

CURRICULUM VITAE ET STUDIORUM

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WORK EXPERIENCE:

2019 – 2021: Sustainability Analyst for Industrial Processes, at the Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing (STIIMA) of the National Research Council (CNR).

My research objective deals with applying Life Cycle Thinking to products and production processes for efficient and sustainable factories within the industrial sector, through interdisciplinary teamwork with a significant innovative component. I developed such research topic into European and national projects, providing environmental consultancy reports for companies, developing academic research papers and holding lectures at various levels.

Concerning European and Italian projects, I participated into EU H2020 E2COMATION and MiSE Lighthouse projects. In both of them, my tasks included the development of a dynamic LCA methodology in order to support company management systems, through the identification of economic or environmental bottlenecks and compliance at international level with reference standards on products and on processes – see European/Italian projects activities.

Concerning consultancy activities, I collaborated with different companies in the footwear and steelmaking sector (see Consultancy activities). I developed LCAs of specific products (based on the Ecoinvent database, attributional version) aimed at providing Environmental Product Declaration (EPD) certification, using the OpenLCA software. I interacted with the company staff to require and manage data from production processes, I analysed different databases (from OpenLCA nexus), reports and research papers whenever I needed to build new LCA datasets, I prepared presentations of my results across different iterations of the LCA. Moreover, I contributed to the development of the methodological report for each activity, explaining the goal and scope of the study, description of life cycle inventory modelling, data quality analysis, interpretation of LCA results. Finally, I worked on improving an Excel tool developed within the EIRES European project. I participated into panels for creation of Product Category Rules (PCR) for certifying the specific products we analyzed (see Standardization activities).

Concerning teaching activities, I collaborated in a university course (Politecnico di Milano, Master of Science level) and a seminar (Università degli Studi della Campania "Luigi Vanvitelli") and in a professional training course (post-diploma school - Fondazione Green ITS) – see Teaching activities.

Concerning academic research activities, I produced 3 papers, which are currently under review [1], [2], [3], 1 conference paper [4] and 3 abstracts for conferences and workshops. I attended and presented my works in 4 different conferences. I developed methodological papers on advanced LCAs with applications in future scenarios within the plastics industry and electric vehicles. In [1], I estimated the environmental impacts related to the introduction of a novel PET depolymerization technology in the European market. By adopting the Stochastic Technology Choice Model, I explicitly included market reactions to the introduction of a novel technology in the LCA, thus enlarging the capabilities of such analysis. Indeed, market parameters such as costs and production capacities of the involved technologies were explicitly modelled, while the stochasticity of the assessment is useful to manage the uncertainty that is related to technological and

Milan, 22/01/2021

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- 2020 – Lecturer at Università degli Studi della Campania “Luigi Vanvitelli” – Architecture and Industrial Design – Annual seminar on Life Cycle Thinking and Sustainable Design, within the course of Materials and Technologies to Design Sustainability.

Other activities and responsibilities:

2020 – Politecnico di Milano – Environmental and Land Planning Engineering – M.Sc. thesis co-supervisor and attendee at thesis evaluation committee. Thesis Supervisor: prof. Giovanni Dotelli. I supervised the development of the thesis named *Uncertainties in Battery Electric Vehicles (BEVs) LCA: Correlation between LCI and the Italian electricity system*. Part of the thesis work was published in [3] and [4].

PUBLICATIONS ON JOURNALS AND CONFERENCES:

- [1] S. Cornago, D. Rovelli, C. Brondi, M. Crippa, B. Morico, A. Ballarino and G. Dotelli, *Consequential Life Cycle Assessment to assess impacts of technology substitution in the case of a novel PET depolymerization technology*, Journal of Cleaner Production – 3rd review round
- [2] O. Edelenbosch, D. Rovelli, A. Levesque, G. Marangoni and M. Tavoni, *Long term, cross-country effects of buildings insulation policies*, Technological Forecasting & Social Change – 2nd review round
- [3] D. Rovelli, S. Cornago, P. Scaglia, C. Brondi, J.S.C. Low, S. Ramakrishna and G. Dotelli, *Quantification of non-linearities in the Consequential Life Cycle Assessment of the use phase of Battery Electric Vehicles*, Frontiers in Sustainability – 1st review round
- [4] D. Rovelli, P. Scaglia, S. Cornago, C. Brondi and G. Dotelli, *Temporal variability and Battery Electric Vehicles influence on LCA impacts of marginal electricity consumption in Italy*, XIV Convegno dell'Associazione Rete Italiana di LCA

OTHER ARTICLES AND ABSTRACTS:

- C. Brondi and D. Rovelli, *L'implementazione della simbiosi industriale: il ruolo chiave della standardizzazione*, Unificazione e certificazione, issue 3, March 2020, pp. 20-21.
- C. Brondi and D. Rovelli, *I nuovi standard a supporto della simbiosi industriale*, Unificazione e certificazione, issue 10, November-December 2020, pp. 31-32.
- Renato Girelli, Enrico Malfa, Giovanni Bavestrelli, Maurizio Zanforlin, Andrea Panizza, Carlo Brondi, Davide Rovelli and Luca Merigo, *Lighthouse Plant “Acciaio_4.0”: an example of integration of the environmental aspect in the production process*, ESTEP Focus Group Circular Economy workshop on “Resi4Future: Residue valorization in iron and steel industry - sustainable solutions for a cleaner and more competitive future Europe”, 6 November 2020, <https://www.estep.eu/events/resi4future-ws/>

AWARDS:

Young researchers 2020 award (2^o position), XIV Convegno dell'Associazione Rete Italiana di LCA

economic projections. In [2] and [4], I coupled the conventional consequential LCA approach with an energy system model (EnergyPLAN) and I analysed the variability of the LCA results of the electricity consumption, both dynamically at the hourly level, across the different months of the year, and among different scenarios of electric vehicles penetration, in Italy. Then, I analysed how the conventional assumption of a proportional relation between environmental impact indicators and the functional unit may not be representative of reality, if significant fleet-level dynamics are generated by the large-scale diffusion of electric vehicles. I employed the Ecoinvent database (consequential version) with the Brightway2 software in [1], [3], [4], while I worked on an energy model in R language in [2].

European/Italian projects activities:

- 2020 – 2021: H2020 European project "E2COMATION Life-cycle optimization of industrial energy efficiency by a distributed control and decision-making automation platform" (Status: ongoing). STIMA-CNR is the coordinator of the project, which will last until April 2024 and involves 17 partners from 9 different countries. The overall budget of the project is € 10 560 000. My tasks are related to the development of a scalable methodology for dynamically assessing the LCA results of manufacturing activities, with a focus on energy use, which will be implemented in a specific tool within an E2COMATION plant. The methodology is based on a simulation model, which tracks mass and energy patterns related to activities of different production units. At the facility level, this modelling structure will be used to compute statistics and assessments in compliance with LCA and Life Cycle Costing frameworks. To ensure the maximum impact of the project results in terms of standardization activities, further tasks are related to the examination of current and emerging standards with reference to product domain (i.e. ISO 14026-46-67, PEF, EPD) on facility management domain (e.g. ISO 26000, ISO 50001, ISO TC 323, ISO 14004, OEF, IEC TC 111, BSI 9000) and on global initiative domain (e.g. Sustainable Development Goals, Science Based Targets, Global Reporting Initiative).
- 2019 – 2021: Lighthouse project financed by the Lombardy Region - MISE - Partner ORI Martin – Tenova (Status: ongoing): my tasks are related to the development of a decision support tool to address the company environmental policy on sustainability. This is achieved through the creation of a dashboard able to dynamically monitor the environmental impacts of several production cycles within the company core business. The dashboard guarantees automatic data collection and treatment, in order to compute environmental impact indicators, and may be integrated with other data management systems of the company. In order to manage LCA data in a flexible environment, I used the Brightway2 software (python language) with the ecoinvent database (attributorial version). I handled the data collection sheets, related to production processes, of the company and connected them with the software tool I developed. The dashboard is can compare LCA results across different impact assessment methods (e.g. ILCD, EPD), different standards (EPD, Greenhouse Gas protocol) and provide a focus on the main drivers of LCA results within a specific time interval.

Consultancy activities:

- 2022 – Assessment and update of company environmental impact monitoring tool, developed in Excel within the Environmental impact evaluation and effective management of resources in the GfK steelmaking (EIRES) project for "Tenova" company. My tasks are related to updating the existing datasets with the most recent LCA databases (Ecoinvent, attributorial version) and impact assessment methods. Moreover, I added new datasets which were modelled according to a literature research, according to ISO 14000 and EPD standards. Then, I modified the calculation and visualization of LCA indicators according to the requirements of Tenova policy and sectoral trends.

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- 2020 – EPD processing and certification services for “ORI Martin” company: LCA of a steel billet, hot-rolled coils for automotive applications. The LCA was developed following the PCR Basic iron or steel products and special steels, except construction steel products (UN CPC 4112).
- 2020 – EPD processing and certification services for “Tenova-Pomini” company: LCA of a 36 ton texturing machine. The activity concerned with the first LCA of a texturing machine, including scenarios on the use and End-of-Life phase of the machine.
- 2020 – EPD processing and certification services for “Industrie Chimiche Forestali” company: LCA of 2 impregnated and 2 extruded textile articles.
- 2020 – EPD processing and certification services for “Vibram” company: LCA of 3 different rubber sole compounds for footwear.

Standardization activities:

- 2020 – Participant panel EPD PCR impregnated and extruded textile articles; product category classification: UN CPC 27997
- 2020 – Participant panel EPD PCR rubber and plastic articles for footwear; product category classification: UN CPC 3627
- 2020 – Participant panel EPD PCR Machine tools for working material through removal of material by laser or similar processes; product category classification: UN CPC 44221

Teaching activities:

- 2020 – Politecnico di Milano – Collaborator within M.Sc. Course: Chemistry and materials for environment (around 150 students - taught in English), professor Giovanni Dotelli. The course constitutes one half of the Integrated course “Chemistry and Materials for Energy and Environment” module and belongs to the School of Industrial and Information Engineering. The course was open to students from different tracks: Environmental, Chemical, Materials, Food and Energy engineering. The course has the objectives to promote a deep understanding of the computational structure of the Life Cycle Analysis (LCA) methodology and to apply this methodology to evaluate the sustainability of materials and processes. I revised the course to include hands-on lectures on the OpenLCA software, carried out with the European reference Life Cycle Database (ELCD) of the Joint Research Center. My lectures dealt with the application of the following topics in the OpenLCA software: Life Cycle Inventory analysis (flows, processes linking and product systems), Life Cycle Impact Assessment (characterization factors, indications on available impact assessment methods), Sensitivity analysis (global, local and dependent parameters, projects), Comparative LCAs (definition of the functional unit) and waste treatment modelling, Multifunctionality treatment according to ISO 14044 hierarchy (subdivision of the system, allocation – causal, physical, economic – system expansion and crediting), indications on End-of-Life modelling. In addition, I provided exercises during the course and I prepared and corrected the course exams.
- 2020 – Teacher within a module of Fondazione Green ITS courses: “Istituto Tecnico Superiore per la Fabbrica Intelligente e l’Industria 4.0”. Module named “Sustainable factory”. Starting from the current environmental crises, the course introduced the students to relevant paradigms within industrial sustainability, both with lectures and open discussions. Definition of circular economy and industrial symbiosis: standardization and economic trends, how to measure circularity, circular business models, ecodesign, strengths and weaknesses of circular economy strategies, examples of applications. Defining and measuring sustainability, environmental certification schemes, corporate social responsibility reports. Ecolabels and greenwashing. Introduction to the development of LCA for ecodesign, applications and connection LCA-EPD, indications on Social LCA and Life Cycle Costing.

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CONFERENCES/WORKSHOPS ATTENDANCE:

1. 9-11 December 2020: XIV Convegno dell'Associazione Rete Italiana di LCA, "Temporal variability and Battery Electric Vehicles influence on LCA impacts of marginal electricity consumption in Italy"
2. 20 October 2020: Brightcon 2020 – Open Sustainability Conference, "Coupling Brightway2 and the Stochastic Technology Choice Model", <https://2020.brightcon.link/>
3. 2 October 2020: Workshop on methods and applications of computational Uncertainty Quantification: experiences and perspectives within DIITET CNR, "Uncertainty quantification within Life Cycle Assessment of a novel PET depolymerization technology", <https://sites.google.com/view/uq-diitet-cnr-2020>
4. 3-4 December 2019: 1st Conference of the Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing, "The role of LCA as sustainability enabler within emerging manufacturing paradigms", <http://www.stiima.cnr.it/conferenza-stiima-2019/>

EDUCATION:

09/2016 – 04/2019

M.Sc. Degree in Energy Engineering, *Energy for Development*, Politecnico di Milano, 110/110 cum laude

- Track: Energy for Development. I gained a broad knowledge in technical and scientific fields, in order to be able to operate in the industrial sector at a multi-scale level: I dealt with both in depth courses on specific technologies and energy analyses of different scenarios for the sustainability of energy systems in diverse areas.
- Thesis title: "The role of building policies for long-term energy efficiency", supervised by prof. Massimo Tavoni and Oreane Edelenbosch, PhD; developed at the multidisciplinary research institute "European Institute on Economics and the Environment" (EIEE), in collaboration with "Potsdam Institute for Climate Impact Research" (PIK). My research work aimed at improving a bottom-up, statistically-based, multi-regional energy simulation model for the buildings sector, which employs a long-term point of view and is coded in R language. I developed a new modelling method, with the capacity to represent long lasting building structures and evaluate decision-making for improving energy efficiency of the building envelope. The contribution of my work are related to the following points: (1) to show how building stock and thermal insulation dynamics across regions can affect world final energy demand until 2050. (2) Investigate the current gap between the European Union buildings policy objective and the estimated future trends. (3) Analyze the amount of final energy saved if the rest of the world would follow European policies. (4) Examine the role of energy prices in improving thermal insulation levels. (5) Outline the impact that uncertainties on input parameters show on the highlighted outcomes. My work contributed to the publication presented in [2].

01/2017 – 06/2017

Attending courses within erasmus exchange program, at Technical University of Denmark (DTU). A unique experience which gave me the opportunity of experimenting a new learning approach, complementing my strong theoretical knowledge with innovative and multidisciplinary engineering projects, developed with people coming from different backgrounds and cultures.

09/2013 – 09/2016

B.Sc. degree in Energy Engineering, Politecnico di Milano, 110/110 cum laude. I gained a strong technical background in industrial systems, with a sound knowledge of basic mathematical and scientific principles.

09/2009 – 06/2013

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