



## nova-Institute's Sustainability Department

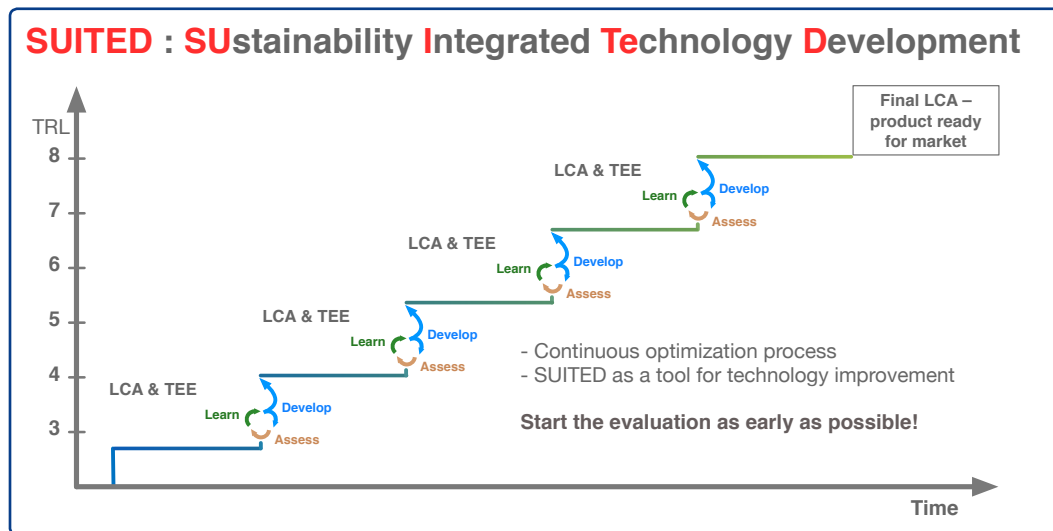


## Use our knowledge and expertise in the area of bio- and CO<sub>2</sub>-based materials and CO<sub>2</sub> fuels to your advantage!

Life Cycle Assessment (LCA) is the most reliable method to identify environmental issues within a process and verify claims of sustainability advantages. It identifies hot spots in processes, materials and products, providing a benchmark against which improvements can be measured. It provides transparent and reliable data in comparison to other products, enabling producers, providers and customers to make well informed decisions.

### Our Services:

- Tailor-made LCA and comprehensive sustainability assessments (SLCA, LCC)
- Support your technology improvement with our SUITED approach (see figure)
- Techno-economic evaluation (TEE) in line with LCA
- Sustainability optimization
- Support in developing your individual assessment methods
- Support in sustainability certification and labeling



### Our Added Value:

- Interdisciplinary team which helps you find solutions beyond sustainability: technology scouting, techno-economic evaluations and benchmarking, market research, feedstock analysis, dissemination / B2B communication and policy assessments
- Europe's biggest network in bio-based and CO<sub>2</sub> economy - we can bring you in contact with relevant/interesting research and business partners

# - Focus on Bio- and CO<sub>2</sub>-based Products

## Life Cycle Inventory data, LCAs and Meta-LCAs for different industrial customers and NGOs

BMW, Deloitte, Evonik, Ford, KPMG, LOGOCOS, Uhde-Inventa Fischer, Reifenhäuser, ESE Expert, REWE, VW and WWF.

## Selected Publications (2013 - 2017)

- **“Handlungsempfehlungen für die Durchführung von Ökobilanzen für die stoffliche Nutzung von Biomasse im Spannungsfeld der Politik - Schwerpunkt: Wirkungskategorie Klimawandel” (2017).** Liptow, C., Carus, M. Lozanovski, A., Linder, J. P., Essel, R., Albrecht, St. & M. Held. nova-Institut, Hürth. Under publication.
- **“Bio-based economy and climate change - Important links, pitfalls and opportunities” (2017).** Carus, M. Prepared for the UN Food and Agriculture Organization (FAO) nova-Institut, Hürth.
- **“Carbon Footprint and Sustainability of Different Natural Fibres for Biocomposites and Insulation Material” (2015).** Barth, M. & M. Carus. nova-Institut, Hürth. [www.bio-based.eu/ecology](http://www.bio-based.eu/ecology)
- **“Life cycle assessment of biomass-based ethylene production in Sweden - is gasification or fermentation the environmentally preferable route?” (2015).** International Journal of Life Cycle Assessment 20 (5): 632-644: Liptow, C., Tillman, A.-M. & M. Janssen.
- **“A comparative life cycle assessment study of polyethylene based on sugarcane and crude oil” (2013).** Journal of Industrial Ecology 16 (3):420-435; Liptow, C. & A.-M. Tillman.
- **“Critical aspects in the life cycle assessment (LCA) of bio-based materials - Reviewing methodologies and deriving recommendations” (2013).** In: Resources, Conservation and

Recycling 73; Pawelzik, P., Carus, M., Hotchkiss, J., Narayan, R., Selke, S., Wellisch, M., Weiss, M., Wicke, B. & M. K. Patel.

- **“Ethylene based on woody biomass—what are environmental key issues of a possible future Swedish production on industrial scale” (2013).** The International Journal of Life Cycle Assessment 18 (5):1071- 1081; Liptow, C., Tillman, A.-M., Janssen, M., Wallberg, O. & GA Taylor.
- **“A Review of the Environmental Impacts of Biobased Materials” (2012).** In: Journal of Industrial Ecology, Vol. 16, Number 51: Weiss, M., Haufe, J., Carus, M., Brandao, M., Bringezu, S., Hermann, B. & M. K. Patel.

## Projects funded by the European Commission / Horizon2020 / BBI

- **ReSolve - REnewable SOLVEnts with high performance in application and improved toxicity profile.** (06/2017 - 05/2020) (LCA, socio-economic assessment)
- **AFTERLIFE - Advanced Filtration TEchnologies for the Recovery and Later conversion of relevant Fractions from wastewater.** (06/2017 - 05/2021) (LCA, TEE, socio-economic assessment)
- **SUPERBIO - SUport and PartnERship for the developemnt of multiple sustainable and market ready value chains in the BIObased Economy.** (06/2016 - 11/2018) (all: LCA, TEE, market research and more)
- **PULP2VALUE - Processing Underutilised Low value sugarbeet Pulp into VALUE added products.** (07/2015 - 06/2019) (Niels de Beus: LCA, TEE, market research)
- **MARISURF - Novel marine derived biomolecules and industrial biomaterials.** (09/2015 - 08/2020) (Dr. Christin Liptow: LCA)




# Our Experience is Your Success




## Projects funded by the European Commission / FP7

- **MIRACLES - Multi-product Integrated bioRefinery of Algae: from Carbon dioxide and Light Energy to high-value Specialties.** (11/2013 - 10/2017) (Elke Breitmayer: LCA, socio-economic assessment)
- **MultiHemp - Multipurpose Hemp: Techno-economic evaluation, life-cycle assessment (LCA) and dissemination for the development of a multipurpose hemp.** (09/2012 - 02/2017) (Niels de Beus: LCA, TEE)

## German Research Projects

- **WeRümA - Development of materials for market-relevant applications from sugar beet pulp.** (01/2017 - 12/2020) (Elke Breitmayer: LCA, TEE).  WeRümA - Werkstoffentwicklung auf Basis von Rübenschnitzeln für marktrelevante Anwendungen.
- **CO2Lubricants - Utilization of atmospheric CO<sub>2</sub> and CO<sub>2</sub>-containing flue gases from power and combustion plants for the production of biobased lubricants.** (10/2016 - 10/2019) (Elke Breitmayer: LCA, TEE).  CO2Lubricants - Stoffliche Nutzung von atmosphärischem CO<sub>2</sub> und CO<sub>2</sub>-haltigen Rauchgasen aus Kraftwerken und Verbrennungsanlagen zur Produktion von biobasierten Schmierstoffen.
- **BioElektroPlast - Microbial Electrosynthesis for the production of Bioplastics from flue gases.** (10/2016 - 10/2019) (Dr. Christin Liptow: LCA).  BioElektroPlast - Mikrobielle Elektrosynthese zur Bioplastik Produktion aus Rauchgas.
- **ZeroCarbFP TP I<sup>1</sup> - Bioplastics - Development of biotechnological processes for the conversion of CO<sub>2</sub>-rich exhaust gas into carbon-containing valuable substances as well as into functional biomass with special biophysical properties for a direct use, for example in the mining and recycling industry.** (10/2016 - 09/2019) (Niels de Beus,

Elke Breitmayer: LCA, TEE).  Bioplastik - Entwicklung biotechnologischer Prozesse zur Umwandlung von CO<sub>2</sub>-reichem Abgas in kohlenstoffhaltige Wertstoffe sowie in Funktionale Biomasse mit speziellen biophysikalischen Eigenschaften für eine direkte Nutzung beispielsweise in der Mining- und Recyclingindustrie.

- **ZeroCarbFP TP II<sup>1</sup> - DeICE Plus - Development of biotechnological processes to produce 1,2-propanediol and a dicarboxylic acid based on crude glycerol from biodiesel production.** (10/2016 - 09/2019) (Niels de Beus, Elke Breitmayer: LCA, TEE).  DeICE Plus - Entwicklung biotechnologischer Prozesse zur Produktion von 1,2-Propandiol und einer Dicarbonsäure auf der Basis von Rohglycerin aus der Biodieselproduktion.
- **ZeroCarbFP TP III<sup>1</sup> - Green Mining - Development of biotechnological processes to produce precious and valuable metals from various substrates in the field of recycling and mining.** (10/2016 - 09/2019) (Dr. Christin Liptow: LCA).  Green Mining - Entwicklung biotechnologischer Prozesse zur Gewinnung von Edel- und Wertmetallen aus verschiedenen Substraten im Bereich Recycling und Bergbau.
- **ZeroCarbFP TP IV<sup>1</sup> - Additives - Development of biotechnological processes to produce additives and functionalized basic fluids for lubricants from industrial secondary streams such as used oil, animal fats and lignocellulose.** (10/2016 - 09/2019) (Elke Breitmayer: LCA, TEE).  Additive - Entwicklung biotechnologischer Prozesse zur Produktion von Additiven und funktionalisierten Grundflüssigkeiten für die Schmierstoffindustrie aus industriellen Nebenströmen, u.a. Altspisefette, tierische Fette, Lignocellulose.
- **ZeroCarb - Overarching Analysis of all subprograms.** (10/2016 - 09/2019) (Niels deBeus: LCA, TEE).  Übergeordnete Analyse für alle Teilprogramme.

# Life Cycle Assessments and Sustainability Evaluations - Focus on Bio- and CO<sub>2</sub>-based Products



## Sustainability Department Team

### Michael Carus, Managing Director, nova-Institut GmbH



Michael Carus studied physics and mathematics at the University of Cologne. After Carus left university in 1983, he became a tele-education teacher at the University of Tübingen, for the topics of ecology, nuclear energy and radioactivity. He worked as science journalist and as scientist at the KATALYSE Environmental Institute with a focus on energy and ecology which was followed by six years as system manager in the IT area (Tektronix GmbH) and by two years in the solar industry (Flachglas Solartechnik). In the beginning of 1993, Carus was promoted to department manager for "renewable resources" at the Cologne KATALYSE Environmental Institute.

At the end of 1994, Michael Carus and five other scientists founded the nova-Institut GmbH - nova-Institute for Ecology and Innovation. Ever since the beginning, Carus has been involved in the company as co-owner and as one of two Managing Directors. Main focus of the work are bio-based chemicals and materials with a focus on technology, markets, policy and sustainability. Today, Michael Carus is recognized as one of the leading European experts, market researchers and policy advisers for bio- and CO<sub>2</sub>-based economy. Carus is main author and co-author of many fundamental reports and policy papers concerning the bio-based economy, markets and sustainability ([www.bio-based.eu/nova-papers](http://www.bio-based.eu/nova-papers) and [www.bio-based.eu/policy](http://www.bio-based.eu/policy)).

### Elke Breitmayer



Elke Breitmayer joined the nova-Institute in 2013. She works on sustainability assessments including Life Cycle Assessments (LCA), Techno-Economic Evaluation (TEE), Socio-Economic Assessments and consumer acceptance studies. She coordinates nova's tasks within various national and international projects aiming at the development of bio- and CO<sub>2</sub>-based materials and chemicals. Within these projects she is responsible of bridging the gap between environmental sustainability and their related value chain economics.

### Background and expertise

Elke studied Agricultural Economics at the University of Hohenheim, Germany with a focus on resource economics and rural development. She started her career in the food industry where she worked in various projects as a specialist for Enterprise Resource Planning Systems. Between 2010 and 2013 she joined a team to assess environmental impacts in intensive agricultural systems in China until she became a member of the nova team. She has a broad scientific and industrial expertise in the economics and sustainability of agricultural and forest-based value chains. Moreover, she has strong knowledge on strategies to increase the resource efficient use of biomass such as the circular economy strategy and cascading use.

### Niels de Beus



Niels de Beus joined nova-Institute in 2015, his work focuses on sustainability assessment (LCA) of bio-based materials and chemicals, system analysis and modelling, and the development of assessment frameworks and decision making tools. Furthermore, his work involves the internal coordination of nova's tasks within EU and national projects and raw material research.

### Background and expertise

Niels de Beus has obtained a Master's degree in biotechnology with a specialisation in bioprocess engineering from Wageningen University. His Master thesis focussed on the modelling and optimisation of biorefineries in a Dutch agricultural system. In his work, Niels de Beus applies his expertise in modelling to perform life cycle and sustainability assessments and combine them with techno-economic and other evaluations, for example material research. This generates valuable insights into the system on multiple levels of sustainability and supports clients in decision making.

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## Dr Christin Liptow



Working at nova since November 2014, Dr Liptow's activities focus on the sustainability assessment (LCA) of bio- and CO<sub>2</sub>-based materials and chemicals - see above. Moreover, she leads several national projects and is responsible for the coordination of nova's tasks in various EU and national projects. An additional focus of Dr Liptow's work is the analysis of policies such as the EU's REDII proposal and how they affect stakeholders in the bio-based sector.

### Background and expertise

Having an engineering background (Bioproduct Technology and Process Engineering and Energy Technology), Dr Liptow received her doctoral degree from Chalmers University of Technology (Göteborg, Sweden; 2008 - 2014). The focus of her thesis was on the Life Cycle Assessment (LCA) of biomass-based chemical building blocks. Particularly she investigated the production of sugarcane and wood based ethylene produced via emerging fermentation and gasification routes.

With her expertise in LCA, one focus of Dr Liptow's work is on method development for challenges related to the LCA of CO<sub>2</sub>- and bio-based materials. Moreover, with her in-depth knowledge on the EU's RED she guides and supports customers in their RED related enquiries.

## Dr Ángel Puente



Dr Ángel Puente, M. Sc., joined nova-Institute in 2017, working in the sustainability department. With his background in Chemistry, Ángel Puente will support nova-Institute in the area of Life Cycle Assessments of bio-based chemicals and materials as well as processes. Moreover, market research and feedstock analysis are topics of his work. He is involved in various European projects on bio-based economy, such as ReSolve (Horizon2020), SuperBio (Horizon2020) and RoadToBio.

### Background and expertise

Ángel Puente studied Chemistry and completed a master in Synthetic, Industrial and Applied Chemistry at the University of Basque Country (UPV-EHU) in Spain where he also took his Ph. D. in Organic Chemistry. His dissertation was based on the design and synthesis of novel organic catalysts and their application in new catalytic and enantioselective reactions. Particularly, within green chemistry, he investigated the suitability of new organic catalysts in water-containing systems.

After receiving his doctoral degree Ángel Puente moved to Munich, Germany, to do a Postdoc in Physical Organic Chemistry. His research activities involved the quantification of the reactivity of organic substances and the investigation of reaction mechanisms. Before joining the nova-Institute in 2017, Ángel attended a Life Science Management course.

**nova-Institute** is a private and independent institute, founded in 1994; nova offers research and consultancy with a focus on bio-based and CO<sub>2</sub>-based economy in the fields of feedstock, techno-economic evaluation, markets, sustainability, dissemination, B2B communication and policy. Today, nova-Institute has 25 employees and an annual turnover of more than 2.5 million €.

**nova-Institut GmbH**  
Industriestr. 300  
50354 Hürth, Germany  
Tel: +49 (0) 2233 48 14 - 40  
Fax: +49 (0) 2233 48 14 - 50  
contact@nova-institut.de  
www.nova-institute.eu



[www.bio-based.eu/ecology](http://www.bio-based.eu/ecology)