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Concentrated Solar energy storage at Ultra-high temperatures aNd Solid-state cONversion

WP6 - Sustainability assessment and TEA

# D6.1-Directives on gender equality and ethics issues

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#### **SUNSON Key Facts**

| Acronym          | SUNSON  |  |  |  |  |  |
|------------------|---|--|--|--|--|--|
| Project title    | Concentrated solar energy storage at ultra-high temperatures and solid-state conversion |  |  |  |  |  |
| GA nº            | 101083827   |  |  |  |  |  |
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| Type of Action   | HORIZON-RIA 'Horizon Europe Research and Innovation Action Programme'                   |  |  |  |  |  |
| Topic identifier | HORIZON-CL5-2021-D3-03-02   |  |  |  |  |  |
| ropic identifier | (Next generation of renewable energy technologies)                                      |  |  |  |  |  |
| Consortium       | 6 organizations, all EU Member States   |  |  |  |  |  |
| Model GA type    | HORIZON Action Grant Budget-Based   |  |  |  |  |  |
|                  |   |  |  |  |  |  |

#### **SUNSON Consortium Partners**

| N. | Partner  | Acronym | Country |
|----|--|---------|---------|
| 1  | Universidad Politécnica Madrid - Instituto Energía Solar | UPM     | ES      |
| 2  | IDENER RESEARCH & DEVELOPMENT                            | IDE     | ES      |
| 3  | Norges Teknisk-Naturvitenskapelige Universitet           | NTNU    | NO      |
| 4  | Plataforma Solar de Almería (PSA-CIEMAT)                 | PSA     | ES      |
| 5  | IonVac Process   | IONV    | IT      |
| 6  | Holistic and ontological solutions for sustainability    | HOLOSS  | PT      |
|    |  |         |         |

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#### **Executive Summary**

This report will outline the ethics and gender issues relevant to the implementation of the SUNSON project. For this, a number of regulations, documents and the Horizon Europe Framework Programme are analysed. The purpose is to explain which measures the SUNSON project has implemented to address gender inequality and comply with ethics requirements. This deliverable results from and is complementary to Task 6.2 - Innovation uptake in the social ecosystem (societal impact, gender, and ethics) and to a seminar held on 30<sup>th</sup> of March 2023, on gender equality and ethics in research and innovation. One of the most important goals of this Deliverable is to establish consortium-wide awareness of gender and ethical issues.

The introduction (Section 1) will briefly outline which relevant documents and principles are most relevant, as well as provide a brief justification for the chosen topics.

Section 2 will deal with ethics issues, in particular with the topics of research integrity, artificial intelligence, data protection and environmental protection. This section will contain general information regarding each topic as well as specific measures taken within the project to tackle them.

Moreover, section 3 will deal with gender aspects. It will, concretely, as in Section 2, contain general information regarding gender aspects (data and the status quo). It will also contain SUNSON's strategy to reduce gender inequalities (in the project as a whole and, when applicable, in each task). To conclude, section 4 will reiterate the principles laid out in sections 2 and 3, alongside the measures to target gender equality and achieve ethical work and reflect on the current situation of both ethical and gender issues within the EU.







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Table 1. Gender Equality in the Consortium......iError! Marcador no definido.





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#### **Abbreviations**

| AI    | Artificial Intelligence  |
|-------|--|
| COSHH | Control of Substances Hazardous to Health                            |
| CSP   | Current Concentration Solar Power                                    |
| DMP   | Data Management Plan   |
| ERA   | European Research Area   |
| GA    | Grant Agreement  |
| GHG   | Greenhouse Gas   |
| FAIR  | Findable, Accessible, Interoperable, Reusable                        |
| EU    | European Union   |
| GDP   | Gross Domestic Product   |
| GDPR  | General Data Protection Regulation                                   |
| GEP   | Gender Equality Plan   |
| IC    | Informed Consent   |
| ICT   | Information and Communications Technology                            |
| M6    | Month 6 (of the project)   |
| ML    | Machine Learning   |
| MSDS  | Material Safety Data Sheets  |
| OECD  | Organisation for Economic Co-operation and Development               |
| OSHA  | Occupational Safety and Health Administration                        |
| PCMs  | Phase Change Materials   |
| REACH | Registration, Evaluation, Authorisation and Restriction of Chemicals |
| RFO   | Research Funding Organisation  |
| STEM  | Science, Technology, Engineering and Mathematics                     |
| S2H2P | Solar to Heat to Power (S2H2P)                                       |



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D6.1 - Directives on gender equality and ethics issues **Introduction** 

#### **1.1 Purpose of the document**

The purpose of this document is to deal with how gender and ethical issues can be addressed during the implementation of the SUNSON project. To do it, the project will have as reference several documents, regulations and frameworks, which will be properly laid out in sections 2 and 3. This report will precede a seminar organised by HOLOSS in M6 of the project and will complement it. The Horizon Europe programme guide will constitute a valuable reference and it will guide the report on its outcomes and purposes. Both ethics and gender issues are included in the programme as a reference and will be further explained in Section 2 and 3.

The SUNSON project will develop a prototype which will be designed, developed, and validated as a modular, ultra-compact and decentralised solution for dispatchable solar power generation with 10 times less volume than CSP technologies that efficiently store solar energy as heat for electricity conversion on demand. For this reason, the ethical approaches identified here are research integrity, artificial intelligence, data protection, health and security and environmental protection. Some of these aspects will already be considered and integrated in WPs and Tasks, such as WP1 - Project Management and Coordination as overarching monitoring of all aspects by the project coordinator, Task 1.4 – Data Management and Open Science, WP 2 - Integration modelling and SUNSON tool development, Task 2.4 - Energy generation forecasting and Demand-side response, Task 2.5 - MDO approach modelling, and WP6 – Sustainability and TEA assessment, Task 6.2 – Innovation uptake in the social ecosystem (societal impact, gender, and ethics).

#### **1.2 Objectives**

- To identify key ethical aspects within the SUNSON project
- To identify key gender aspects within the SUNSON project
- To highlight the importance of ethics and gender issues for research and development actions
- To demonstrate how the project intends to deal with both ethical and gender issues





### 2.1 Ethics in Research and Innovation

Ethical issues are of extreme importance for EU funded projects, as highlighted in the programme guide of Horizon Europe: "For all activities funded by the EU, the ethical dimension is an integral part of research from beginning to end, and ethical compliance is seen as pivotal to achieve real research excellence" [1]. It also states that ethics constitutes "an integral part of research from beginning to end, and ethical to achieve real research excellence" [1]. It also states that ethics constitutes "an integral part of research from beginning to end, and ethical compliance is seen as pivotal to achieve real research excellence" [1]. Also, article 19 – Regulation (EU) 2021/695 establishing Horizon Europe [2] mentions that "respect for human dignity, the physical and mental integrity of a person, the principle of proportionality, privacy, personal data protection, non-discrimination, the protection of the environment and high levels of human health protection" should be taken into consideration.

Given that the programme guide for Horizon Europe mandates that the projects have, besides the ethics assessment that is completed during the development of the proposal and the grant agreement, other measures to integrate both ethics and gender issues, the SUNSON project will integrate the following: Task 6.2 Innovation uptake in the social ecosystem (societal impact, gender, and ethics), D6.2 – Directives on gender equality and ethics issues and both these issues will be constantly checked, reviewed and monitored by the project coordinator and by the members of the project. Additionally, the SUNSON project will consider the core ethics of scientific research and publication (e.g., the European Code of Conduct for Research Integrity), relevant European legislation (e.g., REACH, COSHH, equipment and electrical safety assessments), international conventions and declarations (e.g., The Hague Ethical Guidelines against misuse of chemistry, and the ACS Global Chemists' Code of Ethics), and any applicable national authorisations and ethics approvals. On top of that, the ethical issues will be addressed in T.2.4, T2.5 and T6.3, where they will be constantly monitored to ensure that the four main principles (respect for human autonomy, prevention of harm, fairness and explicability) are fulfilled. Ensuring these three pillars will prevent and minimise the risks of the Artificial Intelligence (AI), consequently maximising the benefits offered by AI systems throughout their life cycle. The AI will be solely based on process and systems data, and there will not be collection or use of personal data of any kind. The project coordinator will ensure that all its members act in accordance with the highest ethical standards and in accordance with national, EU and international legislation. Important ethical guidance's include the Charter of Fundamental Rights of the European Union, the European Convention on Human Rights and its Supplementary Protocols, as well as the General Data Protection Regulation (GDPR). This report initially indicates five major ethical topics that should guide the projects' members:

- 1. Research integrity
- 2. Artificial Intelligence
- 3. Data protection
- 4. Health and Security
- 5. Environmental Protection

While these will serve as a blueprint at the start of the project, they will be constantly updated during the course of the project and, if necessary, modified.



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D6.1 - Directives on gender equality and ethics issues 2.1.1 Research Integrity

Research integrity practices aim to ensure the trustworthiness, reliability, and quality of research results, as well as respect and care for those involved in research. To assist SUNSON partners, the following positive practices for research integrity have been reviewed and summarised [3]:

- **Assignment of credit:** Giving credit where credit is due to those who contributed to the research such as authors, collaborators, funders, and mentors.
- **Fairness in peer review:** Providing timely, helpful, and constructive feedback on others' work, while avoiding conflicts of interest, bias, or misuse of confidential information.
- **Disclosure of potential conflicts of interest:** Disclosing any financial, professional, or personal interests that could affect or appear to affect the conduct or results of the research.
- **Protection of human subjects and human care of animal subjects:** Obtaining informed consent, ensuring privacy and confidentiality, when performing research on social aspect minimising injury and pain, and adhering to ethical standards and laws.
- The fulfilment of institutional and sponsor requirements: Examining and following the guidelines and regulations established by funding organisations and research institutes regarding the planning, execution, analysis, and reporting of research.
- **Commitment to fair and open relationships:** Preserving honesty, integrity, transparency, and mutual respect in all interactions with colleagues, supervisors, students, stakeholders, and the public.
- Avoiding misconduct in research and creative activities: Inhibiting any fabrication, falsification, plagiarism, or other dishonest or deceptive practices that could undermine the reliability or validity of the research.

These practices will help to ensure that research activities in SUNSON will provide accurate, reproducible, useful, and beneficial results to the scientific and industrial communities while having an impact on society. In this way, SUNSON research performing organisations must give researchers proper training in research integrity at all career phases. This entails giving researchers the opportunity to share experiences while coping with the challenges of research integrity. They should also make sure that researchers have access to sufficient knowledge regarding research integrity and ethical research methods. So, the primary lessons are that honesty, transparency, respect, accountability, and rigour are crucial when conducting research. In this line, the primary lessons to be used are:

- The application of appropriate and verifiable procedures when formulating, carrying out, and assessing research.
- Reporting research findings keeping in mind the adherence to rules, regulations and guidelines.
- Adhering to recognised standards or codes of conduct for professionals.

All in all, specific actions have been outlined in line with the European Research Integrity Code of Conduct for Research Integrity [4]:

 "Researchers take into account the state-of the-art in developing research ideas" -WP1 to WP6





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- "Researchers carefully and thoughtfully plan, execute, analyse, and preserve their research."
  -WP1 to WP6
- "Researchers make proper and conscientious use of research funds" all WPs
- "Researchers report their results in a way that is compatible with the standards of the discipline and, where applicable, can be verified and reproduced" -WP1 to WP6
- "Researchers publish results and interpretations of research in an open, honest, transparent and accurate manner, and respect confidentiality of data or findings when legitimately required to do so" **WP7**.

#### 2.1.2 Artificial Intelligence

Despite the high potential of AI, there are also risks, such as privacy, widening socio-economic inequality, malicious use and job opportunity decrement, among others. Hence, it is crucial to assure its proper use while having in mind its trustworthiness, as recently stated by the European Commission in the Ethics Guidelines for Trustworthy AI [5]. Following the guidelines, the trustworthiness of the AI is based on three pillars: the AI must be lawful, ensuring compliance with all applicable laws and regulations; ethical, providing faithfulness to ethical principles and values which are robust, both from a technical and a social point of view.

Human beings have cognitive biases, such as recency and confirmation [6], and they are inherent to our behaviours and, consequently, our data can be affected by them. Given that data is the main foundation for all machine learning (ML) algorithms, it is important for us to structure them in a way that does not amplify these biases. For this reason, the project members will ensure that their teams, in particular the ones that are dealing with the creation and implementation of AI models (IDENER), will have diverse teams, and strive to include minorities, women, amongst other groups, so that these models can be representative of the whole society and minimise error. This method of inclusiveness, closely associated with the "wisdom of crowds" [7] will ensure an ethical implementation of AI. Essentially, the consortium members should pay attention to the aspects laid out below and tackled in WP2 [8].:

- **Explainability:** Organisations using AI should be able to explain the source data, resulting data, what their algorithms do and why they are doing that. AI needs to be traceable to guarantee that no harm will arise, and that if it does, it can be traced back to its cause.
- Responsibility: Responsibility for AI-based decisions.
- **Fairness:** A no bias approach in terms of race, gender or ethnicity should be applied in data sets.
- **Misuse:** Risks of misuse and safety measures in case it happens should be considered at the design phase.

Al is present in the SUNSON project through integration and development of the SUNSON-TOOL (WP2). IDENER will develop an intelligent approach based on artificial neural networks, support vector machines and/or other novel machine learning methods will be applied for coupling generation and demand of the SUNSON innovations (within Task 2.4 framework). In addition, in Task 2.5, IDENER will deploy this Al-based tool with activities related to the multidisciplinary design optimisation (MDO) approach and the final integration into a smart digital tool for developing advanced prediction, optimisation, and replicability assessment of the SUNSON concept solution.







In Task 2.6, all previous elements will be integrated and implemented on a web application, following best practice for user-friendly developments and user interfaces, for the deployment of the SUNSON-Tool. All operators of the equipment will be made aware as appropriate if the AI-system is operational and if any automated actions are to be expected.

The application of AI within the SUNSON project:

- Will not lead to any negative social impacts.
- Will not lead to potential stigmatisation or discrimination against people (at any personal, gender, ethical, cultural, racial level)
- Will not replace any decision-making processes that have a direct impact on human life, wellbeing, or human rights without supervision.

In Task 2.1 and Task 2.2, where the specifications and requirements of the models are defined, it will also be included the technical specifications to develop a robust AI: human agency and oversight, technical robustness and safety, privacy and data governance, transparency and accountability; and ensuring proportionality of the research methods used, in conformity with the Ethics Guidelines For Trustworthy AI [5].

#### 2.1.3 Data Protection

The General Data Protection Regulation (GDPR) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 contains several key principles for the handling of personal data. This regulation provides the framework for the regulation of data protection and privacy issues in the Member States. GDPR requires "data protection by design", which means designing systems, databases, and processes (by technical and organisational measures) that comply with the fundamental rights of data subjects (such as anonymisation/pseudonymisation, data minimisation etc. Furthermore, data protection should be enhanced "by default" instead of as an extra option. According to the European Commission (DG Research & Innovation) [9], data protection is regarded as a "central issue for research ethics in Europe and a fundamental human right" and must, therefore, "be rigorously applied by the research community". Data protection includes measures for both data access and data preservation. Special attention must be paid to special categories of personal data "revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation". In the SUNSON project, the goal of data protection is to safeguard the right to privacy. An individual could be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

Data anonymisation or pseudonymisation is the advised response to ethical data protection concerns. There are several techniques to anonymise personal data such as data masking, data swapping, generalisation, data perturbation, data aggregation and toolkits for anonymisation of data are readily available [10]. However, anonymous data will lose a lot of their value for in-depth research if they are not anonymised to the highest standards and without any remaining risk of re-





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identification [11]. It can destroy the value that data holds as, for example, data aggregation lowers the resolution of the data, which ultimately limits the data's ability to be analysed, or the noise is modulated to minimise risk of inferring information about data subjects. Even though most aggregated data are anonymous, there are some research questions that call for a more in-depth examination of personal data at the individual level. Likewise, anonymisation can deprive a data subject of its rights as stipulated in the GDPR, e.g., the right of access to data by the data subject and the right to data portability, which can no longer be realised.

As a result, pseudonymisation of personal data is often preferred over anonymisation. The term "pseudonymisation" refers to the processing of personal data such that it can no longer be associated with a particular person without the use of extra information. Such extra information must be kept carefully separate from the personal data. Processing of pseudonymous personal data is subject to the GDPR, which implies a legal basis for processing the data subject's personal data should be in place. In the SUNSON project, this legal basis will be covered by the informed consent (IC) form, in which the explicit consent of the data subject is requested to use and share data on EU level. The purpose of the informed consent is to verify that:

- participants are aware that participation is optional, and they have the right to withdraw;
- participants completely comprehend the research's information;
- participants have the possibility to ask questions about the study to researchers;
- participants understand that de-identification of their data will take place;
- participants agree that the research team have the right to access the data;
- recognise that the information will be saved for use in a future study.

#### **INFORMED CONSENT**

**Project Title:** Concentrated Solar energy storage at Ultra-high temperatures aNd Solid-state cONversion

Project ID: 101083827

Thank you for your interest in participating in the SUNSON project. Before you agree to take part, the person organising the research must explain the project to you. You can be fully informed about the aims and purposes of the SUNSON Project at <a href="https://www.sunson.eu/">https://www.sunson.eu/</a>. In any case, please ask the researcher before you to decide whether to join in. It is entirely optional for you to take part in this study. The survey is completely optional, and you are always free to leave. However, once you submit your completed survey, your responses to the study cannot be withdrawn in any way because the survey contains no identifying information. You will receive a copy of this Consent Form to keep and refer to at any time.

By participating in SUNSON, you confirm that:

- you are at least 18 years old and legally able to give consent.

- you have read the information about the research developed in SUNSON, and this informed consent procedure.

- you are completely aware of the objectives of the SUNSON project: https://www.sunson.eu/.







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- You authorise project SUNSON to send you newsletters while the project is in progress.

- you agree to be contacted about participating in seminars, workshops, events and other initiatives set up in project SUNSON.

- you give your consent for project SUNSON to send you direct mail in case of specific feedback on content related to project SUNSON.

- you have been given the opportunity to get additional information regarding the purpose of the study.

- you understand that your participation is anonymous and that no information about you, personally, will be recorded.

- you agree that your data collected in e.g., a survey is used for scientific research and that you have no objections to your data being published in project-related publications without identifying you.

- Any researcher can share information with another researcher(s) and partners participating in this project in an anonymous form. All information you give will be treated as confidential.

This consent form is made pursuant to the relevant national, European and international data protection laws and regulations and personal data treatment obligations. Specifically, this consent document complies with the EU General Data Protection Regulation (2016/679) on the protection of natural persons about the processing of personal data and on the free movement of such data.

#### Figure 1 Informed consent form model

Even pseudonymisation has an impact on the utility of the data, e.g., linking the data across different data sources becomes much more difficult and possible only if specific measures are taken upfront when pseudonyms are generated. Hence, any applications of privacy enhancing technologies, including anonymisation and pseudonymisation, need to be considered by design as a part of the FAIR implementation strategy. Within the project SUNSON, data protection/data processing is addressed in the Grant Agreement (GA), in which the consortium has assured a procedure that complies with national and international laws and regulations. Especially the following aspects are relevant:

- The data processing must be transparent to the data subjects.
- The data processing must be data-saving, i.e., the data must be connected to a specific purpose, and the identification of persons should only be possible for as long as necessary.
- The data itself must be accurate and, where necessary, up to date.
- The data must be processed in a secure way.

Task 7.2 - Dissemination, Communication and Training activities (Scientific Impact) and Task 7.3 -Exploitation and Innovation Management (Economic impact),Deliverable 1.2 includes a Data Management Plan, which ensures that all data are gathered under FAIR premises, data protection and IPR. Also, data collected in T6.2 - Innovation uptake in the social ecosystem (societal impact, gender, and ethics) through surveys will aim to ensure that the needs and attitudes of sub-groups in stakeholder groups are understood. Other than that, data collected in Task 7.2 - Dissemination, Communication and Training activities (Scientific Impact), Task 7.3 - Exploitation and Innovation Management (Economic impact) and T7.4 - Replicability analysis (Increase impacts) will be processed in a secure and transparent way. Information on protected characteristics will be collected to ensure that individuals from a broad range of groups are heard. Data will be aggregated





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in such a way as to prevent the accidental identification of any individuals. All data collection, storage and usage activities will be conducted in compliance with GDPR.

#### 2.1.4 Health and security

The European strategic framework on health and safety at work outlines that "healthy and safe working conditions are a prerequisite for a healthy and productive workforce. Nobody should suffer from job related diseases or accidents and that it is also an important aspect of both the sustainability and competitiveness of the EU economy [12]. Moreover, according to the European Code of Conduct for Research Integrity "researchers have due regard for the health, safety and welfare of the community, of collaborators and others connected with their research" [4]. This includes not only physical health but also mental health. All activities will be performed in compliance with rigorous health and safety regulations to prevent harm to humans and accidents leading to damage of people's health and safety. Regarding workers' health and safety, SUNSON partners strictly follow their national regulations and the EU Strategic Framework on Health and Safety at work 2021-2027 [12].

Also, NTNU, as an associated EU country, will be responsible for the selection, formulation and characterisation of phase change materials (PCMs) and the crucible for melting these materials, as part of the SUNSON-Box prototype, which will be tested during the project demonstration. NTNU will supply these materials and its crucibles for the preliminary tests and demonstration campaign that will be performed in Spain and Italy. All project activities in EU associated countries are activities that would be acceptable within any EU country as they adhere to EU law. All materials/chemicals used/imported/exported within SUNSON are intended to be non-toxic and occupational health and safety (OSHA) regulations will be adhered for their handling. For import/exports, material safety data sheets (MSDS), certificates of origin and invoices will be considered when required and appropriate.

#### 2.1.5 Environmental protection

The EU intends to achieve carbon-neutrality by 2050 with the support of research funding programmes. The main objective is to protect, conserve and enhance the EU's natural capital, turn the EU into a resource efficient, green, competitive, low-carbon economy and safeguard EU citizens from environment-related pressures and risks to their health and wellbeing [13]. The SUNSON project protects the environment and seeks to minimise risks to climate, human health and biodiversity. It will also enhance the European Green Deal which aims to make Europe the world's first climateneutral continent, in part by developing cleaner sources of energy and green technologies, no net emissions of greenhouse gases by 2050, economic growth decoupled from resource use and it will ensure that no person and no place is left behind [14]. Our health, our economy and our well-being depend on the state of the environment, which faces several serious challenges. For this reason, SUNSON proposes a breakthrough in the field of Solar to Heat to Power (S2H2P) generation. The project is integrated in the EU's strategy to achieve climate-neutrality by 2050, hence contributing to the overall strategy to ensure that all aspects of sustainability are met. SUNSON partners will implement requirements of environmental management system, specified by the ISO 14001 standard, to fulfil compliance obligations and to reduce their environmental impact. As stated in the SUNSON GA ambition, one of the main objectives of the project is to "to prove a significant reduction in GHG towards nearly zero-emission energy generation". Moreover, Task 6.1 will incorporate a sustainability analysis through several environmental impact categories such as GHG, resource







efficiency, among others. Additionally, Task 6.4 will integrate the results from the sustainability analysis and will make them public, considering whether the project is environmentally friendly with specific recommendations and conclusions.

### **3 Gender**

#### **3.1 Gender Equality in Research and Innovation**

Gender equality is a core value at the EU and gender mainstreaming is a core strategy to achieve it. According to Eurostat [15], in 2021, there were 2.79 million employed persons with an ICT education, 3.3% more than in 2020. Men represented 84.1% (2.35 million) of the EU's total workforce with an ICT educational background, an increase of 1.3% from the previous year (2.20 million in 2020), while the number of women in employment with an ICT education declined. In 2021, women represented 15.9% (442 800) of the ICT workforce compared with 17.2% (463 800) in 2020. Additionality, only 22% of doctoral graduates and researchers in ICT areas are women, while they represent more than 50% in the fields of health, welfare and education (60% and 67%, respectively) [16]. The magnitude of this gender gap varies significantly across fields of research. There is near parity in the social sciences and psychology, where 45 percent of corresponding authors are women, while women account for only 15 percent of corresponding authors in physics and astronomy. According to the EC, only 2 out of 5 scientists and engineers are women, even though women make up 52% of the European population [17]. This gap increases with seniority and, for instance, women only hold 17.9% of full professorship positions in engineering and technology and only 0.7% of patent applications [17]. However, some positive trends can be identified, such as an increase in the proportion of women holding the highest academic positions (26.2%) compared to the last edition (24.1%) [17].



Figure 2. Women corresponding authors, by science field







In addition, as can be stated in the figure above, results from the OECD International Survey of Scientific Authors (ISSA2) [18] show that on average across OECD countries, women comprise only around 40 percent of all researchers, with great variety between countries: ranging from 23 percent in Luxembourg to 56 percent in Lithuania. They are, on top of that, considerably less likely to be in leadership positions. Only 30 percent of corresponding authors are women, which suggests that female researchers may have less opportunity to enter and advance in their fields. However, it should be taken into consideration that not all women are the same, and some may face multiple disadvantages in their education and workplace due to intersecting social characteristics, such as ethnicity, (dis)ability, socio-economic status, sexual orientation, age, geographic location or migration background. This means that an effective gender equality strategy must consider all these approaches and that women still face inequality in the research arena despite decades spent in efforts to improve their circumstances. A growing number of studies show that diversity, including gender balance and gender perspectives, helps to enhance the scientific quality and social relevance of research [19].

To effectively mitigate gender inequality, the ERA Policy Agenda revigorated the Commissions' commitment to gender equality, and it entails the following aspects [20]:

- 1. Developing a policy coordination mechanism to support all aspects of gender equality through inclusive GEP and policies, and a dedicated EU network for their implementation
- 2. A strategy to counteract gender-based violence including sexual harassment in the European research and innovation system and to assure gender equality in working environments through institutional change in any research funding or performing organisation
- 3. A policy approach to strengthen gender equality, that addresses gender mainstreaming to advance the new ERA
- 4. Developing principles for the integration and evaluation of the gender perspective in research and innovation content in cooperation with national RFOs

Closing the gender gap in Science, Technology, Engineering and Mathematics (STEM) is not only vital for meeting the skills demand in a fast-changing labour market and for addressing challenges such as the twin green and digital transition, but also to achieve a society based on equal opportunities, equal treatment and social justice. Stereotypes and unconscious biases, structural barriers, such as difficult work-life balance, discrimination in recruitment, promotion and funding procedures, harassment and gender-based violence can hinder women, especially those from disadvantaged backgrounds, from pursuing STEM studies and careers [21]. Figure 3 shows the relation between GDP and the existing gap in the STEM areas.

The project members have a responsibility to create a gender-equal, safe and inclusive organisational culture, where the needs of diverse people in different life circumstances are met. The project will also ensure that gender is incorporated in a broader framework that includes intersectionality between gender and other diversity categories, as well as take into account inclusiveness at the geographical and sectorial levels to ensure that all partners are on board and that the innovation and private sectors are also involved. On top of that, it will integrate fair, open,





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inclusive and gender equal career paths in research, consider intersectional perspectives on gender inequalities and support active monitoring and evaluation to ensure continuous improvement.





#### 3.1.1 Gender Equality in Horizon Europe

Gender equality is a core value of the EU, a fundamental right [22] and a key principle of the European Pillar of Social Rights [23]. It reflects who we are. It is also an essential condition for an innovative, competitive and thriving European economy. Gender is the Horizon Europe programme guide as a "cross-cutting principle and aims to eliminate gender inequality and intersecting socio-economic inequalities throughout research and innovation systems (...) [1]. It also provides guidelines on how to comply with gender equality requirements.

The EU is committed to having a gender-neutral and balanced research environment. Researchers should try to minimise gender discrimination and bias as much as possible, and, potentially, eliminate it. The goal is to improve the European research and innovation system, create gender-equal working environments where all talents can thrive and better integrate the gender dimension in projects to improve research quality as well as the relevance to society of the knowledge, technologies and innovations produced. There are three levels addressed in Horizon Europe [22]:

- 1. Having a GEP in place is now an eligibility criterion for certain categories of legal entities from EU countries and non-EU countries associated to Horizon Europe.
- 2. The integration of a gender dimension into research and innovation content is a requirement by default.





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- 3. Increasing gender balance throughout the programme is another objective, with a target of 50% women in Horizon Europe related boards, expert groups and evaluation committees.

#### **3.1.2 Gender equality figures and premises in the SUNSON project**

Throughout the development of this report, the gender-balanced composition of the SUNSON research team was examined using an online questionnaire that was distributed to each partner and filled out by them. Table 1 shows the results obtained.

| N. | Partner  | Female | Male |
|----|--|--------|------|
| 1  | Universidad Politécnica Madrid - Instituto Energía Solar | 3      | 1    |
| 2  | IDENER RESEARCH & DEVELOPMENT                            | 2      | 4    |
| 3  | Norges Teknisk-Naturvitenskapelige Universitet           | 2      | 2    |
| 4  | Plataforma Solar de Almería (PSA-CIEMAT)                 | 0      | 2    |
| 5  | IonVac Process   | 0      | 1    |
| 6  | Holistic and ontological solutions for sustainability    | 2      | 2    |
| 7. | Total  | 9      | 12   |

#### Table 1. Gender Equality in the Consortium

As can be observed in Table 1, the consortium has nine female researchers (42.9%). On the other hand, as part of its governance and organisational structure (D1.1), SUNSON has two committees (namely, the management committee and steering committee), as well as a group of Work Packages Leaders. At this level, the steering committee and management committee are both represented by one woman out of three representatives (33.3%) and four women out of seven representatives (42.9%), respectively. Additionally, four out of the seven representatives who make up the Work Packages Leaders group are female (57.1%). Even though this balance is good, it needs to be preserved or improved if the team composition changes in the future. It is vital to promote a neutral gender-balance. To this end, SUNSON partners will:

- Preserve and enhancing researchers' work-life balance.
- Incorporate gender-diverse practices into experts' and collaborators' work, such as actively include women in leadership roles and promoting equal representation in research teams and management.
- Be particularly aware of how language is used throughout all its activities.
- Be conscious of the need to take into account factors such as age, sex, gender, and ethnicity when locating and inviting participants for meetings, workshops, partnerships, and other events.
- Create gender-neutral job ads that do not use words more commonly associated with men or women, while encouraging women and men with diverse social identities to apply.
- Support leadership individuals connected to the project to talk about advantages of having a more diverse workforce.





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- Use real testimonials from female and male employees with diverse social identities to showcase the projects' commitment with gender equality (in various social media)
- Showcase female role models with diverse social identities in external communication
- Make use of sex-disaggregated data throughout the whole project

#### **4** Conclusions

The EU and Horizon Europe programme place a high priority on ethical and gender problems. With Horizon Europe, the 9<sup>th</sup> European Framework Programme funding research and innovation, the EU intends to create a research and development common area free of bias and where the highest ethical standards and principles are applied.

Representativity and inclusiveness are important aspects to consider when dealing with multiple geographies and contexts, such as in the scope of Horizon Europe projects, and in particular in SUNSON. Ensuring that everyone is represented, regardless of their gender, race, ethnicity, or disabilities, will lead to improvements not just in societal terms, but also in our economies. As presented in the document, gender inequalities are causing the GDP to be less than it could be if parity was achieved, meaning there is a deadweight loss that we should strive to tackle. Women, continue to be underrepresented in research and development, in particular in STEM areas, the primary areas of focus for the SUNSON project. Although some progress has been made, further efforts are necessary to drive meaningful change.

Besides that, this new era of technological development is bringing new ethical challenges to our society. Artificial intelligence, for instance, is being developed at a very fast rate, and if we want to enjoy the full benefits that this transition brings, ethical principles and standards must be understood and designed. There are fears within the society that artificial intelligence can overtake humans in terms of thinking and autonomy, leading to unimaginable consequences. Assurances and clarification should be put in place to ensure that the AI developed will be user-friendly and will not lead to the replacement of human thinking and activity.

To encourage adherence to ethical principles and a gender-neutral balance in the SUNSON project, these ethical and gender challenges are reviewed and analysed in this report to inform and guide partners on this matter. The action is finished with a seminar that takes place in May 2023 (M6). Among the most important outcomes are the understanding of how ethical and gender dilemmas are being and can be met within the project, the importance of meeting ethical and gender requirements for the overall quality of the project, and the number of female researchers who are part of the SUNSON project (9, 42.9%) in its first year. In relation to the last point, it was found that the steering committee and management committee are both represented by one woman out of three representatives (33.3%) and four women out of seven representatives (42.9%), respectively. In addition, the Work Packages Leaders group's representation is made up of four females out of seven members (57.1%). As a last point, SUNSON partners are committed to being thorough with regards to ethical and gender issues and making the whole process inclusive and transparent.



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D6.1 - Directives on gender equality and ethics issues **References and Resources** 

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D6.1 - Directives on gender equality and ethics issues Annexe – Gender and Ethics Seminar



Miguel Pereira

Figure 5. Engaging audience members in conversation



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#### Figure 6. Some tasks in the SUNSON project related to ethical issues

|   |  |         |       | Merete Tangs   |
|---|--|---------|-------|----------------|
| G | ender Equality in the SUN                                | ISON pr | oject | SON            |
|   | Partner  | Female  | Male  | <b>m</b> 7     |
|   | Universidad Politécnica Madrid - Instituto Energía Solar | 3       | 1     | Miguel Pereira |
| 2 | IDENER RESEARCH & DEVELOPMENT                            | 2       | 4     |                |
| 3 | Norges Teknisk-Naturvitenskapelige Universitet           | 2       | 2     | ALCONTRA .     |
| 1 | Plataforma Solar de Almería (PSA-CIEMAT)                 | 0       | 2     |                |
| 5 | IonVac Process   | 0       | 1     | ALC: N         |
| ; | Holistic and ontological solutions for sustainability    | 2       | 2     | Johannes Seif  |
| , | Total  | 9       | 12    | -              |
| • | Tabla 1. Oan dan Emailita in the Oannan                  | ium     |       |                |

one woman out of three representatives (33.3%) and four women out of seven representatives (42.9%), respectively. Additionally, four out of the seven representatives who make up the Work Packages Leaders group are female (57.1%).

#### Miguel Pereira

Figure 7. Gender balance in the SUNSON project



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Figure 8. SUNSON participants



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