الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي والبحث العلمي
جامعة قسنطينة 1 – الإخوة منتوري
كليـــــــــة العلوم الد قيــقة

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
Constantine 1 University – Frères Mentouri
Faculty of Exact Sciences

ANNONCE DE SOUTENANCE DE THESE

Monsieur **NEDJAR Achraf**
Soutiendra sa thèse de Doctorat de Troisième Cycle en Physique
En Cotutelle Internationale

Avec CERGY PARIS UNIVERSITE
Spécialité : « Energies Renouvelables ».

Intitulée : «**Dimensionnement et optimisation d'un système PVT pour la production de froid**»

Date : le 04 juillet 2014 à 17 H00.

Lieu : A la salle de conférences sise au Campus Chaab Erssas - Université Constantine 1 Frères Mentouri.

Devant le jury :

	Nom et prénoms	Grade	Etablissement d'appartenance
Président	DJEZZAR Mahfoud	Professeur	Université Constantine 1 Frères Mentouri
Directrice de thèse (Algérie)	CHAKER Abla	Professeure	Université Constantine 1 Frères Mentouri
Directeur de thèse (France)	ABSI Rafik	Professeur HDR	Ecole D'ingénieurs ECAM – EPMI Cergy Pontoise -
Examinateurs	BOUHDJAR Amor	Professeur	Centre de développement des Energies renouvelables Alger -
	BELAYACHI Naima	Professeure	Université d'Orléans
	BENNACER Rachid	Professeur	Ecole Normale Supérieure Paris – Saclay -

A b s t r a c t :

Abstract: This thesis presents a comprehensive study of a hybrid photovoltaic/thermal (PVT) system performance dimensioned for cold production by adsorption. TRNSYS dynamic simulation software was used to simulate the system, considering meteorological conditions in Algiers, northern Algeria. The study takes into account the actual generation of thermal energy by the collectors, as well as the actual variation in performance of the adsorption chiller. The main objective is to dimension and optimize the solar system with thermal energy storage to guarantee stabilized cooling production throughout the year.
Prior to this, an extensive literature review was carried out, examining PVT hybrid systems, solar sorption cooling systems, as well as existing research exploring the combination of these two technologies.

Secondly, a numerical study of the PVT collector's exchanger geometry determined that the water table geometry offers the best thermal and overall efficiency. In addition, the temperature range of the hot water delivered by collectors with this geometry, notably DualSun manifolds, corresponds to the operating temperatures of adsorption solar chillers. Next, the PVT – Adsorption system components were dimensioned and a mathematical model was developed and validated by published experimental work. A study of the system's performance for cooling needs between 4°C and 8°C revealed that DualSun hybrid collectors offer optimum annual production. Furthermore, the adsorption cooling system is able to meet 36% of year-round demand.

The temperature difference between the inside and outside of the cooling enclosure balances cooling supply and demand. It was also noted that thermal efficiency is strongly affected by ambient temperature, whereas electrical efficiency is more sensitive to solar radiation.

Analysis of storage system losses showed that these depend, on the one hand, on the temperature difference between the inside and outside of the storage tank, with more significant values during the summer season. On the other hand, losses also depend on the volume of the storage tank, which has been optimized to limit heat exchange with the outside.
Economic analysis of the proposed PVT – Adsorption system has revealed its viability under certain key conditions, mainly related to the cost of electricity. Profitability is achieved provided that the cost of electricity exceeds the threshold of 0.08 USD/kWh.

The environmental analysis determined the rate of mitigation of greenhouse gas emissions as a function of the conversion factors associated with electricity generation. The system contributes to the mitigation of around 30 tons of carbon dioxide per year.
The performance of the PVT – Adsorption system was studied under different climates: Mediterranean, humid subtropical and arid desert. The results showed that the system is more productive in an arid desert climate and more efficient in a Mediterranean climate, which offers better regularity between cooling supply and demand.

In sum, the combination of PVT and solar adsorption technologies is therefore proving to be an efficient way of producing cold, and can make a significant contribution to achieving sustainable development goals.