

Curriculum Vitae Dr. David Parra

Personal information

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PhD education: Optimum community energy storage for end user applications (10 July 2014)

2010 (October) -2014 (July) The University of Nottingham (United Kingdom)

E.ON and European Regional Development funded project. Supervised by Prof. Mark Gillott and Prof. Gavin S. Walker.

- Model and simulation of the optimum energy supply including storage for communities
- Design, construction, testing and evaluation of a community hydrogen storage system for a low carbon community in collaboration with ITM Power and McPhy Energy

Other Education

2008 (September)-2009 (September) Universidad Carlos III of Madrid (Spain)

MSc in Thermal and Fluids Engineering. Best student award.

2002-2007 Universidad Carlos III of Madrid (Spain)

Bachelor's degree in Mechanical Engineering with specialisation in Energy.

Current employment: Senior researcher and teaching assistant (maître-assistant)

2016 (August)-Present Institute for Environmental Sciences (ISE), University of Geneva (Switzerland)

- Coordinator of energy storage research at UNIGE
- PI in SCCER-HaE (<http://www.sccer-hae.ch/>)
- Researcher in SCCER-CREST (<http://www.sccer-crest.ch/>)
- PI in Joint Activity Power-to-X

Past employment: Visiting researcher

2017 (September)- 2017 (December) Massachusetts Institute of Technology (USA)

- Funded by the SNSF. I established a long-term collaboration on distributed energy technologies

Past employment: Postdoctoral researcher

2014 (September)-2016 (July) University of Geneva (Switzerland)

Energy efficiency Group led by Prof. Martin K. Patel. Institute for Environmental Sciences (ISE).

- Techno-economic and environmental assessment of energy storage technologies in SCCER-HaE.

Past employment: Researcher

2008 (May)- 2010 (April) Spanish Research Council, CSIC (Spain)

- Design, testing, economic and environmental appraisal of solar thermal installations for heating and cooling, including heat pumps and lithium bromide absorption chillers

Approved research projects

Principal investigator (PI): Total of 676200 CHF as PI

- Short Visit Scheme to MIT. Funded by SNSF. 10000 CHF (2017)
- Power-to-gas whitepaper. Funded by CTI. 7950 CHF (2017)
- Focus study for battery technology. Funded by AEE SUISSE. 5250 CHF out of 11500 CHF (2017).
- SCCER-HaE. Funded by CTI. 2017-2020. 653000 CHF (2016)

Co-investigator: Total of 259000 CHF

- SwissStore. Funded by SNSF. 194000 CHF out of 582000 (2017)
- Prospects for district heating and cooling for the energy transition. Funded by IRENA. 65000 CHF (2015)

Student supervision

PhD students (supervisor and co-supervisor in University of Geneva)

- **Arthur Rinaldi**. November 2017-present. Role of energy storage in Switzerland including different actors
- **Ruchi Gupta**. August 2017-present. Techno-economic analysis and input/output model for energy storage.
- **Alejandro Pena-Bello**. March 2017-present. Optimisation energy storage for distributed renewable energy
- **Martin Soini**. January 2016-present. Energy system analysis including district heating and energy storage.
- **Kai S. Streicher**. October 2015-present. Technical and economic potential of retrofitting the existing residential building stock in Switzerland.

Master students (supervisor and co-supervisor in University of Geneva and University of Nottingham)

- UNIGE: **Marc de Maio** (in progress); **Marzia Carolini** (in progress); **Jean-Paul Eberhard** (in progress); **Aymane Hassan, Arthur Rinaldi, Alejandro Pena-Bello**
- University of Nottingham: **Javier Yip, Matteo Cossuta**

Teaching Activities including coordination

2016-2019

Master program MUSE. University of Geneva (Switzerland)

- Energy Research methods; Environmental challenges (Enjeux); and Energy Storage as part of Physics and Technology of Energy.

2010-2014

The University of Nottingham (United Kingdom)

- Renewable energy laboratory; and Low carbon community tours for students and professionals.

Membership and reviewing activities

- Member of Scientific Committee of the International conference on Sustainable Energy Technologies (SET)
- Member of the Forum EnergieSpeicher Schweiz from AEE Suisse
- Peer reviewer of Nature Energy, Energy Policy, Energy and Buildings, Applied Energy, International Journal of Hydrogen Energy, Journal of Energy Storage and Energy.

Organisation of Conferences

- Where is Energy Innovation Heading? Organised UNIGE and the MIT Energy Initiative and host by Swissnex Boston. November 9, 2017 in Cambridge (USA) (<https://www.swissnexboston.org/event/where-is-energy-innovation-heading/>)

Prices, awards, fellowships

- Recipient of SNSF Short Visit Scheme
- Winner at the Science Slam organised by the Swiss Competence Centre for heat and electricity storage in 2015 (Switzerland).
- Winner at the Midlands Energy Graduate School poster competition in 2011 (United Kingdom).

Major scientific achievements

I contributed to develop the concept of Community Energy Storage (CES) and proposed a method to optimise CES systems (October 2010-August 2014)

During the late 2000s, energy storage with batteries was firstly suggested to grid-connected houses with the increasing of electricity retail prices and the reduction of PV cost. However, it was still very unattractive in economic terms. Community energy storage (CES) was suggested by American Electric Power (AEP) and they installed broadly distributed storage systems at consumer sites. The concept was not yet developed in Europe and moreover, there were several research questions to be answered in order to foster the deployment of CES such as: What is the economic attractiveness of CES performing consumer applications? What is the impact of the size of the community on the performance and the economic benefits of CES? What is the optimal technology and size? And how the combination of applications affect the business case?

My research contribution to knowledge was twofold. First, I developed and applied an optimisation method which demonstrated the positive effect of the community approach on energy storage (in contrast to single home or grid scale energy storage). I explained the factors underpinning the techno-economic improvement and quantified them. In particular, the aggregation of demand profiles (which results in a less spiky profile) has a positive impact on the storage capacity, round trip efficiency and ageing, but also there are economies of scale in capital and operational costs (e.g., maintenance). However, the positive impact of the community approach becomes smoother as the community size increases. Secondly, my research also helped to understand the impact of the UK decarbonisation roadmap and a business case was projected by 2020 for CES systems performing at least two applications. This conclusion was in agreement with a statement of the Vice president of Energy Storage at E.ON in 2016 (<http://newenergyupdate.com/energy-storage/eon-eyes-sales-12-billion-euros-battery-projects>). Overall, my PhD research was published in 7 journal publications, 4 international conferences and 1 thesis dissertation.

I have driven an interdisciplinary review on energy storage for communities, which has become a successful paper (November 2015-May 2017)

I was the first author and coordinator of an interdisciplinary review of energy storage for communities including both academic (Aalborg University, University of Nottingham, University of Applied Sciences of Lucerne and Paul Scherrer Institute) and industrial experts (E.ON) from Switzerland, the UK and Denmark. The review was published in *Renewable & Sustainable Energy Reviews* and covers techno-economic, socio-economic and environmental methods as well as the role of consumers, policy makers, technology developers and utility companies.

My expertise on this topic helped me to be selected as keynote speaker in the international conference on New Pathways for Community Energy and Storage <https://www.rug.nl/research/science-society-group/research-and-projects/co-rise/conference-6-7-june-2019/>

I have established a collaboration between UNIGE-ISE and the MIT Energy Initiative on renewable energy and energy storage (September 2017-December 2017)

I was granted a SNSF short visit scheme grant of 3 months to visit MIT. I was hosted at the Trancik's lab (<http://trancik.mit.edu/>), and I also established collaborations with the group of Marta Gonzalez (https://cee.mit.edu/people_individual/marta-c-gonzalez/) and Prof. Perez-Arriaga (<http://energy.mit.edu/profile/ignacio-perez-arriaga/>). A joint study has already been published in *Applied Energy*, another study is under review with *Renewable & Sustainable Energy Reviews*. Others ideas are discussed for future collaborations.

I have led a collaboration to discuss the policy implications of the additional cost and emissions of batteries (May 2017-March 2019)

UNIGE-ISE, ETHZ-EPG and PSI-LEA have collaborated for the last two years, under my leadership, to develop a new policy analysis after determining the additional costs and emissions of storing electricity in stationary battery systems, therefore it signals levers to minimise the social cost of battery storage. The manuscript has just been accepted in *Environmental Science & Technology* (DOI: 10.1021/acs.est.8b05313) with me as last author.

I have independently supervised two master student projects which were published in peer-reviewed journals (September 2015-October 2018)

Two journal publications were published from two master projects supervised by me at UNIGE. The students are Alejandro Pena-Bello (who is a PhD student currently supervised by me on a daily basis at UNIGE) and Aymane Hassan (currently PhD student at PSI-LEA). Alejandro and Aymane published their work in *the International Journal of Hydrogen Energy* and *Journal of Energy Storage* respectively with me as last author.

I have designed, constructed and successful operated a hydrogen storage system for a low carbon community (February 2012- July 2014)

I was the project manager and first investigator of the design, construction, testing and evaluation of a community hydrogen storage system for a low carbon community in Nottingham (UK). I collaborated with two industrial partners (ITM Power and McPhy Energy) as well as engaged the inhabitants of the community for this novel installation. The various steps of this project together with the major scientific results were published in a publication with me as first author at the *International Journal of Hydrogen*.

I wrote a focus study to inform policy makers in the Swiss Parliament (May 2017-November 2018)

Together with Dr. Alexander Fuchs from ETHZ-D-MAVT, I have co-author a focus study on battery technology funded by AEE SUISSE (Umbrella organisation for the economy of renewable energy and energy efficiency), which is used by AEE SUISSE to inform policy makers in the Swiss Parliament. The study can be accessed in the following link: <https://speicher.aeesuisse.ch/de/fokusstudien>

I wrote a Chapter book for the Royal Society of Chemistry (January 2018-March 2019)

I was selected by the Royal Society of Chemistry, together with other group of prestigious researchers (mainly professors), to write a chapter of the book *Future Lithium-ion Batteries*, in particular the chapter *Emerging Market of Household Batteries*. The online version of the book is already available here: <https://pubs.rsc.org/en/content/ebook/978-1-78801-418-2>