

Sisteme energetice eficiente pentru tranziția energetică și orașe durabile

Monica Siroux

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES STRASBOURG

INSA Strasbourg scoala de ingineri - INSA GROUP

Department Energetica

- 2 Specialitati Electrica si Termica
- 20 profesori, 300 studenti

ICUBE

- Echipa de cercetare Energetica
- 1 Profesor, 7 Assistant professor, 4 PHD

Colaborare Grupul INSA – ARUT

Grupul INSA



ARUT Universitatea Politehnica Bucureşti, Timisoara, Cluj-Napoca, Iași, UTCB

Doubla-diplome 2017 - reinoita UPB Bucuresti 2022





Scoala de Vara UPB INSA 2021- 2025

Colaborare cercetare

COLLOQUE FRANCOPHONE EN ÉNERGIE, ENVIRONNEMENT, ÉCONOMIE THERMODYNAMIQUE COFRET









Optimizare sisteme micro-cogenerare energie renouvelabila (solara, biomase)

TEME CERCETARE

Echipamente energetice: Micro cogenerare, sisteme hibride PVT, geothermie put canadien

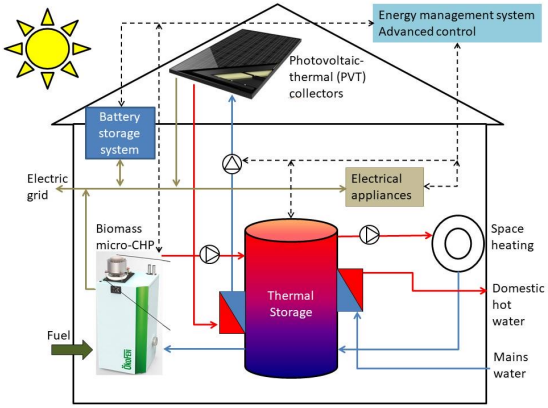
- **Modelizare**
- **Studii experimentale**
- **Optimizarea eficacitatii sistemelor**

Fatade inovante :

- **Developare și caracterizare fatade inovante (dinamice, ventilate)**
- **Metodologii de analiză a performanței energetice**

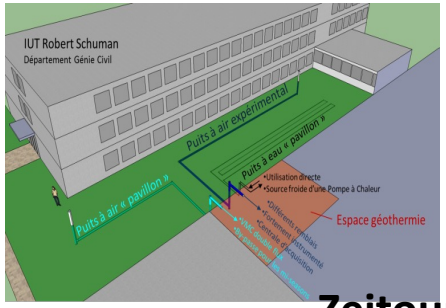
TEME CERCETARE

Systeme hibride, PVT, geothermie



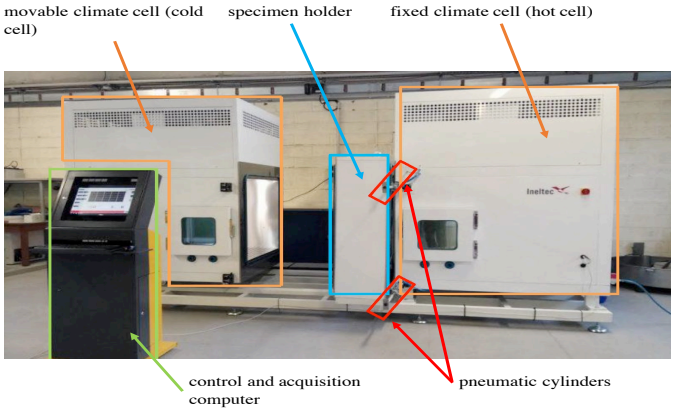


Kallio 2022
Barbu 2021
Voronca 2021



Zeitoun 2024
Cuny 2018

Developare și caracterizare fatade inovante (dinamice, ventilate)



Lahayrech
Tan
Ouoba Nebie
Sukamto 2021

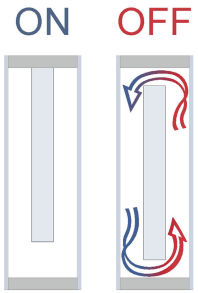
Fațade dinamice

Fațadele dinamice - sisteme care se adaptează la condițiile climatice pentru a optimiza eficiența energetică

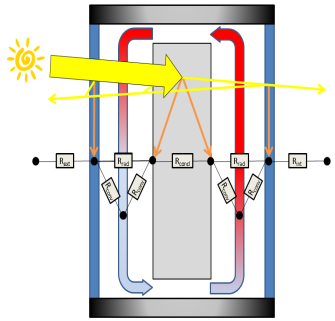
Proiect Chaire de recherche Parois innovantes

Teza Pflug : Development, Characterization, Evaluation of switchable façade

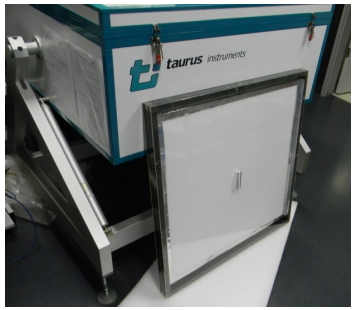
Double vitrage - élément translucide



isolant conducteur



Fraunhofer ISE



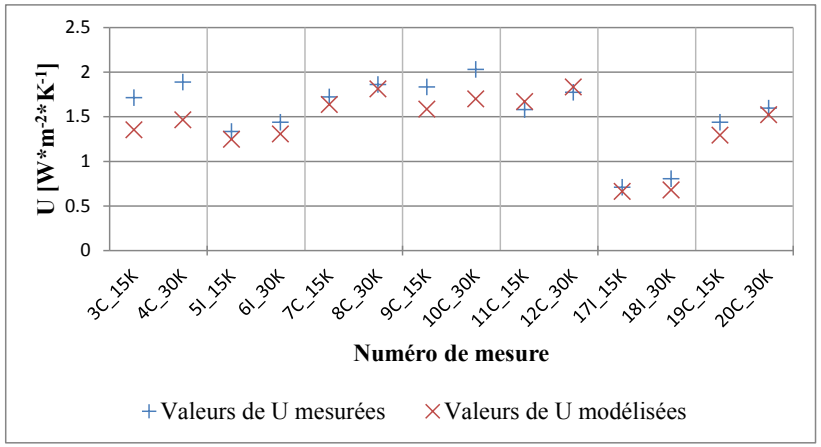
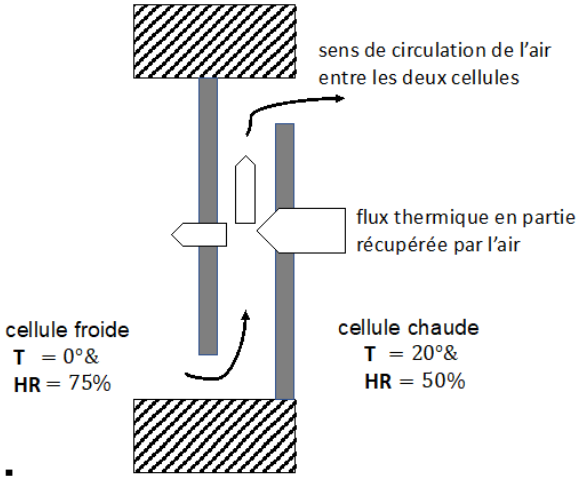
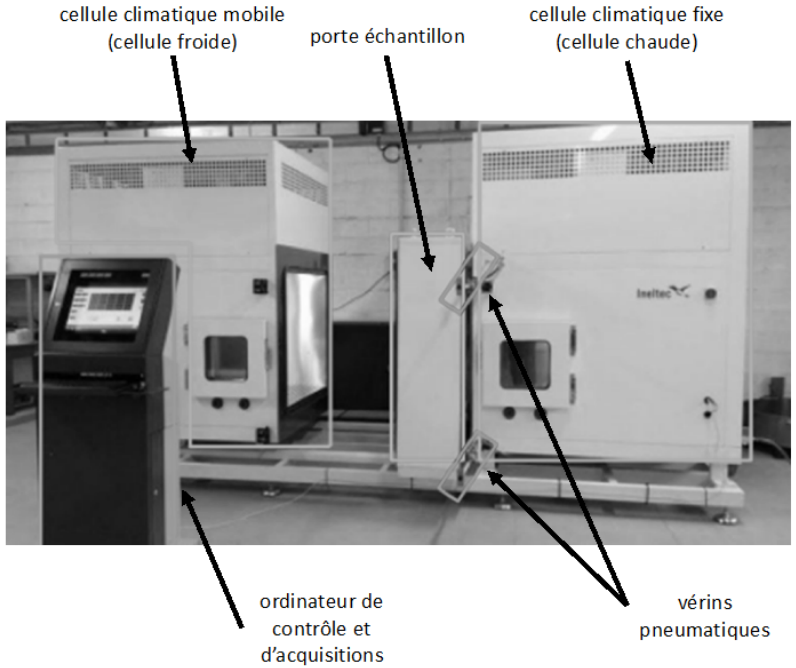


Figure 2 : *Comparaison entre les valeurs de U mesurées et modélisées*

Fațade ventilate





- **2 pereti**
- **1 cavitate aer**

1ère perete fix, 2ème perete mobile variem latimea

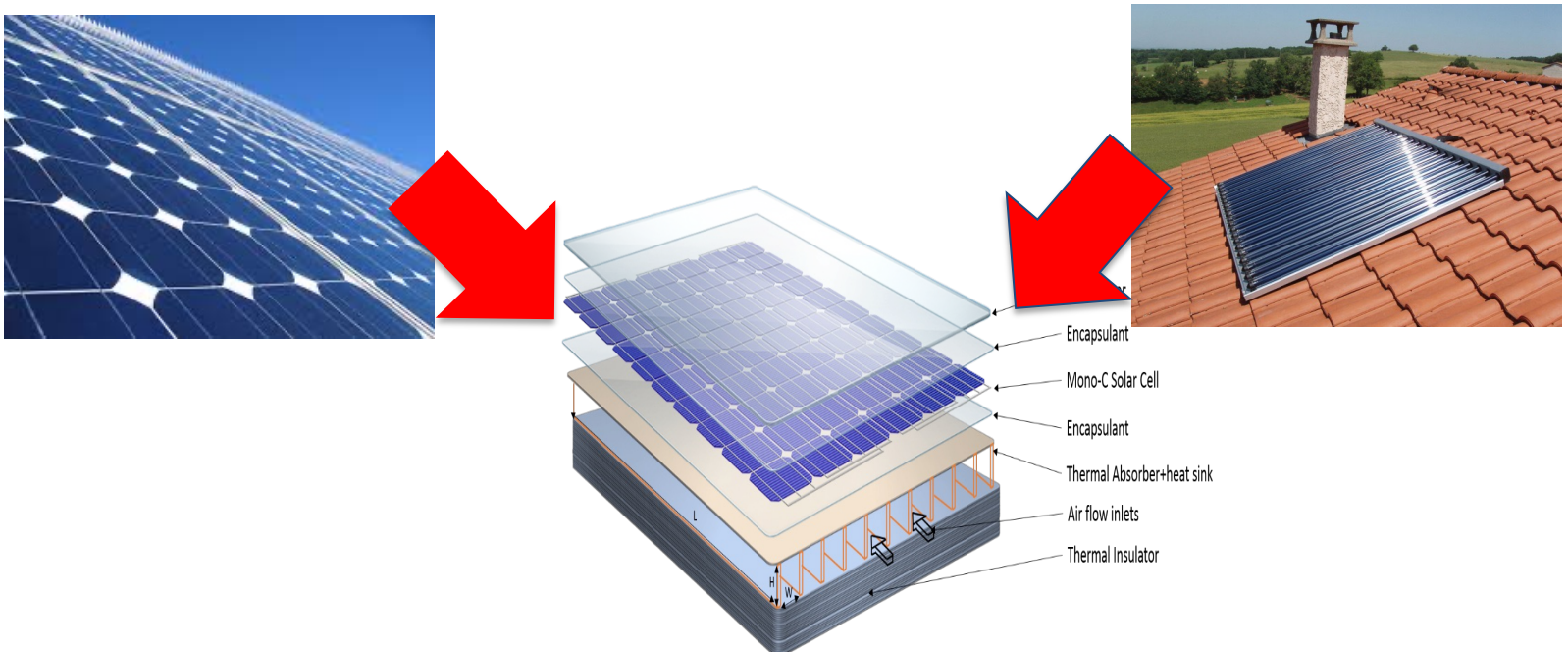
HOT BOX 2 camere climatice + port ech
1ère conditi int, 2ème conditi ext.
- temperature -30°C à +60°C
- humiditate 10% à 98%

Sistem hybrid PVT

PVT = combinație sistem fotovoltaic (PV) + sistem solar termic (T)

PVT produce energie electrică și căldură în același timp

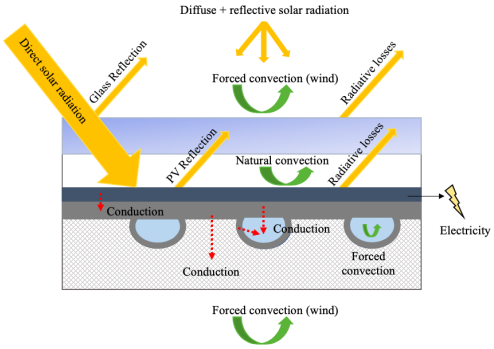
Un sistem solar efficient

- 

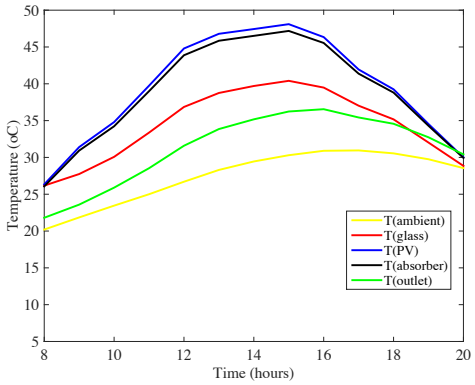
Sistem hibrid PVT

Teza Barbu : Etude optimisation systemes hybrides PVT

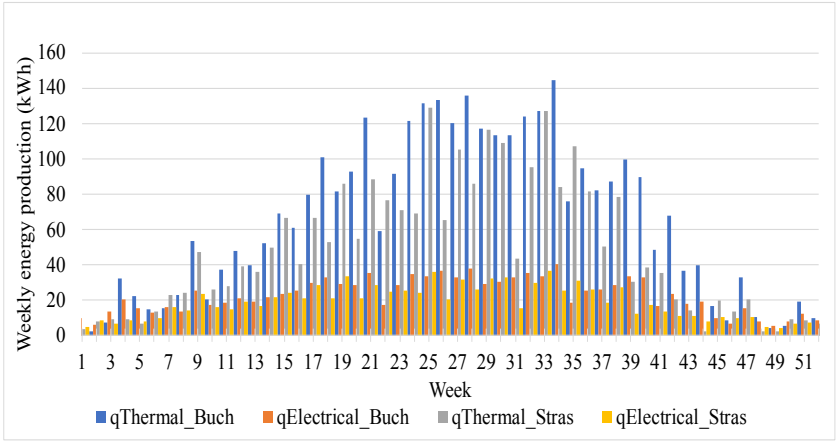
Modelizare PVT



Evolutia temperaturi



Rezultate : productie energie 1an

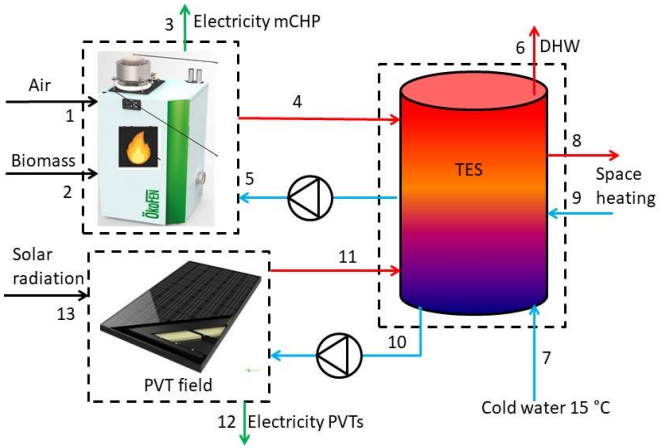


Climat : Bucarest, Strasbourg
Rezultatele au confirmat pertinenta PVT

Sistem hibrid PVT

PROIECT EUROPEAN INTERREG ACA MODES

Trinational (Franta, Germania, Elvetia) Teza Kallio
Sisteme energetice hibride adecvate pentru clădiri durabile

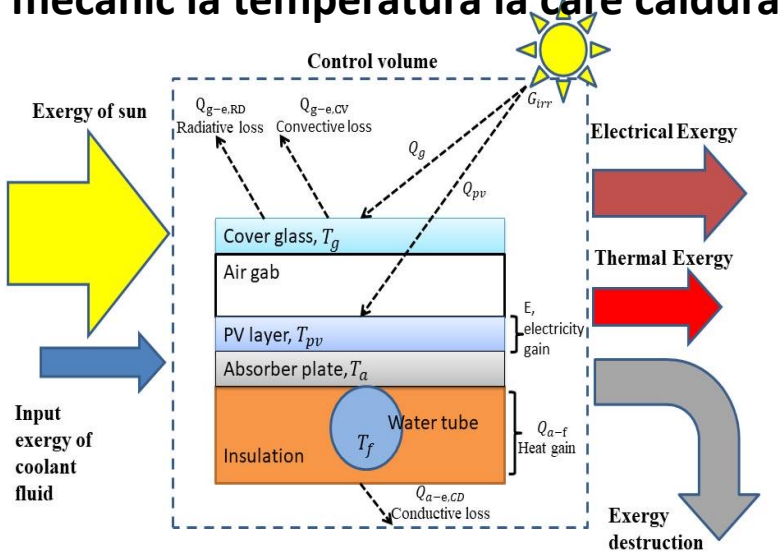


Analiza Exergetica

Teza Kallio

Metoda Exergetica : Analiza calității energiei produse

Analiza exergiei ajută la înțelegerea gradului de utilitate a căldurii produse în ceea ce privește lucrul mecanic la temperatura la care căldura este disponibilă.



Exergy balance

$$\sum \mathrm{Ex_{in}} - \sum (\mathrm{Ex_{th}} + \mathrm{Ex_{el}}) = \sum \mathrm{Ex_d},$$

Thermal exergy

$$\mathrm{Ex_{th}} = \dot{m} c_f \left[(\mathrm{T_{out}} - \mathrm{T_{in}}) - \mathrm{T_0} \ln \frac{\mathrm{T_{out}}}{\mathrm{T_{in}}} \right],$$

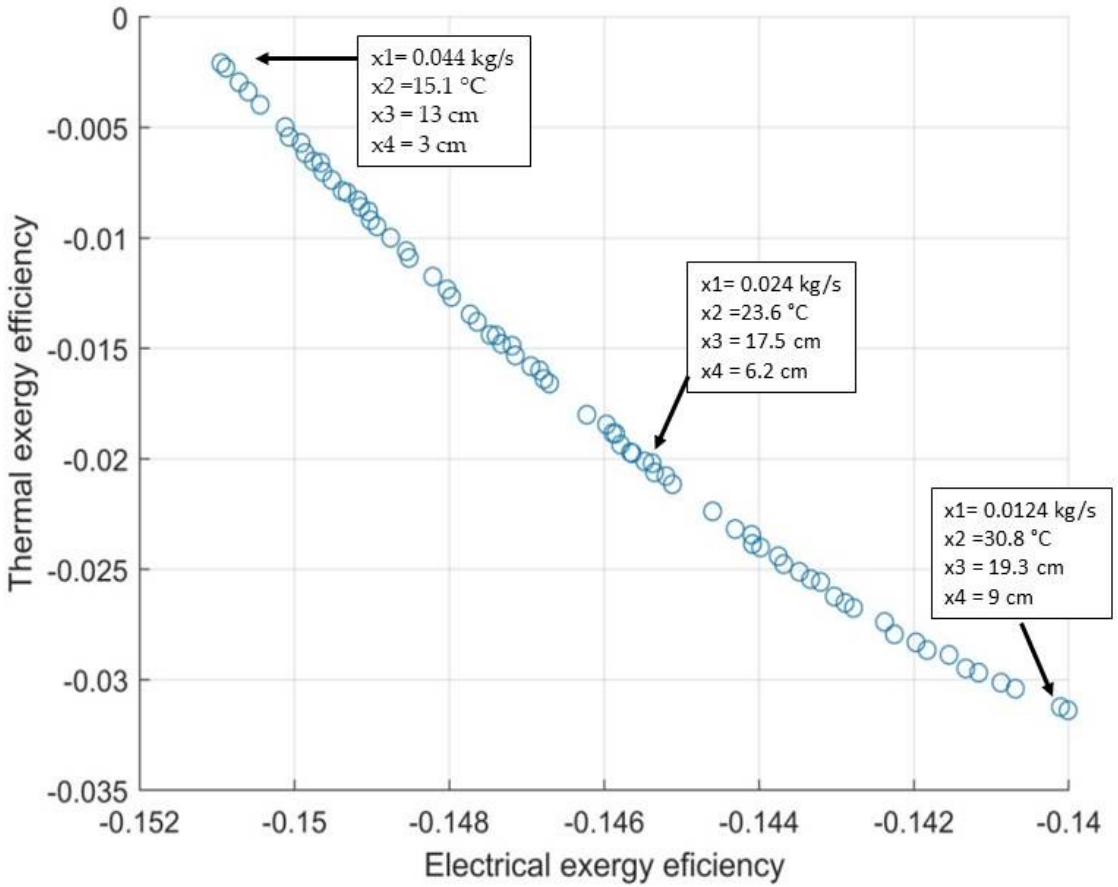
Electrical exergy

$$\mathrm{Ex_{el}} = \eta_{pv} \mathrm{G_{irr}} r A$$

Exergy efficiency

$$\xi_{th} = \frac{\mathrm{Ex_{th}}}{\mathrm{Ex_{in}}},$$

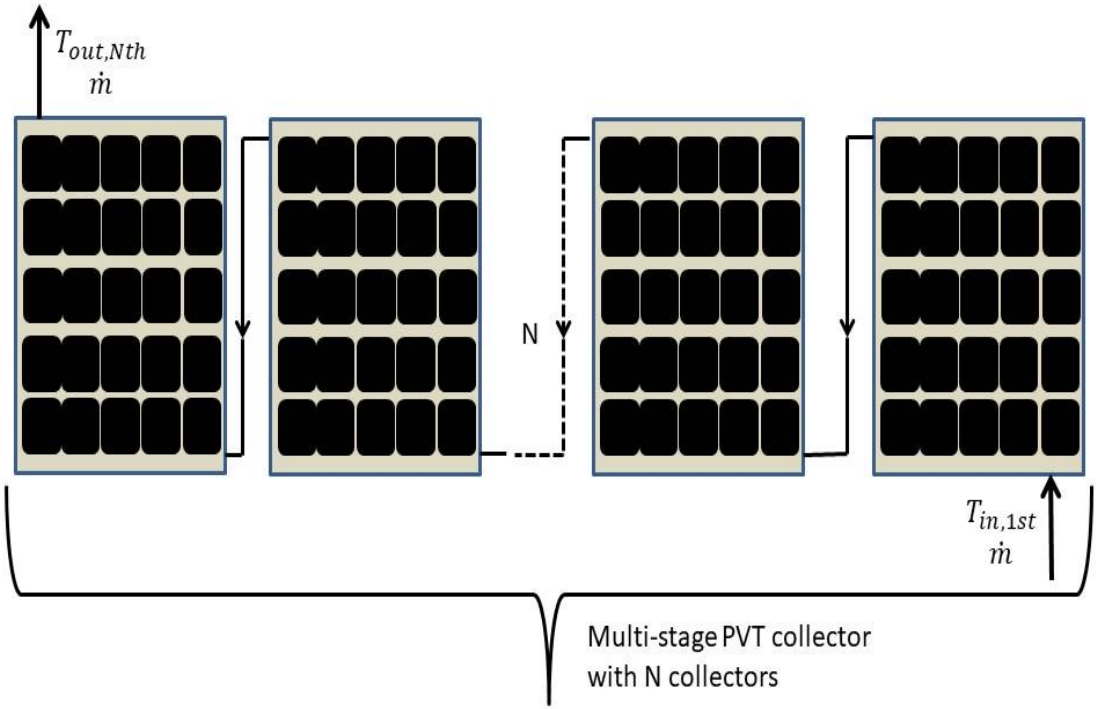
Optimizare Multi-Objective



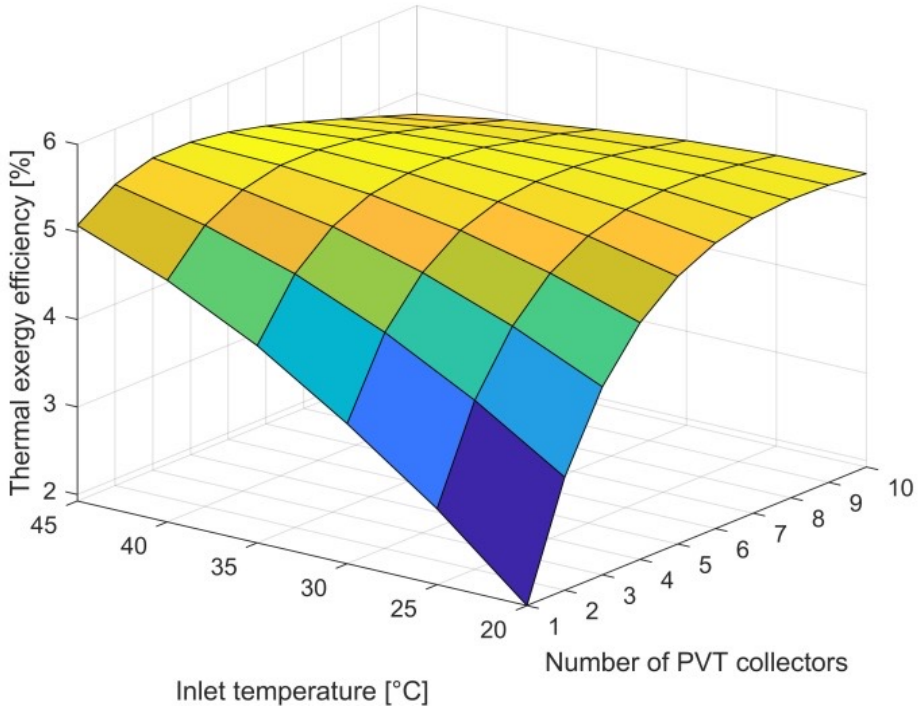
Frontul optim Pareto în spațiul obiectiv al randamentelor exergetice electrice și termice
Mai multe soluții sunt marcate cu valorile variabilelor de proiectare

Optimizare Exergetica multi-stage PVT

Teza Kallio



Optimizare Exergetica multi-stage PVT

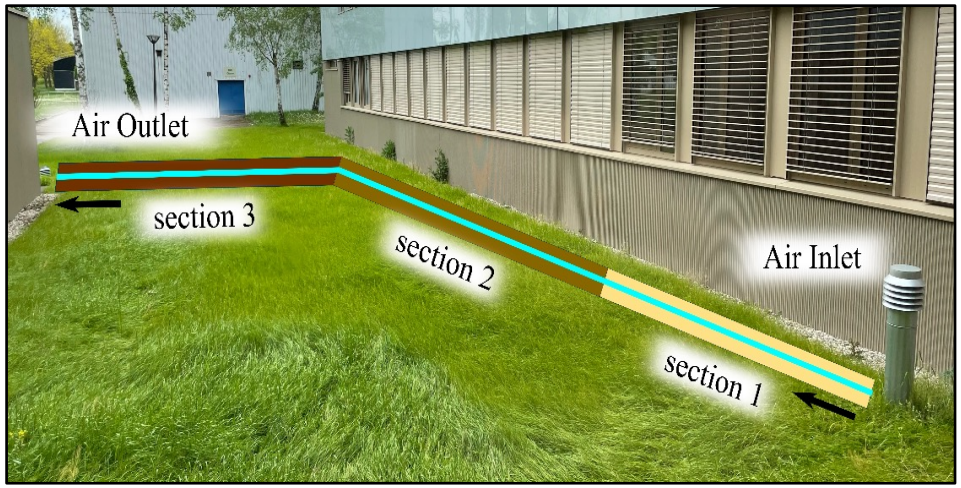


Variația eficienței exergiei termice în funcție de temperatura de intrare a agentului de răcire și de numărul de PVT

Sistem puț canadian

Sistem geotermal pasiv - schimb de căldură aer-sol, utilizat pentru a preîncălzi aerul iarna și a-l răci vara în clădiri

Soluție eficientă - standardele clădirilor nZEB



Zeitoun 2024
Cuny 2018