



CURRICULUM VITAE (CVA)

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IMPORTANT – The Curriculum Vitae cannot exceed 4 pages. Instructions to fill this document are available in the website.

CV date	19/12/2023
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Part A. Personal information

Name	Antonio		
Surname	Calvo Hernández		
Sex	Male	Birth (mm/dd/yyyy)	26/09/1956
DNI,	07813132D		
email address	anca@usal.es	URL Web	https://diarium.usal.es/terminodinamica/
Open Researcher and Contributor ID (ORCID) (*)	0000-0002-5058-0395		

A.1. Current position

Position	Full Professor (Catedrático de Universidad)		
From	2008		
Institution	University of Salamanca		
Department/ Faculty	Department of Applied Physics / Faculty of Sciences		
Country	Spain	Teléfono	+34 677565486
Keywords	Thermodynamics; Optimization; Renewable energies; Energetic efficiency; Concentrated Solar Power; Thermal Storage		

A.2. Previous positions

Period	Position/ Institution/ Country
1980-1987	Teaching Assistant, University of Salamanca, Spain
1987-2008	Associated Professor, University of Salamanca, Spain
2008-	Full Professor, University of Salamanca, Spain

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Graduate in Physics	University of Salamanca	1980
PhD	University of Salamanca	1986

Parte B. CV SUMMARY:

I got my PhD in Physics in 1986. My research interests have evolved from quantum statistical mechanics problems (molecular spectroscopy in dense phases) towards problems related to thermodynamic optimization of energy converters, ranging from theoretical analysis on energy converters as well as applied studies. Briefly, they include automotive engines (particularly spark ignition engines); thermodynamic cycles for electric energy generation plants (mainly concentrated solar arrangements (solar-tower) and/or hybridized with an auxiliary combustion chamber); thermo-economic and sensitivity analysis for both hybrid Brayton-like solar power plants and micro-turbines for distributed generation; sodium thermal electrochemical converters working in different stages and/or coupled to solar collectors; low-dissipation models for thermally driven refrigerators and heat pumps; and pumped heat storage in liquid media. Theoretical studies include finite-time and linear and non-linear thermodynamics frameworks on optimization of energy converter cycles in the weak dissipation regime. Recent theoretical papers also include studies on the link between thermodynamic optimization and stability as well as the analysis of controls of parameters and the connection with different



figures of merit and/or optimized performance regimes. Most recently I am involved in the energy storage subject.

Overall, this work resulted in more than 180 international publications in JCR journals, several book chapters, several invited conferences, and several research stays in international centers. General indicators of quality of my scientific production are the followings: 153 JCR articles (36 in last five years, 31 Q1); h-index: 29 (Web of Science); Times cited: 2800; Average citations per article: 18,3; Average citations per year: 73.7; Average citations last five years (2018-2022): 205; In SCOPUS database 176 publications with 3078 citations and h-index=30.

I belong as lead investigator to a recognized research group (Research Group on Energy Optimization, Thermodynamics, and Statistical Physics) from University of Salamanca that maintains stable research collaborations with several international groups. Also, I am the coordinator of the UIC-004 (Consolidated Research Unit) from Junta de Castilla y León (Spain) and member of the Excellence Unit *Fundamental Physics and Mathematics* of the Salamanca University. I have participated in more than 20 research projects (coordinated 13 of them) and participated in one R&D&i contract with companies of the electric sector.

I collaborate as usual reviewer for about 20 JCR international journal (APS, AIP, MDPI, IOP, Elsevier). External evaluator for the South Africa National Research Foundation (NRF); TUBITAK Young Scientist Awardees (Turkey); ANEP (Spain), DAAD (German Academic Exchange Service), and The Israel Science Foundation on The Breakthrough Research Grant (BRG). I am Member of the Editorial Board of the *Energies* journal (MDPI).

Some institutional responsibilities and merits are listed below:

- Member of the RSE (Real Sociedad Española de Física) and IUFFYM (Instituto Universitario de Física y Matemáticas; Universidad de Salamanca).
- Chair of the Applied Physics Department, University of Salamanca (2004-2012).
- Tutor of more than 15 post-doc visiting scholars coming from different countries as Japan, China, Uruguay, and México.
- I have been recognized with the maximum level in the Spanish system of research evaluation (6/6 research steps).

Finally, I am involved with activities related with teaching research and dissemination, publishing papers in pedagogical journals (<https://diarium.usal.es/termodinamica/>)

Part C. RELEVANT MERITS (last 10 years)

C.1. Publications

1. J. García-Ferrero, R. Merchán, M. J. Santos, A. Medina, A. C. Hernández, P. Canhoto and A. Giostri
Modeling a solar pressurized volumetric receiver integrated in a parabolic dish: Off-design heat transfers, temperatures, and efficiencies
Energy Conversion and Management, 293, 117436 (Oct 2023)
ISI Impact: 10.04 (Q1); DOI: 10.1016/j.enconman.2023.117436
2. B. Chen, J. Gonzalez-Ayala, A. C. Hernández, R. X. Luo, H X Yang, G. Juncheng
A novel electrochemical system with adiabatic pre-charging and pre discharging processes for efficient refrigeration.
Energy Conversion and Management, 293, 117518 (Oct 2023)
ISI Impact: 10.04 (Q1); DOI: [10.1016/j.enconman.2023.117518](https://doi.org/10.1016/j.enconman.2023.117518)
3. J. García-Ferrero, R. Merchán, M. J. Santos, A. Medina, and A. C. Hernández,
Brayton technology for Concentrated Solar Power plants: Comparative analysis of central tower plants and parabolic dish farms
Energy Conversion and Management, 27, 116312 (Nov 2022)
ISI Impact: 11.53 (Q1); DOI:10.1016/j.enconman.2022.116312



4. D. Salomone-González, González-Ayala, A. Medina, J.M.M. Roco, P.L.Curto-Risso, and A. Calvo Hernández
Pumped heat energy storage with liquid media: Thermodynamic assessment by Rankine-like model
Journal of Energy Storage, 56, 105966 (2022)
ISI Impact: 8.90 (Q1); DOI: 10.1016/j.est.2022.105966
5. D. Salomone-González, L.Curto-Risso, A. Calvo Hernández, A. Medina, J.M.M. Roco, and J: González-Ayala
Multi-criteria optimization of Brayton-like pumped thermal electricity storage with liquid media
Journal of Energy Storage, 44, 103242 (2021)
ISI Impact: 6.58 (Q1); DOI: 10.1016/j.est.2021.103242
6. R. Merchán, M. J. Santos, A. Medina, and A. C. Hernández,
High temperature central tower plants for concentrated solar power: 2021 overview
Renew. and Sustain. Energy Reviews, 155, 111828 (2021)
ISI Impact: 15.979 (Q1); DOI: /10.1016/j.rser.2021.111828
7. D. Salomone-González, González-Ayala, A. Medina, J.M.M. Roco, P.L.Curto-Risso, and A. Calvo Hernández
Pumped heat energy storage with liquid media: Thermodynamic assessment by Brayton-like model
Energy Conversion and Management, 226, 113540 (2020)
ISI Impact: 9.71 (Q1); DOI: DOI: 10.1016/j.enconman.2020.113540
8. W. Peng, J. Gonzalez-Ayala, G. Z. Sue, J, Chen and A. Calvo Hernández
Solar-driven thermal electrochemical converter coupled to a Brayton heat engine: parametric optimization.
Renewable Energy, 164, 260-271(2021)
ISI Impact: 8.001 (Q1); DOI: 10.1016/j.renene.2020.09.084
9. W. Peng, S, Sue, J, Chen, and A. Calvo Hernández
A two-stage sodium thermal electrochemical converter: Parametric optimization and performance enhancement
Journal of Power Sources, 480, 229147 (2020);
ISI Impact: 8.24 (Q1); DOI: 10.1016/j.jpowsour.2020.229147
10. J. Gonzalez-Ayala, J. Guo, A. Medina, J.M.M. Roco and A. Calvo Hernández
Energetic Self-Optimization Induced by Stability in Low-Dissipation Heat Engines
Phys. Rev. Letters, 124 (5), 050603 (2020)
ISI Impact: 9.22 (Q1); DOI: 10.1103/PhysRevLett.124.050603
11. R. Merchán, M. J. Santos, I. Heras, J. González-Ayala, A. Medina, A. C. Hernández,
On-design pre-optimization and off-design analysis of hybrid Brayton thermosolar tower power plants for different fluids and plant configurations
Renew. and Sustain. Energy Reviews, 119, 109590 (2020)
ISI Impact: 12.11 (Q1); DOI: 10.1016/j.rser.2019.109590

C.2. Research projects

- **Title: Almacenamiento de energía eléctrica con bombas de calor y su impacto en la matriz energética nacional**
Main researchers: Galione Klot, Pedro Andrés
Number of researchers: 7
Financing agency: Agencia Nacional de Investigación e Innovación (ANII); Fondo Sectorial de Energía, Uruguay; FSE-1-2018-1-153077
Dates: 11/06/2019 - 11/06/2021, 3 years; Budget: (2.379.838 Pesos) 58.760 €

- **Title: *Low-scale hybrid thermosolar plants for distributed energy generation***
Main researchers: Calvo Hernández, A.
Number of researchers: 7
Financing agency: Consejería de Educación; JCyL (Spain), SA017-P17
Dates: 01/01/2017 - 31/12/2019, 3 years; Budget: 108.380 €
- **Title: *Efficient energy converters and sustainable working fluids***
Main researchers: A. Calvo Hernández and Juan Antonio White Sánchez.
Number of researchers: 13
Financing entity: MINECO (Spain), ENE2013-40644-R
Dates: 01/01/2014 - 31/12/2016, 3 years; Budget: 56.870 €
- **Title: *Thermodynamic optimization of energy converters***
Main researcher: Medina, A.
Number of researchers: 7
Financing entity: MINECO(Spain), FIS2010-17147
Dates: 01/01/2011 - 31/12/2013, 3 years; Budget: 30.250 €
- **Title: *Thermodynamics optimization of power cycles***
Main researcher: A. Calvo Hernández
Number of researchers: 5
Financing entity: Consejería de Educación; JCyL (Spain), SA054A08
Dates: 01/01/2008 - 31/12/2010, 3 years; Budget: 10.700 €

C.3. Contracts, technological or transfer merits

- **Reference: LANZADERA_TCUE18-20_010**
Title: *Planta de concentración termosolar de disco parabólico con ciclo Brayton híbrida para generación distribuida de energía(BraySolDish)*
Main researcher: Irene Heras Pérez (10 participantes)
Financing Entity: Fundación General Universidad de Salamanca
Period: 01/07/2019 – 31/12/2019; Budget: 10.000 €
- **Title: *Thermodynamic and simulation study of different working conditions for the Combined Cycle Plant ACECA. Evaluation of the actions that could reduce plant technical minimum***
Main researcher: José Miguel Mateos Roco (5 participantes)
Financing entity: Art. 83 LOU. University of Salamanca / Iberdrola
Period: 01/04/2016 – 31/12/2019; Budget: 77.000 €
- **Title: *Clean and efficient generation of electricity and heat on a small scale: hybrid thermosolar dish*** (PC-TCUE-18-20_002)
Main researcher: María Jesús Santos Sánchez
Financing entity: JCYL, Fundación General Universidad de Salamanca
Period: 19/12/2018 – 19/12/2019; Budget: 10.000 €
- **Reference: IQPC-TERMOSOLARES**
Title: *Thermo-economic optimization of recuperative multi-stage hybrid thermosolar plants in Castilla y León*
Main researcher: Alejandro Medina Domínguez
Financing Entity: Junta de Castilla y León, Fundación General Universidad de Salamanca
Period: 01/04/2016 – 31/03/2017; Budget: 6.000 €
- **Reference: FPC-TERMOHIBRIDAS**
Title: *Thermo and techno-economic assessment of hybrid thermosolar plants*
Main researcher: Antonio Calvo Hernández
Financing entity: Junta de Castilla y León, Fundación General Universidad de Salamanca
Period: 01/04/2016 – 31/07/2016; Budget: 9.000 €