

# Stefan Pauliuk

## Personal details

**Date of birth:** March 1<sup>st</sup>, 1982

**Place of birth:** Herzberg (Elster)

**Citizenship:** German

**Current work address:** University of Freiburg, Faculty of Environment and Natural Resources, Tennenbacher Strasse 4, D-79106 Freiburg, Germany

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## Present position

**Since 2015:** Assistant professor ('Juniorprofessor') for *Sustainable Energy and Material Flow Management* and head of the research group *Industrial Ecology Freiburg* at the Faculty of Environment and Natural Resources, University of Freiburg, Germany.

## Links

[Blog](#)

[Homepage](#)

[Google Scholar](#)

[Twitter](#)

[Teaching](#)

[Github \(software\)](#)

[Figshare \(data\)](#)

[Youtube](#)

## Research interests

+ **Industrial ecology**, in particular the study of global supply chains, sustainable material cycles, sustainable consumption, and environmental footprints of consumption

+ **Prospective assessment** of sustainable development strategies

+ **Scenario analysis** for material cycles and consumption patterns

+ **Indicator and policy development** for resource efficiency, circularity, and sustainability

+ **Method and theory development** for material flow analysis (MFA), life cycle assessment (LCA), supply and use tables (SUT), and multiregional input-output analysis (MRIO).

## Method competence

- + **Industrial ecology methods**, including material flow analysis (MFA), life cycle assessment (LCA), and multiregional input-output analysis (MRIO)
- + **Scenario modelling** and prospective assessment
- + **Software and database development** for industrial ecology (Python and SQL)
- + **Statistical analysis**: regression analysis, statistical inference, and data reconciliation

## Teaching

- + **‘Nachhaltiges Energie- und Stoffstrommanagement’**, (MSc level, 5 ECTS), annually.
- + **‘Research methods in industrial ecology’**, (MSc level, 5 ECTS), annually.
- + **‘Life cycle management’**, together with Rainer Grießhammer, (MSc level, 5 ECTS), annually.
- + **‘Energy and Sustainability’**, together with Ernst Ulrich von Weizsäcker (MSc, 5 ECTS), annually.
- + **‘Master thesis preparation project’** (Research skills, science ethics, and scientific writing at the MSc level, 2 ECTS), annually.
- + **‘Industrial Ecology open online course (IEooc)’**, free online course at MSc level available under <http://www.teaching.industrialecology.uni-freiburg.de/>

## Education and professional experience

**2013-2015: Post-doctoral researcher in the group of Prof. Edgar Hertwich (environmental systems analysis, industrial ecology) at NTNU Trondheim.** My main focus during that time was to contribute to the integration of different systems analysis methods including MFA, IO, LCA, and integrated assessment modeling. I also contributed to the work with physical, mixed unit, and hybrid multiregional IO tables.

**2009-2013: Phd in industrial ecology at the Norwegian University of Science and Technology (NTNU) in Trondheim.** Thesis advisors: Professor Daniel B Müller and Professor Helge Brattebø (both at the Industrial Ecology Programme). Main working areas: material flow analysis; the steel cycle; sustainable buildings and transportation; climate change mitigation; decoupling; method and database development. **Thesis title:** ‘The Role of Stock Dynamics in Climate Change Mitigation’. The Phd committee (Professor Ernst Worrell, Utrecht; Lecturer Dr. Julia Steinberger, Leeds; and Lecturer Dr. Jonathan Cullen, Cambridge, UK) assessed the thesis as “internationally outstanding”.

**2007 - 2008: Scientific employee at Deutsches Elektronensynchrotron (DESY).** Development of control and measurement software.

**2007: University Diploma (MSc equivalent) in physics, University of Jena, Germany.**

Graduated under Professor Reinhard Meinel with a diploma thesis on the topic 'Constructive uniqueness proofs of stationary vacuum black hole spacetimes including the case of degenerate horizons' with final grade „sehr gut“.

## Language skills

**German:** native speaker; **English:** fluent; **Norwegian:** fluent; **French:** basic.

## Leadership experience, committee work, and institutional responsibilities

**Since 2018:** Member of the Nominating Committee of the International Society for Industrial Ecology (ISIE).

**Since 2017:** Academic director of the MSc programme 'Renewable Energy Engineering and Management', University of Freiburg

**Since 2017:** Member of the working group „Material- und Energieeffizienz“, an advisory body for German federal ministries regarding the utilisation of wood and wood products in the German economy

**Since 2016:** Member of the 'Data Transparency Task Force' of the International Society for Industrial Ecology (ISIE).

**2013-2014:** Co-organiser of the IndEcol Forum, an extracurricular activity for Industrial Ecology MSc students

**2008-2010:** Member of the board of the Industrial Ecology Programme at NTNU

**2002-2004:** Member of the board of physics students at Chemnitz University

## Dissemination and community service

+ I tweet, blog about my research, and contribute to the Wikipedia on a regular basis.

+ As a member of the 'Data Transparency Task Force' of the International Society for Industrial Ecology (ISIE), I contribute to the development of standards and best practice guidelines for data sharing as part of the peer-reviewed publication process (<https://is4ie.org/data>)

+ I regularly serve on scientific committees for academic conferences, including the Biannual International Conference of the International Society for Industrial Ecology (ISIE), the International Input-Output Conference, the International Conference on Resource Sustainability (icRS) 2018, the Bioeconomy Congress 2017, the Ecobalance conference in Japan, and the socioeconomic metabolism section conference of the ISIE.

+ I frequently (2-3 times per month) serve as reviewer for scientific journals and organisations, including Environmental Science and Technology, the Journal of Industrial Ecology, the International Energy Agency, Resources Conservation and Recycling, Nature Climate Change, the Journal of Cleaner Production, Ecological Economics, Economic Systems Research, Energy Strategy Reviews, Energy and Buildings, Transportation Research Part D, PLOS ONE, and more.

+ In 2017, I organised the 2-day “Young researcher seminar on Material Flow Analysis and sustainable material cycles” in Freiburg with 15 participants from the wider region.

+ I created and maintain the industrial ecology dashboard on GitHub, which is an inventory of open software repositories that are relevant for industrial ecology researchers. (<https://github.com/IndEcol/Dashboard>)

+ I created and maintain the industrial ecology open online course (IEooc), which is the most comprehensive collection of industrial ecology teaching material available on the web. (<http://www.teaching.industrialecology.uni-freiburg.de/>)

## Conference presentations, talks

I present posters, give presentations, and am invited for seminars and plenary talks at workshops and conferences worldwide. Conferences that I regularly attend include the biannual conference of the International Society for Industrial Ecology (ISIE), the Gordon Research Conference for Industrial Ecology, the Ecobalance conference (Japan), and the International Meeting of the Socioeconomic Metabolism Section of the ISIE.

Selected invited talks:

+ “Politische und ökonomische Steuerung nachhaltiger Stoffkreisläufe”, Plenary talk at the annual working group meeting „Operations Research in Environmental Science“ und „Supply Chain Management“ of the Gesellschaft für Operations Research e.V. (GOR) and the Netzwerk Industrial Ecology, Ulm, March 2018.

+ “Ökologische Fußabdrücke und Ressourcenrucksäcke: Wieviel Wald brauchen wir für die nachhaltige Gestaltung unserer Energie- und Materialversorgung?” Plenary talk about the Land footprint of German final consumption, given at the 37th Congress of the German forest scientists and forest associations in Freiburg, 2017

+ “Between Accuracy and Relevance on the Large Scale: How to Make IE Models Fit for the Future.” Plenary talk at the 2016 Gordon Research Conference for Industrial Ecology, Stowe, Vermont, USA.

+ “Prospective Models of Society's Future Metabolism: What Industrial Ecology has to Contribute.” Plenary talk at the 2015 Biannual Conference of the International Society for Industrial Ecology (ISIE), Surrey, UK.

## Honours and Awards

**2016 Graedel Prize of the Journal of Industrial Ecology** for the best paper published by a junior author in 2015 (DOI 10.1111/jiec.12306).

**2001-2007:** Scholarship from the German National Merit Foundation (Studienstiftung des Deutschen Volkes)

## Membership

- + International Society for Industrial Ecology
- + International Society for Ecological Economics
- + American Chemical Society

## Journal publications

### 2018

**Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations**

Stefan Pauliuk

Resources Conservation and Recycling, Volume 129, 2018, pages 81-92.

### 2017

**Industrial ecology in integrated assessment models.**

Stefan Pauliuk, Anders Arvesen, Konstantin Stadler, and Edgar G. Hertwich

Nature Climate Change 7, 2017, pages 13–20.

**Solid Waste and the Circular Economy - A Global Analysis of Waste Treatment and Waste Footprints.**

Alexandre Tisserant, Stefan Pauliuk, Stefano Merciai, Jannick Schmidt, Jacob Fry, Richard Wood, and Arnold Tukker. Journal of Industrial Ecology 21(3), 2017, pages 628-640.

**Choice of Allocations and Constructs for Attributional or Consequential Life Cycle Assessment and Input-Output Analysis.** Guillaume Majeau-Bettez, Thomas Dandres, Stefan Pauliuk, Richard Wood, Edgar Hertwich, Réjean Samson, and Anders Hammer Strømman. Journal of Industrial Ecology, in press. DOI: 10.1111/jiec.12604

**Correlation between production and consumption-based environmental indicators: The link to affluence and the effect on ranking environmental performance of countries.**

Moana Simas, Stefan Pauliuk, Richard Wood, Edgar G Hertwich, and Konstantin Stadler.

Ecological Indicators 76, 2017, pages 317–323.

**Regional distribution and losses of end-of-life steel throughout multiple product life cycles—Insights from the global multiregional MaTrace model.**

Stefan Pauliuk, Yasushi Kondo, Shinichiro Nakamura, and Kenichi Nakajima.

Resources, Conservation and Recycling 116, 2017, pages 84-93.

**Quantifying Recycling and Losses of Cr and Ni in Steel Throughout Multiple Life Cycles Using MaTrace-Alloy.**

Shinichiro Nakamura, Yasushi Kondo, Kenichi Nakajima, Hajime Ohno, and Stefan Pauliuk.

Environmental Science and Technology 51(17), 2017, pages 9469-9476.

**On the boundary between economy and environment in life cycle assessment.**

Bo Pedersen Weidema, Jannick Schmidt, Peter Fantke, and Stefan Pauliuk. *The International Journal of Life Cycle Assessment*, 2017. In press. DOI 10.1007/s11367-017-1398-4

**2016**

**Commentary: Balance issues in input–output analysis: A comment on physical inhomogeneity, aggregation bias, and coproduction.** Guillaume Majeau-Bettez, Stefan Pauliuk, Richard Wood, Evert A. Bouman, and Anders Hammer Strømman. *Ecological Economics* 126, 2016, 188-197.

**Matching global cobalt demand under different scenarios for co-production and mining attractiveness**

Alexandre Tisserant and Stefan Pauliuk. *Journal of Economic Structures* 5:4, 2016.

**Toward a Practical Ontology for Socioeconomic Metabolism.** Stefan Pauliuk, Guillaume Majeau-Bettez, Edgar G Hertwich, and Daniel B Müller. *Journal of Industrial Ecology* 20(6), pages 1260-1272.

**An Australian Multi-Regional Waste Supply-Use Framework.** Jacob Fry, Manfred Lenzen, Damien Giurco, and Stefan Pauliuk. *Journal of Industrial Ecology* 20(6), pages 1295-1305.

**2015**

**Socioeconomic metabolism as paradigm for studying the biophysical basis of human societies.**

Stefan Pauliuk and Edgar G Hertwich. *Ecological Economics* 119, 2015, pages 83–93.

**A General System Structure and Accounting Framework for Socioeconomic Metabolism.**

Stefan Pauliuk, Guillaume Majeau-Bettez, and Daniel B Müller. *Journal of Industrial Ecology* 19(5), 728-741.

**Lifting Industrial Ecology Modeling to a New Level of Quality and Transparency - A Call for More Transparent Publications and a Collaborative Open Source Software Framework.** Stefan Pauliuk, Guillaume Majeau-Bettez, Christopher L. Mutel, Bernhard Steubing, and Konstantin Stadler. *Journal of Industrial Ecology* 19(6), 937-949.

**2014**

**Global Carbon Benefits of Material Substitution in Passenger Cars until 2050 and the Impact on the Steel and Aluminum Industries.** Roja Modaresi, Stefan Pauliuk, Amund N. Løvik, and Daniel B. Müller. *Environmental Science and Technology* 48(18), pages 10776-10784.

**Dynamic Models of the Fixed Capital Stock and Their Application in Industrial Ecology.** Stefan Pauliuk, Richard Wood, and Edgar G Hertwich. *Journal of Industrial Ecology* 19(1), pages 104-116.

**The Role of In-Use Stocks in the Social Metabolism and in Climate Change Mitigation.** Stefan Pauliuk and Daniel B. Müller. *Global Environmental Change* 24, 2014, pages 132-142.

**Exploring Urban Mines: Pipe Length and Material Stocks in Urban Water and Wastewater Networks.** Stefan Pauliuk, G Venkatesh, Helge Brattembø, and Daniel B. Müller. *Urban Water Journal* 11(4), 2014, pages 274-283.

**2013**

**Carbon Emissions of Infrastructure Development.** Daniel B. Müller, Gang Liu, Amund N. Løvik, Roja Modaresi, Stefan Pauliuk, Franciska S. Steinhoff, and Helge Brattembø. *Environmental Science and Technology* 47(20), 2013, pages 11739-11746.

**The Steel Scrap Age.** Stefan Pauliuk, Rachel L. Milford, Daniel B. Müller, and Julian M. Allwood. *Environmental Science and Technology* 47(7), 2013, pages 3448-3454.

**The Roles of Energy and Material Efficiency in Meeting Steel Industry CO<sub>2</sub> Targets.** Rachel L. Milford, Stefan Pauliuk, Julian M. Allwood, and Daniel B. Müller. *Environmental Science and Technology* 47(7), 2013, pages 3455-3462.

**Steel all over the world: Estimating in-use stocks of iron for 200 countries.** Stefan Pauliuk, Tao Wang, and Daniel B. Müller. *Resources, Conservation and Recycling* 71, 2013, pages 22-30.

**Transforming the Norwegian Dwelling Stock to Reach the 2 Degrees Celsius Climate Target.** Stefan Pauliuk, Karin Sjöstrand, and Daniel B. Müller. *Journal of Industrial Ecology* 17(4), 2013, pages 542-554.

## 2012

**Moving Toward the Circular Economy: The Role of Stocks in the Chinese Steel Cycle.** Stefan Pauliuk, Tao Wang, and Daniel B. Müller. *Environmental Science and Technology* 46(1), 2012, pages 148-154.

**Reconciling Sectoral Abatement Strategies with Global Climate Targets: The Case of the Chinese Passenger Vehicle Fleet.** Stefan Pauliuk, Ni Made Arya Dhaniati, and Daniel B. Müller. *Environmental Science and Technology* 46(1), 2012, pages 140-147.

## 2010

**Iron and steel in Chinese residential buildings: A dynamic analysis.** Mingming Hu, Stefan Pauliuk, Tao Wang, Gjalt Huppes, Ester van der Voet, and Daniel B. Müller. *Resources, Conservation and Recycling* 54(9), 2010, pages 591-600.

## Other selected publications

**Nullius in Verba - Advancing Data Transparency in Industrial Ecology,** by Edgar Hertwich, Niko Heeren, Brandon Kuczenski, Guillaume Majeau-Bettez, Rupert J. Myers, Stefan Pauliuk, Konstantin Stadler, and Reid Lifset. *Journal of Industrial Ecology Forum Piece*, 2018, in press.

**Book Review of Social Ecology: Society-Nature Relations across Time and Space,** edited by H. Haberl et al. Basel, Switzerland: Springer International, 2016, 610 pp., ISBN 978-3-319-33324-3, hardcover, \$119. The review was published in the *Journal of Industrial Ecology*, 21(2), pp 432-433.

**Prospective Assessment of Society's Future Metabolism. What Industrial Ecology has to Contribute.** Stefan Pauliuk and Edgar G Hertwich. Book chapter in "Taking Stock of Industrial Ecology", Roland Clift and Angela Druckman (eds.), Springer 2016.

**Inclusion of Consumption of carbon intensive materials in emissions trading – An option for carbon pricing post-2020.** Karsten Neuhoff, Roland Ismer, William Acworth, Andrzej Ancygier, Carolyn Fischer, Manuel Haussner, Hanna-Liisa Kangas, Yong-Gun Kim, layton Munnings, Anne Owen, Stephan Pauliuk, Oliver Sartor, Misato Sato, Jan Stede, Thomas Sterner, Michael Tervooren, Ruud Tusveld, Richard Wood, Zhang Xiliang, Lars Zetterberg, Vera Zipperer. *Climate Strategies report*, 2016.

**Quantifying Impacts of Consumption Based Charge for Carbon Intensive Materials on Products.** Stefan Pauliuk, Karsten Neuhoff, Anne Owen, Richard Wood, 2016. DIW Discussion paper 1570, German Institute for Economic Research, Berlin.

**Interim report on data sources and the link of the SFA model to the EE IO framework.** Stefan Pauliuk, Sebastiaan Deetman, and René Kleijn. Deliverable D6.2 of the EU-FP7 project DESIRE (DESIRE = Development of a System of Indicators for a Resource Efficient Europe). Trondheim, Norway: Norwegian University of Science and Technology (NTNU), 2014.