



A Compendium of Clean Technology Innovations in India

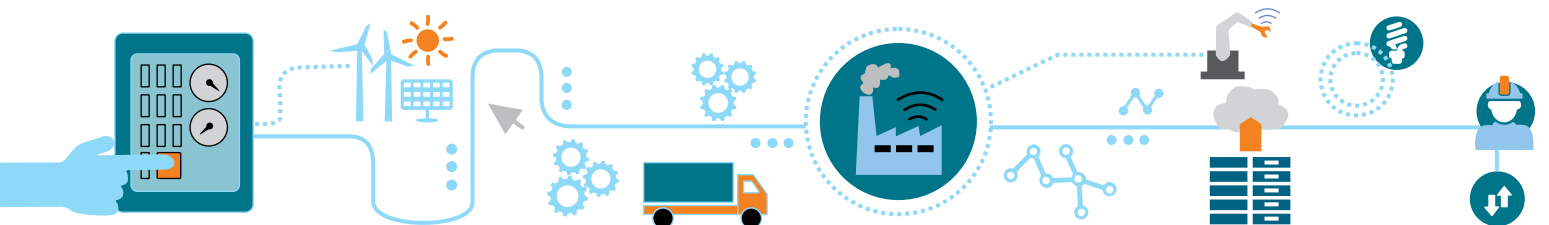


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A Compendium of Clean Technology Innovations in India



Introduction



The Indian government while giving high priority to economic development of the country has taken a considerate approach towards international climate negotiations to safeguard its own growth aspirations while contributing to address climate change concerns. India has taken steps to lower its greenhouse gas emissions trajectory by investing in renewable energy, implementing energy efficiency to reduce end-use energy consumption in industries and cities. Against this backdrop, the emergence of innovative clean technology solutions provides next logical step to advance towards emission reduction goals. Clean technology innovations are emerging as new areas for job creation and important environmentally benign solutions emerge across different sectors to fulfil the country's growth aspirations.

As UNIDO promotes inclusive and sustainable industrial development among its member states, innovations in clean technologies assume importance as low-cost solutions can help to overcome local constraints especially in developing countries. Over the past several years, the continued partnership between the Government of India and UNIDO has facilitated growth of industry, energy and environmental sectors in India. As India's

economy continues to grow the focus shifts towards increasing the efficiency in industrial production and using energy and resources more efficiently in an environment friendly way. UNIDO's activities in India are helping the government to explore and develop alternate and clean energy supply options for industrial applications.

The Global Cleantech Innovation Programme (GCIP) jointly implemented by UNIDO and the Government of India's Ministry of Micro Small and Medium Enterprises, deserves widespread recognition for having identified innovations that make significant contributions to saving energy and water and reducing emissions of greenhouse gases. A short description of select clean technology innovations included in this report provides just a first glimpse of the richness of solutions pursued by innovative Indian. A few amongst these are disruptive innovations that have potential to make noticeable impact from large scale deployment. Thus, concerted efforts are needed to allow scale-up of innovations by creation of an ecosystem that would support the startups and help in commercialization to help the country advance towards climate change and sustainable development targets.



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भारत सरकार
सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES



Message

Micro, Small and Medium Enterprises (MSMEs), including start-ups, are driving cleantech innovation. Accordingly, they are the prime targets for clean technology innovation ecosystem support. In India, 63.3 million MSMEs employ over 110 million people while contribute 28.77 per cent to the country's Gross Domestic Product (GDP). They face numerous challenges in accessing clean technologies which could enhance their efficiency, competitiveness and long-term sustainability, and in developing and selling their innovations. They also require mentoring, guidance and financial support to overcome these challenges.

The Ministry of Micro, Small and Medium Enterprise (M/o MSME) has provided collaborative support to the Global Cleantech Innovation Programme, which was implemented from 2013 to 2017. The GCIP experience in India demonstrated that various indigenous clean technology innovations bring tangible benefits to energy and environmental issues at a local level. These innovations can provide solutions that help advance government's key initiatives like 'Start-up India', 'Make in India', 'Atal Innovation Mission' and 'Swachh Bharat Mission'.

I understand that the GCIP programme identified and built capacity of 84 start-ups in clean technologies covering areas of energy efficiency, renewable energy, water and waste beneficiation. These cleantech start-ups have demonstrated strong credentials by winning at the GCIP global competitions held in the US in 2016, 2017 and 2018.

With encouraging outcome from the UNIDO-led GCIP in India, the Ministry of MSME looks forward to further collaborating with UNIDO for promotion of Clean Technologies in areas such as agriculture and food value chains, chemicals, textile sectors, sustainable cities, circular economy etc.

New Delhi
07.07.2018


(Ram Mohan Mishra)

Foreword



Over the past decades, the partnership between the Government of India and the United Nations Industrial Development Organisation (UNIDO) has evolved to strengthen the country's industrial,

energy and environmental sectors. The adoption of the Sustainable Development Goals by the global community in 2015, specifically SDG9 (industry, infrastructure and innovation) encouraged UNIDO to assist its developing country member states with transition towards Inclusive and Sustainable Industrial Development.

In 2011, UNIDO, with the support of the Global Environmental Facility (GEF) successfully implemented the 'Greening the COP17' project. This paved the way for UNIDO to implement Global Cleantech Innovation Programme (GCIP) in eight countries with the support of GEF. In India, GCIP was launched in May 2013 in partnership with the Ministry of Micro, Small and Medium Enterprises (MSME). Over the past five years, GCIP India received the attention of more than 750 innovators in clean technology (cleantech) and involved more than 100 stakeholders in programme implementation. Cleantech Open, a US based not-for-profit organization served as knowledge partner, provided accelerator training to cleantech entrepreneurs to develop viable business plans and reduce the likelihood of the failures.

GCIP India has been successful in promoting innovators of cleantech startups that have commercialized their innovative clean technology solutions. It did hand-hold innovators during commercialization phase which has helped the innovators to grow and sustain their businesses. UNIDO is pleased to have grown a team of motivated cleantech entrepreneurs and stakeholders, ready to further expand the cleantech sector in India.

The active interest taken by the Ministry of Micro, Small and Medium Enterprises in the programme implementation demonstrates Government of India's keen interest to facilitate cleantech innovations. Cleantech solutions supported through GCIP in India are now available in the market and are gradually getting deployed in industrial, commercial and residential sectors as the awareness grows. Stakeholders of GCIP India are convinced that sustained and proactive support for cleantech innovations by industries and businesses will encourage the young entrepreneurs to develop more cleantech solutions.

GCIP has demonstrated that innovative clean technology solutions are effective to address local energy and environmental challenges in developing countries. Many of these innovations can also help to advance towards the Sustainable Development Goals. Indeed, clean technology innovation is an unique opportunity to fast-track often low-cost solutions for developing countries to tackle climate change and advance the sustainable development goals at large.

As the 4-years of GCIP-India has come to a close, this compendium reflects upon the achievements and learnings. It includes the profiles of 26 clean technology entrepreneurs who with the support from GCIP have entered the market with their innovative solutions that reduce energy consumption, waste generation and greenhouse gas emissions. These 26 innovators set out to mitigate climate change yet succeeded to provide much wider contributions to the Sustainable Development Goals. These encouraging results from GCIP India warrant continuation of a Clean Technology Innovation initiative based on close engagement with local government and industries to create an innovation ecosystem that sustains and rapidly deploys cleantech solutions in the market.

Rene Van Berkel

UNIDO Representative

UNIDO Regional Office in India



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Abbreviations and Acronyms



Cleantech	Clean Technology
CSIR	Council for Scientific and Industrial Research
CTO	Clean Tech Open (a US based accelerator programme)
DIPP	Department of Industrial Policy and Promotion
DST	Department of Science and Technology
EE	Energy Efficiency
FICCI	Federation of Indian Chamber of Commerce and Industries
GCIP	Global Cleantech Innovation Programme
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
GOI	Government of India
IFC	International Finance Corporation
INR	Indian Rupees
IoT	Internet of Things
IT	Information Technology
MSME	Micro, Small and Medium Enterprises
MoMSME	Ministry of Micro, Small and Medium Enterprises
MNRE	Ministry of New and Renewable Energy
NDC	Nationally Determined Contribution
NITI Aayog	National Institution for Transforming India
NRDC	National Research and Development Corporation
PMU	Project Management Unit
RE	Renewable Energy
SDG	Sustainable Development Goal
SIDBI	Small Industries Development Bank of India
SME	Small and Medium Enterprises
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
VC	Venture Capital (fund)



Executive Summary



UNIDO launched the Global Cleantech Innovation Programme in India (GCIP India) in cooperation with the Ministry of Micro, Small & Medium Enterprises (MSME) in May 2013. The programme supported by the Global Environment Facility (GEF) was implemented by UNIDO with support of Cleantech Open (CTO), a USA-based accelerator programme which served as the 'knowledge partner'. Annual innovation competitions were conducted to select startups and entrepreneurs with promising cleantech innovations. The most promising technologies and entrepreneurs received a suite of support including training by Cleantech Open on business development, tailored mentoring from technical and business specialists, intensive review of business plan and strategy to enter the market and sustain and grow business. The startups received hands on training to present innovation and viable business plan to raise funds and launch their product and service in the market.

Between 2014 and 2017, GCIP India held four annual competitions, and received more than 700 applications. A total of 84 small businesses and entrepreneurs who qualified the selection process benefitted from the programme's support.

GCIP's emphasis on market research, business development and financial modelling rather than technology validation or technical development was considered valuable and distinctly different by the participants, who had access to other business incubators and accelerators within India. GCIP India's thematic focus on cleantech – particularly energy efficiency, renewable energy, water efficiency and waste beneficiation - and its support for innovations in businesses with capital-intensive, high startup costs also addressed a gap evident across comparable initiatives. GCIP has been found to be highly relevant to the needs of cleantech startups, and as highlighted in this document,

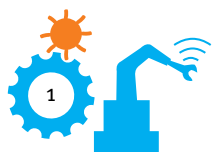
these innovations are relevant to the Government of India's national missions and to the global sustainable development goals.

GCIP was aligned with and relevant to the GEF's operational modalities for Public Private Partnership Programs. The GCIP's hand holding efforts are best described through GEF's guidance on eligible projects that: *“provide support for entrepreneurs and innovators seeking to establish a commercial venture... by specifically encouraging SMEs to expand in green and clean technologies to secure national competitiveness in a global 21st century economy”*.

This compendium takes stock of key achievements of the programme. The GCIP India entrepreneurs went on to win Global Cleantech Innovation Awards and



84 Cleantech Innovators came from 41 cities



thematic awards for energy efficiency, renewable energy and waste beneficiation. This encouraging outcome justifies continued support for innovation allowing the startups room to sustain and scale-up and widen the scope and reach of innovation to other sectors of the economy.

About GCIP India

GCIP was designed to work with emerging cleantech startups through a dominant ‘Accelerator Programme’ through which the selected innovators are trained, mentored, and connected to potential investors, customers and partners. The GCIP programme thus helped innovators with proven product prototypes to seed these in market-ready startup businesses attractive to clients and investors.

GCIP India was one of the few ‘accelerator’ programmes in India that focused exclusively on startups in the area of clean technologies. The programme’s emphasis on ‘softer’ aspects such as business model development, market segmentation, and financial projections, helped participants to recognise and address critical barriers to the commercialisation of their products which requires capital to setup a production line at a reasonable scale to introduce the product in the market. GCIP’s

focus on the cleantech sector was unique and is further differentiated by its emphasis on business development and only participants were selected that had already technically validated their product. Most of the cleantech innovations have strong intellectual property and many have filed or received patents.

About 100 stakeholders were directly associated with GCIP India as mentor; screening committee member; judge; jury; and investor. Cleantech Open delivered through a 2-day in person National Workshop followed by a weekly 1-hour webinar to the entrepreneurs. All through the programme the startups were trained on areas critical to grow the business around the innovation. Each stakeholder, who came from academia, industry, government, financial institution and investor community, on an average devoted 4½ working days of their time to GCIP while each entrepreneur received 22½ hours of dedicated attention from mentors, judges, jury and investor in addition to weekly 1-hour training sessions of CTO.

The accelerator gradually built the capacity of novice cleantech entrepreneurs who are often equipped with strong technical skills and impressive academic qualifications, through training and mentoring over 4 months to develop a clear business strategy and



GCIP-India Accelerator Cycle





GCIP helped to crystallize investments in cleantech startups

avoid common pitfalls which the startups otherwise are susceptible to. The training delivered was successfully internalized by most entrepreneurs who went on to launch their product. An all-round effort by Cleantech Open and the stakeholders has been to see the startups succeed in their endeavours, bring innovations in the market and scale-up their businesses. A few competed internationally at the annual Global Forum and won the Global Cleantech Innovation Award in 2015, 2016 and 2017. Building a realistic business plan around a sound technical innovation helped GCIP trained entrepreneurs to receive over US \$7 million in grant, equity and debt financing.

These achievements set the GCIP programme apart among other similar programmes available to startups in India.

GCIP India Learnings

GCIP India witnessed a steady growth in the business of participating cleantech startups and many made investments to expand their business. A handful of entrepreneurs closed their operations, some walked away from their entrepreneurial venture after receiving the training realizing the inherent weaknesses in their innovations which cannot be sustained on a medium to long-term in a competitive business environment.

Given the limited funding options available for cleantech most GCIP India entrepreneurs launched their journey as a startup with the help of family and friends. Most GCIP entrepreneurs found securing working capital to be very challenging. While a few of those innovations with large scalability

	Ranking Order
Opportunities to showcase technology	1st
Training for business plan development	2nd
Mentorship on business development	3rd
Connection with an investor network	4th
Connection with potential business partners	5th
Technical advice through sector experts	6th

GCIP components found to be beneficial by Cleantech





Links between Clean Innovations and SDGs

demonstrate that cleantech innovations will play a key role in achieving the SDGs by 2030.

One of the main learnings of the GCIP India was from its efforts to address the financing chasm in the cleantech domain. The GCIP programme reached out to Venture Capital funds, Angel Investors, banks as well as non-bank financial institutions to support cleantech entrepreneurs. Traditional mechanisms such as venture capital and private investment funds look for high returns in a very short time frame while the banks offered limited funds with collaterals and conditions which does not fit well with the scale-up plan of clean technology innovations. This critical requirement will need to be addressed if innovation has to continue and cover other sectors of the economy.

opportunities achieved investments from private equity, most struggled to access finance in the form of ‘seed fund’ even after successful demonstration of a prototype and had to borrow from private sources to bootstrap their business.

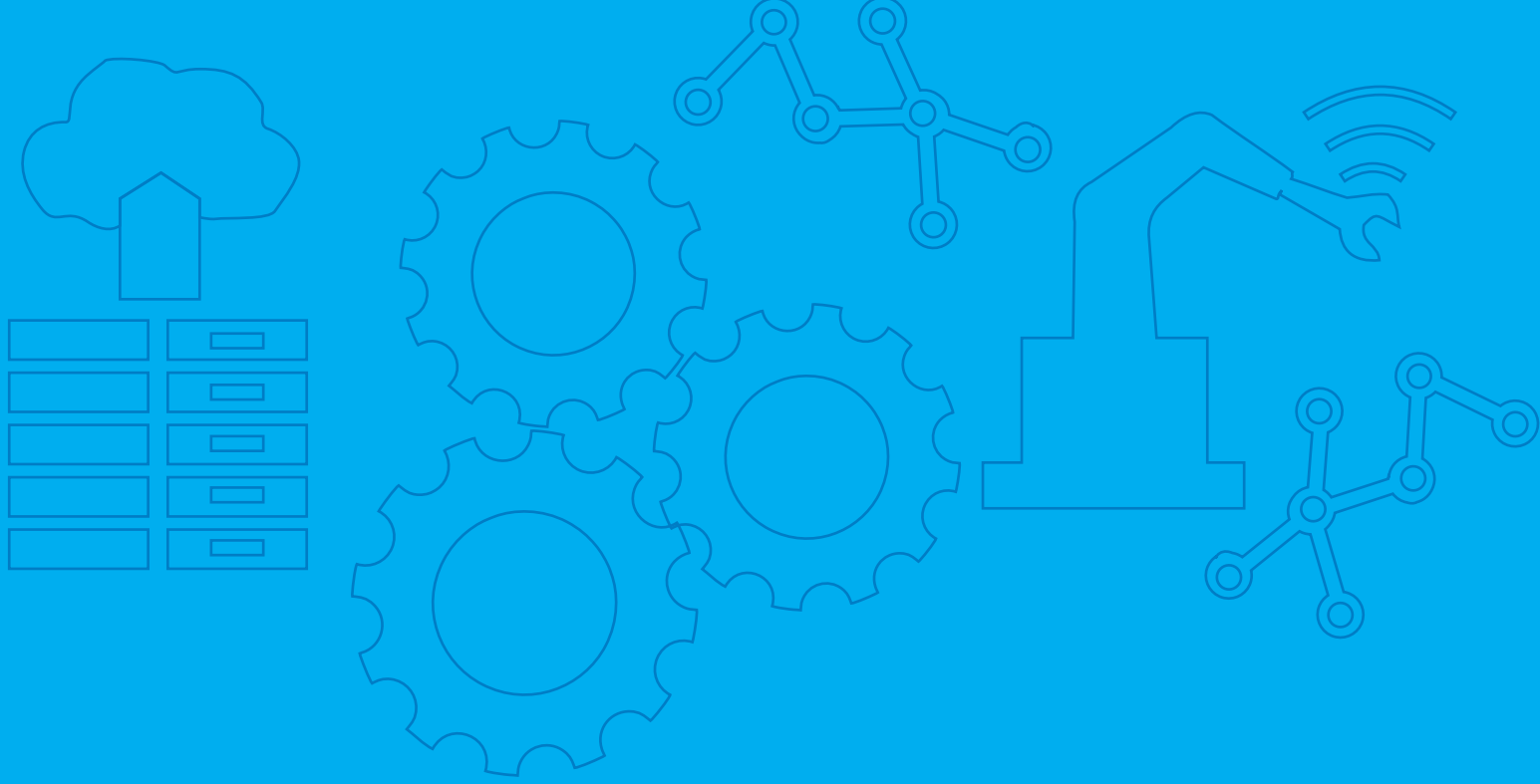
Even though some GCIP innovators presented disruptive and game-changing cleantech innovations in the country, an absence of late-stage private investment for clean technology development and commercialization is one the impediments for scale-up.

Profiles of 26 cleantech entrepreneurs who received GCIP support with a short description of the innovations which are commercialized is included in the report. Each of these innovations have been mapped to Sustainable Development Goals (SDG). The vibrancy and diversity of these innovations demonstrate how cleantech solutions can assist in advancing towards various goals. GCIP thus

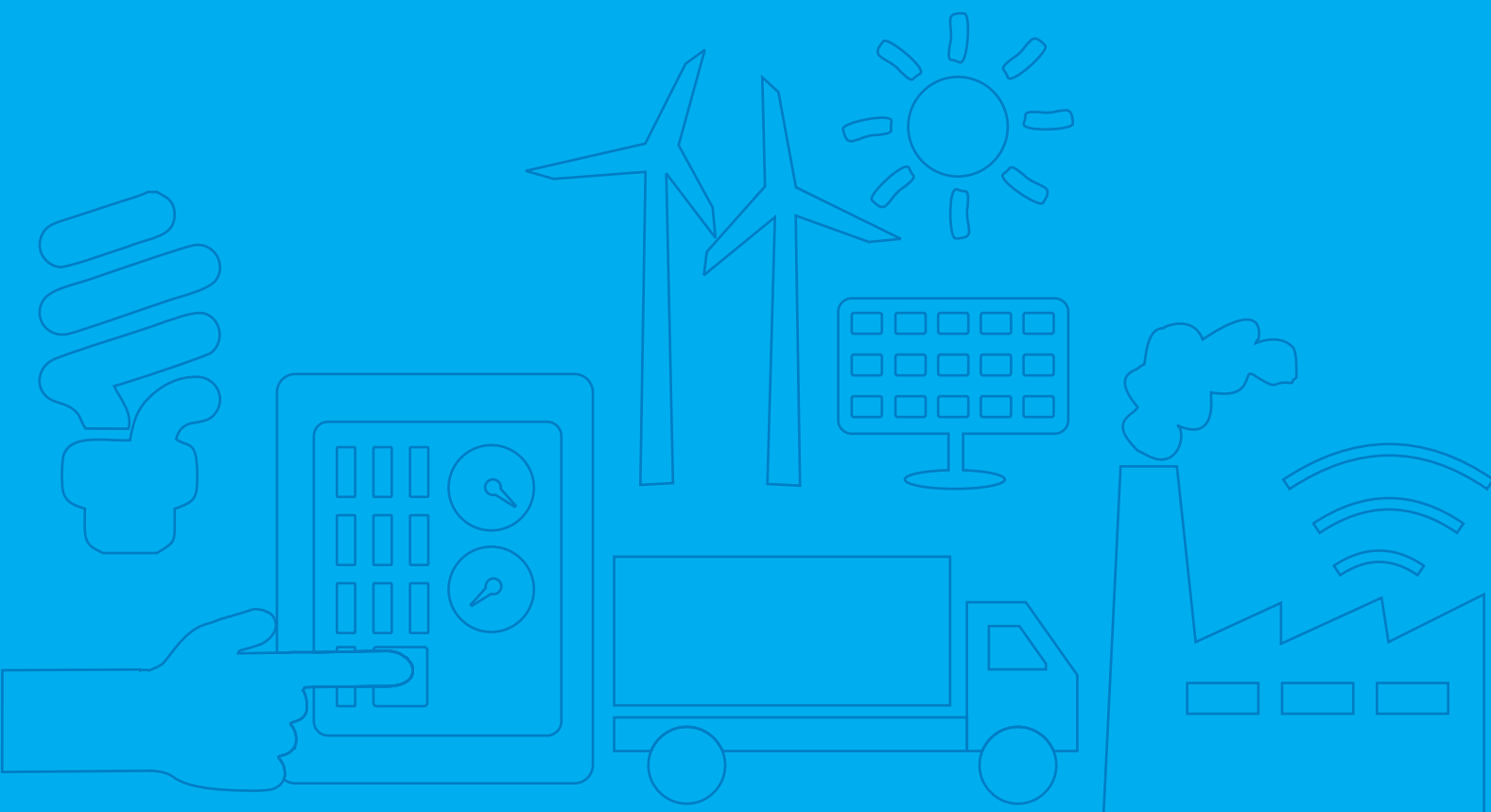
The direct linkage between the cleantech innovations and SDG is clearly established in table A (Annexure A). The linkage with Government of India’s missions and programme is also explored in table B (Annexure B). Cleantech innovations are emerging as unique solutions that can help countries to reduce GHG emissions and help to progress towards SDG.

A programme that was supported on the premise of pursuing innovative clean technology solutions for climate mitigation has emerged as a common link between national initiatives and international agreement on Climate Change. Recognition to this initiative by the national government and closer engagement of private institutions and industries can help create an innovation ecosystem to sustain and scaleup cleantech innovations and help the countries to advance towards their respective Nationally Determined Contributions (towards climate change) and Sustainable Development Goals.





Global Cleantech Innovation Programme India



Global Cleantech Innovation Programme India



The Global Cleantech Innovation Programme (GCIP) is one of the leading initiatives of the United Nations Industrial Development Organization (UNIDO), supported by the Global Environment Facility (GEF), to promote innovative technologies that address climate change concerns among select developing countries. The GCIP identified clean technology innovations and provided capacity building support to entrepreneurs to make their innovations commercially viable. The programme was first launched in South Africa in 2011, and since then has been implemented by UNIDO in seven countries respectively, Armenia, India, Malaysia, Pakistan, Thailand, Turkey and Morocco.

Through annual national competition-based selection processes, GCIP identified promising cleantech innovations and provided training to the

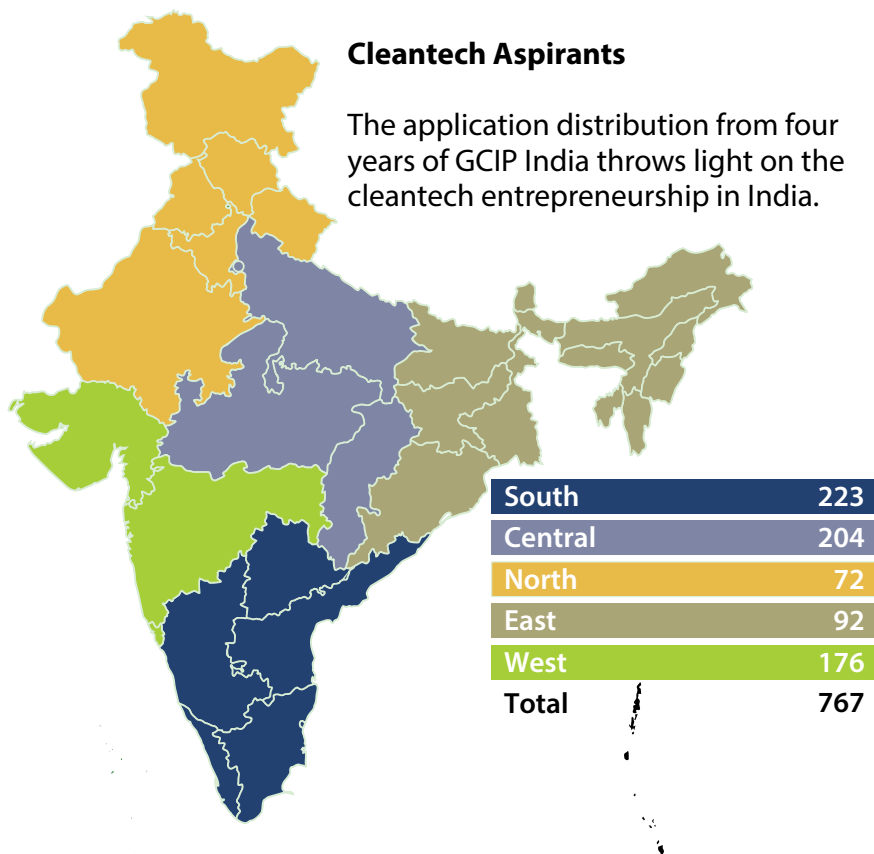
innovators and entrepreneurs. The key objective of the GCIP programme has been to help innovators seed their innovation into a startup enterprises ready to attract customers and investors. Central to the GCIP has been the ‘Accelerator Programme’ delivered by the US Cleantech Open (CTO), which trained the entrepreneurs over four months on the various aspects of developing business strategy, marketing plan and gaining confidence of investors to support the enterprise. CTO served as the programme’s ‘knowledge partner’, providing training materials and running a series of business development-focused webinars. The Accelerator connected these entrepreneurs with mentors who provided guidance to prepare plans on the various aspects of running a business and where possible also with contacting with potential clients. A group of general and specialist mentors were drawn into

the programme to bring in several areas of expertise and years of experience in running a business in India. The training culminated in pitching session in the presence of senior industry and government leaders who selected national winner and runner through a competition amongst the entrepreneurs.

A further highlight of the GCIP was the bringing together of the best startups from each of the seven GCIP countries annually for a global competition in California, organised by the Cleantech Open, for the Global Cleantech Innovation Award.

Cleantech Aspirants

The application distribution from four years of GCIP India throws light on the cleantech entrepreneurship in India.

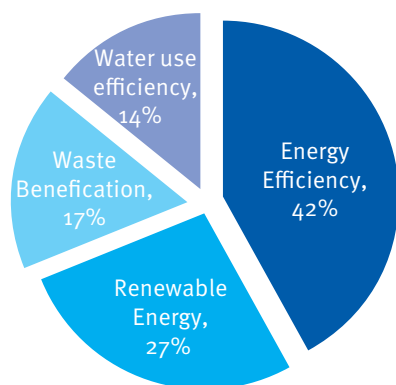


Identification of innovators	Promotional activities to create awareness of the programme, and to solicit entries from potential competition participants
Screening process	Based on assessment of application forms, a screening committee develop a shortlist of 20 'semi-finalists'
National workshop	The 20 semi-finalists attend a workshop with mentors and CTO
CTO Webinars	Semi-finalists attend a series of webinars organised by CTO
Business clinics	Facilitated one-to-one interaction between mentors and semi-finalists based on the specific requirements of innovators
Judging round	On the basis of webinars, mentoring sessions, worksheet exercises, investor presentations and pitching, judges shortlist 6 'finalists'
Jury round and investor pitching	The 6 shortlisted finalists present their pitch to a jury and a set of investors, with national winners subsequently identified
Investor Connect	All 20 semi-finalists attend a day of intensive networking with potential investors
Global CTO Forum	National winners participate in global competition and international Investor Connect, held in the USA

Key Steps of GCIP India Accelerator Programme

The GCIP India Programme 2013-17

In India, the GCIP programme was launched in 2013 in collaboration with the Ministry of Micro, Small and Medium Enterprises. In the four-year implementation, GCIP identified cleantech innovators, and trained and mentored them from four thematic areas of Energy Efficiency, Renewable Energy, Water-Use Efficiency and Beneficial Use of Waste. The MSME (micro, small and medium enterprises) sector was prioritized for GCIP India as they play a vital role in the Indian



Thematic distribution of participants in the GCIP India programme 2013-17

economy contributing to almost half of country's manufacturing output, 40% of exports, and employs more than 110 million people. India's National Action Plan for Climate Change (NAPCC) hence recognizes the need for urgent energy efficiency and related interventions in these sectors. Government of India has therefore marked energy efficiency improvements among MSMEs for economic and environmental sustainability as high priority agenda.

Over the 4 years, GCIP India received applications from 767 startups and eventually provided training and mentoring support to 84 clean technology innovators. These startups were selected through a competition-based approach which identified the innovations that were most compelling in addressing energy and environmental issues but needed support to leapfrog into their potential markets. GCIP programme chose innovations that addressed energy and environmental issues with potentials to make a positive impact if scaled-up rapidly. The key motivation for many innovators for participating in GCIP was the opportunity to participate in an international Accelerator training and mentoring programme of international standard. With a commercially viable prototype ready, GCIP offered them opportunities to sharpen their go-to-



market strategy, build clear understanding of their customers and market segments, fine-tune their financial projection and strengthen their funding strategies. The proactive network of mentors offered guidance and networking which helped to market their solutions to new clients and improved the chances in raising investment to achieve sustainable commercial success.

GCIP India Achievements and Learnings

Over the 4-year period, GCIP India involved more than 100 mentors in the programme. The GCIP India leveraged extensively on this wide array of mentors who participated in the programme as thematic area experts, successful entrepreneurs, screening committee members, judges, juries and investors. These successful entrepreneurs/experts identify with the need for support-systems from their own entrepreneurial journeys and found in the GCIP platform an opportunity to give back to new entrepreneurs. Mentors, who brought thematic area expertise, worked closely with the entrepreneurs, provided one-on-one coaching, helped to develop a 3-year business plan and the strategy to enter the market, fund raising to sustain and grow the business. The judges and jury, who selected the winner and runner-up, critically examined the innovation and the business plan, applicability of the innovation in the domestic market and provided constructive feedback. A key motivation for many of them were the opportunity to stay abreast of developments in the sector and scout for opportunities for investments.

A recent survey of GCIP participants demonstrated that GCIP India programme had influence on the startups that participated in the programme. More than 50% of the GCIP participants (GCIP alumni) surveyed indicated that the programme influenced them to revise their business plans and marketing plans. These entrepreneurs pointed out that the most important impactful learnings from participating in GCIP India were the focus on business development, the mentoring inputs, and the access to wider business and advisory networks.

Ashok Toshniwal

Mentor 2015, 2016 & 2017

“I guided the mentees, to improve the quality and content of their investor presentation including various aspects of business developed around innovation, delivery and how to answer various questions, that might come up from the jury. The art of defending in front of the jury was fine tuned. Interestingly, I found that most of them had to learn the difference between speaking concisely from the presentation rather than delivering a story. A common problem with all of them, being technocrats, was that it is difficult to avoid explaining the technology!”

GCIP alumni have consistently acknowledged that mentoring was the most effective and greatly valued the attention and guidance they received on their business from attending the programme. The one-on-one mentoring served them opportunities to learn from mentor experiences and the insights allowed these entrepreneurs to leapfrog various critical pitfalls in innovator journeys. These personal mentoring and interactions offered tailored advice and created longer-term relationships between mentors and the entrepreneurs. GCIP programme inculcated in them more structured and longer-term business thinking, particularly with regards to customer and market identification and segmentation.

The GCIP survey showed that many participants appreciated the efforts also in retrospective as these learnings came handy later when addressing barriers in business model development, market segmentation, and financial projections. The programme gave insights into the decision making by investors to assist entrepreneurs' long-term planning and pitches to investor communities such that they reposition themselves to achieve investor confidence. These learnings were validated when Indian teams won Global Cleantech Innovation Award in 2015, 2016 and 2017, while they also consistently won awards across the three thematic categories.

This support has delivered positive outcomes for participating businesses. Some entrepreneurs



Saathi Eco Innovation is the **GLOBAL WINNER** of Cleantech Innovation Award in **2017**. Saathi offers 100% biodegradable sanitary pads made from banana-waste fibres and uses zero chemicals.

Promethean Energy won the GCIP Global Category for **ENERGY EFFICIENCY** in **2015** for efficiently recovering waste heat from Air Conditioning systems,
Atomberg Technologies won in the same category in **2016** for energy efficient ceiling fans.

Navalt Solar and Electric Boat is a GCIP Global Winner in the **RENEWABLE ENERGY** category in **2017**. A single solar ferry displaced the use of 42,000 litres of diesel in a year.

Aspartika Biotech won the GCIP Global Category for **WASTE BENEFICATION** in **2017** by utilizing discarded pupae from silk reeling industries and converting it into High Value Nutraceutical like Omega3 fatty acids for animal consumption.

Global Winners from GCIP India

reported major, tangible results (investments, new markets) that would not have been attained if they hadn't participated in GCIP India. The great majority of participants felt that GCIP India helped them to develop stronger companies, more robust business models and – in turn – improved chances of commercial viability and success.

GCIP - platform for Launching Cleantech Innovators

A majority of Clean technology innovations that received hand-holding support were incremental innovations and a few were disruptive innovations that had the potential of being game changer when scaled-up. These innovations needed a platform for wider publicity through various mediums as many startups lacked the necessary resources to create visibility for their innovations. GCIP became platform under the UNIDO and the Ministry of MSME banners that offered a credible brand-value to its innovators. Every year GCIP published a directory of cleantech innovations towards the end of the accelerator programme entitled "Cleanovators", which have been circulated through print and electronic mediums. Subsequently, GCIP publicized the programme through the state television news channel "Doordarshan (DD News) and national daily newspaper "The Economic Times". The nationwide publicity helped in generating inquires for some cleantech innovators. A bigger contribution of

GCIP was to bring the cleantech innovation to the attention of "India Angel Network" – a network of angel investors which typically support IT and service-oriented startups.

Accelerators in India

A survey by Inc42¹ in 2017 on Indian accelerators lists about 60 active accelerator programmes and more than 200 incubators in India. Most of these accelerator programmes were less than a year in business and work with startups on commercialization of their prototypes. Some of these accelerators were limited to a week-long boot-camp offering insight into the basics of business and markets. Many of these accelerators offered equity on behalf of private investors and hence were inclined to work with high risk innovations with higher returns. Only 6 of them indicated cleantech as one of their focus areas largely for enabling design support, IT, and IT enabled services like IoT, and others. Only a couple of them worked with cleantech startups with hardware-intensive products.

¹The Top 60 Active Accelerators in India, Feb 2017, Inc42

Through these services, to an extent the GCIP platform strived not only to play a key role as a launch-pad for its innovators but also attract like-minded stakeholders who could either invest, collaborate or support.





Support provided by GCIP India

Nascent Cleantech Innovation Ecosystem

GCIP's efforts to provide publicity and exposure to cleantech innovations and entrepreneurs, verification of innovation, engagement of banks and investors, government agencies were initial steps towards the development of an entrepreneurial ecosystem for cleantech, forming a small, basic ecosystem that was limited to immediate GCIP stakeholders at this stage.

The mentors and other stakeholders of GCIP who represented private enterprises, senior government officials, academic institutes, banks, and equity investment firms brought domain specific knowledge, expertise and collective experience of several years. A key motivation for many of the stakeholder to associate with GCIP was the opportunity to stay abreast of developments in the sector and scout for opportunities for investments. Interaction with mentors helped the entrepreneurs to accelerate their learning curve, enabling them to



GCIP Stakeholder Network

recognise upcoming problems and avoid common startup mistakes.

GCIP has demonstrated that young entrepreneurs equipped with best technical education are beginning to bring to the fore unique incremental innovations and sometimes disruptive innovations which can be game-changing solutions and benefit domestic, commercial and industrial sectors. GCIP has made vital contributions to build capacity and improve their competitiveness and help them

address both the supply-side and demand-side challenges of their inventions. Also, as seen with GCIP innovators, they cater to various sectors and market segments including business-to-consumer and business-to-business markets, offering innovative solutions that are economically viable. Such innovative solutions are required to overcome challenges faced in other sectors. The linkage between the innovation and the targets of Sustainable Development Goals is mapped in Table 1 in Annexure B.

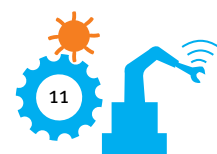
Cleantech Innovations are Hardware Intensive and Need Wider Support System - Hari Rao Founder, Agnisumukh (GCIP National Winner 2015, GCIP Mentor 2017)

A former Indian Revenue Service officer, Hari Rao's passion for cooking inspired him to innovate his cooking which led to him to develop radiant-heat gas burner that has 65% thermal efficiency. He started Agnisumukh in 2014 with a single product for commercial kitchens, and today has a portfolio of 23 products providing diverse range of cooking solutions suited to different cuisines and can operate on liquified petroleum gas, natural gas and bio-gas as fuel.

“ *I have been mentored through accelerator programs where I learnt that beyond manufacturing a product, it is critically important to evolve as a brand. As a startup I have been working to improve the product functionality, design and business process as I am gearing up to become a brand. Innovators often lack access to modern engineering design solutions that save time and critical resources. For improving product design and functionality, I have tied up with Oil companies where Agnisumukh is being given assistance to use modern engineering tools to produce cook stoves with 'Zero Defect'. Through simulation techniques Agnisumukh avoided the need for creating and testing each physical prototype till the final product design was confirmed.* **”**

GCIP demonstrated that while financing was still a key challenge for cleantech innovators in India they were still able to forge ahead with right mentoring and insights into the market. Also, GCIP's guided networking opportunities helped them interact with potential investors who used the GCIP platform to offer key advices. This helped the innovators address some of the key gaps in their investment pitches before they ventured out on their own. The due-diligence that UNIDO performed with scientists and experts in accepting these innovators into the programme and rigorous training and mentoring prepared the innovators to address investor's concerns. These insights helped them reduce their exposure to market risks, thus fetching more trust in potential investors.

The transformation in the innovators' outlook about their product markets and opportunities with the investment communities played a critical role in bridging part of the chasm in commercializing their products or scaling up. The GCIP training included elaborate worksheet exercises that the innovators were mandatorily made to complete to analyse and validate their own business models by largely scrutinizing their IPRs/patents, financial projections, and market potentials. These exercises and the mentoring helped the innovators rectify and strengthen their product positioning to the investment communities. At the end the accelerator programme UNIDO organized one-on-one interaction between entrepreneurs and angel investors, venture capital and banks on the basis of type of funding needed by the entrepreneurs and size of the funds



offered by the investor. Since participation in GCIP, the cleantech startups were able to raise more than USD 7 million through grant, equity and debt. Many of the GCIP innovators successfully raised funds to expand and grow their businesses.

Of the 84 starts-up that received GCIP training, several are operating their business. Profiles of 26 GCIP startups are included in the compendium. During the 4 years of GCIP, a handful of entrepreneurs closed their operations, some walked away from their entrepreneurial venture after they realized the inherent weaknesses in their innovations which cannot be sustained on a medium to long-term in a competitive business environment. The programme experimented with various options available in the country to provide visibility and funding to grow the business, in which there is learning from failure of startups after receiving venture capital funding and also learning that disruptive clean innovation face greater challenge to commercialize the product.

Disruptive Innovations Need Attention

- Dhaval Thakhar CEO, UNESAR

(GCIP Participant 2016)

“*Disruptive cleantech innovations like Solar Stove™ need comprehensive funding support from the government to convert an idea into a viable solution as they tend to deliver impactful solutions to the society. Various startup funding offered by the Gov are routed through equity investments channels like VCs/Angel investors that are highly risk averse. On the other hand, R&D funds and grants available from several ministries largely target to aid academic entities. As startups bring innovations developed in the laboratories to the market some funds should therefore be made available to them for product development and market validation allowing cleantech startups to commercially launch the products.*”

Financing for Cleantech Startups

Shyam Menon, Director, Infuse Ventures

Infuse Ventures is a US \$ 17 million, one of the first and largest cleantech-focused early stage Venture Capital fund in India, which had investments from SIDBI, MNRE, BP, Godrej and IFC. A few GCIP India participants received investment support from Infuse Ventures.

“*Cleantech at large has not been an exciting place for Venture Capital funds. As much of the hardware-based solutions that emerge from the sector have needed enormous amounts of capital with long lead times resulting in customized engineering technologies that cannot scale-up easily. Cleantech innovations that tend to get traction amongst the venture capital community tend to be the ones on the periphery of hardware technologies, that offer IT/ IoT or digitally enabled solutions. On the other hand, the digitally enabled consumption themed consumer focused businesses have attracted quite a lot of venture investments.*

Globally commercial VC fund allocations for cleantech have reduced significantly from its peak in the second half of the decade 2000-2010. At present, there are a few philanthropic and climate funds and impact investment funds where investments are demarcated for specific areas like cleantech and water tech. Limited Partners who invest in VC funds look for high-value returns in 5 or 6 years; cleantech has not delivered the returns expected by VCs. Corporates can ideally step in as strategic long-term capital investors. Many of the large engineering entities are often scouting for technologies that have wider applications across the entire gamut of their operations. Further, Government agencies should step-in to offer early stage product development and prototype grants to de-risk before the entrepreneur raise the first round of institutional investment.”



The overall capacity building support provided through GCIP programme was found to be highly relevant to the needs of programme participants. While there are numerous business incubators and accelerators within India, most of these are not directly aimed at cleantech innovators, particularly those businesses working on product requiring capital-intensive manufacturing with high startup costs a common characteristic for clean energy-related technologies.

At the close of GCIP India, participants greatly valued the immediate network that arose amongst each year's cohort of entrepreneurs. UNIDO India office initiated to link each year's participants and mentors leading to the development of peer-to-peer connections. This has emerged as a GCIP fraternity where entrepreneurs and mentors continue to exchange information and learn about the progress from each other. Post GCIP, the entrepreneurs, mentors and UNIDO staff remain in contact, meet whenever possible and participate in national and international events where UN agencies are involved such as the Vienna Energy Forum and Conference of Parties under the Framework Convention on Climate Change.

Cleantech Innovations in India's National and Global Sustainable Development Objectives

India's policy objectives for energy efficiency and renewable energy market transformations set forward by the National Action Plan for Climate Change and commitment to reduce the emissions intensity of its GDP by 33-35% by 2030 (below 2005 levels) has served as a backdrop which led to development of innovative solutions by entrepreneurs who participated in GCIP India. In 2015 India jointly with all UN member states adopted to the 2030 Sustainable Development Agenda 2030 and its associated Sustainable Development Goals (SDGs). As India's development imperatives are heavily overlapped with SDGs, the NITI Aayog, India's policy commission, has prioritized SDGs on Poverty Eradication, Food Security, Well-being, Gender Equality, Industry and Innovation, Sustainable Use of Oceans and



SDG-9 hinges cleantech innovations for wider development impacts

Partnership for Sustainable Development, such that the advancement of one global goal may lead to progress of other goals.

The 2030 Agenda emphasizes that the transformational objectives of the 17 SDGs are integrated and indivisible. Many innovations in the four thematic areas of energy efficiency, renewable energy, water efficiency and waste beneficiation show clear linkages with the broad development agenda. GCIP innovations tend to cater to multiple SDGs as environmentally sustainable solutions tend to have direct impacts on emission reduction and the natural resources. The diversity of these innovations demonstrates how cleantech innovations contribute to the targets of various sustainable development goals. GCIP thus demonstrate that cleantech innovations will play a key role in achieving the SDGs by 2030. Rapid scale-up of cleantech innovations will countries to advance towards their respective SDG and climate commitments.

Under various ministries the Government of India has several large initiatives to address poverty alleviation, economic growth, environment and climate, industrialization and other areas of the economy. A few of these key national missions are mapped with cleantech innovation as shown in Annexure B. The cleantech innovations thus emerge as a link between many of the Indian government's missions and programmes and the sustainable development goals.

The Road Ahead for Cleantech Innovations in India



GCIP India has delivered an effective, valuable contribution for entrepreneurs working in the country's cleantech sector. While there are numerous business incubators being setup within the country to encourage innovation, GCIP India's focus on the cleantech sector was unique, and is further differentiated by its emphasis on business development since technology validation or technical development had been a selection criterion for entering the programme. Most of the cleantech innovations have strong intellectual property and many have filed for or already received patents. It is estimated that some of the energy efficiency and renewable energy related innovations including energy-efficient ceiling fans, solar ferry, waste heat recovery systems and improved commercial cookstove can help to avoid emissions of over 1.5 million tCO₂ over 10-years. A concerted effort of government and other players in the society to scale-up cleantech innovations can significantly increase the figure of greenhouse gas emissions avoided.

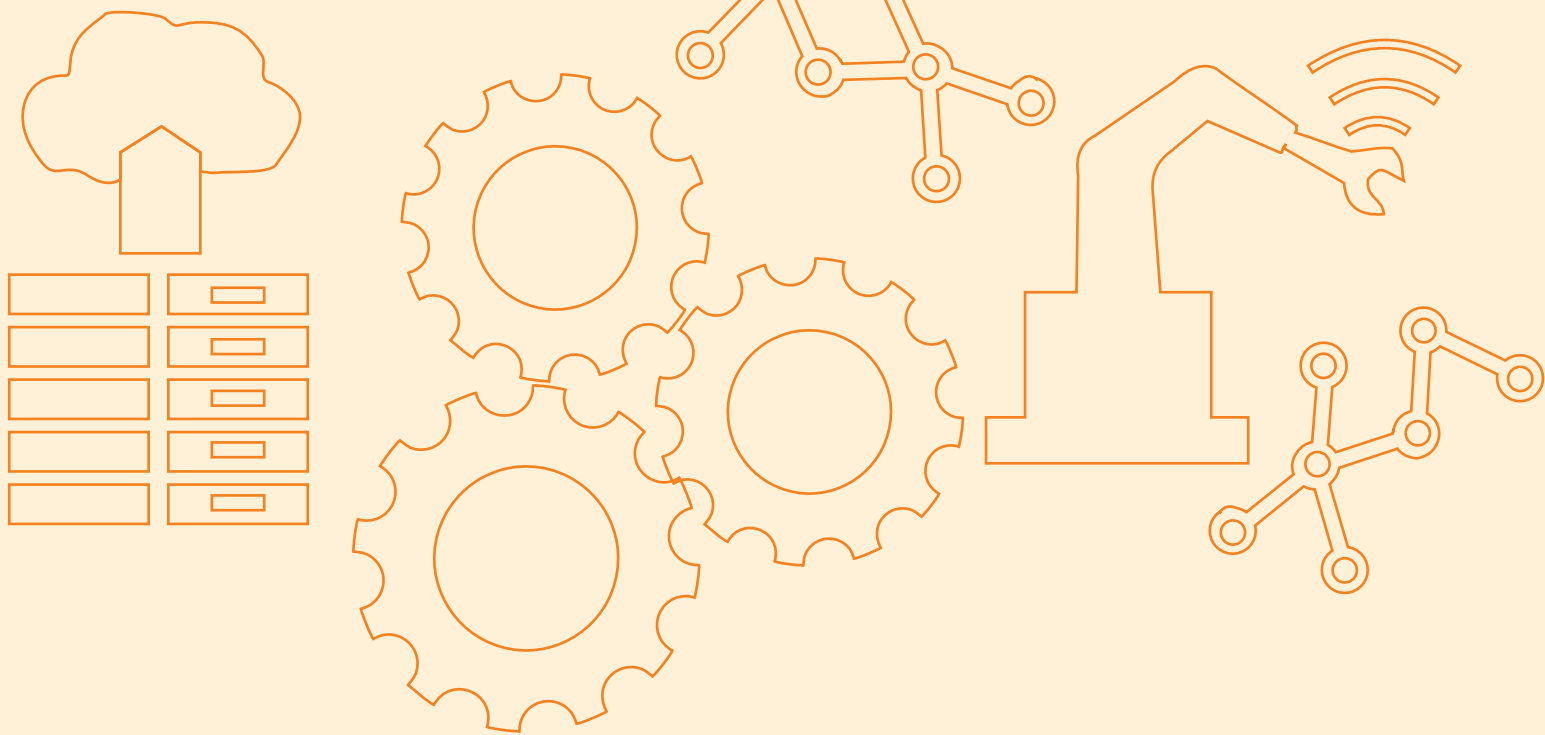
While UNIDO and GEF already recognize that entrepreneurship and innovation will hinge the transformational changes necessary for achieving the goals of the Paris Agreement and the SDGs, the deployment-diffusion of later-stage technological innovations and tailoring innovations to local circumstances will be critical in achieving these objectives. These objectives find synergy in India's commitments to the Mission Innovation (MI), where 22 countries along with the European Union have agreed to accelerate global clean energy innovation by bringing private sector investment to boost

public-sector investment in clean energy research and development.

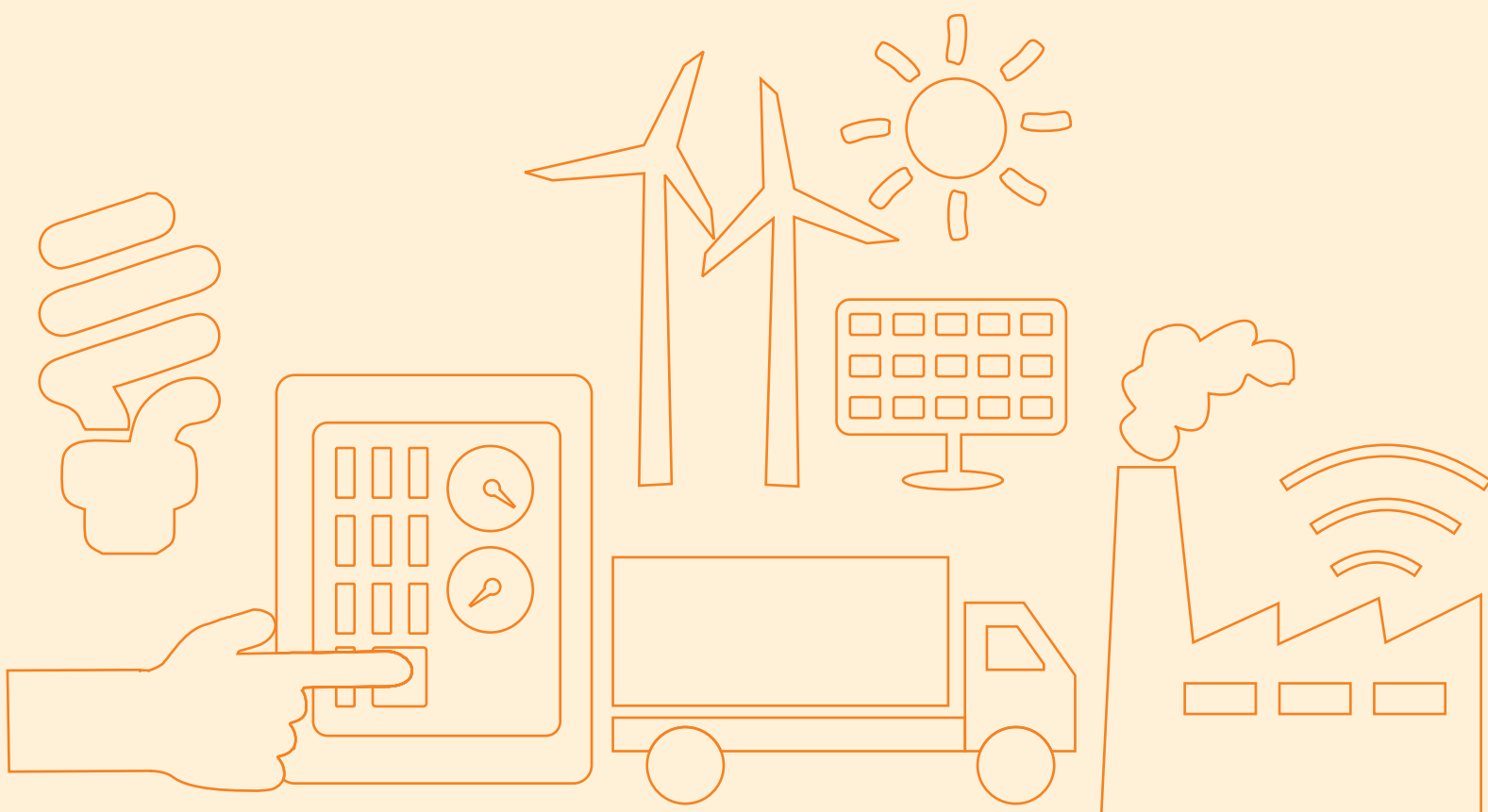
The Cleantech innovation programme was supported to select innovations that directly address climate and environmental issues. The innovations are unique links that contribute towards the Sustainable Development Goals and other local and global efforts to address climate concerns. GCIP India has delivered an effective, valuable contribution for entrepreneurs working in the country's cleantech sector.

After giving a boost to the innovation agenda through several programmes by the Government of India, the next logical step would be to open up the programme and mission to innovative technologies and solutions to achieve the goals. Allowing the cleantech entrepreneurs with access to various missions, the government will ensure that various central and state government departments, agencies and public-sector agencies give recognition to startups and access the innovative products and solutions being offered. This would go a long way to encourage and support startups across various sectors and in turn, will require steps to create a robust innovation eco-system particularly for clean technology which require appraisal tools and funds for the startups to sustain and gradually scaleup. Many of the exiting clean technology innovations can scale-up with help of markets outside India and help other developing countries to meet their respective climate mitigation and sustainable development goals.





Profile of GCIP India Innovators





Neogi Technologies and Research Pvt Ltd. (Formerly Moonlight Engg. Co.)

Innovation “High Accuracy Fuel Metering & Dispensing System” (HAFMDS)

Product Information

“High Accuracy Fuel Metering & Dispensing System (HAFMDS)” is a 100% fit for the recent Govt. objective of “Delivery Fuel at the door step/mini fuel pump on wheels”. This will have a vast impact on the conservation of national resources by avoiding unnecessary travel of huge number of vehicles in a refuelling station and waiting there in a queue which burns precious fuel without any value addition and creates pollution.



Competitive Advantage: “High Accuracy Fuel Metering & Dispensing System (HAFMDS)” is legal metrology certified. Product is driven by brushless DC MOTOR for continuous operation to improve efficiency. Also, the product has India design mark & “ZED GOLD” certification. This establishes its superiority in quality and environmental performance compared to existing products in the market.

Market Penetration: There has been an increase of 27% in sales compared to last FY 2016-2017 from HAFMD. In FY 2017-2018 sales from HAFMD was USD 973,000 as compared to USD 763,000 in 2016-17.

Growth History: Production of “High Accuracy Fuel Metering & Dispensing System (HAFMDS)” grown from 40 per month (In 2014) to 100 per month (In 2018). (Increase of 250%) ✧ Number of People employed at NTR in the year 2014 was 47 which presently is 78. (Increase of 66%) ✧ Total Turnover in 2014 was 48.1 Million INR which is expected to be 90 million INR in the current year 2018-19. (Increase of 87%) ✧ HAFMDS Turnover in 2014 was 25.3 Million INR which is expected to be 65 Million INR in the current year 2018-19. (Increase of 157%).

Category

Energy Efficiency

Industry, Innovation Area

Environment friendly Fuel Management System

GCIP Participant 2014

Mr. Samir Kumar Neogi, CEO

Patent/IPR

Five Patents in the HAFMDS



Key Clientele: Tata Steel Ltd, Larsen & Turbo, Reliance Industries, Indian Oil Ltd, Hindustan Petroleum Corporation Ltd, Gilbarco Veeder-Root Ltd, Café Coffee Day, Sintex Ltd.

Growth Plans: Scale up the sale of “High Accuracy Fuel Metering & Dispensing System (HAFMDS)” to Rs. 140 Million (USD 215,000) by 2020. Apart from it we have planned to launch following products by 2025. ✧ Kerosene Dispensing for PDS ✧ Bio-Diesel Dispensing ✧ Water Distribution with measurement ✧ Edible Oil Distribution with measurement ✧ Solar Powered Dispensing System ✧ Real time monitoring of all the units (IOT).

About the Company: Neogi Technologies and Research Pvt. Ltd. (NTR Pvt. Ltd.) an ‘Emerging SME’ unit, rated in Gold Category in ZED (zero defect zero effect) by the Govt. of India has developed many products in Fuel Management solution, using indigenous technology.

About the Founders: The business was established by Mr. D.P. Neogi who was conferred the National Award in 2005 & The AIMA - Dr J.S. Juneja Award for Creativity & Innovation in Small Medium Industries-2006. The legacy is being continued by his son Mr. Samir Kr. Neogi who is in charge of Innovation and product development.

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Versa Drives Private Limited

Innovation Energy Efficient Ceiling Fan

Product Information

The innovative solution based on BLDC technology, called Superfan, the ceiling fans that consumes 56 per cent less electrical energy compared to conventional ceiling fans available in the market.

Category

Energy Efficiency

Industry, Innovation Area

Ceiling Fans

GCIP Participant 2014

Mr. Sundar Muruganandhan, Managing Director

Patent/IPR

6 patents filed



Competitive Advantage: Superfan is remote-controlled ceiling fan that consumes 35W at full speed, which is 56% less compared to existing fans – offering a cash back return within couple of years.

Market Penetration: Product is sold through sales network in Mumbai, Pune, Rajkot, Ahmedabad, Tamil Nadu, Delhi, Kochi, Jodhpur, Nagpur, Hyderabad, Nasik, Indore, Trissur, and Latur ✦ Over 140,000 of Superfan’s have been sold till date.

Growth History: Production capacity grown from 5,000 to 20,000 fans per month. ✦ From an 80-member team, the company currently has 140 members.



Key Clientele: Power Grid Corporation of India Limited, Ordinance Factory, Nuclear Power Corporation, Indian Railways, Apollo hospitals, National Institute of Technology – Trichy, etc.

Growth Plans: Scale up the ceiling fan business to USD 30 million business in 2 years. ✦ Develop a strong product portfolio in fan division (with all types of fans).

About the Company: Versa Drives Private Limited (VDPL) was started in the year 2010 by Mr. Sundar Muruganandhan and Mr. K. Durgasharan (Active Directors of company) for manufacturing motor control products. VDPL specializes in custom designed motor control solutions for original equipment manufacturers. VDPL produces energy efficient products which are economically viable and environment friendly. As a start-up we launched Super-efficient ceiling fan with the brand name of Superfan in the year 2012.

About the Founders: Mr. Sundar Muruganandhan graduated in 1983 from Annamalai University with BE in EE and has a MSEE degree from university of Missouri-Rolla, USA. He is one of the founders of computer controls corporation and versa drives and has been responsible for new product development, marketing and administration. Mr. Durgasharan Krishnamurthy graduated with BE in EEE from Osmania university in 1984 and has a M.Tech degree in control systems from IIT, Madras. He is one of the founders and has been designing all the products.

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Agnisumukh Energy Solutions Pvt. Ltd.

Innovation **Energy Efficient Radiant Heat Burner System**

Product Information

Energy efficient burner system powered by LPG, natural gas and bio-gas that uniformly produces radiant heat.

Startup Registration Information

Registered with: DIPP

Registration Details: DIPP246

Category

Energy Efficiency

Industry, Innovation Area

Gas Burners

GCIP Participant 2015

Hari Rao, Founder,

National Winner – GCIP 2015

Patent/IPR

Granted in April 2018. Patent number 295436



Competitive Advantage: Radiant heat gas burner system that has high thermal efficiency at 69% and low ambient heat beside being flameless, smokeless, and noiseless. The device has been tested and certified at a thermal efficiency, under Indian Standard 14612, between 65-68.9% as against conventional burners with efficiency rating between 36-45%. This means energy saving of at least 30%.

Market Penetration: Agnisumukh has diversified into wide array of products for Commercial Kitchen; cooking ranges, non-industrial steam boiler, fryer, braising pan, idly steamer, hot plate, tandoor, multipurpose barbeque, space heaters.
 ✧ FY 2015-16 revenue: \$ 0.15 million (cooking ranges, Hotplates).
 ✧ FY 2016-17 revenue: \$ 0.6 million (entire product range).

Growth History: From 6 staff (in 2014), the company now has 45 staff across Bangalore, Chennai, Delhi, Pune, Mumbai, Hyderabad & Trivandrum. ✧ In 2015 the company was valued



at \$ 3.85 million, where 10% of the equity was diluted and investors were allotted shares at a premium of \$ 2.79 per share on a face value of 15 cents. In 2015, it valued for \$ 9.5 million and in 2017 it's valuation is estimated at \$ 300 million.

Key Clientele: President of India's kitchen, Preferred vendor of ITC Group of hotels, Infosys, Radisson Blu, Apollo Hospitals, Bangalore offices. Working with army to replace their 10,000 Army kitchen and Akshayapatra kitchen modernization plan.

Growth Plans: To innovate and integrate all gas-fuel (LPG, natural gas, bio-methane etc) heat applications.

About the Company: Agnisumukh is a cleantech startup from Bangalore, India which is driven by knowledge, technology, design & innovation to manufacture total solutions for radiant heat applications driven by LPG, natural gas & bio gas. This commercial kitchen equipment ranges from clean cook stoves to steam boilers driven by innovative, energy efficient radiant heat gas burner which is flameless, smokeless and noiseless.

About the Founders: Hari Rao belongs to the 1999 Batch of Indian Revenue Service and gave up his job with Indian Government to pursue his passion in cooking. He has been doing research in Indian cuisine for more than two decades with inspiration from grandma's cooking. His vow is to bring back charcoal heat through gas fuel. Rao launched Agnisumukh with the help of Samson John, a green energy consultant & Supriya Chellappan, PhD in Economics, who has expertise in handling large kitchens based on radiant heat gas fuel technology.

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Avani Bio Energy Pvt. Ltd.



Innovation **Harnessing the Energy of Pineneedles for Rural Development**

Product Information

Small scale (10-30 kW) pineneedle gasification-based power plants, set up in distributed manner to create impact on employment, rural economy and ecological conservation in central Himalayas. Using pine needles as fuel in biomass gasification process to generate clean electricity and cooking charcoal for rural needs, generating conservation-based livelihoods, preventing forest fires and reducing deforestation. Optimization of operational scale for fuel collection within a 1 km radius from the plant, by mobilizing local communities.

Category

Energy Efficiency

Industry, Innovation Area

Biomass

GCIP Participant 2015

Rajnish Jain - CEO

Patent/IPR

Pending

Startup Registration Information

Registered with: Companies Act 1956

Registration Details: Registered on 11 May 2011



Competitive Advantage: Significant positive ecological impact through prevention of forest fires unlike agricultural fuels such as rice husk. ✧ Faster carbon sequestration by pine needles relative to other biomass sources as pine needle generation takes only one year. ✧ On demand renewable power generation unlike solar/wind.

Market Penetration: The Central Himalayas has 2 million hectares of pine forest and can generate 1000 MW.

Growth History: 9 kW captive prototype developed in 2009. ✧ 120 kW pilot set up & operated from 2012-15. ✧ 2 pilot units of 10 kW established in 2016. ✧ 4 units of 10 kW nearing completion. ✧ 2 units of 28 kW each under development. ✧ Raised 743,000 USD since 2015 from various organizations such as DOEN foundation, millennium alliance, UNDP and HANS foundation.



Key Clientele: Uttarakhand Power Corporation Ltd. ✧ Future clientele includes power utilities in Himachal Pradesh, North Eastern states, Nepal and Bhutan. ✧ Captive users and rural electrification projects in the target geography.

Growth Plans: Establishment of 500 kW distributed generation capacity by 2020. ✧ Rapid replication to achieve 2.5 MW by 2025.

About the Company: Avani Bio Energy (ABE) is a clean energy company that has developed the process of using pine needles in a gasification system to generate electricity and cooking charcoal for rural energy needs.

About the Founders: Rajnish Jain is an MBA from Lucknow University and has strong analytical and team building skills. He has been working for over two decades in the social development sector, towards disseminating appropriate technologies in the rural Himalayas.

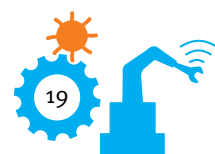
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Brisil Technologies Private Limited

Innovation Recovery of Highly Dispersed Silica from Rice Husk Ash

Product Information

Brisil has developed a technology which uses rice husk ash, a waste, to produce highly dispersible silica. This silica is used in tyres to reduce friction and improve the energy efficiency/performance of vehicles.

Startup Registration Information

Registered with: DIPP; Registration Details: DIPP4898

Category

Energy Efficiency

Industry, Innovation Area

Agro/Industrial Waste, Cleantech

GCIIP Participant 2015

Tanmay Pandya, Founder Director

Patent/IPR

Patent Pending



Competitive Advantage: Currently the rice husk ash, generated after using husk as a fuel in industrial boilers/power plants, is treated as waste and dumped in open grounds affecting the environment. The technology uses the ash to produce advanced silica. The process is 20% more economical and 15% more energy efficient than conventional silica production technologies. Reduction in rolling resistance, thereby improving the mileage by 7 to 10%.

Market Penetration: Company has partnered with a public listed tire company to produce and sell 1 million Kg of silica every year, which is expected to generate revenue of around 0.6 million USD in the FY 2018-19. ✧ Company is in advance stage of testing products with leading global tire companies.

Growth History: Company raised seed funding of USD 30,000 from CIIE, IIM Ahmedabad in 2016. ✧ Company has already set up a unit to treat 2 million Kg of rice-husk ash every year. Plant is funded by a listed tire company and company raised debt of amount USD 150k for the project. The project is commercialized now and is operating near Vadodara, Gujarat. ✧ Company is in process of



setting up 7 million Kg of ash in Gujarat. Company has raised the investor funding of USD 750k for the project and debt funding of USD 1.5 million is in final stages. The project is expected to be operational by December 2018.

Key Clientele: Innovative Tires & Tubes Limited, Future Tires Ltd etc.

Growth Plans: Company plans to reach to ash treatment capacity of 50 million Kg (annually) of ash utilization by 2023. It will result in company generating yearly revenues of USD 18 Millions. ✧ Company is expanding in India, South Asia and Africa by setting up units of various capacities. We have already identified the potential partners and the discussions are in advanced stages. ✧ Company is also tying up with various potential silica users and silica distributors in various geographies.

About the Company: Brisil is a startup in cleantech/advanced material segment, and it is seed funded by Centre for Incubation, Innovation and Entrepreneurship, Indian Institute of Management, Ahmedabad. Company is involved in developing advanced technologies which can address the issues of various industrial and agricultural wastes and can produce advanced materials from it. Company designs, fabricates and commissions plants based on the technology and sales of advanced silicas and other products produced from it.

About the Founders: Brisil's was founded by Tanmay Pandya, a chemical engineering graduate from IIT BHU. Tanmay has worked on development and commercialization of various technologies in past. He developed this technology with other partners and now is involved in commercializing the technology.

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Rhino Machines Pvt Ltd, Anand, Gujarat

Innovation **Ecoflex Energy Efficient Sand Plant**



Product Information

Within the foundry business, Rhino have innovated ecoflex sand plant systems. Energy efficiency is achieved at two stages, power reduces by 50% in production equipment and by 70% in dust collection system. Sales of these systems are based on demonstrated performance.

Category

Energy Efficiency

Industry, Innovation Area

Foundry Industry and Handling System

GCIP Participant 2015

Manish Kothari, Managing Director

Patent/IPR

Not Applied



Competitive Advantage: Affordable, Energy Efficient, Dust Free, Ease of Maintenance, Lesser foot print, Less shed Height, Lesser Foundation work.

Market Penetration: 35 plants completed in Indian foundry and in Saudi Arabia.
 ✧ Installed across India in all clusters.
 ✧ Annual sale of 10 to 15 plants of INR 10 million each which is affordable for MSME'S and gives better productivity.

Growth History: Elevated to the top supplier in India and at par with international suppliers
 ✧ Strongest Indian brand in foundry projects
 ✧ 25+ years in industry and sustained growth over last 3 years.



Key Clientele: Sharp Chucks, Aditya Castalloy, Sagar Ferex, Calcutta Ferrous, Varsha Iron, JPF Metcast, Kejriwal Castings, Mahaveer Alloys, Mangla Engineering.

Growth Plans: Increase plant sale from 7-8 plants/year to 15 to 20 per year ✧ Move ahead in the 40 t/hr and above plants with the technology ✧ Increase Average Sales per plant from USD 150,000 to USD 220,000 per plant ✧ Demonstration & Establishing solution globally.

About the Company: Incorporated in 1996, Rhino's Mission is optimized techno commercial solution, supply, service & resource provider to the foundry industry focussed to develop and establish waste recovery and energy saving solutions as social responsibility.

About the Founders: IIT alumnus R C Kothari started as project engineer in 1983, Manish Kothari-mechanical engineer, joined in 1991 and started innovation journey from 1999 in sand reclamation, and 2007 onwards worked in sand & moulding solutions in foundry domain.

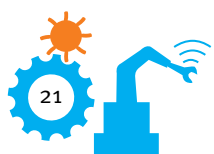
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Jyoti Cero Rubber, Jamshedpur



Innovation Hybrid Idler

Product Information

Jyoti Cero innovated a hybrid idler having high abrasion resistance, 8-10 times better life, low coefficient of friction and 10-12% energy efficient as compare to the conventional products. It is used in steel industries, cement plant, power plant and in mining sector. Tata steel certify a saving of INR 108 million.

Startup Registration Information

Registered with: Udyoog Adhaar
Registration Details: UAN No. JH22B0002316

Category

Energy Efficiency

Industry, Innovation Area

Conveyor belt system for bulk material handling area

GCIP Participant 2015

Mr. Manoj Kumar, Managing Partner

Patent/IPR

Application filed in 2009



Competitive Advantage: Hybrid Idler joint patent with Tata Steel in which we are having 50% share and license of commercial production. The hybrid idlers have very high abrasion resistance properties and very low coefficient of friction. The hybrid idlers have worked dramatically well – the lifespan has been extended eight-ten folds. Its benefits- reduction of cost of replacing idlers, reduction of down time for replacing idlers, reduction in maintenance support and royalty on use of patent.

Market Penetration: Jyoti Cero Rubber sold 10,000 idlers in 2016-17 and the sales grew to 1200 per month from 2017 to 2018.

Growth History: Each year the business has grown by 20% approx. ✦ The team size has almost tripled from 12 in 2015 to 34 in 2018.

Key Clientele: SAIL - (Bokaro Steel Plant, Bhilai Steel Plant, Rourkela Steel Plant, Durgapur Steel Plant, IISCO, SAIL RMD), Tata Steel Ltd - Jamshedpur, Tata Steel - Haldia, Tata Steel - Bamnipol, T.R.F. Ltd.,

Essar Steel Ltd., ELECON, Coal Washary - West BokaroGhato, Iron ore mines - Noamundi, Tata Sponge Iron Ltd. - Joda, Paulwirth India Pvt. Ltd., EWAC Alloys Ltd. L&T, Larsen & Toubro Ltd. ECC and many others.

Growth Plan: Infrastructure development - Currently we are having semi-automatic machine. And we are utilizing 80% of its capacity. We plan to procure fully automatic machines to increase the production capacity about 200%. ✦ Due to limited capacity, we have focused in the eastern zone so far and we plan to setup marketing office in the southern zone, West Zone, North Zone of India to improve and strengthen our distribution & marketing networks.

About the Company: M/S Jyoti Cero Rubber is a group of professionally managed group of engineers. Primarily involved in engineering and designing of products. It was established in the year 2004 with motto for fight against wear and abrasion and provides the solution by using the wide range of polymer.

About the Founders: Jyoti cero Rubber was founded in 2004 by Mr. Manoj Kumar, a mechanical engineer and Mrs. Jyoti Bala having passion for research & development and responsible for the scaling up the business.

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Promethean Energy Pvt Ltd



Innovation **Waste Heat Recovery in Industrial Utilities**

Product Information

Waste heat recovery from industrial utilities like chillers and air compressors – with focus on designing and building high efficiency heat exchangers coupled with a data acquisition and analysis mechanism.

Startup Registration Information

Registered with: DIPP
Registration Details: DIPP-1048

Category

Energy Efficiency

Industry, Innovation Area

Heat recovery systems

GCIP Participant 2015

K.P. Ashwin, Head-Energy Efficiency

Patent/IPR

One IP licensed from IIT Bombay, multiple patent filings under process



Competitive Advantage: Unique design which ensures reliable and safe operation of systems with very high efficiencies. Heat exchanger design and unique business models are our competitive advantage. In air compressors, we can recover 70% of the motor power as useful heat and in chillers, around 15% of the rejected heat can be recovered.

Market Penetration: Key markets include automotive and dairy. ✧ Auto clients include TVS Group, Honda Motorcycles, Ashok Leyland and Volvo Eicher.

Growth History: Started Commercial operations in 2015. ✧ Introduced 2 waste heat recovery systems in 2016. ✧ Raised 0.5 million USD VC funding in 2017. ✧ Increased the 2-member team in 2016 to 9 full-time and 6 part-time employees in 2018. ✧ Revenue in FY 2016-2017 was USD 27,000 and in FY 2017-2018 was USD 166,000.



Key Clientele: Godrej Industries – Chemical Industries. ✧ Raymond Ltd – Textiles. ✧ TVS Group – Automobile. ✧ Mother Dairy – Dairy. ✧ Taj Hotels – Hospitality. ✧ Honda Motorcycles – Automotive.

Growth Plans: Launch newer energy efficiency and heat recovery products for Indian industry. ✧ Penetrate existing markets for higher growth. ✧ We look forward for expansion in textile and automobile sector apart from dairy industry.

About the Company: Promethean Energy Pvt. Ltd. is a private limited firm in the B2B energy efficiency space which focuses on building innovative waste heat recovery solutions for industrial applications. Having started with a heat recovery solution from chillers as an initial product, they currently offer a wide variety of products including heat recovery from compressors, flue gases, exhaust streams, and other products which have unique heat exchanger designs as their core.

About the Founders: Promethean energy was founded by a team of graduates of IIT Bombay and IIM Ahmedabad. Rajat Agarwal, Mechanical Engineer from IIT Bombay, has extensive machine design and fabrication experience. K.P. Ashwin, (IIT Bombay, and IIM Ahmedabad), has worked with Boston Consulting Group on a variety of industrial projects, and handles business development and growth strategy. Together, they bring a strong techno-managerial strength capable of executing technological innovations in the manufacturing space.

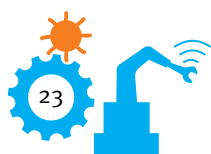
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🌐 www.prometheanenergy.com

📄 https://in.linkedin.com/company/promethean-energy-pvt.-ltd.





Aarshadhaatu Green Nanotechnologies India Pvt Ltd



Innovation **Anti-Fouling Nano Coatings**

Product Information

The Anti-Fouling coating developed by the company is the first ever ship organic nanotechnology-based coating which increases the sea borne time of the ship by impeding the growth of Algae and barnacles.

Category

Energy Efficiency

Industry, Innovation Area

Nanotechnology

GCIP Participant 2016

R B Karthik Aamanchi, Co-Founder & Director

Patent/IPR

Application Filed in 2014



Competitive Advantage: This coating has higher sea borne time being placed at economical price than competitors. The ship gets a savings of 1 million per year. We have a portfolio of 12 products catering to 5 industry sectors.

Market Penetration: The coating as a part of filed study was coated to trailer dredge. ✦ Received an order for 4 ships.

Growth History: Increasing production capacity from 1kg/batch to 5 kg/batch. ✦ Raised 1 Million USD as investment in 2017 and expecting another 10 Million USD. ✦ For FY 2016-17, the revenue generated was USD 23,000 and for FY 2017-18 it increased upto USD 60,000. ✦ The team size has grown from 7 members in 2016 to 20 in 2018.



Key Clientele: Krishnapatnam Port, Tata Chemicals Ltd, Amnion Biosciences, HEMRL-Defence Lab, DRDO, DIAT etc.

Growth Plans: Aiming at revenues of 50 Million USD in next 5 years. ✦ Develop Super Hydrophobic nano coatings for automotive industries. ✦ Develop Nano based Anti-Bacterial fabrics for healthcare and sports wear.

About the Company: Aarshadhaatu is the world's first company to manufacture Nano materials in industrial scale using low carbon technology. The company has developed a unique "E3 Technique" (economical, efficient and eco-friendly) that is environmentally benign. This patented technology has an advantage of natural organic coating on the Nano materials during the manufacturing process leading to better shelf-life and reduced risk of oxidation.

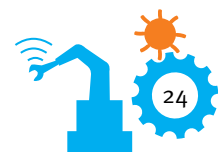
About the Founders: Aarshadhaatu was founded by Dr. ABS Sastry, an eminent scientists and Mr. Karthik, a technopreneur in 2011. Dr. Sastry was pivotal in inventing a patented process for producing Nano materials and Mr. Karthik is responsible for scaling up the process.

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Atomberg Technologies Private Limited, Mumbai

Innovation Energy Efficient Ceiling Fans

Product Information

Gorilla fans consume only 28W at full speed, achieved by brushless DC motor design and a driving algorithm called “atomsense”, which precisely senses various motor parameters in real time and controls the motor in a closed loop, avoiding all possible power losses.

Startup Registration Information

Registered with: DIPP; Registration Details: DIPP 1127

Category

Energy Efficiency

Industry, Innovation Area

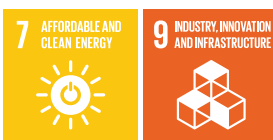
Ceiling Fans

GCIP Participant 2016

Mr. Arindam Paul, Founding Member & Head, Marketing and Strategy, GCIP Global Runner-Up

Patent/IPR

Not available



Competitive Advantage: Gorilla ceiling fans are remote-controlled that consumes 28W at full speed, which is 65% less compared to existing fans – offering a saving of INR 1000 - 1500/fan/year.

Market Penetration: Atomberg sold 150,000 fans in 2017-2018. ✧ Sales growth 1200 fans/month in 2016 to current sales of 10,000-15,000 fans/ month.

Growth History: Online sales of 5000 Units/ Month. ✧ Production Capacity of 25000 Units/ Month. ✧ Awards from Government of India, UNIDO & WWF. ✧ Recognized by Prime Minister of India. ✧ Increased team size from 20 in 2016 to 80 in 2017.

Key Clientele: Tata Power Mumbai & Tata Power DDL (large ceiling fan demand side management programme) & Aditya Birla,



IDFC, ITC, IIT Bombay, IIIT Hyderabad, Hindware, Indian Railways, Reliance Infra., Thangadh ceramic cluster and MSME cluster in Ludhiana.

Growth Plans: Scale up the ceiling fan business to USD 70 million businesses in 5 years. ✧ Develop a complete fan division (with all types of fans including industrial fans with strong product portfolio). ✧ Develop a future product.

About the Company: Atomberg Technology, a modern hardware company was founded by IIT Bombay graduates in 2012. They aspire to combine the attributes of energy efficiency and emerging trends like IoT to come up with smart, intelligent and connected electrical appliances that will bring hitherto unheard levels of comfort to the consumers.

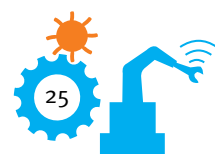
About the Founders: Atomberg was founded in 2012 by IIT Bombay alumni Manoj Meena and Shibarata Das. Meena developed the fans that run on brushless DC motors (BLDC). Shibarata Das who joined him in 2013 was responsible for the scaling up the business.

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Innovation **Energy Efficient Enzymes**

Product Information

Cellzyme Biotech has developed an engineered enzyme that can be used as a green biocatalyst for commercial manufacturing of antibiotics. It's an immobilized enzyme. Idea of business project stems on reducing energy consumption and toxic effluent discharge to produce antibiotics. The product (enzyme) and the process can be used for the large-scale commercial manufacturing of cephalosporin antibiotics.

Startup Registration Information

Registered with: DIPP, BIRAC; Registration Details: DIPP384

Category

Energy Efficiency

Industry, Innovation Area

Pharmaceutical, Biotechnology

GCIP Participant 2016

Dr. Rajkumar Rajagopal, Managing Director; GCIP National Runner-Up

Patent/IPR

Provisional IP



Competitive Advantage: Idea is to convert existing chemical process into an enzymatic process which is cost-effective, greener and safer. ✧ Room temperature process instead of existing process at -60°C. Thus, lower energy consumption. ✧ Elimination of harmful organic solvents during process (eliminating 1.2 million tons nationally). Thus lower environmental footprint. ✧ Elimination of toxic chemicals (total - 3000 tons nationally). ✧ Improves yield by 10%. ✧ Product can be reused for more than 200 cycles.

Market Penetration: Technology Readiness Level (TRL): TRL 7 – Technology Demonstration Stage. Manufacturing Readiness Level (MRL): MRL 9 – Full production process qualified and full metrics achieved. Third party validation trials had been carried out and currently testing at pre-commercial scale.

Key Clientele: Pharmaceutical Industries, Biotech Industries, Food Processing Industries.



Growth Plans: Setting up a manufacturing plant for enzymes. ✧ Product diversification to cater to other pharmaceutical products.

About the Company: Cellzyme offers expertise and advanced technologies for developing novel recombinant enzymes for bioprocess and diagnostics. Cellzyme assists in bio-product manufacturing using sustainable processes.

About the Founders: a) Dr. Rajkumar Rajagopal, PhD from Max Planck Institute of Biomimetic Systems, Golm, Germany (Industrial experience from CFTRI, Mysore, Fraunhofer IBMT, Germany & CSEM S.A, Landquart Switzerland) b) Dr. Vasu Vinayagam, PhD from Anna University, India (Industrial experience from Orchid, Chennai and DNA Technologies, USA).

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Inficold India Private Limited, Noida



Innovation Thermal Energy Storage for Uninterrupted Cooling of Milk and Other Perishables

Product Information

Thermal energy storage to eliminate diesel generator for backing up mission critical cooling applications such as milk/perishables. Also enable solar based round the clock cooling.

Category

Energy Efficiency

Industry, Innovation Area

Dairy Cooling, Cold Chain

GCIP Participant 2016

Dr. Nitin Goel, Founder & COO Inficold

Patent/IPR

1 Issued US Patent (No. 9,903,621); 1 Pending patent in India; 1 Pending patent in USA



Competitive Advantage: Inficold’s thermal storage is the lowest cost option for enabling end to end cold chain in India. Its plug-n-play storage system can attach to any existing or new refrigeration system and convert it into uninterrupted cooling system. The key innovation is two-phase cooling system that enables not only the use of a low-cost phase change materials but also fast cooling. Inficold system is the only thermal energy system to achieve ISO5708 cooling standard, required for milk cooling by dairies.

Market Penetration: Product in operation for more than a year at a farm and has eliminated diesel generator. ✦ Product in pilot phase with some of the leading dairies, including India’s largest dairy. ✦ Product operational at policy setting bodies and national institutes to get policy support.

Growth History: Received equity and grant funding totaling \$1.53 M (2016-18). ✦ Achieved performance and reliability needed for bulk milk cooler integration. ✦ MoU and pilots with some



of the leading players in the milk ecosystem. ✦ Setup initial manufacturing facility in Noida.

Key Clientele: National Dairy Development Board to get to all co-operative dairies - NDDB plans to install 133,000 new units with Total Accessible Market of > \$550 M. ✦ Private dairies in India. ✦ World’s largest dairy and largest food company. ✦ MoU with world’s second largest milk hardware makers (French company) negotiating licensing deal for sales worldwide

Growth Plans: Become a standard for milk cooling hardware for power backup across India. ✦ Achieve volume sales with current pilot clients. ✦ Expand manufacturing to 25 Units/Mo to reach \$1M in revenues run rate by Q1 of 2019. ✦ Achieve \$18M /Year revenues by 2020.

About the Company: Inficold was founded in 2015 with the objective to develop the lowest cost and most efficient battery to run refrigeration/air conditioning apparatus during situations when power is unavailable or too expensive. It has achieved world’s first implementation of a Plug-N-Play thermal storage solution applicable to any compressor-based refrigeration device. Initial focus is on milk cooling as that is a \$1B opportunity in the next few years.

About the Founders: Founded by Dr. Nitin Goel and Dr. Himanshu Pokharna. Founders have developed & commercialized many physical technologies in past. Examples include “Chhotukool” (India’s cheapest refrigerator by Godrej), as well as core thermal technology used in laptops. They have experience in large companies and as startup founders/management. Both founders are IIT Bombay Alumnus and have PhDs from leading universities in the US. Key employees also include another IIT graduate with MS and MBA from University of Chicago.

Contact information:

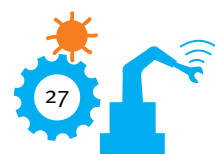
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Rhino Machines Pvt Ltd, Anand, Gujarat



Innovation **Multiflex Moulding Machines**

Product Information

High pressure fully hydraulic moulding machine suited from micro to large foundries in green sand moulding process. Consumes 30 to 50% lesser energy in production, 2% saving in metal & saving in machining.

Category

Energy Efficiency

Industry, Innovation Area

Foundry Industry, High Pressure Moulding Machine

GCIP Participant 2016

Manish Kothari, Managing Director,
Rhino Machines Pvt Ltd.



Competitive Advantage: Simple, affordable & manageable technology for the smallest foundries. Created new market segment, enabled MSME's in technology, challenging established solution providers in medium & large industries.

Market Penetration: 35+ Machines installed and commissioned in last 7 years, 10 orders on hand.
✦ Installed across India in all major clusters.
✦ Presently averaging 2 machines/month. ✦ Entered medium foundries in 2017, Entering large foundries in 2018.

Growth History: Started in 2009, took three years to establish technology, another two years to install in each cluster in India.
✦ Forced elimination of old inefficient solutions in the country. ✦ 25+ years in Industry and sustained growth over last 3 years. ✦ Continuous development, sustained process & service back up opened medium & large foundry market in 2017.



Key Clientele: Sharp Chucks, Aditya Castalloy, Sagar Ferex, Calcutta Ferrous, Varsha Iron, JPF Metcast, Kejriwal Castings, Kores India, N F Forging, Sri Lakshmi Narsimhar, Sky Technocast, Boparai Metals.

Growth Plans: Increase plant sale from 10 machines/year to 30 per year. ✦ Move ahead in higher productivity market and challenge international players. ✦ Increase average sales per plant from INR 0.5 crore to INR 0.75 crore per plant. ✦ Introduce IOT, robotics and process analytics. ✦ Demonstration & establishing solution globally. ✦ Set up new manufacturing facility of international standards.

About the Company: Incorporated in 1996, Rhino's Mission - Optimized Techno Commercial Solution, Supply, Service & Resource Provider to the Foundry Industry focussed to Develop and Establish Waste Recovery and Energy Saving Solutions as Social Responsibility.

About the Founders: IIT alumnus R C Kothari started as project engineer in 1983. Manish Kothari, a mechanical Engineer, joined in 1991 and started innovation journey from 1999 in Sand reclamation, then 2007 onwards in Sand & Moulding Solutions in Foundry Domain.

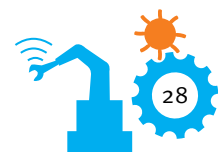
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Innovation **Radiant Cooling**

Product Information

Radiant cooling systems use structural elements like slab, floor or false ceiling to create heat sinks in the space to remove the heat and cool the space. This reduces or eliminates the need for using compressor-based systems for cooling spaces.

Category

Energy Efficiency

Industry, Innovation Area

Green Buildings

GCIP Participant 2016

Madhusudhan Rao Rapole,
Managing Director

Patent/IPR

NA



Competitive Advantage: Radiant cooling systems offer 30-80% reduction in electricity consumption compared to conventional air conditioning. Oorja's solution with two stage cooling tower reduces the electricity consumption upto 95%.

Market Penetration: Many companies & institutions have now adopted radiant cooling systems in their buildings. ✧ Oorja has installed the system in 1 million square feet space so far.

Growth History: Growth from USD 0.3 Million last FY 2016-2017 to USD 1.1 Million in FY 2017-2018. ✧ USD 0.5 Million debt raised from Caspian Impact Investments. ✧ Equity funding



by promoters. ✧ Team size has increased from 14 in 2016 to 21 in 2018.

Key Clientele: Tech Mahindra, Indian Air Force, NCC Ltd., IIM Raipur, Delhi Tourism, Indo Tibetan Border Police, ISRO.

Growth Plans: Targeted Revenue of USD 50 million annually in 5 years. ✧ Promote the system as "Structure Cooling" system dramatically increasing benefit and market size for the solution. ✧ Raise equity funds of USD 2 million in this FY.

About the Company: Oorja energy is a cleantech heating & cooling company providing renewable based & energy efficient heating & cooling products to industrial, commercial & military sectors. Apart from radiant cooling systems, the company also manufactures solar heating & industrial heat recovery systems.

About the Founders: The company was founded by Madhusudhan Rapole who has extensive experience in industrial processes and HVAC.

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📘 <https://www.facebook.com/oorjaenergyeng>



Nishant Bioenergy Private Limited, Chandigarh

Innovation Enterprise Package Consisting Fuel Pellet Plant, Pellet Stoves, Pellet Burner and Training

Product Information

- ✦ 500 Kgs/Hr Biomass Pellet Plant.
- ✦ Pellet Fuels cook stoves (5 Kw to 100 Kw).
- ✦ Pellet Burners (1 Lakh to 5 Lakh KCal).

Category

Bioenergy

Industry, Innovation Area

Fuel Pelleting, Pellet Stoves and Burner

GCIP Participant 2016

Ramesh Kumar Nibhoria, Managing Director

Patent/IPR

Various patent applied for



Competitive Advantage: World's only one stop shop having all technologies to establish decentralized pellet manufacturing businesses. Also impart technical and business training on running project.

Market Penetration: In India, projects are commercialized, 4 Franchisee operating and 2 are in pipe line. ✦ Exported market validation packages to Kenya, Ghana and Uganda.

Growth History: Since 2005, company never got any loan or investment. Through GCIP support, company got its very first investment of USD 260,000 and now has 15000 Sq Feet manufacturing facility with training guest house. From 4 employees, now strength is 16-18.

Key Clientele: Various school/college/company canteens, Sweet Shops/Snacks manufacturers and industries replacing LPG and Diesel with fuel pellets.



Growth Plans: In next 2 years, plans to establish 6-8 Franchisee and establish 900-1000 stoves and more than 100 pellet burners. ✦ Seek investment for growth plan as working capital from banks is still an issue.

About the Company: Nishant Bioenergy is pioneer company in the domain of pellet plant, pellet stoves and pellet burner domain. It conceived first design in the year 1999. Now company is imparting its expertise with new entrepreneur's franchisee to establish decentralized pellet plants having factory to consumer sales concept. They use local biomass, employ local people and sell to local pellet stoves users. Each such project creates 8-10 direct and 20-25 indirect employment. This project also saves 2000-2000 tons of CO2 per year and 600-700 tons of LPG/Diesel.

About the Founders: Ramesh is mechanical engineer (1987) and also alumni of Global Social Benefit Institute (2007,2012). Post engineering, he worked with few engineering organizations then started his first venture of biomass briquette manufacturing in the year 1996. Post failure he started designing briquette stoves and established this domain. Before his innovation, processed biomass was never being used in community kitchens replacing fossil fuels. His project has won Ashden, PCRA and WAF Awards. He has applied for more than 13 patents.

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🌐 www.nishantbioenergy.com

📘 https://www.facebook.com/nishantbioenergy/



UNesar Private Limited, Baroda



Innovation **Solar Stove™ - 24x7 Indoor Cooktop for Every Household (Gas Substitute)**

Product Information

Solar Stove™ is solar based indoor cooktop. The revolutionary compact thermal storage-based solution satisfies all cooking energy needs with superior experience & performance that makes it superior substitute to conventional cooking system. The Solar Stove™ stores solar energy in very convenient thermal storage to meet all cooking energy needs to work indoor, cook all dishes for 24x365; form factor that provides convenience & conventional cooking experience with modern functions suitable for all lifestyles.

Category

Renewable Energy

Industry, Innovation Area

Solar Energy, Consumer durable, Kitchen Appliance

GCIP Participant 2016

Mr. Dhaval Thakkar, Founder & CEO

Patent/IPR

10 patents filed (3 published and 7 non-published)

Startup India Registration Information

Registered with: DIPP; Registration Details: DIPP1605 (tax benefit approved)



Competitive Advantage: Solar Stove™ provides superior indoor cooking experience with zero fuel cost. ✧ First & only solar cooking solution for households that can cook most Indian dishes for 3 meals a day. ✧ Very Aspirational & Compact Form Factor. ✧ No Flame, No fire Hazard, Environment friendly. ✧ No need for any other backup system (Electrical charging option). ✧ Suit all lifestyles with Aspirational Portable & Indoor Cooking. ✧ Most suitable for interior and remote locations.



Market Penetration: NA (pre-commercial stage).

Growth History: Solar Stove™ prototype is successfully developed and successfully laboratory tested, user validated and independent third party validated.

Investment. ✧ Solar Stove™ is presently only technology provider to meet Prime Minister of India's priority of Solar Chulha.

Key Partner: MOU signed with Hindustan Petroleum Corporation Limited (HPCL) for

Growth Plans: Successfully complete product development and pilot with HPCL funding and then scale it to commercialization.

About the Company: UNesar Private Limited is startup developing innovative renewable energy solutions with immediate focus on solar cooking range for households. We are committed to enrich human lives with innovative green & clean energy technologies to meet essential energy needs with best access, appropriateness and economy that eventually impact all life forms and make planet sustainable and healthy. The company was established in 2016 at Vadodara, India.

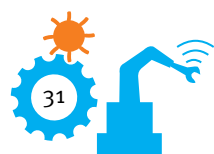
About the Founders: Inventor and founder Dhaval Thakkar is major force behind creating the innovative solutions and forming the venture with dedicated team. Dhaval Thakkar has 10 years of experience in renewable & clean-tech energy solution R&D with 10 patents filed to his credit as sole inventor.

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iMinBit TechIndia Private Limited, Varanasi

Innovation **Water Purification and Treatment**

Product Information

Fully developed Products: 100 LPH (Liters per hour) and 50 LPH. ✦ Sold 90+ units to educational institutes and 40+ units to Indian Army in Varanasi Region from 2015 to 2017. ✦ Filed International patent from World Intellectual Property Organization (WIPO). Novelty Accepted. ✦ Clocked revenue of USD 150,000 in march 2018.

Startup Registration Information

Registered with: MCA, Startup India, MSME, NSIC

Category

Water Efficiency

Industry, Innovation Area

Cost, Energy and Water saving RO based purifier
| With 70% Recovery Rate

GCIP Participant 2016

Naveen Kumar, Founder

Patent/IPR

Filed International patent from World Intellectual Property Organization (WIPO).
Novelty Accepted.



Competitive Advantage: Aquvio price is INR 90,000 (USD 1500), 25% lesser price than the big branded product, Less water wastage, High value for money, Reduction in 50% energy bills, Green and Smart Product, Same day service, Efficient filters.

Market Penetration: The water purifiers market in India is worth USD 1.05 billion and is expected to grow at CAGR of 23% during 2016-2020. The total Addressable commercial water purifiers market is USD 150 million and approx. USD 4 million in the Varanasi region alone. ✦ There is also an option to enter into the household market with 15LPH units.

Growth History: Saved more than 5 crore Litres of water and 21 MW energy. Equivalent to water to 5 Lakh people in a day and electricity to 2500 houses. ✦ Provided potable water to around 5000 underprivileged students and 2 schools. ✦ Affordable to Rural Government Schools and



Institutions due to 30% less market price compared to the current. ✦ The team size has increased from 7 members in 2016 to 18 in 2018. ✦ Expanded operation from Varanasi and are now present in Lucknow (UP) and established a manufacturing plant in Delhi.

Key Clientele: Educational Institutes & Indian Military.

Growth Plans: Expansion to 5 States in 2nd phase. ✦ Conduct R&D to introduce units with higher storage capacity and cooling features.

About the Company: Founded in 2015, Aquvio builds cost and energy saving RO based water purifiers which saves over 70% of the water passing through the filter. The technology is protected by an international patent granted by the World Intellectual Property Organization (WIPO). The company currently sells 2 products i.e. 100 liters per hour unit and a 50 liters per hour unit meeting the potable water needs of educational institutes, corporate offices, hospitals, hotels & restaurants and government bodies in Uttar Pradesh. The startup has expanded to Delhi NCR in current year.

About the Founders: Naveen Kumar, Founder: B.Tech, IIT (BHU), Varanasi. Rohit Kumar Mittal, Co-Founder: B.Tech and M.Tech, IIT (BHU), Varanasi

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**WATSAN ENVIROTECH PVT. LTD.,
Chennai**



Innovation **Water Purifier Without Electricity**

Product Information

Watsan water purifiers run on nano-filtration and do not need electricity and does not waste water. We also supply arsenic and fluoride removal purifiers.

Startup Registration Information

Registered with: DIPP Startup India and Registrar Of Companies; Registration Details: DIPP195 and ROC U29253TN2013PTC091052

Category

Water Efficiency

Industry, Innovation Area

Manufacturing, Water

GCIP Participant 2016

J. Chandrasekaran, Director

Patent/IPR

2 patents published on designing of cartridges and we have GOI license from CSIR (IMMT) for Terafil technology and approvals from DST and CIPET.



Competitive Advantage: Terafil water filters do not need electricity to function, is affordable, free of maintenance and retains all essential minerals and salts needed for the body. A single domestic filter costs \$13 and lasts for up to 15 years. The arsenic version costs around US \$18. This makes the cost of purification extremely low at about 3 cents (INR 2) per tonne of water. Affordable and natural, it is highly suited for the poorest districts of India which often do not have access to continuous electricity.

Market Penetration: We have distributed water filters to 2,00,000 households across India.
✧ Approved by WASAC, Rwanda.

Growth History. Incorporated in 2013.



✧ Started with USD 27,000 turnover, we have increased up to USD 106,000 by March 2018.

Key Clientele: World Vision India. ✧ Nargis Dutt Foundation. ✧ PHED Madhya Pradesh, Assam etc.

Growth Plans: To have dealership network throughout India by 2020. ✧ Get connects/leads from other developing countries and start exporting.

About the Company: Watsan believes that Science is the fulcrum to improve basic human health and makes and supplies electricity free water purifiers and ready to fit toilets.

About the Founders: Chandrasekaran J is a Plastics technologist, consultant to UNIDO-ICAMT, and has 30 years of experience in manufacturing.

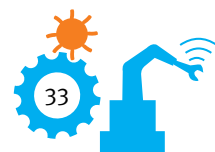
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Aspartika Biotech Private Limited, Bangalore

Innovation **Production of Omega-3 Fatty Acids from Discarded Silk Warm Pupae**

Product Information

High value nutraceutical like omega 3 fatty acids from the world cheapest and richest sources both for human and animal consumption. Poultry feed supplement enriched with omega 3 fatty acids to produce world's most nutritious eggs.

Startup Registration Information

Registered with: Indian Companies Act, 2013 & DIPP
Registration Details: DIPP: DIPP1542 KBITS/26/ADM/2016-17/196

Category

Waste Beneficiation

Industry, Innovation Area

Biotechnology, Nutraceutical

GCIP Participant 2018

Dr. Mousumi Mondal, CTO and
Srinivas B.V, CEO

Patent/IPR

Indian patent application – filed



Competitive Advantage: Omega-3 fatty acid from the cheapest and richest source with consistent quality at affordable prices for all. Highest content of omega-3 fatty acids for infants, pregnant lactating women and geriatric population. Designer eggs enriched with omega-3 fatty acids at affordable price.

Market Penetration: Aspartika has sold around 10 ton of aqua feed supplement in the year 2017-18 ✦ We have also sold the poultry feed supplement in various parts of Karnataka and are slowly diversifying the market to the whole of India.

Growth History: Initiated through a grant in aid from Department of Biotechnology under the Biotechnology Ignition Grant (DBT-BIG, GoI) to the tune of 730,000 USD ✦ Recipient of grants from Government of India under the Biotechnology



Industry Partnership Programme (BIRAC-BIPP) to the tune of USD 300,000 and Government of Karnataka under the Idea2PoC scheme to the tune of USD 64,000 ✦ Recipient of Bank loan to the tune of USD 190,000 from State Bank of India, Government of India under the CGTMSE scheme.

Key Clientele: Human nutraceutical industries, Cosmetic industries and Animal Nutrition industries majorly poultry and aqua.

Growth Plan: Innovate and Scale up the omega 3 fatty acid production ✦ Tap the reeling industries in the vicinity for raw material supply ✦ Seek equity-based funding.

About the Company: Aspartika is a biotech startup from Bangalore focusing on the concept of clean and green technology. The company utilizes the discarded silkworm pupae and manufactures high value nutraceuticals like omega 3 fatty acids for human and animal consumption. In addition to this, the company has developed omega 3 enriched poultry feed supplement fortified with essential minerals to provide world's most nutritious egg. The company is supported by Government of India and Government of Karnataka through various grants and also by State Bank of India through bank loan.

About the Founders: a) Srinivas B V: M.Tech in Biotech and Biotechnology, MBA in operations management with over 10 years R&D, industrial, product development and commercialization experience. b) B R V Ramana: M.com with over 40 years of experience in various fields like business development and commercialization.

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Basil Energetics Private Limited, Chennai

Innovation **Rooftop Solar System with DC Appliances and Smart Nano Grid**

Product Information

Rooftop solar system with DC appliances and controller for Nano-grid. The appliances are super-efficient and run directly from PV panels. No inverter is needed. Air conditioner, refrigerator, ceiling fan and lights operating from DC directly from PV panels. Smart Nano grid enables operation from DC or AC of the power grid.

Startup Registration Information

Registered with: MSME; Registration Details: Udyog Adhaar # TN24B0009500

Category

Energy Efficiency

Industry, Innovation Area

Energy Efficiency & Renewable Energy

GCIP Participant 2017

Dr. R. Ramarathnam, Chairman



Competitive Advantage: Capex reduction to the tune of 50% and OPEX reduction to the tune of 75% obtained. Lesser rooftop area. Ability to run heavier motorized loads.

Market Penetration: Test marketing done in Tamil Nadu. ✧ Tied up with a leading distributor to take the solution on all India basis. ✧ Service network is being established. ✧ Mainly focused on rural affluent customer. ✧ Remote area customers are provided with holistic electricity access.

Growth History: Two years old and gaining

traction in the market. ✧ Pan India presence is the immediate goal.

Key Clientele: Rural affluent households and remote area communities.

Growth Plan: Pan India operation in the next 2 years. ✧ Africa, South Asia, CIS countries and South America will be targeted next.

About the Company: Focused on enabling electricity access to weaker section of the society in rural and remote areas. Energy demand itself is greatly reduced and holistic energy access is enabled. Green Energy for water, sanitation, healthcare, livelihood, home needs and transportation are enabled.

About the Founders: Dr. Ram Ramarathnam graduated from IIT Madras and did his post-graduation & doctorate from IIT Bombay. He has extensive experience in energy efficient appliances and renewable energy.

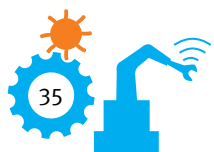
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Cerulean Enviro Tech Pvt Ltd, Pune

Innovation **Grey Water Treatment & Recycling**

Product Information

Automated, compact, energy efficient waste water treatment plant with batch mode of operation giving consistent treated water quality output. The size is customizable varying from 1000 L per day to 50000 L per day capacity. Based on chemical treatment process with modifiable pre and post treatments.

Startup Registration Information

Registered with: DIPP, MSME
Registration Details: DIPP 183, MSME – MH26A0021068

Category

Waste Beneficiation

Industry, Innovation Area

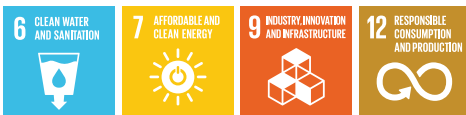
Grey/waste water treatment plants

GCIP Participant 2017

Dr. Sonali Mokashi, Co-founder & Director

Patent/IPR

Granted. Patent No 261355



Competitive Advantage: Multiple recycling (6-7 times) of same water, compact size - 60% less space required than competitor, automated liquid chemical dosing, no dedicated operator needed, consistent treated water quality, 66% saving on fresh water purchase.

Market Penetration: 1st unit was commissioned 2016 to treat in car. ✦ 25000 L of waste water in a car washing facility. ✦ In 2017, seven Similar units have been installed in car washing facilities for waste water treatment & recycling. ✦ 1st industrial canteen waste water recycling plant was installed in 2017, having capacity of 10000 L/day. ✦ Other market segments include auto ancillary industry and chemical manufacturing industry where we plan to install one unit each by end of 2018.



Growth History: With the initial investment of USD 37000, company has generated cumulative revenue of USD 150,000 by March 2018. ✦ The team size has grown from 3 in 2017 to 5 in 2018.

Key Clientele: Sai Service, Videocon, Ace Kudale Car, Jayesh Industries, QH Talbros, Brahma Motors.

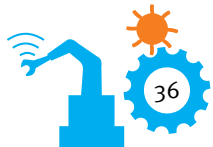
Growth Plans: Target of 80 new plant installations by March 2019, 200 by 2020 and 350 by 2021. ✦ Building sales team of 15 members by 2019, 24 by 2019 and total team of 64 members by 2020 ✦ Develop in house manufacturing & R & D facility by 2020.

About the Company: Cerulean is an Indian company incorporated with an interest of treating & recycling water. It uses a patented chemical treatment process that recycles 90% waste water. This process is integrated in a compact Effluent Treatment Plant which is automated and customizable. The product and underlying technology are sustainable with respect to materials used for manufacturing and process. The process is being extended to industrial effluents and various other segments with modifications in pre and post treatment.

About the Founders: Dr. Sonali Mokashi - Co founder and Director. Sonali is Ph. D. Microbiology with 12 years of research experience in water treatment. Mr. Ajay Mokashi - Co founder and Director is a Mechanical Engineer with post-graduation in Management having 25 years of experience working with MNCs and International companies. Mr. Indrajit Rau - Co founder and Director is a Mechanical Engineer with post-graduation in Management having 11 years of entrepreneur experience.

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Chakr Innovation Private Limited, Delhi

Innovation Diesel Generator Emission Control Device

Product Information

Our device Chakr Shield captures upto 90% of particulate matter emissions from diesel generators without any adverse impact on the generator’s performance. Moreover, captured carbon is not dumped or burnt-off – it is processed, reused in environmentally benign way.

Startup Registration Information

Registered with: DIPP; Registration Details: DIPP1527

Category

Waste Beneficiation

Industry, Innovation Area

Air Pollution abatement technology

GCIP Participant 2017

Ms. Bharti Singhla, Head of strategy
GCIP National Runners up

Patent/IPR

Patent filed



Competitive Advantage: The current alternatives which are used in vehicles and other industrial exhaust streams like DPF and catalytic converter create significant back pressures and are expensive. Moreover, these technologies oxidize the soot particles to carbon monoxide and carbon dioxide, which is not a sustainable solution. Chakr shield, on the other hand is able to capture particulate carbon itself without significant back-pressure. Moreover, we do not just dump or burn off the captured carbon. As carbon is a useful resource, we process the captured particulate matter and use it to create ink pigment. This pigment is non-toxic and is of same quality as the ink used in industries.

Market Penetration: 40+ devices installed in Delhi NCR. ✦ Turnover for FY 17: 100,000 USD

Growth History: Installation capacity from 5 devices in 2015, to 35 devices in 2017 to 50 devices till March 2018. ✦ From a 3-member employee in 2016 to 10 employees (2017) to 25 employees in 2018. ✦ Number of paying clients (large corporates) from 0(2016) to 5(2017) to 10 (2018).



Key Clientele: JSA Law, Indian Oil Corporation, Hindustan Petroleum, IIT Delhi, Tata Realty & Infrastructure Limited, DS Group etc.

Growth Plans: Scaling up production process through use of better equipment. ✦ Increasing value proposition for POINK - Our ink made from pollution. ✦ Research and Development: Expanding scope in R & D by means of targeting other sources of pollution and capturing other pollutants in addition to particulate matter.

About the Company: We are a team of engineers from IIT-Delhi who have devised a novel technique to curb air pollution from diesel generators extensively used in India to provide power back up. The device can capture ~90% of the particulate matter being emitted from diesel generators. Moreover, we do not dump this captured soot but convert it into pigment for ink and paint.

About the Founders: Chakr Innovation was founded by Arpit Dhupar (CTO), Kushagra Srivasava (CEO) and Prateek Sachan (COO) during their days in IIT Delhi. They are passionate problem solvers who strongly believe that the solutions to the biggest problems can be found in the simplest technologies. Kushagra and Arpit have been chosen as Echoing Green Fellows. They have also been featured on the Forbes 30 under 30 Global 2018.

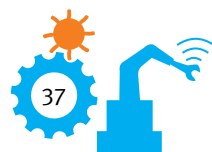
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NavAlt Solar & Electric Boats Private Limited, Kochi



Innovation **Solar Ferry Boats**

Product Information

Navalt has come up with the solution in the inland passenger transport solution, solar ferry, which does not have any problems of pollution (air or water) and has low noise and vibration in addition no smell of diesel. Most importantly the daily operating cost is 1/40 of diesel ferry.

Startup Registration Information

Registered with: DIPP; Registration Details: DIPP2181

Category

Renewable Energy

Industry, Innovation Area

Water Transportation

GCIP Participant 2017

Mr. Sandith Thandasherry, CEO; GCIP Global Renewable Energy Category Winner

Patent/IPR

Under Investigation



Competitive Advantage: Advantage is eco friendliness and very low total cost of ownership compared to diesel ferries. Navalt is creating a new market of solar powered ferries in India’s inland water transport system. We are the firm with proven technology for building solar ferries.

Market Penetration: Navalt has sold India’s first solar ferry to Kerala government. After seeing its success, we already signed up one 100 passenger solar ferry with the same client. We have 500 million USD target customer sub segment in India. Our solar boats can work in most inland water bodies 20 degrees north and south of equator – most of Asia, Africa.

Growth History: Orders for nine solar ferries from 30 to 150 passenger’s capacities from three states in India. We won many global awards and recognition. We were awarded by PM for social innovation. ADITYA is one of the significant small ships of the world selected by RINA, UK.



Key Clientele: Navalt has sold ferries to State Water Transport Department of Kerala. Other states with similar water transportation system like Goa, West Bengal, Gujarat, UP have shown interest in our ferries.

Growth Plans: We are planning significant improvements in next solar boat models. We are developing efficient solutions for patrol vessels, vehicle carrying ships etc. and building our in-house sales team as well as signing up resellers in all regions in India for market expansion.

About the Company: NavAlt was founded in 2013. It envisions an efficient water transport system which doesn’t use fossil fuels. Working towards this vision, we have built ADITYA (75-seater), India’s first solar ferry for public transportation. Navalt is combining advancements in naval architecture, electric power train, and Photovoltaics.

About the Founders: Sandith Thandasherry is co-founder and CEO of NavAlt. He has a B-Tech in Naval architecture from IIT Madras & MBA from INSEAD and 18 years industry experience. Philippe Pallu is co-founder of NavAlt. He is a mathematician and a sailor with 30 years of experience in boating industry.

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Need Innovation Private Limited, Kolkata

Innovation Ceramic Membrane - 3rd Generation Membrane Technology for Filtration Application

Product Information

KERASIEV® ceramic membrane - A 3rd Generation filtration technology for water purification to distillery, dairy to pharmaceutical and waste water to oil refinery applications. It has shelf life of more than 15 years, which reduces the cost of ownership to less than 1/3rd of present available technology/process.

Startup Registration Information

Registered with: Registrar of Companies, Government of West Bengal; Registration Details: CIN. No. L27101PN1985PLC038031

Category

Water and Energy efficiency

Industry

Water, Dairy, Chemical, Distillery & Pharmaceuticals.

Innovation Area

Low cost Ceramic Membrane with 15 years of shelf life.

GCIP Participant 2017

Dr. Sandeep Sarkar, Co- Founder, Top 7 semi-finalist GCIP 2017

Patent/IPR

We have our proprietary know-how and own the trade mark- KERASIEV® Ceramic Membrane



Competitive Advantage: 1/6th the cost of available ceramic membrane (filter). ✧ Reduce the cost of ownership by 1/3rd times.

Market Penetration: KERASIEV® Ceramic Membrane has been applied across the separation application spectrum as pilot and semi commercially since its launch during late 2017. ✧ FY-2017-18 revenue: \$0.1746 million.

Growth History: The company has increased its production capacity from 5 sqm membrane/month during early 2017 to 30 sqm by the end of FY 2017-18. ✧ The staff strength was increased from 2 to 6 during FY 2017-18. ✧ Global Agreement with a Multinational company for application of KERASIEV® Ceramic Membrane in distillery.

Key Clientele: Reserve Bank of India has used KERASIEV® Ceramic Membrane for their high security printing press process recycling and certified the products satisfactory performance. ✧ The product user expressed their interest to upgrade their existing process.

Growth Plan: The estimated ceramic membrane market is 5.1 billion by 2020 with 44% market share by the south-east Asia. With KERASIEV® technology/affordability, 10% share of south-east Asia will be acquired by 2020.

About the Company: Hi-Tech Ceramic process/design developing company. It has developed and commercially introduced the first ceramic membrane technology in India for filtration various application viz. water filtration to waste water recycling, refinery to dairy, pharmaceutical to distillery.

About the Founders: Sandeep Sarkar, has a PhD degree in Chemical Engineering. He has been working as Sr. Scientist, CSIR, Govt. of India for more than 11 years and has lead several R&D projects before starting his own enterprise with Mr. Sasi Kumar, (Chemical Engineer) and Mr. Sandeep Choudhury (Metallurgical Engineer).

Contact information:

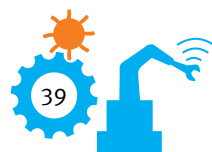
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Saathi Eco Innovations India Private Limited, Ahmedabad



Innovation 100% Biodegradable Sanitary Pads

Product Information

100% biodegradable sanitary pad made from an agricultural by-product, banana fibre, one of the most absorbent and abundant natural fibres in India. Unlike wood pulp or cotton, we don't require additional land. Our all-natural pads don't contain any bleach or chemicals to minimize skin irritation and the release of toxins into the environment upon disposal.

Startup Registration Information

Registered with: DIPP

Category

Waste Beneficiation

Industry, Innovation Area

FMCG, Sanitary Napkin

GCIP Participant 2017

Tarun Bothra, Co-Founder, CTO;

GCIP Global Winner

Patent/IPR

Patent applied



Competitive Advantage: Saathi does local sourcing and manufacturing, which generates local jobs. Competitors use cotton, which when farmed uses 6x the water and 10x the fertilizer as bananas. Saathi pads degrade within 6 months, 1200 times faster than conventional pads, and eliminate the need for incineration, reducing CO2 production. We eliminate 60 kg of pad waste, per woman, in her lifetime.

Market Penetration: Since we began sales in early 2017, we have generated \$81,300 in revenue
✦ We have sold 250,000 pads
✦ Saathi's current active monthly customer base consist of 2,605 women.

Growth History: Set up our own manufacturing facility and set up a corporate office in Ahmedabad
✦ Production capacity has reached 100,000 pads/month
✦ Won multiple national



and global innovation and sustainability competitions; Most recently, Cartier Women's Initiative Awards Finalist
✦ Raised \$353,786 in grants and \$205,000 in equity.

Key Clientele: Ekal Vidyalaya and Arogya Foundation, women pan India; Supported by Canadian government, MIT, Harvard Business School, and others.

Growth Plans: Bring compostable products mass-market that's accessible across income levels and benefits the local economy
✦ By 2023, will reduce plastic waste by 9,000 metric tons and reduce CO2 emissions by 10,000 metric tons.
✦ By 2022, will have USD 19 million in revenue.

About the Company: Saathi is a social enterprise and sustainable manufacturing company that makes eco-friendly hygiene products. We are innovators in the use of alternative materials and zero-waste production. Our mission is to create hygiene products that are good for the body, environment, and community. We started with sanitary pads because they are a necessity for women and only have 16% penetration in India.

About the Founders: Saathi began in 2015, when its four co-founders, Kristin Kagetsu, Tarun Bothra, Amrita Saigal, and Grace Kane - graduates of MIT, Harvard and Nirma University - came together on a mission to create fully eco-friendly, compostable sanitary napkins using locally sourced banana fiber from the state of Gujarat, where Saathi is based. They were all motivated by the potential to make a positive difference for women in India while using an engineering approach focused on ecology and sustainability. Our team has business, technical, and local expertise to develop new products and set up manufacturing.

Contact information:

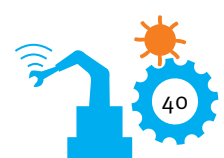
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Sagar Defence Engineering Private Limited, Mumbai



Innovation **TRASHFIN**

Product Information

Trash-Fin is large a drone with an underwater cavity capable of collecting up 500 kg of waste before needing to deposit it elsewhere for processing. In addition to collecting waste, it also sends back valuable data to ground authorities, including information on the quality of water, the weather, and the depth of the river/harbour. It can be controlled through remote or it is capable to perform its tasks without any human intervention.

Category

Waste Beneficiation

Industry, Innovation Area

Unmanned marine surface vehicles, wildlife anti-poaching systems, offshore, oil and gas, maritime, government authorities, natural resource preservation.

GCIP Participant 2017

Mr. Lakshay Dang, Software Lead

Patent/IPR

Being filled

Startup Registration Information

Registered with: DIPP

Registration Details: DIPP- DIPP1861, GeM-12879



Competitive Advantage: Hybrid system, round the clock autonomous waste collection, operation can be carried out with multiple boat at same time, scalability can be fitted on any kind of vessel from 1 meter to 25 meters and above, compact, plug and play architecture, modular, customizable, cost effective, highly rugged and available for all weather environment.

Market Penetration: Apart from collecting waste from the oceans, the company is also looking at sea bed offshore service, mining countermeasures in defence sector, reviving of lakes and ponds and water-level and quality monitoring. The potential addressable market is \$26.5B and we are looking at 12.5%.

Growth History: Self-funded startup. ✧ Incorporated in 2015, with 2 staff in Mumbai,

today in 2018, the company is spread across India and Europe today in 2018.

Key Clientele: We have done pilot projects for the Municipal Corporation of Mumbai, Port of Rotterdam, Government authority, Ministry of Shipping, Defence, Fisheries, Security & Surveillance, National oceanography institutes, National disaster management organizations, Search and rescue etc and are in talks for the National Mission for Clean Ganga project.

Growth Plans: To give rise to clean and resilient oceans. ✧ To make every ship, an autonomous ship. ✧ To accelerate the world's transition towards autonomous.

About the Company: Sagar defence builds unmanned marine & aerial vehicles. Trashfin is our hybrid autonomous vehicle system which does round the clock collection of floating waste. The solution puts no human life at risk and reduces opex and capex.

About the Founders: Capt. Nikunj Parashar, founder of Sagar Defence is a master mariner with sailing experience of 14 years. A Master (FG) post graduate and mechanical engineer by himself, he has a wide expertise of all fields of engineering.

Contact information:

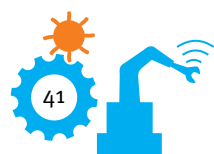
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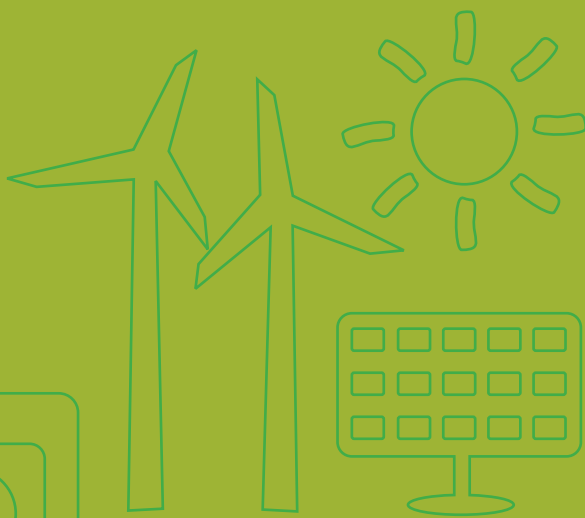
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Annexures



Annexure A: GCIP Innovations Mapped to SDG Targets

GCIP Startups	Product Description	Sustainable Development Goals	
Aarshadhatu	Anti-Fouling coating for ship developed using nano-technology obtained using patented green production processes. Use of nanotechnology-based coating which increases the sea borne time of the ship by impeding the growth of Algae and barnacles.		
Agnisumukh	Energy efficient commercial cookstoves that operates on LPG, Natural Gas and Bio-Gas and delivers high-temperature and uniform radiant-heat for faster cooking using patented burners. Significantly reduces fuel use and ambient heat in commercial kitchen.		
Aquvio	Aquvio builds cost and energy saving reverse osmosis-based water purifiers which saves over 70% of the water passing through the filter.		
Aspartika Biotech	Utilizes discarded silkworm pupae and manufactures high value nutraceuticals like omega 3 fatty acids for human and animal consumption. Poultry feed supplement enriched with omega 3 fatty acids to improve the health of livestock and poultry.		
Atomberg Technologies	Ceiling fan that consumes 28W at full speed, using brushless DC motor and a driving algorithm called “atomsense”, which precisely senses various motor parameters in real time and controls the motor in a closed loop, reducing power losses.		
Avani Bio Energy	Small scale (10-30 kW) gasification-based power plants, using Pine needles as fuel to generate electricity and cooking charcoal for rural needs.		
Basil	Rooftop solar system with DC appliances and Controller for Nano grid. The appliances - air conditioner, refrigerator, ceiling fan are energy-efficient, consume very little power and run directly from solar panels.		
Brasil Technologies	Technology that uses rice-husk ash, to produce highly dispersible silica which is used in tyres to reduce friction and improve the efficiency and performance of vehicles.		
			
			

GCIP Startups	Product Description	Sustainable Development Goals							
Cellzyme Biotech	Engineered enzyme that can be used as a green biocatalyst for commercial manufacturing of antibiotics. It is an immobilized enzyme. Idea stems on reducing energy consumption and toxic effluent discharge to produce antibiotics.	9	7	12	12	7	12	12	12
Cerulean	Automated, compact, energy efficient waste water treatment plant with batch mode of operation giving consistent treated water quality output. The size is customizable varying from 1000 L per day to 500000 L per day capacity.	9	7	6	6	7	6	6	6
Chakr Innovation	Chakr Shield captures upto 90% of particulate matter emissions from diesel generators without any adverse impact on the generator's performance. Captured carbon is reused in environmentally friendly way and converted into pigment for inks/paints.	9	7	11	11	7	11	11	11
Inficold	Thermal energy storage to eliminate diesel generator for backing up mission critical cooling applications such as milk/perishables products. Also operates on solar power for round the clock cooling.	9	7	12	12	7	12	12	12
Jyoti Cero	Hybrid idler having high abrasion resistance, 8-10 times better life, low coefficient of friction and 10-12% energy efficient as compare to the conventional products .	9	7	7	7	7	7	7	7
NavAlt	Solar ferry that uses solar photovoltaic system and battery storage to drive the electric propulsion system. Solar ferry does not contribute to air or water pollution and has low noise and vibration. It's daily operating cost is 1/40th of a diesel ferry.	9	7	6	6	7	6	6	6
Need Innovation	Developed and commercially introduced the first ceramic membrane technology in India for filtration various application viz. water filtration to waste water recycling, refinery to dairy, pharmaceutical to distillery.	9	6	12	12	6	12	12	12
Neogi Technologies	“High Accuracy Fuel Metering & Dispensing System” (HAFMDS), driven by brushless direct-current motor for low energy consumption and operating on solar power for reliable and continuous operation	9	7	7	7	7	7	7	7
Nishant Bioenergy-India	Innovative pellet-based cook stove and burners for commercial kitchens and micro industries that saves more than 35% in fuel cost while replacing fossil fuels with carbon neutral biomass pellets. Low cost technology to make biomass fuel pellets.	9	7	7	7	7	7	7	7

Sustainable Development Goals

Product Description

GCIIP Startups

Waste heat recovery from industrial utilities like chillers and air compressors – by designing and building high efficiency heat exchangers coupled with a data acquisition and analysis mechanism.

Promethean Energy



Radiant Cooling systems which use structural elements like floor or false ceiling to create heat sinks in the space to remove the heat and cool the space.

Oorja Energy



EcoFlex sand plant systems which delivers efficiency by reducing power consumption in production equipment and in dust collection system.

Rhino Machines



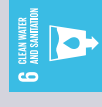
High pressure fully hydraulic Moulding Machine suited from small to large foundries in Green Sand Moulding Process. Consumes 30 to 50% lesser energy in production are delivers 2% saving in metal use and machining

Rhino Machines



100% biodegradable sanitary pad made from an agricultural by-product, banana fibre, one of the most absorbent and abundant natural fibres in India. These all-natural pads don't contain any bleach/chemicals to minimize skin irritation and the release of toxins into the environment upon disposal.

Saathi Eco Innovations



Trash Fin is large drone with an underwater cavity capable of collecting up 500 kg of waste before needing to deposit it elsewhere for processing. It also sends back valuable data to ground authorities, including information on the quality of water, the weather, and the depth of the river/ harbour.

Sagar Defence Engineering



Solar Stove™ is solar based indoor cooktop. A compact thermal storage-based solution, which stores solar energy in very convenient thermal storage system that meets cooking energy needs of a Indian household.

Unesar



Ceiling fan based on brushless direct-current motors BLDC technology, which consumes 56 per cent less electrical energy compared to conventional ones.

Versa Drives



Watsan water purifier a low-cost water filtration solution that uses nano-filtration technology developed by CSIR and do not need electricity.

Watsan Envirotech



Annexure B: GCIP Innovations Mapped to GoI National Missions and Programmes

GCIP Startups	Product Description	Government of India Programmes		National Missions
		Programmes		
Aarshadhatu	Anti-Fouling coating for ship developed using nano-technology obtained using patented green production processes. Use of nanotechnology-based coating which increases the sea borne time of the ship by impeding the growth of Algae and barnacles.	Promoting Startups in the Biotechnology Sector (DBT)	Technology Scheme (MOEFCC)	National Mission for Enhanced Energy Efficiency (NAPCC)
Agnisumukh	Energy efficient commercial cookstoves that operates on LPG, Natural Gas and Bio-Gas and delivers high-temperature and uniform radiant-heat for faster cooking using patented burners. Significantly reduces fuel use and ambient heat in commercial kitchen.		Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
Aquvio	Aquvio builds cost and energy saving reverse osmosis-based water purifiers which saves over 70% of the water passing through the filter.	Water Technology Initiative Programme (DST)	Clean Technology Scheme (MOEFCC)	National Water Mission (NAP-CC)
Aspartika Biotech	Utilizes discarded silkworm pupae and manufactures high value nutraceuticals like omega 3 fatty acids for human and animal consumption. Poultry feed supplement enriched with omega 3 fatty acids to improve the health of livestock and poultry.	Promoting Startups in the Biotechnology Sector (DBT)	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
Atomberg Technologies	Ceiling fan that consumes 28W at full speed, using brushless DC motor and a driving algorithm called “atomsense”, which precisely senses various motor parameters in real time and controls the motor in a closed loop, reducing power losses.			National Mission for Enhanced Energy Efficiency (NAPCC)
Avani Bio Energy	Small scale (10-30 kW) gasification-based power plants, using pine needles as fuel to generate electricity and cooking charcoal for rural needs.			National Mission on Sustainable Habitat (NAPCC)
				National Mission for Sustaining the Himalayan Ecosystem (NAPCC)
				Atal Innovation Mission
				Make In India Mission
				Startup India Mission

GCIIP Startups		Government of India Programmes		National Missions	
		Programmes			
Basil	Rooftop solar system with DC appliances and Controller for Nano grid. The appliances - air conditioner, refrigerator, ceiling fan are energy-efficient, consume very little power and run directly from solar panels.	Clean Energy Research Initiative (DST)	Technology Development and Transfer programme (DST)	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
		Clean Energy Research Initiative (DST)	Technology Development and Transfer programme (DST)		National Mission for Enhanced Energy Efficiency (NAPCC)
Brisil Technologies	Technology that uses rice-husk ash, to produce highly dispersible silica which is used in tyres to reduce friction and improve the efficiency and performance of vehicles.				National Mission for Enhanced Energy Efficiency (NAPCC)
Cellzyme Biotech	Engineered enzyme that can be used as a green biocatalyst for commercial manufacturing of antibiotics. It is an immobilized enzyme. Idea stems on reducing energy consumption and toxic effluent discharge to produce antibiotics.			Promoting Startups in the Biotechnology Sector (DBT)	National Mission for Enhanced Energy Efficiency (NAPCC)
Cerulean	Automated, compact, energy efficient waste water treatment plant with batch mode of operation giving consistent treated water quality output. The size is customizable varying from 1000 L per day to 500000 L per day capacity.	National Mission for Clean Ganga (MOWR)	Water Technology Initiative Programme (DST)	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
		Clean Energy Research Initiative (DST)	Technology Development and Transfer programme (DST)	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
Chakr Innovation	Chakr Shield captures upto 90% of particulate matter emissions from diesel generators without any adverse impact on the generator's performance. Captured carbon is reused in environmentally friendly way and converted into pigment for inks/paints.				
Inficold	Thermal energy storage to eliminate diesel generator for backing up mission critical cooling applications such as milk/perishables products. Also operates on solar power for round the clock cooling.			Clean Technology Scheme (MOEFCC)	National Mission for Enhanced Energy Efficiency (NAPCC)
Startup India Mission					
Make In India Mission					
Atal Innovation Mission					

Government of India Programmes		Government of India Programmes	
		Programmes	National Missions
GCIP Startups	Product Description	Hybrid idler having high abrasion resistance, 8-10 times better life, low coefficient of friction and 10-12% energy efficient as compare to the conventional products .	National Mission for Enhanced Energy Efficiency (NAPCC)
		Solar ferry that uses solar photovoltaic system and battery storage to drive the electric propulsion system. Solar ferry does not contribute to air or water pollution and has low noise and vibration. It's daily operating cost is 1/40th of a diesel ferry.	National Solar Mission (NAPCC)
Jyoti Cero	Clean Energy Research Initiative (DST)	National River Conservation Plan (MOEFCC)	National Water Mission (NAPCC)
NavAlt		Clean Technology Scheme (MOEFCC)	
Need Innovation	Developed and commercially introduced the first ceramic membrane technology in India for filtration various application viz. water filtration to waste water recycling, refinery to dairy, pharmaceutical to distillery.	Technology watch and Fore-sighting (DST)	National Mission on Sustainable Habitat (NAPCC)
Neogi Technologies		Clean Technology Scheme (MOEFCC)	
Nishant Bioenergy-India	"High Accuracy Fuel Metering & Dispensing System" (HAFMDS), driven by brushless direct-current motor for low energy consumption and operating on solar power for reliable and continuous operation.	Clean Technology Scheme (MOEFCC)	National Mission for Enhanced Energy Efficiency (NAPCC)
Promethean Energy	Waste heat recovery from industrial utilities like chillers and air compressors – by designing and building high efficiency heat exchangers coupled with a data acquisition and analysis mechanism.	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
			National Mission for Enhanced Energy Efficiency (NAPCC)
Oorja Energy	Radiant Cooling systems which use structural elements like floor or false ceiling to create heat sinks in the space to remove the heat and cool the space.	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)

Government of India Programmes		National Missions	
GCIP Startups	Product Description	Programmes	National Missions
Rhino Machines	EcoFlex sand plant systems which delivers efficiency by reducing power consumption in production equipment and in dust collection system.	Technology Development and Transfer programme (DST)	National Mission for Enhanced Energy Efficiency (NAPCC)
Rhino Machines	High pressure fully hydraulic Moulding Machine suited from small to large foundries in Green Sand Moulding Process. Consumes 30 to 50% lesser energy in production and delivers 2% saving in metal use and machining.	Technology Development and Transfer programme (DST)	National Mission for Enhanced Energy Efficiency (NAPCC)
Saathi Eco Innovations	100% biodegradable sanitary pad made from an agricultural by-product, banana fibre, one of the most absorbent and abundant natural fibres in India. These all-natural pads don't contain any bleach/chemicals to minimize skin irritation and the release of toxins into the environment upon disposal.	Clean Technology Scheme (MOEFCC)	National Mission on Sustainable Habitat (NAPCC)
Sagar Defence Engineering	Trash Fin is large drone with an underwater cavity capable of collecting up to 500 kg of waste before needing to deposit it elsewhere for processing. It also sends back valuable data to ground authorities, including information on the quality of water, the weather, and the depth of the river/ harbour.	National Mission for Clean Ganga (MOWR)	National Water Mission (NAPCC)
Unesar	Solar Stove™ is solar-based indoor cooktop. A compact thermal storage-based solution, which stores solar energy in very convenient thermal storage system that meets cooking energy needs of a Indian household.	Clean Energy Research Initiative (DST)	National Solar Mission (NAPCC)
Versa Drives	Watsan water purifier a low-cost water filtration solution that uses nano-filtration technology developed by CSIR and do not need electricity.	National Rural Drinking Water Programme (MODWS)	National Mission for Enhanced Energy Efficiency (NAPCC)
Watsan Envirotech	Watsan water purifier a low-cost water filtration solution that uses nano-filtration technology developed by CSIR and do not need electricity.	Water Technology Initiative Programme (DST)	National Mission on Sustainable Habitat (NAPCC)
			Atal Innovation Mission
			Make In India Mission
			Startup India Mission

UNIDO Project Management

Unit - GCIP 2017



Sanjaya Shrestha
Industrial Development
Officer

Sanjaya Shrestha joined UNIDO in 2002 as Industrial Development Officer. He was in the UNIDO Regional Office for South Asia in New Delhi for five years as a focal point for energy and environment projects. Before joining UNIDO, he worked as Manager for Electricity Utility and ESCO companies in Kathmandu, Bangkok and Sydney. Presently, Mr. Shrestha is based at the UNIDO Headquarters in Vienna and works for the Energy Department. His main responsibilities include development, implementation and monitoring of industrial energy efficiency, renewable energy applications in industry and clean/low carbon technology projects primarily in the South East Asia and South Asia regions.

Mr. Shrestha has a Bachelor of Engineering in Electrical Engineering from Indian Institute of Technology, India and a Master of Engineering in Energy Technology, from Asian Institute of Technology, Thailand.



Sandeep Tandon
National Project Manager

Sandeep Tandon has more than 29 years' professional experience, with specialization in the area of energy efficiency and climate change for two decades in leadership role. He has been involved in design and implementation of large and often complex projects on Climate Change mitigation and many first-of-a-kind projects in India including bagasse cogeneration, power plant efficiency improvement and others that have avoided an estimated 100million tons of CO₂ emissions. He has provided advisory support in the implementation of energy efficiency projects in Mongolia, Malaysia, Bangladesh, and Thailand. He has experience of working with private sector multinational consulting firms, state governments and International Development Agencies including UNIDO, UNDP, and USAID. Sandeep has a Bachelor's in Electrical Engineering from D A university, Indore and M. Tech. in Energy Studies from IIT Delhi.



Reshmi Vasudevan
Programme Expert

Reshmi Vasudevan brings 16 years of experiences working on sustainable development research, energy efficiency policies and low carbon market transformation. Her experiences include research and stakeholder engagement for promoting energy efficiency policies and market transformation in India, research at Lund University Centre for Sustainable Studies, Sweden, programme management of USAID's South Asia Regional Initiative for Energy Integration. Reshmi's earlier work experience includes software engineering stints at Hewlett Packard. At UNIDO Reshmi has been part of the Global Cleantech Innovation Programme and the Facility for Low Carbon Technology Deployment. Reshmi holds a masters in Environmental Science with a focus on Sustainable Development and a masters in Software Engineering.



Rishabh Goel
Project Associate

Rishabh Goel is associated with UNIDO for over five years and has been closely associated in the implementation of GCIP Programme since its inception in India. He has played a key role in the implementation of GCIP challenge, engaging programme resource persons such as mentors, investors, consulting organizations. He has been instrumental in reaching out to the startups registered with the Indian government and instigating them to participate in GCIP accelerator. He is fully conversant with the implementation of an technology accelerator programme aimed at building the capacity of a startup. He holds a Masters in Business Administration and a Bachelor's degree in Electronics and Communication Engineering.



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