80 YEARS OF IMPACT

Council of Scientific & Industrial Research

Low Cost and Hazard Resistant Houses for the Nation

Rural Tech. Park at SIRD Bhubaneshwar, after completion

IN early May 2019, cyclone Fani ravaged the coast of Odisha. Winds at 175 km per hour and very heavy rains destroyed and damaged, among other things, lakhs of houses. However, some houses braved the raging winds and pouring rains. These houses that weathered the cyclonic storm were designed and built by the CSIR's Central Building Research Institute (CSIR-CBRI), Roorkee.

In the year 2018, India's largest and premier building research institute was approached by the Government of Odisha to provide technical assistance, support and guidance on housing designs and to suggest improvements. CSIR-CBRI focused on capacity building of project administrators and Engineers, to ensure high quality deliverables with precision and speed.

Several training sessions of five days each were organised (online/offline) at CSIR-CBRI, where around 5000 engineers and artisans of Panchayati Raj Department of Government of Odisha participated. When all these participants returned to their respective headquarters, they acted as the master trainers to train fellow officers. As an outcome of the combined efforts of CSIR-CBRI & the Panchayati Raj Department of Government of Odisha, more than 9 lakh houses were constructed.

Impressed with the work of CSIR-CBRI, the Government of Odisha also requested CSIR-CBRI to help them establish a Rural Technology Park at Bhubaneshwar for demonstration, training and wider dissemination of alternative building technology in Odisha State.

CSIR-CBRI also performed a thorough study of the cyclone Fani damaged houses, identified the deficiencies and suggested measures for rebuilding safe and sturdy houses. The Government of Odisha sought the help of CSIR-CBRI for reconstruction of about 25 lakh houses affected by cyclone Fani.

A house to live in is a basic need of every human. The Government of India has affirmed its commitment to provide "Housing for All" by the year 2022. In pursuance to this goal, the Pradhan Mantri Avas Yojna-Gramin (PMAY-G) scheme was approved to provide assistance for construction of *pucca* houses in rural areas.

However, a short period of time and limited resources do not support the traditional system of construction. The requirement is to construct cost-effective rural houses for different geo-climatic conditions and address potential natural hazards prevalent in the country.

The CSIR-CBRI has also been entrusted with the responsibility for architectural and structural validation of the rural housing designs by the United Nations Development Programme (UNDP), on the advice of the Ministry of Rural Development of the Government of India. The CSIR-Central Building Research Institute (CSIR-CBRI) has reviewed the designs by UNDP and has suggested appropriate S&T interventions to make the houses more durable, resistant to natural disasters and comfortable to live-in. Local materials were utilised to the maximum extent in construction in order to achieve economy, acceptability of local society and employment generation.

For safety against earthquakes in low and moderate intensity zones and to protect from high winds it was suggested that all the walls of the house must be tied together using RC plinth, lintel, roof and gable bands to have integral box action. Where RC bands are not possible bamboo or timber bands may be used with secure connections at corners and junctions. Necessary interventions were also suggested in foundations to meet the requirements of local hazards such as floods and swelling soil.

A comprehensive document *"Pahal: Prakriti Hunar Lokvidya – A Compendium of Rural Housing Typologies"* showcasing different designs of rural housing in Odisha state can be referred at the following link: https://cbri.res.in/wp-content/uploads/2020/11/pahal.pdf

Technical session

Live demonstration

Rural Tech. Park at SIRD, Bhubaneshwar, during construction

Adapted from the CSIR Blog (https://www.csir.res.in/csirblog-success-stories)

80 YEARS OF IMPACT

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Providing Pure Drinking Water with TERAFIL

AFTER completing his Post Graduation from the Central Institute of Plastics Engineering & Technology (CIPET) in 1989, J. Chandrasekaran worked in plastics and engineering companies for twenty years. In 2009, Chandrasekaran received a call from Dr S.K. Nayak, his former CIPET teacher, who had become the Director-General of CIPET (now Central Institute of Petrochemicals Engineering & Technology). Dr S.K. Nayak invited Chandrasekaran and a few industrialists to attend a technology demonstration at CIPET. Although Chandrasekaran had worked in industries, he was not an industrialist. So, he was a bit unsure, but he wanted to 'obey' his Guru's orders and so visited CIPET.

The visit changed Chandrasekaran's life. It also enabled him to touch the lives of lakhs of Indians.

On that day in CIPET, scientists from the CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneshwar, presented to the assembled industrialists, TERAFIL, a low-cost technology to purify water. The scientists explained and demonstrated how TERAFIL purifies both surface and groundwater at a minimal cost.

What makes the TERAFIL technology a low-cost one is its easily available ingredients and the simple process to make the filters. The three major ingredients for the filter

are pottery clay, sand and wood sawdust. These are mixed to form 'dough' from which disc, brick and candle-shaped water filters are cast.

The filters are then dried and heated at very high temperatures. At a high temperature, the wooden sawdust embedded in the filters burns away, resulting in pores in what now becomes the TERAFIL filter. These pores are separated from each other by thin semi-permeable clay walls. The clay wall contains a large number of ultra-fine capillary openings that allow water to permeate while trapping the pathogens and heavy metals like iron. The cost of water purification is just about three paise per litre.

However, most of the industrialists present in CIPET on that day were not very enthusiastic about the low-cost technology. The more common RO water technology that catered to the urban population offered higher returns. The proposition of a low-cost filter to be sold in rural areas for marginal returns did not appeal to them, except Chandrasekaran.

Hailing from a village in Tamil Nadu and having travelled widely in the state, Chandrasekaran knew first-hand about the poor water quality in the rural areas. Even today, water in many rural areas is highly turbid and contaminated with bacteria such as *Vibrio, Salmonella* and *Shigella* that cause cholera and dysentery. It also contains disease-causing protozoa and other microbes like guinea, round, hook and tapeworms.

In the CIPET hall, perhaps sensing the uncertainty prevailing in the minds of those present, the CIPET Director-General suddenly announced that his former student Chandrasekaran would take up the CSIR-IMMT technology and scale it up. Chandrasekaran was caught off-guard. But his heart warmed at his former teacher's trust in him. Moreover, Chandrasekaran recognized the enormous potential that the TERAFIL technology held.

The next day, Chandrasekaran gave up his job. He underwent training at CSIR-IMMT where he was taught the finer process of making TERAFILs. Soon, he licensed the TERAFIL technology from CSIR-IMMT. And he set out to manufacture TERAFIL water filters.

And manufacture, he did. It is not just Chandrasekaran who has obtained licenses from CSIR-IMMT. In fact, CSIR-IMMT has to date licensed the TERAFIL technology to more than 120 MSMEs, NGOs and other government agencies. Today, there are over 3 lakh units of domestic filters and 50,000 units of community filters installed in rural and urban areas based on the TERAFIL technology.

Other than the low-cost of purchase, the maintenance cost of TERAFIL is also minimal. The life of the inexpensive filter is a good three years, sometimes even longer. With use, the filter surface does get clogged, but all that is required is periodic scrubbing, rejuvenates the flow rate of the TERAFIL. If bacterial contamination is suspected, mild chlorination would make the water 100% bacteria-free.

It is estimated that 60 million litres of affordable & safe drinking water are produced every day using CSIR-IMMT's TERAFIL technology. In the last five years, CSIR-IMMT has transferred the technology to 18 MSMEs across India and has provided training to the licensees.

Chandrasekaran went on to set up Watsan Envirotech Pvt. Ltd., the leading producer of TERAFIL based filters. Today, he is a man with a mission. His mission is to provide clean drinking water and sanitation. He has also taken TERAFIL beyond India's shores and has found worldwide acclaim for his dedication to providing clean drinking water. Besides, he has also developed add-ons to remove arsenic and fluoride from the water, along with TERAFIL.

TERAFIL is yet another CSIR technology that has turned an employee into an employer, generated jobs and most importantly, touched lives.

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