Potential impact and main dissemination activities and exploitation results

Please provide a description of the potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and the exploitation of results. The length of this part cannot exceed 10 pages.

A key aspect of the FRESH NRG project was its strong focus on industrial exploitation of the scientific results. Therefore, the FRESH NRG project has resulted in the creation of a very competitive linear Fresnel collector, which can be used for several applications such as solar process heat, solar cooling and small-scale CSP systems.

The **potential impact** of the FREHS NRG collector development was analysed in detail first for solar process heat applications, but the overall findings were found to be valid also for other applications such as solar cooling and power generation. The findings shows, that with the low fuel prices registered in 2016, no system can achieve an economic yield of 40 €/m²/yr. On the other side, the minimum system price in is 387 €/m². This means that the nominal payback time is indicatively higher than 387/40 = approx. 10 years. In this challenging environment, the industrial strategy of Soltigua will be to focus on selected industries or clients, which can benefit from public support such as in incentive schemes and which can be more committed to the transition towards sustainable heat production. In this respect, district heating emerged as an interesting application area for installations to be made in Southern Europe, with early contacts made with solar district heating development projects in Italy and Spain. Parallel to the above, an equally important part of the industrial exploitation will focus on decreasing the different parts of total system cost, so that the breakthroughs achieved within FRESH NRG can be matched by parallel achievements along the other cost components in order to make the final system more competitive in the marketplace.

The findings reported above for solar process heat are valid also for solar cooling and CSP. More specifically, lower energy cost poses a challenge also to these two applications of the FRESH NRG collector. It is therefore important to decrease further the cost of collectors, also by realizing systems of adequate size. This is particularly important in the field of solar cooling, where the industrial exploitation will focus on the pursuit of large scale solar cooling systems, such as the one recently announced by solar thermal EPC SOLID, who will realize a solar field of more than 4,000 m² to serve the solar cooling of a military hospital in Nicaragua[1]. CSP application are already of adequate size for the FRESH NRG collector. A small-scale CSP application of 1 MW_{el} requires already more than 10,000 m², which become more than 15,000 m² if the CSP system requires thermal storage. This makes it possible to offer the FRESH NRG collector at competitive price. However, specific to CSP applications is the competition coming from more and more competitive PV technology, which suggests to focus on exploiting the FRESH NRG collector within policies which value the dispatchability of CSP vs. the intermittent nature of PV systems. In this respect, the linear Fresnel collector developed within FRESH NRG has been adopted to be the one of the pillars of a Horizon 2020 CSP demonstration project called ORC PLUS, in which approx. 4,900 m² of linear Fresnel collectors will be developed and installed in Morocco in 2017, i.e. during the first year after the completion of FRESH NRG. We consider

[1] See also http://www.solid.at/en/news-archive/2016/276-solid-climatizes-hospital-in-nicaragua-with-a-large-solar-thermal-plant-it-is-the-first-solar-thermal-project-financed-by-a-soft-loan/

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792

this a first successful exploitation of the FRESH NRG results. Also, the contact with the Government of the Island of La Reunion (mentioned during the project review) is continuing and during the next months they should finalize the regional planning of a 10,000 to 20,000 m^2 system for the implementation of a "tropicalized" version of the FRESH NRG collectors during the first 3 years after the end of the project.

In terms of scientific exploitation, the experience of FRESH NRG has been very useful in improving and optimizing the link between rigorous scientific research and rapid industrial implementation. For example the seamless process established between ISE and Soltigua during the creation of the FRESH NRG collector prototypes is continuing in other joint developments, such as the development of optimized and robot based cleaning system for linear Fresnel collectors.

Different **dissemination activities** were prepared and developed during the FRESH NRG project duration to introduce the project itself to the public as well as to share and discuss the technical project results with the scientific community.

As first activity the FRESH NRG project website was the set to provide a platform for the exchange of information on the integrated collector development with the scientific community as well as the results of the testing and application analysis with the public. The website for the FRESH NRG project was designed to present the public the idea and value chain of the FRESH NRG project at a glance. Following the integrated approach of the project the design of the components, the collector, the implementation and test disruptive innovations are shown. Furthermore, an access to the internal team site is available to upload and internally share project files as well as to organize and publish news and event announcements.

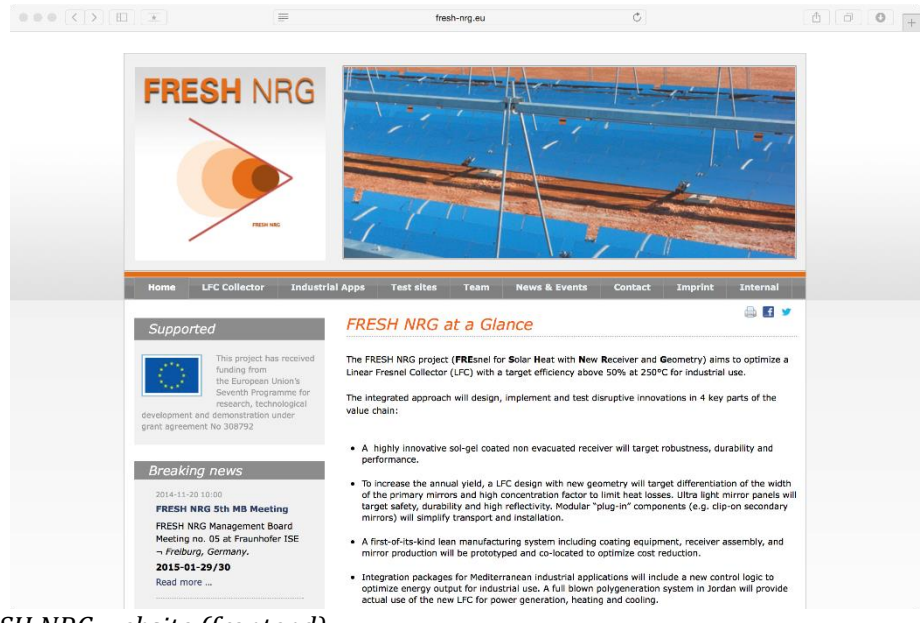

Figure 1. FRESH NRG website (frontend)

Within the dissemination activities of the FRESH NRG project, annual expert workshops were hold to inform the scientific community and the industry about the FRESH NRG developments. It was planned to organize the workshops at the institutes of the scientific partners (ISE, HSR-SPF and MUTAH). Whereas the 1st workshop took place on March 20th, 2014 at HSR-SPF (organized by HSR-SPF and JER), the consortium decided to use the opportunity to link the 2nd

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792

workshop (organized by ISE and JER) to the 6th experts meeting of the IEA-SHC Task 49 in Milano, Italy (September 24th, 2014). As the pilot installation at Mutah University was not finalized in May 2016, the consortium decided to rearrange the venue of the 3rd workshop (organized by JER) to Brussels in cooperation with the ESTIF. The third workshop took place on May 24th, 2016.

Fig. .2 Impression from the workshop "Components Characterization for Medium Temperature Collectors: Performance, Quality and Durability" (Source: JER)

These periodically organized international expert workshops with strong support from ESTIF included selected external experts from other ongoing research or commercial projects in the field of industrial solar process heat. The workshops provided a broad and complete view on the topics and the outcomes and didn't only support the progress of FRESH NRG but also delivered results useful for the standardization and development progress of the technology itself.

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792

Figure 3 Impression from the workshop "Certification of Medium Temperature Collectors based on In-Situ Measurement" (Source: JER)

Figure 4 :Impression from the workshop "Solar heat for Industrial Processes: FRESH NRG Project" (Source: ESTIF)

Three workshops were successfully performed within the frame of the FRESH NRG project. In the frame of this workshops all relevant topics of the project ranging from components development and characterization over collector testing and certification to the application of medium temperature collectors for solar heat in industrial processes have been presented in numerous presentations. The workshops were visited by more than 80 experts from industry and research institutions.

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792

Additionally, a further workshop was conducted as part of the official presentation of the FRESH NRG collector field at Mutah University, Jordan on August 29th, 2016 with about 65 participants from research institutes, industry stakeholders and policy makers. During the workshop remarks on the final findings from the very short installation time and commissioning of the FRESH NRG collector field were presented. Additionally, a visit of the FRESH NRG collector field was also part of the workshop agenda to show the new technology in operation. Moreover, a national television coverage and newspaper journalists have reported on the workshop.

Figure 5 Impression from the FRESH NRG workshop at Mutah University (Source: MUTAH)

The FRESH NRG project, the demonstration site and performance figures of the new LFC collector were also presented during the international trade fair InterSolar Europe 2014 in Munich, Germany from June 4th to 6th on the booth of Soltigua. Furthermore, Soltigua has given a presentation about the FRESH NRG project end of October 2014 to new potential industrial and scientific partners at the French overseas territory La Reunion. The speech was part of the Horizon 2020 program presentation. Moreover, Soltigua has successfully presented the project at the Beirut Energy Forum 2015 on September 11th, 2015.

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792

Figure .6 Soltigua booth at InterSolar Europe 2014 (Source: Soltigua)

As a final important dissemination activity a "Handbook for solar industrial applications" was prepared, which is the only public available Deliverable of the project. The handbook is presenting a general overview of suitable technologies for solar industrial process integration. Starting with different collector types and technologies as well as common working fluids and moreover several system applications as storage types. Furthermore, general system design settings assisted with a few rule of thumbs for the design process are given including some calculation examples. Besides a scope of application and further potentials of process integration also three detailed case studies are presented. The three case studies address industrial and commercial applications including solar cooling as well as hot water and steam generation for various countries (Italy, Chile and Jordan) to show the application potential of the new FRESH NRG collector.

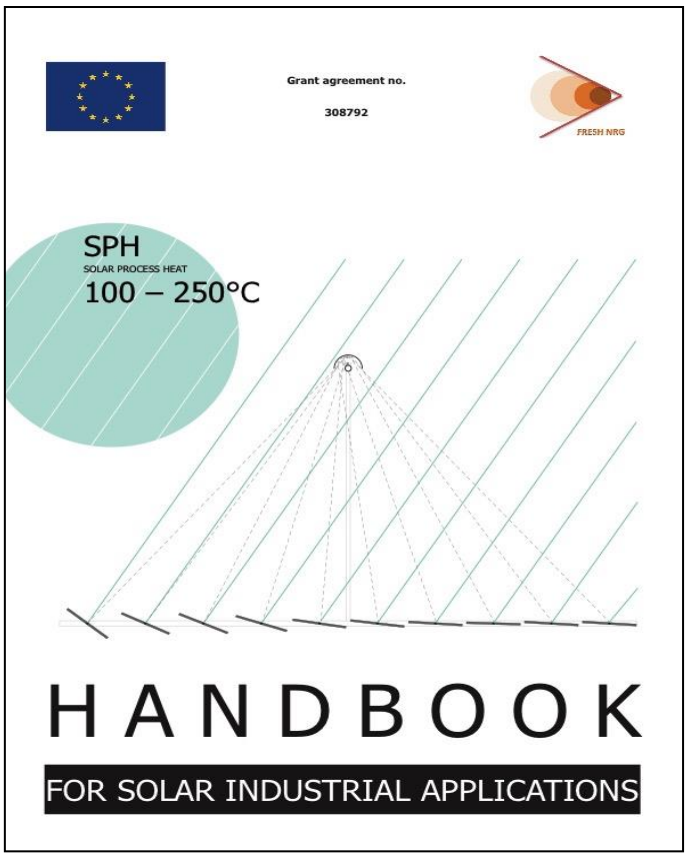

Figure 7 Front cover of Handbook for solar industrial applications

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308792