

Dr. G. Sridhar

Director General

Sardar Swaran Singh National Institute of Bioenergy

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Executive Summary

Innovative, intuitive and result driven researcher with decades of proven experience in the field of Renewable/Sustainable energy, Thermal engineering and Prime movers. Experimentalist with strong problem-solving skills and passion for technology. Skilled in establishing competency/experimental R&D test centre, technology road mapping, conceptualization, technology development, testing and field implementation of relevant and cost effective technologies for emerging markets. Excels in motivating, mentoring and working with team constituting of low to high technical skilled personnel. Areas of expertise/interest are:

- ❖ Renewable/Bio/Clean/Green Energy
- ❖ Biomass gasification – Heat/Power/CHP
- ❖ Waste-to-Electricity/Heat and thermal engineering sciences/Energy efficiency
- ❖ Advanced biomass stoves/combustors
- ❖ Engines – alternate fuels/gaseous fuels
- ❖ Value added products from biomass: Torried biomass, Activated carbon
- ❖ Established of Research lab/test centres
- ❖ Initiating new programs and mentoring
- ❖ Technology transfer & implementation
- ❖ Global/international funded projects

Professional Experience

Sardar Swaran Singh National Institute of Bioenergy
Kapurthala, Punjab, India (<https://www.nibe.res.in>)

May 2022 to Present

Currently serving as **Director General** – in the leadership role for the state-of-the-art autonomous research institution on bioenergy, established under the aegis of Ministry of New and Renewable Energy, Govt. of India.

Consultant / Program Manager

Sept 2014 to May 2022

Worked as an Independent Researcher and Program Manager for NineSigma Holdings, a multilocal Open innovation or Technology scouting company based out of Europe (Headquarters in Japan) since 2015.

Also provided Consultancy for technology initiatives undertaken by Foundations, Small entrepreneurs and Companies (Ingersoll Rand and others) on technology related matters

M S Ramaiah School of Advanced Studies,
Bangalore, India

Sept 2013 till Jan 2014

Research Professor in academic R&D. Involved in setting of research facility in the field of Energy Systems. Involved in conceptualisation & development of Prototypes, particularly on waste-to-energy including Organic Rankine Cycle based power plant. Work also involved some teaching to post graduate students.

**Siemens Corporate Research & Technologies
STSPL, Bangalore, India**

Oct 2007 to May 2013

Served in the role of *Senior Member Technical Staff* in a corporate R&D initiative in the area of decentralized or distributed power generation technologies. Responsible for technical and project management of biomass program, realizing the objectives laid out in the technology roadmap. The work largely involved conducting research, technology development (from concept to working prototype) and testing of prototypes meant for power generation using biomass fuel and hybrid system with solar energy. Major highlights/achievements are:

- ❖ Conceiving and establishment of competency centre in biomass energy at Siemens. Setting up of state-of-the art R&D test facility at Bangalore.
- ❖ Laid out the technology roadmap based on the gaps and opportunities in the emerging markets
- ❖ Involved in technology development – for example developing state-of-the art gas cleaning system, combustor for Stirling engine, fuelling components/control system for gas engines. Involved right from conceptualization, establishing proof of concept, prototype development, testing and validation using computation tools such as CFD.
- ❖ Experienced in working with global teams of Siemens in new technology development.
- ❖ Planning, execution, mentoring of team members/interns, project management, exploring collaborating opportunities with research institutions in India/overseas and identifying topics of future research work (open innovation).

**Karnataka State Council for Science & Technology
Bangalore, India**

1992 to 2007

Served as *Project Engineer*, with posting at Combustion, Gasification and Propulsion Laboratory, Indian Institute of Science, Bangalore. Also worked on deputation as *Senior Scientific Officer*, Centre for Sustainable Technologies, Indian Institute of Science, Bangalore for 8 months duration. Worked on large number of R & D projects funded by federal agencies such as Ministry of New and Renewable Energy, Department of Science and Technology, Government of India. Expertise gained in the domain of biomass combustion, gasification, prime movers such as dual-fuel engines, gas engines, stirling engine and micro gas turbine. Involved in all aspects of experimental research such as conducting fundamental research, conceptualizing technologies/products, technology development, testing as per protocols, technology transfer and field implementation. A few of the contributions are highlighted.

- ❖ Design, development and testing of biomass gasifiers from 5 kWe to 1.5 MWe capacities for a variety of feed stocks and application – rural electrification, industrial captive heating/electricity, grid-linked independent power producer.
- ❖ Testing of biomass gasifier along with the Swiss scientists in India and Switzerland. Commissioned systems in Switzerland, Chile, Japan and Thailand.
- ❖ Development and testing of High pressure gasifier (5 atm) along with 32 kWe Rovers Gas turbine. The work involved redesigning of fuel injector to inject producer gas into the combustion chamber of the gas turbine.
- ❖ Involved in technology transfer activity – technical support to Licensees both in India and Overseas.
- ❖ Involved in approval/certifying of a large number of field implemented systems for grant of subsidy under federal government program (MNRE biomass gasification program).
- ❖ Design, development and testing of fuel efficient biomass stoves for cooking, heating and industrial applications. Worked with British Petroleum in product development and implementation of a cost effective and efficient biomass cook stove – URJA.
- ❖ Research and developmental work related to producer gas engine. Developed gas fuelling system (gas carburetor) for producer gas fuel.
- ❖ Worked with various engine manufacturers on producer gas engine development (1 to 250 kWe) – Greaves, Kirloskar, Cummins etc. Extensively involved with Cummins in conversion/adaptation of natural gas engine for producer gas operation; joint testing and field implementation, periodic monitoring and inspection.
- ❖ Evaluation of performance of small capacity diesel engine using alternate non-edible oils such as Jatropha, Pongamia and Mahua.
- ❖ Providing training to national and international participants in the area of bio-energy and gas engines.

Supervision

Supervised over 20 batches of under-graduate Engineering student and five Master degree students +
Mentored six Dual Degree student (internship)

Publications

Over 60 publications including books, reports, patents and others

<https://scholar.google.com/citations?user=6xslacoAAAAJ&hl=en>

Major Achievements/Credits

- ❖ Team member that was awarded the FICCI annual award for outstanding achievement in Science & Technology (2005)
 - ❖ Technical partner for the Bioenergy Project for Rural India (BERI), a UNDP project implemented successfully in Karanataka, India.
 - ❖ Peer reviewer for international journals such as Journal of Power & Energy, Journal of Automobile Engg, Biomass & Bioenergy, Energy Conversion & Management etc
 - ❖ Peer reviewer for international conferences such as European biomass conference, IEEE conference on sustainable energy technologies.
 - ❖ Merit/appreciation awards at Siemens
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Education

Indian Institute of Science, Bangalore, India
PhD, Faculty of Engineering

College of Engineering, Osmania University
BE, Mechanical Engineering

Personal Details

Age	56 yrs
Marital Status	Married, with one child
Permanant Address	Seshasayee, 444, VI Main, II Cross, Basaweshwar Nagar III Stage, III Block, Bangalore 560 079, India Tel: +919972598204 E-mail: gururajaraosridhar@gmail.com ; srigrao14@gmail.com

Notable Contributions related to IC engines

- ❖ Systematic investigation of spark ignited engine operation using producer gas at varying compression ratios. The work involved in-cylinder pressure data acquisition, overall energy balance and emission measurements. Parametric studies were conducted with respect to identifying of optimum ignition timing and air-to-fuel ratio for maximum power output.
- ❖ Design, development and testing of gas carburetor for low energy density gas ~ biomass derived producer gas.
- ❖ CFD studies related to in-cylinder fluid flow (non reacting flow) in high compression ratio reciprocating engine over a complete engine cycle. The study revealed the complexity of fluid flow during squish/reverse squish time period.
- ❖ Computation of laminar burning velocity for producer gas + air mixture at typical engine conditions using in-house developed code. This work revealed the effect of pressure, temperature and recycled gas on laminar burning velocity.
- ❖ Formulated a Zero-dimensional code for engine cylinder pressure calculation over a complete engine cycle. This code has been validated against experimental pressure-time curves recorded on engine combustion chamber geometries (two engines) operating with producer gas fuel at varying compression ratio, ignition timing and fuel-air equivalence ratio. This code is suitable for prediction of engine power output for certain combustion chamber geometries.
- ❖ Dynamic simulation of producer gas engine operation using mean valve engine model.
- ❖ Adaptation of Cummins natural gas engine for producer gas operation; joint testing and field implementation, periodic monitoring and inspection along with Cummins India Ltd.
- ❖ Development and testing of High pressure gasifier (5 atm) along with 32 kWe Rovers Gas turbine. The work involved redesigning of fuel injector to inject producer gas into the combustion chamber of the gas turbine. With the redesigned fuel injector, the gas turbine was successfully operated using producer gas.
- ❖ Evaluation of performance of dual-fuel engines - in terms of maximum diesel substitution and emissions (engine capacities between 5 kWe and 600 kWe)
- ❖ Evaluation of performance of small capacity diesel engine using non-edible oils such as Jatropha, Pongamia and Mahua.

Notable Contributions related to bio-energy

- ❖ Design, development and testing of biomass gasifiers from 5 kWe to 1.0 MWe capacity for a variety of feed stocks. This is an on-going exercise wherein there is constant improvement in the product based on the feed back from the field installations.
- ❖ Experimental investigations on Stirling engine for the possibility of using heat by combusting producer gas in a cyclone combustor.
- ❖ Design, development and testing of Cyclone combustor (Patent pending) that can combust un-cleaned producer gas for power generation/thermal requirement. Successfully tested and achieved a peak flame temperature of more than 1200 C. The trials were carried out in a well instrumented test rig.
- ❖ Development of state-of-the-art gas cleaning system such as wet Electro-static precipitator (Patent pending) for cleaning of producer gas.

- ❖ Design, development and testing of auto-start system (Patent pending) for producer gas engine.
- ❖ Testing of 75 kg/hr biomass gasifier along with the Swiss scientists in India and Switzerland.
- ❖ Design and Development and testing of Cyclone gasifier for pulverized biomass fuels for power generation application.
- ❖ Research and developmental work related to producer gas engine. Apart from basic research involved in adaptation and testing of engines between 1 kWe and 250 kWe capacity. Developed gas fuelling system (gas carburetor) for producer gas fuel.
- ❖ Design, development and testing of fuel efficient biomass stoves for cooking, heating and industrial applications.
- ❖ Involved in technology transfer activity – technical support to Licensees both in India and Overseas.
- ❖ Providing training to national and international participants in the area of bio-energy and gas engines.

Publications in International Journals

1. *G. Sridhar*, P.J. Paul and H.S. Mukunda, Biomass Derived Producer Gas as a Reciprocating Engine Fuel – An Experimental Analysis, *Biomass & Bioenergy*, Vol. 21, 2001, pp. 61-72.
2. S. Dasappa, H. V. Sridhar, *G. Sridhar*, P. J. Paul, H. S. Mukunda, Biomass gasification – a substitute to fossil fuel for heat application, *Biomass and Bioenergy*, Vol 25, 2003, pp 637-649.
3. *G. Sridhar*, P.J. Paul and H.S. Mukunda, Simulation of fluid flow in high compression ratio reciprocating IC engine, *Journal of Power & energy*, Part A, Proc. Instn. Mech Engrs Vol 218, 2004, pp – 403-416.
4. *G. Sridhar*, H.V. Sridhar, S. Dasappa, P.J. Paul, N.K.S. Rajan and H.S. Mukunda, Development of Producer Gas Engines, *Journal of automobile engineering*, Part D, Proc. Instn. Mech Engrs, Vol. 219, 2005, pp – 423-438.
5. *G. Sridhar*, P.J. Paul and H.S. Mukunda, Computational Studies of Laminar Burning Velocity of a Producer Gas and Air Mixture at typical Engine Conditions, *Journal of Power & energy*, Part A, Proc. Instn. Mech Engrs Vol 219, No. 3, 2005, pp – 195- 202.
6. *G. Sridhar*, P.J. Paul and H.S. Mukunda, Zero-Dimensional Modeling of Producer Gas Based Reciprocating Engine, paper accepted for publication in the *Journal of Power & energy*, Part A, Proc. Instn. Mech Engrs, Vol. 220, No. 8, 2006, pp. 923-932.
7. Sharma Monikankana, H.S. Mukunda and *G. Sridhar*, Solid fuel block as an alternate fuel for cooking and barbecuing: Preliminary results, *Energy Conversion and Management*, Vol. 50, Issue 4, April 2009, pp. 955-961.
8. S. Dasappa, H. V. Sridhar, *G. Sridhar*, P. J. Paul, Science and technology aspects of bio-residue gasification, *Biomass conversion and biorefinery*, Vol 1, No. 3, 121-131, 2011
9. S. Dasappa, *G. Sridhar*, P. J. Paul, Adaptation of small capacity natural gas engine for producer gas operation Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science June 2012 226: 1568-1578.
10. Amit Kumar Singh Parihar, Chandrasekhar Joshi, *G. Sridhar*, The performance of cyclones in producer gas cleaning: experimental and modeling studies Proceedings of the Institution of

Mechanical Engineers, Part A: Journal of Power and Energy Journal of Power and Energy Volume 226 Issue 6, September 2012, pp. 776-793.

11. Vinayak B Kulkarni, Amit Kumar Singh Parihar, *G. Sridhar*, Gasification of high and low density agro wastes, Journal of Technology Innovations in Renewable Energy, 2013, Vol. 2, pp. 376-387.
12. Arpit Jain, *G. Sridhar*, Dynamics of Producer Gas Engine Operation, Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy, Vol. 228(5) 563–573, April 2014
13. Srinivasan Dattarajan, Ramsatish Kaluri, *G. Sridhar*, Development of combustor to burn raw producer gas, Fuel Processing Technology, 126 (2014), 76-87.
14. Amit Kumar Singh Parihar, Thomas Hammar, *G. Sridhar*, Development and testing of tube type wet ESP for producer gas cleaning, International Journal of Renewable Energy, 2015, 74, 875-883.
15. Amit Kumar Singh Parihar, Thomas Hammar, *G. Sridhar*, Development and testing of plate type wet ESP for producer gas cleaning International Journal of Renewable Energy, 2015, 77, 473-481.

Publications in National Journals

1. *G. Sridhar*, H. V. Sridhar, S. Dasappa, P. J. Paul et al, Case studies on small scale biomass gasifier based decentralized energy generation systems, pp. 17 -25, Vol. I, March 2007.
2. S. Dasappa, P. J. Paul, N. K. S. Rajan, H. S. Mukunda, *G. Sridhar*, H.V. Sridhar, Biomass gasification technology – a route to meet energy needs, Current Science, Vol. 87, No. 7, 2004, pp – 908-916.
3. *G. Sridhar*, H. V. Sridhar, S. Dasappa, P. J. Paul, N. K. S. Rajan, U. Shrinivasa, H. S. Mukunda., Technology for gasifying pulverised biofuels including agricultural residues, Energy for Sustainable Development, pp. 9 -18, Vol.III, no. 2, 1996.

Publications in National & International conferences

1. Arpit Jain, *G. Sridhar*, Simulation of Producer gas engine operation, , 20th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Milan, Italy, June 2012.
2. *G Sridhar*, Experimental and Modeling Aspects of Producer Gas Engine, IEEE ICSET 2008 CONFERENCE, SMU Conference Centre, Singapore 24 – 27 November 2008.
3. *G Sridhar*, S Dasappa, H V Sridhar, P J Paul, and N K S Rajan, Green Electricity – a case study of grid linked independent power producer, 15th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Berlin, Germany, May 2007.
4. *G Sridhar*, H V Sridhar, S Dasappa, P J Paul, D. Subbukrishna and N K S Rajan, Green Electricity from Biomass Fuelled Producer Gas Engine, 14th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Paris, France, October 2005.

5. *G. Sridhar*, S. Dasappa, H.V. Sridhar, P.J. Paul and N.K.S. Rajan, Gaseous Emissions Using Producer Gas Fuel in Reciprocating Engines, paper no. 2005-01-1732, Proceedings of SAE centenary conference (SP- 1978), held at Detroit 10-14 April 2005.
6. S. Dasappa, *G. Sridhar*, H.V. Sridhar, P. J. Paul, H. S. Mukunda, On the advances in thermo chemical conversion technology, Proceeding of the 2nd world conference on biomass for energy, industry and climate change, held at Rome, Italy, 10-14 May 2004.
7. H. V. Sridhar, *G. Sridhar*, S. Dasappa., N. K. S. Rajan, P. J. Paul, H. S. Mukunda, Experience on use of biomass gasifiers in crumb rubber industries, Proceedings of the national conference on advances in mechanical engineering held at Shimoga, Karnataka, 12-14 February 2004.
8. H. V. Sridhar, *G. Sridhar*, S. Dasappa., N. K. S. Rajan, P. J. Paul, H. S. Mukunda, Field experience of IISc gasification systems, Proceeding of the seminar on biomass gasifiers, Rubber Board, Kottayam, 2003.
9. *G. Sridhar*, P.J. Paul and H.S. Mukunda, Experiments and Modelling of Producer Gas based Reciprocating Engines, Proceedings of the 2002 Fall Technical Conference of the ASME Internal Combustion Engines Division, held at New Orleans, Louisiana, USA, Paper No. ICEF2002-520, ICE-Vol. 39, 2002, pp. 377-388.
10. M. Jayamurthy, S. Dasappa, P. J. Paul, *G. Sridhar*, H. V. Sridhar, H. S. Mukunda, N. K. S. Rajan, C Barge, T Liliedahl, K. Sjostrom., Tar characterisation in new generation agro-residue gasifiers - cyclone and downdraft open top twin air entry systems, Biomass Gasification and Pyrolysis, State of the art and future prospects, pp. 235--248, CPL Press, 1997.
11. H. S. Mukunda, S. Dasappa, P. J. Paul, N. K. S. Rajan, U. Shrinivasa, *G. Sridhar*, and H. V. Sridhar, Fixed bed gasification for electricity generation, Biomass Gasification and Pyrolysis, State of the art and future prospects, pp. 105--116, CPL Press, 1997.
12. *G. Sridhar*, G. A. Rakesh, J. Srinivasan, S. Dasappa, P. J. Paul and H.S. Mukunda, Experimental studies on the performance of Hamara ST-5 Stirling engine and possibilities for performance improvement, Fourth National Conference on Biomass Gasification, Baroda, Jan 1993.

Books

1. *G. Sridhar* and Ravindra Babu Yarasu (2010). Facts about Producer Gas Engine , Paths to Sustainable Energy, Jatin Nathwani and Artie Ng (Ed.), ISBN: 978-953-307-401-6, InTech, Available from: <http://www.intechopen.com/articles/show/title/facts-about-producer-gas-engine>
2. Biomass to Bioenergy, The Science and Technology of the IISc bio-energy systems, ABETS, IISc, Bangalore, 2003, pp 154.

Posters, Reports & Others

1. *G Sridhar*, DN Subbukrishna H V Sridhar, S Dasappa, P J Paul, and H S Mukunda, Torrefaction of Bamboo, 15th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Berlin, Germany, May 2007.
2. S Dasappa, *G Sridhar*, H V Sridhar, N K S Rajan, P J Paul, A. Upasani, Producer gas engines – proponent of clean energy technology, 15th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Berlin, Germany, May 2007.
3. H V Sridhar, *G Sridhar*, S Dasappa, P J Paul, and H S Mukunda, On the operation of high pressure biomass gasifier with gas turbine, 15th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Berlin, Germany, May 2007.

4. *G Sridhar*, D N Subbukrishna H V Sridhar, S Dasappa, P J Paul, and H S Mukunda, Torrefaction of Bamboo, 15th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Berlin, Germany, May 2007.
5. H V Sridhar, *G Sridhar*, S Dasappa, N K S Rajan and P J Paul, Experience Of Using Various Biomass Briquettes In IBG (IISc Bioresidue Gasifier), Proceedings of 14th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Paris, France, October 2005.
6. Sharma Monikankana, H.S. Mukunda and *G. Sridhar*, Experimental Studies on Combustible Fuel Block Strategy For Cooking, Experimental Studies On Combustible Fuel Block Strategy For Cooking, Proceedings of 14th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Paris, France, October 2005.
7. P J Paul, S Dasappa *G Sridhar*, H V Sridhar, Biomass derived energy carriers as fuels in engines and fuel cells, published in Biomass based decentralized power generation, published by Sardar Patel Renewable Energy Research Institute, Vallabh Vidyanagar, 2005
8. Completion of Advanced biomass gasification report for MNES – 2004
9. Long duration qualification and testing of Cummins gas engines – 2002
10. Report on testing of bamboo in open top gasifiers –prepared for NMBA, TIFAC, DST – 2003.
11. Testing of biomass briquettes in open top down draft gasifier -1998/99.
12. Adaptation of IISc-Dasag Gasifier for application in Switzerland, prepared for Swiss Federal Office of Energy, Switzerland, 1997.
13. Experience on testing of IISc-DASAG open top wood gasifier in Switzerland, published in Bun-India Newsletter, Vol. 1.2, Dec 1996.
14. Investigation of Producer gas fuelled spark ignition engine at High compression ratio, internal report, 1997.
15. Evaluation of performance of biogas fuelled gas engines (1 MWe unit) at Ugar Sugar Ltd, Belgaum.
16. Biomass assessment for Malavalli power project in Mandya district, Karnataka, KSCST report, 1996.
17. Evaluated over half a dozen biomass gasifiers in connection the granting of central financial assistance scheme of MNES, Govt of India.
18. A number of technical proposals, internal project documents, annual reports and project completion reports.
19. Participation in popularizing the use of biomass among school and college students in Karnataka called “REACH”.
20. Report on the gasifier tests by Indian Institute of Science-Swiss team, internal report, 1994.
21. A no. of comprehensive internal test reports including technical paper in in-house magazine at Siemens: 2008-2013

Patents/Intellectual Property

Patents Granted (G. Sridhar is a Co-inventor with Indian Institute of Science as Assignee)

1. CN Technology for cleaning Tar and Dust Laden Gases for use in reciprocating Engines/Gas Turbines for Power Generation, Indian Patent Granted no. 215917
2. Biomass Gasifier – Switzerland, SWISS PATENT GRANTED NO. 693929, April 30, 2004
3. IISc Advanced Biomass Cook Stoves, Indian Patent Granted No. 229283

Patent Application Filed: (G. Sridhar is a sole/Co-inventor with SIEMENS AKTIENGESELLSCHAFT as Assignee)

1. Enriched gasification process technology for agro-residue (901/KOL/2010, 2010.08.12)
2. Integrated cyclone and rotary gasification for (201108560 IN)
3. Self-fuelled black start solution for a biomass gasifier (EP 10167318.4, 25.06.2010)
4. Low energy density fuel gas feed control system (787/KOL/2013, 2013.06.28)
5. Sub-Atmospheric combustion system for dust and tar laden gases (197/KOL/2013, 2013.02.21)
6. Cyclone combustor for producer gas laden with tar and particulate matter (429/KOL/2013, 2013.04.17)
7. Compact and hybrid gas cleaning unit based on electrostatically assisted inertial separation (PCT/EP2011/055839, 2011.04.13)
8. Compact and Hybrid gas cleaning system (32/KOL/2011, 2011.01.11)
9. Plate type ESP for fuel gas cleaning applications (PCT/EP2011/070251, 16/11/2011)

Accomplishment & Overseas Visits

- ❖ Switzerland in the year 1996 in connection with the installation, commissioning & testing of 75 kg/hr gasifier. The gasifier system was built and shipped from India. The project was sponsored by the federal govt. of Switzerland.
- ❖ Chile in the year 1999 in connection with the installation and commissioning of a 50 kWe gasifier system on a remote un-electrified island. The project was sponsored by UNDP, Chile.
- ❖ Japan in the year 2003 in connection with testing of gasifier and consultancy to gasifier licensee.
- ❖ Visited Rome (2004), Paris (2005), Germany (2007), USA (2008), Singapore (2008), Italy (2012) for attending international conference on biomass for presentation of paper/s.
- ❖ Thailand in the year 2006 in connection with testing and assessment of a state-of-the-art gasification technology power plant working on rice husk briquette
- ❖ A no. of visits to Germany, Italy, USA and other European countries in connection with technology opportunities
- ❖ As part of high level delegation on Knowledge Exchange Tour on Green Hydrogen to Europe (September 2022)