

Michele Manfroni, PhD

Research Scientist,
Grenoble Applied Economics Lab
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[Rivista Energia 1, 2](#)
[Liphe4](#)

Professional Summary

Energy and sustainability research scientist experienced in biophysical accounting, integrated assessment (energy, economy, environment) modelling, risk and decision making under deep uncertainty.

Former business experience in energy markets (hedging strategy & risk management operations), currently leading a non-profit organization involved in sustainability education & training and providing independent consultancies.

Perpetual learner, creative and reflexive with excellent listening and communication skills. Known for ethical integrity, reliability, high-energy and adaptability, with swift capacity to learn and apply new skills.

Accomplishments & Main Contributions

Research highlights: Developed a **novel modeling framework**, grounded in complexity theory, to evaluate the potential biophysical limits of social-ecological systems under energy constraints.

Generated **the first-ever global EROI map**, representing a pioneering and potentially groundbreaking dataset.

Conducted a systematic **assessment of epistemic and methodological blind spots** in Integrated Assessment Models (key tools utilized by the IPCC).

Proposed **socio-metabolic fragility** as a heuristic to inform policymaking under the deep uncertainty posed by ecological complexity (in progress).

Business highlights: Promoted to Head of a team of five consultants within just four months, overseeing energy procurement projects across multiple European markets (UK, Netherlands, Portugal, Spain, France) for major international clients, including Coca-Cola, Calderys, and Mango. Demonstrated a strong track record in building relationships with new international clients, such as Herba Ricemills and the Ebro Foods Group, to support their energy procurement needs.

Work History

05/2024 to Current

Research Scientist, Grenoble Applied Economics Lab (GAEL) – University of Grenoble, Grenoble, France

- **PI project Fiesta (Feasible Energy Scenarios Intercomparison Assessment):** 238.000 €. Ecological Macroeconomic Modelling, Integrated Assessment Models (theory & methodology), Transformation to low carbon economy, Global Energy Return on

Investment (EROI) Assessment, Systemic Risk, Socio-Metabolic Fragility, Epistemic questions in modelling.

Vice President, Scientific Association Liphe4 – Barcelona, Spain

- Liphe4 aims at generating awareness on the most urgent sustainability issues. We are engaged in education, training & consultancy for a wide range of societal actors, from the public sector and policy makers to businesses and citizens.

Consultant – Freelance (remote)

- **Macroeconomic Modeling for the University of Texas at Austin, Energy Institute (UTEI) and the Cynthia and George Mitchell Foundation (CGMF), Texas US:** *Developing a model for understanding the macroeconomic impacts of an orderly phase-down of unabated fossil fuels*

09/2023 to 04/2024

Magnus Commodities, Veolia Group, Barcelona, Spain

Global Consultant Manager (01/2024-04/2024)

- Responsible of energy procurement for a portfolio of international clients, working across several European energy markets with a team of five people.

Energy Consultant (09/2023-12/2023)

- Italian and Spanish energy markets: Risk management - active portfolio management, hedging strategy & operations; account management – invoicing, budgeting and tenders; analysis & reporting about energy markets (gas, power, LNG, EUA, GOs, oil, coal); monitoring regulatory updates and advances in climate laws at national and EU level; publishing articles and analyses about energy-related topics; energy procurement contracts negotiation.

03/2023 to 08/2023

Postdoctoral Researcher, Institute of Environmental Science and Technology – Autonomous University of Barcelona, Barcelona, Spain

- EU Socio-technical Transitions, Plausibility analysis of European net-zero policies (EVs, phase out of Russian oil), Industrial energy accounting, National accounting data (Eurostat).

02/2021 to 11/2022

Freelance Writer, Rivista Energia – Rie Ricerche Industriali e Economiche (Prof. Alberto Clò), Bologna, Italy

- Writing dissemination pieces about energy and the economy

02/2017 to 02/2023

Institute of Environmental Science and Technology, Autonomous University of Barcelona (ICTA-UAB), Barcelona, Spain.

PhD Researcher (04/2018 to 02/2023). Supervisor: Prof. Mario Giampietro

PhD Thesis: **Relational Analysis of the Oil Metabolism: exploring biophysical limits to the development of social-ecological systems.** *Excellent Cum Laude and International Mention*

- Multiscale Integrated Assessment of social-ecological metabolism (MuSIASEM), Industrial ecology, Urban Metabolism, LCA, Complexity, Energetics, Carbon accounting, Labor and human time accounting, Fossil fuels – economics, engineering, environment, Post-Normal Science, Decision-making under deep uncertainty, Science for Policy, Data analysis & management, Working in EU projects, public speaking, Scientific writing.
 - Visiting fellow at the **Uppsala University, Department of Earth Sciences, Natural Resources and Sustainable Development (09/2021-12/2021)**

Visiting Graduate Student (02/2017 to 11/2017)

- Structural and functional comparative analysis of the EU energy metabolism

11/2017 to 03/2018

Validation Engineer, CTP Systems (Akka Technologies Group) – Poggibonsi (FI), Italy

09/2008 to 08/2014

Professional Volleyball and Beach Volleyball Competitor – National league (*Serie B*, volleyball, and *Campionato Italiano*, beach volleyball)

Education

02/2014 to 12/2016

Master's Degree in Thermomechanical Engineering, 108/110 – Università Politecnica delle Marche, Ancona, Italy

- 2014-2015: Exchange Student, Energy Engineering, Universidad Politécnica de Madrid, Madrid, Spain.

09/2009 to 10/2013

Bachelor's Degree in Aerospace Engineering, 110/110 with honors – University of Bologna, Forlì Campus, Italy

Skills

- Ecological Economics
- Industrial Ecology, Societal Metabolism, Sustainability Assessment
- Science and Technology Studies
- Biophysical Accounting and LCA (SimaPro)
- Energy Modeling
- Energy Transitions
- Science for Policy, Epistemic issues in Modelling and Decision making under deep uncertainty
- Data Analysis and Visualization (Python, R)
- Scientific Writing
- Teaching
- Public Speaking
- Consulting

Languages

Italian: Native

English: Proficient (C1/C2)

Spanish: Bilingual

French: Beginner (A2)

Catalan: Beginner (A1)

Publications, Conferences & Seminars

- Manfroni** et al. 2022, “**Securing Fuel Demand with Unconventional Oils: A Metabolic Perspective**”. *Energy*, <https://doi.org/10.2139/ssrn.3965537>.
- Manfroni** et al. 2021, “**The Declining Performance of the Oil Sector: Implications for the Global Climate Change Mitigation**”, *Applied Energy*, <https://doi.org/10.1016/j.apenergy.2021.117210>
- Manfroni** et al. 2021, “**The profile of time allocation in the metabolic pattern of society: An internal biophysical limit to economic growth**”, *Ecological Economics*, <https://doi.org/10.1016/j.ecolecon.2021.107183>
- Manfroni**, PhD Dissertation, “**Relational Analysis of the Oil Metabolism: Exploring Biophysical Limits to the Development of Social-Ecological Systems**”, Autonomous University of Barcelona, March 2023
- Di Felice et al. 2024, “**Towards nexus thinking in energy systems modelling: A multi-scale, embodied perspective**” *Energy Policy*, <https://doi.org/10.1016/j.enpol.2024.114052>
- Manfroni**, et al., 2022 “**Surfing the oil hierarchy: a multi-scale assessment of decarbonization pathways for the EU oil sector**”, *Conference paper*, ICEE 2022.
- Giampietro et al. “**Report on the experience of applications of the Nexus Structuring Space in Quantitative Storytelling**” *MAGIC (H2020-GA 689669) project deliverable 4*.
- Manfroni** et al., “**Industrial Energy in IAMs**”, *Chapter in the Book “Net Energy Analysis: The State of the Art”*, Routledge (forthcoming, August 2025)
- Manfroni** and Vidal, “**Raw Materials and Waste Management**” Chapter in the “*Handbook in Ecological Macroeconomics*”, Open Book Publisher (forthcoming, September 2025).

- Invited Expert** at the Glion Workshop 2024, **Modeling a Phasing Out Unabated Fossil Fuel Consumption for a Net-zero Economy**, Glion, Switzerland, July 22-25 2024.
- Invited Researcher**, Seminar for the Must4Water project: **Epistemic Opacity in Sustainability Assessment - Philosophical, methodological and practical issues**. January 18, 2024, University of Florence
- Speaker** at the ESEE 2022, 14th Conference of the European Society for Ecological Economics. “Will Achilles catch up with the tortoise? It's high time for transformative action on sustainability”, title of the presentation: **Metabolic energy auditing to inform the transition away from fossil fuels** of the. June 14-17th 2022, Pisa, Italy.
- Speaker** at the ICEE 2022 Conference. Energy & Environment: Bringing together Economics and Engineering – Technologies, Markets and Policies, **Surfing the oil hierarchy: a multiscale assessment of decarbonization pathways for the EU oil sector**. June 2-3rd, 2022, Porto, Portugal
- Invited speaker** by Federmanager & Confindustria Puglia, **Surfing the complexity of energy systems: a systemic perspective on the green transition**. March 16th, 2022 (online webinar).
- Speaker** at the Energy Modelling Platform for Europe 2019 (EMP-E 2019), **Modelling the Implementation of a Clean Planet for All Strategy**, October 8-9th, 2019. **European Commission, DG Research & Innovation**, 21 rue de Champ de Mars – Marsveldstraat, 1050 Brussels
- Invited Workshop participant** at the **International Workshop on Extreme Events and Energy Transitions: Tackling the Challenges of Climate Change by Integrating Social and Complex Systems Science**. September 22-27th 2019, JRC Ispra
- Speaker** at the conference ERSCP 2019 – Circular Europe for Sustainability: Design, Production and Consumption. **The profile of human time allocation across hierarchical levels of organization as an emergent property of societal metabolic pattern**. October 15-18th, 2019, Barcelona.

Dissemination (in Italian)

- Manfroni** 2022, “**Shale oil: shortages in the midst of abundance**”. Essay protected by copyright.
- Manfroni**, 2022, “**Waking up from the renewable dream: an increasingly carbon-intensive society**”, <https://www.rivistaenergia.it/2022/05/risvegliarsi-dal-sogno-rinnovabile-una-societa-sempre-piu-carbon-intensive/>.
- Manfroni**, 2022, “**Waking up from the renewable dream: pillars and gaps in the green narrative**”, <https://www.rivistaenergia.it/2022/05/risvegliarsi-dal-sogno-rinnovabile-pilastr-e-lacune-della-narrativa-verde/>.
- Manfroni**, 2021, “**The cost of complexity: Soddy's prophecy and the acceptance of biophysical limits**”, <https://www.rivistaenergia.it/2021/12/il-costo-della-complessita-3-la-profezia-di-soddy-e-laccettazione-dei-limiti-biofisici/>.
- Manfroni**, 2021, “**The cost of complexity: green rhetoric will not save us from today's and tomorrow's crises**”, <https://www.rivistaenergia.it/2021/12/il-costo-della-complessita-2-la-retorica-verde-non-ci-salvera-dalle-crisi-di-oggi-e-domani/>.
- Manfroni**, 2021, “**The cost of complexity: energy crises, debt and inflation**”, <https://www.rivistaenergia.it/2021/12/il-costo-della-complessita-1-crisi-energetiche-debito-e-inflazione/>.
- Manfroni**, 2021, “**Energy cannibalism and the Red Queen effect: checkmate to decarbonization?**”, <https://www.rivistaenergia.it/2021/10/cannibalismo-energetico-ed-effetto-regina-rossa-scacco-matto-alla-decarbonizzazione/>.
- Manfroni**, 2021, “**The senescence of the oil sector**”, <https://www.rivistaenergia.it/2021/04/la-senescenza-del-settore-petroliero/>.
- Manfroni**, 2021, “**Is techno-optimism the perfume of the ecological transition?**”, <https://www.rivistaenergia.it/2021/03/il-tecnico-ottimismo-e-il-profumo-della-transizione-ecologica/>.

Manfroni, 2021, "**The Chinese "Dual Circulation Strategy": a possible blow to the global climate agenda**", <https://www.rivistaenergia.it/2021/02/la-dual-circulation-strategy-cinese-un-possibile-brutto-colpo-per-lagenda-climatica-globale/>.

Teaching & Supervision

Teacher & Organizer, **Liphe4 Schools 2018-2024:**

- **2023 Winter School:** Sustainability Modeling of Complex Agroecological Systems- Challenges and Alternatives to Current Approaches (Grenoble)
- **2023 Summer School:** Energy Transitions - Diagnosing wishful thinking and identifying critical vulnerabilities (Barcelona)
- **2019 Summer School:** Complex Sustainability Challenges: The Nexus Between Water, Energy and Food (Barcelona)
- **2018 Summer School:** Can Cities Be Sustainable? Novel tools to explore urban metabolism (Geneve)

Trainer for the Catalan regional authority, Introduction to Sustainability, multiple sessions between February and May 2023.

Teacher at the **Climate Change and Business Carbon Footprint seminar**, Faculty of Petroleum & Mining Engineering, Geology and Environment, **Universidad Central de Ecuador**, Quito. 13-23th December 2021.

Supervision:

Roman Caruso, Visiting Master student, University of Montpellier (France). 6 months, 02/2019-07/2019.

Samuel Marot Robinson, Master student (thesis), Autonomous University of Barcelona, 02/2023-09/2023.

Tristan Martin, Master student (Thesis internship), Ecole de Ponts, ParisTech, 09/2024-01/2025.