

SUMMARY

10 years of experience in developing and executing green energy initiatives ranging from waste to energy conversion, and hydrogen and liquid fuels synthesis in US, EU, and South Asia. Diverse experience includes leading cross-functional international teams to manage ambiguous and complex carbon mitigation and waste resourcing initiatives from ideation to commissioning through rigorous lab-to-field scaling approach. Recent experience includes conducting FEED (Front End Engineering Design) analysis for medical waste to liquid fuels plants in US and EU.

PROFESSIONAL EXPERIENCE

- **Earth Engineering Center** The City College of New York
Associate Director (Full-time) *August 2020 - present*
 - **Sustainable Refinery Applications:** Executed BASF-NeoLiquid-EEC renewable feedstock initiative for sustainable fluidized catalytic cracking operations resulting in replacement of a portion of refiner's fossil inputs with mixed solid wastes. Performed business strategy analysis to show economical feasibility at \$60/bbl for pyrolysis units processing 50 tons per day.
 - **FEED pyrolysis:** Performed Front End Engineering Design for the client to convert medical waste to liquid fuels via pyrolysis, resulting in implementation of oil processing strategies to present lowest cost to plant operators, based on tipping fee contracts and end of use applications. Gasification FEED studies are on-going for pulper-tailing gasification to generate heat and electricity at the client facility.
 - **Catalyst evaluation strategy:** Estimated catalyst performance in CRU units using second order conversion in ACE reactors and developed advanced catalyst assessment methodology allowing catalyst ranking for mass production of FCC catalysts. The new technique corrected the usual modus-operandi and reduced testing quantities, thereby saving operating costs.
 - **CO₂ based equilibrium shift:** Developed nano-surfactant mediated lithium orthosilicate absorbents for high temperature CO₂ capture, and for use in steam methane reforming application for higher than equilibrium hydrogen production. Currently leading a team of researchers for reactor scaling and modular installation.
 - **Artificial Neural Network Models** - Developed deep learning models using TensorFlow API, to predict gasification and reforming derived syngas composition for a wide range of feedstock, thereby reducing the need for conducting multiple expensive experiments.

- **Department of Chemical Engineering** The City College of New York
Senior Research Associate *September 2018 - August 2020*
 - Characterizing coke formed on zeolite based catalysts in a commercial fluidized catalytic cracking unit. Identifying the nature of coke, enabled the catalyst manufacturer to tailor surface acidity and Z/M ratios to prevent hard coke yields, resulting in reduced deactivation at refineries.
 - Design and commissioning of blast chamber for Con Edison's manhole explosion prevention project resulting in re-engineering manhole lids and inclusion of perlite inserts for preventing detonation like events and power blackouts. Provided Con Edison with deeper understanding of the existing underground service system with respect to conditions which lead to explosions.
 - Successful commissioning and operation of high pressure 3 ton per day hydrothermal reactor designed for converting high moisture organic feedstock to syngas and bio-char. The HTC-gasification coupled technology enabled extraction of energy from wet carbon based waste such as agriculture and animal residue, spent grains and stillage, paper, and food waste which are widely available for the client in New York.

- **HBI-Italia & Free University of Bolzano** Italy
Chief Technical Officer & Research Associate *January 2017 - September 2018*
 - On-site monitoring of biomass gasifiers to analyze mass and energy fluxes, syngas yield and combined heat and power generation in South-Tyrol (Italy). Provide engineering solutions to reduce thermal losses and char yield.
 - Designed CO₂-air gasification system to convert carbon dioxide to syngas by operating the gasifier at carbon boundary point conditions. The research activity showed a promising route for the conversion of CO₂ to valuable fuels and chemicals, confronting the pressing problem of environmental deterioration and additionally adding revenue to the system that would otherwise disburse huge resources in merely burying CO₂.
 - Coordinate and emphasize process safety management program elements for implementing the conversion of syngas to liquid fuels in high pressure and temperature reactors.
 - Managing activities to ensure on-time, on-budget and on-quality project completion. Resolving issues and conflicts, co-ordinating project work, and periodic reporting of project status.

- **Advanced Bio-residue Energy Technology Society** India
Project Engineer *June 2015 - November 2016*
 - Designing fixed bed catalytic reactor for Fischer Tropsch synthesis and development of high temperature fuel-rich combustion method for the synthesis of Co/Al₂O₃ catalysts with reduced formation of CoAl₂O₄ species.
 - Operation and optimization of 100 kg/h throughput oxy-steam biomass gasification to generate ~ 60 Nm³/h hydrogen. Characterization of impurities in syngas and coupling syngas cleaning and cooling systems.
 - Identification of optimum steam to biomass ratio and ideal equivalence ratio for the maximum yield of syngas from agro-residue wastes and residual forest wood
 - Techno-economic analysis, to recognize the economic feasibility of waste to liquid fuel plant at a throughput of 7200 tonnes per year, with particular reference to India

EDUCATION

- **Indian Institute of Science** Bangalore, India
Doctor of Philosophy, Combustion Gasification and Propulsion Laboratory *May 2016*
Thesis: Combustion synthesized cobalt catalysts for liquid fuel generation via Fischer Tropsch reaction
- **BVB College of Engineering and Technology** Hubli, India
Master of Technology, Mechanical Engineering *May 2009*
Thesis: Numerical modelling and experimental analysis of mixed mode combustion
- **Manipal Institute of Technology** Manipal, India
Bachelor of Engineering, Chemical Engineering *March, 2007*

PEER REVIEWED JOURNAL PUBLICATIONS

- **Operation and Thermodynamic Modeling of a Novel Advanced Hydrothermal Reactor Introduction of the Novel 3-Step Evolution Model**
 Vakalis, Stergios, Snehes Shivananda Ail, Konstantinos Moustakas, and Marco J. Castaldi.
 Energies; 16(4): 2032 (2023)
- **Processing renewable and waste-based feedstocks with fluid catalytic cracking: Impact on catalytic performance and considerations for improved catalyst design**
 Mastry, Melissa Clough, Lucas Dorazio, James C. Fu, Juan Pedro Gómez, Sergio Sedano, Snehes Shivananda Ail, Marco J. Castaldi, and Bilge Yilmaz
 Frontiers in Chemistry 11:15 (2023)
- **Fuel-lean combustion synthesized cobalt catalysts for Fischer-Tropsch reaction**
 Piazzzi, Stefano, Snehes Shivananda Ail, Vittoria Benedetti, Francesco Patuzzi, and Marco Baratieri
 Catalysis Today 379:105-113 (2021)
- **Valorization of wastes from the food production industry: A review towards an integrated agri-food processing biorefinery**
 Pains, Jacopo, Vittoria Benedetti, Snehes Shivananda Ail, Marco J. Castaldi, Marco Baratieri, and Francesco Patuzzi
 Waste and Biomass Valorization:1-20 (2021)
- **Approaching a zero-waste strategy by reuse in New York City: Challenges and potential**
 Lugo, Michael, Snehes Shivananda Ail, and Marco J. Castaldi
 Waste Management & Research; (2020)
- **Investigating the feasibility of valorizing residual char from biomass gasification as catalyst support in Fischer-Tropsch synthesis**
 Benedetti, Vittoria, Snehes Shivananda Ail, Francesco Patuzzi, Davide Cristofori, Reinhard Rauch, and Marco Baratieri
 Renewable Energy 147:884-894 (2020)
- **Experimental investigations of air-CO₂ biomass gasification in reversed downdraft gasifier**
 D. Antolini, Snehes Shivananda Ail, F. Patuzzi, M. Girigiante, M. Baratieri
 Fuel; 253:1473-1481 (2019)
- **Valorization of char from biomass gasification as catalyst support in dry reforming of methane**
 Benedetti, Vittoria, Snehes Shivananda Ail, Francesco Patuzzi, and Marco Baratieri
 Frontiers in Chemistry 7:119 (2019)

- **Experimental and modeling analysis of Air and CO₂ biomass gasification in a reverse lab scale downdraft gasifier**
Antolini, Daniele, Snehash Shivananda Ail, Francesco Patuzzi, Maurizio Grigiante, and Marco Baratieri
Energy Procedia 158 (2019): 1182-1187.
- **Fuel-rich combustion synthesized Co/Al₂O₃ catalysts for wax and liquid fuel production via Fischer Tropsch reaction**
Snehash Shivananda Ail, V. Benedetti, M. Baratieri, S. Dasappa
Industrial & Engineering Chemistry Research; 57:3383-3841 (2018)
- **Fischer-Tropsch route for the conversion of biomass to liquid fuels - Technical and economic analysis**
Snehash Shivananda Ail, H S Mukunda, S Mahapatra, S Dasappa
Energy; 130:182-191 (2017)
- **Characterization of the producer gas from an open top gasifier: Assessment of different tar analysis approaches**
Dario Prando, Snehash S., David Chiamonti, Marco Baratieri, S. Dasappa
Fuel; 181:566-572 (2016)
- *Investigations into enhanced wax production with combustion synthesized Fischer Tropsch catalysts*
Snehash Shivananda Ail & S Dasappa
Energy Conversion and Management; 116:80-90 (2016)
- **Biomass to liquid transportation fuel via Fischer Tropsch synthesis—Technology review and current scenario**
Snehash Shivananda Ail, and S. Dasappa
Renewable and sustainable energy reviews 58 (2016): 267-286.

PEER REVIEWED CONFERENCE PUBLICATIONS

- **Investigations to Intensified Hydrogen Production Via Sorption Enhanced Water Gas Shift Reaction**
Snehash Shivananda Ail, Anthony Wallace, Michael Smith, Charles Coe, Marco J. Castaldi
North American Catalysis Society Meeting, New York, New York, May 22-27, 2022
- **Investigations into the catalytic cracking of pyrolysis oil obtained from plastic and biomass wastes**
Snehash Shivananda Ail, Golam Chowdhury, Marco J. Castaldi, Lucas Dorazio, Jian Shi, James Fu, and C.P. Kelkar
9th International Conference on Engineering for Waste and Biomass Valorisation, Copenhagen, Denmark, June 27-30, 2022
- **Load modulation capability of an open top gasifier by varying the second stage air flow rate**
Daniele Antolini, Snehash Shivananda Ail, Carlo Caliguri, Francesco Patuzzi, Massimiliano Renzi, Marco Baratieri
7th International Conference on Engineering for Waste and Biomass Valorization, Prague, July 2-5, 2018
- **Gasification based synchronized production of fuels and electricity from woody biomass - A techno-economic analysis**
Snehash S. Ail, Piazza S., Basso D., Patuzzi F., Kumar S., Baratieri M.
26th European Biomass Conference and Exhibition, Copenhagen, 2017, 2CV.2.22
- **Characterization of tar depositions of three commercial gasification systems**
Prando D, Snehash Shivananda Ail, Karl M, Chiamonti D, Dasappa S, Baratieri M
Proceedings of the 23rd European Biomass Conference & Exhibition, Wien (Austria), 2015: 362-365
- **Characterization of SiO₂ supported Co catalysts synthesized by solution combustion method for Fischer Tropsch synthesis**
Snehash Shivananda Ail and, S Dasappa
8th International Conference on Environmental Catalysis, Asheville-NC, USA, August 24-27, 2014
- **CO₂ capture through biomass gasification**
Sandeep K, Snehash S, S Dasappa
19th European Biomass Conference and Exhibition ISBN-10:88-89407-55-7; 1127-1133; June 2011

PATENT

- **Metal catalysts and process for the preparation of catalysts thereof**

Snehesh Shivananda Ail & S Dasappa

International patent - Publication number - WO2017094030 A3

The invention demonstrates the use of combustion synthesis procedure to develop reaction-specific tailored catalysts with high metal loadings and applicable to wide range of catalytic processes.

HONORS AND AWARDS

- **Invited Lecture:** "Upgrading pyrolysis oil derived from waste plastics – routes to realize circularity in plastics" at the Columbia Climate School, Columbia University, New York, April 14, 2023.
- **Best presentation** "Load modulation capability of an open top gasifier by varying the secondary air flow rate" at the 7th International Conference on Engineering for Waste and Biomass Valorisation (WasteEng 2018), Prague, Czech Republic, June 2 - 5, 2018
- **MHRD Fellowship:** Recipient of graduate research scholar fellowship from Ministry of Human Resource and Development (MHRD), Govt of India for pursuing Ph.D (from August 2009 - July 2014)
- **Academic Excellence:** Award for first rank in Master of Technology - Energy Systems Engineering by Visvesvaraya Technological University during the year 2007-2009.

SERVICE

- Reviewer for articles from Energy, Fuel, and Bioresource Technology
- Organized Waste-to-Energy Research Technology (WtERT) Conference in October-2022 at the Advanced Science and Research Center, CUNY, New York
- Member service to
 - American Society of Mechanical Engineers - Material and Energy Recovery Division
 - Waste to Energy Research and Technology -USA (WtERT-USA) - Associate Director
 - Catalysis Society of Metropolitan New York

ADDITIONAL INFORMATION

- Software competencies: Aspen HYSYS (Intermediate); Excel (Advanced); Origin (Advanced); Python (Intermediate)
- Chemical and material characterization using XRD, XPS, SEM/EDS, chemisorption/physisorption analyzer, GC-MS/TCD/FID, ICP-MS, MALDI-TOF