

International Conference on Fast Reactors and Related Fuel Cycles: Next Generation Nuclear Systems for Sustainable Development (FR17)



Contribution ID: 285

Type: ORAL

Progress in the ASTRID Gas Power Conversion System development

Tuesday, June 27, 2017 10:40 AM (20 minutes)

Within the framework of the French 600 MWe Advanced Sodium Technological Reactor for Industrial Demonstration project (ASTRID), two options of Power Conversion System (PCS) were studied during the conceptual design phase (2010-2015):

- the use of a classical Rankine water-steam cycle, similar to the solution implemented in France in Phenix and Superphenix, but with the goal of greatly reducing the probability of occurrence and limiting the potential consequences of a sodium-water reaction; chosen as the reference for the ASTRID Plant Model during the conceptual design phase due to its high level of maturity,
- an approach which has never been implemented in any Sodium Fast Reactor using a Brayton gas cycle. Its application is mainly justified by safety and acceptance considerations in inherently eliminating the sodium-water and sodium-water-air reaction risk existing with a Rankine cycle.

The ASTRID conceptual design phase period allowed to greatly increase the maturity level of a standalone Gas Power Conversion System option. It has been thus decided to lay during the 2016-2017 phase the ASTRID Gas PCS integration studies at the same level as that achieved by ASTRID Water based PCS at the end of 2015. The 2016-2017 period, in which the Gas PCS is integrated in the overall layout of the reactor, will allow to better specify the technical and economic implications of the selection of gas PCS taking into account all the aspects of the integration of such an option. A well-documented comparison between the two systems will be therefore facilitated.

This paper resumes progress in the integration of the Gas Power Conversion System in the Astrid Reactor Plant Model. It describes the main characteristics defined particularly on the Balance of Plant (BOP), the turbomachinery, the Sodium Gas Heat Exchangers (SGHE) as well as expected performances, operability and safety analysis.

Country/Int. Organization

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Session Classification: 1.3 SYSTEM DESIGN AND VALIDATION

Track Classification: Track 1. Innovative Fast Reactor Designs