



Climate Change Adaptation through Small-Scale
and Protective Infrastructure Interventions in
Coastal Settlements of Cambodia (CCA4CS)

Resilient Demo Housing Constructions in Kep and Preah Sihanouk Provinces

Building Resilience at the Coast: Climate-Adaptive Housing for Vulnerable Communities



MAY 2025
PHNOM PENH, CAMBODIA

BRIEF SUMMARY

Output 3.5 of Component 3 focused on strengthening climate resilience in vulnerable communities by constructing demonstration resilient housing units.

KEY ACHIEVEMENTS

Phase 1 Implementation

- A contract was signed with Raknika Construction and Consulting Services Co., Ltd. on 16 March 2023.
- Eight resilient homes were constructed and handed over to beneficiaries in Kep Province on 3 April 2024.
- Local labour was employed, contributing to local income generation.
- Environmental and Social Safeguards (ESS) assessments confirmed the successful completion of construction, though the report noted areas for design improvement, such as cost reduction and expansion potential.

Phase 2 Scaling-Up

- In August 2023, the Adaptation Fund Board approved reallocating unspent funds from Output 3.4 to support scaling up Outputs 3.5 and 3.7 (Decision B.42/40).
- A Resilient Housing Expert was hired in July 2024 to revise designs and cost structures based on Phase 1 experience.
- A comprehensive housing assessment was conducted in September 2024, with refined designs presented to the PMC on 16 September.
- In Kep, 12 houses were built under the oversight of sub-national authorities and completed by June 2025, while in Prey Nob, the 7 houses were completed by September 2025.
- Labourers were trained in resilient construction techniques.
- Daily remote guidance and fortnightly site visits ensured quality control throughout construction.
- A formal handover ceremony of the 7 resilient houses at Prey Nob was held on 27 October 2025, attended by national and provincial officials, partners, and community members.

GOOD PRACTICES

1. Proactive Technical Support: The Resilient Housing Expert used Telegram groups to provide real-time technical guidance to subcontractors, streamlining quality control and enabling flexible adjustments based on land availability.

2. Climate-Smart, Inclusive Design: The revised housing models emphasized energy efficiency, durability, and accessibility. Key features included reinforced foundations, anti-heat roofing, solar panels, rainwater tanks, and accessible design elements for elderly and disabled residents.

3. Skills Development and Livelihood Enhancement: Both male and female labourers, including unskilled individuals and family members of beneficiaries, participated in the construction process. This training broadened local income opportunities and empowered communities.

LESSONS LEARNED

1. Land Size Constraints: Discrepancies between reported and actual land sizes led to last-minute design modifications. Future projects must verify land boundaries with official documentation before construction.

2. Affordability Challenges: While technically sound, the demonstration homes may be cost-prohibitive for some communities. Future designs should consider modular cost-saving alternatives, such as simpler flooring and sanitation options.

3. Gender Participation Gaps: Female participation in construction remained limited due to entrenched norms, lack of prior experience, and childcare burdens. More realistic participation targets and tailored support are needed.

4. Climate Disruptions: Prolonged and unseasonal rains significantly delayed construction activities. Projects must integrate robust contingency planning to account for extreme weather.

RECOMMENDATIONS

1. Land Verification: Prepare and sign official land confirmation letters with households and local authorities before construction to prevent design conflicts and ensure compliance.

2. Gender-Inclusive Outreach: Promote women's participation through realistic targets, success story sharing, and support measures like skills-based training and childcare provisions.

3. Continuous Monitoring and Communication: Maintain daily contact between technical experts and contractors through online platforms to ensure consistent quality and real-time issue resolution.

4. Post-Construction Resilience Monitoring: Establish a long-term plan to track the performance of climate-resilient features over time, particularly during adverse weather events.

5. Weather Contingency Planning: Develop site-specific contingency protocols, including material protection, scheduling flexibility, and alternative construction techniques suited to wet conditions.

PROJECT OVERVIEW

Since August 2021, the United Nations Human Settlements Programme (UN-Habitat) and the National Council for Sustainable Development (NCSD) have been implementing the "Climate Change Adaptation through Protective Small-Scale Infrastructure Interventions in Coastal Settlements of Cambodia" Project (CCA4CS), with financial support from the Adaptation Fund.

The project aims to strengthen climate resilience and adaptation in Cambodia's most vulnerable coastal settlements, in Kep Province and Prey Nob District of Preah Sihanouk Province, through targeted interventions around three interconnected components:

Component 1: Community-scale knowledge and capacity enhanced to sustain the adaptation benefits of the project's investments.

Component 2: Government planning and technical capacity enhanced and knowledge captured and disseminated to sustain and enhance the project's adaptation benefits.

Component 3: Resilience built through investment in small-scale protective and basic service infrastructure and natural assets.

These initiatives will enhance communities' capacity to withstand climate-related challenges by focusing on areas where ecotourism can support long-term sustainability. Through these components, the project addresses immediate climate risks and lays the foundation for long-term sustainability and resilience in Cambodia's coastal communities.

RATIONALE FOR THE INTERVENTION

The marginalised households are disproportionately affected by natural disasters, lacking the resources and capacity to cope, recover, or adapt. In Cambodia's coastal regions, this vulnerability is particularly severe.

Storm surges, flooding, and seawater intrusion frequently impact Kep Province, which lies on low-lying terrain near the sea. Similarly, Prey Nob District in Preah Sihanouk Province faces high exposure to coastal hazards due to its location and elevation. Poor households often reside in structurally weak homes made of zinc sheets or thatched roofs. These dwellings offer little protection against climate hazards, powerful winds, and storms.

Stakeholder consultations and site assessments conducted during the project development phase confirmed the severity of this problem. In some communes, up to 80 per cent of houses are damaged annually by high winds, with approximately 200 homes destroyed yearly. This evidence underscored the urgent need for climate-resilient housing interventions.



Photo 1: Design of a demo resilient house (Phase 1)



Photo 2: Design of a demo resilient house (Phase 2)

BRIEF DESCRIPTION OF THE INTERVENTION

To address these vulnerabilities, the project implemented Output 3.5 under Component 3, focusing on enhancing housing resilience in Kep and Prey Nob through a three-pronged approach.

1. The project aimed to develop practical and climate-resilient house designs and to replicate them using local labour and materials, thereby promoting affordability, community ownership, and broader adoption.
2. The intervention emphasised capacity-building for unskilled and semi-skilled local labourers, equipping them with construction techniques tailored to climate-resilient structures. The training created a skilled local workforce for future resilient construction projects.
3. The project aimed to construct demonstration homes that incorporate these design principles and serve as tangible, replicable models for future replication.

This intervention aimed to benefit 27 vulnerable households by providing resilient homes while indirectly reaching approximately 55,604 people (50% women) through knowledge transfer and exposure to improved construction practices.

This report captures the implementation process, primary outcomes, best practices, challenges, and key recommendations emerging from this intervention to inform future projects focused on climate-resilient housing in coastal Cambodia.

KEY ACHIEVEMENTS

The project team implemented the intervention in two phases to ensure long-term ecological and community resilience. They coordinated with subnational authorities, who assisted in selecting beneficiaries based on poverty status, including ID Poor criteria.¹

Phase 1

In Phase 1, following a competitive procurement process, the National Council for Sustainable Development (NCSD) signed a contract (No. 00112023/CCA4CS) with Raknika Construction and Consulting Service Co., Ltd. on 16 March 2023.

The company constructed eight resilient houses in Kep and Preah Sihanouk Provinces (Prey Nob District) and officially handed them to vulnerable families on 3 April 2024. Local skilled and unskilled labourers participated in the construction, creating jobs, and supporting local livelihoods.

Monitoring and evaluation conducted by the NCSD, UN-Habitat, and an Environmental and Social Safeguards (ESS) consultant confirmed the timely completion of construction and overall quality of the homes. However, several areas for improvement were noted, including the relatively high cost of replication, limited flexibility in the original housing design for future expansion, and inadequate integration of tree planting in the compound.

Phase 2

In Phase 2, the project expanded its scope after the Adaptation Fund Board approved (on 11 June 2024, Ref: 2024/108) reallocating unspent funds from Output 3.4 to scale up resilient housing under Output 3.5 (Decision B.42/40).

A Resilient Housing Expert was recruited on 22 July 2024 to revise the designs and cost estimates based on the experience during the implementation of Phase 1.

In September 2024, the Housing Expert conducted a comprehensive housing assessment in both provinces to evaluate the housing design and materials and proposed a new design along with associated cost estimates. The Project Management Committee (PMC) meeting on 16 September 2024 approved the improved design proposal.

During the Environmental and Social Safeguards Monitoring in December 2024, the consultant recommended: **the project team visit the site at least every fortnight**. Therefore, the NCSD team, particularly the Adaptation Officer, regularly monitored field activities in collaboration with the Resilient Housing Expert, utilizing a monitoring sheet. They also communicated with the subcontractors daily and provided technical guidance

based on the photos and questions they received from the subcontractors.

In Kep, the project team transferred full responsibility for constructing 12 demonstration homes to the sub-national authorities. These authorities managed the bidding process, selected the contractors and beneficiaries, and oversaw the implementation of the project.

Seng Chanrithy Construction Company was selected through competitive bidding in January 2025. In February 2025, they participated in on-site technical training sessions led by the Resilient Housing Expert. All 12 houses were completed by early June 2025.

In March 2025, the project team discussed the critical eligibility criteria for beneficiary selection with the Prey Nob District Administrative and three communes (Teuk La'ork, Teuk Thla, and Samaki). The seven beneficiary households were selected from three communes.

The handover ceremony of the 12 houses was held on 26 June 2025 and presided over by His Excellency Pheav Sovuthy, Under Secretary of State at the Ministry of Environment and Chair of the Project Management Committee. Other participants at the ceremony included Mrs. Tit Sokha, Deputy Governor of Kep Province, and representatives from the NCSD, UN-Habitat, a construction company, local authorities, and the community. The project team placed a signboard on the site displaying the logos of the NCSD, MoE, UN-Habitat, and the Adaptation Fund.

The construction of the seven additional resilient houses in Prey Nob District was completed in October 2025. The handover ceremony of the 7 houses was held in October 2025 and presided over by His Excellency Pheav Sovuthy, Under Secretary of State at the Ministry of Environment and Chair of the Project Management Committee. Other participants at the ceremony included Mrs. Nay Sally, representative of Preah Sihanouk Province, and representatives from the NCSD, UN-Habitat, a construction company, local authorities, and the community. The project team placed a signboard on the site displaying the logos of the NCSD, MoE, UN-Habitat, and the Adaptation Fund.

GOOD PRACTICES

1. Real-Time Technical Support via Telegram

Dedicated Telegram messenger groups for daily communication between field contractors and technical experts proved highly effective and provided intensive and proactive guidance. This communication complemented the bi-weekly field visit to ensure quality control of the construction. The Resilient Housing Expert was able to respond immediately to questions about material selection and troubleshoot technical issues. This minimised delays, reduced errors, and enabled quick design adjustments on-site — significant for remote areas with limited oversight capacity.

¹ The Ministry of Planning established the Identification of Poor Households Program (ID Poor) in 2006 to provide regularly updated information on poor and at-risk households. Based on Sub-Decree 291 on Identification of Poor Households in December 2011, ID Poor is the mandatory standard tool for all organisations that want to target

social services to poor households and at-risk households in Cambodia. ID Poor categorises households into four categories, namely (1) poor level 1 - very poor, (2) poor level 2 - poor, (3) at-risk, and (4) non-poor.



"I was a farmer without other livelihood options, but I can work as a construction worker now. Experience and skills from this project allow me to work for other construction sites from now on. It's a new income source that I can rely on."

2. Adaptive and Climate-Smart Housing Design

Project teams tailored the homes to local climate and site conditions. In Phase 2, they focused their innovations on affordability, energy efficiency, and eco-friendliness. Compared to traditional houses, the new design features elevated reinforced foundations for flood resilience, strong beams, anti-heat roofing to reduce indoor temperatures, and solar panels for an off-grid energy supply. Other features — rainwater harvesting tanks, ventilation systems, and disability-friendly handrails — ensured houses were inclusive, environmentally responsive, and future-proofed for extreme weather conditions.

3. Local Workforce Empowerment

The project created jobs for unskilled and semi-skilled labourers from the local community, many of whom were women and youth. They received practical on-the-job training and earned income during the construction period. Some were family members of beneficiary households, strengthening local engagement, social equity, and the long-term sustainability of the housing intervention. Nam Hum, a female labourer, said: "I am a farmer without other livelihood options. After the training, I can work as a construction worker. My experience and skills from this project will allow me to work on other construction sites in the future. It's a new income source that I can rely on."

LESSONS LEARNED

1. Inaccurate Land Size and Boundary Data

Land demarcation emerged as a significant bottleneck. The actual size of the housing plots often differed from those recorded during beneficiary selection and verbal communication. These discrepancies forced time-consuming changes to housing layouts and foundation placement. To avoid such issues, early-stage surveys using GPS or GIS tools, along with formal validation of land ownership records, should be mandatory.

2. Affordability Challenges for Broader Replication

During the ESS mission, the demonstration homes were seen as high-quality but expensive for average low-income families to replicate without subsidies. To support future scalability, cost-saving options should be explored — for example, substituting high-specification materials with local alternatives for sanitation and flooring while maintaining core structural integrity and climate resilience.

3. Gender Participation Barriers

Despite setting gender equity targets, the project experienced less female participation than desired during training and construction. As outlined in the project document, the 50 per cent target for female involvement proved highly ambitious. Cultural norms, traditional gender roles, limited experience, safety concerns, and childcare responsibilities all contributed to this gap. These factors reduced the intervention's overall inclusivity, highlighting the challenge of achieving gender parity in traditionally male-dominated sectors. Project teams must redesign programs to address these barriers by providing childcare support, launching awareness campaigns, and offering role-model training opportunities.

4. Weather-Induced Construction Delays

Unexpected and intense unseasonal rainfall disrupted construction timelines and material transport. The constructed team suspended work due to safety concerns and waterlogged conditions. The unpredictable and intense weather patterns, a key impact of climate change, caused the delay in the construction. These challenges underscore the need for risk-informed scheduling, seasonal planning, and investment in protective infrastructure such as raised storage platforms.

RECOMMENDATIONS

1. Land Verification Protocols

Future housing interventions must require verified land demarcation using up-to-date cadastral maps, GPS/GIS tools, and signed consent from all relevant parties (e.g., village leaders, district officials, and landowners). These checks should be completed during the pre-construction phases to prevent construction delays and minimise the need for redesign.

2. Gender-Inclusive Participation Measures

Dedicated strategies should be implemented to promote gender balance in technical roles. These may include tailored training modules for women, flexible work shifts, access to childcare, and recruitment of female supervisors or mentors to encourage participation. Additionally, project teams should set targets that reflect the local context and socio-cultural realities.

3. Institutionalise Digital Supervision Platforms

Digital communication tools like Telegram or WhatsApp groups should become standard practice for remote construction monitoring. These platforms enable daily updates, visual documentation, and quicker resolution

of on-site technical issues, even in geographically dispersed settings.

4. Establish Long-Term Monitoring Systems

Project teams must evaluate resilient housing features after construction to assess their performance under real weather conditions. They should check for roof leaks, test the durability of solar panels, and examine the efficiency of drainage systems. The monitoring protocol should incorporate community feedback, conduct site inspections, and track environmental performance indicators as standard practice.

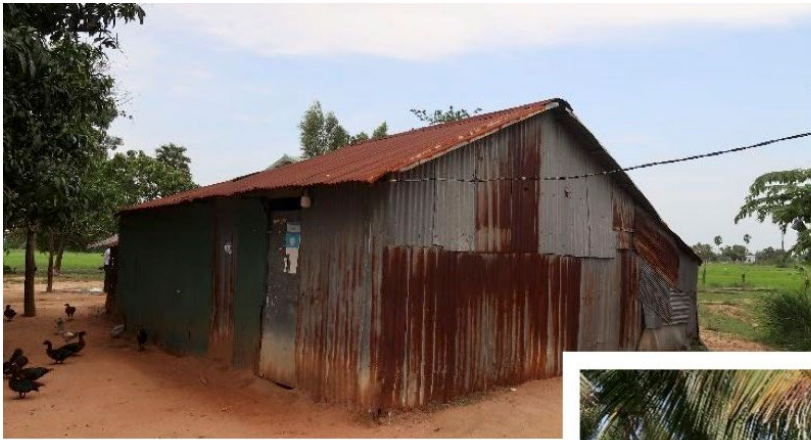
5. Integrate Climate-Adaptive Construction Planning

Construction schedules should align with dry seasons, and contingency plans must be in place for extreme events. Projects should invest in site protection measures — e.g., sandbag perimeters, drainage ditches, or waterproof tarpaulins — during heavy rainfall. Project planners should budget for delays in advance and seek approval for flexible timelines. They should also establish protocols for halting construction and securely storing materials.

DOCUMENTATION

Name	Type	Produced Date	Location
Technical design (Phase 1)	Design	February 2024	Link
Technical design (Phase 2)	Design	2024	Link 1 Link 2
Training Report	Report	June 2025	Link
Monitoring Report in Kep	Report	2025	Link
Monitoring Report in Prey Nob	Report	2025	Link

EXISTING HOUSES



TRAINING



CONSTRUCTION



ESS ASSESSMENT





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