THE EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER

Reporting

Project Information

EU-SOLARIS

Grant agreement ID: 312833

Status
Closed project

Start date
1 November 2012

End date
31 October 2016

Funded under
FP7-INFRASTRUCTURES

Overall budget
€ 5 917 155,71

EU contribution
€ 4 447 919,64

Coordinated by
DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV
Germany

Final Report Summary - EU-SOLARIS (THE EUROPEAN SOLAR RESEARCH INFRASTRUCTURE FOR CONCENTRATED SOLAR POWER)

Executive Summary:
EU-SOLARIS is designed as a large distributed Research Infrastructure (RI) of European character and global reach. The main purpose of this RI is to foster, contribute to, and promote the scientific and technological development of Concentrating Solar Thermal (CST) and Solar Chemistry (SCH) technologies. It's primary objective is to provide scientists and industry with the needed RIs capabilities for advancing the state of the art of these technologies and reinforcing Europe´s leadership in this field.
CST technologies must achieve a significant cost reduction in a short-medium term to become more competitive with fossil-fuelled systems, especially considering that the externalities of fossil fuel, the damage to the environment and adverse effect on climate change are not yet integrated to any significant degree in the cost of using them.

European industry is currently leading the sector at international level, however it is necessary to offer added value solutions to maintain this position and increase the competitiveness of the European companies. European industry should differentiate clearly from other regions and avoid a competition based only on price. The development of innovative solutions must be supported by research and technological development (RTD) in strong collaboration between industry and academia. It is in this context where EU-SOLARIS will play a relevant role becoming the European RI reference for CST and SCH technologies.
EU-SOLARIS will offer the more favorable conditions for the development of advanced projects by the scientific and industrial communities in Europe in different ways: providing this sector with the most comprehensive set of EU test facilities and laboratories, providing up to 170 services which cover all the subjects related to key components and subsystems, optimizing the use of the associated national research facilities, improving their management, expanding and upgrading their services, streamlining and enhancing the user experience, and leveraging synergies among them, developing common test protocols for all EU facilities in this field, and developing innovative test equipment and optimizing the Access to the experimental facilities coordinated by EU-SOLARIS, with proper procedures according to each type of Access.
The EU-SOLARIS Preparatory Phase project (1 November 2012 -31 October 2016) aimed to carry out the preparatory work needed for the creation of a large distributed Research Infrastructure (RI) of European character and global reach. The preparatory work addressed the legal aspects, governance, financial aspects, the identification of the potential technical services portfolio, definition of clear rules for users; preparing all the necessary mechanisms to secure sustainable financial resources; defining appropriate systems for knowledge and IPR management; establishing joint future development of research facilities; and elaborating effective rules for the dissemination of project.
EU-SOLARIS will be established as a European Research Infrastructure Consortium (ERIC). Business issues are addressed in a financial plan, with three different scenarios, assuming it will have to be financed mainly by the in-cash contributions of its partners; the activity will also be co-financed by private sector (thorough services to industry and training events), and public funds/grants for project execution.
In summary, all the background information and documents required to implement EU-SOLARIS ERIC have been elaborated during the preparatory phase, and the administrative process for its legal implementation can be initiated.
The EU-SOLARIS project has been coordinated by the Spain CTAER during the preparatory phase and the consortium involves 15 partners from 9 countries: 13 key Scientific Centres, the Spanish Ministry of Economy and Competitiveness and the European STE Industry Association (ESTELA) and it will be coordinated by CIEMAT-PSA in the operational phase.

Project Context and Objectives:
The EU-SOLARIS project
EU-SOLARIS is a project, co-funded by the 7th Framework Programme of the European Union that aims to carry out the preparatory work needed for the creation of a large distributed Research Infrastructure (RI) of European character and global reach. The main purpose of this distributed RI is to foster, contribute to, and promote the scientific and technological development of Concentrating Solar Thermal (CST) and Solar Chemistry (SCH) technologies. EU-SOLARIS primary objective is to provide scientists and industry with the needed RIs capabilities for advancing the state of the art of these technologies and reinforcing Europe´s leadership in this field. EU-SOLARIS aims to create a new legal entity to explore and implement new and improved rules and procedures for distributed RI for CST and SCH technologies, in order to

new and improved rules and procedures for distributed RI for CST and SCH technologies, in order to optimize RI use, development and Research and Technology Development (RTD) coordination. This entity is expected to be the first of its kind, where industrial needs and private funding will play a significant role.
The EU-SOLARIS project is under the umbrella of the ESFRI (European Strategy Forum on Research Infrastructures). The ESFRI has been set up by the EU Council of Research Ministers in 2002 and it aims at supporting the development of a European policy for RI and discusses a long term vision at European level.
The EU-SOLARIS project has been coordinated by the Spanish CTAER during the preparatory phase and the consortium involves 15 partners from 9 countries: 13 key Scientific Centres: CIEMAT-PSA (Spain), CyI (Cyprus), CNRS - PROMES (France), DLR (Germany), APTL-CERTH (Greece), CRES (Greece), ENEA (Italy), WEIZMANN (Israel), LNEG (Portugal) ,U.EVORA (Portugal), GÜNAM (Turkey), SELCUK U (Turkey), and the Spanish Ministry of Economy and Competitiveness and the European STE Industry Association (ESTELA).
In the current state of development, once the preparatory phase has been completed, EU-SOLARIS has all the documentation and knowledge necessary for its legal implementation as an ERIC, and the administrative process for its legal implementation can be initiated as soon as at least three Member

States decide to go ahead. The coordination of the implementation phase will be undertaken by the CIEMAT-PSA.
Context
“Current trends in energy supply and use are unsustainable – economically, environmentally and socially”. These words are expressed in the foreword of the latest technology roadmap for Solar Thermal Electricity published by IEA 2014. Global warming due to greenhouse gases (GHG) emissions is becoming a major challenge for all the countries in the world in this century. Renewable, carbon free and clean energy sources are required to reduce the impact of the production of energy in our environment. Solar thermal electricity produced by CST plants do not produce greenhouse gas emissions so it is a key technology for mitigating climate change, and additionally CST plants enhances energy security due to its flexibility when operating (energy storage capability). Energy storage allows increasing dispatchability and flexibility for the operation of the CST plants, showing clear advantages against another renewables technologies as PV or wind turbines. At the same time, the deployment of CST plants (with thermal energy storage) increase the flexibility of the power grid, enabling higher penetration from variable renewable technologies such as PV and wind turbines without compromising the grid stability.
In the last ten years, CST has expanded rapidly from a newly introduced technology to become a reliable energy generation solution. However, by the end of 2015, only 4.9 GW of solar thermal electricity projects were operational worldwide. The projects under construction at the time of writing will add at least another 400 MW over the next two years. These projects are located mostly in South Africa, India, the Middle East and Morocco.
Costs for CST have already declined but further reductions are possible. The primary factor affecting the cost of CST is market volume. Just as with any other energy technology, costs come down along a solid deployment programme based on a political decision to establish a technology. Such a political decision leads to a positive investment environment with preferential financing conditions and/or tax and investment incentives. This is expected to also create the conditions for progressively bringing to market innovative solutions that will, in turn, further reduce costs and increase business opportunities beyond the electricity sector in countries that decide to launch such programmes.
A strong CST deployment programme, ensuring a CST market volume of around 30 GW per year, could avoid the need for new fossil fuel power plants and replace decommissioned fossil fuel power plants. In

avoid the need for new fossil fuel power plants and replace decommissioned fossil fuel power plants. In this way, CST technologies would strongly contribute to the reduction of global CO2 emissions. Solar Thermal Electricity (STE) dispatchability capabilities would also enable a further reduction in GHG emissions by allowing increased penetration of intermittent renewable energy technologies in a reliable and affordable way.

For Solar Chemical technologies, existing options are numerous, while the field of research is vast as scientists continue to seek and evaluate new materials and reactor concepts in an effort to increase production efficiency. However, the implementation of the available solar fuels technologies in CST facilities still has key-challenges to overcome. Further development of promising thermochemical processes that are based on non-carbonaceous sources is expected to further enhance the adaptation of solar technologies for the production of renewable energy. Moreover, there are clear signs that new frontiers in the areas of energy production and storage will be generated.

The three predominant STE technologies are parabolic troughs (PT), linear Fresnel reflectors (LFR) and towers, also known as central receiver systems (CRS). A fourth type of STE plant is a parabolic dish, usually supporting a Stirling engine at its focus. These technologies differ with respect to optical design, shape of receiver, nature of the heat transfer fluid and capability to store heat before it is turned into electricity.

The combination of production technology with thermal energy storage (molten salts for example) and hybridization with another energy sources (renewable as biomass, or non-renewable as natural gas) have focused the efforts in the latest decade; the objective of this combination is to increase the dispatchability of energy and ensure a faster start-up of the CST plant in the morning.

Regarding investment costs and operation/maintenance costs, CST plants still have high investment costs: from 4.000 $/kW to 9.000 $/kW, depending on the solar resource and the size of the storage system and the size of the solar field. Operation and maintenance (O&M) costs have been assessed in the Spanish STE plants at 25 $/MWh, including fuel costs for backup and water consumption for mirror cleaning, feedwater make-up and condenser cooling. As plants become larger, investment and operation/maintenance costs per MW will decrease, and could be cut by half in large plants benefitting from better solar resource. The estimations of the reduction of the investment costs in the hi-Ren scenario reach around 50% by 2050.

EU-SOLARIS main objectives

Because of its dispatchability and other numerous advantages, Concentrating Solar Thermal (CST) technologies are expected to play an increasing pivotal role in the necessary transition away from fossil fuels and towards renewable energies. A transition that must take place at an unprecedented rate and scale if we are to avoid environmental damages to our planet that are so catastrophic that they have the potential to threaten our survival as a species. The European Distributed Large Scale Research Infrastructure for CST technologies, EU-SOLARIS, is being created to support European researchers and industry in their efforts to develop the next generations of CST technologies. In so doing, EU-SOLARIS will play an essential role in consolidating Europe’s leadership on these strategic energy technologies

The EU-SOLARIS project is under the umbrella of the ESFRI (European Strategy Forum on Research Infrastructures). The ESFRI has been set up by the EU Council of Research Ministers in 2002 and it aims at supporting the development of a European policy for RI and discusses a long term vision at European level.

The EU-SOLARIS, the European Distributed Large Scale Research Infrastructure for CST Technologies will: become a unique distributed RI for CST technologies, optimize RI development and R&D coordination in Europe by creating a new legal entity to explore and implement new and improved rules and procedures

in Europe by creating a new legal entity to explore and implement new and improved rules and procedures for RI related to CST technologies, provide the most complete, high quality scientific infrastructure portfolio at international level for CST and SCH technologies, facilitate researchers´ access to highly specialised RI through a single access point by linking scientific communities, industry and universities involved in the CST sector, ensure the alignment of the RI activities with the industry's needs, and maintain Europe at the forefront of CST technologies development.
EU-SOLARIS should replace European programs like SFERA to assure and support the access to the high-quality experimental facilities of the main EU-SOLARIS partners, thus preventing RTD centers from having serious problems to be able to advance in these subjects, from having budgetary imbalances and a decrease of their scientific capacity whenever regular 4-year access programs like SFERA end, because the link with the universities, which are one of the main beneficiaries of SFERA, will be seriously affected after the termination of this access programme.
The technical, legal and financial preparations required for its creation were addressed in the context of a number of policy issues related to the management of a distributed research infrastructure. In addition, the project had to consider risk management and quality control.
The specific objectives of the EU-SOLARIS Preparatory Phase project were the following:

1. Organisation and legal structures. EU-SOLARIS PP has as one of the main objectives its constitution as an adequate legal vehicle/status for the new distributed research infrastructure. The EU-SOLARIS legal status should allow the optimal development of its activities. The objective is to develop and get agreement on a legal framework for the continued cooperation of countries involved in EU-SOLARIS, the legal basis of the infrastructure itself, its organisation and governance structure, an IPR policy and agreements of collaboration with research centres and industry.
2. Financial issues. Assessing economic sustainability, a business plan has been developed in order to achieve financial sustainability of EU-SOLARIS in its operational phase, including the definition of the business scenarios that have being used to evaluate the required financing sources, as well as a Strategic Plan and assessment of financial schemes.
3. Access to infrastructure. Definition of a single point of access to distributed infrastructure and clear access rules for scientific users and industry (whenever required by the User). Furthermore, user policies will be developed. EU-SOLARIS will assess - using the gained experience of the consortium partners in SFERA - and propose access to their partners' state-of-the-art STE research facilities.
4. Innovation and Contacts with Industry. The main purpose of this objective has been to find effective relationships and new collaboration models – technical and financial - between industry and EU-SOLARIS in order to enhance both the faster advance of the technology and the increased contribution of industrry and research centres in achieving this goal.
5.Capacity Building & Services. The primary objective concerning this item is the analysis of current state of research facilities and conclude the future needs – both for technological equipment as for human resources - as well as projected future developments. In this regard the whole set of facilities under the umbrella of EU-SOLARIS will pose the widest range of technical services for the development of STE technologies around the World.
6. Distributed Facility Activity & Logistical Work. This objective is to help the scientific user community in STE, providing access to its facilities for the scientific community in Europe and beyond. Oher issue in this objective is the identification of the stakeholder community and synergies with other ESFRI projects, research/science infrastructure facilities or any other related initiatives regarding STE. Other fundamental outcome of EU-SOLARIS concerning this objective is to establish the needs of e-infraestructure.
7. Technical design of STE Research Infrastructure and Research Activities. The main purpose of this

7. Technical design of STE Research Infrastructure and Research Activities. The main purpose of this objective is the analysis and assessment of possible innovations in software, research tools and processes; recommendations on priorities; development of a roadmap for implementation and validation and the definition and design of optimised high performance test facility components to provide top level experimental opportunities for R&D to clients from industry and science.
8. Quality and risk analysis. The preparatory work in these domains was reviewed in terms of quality control, risk assessment and mitigation strategies.
9. Dissemination and promotion activities. Promotion activities are aimed at getting the support of all stakeholders such that the infrastructure can indeed be realised after this preparatory phase. In the formative aspects a procedure for an internship programme and a proposal of a framework agreement with several Universities for a doctoral education programme and Training Activities have been done.

Project Results:
The preparatory phase of EU-SOLARIS project (1 November 2012 - 31 October 2016) aims to carry out the preparatory work needed for the creation of a large distributed Research Infrastructure (RI) of European character and global reach. The EU-SOLARIS vision is to further assist the Concentrating Solar

Thermal (CST) and Solar Chemistry (SCH) technologies deployment by enhancing the Research Infrastructures, (RIs), development and Research and Technological Development (RTD) coordination. EU-SOLARIS should become the European reference research infrastructure in Concentrating Solar Thermal and Solar Chemistry Technologies development and has the mission to offer the most favourable conditions for the development of research activities for the CST scientific and industrial communities. Successfully implementing is only possible through international cooperation.
Research infrastructures on CST and SCH have already contributed to the development of technologies in these sectors (through the validation of components' and systems' designs, through the exploration of potential innovations, etc.).
A series of main cornerstones have been accomplished. Among these are the identification of the potential technical services portfolio of EU-SOLARIS and the legal and governance structure to be adopted by the future EU-SOLARIS entity. The legal structure proposed by the consortium of the EU-SOLARIS Preparatory Phase project is the European Research Infrastructure Consortium (ERIC). The proposed governance structure is a simple collegiate structure composed of the General Assembly, the Managing Director, and several consultative bodies, such as a Financial Committee, a Technical Committee and a Board of National Nodes Directors.
Also, training courses have been scheduled for the implementation phase of the project, which intends to promote the creation of a new generation of young 'solar' researchers.
All the background information and documents required to implement EU-SOLARIS ERIC have been elaborated during the preparatory phase, and the administrative process for its legal implementation can be initiated.
The EU-SOLARIS preparatory phase paved the way towards the EU-SOLARIS research infrastructure implementation. The project consortium consisted of expert institutes to prepare all necessary details for EU-SOLARIS, one Ministry and the European Solar Thermal Electricity Industry Association, ESTELA, which provide an excellent mix of actors relevant for supporting the needed further development of the CST technologies. Also an Advisory Board for Funding and Administration has been implemented with official representatives of interested EU member states and associated states in order to prepare a cooperation agreement on the implementation and long term maintenance of the EU-SOLARIS infrastructure. A policy and science board was overseeing the progress of the preparatory process

infrastructure. A policy and science board was overseeing the progress of the preparatory process.
All the available public outcomes of the project are accessible in the project website (www.eusolaris.eu) in the “Deliverable” section of it.
The EU-SOLARIS Preparatory Phase project is structured into eight Work Packages (WPs):
■ WP1 – Governance and financial issues;
■ WP2 – Legal status and user access policies;
■ WP3 – Capacity building and services;
■ WP4 – Innovation and contacts with industry;
■ WP5 – Distributed facility activity and logistical work;
■ WP6 – Dissemination and outreach;
■ WP7 – Technical design of STE research infrastructure and research activities;
■ WP8 – Management;
The structure combines horizontal activities (management, legal consultancy, human resources, communication) and vertical activities (knowledge breakdown, systems, project management, Intellectual Property Rights (IPR) and Technology Transfer (TT) measures). The project activities are further grouped into four principal subjects, which are the following:

■ EU-SOLARIS constitution and relationships strengthening;
■ EU-SOLARIS distributed facility and logistical activities;
■ External activities to assess the EU-SOLARIS impact and outreach;
■ Related technology activities;

Four years of preparations of the construction and operations of the EU-SOLARIS resulted in many documents, databases describing all the documentation and knowledge necessary for its legal implementation as an ERIC.

The main documents directly related to the development of the EU-SOLARIS are,

1. The EU-SOLARIS Legal Status and Governance;
2. The user access policies;
3. Existing and future services;
4. EU-SOLARIS Strategic Research Agenda (SRA) roadmap;
5. Formulas of collaboration with industry;
6. Future research infrastructures and E-infrastructure;
7. Business Plan and financial plans.

Together, these documents constitute the building blocks for the implementation phase of the EU-SOLARIS.

EU-SOLARIS Business Plan

The deliverable Business Plan includes the definition of the legal status and governance, the strategic plan for EU-SOLARIS (including sector review, user needs analysis, industry trends and a plan for the future development), and the definition of the business scenarios that have being used to evaluate the required financing sources. All the information has been obtained from deliverables from EU–SOLARIS project and external sources.

external sources.

The document has been validated twice with all the project partners before submitting it. The EU-SOLARIS Business Plan summarizes the information generated in the preparatory phase of the project and proposes scenarios for its financing. In addition, the Business Plan develops a Strategic Plan for the EU-SOLARIS implementation phase. The EU-SOLARIS Business Plan consists of four parts:
1. Executive Summary;
2. Legal Status and Governance;
3. Strategic Plan ;
4. Financial Plan .

Legal Status and Governance
Legal Status
Different potential alternatives have been discussed about the Legal Status and Governance for EU-SOLARIS, an entity with an international and pan-European dimension. During the analysis, different stakeholders have participated and different sources have been considered in the decision-making

process for the best choice. Some of the most relevant have been: experts from different entities participating in the EU-SOLARIS project, analysis of other similar entities and the solution adopted by other ESFRI projects, and finally the advice and guidance of GARRIGUES, a prestigious company with recognized and deep expertise in legal topics. The partners selected ERIC (European Research Infrastructure Consortium) as the most suitable legal form for EU-SOLARIS, with a simple collegiate system for the Governance model.

This legal status is compatible with the EU-SOLARIS consortium partners' legal form and it is a legal personality, which simplifies the operation of the entity; besides, most of the ESFRI projects have chosen this option since the implementation in the EU dimension is easier. The main characteristics of an ERIC are summarized below:
■ it is an entity with its own legal personality and full legal capacity, recognised by all of the Member States of the EU;
■ in view of the reduced legal regulation of ERIC, its regime of internal organisation is highly flexible, allowing the ERIC members to define in their By-laws, on a case-by-case basis, their rights and obligations, the governing bodies of the ERIC and their powers;
■ the liability of the members of an ERIC shall, in general, be limited to their respective contributions, irrespective of the fact that higher liability may be established, including unlimited liability; and
■ the ERIC should be recognised by the Member State or associated country in which it has its registered office, as an international organisation for the purposes of Community regulations on value added tax and special taxes, as well as with regard to public contracting procedures.
Pursuant to the provisions of the ERIC Regulation, an ERIC should be comprised of, at least, three countries, of which one must necessarily be a Member State (in the original wording of the ERIC regulation at least three Member States are required), and the other two may be Member States or associated countries.
The foregoing should not be confused with the number of organizations which, by representation, intervene for and on behalf of the member countries. Consequently, and by way of example, three public organizations assigned to one State could not constitute an ERIC.
Governance

Governance

EU-SOLARIS is created as an entity with Pan-European and international dimension, for that reason, the Governance structure will have to comply with different requirements:

■ Effective and efficient structure: the structure must be financed by EU-SOLARIS members' contributions, projects and incomes from its business activity. Simpler structures reduce bureaucracy and contribute to a better use of the resources;

■ Compliance with EU and national laws: it is necessary to consider the different forms of governance provided in the national Laws of the consortium partners of the project and in the European Union, taking into account the Pan-European status and scope of the project, comprised in a Community programme to promote the collaboration and interconnection of the Member States and associated countries, in this particular case, in the CST field;

■ Democratic participation and cohesion of its members must be guaranteed.

The best Governance structure that complies with the previous requirements and which has been adopted by EU-SOALRIS for its operational phase is the Simple Collegiate System, including the following bodies: the General Assembly, the Managing Director, and several consultative bodies, such as Financial Committee, Technical Committee and Board of National Nodes Directors. It is the simplest structure,

offering high flexibility in the decision-making process while keeping lowest overhead expenses and internal regulatory requirements.

Each of the main EU-SOLARIS governing bodies are described in detail in the following paragraphs.

1. The General Assembly

Through the General Assembly the members of the ERIC would state their particular wish in order to translate it, via the corresponding majority system, into EU-SOLARIS' corporate wish, binding on all of the members (without prejudice to the possibility of providing for potential rights of separation) and on the Managing Director of EU-SOLARIS.

2. Managing Director

The Managing Director of EU-SOLARIS would be responsible for managing and coordinating the ordinary running of EU-SOLARIS and assumes the duties of executing the resolutions adopted by the General Assembly.

The Managing Director would also represent EU-SOLARIS vis-à-vis third parties, acting as sole administrator of EU-SOLARIS. Consequently, this person would be the person empowered to administrate and dispose of EU-SOLARIS' property and rights, and to execute and conclude contracts and any type of documents vis-à-vis third parties.

3. EU-SOLARIS Technical Committee

It is advisable to set up an eminently technical committee, comprised of renowned scientists and specialists of verified good reputation and experience in the fields of research and energy, towards which EU-SOLARIS shall target its activity.

As far as possible, it might be appropriate for such committee to be comprised of both experts belonging to the scientific community of each one of the countries to which EU-SOLARIS' members belong and by independent experts, not related to EU-SOLARIS' members.

The members of the Technical Committee shall be appointed by the General Assembly.

4. EU-SOLARIS Financial Committee

Projects of EU-SOLARIS' magnitude and scope, on a transnational level and requiring the participation of members in different countries and the management of a significant amount of funds make it highly recommendable for a Financial Committee to exist, comprised of experts and professionals on the subject, collaborating in the correct management of the economic resources available and helping to identify new

collaborating in the correct management of the economic resources available and helping to identify new sources of financing for EU-SOLARIS; and the supervision of EU-SOLARIS' activity, particularly in the economic and financial field, by way of internal audit.
It is advisable that the Financial Committee is comprised not only of persons representing the interests of each member, but also by independent professionals, favouring the balance of interests and contributing to the impartiality and independence of this body.
The Financial Committee should be comprised of experts in control (accounting, auditing and risk management) and in economic and financial issues.
5. EU-SOLARIS Board of national nodes directors
The proposed structure would finally be completed by the Board of National Nodes Directors, a consulting body comprised with the directors of the entities collaborating with EU-SOLARIS in the CST field ("National Nodes").
To the extent that EU-SOLARIS is configured, on a preliminary basis, as a distributed RI, both as regards its central node and the National Nodes with which EU-SOLARIS reaches cooperation agreements, a body is required that allows the scientific activity of EU-SOLARIS to be coordinated in the different National Nodes.Therefore the Board of National Directors shall oversee the coordination of the

implementation of the scientific and technical strategies approved by the General Assembly collaborating with the Managing Director.
The Board of National Nodes Directors shall be responsible, under the supervision of the Managing Director for all national scientific activities related to EU-SOLARIS, maintaining coherence and consistency across EU-SOLARIS and collaboration between its members and its collaborating entities.
Strategic Plan of EU-SOLARIS
A. Strategic analysis
Research infrastructures (RIs) are taking relevance and are playing an important role in the development of technology in different areas. They are becoming a key instrument in bringing together a wide diversity of stakeholders, such as industry, academia, end users, to develop solutions and technology with an optimal use of resources. RIs offer a single contact point where facilities, resources and research services are effectively offered to users from different countries to increase the sector competitiveness through the collaboration between industry and scientific community.
B. EU SOLARIS aim
EU SOLARIS vision, mission and strategic objectives set up the organization aim and define the path to follow in order to achieve the goals. These definitions will let the organization to focus the efforts towards getting the course in the defined direction.
C. EU SOLARIS vision
Become the European reference research infrastructure in Concentrating Solar Thermal and Solar Chemistry Technologies development.
D. EU SOLARIS mission
Offer the most favourable conditions for the development of research activities for the CST scientific and industrial communities.
EU SOLARIS strategic objectives
EU SOLARIS has the following strategic objectives to be deployed in the next five years:
Objective 1. Coordinate, as a unique infrastructure of distributed character, the main European CST research infrastructures. EU-SOLARIS will coordinate all distributed research infrastructures, available from the partner's facilities, as a single contact point. It will enable EU-SOLARIS as the reference and excellence research infrastructure in Europe and will provide industry and academia with outstanding

excellence research infrastructure in Europe and will provide industry and academia with outstanding research services. EU-SOLARIS will offer a single contact point where facilities, resources and research services are effectively offered to users demanding this service.

Objective 2. Propel the collaborative research among the main European centres related to Concentrating Solar Thermal technologies. EU SOLARIS will foster and promote the collaboration among the research centres at European level to harmonize their protocols and testing procedures.

Objective 3. Reinforce the collaboration between the scientific and industrial sectors of CST technologies. EU-SOLARIS will act as a catalyser that connect offer and needs in the field of Concentrating Solar Thermal and Solar Chemistry Technologies development. The collaboration between industry and research community will be pushed to improve competitiveness of industrial sector in EU.

Objective 4. Identify new requirements for the improvement of the existing research facilities, and for the construction of new ones. EU-SOLARIS will improve and update existing RI facilities to bring partners' RI facilities to the state-of-art-technology with a vision to the future and synergy among the facilities.

The upgrade plan includes the improvement of the infrastructures to measure all experimental parameters with the more accurate devices and will have the ability to supply the right conditions and the flexibility to perform a wide variety of research experiments. The upgrade plan will also increase the effectiveness of the RI facilities by optimising resources, reducing costs, increasing synergies, and avoiding overlapping resources.
Objective 5. Lead and coordinate the dissemination of results and good practices contributing to the reinforcement of the European leadership position in CST and SCH technologies at an international level. EU SOLARIS will contribute to reinforce the leading position of European companies in these sectors worldwide through the coordination of dissemination of Project results, training and best practices publications in the sector.

User needs analysis
As a general definition, EU-SOLARIS is addressed to those organisations and individuals who are involved in CST activities by using, promoting or supporting it. Researchers and scientists are examples of typical users for the new entity. But user communities are not only composed of scientists and research engineers (either from public or private industry), it can also be providers of products, funders, engineers, policy makers, the commercial sector, the education sector, etc. Therefore, to provide an extensive list of the users, an inter-sectorial approach has been adopted to identify user communities.
The EU-SOLARIS project consortium has elaborated two surveys, with one being targeted to the research community and the other to the industry sector. The two groups had to answer on their degree of satisfaction regarding their collaboration on RTD projects, covering both legal and technical aspects. Concerning Legal aspects, the most common framework of cooperation with research centres is through national projects and EU projects. This generally allows for having substantial financial support from governmental institutions and provides a strong support to the technological development of STE.
The key conclusions of the study and identification of users' needs that can be drawn is that there is a gap in the way of functioning between research and industry, related to lack of communication, project size, confidentiality and time-budget approach.

Industry trends

The financial aspect clearly comes out to be the major barrier to the development of innovative STE technologies: the innovations listed are not affordable and their inaccessibility prevents improvements in the efficiency of the technology.

The second aspect hindering the development of these technologies is technical constraints. Many physical limitations due to material degradation are identified (e.g. HTF temperature). Some innovative topics also raise the problem of system complexity (e.g. thermo-chemical storage), or are not advantageous with regards to other technologies (e.g. PV).

No particular reference was made regarding policy-related bottlenecks at any level whatsoever. However, it is relevant for the industry sector to have a stable policy framework in which different stakeholders in the value chain can feel they work in a trust environment. This shows that the concern of the researchers and engineers are much beyond this level and that the STE sector is perhaps in too early a stage to deal with policy matters, as the first problem to solve is how to get to a – technically and economically – competitive system, before being able to bring it to national or international policy discussions.

Overall, it appears that the ratio between cost and quality is the biggest problem, as it turns out to be extremely difficult, according to respondents, to combine them in an effective way: quality advanced materials (not yet in application) have non-affordable costs while affordable materials and systems show a yield that is too low to be competitive in the market.

This situation creates a strong tension in the STE sector, with regards to the parallel development of other renewable technologies. As of now, the plants currently under construction at big commercial scales are based on non-innovative and well established concepts and systems, since the reliability of those configurations has been proven through the observation of the existing plants in operation around the world. The drawback of investing in the cheapest-solution-that-works is that some aspects such as the environmental profile, with the use of synthetic oil for instance (which also has strong physical limitations at high temperatures), are not taken into consideration. Also, it does not help in improving the systems towards innovative solutions to have a smaller loss of thermal energy due to conduction, storage, heat exchangers etc. within the traditional configuration.

Investing in research and innovation at the industrial level and implementing those new concepts in commercial plants after proven validity is a huge engagement which is not exempt of risks. It is the biggest challenge of STE for the decade to come and this is an unavoidable step to deserve the denomination of ‘mature technology’. It requires substantial commitments from all types of stakeholders and this is the message that ESTELA, representing the STE European industrial sector, is putting in words and claiming at the European level beyond the policy makers of the European Institutions.

Respondents from research and from industry in this panel clearly pointed out the difficulty to overcome the exorbitant costs of promising materials or systems. The financial hurdles are obviously added to the technical challenges such as meteorological circumstances and thermodynamic limitations.

Fortunately, the creation/development of industrial national associations is slowly pushing the governments to move forward. We can now observe active national STE associations in the following countries: Spain, Italy, France and Germany. ESTELA is in close collaboration with them all and does its best to set up an innovative project that will be proposed for the Horizon 2020 programme, in order to demonstrate the feasibility of building up an innovative plant, taking into account the geo-political needs and constraints of the European landscape. This vision is well described in the Implementation Plan 2013-2015 of the Solar Industrial Initiative of the SET-Plan and will be reinforced in the SET-Plan Integrated

2015 of the Solar Industrial Initiative of the SET-Plan and will be reinforced in the SET-Plan Integrated Roadmap, currently under elaboration by the European Commission.

SWOT analysis

SWOT analysis offers a general overview of the sector (external analysis) and how EU-SOLARIS will face the identified challenges (internal analysis). This analysis evaluates the strengths, weaknesses, opportunities and threats involved in EU-SOLARIS project.

a. Strengths

■ EU SOLARIS partners are the most relevant stakeholders in the sector; these partners are convinced of the advantages to join efforts through EU-SOLARIS.

■ EU SOLARIS will offer new world-class research infrastructures and will optimize the use of the national facilities, increasing the use ratio of them.

■ The integration of all the facilities under a common framework (i.e. common protocols, standards and contractual terms) will ease the effective collaboration between industry and scientific community and hence reinforce the international cooperation between EU countries.

■ A more effective coordination among all the stakeholders will be implemented by EU SOLARIS.

■ EU SOLARIS will integrate all the national facilities and resources into networks that will:

1. Offer first class research services – more qualified human resources and most advanced technologies in EU will be available for EU-SOLARIS users.
2. Have a single access point for all the aspects related to legal issues, such as contracts, confidentiality, and intellectual property among others. It will reduce the legal paperwork to do for industrial sector and hence will reduce the time required to initiate a collaboration project.
3. Develop common procurement procedures in order to decrease costs and achieve significant impact in access to services.
4. Foster the participation of SMEs in research projects where the company size is a barrier, it will increase the innovation in the sector.

b. Weaknesses

■ There is not a deep experience background in research infrastructure in Europe which can support all the processes and procedures required. There are a lot of administrative challenges to face before EU-SOLARIS can be fully operative.

■ There could be conflicts among national laws from the different countries which can led to complex internal procedures at EU-SOLARIS.

■ Skilled people is required for coordinating EU-SOLARIS.

■ Short term financing is required to start the deployment of EU-SOLARIS.

■ Long-term financing: lacking funds for the operation threaten continuity.

c. Opportunities

■ CST technology will contribute in an effective way to reduce GHG emissions.

■ There are long terms targets in terms of installed capacity for STE plants in next 30 years at different regions according to the best available places where this technology can perform in a better way.

■ There is a political support for the implementation and deployment of this technology because it produces clean and renewable energy, and also because of its capacity to storage energy and deliver it on demand.

■ There is support from EU to develop innovative RTD and demonstration projects in this field which strength research and improve operation in STE plants.

■ EU is pushing to strength international cooperation on RTD projects to increase the competitiveness of

■ EU is pushing to strength international cooperation on RTD projects to increase the competitiveness of the STE industrial sector in EU.
■ The STE sector has experienced important changes in the last years. Nowadays companies are in a strong competition for the new plants, which started to be tendered at world level. Companies have now urgent needs for technological improvements:
1. Regarding their own plants: reducing operational costs, increasing eco-sustainability factors and increasing production – except in Spain, where the legal framework makes the production increase unprofitable for plant owners.
2. Regarding international tender processes: Reducing the investments and increasing the efficiency.
d. Threats
■ The existing procedures for permitting the plants are large and unpredictable in many cases. It is required the definition and development of streamlined permitting procedures that ease the implementation of projects and reduce the time to market.
■ Retroactive changes in legislation, that can impact negatively on the expected return on investment of the STE plants, will make that the international investors will not take the risk of investing in countries where there is not a stable, long-term and predictable laws.

■ There is not a set of clear and long-term support schemes to ensure profitability for investors in the long term, which increase the risk of the business.
■ STE plants require large investment for the engineering and construction/installation. The return on investment periods are also large. There is also a lack of private finance for this kind of projects, finance costs are high which reduces the innovation capacity in the sector.
■ Instability of the electricity prices in the market, it makes difficult to define trusted long term business plans for financing entities.
■ The development of cheap electricity storage technologies (batteries) is also threatening to STE since it would remove some of the main advantage over other technologies for the production of electricity.
EU-SOLARIS available facilities
One of the main technological assets of EU-SOLARIS is the comprehensive set of RIs owned by the Partners, covering the range from a few kW to several MW of unit thermal power. These RIs are composed of both outdoor test facilities and indoor laboratories. The existing RIs available for EU-SOLARIS are summarized in the following paragraphs
Currently, EU-SOLARIS partners' resources account for forty-seven (47) outstanding RIs that are fully operated by EU-SOLARIS partners: 7 Solar Towers, 10 Parabolic Troughs, 2 Linear Fresnel, 7 Parabolic Dishes, 18 Solar Furnaces, and 3 Solar Simulators. The existing RIS available for EU-SOLARIS are summarized in the following paragraphs
Central Receivers
EU-SOLARIS partners operate six experimental central receivers, which main technical parameters are listed in next table. These facilities are used not only for testing of components (central receivers, heliostats, secondary concentrators, etc) but also for control systems and operation strategies. Most of these facilities are provided with several test platforms installed at different levels in the tower. (table 1)

Parabolic Trough facilities
At present, EU-SOLARIS partners have eight test facilities with parabolic trough collectors. Next Table gives their main technical parameters. These facilities are used for many different purposes: testing of components (receiver tubes, mirrors, solar tracking systems and local controls), new working fluids (water/steam, compressed gases, thermal oils and molten salts) and complete new collector prototypes

(water/steam, compressed gases, thermal oils and molten salts) and complete new collector prototypes (small and large size prototypes). Most of the new parabolic trough designs and components installed in modern STE plants have been previously qualified in these facilities.(Table 2)

Linear Fresnel (LF) and Parabolic Dish (PD) test facilities

The only LF test facility owned by the EU-SOLARIS partners is the FRESDEMO plant operated by PSA. It is composed of a North-South oriented Linear Fresnel concentrator of 100 m length and 22m width, provided with a single-tube receiver using water as working fluid and a maximum working temperature of 400°C.

Concerning parabolic dishes, there are seven units in operation at PSA (six units) and CNRS-Odeillo (one unit), with thermal powers ranging for 40 to 52 kW, and solar concentration factors from 10 000 to 16 000. Besides the evaluation of new Stirling engines, these facilities are excellent test benches for accelerated-ageing studies of STE plant components working under high solar flux conditions (e.g. central receivers).

Solar furnaces and solar simulators

Solar furnaces and solar simulators are very flexible and user friendly facilities because they allow many

different types of tests with high solar radiation fluxes, which make experiments at very high temperatures possible. EU-SOLARIS partners are operating 17 solar furnaces with unit thermal powers ranging from 0,125 kW up to 1 000 kW, reflecting surfaces from less than 1 m2 up to 1830 m2 and concentration factors between 2 500 and 16 000. Five solar furnaces, including the current biggest one, are operated by CNRS at Odeillo (France), while three are operated by PSA in Spain, one is operated by DLR in Germany and another one is operated by LNEG in Portugal

Concerning solar simulators, EU-SOLARIS partners are operating one 20-kW simulator at Greece (by APTL), one 18-kW simulator at Germany (by DLR) and one 4-kW simulator in Spain (by PSA). More and more powerful simulators will be available by 2017.

Laboratories

The experimental facilities described in the former paragraphs are complemented by a large number of laboratories. The types of laboratories available and their owners are shown in the following table according to their specialization. (Table 3)

EU SOLARIS Research Infrastructure services

Specific RI supported services includes a list of about 170 available services as result of an iterative process of identification and definition.

The available services have been classified in a total of 16 types of services covering the different key subsystems of STE, the other applications of Solar Concentration and the associated horizontal activities. The largest number of available services is related to the testing and qualification of reflectors, concentrator, absorbers and receivers. The amount of Training and Access to Facilities services is also significant.

The services portfolio covers characterisation/qualification of almost all the key subsystems in STE plants and other applications of solar concentration as well as access to facilities, training and technological advising.

Some of the same services are provided by several partners. This redundancy shows a suitable environment to advance standardisation of procedures or benchmarking.

Besides and in line with the spirit of the EU-SOLARIS project to strengthen ties between the concentrating solar test facilities from the point of view of supply of services, some of the partners are already working in

solar test facilities from the point of view of supply of services, some of the partners are already working in the joint provision of services, as in the case of access to facilities services within SOLLAB and SFERA alliances or the joint offer of some experimental services already having agreed between DLR and CIEMAT-PSA.
Since the EU-SOLARIS project focuses on RTD facilities, most of the identified services are offered on an experimental basis in the facilities of the partners (with experimental character, access, training, studies, etc.). Occasionally some services are required as a diagnostic in-situ of the STE (such as measures of thermal or vacuum losses in receivers, piping, storage tanks, etc.) or for experimental verification of the performance of subcomponents plants or complete plants. The list of such “in-situ” services for STE plants may have to be strengthened in upcoming reviews of the catalogue prepared in the preparatory phase of EU-SOLARIS.
This classification results in a total of 16 types of services covering the different key subsystems of STE, the other applications of Solar Concentration and the associated horizontal activities.
Facilities providing services related with STE also provide qualification services for other applications of Solar Concentration such as Solar Chemistry or Solar Fuels and Materials Testing, Sensor Calibration for High Solar Fluxes or High Temperature Measurements, etc.

Commercially the most widespread and the main application for the purposes of the EU-SOLARIS project is STE production. This class includes most of the experimental services on materials, components, systems and subsystems used or usable in STE technologies as well as most of the non-experimental services above mentioned.
The range of available services (among the project partners) spans from the use of large experimental facilities (as those from WEIZMANN, CNRS-THEMIS, CTAER and CIEMAT-PSA) that allow tests of prototypes or very near actual size, to the use of solar furnaces (highlighting the facilities in CNRS-PROMES , CIEMAT-PSA and DLR) and solar simulators that allow testing at indoor conditions (at DLR, CIEMAT-PSA, etc.) with high solar concentrations and temperatures, the use of laboratory characterisation and qualification of materials (CNRS-PROMES, CyI, APTL-CERTH, LNEG, CIEMAT-PSA, DLR, etc.) to use specific software tools and expertise for modeling and evaluation of components and systems of these CST technologies (e.g. UEVORA, ENEA, etc.).
Training services
EU-SOLARIS intends to be the reference for training on CST and SCH technologies in Europe. In order to develop training programmes, a survey of the existing offers, regular seminars and short courses, at European level was carried out, and a range of courses at different levels has been defined, including the new needs on training of CST plant operation and maintenance personnel.
Considering the training offer available and the objective of setting up EU-SOLARIS courses of different nature, target and duration, the following training services have been defined: Seminars, Technical, Pre-doctoral and Doctoral.
EU-SOLARIS service definition
EU-SOLARIS will provide to industry and scientific community the following services:
1. Training courses and dissemination activities – specific technical skills are required for professionals working in this sector. EU-SOLARIS will use the available infrastructure and knowledge to provide industry specific contents that will improve the competitiveness of the sector: specific in-site training courses will be offered to potential partners. A master degree will also be promoted by EU-SOLARIS with an international focus. EU-SOLARIS will also promote and coordinate an annual congress to share expertise and know-how among the scientific community and industry.
2. R&D services – EU-SOLARIS will participate and promote the participation of the industry and scientific

2. R&D services – EU-SOLARIS will participate and promote the participation of the industry and scientific community in different STE specific topics in H2020 program and other research funding mechanism. The involvement of EU-SOLARIS as a project partner will give visibility to the entity and will give technical content to it. IP services will also be provided to industry upon request.
3. Specific consultancy services – based on the vast knowledge under the framework of EU-SOLARIS (considering all the partners involved in it), this entity can provide highly specialized consulting services to industry, specifically technical due diligence for new or innovative technology to be implemented in power plants or performance guarantee studies for new components or parts of installation. These kind of services will be valued by industry to ease the implementation of innovative solutions in real power plants, reducing the technical risk in front of financing entities.
4. Research Infrastructure access – EU-SOLARIS will promote and increase the effective use of the existing RI for participating partners. EU-SOLARIS will coordinate the available RI hours that each partner offers to a RI pool; EU-SOLARIS will foster the demand of the RI use and will increase the bookings among the scientific community and industrial sector.
5. Research Infrastructure services – EU-SOLARIS will provide specific services for testing and validation of components, these services will be provided using the existing RI from the different partners, EU-

SOLARIS will coordinate the services and will direct the customer to the best RI available if such a service is requested by the customer.
The availability of experimental services for qualification of key components in CST have contributed to the reliability, promotion and market entry of STE plants by facilitating the knowledge and improvement of performances of components and subsystems and to the risk mitigation by allowing the operation of prototypes (of CST components) under realistic conditions.
The necessary evolution of technology to better efficiencies and implementation of innovations will require the maintenance of experimental facilities and services currently available and the development of new services and capabilities to accompany the improvements required to advance the learning curve of CST technologies.
The EU-SOLARIS project addresses the challenges in CST technologies by a pan-European working team through a major upgrade of existing facilities in Europe and development of new ones. The initiative focuses on the high-level target of establishing a strong and distributed infrastructure to further assist the STE deployment.
Different modes of access to RIs:
Three types of access will be offered by EU-SOLARIS to the Users:
1. Market-based Access: This type of Access applies when the requested Access has a clear commercial objective (e.g. qualification of a prototype, development of an innovative component or technology, etc.) and it is especially suited for companies (e.g. equipment manufacturer, engineering companies, industrial developers, etc.) wanting to test new designs or concepts at a pilot scale. The cost of this Access will be fully paid by the User. Since this Access is aimed at developing a commercial product a more intensive use of the RIs is demanded by the applicants Therefore, the duration of a market-based Access could be of several months or even several years. It is also suitable for small RTD groups that have got externally to EU-SOLARIS the funding required to pay 100% of the cost associated to the requested Access to conduct experiments in the RIs included in EU-SOLARIS and they do not want to enter the selection process that is compulsory for the “Quality-based” Access.
2. Quality-based Access: this Access is more likely to be requested by public RTD groups working on CST technologies and chemical applications when they need RIs that they do not have. The quality-based Access mode is exclusively dependent on the scientific excellence, originality, quality and feasibility of the

Access mode is exclusively dependent on the scientific excellence, originality, quality and feasibility of the objectives pursued by the applicants. These features are therefore the parameters to be evaluated by a Selection Panel and the Access Committee that will be implemented in EU-SOLARIS for this purpose. Depending on the Access policy finally adopted for EU-SOLARIS RIs and the availability of funds, the quality-based Access will be partially or totally financed by EU-SOLARIS.
3. Archival Access: this Access mode is more oriented to on-line and remote access to data bases of information related to the RIs and their experimental results. The Archival Access mode aims at Users in need of scientific data and/or advanced integrated digital services to carry out world class (cross-disciplinary) research. These digital services do not include the remote performance of test by Users, but the access to services that might be useful for Users to remotely prepare experiments or conduct high-level solar research (e.g. access to simulation computer codes related to the RIs, access to non-commercial computer codes specially developed for solar research, etc.).

EU-SOLARIS human resources
EU-SOLARIS will service industry and scientific community through the RI utilization. EU-SOLARIS will be supported by each of the RI technical and management personnel when providing services to final

customers. Every EU-SOLARIS partner will use their own internal resources to service the final customers, independently if the customer was approached by EU-SOLARIS or the partner. EU-SOLARIS will benefit indirectly of consolidated and skilled resources when offering services to industry or scientific community. For that reason, it is relevant to detail the human resources of EU-SOLARIS partners, as it will let a better understanding of the relevance of EU-SOLARIS for the sector.
The human resources of EU-SOLARIS partners consist of a total of 493 people, divided into 258 scientists and researchers, 104 engineers and technicians, and 131 people involved in management and other. Scientists and researchers are leading the visions of the new technologies and development activities. Engineers and technicians design and execute the experiments and the laboratories' calibration testing. Management staff is composed of managers and secretaries, while "Other" staff is composed of students and research assistants.
The combination of RI and highly skilled human resources enable EU-SOLARIS to offer the most important portfolio of RTD services in the world with a total of 170 services covering testing/characterisation/qualification of almost all the key subsystems in STE plants (reflectors, concentrators, absorbers and receivers); and other applications of solar concentration as well as access to facilities, training and technological advising. EU-SOLARIS will be at the forefront of the technology, for which it is crucial to maintain and upgrade the existing infrastructures, and also to build new ones if required in the future.
Financial Plan
Financial projections for EU-SOLARIS have been done over its first 5 years of operation, in different scenarios (optimistic, most likely and pessimistic), where each scenario represents consciously several alternative future developments. EU-SOLARIS will be fully developed by year 5, so the annual budget will be increasing during the first years until the full plan is deployed.
The EU-SOLARIS model is based on the six following founding principles:

1. EU-SOLARIS will operate on the basis of a non-profit entity, established under such a legal form that guarantees its European and international visibility and recognition.

2. EU-SOLARIS is conceived as a unique distributed research infrastructure for STE, so EU-SOLARIS will

2. EU-SOLARIS is conceived as a unique distributed research infrastructure for STE, so EU-SOLARIS will set up a Central Executive Management Office in the designated country (Central Node), and efficient interfaces between member countries (National Nodes). Therefore, EU-SOLARIS staff will be located at the Central Node although the presence of representatives of EU-SOLARIS in the National Nodes is envisaged, these people are not part of the human resources for the new entity.

3. The establishment of a central node in the designated country is expected while most (if not all) of the participant countries will be established as national nodes.

4. The main activity for EU-SOLARIS will be the improvement of the accessibility and interoperability of the existing RIs to the research communities, including both small RTD groups and important industries (e.g. components manufacturers, engineering companies, promoters...).

5. The estimation for the investments that will be undertaken will have as their main objective the improvement of the existing RIs (both equipment and protocols) as well as the financing of the quality-based access and the construction of new RIs.

6. Costs have been estimated for the establishment of a central coordinating and executive unit (central node), taking into account staff, and the rest of implementation and operational costs described in the financial plan.

7. EU-SOLARIS will receive regional, national and European level funding to cover costs, and from potentially other additional sources, such as the industry sector. These incomes will be balanced with revenues from access fees and other additional streams.
In conclusion, it can be briefly summarised that:
The operation of EU-SOLARIS as a legal entity is economically feasible, thanks to the Member States' annual contributions and to the possibilities of generating additional revenues through the sales of expert services and training.
It has been assumed that EU-SOLARIS will be fully developed in five years according to the strategic plan, for that reason it is required to increase the total Members contributions year by year. But, if it is considered also the increase in the numbers of Members during the five-year scope, the average Member contribution is stable and delimited.
Member States contribution will be the main finance source for EU-SOLARIS activity. In return, Member States will have access to best international RI for the scientific community, coordinating efforts among all the research centres in Europe.
If the research centres that are contributing the use of their research facilities to EU-SOLARIS keep their research facilities at the technology forefront as envisaged, and the Member States of the future EU-SOLARIS legal entity support the financing of the ambitious research infrastructure that could be demanded by the industrial sector during the EU-SOLARIS operational Phase, EU-SOLARIS will remain the largest research infrastructure of reference for CST and Solar Chemistry technologies. As such, it will attract the interest of industry and researchers all over the world, which in turn will facilitate the consolidation of the economic feasibility of its operation.
Under the hypothesis considered in this business plan, EU-SOLARIS will be able to significantly impact European research and industry on the CST and Solar Chemistry fields through its ambitious and growing Access and research programmes related to the improvement of testing equipment and procedures, thus

Access and research programmes related to the improvement of testing equipment and procedures, thus helping to consolidate the European leadership on these technologies.

Potential Impact:
Potential impact
EU-SOLARIS is designed as a large distributed RI of European character and global reach. The main purpose of this distributed RI is to foster, contribute to, and promote the scientific and technological development of Concentrating Solar Thermal (CST) and Solar Chemistry (SCH) technologies. EU-SOLARIS primary objective is to provide scientists and industry with the needed RIs capabilities for advancing the state of the art of these technologies and reinforcing Europe´s leadership in this field.
CST technologies must achieve a significant cost reduction in a short-medium term to become more competitive with fossil-fuelled systems, and EU-SOLARIS can contribute to this effort in different ways:
- providing this sector with the most comprehensive set of EU test facilities and laboratories (large outdoor facilities: 7 for Tower technology, 10 for parabolic-trough technology, 4 for thermal storage, 18 solar furnaces, 3 solar simulators and 7 parabolic dishes; 30 laboratories for: optics, radiometry, equipment testing, chemistry and meteorology);

- providing up to 170 services that have been grouped into 16 different types, which cover all the subjects related to key components and subsystems (e.g. solar reflectors and concentrators, receivers, heat transfer fluids, thermal storage, heat exchangers and horizontal activities like policy and planning activities);
- optimizing the use of the associated national research facilities, improving their management, expanding and upgrading their services, streamlining and enhancing the user experience, and leveraging synergies among them;
- developing common test protocols for all EU facilities in this field, and developing innovative test equipment;
- providing Access to the facilities coordinated by EU-SOLARIS, with proper procedures according to each type of Access.
One of the more important challenges we are facing in this technology sector is the lack of a well-defined alignment of National priorities among the potential Member States concerning CST technologies, and a consensus about the joint effort that must be devoted now to achieve a significant cost reduction.The industry is a major actor in the EU-SOLARIS project, and an appropriate response to their needs and demands in terms of services and infrastructure is a fundamental pillar of EU-SOLARIS.
One of the added values of EU-SOLARIS is that EU-SOLARIS will offer to the world a unique European distributed research infrastructure in CST and Solar Chemistry technologies. The existence of EU-SOLARIS will provide, whenever requested by Users, a central contact point for European RIs in this field, thus enhancing the access of European and non-European Users to the complete set of European RIs coordinated by EU-SOLARIS.
Once implemented, EU-SOLARIS will also provide the Member States with a legal vehicle to channel their financial contributions to a common fund for further development and optimization of CST and SCH technologies, thus making the national efforts to keep the current European leadership in this field more efficient. The existence of EU-SOLARIS as an ERIC will also enhance the alignment of national policies and RTD programs devoted to these technologies and will avoid overlapping or duplication of activities developed at national level.
The legal implementation of EU-SOLARIS as an ERIC will assure the long-term financial commitments required to define and develop an efficient plan to quickly achieve the cost reduction required by this

required to define and develop an efficient plan to quickly achieve the cost reduction required by this sector, because the financial contributions are guaranteed by the Member States, not by national entities or RTD centres with a non-guaranteed funds availability.
Last, but not least, Implementation of EU-SOLARIS as an ERIC will leave the door open to a joint effort by the Member States to invest in a large new experimental facility if needed in the future, because the legal nature of an ERIC is especially suited to this purpose. Although the analysis performed during the preparatory phase has depicted that a new large experimental facility is not needed at present in Europe, such new RI could be needed in the future, and in such a case EU-SOLARIS would be of great help to channelize national efforts to this extent.
The portfolio of European RIs for CST and SCH technologies has significantly grown during the last years and no new large experimental facility is required now to boost the commercial and technical development of this sector. What this sector needs now concerning RIs is a better coordination and harmonization among all the existing European test facilities, together with an efficient Access program to optimize their use, and a long-term commitment undertaken by the Member States to make achievement of these objectives feasible.
Benefits for scientific community and industrial sector

EU-SOLARIS RI will offer new world-class research infrastructures and will optimize the use of the national facilities, increasing the use ratio of them. Also, EU-SOLARIS will offer:
■ A single access point for all the aspects related to legal issues, such as contracts, confidentiality, and intellectual property among others;
■ First class research services – more qualified human resources and most advanced technologies in EU will be available for EU-SOLARIS users;
■ Integration of all the facilities under a common framework (i.e. common protocols, standards and contractual terms), which will ease the effective collaboration between industry and scientific community and hence reinforce the international cooperation between EU countries;
■ Development of common procurement procedures in order to decrease costs and achieve significant impact in access to services;
■ Fostering in the participation of SMEs in research projects where the company size is a barrier, it will increase the innovation in the sector.
Benefits and ways to join/collaborate with EU-SOLARIS RI
ESFRI RIs are becoming a key instrument, which offer a single contact point where facilities, resources and research services are effectively offered to users from different countries and they increase the sector competitiveness through the collaboration between industry and scientific community.
.

Main dissemination activities
The following dissemination activities have been performed during the preparatory phase of EU-SOLARIS:
a. Creation of the EU-SOLARIS official website (www.eusolaris.eu) which was regularly updated and enriched by adding new information, in terms of content and structure, with particular focus on the deliverable menu - where all the publishable outcomes were uploaded – on the technology menu – including updated information on CST technologies - and on the library menu - covering reports, legislation, CST links, multimedia gallery and educational video. A mobile version of the project website was also created and also a QR-code linked to it.
b. Design, elaboration, production and distribution to partners of a dissemination material package (logo

b. Design, elaboration, production and distribution to partners of a dissemination material package (logo, leaflets, PowerPoint presentations, roll-up, poster, videos, pictures, dissemination material including handbags and notebooks with pens, etc.) which is regularly being used in the different dissemination actions carried out by the consortium partners.
c. Participation and representation in the different dissemination activities at international and national events to raise public awareness on the EU-SOLARIS PP project's objectives, goals and benefits and increase outreach.
d. Organisation of national info days/workshops in most of the participating countries, where the project outcomes and the next steps of the project were presented. These events were addressed to the general public, key professionals, scientific communities, and policy makers, providing information on the EU-SOLARIS technological area, achievements and results.
e. Organisation of the EU-SOLARIS European conference in Brussels and creation of additional dissemination material (coins wallet and USB charger set), distributed to the conference participants. The objective of the EU-SOLARIS European Conference was to present the vision, the achievements and the results of the EU-SOLARIS project and also give the future outlook on the research infrastructures development and Research and Technology Development coordination in Europe, in the framework of the

Concentrated Solar Thermal and Solar Chemistry Technologies aspects and potentials in Europe.
f. Communication Plans for the Preparatory Phase of EU-SOLARIS at the beginning and at the end of the project. In the report on the final communication plan of the project, all the communication actions carried out during the PP of EU-SOLARIS are described. This includes the description of the created dissemination material pack and the organised events by the consortium.
g. An extensive list of contacts has been created. This database is currently stored online in a CRM tool, named Insightly. Further questionnaires can be sent on a bi-annual basis to get information from the different experimental facilities participating in Eu-SOLARIS and know the new users of their infrastructures and potential new stakeholders.
Some of the most relevant target groups identified are listed below:
1. Industrial associations related to CST
• ESTELA, Anest, AUSTELA, Sastela, STELAWORLD
• China National Solar thermal Energy Alliance - China
• Solar Energy Corporation of India (SECI) - India
• Solar Energy Industries Association (SEIA) – USA
• Emirates Solar Industry Association (ESIA) – UAE
• Saudi Arabia Solar Industry Association (SASIA) – Saudi Arabia
• SER, France Solar Industry, SOLER – France
• PROTERMOSOLAR, SOLARCONCENTRA, AEDyR, Solartys – Spain
• Deutsche CSP, BSW – Germany
• APISOLAR, IPES, APREN, EnergyIn – Portugal
• EBHE – Greece
• GENSED – Turkey
• AssoRinnovabili, APER, ANEST – Italy
• SEAPEK - Cyprus
2. EU associations related to CST or renewable energy:
• EASE - The European Association for Storage of Energy – Europe
• EERA – European Energy Research Alliance – Europe
• ESTIF - European Solar Thermal Industry Federation – Europe

• ESTIF - European Solar Thermal Industry Federation – Europe
• EDS - European Desalination Society – Europe
• REA - Renewable Energy Association – UK
• EUREC - The Association Of European Renewable Energy Research Centres
3. Worldwide stakeholders
• The online Platform for CSP – Brazil
• The International Solar Energy Society (ISES) – International
• The International Energy Agency (IEA) – International
• The International renewable Energy Agency (IRENA) – International
• SolarPACES – International
International conferences and journals will be used for the communication activities:
4. International conferences:
• SolarPACES Conferences;
• CSP today Conferences;
• CSP Focus Conferences;
• ASME Energy Sustainability Conferences;

• IRES International Renewable Energy Storage Conference and Exhibition.
5. Journals and magazines:
• ASME Journal of Solar Energy Engineering (JSEE) – International;
• ELSEVIER Solar Energy – International;
• ELSEVIER Solar Energy Materials and Solar Cells – International;
• FuturEnergy – International;
• Sun and Wind Energy – International.
Logo..

List of Websites:
List of websites
www.eusolaris.eu
www.eusolaris.com
www.eusolaris.org

Main contacts
Phd. Eduardo Zarza
E.mail eduardo.zarza@psa.es
Tel: +34 616 958 063
Tel : +34 950 38 79 31

final1-logo.jpg

Related documents

final1-final-report-tables.pdf

Last update: 24 October 2017
Record number: 204265