



# JOB DESCRIPTION

(START DATE : 01/09/22)

(END DATE : 01/09/25)

**TOPIC : 10-40kV SYNTHESIZED SWITCHES BASED ON 1.2 TO 3.3 kV SWITCHES  
FOR MEDIUM VOLTAGE / HIGH POWER APPLICATION**

Le bourget du lac (73370), 29/04/2022. France

## Job title

PhD offer in medium voltage power electronics for photovoltaics.

## Location

French Alternative Energies and Atomic Energy Commission, Le bourget du lac (73370), Savoie , France.

## Description of the institute

CEA is the French Alternative Energies and Atomic Energy Commission, a public body established in October 1945. CEA is the largest technology research and development provider in France, whose role is to transfer this know-how to the industry. CEA has staff of about 16000 people, a budget of 4.3 billion Euros per year, and has filed more than 650 priority patents. The CEA operates ten research centres in France, each specializing in specific fields.

CEA is operating today more than 350 people at INES, the French institute of solar energy, which has started operations in 2005. After a strong phase of growth, today ten CEA-labs at INES cover the complete value chain of photovoltaics: material, cells, modules, solar systems, and storage systems. Furthermore, three labs deal with energy in buildings. As a technological research centre, CEA focuses on R&D activities from TRL 4 to TRL 7, with the objective of transferring innovations to French and European industrial partners. Over 200 industrial partners, SME's, medium, French and International groups are permanently in contract with CEA to develop innovations.

With the aim to maximize the penetration of solar system in the electricity network, research efforts are made on smartgrids, energy management, demand response and grid coupled storage systems. These efforts are demonstrated on the INES campus, which has benefited from large investments, for example a multi microgrid platform with a PV system of 160 kW. Another demonstration example is the solar mobility station, where our energy management system assures the solar charging of electric vehicles and the minimization of the resulting grid impact. The power electronics group of the lab for photovoltaic systems participates in this project. It deals with the development of advanced power electronics for PV systems and battery systems based on latest semiconductors available (SiC, GaN) in a MV/MW range. The lab has been at the origin of technology transfer to industrial partners as well as the creation of start-ups.

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Page 1/2



## **Context**

AC network under 320 to 800 V from the usual level of 1500 VDC on PV strings, before using 50Hz transformers to inject to the 50Hz-20kV AC grid. This approach imposes a very large current on both conductors and semiconductors, which can only worsen with the current trend toward higher-power PV plants.

Another approach, promoted by CEA, consists in increasing the voltage of both the PV strings of the power plant and of the AC injection point.

This approach can be based on commercially available semiconductors (1.2kV, 1.7kV, or 3.3kV ratings) used in multilevel converters, whose topologies become quite complex at the highest voltages.

It can advantageously also be based on high voltage semiconductors, used in converters with simpler topologies. However, these components currently do not exist except at the demonstration level in 6.5 kV, 10kV and 15 kV ratings.

## **Work description**

During this thesis, it is proposed to synthesize high voltage switches (10 to 40 kV), from 1.2kV to 3.3 kV SiC switches that are commercially available and already proven.

The final objective will be the demonstration of these synthesized switches in real operation. One of the major scientific and technical obstacle will be the dynamic balancing of switches placed in series, necessary to ensure the correct switching operation of the synthetic switch.

## **Education / Skills / Experience**

Completed university degree (Master/Diploma/PhD) in electrical engineering, power electronics, physics or a comparable subject. Experience analog electronics; knowledge of the physics of semiconductor components and their characterization is suitable.

## **Contacts (please send a detailed curriculum vitae and a cover letter to apply)**

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