PhD SCHOLARSHIP APPLICATION FORM 2016

ORGANISATION Business Division Business Area	**TECNALIA RESEARCH & INNOVATION** ENERGY AND ENVIRONMENT Solar Power
Scholarship location Province/Building	GIPUZKOA/Parque Científico y Tecnológico de Gipuzkoa - Mikeletegi Pasalekua, 2-Donostia-San Sebastian
Tutor	Mr Iñigo Iparraguirre

SCHOLARSHIP DESCRIPTION

Title: Development of optimised solar thermal collector for medium-temperature (100-250 ºC) energy generation.

Brief Description of Scholarship:

The aim of this PhD scholarship is to develop a solar thermal collector optimised for 100-250 ºC temperature range to generate the energy required by production processes.

Solar thermal technology has evolved greatly for both low (<100 ºC) and high (>250-300 ºC) temperatures. However, over recent years the sector with the highest growth potential seems to be the use of solar collectors of up to 250 ºC to generate thermal energy in production processes.

Most collectors available to date are mainly small-scale copies of high-temperature solar thermal collectors. As a result, designs are not optimized to serve a specific use in terms of design concept, industrial areas integrability, materials, components and energy generation. In addition, this lack of optimization makes the current costs per collector m^2 and therefore energy generation cost (€/kWh) to be high although there already exist technologies with a relatively low investment return in places with high solar energy resources and scarce access to inexpensive energy sources such as natural gas or biomass.

Tecnalia is especially active in this medium temperature solar sector. We are developing materials such as specific components for these solar thermal applications while also working with existing global collector databases for this temperature range. Moreover, we are positioned on the main European platforms and associations such as Solarconcentra (medium temperature group), EERA-CSP, Task 49-IEA. Thanks to this we have a detailed vision of existing collectors on the market, related problems and potentiality.

As we are aware of this large potential market and the detailed knowledge of existing technology, we are proposing this doctoral dissertation to develop a collector to satisfy the operation and costs requirements of energy generation.

Scholarship description:

Medium-temperature (100-250 ºC) solar thermal energy technology is not new but has yet to experience technological and market evolution compared to low-temperature (<100 ºC) collectors for domestic hot water and pool heating or high-temperature (>250-300 ºC) collectors in solar thermal electricity generation.

However, in recent years these technologies have started to strongly develop to generate thermal energy in production processes in particular. This sector is expected to experience strong growth in forthcoming years with major technological development and innovations which will reduce energy generation costs; installation robustness will reduce operation and maintenance efforts; and higher solar thermal generation fractions may be achieved in energy demand total. This solar thermal concentration technology application is increasingly gaining momentum in different solar thermal forums and is an upward trend for the sector companies.

The use of solar thermal collectors in production processes must be considered one of the key technologies to enabling tackling increasingly important challenges related to production process efficiency, fossil fuel use reduction, cutting down on greenhouse emissions from industries, lessen uncertainties related to fossil fuel price fluctuations and improved competition derived from reduced energy costs.

In this regard, it is worth taking into account that industry, along with residential areas, are the highest energy consumer sector and a very high percentage of that consumed energy is solar thermal energy (please see Figure 1). A very significant percentage of the heat consumed can be generated by solar thermal sources.

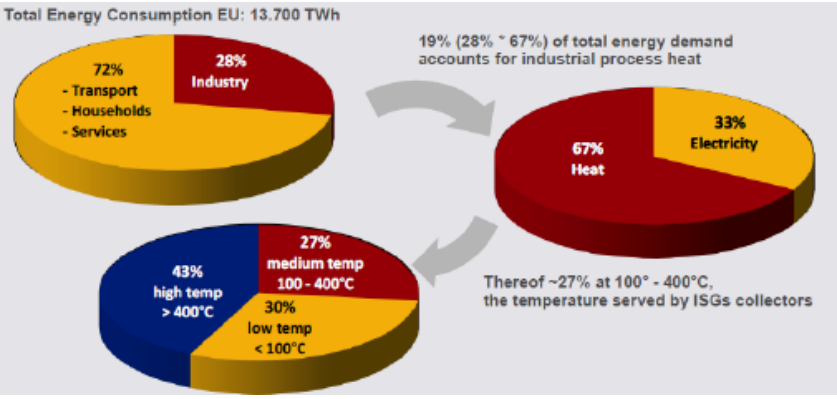

Figure 1. IEA, 2013 “Strategic Research and Innovation Agenda for Renewable Heating & Cooling”.

Other applications such as solar cooling, solar thermal Organic Rankine Cycles (ORC) for distributed power generation and even solar desalination also have niche markets and therefore solar technological developments will be used in these fields. Nevertheless, as Figure 2 illustrates, the technology with the highest potential in forthcoming years and decades is expected to be medium-temperature thermal energy generation for production processes.

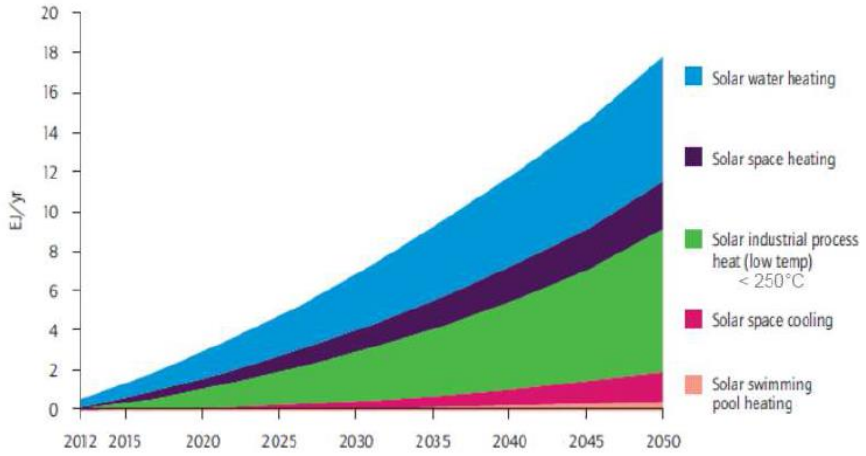

Figure 2. IEA Technology Roadmap SHC, Industrial Solar, International Solar Energy Society Webinar (01/2014).

To date most medium-temperature thermal collectors available on the market are based on design concepts transferred from high-temperature solar thermal technology. Therefore, most collectors share significant similarities with cylindrical-parabolic collectors and large Fresnel collectors used for electricity generation. This requires new design concepts for specific collectors suitable for this temperature range and applications. The new collectors must enable energy generation which is better adjusted to existing energy demand at each place and time, suitable materials in terms of functionality and costs and also hybrid strategies with standard thermal generation sources (industrial heaters and boilers).

One of the key targets is to develop technology capable of achieving competitive energy generation costs with other sources such as fossil fuels. In this regard, the main sector experts (Solar Heating & Cooling Technology Roadmap Validation Workshop, European Solar Thermal Technology Panel, ESTTP) have set up a series of targets and expected evolution in forthcoming years. In this way, medium temperature (<250 ºC) solar fields should not exceed €400/m^2 costs (excluding thermal energy storage) by the end of 2017. This would represent c€6 and c€9 /kWh thermal energy generation costs. However, these costs should evolve to €300/m^2 solar fields (c€4 to 7 /kWh) by 2020.

Tecnalia carries out activity in this field of medium temperature solar technologies for production processes, as part of the major international and national groups (Task 49 “SHC, IEA”, Solarconcentra, European Energy Research Alliance “EERA-CSP”, etc.) and is working on different projects in the sector. Along with its own projects and others carried out with companies, Tecnalia leads medium temperature solar thermal activity in the European project STAGE-STE (FP7). This project was created by EERA-CSP, the European solar thermal sector leading group of centres and universities. Tecnalia co-ordinates all medium temperature solar thermal activity, leading the creation of an international medium-temperature collectors database besides working towards the development of a specific collector for these applications. The PhD student participation in these projects will contribute to his/her research line integration and acquiring a detailed vision of the technological challenges ahead to be able to develop a collector meeting the targets described above.

Requirements:

The PhD candidate shall meet the following requirements:

- Qualifications and Speciality: Mechanical Engineering
- Languages: Fluent in English
- IT skills: 3D design tools and fluid mechanic simulations
- The following will be a plus: Having worked or finished an end-of-degree project on concentrated solar thermal technologies.