eligibility conditions for each budget category

For each budget category, the **specific eligibility conditions** are as follows:

[8] For the definition, see Article 180(2)(a) EU Financial Regulation 2018/1046: '**action grant**' means an EU grant to finance "an action intended to help achieve a Union policy objective".

[9] See Article 125 EU Financial Regulation 2018/1046.

A. Contributions for seconded staff

Contributions for seconded staff (A.1 Top-up allowance and A.5 Special needs allowance) are eligible, if they fulfil the general eligibility conditions and are calculated as unit contributions in accordance with the method set out in Annex 2a, and if:

for A.1 Top-up allowance:

(a) the number of units declared:

(i) corresponds to the number of months spent by the seconded staff on the research and innovation activities and

(ii) does not exceed the maximum number of months (per seconded staff member) set out in the call conditions

(b) the seconded staff comply with the following conditions:

(i) be seconded full-time

(ii) be — at the date of secondment — one of the following:

- a doctoral candidate (i.e. not in possession of a doctoral degree[10])
- a post-doctoral researcher (i.e. in possession of a doctoral degree), or
- administrative, managerial or technical staff supporting research and innovation activities under the action, and

(iii) have been — at the date of secondment — actively engaged in or linked to research and innovation activities for at least 1 month at the sending:

- beneficiary (or an associated partner linked to the beneficiary and located in the same country) or
- associated partner

(c) the secondments comply with the following conditions:

(i) last at least 1 month (per seconded staff member)

(ii) be between different countries

(iii) for secondments within the EU Member States or Horizon Europe associated countries: be between different sectors (academic and non-academic)[11], except for interdisciplinary secondments, which are limited to a maximum of 1/3 of the total months spent on research and innovation activities under the action

[10] As defined in the call conditions.

[11] For secondments from an associated partner linked to the beneficiary: only the sector (academic or non-academic) of the beneficiary counts, i.e. the associated partner linked to the beneficiary will be considered to belong to the same sector as the beneficiary.

(iv) for secondments from an EU Member State or Horizon Europe associated country: be from a beneficiary (or associated partner linked to the beneficiary) established in a EU Member State or Horizon Europe associated country to an associated partner established in a non-associated non-EU country, and

(v) for secondments to an EU Member State or Horizon Europe associated country: be from an associated partner established in an eligible non-associated non-EU country to a beneficiary (or associated partner linked to the beneficiary) established in a EU Member State or Horizon Europe associated country

(d) the contributions have been fully incurred for the benefit of the seconded staff

This condition is met if they have been fully used for the seconded staff member for whom they are claimed.

for A.5 Special needs allowance:

(a) they are used for seconded staff members with disabilities whose long-term physical, mental, intellectual or sensory impairments are certified by a competent national authority and of such nature that their participation in the action would not be possible without the special needs items or services

(b) the special needs items or services are not already covered from another source (such as social security or health insurance)

(c) the number of units declared corresponds to the number of special needs units that were needed for implementing the action.

B. Institutional contributions

Institutional contributions (B.1 Research, training and networking contribution and B.2 Management and indirect contribution) are eligible, if they are calculated as unit contributions in accordance with the method set out in Annex 2a, and if the top-up allowance is eligible.

6.3 Ineligible contributions

'Ineligible contributions' are:

(a) units that do not comply with the conditions set out above (see Article 6.1 and 6.2)

(b) units implemented during grant agreement suspension (see Article 31) and

(c) units for activities already funded under other EU grants (or grants awarded by an EU Member State, non-EU country or other body implementing the EU budget), except for the following case:

(i) Synergy actions: not applicable

(d) other:

(i) country restrictions for eligible costs: not applicable.

6.4 Consequences of non-compliance

If a beneficiary declares unit contributions that are ineligible, they will be rejected (see Article 27).

This may also lead to other measures described in Chapter 5.

CHAPTER 4 GRANT IMPLEMENTATION

SECTION 1 CONSORTIUM: BENEFICIARIES, AFFILIATED ENTITIES AND OTHER PARTICIPANTS

ARTICLE 7 — BENEFICIARIES

The beneficiaries, as signatories of the Agreement, are fully responsible towards the granting authority for implementing it and for complying with all its obligations.

They must implement the Agreement to their best abilities, in good faith and in accordance with all the obligations and terms and conditions it sets out.

They must have the appropriate resources to implement the action and implement the action under their own responsibility and in accordance with Article 11. If they rely on affiliated entities or other participants (see Articles 8 and 9), they retain sole responsibility towards the granting authority and the other beneficiaries.

They are jointly responsible for the *technical* implementation of the action. If one of the beneficiaries fails to implement their part of the action, the other beneficiaries must ensure that this part is implemented by someone else (without being entitled to an increase of the maximum grant amount and subject to an amendment; see Article 39). The *financial* responsibility of each beneficiary in case of recoveries is governed by Article 22.

The beneficiaries (and their action) must remain eligible under the EU programme funding the grant for the entire duration of the action. Unit contributions will be eligible only as long as the beneficiary and the action are eligible.

The **internal roles and responsibilities** of the beneficiaries are divided as follows:

(a) Each beneficiary must:

(i) keep information stored in the Portal Participant Register up to date (see Article 19)

(ii) inform the granting authority (and the other beneficiaries) immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 19)

(iii) submit to the coordinator in good time:

- the prefinancing guarantees (if required; see Article 23)

- the financial statements and certificates on the financial statements (CFS) (if required; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

- the contribution to the deliverables and technical reports (see Article 21)
- any other documents or information required by the granting authority under the Agreement

(iv) submit via the Portal data and information related to the participation of their affiliated entities.

(b) The coordinator must:

(i) monitor that the action is implemented properly (see Article 11)

(ii) act as the intermediary for all communications between the consortium and the granting authority, unless the Agreement or granting authority specifies otherwise, and in particular:

- submit the prefinancing guarantees to the granting authority (if any)
- request and review any documents or information required and verify their quality and completeness before passing them on to the granting authority
- submit the deliverables and reports to the granting authority
- inform the granting authority about the payments made to the other beneficiaries (report on the distribution of payments; if required, see Articles 22 and 32)

(iii) distribute the payments received from the granting authority to the other beneficiaries without unjustified delay (see Article 22).

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including affiliated entities).

However, coordinators which are public bodies may delegate the tasks set out in Point (b)(ii) last indent and (iii) above to entities with 'authorisation to administer' which they have created or which are controlled by or affiliated to them. In this case, the coordinator retains sole responsibility for the payments and for compliance with the obligations under the Agreement.

Moreover, coordinators which are 'sole beneficiaries'[12] (or similar, such as European research infrastructure consortia (ERICs)) may delegate the tasks set out in Point (b)(i) to (iii) above to one of their members. The coordinator retains sole responsibility for compliance with the obligations under the Agreement.

The beneficiaries must have **internal arrangements** regarding their operation and co-ordination, to ensure that the action is implemented properly.

If required by the granting authority (see Data Sheet, Point 1), these arrangements must be set out in a written **consortium agreement** between the beneficiaries, covering for instance:

[12] For the definition, see Article 187(2) EU Financial Regulation 2018/1046: "Where several entities satisfy the criteria for being awarded a grant and together form one entity, that entity may be treated as the **sole beneficiary**, including where it is specifically established for the purpose of implementing the action financed by the grant."

- the internal organisation of the consortium
- the management of access to the Portal
- different distribution keys for the payments and financial responsibilities in case of recoveries (if any)
- additional rules on rights and obligations related to background and results (see Article 16)
- settlement of internal disputes
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal arrangements must not contain any provision contrary to this Agreement.

ARTICLE 8 — AFFILIATED ENTITIES

Not applicable

ARTICLE 9 — OTHER PARTICIPANTS INVOLVED IN THE ACTION

9.1 Associated partners

The following entities which cooperate with a beneficiary will participate in the action as ‘associated partners’:

- **UNIVERSIDAD NACIONAL DEL LITORAL (UNL)**, PIC 998777476
- **UNIVERSITI PUTRA MALAYSIA (UPM)**, PIC 999650282
- **UNIVERSIDAD BERNARDO O'HIGGINS (UBO)**, PIC 884603432
- **UNIVERSIDAD DE SANTIAGO DE CHILE (USACH)**, PIC 986427436
- **UNIVERSIDAD DEL VALLE (UVALLE)**, PIC 974162271
- **KOKURITSU DAIGAKU HOJIN KYUSHU KOGYO DAIGAKU (Kyutech)**, PIC 954274167
- **NEW YORK UNIVERSITY (NYU)**, PIC 999437561
- **UNIVERSITY OF WATERLOO (UW)**, PIC 996231614
- **UNIVERSIDAD TECNICA FEDERICO SANTA MARIA (UTFSM)**, PIC 999633792
- **UNIVERSIDAD NACIONAL DE SAN JUAN (UNSJ)**, PIC 972856457
- **THE UNIVERSITY OF MANCHESTER (UNIMAN)**, PIC 999903840
- **Tanta University (TU)**, PIC 930247849
- **Western Michigan University (WMU)**, PIC 899854160

- **THE UNIVERSITY OF QUEENSLAND (UQ)**, PIC 999881724
- **CELSIA COLOMBIA S.A E.S.P (CELSIA)**, PIC 878312885
- **Diveg s.a.s. (Diveg)**, PIC 878317929
- **RWE STOEN OPERATOR SP ZOO (STOEN)**, PIC 951920268
- **E.ON GROUP INNOVATION GMBH (EGI)**, PIC 893549548

Associated partners must implement the action tasks attributed to them in Annex 1 in accordance with Article 11. They may not charge contributions to the action (no unit contributions) and the costs for their tasks are not eligible.

The tasks must be set out in Annex 1.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interests), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the associated partners.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the associated partners.

9.2 Third parties giving in-kind contributions to the action

Other third parties may give in-kind contributions to the action (i.e. personnel, equipment, other goods, works and services, etc. which are free-of-charge) if necessary for the implementation.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge contributions to the action (no unit contributions) and their costs are considered entirely covered by the unit contributions paid to the beneficiaries.

The third parties and their in-kind contributions should be set out in Annex 1.

9.3 Subcontractors

Subcontractors may participate in the action, if necessary for the implementation.

Subcontractors must implement their action tasks in accordance with Article 11. The beneficiaries' costs for subcontracting are considered entirely covered by the unit contributions (irrespective of the actual subcontracting costs incurred, if any).

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the subcontractors.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the subcontractors.

9.4 Recipients of financial support to third parties

If the action includes providing financial support to third parties (e.g. grants, prizes or similar forms of support), the beneficiaries must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping)also apply to the third parties receiving the support (recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the recipients.

ARTICLE 10 — PARTICIPANTS WITH SPECIAL STATUS

10.1 Non-EU participants

Participants which are established in a non-EU country (if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)
- for the submission of certificates under Article 24: to use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC[13]
- for the controls under Article 25: to allow for checks, reviews, audits and investigations (including on-the-spot checks, visits and inspections) by the bodies mentioned in that Article (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.).

Special rules on dispute settlement apply (see Data Sheet, Point 5).

10.2 Participants which are international organisations

Participants which are international organisations (IOs; if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)
- for the submission of certificates under Article 24: to use either independent public officers or external auditors which comply with comparable standards as those set out in EU Directive 2006/43/EC
- for the controls under Article 25: to allow for the checks, reviews, audits and investigations by the bodies mentioned in that Article, taking into account the specific agreements concluded by them and the EU (if any).

[13] Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

For such participants, nothing in the Agreement will be interpreted as a waiver of their privileges or immunities, as accorded by their constituent documents or international law.

Special rules on applicable law and dispute settlement apply (see Article 43 and Data Sheet, Point 5).

10.3 Pillar-assessed participants

Pillar-assessed participants (if any) may rely on their own systems, rules and procedures, in so far as they have been positively assessed and do not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries.

'Pillar-assessment' means a review by the European Commission on the systems, rules and procedures which participants use for managing EU grants (in particular internal control system, accounting system, external audits, financing of third parties, rules on recovery and exclusion, information on recipients and protection of personal data; see Article 154 EU Financial Regulation 2018/1046).

Participants with a positive pillar assessment may rely on their own systems, rules and procedures, in particular for:

- record-keeping (Article 20): may be done in accordance with internal standards, rules and procedures
- currency conversion for financial statements (Article 21): may be done in accordance with usual accounting practices
- guarantees (Article 23): for public law bodies, prefinancing guarantees are not needed
- certificates (Article 24):
    - certificates on the financial statements (CFS): may be provided by their regular internal or external auditors and in accordance with their internal financial regulations and procedures
    - certificates on usual accounting practices (CoMUC): are not needed if those practices are covered by an ex-ante assessment

and use the following specific rules, for:

- recoveries (Article 22): in case of financial support to third parties, there will be no recovery if the participant has done everything possible to retrieve the undue amounts from the third party receiving the support (including legal proceedings) and non-recovery is not due to an error or negligence on its part
- checks, reviews, audits and investigations by the EU (Article 25): will be conducted taking into account the rules and procedures specifically agreed between them and the framework agreement (if any)
- impact evaluation (Article 26): will be conducted in accordance with the participant's internal rules and procedures and the framework agreement (if any)
- grant agreement suspension (Article 31): certain costs incurred during grant suspension are eligible (notably, minimum costs necessary for a possible resumption of the action and costs

relating to contracts which were entered into before the pre-information letter was received and which could not reasonably be suspended, reallocated or terminated on legal grounds)

- grant agreement termination (Article 32): the final grant amount and final payment will be calculated taking into account also costs relating to contracts due for execution only after termination takes effect, if the contract was entered into before the pre-information letter was received and could not reasonably be terminated on legal grounds

- liability for damages (Article 33.2): the granting authority must be compensated for damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement only if the damage is due to an infringement of the participant's internal rules and procedures or due to a violation of third parties' rights by the participant or one of its employees or individual for whom the employees are responsible.

Participants whose pillar assessment covers procurement and granting procedures may also do purchases, subcontracting and financial support to third parties (Article 6.2) in accordance with their internal rules and procedures for purchases, subcontracting and financial support.

Participants whose pillar assessment covers data protection rules may rely on their internal standards, rules and procedures for data protection (Article 15).

The participants may however not rely on provisions which would breach the principle of equal treatment of applicants or beneficiaries or call into question the decision awarding the grant, such as in particular:

- eligibility (Article 6)

- consortium roles and set-up (Articles 7-9)

- security and ethics (Articles 13, 14)

- IPR (including background and results, access rights and rights of use), communication, dissemination and visibility (Articles 16 and 17)

- information obligation (Article 19)

- payment, reporting and amendments (Articles 21, 22 and 39)

- rejections, reductions, suspensions and terminations (Articles 27, 28, 29-32)

If the pillar assessment was subject to remedial measures, reliance on the internal systems, rules and procedures is subject to compliance with those remedial measures.

Participants whose assessment has not yet been updated to cover (the new rules on) data protection may rely on their internal systems, rules and procedures, provided that they ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subject

- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes

- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed

- accurate and, where necessary, kept up to date

- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and

- processed in a manner that ensures appropriate security of the personal data.

Participants must inform the coordinator without delay of any changes to the systems, rules and procedures that were part of the pillar assessment. The coordinator must immediately inform the granting authority.

Pillar-assessed participants that have also concluded a framework agreement with the EU, may moreover — under the same conditions as those above (i.e. not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries) — rely on the provisions set out in that framework agreement.

SECTION 2 RULES FOR CARRYING OUT THE ACTION

ARTICLE 11 — PROPER IMPLEMENTATION OF THE ACTION

11.1 Obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement, the call conditions and all legal obligations under applicable EU, international and national law.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 12 — CONFLICT OF INTERESTS

12.1 Conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the Agreement could be compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other direct or indirect interest (‘conflict of interests’).

They must formally notify the granting authority without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The granting authority may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the beneficiary may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 13 — CONFIDENTIALITY AND SECURITY

13.1 Sensitive information

The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet (see Point 6).

If a beneficiary requests, the granting authority may agree to keep such information confidential for a longer period.

Unless otherwise agreed between the parties, they may use sensitive information only to implement the Agreement.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

(a) need to know it in order to implement the Agreement and

(b) are bound by an obligation of confidentiality.

The granting authority may disclose sensitive information to its staff and to other EU institutions and bodies.

It may moreover disclose sensitive information to third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party

(b) the information becomes publicly available, without breaching any confidentiality obligation

(c) the disclosure of the sensitive information is required by EU, international or national law.

Specific confidentiality rules (if any) are set out in Annex 5.

13.2 Classified information

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/444[14] and its implementing rules).

Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting authority.

Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

Specific security rules (if any) are set out in Annex 5.

13.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 14 — ETHICS AND VALUES

14.1 Ethics

The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

Specific ethics rules (if any) are set out in Annex 5.

14.2 Values

The beneficiaries must commit to and ensure the respect of basic EU values (such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

Specific rules on values (if any) are set out in Annex 5.

14.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 15 — DATA PROTECTION

15.1 Data processing by the granting authority

[14] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

Any personal data under the Agreement will be processed under the responsibility of the data controller of the granting authority in accordance with and for the purposes set out in the Portal Privacy Statement.

For grants where the granting authority is the European Commission, an EU regulatory or executive agency, joint undertaking or other EU body, the processing will be subject to Regulation 2018/1725[15].

15.2 Data processing by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (in particular, Regulation 2016/679[16]).

They must ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation.

The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement.

15.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 16 — INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS —ACCESS RIGHTS AND RIGHTS OF USE

[15] Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).

[16] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (‘GDPR’) (OJ L 119, 4.5.2016, p. 1).

16.1 Background and access rights to background

The beneficiaries must give each other and the other participants access to the background identified as needed for implementing the action, subject to any specific rules in Annex 5.

'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

(a) held by the beneficiaries before they acceded to the Agreement and

(b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

16.2 Ownership of results

The granting authority does not obtain ownership of the results produced under the action.

'Results' means any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

16.3 Rights of use of the granting authority on materials, documents and information received for policy, information, communication, dissemination and publicity purposes

The granting authority has the right to use non-sensitive information relating to the action and materials and documents received from the beneficiaries (notably summaries for publication, deliverables, as well as any other material, such as pictures or audio-visual material, in paper or electronic form) for policy, information, communication, dissemination and publicity purposes — during the action or afterwards.

The right to use the beneficiaries' materials, documents and information is granted in the form of a royalty-free, non-exclusive and irrevocable licence, which includes the following rights:

(a) **use for its own purposes** (in particular, making them available to persons working for the granting authority or any other EU service (including institutions, bodies, offices, agencies, etc.) or EU Member State institution or body; copying or reproducing them in whole or in part, in unlimited numbers; and communication through press information services)

(b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes)

(c) **editing or redrafting** (including shortening, summarising, inserting other elements (e.g. meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation)

(d) **translation**

(e) **storage** in paper, electronic or other form

(f) **archiving**, in line with applicable document-management rules

(g) the right to authorise **third parties** to act on its behalf or sub-license to third parties the modes of use set out in Points (b), (c), (d) and (f), if needed for the information, communication and publicity activity of the granting authority

(h) **processing**, analysing, aggregating the materials, documents and information received and **producing derivative works**.

The rights of use are granted for the whole duration of the industrial or intellectual property rights concerned.

If materials or documents are subject to moral rights or third party rights (including intellectual property rights or rights of natural persons on their image and voice), the beneficiaries must ensure that they comply with their obligations under this Agreement (in particular, by obtaining the necessary licences and authorisations from the rights holders concerned).

Where applicable, the granting authority will insert the following information:

"© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the [name of granting authority] under conditions."

16.4 Specific rules on IPR, results and background

Specific rules regarding intellectual property rights, results and background (if any) are set out in Annex 5.

16.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

ARTICLE 17 — COMMUNICATION, DISSEMINATION AND VISIBILITY

17.1 Communication — Dissemination — Promoting the action

Unless otherwise agreed with the granting authority, the beneficiaries must promote the action and its results by providing targeted information to multiple audiences (including the media and the public), in accordance with Annex 1 and in a strategic, coherent and effective manner.

Before engaging in a communication or dissemination activity expected to have a major media impact, the beneficiaries must inform the granting authority.

17.2 Visibility — European flag and funding statement

Unless otherwise agreed with the granting authority, communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded

by the grant must acknowledge EU support and display the European flag (emblem) and funding statement (translated into local languages, where appropriate):

The emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

Apart from the emblem, no other visual identity or logo may be used to highlight the EU support.

When displayed in association with other logos (e.g. of beneficiaries or sponsors), the emblem must be displayed at least as prominently and visibly as the other logos.

For the purposes of their obligations under this Article, the beneficiaries may use the emblem without first obtaining approval from the granting authority. This does not, however, give them the right to exclusive use. Moreover, they may not appropriate the emblem or any similar trademark or logo, either by registration or by any other means.

17.3 Quality of information — Disclaimer

Any communication or dissemination activity related to the action must use factually accurate information.

Moreover, it must indicate the following disclaimer (translated into local languages where appropriate):

> "Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [name of the granting authority]. Neither the European Union nor the granting authority can be held responsible for them."

17.4 Specific communication, dissemination and visibility rules

Specific communication, dissemination and visibility rules (if any) are set out in Annex 5.

17.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 18 — SPECIFIC RULES FOR CARRYING OUT THE ACTION

18.1 Specific rules for carrying out the action

Specific rules for implementing the action (if any) are set out in Annex 5.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

SECTION 3 GRANT ADMINISTRATION

ARTICLE 19 — GENERAL INFORMATION OBLIGATIONS

19.1 Information requests

The beneficiaries must provide — during the action or afterwards and in accordance with Article 7 — any information requested in order to verify eligibility of the unit contributions declared, proper implementation of the action and compliance with the other obligations under the Agreement.

The information provided must be accurate, precise and complete and in the format requested, including electronic format.

19.2 Participant Register data updates

The beneficiaries must keep — at all times, during the action or afterwards — their information stored in the Portal Participant Register up to date, in particular, their name, address, legal representatives, legal form and organisation type.

19.3 Information about events and circumstances which impact the action

The beneficiaries must immediately inform the granting authority (and the other beneficiaries) of any of the following:

(a) **events** which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:

(i) changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration of honour signed before grant signature)

(ii) linked action information: not applicable

(b) **circumstances** affecting:

(i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

19.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 20 — RECORD-KEEPING

20.1 Keeping records and supporting documents

The beneficiaries must — at least until the time-limit set out in the Data Sheet (see Point 6) — keep records and other supporting documents to prove the proper implementation of the action in line with the accepted standards in the respective field (if any).

In addition, the beneficiaries must — for the same period — keep adequate records and supporting documents to prove the number of units declared; beneficiaries do not need to keep specific records on the actual costs incurred.

The records and supporting documents must be made available upon request (see Article 19) or in the context of checks, reviews, audits or investigations (see Article 25).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 25), the beneficiaries must keep these records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

20.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, unit contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 21 — REPORTING

21.1 Continuous reporting

The beneficiaries must continuously report on the progress of the action (e.g. **deliverables,**

milestones, outputs/outcomes, critical risks, indicators, etc; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority).

Standardised deliverables (e.g. progress reports not linked to payments, reports on cumulative expenditure, special reports, etc; if any) must be submitted using the templates published on the Portal.

21.2 Periodic reporting: Technical reports and financial statements

In addition, the beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2):

- for additional prefinancings (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part.

The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool.

The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities)
- the explanation on the use of resources (or detailed cost reporting table, if required)
- the certificates on the financial statements (CFS): not applicable.

The **financial statements** must detail the contributions for the units implemented in the reporting period.

Unit contributions which are not declared in a financial statement will not be taken into account by the granting authority.

By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries confirm that:

- the information provided is complete, reliable and true
- the unit contributions declared are eligible (see Article 6)
- the contributions can be substantiated by adequate records and supporting documents (see Article 20) that will be produced upon request (see Article 19) or in the context of checks, reviews, audits and investigations (see Article 25)

Beneficiaries will have to submit also the financial statements of their affiliated entities (if any). In case of recoveries (see Article 22), beneficiaries will be held responsible also for the financial statements of their affiliated entities.

21.3 Currency for financial statements and conversion into euros

The financial statements must be drafted in euro.

21.4 Reporting language

The reporting must be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

21.5 Consequences of non-compliance

If a report submitted does not comply with this Article, the granting authority may suspend the payment deadline (see Article 29) and apply other measures described in Chapter 5.

If the coordinator breaches its reporting obligations, the granting authority may terminate the grant or the coordinator's participation (see Article 32) or apply other measures described in Chapter 5.

ARTICLE 22 — PAYMENTS AND RECOVERIES — CALCULATION OF AMOUNTS DUE

22.1 Payments and payment arrangements

Payments will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

They will be made in euro to the bank account indicated by the coordinator (see Data Sheet, Point 4.2) and must be distributed without unjustified delay (restrictions may apply to distribution of the initial prefinancing payment; see Data Sheet, Point 4.2).

Payments to this bank account will discharge the granting authority from its payment obligation.

The cost of payment transfers will be borne as follows:

- the granting authority bears the cost of transfers charged by its bank
- the beneficiary bears the cost of transfers charged by its bank
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

Payments by the granting authority will be considered to have been carried out on the date when they are debited to its account.

22.2 Recoveries

Recoveries will be made, if — at beneficiary termination, final payment or afterwards — it turns out that the granting authority has paid too much and needs to recover the amounts undue.

Each beneficiary's financial responsibility in case of recovery is in principle limited to their own debt and undue amounts of their affiliated entities.

In case of enforced recoveries (see Article 22.4), affiliated entities will be held liable for repaying debts of their beneficiaries, if required by the granting authority (see Data Sheet, Point 4.4).

22.3 Amounts due

22.3.1 Prefinancing payments

The aim of the prefinancing is to provide the beneficiaries with a float.

It remains the property of the EU until the final payment.

For **initial prefinancings** (if any), the amount due, schedule and modalities are set out in the Data Sheet (see Point 4.2).

For **additional prefinancings** (if any), the amount due, schedule and modalities are also set out in the Data Sheet (see Point 4.2). However, if the statement on the use of the previous prefinancing payment shows that less than 70% was used, the amount set out in the Data Sheet will be reduced by the difference between the 70% threshold and the amount used.

The contribution to the Mutual Insurance Mechanism will be retained from the prefinancing payments (at the rate and in accordance with the modalities set out in the Data Sheet, see Point 4.2) and transferred to the Mechanism.

Prefinancing payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.2 Amount due at beneficiary termination — Recovery

At beneficiary termination there will be no payment, but the grant must be provisionally closed for the beneficiary which leaves the consortium (and the affiliated entities which had to end their participation together with the beneficiary, if any).

Payments (if any) will be made with the next interim or final payment.

The **amount due** will be calculated in the following step:

Step 1 — Calculation of the total accepted EU contribution

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the beneficiary for all reporting periods, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution' for the beneficiary.

The **balance** is then calculated by deducting the payments received (if any; see report on the distribution of payments in Article 32), from the total accepted EU contribution:

{total accepted EU contribution for the beneficiary

minus

{prefinancing and interim payments received (if any)}}.

If the balance is **positive**, the amount will be included in the next interim or final payment to the consortium.

If the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount due, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered and ask this amount to be paid to the coordinator (**confirmation letter**).

If payment is not made to the coordinator by the date specified in the confirmation letter, the granting authority may call on the Mutual Insurance Mechanism to intervene, if continuation of the action is guaranteed and the conditions set out in the rules governing the Mechanism are met.

In this case, it will send a **beneficiary recovery letter**, together with a **debit note** with the terms and date for payment.

The debit note for the beneficiary will include the amount calculated for the affiliated entities which also had to end their participation (if any).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

The amounts will later on also be taken into account for the next interim or final payment.

22.3.3 Interim payments

Interim payments reimburse the eligible contributions claimed for the units implemented during the reporting periods (if any).

Interim payments (if any) will be made in accordance with the schedule and modalities set out the Data Sheet (see Point 4.2).

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **interim payment** will be calculated by the granting authority in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the interim payment ceiling

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the action for the reporting period, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions from beneficiary termination (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the interim payment ceiling

The resulting amount is then capped to ensure that the total amount of prefinancing and interim payments (if any) does not exceed the interim payment ceiling set out in the Data Sheet (see Point 4.2).

Interim payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.4 Final payment — Final grant amount — Revenues and Profit — Recovery

The final payment (payment of the balance) reimburses the eligible contributions claimed for the remaining units implemented (if any).

The final payment will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

Payment is subject to the approval of the final periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **final grant amount for the action** will be calculated in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the action for all reporting periods, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the maximum grant amount

If the resulting amount is higher than the maximum grant amount set out in Article 5.2, it will be limited to the latter.

Step 3 — Reduction due to the no-profit rule

Not applicable

The **balance** (final payment) is then calculated by deducting the total amount of prefinancing and interim payments already made (if any), from the final grant amount:

{final grant amount

minus

{prefinancing and interim payments made (if any)}}.

If the balance is **positive**, it will be **paid** to the coordinator.

The amount retained for the Mutual Insurance Mechanism (see above) will be released and **paid** to the coordinator (in accordance with the rules governing the Mechanism).

The final payment (or part of it) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

If — despite the release of the Mutual Insurance Mechanism contribution — the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to recover, the final grant amount, the amount to be recovered and the reasons why
- requesting a report on the distribution of payments to the beneficiaries within 30 days of receiving notification and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received) and the coordinator has submitted the report on the distribution of payments, it will calculate the **share of the debt per beneficiary**, by:

(a) identifying the beneficiaries for which the amount calculated as follows is negative:

{{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action}**,**

minus

{prefinancing and interim payments received by the beneficiary (if any)}**}**

and

(b) dividing the debt:

{{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount to be recovered**}**.

and confirm the amount to be recovered from each beneficiary concerned (**confirmation letter**), together with **debit notes** with the terms and date for payment.

The debit notes for beneficiaries will include the amounts calculated for their affiliated entities (if any).

If the coordinator has not submitted the report on the distribution of payments, the granting authority will **recover** the full amount from the coordinator (**confirmation letter** and **debit note** with the terms and date for payment).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.3.5 Audit implementation after final payment — Revised final grant amount — Recovery

If — after the final payment (in particular, after checks, reviews, audits or investigations; see Article 25) — the granting authority rejects unit contributions (see Article 27) or reduces the grant (see Article 28), it will calculate the **revised final grant amount** for the beneficiary concerned.

The **beneficiary revised final grant amount** will be calculated in the following step:

Step 1 — Calculation of the revised total accepted EU contribution

Step 1 — Calculation of the revised total accepted EU contribution

The granting authority will first calculate the ‘revised accepted EU contribution’ for the beneficiary, by calculating the ‘revised accepted contributions’.

After that, it will take into account grant reductions (if any). The resulting ‘revised total accepted EU contribution’ is the beneficiary revised final grant amount.

If the revised final grant amount is lower than the beneficiary’s final grant amount (i.e. its share in the final grant amount for the action), it will be **recovered** in accordance with the following procedure:

The **beneficiary final grant amount** (i.e. share in the final grant amount for the action) is calculated as follows:

{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action}.

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered (**confirmation letter**), together with a **debit note** with the terms and the date for payment.

Recoveries against affiliated entities (if any) will be handled through their beneficiaries.

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.4 Enforced recovery

If payment is not made by the date specified in the debit note, the amount due will be recovered:

(a) by offsetting the amount — without the coordinator or beneficiary's consent — against any amounts owed to the coordinator or beneficiary by the granting authority.

In exceptional circumstances, to safeguard the EU financial interests, the amount may be offset before the payment date specified in the debit note.

For grants where the granting authority is the European Commission or an EU executive agency, debts may also be offset against amounts owed by other Commission services or executive agencies.

(b) financial guarantee(s): not applicable

(c) joint and several liability of beneficiaries: not applicable

(d) by holding affiliated entities jointly and severally liable (if any, see Data Sheet, Point 4.4)

(e) by taking legal action (see Article 43) or, provided that the granting authority is the European Commission or an EU executive agency, by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 100(2) of EU Financial Regulation 2018/1046.

If the Mutual Insurance Mechanism was called on by the granting authority to intervene, recovery will be continued in the name of the Mutual Insurance Mechanism. If two debit notes were sent, the second

one (in the name of the Mutual Insurance Mechanism) will be considered to replace the first one (in the name of the granting authority). Where the MIM intervened, offsetting, enforceable decisions or any other of the above-mentioned forms of enforced recovery may be used mutatis mutandis.

The amount to be recovered will be increased by **late-payment interest** at the rate set out in Article 22.5, from the day following the payment date in the debit note, up to and including the date the full payment is received.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2015/2366[17] applies.

For grants where the granting authority is an EU executive agency, enforced recovery by offsetting or enforceable decision will be done by the services of the European Commission (see also Article 43).

22.5 Consequences of non-compliance

22.5.1 If the granting authority does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus the rate specified in the Data Sheet (Point 4.2). The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only on request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

If payments or the payment deadline are suspended (see Articles 29 and 30), payment will not be considered as late.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

22.5.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the coordinator may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 23 — GUARANTEES

Not applicable

[17] Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, p. 35).

ARTICLE 24 — CERTIFICATES

Not applicable

ARTICLE 25 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

25.1 Granting authority checks, reviews and audits

25.1.1 Internal checks

The granting authority may — during the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing unit contributions, deliverables and reports.

25.1.2 Project reviews

The granting authority may carry out reviews on the proper implementation of the action and compliance with the obligations under the Agreement (general project reviews or specific issues reviews).

Such project reviews may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiary concerned and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent, outside experts. If it uses outside experts, the coordinator or beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The coordinator or beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The granting authority may request beneficiaries to provide such information to it directly. Sensitive information and documents will be treated in accordance with Article 13.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with the outside experts.

For **on-the-spot visits**, the beneficiary concerned must allow access to sites and premises (including to the outside experts) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a **project review report** will be drawn up.

The granting authority will formally notify the project review report to the coordinator or beneficiary concerned, which has 30 days from receiving notification to make observations.

Project reviews (including project review reports) will be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

25.1.3 Audits

The granting authority may carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Such audits may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the beneficiary concerned and will be considered to start on the date of the notification.

The granting authority may use its own audit service, delegate audits to a centralised service or use external audit firms. If it uses an external firm, the beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. Sensitive information and documents will be treated in accordance with Article 13.

For **on-the-spot** visits, the beneficiary concerned must allow access to sites and premises (including for the external audit firm) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **draft audit report** will be drawn up.

The auditors will formally notify the draft audit report to the beneficiary concerned, which has 30 days from receiving notification to make observations (contradictory audit procedure).

The **final audit report** will take into account observations by the beneficiary concerned and will be formally notified to them.

Audits (including audit reports) will be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

25.2 European Commission checks, reviews and audits in grants of other granting authorities

Where the granting authority is not the European Commission, the latter has the same rights of checks, reviews and audits as the granting authority.

25.3 Access to records for assessing simplified forms of funding

The beneficiaries must give the European Commission access to their statutory records for the periodic assessment of simplified forms of funding which are used in EU programmes.

25.4 OLAF, EPPO and ECA audits and investigations

The following bodies may also carry out checks, reviews, audits and investigations — during the action or afterwards:

- the European Anti-Fraud Office (OLAF) under Regulations No 883/2013[18] and No 2185/96[19]
- the European Public Prosecutor's Office (EPPO) under Regulation 2017/1939
- the European Court of Auditors (ECA) under Article 287 of the Treaty on the Functioning of the EU (TFEU) and Article 257 of EU Financial Regulation 2018/1046.

If requested by these bodies, the beneficiary concerned must provide full, accurate and complete information in the format requested (including complete accounts, individual salary statements or other personal data, including in electronic format) and allow access to sites and premises for on-the-spot visits or inspections — as provided for under these Regulations.

To this end, the beneficiary concerned must keep all relevant information relating to the action, at least until the time-limit set out in the Data Sheet (Point 6) and, in any case, until any ongoing checks, reviews, audits, investigations, litigation or other pursuits of claims have been concluded.

25.5 Consequences of checks, reviews, audits and investigations — Extension of results of reviews, audits or investigations

25.5.1 Consequences of checks, reviews, audits and investigations in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to rejections (see Article 27), grant reduction (see Article 28) or other measures described in Chapter 5.

Rejections or grant reductions after the final payment will lead to a revised final grant amount (see Article 22).

Findings in checks, reviews, audits or investigations during the action implementation may lead to a request for amendment (see Article 39), to change the description of the action set out in Annex 1.

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations in any EU grant may also lead to consequences in other EU grants awarded under similar conditions ('extension to other grants').

Moreover, findings arising from an OLAF or EPPO investigation may lead to criminal prosecution under national law.

25.5.2 Extension from other grants

Results of checks, reviews, audits or investigations in other grants may be extended to this grant, if:

(a) the beneficiary concerned is found, in other EU grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and

[18] Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18/09/2013, p. 1).

[19] Council Regulation (Euratom, EC) No 2185/96 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15/11/1996, p. 2).

(b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — within the time-limit for audits set out in the Data Sheet (see Point 6).

The granting authority will formally notify the beneficiary concerned of the intention to extend the findings and the list of grants affected.

If the extension concerns **rejections of unit contributions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings

(b) the request to submit revised financial statements for all grants affected

(c) the correction rate for extrapolation, established on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected, if the beneficiary concerned:

(i) considers that the submission of revised financial statements is not possible or practicable or

(ii) does not submit revised financial statements.

If the extension concerns **grant reductions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings and

(b) the **correction rate for extrapolation**, established on the basis of the systemic or recurrent errors and the principle of proportionality.

The beneficiary concerned has **60 days** from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method/rate**.

On the basis of this, the granting authority will analyse the impact and decide on the implementation (i.e. start rejection or grant reduction procedures, either on the basis of the revised financial statements or the announced/alternative method/rate or a mix of those; see Articles 27 and 28).

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, unit contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 26 — IMPACT EVALUATIONS

26.1 Impact evaluation

The granting authority may carry out impact evaluations of the action, measured against the objectives and indicators of the EU programme funding the grant.

Such evaluations may be started during implementation of the action and until the time-limit set out

in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiaries and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent outside experts.

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

26.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the granting authority may apply the measures described in Chapter 5.

CHAPTER 5 CONSEQUENCES OF NON-COMPLIANCE

SECTION 1 REJECTIONS AND GRANT REDUCTION

ARTICLE 27 — REJECTION OF CONTRIBUTIONS

27.1 Conditions

The granting authority will — at beneficiary termination, interim payment, final payment or afterwards — reject any unit contributions which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 25).

The rejection may also be based on the extension of findings from other grants to this grant (see Article 25).

Ineligible unit contributions will be rejected.

27.2 Procedure

If the rejection does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the rejection, the amounts and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the rejection (payment review procedure).

If the rejection leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

27.3 Effects

If the granting authority rejects unit contributions, it will deduct them from the contributions declared and then calculate the amount due (and, if needed, make a recovery; see Article 22).

ARTICLE 28 — GRANT REDUCTION

28.1 Conditions

The granting authority may — at beneficiary termination, final payment or afterwards — reduce the grant for a beneficiary, if:

(a) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (see Article 25).

The amount of the reduction will be calculated for each beneficiary concerned and proportionate to the seriousness and the duration of the errors, irregularities or fraud or breach of obligations, by applying an individual reduction rate to their accepted EU contribution.

28.2 Procedure

If the grant reduction does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the reduction, the amount to be reduced and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the reduction (payment review procedure).

If the grant reduction leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

28.3 Effects

If the granting authority reduces the grant, it will deduct the reduction and then calculate the amount due (and, if needed, make a recovery; see Article 22).

SECTION 2 SUSPENSION AND TERMINATION

ARTICLE 29 — PAYMENT DEADLINE SUSPENSION

29.1 Conditions

The granting authority may — at any moment — suspend the payment deadline if a payment cannot be processed because:

(a) the required report (see Article 21) has not been submitted or is not complete or additional information is needed

(b) there are doubts about the amount to be paid (e.g. ongoing audit extension procedure, queries

about eligibility, need for a grant reduction, etc.) and additional checks, reviews, audits or investigations are necessary, or

(c) there are other issues affecting the EU financial interests.

29.2 Procedure

The granting authority will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day the notification is sent.

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining time to pay (see Data Sheet, Point 4.2) will resume.

If the suspension exceeds two months, the coordinator may request the granting authority to confirm if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the report and the revised report is not submitted (or was submitted but is also rejected), the granting authority may also terminate the grant or the participation of the coordinator (see Article 32).

ARTICLE 30 — PAYMENT SUSPENSION

30.1 Conditions

The granting authority may — at any moment — suspend payments, in whole or in part for one or more beneficiaries, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

  (i) substantial errors, irregularities or fraud or

  (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant.

If payments are suspended for one or more beneficiaries, the granting authority will make partial payment(s) for the part(s) not suspended. If suspension concerns the final payment, the payment (or recovery) of the remaining amount after suspension is lifted will be considered to be the payment that closes the action.

30.2 Procedure

Before suspending payments, the granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to suspend payments and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

At the end of the suspension procedure, the granting authority will also inform the coordinator.

The suspension will **take effect** the day after the confirmation notification is sent.

If the conditions for resuming payments are met, the suspension will be **lifted**. The granting authority will formally notify the beneficiary concerned (and the coordinator) and set the suspension end date.

During the suspension, no prefinancing will be paid to the beneficiaries concerned. For interim payments, the periodic reports for all reporting periods except the last one (see Article 21) must not contain any financial statements from the beneficiary concerned (or its affiliated entities). The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

ARTICLE 31 — GRANT AGREEMENT SUSPENSION

31.1 Consortium-requested GA suspension

31.1.1 Conditions and procedure

The beneficiaries may request the suspension of the grant or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 35) — make implementation impossible or excessively difficult.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the suspension takes effect; this date may be before the date of the submission of the amendment request and
- the expected date of resumption.

The suspension will **take effect** on the day specified in the amendment.

Once circumstances allow for implementation to resume, the coordinator must immediately request another **amendment** of the Agreement to set the suspension end date, the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the amendment. This date may be before the date of the submission of the amendment request.

During the suspension, no prefinancing will be paid. Moreover, no units may be implemented. Ongoing units must be interrupted and no new units may be started. Unit contributions for activities implemented during grant suspension are not eligible (see Article 6.3).

31.2 EU-initiated GA suspension

31.2.1 Conditions

The granting authority may suspend the grant or any part of it, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

  (i) substantial errors, irregularities or fraud or

  (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant

(c) other:

  (i) linked action issues: not applicable

  (ii) the action has lost its scientific or technological relevance

31.2.2 Procedure

Before suspending the grant, the granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to suspend the grant and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

The suspension will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification).

Once the conditions for resuming implementation of the action are met, the granting authority will formally notify the coordinator a **lifting of suspension letter**, in which it will set the suspension end date and invite the coordinator to request an amendment of the Agreement to set the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see

Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the lifting of suspension letter. This date may be before the date on which the letter is sent.

During the suspension, no prefinancing will be paid. Moreover, no units may be implemented Ongoing units must be interrupted and no new units may be started. Unit contributions for activities implemented during suspension are not eligible (see Article 6.3).

The beneficiaries may not claim damages due to suspension by the granting authority (see Article 33).

Grant suspension does not affect the granting authority's right to terminate the grant or a beneficiary (see Article 32) or reduce the grant (see Article 28).

ARTICLE 32 — GRANT AGREEMENT OR BENEFICIARY TERMINATION

32.1 Consortium-requested GA termination

32.1.1 Conditions and procedure

The beneficiaries may request the termination of the grant.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the consortium ends work on the action ('end of work date') and
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

The termination will **take effect** on the termination date specified in the amendment.

If no reasons are given or if the granting authority considers the reasons do not justify termination, it may consider the grant terminated improperly.

32.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the unit contributions for activities implemented before the end of work date (see Article 22).

If the granting authority does not receive the report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

Improper termination may lead to a grant reduction (see Article 28).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.2 Consortium-requested beneficiary termination

32.2.1 Conditions and procedure

The coordinator may request the termination of the participation of one or more beneficiaries, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing)
- the date the beneficiary ends work on the action ('end of work date')
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

If the termination concerns the coordinator and is done without its agreement, the amendment request must be submitted by another beneficiary (acting on behalf of the consortium).

The termination will **take effect** on the termination date specified in the amendment.

If no information is given or if the granting authority considers that the reasons do not justify termination, it may consider the beneficiary to have been terminated improperly.

32.2.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement and the explanation on the use of resources

(iii) a second **request for amendment** (see Article 39) with other amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the unit contributions for activities implemented before the end of work date (see Article 22).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the second request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the second request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

Improper termination may lead to a reduction of the grant (see Article 31) or grant termination (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.3 EU-initiated GA or beneficiary termination

32.3.1 Conditions

The granting authority may terminate the grant or the participation of one or more beneficiaries, if:

(a) one or more beneficiaries do not accede to the Agreement (see Article 40)

(b) a change to the action or the legal, financial, technical, organisational or ownership situation of a beneficiary is likely to substantially affect the implementation of the action or calls into question the decision to award the grant (including changes linked to one of the exclusion grounds listed in the declaration of honour)

(c) following termination of one or more beneficiaries, the necessary changes to the Agreement (and their impact on the action) would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(d) implementation of the action has become impossible or the changes necessary for its continuation would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(e) a beneficiary (or person with unlimited liability for its debts) is subject to bankruptcy proceedings or similar (including insolvency, winding-up, administration by a liquidator or court, arrangement with creditors, suspension of business activities, etc.)

(f) a beneficiary (or person with unlimited liability for its debts) is in breach of social security or tax obligations

(g) a beneficiary (or person having powers of representation, decision-making or control, or person

essential for the award/implementation of the grant) has been found guilty of grave professional misconduct

(h) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed fraud, corruption, or is involved in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking

(i) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) was created under a different jurisdiction with the intent to circumvent fiscal, social or other legal obligations in the country of origin (or created another entity with this purpose)

(j) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

  (i) substantial errors, irregularities or fraud or

  (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.)

(k) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 25)

(l) despite a specific request by the granting authority, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its affiliated entities or associated partners that is in one of the situations under points (d), (f), (e), (g), (h), (i) or (j) and to reallocate its tasks, or

(m) other:

  (i) linked action issues: not applicable

  (ii) the action has lost its scientific or technological relevance

32.3.2 Procedure

Before terminating the grant or participation of one or more beneficiaries, the granting authority will send **a pre-information letter** to the coordinator or beneficiary concerned:

- formally notifying the intention to terminate and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the termination and the date it will take effect (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

For beneficiary terminations, the granting authority will — at the end of the procedure — also inform the coordinator.

The termination will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification; 'termination date').

32.3.3 Effects

(a) for **GA termination**:

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the last open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted (see Article 22). Only units implemented until termination will be accepted.

If the grant is terminated for breach of the obligation to submit reports, the coordinator may not submit any report after termination.

If the granting authority does not receive the report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

Termination does not affect the granting authority's right to reduce the grant (see Article 28) or to impose administrative sanctions (see Article 34).

The beneficiaries may not claim damages due to termination by the granting authority (see Article 33).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

(b) for **beneficiary termination**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, and the explanation on the use of resources

(iii) a **request for amendment** (see Article 39) with any amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted (see Article 22). Only units implemented until termination will be accepted.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only unit contributions included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

SECTION 3 OTHER CONSEQUENCES: DAMAGES AND ADMINISTRATIVE SANCTIONS

ARTICLE 33 — DAMAGES

33.1 Liability of the granting authority

The granting authority cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of the implementation of the Agreement, including for gross negligence.

The granting authority cannot be held liable for any damage caused by any of the beneficiaries or other participants involved in the action, as a consequence of the implementation of the Agreement.

33.2 Liability of the beneficiaries

The beneficiaries must compensate the granting authority for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement, provided that it was caused by gross negligence or wilful act.

The liability does not extend to indirect or consequential losses or similar damage (such as loss of profit, loss of revenue or loss of contracts), provided such damage was not caused by wilful act or by a breach of confidentiality.

ARTICLE 34 — ADMINISTRATIVE SANCTIONS AND OTHER MEASURES

Nothing in this Agreement may be construed as preventing the adoption of administrative sanctions (i.e. exclusion from EU award procedures and/or financial penalties) or other public law measures, in addition or as an alternative to the contractual measures provided under this Agreement (see, for instance, Articles 135 to 145 EU Financial Regulation 2018/1046 and Articles 4 and 7 of Regulation 2988/95[20]).

SECTION 4 FORCE MAJEURE

ARTICLE 35 — FORCE MAJEURE

A party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of other participants involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

CHAPTER 6 FINAL PROVISIONS

ARTICLE 36 — COMMUNICATION BETWEEN THE PARTIES

36.1 Forms and means of communication — Electronic management

EU grants are managed fully electronically through the EU Funding & Tenders Portal ('Portal').

All communications must be made electronically through the Portal, in accordance with the Portal Terms and Conditions and using the forms and templates provided there (except if explicitly instructed otherwise by the granting authority).

Communications must be made in writing and clearly identify the grant agreement (project number and acronym).

Communications must be made by persons authorised according to the Portal Terms and Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of

[20] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in their appointment letter (see Portal Terms and Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Portal.

36.2 Date of communication

The sending date for communications made through the Portal will be the date and time of sending, as indicated by the time logs.

The receiving date for communications made through the Portal will be the date and time the communication is accessed, as indicated by the time logs. Formal notifications that have not been accessed within 10 days after sending, will be considered to have been accessed (see Portal Terms and Conditions).

If a communication is exceptionally made on paper (by e-mail or postal service), general principles apply (i.e. date of sending/receipt). Formal notifications by registered post with proof of delivery will be considered to have been received either on the delivery date registered by the postal service or the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

36.3 Addresses for communication

The Portal can be accessed via the Europa website.

The address for paper communications to the granting authority (if exceptionally allowed) is the official mailing address indicated on its website.

For beneficiaries, it is the legal address specified in the Portal Participant Register.

ARTICLE 37 — INTERPRETATION OF THE AGREEMENT

The provisions in the Data Sheet take precedence over the rest of the Terms and Conditions of the Agreement.

Annex 5 takes precedence over the Terms and Conditions; the Terms and Conditions take precedence over the Annexes other than Annex 5.

Annex 2 takes precedence over Annex 1.

ARTICLE 38 — CALCULATION OF PERIODS AND DEADLINES

In accordance with Regulation No 1182/71[21], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

[21] Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8/6/1971, p. 1).

'Days' means calendar days, not working days.

ARTICLE 39 — AMENDMENTS

39.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

39.2 Procedure

The party requesting an amendment must submit a request for amendment signed directly in the Portal Amendment tool.

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3). If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why
- the appropriate supporting documents and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The granting authority may request additional information.

If the party receiving the request agrees, it must sign the amendment in the tool within 45 days of receiving notification (or any additional information the granting authority has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date of entry into force or other date specified in the amendment.

ARTICLE 40 — ACCESSION AND ADDITION OF NEW BENEFICIARIES

40.1 Accession of the beneficiaries mentioned in the Preamble

The beneficiaries which are not coordinator must accede to the grant by signing the accession form (see Annex 3) directly in the Portal Grant Preparation tool, within 30 days after the entry into force of the Agreement (see Article 44).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 44).

If a beneficiary does not accede to the grant within the above deadline, the coordinator must — within 30 days — request an amendment (see Article 39) to terminate the beneficiary and make any changes necessary to ensure proper implementation of the action. This does not affect the granting authority's right to terminate the grant (see Article 32).

40.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 39. It must include an accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool.

New beneficiaries will assume the rights and obligations under the Agreement with effect from the date of their accession specified in the accession form (see Annex 3).

Additions are also possible in mono-beneficiary grants.

ARTICLE 41 — TRANSFER OF THE AGREEMENT

In justified cases, the beneficiary of a mono-beneficiary grant may request the transfer of the grant to a new beneficiary, provided that this would not call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiary must submit a request for **amendment** (see Article 39), with

- the reasons why
- the accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool and
- additional supporting documents (if required by the granting authority).

The new beneficiary will assume the rights and obligations under the Agreement with effect from the date of accession specified in the accession form (see Annex 3).

ARTICLE 42 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE GRANTING AUTHORITY

The beneficiaries may not assign any of their claims for payment against the granting authority to any third party, except if expressly approved in writing by the granting authority on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the granting authority has not accepted the assignment or if the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the granting authority.

ARTICLE 43 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

43.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

Special rules may apply for beneficiaries which are international organisations (if any; see Data Sheet, Point 5).

43.2 Dispute settlement

If a dispute concerns the interpretation, application or validity of the Agreement, the parties must bring action before the EU General Court — or, on appeal, the EU Court of Justice — under Article 272 of the Treaty on the Functioning of the EU (TFEU).

For non-EU beneficiaries (if any), such disputes must be brought before the courts of Brussels, Belgium — unless an international agreement provides for the enforceability of EU court judgements.

For beneficiaries with arbitration as special dispute settlement forum (if any; see Data Sheet, Point 5), the dispute will — in the absence of an amicable settlement — be settled in accordance with the Rules for Arbitration published on the Portal.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 22 and 34), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice — under Article 263 TFEU.

For grants where the granting authority is an EU executive agency (see Preamble), actions against offsetting and enforceable decisions must be brought against the European Commission (not against the granting authority; see also Article 22).

ARTICLE 44 — ENTRY INTO FORCE

The Agreement will enter into force on the day of signature by the granting authority or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

CARLOS BELTRAN ALVAREZ with ECAS id ngomezjo signed in the Participant Portal on 29/07/2024 at 09:47:25 (transaction id SigId-28547-TIzPMKhJcHYNAnHzlcT1UnSi7E1YWktuo4IQJBbWZ2L5EexTgLzeqlPU4ETTDjouIhkrQMlSI7Fv5IT5d3l09mG-yntOf97TTHqAX5yfJ7HQNG-4NqSbImjOOztOThzW30kizWaHq47Oow0hUvcezR7y88h32VsocZyiCO85Gsq9QxpjxgeKLdaKIczec6TlzxDSc8G). Timestamp by third party at 2024.07.29 09:47:32 CEST

For the granting authority

Signed by Monika HOLIK with ECAS id holikma as an authorised representative on 01-08-2024 13:00:57 (transaction id SigId-31536-Cfejw6ZAs0g0lUmktn9e7ufx9uCZvQdzWxK0J0OOkQeWnuxHWUaO0o5lO1GNoOFY3QGEV7BxIv88FagyMVv4Xa-rS0vSrmBGYCptdzV9G6vOB-zaa31K7LQTohf0JvhutyeDTXh30ZX55RMiyoray8ml4MostzKSzJ3fPZiiDRxuwj8uW9kD0Dn3DgiMLwbNujOf0) 2024.08.01 13:02:05 CEST

ANNEX 1

Horizon Europe (HORIZON)

Description of the action (DoA)

Part A

Part B

DESCRIPTION OF THE ACTION (PART A)

COVER PAGE

Part A of the Description of the Action (DoA) must be completed directly on the Portal Grant Preparation screens.

PROJECT *Grant Preparation (General Information screen) — Enter the info.*	
Project number:	101182948
Project name:	Development of knowledge and technology to implement retrofilling in power transformers using biodegradable or recycled fluids and fostering circular economy
Project acronym:	RETROTRAFO
Call:	HORIZON-MSCA-2023-SE-01
Topic:	HORIZON-MSCA-2023-SE-01-01
Type of action:	HORIZON-TMA-MSCA-SE
Service:	REA/A/03
Project starting date:	fixed date: 1 January 2025
Project duration:	48 months

TABLE OF CONTENTS

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

PROJECT SUMMARY

Project summary

Grant Preparation (General Information screen) — Provide an overall description of your project (including context and overall objectives, planned activities and main achievements, and expected results and impacts (on target groups, change procedures, capacities, innovation etc)). This summary should give readers a clear idea of what your project is about.

Use the project summary from your proposal.

Power transformers play a crucial role in electric power transmission and distribution systems, being both expensive and strategically important. Their prolonged efficient operation is essential to prevent long-term power outages. With tens of thousands of transformers worldwide approaching the end of their typical 30-40 year lifespan, the question of recycling becomes significant. Remarkably, around 95% of a power transformer's materials could potentially be recycled. Recognizing the importance of a circular economy, the European Commission adopted a Circular Economy plan in 2020, aiming to shift from a linear "take, make, dispose" model to a circular one where waste becomes a new resource. While the initial focus was on energy efficiency in transformers, the impact of materials is not negligible. The upcoming revision of the eco-design regulation for transformers in 2023 will introduce new requirements on material efficiency.

The proposed project will develop research on transformer retrofilling with alternative or recycled insulating liquids. This technique is based on the replacement of the mineral oil of a transformer in service with a biodegradable and less-flammable fluid. The procedure would lead to safer and more environmentally friendly transformers and could allow the application of higher loads, deferring the replacement of equipment in service. However, the technique has not been sufficiently studied, it is needed to evaluate the impact of retrofilling on the operation of the transformer and to assess its economic and technical feasibility. Project's researchers have applied the circular economy concept to power transformers in various ways during project definition:
a) Evaluating the efficient use of materials throughout a transformer's life cycle (renewable or re-refined oils instead of conventional oils);
b) Lifetime extension through dielectric and thermal design review and guidance on operation and maintenance.

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	UC	UNIVERSIDAD DE CANTABRIA	ES	999880075
2	BEN	UC3M	UNIVERSIDAD CARLOS III DE MADRID	ES	999899572
3	BEN	UWB	ZAPADOCESKA UNIVERZITA V PLZNI	CZ	999843894
4	BEN	UNIZA	ZILINSKA UNIVERZITA V ZILINE	SK	999969606
5	BEN	BEST	BALIKESIR ELEKTROMEKANIK SANAYI TESISLERI ANONIM SIRKETI	TR	906675200
6	BEN	SMT	SEA MARCONI TECHNOLOGIES DI VANDERTUMIATTI SAS	IT	986834060
7	BEN	SUT	POLITECHNIKA SLASKA	PL	999899087
8	BEN	TUKE	TECHNICKA UNIVERZITA V KOSICIACH	SK	999839238
9	BEN	UEF SAV	USTAV EXPERIMENTALNEJ FYZIKY SLOVENSKEJ AKADEMIE VIED	SK	999604983
10	BEN	BCMATERIALS	FUNDACION BCMATERIALS - BASQUE	ES	928273511

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
			CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES		
11	AP	UNL	UNIVERSIDAD NACIONAL DEL LITORAL	AR	998777476
12	AP	UPM	UNIVERSITI PUTRA MALAYSIA	MY	999650282
13	AP	UBO	UNIVERSIDAD BERNARDO O'HIGGINS	CL	884603432
14	AP	USACH	UNIVERSIDAD DE SANTIAGO DE CHILE	CL	986427436
15	AP	UVALLE	UNIVERSIDAD DEL VALLE	CO	974162271
16	AP	Kyutech	KOKURITSU DAIGAKU HOJIN KYUSHU KOGYO DAIGAKU	JP	954274167
17	AP	NYU	NEW YORK UNIVERSITY	US	999437561
18	AP	UW	UNIVERSITY OF WATERLOO	CA	996231614
19	AP	UTFSM	UNIVERSIDAD TECNICA FEDERICO SANTA MARIA	CL	999633792
20	AP	UNSJ	UNIVERSIDAD NACIONAL DE SAN JUAN	AR	972856457
21	AP	UNIMAN	THE UNIVERSITY OF MANCHESTER	UK	999903840
22	AP	TU	Tanta University	EG	930247849
23	AP	WMU	Western Michigan University	US	899854160
24	AP	UQ	THE UNIVERSITY OF QUEENSLAND	AU	999881724
25	AP	CELSIA	CELSIA COLOMBIA S.A E.S.P	CO	878312885
26	AP	Diveg	Diveg s.a.s.	CO	878317929
27	AP	STOEN	RWE STOEN OPERATOR SP ZOO	PL	951920268
28	AP	EGI	E.ON GROUP INNOVATION GMBH	DE	893549548

LIST OF WORK PACKAGES

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
WP1	Aging of the dielectric system	1 - UC	74.00	3	39	D1.1 – Characterization of dielectric materials D1.2 – Dielectric aging after retrofilling D1.3 – Modelling dielectric aging after retrofilling
WP2	Thermal and dielectric performance	7 - SUT	109.00	9	43	D2.1 – Cooling performance after retrofilling D2.2 – Dielectric performance after retrofilling
WP3	Operation and environment	2 - UC3M	96.00	13	46	D3.1 – Optimum retrofilling procedure D3.2 – Operation and maintenance after retrofilling D3.3 – Testing retrofilling: cooling, moisture, mechanics. D3.4 – Life cycle assessment considering retrofilling
WP4	Dissemination and exploitation	4 - UNIZA	0.00	1	48	D4.1 – Website and logo D4.2 – Dissemination and Exploitation Plan
WP5	Transfer of knowledge	3 - UWB	0.00	3	48	D5.1 – Transfer of Knowledge Plan
WP6	Coordination and management	1 - UC	0.00	1	48	D6.1 – Data Management Plan D6.2 – Progress report D6.3 – Mid-term Meeting

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Work package WP1 – Aging of the dielectric system

Work Package Number	WP1	Lead Beneficiary	1 - UC
Work Package Name	Aging of the dielectric system		
Start Month	3	End Month	39

Objectives
WP1 will characterize how dielectric materials degrade over time after undergoing retrofilling, in comparison with the commonly used reference fluid. In the laboratory, accelerated aging experiments will be carried out with representative samples of different winding systems for different operating conditions to quantify the evolution of physical-chemical properties in the dielectric system. Person months (PMs): 74, includes 5PM from AP UNIMAN (UK) to MS/AC

Description
Task 1.1. Physic chemical evaluation (M3-M21) [Leader: UVALLE, PMs: 20, Participants: UC, UC3M, UNIZA, BCMATERIALS, UEF SAV, SMT, NYU, Profile: P3, G2, G3, C4] The physical and chemical properties of the fluids considered, both fluids originally in the transformer and the replacement fluid, will be analysed in the laboratory to compare different characteristics. At least three types of insulating liquids will be evaluated during the project: a NE, a SE, and a recycled oil (RO). Additionally, the solid insulation that will be used in the tests will be defined. Solid materials will include conventional Kraft paper, TUK paper and pressboard of different densities. Inclusion of studies on other high-temperature solid insulating materials as Nomex will be explored. A comprehensive evaluation of these materials will be carried out. The evaluation will include a complete physicochemical characterization of the different liquids and solid insulating materials. This analysis will be basic and will constitute the starting point of the following task, where the aging experiments will be implemented. Task 1.2. Aging of dielectric fluids and solid components (M7-M35) [Leader: UWB, PMs: 42, Participants: UC, UNIMAN, UNIZA, BCMATERILS, UEF SAV, TUKE, BEST, SMT, TU, UPM, UBO, UQ, UTFSM, Profile: P3, C3, C4, G2, G3] Aging tests will be carried out in containers, where cellulosic components and fluid mixtures that approximate the characteristics of the fluids available in the transformer after a retrofilling process would be mixed. In this analysis, different types of cellulosic components will be considered, such as Kraft paper, TUK, DDP, Crepe, pressboard PSP 3055, PSP 3051 and PSP 3052 and Nomex. These containers will be placed in the ovens for long periods at high temperatures. During accelerated aging, three temperatures will be used to know the effect of high temperatures on these insulation systems. These temperatures will be chosen considering the hot spot conditions obtained during the thermal-fluid study of the liquids obtained after retrofilling. Task 1.3. Analysis of results of aging processes (M25-M39) [Leader: UC3M, PMs: 12, Participants: UC, UC3M, UNIMAN, UNIZA, UWB, BCMATERIALS, TUKE, SMT, TU, NYU, UTFSM, Profile: C3, C4, G2] Throughout the previous aging processes, several parameters will be measured for the characterization of solid dielectric materials (frequency dielectric spectroscopy (FDS), degree of polymerization (DP) or mechanical resistance (TI), and for the characterization of the resulting fluids after replacement (dissolved gases, breakdown voltage, tan delta, resistivity, water content, interfacial tension, and acidity). The results of the ageing tests will be used to develop mathematical models to characterize the ageing process of the solid insulation in retrofilled transformers. These models will be used to evaluate the increase in the life expectancy of the transformer insulation systems resulting from retrofilling. Additionally, these models will be used to determine the maximum admissible temperature load when a transformer has undergone a retrofilling process.

Work package WP2 – Thermal and dielectric performance

Work Package Number	WP2	Lead Beneficiary	7 - SUT
Work Package Name	Thermal and dielectric performance		
Start Month	9	End Month	43

Objectives
The main objectives of this work package are to know how the dielectric and fluid-thermal response changes in a transformer that has replaced its insulating and cooling fluid with another with different characteristics, and to study the thermal performance of transformer windings when immersed in different fluids, both high-order and low-order models will be used. Similarly, computational tools will be used to model dielectric stress in transformer windings that have undergone retrofilling. Person months (PMs): 115, inlcudes 6PM foreseen from AP UNIMAN to TC (kyutech, Japan). Funded 109PM.

Description
Task 2.1. Thermal Performance (M9-M41) [Leader: UNL, PMs: 50, Participants: SUT, UC, UNIZA, UWB, BCMATERIALS, UEF SAV, TUKE, BEST, TU, UPM, USACH, Profile: P3, G3, G2] Different typical geometries of transformers will be selected. Those groups will cover different voltage levels, rated powers, constructive types, winding geometries, etc. Those geometries will be object of the simulation studies on the field of thermal transfer and fluid mechanics. The specific characteristics of the liquids resulting from the retrofilling process that affect thermal performance will be determined: viscosity, density, thermal conductivity and heat capacity. The variation of these properties with temperature is necessary information to implement computational models of computational fluid mechanics. Fluid-thermal simulations of transformer cooling circuits will be performed, using the physical properties of fluids resulting from retrofilling. CFD-based simulations and THN models and will be implemented, obtaining flow distributions and hot spots. Task 2.2. Dielectric Performance (M9-M43) [Leader: UNIZA, PMs: 65, includes 6PM from AP UNIMAN to TC Japan (Kyutech). Participants: SUT, UC, UC3M, UNIMAN, UWB, UEF SAV, TUKE, BEST, TU, UPM, UV, Kyutech, NYU, UTFSM, UW, Profile: C4, G2, G3, P3] Experimental tests will be carried out to obtain the dielectric properties of the liquid and solid insulation of retrofilled transformers. These parameters will be an input for the dielectric models. To evaluate the liquid insulation of retrofilled transformers, mixtures of MO and alternative fluids in different proportions will be tested both in fresh and aged conditions. For the analysis of the solid insulation, test objects using paper and pressboard impregnated with MO surrounded by an alternative insulating liquid with a certain degree of contamination with MO. The tests will comprise the determination of parameters to calculate the field distribution in the transformer (i.e., permittivities of oil and paper) and other high-voltage tests to assess the safety margins of the different parts of the insulation (partial discharges, AC tests, impulse tests, dielectric strength of big volumes of oil, etc).

Work package WP3 – Operation and environment

Work Package Number	WP3	**Lead Beneficiary**	2 - UC3M
Work Package Name	Operation and environment		
Start Month	13	**End Month**	46

Objectives
WP3 will address the study of different aspects related to the safety, operation and maintenance of transformers that have been filled with a fluid different from that initially considered in their design: optimum retrofilling processes, quantification of retrofilling impact in the life cycle of transformers, load management and maintenance guides for retrofilled transformers, and validation of models and procedures on test platforms and real substations. Person months(PMs): 96

Description
Task 3.1. Retrofilling Procedure and Safety (M13-M43) [Leader: UC3M, PMs: 17, Participants: UC, DIVEG, UNSJ, UNL, UPM, UVALLE, Profile: G2, G3, C4] Evaluation methods for level of contamination (old fluid/new fluid) will be proposed. At present, there are no methods readily applicable to evaluate the contamination rate of NEs and SEs with MO. Mixtures of MO with NE and SE on

known proportions will be prepared and analytical techniques and physicochemical measurements will be applied to the mixtures to allow a quantification of the amount of MO in the mixture. The impact of the procedure used on the quality of the retrofilling will also be analysed, observing variables such as vacuum, temperature, time, or insulation thickness. The compatibility of materials in retrofilling processes will be assessed. Compatibility is critical in the case of transformer gaskets, but other material elements included in the bushings, tap changer or other accessories will be included in the analysis. From a safety standpoint, parameters such as flash point and fire point will be analysed.

Task 3.2. Operation and Maintenance (M18-M45) [Leader: UPM, PMs: 29, Participants: UC, UC3M, UNIMAN, UWB, BEST, SMT, UNSJ, TU, UPM, UBO, UQ, UTFSM, Profile: G2, G3, C4]

Experiments will be proposed in the laboratory where conditions that correspond to possible insulation failures due to retrofilling are simulated. Different faults will be emulated to determine the dissolved-gas analysis (DGA) patterns that are measured in the missed insulation systems that characterize retrofilled transformers. Thermal faults, partial discharges and electric arks will be emulated in the different insulation systems to develop interpretation schemes that can be applied to retrofilled transformers. A Gas Spectrometer will be used to this end. The analysis will be completed by evaluating the results of maintenance tests on real transformers that were subjected to retrofilling, if available. The ageing model and the moisture dynamics model developed will be used to determine the maximum admissible temperature-load when a transformer has undergone a retrofilling process.

Task 3.3. Experimental evaluation of transformer retrofilling (M23-M46) [Leader: BEST, PMs: 39, Participants: SUT, UC, UC3M, TUKE, SMT, EGI, STOEN, CELSIA, UNL, UPM, UVALLE, WMU, Profile: G2, G3, C4]

In this task, simulations of retrofilling procedures will be carried out on experimental platforms that will simulate the geometry, processes, and components of a real core type power transformer. The consortium already has available a basic platform that emulates a 100 MVA transformer. This platform will be updated and will allow the validation of the models developed in this project. Other platforms will allow the simulation of moisture and mechanical dynamics in transformers that have undergone retrofilling. Estimation of the change in moisture content into the dielectric materials (cellulose and dielectric oil), is caused by the temperature variability due to the transformer load. To estimate the moisture dynamics in transformers, it is necessary to know the thermal-fluid behaviour of the transformer which can be obtained from its modelling.
On the other hand, this task will focus on obtaining the mechanical properties of various cellulosic materials, used as solid insulation in power transformers. The tests will be designed considering realistic conditions. Different types of mechanical stresses will be applied, covering static and dynamic traction and compression tests. The comparison of these properties and their evolution will be carried out both when conventional dielectric oils and mixtures resulting from retrofilling are used.
Finally, a retrofilling process will be implemented in a STOEN substation in Poland.

Task 3.4. Environmental impact (M29-M46) [Leader: UNSJ, PMs: 11, Participants: UC, UC3M, NYU, WMU, Profile: G2, G3]

This task aims to quantify the effect of retrofilling processes on the entire life cycle of a power transformer. In this sense, emissions references will be defined for the use of materials and energy. Work will also be done on updating the description of the specific requirements for retrofilled transformers, Product Category Rule (PCR). Parameters such as lifetime, load-factor, and methodology for End of Life (EoL) will be considered. This is the previous step to carry out life cycle assessment studies and communicate their results through Environmental Product Declarations, in line with international standards ISO 14025 and ISO 14044. This way, the impact assessment of different technologies, techniques, operational influence, and end of life (Circularity), will be part of the analysis performed in this activity.

Work package WP4 – Dissemination and exploitation

Work Package Number	WP4	**Lead Beneficiary**	4 - UNIZA
Work Package Name	Dissemination and exploitation		
Start Month	1	**End Month**	48

Objectives
The RETROTRAFO project efficiently communicates and exploits its work and results through dissemination to scientific communities and targeted stakeholders. It emphasizes outreach to engage diverse stakeholders, including the

general public, and organizes dissemination events for long-term sustainability. Additionally, the project focuses on exploiting results for practical applications and maximizing impact of retrofilling technique in power systems. Person months(PMs): 0

Description
Task 4.1. Scientific activities (M1-M48) [Leader: UC3M, Participants: All] To inform the research community on the relevant scientific field and to help maximize scientific and technical results of the project: publication in international open access high-impact journals, popular science journals, broadcast Press releases in mass media, social media and partner's websites, participation in external national/international conferences, networking with international organisations and other EU projects. The consortium is committed to generating at least two international conferences per year and ten open-access publications. At the end of the project, a final workshop event will be organised to maximize results dissemination and evaluate ongoing measures. This will be open, transparent and free of charge. Task 4.2. Outreach activities (M1-M48) [Leader: UC, Participants: All] To ensure awareness of the importance of research and contribution of the project to society (training, entrepreneurship, career perspectives, transfer of knowledge) and the necessity to build up a new generation of professionals focused on science, research and innovation through: project website, social media, newsletters, brochures, flyers, info videos, informational material in layman form, visits to universities and R&D centres, scientific coffees events and researchers' night events, open days, television and radio. Task 4.3. Exploitation of results (M1-M48) [Leader: BEST, Participants: All] Exploitation of results through the participation of the non-academic sector, which will use the results for their commercial use. The project exploitation and sustainability report, slated for delivery near project completion, will investigate potential business models for future market acceptance of project outcomes. It aims to generate lasting value post-project and maximize impact. The plan will outline each partner's exploitable vision, with a focus on the transfer of knowledge of the staff exchanged. This will enhance their career perspectives, improving their competences to create spin-offs.

Work package WP5 – Transfer of knowledge

Work Package Number	WP5	Lead Beneficiary	3 - UWB
Work Package Name	Transfer of knowledge		
Start Month	3	End Month	48

Objectives
The goal of this WP is to assure the correct transfer of knowledge in two different ways: - Enhancing of the staff seconded capabilities to the host institutions. - Knowledge transference from seconded staff to the rest of the personnel working in the origin institution and students in the case of academic institutions. Person months(PMs): 0

Description
Task 5.1. Supervision of the Training Program (M3-M48) [Leader: TU, Participants: All] It consists of the monitoring and supervision of the staff exchanged among the Host and Origin Institution during all the secondments. Periodically, the seconded members will need to report their progress and the activities in which they have been involved to analyse the compliance with the plan decided by the RETROTRAFO consortium. Task 5.2. Implementation of the Transfer of Knowledge Plan (M3-M48) [Leader: BCM, Participants: All] Development of a Plan, which will include the activities, workshops, theoretical and practical courses, etc, and the timeline of each event. The staff seconded must write reports of their stays to transfer the knowledge obtained in the

different Host Institutions to the rest of the institution and the society. The goal is to involve the scientific community, society and other research areas to create networking and new opportunities of knowledge for future projects and collaborations.

Work package WP6 – Coordination and management

Work Package Number	WP6	Lead Beneficiary	1 - UC
Work Package Name	Coordination and management		
Start Month	1	End Month	48

Objectives

The goal is to ensure an adequate coordination and efficient management of the scientific, technical, administrative, financial and legal matters, the secondments in accordance with the plan, guidelines and agreements, to optimize the project planning and improve the quality of results. Specific objectives are:
- Ensure the proper management of the project according to approved plans, guidelines and agreements.
- Guarantee the communication between the consortium and the EC, and also within the project partners.
- Monitor and control the progress of the project, the technical and financial progress reports, events, secondments, training activities and correct transfer of knowledge.
- Analyse, monitor and control deviations due to progress, costs, secondment procedure, and financial and planning changes.
- Manage and solve conflicts between partners and/or exchange staff.
- Ensure quality achievement in research, supervision and training and results improvement during project life.
- Manage secondments of the staff (travel, accommodation, training in the host institution, participation in workshops, conferences, etc).
Person months(PMs): 0

Description

Task 6.1. Network organisation and Management structure (M1-M6) [Leader: UC, Participants: All]

Organisation of the Kick-off Meeting, where the formal constitution of management structure of the project will take place (nominees): Network Coordinator (NC), Steering Committee (SC), Technical Board (TB), Advisory Board (AB) and Financial and Administrative Support (FAS). Negotiation and signature of the Consortium Agreement where the procedures and functions of each committee are described.

Task 6.2. Technical, Financial and day-to-day management (M1-M48) [Leader: UC, Participants: All]

Technical and financial management, budgeting, funding distribution, technical and financial reports every annual network meeting, monitor compliance by beneficiaries with their obligations stated in the GA, development of annual network meetings, conflicts and risks management, monitoring and control of deliverables, communication with EC.

Task 6.3. Data and IPR management (M1-M48) [Leader: TUKE, Participants: All]
Throughout the project's duration, a Data Management Plan (DMP) will be furnished and updated to guarantee adherence to EU data privacy regulations, while also safeguarding the rights of research participants. IPR strategy will be defined to assure the correct implementation of the Consortium Agreement signed among beneficiaries in the kick-off meeting.

Task 6.4. Quality management and secondment strategy (M1-M48) [Leader: UM, Participants: All]:

Quality control of the project activities, tracking the effectiveness of the innovation process throughout the project's lifespan and upholding the excellence of project tasks, which is pivotal for attaining favourable results. Monitoring and control of seconded staff to guarantee an efficient management of the research plan. It includes the formalization of the secondment, manage the travel and accommodation procedure, control of the training activities, return period to the main institution and final transfer of knowledge.

STAFF EFFORT

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
1 - UC	10.00	20.00	28.00				58.00
2 - UC3M	2.00	6.00	12.00				20.00
3 - UWB	11.00	2.00	2.00				15.00
4 - UNIZA	4.00	4.00					8.00
5 - BEST	2.00	4.00	4.00				10.00
7 - SUT		18.00					18.00
8 - TUKE		9.00	4.00				13.00
9 - UEF SAV	10.00	6.00					16.00
10 - BCMATERIALS	9.00	5.00					14.00
11 - UNL		18.00	20.00				38.00
12 - UPM	3.00	15.00	7.00				25.00
15 - UVALLE	12.00		4.00				16.00
20 - UNSJ			12.00				12.00
21 - UNIMAN	5.00						5.00
22 - TU	6.00	2.00	3.00				11.00
Total Person-Months	74.00	109.00	96.00	0.00	0.00	0.00	279.00

LIST OF DELIVERABLES

Deliverables

Grant Preparation (Deliverables screen) — Enter the info.

The labels used mean:

Public — fully open (⚠ automatically posted online)
Sensitive — limited under the conditions of the Grant Agreement
EU classified —RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444

Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D1.1	Characterization of dielectric materials	WP1	1 - UC	R — Document, report	PU - Public	21
D1.2	Dielectric aging after retrofilling	WP1	1 - UC	R — Document, report	SEN - Sensitive	35
D1.3	Modelling dielectric aging after retrofilling	WP1	1 - UC	R — Document, report	SEN - Sensitive	39
D2.1	Cooling performance after retrofilling	WP2	7 - SUT	R — Document, report	SEN - Sensitive	41
D2.2	Dielectric performance after retrofilling	WP2	7 - SUT	R — Document, report	SEN - Sensitive	43
D3.1	Optimum retrofilling procedure	WP3	2 - UC3M	R — Document, report	PU - Public	43
D3.2	Operation and maintenance after retrofilling	WP3	2 - UC3M	R — Document, report	SEN - Sensitive	45
D3.3	Testing retrofilling: cooling, moisture, mechanics.	WP3	2 - UC3M	R — Document, report	SEN - Sensitive	46
D3.4	Life cycle assessment considering retrofilling	WP3	2 - UC3M	R — Document, report	SEN - Sensitive	46
D4.1	Website and logo	WP4	4 - UNIZA	DEC —Websites, patent filings, videos, etc	PU - Public	3
D4.2	Dissemination and Exploitation Plan	WP4	4 - UNIZA	R — Document, report	PU - Public	6
D5.1	Transfer of Knowledge Plan	WP5	3 - UWB	R — Document, report	PU - Public	12

Deliverables

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D6.1	Data Management Plan	WP6	1 - UC	DMP — Data Management Plan	PU - Public	6
D6.2	Progress report	WP6	1 - UC	R — Document, report	SEN - Sensitive	13
D6.3	Mid-term Meeting	WP6	1 - UC	R — Document, report	SEN - Sensitive	18

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

Deliverable D1.1 – Characterization of dielectric materials

Deliverable Number	D1.1	**Lead Beneficiary**	1 - UC
Deliverable Name	Characterization of dielectric materials		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	21	**Work Package No**	WP1

Description
Report on the comparison of the characterization of dielectric materials after retrofilling

Deliverable D1.2 – Dielectric aging after retrofilling

Deliverable Number	D1.2	**Lead Beneficiary**	1 - UC
Deliverable Name	Dielectric aging after retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	35	**Work Package No**	WP1

Description
Report on the impact of aging in the dielectric system of retrofilled power transformers

Deliverable D1.3 – Modelling dielectric aging after retrofilling

Deliverable Number	D1.3	**Lead Beneficiary**	1 - UC
Deliverable Name	Modelling dielectric aging after retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	39	**Work Package No**	WP1

Description
Report on the modelling of aging processes in power transformers after a retrofilling process.

Deliverable D2.1 – Cooling performance after retrofilling

Deliverable Number	D2.1	**Lead Beneficiary**	7 - SUT
Deliverable Name	Cooling performance after retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	41	**Work Package No**	WP2

Description
Report on the impact of retrofilling in the cooling performance of power transformers

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

Deliverable D2.2 – Dielectric performance after retrofilling

Deliverable Number	D2.2	**Lead Beneficiary**	7 - SUT
Deliverable Name	Dielectric performance after retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	43	**Work Package No**	WP2

Description
Report on the impact of retrofilling in the dielectric performance of power transformers

Deliverable D3.1 – Optimum retrofilling procedure

Deliverable Number	D3.1	**Lead Beneficiary**	2 - UC3M
Deliverable Name	Optimum retrofilling procedure		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	43	**Work Package No**	WP3

Description
Report on optimum retrofilling procedure, admissible contamination, and safety guide

Deliverable D3.2 – Operation and maintenance after retrofilling

Deliverable Number	D3.2	**Lead Beneficiary**	2 - UC3M
Deliverable Name	Operation and maintenance after retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	45	**Work Package No**	WP3

Description
Report on admissible temperature-load and maintenance markers in retrofilled transformers

Deliverable D3.3 – Testing retrofilling: cooling, moisture, mechanics.

Deliverable Number	D3.3	**Lead Beneficiary**	2 - UC3M
Deliverable Name	Testing retrofilling: cooling, moisture, mechanics.		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	46	**Work Package No**	WP3

Description
Report on retrofilling performance in experimental platforms: cooling, moisture, mechanics.

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

Deliverable D3.4 – Life cycle assessment considering retrofilling

Deliverable Number	D3.4	**Lead Beneficiary**	2 - UC3M
Deliverable Name	Life cycle assessment considering retrofilling		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	46	**Work Package No**	WP3

Description
Report on the impact of retrofilling in the entire life cycle of power transformers.

Deliverable D4.1 – Website and logo

Deliverable Number	D4.1	**Lead Beneficiary**	4 - UNIZA
Deliverable Name	Website and logo		
Type	DEC —Websites, patent filings, videos, etc	**Dissemination Level**	PU - Public
Due Date (month)	3	**Work Package No**	WP4

Description
RETROTRAFO portal used also as a repository and corporate identity of the project

Deliverable D4.2 – Dissemination and Exploitation Plan

Deliverable Number	D4.2	**Lead Beneficiary**	4 - UNIZA
Deliverable Name	Dissemination and Exploitation Plan		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	6	**Work Package No**	WP4

Description
A plan for the dissemination and exploitation of the project, including communication activities

Deliverable D5.1 – Transfer of Knowledge Plan

Deliverable Number	D5.1	**Lead Beneficiary**	3 - UWB
Deliverable Name	Transfer of Knowledge Plan		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	12	**Work Package No**	WP5

Description
A description of the methodology for Knowledge Transfer employed by RETROTRAFO and a wide range of activities for effective and efficient Knowledge Transfer.

Deliverable D6.1 – Data Management Plan

Deliverable Number	D6.1	Lead Beneficiary	1 - UC
Deliverable Name	Data Management Plan		
Type	DMP — Data Management Plan	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP6

Description
A description of the data management life cycle for all data to be collected, processed and/ or generated by the project

Deliverable D6.2 – Progress report

Deliverable Number	D6.2	Lead Beneficiary	1 - UC
Deliverable Name	Progress report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP6

Description
A report on all project activities after first year of implementation

Deliverable D6.3 – Mid-term Meeting

Deliverable Number	D6.3	Lead Beneficiary	1 - UC
Deliverable Name	Mid-term Meeting		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	18	Work Package No	WP6

Description
The minutes of the Mid-term review meeting.

LIST OF MILESTONES

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
1	Kick-off meeting and project launch	WP2, WP4, WP3, WP5, WP1, WP6	1 - UC	Kick-off meeting with attendance from most partners was organized. Minutes approved by the consortium.	1
2	RETROTRAFO project website, Social Media accounts and corporate identity are settled	WP4	4 - UNIZA	Project website, including repository, is functioning, logo and Social Media accounts where first announcements are made are created and used. D4.1	6
3	Aging of the dielectric system is completed	WP1	1 - UC	Complete Physical, Chemical, Dielectric and Mechanical Characterization of the insulating system of a transformer, and Dielectric Aging Models after a Retrofilling process (D1.1, D1.2, D1.3).	39
4	Thermal and dielectric performance were analyzed	WP2	7 - SUT	Computational Models will be made available. These will allow the analysis of fluid-thermal and dielectric performance of transformers after Retrofilling (D2.1 and D2.2).	43
5	Operation and environment are finalized	WP3	2 - UC3M	Safe Retrofilling Procedure, Maximum Admissible Load Model, and Life Cycle Assessment considering Retrofilling are presented. D3.1, D3.2 and D3.3.	46

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

LIST OF CRITICAL RISKS

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	Delay in Consortium Agreement and Grant Agreement preparation	WP6	Partners have participated before in other projects, so they have knowledge on deadlines, IPR issues… To minimize conflicts, beneficiaries will sign an internal agreement before the evaluation summary report to distribute allocation of budget, tasks and IPR responsibilities.
2	Resignation of a beneficiary/partner organization	WP2, WP4, WP5, WP3, WP1, WP6	In case a beneficiary/partner organization leave the network, the goals of the work package will be reassigned accordingly, and communicated to the Steering Committee for endorsement
3	Difficulties in handling IPR	WP2, WP4, WP3, WP5, WP1, WP6	Project management will establish detailed procedures for managing IPR and for weighting publication and IPR interests. The previous experience of partners in academy/industry collaboration will ease the IPR management. All partners have experience on IPR management. Also, this data will be provided in the Consortium Agreement
4	Disagreement and disputes among partners	WP2, WP4, WP3, WP5, WP1, WP6	All the network partners are well-established organizations with previous experience in successful projects under the umbrella of EC. The project proposal is well defined with a clear structure for management, decision making and conflict resolution among partners.
5	Budgeting	WP2, WP4, WP3, WP5, WP1, WP6	The Technical Board will control the financial management of the network, in close collaboration with the Network Coordinator and Financial Services at UC, who will also liaise directly with financial officer of partner organisations, when necessary, to resolve any issues concerning the finances of the project.
6	Foreseen money from Category A is not enough to cover all secondments costs for some costly destination	WP2, WP4, WP3, WP5, WP1, WP6	Transfer of some amount of money from budget Category B to Category A, for these cases.
7	Delay in secondments procedure	WP2, WP3, WP1, WP6	This problem will be solved thanks to the Technical Board, which will be responsible to organize the travel and accommodation of the seconded staff in time. In case of delay, the person will be seconded as soon as possible, but the period of time will not be reduced as well as the frequency and the rest of stays.
8	Low scientific quality	WP2, WP3, WP1	Progress on the research programme and the scientific quality will be monitored periodically

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
			in the Steering Committee meetings. This Committee will take the necessary actions to resolve any reported issue.
9	Inability of partner to meet objectives	WP2, WP4, WP3, WP5, WP1, WP6	Early identification and reporting to project coordinator & steering board. Initial measure: talk to partner and analyse possible solutions..
10	Seconded staff not performing according to expected standard	WP2, WP3, WP1	Often organize meetings with person in secondment. Delegation to another supervisor. Strict plan.
11	Departure of high impact expert or a critical technician	WP2, WP4, WP3, WP5, WP1, WP6	All partners are well structured organisations, with enough expertise, allowing them to replace any loss or departure of vital experts or technicians.
12	Changes in regulations	WP2, WP3, WP1	The network participants are all active organisations in standardisation bodies; hence they will always be monitoring all relevant standardisation bodies for changes, to keep the project aligned with standards.
13	Underestimation of the effort needed to perform planned tasks within WPs	WP2, WP3, WP1	Delegation of staff member which are more skills and who conduct task more efficiently.
14	Non-availability of the industrial test platforms	WP3	To have the test platforms ready once the WP1 and WP2 have been completed, the start of the work on the industrial platform for testing retrofilling scenarios has been advanced to M23. In case of non-availability of any of the industrial test platforms, an alternative platform will be built with the budget generated by the project or the contribution of the partners.
15	Delay in the implementation of secondments	WP2, WP3, WP1	1.1. Secondments' implementation will be monitored by a designated person at the level of each participant. At project level, the Coordinator will organise Skype meetings every 1-2 months to discuss the monitoring of secondments and collect any information about possible identified delays at participants' level, both at sending and hosting institutions. On the other hand, each Participant takes responsibility that the secondments take place as planned and reports immediately or maximum 2 months prior to the scheduled secondment any possible deviation to the Coordinator. 1.2. Once a potential delay is identified, action plans will be agreed at Consortium level or by the Steering Committee (where is the case). The Coordinator will inform REA about the solution found. 1.3. For secondments in third countries, the beneficiary will identify in time the human

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
			resources to be seconded and the necessity of visa. In order to avoid visa issues, administrative support and follow-up needs to be put in place several months prior to the scheduled secondment, so that the visa is obtained on time. 1.4. A chapter specifically dedicated to this risk and the method to implement upfront monitoring and continuous reporting will be included in the Consortium Agreement and in the Partnership Agreement accordingly. 1.5. staff turnover: all participants will identify additional personnel with the necessary experience, not intended initially to be seconded in the project work, so that the risk is minimized.
16	Withdrawal of participants	WP2, WP4, WP3, WP5, WP1, WP6	If possible, another participant from the consortium will carry out the tasks/WP of the withdrawing one. If not, a new entity with the same specific expertise could be included in the project upon agreement of REA.
17	Shortage of funding for third country partners	WP2, WP4, WP3, WP5, WP1, WP6	(Third country) associated partners not eligible for EU funding would ensure their own funding (e.g. national funds) and complete the transfer of knowledge for the activities they engaged in the project. A Partnership Agreement will be signed.

MSCA SE PARTNER EXCHANGES AND OVERALL FUNDED EXCHANGES

Partner exchanges

Summary of secondment months per sending partner (beneficiaries and associated partners)

Partner No	Partner Name	Country	Country Group	Academic Sector	Number of Secondment Months Period 1	Number of Secondment Months Period 2	Total Number of Secondment Months
1	UC	ES	EU/AC	Y	48	10	58
2	UC3M	ES	EU/AC	Y	8	12	20
3	UWB	CZ	EU/AC	Y	10	5	15
4	UNIZA	SK	EU/AC	Y	8	0	8
5	BEST	TR	EU/AC	N	2	8	10
7	SUT	PL	EU/AC	Y	4	14	18
8	TUKE	SK	EU/AC	Y	2	11	13
9	UEF SAV	SK	EU/AC	Y	13	3	16
10	BCMATERIALS	ES	EU/AC	Y	6	8	14
11	UNL	AR	TC	Y	20	18	38
12	UPM	MY	TC	Y	18	7	25
15	UVALLE	CO	TC	Y	12	4	16
20	UNSJ	AR	TC	Y	0	12	12
21	UNIMAN	UK	TC	Y	3	2	5
22	TU	EG	TC	Y	7	4	11

Overall funded exchanges

Summary of secondment months funded by the EU per beneficiary (as sending partner + seconded to partner)

Partner No	Partner Name	Country	Number of Secondment Months Period 1	Number of Secondment Months Period 2	Total Number of Secondment Months
1	UC	ES	78	31	109
2	UC3M	ES	29	26	55
3	UWB	CZ	10	5	15
4	UNIZA	SK	8	0	8
5	BEST	TR	2	8	10
6	SMT	IT	0	6	6
7	SUT	PL	10	18	28
8	TUKE	SK	2	11	13
9	UEF SAV	SK	13	3	16
10	BCMATERIALS	ES	6	8	14

ANNEX 1

Horizon Europe (HORIZON)

Description of the action (DoA)

Part B

HISTORY OF CHANGES			
VERSION	**DATE**	**CHANGE**	**PAGE**
1.0	19.06.2024	Initial version according to the instructions in the EC template and guidance document provided by the Project Officer. The tables with WPs' descriptions, deliverables and milestones moved to Part A. Ethics section and situation from UK AP UNIMAN were added. Comments of evaluators on the methodology have been addressed.	-
2.0	24.06.2024	New version where the comments of the evaluators on Impact, section on Credibility of the measures to enhance the career perspectives of staff members have been attended. Addition of Table 6 and all Letter of Commitments from AP.	

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1. Excellence

1.1. Quality and pertinence of the project's research and innovation objectives

- Summary

The proposed project will develop research on the topic of ***transformer retrofilling with alternative insulating*** liquids. This technique is based on the replacement of the ***mineral oil (MO)*** of a transformer in service with a ***biodegradable*** and ***less-flammable liquid***. According to prior research, the procedure would lead to safer and more ***environmentally friendly*** transformers with ***lower fire risk***, ***higher loading capacity*** and ***increased life expectancy***. All these features are in line with the concepts of ***circular economy*** which is based on using as ***little resources for as long as possible***, while extracting as much value as possible in the processes [1]. However, the technique ***has not been sufficiently studied*** and more research is needed to evaluate the ***impact of retrofilling*** on the operation of the transformer and to assess its economic and technical feasibility of the method.

- Introduction, objectives and overview of the research and innovation programme.

Transformers are essential elements for the ***efficient transmission of electric energy*** throughout the power system. The European Commission estimates that 2.9% of all energy generated across the 27 EU countries (EU27) and the UK is wasted through transformer losses. The ***losses*** that occur in transformers depend on their ***design*** and ***load,*** and ***determine*** the ***working temperature***. In 2021, an update to the ***Eco-design Regulation No 548/2014 (Tier 2)***, implementing ***Directive 2009/125/EC***, came into force, which limited the maximum losses in transformers according to their size. Since a high ***temperature increases the aging rate*** of the insulation system of these machines, ***cooling systems*** based on dielectric fluids are designed. Historically, transformers have been filled with ***dielectric liquids*** based on hydrocarbons, as MO. While these fluids have proven to be excellent insulating and cooling agents, they also pose challenges concerning their environmental impact and associated fire risk. The surge in renewable energies and a growing ***concern about environmental sustainability and safety of power systems*** have prompted the search for safer and more ecological materials in the field of electrical engineering. Among alternative insulating liquids, ***natural (NE) and synthetic esters (SE)*** are the most extended options, although electrotechnical ***biodegradable hydrocarbons (BH)*** and ***recycled oils (RO)*** are available as well.

Ester-based liquids are ***K-type fluids*** (IEC K-type liquids are defined as less flammable fluids as those with a fire point >300°C), which reduces drastically the fire risk of transformers [2]. Additionally, they present other relevant advantages, as their ***biodegradability***, reducing the environmental impact in case of accidental leakage to the ground or water, and their protective effect over the cellulosic insulation. This last feature is very relevant for the transformer operation since they would allow the application of ***higher load factors*** to the transformers and ***increase the expected life of the equipment*** [3]. The use of esters has increased significantly in the last two decades. These materials are currently the main solution for certain applications, as ***off-shore renewable energies*** or ***traction transformers***, and some distribution and transmission companies, as Terna (Italy) or CPFL Energia (Brazil), are already choosing NE insulation for their new units [4, 5]. However, the installation of a new ***ester-based transformer*** requires a ***high investment*** that is, in general, not justified from the economical point of view if a MO-filled transformer with remaining life is in place. As an alternative, ***retrofilling of MO-filled units with a biodegradable insulating liquid*** has been proposed to improve some characteristics of the asset ***without investing in a new machine***.

Transformer retrofilling is a relatively new practice, but its application has grown sharply in the last years. At present, there are ***no regulations*** concerning the method, although in ***December 2023***, an international ***International Electrotechnical Commission working group (IEC-JWG46)*** was created to "Prepare a ***guide for retrofilling mineral oil-immersed transformers with alternative insulating liquids"*** [6].

Transformer retrofilling procedures are designed to remove as much MO from the transformer as possible and it is to be expected that the remaining MO in the tank or core after completing the process will be relatively small. However, ***because*** of the nature of ***cellulose*** and oil and the physics of mass transport process, it is ***not possible to remove a big part of the MO adsorbed in the solid insulation*** and, when a transformer is retrofilled with an alternative liquid its solid insulation will remain mostly impregnated with MO. Once the retrofilled transformer is ***back in service***, part of the ***MO will migrate*** towards the new insulating liquid and the transformer will ***operate with a mixed insulation*** [7]. The presence of remaining MO in retrofilled transformers ***introduces some uncertainties*** that have not been studied in detail, such as, how the dynamics of MO migration from the solid insulation towards the recently introduced liquid is, what

the characteristics of the MO-contaminated liquid are, or how the fact of operating with a mixture of insulating liquids ***affects the operation*** of the transformer ***and the predictive maintenance*** tests results.

The ***proposed project*** will investigate ***transformer retrofilling in depth***. Aspects as the safety of retrofilling ***procedures***, the enhancement of the ***loading*** capability and ***life expectancy*** achieved by the technique, and the changes that must be introduced in the interpretation ***schemes for the maintenance*** tests will be studied. Additionally, the possibilility of ***applying BH and RO*** for transformer retrofilling purposes will be investigated. The knowledge obtained during the project will facilitate the application of the method to more transformers, including larger units, what will ***contribute to implementing a circular economy***, whose principles are based on recycling, refurbishing or remanufacturing, reuse and extending the life of products.

The topic of the project is spreading within the industry, but current availability of ***knowledge is very limited***, and it is mostly owned by oil manufacturers and transformer companies. The project will provide a deeper knowledge on the physical phenomena that take place after retrofilling a transformer, ***spreading*** the generated ***results towards the scientific*** community ***and the industry***.

The ***research and innovation objectives*** proposed by the project, and expected output are classified below:

Obj. 0	**Strengthen a community of personnel trained in the implementation of the retrofilling technique within future sustainable electrical networks, through appropriate secondment and training (➔WP1-6).**
Description	Form the academic point of view: Widen knowledge about different tools and equipment used in productive sector to thermal-dielectric modelling, materials degradation and assets assessment; Learning about different environments and research methodologies in different continents (Europe, Africa, Asia, Australia, and America); Exchange experience and knowledge with other researchers; Fostering communication skills thanks to workshops, seminars and conferences. From the networking point of view: Preparing young researchers for a career in both sectors (academic and companies); Enhancing geographical mobility in academic institutions and private companies; Improvement of management skills within projects in which are involved different institutions; Providing additional funding for research projects; Inspiring new research lines which serve to create improved job opportunities.
KPIs	This goal will be achieved by completing all tasks described in the proposed work packages.
Obj. 1	**Increasing the sustainability of transformers, by replacing fossil-fuels-based materials by environmentally friendly insulating liquids obtained from vegetable seeds or generated through laboratory processes. (➔*WP1*)**
Description	The oil-paper insulation of retrofilled transformers will be investigated in depth, gaining knowledge on its typical composition, but also on the physic-chemical properties of mixed insulating materials in fresh and aged condition. Aging tests will be carried out with cellulosic components and fluid mixtures that approximate the characteristics of the fluids available in the transformer after a retrofilling processes. These resulting fluids will be characterized with the addition of functional nanoparticles. Retrofilling processes involve the use of materials with different characteristics, whose compatibility was not initially considered in the design stage of the transformer. Throughout the aging process, several parameters will be measured for the characterization of solid dielectric materials, and for the characterization of the resulting fluids after replacement. These results are expected to contribute to the development of mathematical models that characterize aging measured in the laboratory. Thus, these would serve to diagnose the remaining life of new insulation systems resulting from power transformer retrofilling processes.
KPIs	At least three types of cellulosic components impregnated with fluids, products of at least five retrofilling scenarios, will be characterized by at least two standardized methods. This characterization will consider new dielectric materials and materials in four stages of aging. Regarding the types of fluids with which retrofilling will be proposed, the MO will be replaced by at least a SE, a NE, a BH and a RO. Three different types of components present in transformer will be tested in terms of compatibility with possible fluids resulting from retrofilling scenarios. One aging model will be obtained for each retrofiling scenario evaluated (considering an SE, a NE, a BH and a RO). *Minimum 10 scientific contributions are expected to be published. Objective 1 will be achieved by month 36.*
Obj. 2	**Contributing to increase the flexibility and reliability of power systems by application of transformer retrofilling, redesigning transformers to adapt them to changing operative conditions, and promoting larger overloading capabilities. The flexibilization of the transformers' loading capacity will facilitate the integration of new elements of power systems, as the renewable energies or charging systems for electric vehicles in urban environments. (➔*WP2*)**
Description	The change in the properties of the liquid and solid insulation will imply a variation in the transformer temperature map and in the electric field distribution. The dielectric and thermal performance of a selection of transformer geometries (different voltages, powers and constructive types) will be analysed

	in depth to identify weaknesses that may arise as a consequence of retrofilling, considering the effects of nanoparticles in these fields. General conclusions will be extracted in the study, concerning the need for reclassification or design review of typical transformer geometries. Moreover, transformer retrofilling may provide more loading flexibility, allowing the safe application of larger overloads to transformers. The possibility of loading transformers beyond their nameplate values will be investigated including the evaluation of long-term and short-term overloads, which are limited by the risk of insulation ageing and bubble formation.
KPIs	Numerical simulations will be proposed on the evaluation of the retrofilling optimal conditions. The dielectric and thermal performance of a selection of, at least three, transformer geometries (different voltages, powers and constructive types) will be analysed in depth to identify weaknesses that may arise as a consequence of retrofilling. The loading capability of retrofilled transformers will be evaluated in the project, developing at least an algorithm or tool to manage transformer dynamic loading for retrofilling scenarios. *Minimum 5 scientific contributions are expected to be published. Objective 1 will be achieved by month 40.*
Obj. 3	**Contributing to circular economy by increasing the safety of the technique that contributes to lower risk of fire, by promoting a maximum utilization of the remaining life of assets deferring their need for replacement, and increasing the use of recycled materials, as RO, for transformer insulation purposes. This will allow its reliable application to transformers of larger voltage levels and rated powers. (➔*WP3*)**
Description	The new operative conditions after retrofilling may be more favourable or lead to the apparition of criticalities. A safe retrofilling procedure will be defined to ensure that the contamination rate of the new insulating fluid remains below 7%. New schemes for interpretation of the maintenance tests will be developed. Economic models will be established to evaluate the contribution of retrofilling to the transition towards the circular economy and a standardized life cycle assessment. Additionally, the use of nanoparticles, recycled fluids and biodegradable hydrocarbons for transformer retrofilling will be explored. Experiments will be carried out on experimental platforms that reproduce the operating conditions of retrofilled transformers and in a real substation on the Polish power grid. Tests will focus on validating the models previously generated to predict the distribution of temperatures, on the dynamics of moisture in the fluid under variable loading conditions, and on verifying the effects of the distribution of mechanical stresses on the insulation of conductors subjected to different load regimes.
KPIs	The results obtained during the characterization of the fluids will serve to propose a maintenance guide for retrofilled transformers, considering at least one fluid of each type. At least a model or tool will be developed to evaluate the impact of retrofilling on the life cycle of a transformer, the economic feasibility of the technique and its contribution to the circular economy. At least three experimental platforms will be built or adapted to be able to simulate retrofilling under realistic conditions the distribution of temperatures and mass flows within real windings, dynamics of moisture depending on load index and the distribution of mechanical stresses on the insulation materials. A real substation will serve also to test models. Retrofilling procedures will be experimentally evaluated providing guidance on the optimal conditions that can be applied, considering at least two insulating fluids in the study: a NE and a SE. Additionally a mathematical model will be developed to predict the residual MO concentration in the solid and liquid insulation of retrofilled transformers of simplified geometry. *Minimum 15 scientific contributions are expected. Objective 1 will be achieved by month 46.*

- Pertinence and innovative aspects of the research programme.

The novelty and the interest of the industry in the topic is availed by the recent creation of the international ***International Electrotechnical Commission IEC-TC10-WG46*** *"Retrofilling mineral oil-immersed transformers with alternative insulating liquids"* and the ***International Council on Large Electric Systems CIGRÉ WG A2/D1.72*** *"Retrofill of Mineral Oil in Transformers – Motivations. Considerations and Guidance"*; both groups have been ***joined by researchers of SMT, UC and UC3M***. The presence of the researchers of the project in these working groups, and their intense cooperation in transference projects and industrial PhD programs will facilitate the ***alignment*** of the developed activities ***with the interests of the industry***, promoting a fast transfer of technology toward the productive sector ***and the internationalization of the European science and technology***.

According to CIGRÉ ***[2],*** the first reported retrofilling processes on distribution transformers with NE date from 1997. In 2001, retrofilling of a power transformer was reported for the first time, and later, in 2003, a very large unit of 161 kV/200 MVA was subjected to retrofilling with NE as well. Nowadays, the number of transformers that have been retrofilled has increased sharply for low and medium power ratings ***[8],*** and is slowly increasing for power transformers ***[9, 10].*** According to data provided by Cargill ***[11]***, by 2023 more than ***50000 small and medium sized transformers*** and more than ***150 big power transformers*** of voltage up to 420 kV and ratings up to 200 MVA have been ***retrofilled with NE around the world [12].***

Transformer retrofilling consists of draining the MO of an equipment that was designed and had worked with this material filling the tank and replacing it with a different insulating liquid, generally a NE or SE. At present, ***there are no standardized procedures for retrofilling transformers with alternative liquids***, and fluids' manufacturers have developed their own procedures [13, 14]. Some scientific publications detail the procedures that must be followed for a safe transformer retrofilling that gets to ***remove a maximum amount of MO*** [12, 15, 16]. The steps of a ***typical retrofilling process*** are summarized in Figure 1; firstly, MO is drained from the tank and the active part is kept inside the empty tank dripping oil for some days, then the transformer's active part and the surface of the solid insulation are flushed with hot ester; finally, the tank is filled with ester, preferably under vacuum. Before filling the tank, it is advisable to assess the state of some elements such as gaskets or clampings, as well as removing dregs and sludge from its walls.

Up to date ***not much research has been published*** on the field of transformer retrofilling. On the one hand, the ***practice*** is still ***relatively new***, and it has been mainly developed by the ***transformer and insulating fluids'*** industry, which are ***not so prone to disseminating their results***. Additionally, there is a ***difficulty*** in investigating the topic on ***experimental prototypes***, since the studies require some chemical or electrical characterization of the test objects and the fluids, which is ***not sufficiently defined***.

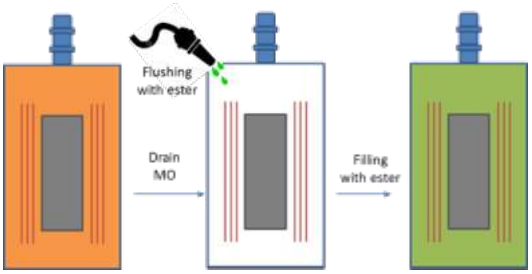


Fig. 1: Steps for transformer retrofilling with ester

Some previous works have carried out studies concerning the ***analysis of the properties of mixtures*** of insulating fluids, as the mixtures that would be present in retrofilled transformers [17, 18, 19]. Most authors determine physic-chemical properties such as breakdown voltage (BDV), viscosity, density, tan delta, acidity, and permittivity. Several works [17, 15] investigate the fire and flash points of mixtures reporting that esters containing ***MO amounts above 7%*** experience a significant ***drop on their fire properties***. One limitation of these works is that they ***mostly characterize the properties of mixtures of new alternative fluids*** with new MO while in real scenarios, the MO that remains in the transformer tank has some ageing degree and the mixture of MO and alternative fluid will age once the transformer is back into service. Additionally, there is a ***lack of information*** on properties such as ***impulse BDV, BDV at large oil gaps or partial discharges of oil mixtures***.

A few authors have carried out ***experimentation on laboratory prototypes*** on the topic of transformer retrofilling. McShane [17] and Feng [20] conducted a study to analyse the ageing process of paper samples to retrofilling with alternative liquids, finding that the degree of polymerization (DP) of the paper aged in presence of MO decreased more significantly than the paper immersed in the oil mixture. The research group of UC3M has also previously conducted a preliminary study to evaluate the degradation of the retrofilled Kraft paper in the laboratory [21] using a NE as retrofilling liquid. Dixit et al. [22] carried out an experimental study aimed at analysing the ***temperature distribution of retrofilled transformers*** on two twin transformers of 5 kVA and voltage 230 V/2 kV that were equipped with fiber optic temperature sensors installed along the windings and the ducts. Breazeal et al. [23] carried out a study on eleven small 12 kV transformers of rated powers within 37.5 and 25 kVA subjected to overloads from 115 to 145 % for one year to evaluate the diffusion of MO from the solid insulation towards the oil. Although ***these studies*** provide relevant results, their ***scope was limited and there are wide areas that remain uninvestigated***, as the impact of ***SE-retrofilling*** on ageing performance, the development of ***ageing models*** or the analysis of the impact of the oil flow in the ***MO migration***.

Some studies analyse the performance of retrofilled transformers by ***simulation***, assessing the impact of retrofilling on the ***temperature distribution*** of the transformer [24, 25] and on the ***dielectric safety margins*** of the different parts of the oil-paper insulation [12, 24, 26]. Although those studies are relevant, it is ***necessary*** to carry out a systematic ***evaluation of typical geometries and constructive groups*** to obtain general conclusions that may provide guidance regarding the safety of retrofilling transformers with different constructive types, ***voltage levels, and power ratings***. Finally, some publications report ***experiences on real transformers*** that have been ***subjected to retrofilling*** with NE or SE. Figure 2 summarizes the characteristics of those transformers. Some studies show data on maintenance tests performed, suggesting

that gas patterns and other ***markers may vary significantly*** after changing the insulating liquid of a transformer. Regarding the application of ***BH and RO for transformer retrofilling, no previous experience*** has been reported up to date.

Reference	Power	Rated Voltage	Variables and performed tests							
			Water	Tan delta	BDV	DGA	Acidity	Fire pt.	Viscosity	Temperat.
[23]	25 kVA	15 kV	X	X	X	X	X			
[27]	315 kVA	10 kV		X	X			X		X
[28]	12.5 MVA	66 kV	X		X	X				X
[9]	16 MVA	88 kV	No data							
[12]	16 MVA	220 kV	No data							
[24]	25 MVA	230 kV		X	X	X			X	
[15]	40 MVA	110 kV	X	X	X	X				

Fig 2 – Tests performed to transformers subjected to retrofilling [27, 28].

Fundamental research will also be represented in this proposal through the incorporation of ***nanoparticles into the liquids*** resulting ***from retrofilling***. These have demonstrated their effectiveness in ***improving the thermoelectric properties*** of insulating liquids. Various limitations of insulating liquids are currently being solved using different nanoparticles by adding an appropriate concentration to the base liquids. The project will analyse the effect of nanoparticles in retrofilling processes, specifically focusing on the challenge of long-term stability [29]. ***No previous references have been found*** in this line of research.

Considering the previously presented state-of-the-art revision, six work packages are proposed.

1.2. Soundness of the proposed methodology

- Overall methodology:

The project is organized in six work packages (WP). Each technical WP is oriented towards the achievement of one of the objectives proposed. The WPs are divided in tasks that will be carried out using different methodological approaches (theoretical analysis, experimentation in laboratory, numerical simulation, using emulation platforms, and real substations). The methodology applied to develop each task is described in detail in Sec. 3.1. The methodology of the project contemplates an interdisciplinary approach, and researchers with different background will be allocated in each task. Additionally, the interaction with international groups in the topic of the proposal and with the industry is a relevant part of the project; it is expected that those interactions will provide a continuous exchange of ideas that will contribute to increase the impact of the project. The project is structured into ***three main work packages: WP1, WP2, and WP3, which are interconnected and dependent*** on each other to achieve the project's objectives.

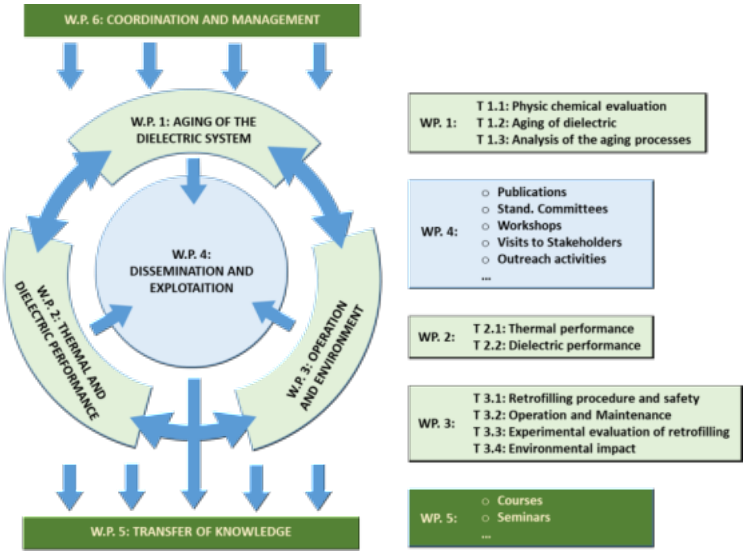
WP1: Aging of the Dielectric System (Materials Characterization, ***Obj.1***)
WP1 proposes the assessment of the aging processes in dielectric materials used in power transformers after retrofilling. In this case is also necessary to carry out documentary research. Experimental research (laboratory scale) will be carried out in a basic container to observe the evolution of typical parameters. This is again a clear example of applied research since it tries to determine aging models that would be useful for proper design of windings cooled by natural esters or recycled oils. Furthermore, the results obtained from these comparative studies would support the development of condition monitoring techniques for transformers that change the type of cooling fluid. Thus, aging tests will be carried out in ovens for heat treatments. To do this, a container will be built where cellulosic components and fluid mixtures that approximate the characteristics of the fluids available in the transformer after a retrofilling process would be mixed. In this analysis, different types of cellulosic components will be considered, such as Kraft paper, TUK, DDP, Crepe, pressboard PSP 3055, PSP 3051 and PSP 3052 and Nomex. These containers will be placed in the ovens for long periods at high temperatures. During accelerated aging, three temperatures will be used to know the effect of high temperatures on these insulation systems.

- Therefore, in this first package, the ***physical, chemical, electrical, and thermal characterization*** of materials representative of the electrical system of a transformer that has undergone retrofilling will be carried out.
- The information obtained in this WP will be crucial for the subsequent work packages, as it will provide necessary ***data for*** the development of ***numerical models in WP2*** and for the definition of ***safe retrofilling procedures in WP3***.

WP2: Thermal and Dielectric Performance (Development of Numerical Models, ***Obj.2***)

This work package proposes the evaluation of the distribution of temperature in different parts (mainly, windings and radiators) of the cooling circuits in power transformers after retrofilling. In this case, it can be considered that part of the objective will need to use documentary research, since the analysis, interpretation and confrontation of the collected information will be fundamental. Moreover, CFD models will be used to determine the thermal response of the windings. The purpose is to obtain a technical solution that it is based on fundamental research, in this case the equations that govern fluid mechanics and heat transfer. The same conclusion is also valid for THN models. On the other hand, the electric field distribution of the transformer representative geometries selected will be analysed using Finite Element Method (FEM) and considering different voltages waveforms (i.e., AC, lightning impulse full-wave and impulse chopped-wave). The dielectric margins of the different parts of the insulation will be calculated and compared with the dielectric margins of the transformer insulation before retrofilling.

- Based on the information obtained in WP1, numerical models will be developed in this package to visualize the effect of retrofilling on the thermal and dielectric performance of retrofilled transformers.
- The results from the models will be useful for setting temperatures during accelerated aging processes, and the ***feedback between WP1 and WP2 will be continuous.***



WP3: Operation and Environment: (Operation Review and Procedures Definition, ***Obj.3***)

WP3 proposes an investigation into the cost and benefit analysis of the use of retrofilling technique in transformers through different aspects such as design, operation, management, procedure, safety and environmental impact. New test platforms and/or upgraded existing test platforms will be used to validate the behavior of different winding geometries after retrofilling. The methodology used in this case could be considered as technological innovation or experimental development research, since the new knowledge generated during the project (WP1 and WP2) will be used by the companies for application of retrofilling in transformers. In addition to the cost of retrofilling and benefit from a possible lifetime extension, other parameters such as cost of maintenance, risk of failures, environmental impact and the failure management have to be considered for a comprehensive cost benefit analysis. Therefore, WP3 also propose comparative studies on important aspects of retrofilling: life cycle assessment and diagnosis of transformers that have undergone retrofilling. Finally, simulations of retrofilling procedures will be carried out on experimental platforms that will simulate the geometry, processes, and components of a real core type power transformer, in order to verify the accuracy of the models obtained in WP1 and WP2.

- Consequently, in WP3, the operation of retrofilled transformers will be reviewed, and procedures for dynamic loading and ***overload management*** will be defined.
- The information obtained in WP2 regarding the modification of ***dielectric and thermal responses*** will be crucial in this package, e.g. the temperature distributions obtained in WP2.
- Additionally, safe procedures for transformer retrofilling, based on the characterization conducted in WP1, will be defined in this WP, and a ***post-retrofilling maintenance guide*** will be proposed.
- The interdependence between the WPs is reinforced by the intention to validate the models developed in WP2 through retrofilling tests on emulation platforms and real transformers under real operating conditions, WP3. This validation will ensure the accuracy and usefulness of the models for practical applications.
- Knowledge of the consequences of a retrofilling process obtained throughout all the project tasks will contribute to the correct definition of the life cycle assessment of this procedure in WP3.

If problems appear in the application of this methodology, the Steering Committee will apply the contingency plans defined in the risk list, section 3.1.

- Integration of methods and disciplines to pursue the objectives:

The work packages will be executed by a team where professionals from the different disciplines (***MSCA keywords***) will be involved ***(physicists (P3), chemists (C3 and C4), mechanical engineers (G3) and electrical engineers (G2))***. The project will also serve to promote collaboration between professionals from the same field, but who work in different institutions. RETROTRAFO will create a working group with physicists, chemists and engineers who work for the companies and for several universities. This will certainly foster synergies that will enhance the quality of results within WP1. Something equivalent will emerge in WP2, where engineers, chemists and physicists working for different institutions will collaborate. WP3 could be described as the most interdisciplinary because it requires the collaboration of specialists on ***physicochemical characterization techniques of materials and nano-insulating liquids (WP1)*** and from ***dielectric materials, high voltage, fluid mechanics and heat transfer (WP2)***. WP3 will be mainly based on industrial scale winding prototypes and real substations. In them, researchers from both fields will test the studies and simulations implemented in the previous WPs. The interaction of different scientists is likely to encourage the production of high-value results. The multidisciplinary and interdisciplinary aspects mentioned in technical work packages will also have an impact on non-technical work packages. Thus, in WP4, scientific ***publications*** that may arise will ***benefit from*** the authors with ***different experiences and backgrounds***. The exploitation and capitalization of results will also benefit from a multidisciplinary environment. In the case of WP5, the training received by the staff seconded will take advantage of experts with different background or coming from another scientific discipline.

RETROTRAFO partners recognize the imperative to expand the scope of their researchers' endeavors and enhance their institutions' collective expertise to effectively tackle the ***complexities of retrofilling*** and the constantly evolving energy supply systems. The project's aims to encompass numerous ***interdisciplinary challenges*** spanning various sectors, and the participants stand prepared to tackle them through synergistic cooperation and the exchange of specialized knowledge. ***Academic collaborators*** are poised to contribute innovative insights in their respective domains, while ***industrial partners*** bring invaluable practical know-how and address real-world challenges prevalent in the industry today. ***Knowledge transfer*** will occur ***during each secondment***. This ensures a mutual exchange of new insights between secondees and hosts, enriching both parties with fresh perspectives and expertise.

Regarding ***same-sector secondments*** that meet the ***interdisciplinary*** conditions, 43 secondments are proposed in this project, all of them belonging to two different scientific disciplines.

Partner	From	To	Task	Nº	From	To	Task	Nº
UEF SAV C4 16PMs	C4-Applied Chemistry	G2-Electrical engineering	1.2	7	C4-Applied Chemistry	P3-Condensed matter physics	1.2	3
	C4-Applied Chemistry	G2-Electrical engineering	2.1	4	C4-Applied Chemistry	G3-Fluid mechanics	2.2	2
BCMATERIALS C3-P3 14PMs	P3-Condensed matter physics	C4-Applied Chemistry	1.1	3	P3-Condensed matter physics	G2-Electrical engineering	1.3	2
	P3-Condensed matter physics	G2-Electrical engineering	1.2	1	P3-Condensed matter physics	G2-Electrical engineering	2.1	4
	P3-Condensed matter physics	C4-Applied Chemistry	2.1	1	C3-Physical Analy. Chemistry	P3-Condensed matter physics	1.1 1.3	3
TUKE G2 13PMs	G2-Electrical engineering	G3-Fluid mechanics	2.2	7	G2-Electrical engineering	G3-Fluid mechanics	1.2	2
	G2-Electrical engineering	G3-Fluid mechanics	3.1	2	G2-Electrical engineering	G3-Fluid mechanics	3.3	2

The host institutions involved in ***same-sector secondments*** would be UWB (G2), UC (G2, G3), SUT (G2, G3), UC3M (G2, G3), UEF SAV (C4), BCMATERIALS (C3-P3), UNIZA (P3) and TUKE (G2).

- Gender dimension and other diversity aspects:

Due to the nature of the problem at hand the RETROTRAFO project's impact on gender dimension and other diversity aspects is not very relevant. The RETROTRAFO consortium is fully committed to European Commission's: ***Gender Equality Strategy, EU Anti-racism Action Plan, EU Roma strategic framework for equality, inclusion, and participation, LGBTIQ Equality Strategy and Strategy for the Rights of Persons with Disabilities***. Equality will be fully considered in project management structure and in research teams throughout the entire lifespan of this project.
At a management level, the ***UC*** (leading project entity) has since 2010 Equality and Social Responsibility Area, which is responsible for promoting measures that incorporate ***equality and social responsibility***

transversally in all ***UC*** policies, as well as ensuring their compliance. If there are enough people interested in being members of the Committees and Boards that will work in the organization and management structure of the project, there will be equal participation of women and men, except in the ***Steering Committee***. The previous is guaranteed since of the 28 partners of the consortium 4 are led by women (***UC3M***, ***USACH***, ***UBO***, and ***UW***). This way two of the WPs will be led by women, (Prof. Inmaculada Fernández in WP1, Prof. Belén García in WP3). Moreover, the project directly involves both genders (16 women and 81 men) for senior and junior researchers.

RETROTRAFO is committed to promoting, collecting and monitoring the participation of women in secondments and project activities, as well as making visible the participation of women in research, workshops and dissemination activities such as ***Women and Girls in Science*** or ***International Women's Day*** on March 8th. The following actions will be taken:

- Women participation in the decision-making bodies, and gender balance for the speakers at training and networking project events will be carefully promoted.
- Responsibilities will be shared based on pure merit.
- Involving women in technical/scientific positions in our project.
- Taking special actions to bring more women into the project.
- Linking with networks of women scientists in the field of the project.
- ***Technical Board*** will ensure to meet the (gender) diversity goals of the consortium for SE.
- Maternity leave, part time working and work from home will be implemented when necessary.
- Gender and diversity aspects will be monitored by ***Technical Board*** and ***Network Coordinator***.

- Open science practices:

Through the project implementation, open science practices will be followed by the RETROTRAFO consortium. The project will always be giving priority to documenting and sharing the scientific outputs, this way all the published research outputs will be made freely accessible to researchers and general public.

The consortium will aim to publish the main outputs of the project in open-access peer-reviewed journals such as ***IEEE Access*** or MDPI journals as ***Applied Science*** or ***Energies***. Papers published in Conference or not open access journals will have a preprint version in institutional repositories; for example, UC have ***UCREA***. If a partner has not an open access repository the European Open Science Cloud (***EOSC***) or ***Zenodo*** will be used.

RETROTRAFO will promote the adoption of open science also through organizing workshops and seminars; these activities will involve project members and researchers/innovators from the host institutions. The seminars will be used especially to train ESRs, but also for the improvement of their communication skills. ***Presentations will be uploaded on the project website.***

RETROTRAFO will also communicate research results to non-specialist audiences in the context of public engagement and citizen science initiatives. Project will involve the general public in multiple ways, like, via participation in events such as the ***European Researchers' Night*** or Women and Girls in Science.

To ensure the early and open sharing of our research to different stakeholders, civil society organizations, end-users and citizens, project ***website and social network will be used to disseminate these publications*** and activities.

- Research data management and management of other research outputs:

The aim of data management in the RETROTRAFO project is to securely store and distribute project data while maintaining privacy and preventing unauthorized access to personal information. This involves creating a ***Data Management Plan (DMP, D6.1 updated at M24)***, which will: 1) outline the data generated within the project for sharing among consortium partners; 2) ensure collected data uphold privacy standards and do not disclose sensitive information; 3) detail how the collected data will be utilized throughout the project; 4) specify which data will be publicly accessible and establish procedures for timely dissemination; 5) preserve generated data beyond the project's duration; 6) ensure data security through regular backups.

The RETROTRAFO project commits to gathering data following FAIR data principles. Regarding data Findability, research outputs such as journal and conference papers will be deposited in Open Access Repository platforms, while each partner will store their data on their respective corporate servers. In terms of Accessibility, private and personal participant data will be securely protected using keys/passwords for access, with dedicated communication protocols in place and strictly adhered to. For data Interoperability, institutional repositories like EOSC and UCREA facilitate long-term archival of data in any format. Lastly, in terms of Reusability, the default licensing will be Creative Commons Attribution, promoting the reuse of data and research outputs.

1.3. Quality of the proposed interaction between the participating organisations

- Contribution of each participating organisation in the activities planned.

The following table presents the contribution that each of the partners will provide to the project:

Partner	Contribution	WP	PMs/ Staff hosted	PMs/ Staff seconded	WS	Seminars/ T.Courses
BCMATERIALS -Spain Fundación BCMaterials (C3, P3)	- Advanced structural characterization of planar and developed interfaces - In operando structural study - Synthesis of different types of nanoparticles and nanofluids	1,2, 4,5, 6	3/3	14/11	1, 2	6 / 1
UEF-SAV- Slovakia Institute Exper. Physics SAS (C4)	- Dielectric and thermal performance of dielectric liquids - Nano-modification of transformer oils - Transformer temperature rise analysis	1,2, 4,5, 6	4/3	16/7	1, 2	6 / 1
SUT-Poland Silesian University Technology (G2, G3)	- Thermal and flow field computation in transformers including coil/core anisotropic properties modeling - Electromagnetic field computation in low- and high-frequency transformers	2,4, 5,6	15/10	18/4	2	7 / 2
TUKE-Slovakia Technical Univ. Košice (G2)	- Electrical insulation systems for high-voltage devices and apparatus - Dielectric spectroscopy of solids and liquids in the time and frequency domain - Partial discharge analysis and breakdown in dielectric fluids for power transformers	2,3, 4,5, 6	3/3	13/8	2, 3	6 / 2, 3
UC- Spain University Cantabria (G2, G3)	- Dielectric system of power transformers. - Thermo-fluid analysis of power transformers with computational fluid-dynamics software. - Accelerated thermal aging of dielectric systems	All	62/37	58/13	1, 2, 3	5 / 1, 2, 3
UC3M-Spain University Carlos III (Spain) (G2)	- Transformer design and field drying - Condition monitoring - Ageing of insulation and characterization of physico-chemical and dielectric properties of different fluids	All	47/18	22/4	1, 2, 3	5 / 1, 2, 3
UNIMAN-UK University Manchester (G2)	- Electrical, thermal and ageing studies on biodegradable oils - Facilities to conduct laboratory scale ageing experiments and equipment to measure physico-chemical and dielectric properties	1,2, 4,5, 6	1/1	11/6	1, 2	6 / 1, 2
UNIZA-Slovakia Univ. Zilina (P3)	- Ultrasonic spectroscopy of materials - Dielectric analysis of power transformers - Dielectric spectroscopy of electro - insulation materials	1,2, 4,5, 6	3/3	8/4	1, 2	6 / 1, 2
UWB- Czechia Univ. West Bohemia (G2)	- High voltage insulating system diagnostic - Online diagnostics - Dielectric fluids design	All	9/9	15/15	1, 2, 3	5 / 1, 2, 3
BEST- Turkey Transformer Company (G2, G3)	- CFD - thermal analysis and Electromagnetic FEA solutions - Transformer design and organization - Thermal-fluid performance testing in experimental setup - Design, manufacture, sale, installation, servicing and repairing of mobile, power and distribution transformers	All	9/5	10/6	1, 2, 3	5 / 1, 2, 3
CELSIA- Colombia Company (G2)	- Management of fleets of power transformers - Monitoring of power transformers - Maintenance and operation procedures	3,4, 5,6	6/3	0/0	3	7 /3
DIVEG- Colombia Company	- Dielectric fluids design - Interpretation of aging and faults markers - Transformer filling procedures	3,4, 5,6	2/2	0/0	3	7 /3

(C4)						
EGI-Germany Company (G2)	- Management of fleets of power transformers - Monitoring of power transformers - Maintenance and operation procedures	3,4, 5,6	2/2	0/0	3	7 /3
STOEN -Poland Company (G2)	- Management of fleets of power transformers - Monitoring of power transformers - Maintenance and operation procedures	3,4, 5,6	3/3	0/0	3	7 /3
SMT-Italy SEA MARCONI-Company (C4)	- Modeling and forecasting transformer ageing faults with analysis of insulating liquids and diagnostic algorithms - Purposely-designed equipment for accelerated ageing of liquid and solid insulations - Degradation diagnosis of insulating fluids and electrical equipment, equipped with a wide set of lab instruments	1,3, 4,5, 6	22/12	0/0	1, 3	6 / 1, 3
UNSJ-Argentina Universidad N. San Juan (G2)	- Asset management - Aging and modelling of power transformers	3,4, 5,6	0/0	12/2	3	7 /3
Kyutech-Japan Kyushu Institute of Technology (G2)	- Dissolved gas analysis and streaming electrification of biodegradable insulating oils - Partial discharge measurement - Optical observation of streamer discharge propagation along the interface between insulating oil and pressboard.	2,4, 5,6	10/5	0/0	2	7 /2
NYU-US New York University (G2)	- Transformers modelling - Electrical machines design and construction. - Electromagnetic Transients and Thermal Fields	All	19/5	0/0	1, 2, 3	5 / 1, 2, 3
TU-Egypt Tanta Univer. (G2, G3)	- Dielectric measurement and analysis of insulating fluids - Thermal performance of power transformers - Aging assessment and condition monitoring of power transformer insulation"	All	6/4	11/7	1, 2, 3	5 / 1, 2, 3
UBO-Chile Universidad B. O´Higgins (G3)	- Spectroscopic characterization - Electron microscopy (SEM and TEM) - X-ray diffraction	1,3, 4,5, 6	10/4	0/0	1, 3	6 / 1, 3
UNL-Argentina Universdad N. del Litoral (G3)	- Computational Thermo-Fluid Dynamics (CTFD) - High Performance Computing (HPC) - Fluid Structure Interaction (FSI) - Development of Code Saturne in HPC platforms - Setup of experimental facilities for electric transformers	2,3, 4,5, 6	2/1	38/8	2, 3	6 / 2, 3
UPM University Putra Malaysia (G2, G3)	- Numerical life assessment of transformers - Thermal modelling and paper ageing - Non-destructive methods to evaluate condition - Biodegradable oil application in transformers - Partial discharge measurements - Winding deformation analysis-finite elements	All	6/4	25/11	1, 2, 3	5 / 1, 2, 3
UQ-Australia University Queensland (G2)	- Condition monitoring of power transformers - Retro filling of transformers - Transformer thermal modelling - PD analysis of transformers - Transformer vibro acoustic analysis	1,3, 4,5, 6	3/2	0/0	1, 3	6 / 1, 3
USACH-Chile Univ. Santiago de Chile (G3)	- Computational thermo-fluid-dynamics - Modeling free-surface flows - Fluid-structure interactions using - Embedded techniques / Experimental validation	2,3, 4,5, 6	8/4	0/0	2, 3	6 / 2, 3
UTFSM-Chile Universidad T. Federico Santa Maria (G2)	- Monitoring and Diagnosis of HV Equipment. - Design of Inductive Sensors and UHF Antennas for Partial Discharge Measurement. - Design of Bioinspired Systems for the Characterization of Transformer Insulation.	All	16/8	0/0	1, 2, 3	5 / 1, 2, 3
UVALLE-Colombia Universidad del Valle (G2)	- Computational simulation of moisture dynamics - Emulation of thermal behavior of power transformers - Testing Moisture Dynamics on laboratory setups	1,3, 4,5, 6	4/2	16/6	1, 3	6 / 1, 3
UW-Canada	- Liquid dielectrics.	2,4,	6/2	0/0	2	7 /2

University Waterloo (G2)	- Oil-paper ageing under fast transients. - Wind farm connected transformers. - Thermal ageing of oil-paper insulation.	5,6				
WMU-US Western Michigan Univ. (G2)	- Transformer modeling and design - Optimal dielectric design - Finite element method (FEM) analysis	3,4, 5,6	4/2	0/0	3	7 /3

- Justification of the main networking activities (e.g. workshops/trainings/conferences, etc.).

The ***first group*** of networking activities will be based on the organization of ***training courses*** (theoretical and practical), which at least include:

1. ***TC1:"Degradation assessment of dielectric paper and oil"*** (June 2025). This course will provide an exchange of methodologies between the partners, as well as training in procedures that have not been used by some participants. This facilitates the development of a general methodology which can provide a better aging analysis of dielectric systems after a retrofilling scenario (***WP1 leader***). ***Duration: 2 days.***
2. ***TC2:*** "***Winding geometries and specific characteristics of dielectric materials***" (June 2026). This course will transfer the experience of the companies in these issues to the rest of partners which will make easier the contribution of the rest to the development of thermal-dielectric modelling in retrofilled transformers (***WP2 leader***). ***Duration: 2 days.***
3. ***TC3:*** "***Design of experimental platforms***" (June 2027). This course will describe the characteristics of existing platforms in UVALLE, UC3M, UW, UEF SAV, and BEST and the criteria applied to carry out their design and building. This knowledge transfer will help the rest of partners to test retrofilling in the different platforms conveniently and therefore they will obtain more useful information from these tests (***WP3 leader***). ***Duration: 2 days.***

The ***second group*** of networking activities includes the organization of ***seminars*** at host institutions. Some examples are shown below (more information is gathered in Annexes ***Part B2***):

Design and construction of core type windings. Thermal modelling and thermal design of power transformers with CFD. Simplification of sources of power losses. Use of Salome and Code Saturne to simulate thermo-fluid dynamics problems in HPC Platforms. THN Modelling in power transformers. Reduced-order modelling in power transformers. Transformer fire risk assessment. Moisture modelling in power transformers. Investigation of Streaming electrification of biodegradable liquid. Thermal and moisture dynamics and its influence in aging of cellulosic materials immersed in biodegradable oils. ***A least 10 seminars would be organized each of the four years of the project.*** (***WP5 leader***). ***Duration:2-5 hours.***

The ***third group*** of networking activities will be based on the organization of ***workshops***. which will be open to external stakeholders, boosting the impact of the results obtained. On the other hand, these workshops will be coordinated with both ***IEC-TC10-WG46*** and ***CIGRÉ WG A2/D1.72***. These workshops could serve for the development of new technological solutions and for the formation of future research consortiums. This group of activities will include three workshops (***WP5 leader***):

1. ***WS1:***"Behaviour of the insulation system in retrofilled transformers" (2025). This workshop will be held within the activities of the ***International Conference on Dielectric Liquids (ICDL 2025)***. It is a research-oriented conference on dielectric liquids, held in Europe every two years. This workshop will be held in ***Lodz (Poland)*** May 18-22, 2025. The project partners regularly collaborate with the organization of this conference. ***Duration: 2-3 days.***
2. ***WS2:*** "Thermal and dielectric performance of retrofilled transformers" (2026). This workshop will be held within the activities of the ***International Conference of Dielectrics (ICD 2026)***, which takes place in even-numbered years. The project partners regularly collaborate with the organization of this conference. ***Duration: 2-3 days.***
3. ***WS3:*** "Operation, safety and environment aspects in retrofilled transformers" (2027). This workshop will be used to present the results obtained by RETROTRAFO and will be held within the ***conference MyTransfo 2027.*** This is the most important European event on the management of fleets of transformers and insulating oils. It will be held in ***Turin (Italy)*** and will be organized by the industrial partner ***SMT,*** the main promoter of this conference. ***Duration: 2-3 days,***

The ***fourth group*** of networking activities will be based on the participation in ***scientific conferences***, because they are suitable for scientific networking due to the participants variety (universities, technology companies and research institutes). Thus, conferences promote short courses and tutorials about topics of

great interest. The partners will try to present in these conferences the results of the project through leaflets distribution to broaden the public who will be aware of RETROTRAFO results. The work packages that are developed fit within the topics considered by several international conferences of great prestige: ***(EIC)*** Electrical Insulation Conference, ***(ICD)*** International Conference on Dielectrics, ***(ICHVE)*** International Conference on High Voltage Engineering, ***(ICEMPE***) International Conference on Electrical Materials and Power Equipment, ***(ICDL)*** International Conference on Dielectric Liquids, etc. ***An average of 10 papers would be presented in these or similar conferences, each of the four years of the project.*** (***WP4 leader***). ***Duration: 2-5 days.***

2. Impact

2.1. Developing new and lasting research collaborations

- Describe the development and sustainability of new and lasting research collaborations

The relationship between the partners is already producing interesting results. In recent times, the number of joint initiatives is increasing, this project proposal will be the structure that will foster again a long-term relationship between the partners. Collaboration within a four-year research project, with ***international mobility, will most likely create links*** that will last and increase productivity over time because each partner has different experiences and problems in their countries. The ***exchange of experiences, methods and procedures*** during the secondments of this project can help to find existing ***problems in*** many ***companies*** around the world that require ***effective solutions***. The development of these solutions will enhance collaborations between partners.

The ***self-sustainability of the partnership*** after the end of the project will be based on future applications for research projects, both in national international framework, for instance, ***National Plans for Scientific, Technical and Innovation Research*** or ***HORIZON EUROPE***. In this sense, the partners have demonstrated that they have the capacity to raise funds to finance their research activities. The ***UC*** carried out projects related to the insulation of transformers under grants (PID2019-107126RB-C22, DPI2015-71219-C2-1-R, DPI2013-43897-P, DPI2011-23743). ***UNL*** was working in two projects funded by the Argentinian government (grants CONICET PIP 11220150100588CO, FONCyT PICT 2016-0708) on the optimization of the oil channels of the transformer and enhancement of the heat transfer.

UC led the project ***BIOTRAFO*** which was financed by the Horizon 2020 ***MSCA-RISE 2018 grant*** No ***823969***. Many of the participants in the RETROTRAFO proposal participated in the BIOTRAFO consortium; ***UVALLE, UNL, UC3M, Kyutech, SUT, BEST, UNIMAN, SMT and UC. TU, UVALLE and UC*** are collaborating under a project promoting mobility of students and professors, awarded by the Call 2023 of ***ERASMUS+ KA171, 2023***-1-ES01-KA171-HED-000122364.

The ***companies involved in this project*** proposal have departments and ***budgets dedicated to research***. In fact, these companies have previously worked on projects financed by regional, national and European organizations. This also highlights the group's solvency to maintain collaboration in research after the end of RETROTRAFO (e.g. Although ***BIOTRAFO*** ended, the ***consortium*** continues ***working*** today on a ***platform built by BEST transformers***)

Other possible support for ***self-sustainability*** of the partnership could be ***found in stakeholders***. From the dissemination activities of RETROTRAFO, for instance, ***workshops*** or participation in international ***conferences***, ***new partners*** could be found that would collaborate in the maintenance of the research topics, once the support of the MSCA-SE 2023 call ends (e.g. Some partners of this proposal met for the first time in this type of event.).

- Describe how the project will generate knowledge transfer

With the aim of support the exchange of knowledge between partners, different activities will be promoted:

Program of stays: This project intends to improve the current knowledge on the performance of power transformers after a retrofilling process. To this end, a consortium of 28 partners has been formed.

The ***WP1*** proposes 74 months of secondments. The topic in this case is the aging of transformers after retrofilling. The partners working in WP1 are experts in aging behaviour of dielectric materials. Nevertheless, not all the partners have the devices needed to carry out the measurement of ***physical and chemical characteristics***, therefore the secondments will be used to learn all the ***infrastructures*** available in

the network as well as the methodologies used in each institution to define a unique ***methodology*** which can be implemented in the whole network. This will be achieved through ***seminars***.

The ***WP2*** proposes 115 months of secondments. The topic in this case is the thermo-dielectric analysis of power transformers using retrofilling oils. The partners working in WP2 are experts in ***thermal and flow field computation*** in transformers although using different tools (Code Saturne in HPC platforms, ANSYS and COMSOL software) and setup of experimental facilities for electric transformers. There is ***not an homogeneity in the tools*** used by partners in thermal modelling, so the stays will allow to train the whole partners in all the tools through ***seminars*** and ***training courses*** developed by host institutions. Moreover, the secondments will be trained on the experimental facilities built by BEST. The partners (***SUT***, ***UC***, ***UC3M***, ***UNIMAN***, ***UNIZA***, ***BEST***, ***TU***, ***UPM***, ***UVALLE***, ***Kyutech***, ***NYU***, ***UTFSM***, ***UW***) are experts in the design of the dielectric system used in power transformers, but as in the previous case, ***different numerical methods and tools*** are used by the academic partners and the manufacturers. The project will help to find the optimum way to determine the ***dielectric stress*** in a common way along the different parts of the windings, considering a transformer that has undergone retrofilling. ***Seminars and training courses*** developed by host institutions will serve to adapt techniques to different insulation configurations and transformer sizes, checking dielectric margins after retrofilling. Similarly, each of the stays will lead to ***a seminar at the institution of origin***. Researchers who have returned from a stay to their institution or company, will give a seminar in which they must explain all the knowledge acquired in that period, which increase the knowledge of PhD and MSc students.

The ***WP3*** proposes 96 months of secondments (***described in Part B2***). This work package will consider retrofilling from different perspectives: safe procedure, operation and maintenance, case studies on emulation platforms and real substations, and life cycle assessment (LCA). ***All*** the project ***partners will work on WP3***. The experience of manufacturers of transformers (***BEST***) and dielectric fluids (***DIVEG***) will be fundamental and must be shared with academic researchers through appropriate transfer activities, ***training courses*** or ***seminars***. In this WP3, this transfer will occur in the design of ***safe retrofilling procedures*** and in the use of ***platforms for emulating the operation*** of transformers that have undergone retrofilling. Similarly, the ***electrical*** energy distribution companies and managers of fleets of transformers (***CELSIA***, ***STOEN***, ***EGI***), in collaboration with the power transformer diagnostic laboratory (***SMT***), will exchange its practical knowledge with the more theoretical knowledge of the academic partners, ***in the implementation of a retrofilling process in a real substation in Poland.*** In this sense, training courses or seminars will also be used to enhance the transfer of knowledge in studies on ***operation and maintenance guides***, and in the ***life cycle assessment*** in transformers that replaced their fluid with another biodegradable or recycled one. The partners from the consortium will coordinate the ***training of younger researchers*** who ***visit*** the facilities of the ***companies*** ***BEST***, ***SMT***, ***CELSIA***, ***STOEN***, ***EGI*** and ***DIVEG***.

All the ***secondments*** and seminars will allow the appropriateness of ***knowledge-sharing*** within RETROTRAFO team in the thermal and dielectric modelling, life cycle assessment, operation, maintenance and thermal aging. Moreover, this training exchange will complement the use of ***different tools and methodologies*** applied on the studies, contributing towards the further integration of studies on power transformers after retrofilling. Additionally, ***three workshops*** (WS) will be held, in connection with the RETROTRAFO activities. These WS will evaluate the degree of execution of the different tasks. The results obtained will be studied and improvements will be proposed. Each of the work packages will be considered individually, and their responsible researcher will explain the progress made and the difficulties faced. Finally, a ***RETROTRAFO website*** will be created and it will contain all the information related to the project, objectives, reports, calls for seminars and workshops, scientific articles, etc.

Promoting an interdisciplinary environment RETROTRAFO will promote the exchange of knowledge between ***researchers*** working in aging studies of transformer ***dielectric materials*** (WP1) and researchers working in ***thermal and dielectric analysis*** in transformer windings (WP2). In this sense, WP3 will be focused on the implementation of studies on real transformer windings (industrial scale), LCA, safe procedures, operation, and maintenance after retrofilling. On all these fields, researchers with both profiles, thermo-dielectric modelling and aging of dielectric materials, ***will work together***. This ***interaction can be highly beneficial*** to the project results, with a high probability of synergies occurring between both groups. The experience of industrial partners will greatly facilitate this transfer of knowledge.

- Describe the contribution of the action to the improvement of the research and innovation potential.

Transformer retrofilling has been widely applied in the United States and Asia, but the spread of the technique ***in Europe has been more limited***. RETROTRAFO project will contribute to the penetration of the technique across the European market. This will impact on the safety of the system and increase the competitiveness. In this sense, ***RETROTRAFO will strengthen the research and innovation capabilities of companies involved.*** The ***transformer manufacturer*** will position itself as a possible provider of services associated with transformer retrofilling within a global market. Additionally, they can benefit from improved thermal and dielectric design that accounts for potential fluid shifts, near-guaranteed temperature rises, reduced material of construction use, and more optimal testing procedures. The ***electricity distribution companies*** will benefit from the results related to dynamic load management or useful life evaluation after a retrofilling process executed with a standardized procedure. The ***manufacturer of biodegradable dielectric fluid*** will benefit from all the knowledge generated about the performance of its product, being able to implement improvements that enhance its competitiveness in the market. Finally, the ***laboratory dedicated to the analysis of transformer oils*** will position itself as a reference, within its geographical area, in monitoring the status of machines that were subjected to a retrofilling process.

The academic research groups that participate in RETROTRAFO will further develop competence and increase knowledge base to meet more and more demanding industrial and scientific challenges. The knowledge generated by ***RETROTRAFO will become integral part of power engineering educational programmes.*** The facilities developed during this project will be also frequently used to provide the fundamental engineering training for the students, researchers and engineers. Only at UC, the department at which participants are associated oversees 88 subjects in 12 degrees and 4 masters.

The ***Horizon Europe Programme***, like its predecessor Horizon 2020, will be the fundamental instrument to carry out the EU's R&D&I policies. RETROTRAFO fits perfectly with one of the societal challenges mentioned by this EU Framework Programme for Research and Innovation: ***Cluster 5-Climate, Energy and Mobility***. This cluster aims to fight climate change by better understanding its causes, evolution, risks, impacts and opportunities, and by ***making the energy and transport sectors more climate and environment-friendly, more efficient and competitive, smarter, safer and more resilient.***

Transformers are basic components of power systems that supply electricity around the world. ***Most*** of these devices ***currently use mineral oil, derived from petroleum***, for cooling and insulation. The replacement of this type of oil with esters (***NE or SE***), which will be ***biodegradable in the event of a spill***, will represent a great step forward in this type of technologies. Similarly, the implementation of retrofilling with ***biodegradable (BH) or recycled (RO) mineral oil*** will be an important step forward in achieving a ***circular economy in the electricity sector***. Biodegradable dielectric liquids ***(K type)*** are also characterized by excellent properties from the point of view of ***fire*** safety. ***Serious accidents*** caused by the fire of ***overloaded transformers in city centres*** are frequently reported, the ***poor flash point of mineral oils*** is considered a major problem for people's safety. Additionally, if we analyze these fluids based on energy security perspective, these alternative liquids represent an adequate solution since they are ***not from fossil resources***, such as mineral oils, and they can ***reduce European energy dependence***.

Since the project partners are experts in different aspects concerning power electric transformers, and participate in national and international working groups in standardization (***IEC-TC10-WG46*** and ***CIGRÉ WG A2/D1.72***), the results obtained are expected to have a direct impact on the establishment of a ***new regulations and guides on electrical transformers***, which will be adapted to the management of transformers that have been retrofilled with a new and sustainable fluid. This would enhance its use, which would undoubtedly have a strong direct ***impact on oil and transformer manufacturers, fleets managers and diagnosis companies***; and indirect in all ***European citizens***, since the electricity they consume goes through an average of four transformers before reaching households.

The circular economy is a key pillar of the ***EU Green Deal,*** The use of ***materials must be optimised***, both by limiting their quantity and by improving their circularity (design-for-recycling). In 2015, the ***regulation No 548/2014*** on implementing ***Ecodesign Framework Directive 2009/125/EC*** with regard to ***small, medium and large power transformers*** came into force. This regulation establishes eco-design requirements for placing on the market or putting into service power transformers with a minimum power rating of 1 kVA. In the 2017 report on the implementation of the ***Circular Economy Action Plan, the European Commission*** underlined that the implementation of the ***ecodesign*** working plan ***will have an increased focus on circular economy and resource efficiency beyond energy efficiency.*** In April 2022, the European Parliamentary Research Service (EPRS) published a document about the next ***review of the Ecodesign Directive.*** This focused largely on energy aspects, its revision became ***necessary*** in light of the transition to a ***circular***

economy where the use of natural ***resources is reassessed to maximise their value and minimise their waste***. The studies carried out within the framework of ***RETROTRAFO*** would serve to ***generate knowledge*** that facilitates the ***updating of the Ecodesign Directive***. The evaluation of losses in transformers, and therefore ***efficiency***, will be a fundamental part of the implementation of ***WP2*** in terms of thermal response after retrofilling. For the revision of the directive, the ***efficiency levels of the transformers*** must be ***combined*** with ***environmental*** and ***circular economy*** criteria, which will be widely discussed during the execution of the tasks corresponding to ***WP3***.

2.2. Credibility of the measures to enhance the career perspectives of staff members

- Describe how the action contributes to realising the potential of individuals.

The RETROTRAFO project will enhance the capabilities of participating researchers, especially younger individuals in a variety of ways:

Academic advantages: Widen knowledge about different tools and equipment used in productive sector for thermal-dielectric modelling and aging assessment; Learning about different environments and research methodologies in different continents (Europe, Africa, Asia, Australia and America); Exchange experience and knowledge between ER and ESR; Fostering communication skills thanks workshops, seminars and conferences.

Extensive networking advantages: Preparing young researchers for a career in both sectors (academic and private companies); Enhancing geographical mobility in academic institutions and private companies; Improvement of management skills within projects in which are involved different institutions; Providing additional funding for research projects; Inspiring new research lines which serve to create improved job opportunities.

Collaboration in research and innovation between companies and the academic world is one of the objectives pursued by the Horizon Europe program. In this way, the companies and academic institutions that are part of the consortium will improve the opinion that society has of them because they are working in the development of technological solutions with high added value. This situation will ***help productive sector*** to increase its sales ***in an increasingly competitive market***. In a similar way, the demand for services offered by academic institutions is going to increase thanks a better formation received by students through geographical mobility and knowledge exchange networks.

Regarding possible ***promotion in academic sector***, RETROTRAFO will support the possibilities of the researchers participating. Of a total of 145 researchers involved in the proposal, 97 will execute secondments. Considering the number of researchers who will travel to other institutions, 78% of them have not reached top positions in their careers (only 21 of 97 have a position of full professor or principal researcher), and between them, 34 have not obtained their PhD at this moment (35 %).

More precisely, for Junior Researchers (Graduate Students and Postdocs), RETROTRAFO will offer:

1. Mentorship Programs:
    - Pair junior researchers with senior researchers for mentorship, providing guidance on career development, research strategies, and networking.
    - Regular one-on-one meetings to discuss progress, challenges, and career goals.
2. Structured Training Programs:
    - Offer workshops on advanced research methodologies, grant writing, and project management.
    - Provide training in soft skills such as communication, leadership, and teamwork.
3. International Research Opportunities:
    - Facilitate long-term secondments at partner institutions to gain diverse research experiences.
    - Promote participation in international conferences and workshops to present research and network with global experts.
4. Career Development Plans:
    - Develop individualized career development plans with clear milestones and goals.
    - Offer regular reviews and feedback to ensure progress and identify areas for improvement.
5. Publication Support:
    - Assist junior researchers in publishing their work in high-impact journals.
    - Provide resources for language editing and submission processes.

For Mid-Career Researchers (Assistant Professors and Associate Professors):

1. Leadership and Management Training:
    - Offer training in research group management, grant management, and departmental administration.
    - Encourage participation in leadership programs and workshops.
2. Collaborative Research Projects:
    - Promote collaborative research projects within the consortium to build research portfolios and gain experience in leading international teams.
    - Provide seed funding for pilot projects to help secure larger grants.
3. Teaching and Curriculum Development:
    - Support mid-career researchers in developing new courses and curricula, integrating their research into teaching.
    - Offer opportunities to lead workshops and seminars within the consortium.
4. Recognition and Rewards:
    - Implement recognition programs to reward outstanding contributions in research, teaching, and service.
    - Provide incentives such as research funding, travel grants, and awards.
5. Networking and Professional Development:
    - Encourage attendance at international conferences, professional societies, and academic networks.
    - Facilitate sabbaticals and research visits to prestigious institutions.

For Senior Researchers (Full Professors and Distinguished Professors):

1. Strategic Leadership Roles:
    - Involve senior researchers in strategic decision-making processes within the consortium.
    - Offer roles such as project coordinators, advisory board members, and committee chairs.
2. Mentorship and Coaching:
    - Encourage senior researchers to mentor junior and mid-career researchers, sharing their expertise and networks.
    - Provide training in effective mentorship and coaching techniques.
3. High-Impact Research Initiatives:
    - Support senior researchers in leading high-impact, interdisciplinary research initiatives that align with the consortium’s goals.
    - Offer funding and resources for large-scale projects and collaborative research centers.
4. Recognition and Legacy Building:
    - Recognize senior researchers' contributions through awards, named lectureships, and honorary positions.
    - Support initiatives that allow senior researchers to establish enduring research programs and legacies.
5. Administrative and Policy Roles:
    - Encourage senior researchers to take on administrative roles such as department chairs, deans, and provosts.
    - Provide opportunities to influence research policy and strategy within and beyond the consortium.

Moreover, RETROTRAFO would propose Cross-Level Initiatives:

1. Interdisciplinary Research Groups:
    - Create interdisciplinary research groups within the consortium to foster collaboration across different fields and experience levels.
    - Organize regular meetings, seminars, and retreats to discuss research progress and explore new ideas.
2. Career Progression Workshops:
    - Hold workshops on career progression, covering topics like tenure, promotion criteria, and transitioning to administrative roles.
    - Provide insights into career paths within academia and industry.

3. Internal Funding Competitions:
    - Establish internal funding competitions to support innovative research ideas and pilot projects.
    - Encourage researchers at all levels to apply, fostering a competitive and innovative research environment.
4. Alumni Network and Support:
    - Develop a robust alumni network to support career development beyond the consortium.
    - Organize alumni events, webinars, and networking sessions to maintain connections and facilitate ongoing collaboration.

These measures will not only enhance the career perspectives of staff members at various stages but also strengthen the overall research environment within the RETROTRAFO project, fostering a culture of excellence, collaboration, and continuous development

Exchange experiences allow researchers to take ***contact with other institutions and working markets***, so they could be considered for ***future position offers***, derived from researching projects or ordinary job needs in any of the RETROTRAFO partners, or from companies placed in the same countries. For this it is essential to count on a diverse network of partners from several countries. In RETROTRAFO ***22 research institutions and 6 companies from 17 countries***.

Thus, as an example, ***UC*** currently employs more than 2000 people, dedicated in its majority to teaching and research activities, but also to providing services and assessment to companies. In this sense, 75.6% of contracted research funding in ***UC*** proceed from productive sector, and, of these, 28.6% come from competitive contracts and 71.4% from services to companies. Other participating universities as ***SUT*** employ 1668 academics, ***UNIMAN*** 6500, while in ***UC3M*** 2178 people are dedicated to teaching and research.

Respecting companies involved in RETROTRAFO, together present an annual turnover of more than 674.13M€, going from only 90 employees in case of ***SMT*** (9***M€*** turnover) to beyond 1500 employees in the case of ***BEST*** Transformers and ***300M€*** turnover.

Nevertheless, other companies established in partners' countries whose activities are related power transformers may be sources of ***job opportunities***, as ***Hitachi Energy*** (40000 employees), ***REDEIA*** (2420) or ***Repsol*** (24000). ***International experience*** of job applicants is highly valued by these multinational companies. In this sense, mobility promoted by RETROTRAFO give participants access to ***different labour markets*** where their profiles could be more demanded. People with a ***doctoral*** or equivalent ***degree have the highest employment rate*** of any educational attainment level in almost all OECD countries. Researchers may take ***advantage*** of acquired ***knowledge of equipment, methodologies, regulations*** by setting up ***new business*** focused on resolving manufacturing companies' demands.

To this point other aspects that have effects on the appearance of career opportunities must be pointed, mainly related with near development of electric sector. Thus, several indicators support an ***increase of electric energy demand*** during following years, esti***mate in a 7% in Spain for the period 2021-30, or in a 3% per year in the world, until it would suppose a 27%*** of total demand of energy.

The ***impact of electric vehicles*** over electric demand could explain in part these estimations. Additional electricity generation will be required in the European Union to meet the extra energy demand arising from an 80% share of electric vehicles in 2050. The share of Europe's total electricity consumption from electric vehicles will increase from approximately 0.03% in 2014 to ***around 4-5% by 2030 and 9.5% by 2050***. This scenario will need an ***enhancement of 15% of installed power*** and consequent adaptation of electric grid.

Here are some proposed measures to enhance the career perspectives of staff members working in private companies related to the electrical sector, tailored to specific career steps at partners such as manufacturers of transformers, utilities, and laboratories checking oil quality in transformers, and considering different experience levels:

For Junior Engineers (Entry-Level and Early-Career):

1. Mentorship Programs:
    - Pair junior engineers with senior engineers or managers for mentorship, providing guidance on career development, technical skills, and industry insights.
    - Regular meetings to discuss career goals, progress, and professional growth.
2. Technical Training and Certifications:

- Offer training programs on advanced technical skills, industry standards, and the latest technologies in power generation and distribution.
- Support engineers in obtaining relevant certifications such as Professional Engineer (PE), Certified Energy Manager (CEM), and others pertinent to the sector.

3. Cross-Departmental Rotations:
   - Implement rotational programs that allow junior engineers to work in different departments (e.g., design, manufacturing, quality assurance, and field service) to gain a broad understanding of the business.
   - Provide opportunities to work on diverse projects to enhance problem-solving skills and adaptability.
4. Participation in Industry Conferences and Workshops:
   - Encourage attendance and participation in industry conferences, seminars, and workshops to stay updated on industry trends, network with professionals, and present their work.
   - Offer funding or sponsorships for attending these events.

For Mid-Career Engineers (Project Engineers and Managers):

1. Leadership and Management Training:
   - Provide training programs focused on leadership, project management, financial acumen, and strategic planning to prepare mid-career engineers for managerial roles.
   - Encourage participation in executive education programs and professional development courses.
2. Opportunities for Advanced Degrees:
   - Support mid-career engineers in pursuing advanced degrees such as a Master's in Engineering Management (MEM), MBA, or other relevant programs through company sponsorship or flexible work schedules.
   - Collaborate with academic partners to offer tailored executive education programs.
3. Lead Cross-Functional Projects:
   - Assign mid-career engineers to lead cross-functional teams on strategic projects, fostering collaboration and enhancing their leadership experience.
   - Provide opportunities to manage innovative projects that align with the company’s goals of creating sustainable solutions.
4. Recognition and Incentives:
   - Implement recognition programs to reward outstanding contributions in innovation, project management, and operational efficiency.
   - Offer incentives such as bonuses, stock options, and career advancement opportunities.

For Senior Engineers (Senior Managers and Technical Experts):

1. Strategic Leadership Roles:
   - Involve senior engineers in strategic decision-making processes and company leadership teams.
   - Offer roles such as technical directors, chief engineers, or department heads to leverage their expertise and leadership skills.
2. Mentorship and Knowledge Transfer:
   - Encourage senior engineers to mentor junior and mid-career engineers, sharing their knowledge and expertise.
   - Establish formal knowledge transfer programs to preserve institutional knowledge and foster a culture of continuous learning.
3. Industry Leadership and Advocacy:
   - Support senior engineers in taking leadership roles in industry associations, standards committees, and professional societies.
   - Encourage participation in industry advocacy and policy-making to influence the future of the electrical sector.
4. Innovation and R&D Leadership:
   - Provide opportunities for senior engineers to lead research and development initiatives focused on innovative and sustainable solutions.

- Allocate resources and funding for senior engineers to pursue groundbreaking projects and patents.

Cross-Level Initiatives:

1. Professional Development Plans:
   - Develop individualized professional development plans for engineers at all levels, with clear career paths, goals, and milestones.
   - Regularly review and update these plans to reflect evolving career aspirations and company needs.
2. Collaboration with Academic and Research Institutions:
   - Facilitate partnerships with universities and research institutions for collaborative research projects, internships, and continuous education programs.
   - Encourage engineers to participate in joint industry-academic research projects.
3. Internal Mobility and Career Advancement:
   - Promote internal mobility by offering engineers opportunities to move across different functions, departments, and global locations.
   - Create clear and transparent career advancement frameworks to motivate engineers to pursue higher roles within the company.
4. Innovation Labs and Hackathons:
   - Establish innovation labs where engineers can work on creative solutions to industry challenges in a collaborative environment.
   - Organize hackathons and innovation challenges to foster a culture of creativity and problem-solving.
5. Diversity and Inclusion Programs:
   - Implement diversity and inclusion initiatives to ensure a diverse workforce that brings different perspectives and ideas.
   - Provide training on unconscious bias, cultural competency, and inclusive leadership.

By implementing these measures, RETROTRAFO can significantly enhance the career perspectives of engineers at various levels within the private companies involved in the project, fostering a culture of continuous improvement, innovation, and professional growth.

2.3. Suitability and quality of the measures to maximise expected outcomes

- Plan for the dissemination and exploitation activities, including communication activities:

RETROTRAFO will develop a dissemination strategy that will guide the initiatives to be executed throughout the implementation of the project, taking into account also the promotion of results after the four years financed by the MSCA-SE 2023 call. This ***strategy*** will define the types of audiences of interest and the ***most appropriate content for each audience***. The project will have a work package (WP4) that will coordinate all the actions of dissemination and exploitation raised.

a) A first set of measures will involve the most common forms of ***dissemination*** used in the ***academic*** world:

a1. Workshops. This is essential for providing a framework for most secondments for researchers from the universities and companies, as well as a platform for discussion of the progress of their research, while also strengthening cohesion among team members. The students from host universities will be encouraged to participate to increase the impact on academic training.

a2. Training courses. These courses will transfer the experience from companies to academic institutions which are involved in this project. The students from host universities and workers from private companies will be encouraged to participate to increase the impact on training.

a3. Submission of, at least, ten papers per year to different ***conferences and scientific journals***. The journals in which the results of RETROTRAFO could be published include: *Elsevier:* Electric Power Systems Research, International Journal of Thermal Sciences and ***Applied Thermal Engineering***, where ***Prof. Smolka (SUT)*** is member of the ***Editorial board.*** *IEEE*: Transactions on Dielectrics and Electrical Insulation, Electrical Insulation Magazine, and ***Transactions on Power Delivery***, where ***Prof. De León (NYU)*** is member of the ***Editorial board (Editor-in-Chief)***. *Springer:* ***Electrical Engineering-Archiv für***

Elektrotechnik, where ***Prof. Ortiz (UC)*** is member of the ***Editorial board***. The publications generated during the development of RETROTRAFO will be in all cases "Open Access".

a4. Within the dissemination activities planned by RETROTRAFO, the results obtained will be provided to the ***working groups*** that are currently ***active in CIGRE*** and that deal with similar topics. Started in ***2023***: TOR-JWG A2_D1.72. TOR-JWG A2_C3.70. TOR-JWG D1_A2.80. TOR-JWG D1_A2.79. Started in ***2022***: TOR-WG A2.68. TOR-WG A2.69. TOR-JWG A2_D1.66. TOR-JWG A2_D2.65

a5. There is another important channel for the dissemination of RETROTRAFO results which is related to the ***standardization*** system, at ***national and international*** levels. The consortium partners are members of their respective national committees (e.g. ***UNE/CTN207/SC14*** Power Transformers, ***UNE/CTN207/SC10*** Fluids for electrotechnical applications) and also participate in working groups promoted by the International Electrotechnical Commission (e.g. ***IEC TC10-14 JWG 46, IEC TC10 WG 45***).

a6. Staff members will also be encouraged to place their results in their respective online ***academic Repositories*** as well as on the RETROTRAFO portal.

b) A second set of measures envisages the creation of a ***RETROTRAFO website*** with links to the institutional websites of different partners. This portal will have three main features:

b1. An ***area reserved for the collection of data*** on the evolution of the research carried out by staff members which allows for the monitoring of results achieved at the various stages of the RETROTRAFO project. The main objective is to increase the level of inter-knowledge about preliminary results among members and facilitate the monitoring of the work by coordination teams. Information about the activities of the project's researchers will be disseminated on the website, covering secondments and publications. To this end, ***each researcher will deliver a page-long standard report with a description of the activities carried out during his or her stay***. These reports will be posted on the RETROTRAFO website.

b2. The creation of a ***bank of videos*** to be stored and classified, featuring video recordings of the RETROTRAFO workshops, as well as training courses.

b3. The creation of a ***bank of tutorials*** related with thermal-dielectric modelling and accelerated dielectric aging in laboratory. The aim is to offer a set of work methodologies which can make easier the use of new tools and measure devices. We are convinced that these tutorials help to create a uniformity of models and methodologies. These tutorials will later use for the purposes of teaching.

The items due to be made available on RETROTRAFO's portal are strictly for ***educational purposes***. Their use will be subject to the rules of ***Copyright and Fair Use law***.

The RETROTRAFO ***diffusion strategy aims to enhance*** its impact on current knowledge on the performance of power transformers that underwent retrofilling with biodegradable or recycled fluids. The ***possible impacts*** of project diffusion include:

- Obtaining of feedback from stakeholders which will be critical to improve the degree of innovation.
- The knowledge of all the stakeholders will allow in the short term to define larger projects.
- Boosting partners around the world, such as experts in biodegradable or recycled fluids, thermal and dielectric studies and characterization of dielectric materials.
- Increase of national and international companies' competitiveness, opening new business opportunities.
- Increase of younger researchers' skills and their future career prospects.
- Intensification of the collaboration within the standardization groups to define future standards and guides about retrofilling implementation in power transformers, IEC-TC10-WG46 and CIGRE WG A2/D1.72.
- Increase of the number of international collaborative publications per year.

Communication activities

The communication plan is designed to prepare, as broadly as possible, the concerned community (industry, researchers, academia, investors, innovation hubs, EU) to assess, accept, adopt and facilitate turning the RETROTRAFO new knowledge into a socio-economic viable and sustainable innovation. ***Communication activities*** include both ***internal and external communication channels*** to promote the project and its results. The communication materials will be designed and devised according to different needs, closely following the evolution of the project. Moreover, specific RETROTRAFO communication initiatives will be ***organised to attract*** a critical mass of ***stakeholders***. The table below details the envisaged

RETROTRAFO communication activities that will focus on the following ***target audiences*** in relation with the ***expected impacts*** described in the part.

Objectives	***Type of event, initiative or media***	***Targets***
To ***disseminate*** generally ***understandable information*** about the project idea, approach and results.	- ***Visual identity***: Branding of the project will be built as soon as the project starts with an original visual identity. - ***RETROTRAFO portal***: It will enable project communication. The site will be updated regularly with results. It will be supported by FAQ, videos and animations. This material will be concise and of professional quality. - ***Social media and network***: This will include RETROTRAFO X account to broadcast project news at high frequency which will be maintained to keep in contact with local communities as well as attract new users (even outside of Europe). Feeds will also be available on the RETROTRAFO LinkedIn page which aims to identify representatives from key audiences targeted through animated discussions, opinion and insights sharing and crowd sourcing. - ***Press release*** for important project events to stimulate more broader public interest and foster the creation of partnerships with regional networks, partners, and investors.	At least 20,000 single visits(website) At least 300 followers (X); 1 monthly update (LinkedIn)
To ***interact with stakeholders***, other researchers, local innovation hubs in the field, investors and the general public	- ***Workshops***: will be organized to disseminate on the open calls to reach start-ups, SMEs and midcaps. They will be organized through the local innovation stakeholders associated to RETROTRAFO, local meet up communities etc. - ***Webinars***: will complement local workshops. - ***Events***: will be organized in connection with existing national or international trade and industry events to showcase the results. - ***Leaflet***: will be produced as the project evolves (inception, mid-term and final versions) and will contain the overall ambition of the project, as well as results from completed WPs and the expected outcomes from WPs that are active at the time. Each leaflet will be produced and printed in local languages, with copies also produced in English. Each local partner will assume the task of translating the leaflet within a month of its publication. Electronic versions of the brochure will be made available on the website. - ***Project poster/banner***: They will be created for presentations within relevant European and international events. It will represent an abstract version of the most up-to-date brochure with extensive visuals. For versions in the partners' languages, each partner will provide a translation that can be integrated into the master-copy layout and send to the partners electronically. All partners will assume responsibility to maximize the visibility of the project and convey its findings and outputs to the relevant stakeholders relying on their strong outreach capacity. They will be encouraged to present the project (poster, paper) at relevant national, European and international events.	At least four of these activities per year.
To ***push scientific and technological innovations*** for uptake by market actors, increase the accessibility	- ***Dissemination*** of confidential and restricted ***deliverables*** having a direct ***potential*** use for other ***stakeholders***. - ***Business-to-business communication*** in dedicated (online) magazines including Third parties (**IEEE Electrical Insulation Magazine, Transformers Magazine**) - Disseminating project results at working groups (**IEC-TC10-WG46 and CIGRE WG A2/D1.72**) - ***Blog posts by*** RETROTRAFO ***experts and guest*** blogs by Third parties to share RETROTRAFO learnings and success stories	At least two of these activities per year

- Strategy for the management of intellectual property, foreseen protection measures.

RETROTRAFO ***Steering Committee*** will supervise the protection of background know-how, the exploitation and dissemination of results, and the ***management of Intellectual Property Rights (IPRs)*** that might be generated by the project. They will be helped and advised by the ***Legal Office of UC***. Individual partners will normally retain intellectual property rights as regards the results of their individual tasks. The intellectual contributions of secondments will be safeguarded and acknowledged, for instance by naming them on patents and in rewards schemes operated by their employers.

The network as a whole will, via its ***Steering Committee***, make arrangements for the management of collective intellectual property and rights over it. Intellectual Property should be exploited, as well as recognising the intellectual property rights of the partners and researchers who originated the work, the rights to exploit will also be fully defined in a **Consortium Agreement** on a fair, balanced and equitable basis (e.g. exclusive or non-exclusive royalty payment or fee). The detailed IPR rules will be set down in the Consortium Agreement to be approved by all parties prior to entry into the contract with the European Commission. This agreement will deal with the following topics:

- Background IPRs: Identification and access rights to pre-existing know-how and knowledge for executing the project and for the ultimate exploitation of results.
- Arising IPRs: Ownership and access rights for commonly developed technologies.
- Publication of knowledge generated by the project.
- Management and licensing of software that may be developed.
- Management of IPRs generated by students paying tuition fees.
- Liabilities, defaults and remedies, and confidentiality.

Non-disclosure and compliance: All researchers will be required to comply with the nondisclosure agreements of the RETROTRAFO consortium and to follow basic rules of confidentiality and proper documentation. All researchers involved in the project will receive an introduction to IPR issues relevant to the project during the kick-off meeting and further training from the organisations of the members, as required.

2.4. The project's contribution to expected scientific, societal and economic impacts

- Expected scientific impact(s)

The proposal is focused on the ***improvement of an industry process***, as is the generation, transmission and distribution of energy. In particular, the project may contribute to ***extending the life of*** the power and distribution ***transformers*** that are currently in operation in the European power system, ***deferring*** their need for ***replacement*** in a next future and allowing the ***increase*** of their ***loading capacity***. Relevant progress is expected on the following aspects that are currently unsolved in relation to transformer retrofilling:

- Insight will be gained on the retrofilling process of MO-filled transformers with biodegradable and recycled fluids. Developing ***safe and reliable retrofilling procedures*** will suppose a step forward towards the gradual substitution of MO with environmentally friendly liquids worldwide. This will allow reliable retrofilling to transformers of ***larger voltage levels and rated powers***.
- ***Loading guidelines*** will be generated to determine the maximum admissible load and to manage transformer ***overloads*** in retrofilled transformers. This result is especially relevant because of the ***lack of Standards*** applicable to the exploitation of these machines. These tools will contribute to increase the ***flexibility and reliability of power systems*** by application of transformer retrofilling, which is associated with larger overloading capabilities and ***lower risk of fire***. The flexibilization of the transformers' loading capacity will facilitate the integration of new elements of power system, as the ***renewable energies or charging systems for electric vehicles*** in urban environments.
- Procedures will be proposed to ***estimate the remaining life*** of a transformer that has undergone a retrofilling process. This will have an impact on extending the life of the transformers, caused by the ***protection*** on the ***dielectric paper*** of some ***biodegradable fluids***. This will increase the sustainability of transformers, by replacing fossil-fuels-based materials by environmentally friendly insulating liquids obtained from vegetable seeds or generated through laboratory processes.
- The dielectric and thermal performance of retrofilled transformers will be analysed from a theoretical point of view, developing ***tools*** that can be used ***to assess*** on the ***safety*** of a ***retrofilling from the thermal or dielectric prospective***. The analysis will also be useful for transformer manufacturers in the design of more reliable and efficient transformers capable of ***operating with fluids of different properties***.
- Threshold values and interpretation schemes will be provided for the main ***markers of the condition of the fluids present in retrofilled transformers***. Unlike what happens with transformers filled with MO or esters, there are ***no international standards*** that apply when carrying out ***maintenance*** on retrofilled transformers.
- ***Models*** that determine the ***economic impact of retrofilling*** will contribute to the consolidation of the technique. This will promote the adoption of the ***circular economy*** by promoting a maximum utilization of the remaining life of assets ***deferring*** their need for ***replacement***, redesigning the transformers to adapt

them to changing operative conditions and increasing the use of ***recycled materials***, as RO, for transformer insulation purposes.

- Expected economic/technological impact(s).

The ***economic impact*** of successfully implementing ***transformer retrofilling*** would be very relevant for the productive sector. Savings related with the ***extension*** of transformers' ***expected life*** and ***increased overload*** ability must be added to a ***lower*** need for ***investment in fire mitigation systems and insurances*** and a dramatic ***decrease*** of the economic ***losses related with oil spills and fires*** in transformers. Moreover, the knowledge obtained during the project will facilitate the application of retrofilling to larger ***transformers*** which ***contain tons of*** materials, including ***copper, stainless steel, and dielectric fluid.*** Extending the life of these assets will contribute to the transition towards a ***circular economy***.

Once results of the project are obtained, the partners will analyse if they could be susceptible of being exploited commercially. Considering the work packages of this project, it is expected to obtain results of several types. A very important part of the results will provide information on the ***geometric and materials limitations*** that may appear when implementing retrofilling in a transformer with a different fluid. The ***most likely results*** in this case could be:

- ***Procedures*** for properly carrying out the ***fluid change***.
- Tools for ***optimal load management*** without reducing the useful life of the insulation.
- Identification of ***markers*** that can provide relevant information on the necessary ***maintenance***.
- ***Aging models*** of transformers that have undergone retrofilling.
- ***Limitations*** due to retrofilling according to the ***thermal and dielectric*** performance of the machine.
- Model for evaluating the environmental ***impact of retrofilling on the life cycle*** of a transformer.
- Economic assessment tool of the ***impact of retrofilling on the Total Cost of Ownership***.

The RETROTRAFO partners will sign a ***consortium agreement*** that will detail the ***exploitation rights***. In addition, this document will detail the way in which intellectual property rights will be managed. In this sense, purely ***academic results*** will be considered in the ***public domain***, while ***industrial innovations*** will be ***protected by patents***. The management of results exploitation tasks within the project will be led by the industrial partners, who have more experience in this field. The rest of the project partners will provide their points of view, enhancing the innovation in retrofilled transformers or in the new services offered. Most probable ***lines of exploitation*** of obtained knowledge and results, in case they were suitable, may consist in:

- Production, sale and installation of power ***transformers optimized for possible retrofilling***.
- ***Adaptation of monitoring and maintenance systems*** for transformers after a retrofilling process.
- Sale of ***design and simulation software***, and associated training and support services.
- Transformer ***design engineering services***.
- ***Testing services*** for new materials from transformer component suppliers.

While first and last lines of exploitations seem suitable for industrial and academic partners respectively, the other three would require further collaboration from both type of RETROTRAFO partners, for which co-participated companies may be required.

Both the objectives of this proposal and the possible ***exploitable results*** have been defined considering the ***suggestions*** and advice of various ***stakeholders*** in the transformer industry including ***transformer manufacturers*** (ORMAZABAL, IMEFY, HITACHI and BEST), ***oil manufacturers*** (DIVEG, REPSOL, CARGILL and NYNAS), ***distribution companies*** (CELSIA, STOEN, EGI, IBERDROLA, EDP and REPSOL) and ***service laboratories*** (SEA MARCONI and CEIS). This guarantees the alignment of the project scope with the concerns of the productive sector. In addition, ***personnel from companies*** such as CELSIA, CEIS, BEST and CARGILL are or ***have been part of the UVALLE, UC3M and UC*** work team, during their master's or doctoral studies.

Thus, the use of biodegradable fluids during retrofilling can lead to the following ***quantitative benefits***:

- Average total ***cost of ownership savings*** = ***17%***
- ***Increase in load capacity*** compared to mineral oil = ***20%***
- Extension of ***insulation life*** = ***5 to 8 times longer***
- Transformer ***life extended*** = ***up to 50%***
- Increase in flash and ***combustion point*** compared to mineral oil = ***2 times more***

The economic/technological impact will be also linked to the participation of the researchers in of ***standardization committees*** and ***international working groups (WGs)*** on the topic of the project. Those committees gather professionals from ***manufacturers, power companies, and research centres***. The involvement of the researchers of the project in these groups will provide an opportunity to share knowledge and ***join forces*** with the main transformer ***stakeholders*** to ***improve the safety and sustainability*** of electric power systems by means of transformer retrofilling. Involvement of members in WGs is below:

Working group or committee	Objective	Related WP	Participating researchers
IEC TC10-14 JWG46 (2023)	***Guide for retrofilling*** mineral oil immersed transformers with alternative insulating liquids	All WPs	UC, UC3M
IEC TC112 WG4 (permanent group= PP)	Evaluation and qualification of ***electrical insulating materials*** and systems	T1.2	UWB
IEC TC14 WG32 (PP)	Power ***transformers*** and reactor fittings	All WPs	UWB
IEC TC10 WG 45 (2022)	Interpretation of ***disolved gas analysis tests in NE and SE***-filled transformers	T1.3	UC3M
IEC MT 30 (2022)	Revision of the ***High Voltage testing procedures*** for electrotecnical fluids	All WPs	UC3M
IEC/TC 14/AHG 40 (2023)	Power ***transformers*** related to energy transition such as ***PV, battery storage, e-chargers and hydrogen generation***	T3.2	UC
CENELEC TC 14 WG32 (PP)	Review of the Regulation on ***Energy Performance*** of Power ***Transformers***	T2.1	UC
CIGRE-JWG-A2-D1.72 (2023)	***Retrofill*** of mineral oil in transformers–Motivations, Considerations and ***Guidance***	All WPs	UC3M
CIGRE JWG D1/A2.79 (2023)	Improved understanding of ***dynamic behaviour of winding*** insulating materials in liquid insulated power transformers	T3.3	UC
CIGRE JWG A2/C3.70 (2023)	***Life Cycle Assessment (LCA)*** of Transformers	T3.4	UC
CIGRE JWG D1/A2.80 (2023)	Functional properties of non-metallic ***solid materials*** for liquid filled transformers and reactors and their ***compatibility*** with insulating liquids	T3.1	UC

- Expected societal impact(s).

The results of the project will contribute to developing more sustainable, safe and efficient power transformers. This contribution is directly aligned with the United Nations (UN) ***Sustainable Development Goal 7 "Affordable and Clean Energy"***, and it is partially aligned with other Goals as: 9 "Industry, Innovation and Infrastructure", 11 "Sustainable cities and communities", 12 "Responsible consumption and production", and 13 "Climate action". Thereby the project will contribute to creating a ***cleaner and healthier environment, benefiting communities and individuals in the long term***. The expected outcomes associated with each of these UN Goals are summarized below:

Expected outcome	Description	UN Goal
Regulatory framework	Development of new ***standards*** related to transformer ***retrofilling***	7, 9, 11, 12, 13
CO2 emission reduction	Increase of the ***life expectancy*** of transformers involving a better use of the assets	7, 12, 13
Increase of safety	Decrease of ***fire risk*** of the transformer due the increase of fire point of the dielectric fluid	7, 9, 11
Reduce ecological impact	Less ***environmental risk*** due to the increase of the biodegradability of the dielectric fluid	7, 9, 11

In this sense, the use of biodegradable fluids during retrofilling can lead to the following quantitative benefit: ***CO2 emissions compared to mineral oil = 56 times less***.

Moreover, the project will have a broader impact on society by contributing to the development of a ***skilled workforce in the field of transformers***. The project will provide opportunities for researchers, and for graduate, master, and PhD students, allowing them to enhance their skills and knowledge in the field. This is undoubtedly beneficial for RETROTRAFO partners, as well as for the ***European scientific system***.

3. Quality and Efficiency of the Implementation

3.1. Quality and effectiveness of the work plan, risks and work packages

The management structure of RETROTRAFO comprises the following bodies:

1. The ***Network Coordinator*** will be in charge of the research plan and finances,
2. The ***Steering Committee*** is the highest decision-making body of the consortium,
3. The ***Technical Board*** is responsible for training and research activities within the project,
4. The ***Advisory Board*** will advise on scientific objectives, promote results exploitation, and support the management structure.
5. The ***Financial and Administrative Support*** provide support to the project with specialized personnel

A detailed explanation of the ***management structure, of the work packages,*** and of the ***risk list*** is presented in the Part A of the description of Action.

3.2. Quality, capacity and role of each participant

- Appropriateness of the research infrastructure and capacity of each participating organisation;

Availability of the expertise and human resources, to carry out the proposed research project.

RETROTRAFO needs researchers with experience in two main scientific areas, namely, the ***modelling and testing of thermo-dielectric systems (A)*** and the ***characterization of dielectric materials (B)***. Thus, it can be affirmed that the project counts on people of wide professional trajectory in both areas of knowledge (***MSCA keywords***). The ***ORCID*** number of the principal researchers is available in Part A of this application. The human resources that the proposal has assigned to each area are listed below; ***Senior Researcher (SR)***, ***Early-Stage Researcher (ESR)***:

Partner	*SRs*	*ESRs*	*Task*	*Expertise*	*Partner*	*SRs*	*ESRs*	*Task*	*Expertise*
European academics					*Companies*				
BCMATERIALS	1	3	1.1-1.2-2.1	B (P3)	STOEN	2	0	3.3	A (G2)
BCMATERIALS	1	2	1.2-1.3	B (C3)	SMT	3	0	1.1-1.2-1.3-3.2-3.3	B (C4)
UEF SAV	7	1	1.2-2.2	B (C4)	*Non-European academics*				
SUT	1	1	2.1	A (G3)	UNSJ	2	0	3.1-3.2-3.4	A (G2)
SUT	0	2	2.2	A (G2)	Kyutech	2	2	2.2	A (G2)
TUKE	5	3	2.2-3.3	A (G2)	NYU	2	3	1.1-1.3-2.2-3.4	A (G2)
UC	5	2	1.1-2.1-2.2-3.2-3.3-3.4	A (G3)	TU	1	0	2.1	A (G3)
UC	4	1	1.1-1.2-1.3-2.2-3.3-3.4	A (G2)	TU	4	2	1.2-2.2-3.2	A (G2)
UC3M	2	1	1.3-2.2-3.1-3.2-3.3	A (G2)	UBO	3	2	1.2-3.2	A (G3)
UNIMAN	3	3	1.2-1.3-2.2	A (G2)	UNL	5	3	2.1-3.1-3.3	A (G3)
UNIZA	4	0	1.2-2.1-2.2	B (P3)	UPM	2	0	2.1	A (G3)
UWB	2	3	1.2-1.3-2.1-3.2	A (G2)	UPM	6	3	1.2-2.2-3.1-3.2-3.3	A (G2)
Companies					UQ	3	3	1.2-3.2	A (G2)
BEST	2	0	2.2-3.2	A (G2)	USACH	2	0	2.1-3.3	A (G3)
BEST	4	0	1.2-2.1-3.3	A (G3)	UTFSM	3	0	1.2-1.3-2.2-3.2	A (G2)
CELSIA	5	0	3.3	A (G2)	UVALLE	3	3	1.1-3.1-3.3	A (G2)
DIVEG	2	0	3.1	B (C4)	UW	2	2	2.2	A (G2)
EGI	3	0	3.3	A (G2)	WMU	1	3	3.3-3.4	A (G2)

The staff organization in each of the two areas of the project is adequate and sufficient. It is appropriate because the experts involved in each area are ***internationally recognized***, and because the ***number of people*** involved in each work package ensures the completion of the proposed tasks within the expected timeframe.

Description of the necessary infrastructures and any major items of technical equipment

Most of the material necessary for the realization of the project (***facilities, infrastructure and equipment***) is already available in the laboratories of the partners. Some examples are:

Equipment with high computing capacity: Workstations, ***Seshat cluster***, ***Pirayu cluster***, ***ALTAMIRA Supercomputer***, Licences: Comsol, Ansys, Matlab, Power Factory, ETAP, EMTP, etc. ***Materials characterization laboratories:*** Dissolved gas meter Karl Fischer moisture analyzer, Acidity analyzer, Dissipation factor meter, Dielectric strength meter, Viscometer, Density meter, Equipment for measuring the degree of polymerization (IEC 60450), Equipment for the measurement of the tensile index (ISO 1924-2), Equipment for the measurement of Partial Discharges, Applied Voltage tests, Impulse tests, Field emission scanning electron microscopy, Energy-dispersive X-ray spectroscopy, Fourier transform infrared, Thermogravimetric/differential scanning calorimetry, Raman spectroscopy, etc. ***Experimental simulation***

platforms: UVALLE-UC3M: Moisture dynamics, Mechanical stress in windings due to load or short-circuits, BEST: Transformer cooling system of 100MVA (Including radiator, tank and winding replica), etc. ***Real substations***: At least one transformer will be monitored and will be subjected to retrofilling in a substation belonging to the energy distributor RWE STOEN in Warsaw (Poland).

Hosting

The members of the ***Steering Committee***, the Principal Investigators of each beneficiary, will be responsible for the support structure for hosting in RETROTRAFO. The ***Network Coordinator*** will support all of them in their work in this matter. The hosting facilities jointly offered by the institutions involved in RETROTRAFO provide an ***assurance*** that the researchers from partner institutions will be given the support they require to successfully carry out their activities during secondments.

Academic Partners: All the academic partners that participate in the project have an ***International Relations Office (IRO)*** in their institutions, and UC, SUT, UC3M, UNIMAN, UWB and BCMATERIALS have the HRS4R (HR Excellence in Research) logo. These offices are used to house foreign academics and provide them with adequate facilities. They provide practical facilities of an excellent standard: permanent secretary and TECH staff; well-equipped workspaces (computers, printers, scanners and Wi-Fi); offices for researchers; access to the research library equipped with ICT facilities, and conference rooms for team meetings and workgroup sessions associated with the project's objectives. The administrative staff has profound experience in the management of large-scale research projects at international level and they ***will help visiting researchers in hosting.*** In addition, the partners also have the facilities required for carrying out RETROTRAFO, laboratories, rooms equipped with computers, internet, and several meeting rooms.

Non-academic partners: In an analogous way, the industrial partners of this proposal will be able to offer the visiting researchers the necessary help to be able to carry out their work in suitable conditions. The principal investigators of each beneficiary will supervise the whole process of hosting new researchers in their facilities. ***They will be provided with the necessary information. They will be given access to the company's premises, offices, meeting rooms, libraries, laboratories, etc***. In the case that in the country in which the company is located, there is an academic partner of the project, they will also support the task of hosting. For example, UVALLE will support CELSIA and DIVEG. In similar way, SUT will support STOEN.

- Consortium composition and exploitation of **complementarities**: Some examples are shown below.

Participants	***Expertise***	***Existing synergy***
BEST and UC	Numerical and experimental analysis of the thermal response of biodegradable liquids in large power transformers	The senior researcher Mr. Ramazan Altay (BEST) is close to completing his doctoral studies at UC. The collaboration of BEST and UC during recent years has led to the construction of a full-scale platform for the emulation of the cooling of a 100MVA transformer with different fluids. Another senior researcher Mr. Kerem Koseoglu (BEST) is just enrolled in a PhD Programme at UC. (➔***Task 2.1 and 3.3***)
UVALLE, TU and UC	Influence of temperature and load in moisture dynamics in power transformers	These partners collaborated in a project promoting mobility of students and professors, awarded by the Call 2023 of ERASMUS+ KA171, 2023-1-ES01-KA171-HED-000122364. (➔***Task 2.1 and 3.3***)
UVALLE, UNL, Kyutech, SMT, SUT, BEST, UNIMAN, UC3M and UC	Knowledge on power transformers immersed in biodegradable fluids.	Project "Raising knowledge and developing technology for the design and deployment of high-performance power transformers immersed in biodegradable fluids (BIOTRAFO)". It was executed under the call H2020-MSCA-RISE-2018 (GA ID: 823969) by most of the partners of RETROTRAFO. In this project, studies very similar to those proposed in the three work packages were carried out. (➔ ***all Tasks***) ***This proposal included: open science practices and gender aspects.***
UC3M and UC	Evaluation of the properties of dielectric liquids when nanoparticles are added	The development of the project "Improvement of Insulation Systems in Transformers by using Dielectric Nanofluids. Thermal Characterization and Modelling (DPI2015-71219-C2-1-R)" by

		UC3M and UC. In this project, studies very similar to those proposed in first and second work packages were carried out. This project was funded by the Spanish Ministry of Economy. (➔***Task 1.1, 2.1 and 2.2***) ***This proposal included: open science practices and gender aspects.***
UNIMAN and UC3M	Moisture dynamics on dielectric materials used in power transformers	The exchange of researchers between UNIMAN and UC3M. A PhD student from the UC3M spent a six-month predoctoral stay at the UNIMAN. Later, once he reached the doctor degree, he enjoyed a postdoc contract at the UNIMAN. More recently, another student of UC3M spent three months in UNIMAN. (➔***Task 1.2, 2.1 and 2.2***)

Table 6.1– Data for <u>non-academic</u> beneficiaries

Name	Location of research premises (city/ country)	Type of R&I activities	No. of full - time employees involved in the project	No. of employees in R&I	Web site	Annual turnover (approx. in Euro)
BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST)	BALIKESİR/ TURKEY	Design, Thermal, structural, fluid and electrical analyses, validation and production of power transformers.	5	105	besttransformer.com	300M
SEA MARCONI TECHNOLOGIES di Vander Tumiatti SAS	Collegno (TO)/ ITALY	Diagnostic and prognostic tools for liquid filled electrical transformers. Design and engineering of equipment for the treatment of transformer liquids.	3	7	seamarconi.com	9.13M

Table 6.2– Data for <u>non-academic</u> Associated Partners

Name	Location of research premises (city/ country)	Type of R&I activities	No. of full - time employees involved in the project	No. of employees in R&I	Web site	Annual turnover (approx. in Euro)
CELSIA	Cali, Valle del Cauca/ COLOMBIA	Monitorization and analyses of generation, transmission, and efficient commercialization	5	15	celsia.com/es	298M
DIVEG	Bogotá/ COLOMBIA	Development of new fluids, optimization and compatibility studies, research of physical and chemical properties and environmental impact evaluation	1	2	https://diveg.co/	0.35M
E.ON Group Innovation	Munich/ GERMANY	Energy networks operation and maintenance and other energy solutions.	3	43	eon.com/innovation	26M
RWE	Warsaw/ Poland	Looking for new solutions in onshore wind, offshore wind and solar generation and transmission of energy.	2	4	pl.rwe.com/en/	245.9M

The indicative plan of secondments from UNIMAN (UK) to MS/AC entities in the consortium is 5 Person Months. The indicative plan of secondments from UNIMAN (UK) to Third Countries entities in the consortium is 6 Person Months.

4. Ethic Issues

Project RETROTRAFO will be managed in compliance with ethical principles and applicable international, EU and national law in the implementation of research and innovation activities. Any ethical concerns raised by those activities will be handled following rigorously the recommendations provided in the European Commission Ethics Self-Assessment Guidelines.

5. Letters of Commitment for Associated Partners

NYU | TANDON SCHOOL OF ENGINEERING

Ivan Selesnick
Professor and Department Chair
Electrical and Computer Engineering
Tandon School of Engineering
New York University
6 Metrotech Center
Brooklyn, NY 11201, USA
selesi@nyu.edu

February 15, 2024

Re: RetroTrafo project invitation and support.

To Whom It May Concern:

I undersigned Ivan Selesnick, as Legal Authorized Representative of the Department of Electrical and Computer Engineering in the Tandon School of Enginneering at New York University, commit to set up all necessary provisions to host the secondments contributing to the development and implementation of the proposal number SEP-211016712 (acronym RetroTrafo) submitted within the call HORIZON-MSCA-2023-SE-01 should the proposal be funded as follows:

It is considered that the necessary provisions that NYU will make available to visiting researchers will consist of technical advice, office space, and the necessary research facilities in our Power Lab for the period of our collaboration.

RETROTRAFO project researchers who visit NYU will have their own economic support to cover travel and living expenses during their stay in New York City. Likewise, they will have access to all NYU facilities as a postdoctoral fellow. There is no tuition involved because they will not be taking courses for credit.

We will contribute to the work that will be developed in the WP2, dedicated to the analysis of dielectric and fluid-thermal response changes in a transformer where its cooling fluid has been replaced with another with different characteristics.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Sincerely,

Ivan Selesnick

Ivan Selesnick
Professor and Department Chair
Department of Electrical and Computer Engineering
Tandon School of Engineering, New York University

CELSIA

LETTER OF COMMITMENT

I undersigned[1] JULIAN DARIO CADAVID VELASQUEZ, in my quality of Legal Authorized Representative of[2] CELSIA energy generation, transmission and distribution company, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the provision of non-confidential information regarding the following activities

MATERIALS, SAFETY AND ENVIRONMENT

- Physic chemical evaluation
- Aging of solid dielectric components
- Fire safety

TRANSFORMERS MANAGEMENT

- Operation
- Maintenance
- Retrofilling

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

Promuevo la diversidad y las opiniones diferentes en mi trabajo
JULIAN CADAVID
Lider Transmisión y Distribución
Teléfono: 6023210000
jcadavid@celsia.com

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

July 05th, 2024
Essen, Germany

Consent Letter from E.ON Group Innovation GmbH

To whom it may concern:

We, the undersigned, **Florian Fecher** and **Rajkiran Kumar**, in our quality as legally authorized representatives of **E.ON Group Innovation GmbH**, commit contributing to the development and implementation of the proposal number **101182948** acronym **RETROTRAFO** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded by providing expert secondments and hosting expert secondments from other project participants to the extent reasonably required and necessary for the project and subject to further alignment, it being understood that no financial compensation and/or travel cost and costs for accommodation will be owed by E.ON Group Innovation GmbH for any secondees hosted.

In doing so, we will contribute to the following:

a) the physical chemical evaluation of the biodegradable or recycled insulating liquid;

b) analysis and results of the aging process; and

c) advanced diagnosis and maintenance of transformers that have undergone retro filling.

We are aware of and agree with the principle that sending and hosting of secondees is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Florian Fecher
Digital unterschrieben von Florian Fecher
Datum: 2024.07.05 09:10:35 +02'00'

Florian Fecher

Head of the Department- Future Lab

Rajkiran Kumar
Digitally signed by Rajkiran Kumar
Date: 2024.07.05 08:56:30 +02'00'

Rajkiran Kumar

Future Lab

STOEN
OPERATOR
powered by e·on

www.stoen.pl
T +48 22 821 31 31
Correspondence address:
Stoen Operator Sp. z o.o.
Piękna 46 street
00-672 Warsaw

Date:
09.07.2024

The letter concern: The document is a commitment from the Legal Authorized Representatives of Stoen Operator Sp. z o.o. to support the RETROTRAFO project (proposal number 101182948) under the HORIZON-MSCA-2023-SE-01 call. It includes a pledge to take necessary steps to send and host secondments for the project's development and implementation, provided the proposal is funded. The authors acknowledge that setting up these provisions is essential for funding and express readiness to provide further information upon request.

I undersigned Leszek Bitner and Tomasz Żuraw, in my quality of Legal Authorized Representative of Stoen Operator Sp. z o. o. Piekna 46 street, 00-672, Warsaw (NIP 525-238-60-94), commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number 101182948 acronym RETROTRAFO submitted within the call HORIZON-MSCA-2023-SE-01 should the proposal be funded.

We will contribute to the

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

LESZEK ANDRZEJ BITNER Elektronicznie podpisany przez LESZEK ANDRZEJ BITNER

PROKURENT
Tomasz Żuraw

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

Del Llano S.A.
le juega limpio
a COLOMBIA

ACEITE VEGETAL PURO
Del Llano
NIT. 800.043.202-8

I undersigned[1] Pedro Miguel Bernal, in my quality of Legal Authorized Representative of[2] Diveg s.a.s., commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym Retro Trafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute supplying the necessary samples of vegetable dielectric oil ADV-1601 and all our knowledge and experience regarding this product, as we are the developer and manufacturer in Colombia of this biodegradable dielectric oil.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Pedro Miguel Bernal
February 2nd/2024

[1] First name and surname
[2] Name of the organisation/faculty/department

Un Aceite Más ROJO...
Para un Futuro MÁS VERDE

Bogotá, Calle 100 No. 14-63 Oficina 901 - Cel.: 315 344 34 57 Tel.: (091) 218 32 39
Villavicencio, Km 8 vía Restrepo - Cel.: 315 315 61 82 Tel.: (098) 681 91 60

Kyutech
Kyushu Institute of Technology

February 7th 2024

Subject: Kyushu Institute of Technology support the project
"Development of knowledge and technology to implement retrofilling in power transformers using biodegradable or recycled fluids and fostering circular economy (RetroTrafo)."

I undersigned **Seiichi Serikawa**, in my quality of Legal Authorized Representative of Department of Electrical and Electronic Engineering, Kyushu Institute of Technology , commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the Horizon Europe Framework (HORIZON) program, and, in the context of the proposed project, we commit to carrying out procedures to:

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

February 8th 2024

Seiichi Serikawa

Seiichi Seikawa, Dean of Faculty of Engineering
Professor
Department of Electrical Engineering and Electronics
KYUSHU INSTITUTE OF TECHNOLOGY
1-1 Sensui - cho,Tobata - ku, Kitakyushu 804 - 8550 JAPAN

http://www.kyutech.ac.jp

Kyushu Institute of Technology

Tanta University
President Office

Support Letter

I undersigned[1] **Prof. Mahmoud Ahmed Zaki Mohamed** in my quality of Legal Authorized Representative of[2] **Tanta University** commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number **SEP-211016712** - acronym **RetroTrafo** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the Horizon Europe Framework (HORIZON) program, and, in the context of the proposed project, we commit to carrying out procedures to:

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Name: **Prof. Mahmoud Ahmed Zaki Mohamed,**
President of Tanta University

date: *17/01/2024,* ***signature***

[1] First name and surname
[2] Name of the organisation/faculty/department

Address: Algeish Street, Tanta, Egypt
Tel: 3317962 & 3313619 Fax: 3302785

العنوان : شارع الجيش – طنطا – جمهورية مصر العربية
تليفون : ٣٣١٧٩٦٢ & ٣٣١٣٦١٩ فاكس : ٣٣٠٢٧٨٥

Web Site: www.tanta.edu.eg & E-mail : president@uny.tanta.edu.eg

UNIVERSIDAD BERNARDO O'HIGGINS

SUPPORT LETTER

Santiago of Chile – 26 January, 2024

I undersigned Claudio Ruff Escobar, in my quality of Legal Authorized Representative of Universidad Bernardo O'Higgins, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will commit to the following actions:

- Ensure compliance with the necessary requirements to receive renowned researchers from partner institutions.
- Facilitate all the indispensable conditions for researchers to execute the suggested activities, including participation in conferences, conducting short courses, carrying out research, strengthening professional networks, and visiting local institutions.
- Provide support by assigning staff from our Faculty of Engineering, Science, and Technology to the beneficiary institutions, in order to carry out the activities designated by the project. In addition, we will make available our infrastructure, including the chemistry laboratory, for the development and physicochemical evaluation of dielectric materials.
- Contribute to the preparation of two scientific publications and participate in six conferences specialized in the field.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

UNIVERSIDAD BERNARDO O'HIGGINS
RECTORÍA

DR. CLAUDIO RUFF ESCOBAR
Rector
Universidad Bernardo O'Higgins

Casa Central – Avenida Viel 1497 Ruta 5 Sur – Santiago | Campus Rondizzoni – General Gana 1702 – Santiago
Mesa Central: (56-2) 2477 4110
www.ubo.cl

MANCHESTER 1824
The University of Manchester

Directorate of Research and Business Engagement Support Services

The University of Manchester
Christie Building
Oxford Road
Manchester M13 9PL

I, the undersigned, Dr Andrew Walsh, in my quality of Legal Authorized Representative of the University of Manchester, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number **101182948** – acronym - **RETROTRAFO** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the execution the 11 PMs of secondments associated with work packages one and two. The indicative plan of secondments from UNIMAN (UK) to MS/AC entities in the RETROTRAFO consortium is 5 Person Months. The indicative plan of secondments from UNIMAN (UK) to Third Country entities in the RETROTRAFO consortium is 6 Person Months.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Dr Andrew Walsh
Director of Research and Business Engagement Services
(Liz.Fay@manchester.ac.uk)

THE UNIVERSITY OF MANCHESTER
OXFORD ROAD, MANCHESTER
M13 9PL
UK

I undersigned Dr. Enrique Mammarella, in my quality of Legal Authorized Representative of Universidad Nacional del Litoral, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number *SEP-211016712* - acronym *RetroTrafo* submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

The staff at *Centro de Investigación de Métodos Computacionales (CIMEC)* has developed models of oil transformers, including reduced models for the thermo-fluid-dynamic analysis of power transformers radiator working in ONAF and ONAN modes, and design and optimization of Vortex Generators as passive devices that enhance the heat exchange in radiators and oil channels. Our institution has also a long history in the operation and development of CFD software in HPC equipment; with a total installed power of 2,400 cores.

We will contribute to the development of computational thermo-fluid-dynamic models in order to compute in-silico the distribution of temperature along the windings of power transformers using biodegradable liquids. In this respect, we will provide our expertise in using the Open Source software Code-Saturne and the computing capabilities of our HPC clusters.

We will contribute to the Horizon Europe Framework (HORIZON) program, and, in the context of the proposed project, we commit to carrying out procedures to:

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium).
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Digitally signed by MAMMARELLA Enrique Jose
Date: 2024.02.01 12:37:58 ART

Dr. Enrique Mammarela
Rector
Universidad Nacional del Litoral
02/02/2024

UNIVERSIDAD NACIONAL DEL LITORAL
Secretaría de planeamiento institucional e internacionalización
Bv. Pellegrini 2750 - S3000ADQ Santa Fe - República Argentina
457/1110 int. 149 - planeamiento-internacionales@unl.edu.ar

Associated with document Ref. Ares(2024)5442585 - 26/07/2024

CONICET

INSTITUTO DE ENERGÍA ELÉCTRICA

I, the undersigned,[1] Marcelo G. Molina, in my quality of Legal Authorized Representative of[2] the Instituto de Energía Eléctrica of the Universidad Nacional de San Juan and CONICET, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the development of asset management models for power transformers; especially, in thermal and aging modelling of power transformers that have been filled with an insulating fluid different from that considered when they were designed. On this regard, the current models developed by our researchers must be adapted for this special case.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Dr. Ing. Marcelo Gustavo Molina
DIRECTOR
Instituto de Energía Eléctrica
Facultad de Ingeniería
UNSJ - CONICET

PhD. Eng. Marcelo Molina,

20/01/2024

[1] First name and surname/
[2] Name of the organisation/faculty/department

Av. Libertador General San Martín 1109 (Oeste)
J5400ARL. San Juan, República Argentina
Tel.: 54 264 4226444 - Fax: 54 264 4210299
ieedir@iee.unsj.edu.ar | www.iee-unsj.org

UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

PEJABAT TIMBALAN NAIB CANSELOR (PENYELIDIKAN DAN INOVASI)
OFFICE OF THE DEPUTY VICE CHANCELLOR (RESEARCH AND INNOVATION)

Dear Sir/Madam,

I undersigned **Profesor Dr. Zamberi Sekawi, Deputy Vice Chancellor (Research and Innovation),** in my quality of Legal Authorized Representative of **Universiti Putra Malaysia,** commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number **RetroTrafo** - acronym **SEP-211016712** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the [*explanation of the activities performed by the associated partner organisations in order to ensure a successful implementation of the project.*

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions.
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded. The provision funding to the Universiti Putra Malaysia should be transferred to institution.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

.....
(Signature)

PROFESOR DR. ZAMBERI SEKAWI
Deputy Vice Chancellor (Research and Inovasi)
Universiti Putra Malaysia
43400 UPM Serdang
Selangor Darul Ehsan

Date: 16 January 2024

Pejabat Timbalan Naib Canselor (Penyelidikan dan Inovasi), Universiti Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia
Pejabat Timbalan Naib Canselor (P&I) 603-9769 1002, Pejabat Pentadbiran TNCPI 603-9769 1608, Pejabat Pengarah, Pusat Pengurusan Penyelidikan (RMC) 603-9769 1610, Pejabat Pengarah, Putra Science Park (PSP) 603-9769 1291
http://www.tncpi.upm.edu.my

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Electrical Engineering and
Computer Science

23 February 2024

Re: RetroTrafo project invitation and support

To Whom It May Concern,

Letter of Support – Project "Development of knowledge and technology to implement retrofilling in power transformers using biodegradable or recycled fluids and fostering circular economy"_HORIZON-MSCA-2023-SE-01

I, undersigned, Prof Michael Brünig, in my capacity as Legal Authorized Representative and Head of School of Electrical Engineering and Computer Science (EECS) at The University of Queensland (UQ), commit to set up all necessary provisions to host the secondments contributing to the development and implementation of the proposal number SEP-211016712 (acronym RetroTrafo) submitted within the call HORIZONMSCA-2023-SE-01 should the proposal be funded as follows:

It is considered that the necessary provisions that EECS will make available to two visiting researchers for a period of one year will consist of technical advice, office space with workstation, and the available research facilities in our Intelligent Condition Monitoring laboratory for the period of our collaboration.

RETROTRAFO project researchers who visit EECS will have their own financial support to cover travel and living expenses during their stay in Brisbane.

The UQ team will contribute to the work that will be developed in WP1, dedicated to study the ageing of the dielectric system.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Regards

Signature .....

Name: Professor Michael Brünig

Position title: Head of School, Electrical Engineering and Computer Science, University of Queensland

The University of Queensland
Brisbane QLD 4072 Australia
T +61 7 3365 3869
F +61 7 3365 8540
E hos-pa@itee.uq.edu.au
W uq.edu.au
ABN: 63 942 912 684
CRICOS PROVIDER NUMBER 00025B

VICERRECTORÍA DE INVESTIGACIÓN INNOVACIÓN Y CREACIÓN
DIRECCIÓN DE INVESTIGACIÓN CIENTÍFICA Y TECNOLÓGICA
DICYT Apoyando a la Comunidad Investigadora

Template of Commitment letter for associated partners

I undersigned[1] Rodrigo Vidal, in my quality of Legal Authorized Representative of[2] Universidad de Santiago de Chile, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number **SEP-211016712** - acronym **RetroTrafo** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the Horizon Europe Framework (HORIZON) program, and, in the context of the proposed project, we commit to carrying out procedures to:

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Rodrigo Vidal Rojas
Rector
Universidad de Santiago de Chile
17/01/2024 15:57:20

Dr. Rodrigo Vidal Rojas
Rector

January 12th, 2024

[1] First name and surname
[2] Name of the organisation/faculty/department

UNIVERSIDAD DE SANTIAGO DE CHILE
Av. Libertador Bernardo O´Higgins nº3363 - Estación Central - Santiago – Chile
www.usach.cl

#SOMOSUSACH

LETTER OF COMMITMENT

I undersigned Monica Pacheco, in my quality of Legal Authorized Representative of the Federico Santa María Technical University, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the Horizon Europe Framework Programme (HORIZON), and, in the context of the proposed project, we commit to carrying out procedures to:

- Facilitate the necessary laboratory spaces so that researchers who stay at our institution can properly carry out their research activities.
- Provide all the necessary conditions for researchers to develop activities such as: conferences, talks, short courses, research, networking, or visits to other laboratories.
- Support the assignment of our academic, Jorge Ardila Rey, to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

MONICA PACHECO
Firmado digitalmente por MONICA PACHECO
Fecha: 2024.01.24 16:52:38 -03'00'

Mónica Jeanette Pacheco Doll

Director Dirección General de Investigación, Innovación y Emprendimiento.

Legal representative

Date : 23 / 01 / 2024 Valparaiso, Chile

Universidad del Valle

8th February 2024

20240208-688-I

To Whom It May Concern

I undersigned Guillermo Murillo Vargas, in my quality of Legal Authorized Representative of **Universidad del Valle (Colombia)**, commit to setting up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number SEP-211016712 - acronym RetroTrafo submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the coordination activities related to the secondments both hosting and sending. Additionally, we will participate, in association with the partners, in the following work packages: Materials, Safety, and Environment (WP1), Design and Manufacturing (WP2), Transformers Management (WP3), Dissemination, Exploitation, and Transfer of Knowledge (WP4), and Project Management (WP5).

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

It is a priority for our University to support our researchers to strengthen and broader international, intersectoral and interdisciplinary collaborative networks that will increase and broaden the research and innovation impact.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Guillermo Murillo Vargas,
President, Universidad del Valle
Date: 9 feb.. 2024

Vo.Bo.
Vicerrectora de Investigaciones

Vo.Bo. Carlos A. Madera
Vicedecano de Investigaciones
Facultad de Ingeniería

Ciudad Universitaria Meléndez – Calle 13 No. 100-00
Correo electrónico: vdip.ingenieria@correounivalle.edu.co
https://www.univalle.edu.co/
Santiago de Cali – Colombia

UNIVERSITY OF WATERLOO

February 15, 2024

Consent Letter from the University of Waterloo

To whom it may concern:

I, the undersigned, Kankar Bhattacharya, in my quality of Legal Authorized Representative of the University of Waterloo, Professor and Department Chair of Electrical and Computer Engineering, commit to set up all necessary provisions to send/host the secondments contributing to the development and implementation of the proposal number **SEP-211016712** (acronym **RetroTrafo)** submitted within the call **HORIZON-MSCA-2023-SE-01** should the proposal be funded.

We will contribute to the Horizon Europe Framework (HORIZON) program, and, in the context of the proposed project, we commit to carrying out procedures to:

- Meet the requirements to host outstanding researchers from the associated institutions (the cost of the stays will be covered by the beneficiaries of the consortium)
- Provide all the necessary conditions for researchers to develop the proposed activities such as: conferences, short courses, research, networking, visits to local institutions...
- Support the assignment of our staff to the beneficiary institutions to carry out the activities proposed by the project.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded.

We are pleased to provide any additional information on our commitment to the project upon your request or the request of the European Commission.

Sincerely,

Kankar Bhattacharya, PhD, P.Eng., FIEEE
Professor and Chair
Department of Electrical and Computer Engineering
kankar.bhattacharya@uwaterloo.ca

PROJECT: Development of knowledge and technology to implement retrofilling in power transformers using biodegradable or recycled fluids and fostering circular economy (RetroTrafo)

519-888-4567 | uwaterloo.ca | 200 UNIVERSITY AVENUE WEST, WATERLOO, ON, CANADA N2L 3G1

WESTERN MICHIGAN UNIVERSITY

College of Engineering and Applied Sciences
Office of the Dean

February 22, 2024

Re: RetroTrafo project invitation and support

To Whom It May Concern:

I, the undersigned, Dr. Steven E. Butt, as Dean of the College of Engineering and Applied Sciences at Western Michigan University (Kalamazoo, Michigan, USA), commit to support all necessary provisions to host the secondments contributing to the development and implementation of the proposal number SEP-211016712 (acronym RetroTrafo) submitted within the call HORIZONMSCA-2023-SE-01 should the proposal be funded as follows.

It is considered that the necessary provisions that WMU will make available to visiting researchers will consist of technical advice, laboratory space, and the necessary research facilities at the WMU Power Lab and WMU InterEnergy Center for the period of our collaboration.

RetroTrafo project researchers who visit WMU will have their own economic support to cover travel and living expenses during their stay in Kalamazoo, Michigan, USA. They will have access to appropriate WMU facilities as visiting research scholars. There is no tuition involved because they will not be taking courses for credit.

We will contribute to the work that will be developed in the WP2, dedicated to the analysis of dielectric and fluid-thermal response changes in a transformer where its cooling fluid has been replaced with another with different characteristics.

I am aware of and agree with the principle that the setting up of such provisions is a precondition for the proposal to be funded within the confines of any possible export control requirements.

We are pleased to provide any additional information on our commitment towards the project upon your request or the request of the European Commission.

Sincerely,

Steven E. Butt, PhD
Professor and Dean

1903 W. Michigan Ave., Kalamazoo, MI 49008-5314
Phone: (269) 276-3253 • Fax: (269) 276-3257 • wmich.edu/engineer
Physical Address: C-242 Floyd Hall – Parkview Campus (4601 Campus Drive, Kalamazoo, MI 49008)

ANNEX 2

ESTIMATED BUDGET FOR THE ACTION

Forms of funding	Estimated EU contribution					
	Estimated eligible unit contributions (per budget category)				Total	Maximum grant amount[1]
	A. Contributions for seconded staff members		B. Institutional contributions			
	A.1 Top - up allowance	A.5 Special needs allowance	B.1 Research, training and networking contribution	B.2 Management and indirect contribution		
	Unit contribution[2]	Unit contribution[2]	Unit contribution[2]	Unit contribution[2]	h = a + e + f + g	i
	a	e	f	g		
1 - UC	250 700.00	0.00	141 700.00	109 000.00	501 400.00	501 400.00
2 - UC3M	126 500.00	0.00	71 500.00	55 000.00	253 000.00	253 000.00
3 - UWB	34 500.00	0.00	19 500.00	15 000.00	69 000.00	69 000.00
4 - UNIZA	18 400.00	0.00	10 400.00	8 000.00	36 800.00	36 800.00
5 - BEST	23 000.00	0.00	13 000.00	10 000.00	46 000.00	46 000.00
6 - SMT	13 800.00	0.00	7 800.00	6 000.00	27 600.00	27 600.00
7 - SUT	64 400.00	0.00	36 400.00	28 000.00	128 800.00	128 800.00
8 - TUKE	29 900.00	0.00	16 900.00	13 000.00	59 800.00	59 800.00
9 - UEF SAV	36 800.00	0.00	20 800.00	16 000.00	73 600.00	73 600.00
10 - BCMATERIALS	32 200.00	0.00	18 200.00	14 000.00	64 400.00	64 400.00
11 - UNL						
12 - UPM						
13 - UBO						
14 - USACH						
15 - UVALLE						
16 - Kyutech						
17 - NYU						
18 - UW						
19 - UTFSM						
20 - UNSJ						
21 - UNIMAN						
22 - TU						
23 - WMU						
24 - UQ						
25 - CELSIA						
26 - Diveg						
27 - STOEN						
28 - EGI						
Σ consortium	630 200.00	0.00	356 200.00	274 000.00	1 260 400.00	1 260 400.00

[1] The 'maximum grant amount' is the maximum grant amount fixed in the grant agreement (on the basis of the sum of the beneficiaries' estimated units).
[2] See Annex 2a 'Additional information on the estimated budget' for the details (units, amount per unit).

ANNEX 2a

ADDITIONAL INFORMATION ON UNIT COSTS AND CONTRIBUTIONS

HE MSCA Doctoral Networks/Post-doctoral Fellowships and HE ERA fellowships

See Additional information on unit costs and contributions (Annex 2a and 2b)

HE MSCA Staff Exchanges

See Additional information on unit costs and contributions (Annex 2a and 2b)

HE MSCA COFUND

See Additional information on unit costs and contributions (Annex 2a and 2b)

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDAD CARLOS III DE MADRID (UC3M), PIC 999899572, established in CALLE MADRID 126, GETAFE (MADRID) 28903, Spain,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Isabel Ballesteros Lopez with ECAS id n00dcu6h signed in the Participant Portal on 01/08/2024 at 19:25:51 (transaction id SigId-38480-7FzGwudckqzgfP0u2u3PQe2slNSWAkmNMhDiRQlROISZcCZqiga68oKhmHzR5vZzzduLUzoHIpvpyFPUxgsjen9G-yntOf97TTHqAX5yfJ7HQNG-DN5Zzxdx0TbDPcx9wOTVDcTQohRlBzHEbIF1jhcbzMOhAqWFcb12jUReAL9dJdtQQ3PbRJrZYfMp9Dv6gNZlbjG). Timestamp by third party at 2024.08.01 19:25:57 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ZAPADOCESKA UNIVERZITA V PLZNI (UWB), PIC 999843894, established in UNIVERZITNI 8, PILSEN 301 00, Czechia,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Miroslav Lávička with ECAS id n00cbent signed in the Participant Portal on 09/08/2024 at 12:11:15 (transaction id SigId-99617-3lfvFg HKCXwSpcFpapzJkhO0B8SVyzizL62pNB0Ta0e5ByRBXcJhQUh8kgY4T VYlnI2CgbXxV4cKPxMTuTO78EG-yntOf97TTHqAX5yfJ7HQNG-LjseHo vThSXwtiJ3BFx3vzqzXwh9DxaawaqBKPOzTGGmZmDJ095DWUPeulJz tpieSaXUeqpSabRbOQydv55n5xO). Timestamp by third party at 2024.08.09 12:11:21 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ZILINSKA UNIVERZITA V ZILINE (UNIZA), PIC 999969606, established in UNIVERZITNA 8215/1, ZILINA 010 26, Slovakia,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Jan CELKO with ECAS id ncoretat signed in the Participant Portal on 12/08/2024 at 15:08:39 (transaction id SigId-113333-OluhiY3DqXYz f7DuYooxPK8UzhHU6D6uuQ9P1BAlPkoCwzZ5Ut8ajUpO8dWCY07s GnchmlX1Wqx4cdq8EcRPuO0-yntOf97TTHqAX5yfJ7HQNG-FziMi5x 1dxOaYPbfLNZEkfslHXnvzZEh3BHrG5HXCSWuuxgTf0Wu0wzcDw8r YLsWeqHVvcHmSV0Hclwf1pzNnOG). Timestamp by third party at 2024.08.12 15:08:46 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

BALIKESIR ELEKTROMEKANIK SANAYI TESISLERI ANONIM SIRKETI (BEST), PIC 906675200, established in GUMUSCESME MAHALLESI 252 SOKAK 1-13/A ALTIEYLUL, BALIKESIR 10100, Türkiye,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Ramazan Altay with ECAS id n0024gw7 signed in the Participant Portal on 03/08/2024 at 17:35:23 (transaction id SigId-50193-F0FKY OInzfvielDLSfqdCBdzl61bTafzUNRWMgubsgIk4Ov7ZPEFoOjzzc627 5N7cR4a6kzVMyPovsBztzbzQGznG-yntOf97TTHqAX5yfJ7HQNG-TG EE6iNt6XH2xWVlLzUdKldcXBbzvCbr1rvag9NU7qFDMy5wfjDCTW3K ZukIKdfQNjYuy5ErtsGzpEFHdjLnuzy). Timestamp by third party at 2024.08.03 17:35:28 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SEA MARCONI TECHNOLOGIES DI VANDERTUMIATTI SAS (SMT), PIC 986834060, established in VIA PRINCIPI D ACAJA 11, TORINO 10143, Italy,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Vander TUMIATTI with ECAS id ntumiava signed in the Participant Portal on 26/08/2024 at 10:16:41 (transaction id SigId-12339-pLOfdEp1uNvfyuEyfaC74jd9YiQUU1RKNsb6VJimujatsXZKZEBhk2jBzGzPbL2MnTShF5J6LhK0a61gzjILSp0-jpJZscgsw0K3AqgQ9TY66G-0u9tE2mMNHHfgDYDOmsFm7Rq0yCJxJ6GPSE7UPi7fVzW7OfIPaYXunmzRuiYvmvcb1Hy0uIkPyRfSkN9ENwiS3). Timestamp by third party at 2024.08.26 10:16:48 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

POLITECHNIKA SLASKA (SUT), PIC 999899087, established in AKADEMICKA STREET 2A, GLIWICE 44-100, Poland,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Jacek SMOLKA with ECAS id nsmolkja signed in the Participant Portal on 02/08/2024 at 08:38:45 (transaction id SigId-39898-bwt5GIBozIsJH5HCoP1gmHQ0zkhIkyfkskIUgu6OE8oPpVj2NA5BsXE4BIWAJJshtiwtIfqeg6g1oJhCKekzydG-yntOf97TTHqAX5yfJ7HQNG-YykoJKL9TrQu4cYYmk2G3AV8XrYtWkYLEtC5IYO9qHcohbxQ353APIDiAEWtcVorNFBgzpUMPelC6qzafZ2XEn). Timestamp by third party at 2024.08.02 08:38:51 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TECHNICKA UNIVERZITA V KOSICIACH (TUKE), PIC 999839238, established in LETNA 9, KOSICE 042 00, Slovakia,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Peter MESÁROŠ with ECAS id nmesarpe signed in the Participant Portal on 05/08/2024 at 12:37:38 (transaction id SigId-56047-4UPsyMfhfrpBqxhTD8fa96bBev2zGjmzTClwboYofqkiS8mVXqu7iQKPeXqsoc0KkdGYgKq0tXO27HF4RYMwqe-yntOf97TTHqAX5yfJ7HQNG-dDRGIGwxTp77sUcgDwdPbeBFsyapyiCGDYws3zXwwedupyQ6sSoVfF8Cug37zSOwBGzPen2pVHLyhJkfRtGAHB0). Timestamp by third party at 2024.08.05 12:37:43 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

USTAV EXPERIMENTALNEJ FYZIKY SLOVENSKEJ AKADEMIE VIED (UEF SAV), PIC 999604983, established in WATSONOVA 47, KOSICE 04001, Slovakia,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Zuzana GAZOVA with ECAS id ngazovzu signed in the Participant Portal on 02/08/2024 at 13:26:26 (transaction id SigId-45043-QywwedNmLgw8uDRyznJdfBlNCAK5LVkOzQ1bAlE6X2oDg1J9IzrbnMRDShEiIoVYH1D03Xzln3bS5zX3cMcXC75-yntOf97TTHqAX5yfJ7HQNG-lkazqeUnfw7YAdMwlwaulpizy6HVDRNA1KaKnMWDolmWsJLda4UkDzzfmumCzZBaVzmMwnzs6obYOBSkIobfNktK). Timestamp by third party at 2024.08.02 13:26:31 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES (BCMATERIALS), PIC 928273511, established in BARRIO SARIENA S/N, LEIOA 48940, Spain,

hereby agrees

to become beneficiary

in Agreement No 101182948 — RETROTRAFO ('the Agreement')

between UNIVERSIDAD DE CANTABRIA (UC) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Iñaki Serna with ECAS id n0073vjr signed in the Participant Portal on 02/08/2024 at 00:19:10 (transaction id SigId-38967-wVpL1rVVkcK1qj1twTmSWgLWtR3Xsa8gJXutbriIAWIlSXAUfTzP7QK8nVejjeygIJQEyh3u4lpx6cgMF5MBTG-yntOf97TTHqAX5yfJ7HQNG-zgacG2ffFJffvMWXMWZ5FZpUjWojSlC9wGHrY7g59mgQbXiozjcLcSZxpqsUrfFsQdftP7RT1zvmTfSmaXJ3r2W). Timestamp by third party at 2024.08.02 00:19:16 CEST

FINANCIAL STATEMENT FOR [PARTICIPANT NAME] FOR REPORTING PERIOD [NUMBER]

	EU contribution								
	Eligible unit contributions (per budget category)								**Requested EU contribution**
	[OPTION for all MSCA ToA except COFUND: **A. . Contributions for** *[* **recruited researchers***]* *[* **seconded staff members***]][OPTION for COFUND:* **A. COFUND contributions***]*					*[OPTION for all MSCA ToA except COFUND:* **B. Institutional contributions***]*		**Total**	
	[OPTION for DN and PF : A.1 Living allowance*]* *[OPTION for SE:* A.1 Top - up allowance*]* *[OPTION for COFUND:* A.1 COFUND allowance*]*	*[OPTION for DN and PF:* A.2 Mobility allowance*]*	*[OPTION for DN and PF:* A.3 Family allowance*]*	*[OPTION for all MSCA ToA except SE:* A.4 Long-term leave allowance*]*	A.5 Special needs allowance	*[* B.1 Research, training and networking contribution*]*	*[* B.2 Management and indirect contribution*]*		
Forms of funding	Unit contribution[1]	*[* Unit contribution[1] *]*	*[* Unit contribution[1] *]*	*[* Unit contribution[1] *]*	Unit contribution[1]	*[* Unit contribution[1] *]*	*[* Unit contribution[1] *]*	h = a *[* + b *][* + c*]* *[* + d*]* + e *[* + f*]* *[* + g*]*	i
	a	*[* b*]*	*[* c*]*	*[* d*]*	e	*[* f*]*	*[* g*]*		
XX – [short name beneficiary/affiliated entity]									

The beneficiary/affiliated entity hereby confirms that:

The information provided is complete, reliable and true.

The unit contributions declared are eligible (see Article 6).

The contributions can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 19, 20 and 25).

[1] See Annex 2a 'Additional information on the estimated budget' for the details (units, amount per unit).

ANNEX 5

SPECIFIC RULES

CONFIDENTIALITY AND SECURITY (— ARTICLE 13)

Sensitive information with security recommendation

Sensitive information with a security recommendation must comply with the additional requirements imposed by the granting authority.

Before starting the action tasks concerned, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task. The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary.

For requirements restricting disclosure or dissemination, the information must be handled in accordance with the recommendation and may be disclosed or disseminated only after written approval from the granting authority.

EU classified information

If EU classified information is used or generated by the action, it must be treated in accordance with the security classification guide (SCG) and security aspect letter (SAL) set out in Annex 1 and Decision 2015/444[1] and its implementing rules — until it is declassified.

Deliverables which contain EU classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving EU classified information may be subcontracted only with prior explicit written approval from the granting authority and only to entities established in an EU Member State or in a non-EU country with a security of information agreement with the EU (or an administrative arrangement with the Commission).

EU classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS (— ARTICLE 14)

Ethics and research integrity

The beneficiaries must carry out the action in compliance with:

- ethical principles (including the highest standards of research integrity)

[1] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

and

- applicable EU, international and national law, including the EU Charter of Fundamental Rights and the European Convention for the Protection of Human Rights and Fundamental Freedoms and its Supplementary Protocols.

No funding can be granted, within or outside the EU, for activities that are prohibited in all Member States. No funding can be granted in a Member State for an activity which is forbidden in that Member State.

The beneficiaries must pay particular attention 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 persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- aim at human cloning for reproductive purposes
- intend to modify the genetic heritage of human beings which could make such modifications heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed)
- intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer, or
- lead to the destruction of human embryos (for example, for obtaining stem cells).

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the granting authority.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity[2].

This implies compliance with the following principles:

- reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources
- honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way

[2] European Code of Conduct for Research Integrity of ALLEA (All European Academies).

- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment

- accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the Code.

Activities raising ethical issues must comply with the additional requirements formulated by the ethics panels (including after checks, reviews or audits; see Article 25).

Before starting an action task raising ethical issues, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task, notably from any (national or local) ethics committee or other bodies such as data protection authorities.

The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary, which shows that the documents cover the action tasks in question and includes the conclusions of the committee or authority concerned (if any).

VALUES (— ARTICLE 14)

Gender mainstreaming

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action and, where applicable, in line with the gender equality plan. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE (— ARTICLE 16)

Definitions

Access rights — Rights to use results or background.

Dissemination — The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.

Exploit(ation) — The use of results in further research and innovation activities other than those covered by the action concerned, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

Fair and reasonable conditions — Appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

FAIR principles — ‘findability’, ‘accessibility’, ‘interoperability’ and ‘reusability’.

Open access — Online access to research outputs provided free of charge to the end-user.

Open science — An approach to the scientific process based on open cooperative work, tools and diffusing knowledge.

Research data management — The process within the research lifecycle that includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing.

Research outputs — Results to which access can be given in the form of scientific publications, data or other engineered results and processes such as software, algorithms, protocols, models, workflows and electronic notebooks.

Scope of the obligations

For this section, references to ‘beneficiary’ or ‘beneficiaries’ do not include affiliated entities (if any).

Agreement on background

The beneficiaries must identify in a written agreement the background as needed for implementing the action or for exploiting its results.

Where the call conditions restrict control due to strategic interests reasons, background that is subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions and that impact the exploitation of the results (i.e. would make the exploitation of the results subject to control or restrictions) must not be used and must be explicitly excluded from it in the agreement on background — unless otherwise agreed with the granting authority.

Ownership of results

Results are owned by the beneficiaries that generate them.

However, two or more beneficiaries own results jointly if:

- they have jointly generated them and
- it is not possible to:
    - establish the respective contribution of each beneficiary, or
    - separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree — in writing — on the allocation and terms of exercise of their joint ownership (‘**joint ownership agreement**’), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement or consortium agreement, each joint owner may grant non-exclusive licences to third parties to exploit the jointly-owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

The joint owners may agree — in writing — to apply another regime than joint ownership.

If third parties (including employees and other personnel) may claim rights to the results, the beneficiary concerned must ensure that those rights can be exercised in a manner compatible with its obligations under the Agreement.

The beneficiaries must indicate the owner(s) of the results (results ownership list) in the final periodic report.

Protection of results

Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests.

Exploitation of results

Beneficiaries which have received funding under the grant must — up to four years after the end of the action (see Data Sheet, Point 1) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must (unless otherwise agreed in writing with the granting authority) use the Horizon Results Platform to find interested parties to exploit the results.

If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement (see Article 17) in (information related to) the standard.

Additional exploitation obligations

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action (see Data Sheet, Point 1).

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at

fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Additional information obligation relating to standards

Where the call conditions impose additional information obligations relating to possible standardisation, the beneficiaries must — up to four years after the end of the action (see Data Sheet, Point 1) — inform the granting authority, if the results could reasonably be expected to contribute to European or international standards.

Transfer and licensing of results

Transfer of ownership

The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licences

The beneficiaries may grant licences to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations.

Exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights.

Granting authority right to object to transfers or licensing — Horizon Europe actions

Where the call conditions in Horizon Europe actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated with Horizon Europe, and

- the granting authority considers that the transfer or licence is not in line with EU interests.

Beneficiaries that intend to transfer ownership or grant an exclusive licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations.

The granting authority may request additional information.

If the granting authority decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Limitations to transfers and licensing due to strategic assets, interests, autonomy or security reasons of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security reasons, the beneficiaries may not transfer ownership of their results or grant licences to third parties which are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless they have requested and received prior approval by the granting authority.

The request must:

- identify the specific results concerned
- describe in detail the new owner and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or license on the strategic assets, interests, autonomy or security of the EU and its Member States.

The granting authority may request additional information.

Access rights to results and background

Exercise of access rights — Waiving of access rights — No sub-licensing

Requests to exercise access rights and the waiver of access rights must be in writing.

Unless agreed otherwise in writing with the beneficiary granting access, access rights do not include the right to sub-license.

If a beneficiary is no longer involved in the action, this does not affect its obligations to grant access.

If a beneficiary defaults on its obligations, the beneficiaries may agree that that beneficiary no longer has access rights.

Access rights for implementing the action

The beneficiaries must grant each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- informed the other beneficiaries that access to its background is subject to restrictions, or
- agreed with the other beneficiaries that access would not be on a royalty-free basis.

The beneficiaries must grant each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

Access rights for exploiting the results

The beneficiaries must grant each other access — under fair and reasonable conditions — to results needed for exploiting their results.

The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for entities under the same control

Unless agreed otherwise in writing by the beneficiaries, access to results and, subject to the restrictions referred to above (if any), background must also be granted — under fair and reasonable conditions — to entities that:

- are established in an EU Member State or Horizon Europe associated country
- are under the direct or indirect control of another beneficiary, or under the same direct or indirect control as that beneficiary, or directly or indirectly controlling that beneficiary and

- need the access to exploit the results of that beneficiary.

Unless agreed otherwise in writing, such requests for access must be made by the entity directly to the beneficiary concerned.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for the granting authority, EU institutions, bodies, offices or agencies and national authorities to results for policy purposes — Horizon Europe actions

In Horizon Europe actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, EU institutions, bodies, offices or agencies for developing, implementing and monitoring EU policies or programmes. Such access rights do not extend to beneficiaries' background.

Such access rights are limited to non-commercial and non-competitive use.

For actions under the cluster 'Civil Security for Society', such access rights also extend to national authorities of EU Member States for developing, implementing and monitoring their policies or programmes in this area. In this case, access is subject to a bilateral agreement to define specific conditions ensuring that:

- the access rights will be used only for the intended purpose and
- appropriate confidentiality obligations are in place.

Moreover, the requesting national authority or EU institution, body, office or agency (including the granting authority) must inform all other national authorities of such a request.

Additional access rights

Where the call conditions impose additional access rights, the beneficiaries must comply with them.

COMMUNICATION, DISSEMINATION, OPEN SCIENCE AND VISIBILITY (— ARTICLE 17)

Dissemination

Dissemination of results

The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests.

Additional dissemination obligations

Where the call conditions impose additional dissemination obligations, the beneficiaries must also comply with those.

Open Science

Open science: open access to scientific publications

The beneficiaries must ensure open access to peer-reviewed scientific publications relating to their results. In particular, they must ensure that:

- at the latest at the time of publication, a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication, is deposited in a trusted repository for scientific publications

- immediate open access is provided to the deposited publication via the repository, under the latest available version of the Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights; for monographs and other long-text formats, the licence may exclude commercial uses and derivative works (e.g. CC BY-NC, CC BY-ND) and

- information is given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication.

Beneficiaries (or authors) must retain sufficient intellectual property rights to comply with the open access requirements.

Metadata of deposited publications must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent, in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: publication (author(s), title, date of publication, publication venue); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication.

Open science: research data management

The beneficiaries must manage the digital research data generated in the action ('data') responsibly, in line with the FAIR principles and by taking all of the following actions:

- establish a data management plan ('DMP') (and regularly update it)

- as soon as possible and within the deadlines set out in the DMP, deposit the data in a trusted repository; if required in the call conditions, this repository must be federated in the EOSC in compliance with EOSC requirements

- as soon as possible and within the deadlines set out in the DMP, ensure open access — via the repository — to the deposited data, under the latest available version of the Creative Commons Attribution International Public License (CC BY) or Creative Commons Public Domain Dedication (CC 0) or a licence with equivalent rights,

following the principle 'as open as possible as closed as necessary', unless providing open access would in particular:

- be against the beneficiary's legitimate interests, including regarding commercial exploitation, or
- be contrary to any other constraints, in particular the EU competitive interests or the beneficiary's obligations under this Agreement; if open access is not provided (to some or all data), this must be justified in the DMP

- provide information via the repository about any research output or any other tools and instruments needed to re-use or validate the data.

Metadata of deposited data must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s), venue and embargo); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for related publications and other research outputs.

Open science: additional practices

Where the call conditions impose additional obligations regarding open science practices, the beneficiaries must also comply with those.

Where the call conditions impose additional obligations regarding the validation of scientific publications, the beneficiaries must provide (digital or physical) access to data or other results needed for validation of the conclusions of scientific publications, to the extent that their legitimate interests or constraints are safeguarded (and unless they already provided the (open) access at publication).

Where the call conditions impose additional open science obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) immediately deposit any research output in a repository and provide open access to it under a CC BY licence, a Public Domain Dedication (CC 0) or equivalent. As an exception, if the access would be against the beneficiaries' legitimate interests, the beneficiaries must grant non-exclusive licenses — under fair and reasonable conditions — to legal entities that need the research output to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Plan for the exploitation and dissemination of results including communication activities

Unless excluded by the call conditions, the beneficiaries must provide and regularly update a plan for the exploitation and dissemination of results including communication activities.

SPECIFIC RULES FOR CARRYING OUT THE ACTION (— ARTICLE 18)

Implementation in case of restrictions due to strategic assets, interests, autonomy or security of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security, the beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners, subcontractors or recipients of financial support to third parties are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless otherwise agreed with the granting authority.

The beneficiaries must moreover ensure that any cooperation with entities established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) does not affect the strategic assets, interests, autonomy or security of the EU and its Member States.

Specific rules for MSCA actions

When implementing MSCA Doctoral Networks (DN), Postdoctoral Fellowships (PF) and COFUND actions, the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[3] and ensure that the researchers and all participants involved in the action are aware of them

- ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position

- ensure that the employment contract, other direct contract or fixed-amount-fellowship agreement (see Article 6) specifies:

    - the name of the supervisor(s) for the research training activities

    - the starting date and duration of the research training activities

    - the monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid)

    - the obligation of the researcher to work exclusively for the action, unless part-time for professional reasons is allowed and has been approved (and for MSCA-DN and MSCA-PF: not to receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiary or other entities mentioned in Annex 1)

    - the working pattern of the researcher

    - the arrangements related to the intellectual property rights (during implementation of the action and afterwards), in particular full access — on

[3] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

a royalty-free basis — for the researcher to background and results needed for their activities under the action

- the obligation of the researcher to inform as soon as possible about events or circumstances likely to affect the implementation of the action or the compliance with requirements under the Agreement (see Article 19)
- the obligation of the researcher to maintain confidentiality (see Article 13)
- the obligation of the researcher to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Articles 17)
- where set out in the call conditions, the obligation of the researcher to carry out a mandatory return period of 12 months

- assist the researchers in the administrative procedures related to the recruitment
- inform the researchers about:
  - the description, conditions, location and timetable for the implementation of the research training activities
  - the rights and obligations toward the researchers under this Agreement
  - the obligation of the researchers to complete and submit — at the end of the research training activities — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the granting authority
- ensure full access — on a royalty-free basis — for the researchers to background and results needed for their activities under the action
- ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the researchers are adequately supervised and receive appropriate career guidance
- ensure that personalised career development plans are established, support their implementation and update in view of the needs of the researchers
- ensure an appropriate exposure to the non-academic sector (if applicable)
- respect the maximum limit for secondments set out in the call conditions
- respect the conditions for the outgoing and return phases set out in the call conditions (if any)
- ensure that the researchers are informed that they are ‘Marie Skłodowska-Curie fellows’
- for MSCA-DN and MSCA-COFUND:

- advertise and publish vacancies internationally, including on the web-sites requested by the granting authority, indicating the gross salary (not including employer's social contributions) to be offered to the researcher
- recruit the researchers, following an open, transparent, merit-based, impartial and equitable recruitment procedure (for postdoctoral programmes in MSCA-COFUND: with regular selection rounds and international peer review), on the basis of:
  - their scientific skills and the relevance of their research experience
  - the impact of the proposed training on the researcher's career
  - a fair gender representation (by promoting genuine equal access opportunities throughout the recruitment process)

  The selection committees must bring together diverse expertise, have an adequate gender balance and include members from different countries and with relevant experience to assess the candidates.
- ensure that no conflict of interest exists in or arises from the recruitment

- for MSCA-DN and MSCA-PF:
  - ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entities mentioned in Annex 1)
  - host the researchers at their premises (or at the premises of other participants in the action)
- for MSCA-COFUND where doctoral or post-doctoral programmes are implemented as financial support to third parties through implementing partners:
  - ensure that the implementing partners comply with the same standards and procedures for implementing the research training activities, including the recruitment and working conditions for researchers, the specific rules for MSCA-COFUND actions and the specific rules on ethics and research integrity set out in Annex 5
  - implement effective monitoring and oversight arrangements towards the implementing partners, covering all aspects relating to the action
  - ensure effective and reliable reporting by the implementing partners, covering the activities implemented, information on indicators, as well as the legality and regularity of the expenditure claimed
  - ensure that the implementing partners provide that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the final recipients.

When implementing Horizon Europe MSCA Staff Exchanges (MSCA-SE), the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[4] and ensure that the seconded staff and all participants involved in the action are aware of them
- ensure that the seconded staff enjoys at the place of the implementation at least the same standards and working conditions as those applicable to local staff holding a similar position
- assist the seconded staff with the administrative procedures related to their secondment
- inform the seconded staff about:
  - the description, conditions, location and timetable for the implementation of the secondment
  - the rights and obligations of the beneficiary toward the seconded staff under this Agreement
  - the obligation of the seconded staff to complete and submit — at the end of the secondment — the evaluation questionnaire and — two years later — the follow-up questionnaire provided by the granting authority
  - the arrangements related to the intellectual property rights between the beneficiary and the seconded staff (during the secondment and afterwards), in particular full access — on a royalty-free basis — for the staff to background and results needed for their activities under the action
  - the obligation of the seconded staff to maintain confidentiality (see Article 13)
  - the obligation of the seconded staff to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Article 17)
- ensure that the seconded staff do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the seconded staff are adequately mentored
- ensure that the rights and obligations of the seconded staff remain unchanged during the secondment
- ensure full access — on a royalty-free basis — for the staff to background and results needed for their activities under the action

[4] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- if appropriate, ensure that seconded staff are reintegrated after the secondment
- ensure that the seconded staff are covered by an adequate medical insurance scheme
- ensure that the seconded staff have the relevant expertise for the action
- use the top-up allowance (see Article 6) to contribute to the subsistence, accommodation and travel of the seconded staff.

Specific rules for ERA Fellowship actions

When implementing ERA Fellowships, the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[5] and ensure that the researchers and all participants involved in the action are aware of them
- ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position
- ensure that the employment contract, other direct contract or fixed-amount-fellowship agreement (see Article 6) specifies:
    - the name of the supervisor(s) for the research training activities
    - the starting date and duration of the research training activities
    - the monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid)
    - the obligation of the researcher to work exclusively for the action, unless part-time for professional reasons is allowed and has been approved (and not to receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiary or other entities mentioned in Annex 1)
    - the working pattern of the researcher
    - the arrangements related to the intellectual property rights (during implementation of the action and afterwards), in particular full access — on a royalty-free basis — for the researcher to background and results needed for their activities under the action

[5] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

    - the obligation of the researcher to inform as soon as possible about events or circumstances likely to affect the implementation of the action or the compliance with requirements under the Agreement (see Article 19)
    - the obligation of the researcher to maintain confidentiality (see Article 13)
    - the obligation of the researcher to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Articles 17)
    - where set out in the call conditions, the obligation of the researcher to carry out a mandatory return period of 12 months
- assist the researchers in the administrative procedures related to the recruitment
- inform the researchers about:
    - the description, conditions, location and timetable for the implementation of the research training activities
    - the rights and obligations toward the researchers under this Agreement
    - the obligation of the researchers to complete and submit — at the end of the research training activities — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the granting authority
- ensure full access — on a royalty-free basis — for the researchers to background and results needed for their activities under the action
- ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the researchers are adequately supervised and receive appropriate career guidance
- ensure that personalised career development plans are established, support their implementation and update in view of the needs of the researchers
- ensure an appropriate exposure to the non-academic sector (if applicable)
- respect the maximum limit for secondments set out in the call conditions
- respect the conditions for the outgoing and return phases set out in the call conditions (if any)
- ensure that the researchers are informed that they are ‘ERA fellows’
- ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entities mentioned in Annex 1)

- host the researchers at their premises (or at the premises of other participants in the action)

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