3.1.2. Adapting to floods and droughts in India through the water storage technology Bhungroo

Participating country: India

Partner: Naireeta Services Private Ltd.

Start of technology uptake process: 2007

Climate technology: Storm water management technology

Contribution to NDC implementation: Better adapting to climate change through enhanced investments in sectors vulnerable to climate change, including agriculture, water and disaster management; creating additional carbon sinks; and addressing the challenges of poverty eradication, food security and nutrition, gender equality and the empowerment of women, and water and sanitation

Further information:
Naireeta Services: www.naireetaservices.com.
Videos explaining the Bhungroo technology: https://www.youtube.com/watch?v=E9ynVXjf-i8 and https://www.youtube.com/watch?v=QAMarW5IBG8&t=52s.

Climate technology: Bhungroo is a storm water management technology that utilizes detailed geophysical and geological analysis and data simulation for filtering, injecting and storing excess storm water in pipes[11] within subsoil layers. The technology works on the principles of aquifer storage and recovery, managed aquifer recharge and recovery, and vertical drainage. Using a surface space of only one to two square metres, each Bhungroo can conserve one to four million litres of water each year within its subsurface zone. Seventeen different technical designs of the technology have been created and operationalized for women smallholders in different agroclimatic zones across India, as well as in Bangladesh, Ghana and Viet Nam.

11 *Bhungroo* is a colloquial Gujarati word meaning 'straw' or 'hollow pipe'.

Uptake of the climate technology: In India, the occurrence of flash floods, extreme weather events and droughts has increased in frequency and in unpredictability. In 2000, the National Bureau of Soil Survey and Land Use Planning estimated that 11.6 million ha land (7.5 per cent of India's total arable land), mainly in western and northern India as well as in some eastern coastal areas, was prone to waterlogging, and that on 6 million ha of this land waterlogging led to heavy crop damage.[12] The successful uptake of the Bhungroo technology at the rural community level was ensured by building on locally available resources and skills and locally manageable maintenance processes. The technology was introduced through a capacity-building programme targeted at three groups: (1) land-owning farmers who can afford to invest in the technology; (2) poor, vulnerable, illiterate women farmers working collectively in self-help groups and benefitting from a grant programme developed by Naireeta Services; and (3) smallholders supported by a government programme. Geological, geohydrological, geophysical, mechanical engineering, civil engineering and agriscience principles for installing the Bhungroo technology units are explained to women smallholder farmers in their own language and in simple terms. The uptake of the technology starts with a water needs assessment, and is followed by drilling, casing, procurement of filtration materials, erection of the filtration chamber, testing and geotagging. Each of these activities includes various subactivities, all of which are carried out in line with traditional knowledge and in a culturally acceptable manner. For example, the water needs assessment takes into account traditional knowledge of local seasonal variations, crop patterns and irrigation types. An assessment of total storm water availability, including storm water sources, minimum and peak volumes, and duration of inflow per source, is then made. All data collection tools are designed for unschooled users and result in the creation of open-source knowledge.

Gender-responsiveness: Given the predominant patriarchal rural system in India, the technology was, in its early days, targeted at male smallholders. However, male farmers did not have the required trust in, and experience of, collective ownership and management. They were also lacking in time to invest in refining and adapting the technology to their local soil and water situations. At the same time, female participation in the development of the technology was increasing and achieving better results with increasing cost-effectiveness of the Bhungroo units through collective leadership. Women therefore became Naireeta Service's target group for localizing and disseminating the technology. Since then, thanks to a "women in climate leadership programme" developed by Naireeta Services, women in many communities in India have embraced the technology and managed its uptake process from initiation through to scaling up and maintenance. The programme, which consists of technical training and support, enables poor women farmers to become ambassadors of the Bhungroo technology and to sell their technical consultancy services, thus turning them into micro-entrepreneurs. During 2021 and 2022, Naireeta Services trained another 2,150 women climate leaders from 16 villages, scaling up awareness about the technology in new areas.

The joint ownership, operation and maintenance of the technology by groups of women within a community leads to the joint ownership of the irrigation water the technology produces, transforming the social status of the beneficiaries from agricultural labourers to financially self-reliant farmers comparable with landowners. Naireeta Services makes it a condition to hand over the technology ownership rights to the women in charge of the technology in order for the community to use the irrigation water. The ownership rights are documented within the local governance system and in line with local social norms. This is another key component of how the technology contributes to gender mainstreaming in climate action. The Bhungroo technology has received various awards for its innovative approach that empowers women, including the UNFCCC Momentum for Change Award, now called the United Nations Global Climate Action Award, the Gender Just Climate Solutions Award of the women and gender constituency, the Cartier Women's Initiative Award and the Buckminster Fuller Challenge Grand Prize.

Financing: Naireeta Services has developed a financing model for the technology uptake, which is based on a two-tier marketing strategy: Bhungroo units are sold for profit to rich farmers, who have a proven return on investment within two and half years, and Naireeta Services then uses its profits to mobilize grants that enable poor, illiterate women farmers to access the technology. The collective ownership of the Bhungroo units by underprivileged women farmers is a prerequisite for accessing the grant-supported technology. Collective ownership is key to ensuring gender equality and women's empowerment. Women farmers benefit via improved revenues secured through increased crop production, as well as fees earned through the provision of maintenance services to other communities using the same technology. Food security, the doubling of agriculture-based income, and freedom from debt and interest payments are usually achieved within two to three years after the installation of the technology.

Contribution to NDC implementation: As part of its NDC (submitted in 2016), India aims to "better adapt to climate change by enhancing investments in…sectors vulnerable to climate change, particularly agriculture, water…and disaster management", create an additional carbon sink of 2.5 to 3 billion t CO_2 eq through additional forest and tree cover by 2030 and address "the challenges of poverty eradication, food security and nutrition… gender equality and women empowerment, water and sanitation, energy…"

12 http://www.iiwm.res.in/pdf/Bulletin_30.pdf.

By December 2022, 5,324 Bhungroo technology units had been put in place, benefiting more than 15,000 women smallholders and nearly 160,000 poor rural people (i.e. on average 30 benefactors per Bhungroo unit). The technology offers a sustainable solution to enhance investment in climate change adaptation in the agriculture and water sectors and in disaster management. In addition, the 5,324 units installed can lead to the absorption of 120,000–137,360 t CO_2 eq per year[13] through increased growth of vegetation, according to a pilot study conducted in 2018 by Naireeta Services.

The Indian Government has incorporated the Bhungroo technology within its NRLM policy as a means of increasing action on climate change adaptation while advancing poverty eradication, livelihood generation and food security. A total budget of USD 5.1 billion has been allocated for the implementation of NRLM with the aim of directly benefitting 70 million poor rural households.

Bhungroo, one of the technologies supported under the NRLM, benefits from a dedicated loan plan, but the formal bank credit system and policy measures generally reserve loans or financial support for landowners. Since only around 14 per cent of agricultural land in India is owned by women, according to India's agricultural census of 2015–2016,[14] in practice the system excludes women farmers from accessing loans for the Bhungroo technology, as Indian women generally have no land tenure rights. Approximately 14 million of the 23 million rural households headed by women are considered deprived (without land, proper housing or education).[15] If only 10 per cent of these 14 million households were able to access the technology through a targeted gender-responsive policy incentive, up to 0.68 million ha land (deprived women farmers cultivate 0.5 ha land on average)[16] could be turned into productive land in winter and during the monsoon season. This could increase income and food security for about 7.5 million poor rural people (5.4 people per household) and create a carbon sink of 38–43 million t CO_2 eq per year. To date, no policy changes have yet materialized to implement more

13 The estimates are based on an in-house study, which found that one Bhungroo unit can support crop cultivation on about 5 acres (2 ha) of land and that, depending on the crop, an average of 22.5–25.8 t CO_2 eq can be sequestered per acre per year.
14 Available at https://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf.
15 Socio Economic and Caste Census 2011 of the Government of India.
16 Field data from Naireeta Services based on 10 years of work with women farmers in different states of India.

gender-responsive measures. However, Naireeta Services intends to continue to advocate for a better integration of the gender dimension in order to unlock the strong social and climate benefits of the technology.

Challenges and lessons learned: Every Bhungroo technology site is unique and has a plethora of different geological, geohydrological, agricultural, mechanical and civil engineering challenges. To address these challenges in a cost-efficient manner, Naireeta Services has entered into local, national and international partnerships and conducts continuous research into adjusting processes and refining the technology. In addition to the work of Naireeta Services in India, since 2018, 10 Bhungroo technology units have been installed in Bangladesh, three in Ghana and two in Viet Nam, which continue to be in operation as at December 2022.

Uptake of the technology in rural communities facing extreme poverty has been a challenge as it requires pooling the financial and human resources of several smallholders and turning to collective ownership, operation and maintenance. Women organized in self-help groups have proven to be much more experienced in and accepting of collective management of Bhungroo technology units than men. The ability of women to work together has also led to a constant improvement of the technology. However, women's lack of land ownership rights still remains a serious barrier to uptake, in particular as it limits women's access to microcredit instruments and to government support programmes designed to promote the technology. This makes the gender approach particularly relevant for the successful uptake of the technology. Key lessons could be shared at the national level via the NRLM and at the global level via the UNFCCC gender action plan.

Long-term sustainability, replicability and potential for scaling up: In the next five years, an additional 10,000 Bhungroo technology units will be installed across the globe, enabling 50,000 farmers to triple their agricultural income, on average, impacting about 250,000 poor rural people indirectly. Scaling up of the technology will also lead to improved soil fertility in 20,000 ha land, the first-time productive use of 89,000 ha land in the winter and the training on climate change of 15,000 women and youth farmers. In addition to the work of Naireeta Services in India, Bangladesh,[17] Ghana and Viet Nam, the replication and scaling-up of the Bhungroo technology is also under way in Rwanda and Kenya. Furthermore, Naireeta Services has receiving demands for piloting the Bhungroo technology in the Lao People's Democratic Republic, Malawi and Nigeria.

3.1.3. Making buildings more energy-efficient in South Africa

Participating country: South Africa

Partners: SANEDI, TIPSASA

Start of technology uptake process: 2015

Climate technology: Energy-efficient building technology

Contribution to NDC implementation: Using innovative energy-efficient solutions to achieve sectoral GHG emission reduction targets

Climate technology: The passive thermal control technology project uses a combination of heat- and light-reflective roof coating and traditional thermal insulation that significantly increases the energy efficiency of buildings. The thermal insulation largely acts as a barrier to heat flow or heat transfer from the building (heat loss during the colder months), whereas cool-coated roofs prevent absorption of heat by the building by means of solar reflectance, reducing heat transfer to the interior. These technologies are energy-passive, relatively low cost and low maintenance.

Uptake of the climate technology: Historically, insulation has been the only trusted and effective passive thermal control technology used for both heating and cooling of a building. However, in the South African context, insulation is far more effective at retaining building heat than cooling it. The reflective cool roof technology has an inexpensive one-off cost of application and can last from 10 years up to the life of the roof. To achieve similar cooling as a cool roof, the thickness of the bulk insulation has to be increased. The return on investment if insulation thickness is doubled, tripled or quadrupled is 13, 17 or 19 years respectively. However, both technologies are needed as they address different challenges.

Inspired by international research, SANEDI initiated a local programme with TIPSASA, South Africa's leading industry body on passive heating and cooling, to develop and deploy the passive cooling technology in line with the local context. As a member of TIPSASA, the South African Cool Surfaces Association was legally allowed to participate and contribute to the regulation of cool coating product quality, preventing technology failure and reputational damage. More important, SANEDI wanted to avoid reducing the minimum standards already set for insulation, if cool roofs were included in the energy efficiency design. This reduction in minimum standards

17 The work in Bangladesh is funded by the Millennium Alliance.