Brunel University London

Mechanical Engineering
College of Engineering, Design and Physical Sciences

Institute of Energy Futures
Energy Efficient and Sustainable Technologies Theme

The Heat Pipe Solar Roof

and

The EU PVADAPT Project

Prefabrication Recyclability and Modularity for cost reductions in Smart BIPV systems

By

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OVERVIEW

- Introduction
- Solar Energy Systems
- Heat pipes
- Experimental setup and results

RENEWABLE ENERGY RESOURCES

SOLAR ENERGY

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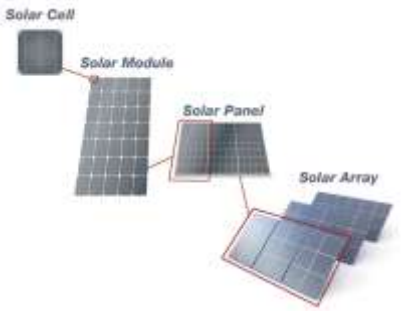
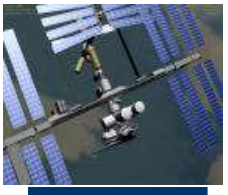
Solar Energy: Solar-Electrical





Space

Telecom

Solar Home Systems

Water Pumping

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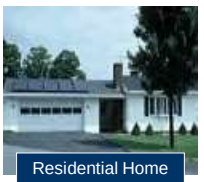
Solar Energy: Solar-Electrical

Commercial Building Systems (50 kW)



Residential Home Systems (2-8 kW)

PV Power Plants (> 100 kW)

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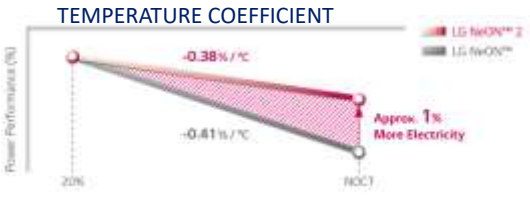

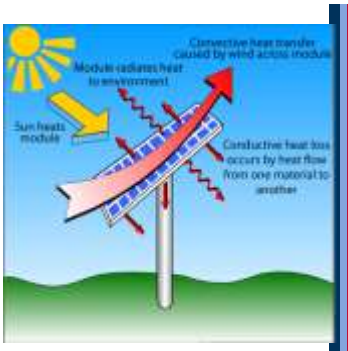

Curtesy of pveducation.org

cooling will be required to achieve the highest performance

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Solar Energy: Solar-Thermal

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Solar Energy: Solar-Thermal

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Electrical and Thermal Solar Energy Conversion Systems

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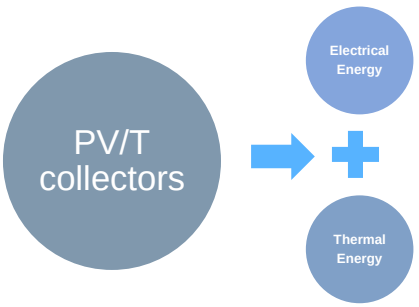

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Solar Energy: Solar-Thermal & Electrical PV/T

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Challenges with conventional PV/T systems

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Heat Pipes?

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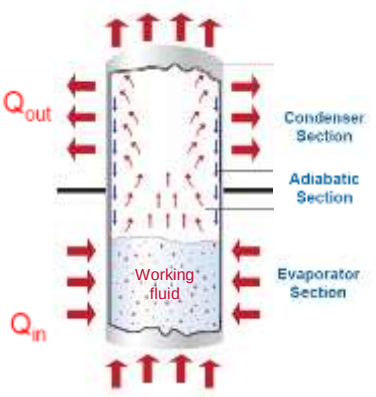

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Heat Pipes use in Industrial Applications

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Cross flow HP units

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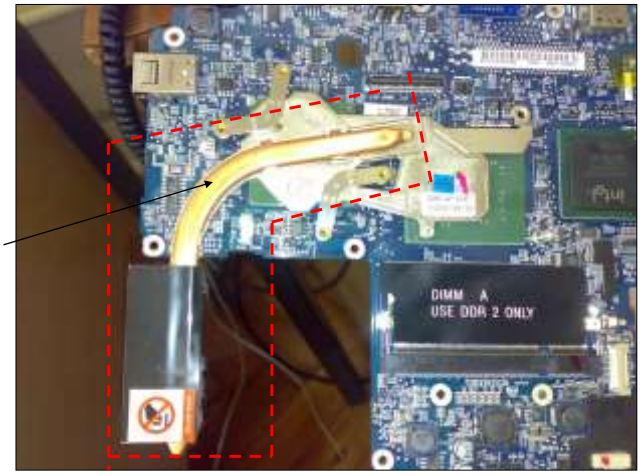
Heat Pipe



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Heat Pipes use in Solar Energy

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Shortcomings?

Addressing the shortcomings of current PV/T systems using the flat heat pipe technology

1. Isothermal surfaces
2. 100% utilisation of the surface area
3. Efficient heat transfer process
4. Ease of PV installation
5. Cost effective
6. Can form building skin to replace current roof materials

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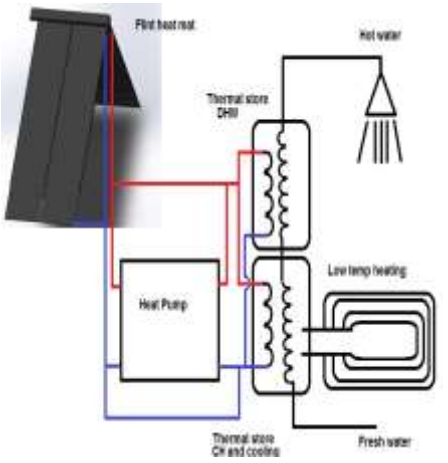

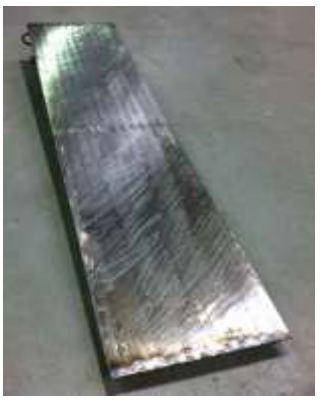

Royal Dutch Shell	Solar roof using the flat heat pipe technology

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[The heat pipe solar roof, contract number EEF371]

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The Flat Heat Pipe

Funded by DECC

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UK Demo Sites


Cardiff


Kent


Watford - BRE

Patents

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1. Jouhara, H., Lester, S., (**2014**), "Heat Transfer Apparatus", UK patent application No. **1410924.3.** Status: **Filed**. Filing date: 19/06/2014. Applicant: Flint Engineering & Econotherm (UK) ltd.

1. Jouhara, H., Lester, S., (**2014**), "Radiator", UK patent application No. **1410933.4.** Status: **Filed**. Filing date: 19/06/2014. Applicant: Flint Engineering.

Experimental Results

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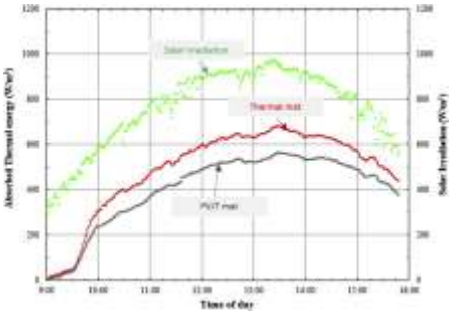

Results

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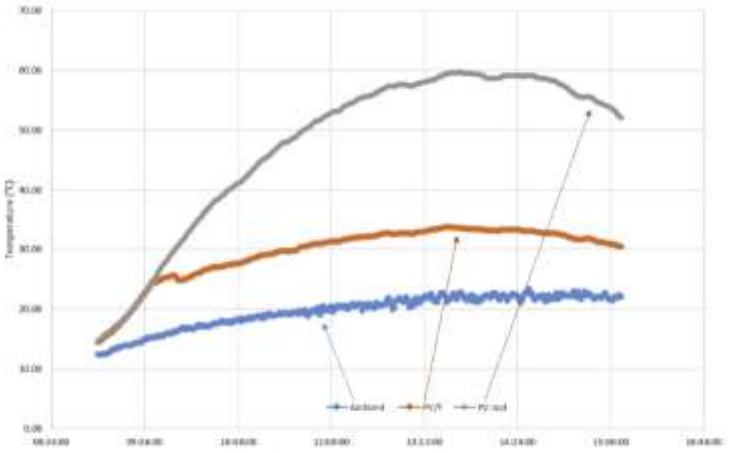

Fig. 7. The effect of cooling on the heat mat temperature for PV and PV/T cases.

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Results

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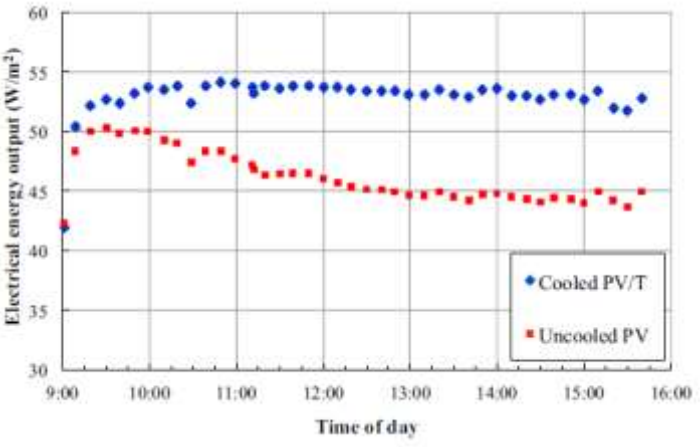

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PVadapt

http://www.pvadapt.com/

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FHP applications: The Photovoltaic Roof

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- Flat heat pipes can be **bonded with most types of PV devices** (Si monocrystalline and polycrystalline, DSSCs, polymer or other thin film cells)
- **Substantial heat recovery** through the PV/HP system
- Simultaneous cooling of the PV device leading to **higher efficiency and longer operating life**
- **Robust components** – no moving parts
- **Multifunctional**: defrosting, building cooling, can be fabricated as facade

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Project PVadapt

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Funded:
- €14M
- European Commission

The overall goal of the project is the delivery of a prefabricated, modular and multifunctional turn-key BIPV system.

Objectives:
- Production of a PV/T active energy component comprised of flat heat pipes (Heat Mat-HM) in a PV module.
- Development of a prefabricated structural panel with multiple passive functions (thermal, resilience, stability, waterproofing among others).
- Implementation of a Smart Envelope System to achieve critical functions such as load estimation and predictive maintenance.
- Delivery of an environmentally and financially viable product.

Horizon 2020 - LC-SC3-RES-6-2018

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Prefabrication, Recyclability and Modularity for cost reductions in Smart BIPV systems

•18 Project Partners
- UK- BUL, FLINT
- Ireland- TNI
- Greece- CONKAT, EYDAP, CORE INNOVATION, NTUA
- Spain- BILBAOVIVIENDAS, LKS,
- Portugal- COOL H
- Austria- UASB, GWR, ALCN
- Germany- EMTECH
- Italy- UNISMART
- France- APOLLON SOLAR
- Belgium- MERIT
- Norway- SINTEF

PVAdapt installation sites

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Coimbra, Portugal

PVAdapt installation sites

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Bilbao, Spain

PVAdapt installation sites

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Baumgartner, Austria

PVAdapt installation sites

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Laboratory test, Greece

PVAdapt installation sites

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Greece, Petrol stations

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PVadapt

Prefabrication, Recyclability and Modularity for cost reductions in Smart BIPV systems (**PVadapt**) – Start date: 01/10/2018

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