

**EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)**

REA.C – Future Society
C.4 – Reforming European R&I and Research Infrastructures

GRANT AGREEMENT**Project 101132182 — CACTUS****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':

COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA), PIC 999992401, established in RUE LEBLANC 25, PARIS 15 75015, France,

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

2. **EUROPEAN SYNCHROTRON RADIATION FACILITY (ESRF)**, PIC 999484121, established in 71 AVENUE DES MARTYRS, GRENOBLE 38000, France,

3. **INSTITUT MAX VON LAUE - PAUL LANGEVIN (ILL)**, PIC 999933522, established in 71 AVENUE DES MARTYRS, GRENOBLE 38000, France,

4. **ACCADEMIA EUROPEA DI BOLZANO (Eurac Research)**, PIC 999887253, established in VIALE DRUSO 1, BOLZANO 39100, Italy,

5. **FUNDACION TECNALIA RESEARCH & INNOVATION (TECNALIA)**, PIC 999604110, established in PARQUE CIENTIFICO Y TECNOLOGICO DE GIPUZKOA, PASEO MIKELETEGI 2, DONOSTIA-SAN SEBASTIAN (GIPUZKOA) 20009, Spain,

6. **ICARES CONSULTING (BECQUEREL)**, PIC 928696916, established in VIEUX CHEMIN DE L'HELPE 148, RIXENSART 1332, Belgium,

7. **CORPORACION ATAMOS TEC (ATAMOSTEC)**, PIC 883000119, established in URIBE 636 OFFICE 302, ANTOFAGASTA 1271616, Chile,

8. EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER (EU-SOLARIS ERIC), PIC 883665733, established in CARRETERA A SENES KM 4, Tabernas 04200, Spain,

9. UNIVERSIDAD NACIONAL DE COLOMBIA (UNC), PIC 999878814, established in CARREA 45 26-85 EDIFICIO URIEL GUTIERREZ QUINTO PI CIUDAD UNIVERSITARIA, BOGOTA 111321, Colombia,

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 action¹

Annex 2 Estimated budget for the action

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

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DATA SHEET**1. General data**

Project summary:

Project summary
73% of the global CO2 emissions are generated by the energy sector (including transport and buildings). Electrification, combined with power generation using low carbon, renewable energy sources represent a viable path to tackle climate change. In this context, solar power represents today, not only the cheapest energy source, but also the quickest to deploy. Solar power installations, particularly PV have been growing exponentially, a trend which is expected to continue especially considering the fluctuating and volatile gas and oil markets. In an energy system, where solar photovoltaic power will represent the major energy source (potentially up to 69% of the global energy supply by 2050), the need to understand, improve and forecast the operations of PV plants becomes critical for the security and safety of the society. CACTUS proposes to improve the research infrastructure (RI) and its portfolio of services for an enhanced solar PV performance, particularly adapted for various climate conditions (such as tropical, desert, temperate), considering the whole lifetime of PV projects, from design, installation, operations, decommissioning and End of Life. This will be achieved by linking outdoor and indoor measurements with physical parameters based on material analysis, improving algorithms for O&M, developing common data treatment procedures, assessing sustainability related aspects, while enhancing bi-regional scientific cooperation (EU-LATAM) in the renewable energy sector.

Keywords: not defined

Project number: 101132182

Project name: Enhanced Solar PV performance through improved research infrastructure for adapted climate conditions

Project acronym: CACTUS

Call: HORIZON-INFRA-2023-DEV-01

Topic: HORIZON-INFRA-2023-DEV-01-06

Type of action: HORIZON Coordination and Support Actions

Granting authority: European Research Executive Agency

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

Project starting date: fixed date: 1 December 2023

Project end date: 30 November 2025

Project duration: 24 months

Consortium agreement: Yes

2. Participants**List of participants:**

N°	Role	Short name	Legal name	Ctry	PIC	Max grant amount
1	COO	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	999992401	375 389.65
2	BEN	ESRF	EUROPEAN SYNCHROTRON RADIATION FACILITY	FR	999484121	60 187.50
3	BEN	ILL	INSTITUT MAX VON LAUE - PAUL LANGEVIN	FR	999933522	80 575.00
4	BEN	Eurac Research	ACCADEMIA EUROPEA DI BOLZANO	IT	999887253	162 500.00
5	BEN	TECNALIA	FUNDACION TECNALIA RESEARCH & INNOVATION	ES	999604110	156 878.75
6	BEN	BECQUEREL	ICARES CONSULTING	BE	928696916	167 343.75
7	BEN	ATAMOSTEC	CORPORACION ATAMOS TEC	CL	883000119	215 875.00

N°	Role	Short name	Legal name	Ctry	PIC	Max grant amount
8	BEN	EU-SOLARIS ERIC	EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER	ES	883665733	159 875.00
9	BEN	UNC	UNIVERSIDAD NACIONAL DE COLOMBIA	CO	999878814	117 312.50
Total						1 495 937.15

Coordinator:

- COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA)

3. Grant**Maximum grant amount, total estimated eligible costs and contributions and funding rate:**

Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
1 495 937.15	1 495 937.15

Grant form: Lump Sum**Grant mode:** Action grant**Budget categories/activity types:** Lump sum contributions**Cost eligibility options:** n/a**Budget flexibility:** No**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
					Final payment	90 days from receiving periodic report
1	1	24	Periodic report	60 days after end of reporting period		

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	1 196 749.72

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (74 796.86), 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 conditions (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:

FR7630004008180002121622127

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 2018/1046⁴ 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.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371⁵ and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995⁶, 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 2988/95⁷.

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 **101132182 — CACTUS** ('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 grant⁸ which takes the form of a lump sum grant for the completion of work packages.

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 (lump sum breakdown) is set out in Annex 2.

It contains the estimated eligible contributions for the action (lump sum contributions), broken down by participant and work package.

Annex 2 also shows the types of contributions (forms of funding)⁹ to be used for each work package.

5.5 Budget flexibility

Budget flexibility does not apply; changes to the estimated budget (lump sum breakdown) always require an amendment (see Article 39).

Amendments for transfers between *work packages* are moreover possible only if:

- the work packages concerned are not already completed (and declared in a financial statement) and
- the transfers are justified by the technical implementation of the action.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE CONTRIBUTIONS

6.1 and 6.2 General and specific eligibility conditions

Lump sum contributions are eligible ('eligible contributions'), if:

- (a) they are set out in Annex 2 and
- (b) the work packages are completed and the work is properly implemented by the beneficiaries and/or the results are achieved, in accordance with Annex 1 and during in the period set out in Article 4 (with the exception of work/results relating to the submission of the final periodic report, which may be achieved afterwards; see Article 21)

They will be calculated on the basis of the amounts set out in Annex 2.

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.

6.3 Ineligible contributions

‘Ineligible contributions’ are:

- (a) lump sum contributions that do not comply with the conditions set out above (see Article 6.1 and 6.2)
- (b) lump sum contributions 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
- (c) other:
 - (i) country restrictions for eligible costs: not applicable.

6.4 Consequences of non-compliance

If a beneficiary declares lump sum 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. Lump sum 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): not applicable
 - 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’¹⁰ (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:

- 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

Not applicable

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 lump sum contributions) and their costs are considered entirely covered by the lump sum contributions paid to the beneficiaries.

¹⁰ 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 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 lump sum contributions for implementing the work packages (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: use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC¹¹
- for the controls under Article 25: 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.).

¹¹ 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).

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).

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 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 2015/444¹² 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

¹² 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).

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

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 2018/1725¹³.

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 2016/679¹⁴).

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.

¹³ 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).

¹⁴ 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).

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

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



Funded by the
European Union



Co-funded by the
European Union



Funded by the
European Union



Co-funded by the
European Union

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 lump sum 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 (proper implementation of the work and/or achievement of the results as described in Annex 1) in line with the accepted standards in the respective field (if any); 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, lump sum 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 statement (consolidated statement for the consortium)
- the explanation on the use of resources (or detailed cost reporting table): not applicable
- the certificates on the financial statements (CFS): not applicable.

The **financial statement** must contain the lump sum contributions indicated in Annex 2, for the work packages that were completed during the reporting period.

For the last reporting period, the beneficiaries may exceptionally also declare partial lump sum

contributions for work packages that were not completed (e.g. due to force majeure or technical impossibility).

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

By signing the financial statement (directly in the Portal Periodic Reporting tool), the coordinator confirms (on behalf of the consortium) that:

- the information provided is complete, reliable and true
- the lump sum contributions declared are eligible (in particular, the work packages have been completed, that the work has been properly implemented and/or the results were achieved in accordance with Annex 1; see Article 6)
- the proper implementation and/or achievement 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).

In case of recoveries (see Article 22), beneficiaries will be held responsible also for the lump sum contributions declared for their affiliated entities (if any).

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

In case of beneficiary termination, the granting authority will determine the provisional amount due for the beneficiary concerned.

This will be done on the basis of work packages already completed in previous interim payments. Payments for ongoing/not yet completed work packages which the beneficiary was working on before termination (if any) will therefore be made only later on, with the next interim or final payments when those work packages have been completed.

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, on the basis of the beneficiary’s lump sum contributions for the work packages which were approved in previous interim payments.

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:

$$\begin{aligned} & \{\text{total accepted EU contribution for the beneficiary} \\ & \text{minus} \\ & \{\text{prefinancing and interim payments received (if any)}\} \}. \end{aligned}$$

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.

22.3.3 Interim payments

Interim payments reimburse the eligible lump sum contributions claimed for work packages 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 and the work packages declared. Their approval does not imply recognition of compliance, authenticity, completeness or correctness of their content.

Incomplete work packages and work packages that have not been delivered or cannot be approved will be rejected (see Article 27).

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 lump sum contributions for the approved work packages.

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 remaining eligible lump sum contributions claimed for the implemented work packages (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 and the work packages declared. Their approval does not imply recognition of compliance, authenticity, completeness or correctness of their content.

Work packages (or parts of them) that have not been delivered or cannot be approved will be rejected (see Article 27).

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 lump sum contributions for the approved work packages.

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

Not applicable

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:

$$\begin{aligned} &\{\text{final grant amount} \\ &\text{minus} \\ &\{\text{prefinancing and interim payments made (if any)}\}\}. \end{aligned}$$

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:

$$\left\{ \left\{ \begin{array}{l} \text{total accepted EU contribution for the beneficiary} \\ \text{divided by} \\ \text{total accepted EU contribution for the action} \end{array} \right\} \times \left\{ \begin{array}{l} \text{final grant amount for the action} \end{array} \right\} - \left\{ \begin{array}{l} \text{prefinancing and interim payments received by the beneficiary (if any)} \end{array} \right\} \right\}$$

and

- (b) dividing the debt:

$$\left\{ \left\{ \begin{array}{l} \text{amount calculated according to point (a) for the beneficiary concerned} \\ \text{divided by} \\ \text{the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)} \end{array} \right\} \times \left\{ \begin{array}{l} \text{the amount to be recovered} \end{array} \right\} \right\}$$

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 lump sum 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:

$$\left\{ \begin{array}{l} \text{total accepted EU contribution for the beneficiary} \\ \text{divided by} \\ \text{total accepted EU contribution for the action} \end{array} \right\} \times \text{final grant amount for the action}.$$

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 23.5, 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 2015/2366¹⁵ 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 reference rate applied by the European

¹⁵ 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).

Central Bank (ECB) for its main refinancing operations in euros, plus the percentage specified in the Data Sheet (Point 4.2). The ECB reference rate to be used 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

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 lump sum 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. 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.

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.

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 883/2013¹⁶ and No 2185/96¹⁷
- 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 findings

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

¹⁶ 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).

¹⁷ 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).

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

Findings 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
- (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 lump sum 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, lump sum 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 interim payment, final payment or afterwards — reject any lump sum 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 lump sum 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 lump sum contributions, it will deduct them from the lump sum 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 (extension of findings; see Article 25.5).

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 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 (extension of findings; see Article 25.5).

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 work may be done. Ongoing work packages must be interrupted and no new work packages may be started.

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 (extension of findings; see Article 25.5)
- (c) other:

- (i) linked action issues: not applicable
- (ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

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 work may be done. Ongoing work packages must be interrupted and no new work packages may be started.

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 lump sum contributions for activities implemented before the end of work date (see Article 22). Partial lump sum contributions for work packages that were not completed (e.g. due to technical reasons) may exceptionally be taken into account.

If the granting authority does not receive the report within the deadline, only lump sum 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
- (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 reports submitted in previous interim payments (i.e. beneficiary's lump sum contributions for completed and approved work packages).

Lump sum contributions for ongoing/not yet completed work packages will have to be included in the periodic report for the next reporting periods when those work packages have been completed.

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; see Article 25.5)
- (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, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

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 and taking into account the lump sum contributions for activities implemented before termination takes effect (see Article 22). Partial lump sum contributions for work packages that were not completed (e.g. due to technical reasons) may exceptionally be taken into account.

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 lump sum 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
- (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 reports submitted in previous interim payments (i.e. beneficiary's lump sum contributions for completed and approved work packages).

Lump sum contributions for ongoing/not yet completed work packages will have to be included in the periodic report for the next reporting periods when those work packages have been completed.

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 2988/95¹⁸).

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.

¹⁸ 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 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 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 1182/71¹⁹, 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.

‘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.

¹⁹ 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).

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

For the granting authority



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	
<i>Grant Preparation (General Information screen) — Enter the info.</i>	
Project number:	101132182
Project name:	Enhanced Solar PV performance through improved research infrastructure for adapted climate conditions
Project acronym:	CACTUS
Call:	HORIZON-INFRA-2023-DEV-01
Topic:	HORIZON-INFRA-2023-DEV-01-06
Type of action:	HORIZON-CSA
Service:	REA/C/04
Project starting date:	fixed date: 1 December 2023
Project duration:	24 months

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List of deliverables	12
List of milestones (outputs/outcomes)	19
List of critical risks	20
Project reviews	21

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.

73% of the global CO₂ emissions are generated by the energy sector (including transport and buildings). Electrification, combined with power generation using low carbon, renewable energy sources represent a viable path to tackle climate change. In this context, solar power represents today, not only the cheapest energy source, but also the quickest to deploy. Solar power installations, particularly PV have been growing exponentially, a trend which is expected to continue especially considering the fluctuating and volatile gas and oil markets.

In an energy system, where solar photovoltaic power will represent the major energy source (potentially up to 69% of the global energy supply by 2050), the need to understand, improve and forecast the operations of PV plants becomes critical for the security and safety of the society. CACTUS proposes to improve the research infrastructure (RI) and its portfolio of services for an enhanced solar PV performance, particularly adapted for various climate conditions (such as tropical, desert, temperate), considering the whole lifetime of PV projects, from design, installation, operations, decommissioning and End of Life. This will be achieved by linking outdoor and indoor measurements with physical parameters based on material analysis, improving algorithms for O&M, developing common data treatment procedures, assessing sustainability related aspects, while enhancing bi-regional scientific cooperation (EU-LATAM) in the renewable energy sector.

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	999992401
2	BEN	ESRF	EUROPEAN SYNCHROTRON RADIATION FACILITY	FR	999484121
3	BEN	ILL	INSTITUT MAX VON LAUE - PAUL LANGEVIN	FR	999933522
4	BEN	Eurac Research	ACCADEMIA EUROPEA DI BOLZANO	IT	999887253
5	BEN	TECNALIA	FUNDACION TECNALIA RESEARCH & INNOVATION	ES	999604110
6	BEN	BECQUEREL	ICARES CONSULTING	BE	928696916
7	BEN	ATAMOSTEC	CORPORACION ATAMOS TEC	CL	883000119
8	BEN	EU-SOLARIS ERIC	EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER	ES	883665733
9	BEN	UNC	UNIVERSIDAD NACIONAL DE COLOMBIA	CO	999878814

LIST OF WORK PACKAGES

Work packages <i>Grant Preparation (Work Packages screen) — Enter the info.</i>						
Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
WP1	Project management and quality assurance	1 - CEA	19.50	1	24	D1.1 – Management Plan I D1.2 – DMP I D1.3 – Management Plan II D1.4 – DMP II
WP2	Enhancing RI	8 - EU-SOLARIS ERIC	44.00	1	24	D2.1 – Indoor protocols D2.2 – Best practices and sustainability guidelines
WP3	New services	5 - TECNALIA	29.50	6	24	D3.1 – Indoor characterization services D3.2 – Available data D3.3 – O&M tools
WP4	Knowledge program (research mobility and education)	1 - CEA	18.00	1	24	D4.1 – Talents and capacities of RI D4.2 – Training activities
WP5	Sustainability	4 - Eurac Research	20.50	1	24	D5.1 – Sustainability of RI
WP6	Communication, dissemination and exploitation	6 - BECQUEREL	26.00	1	24	D6.1 – CDE plan-1 D6.2 – CDE plan-2 D6.3 – Exploitation plan D6.4 – Climate specific RI D6.5 – Policy Briefing

Work package WP1 – Project management and quality assurance

Work Package Number	WP1	Lead Beneficiary	1. CEA
Work Package Name	Project management and quality assurance		
Start Month	1	End Month	24

Objectives

Objectives

(i) To coordinate supporting activities to produce deliverables and milestones with the project partners, stakeholders and the European Commission. (ii) To establish reporting, regular progress monitoring and quality assurance. (iii) To ensure sound management of the data collected, processed and/or generated. (iv) To prepare project meetings and produce progress (periodic and final) reports. (v) To manage the financial, legal, administrative and technical risks.

Description

Description of work

Task 1.1: Coordinating and Managing Quality Assurance (M1 – M24) [Leader: CEA, supported by: all partners]

The Project Coordinator (PC) is supported by partners and chairs the Management Committee (MC). The MC members are one representative per partner with PC having the casting vote. The MC addresses the project strategic and technical aspects including the delivery of deliverables, achievement of milestones, management of risks, quality of work, concluding reporting and monitoring of budget. The Project Management and Quality Assurance Plan (MQAP) is devised by the MC and implemented by the PC. The MQAP includes assignment of roles and structures, quality assurance procedures, supervision methodologies for tasks, deliverables, milestones, KPIs, risks and budget. PC ensures contractual obligations and sound financial and administrative management, coordination of partners, resources, project administrative support and logistics; reporting requirements, mobilizing relevant staff, management of the consortium and implementation of activities, development of deliverables, monitor the cash-flow, manage the risks, liaison with the European Commission, coordinating, preparing and submitting the reports for Mid-Term and Final Review (M12, M24). Task 1.2: Managing project meetings (M1 – M24) [Leader: CEA, supported by: all partners]

PC is supported by partners and chairs the MC which will meet 4 times in-person to ensure project planning, implementation and assessment of work. The Kick-off meeting will provide the project planning and work allocation. Next project meetings will review and outline the work-plan for the next period while the last one will ensure smooth completion of the project (two meetings will be in LA and 2 in EU). Each partner and WP leaders will submit reports and presentations beforehand to report on the progress made including costing. Virtual progress meetings, unless an in-person meeting is scheduled, will also be held monthly. Two IAB Meetings are scheduled M6-M20 where partners will present the project activities for review and suggested improvements. Minutes will be recorded and distributed by the PC. The reports and IAB feedback will feed into the Task 1.1 for EC reporting.

Task 1.3: Managing Data (M1 – M24) [Leader: EU-S, supported by: all partners]

CACTUS will generate and/or process and collect data which requires sound and FAIR management that is to be made findable, accessible, interoperable and reusable. A Data Management Plan (DMP) is formulated in line with the EC template and remains a living document during the life cycle of the project that includes information on the handling of data during and after the project, what data will be collected, processed and/or generated which methodology and standards will be applied whether data will be shared/made open access and how data will be curated and preserved according to GDPR including post-project lifetime, ensuring that all aspects of the data, handling, treatment, reporting and access are clear to all partners. EU-S will support the PO for the DMP and its compliance. This task will include a data best practice training together with WP4.

Work package WP2 – Enhancing RI

Work Package Number	WP2	Lead Beneficiary	8. EU-SOLARIS ERIC
Work Package Name	Enhancing RI		
Start Month	1	End Month	24

Objectives

(i) To assess the existing RIs and understand how they could be enhanced to tackle the green transition. (ii) To evaluate the best practices for studying the short-term influence of local conditions on the performance and O&M of solar and PV plants. (iii) To review the degradation and failure assessment tools of PV systems at frontier research to provide key data for securing the green transition.

Description

Description of work

Task 2.1: Protocols for unravelling materials behaviour in degraded PV modules (M1 – M24) [Leader: ESRF, supported by: all partners]

Advanced characterisation has the potential to unravel the degradation mechanisms occurring in PV modules in Desert (Chile), tropical (Colombia) and temperate environments (Italy, France and Spain). The purpose of this task is to develop protocols to take advantage of the existing RI dedicated to material analysis. The PV modules currently monitored by ATA in Chile, UNC in Colombia, EURAC in Italy, TEC in Spain and CEA in France will permit to identify samples of interest. ESRF and ILL will perform feasibility tests for various beam analysis options (including multi-scale industrial imaging). Clear procedures for sample and test preparation will be established. The allowed analysis could help the PV community to select appropriate materials for durable modules in outdoor thanks to indoor characterization.

Task 2.2: Aligning RIs data collection protocols for outdoor measurements (M4 – M24) [Leader: EU-S, supported by: ATA, TEC, EURAC, CEA, UNC]

Reliable research outputs require high quality data. In the case of solar power, its production depends on the solar resource available, and the meteorological and environmental conditions. The various environments in which the partners have infrastructures is a chance to learn from each other. EU-S is classifying atmospheric corrosivity (ISO 9223) at different points in the Atacama Desert involved in the durability of materials used in structures. In addition, solar resource and meteorological conditions are being measured by ATAMOSTEC in the inner and coastal areas of Atacama Desert in Antofagasta Region. UNC has different PV installation facilities on six different campuses in Colombia (Medellin, San Andres, Bogotá, La Paz, and Leticia), which are monitored continuously. EURAC, TEC and CEA are monitoring PV production and solar resources and meteorological conditions in different EU locations. Therefore, this task focuses on measurement equipment and measurement protocols. Using inputs from T4.2.1, we will (1) evaluate the tools and processes for data gathering (for parameters such as solar irradiance, temperature, humidity and wind); (2) assess their limitations; and (3) define climate specific best practice guidelines for higher data quality validated by the MC.

Task 2.3: Sharing best practices in operation and maintenance and failures detection (M1 – M24) [Leader: TEC, supported by: EURAC, ATA, UNC, CEA]

Subtask 2.3.1 Soiling assessment (M1-M12) [Leader: CEA, supported by: EURAC, CEA, ATA, UNC, EU-S]

Maintaining PV plants along their lifespan is of prime interest to ensure bankability. Among the O&M concerns, soiling needs to be assessed. It allows to separate the performances losses caused by soiling from the physical degradations of the PV modules. Thanks to the data collection in the RIs (ATAM, UNC, EURAC, TEC) soiling can be assessed at different balance-of-system levels or with dedicated soiling sensors that improve the diagnostic. The aim of this task is (1) evaluate the tools, equipment and processes for soiling estimation in the involved RIs (2) assess the limitations on the different tools, (3) formulate demands for a better soiling assessment and (4) define best practice guidelines in soiling assessment for higher data quality, contributing with the international community.

Subtask 2.3.2 Enhancing PV plant failures assessment (M12-M24) [Leader: TEC, supported by: EURAC, CEA, ATA, UNC, EU-S]

Once soiling is subtracted from production data, the latter can be used to determine the health status of a PV plant. PV plants degrade at various rates according to the environment and the PV modules durability. Accelerated ageing chambers and data analytics can help to understand the degradation mechanisms at lab scale. The degradation rate of a PV plant can be determined thanks to different data processing. The aim of this task is to (1) evaluate the different tools for failures assessment currently used in the RIs, (2) define the pros and cons for each tool and (3) design roadmaps to implement early failure detection tools in the RIs.

Work package WP3 – New services

Work Package Number	WP3	Lead Beneficiary	5. TECNALIA
Work Package Name	New services		
Start Month	6	End Month	24

Objectives
(i) Create new services from improved RI with commercial potential (ii) Enhance PV plant profitability and sustainability through open sources tools (iii) Create datasets for indoor/outdoor models' calibration for specific climates
Description
<p>Task 3.1: Advanced characterization for a climate specific PV module selection (M6 – M24) [Leader: CEA, supported by: ATA, UNC, ESRF, ILL, EURAC, TEC]</p> <p>Subtask 3.1.1 Indoor lab requirements (M6-M18) [Leader: CEA, supported by: ATA, UNC, TEC] Accurate measurements of PV performances in an indoor lab are a great help to understand the underlying reasons for degradations of PV modules. CEA has expertise and an adequate RI for such research work. The aim of this subtask is to assess CAPEX and OPEX for development, operations and maintenance of indoor lab(s) able to perform the measurements required to follow the protocols for selected locations, including identification of equipment required.</p> <p>Subtask 3.1.2 Beamlines services valorisation (M12-M24) [Leader: ESRF, supported by: CEA, EURAC, ILL] Based on the feedback from T2.1, a scientific evaluation of the new services offered by ESRF and ILL to the PV community will be carried out. The aim will be to anticipate how the generated data could be relevant for the simulation of degradation of PV modules for the prediction of power plant outputs according to the installation location. Demo testing will be performed on selected samples.</p> <p>Task 3.2: Improved tools for enhancing plant profitability (M6– M24) [Leader: EURAC, supported by: TEC, CEA, UNC, ATA]</p> <p>Subtask 3.2.1 Open sources tools for plant design [Leader: EURAC, supported by: TEC, CEA, UNC, ATA] EURAC together with TEC, CEA, UNC and ATA will develop python based open-source models to design PV plants based on objective functions for e.g. NPV, LCOE, etc, and multi-objective optimisation. EURAC together with TEC will develop open-source templates that can be used to calculate LCOE (TEC) / LCA / LCC related parameters in various geographical / climatic context. EURAC together with TEC will analyse typical O&M contracts in various countries and define optimised strategies and guidelines, which will consider the country / climate specific requirements.</p> <p>Subtask 3.2.2 Tools for PV plants O&M (proof of concept for Failure detection and Diagnosis) (M6-M18) [Leader: TEC, supported by: ATA, UNC, CEA]</p> <p>TEC has a deep knowledge on Fault Detection and Diagnosis (FDD) tools based on PV generator array state parameters. These techniques have shown a great potential for early failure detection, diagnosis and predictive maintenance, which could be used to increase PV plant lifetime, reliability, performance and profitability. However, the results are too sensitive to the boundaries used in the tools. The validity of the approach needs to be studied on a wider range of case studies to enhance the quality of the outputs. Thus, TEC in collaboration with ATA, UNC and CEA will first (1) check the tools based on enhanced RI datasets obtained from T3.3 and then (2) improve them for the different selected locations.</p> <p>Task 3.3: Datasets for models' calibration (M12 – M24) [Leader: UNC, supported by: TEC, EURAC, ATA, CEA]</p> <p>With aligned outdoor measurements for all involved partners (MS2), UNC, TEC, EURAC, ATA, and CEA will provide high quality datasets to calibrate and validate indoor lab protocols (T3.1) and facilitate the proper parameterization of O&M services (T3.2) to different climates.</p>

Work package WP4 – Knowledge program (research mobility and education)

Work Package Number	WP4	Lead Beneficiary	1. CEA
Work Package Name	Knowledge program (research mobility and education)		
Start Month	1	End Month	24

Objectives
Enhance scientific collaboration, joint initiatives in management and staff development in the renewables energy sector in both regions, thereby supporting the rollout of bi-lateral cooperation in the energy and climate change mitigation areas based on: (i) Mentoring program (ii) Exchange /students training /online
Description
<p>Description of work</p> <p>Task 4.1: Knowledge exchange plan (M1 – M4) [Leader: CEA supported by: all partners]</p>

The main topics (such as tool calibrations, preparation of samples, data quality) which are required for knowledge support, the best format (between mentoring, advanced schools, research visits) will be identified. Using these inputs, a detailed knowledge exchange plan will be created based on the needs and opportunities within the consortium.

Task 4.2 Strengthen management capacities and complementarity (M1 – M24) [Leader: CEA, supported by: all partners]
Based on the EU-LAC view for the cooperation regarding management capacities, this task will perform the following subtasks:

Subtask 4.2.1 Creation of innovations scorecards (M1-M6) [Leader: CEA, supported by: all partners] Innovation scorecards will be defined as a stock from current innovation landscape. It will help understanding specificities of technological developments for each region (sensors for solar production and availability of solar resource, electronic loads).

Subtask 4.2.2 Capacity improvement and management of data and processes (M6-M18) [Leader: CEA, supported by: all partners] Based on the principle of “learning by doing”, stakeholders (such as researchers and technicians) will be embedded for 2-week periods within relevant ongoing activities at each of the participants’ premises at least once. Over the lifetime of the project, 2 such exchanges could take place for each of the research partners – based on the overall thematic areas described and ongoing research activities (such as calibration of equipment, outdoor measurement protocols).

Subtask 4.2.3 Consortium workshops (M6-M24) [Leader: CEA, supported by: all partners] The topics will be defined according to the capacities and needs from the partners. Some of the relevant topics, which could be included in the workshop's schools, could include ground-based instrumentation (what equipment for what purpose), LCA assessments (either for manufacturing or operations), PV module degradation or failure assessment. The format could be online or onsite (depending on the budget allocated to the task).

Task 4.3: Mapping of (HR) talents and potential development of new RI capacities, including potential funding sources (M18 – M24) [Leader: BI, supported by: all partners]

This task will map the HR talents required by the RI considering potential new research services, which can be offered to new partners, including potential collaboration with other ERICs (data, aerosol, gas...) and listing funding opportunities for further development and collaboration.

Work package WP5 – Sustainability

Work Package Number	WP5	Lead Beneficiary	4. Eurac Research
Work Package Name	Sustainability		
Start Month	1	End Month	24

Objectives

The main objective of this WP is to address the sustainability of the project, the collaboration, the RI and the outputs provided. In detail:

(i) To standardise research methodologies in the field of sustainability, bankability and socially related aspects. (ii) To derive knowledge related to sustainability and bankability by using data from research infrastructure and create common repositories for sustainability assessments. (iii) To analyse the impact of climate specific labels (desert/tropical/alpine) in terms of environmental and cost criteria. (iv) To define guidelines on how to include social-LCA in non-pricing criteria for the PV and energy sector (v) to address a sustainability framework for knowledge transfer between regions EU-LAC.

Description

Description of work

Task 5.1: Sharing a research infrastructure for PV sustainability assessment (M6 – M24) [Leader: EURAC, supported by all partners]

Subtask 5.1.1 Sustainability and end-of-life strategies for PV (M12-M24) [Leader: EURAC, supported by: CEA, ATA, BI]

Sustainability assessment rely on the R-ladder strategy: reduce, reuse, recycle. At each step, data must be collected where the methodology need to be harmonised. The assessment is carried out by leveraging on LCA. In this Task, EURAC and CEA will create a common repository including the use of materials, materials reduction roadmap, geolocated supply chain, energy use along the manufacturing step, delivery, construction, monitoring and end of life for various locations / climates.

Subtask 5.1.2 Market oriented research: speeding up bankability (M13 – M24) [Leader: EURAC, supported by: BI, CEA, TEC, ATA, UNC]

Exposing materials to outdoor harsh environment goes beyond the use of indoor accelerated aging and needs data gathering from outdoor RI during long time periods (>10 years) to represent real conditions and improve reliability of PV. PV modules exposed to combined environmental factors can lead to new degradation models. EURAC and CEA will analyse data coming from PV modules installed in RI and derive degradation analysis to include this in future bankability assessment. The concept of bankability must also be harmonised and EURAC will lead guidelines on how to assess technical bankability of PV modules.

Subtask 5.1.3 Social oriented research and non-pricing KPIs [Leader: BI, supported by: EURAC, CEA, all]

BI, EURAC and CEA will analyse the status of social-LCA methodologies and how they differ in the various geographical/social contexts using real data coming from RI.

Task 5.2: Sustainability of solar RI (M18 – M24) [Leader: CEA, supported by EURAC, TEC, BI, ATA, UNC]

This task lead with the assessment of the global sustainability of RI enhancing the value chain of PV from materials to system implementation and O&M procedures. RI are key to develop the technology but also to gather information and create new benefit and services wherever they are in the world. CEA, supported by all partners will define the sustainability criteria of the RIs from a technical, financial, social and strategic point of view considering gender equity aspects and cultural aspects following the RESINFRA EU-LAC recommendations. Different options will be evaluated for the future of PV RI including the possibility of a PV ERIC or other strategies.

Task 5.3: Impact evaluation of RI and CACTUS on energy transition and United Nations Sustainable Development Goals (M12-M24) [Leader: EURAC, supported by all partners]

In this task, CACTUS will assess general energy transition roadmaps and the EU strategic agenda (SRIA) defined by countries and EC based on the UNSDG. As a general view, all partners leaded by EURAC will evaluate the impact of CACTUS and its enhanced RI in the sustainable development of PV as a driver for green energy ecosystems. A workshop with decision makers and supported by IAB will be organized addressing how do these RIs contribute to the UNSDG.

Work package WP6 – Communication, dissemination and exploitation

Work Package Number	WP6	Lead Beneficiary	6. BECQUEREL
Work Package Name	Communication, dissemination and exploitation		
Start Month	1	End Month	24

Objectives

Defining the CDEP, identifying relevant target groups, tools and channels for communication, establishing the means for the project promotion and monitoring D&C activities.

Assessing market needs/relevance for climate specific standards – linking them with need for global data in the solar power sector (thus global infrastructures)

Description

Description of work

Task 6.1 Communication, dissemination and exploitation plan (M1 – M24) [Leader: BI, supported by: all partners]

The CDE plan will be defined including: (1) the identification of D&C strategies, including the channels and tools for implementation, (3) stakeholder analysis for D&C and (3) guidelines for supporting the partners in the implementation of the activities. The visual identity of the project, and the relevant templates will also be created for sharing in the CDEP. C&D activities will be monitored for the final version of the CDE report (due in M23).

Task 6.2: Outreach and influencing tools (M1 – M24) [Leader: BI, supported by: all]

A set of branding and communication tools will be designed to create a recognizable project identity for all the communication channels. The outreach activities include (1) project website (M4) and maintained up to 3 years after the project ends, (2) Fliers, and other informative materials, (3) Social media tools which will be maintained throughout the project (such as LinkedIn). (4) 2 Webinars will be organized during the project (Technical learnings, Available funding sources for further research/recommendations on future activities).

Task 6.3 Identify market needs for climate specific standards which could be provided by the RIs (M1 – M12) [Leader: BI, supported by: all]

This task will assess what is the economic, social and environmental benefit, to the industry and to the research

community, of climate-specific measurement protocols (for tropical, desertic and temperate zones) of materials, PV plant designs and operations.

Task 6.4 Exploitation of project results and solutions (M12 – M24) [Leader: BI, supported by: all]

Subtask 6.4.1 Inventory of Exploitable Results (ER) (M12 – M18) [Leader: BI, supported by: all]

Project results will be identified. The added value proposition will be identified, including a brief description and value proposition for each ER. A summary table listing the results, business visions and needed steps will be an input for the exploitation plans to be developed in T6.4.2

Subtask 6.4.2 Exploitation plans and IPR strategies (M18 – M24) [Leader: BI, supported by: all]

Based on the outputs of the previous task, a detailed exploitation plan will be defined for the Key ERs to maximize the impacts. The plan will include among others, information on future research activities, the associated stakeholders, value proposition, exploitation route and results protection. IPR protection strategies and agreements among partners will be discussed and implemented.

STAFF EFFORT

Staff effort per participant <i>Grant Preparation (Work packages - Effort screen) — Enter the info.</i>							
Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
1 - CEA	7.00	4.00	4.00	4.00	7.00	3.00	29.00
2 - ESRF	0.50	3.00	1.00			0.50	5.00
3 - ILL	0.50	1.00	1.50			0.50	3.50
4 - Eurac Research	2.00	3.00	4.00	2.00	5.00	1.50	17.50
5 - TECNALIA	0.50	5.00	8.00	1.50	0.50	1.00	16.50
6 - BECQUEREL	1.50			2.50	3.50	11.50	19.00
7 - ATAMOSTEC	3.00	7.00	6.00	5.00	3.00	6.00	30.00
8 - EU-SOLARIS ERIC	3.00	12.00		1.00		1.00	17.00
9 - UNC	1.50	9.00	5.00	2.00	1.50	1.00	20.00
Total Person-Months	19.50	44.00	29.50	18.00	20.50	26.00	157.50

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	Management Plan I	WP1	1 - CEA	R — Document, report	SEN - Sensitive	3
D1.2	DMP I	WP1	1 - CEA	DMP — Data Management Plan	PU - Public	6
D1.3	Management Plan II	WP1	1 - CEA	R — Document, report	SEN - Sensitive	21
D1.4	DMP II	WP1	1 - CEA	DMP — Data Management Plan	PU - Public	24
D2.1	Indoor protocols	WP2	2 - ESRF	R — Document, report	SEN - Sensitive	18
D2.2	Best practices and sustainability guidelines	WP2	8 - EU-SOLARIS ERIC	R — Document, report	PU - Public	24
D3.1	Indoor characterization services	WP3	1 - CEA	R — Document, report	SEN - Sensitive	18
D3.2	Available data	WP3	9 - UNC	DATA — data sets, microdata, etc	PU - Public	21
D3.3	O&M tools	WP3	5 - TECNALIA	R — Document, report	SEN - Sensitive	24
D4.1	Talents and capacities of RI	WP4	6 - BECQUEREL	R — Document, report	PU - Public	21
D4.2	Training activities	WP4	1 - CEA	R — Document, report	PU - Public	24
D5.1	Sustainability of RI	WP5	4 - Eurac Research	R — Document, report	PU - Public	18
D6.1	CDE plan-1	WP6	6 - BECQUEREL	R — Document, report	SEN - Sensitive	4

Deliverables

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D6.2	CDE plan-2	WP6	6 - BECQUEREL	R — Document, report	SEN - Sensitive	23
D6.3	Exploitation plan	WP6	6 - BECQUEREL	R — Document, report	SEN - Sensitive	24
D6.4	Climate specific RI	WP6	7 - ATAMOSTEC	R — Document, report	SEN - Sensitive	12
D6.5	Policy Briefing	WP6	6 - BECQUEREL	R — Document, report	PU - Public	24

Deliverable D1.1 – Management Plan I

Deliverable Number	D1.1	Lead Beneficiary	1. CEA
Deliverable Name	Management Plan I		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	3	Work Package No	WP1

Description
Detailed Project Management Plan, including Quality & Best Practice Manual for all activities

Deliverable D1.2 – DMP I

Deliverable Number	D1.2	Lead Beneficiary	1. CEA
Deliverable Name	DMP I		
Type	DMP — Data Management Plan	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP1

Description
Initial Data Management Plan

Deliverable D1.3 – Management Plan II

Deliverable Number	D1.3	Lead Beneficiary	1. CEA
Deliverable Name	Management Plan II		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	21	Work Package No	WP1

Description
Updated Project Management Plan

Deliverable D1.4 – DMP II

Deliverable Number	D1.4	Lead Beneficiary	1. CEA
Deliverable Name	DMP II		
Type	DMP — Data Management Plan	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP1

Description
Final Data Management Plan

Deliverable D2.1 – Indoor protocols

Deliverable Number	D2.1	Lead Beneficiary	2. ESRF
Deliverable Name	Indoor protocols		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	18	Work Package No	WP2

Description
Protocols for sample preparation and measurement of PV modules at ESRF and ILL facilities.

Deliverable D2.2 – Best practices and sustainability guidelines

Deliverable Number	D2.2	Lead Beneficiary	8. EU-SOLARIS ERIC
Deliverable Name	Best practices and sustainability guidelines		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP2

Description
Best practice guidelines (1) for climate-specific data quality collection (2) for operation and maintenance of PV plants and sustainability of PV guidelines (WP2 and WP5)

Deliverable D3.1 – Indoor characterization services

Deliverable Number	D3.1	Lead Beneficiary	1. CEA
Deliverable Name	Indoor characterization services		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	18	Work Package No	WP3

Description
Protocols, design and techno-economic analysis for testing at indoor lab adapted to different climate specifications

Deliverable D3.2 – Available data

Deliverable Number	D3.2	Lead Beneficiary	9. UNC
Deliverable Name	Available data		
Type	DATA — data sets, microdata, etc	Dissemination Level	PU - Public
Due Date (month)	21	Work Package No	WP3

Description
List of the available data in the datasets

Deliverable D3.3 – O&M tools

Deliverable Number	D3.3	Lead Beneficiary	5. TECNALIA
Deliverable Name	O&M tools		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP3

Description
Improved O&M tools for RI and plant design to create new services

Deliverable D4.1 – Talents and capacities of RI

Deliverable Number	D4.1	Lead Beneficiary	6. BECQUEREL
Deliverable Name	Talents and capacities of RI		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	21	Work Package No	WP4

Description
Map of (HR) talents, new RI capacities and funding sources.

Deliverable D4.2 – Training activities

Deliverable Number	D4.2	Lead Beneficiary	1. CEA
Deliverable Name	Training activities		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP4

Description
Listing all training activities, including exchanges and locations where these took place, workshops and topics presented

Deliverable D5.1 – Sustainability of RI

Deliverable Number	D5.1	Lead Beneficiary	4. Eurac Research
Deliverable Name	Sustainability of RI		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	18	Work Package No	WP5

Description
Whitepaper on sustainability of solar related RI platform

Deliverable D6.1 – CDE plan-1

Deliverable Number	D6.1	Lead Beneficiary	6. BECQUEREL
Deliverable Name	CDE plan-1		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	4	Work Package No	WP6

Description
First version CDE plan

Deliverable D6.2 – CDE plan-2

Deliverable Number	D6.2	Lead Beneficiary	6. BECQUEREL
Deliverable Name	CDE plan-2		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	23	Work Package No	WP6

Description
Final version CDE plan

Deliverable D6.3 – Exploitation plan

Deliverable Number	D6.3	Lead Beneficiary	6. BECQUEREL
Deliverable Name	Exploitation plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP6

Description
Exploitation Plan and IPR protection strategies

Deliverable D6.4 – Climate specific RI

Deliverable Number	D6.4	Lead Beneficiary	7. ATAMOSTEC
Deliverable Name	Climate specific RI		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP6

Description
Report including assessment of climate-specific protocols and standards by RI

Deliverable D6.5 – Policy Briefing

Deliverable Number	D6.5	Lead Beneficiary	6. BECQUEREL
Deliverable Name	Policy Briefing		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP6

Description
Report with relevant information to the EU policy makers and links with the other Research Infrastructures/and with the EOSC family

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	Internal communication and management tool set up, website and social media channels up and running, consortium bodies and IAB established	WP1, WP6	1-CEA	Website and social media, management tools available	4
2	Training programme and Results Ownership List (ROL) drafted	WP4, WP6	1-CEA	List of tentative exchange program on the website. List of results of ownership.	4
3	IAB meeting 1	WP1, WP6	1-CEA	Minutes of the meeting	7
4	First set of common protocols: (i) for sample preparation and (2) for outdoor measurements	WP2	8-EU-SOLARIS ERIC	List of protocols available (preparation for D2.1 and D2.2)	9
5	Repository data for sustainability assessment	WP5	4-Eurac Research	of data available (preparation for D5.1)	12
6	Datasets available for models' calibration	WP2, WP3	5-TECNALIA	List of datasets available (preparation for D3.1)	15
7	Demo samples defined for beam testing	WP3	5-TECNALIA	List of samples available (preparation for D2.1)	15
8	IAB meeting2	WP1, WP6	1-CEA	Minutes of the meeting	19
9	Workshop on Energy transition	WP6, WP5	6-BECQUEREL	Minutes of workshop	22

LIST OF CRITICAL RISKS

Critical risks & risk management strategy <i>Grant Preparation (Critical Risks screen) — Enter the info.</i>			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	EU-LAC difficulties in communication (Medium Probability / High Impact)	WP4, WP2, WP1, WP6, WP3, WP5	Establish regular meetings in adapted schedules for both regions.
2	Project delay(s) in delivery outside plan (Low Probability / Medium Impact)	WP1	Contingency plans are adopted and implemented through PSC to specific conditions such as resource reallocation, work and activity rescheduling
3	Project team(s) and experts changes (Medium Probability / Low Impact)	WP1	Substitutes with similar expertise and equivalent or higher qualifications will be requested while their role and responsibilities are explained.
4	Lack of high quality data to compare the different RI (Medium Probability, High impact)	WP2, WP3	Establishment of clear protocols, identification of bottlenecks to provide better recommendations. Discussion with IAB.
5	Lack of involvement of relevant stakeholders in the use of shared infrastructure (Medium Probability, Medium impact)	WP4, WP3	The community at large will be involved with the activities in WP4 to make sure that the infrastructure available at EU and LAC are known and properly promoted and that new services are created
6	Difficulties in providing updated open data for sustainability (Medium probability, low impact)	WP5	Data sharing agreement will be signed between partners if needed. Data from partners outside the network will also be defined in terms of data sharing agreement defining the dissemination level and the term of use.
7	Difficulties in accessing large scale infrastructure (ESRF / ILL) by LAC partners (Low probability, Low impact)	WP4, WP2, WP1, WP6, WP3, WP5	Access to large-scale infrastructure is subject to dedicated call for proposals. EU will support LAC partners in preparing high quality proposals for measurements.
8	Business cases for intended RIs in EU-LAC not good enough for their future exploitation by local partners (Medium Probability / medium impact)	WP6	WP6 is devoted to the exploitation plans of the different services, datasets, and RIs. Potential difficulties will be detected and minimized during the project life. Potential users will be identified and consulted in this process to minimise risks.

PROJECT REVIEWS

Project Reviews <i>Grant Preparation (Reviews screen) — Enter the info.</i>			
Review No	Timing (month)	Location	Comments
RV1	27	TBC	Final review meeting to be organised within one month after the submission of the periodic report.



Horizon Europe (HORIZON)

Description of the action (DoA) (Part B)

Version 2.1
15 November 2022

History of changes

Part B		
date	Page/section	Nature of change and reason / justification of change proposed (<i>if applicable</i>)
31/07/23	27, section 3, Table 3.1c	Simplification of deliverables list suppressing progress and final report and <i>Rationalization of deliverables</i> , e.g merging any similar ones, removing the ones that can be included in standard periodic reports. Modification also done in part A.
24/09/23	13, section 2.1.1	Different wording to take into account the comment from PO about double funding.
24/09/23	2, table of contents	Addition of a table of contents
24/09/23	Footer	Addition of [101132182] [CACTUS]
24/09/23	21-29, section 3, Tables 3.1a, 3.1b, 3.1c, 3.1d, 3.1e, 3.1f, 3.1g, 3.1h, 3.1i	Deletion of the tables 1a, 3.1b, 3.1c, 3.1d, 3.1e, 3.1f, 3.1g, 3.1h, 3.1i
02/10/23	9, section 1.2.4, table 1.4	Addition of IAB members
02/10/23	19, section 2.2	Addressing the shortcomings described in the ESR
05/10/23	1 & 2	Minor & formal modifications, headers out, and page 1 added

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Proposal template Part B: technical description

ENHANCED SOLAR PHOTOVOLTAIC PERFORMANCE THROUGH IMPROVED RESEARCH INFRASTRUCTURE FOR ADAPTED CLIMATE CONDITIONS: CACTUS

#@APP-FORM-HECSA@#

Common Acronyms: DCE: Dissemination & Communication & Exploitation; LCA: Life cycle analysis; RI Research infrastructures; LAC: Latin-American and Caribe; PV: photovoltaics; LCOE: Levelized Cost of Energy; O&M: operation and maintenance; IAB: international Advisory Board, SRIA: Strategic Research and Innovation Agenda; UNSDG: UN Sustainable Development Goals.

1. Excellence #@REL-EVA-RE@#

1.1 Objectives #@PRJ-OBJ-PO@#

In 2020, renewable energy (RE) sources surpassed for the first-time fossil fuels in the EU-27 electricity sector¹. However, the share of RES in the Integrated EU Energy System (21.3%) is still low (especially in heating, cooling, and transport sectors) and it falls far short of the 2030 targets of 32% RE share and climate-neutral vision by 2050². Although CO₂ emissions were compelled to drop the COVID-19 in 2020, worldwide energy-related CO₂ emissions remained at 31.5 Gt, contributing to CO₂ attaining its highest-ever average annual concentration of 412.5 ppm – roughly 50 % greater than at the start of the industrial revolution³ and driving the actual climate crisis. On the other hand, 12 million people were directly and indirectly employed in the RE industry⁴. Solar energy and concretely photovoltaic (PV) electricity are uniquely positioned to support world energy transition and climate change objectives as well as to foster jobs generation and economic growth in the context of the Green Deal⁵ and COP27 objectives. PV energy continues in its leadership position in generation technologies installed worldwide, with 139 GW in 2020, an increase of 21 % compared to 2019, reaching 760 GW in accumulated⁶. Many opportunities arise for PV in several fields from large-scale production to integrated PV (vehicle-integrated PV-VIPV, infrastructure-integrated PV, agriPV, and floatingPV) and other related to new applications and developments (spacePV, Internet of Things, ...). Moreover, solar energy in general, and photovoltaics, are today preparing the new ecosystem for green fuels and hydrogen production, solving one of the main drawbacks of energy storage⁷ and creating a whole green ecosystem (Chile has been one of the pioneers in the world to develop their own green H₂ strategy)⁸.

Thus, the concept of PV everywhere is becoming more and more current.

In today's market, PV module producers typically guarantee that modules will retain at least 80 % of the initial peak power after 25 years, and increasingly, 30 years. There is a trend to stipulate an initial power loss in the first year of operation e.g., 2 % and thereafter an average annual degradation rate e.g., 0.5 %. However, there is a need to gather facts and evidence that these values can be met or in some cases even improved with the final aim of having more accurate business models. In this context, the subject of degradation and reliability of PV systems is still a concern within the PV community evoked by different projects and strategy groups⁹, mainly due to:

1. The appearance of new and different failure modes in operation as new technologies are explored.
2. Variation in the use of PV technologies and applications.
3. Installation in climate conditions different from standards.
4. Lack of testing infrastructures for real conditions.
5. Lack of protocols and data for quality assessment in the whole chain: from materials to O&M.

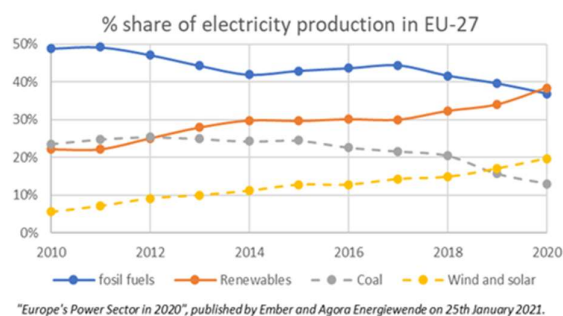


Figure 1.1 Renewables overtake fossil fuels

¹ <https://ember-climate.org/project/eu-power-sector-2020/>

² https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2050-long-term-strategy_en

³ <https://www.iea.org/reports/global-energy-review-2021/co2-emissions>

⁴ <https://irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021>

⁵ European Commission, The European Green Deal. COM(2019) 640; 2019

⁶ IEA-PVPS Snapshot of Global PV Markets2021

⁷ <https://blogs.worldbank.org/ppps/green-hydrogen-key-investment-energy-transition>

⁸ https://energia.gob.cl/sites/default/files/estrategia_nacional_de_hidrogeno_verde_-_chile.pdf

⁹ <https://serendipv.eu/>, <https://trust-pv.eu/>, <https://etip-pv.eu/publications/sria-pv/>

Finally, yet importantly, and for the whole solar and PV technologies, an increasing focus will be needed on **sustainability, circular economy aspects, and to socio-economic effects** associated with the massive and the terawatt-scale deployment¹⁰. Under this framework, the **necessity to work with a wide approach considering the whole value chain of the research and the cross-cutting capacities is mandatory to succeed energy transition worldwide and react to the climate crisis**. The CACTUS consortium is created to respond to this global need.

Why? Because energy is one of the **major pillars for worldwide development** and solar energy, as decentralized and sustainable source of energy, plays a high impact role to overcome the UNSDG¹¹ tackling directly or indirectly almost all of them. Moreover, while there is a lot of experience in specific climates, other climates are clearly underrepresented even if they are becoming key markets for PV.

Why with LAC? Because LAC has **complete different climate conditions** compared to EU. Between both regions, we can cover almost all representative conditions for testing and validating technologies: desert, tropical, Mediterranean, Atlantic and continental climates; low, medium and high levels of irradiation; low and high levels of ultraviolet radiation; humid or dry, hot or cold environments ... RI dedicated to different environmental conditions allowing high quality monitoring data are critical for the sustainability of PV.

How? With an **integrative and sustainable approach** for Energy, PV, RIs and project management. Using existing renown ESFRIS Landscapes (ILL & ESRF), the unique Solar ERIC (EU-SOLARIS) and a set of renown institutions in the field of PV development with outstanding infrastructures in Europe and leading the three main projects in outdoor performance of PV (CEA, EURAC and TEC) with the support of BI (expert in market, sustainability training and communication of energy topics). In addition, the consortium is completed with two major actors in LAC in the field of PV: ATAMOSTEC in Chile and UNC in Colombia with extensive RI and knowledge.

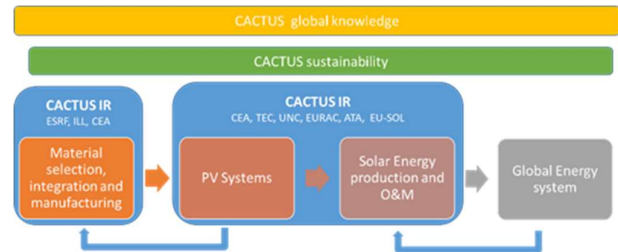


Figure 1.2 How CACTUS works?

Who? An **outstanding and enthusiastic consortium** based on complementary capacities covering the whole value chain of PV technology and beyond. Scientific excellence, combined with technical skills, market, social and environmental assets are in the consortium represented by several partners including 2 Landscape ESFRIS and 1 ERIC.

When? During **2 years of exchanges**: methodologies, data, testing methods, protocols, training, workshops, travels, meetings, best practices...

Where? Between Europe and Latin America regions.

Therefore, the main objective of CACTUS is to **develop a bi-regional and sustainable ecosystem of complementary RIs**, strengthening the **knowledge and collaboration** between the EU and LAC regions, by enabling the research of solar and photovoltaic technologies adapted to different climate conditions. CACTUS will contribute to the **green energy transition** by tackling global challenges linked to **energy and climate change** (both mitigation and adaptation) with the provision of R&D tools for reliable, bankable, sustainable and socially accepted solar technologies.

So, **what is CACTUS?** CACTUS is a proposal born thanks to a **successful and enthusiastic exchange between EU and LAC researchers** considering the needs and high-impact potential of solar power systems, aiming to build a **strong PV R&I ecosystem to improve the development of scientific, environmental, technical, and social capacities**. This development will lay the ground for further research in solar power, a major technology required for the green energy transition and climate change mitigation, directly affecting life quality and human well-being, and aligned with UNSDG.

¹⁰ Taylor, N., Jäger-Waldau, A., Photovoltaics Technology Development Report 2020, EUR 30504 EN, Publications Office of the European Union, Luxembourg 2020, ISBN 978-92-76-27274-8, doi:10.2760/827685, JRC123157

¹¹ <https://sdgs.un.org/goals>

Table 1.1: Objectives and means in CACTUS

CACTUS specific Objectives		Means
O1	Improve all outdoor and indoor RI to assess the lifetime, reliability, performance & profitability of sustainable PV generation for different climate conditions.	Through methodologies, protocols testing, assessment and data exchange: WP2, WP5.
O2	Improve the portfolio of services by RI for solar and PV in different climate areas considering the whole system lifetime: design, installation, O&M, decommission, end of life.	Through WP3 and exchanges with stakeholders WP6, WP4.
O3	Develop common data treatment protocols and assessment in view of RI improvement and services.	Through methodologies and open-source access. Supported by H2020 SerendiPV project WP3, WP2.
O4	Improve the techno-economic, social and sustainable assessment of PV in different climate conditions to help define RI investment roadmaps for policy makers.	Through the integrated approach based on sustainability as main driver for the project WP5.
O5	Enhance sustainable bi-regional cooperation (EU-LAC) in the renewable energy sector to tackle global and local climate change challenges	Through the whole project, with the IAB, and the DCE strategy WP4, WP6 and WP1.
O6	Enhance EU-LAC scientific collaboration, joint initiatives in management and staff development in the renewables energy sector to assure sustainability in RI and research.	Through workshops, exchanges, meetings and visits WP4, WP6 and WP1.

#\$PRJ-OBJ-PO\$#

1.2.1 CACTUS relevance with HORIZON-INFRA-2023-DEV-01-06

CACTUS approach is in line with the goals defined by HORIZON-INFRA-2023-DEV-01-06. Table 1.2 lists how CACTUS will aim at specific objectives of the call.

Table 1.2: HORIZON-INFRA-2023-DEV-01-06 meets CACTUS

HORIZON-INFRA-2023-DEV-01-06 Cooperation in strategic areas	CACTUS approach
<i>Support the rollout of bi-regional cooperation in one or more of the priority areas identified by the EU-CELAC Research Infrastructure Working Group through the Horizon 2020 grant EU-LAC RESINFRA[3] (energy, health, biodiversity and climate change, food security and information and communication technologies)</i>	CACTUS focuses in RI for solar energy deployment covering the whole value chain. Solar energy is a driver for climate change mitigation and impacts directly on society and the whole water-energy-food ecosystem. The consortium is a well-balanced team between EU and LAC partners. A strong IAB is foreseen to cover policy makers and other relevant actors from EU and LAC.
<i>Implement specific actions aimed at enhancing RI performance and impact in both regions,</i>	CACTUS considers two ESFRIS, 1 ERIC and 5 complementary PV platforms. Two LAC and four EU countries consolidate the consortium. WP2 works in the improvement of RI, their sustainability, and performance.
<i>...such as joint initiatives in management and staff development,</i>	A strong focus is on the exchange, training and staff development for the sustainability of the RI, as well as the creation of innovation scorecards: WP4.
<i>...developing new services (in particular remote access) sharing data or supporting reciprocal access.</i>	A complete WP3 is dedicated to create new services with a strong focus on sharing high quality data. A year of open data is proposed in the project. New methodologies and data sets are key in the proposal considering different topics, meteorological data, sustainability, energy...
<i>Activities should take into account the Sustainability Plan developed by the EU-CELAC Research Infrastructure Working Group through the grant EU-LAC RESINFRA</i>	WP5 is dedicated to sustainability as a whole: in cooperation, the RI, and the PV value chain and products. The sustainability is also based on social and knowledge transfer assured in WP4 and WP6.
<i>Proposals should focus in particular on collaboration agreements in the long term that would remain open to potential new participants in the LAC region.</i>	CACTUS arises from the EU projects collaboration started in 2017 through <i>GoPV</i> , and followed in 2020 by <i>TrustPV</i> and <i>SerendiPV</i> and the EU-Chilean collaboration <i>ATAMOSTEC</i> granted by CORFO in 2017. All projects work to enhance the PV reliability, quality and sustainability. CACTUS is the next step, adding also good practices and widening the collaboration to other RI. A sustainability plan is an output for CACTUS based on RESINFRA EU LAC recommendations.

1.2.2 RESINFRA EU-LAC meets CACTUS

RESINFRA EU-LAC pursues the construction of a bi-regional collaboration between the European Union and the LAC countries, envisaging a range of different activities that will contribute to this aim. RESINFRA EU LAC is based on three pillars:

- (i) Increased mobility of researchers between the two regions
- (ii) Promotion of access to research infrastructures of global interest to improve sharing of data and scientific excellence
- (iii) Focus cooperation on jointly defined grand challenges to create critical mass.

The **mandate** is clear: “to support policy coordination and the exchange of information to mobilize and strengthen RI cooperation between both regions, contributing to solve the global challenges while facilitating researchers’ mobility and the international access of RI”. In this sense, the CACTUS proposal is based in all recommendations and outputs from this project and the EU-CELAC Working Group on Research Infrastructures (WG RI) as presented in Table 1.3.

Table 1.3: RESINFRA EU-LAC meets CACTUS

RESINFRA EU LAC	CACTUS
<i>Identify a list of LAC RIs to be considered in the construction of the EU-LAC RI collaboration.</i>	Photovoltaic RIs in Chile and Colombia have been set up and can provide solid and relevant data to help the green Energy Transition and SDGs globally. In both cases, they work with relevant national universities in collaborative projects in the framework of solar energy.
<i>Gather and analyze information on strategies, policies, national roadmaps and funding tools at national and regional level to support the construction and operation of RIs within the LAC science and technology systems.</i>	CACTUS partners have identified a lack of cooperation in Solar PV between the EU and LAC in the whole value chain, from materials to services. The whole ecosystem and knowledge need to be built specially on climate-specific research. The Advisory Board considers public decision-makers and strategic association/ persons.
<i>Develop pilots aimed at enhancing the cooperation and coordination between European and LAC RIs at both policy and practical implementation levels.</i>	CACTUS proposes the first attempt to work in an integrative way considering different kinds of RI useful to develop sustainable solar energy RI and products/services.
<i>Define and implement a proactive and comprehensive Communication and Dissemination Plan.</i>	CACTUS has a strong DCE plan considering EU and LAC. CACTUS is supported by BI who is an experienced actor in the field of DCE in energy with many successful collaborative projects.
<i>Propose actions for the continuity of the collaboration beyond the end of the Project.</i>	CACTUS comes from already existing EU and LAC projects and moves forward with a sustainability plan for RI and collaboration to assure the continuity of the collaboration providing tools for funding, and strategical research topics.
<i>Establishing a Reporting Board to ensure appropriate quality control of the project deliverables and communication to the EU-LAC RI WG</i>	A Project Management Plan is prepared at the beginning of the project to ensure the quality of the reporting. A risk assessment is also done and will be continuously updated during the project life. The data quality manager will assess the PC for the data management plan. The PC together with the SC will assure the good reporting on time for the whole project.

1.2.3 CACTUS Concept

Based on a common will between EU and LAC RIs to find synergies for the enhancement of the scientific excellence of both regions, the concept of CACTUS is to **exploit existing infrastructures through a scientific exchange program between partners of the consortium**. The discovery of the existing infrastructures and methods in different physical and cultural environments is the source of the anticipated improvements of the RIs that will be achieved through this project. The focus will be to create a sustainable research network on the long-term PV performance in different climate conditions. This network will develop new services to ensure better **PV durability and sustainability**.



Figure 1.3 The members of the CACTUS consortium

The ability of CEA, EURAC, TECNALIA, ATAMOSTEC and UNC to monitor the performances of PV modules through **dedicated research infrastructures in different environments** (Chile, France, Spain, Italy and Colombia) is a chance to exchange on their knowledge and expertise to improve share of the data between the members. These RIs can provide valuable samples to study the degradation modes of the PV modules in different environments. Aged PV modules with monitoring data that could be characterized at CEA, ESRF and ILL infrastructures will provide useful in-depth understanding of the physics behind the degradations of the PV modules. These findings will help to generate roadmaps for the green transition through the enhancement of the durability of PV modules. The assessment

of the sustainability of PV modules is key for the energy roadmaps of EU and LAC.

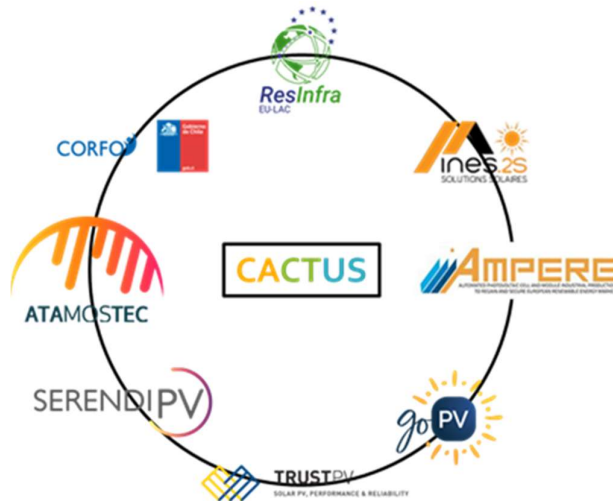


Figure 1.4 Background and supports for CACTUS.

CACTUS builds on the results of previous EU projects such as **SERENDI PV**, **TRUST PV**, **AMPERE**, **ATAMOSTEC**, **INES.2S** and **GOPV** and follows the RESINFRA EU-LAC recommendations. SERENDI PV focuses on how to reduce the Levelized Cost of Energy (LCOE) for PV and how to make possible the integration of a rapidly increasing PV power in the current power networks. To achieve these goals, an important part of the project is about the improvement of the reliability of PV modules, forecasting and data sharing. CACTUS will use this knowledge to share it with the partners out of SERENDI PV and develop adequate RIs to sustain the same goals. CACTUS will also evaluate the use of SERENDI's PV open data platform for PV data sharing.

TRUST PV works on the performance and reliability of solar power plants. Its first objective was to increase the reliability and lifetime of system components by reducing the number of failures and failure lifetime. The lessons learned from this project will fuel CACTUS knowledge share program on how to collect high-quality monitoring data, how to detect efficiently failures and how to enhance the materials and processes used for PV modules to achieve better durability. CACTUS will continue in this direction and develop new services to progress in that way. GO PV goal was to achieve an extended lifetime for PV modules produced in Europe with lower cost, improved LCOE and lower energy payback time. CACTUS is in line with this sustainability goal. It will enlarge the sustainable approach, not only to PV, but also to RIs and project management. A sustainability plan for RI and collaboration between EU-LAC partners will be developed to assure the continuity of the collaboration providing tools for funding and strategic research topics. The successful goal of AMPERE was to setup an innovative 100 MWp full-scale automated pilot line to prepare for the next step towards GW plants. In this project, the PV module Life Cycle Assessment (LCA) was carried out and new standards were developed to increase the reliability of the PV modules produced on the automated pilot line and facilitate the selection of materials for durable PV modules. CACTUS will take advantage of this feedback to refine the standards. INES.2S is supported by CEA to integrate PV everywhere thanks to the development of innovative applications, smart electricity management and reliable components. Training activities accompany the development of this work. All these topics will benefit directly to CACTUS. The project ATAMOSTEC (funded by CORFO in Chile) in LAC is also an asset for CACTUS. The availability of an existing RI adapted to the development and experimentation of high-radiation PV technologies is valuable for the consortium and the PV community to test materials and systems.

Sustainability assessment relies on the R-ladder strategy: reduce, reuse, and recycle. Durability of PV modules would allow limiting the depletion of resources, speeding up the bankability of PV projects and diminishing the quantity of PV modules to recycle. To investigate such topics, the benefits from the collaboration of EU and LAC existing RIs for sustainability assessment of PV systems are priceless. The collaboration between RI collecting data in different climate areas and RI characterizing materials will be of prime interest in order to evaluate early signs of degradation of PV modules. Being able to anticipate, as early as possible, the performances degradation of PV modules could lead to substantial savings in the green transition.

The **networking effort** in the project is thought to develop a **sustainable environment** for the RIs of the EU-LAC consortium with new services developed, enhanced scientific knowledge and improved protocols for data collection and O&M. This can be achieved through regular meetings, webinars, schools and workshops. Topics for knowledge exchanges will be defined according to the capacities and needs of the partners. The identified topics are LCA, PV

module degradation, indoor PV modules characterization, outdoor solar resource and PV monitoring. Based on the principle of “learning by doing”, researchers will visit EU and LAC RIs during research exchanges. This learning experience will allow EU-LAC researchers to acquire hands-on experience and enhance international cooperation. It will support educational programs in the energy sector including research methodology training for academic personnel, particularly for those responsible for education and training.

The overall approach of CACTUS is summed up in figure 1.5. It focuses on a **holistic sustainability approach across social, economic and environmental aspects for RI and PV deployment worldwide**. The existing RIs (ESFRIS landmarks, EU and LAC PV infrastructures and EU SOLARIS) will collaborate thanks to the input of RESINFRA EU-LAC to enhance the durability of PV systems. Detailed work will be performed **overall the value chain from the materials used in PV modules up to the O&M services** associated with the management of a PV plant. This collaboration will generate **new services for the scientific and industrial PV and energy community**. The intensive knowledge exchange will reinforce the EU-LAC scientific and industrial network working on PV and improve the overall scientific level of the members of the consortium. High quality protocols and data management plan will be generated. It will participate in the **emergence of a sustainable network of EU-LAC PV infrastructures dedicated to PV systems sustainability**.

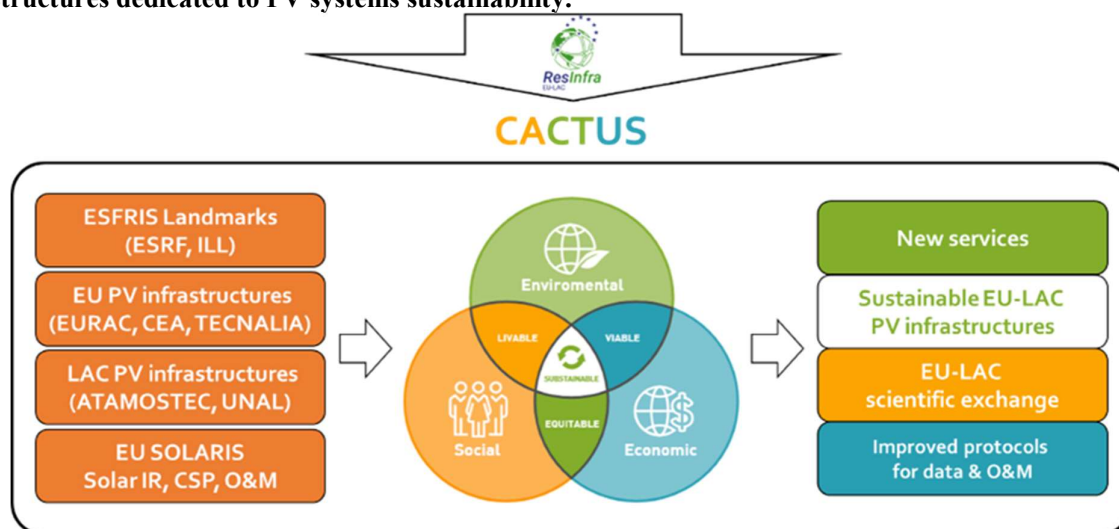


Figure 1.5 CACTUS concept.

1.2.4 CACTUS methodology

To reach the CACTUS goals, the project is built on 6 work packages.

WP1 (*Project management and quality assurance*) will manage the project thanks to coordination to structure the partners efforts. Regular meetings will be held to review the project planning and the work allocation. Data will be collected from CACTUS and managed in a **Data Management Plan (DMP)** which will be shared during and after the project. An **International Advisory Board (IAB)** will be key to supporting CACTUS. A set of experts from different areas will provide insights and valuable input to CACTUS to enhance the impact of the project, to establish clear roadmaps, to orientate general objectives, or minimize risks. Special attention has been given to gender equity. The description is in table 1.4.

Table 1.4: Confirmed and foreseen IAB members

International Advisory Board			
Name	Affiliation	Country	Expertise
Ulrike Jahn	VDE, IEA-PVPS	EU	quality, reliability, sustainability of PV
Prof. Ivan Gordon	EERA	EU	energy, photovoltaics, networking, RI
Ana Maria Ruz	CORFO	CHILE	energy, public policies
Dr. Jonathan Leloux	Lucisun	EU	data management, solar, meteorology
To be contacted to avoid a conflict of interest	MinENERGIA	Colombia	energy, public policies, certification
	MinENERGIA	CHILE	energy, public policies, certification
	RESINFRA EU-LAC		RI EU-LAC cooperation
To be contacted as industry association	SER-Colombia	Colombia	Energy, industry, photovoltaics
	ACESOL, ACERA,	CHILE	Energy, industry, mining

WP2 (*Enhancing RI*) will assess the existing RIs, and evaluate the best practices for solar resource assessment, PV outdoor measurements, soiling estimation, and failures detection. The existing indoor and outdoor RIs of the partners of the consortium are listed in table 1.5 and pictures of some RIs of the consortium are presented in figure 1.6. The diversity of infrastructure localities is one of the strengths of the consortium. It brings complementarity to this emerging scientific network between EU-LAC RIs.



Figure 1.6 – (Left) CEA indoor RI in France. (Center) ATAMOSTEC outdoor RI in Atacama Desert in Chile. (Right) TECNALIA outdoor RI in Spain.

Table 1.5: Description of indoor & outdoor RI and capacities of CACTUS

INDOOR RI		CEA	EURAC	TEC	EU-SOL	ESFR	ILL	UNC
LOCATION	Place	Le Bourget du Lac (France)	Bolzano (Italy)	San Sebastian (Spain), TECNALIA HQs	Plataforma Solar de Almería, Spain	Grenoble, France	Grenoble, France	Medellín, Bogotá
	Beginning	2005	2012	2011	1977	1994	1967	2016
SYSTEM	Equipment	Laboratories for manufacturing and characterization of PV modules	Laboratories for characterization of PV modules	Laboratories for manufacturing and characterization of PV modules		40 synchrotron X-ray beamlines covering a wide range of X-ray techniques including tomography, topography, spectroscopy, X-ray diffraction and scattering	40 neutron beamlines covering a wide range of techniques including tomography and reflectometry	Nationwide monitoring system for the PV power plants and energy storage systems.
	characterization	module complete characterization platform (all sizes)	module electrical characterization	UV-Vis-NIR spectrophotometer with integrating sphere, External Quantum Efficiency measurement, cell solar simulator, module solar simulator, electroluminescence measurement	Aging of optical solar components	module complete characterization or components. Sample preparation may be required. Sample environments can be developed to mimic end-use conditions.	module complete characterization or components. Sample prep may be required. Sample environments can be developed to mimic end-use conditions.	Platform for the analysis and processing of information gathered in the plants, electric variables (power, energy, yield) and variables of the storage systems.
	others	indoor climatic chambers, indoor soiling chambers	accelerated aging	indoor climatic chambers, tabber & stringer equipment, laminators, autoclaves	indoor climatic chambers, optical characterization instrumentation			

OUTDOOR RI		CEA	EURAC	TEC	EU-SOL	ATA	ATA-2	UNC
LOCATION	Place	Le Bourget du Lac, France (45.642196, 5.874964)	Bolzano, Italy (46.494518, 11.348130)	Derio, Spain, TECNALIA HQs (43.296230, -2.870876)	Atacama Desert (-24.090398, -69.929062)	Atacama Desert (-24.090398, -69.929062)	Atacama Desert (-23.837275, -69.895075)	Medellín (6.25184, -75.56359) Bogotá (4.60971, -74.08175)
	Climate	Warm temperate (Cfb)	Warm Summer Continental Climate (Dfb)	Marine West Coast Climate (Cfb)	Desert (BWk)	Desert (BWk)	Desert (BWk)	Tropical
	Beginnings	2005	2010	1999	2017	2012	2017	2019, 2020
SYSTEM	Equipments	meteo station / pyranometers / reference solar cells / albedometer / monitoring of production	meteo station / monitoring of production	meteo station	NA	meteo station / monitoring of production	meteo station / monitoring of production	Monitoring production
	PV technologies modules	PERC, PERT, HJT	all	PERC, TopCon, HJT	NA	Mono-silicon monofacial/	Polycrystalline monofacial	Polycrystalline monofacial

						Bifacial PER/PERC/HJT	BYDP6C-30	
	PV technologies systems	fixed / single axis / double axis, BIPV systems, Floating PV, vertical PV, VIPV	fixed / single axis / double axis	Ground-mounted PV systems, BIPV systems, Nearshore PV, AgriPV (greenhouse)	NA	fixed / single axis tracker	single axis tracker	Fixed rooftop
	Power	NA	62 kWp + 20 kWp	NA	NA	NA	1080 Wp	80 kWp + 70kWp
	Area size	3000 m2	2500 m2 + 500 m2	500 m2	NA	60.000 m2 (2.000 m2 facilities)	40.000 m2	250m2 + 300m2
	O&M facilities	Yes	Yes (by EURAC)	Yes (at module level)	NA	Yes (Bos/O&M)	Yes (BoS/O&M)	
DATA	monitoring system	YES	YES	YES	NA	YES	YES	YES
	Grid connection	YES	YES	YES	NA	YES	YES	YES
	Meteorological data	YES	YES	YES	YES	YES	YES	NO
	Time resolution	5 min	5 min	5 min	5 min	5 min	5 min	5 min

Unraveling the degradation modes in aged PV modules, with the help of the ESRF and ILL RIs, will be a leap towards longer PV modules lifetime in the different climate areas available in CACTUS and easier simulation of the degradation modes thanks to a better understanding of the physicochemical mechanisms behind.

WP3 (*New services*) aims to create new services from the improved RIs. Thanks to the results from WP2 on the beamlines protocols developed to serve the PV community, new services will be designed to generate useful outputs for degradation simulation and enhancement of PV plant profitability. The requirements for the establishment of indoor labs will provide the necessary elements for the evaluation of the economic benefits of the development of associated services for the different regions of interest in EU-LAC. Different tools, e.g., open-source models and datasets, will be shared with PV community for PV plants design optimization, models' calibration and O&M improvement.

WP4 (*Knowledge program*) will focus on the joint initiatives in management and staff development for both regions. The bi-lateral cooperation will involve mentoring, exchanges, innovation scorecards and workshops. A mapping of the HR talents required by the RI considering potential new research services, potential collaboration with other ERICs (data, aerosol, gas...) and new funding opportunities will be done.

WP5 (*Sustainability*) will ensure the sustainability of PV based on social-LCA methodologies, as well as the solar RIs sustainability needed to support the PV development from a technical, financial, social and strategic point of view. The impact evaluation of the project on energy transition and United Nations sustainable goals will lead to suggestions for updated roadmaps in a workshop with decision makers and the IAB.

WP6 (*Communication, dissemination and exploitation*) will identify the relevant target groups, tools and channels for communication of the project. The identification of the market needs will be assessed in terms of economic, social and environmental benefits, for the industry and research communities, on climate-specific measurement protocols (for tropical, desertic and temperate zones) of materials, PV plant designs and operations. The exploitation will aim at maximizing the impact of the outputs of the project.

1.2.5 Compliance with “do no significant harm” principle

Our project strongly supports the “do no significant harm” ambitions concerning all six environmental objectives of the EU Taxonomy Regulation No 2020/852. (1) Harmful if raises GHG emissions - harm to climate change mitigation, (2) impact in climate change adaptation, (3) Sustainable use and protection of water and marine resources, (4) Transition to circular economy – if it leads to significant inefficiencies in the use of materials or in the direct or indirect use of natural resources or significant increase of waste, (5) Pollution prevention and control. (6) Protection and restoration of biodiversity and ecosystems. A long-term research objective of the instruments to be developed in CACTUS is to increase the lifetime of PV systems. The establishment of climate specific protocols should help to better design, operate and manage such systems to achieving longer PV systems operations. Adapting PV systems to their operational environment for increased system lifetime would have a direct impact on (1) climate change mitigation, and (2) adaptation, as well as on the (3) reduction of water resources, (4) reduction of use of natural resources which are required during the manufacturing, the maintenance and the recycling of the PV modules. Climate change will also contribute to more extreme weather conditions. CACTUS enables research tools for continuous evaluation of the environmental impacts on the lifetime of PV systems. This will contribute to further improvements of the PV systems specifications for increased resiliency. Thus, CACTUS provides the means to promote adaptation to climate change (2). Pollution is prevented (5) by minimizing the waste created by non-

operational systems and by maximizing the electricity production thanks to enhanced plant management tools. Working towards increased system lifetime will protect ecosystems (6) by better use of natural resources. Especially when thinking about the magnitude of multi-TW PV electricity generation capacity which will be required in the future.

1.2.6 Open science practices

To facilitate access to and re-use of research data generated by CACTUS, the consortium will prepare a data management plan (D1.2 & D1.5). In this plan, it will be determined and explained which of the research data generated will be made publicly available, based on the guidelines on data management in Horizon Europe and under the basis of as open as possible, as closed as necessary. Numerous Open Science (OS) approaches are seen to boost the impact of our research and foster meaningful interactions with local communities, in particular:

- **Early and open sharing of research:** is adopted mostly to CACTUS supported scientific articles provided through collaboration with the SERENDI-PV project and its collaborative platform for PV data sharing.
- **Measures to ensure reproducibility of research outputs:** are developed through the integration into open-source platforms such as Zenodo, EIRIE, OpenAIRE and InvestigaM.
- **Providing open access to research outputs:** educational resources created will be posted on Open Educational Resources (OER) such as OERCommons and/or under Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights to enhance and ease the reuse of the produced material. For scientific papers, a trustworthy repository such as Open Research Europe will be used to make them available “green” or “gold” open access guaranteeing readability online, downloadable and printable. Data created will be put in a trustworthy repository such as Zenodo, EIRIE11, OpenAIRE and InvestigaM and comply with the FAIR principles as per previous approach.
- **Participation in open peer-review:** to be as transparent as feasible, with open names, open reports, and open participation.
- **Involving all relevant knowledge actors:** including all members of society public authorities, industry, academia and citizens with a strong emphasis on industry-academia to policymakers and regulator feeding to local communities.

1.2.7 Data management and management of other research outputs

CACTUS will manage different numerical and measured types of data and research outputs. Including for example operational data for PV production from various sites, sustainability assessment data (relevant for LCA), datasets linked to the measurement and characterization equipment, data linked to location and environmental conditions. Partners provide these data at the beginning and all along the project. The project will develop a Data Management plan (DMP) in D1.2 & D1.5 to explain how the consortium will manage data generated by the project during its timeslot and beyond. This document will reflect the status at any current time, of data (data, metadata, and images, from knowledge, tests and numerical activities) being provided or produced during the project to facilitate access to and re-use of Research data generated by CACTUS. The DMP is a live document throughout the project to monitor (i) data overview, (ii) FAIR data, (iii) research results, (iv) allocation of resources, (v) data security, (vi) data ethics and any other project related aspects. The consortium will strive to ensure that everything produced is openly available to ensure public access to scientific publications arising from the project. According to the European Commission Guidelines on Data Management arising from projects in the Horizon Europe programme, scientific data should be “FAIR” (or Findable, Accessible, Interoperable, Re-usable) helping to maximize the added value gained by digital publishing to ensure transparency, reproducibility, and reusability. More specifically CACTUS will be based in the following concepts:

- **Findability of data/research outputs** is realized by depositing relevant research data that are not subject to access restrictions (e.g., patents/IP) in a data repository, i.e. most likely Figshare or Zenodo (to be decided once the project has started). Additionally, a specific metadata template will be defined to describe, discover, and trace existing data collected by the CACTUS project. The templates will be sent and filled out by the data owners/data providers and saved in a repository selected at the start (by M6).
- **Accessibility of data/research outputs.** If the data are not subject to access restrictions (e.g., patents/IP, confidentiality, NDAs, etc.), then they can be disseminated via a data repository as explained above. These data will be available open access (albeit possibly with some temporary embargoes if so required).
- **Data ownership and data access.** The ownership of the data shall remain with the partner generating them. Legal issues and foreseeable data restrictions (e.g. as a result of confidentiality, secrecy agreements, patenting, etc.) will be discussed at the start of the project and formally agreed upon (information to be included in first version of DMP). Data will be shared between project partners during the project and the access to the data will

be guaranteed after the project ends for the partners of CACTUS.

- **Reusability of data/research outputs.** As mentioned above (Findability of data/research outputs), a usage license will be attached to all research data published in data repositories. Specifically, research data needed to validate the results in the scientific publications will be deposited in a data repository at the same time as a publication. Non-public research data will be archived at the repository using a restricted access option.
- **Curation and storage/preservation costs.** Relevant data/results will be stored for >10 years after project end. Cost of data preservation after the project end are null because the chosen repositories do not apply fees for archiving and data curation. During the project, a cloud storage solution will be adopted to share data among partners. The cost to activate and maintain it for the duration of the project will be covered by the project budget.

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2. Impact #IMP-ACT-IA@#

2.1 Project's pathways towards impact

CACTUS is fully aligned with the ambitions of HORIZON-INFRA-2023-DEV-01-06. Indeed, this Horizon Europe call aims at strengthening the bilateral cooperation on research infrastructures with Latin America while developing, consolidating, and optimizing the European RIs landscape, maintaining global leadership from basic to applied research, with the support of other countries.

2.1.1 Project's contributions to the expected outcomes

Scientific impact

Outcome 2: strengthening EU-LAC bi-regional scientific collaboration.

Four main pillars of cooperation identified by the RESINFRA-EULAC working group are: mobility of researchers, cooperation of RI; global challenges, and innovation. CACTUS contributes to each of the topics identified:

- The improvement of the outdoor and indoor RI for the assessment of the solar power KPIs for different climate conditions (**Objective 1**).
- The creation of new services by RIs (**Objective 2**) for solar power research such as:
 - o In-depth characterization of PV samples by ESFRIs, enabling the physical modelling of material degradation.
 - o Improvement of tools for enhancing plant profitability.
- The creation of common data treatment protocols adapted for each relevant environmental specification considered for solar power (**Objective 3**).

The environmental specificities represented by the infrastructures in the consortium enable a full coverage of the main weather specifications relevant for solar power assessment: *desertic* (in the Atacama region in Chile), *tropical* (with very strong humidity and daily temperature fluctuations up to 40 °C in Colombia) and the *temperate* and seasonal continental weather found in Europe.

In terms of innovation the CACTUS will contribute to improving RIs with for the development of methodologies and best practices for the identification and direct comparison of real operation conditions of solar power systems with a wide climatic coverage, enabling the development of protocols for measurements and operations, feeding information to standardized databases for enhanced modelling algorithms. Therefore, through innovation and cooperation, CACTUS offers a perfect setting for strengthening the EU-LAC scientific collaboration in the solar power research area, which directly tackles one of the main global challenges, *climate change*.

The project also foresees researcher mobility with various internships, trainings, and workshops, with the corresponding budget allocated for such activities. The consortium is aware of funding opportunities available to support early career researchers, which could provide future support to the project to enhance the sustainability of the project, such as Becas Chile, or the European programs such as ALFA and Erasmus Mundus/plus programmes¹². The complementarity and diversity of know-how available in the consortium, further supported by the participation of well-known researchers, promotes joint scientific developments in the solar power field with various publications already foreseen, including for example a paper on the sustainability of solar related RI platforms; best practice guidelines for climate-specific data collection and another publication for operations and maintenance of PV plants.

Economic/technological impact

Outcome 1: contribution to the EU-CELAC Strategic roadmap, in particular its 'Research Infrastructures' pillar.

¹² <https://eulac-focus.net/publications--repository/key-publications/>

The EU-CELAC strategic roadmap identified four points for its RIs pillar: (1) *Build collaboration, supporting frontier R&I and provision of transnational services, supporting education and skills development.* (2) *Strategic role of RI.* (3) *Shared understanding of issues as road-mapping, governance, and access policies, practical support to partnering RI thanks to the IAB support to CACTUS.* (4) *RI cooperation for sustainable development (green transition) in particular energy, climate change, biodiversity and food security.* CACTUS contributes to each of the targets defined in this strategy.

When it comes to **frontier research** in the solar power field: the sector is turning towards seamless integration of PV devices into a variety of applications (agriPV, BIPV, floating-PV). Moreover, manufacturing systems adapted to **specific climatic operations** is also increasingly important. In this context, CACTUS prepares the RI landscape to provide transnational research services answering to the industry's needs for the energy transition regarding PV power. CACTUS developments will enable the direct comparison of technological choices for **bankability** studies for different types of weather (WP5), evaluating degradation mechanisms (WP2, WP3), developing **data collection protocols** for improvement of O&M algorithms and digital twins for PV operations (WP3).

The economic relevance of the outputs from the research enabled in CACTUS can be better quantified by considering that today about at least 7% of solar PV power production is lost due to operational related issues¹⁵. Table 2.1 hints of the economic relevance of technical issues affecting PV operations. IEA data is used for current and projected solar power generation (see Fig. 2.1). The calculations are based on a world average electricity price of ~100€/MWh¹⁶.

With 2500kWh/m² (Global Horizontal Irradiance), the solar resource in the Atacama Desert in Chile is the highest in the world. Lacking any support mechanisms for investment (such as tax credits or feed in tariffs), the financing of PV plants by investors or banks puts a strong emphasis on modelling and spot prices forecasts. Such a financing structure is gaining traction in Europe¹⁷. CACTUS enables a reliable data collection capacity for the improvement of the modelling algorithms, which need better adaptation for harsh weather conditions like the ones in the Atacama Desert. On the long term this will translate into higher reliability from the PV systems outputs providing better tools for system design and **supporting the energy transition**.

The **strategic research** outputs enabled by the infrastructure developed in CACTUS can support researchers, willing to understand the physical mechanisms resulting in system failure thanks to advanced material analysis, modelling specialists willing to create better algorithms based on real and reliable data, PV manufacturers and system designers who would be able to have a direct comparison of their materials for specific climate designs and adapt them for higher system resilience; plant operators who could develop more adequate O&M practices based on the guidelines established in the project, grid integrators with a better assessment of the solar power resource.

Outcome 3: enhanced EU-LAC cooperation on research infrastructures in strategic areas.

The strategic areas defined by the RESINFRA-EULAC working group include **energy**, **climate change**, biodiversity, food security, health, and **emerging technologies**¹⁸. The strategic long-term impact of the R&D tools developed in CACTUS will contribute to the energy system through the improvement of solar power systems. In the net-zero

Table 2.1 Quantification of the economic impact of PV power production based on current projection scenarios for PV penetration up to 2050.

Year	Annual PV production [TWh]	Economic losses linked to issues in PV operations [billion euros/year]	
		For 7 % system loss	For 20 % system loss
2021	1000 ¹³	7	20
2030	7000 ¹	49	140
2050	12000 ¹⁴	84	240

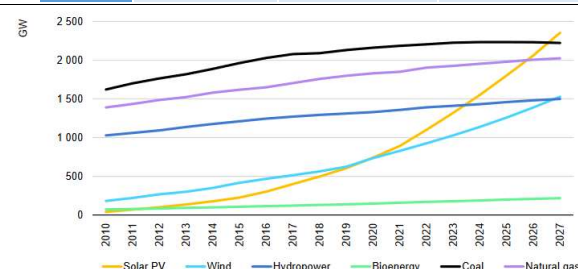


Figure 2.1 Cumulative power capacity by technology 2010-2027. From IEA Renewables 2022

¹³<https://www.iea.org/data-and-statistics/charts/renewable-power-generation-by-technology-in-the-net-zero-scenario-2010-2030>

¹⁴ Breyer et al. "Reflecting the energy transition from an European perspective and in the global context – relevance of solar photovoltaics benchmarking two ambitious scenarios", WCPEC 2022, Milan, Italy.

¹⁵ D. Moser et al., "Identification of technical risks in the PV value chain and quantification of the economic impact", <https://doi.org/10.1002/pip.2857>

¹⁶ <https://www.iea.org/data-and-statistics/charts/sectoral-electricity-price-distributions-2020>

¹⁷ <https://www.pv-tech.org/chile-land-of-opportunity-for-renewable-energy/>

¹⁸ https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/europe-world/international-cooperation/latin-america-and-caribbean_en

scenarios solar PV power represents about 70% of the total electricity generation contributing to reduce the CO₂ emissions and therefore tackling climate change¹⁶. CACTUS will enable the provision of research services for enhanced quality assurance targeting an increased lifetime, reliability, and innovation of solar systems. This will be achieved by (1) supporting well-established ESRIs to develop protocols for the sampling of PV systems (WP2), (2) developing new services where users (both from the research and industry community) can test their bill of materials in outdoor settings adapted for specific climates and use the data for the improvement of modelling algorithms (WP3) – this is of greater relevance for emerging technologies such as perovskites PV, (3) providing reliable inputs for the creation of international standards for the design, operations, and management of PV systems through the definition of data gathering protocols for solar KPIs and solar resource assessment.

Societal impact

Outcome 4: Enhanced research capacities in the LAC region and in the EU.

The exchanges planned throughout the project between the different research institutions will enable the reduction of the fragmentation of the R&I ecosystem, increasing the capacity of each participating region by **enabling access to complementary data** only available over different geographical situations. This results in increased modelling capabilities and improved research practices. The stronger links between the RIs, and the sharing of a platform for common scientific endeavors in the solar power sector support the development of a common research area, thereby embracing and supporting the SOM CELA strategic roadmap¹⁹. With all its activities, CACTUS encourages indeed open access data sharing across regions for better science and for support of evidence-based policy (as in the protocols for climate specific standards creation) related to the solar power sector.

Besides the technological exchanges, capacity enhancement will be particularly developed through the knowledge program planned in WP4, focusing on joint-initiatives for management and staff development with activities including mentoring, trainings, creation of innovations scorecards and workshops.

The sustainability plan foreseen for RIs (WP5) aims to ensure the **continuity of the collaboration** by providing tools for funding and defining strategic research topics. The RI development and ecosystem achieved in CACTUS support the transition to a more sustainable, diversified and environmentally friendly economy through the improvement of tools for an enhanced solar-based power generation.

Other societal impacts

Future research and innovation projects conceived and implemented thanks to the RIs development in CACTUS will have a direct contribution to lowering the CO₂ emissions, increasing job creation in the solar power sector and accelerating the penetration of solar power in energy systems.

The RIs participating in the project will **increase** their international **visibility** in the field and widen their bi-regional sectoral knowledge, through the dissemination and communication of the project results, and the exchanges amongst CACTUS researchers (who are also involved in several research and industry networks).

Finally, CACTUS believes that combining efforts from both regions is key for shaping the future of the technology, increasing growth and improving lives thanks to science and evidence-based information for the deployment of a secure, renewable, affordable, local, and environmentally friendly energy source and a sustainable future.

2.1.2 Contribution to the expected impacts

Expected impact	CACTUS's contribution
<i>Disruptive research and breakthrough science and innovation through cutting-edge, interconnected and sustainable Research Infrastructures;</i>	The green transition needs durable PV modules to reach the necessary sustainability of the energy production infrastructures. CACTUS will bring to the international PV community high-quality tools to provide accurate estimate of the durability of the PV modules. ESRF and ILL will develop completely new services for PV thanks to their facilities. It will provide unparalleled understanding of the degradation mechanisms of the next PV modules generation currently monitored in the CEA, EURAC, UNC, ATA and TEC RIs. Furthermore, the diversity of climate conditions in the consortium will give complete feedback to provide a glimpse into the future of PV. Enhanced tools for soiling failure detection to limit the production losses of PV plants is also of prime interest to secure bankable investments in PV. The cooperation of the consortium on this topic will deliver improved protocols that could not be as complete without the sharing of knowledge.
<i>Strengthened scientific excellence and performance and efficiency of the EU Research Area, increasing</i>	CACTUS will enhance the training, skills and experience of the researchers involved in the project, increasing the links between academia and industry to turn research into innovative results. Moreover, the identification of HR needs by the relevant RIs (WP4)

¹⁹ https://commission.europa.eu/system/files/2021-07/eu-celac_strategic-roadmap-2021-2023.pdf

<i>its attractiveness to researchers from all over the world</i>	will provide inputs about the needs for researchers, technicians etc, increasing the information of HR requirements and potentially their mobility across the different regions.
<i>Coordinated research infrastructure capacity among countries and regions, also by exploiting possibilities given by the smart specialization processes;</i>	The RIs are very complimentary in CACTUS. The capacities and specialization of the various consortium members enables an optimal collaboration and exploitation of the diverse research infrastructures. ESFR and ILL will focus on in-depth material characterization based on beam analysis; while SOLARIS-ERIC's focus will be on solar resource assessment, the Latin American partners bring their wide experience on operations in harsh weather conditions both desertic (ATA) and tropical (UNC), and the European RTOs contribute with their long-term technological experience, sustainability assessments, methodological approach and experience in the development of scientific roadmaps for policy support.
<i>Reinforced R&I capacities enabling systemic changes needed for a truly transformative societal and economic recovery and a strengthened resilience of critical sectors, as outlined in the Recovery Plan;</i>	The fight against climate change requires a rapid increase in the penetration of renewable energy sources. Solar PV is the cheapest and easiest power source for deployment. The green energy transition requires thus a global penetration up to unprecedented levels, translating to a new moto: PV everywhere! CACTUS supports the creation of clear and meaningful roadmaps linking basic research, technological development and industry needs thanks to the outputs of research platforms with the scientific and technological resources; establishing communication with the different stakeholders and providing a deep understanding of the societal needs in the energy sector to participate in its transformation, increasing its resilience by supporting the provision of a sustainable, affordable, reliable and environmentally friendly (both from a low carbon and resources utilization perspectives), solar power source. CACTUS specific contribution is based on RI development for high quality data, best practices and protocols for solar power assessment enabling the scientific roadmap creation.
<i>Improved European response, in cooperation with international players, to emerging socio-economic and related scientific and technological challenges at global level.</i>	The transformation of the energy system requires the creation of new services, while developing, improving and adapting the research capacity to the changes required by the society and the industry. The complementarity presented by the international collaboration in CACTUS enables an improved response answering to the need for climate-specific solar power systems with a deeper understanding of the physical parameters affecting their performance, development of RI methods and best practices for better assessment of solar power outputs and thereby improving the response for climate change

2.1.3 Potential barriers to outcomes and wider impacts

POLITIC.	CACTUS is fully in line with the objectives of the EC, such as the content of the “Clean Energy for All Europeans” package ²⁰ and the Green Deal aiming at carbon neutrality by 2050, and is fully in line with the renewable energy development ambitions established at national and supra-national levels, such as the “Fit for 55” ambition. Moreover, as CACTUS also aims at stimulating the European PV research by identifying needs and funding sources. Hence, possible political obstacles seem overall minimal.
ECONO.	The presence of two ESFRIs, one ERIC and several well-recognized RTOs in the consortium both from Europe and Latin America, the alignment of the project targets with the current sector research needs, and the understanding of these needs thanks to the excellent network access available in the consortium mitigates the economic risks and help ensure acceptance of developed RI ecosystem. The consortium will nevertheless keep a close eye on market and industry developments as part of the exploitation activities in WP6.
SOCIAL	Social risks are also perceived as limited. Indeed, the transition to a more environmentally friendly energy model is in general considered as one of the main objectives of coming decades, as reflected in European objectives for 2030 and 2050. Regulatory pressure to achieve higher PV penetration is likely to increase, as the various directives enacted by the EC demonstrate, this will increase the need for RI dedicated to the assessment of solar power production.
TECHNO	All WPs contribute to the goals of the project and no major barrier is foreseen in terms of technological feasibility. Solutions have already been foreseen to mitigate technological risks in case some WP activity does not meet the expected performance. In some countries, grid access is becoming more challenging for PV systems due to their concentration in localized areas. This could potentially limit the deployment of the technology and therefore market penetration. Nevertheless, no impact from this factor is expected at the research level stage.
ENVIR	Potential environmental barriers appear quite limited. All targets of the project aim to increase the operational lifetime of solar power systems, complying with existing environmental regulation and therefore reducing consumption of materials for fabrication of PV systems, increasing the positive impact of PV power generation thanks to an extended lifetime. Moreover, a sustainability assessment for RIs is foreseen during the project.

²⁰ <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans>

The creation of legislation relevant for the acceptability and operability of PV systems requires trustworthy, reliable, and relevant data. CACTUS supports this with its RI ecosystem and the creation of protocols for climate-specific solar power generation which could result in standardization or labelling. During the project, the regulation potentially affecting renewable energy technologies will be screened keeping an eye for the potential contribution of RIs to policy making.

2.2 Measures to maximise impact - Dissemination, exploitation and communication #@COM-DIS-VIS-CDV@#

Dissemination, communication, and exploitation activities are closely interlinked and must be undertaken in a coordinated way, thus exploiting synergies and avoiding overlaps. Within WP6, a series of documents will guide the strategies for communication, dissemination and exploitation. The communication and dissemination plan will be prepared at the beginning of the project, to ensure the optimal transfer of knowledge and outreach of the project. It will include an outline for exploitation activities. Detailed exploitation plans and IPR strategies will be prepared as the project evolves (M24), accompanied by other exploitation-related documents. The following figure presents the target groups for C&D in CACTUS:



Figure 2 Target groups in CACTUS.

The dissemination and communication will be structured over various activities including logo creation and visual presentation of the project followed by:

- 1. Publications:** conventional and electronic. **Public website**, with static and dynamic contents, to present the CACTUS project and its public deliverables and highlights, linking to other relevant contents. **Electronic newsletter** twice per year. **Leaflets** to be distributed at events and conferences. A **dissemination Kit**, with material (e.g., text and pictures including copyright clearance), which the EU may use for its own dissemination of the results (available on the project website). (**Task 6.2**). Open access **Publications** to be shared through white papers or via the participation in workshops, conferences and journal submissions.
- 2. Networking, communication & interaction:** besides the internal exchanges between consortium members, which will already enhance the international cooperation and understanding of each region's capacities and needs, CACTUS will interact with other European Projects, Clusters and Associations. CACTUS consortium members are involved in projects such as H2020 Trust-PV, Serendi-PV and Horizon's Europe PROMISE. They are also actively participating in various international research, lobbying, and manufacturing associations such as: European Technology and Innovation Platform (ETIP PV)²¹, European Solar Manufacturing Council (ESMC)²², IEA PV Power Systems Program²³, Solar Power Europe (SPE)²⁴, the Association of EU Research Centers (EUREC)²⁵.
- 3. International Advisory Board (IAB) and connection to policy makers and research community:** external experts, representing different sectors relevant for the project development. Their role is to advise on the scientific, sustainable, technical, standardization and policy aspects. A special mention to the EU-CELAC Working Group on Research Infrastructures (WG RI) that will be solicited, consulted and informed about the relevant information for the RI strategy.
- 4. Participation and organization of events, workshops and webinars** to communicate with the scientific community and society about the outputs from the CACTUS project. Two events are foreseen in Chile, a workshop in Colombia and a final workshop in the EU. The specific content will be defined as part of the knowledge program prepared in Task 4.1. Nevertheless, the target for the events is to share information about the research capacity which will be created through the project. A final workshop in Europe will include the learnings from CACTUS, including relevant inputs for decision makers and the relevance of Solar PV RIs as drivers for the energy transition (T5.3). Furthermore, consortium members will participate in **technical, commercial Fairs and**

²¹ <https://etip-pv.eu/>

²² <https://esmc.solar/>

²³ <https://iea-pvps.org/>

²⁴ <https://solarpowereurope.org/>

²⁵ <https://eurec.be/>

Exhibitions for the dissemination to potential research partners & end-user groups (such events include Intersolar, EUPVSEC, ...).

Table 2 Most relevant communication and dissemination measures planned for CACTUS, including indicator metrics

Project outcome to measure impact	Activity	Target Group	Indicator metrics
Project website and updates	General information about the project	Scientists, industry & public audience	>3 updates/year, >1000+ views over 2 years
Participation in conferences	Knowledge exchange	Scientists, industry, associations, public audience	> 6 in total
Events and workshops	General information	Scientists, industry & public audience	3 events in Latin America and a final workshop in Europe
Webinars	General information	Scientists, industry & public audience	2 webinars 50 participants each
Scientific publications	Research	Scientists, engineers, industry	>12 in total
Press releases	General information	Scientists, engineers, industry & public audience	>6 press releases in total
Online publishing (magazines, newspapers, blog posts)	General information	Scientists, engineers, industry & public audience	At least 1 bi-monthly
Project leaflets	Number of distributed leaflets & posters	Scientific, industry, associations & public audience	100+ leaflets / year

In the DCE strategy, **CACTUS will give special attention to reaching LAC stakeholders** (and other countries which are of the consortium). Connections with different external relevant actors will be made by means of the IAB members, and the EU- CELAC WG RI among others, to guarantee that results reach the EU-LAC RI community and enhance the overall collaboration to face future challenges together.

Exploitation strategy

Through successful dissemination and exploitation of project results, each partner is expected to strengthen its position in the research community. The main role of exploitation is to describe the method that each of the project partners individually, as well as the consortium, intends to apply to successfully leverage their engagement in the project and the project outcomes. To maximize the prospective benefits, a proper Exploitation Plan respecting IPR issues is a crucial instrument. While the first version of the DCE plan will focus more on communication and dissemination activities (D6.1), detailed information about exploitation including owner identification, potential exploitation routes and IPR strategies will be clearly stated in the final version of the CDE plan (D6.3).

In general, the first step of the exploitation will include the clarification of the term “exploitation” and the partners’ obligation to exploit. This will be done at the beginning of the project. The current inventory of exploitable results and potential exploitation routes will be updated periodically throughout the duration of the project. During the General Assembly meetings, a timeslot will be allocated for the follow-up of the exploitable results inventory (as part of the WP6 activities). The final version, published in D6.3, will contain further information, i.e. describing the partners’ exploitable claims and expectations, suggesting the most suitable form of IP protection; assessing the risks that might endanger the project’s objectives; and proposing exploitation routes for Key Exploitable Results. Furthermore, the partner responsible for exploitation activities (BI) will assist project partners in managing and optimizing ERs. Exploitation will be closely linked to dissemination, IPR, and communication activities. Together with the Exploitation Plans, a first draft of a Results Ownership List (ROL) will be prepared and finalized with all consortium members provided with the final reporting of the project (M24).

The project ecosystem is composed of:

- internal stakeholders (researchers, scientists, students in project partner organisations)
 - o the primary tasks of CACTUS engage internal stakeholders in project activities.
- external stakeholders (researchers, scientists, students in other research organisations; PV industry (manufacturing to project development, O&M and end-of-life); research policy makers; policy makers; general public).

Consolidating CACTUS understanding and vision of external stakeholders needs that can be met by CACTUS activities now and post project will take place in engagement activities that include:

- with relation to new services: Industry: project workshops (2); industry fairs (1); leaflet at fairs & exhibitions (>100).
- with relation to new services: Industrial exploitation: new services and opportunities for industry after evaluation for market needs.

Industry engagement will be two faceted : 1/ developing a more precise understanding of how CACTUS can respond to industry needs with relation to new services to be developed (WP2, 3, 5) 2/ensuring the new services can be

developed, marketed and supported sustainably post-project (WP6) . Project workshops and participation in industry fairs will bring industry actors and project researchers together to confront industry needs and research plans for degradation simulation to enhance PV plant profitability.

Specific measures: Before M12 - CACTUS roadshow in 2 industry fairs (in LAC and 1 in EU) where specific meetings with industry actors will be planned to confront research and industry expectations and needs from the project, and feedback industry requirements to tasks in WP2, 3 and 5. Results will also inform the WP6 exploitation plans and identify new project communication and disseminations opportunities.

Responding to societal needs at large will be accomplished through contributions to policy and roadmaps:

- Policy-makers (incl. standardization bodies): events (2), recommendations/white papers (2), SRIA update.

Table 2.3 Activities to promote the project exploitation and means of verification

Target groups	Main activities	Means of verification
Researchers, and industrial groups	Promotion of the RIs using the innovation scorecard as a basis (T4.2.1) including the current stock of innovative tools and services available at the RIs, and the technological specificities which are provided by each RI.	Organisation of 3 workshops (Chile, Colombia and one in the EU), showcasing RIs capacities based on their innovation score
Researchers, PV lobbying associations, and Policymakers	Creation of a roadmap defining research targets and identifying potential means of funding, for the sustainability of solar research infrastructure (T5.3) including the evaluation of the creation of a PV-ERIC or other strategies	D5.1: white paper on the sustainability of solar-related RI platform
Mainly targeted at Policymakers, Also relevant for researchers, industry & associations	Public event showcasing the main results of CACTUS, with a strong focus on the impact of Solar PV RI as a driver for the green energy transition and the relevance of solar PV RI for the achievement of the UN Sustainable Development Goals	Final Workshop to share learnings with decision-makers

#§COM-DIS-VIS-CDV§#

2.3 Summary

Table 2.2 Key exploitable results of CACTUS.

Number	Result description	Owner(s)	WP	Linked to Objective	End-user(s)	IPR (patent, proprietary know-how, publication..., license, new service)
1	Assessment for climate specific protocols and recommendations for standard creation or labelling	ATA, CEA, EURAC, TEC UNC	2	O1	Researchers, PV manufacturers, developers	Publication and proprietary know-how
2	Protocols for the sample preparation and measurements of PV modules at ESRF	ESRF	2	O2	Researchers, PV manufacturers	Proprietary know-how to be used as a new service
3	Protocols for the sample preparation and measurements of PV modules at ILL	ILL	2	O2	Researchers, PV manufacturers	Proprietary know-how, to be used as a new service
4	Indoor lab design (equipment, measurements, procedures) for the assessment of PV systems as a service , considering different climate specifications (desertic, tropical, temperate)	ATA, CEA, UNC, TEC	3	O1 O2	Researchers, PV manufacturers, developers and installers	Proprietary know-how, to be used as a new service
5	White paper on sustainability of solar related RI platform and best practices	EURAC	5	O4	Researchers, policy makers	Publication
6	Guidelines for climate-specific data quality collection of solar resource (irradiance)	EU-SOL, TEC EURAC, CEA, ATA, UNC	2	O3	Researchers, industry (including EPCs, PV owners), financing institutions	Publication
7	Guidelines for climate-specific data quality collection of environmental conditions relevant for solar power production	EU-SOL, TEC, EURAC, ATA, UNC, CEA	2	O3	Researchers, industry (including manufacturers, EPCs, PV owners), financing institutions, traders)	Publication
8	Guidelines for climate-specific operation and maintenance procedures of PV plants, focusing on soiling and failure assessments	TEC, ATA, UNC, CEA	2	O3	Researchers, industry (including manufacturers, EPCs, PV owners)	Publication
9	Map of HR talents, new RI capacities and funding opportunities	BI	4	O5 O6	Universities, RTOs, Policy makers, lobbying associations	Publication
10	Improved O&M tools for RI, plant design and operations	TEC, CEA, EURAC, ATA, UNC	2	O1	Researchers and developers, energy traders	Proprietary know-how
11	Guidelines for sustainability of PV technology	EURAC	5	O1	Researchers, policy makers & financing institutions	Publication
12	Strengthening of management capacities by the creation of an innovation scorecard for solar measurement equipment	CEA, TEC, ATA, UNC, EURAC	4	O6	Researchers and developers	Publication and proprietary know-how

KEY ELEMENT OF THE IMPACT SECTION

SPECIFIC NEEDS	EXPECTED RESULTS	D&E&C MEASURES (per target groups)	TARGET GROUPS	OUTCOMES	IMPACTS
Developing, consolidating and optimizing the European research infrastructures landscape, maintaining global leadership.	Best practices for RI management to study the short-term influence of local conditions on the performance and O&M of solar and PV plants	Scientific community: scientific publications (>10), conferences (>6), dedicated workshop (2), 2 webinars.	Scientific & academic community active in physics, materials, solar, PV (incl. EU funded projects).	Technological: reliable, sustainable and bankable PV production solutions for TW-era demonstrated for different climate conditions. Deploy a strong and sustainable RI ecosystem for the whole PV value chain from materials to operations to develop high scientific excellence.	Strong contribution to the EU-CELAC Strategic roadmap , in particular its ‘Research Infrastructures’ area regarding renewable energy potential and collaboration.
Enhance RI capacity to support frontier research and address the emerging and new scientific and societal objectives associated with the transition towards a sustainable and resilient Europe .	New services: Degradation and failure assessment tools of PV systems at frontier research based on improved RI capabilities. Enhance PV plant profitability and sustainability through open sources tools	Industry: project workshops (2); industry fairs (1); leaflet at fairs & exhibitions (>100).	European and LAC PV actors and developers: installers, O&M companies, like ENEL, IBERDROLA, AKUO, EDF, TOTAL, ENGIE... and SMEs...	Support EU research: Maintaining leadership and strong innovation base in the solar and PV sector thanks to the development of competitive and sustainable PV value chain. Develop fruitful exchanges to create new research addressing scientific and societal challenges for energy and green transition.	Create an EU-LAC PV outstanding RI ecosystem considering from basic science to system integration (all TRLs value chain) with and holistic approach merging competences and skill from different existing RI
Promote disruptive research and breakthrough science and innovation through cutting-edge, interconnected and sustainable Research Infrastructures.	New PV outstanding EU-LAC RI ecosystem with complementary competences and skills from different existing RI	Policy-makers (incl. standardization bodies): events (2), recommendations/white papers (2), SRIA update.	European and LAC PV manufacturers: ENEL, MB, Voltec, and newcomers	Assist policy makers: Scenario for a low-environmental impact of PV with efficient use of abundant materials and reliable: <i>eco-design</i> . Definition of climate adapted technology: <i>climate-labelling</i> . Harmonization of Roadmaps considering <i>all TRL levels in the R&I development</i> .	Strong EU-LAC bi-regional scientific collaboration in the field of energy, improving the services offered by RI for R&I based on a sustainable and complementary approach.
Ensure sustainability and reliability of PV and increase the competitiveness of PV solutions worldwide to allow the sustainable penetration of renewable energies towards a green transition .	New services and protocols: Datasets for indoor/outdoor models’ calibration for specific climates based on RI and cross capacities	Industrial exploitation: new services and opportunities for industry after evaluation for market needs.	Renewable energy providers and integrators: combined solutions for solar energy and others ENGIE, Iberdrola, Acciona...	New markets & sustainable deployment: Deployment of new services given by RI in major scientific areas: material degradation, fundamental physical understanding, holistic system, integration... Optimize the O&M of PV and the impact of PV on landscapes.	Create new capacities, new jobs, services, and improve research areas on the scientific and basic science and to accompany industrial technological transfer for local ecosystem.
Strengthen scientific excellence and performance and efficiency of the European Research Area, increasing its attractiveness to researchers from all over the world.	Enhanced Scientific collaboration , joint initiatives in management and staff development in the renewables energy sector in both regions. Creation of new expertise.	Society/general public/end consumers: communicate potential of RI on PV, new challenges and opportunities: social media posts and website updates.	Organizations & associations: EERA, SPE, ESMC, ETIP PV, EUREC, ESIA, ACERA, IEA PVPS...	RI: creation of a global RI ecosystem around PV from materials to integrative approach: Combining skills, capacities with a common goal, practices, methodologies and data management to improve globally the scientific excellence in the field of PV, materials, system, solar...	Sustainable penetration of PV adapted to each climate conditions (reliable, bankable and socially accepted) based on RI outputs.
Reinforced R&I capacities	Best practices: Standardize research		Polymakers &	Knowledge: create a network of experts in the	

SPECIFIC NEEDS	EXPECTED RESULTS	D&E&C MEASURES (per target groups)	TARGET GROUPS	OUTCOMES	IMPACTS
<p>enabling systemic changes needed for a truly transformative societal and economic recovery and a strengthened resilience of critical sectors like energy and climate change impacting the whole society.</p>	<p>methodologies in the field of sustainability, bankability and socially related aspects for energy, and climate change related aspects</p> <p>Improved Data management with common repositories for sustainability assessments / guidelines on how to include social-LCA in non-pricing criteria for the PV and energy sector and new capacities</p>		<p>Standardization bodies at EU, LAC and national/regional levels. EU-LAC WG on RI</p> <p>End-users (developers, installers) & general public - especially relevant for individual use and landscape /environment impact.</p>	<p>field of PV, combining new capacities to enhance R&I capacities in EU and LAC towards a scientific excellence in the field.</p> <p>Roadmaps: improve the national PV and energy roadmaps from low TRL up to implementation. Stablish the bases for sustainable RI as main vector for scientific, technological and industrial research complementarity and deployment with reinforced capacities specially in LAC regions (similarly as SRIA in EU).</p>	

#§IMP-ACT-IA§#

3. Quality and efficiency of the implementation @@QUA-LIT-QL@# @@WRK-PLA-WP@#

3.1 Work plan and resources

CACTUS is proposing a well-integrated approach where all the steps feed into the next stage and potentially backwards, if required. To ensure the sustainability of the overall project, infrastructure, and exchanges, WP5 is setup to be the driver of the proposal. WP1 assures the smooth coordination between EU, LAC partners and the EC. Three core WPs address the three main objectives of the project: WP2 dedicated to enhancing the RIs in EU and LAC, WP3 to the creation of new services by the different RI and the knowledge generated by the project, and WP4 oriented to the scientific & technical exchange between

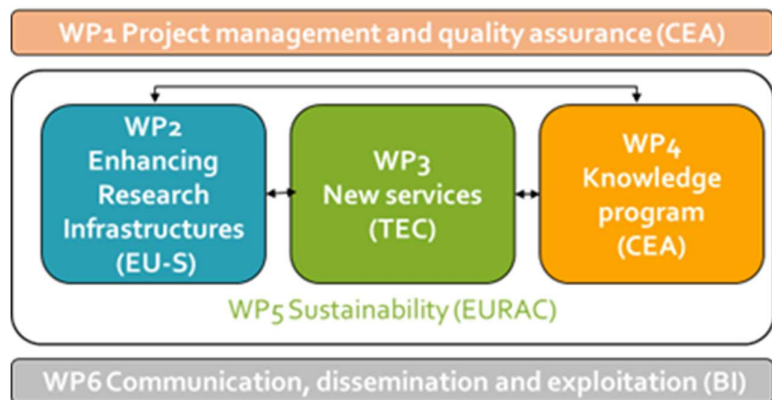


Figure 3.1: CACTUS WP structure

partners to increase the global knowledge in photovoltaics, in RI and globally in the green energy transition. Finally, WP6 deals with the dissemination, the communication and the exploitation of the results of the project, to spread the CACTUS results to the different stakeholders (scientific community, industry, decisions-makers and citizens). Figure 3.1 summarizes the structure of the project, Table 3.1a the list of the WP and Table 3.1b, the work planned in each WP.

3.2 Capacity of participants and consortium as a whole @@CON-SOR-CS@# @@PRJ-MGT-PM@#

CACTUS is a **multi-disciplinary** and divers consortium that pools **complementary expertise, unique competencies and state-of-the-art infrastructures and equipment**. CACTUS is formed by 7 partners from 4 European countries, including 1 ERIC AND 2 Landscape ESFRIs, 3 research centres and 1 SME and 2 partners from LAC: ATA in Chile and UNC in Colombia. The selected partners **bring together European and Latin America's reference solar energy Research Infrastructures. The consortium covers the entire value chain of innovative and frontier research** from materials, data collection and analysis, PV manufacturing, circular economy, market and policies (see Fig. 3.2.1). CACTUS is formed by **several European centres** pushing to keep a strong, low carbon and innovative upstream PV industry development (EURAC, TEC, CEA); discovery and development of different PV Modules materials and designs, advanced data simulation and modelling (CEA, ESRF, ILL, EU-SOL); **experts in technology transfer**, real-life PV power generation, recycling and sustainability focused on PV markets, competitiveness and exploitation of PV solutions (CEA, EURAC, TEC, EU-SOL, BI).

To complement the knowledge created in Europe, we have two countries who bring their expertise in the photovoltaic value chain specifically for tropical (UNC) and desert/high radiation (ATA) to complete and improve the data and new services to be provided by the participating institutes (fig 3.2.2). Having partners in key points in the innovation and PV value chain, pioneers in the scientific research, who all interact with a broad network of other academic, commercial, and political entities, the success of CACTUS will create a unique RI platform to consolidate the EU's leadership in driving the energy transition and PV everywhere.

Altogether, the consortium pools complementary expertise, unique competencies as well as state-of-the-art infrastructure and equipment (e.g. PV materials, PV manufacturing, encapsulation, sustainability, durability and reliability assessment, and LCA) in all fields required to reach CACTUS's ambitious objectives. In line with the standards of RES-INFRA EU-LAC, the partners have been carefully selected to simultaneously ensure (i) to provide a relevant mix of solid and relevant RI and knowledge to be shared among participants and newcomers, (ii) balanced distribution between EU capacities, and (iii) enhancing the cooperation and coordination between European and LAC RIs at both policy and practical implementation levels. It is highlighted that **all partners involved have experience in Horizon Europe and H2020 (and FP7) projects**, which warrants and efficient execution, operational life, reporting and management of the project.

The consortium in a nutshell: CACTUS

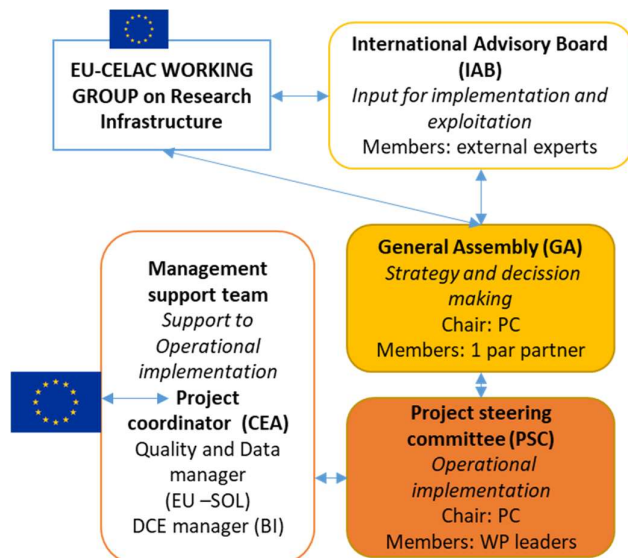


Figure 3.2.3: CACTUS management structure

Project Coordinator **CEA** and specifically its Solar Technologies Department located at INES is a world leader in research and development for advanced photovoltaic solar technologies, their integration into electrical systems and intelligent energy management. CEA has also experience in modelling, simulation and climate-specific materials performance research, PV design, manufacturing and LCA. CEA has ample of experience in project management as a partner coordinator in collaborative research projects on a national, EU and international level. The coordinator, Dr. Romain Couderc has a strong experience in photovoltaics and degradation mechanisms. He has been WP leader in the EU-Chilean ATAMOSTEC project and has participated in several H2020 and Horizon Europe projects. The **ESRF** has defined seven EBS science goals, in line with UNESCO's objectives for sustainable development and with the global challenges identified by the EU's Horizon Europe research and innovative programme. Synchrotrons provide with unique techniques

for learning about the structure and behaviour of matter at the molecular and atomic level. **EURAC** focuses on performance and reliability of photovoltaic systems, solar resources, exploitation and mitigation of variability, PV integration in electricity grids and building integrated photovoltaics. **EU-Solaris** is the European Research Infrastructure for CSP and Solar Thermal Energy (includes the participation of France, Spain, Germany, Italy, Cyprus, and Portugal) and is an ESFRI landmark as well as an ERI, offering a variety of state-of-the art outdoor labs and data collected. **TECNALIA** scopes of action are: smart manufacturing, digital transformation, energy transition, sustainable mobility, Personalised health, urban ecosystem and circular economy. Has participation in the European Commission's Horizon 2020 programme. **BECQUEREL INSTITUTE** has a comprehensive knowledge of research funding programs, experience in project management as well as in dissemination and exploitation of innovations, at a national, international and EU level. Also, it provides industrial and economic information to the ecosystem, and performs LCA, environmental and social impact of renewable energy projects and innovations. Institut Laue Langevin (**ILL**) covers topics in biology, (green) chemistry and materials science, as well as condensed matter, nuclear and particle physics. **FILL2030** is part of the EU's Horizon 2020 research and innovation programme aimed, among other topics, to create new service packages for academia and industry; tools to identify emerging user groups; and demonstrations of the socio-economic impact of research conducted at ILL. With this complete portfolio of expertise in materials, knowledge, expertise and infrastructures, CACTUS shall be able to implement a carefully managed plan in order to meet the objectives, deliverables, goals and sustainability of the project.

CACTUS's management and QA structure will rely on a Management Support Team (MST) and two important bodies – the General Assembly (GA) and the Project Steering Committee (PSC). The GA, composed of one key senior representative from each partner organization, is the decision-making body of the consortium. It will be established at the beginning of the project. The PSC, comprising of all WP Leaders, will be responsible of the supervision of the project tasks' implementation supporting the Project Coordinator (Romain Couderc, CEA) in the overall work coordination. Moreover, the coordinator will be supported by the quality manager (EU-SOL) and the dissemination, communication and exploitation manager (BI). The GA will in addition receive support from external experts of IAB and the EU CELAC Working group on Research Infrastructures. This group will be consulted and invited to give support, guidelines to the project, and will also benefit from exchanges, and results. All partners will have a role in each work package, which tasks have been assigned to the adequate partner, considering its relevant experience.

Table 3.2a List of contributions of the partners in each WP.

WPs	Each partners main contribution (knowledge and tasks)	Other contributions
WP1	CEA: Management and Coordination; All partners: QA; FAIR management of the Data Management Plan; and timely reporting.	IAB will contribute to ensure the strategic objectives and impact of the project.

WP2	ESRF & ILL: indoor capacities and material assessment; EURAC, CEA, TEC, ATA UNC: outdoor PV RI; CEA, TEC, UNC: indoor PV RI; EU-SOL: solar RI; TEC: O&M, soiling and failure detection and O&M.	Through the partners' network with private and public sector, the information shall be enriched with different campaign measurements, such as PV failure diagnosis, re-use of decommissioned PV modules and other related project and studies.
WP3	CEA: Indoor labs; ESRF, ILL, CEA & EURAC: New services; EURAC, TEC, CEA, UNC, ATA: Plant profitability; TEC, ATA UNC, CEA: Tools for O&M; UNC, TEC, EURAC, ATA, CEA: model calibration.	IAB will contribute with complementary information at country, regional and sectoral information regarding PV performance and needs.
WP4	CEA: knowledge exchange plan & management capacities; All partners: training and workshops, transversal cooperation; BI: new RI capacities over PV and market	Potential collaboration with other ERICs and partners in both regions shall strengthen the project implementation and its future development.
WP5	EURAC, ATA, BI, CEA: sustainability and end-of-life EURAC, BI, CEA, TEC, ATA, UNC: market and social-oriented research; All partners: global RI sustainability; EURAC: Impact on energy transition	IAB will contribute to understand what PV requires in terms of research and knowledge creation, in issues relevant to a positive social and lowered environmental impact.
WP6	BI: CDE plan, market assessment & exploitation; All partners : CACTUS CDE	Partners' networks in each region shall participate in communication and dissemination activities as well as in the identification of market and public sector needs.

Also, as shown in Table 3.2a, the Advisory Board as well as the partners' networks shall be involved in the outcomes and impact of the project.

LAC Partners: Chile and Colombia

ATAMOSTEC is a consortium formed by 5 Chilean universities, industrial partners, CEA (France), and ISC Konstanz, which seeks to develop bifacial module technologies specially adapted to Desert and high radiation conditions. ATAMOSTEC (Atacama Modules and Systems Technologies), brings to CACTUS sound Desert characterization and PV module degradation data, O&M strategies, and knowledge created by several projects developed in Chile in collaboration with an extensive network of partners from the private and public sector.

The **UNC** (Universidad Nacional de Colombia) has several PV installation facilities on six different campuses (Medellin, San Andres, Bogotá, La Paz, and Leticia), which are monitored continuously. The data is collected and shared for research purposes. Also, information on weather conditions is available from national and local instruments (humidity and temperature mainly). The UNC will contribute to CACTUS with information on PV performance, degradation and optimization knowledge, specific to tropical conditions.

#§CON-SOR-CS§# #§PRJ-MGT-PM§#

ANNEX 2

ESTIMATED BUDGET (LUMP SUM BREAKDOWN) FOR THE ACTION

Forms of funding	Estimated EU contribution						Maximum grant amount ¹
	Estimated eligible lump sum contributions (per work package)						
	WP1 Project management and quality assurance	WP2 Enhancing RI	WP3 New services	WP4 Knowledge program (research mobility and education)	WP5 Sustainability	WP6 Communication, dissemination and exploitation	
	Lump sum contribution	Lump sum contribution	Lump sum contribution	Lump sum contribution	Lump sum contribution	Lump sum contribution	
	a	b	c	d	e	f	g = a + b + c + d + e + f
1 - CEA	108 283.71	44 019.26	44 019.26	44 019.26	102 033.71	33 014.45	375 389.65
2 - ESRF	5 437.50	40 125.00	10 875.00	0.00	0.00	3 750.00	60 187.50
3 - ILL	6 250.00	12 500.00	57 450.00	0.00	0.00	4 375.00	80 575.00
4 - Eurac Research	22 500.00	22 500.00	30 000.00	33 750.00	37 500.00	16 250.00	162 500.00
5 - TECNALIA	24 711.25	39 770.00	65 380.00	12 258.75	4 086.25	10 672.50	156 878.75
6 - BECQUEREL	20 781.25	0.00	0.00	19 375.00	26 250.00	100 937.50	167 343.75
7 - ATAMOSTEC	34 750.00	76 375.00	20 625.00	15 750.00	10 250.00	58 125.00	215 875.00
8 - EU-SOLARIS ERIC	31 375.00	114 250.00	0.00	7 125.00	0.00	7 125.00	159 875.00
9 - UNC	20 625.00	57 750.00	15 750.00	7 625.00	4 875.00	10 687.50	117 312.50
Σ consortium	274 713.71	407 289.26	244 099.26	139 903.01	184 994.96	244 936.95	1 495 937.15

¹ The 'maximum grant amount' is the maximum grant amount fixed in the grant agreement (on the basis of the sum of the beneficiaries' lump sum shares for the work packages).

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EUROPEAN SYNCHROTRON RADIATION FACILITY (ESRF), PIC 999484121, established in 71 AVENUE DES MARTYRS, GRENOBLE 38000, France,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUT MAX VON LAUE - PAUL LANGEVIN (ILL), PIC 999933522, established in 71 AVENUE DES MARTYRS, GRENOBLE 38000, France,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ACCADEMIA EUROPEA DI BOLZANO (Eurac Research), PIC 999887253, established in VIALE DRUSO 1, BOLZANO 39100, Italy,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FUNDACION TECNALIA RESEARCH & INNOVATION (TECNALIA), PIC 999604110, established in PARQUE CIENTIFICO Y TECNOLOGICO DE GIPUZKOA, PASEO MIKELETEGI 2, DONOSTIA-SAN SEBASTIAN (GIPUZKOA) 20009, Spain,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **and the European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ICARES CONSULTING (BECQUEREL), PIC 928696916, established in VIEUX CHEMIN DE L'HELPE 148, RIXENSART 1332, Belgium,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CORPORACION ATAMOS TEC (ATAMOSTEC), PIC 883000119, established in URIBE 636 OFFICE 302, ANTOFAGASTA 1271616, Chile,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER (EU-SOLARIS ERIC), PIC 883665733, established in CARRETERA A SENES KM 4, Tabernas 04200, Spain,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **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

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDAD NACIONAL DE COLOMBIA (UNC), PIC 999878814, established in CARREA 45 26-85 EDIFICIO URIEL GUTIERREZ QUINTO PI CIUDAD UNIVERSITARIA, BOGOTA 111321, Colombia,

hereby agrees

to become beneficiary

in Agreement No 101132182 — CACTUS ('the Agreement')

between COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) **and the European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

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the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

FINANCIAL STATEMENT FOR THE ACTION FOR REPORTING PERIOD [NUMBER]

EU contribution												
Eligible lump sum contributions (per work package)												Requested EU contribution
	WP1 [name]	WP2 [name]	WP3 [name]	WP4 [name]	WP5 [name]	WP6 [name]	WP7 [name]	WP8 [name]	WP9 [name]	WP10 [name]	WP [XX]	
Forms of funding	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	[Lump sum contribution// Financing not linked to costs]	
Status of completion	COMPLETED	COMPLETED	COMPLETED	COMPLETED	COMPLETED	COMPLETED	COMPLETED	PARTIALLY COMPLETED	PARTIALLY COMPLETED	COMPLETED	NOT COMPLETED	
	a	b	c	d	e	f	g	h	i	j	k	l = a + b+ c + d+ e+ f+ g+ h+ i+ j+ k
1 – [short name beneficiary]												
1.1 – [short name affiliated entity]												
2 – [short name beneficiary]												
2.1 – [short name affiliated entity]												
X – [short name associated partner]												
Total consortium												

The consortium hereby confirms that:

The information provided is complete, reliable and true.

The lump sum contributions declared are eligible (in particular, the work packages have been completed and the work has been properly implemented and/or the results were achieved; see Article 6).

The proper implementation of the action/achievement of the results 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, 21 and 25).

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 2015/444¹ 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 Integrity².

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).

Granting authority right to object to transfers or licensing — Euratom actions

Where the call conditions in Euratom 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 or non-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 to the Euratom Research and Training Programme 2021-2025 and
- the granting authority considers that the transfer or licence is not in line with the EU interests.

Beneficiaries that intend to transfer ownership or grant a 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 results, 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 (including the defence interests of the EU Member States under Article 24 of the Euratom Treaty).

The granting authority may request additional information.

If the granting authority decides to object to a transfer or licence, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information 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.

Access rights for the granting authority, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy — Euratom actions

In Euratom 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, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy for developing, implementing and monitoring Euratom policies and programmes or for compliance with obligations assumed through international cooperation with non-EU countries and international organisations.

Such access rights include the right to authorise third parties to use the results in public procurement and the right to sub-license and are limited to non-commercial and non-competitive use.

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 Commons 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.

Only publication fees in full open access venues for peer-reviewed scientific publications are eligible for reimbursement.

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 Commons 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.

Recruitment and working conditions for researchers

The beneficiaries must 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 Researchers³, in particular regarding:

- working conditions
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and all participants involved in the action are aware of them.

Specific rules for access to research infrastructure activities

Definitions

Research Infrastructures — Facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields. This definition includes the associated human resources, and it covers major equipment or sets of instruments; knowledge-related facilities such as collections, archives or scientific data infrastructures; computing systems, communication networks, and any other infrastructure, of a unique nature and open to external users, essential to achieve excellence in research and innovation. Where relevant, they may be used beyond research, for example

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).

for education or public services, and they may be ‘single-sited’, ‘virtual’ or ‘distributed’⁴:

When implementing access to research infrastructure activities, the beneficiaries must respect the following conditions:

- for transnational access:

- access which must be provided:

The access must be free of charge, transnational access to research infrastructure or installations for selected user-groups.

The access must include the logistical, technological and scientific support and the specific training that is usually provided to external researchers using the infrastructure. Transnational access can be either in person (hands-on), provided to selected users that visit the installation to make use of it, or remote, through the provision to selected user-groups of remote scientific services (e.g. provision of reference materials or samples, remote access to a high-performance computing facility).

- categories of users that may have access:

Transnational access must be provided to selected user-groups, i.e. teams of one or more researchers (users).

The majority of the users must work in a country other than the country(ies) where the installation is located (unless access is provided by an international organisation, the Joint Research Centre (JRC), an ERIC or similar legal entity).

Only user groups that are allowed to disseminate the results they have generated under the action may benefit from the access (unless the users are working for SMEs).

Access for user groups with a majority of users not working in a EU Member State or Horizon Europe associated country is limited to 20% of the total amount of units of access provided under the grant (unless a higher percentage is foreseen in Annex 1).

- procedure and criteria for selecting user groups:

The user groups must request access by submitting (in writing) a description of the work that they wish to carry out and the names, nationalities and home institutions of the users.

The user groups must be selected by (one or more) selection panels set up by the consortium.

⁴ See Article 2(1) of the Horizon Europe Framework Programme Regulation 2021/695.

The selection panels must be composed of international experts in the field, at least half of them independent from the consortium (unless otherwise specified in Annex 1).

The selection panels must assess all proposals received and recommend a short-list of the user groups that should benefit from access.

The selection panels must base their selection on scientific merit, taking into account that priority should be given to user groups composed of users who:

- have not previously used the installation and
- are working in countries where no equivalent research infrastructure exist.

It will apply the principles of transparency, fairness and impartiality.

Where the call conditions impose additional rules for the selection of user groups, the beneficiaries must also comply with those.

- other conditions:

The beneficiaries must request written approval from the granting authority for the selection of user groups requiring visits to the installations exceeding 3 months (unless such visits are foreseen in Annex 1).

In addition, the beneficiaries must:

- advertise widely, including on a their websites, the access offered under the Agreement
- promote equal opportunities in advertising the access and take into account the gender dimension when defining the support provided to users
- ensure that users comply with the terms and conditions of the Agreement
- ensure that its obligations under Articles 12, 13, 17 and 33 also apply to the users
- keep records of the names, nationalities, and home institutions of users, as well as the nature and quantity of access provided to them

- for virtual access:

- access which must be provided:

The access must be free of charge, virtual access to research infrastructure or installations.

‘Virtual access’ means open and free access through communication networks to digital resources and services needed for research, without selecting the users to whom access is provided.

The access must include the support that is usually provided to external users.

Where allowed by the call conditions, beneficiaries may in justified cases define objective eligibility criteria (e.g. affiliation to a research or academic institution) for specific users.

- other conditions:

The beneficiaries must have the virtual access services assessed periodically by a board composed of international experts in the field, at least half of whom must be independent from the consortium (unless otherwise specified in Annex 1). For this purpose, information and statistics on the users and the nature and quantity of the access provided, must be made available to the board.

The beneficiaries must advertise widely, including on a dedicated website, the access offered under the grant and the eligibility criteria, if any.

Where the call conditions impose additional traceability⁵ obligations, information on the traceability of the users and the nature and quantity of access must be provided by the beneficiaries.

These obligations apply regardless of the form of funding or budget categories used to declare the costs (unit costs or actual costs or a combination of the two).

⁵ According to the definition given in ISO 9000, i.e.: “Traceability is the ability to trace the history, application, use and location of an item or its characteristics through recorded identification data.” The users can be traced, for example, by authentication and/or by authorization or by other means that allows for analysis of the type of users and the nature and quantity of access provided.