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MAKING A CASE FOR INTEGRATING A COMPREHENSIVE CARE SERVICES INFRASTRUCTURE INTO CLIMATE ADAPTATION PLANNING AND FINANCE

CAREN GROWN, JEROME DE HENAU, AND IPEK ILKKARACAN

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Caren Grown, Jerome De Henau, and Ipek Ilkkaracan

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Caren Grown, Brookings Institution
Jerome De Henau, Open University
Ipek Ilkkaracan, Istanbul Technical University

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Abstract

Climate adaptation planning has largely overlooked care systems, despite these systems' central role in determining whether households and communities can withstand climate shocks. Care systems function as critical resilience infrastructure: They protect vulnerable populations, enable workforce participation, and maintain essential services during crises. When care systems are weak, climate shocks cascade into broader social and economic failures. When they are strong, they act as shock absorbers that stabilize communities. Integrating care into adaptation planning is therefore not a social add-on, but a core strategy for reducing vulnerability and ensuring system-wide resilience.

This paper argues that investing in a comprehensive care services infrastructure is foundational to climate adaptation and identifies the needs and actions necessary for adapting the care services sectors to climate change. Building resilience of a care services infrastructure involves adapting both services and physical infrastructure. For services, the key elements of the needs and actions identified include integration of workforce requirements to respond to rising care needs under substantially more constrained conditions during climate disruptions and support for adaptation planning, preparedness, training, and administration. The physical environments in which care is provided—both institutional care facilities and home-based settings—also need to be adapted to be capable of withstanding and responding to climate-related hazards. This includes both retrofitting existing buildings and developing new infrastructure using climate-resilient, inclusive, and sustainable design principles, such as nature-based solutions. The heart of the paper is an empirical methodology for estimating the costs of investing in a climate-resilient care services infrastructure, focusing on early childhood education and care and long-term care services. The methodology is then applied to data from Bangladesh, one of the most vulnerable countries to climate change. The results reveal that the magnitude of required investments in a climate-resilient care services infrastructure is substantial, with the largest share of spending directed toward new employment. However, these estimates need to be considered alongside the costs of inaction and the broader economic returns associated with investments in care services sectors.

1. Introduction

The National Oceanic and Atmospheric Administration and European Center for Medium-Range Weather Forecasts warned in May 2026 that temperatures over the next two years could reach record highs, and El Niño conditions will intensify drought, flooding, disease prevalence, and food insecurity (Zhong and Stevens 2026).[1] As with other climate extremes, the WHO (2023) and UNICEF (2024) caution that the impacts will be felt most acutely by young children, older persons, and people with disabilities, while simultaneously disrupting health services, schools, and other essential systems. In this context, a system of care services is critical resilience infrastructure that determines whether households and communities can absorb, respond to, and recover from climate shocks.

A comprehensive care services infrastructure rests on formal professional care with universal coverage through affordable, accessible, and high-quality services and decent jobs for the care workforce in early childhood care, education, health care, and long-term care. It can strengthen preparedness and response efforts to various climate hazards and ensure continued care provisioning under extreme weather events, minimizing disruptions, as compared to the case where such provisioning is dependent exclusively on family care.

In many low- and middle-income countries, and even in some high-income countries, however, deficits in paid care services are widespread. This became glaringly evident during COVID-19. But even before the COVID-19 pandemic, institutions like the International Labour Organization (ILO 2018) and the World Bank (Devercelli and Beaton-Day 2020) highlighted a global care crisis. Before COVID-19, 43% of pre-primary school-age children with employed mothers globally did not have any access to formal child care services, with nearly 80% of those 350 million children living in low- and middle-income countries (Devercelli and Beaton-Day 2020). The ILO (2018) projected that the number of care recipients will grow substantially, reaching 2.3 billion by 2030, reflecting an additional 100 million older people and a largely unchanged global population of children.[2]

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[1] Extreme weather events already hit hard in many countries: Mozambique confronted its worst floods in decades in early 2026 (Africanews and AP 2026): 12,000 homes, 126 schools, and 13 health facilities were damaged or destroyed (CARE 2026). The disruption of essential services forced 100,000 people into temporary shelters, many of which were inaccessible to older people and people with disabilities. Heat waves in Australia reached record highs in January 2026 (Stock 2026), escalating dangerous conditions for older people, young children, and people with chronic conditions (Australian Government Department of Health, Disability and Ageing 2025; HMRI 2026). In Kenya, catastrophic drought has driven widespread food insecurity, prompting school systems to deploy emergency food supplies to protect children and sustain retention (Ojwang'-Kna 2026). And in Bangladesh, intensifying pollution and climate change are acutely straining its already underfunded and understaffed health system (Hayden 2026).

[2] Although children will still comprise the vast majority of dependents worldwide, this pattern will be highly uneven, with child-related care demand concentrated in high-fertility regions such as Africa and the Arab States, while many other high and middle-income countries will experience declining child populations and rapidly increasing elder-care needs (ILO 2018).

There is an inextricable link between the global care crisis and the climate crisis, both of which constitute compounding, interlocking emergencies. Climate change increases the need for caregiving, both paid and unpaid, through several channels. Climate hazards, such as rising temperatures and extreme weather events, increase the need for care due to sudden illnesses and climate-induced disabilities. The most vulnerable populations, including children, older adults, and individuals with disabilities, face increased morbidity and mortality due to such factors as limited mobility, heightened susceptibility to disease and temperature extremes, and a decreased capacity to independently fulfill essential life-sustaining needs (WHO 2014; Romanello et al. 2024; UNICEF EAPRO 2022; UNICEF 2025).

Climate change also damages care infrastructure; for instance, extreme weather events such as severe flooding, hurricanes, cyclones, and typhoons impair care facilities (e.g., hospitals, clinics, daycare centers, nursing homes, and schools) and stop or disrupt their operations (Floro and Poyatzis 2018). The need for paid care services increases in the context of climate disasters, requiring additional work hours of paid care workers under substantially more constrained conditions, such as coping with facility damage. Spikes in illnesses and disabilities place immediate stress on emergency rooms, paramedics, nursing staff, child care, and long-term care workers (Tesfaye et al. 2025). Climate change also reduces access to essential inputs for care, such as water and food, and complementary infrastructure such as safe shelter. At the same time, the care system itself needs to be adapted to climate change.

A comprehensive care services infrastructure builds climate resilience as it can support the well-being and functioning of individuals and communities before, during, and after climate shocks. As such, this paper claims that investing in comprehensive care services is a climate adaptation strategy—one that builds long-term resilience by protecting health, reducing social vulnerabilities, and strengthening communities' capacity to prepare, face, and recover from climate hazards. A well-functioning care system that is itself adapted to climate change can enable paid and unpaid caregivers to anticipate and plan for climate disruptions, which can potentially minimize the adverse effects on households and communities. When care services and infrastructure are in place, vulnerable groups may face reduced exposure to health risks. Families, in turn, can rely on structured support rather than bearing the burden alone. Moreover, investing in public care provision can allow unpaid caregivers, often women, to engage in paid work and improve their financial resilience. Paid caregivers, in turn, benefit from better working conditions and training to respond to emergencies, further strengthening social preparedness (UN Women 2023).

Despite the increasing evidence of the linkages between climate change and care, care services are excluded from most climate adaptation discourses (Trelegan et al. 2026). At the same time, research and policy debates on care have not directly addressed the question of the climate adaptation needs of this essential infrastructure. This paper thus makes a unique contribution, bringing together these two strands of literature and defining climate resilience in relation to comprehensive care services infrastructure. It focuses on two subsectors: early childhood education and care (ECEC) and long-term care (LTC), which have been nonexistent in climate adaptation planning and finance. We explain this further in Section 2 below.

The paper begins by identifying the blind spots in the care services costing literature and in climate adaptation finance research. It then identifies the needs and actions necessary for the adaptation of care services sectors to climate change. This is followed by an empirical methodology for estimating the costs of investing in a comprehensive climate-resilient care services infrastructure in low- and lower-middle-income countries. The final section applies the methodology to data from Bangladesh. Our objective is to support policymakers, urban planners, the climate adaptation finance community, and care advocates with practical steps to inform decisionmaking and investment strategies. Recognizing that there is no one-size-fits-all design, the adaptation actions and methodology are intended to be adaptable to diverse local conditions and varying climate hazards.

2. Blind spots in the care services costing, and climate planning and finance adaptation literatures

Within the academic and policy literatures on investment in care services, no study considers the costs of adapting social or physical infrastructure of the sector to climate change, although recent work discusses care in the context of climate change (UN Women 2023). This literature contains rich information on the costs of investing in formal care services infrastructure based on decent jobs for the care workforce (De Henau and Himmelweit 2021; Ilkkaracan and Kim 2019). It also contains policy tools—produced by the ILO and UN Women—that can be used by governments and civil society to estimate and close financing gaps in any national context (ILO n.d.; UN Women and ILO 2021). Indeed, our methodology in Section 4 builds upon these tools.

A notable finding from this literature is that public investment in care services and infrastructure delivers multiple dividends, which can be extended to the context of climate adaptation. Studies by Antonopoulos et al. (2010 and 2014); Ilkkaracan et al. (2015 and 2021); De Henau et al. (2016 and 2017); Kim et al. (2019); Ilkkaracan and Kim (2019); Onaran and Oyvat (2023); and Gultekin et al. (2025) provide empirical evidence that such investment boosts overall employment and output. Onaran and Oyvat (2023), for instance, find that public spending on care services and infrastructure in emerging markets increases employment by about 6% and gross domestic product (GDP) by up to 11% after five years, thereby expanding a country's fiscal space. This is important because expanded access to employment and earnings can enable households and communities to better manage climate impacts, maintaining well-being and service continuity, and avoiding worst-case outcomes.

The climate adaptation finance literature similarly ignores the costs of comprehensive care services infrastructure as an adaptation strategy, especially with respect to LTC and ECEC (Trelegan et al. 2026). This is because formal care services in these two subsectors of the care economy are largely absent in low- and middle-income countries (but still also in many high-income countries). Yet even adaptation strategies to support informal care, which is abundant in all economies, are extremely rare.

Generally, estimating and tracking adaptation finance is challenging because there are no standardized taxonomies or clear definitions regarding what qualifies as adaptation activities and needs (UNFCCC 2009; Puig et al. 2016). Climate adaptation costs can be described as the expenses involved in planning, preparing for, enabling, and executing adaptation actions aimed at reducing damage or taking advantage of favorable opportunities presented by climate change (UNEP 2023; IPCC 2007; UNFCCC 2022). Costing is often carried out through the development of National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) prepared by countries. The adaptation finance needs in these plans tend to be based on program and project-level costing in various sectors (such as agriculture or energy), and projected costs are based on the specific context and its associated climate vulnerabilities as assessed by the country.[3]

Studies that estimate and track climate finance find that adaptation costs are underestimated, and flows are still less than estimated needs (Bhattacharya et al. 2024), especially in low- and middle-income countries. Estimates of the costs of adaptation for developing countries up to 2035 range from $310 billion per year to $365 billion per year (in 2023 prices), depending on the method used (UNEP 2025).[4] Adaptation costing studies typically cover coastal zones, flood protection and water, infrastructure, agriculture, fisheries, aquaculture, and marine resources, terrestrial biodiversity and ecosystem services, health, early warning and adaptive social protection, education, financial services, and research and innovation for adaptation solutions.

Globally, two sectors comprise the largest share of adaptation finance—agriculture, forestry, and fishing, representing about 20% of total adaptation finance, and water

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[3] NDCs are a country's public pledge detailing their national investment and development plans to help them develop more sustainable economies. These submissions are updated every five years, and the next set is due by the end of 2025. NAPs identify and prioritize adaptation options, ideally with associated cost estimates. They involve an iterative planning process based on analyses of current and future changes in climate and vulnerability to impacts (UNFCCC n.d.-a; Hammill et al. 2020).

[4] The literature identifies two primary approaches to assess the financial requirements for climate adaptation: top-down macroeconomic modeling and bottom-up country project-level cost assessments that countries undertake for their NDCs. These approaches for calculating adaptation costs, while mostly used and available for middle- and low-income countries, are not directly comparable, highly dynamic, and challenging to implement in countries due to technical and financial capacity gaps (UNEP 2023).

supply and sanitation, representing around 19% (UNEP 2023). These two sectors provide inputs to the care system. The health, education, and social protection sectors are part of a comprehensive care services infrastructure, but due to fiscal constraints, these sectors are generally underfinanced in many low- and middle-income countries. The estimated share of adaptation expenditure in these sectors as a percentage of total adaptation finance is relatively low (between 4-6% for health and 2% for education), broadly matching their contribution to GDP of these countries. This reflects both that these services are less developed than necessary (with lower spending than higher-income countries) and the view, until recently, that they were less important for adaptation (UNEP 2023).[5] A 2023 review of information in NDCs submitted by 193 parties found that 60% referred to climate-sensitive health risks and two-thirds set health adaptation priorities, but costing estimates were incomplete (WHO 2023).[6]

Trelegan et al. (2026) conducted a complementary in-depth analysis of 97 recent NAPs/NDCs from Non-Annex I countries to identify how often and in what ways adaptation plans recognize care recipients, caregivers, and care-related infrastructure. The analysis covers six domains of care services infrastructure: 1) ECEC; 2) LTC; 3) education; 4) health; 5) disaster risk reduction (DRR); and 6) housing. While 85% of adaptation plans refer to elements of care services infrastructure, these elements are incorporated only in limited and inconsistent ways.

Understandably, health and education interventions dominate the analysis. Health measures in two-thirds of the plans commonly entail strengthening primary care networks and community clinics, linked with community health workers for outreach and continuity of essential services during shocks; workforce training in emergency care, sexual and reproductive health, maternal care, mental health, and gender-based violence response. Plans also emphasize facility resilience upgrades such as water, sanitation, and hygiene (WASH), cooling systems, backup energy, and green standards, along with surveillance, early warning, and risk communication systems to prevent service disruptions. Education interventions are also referenced in two-thirds of plans, including, for instance, curriculum reforms (adding climate/disaster risk reduction content), teacher professional development (disaster risk reduction, first aid, inclusive pedagogy), and resilient school infrastructure (elevated/retrofitted buildings, WASH, backup/renewable power). Some plans also designate schools as resilience hubs—temporary shelters or safe spaces in resettlement.[7]

Population segments requiring care, such as children, older people, and people with

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[5] These percentages were derived from sectoral estimates aggregated up from National Adaptation Plans and macromodel estimates which cover the costs of disease control to address increases in malaria, dengue and diarrheal diseases and to address increased heat-related mortality, plus indicative costs of increased disease surveillance and making Water Sanitation and Hygiene for All and health infrastructure resilient.

[6] Refers to countries that ratified the UNFCCC (UNFCC n.d.). Non-Annex 1 countries refer to developing countries.

[7] Our analysis does not go deeper into these two sectors.

disabilities, are explicit in only one-third of adaptation plans. However, activities for these populations rarely identify the activities that support their care and instead recommend these groups for engagement in climate action or recognize them as “at-risk” or “vulnerable.” This means that ECEC and LTC are almost entirely absent from adaptation plans. The Philippines NAP is the only plan to explicitly reference ECEC, recommending daycare centers and recreational spaces in resettlement areas. Additionally, only four country plans—St. Lucia, the Philippines, the United Arab Emirates, and Kiribati—mention training for long-term caregivers or care workers, and just St. Lucia’s NAP commits to expanding the care workforce and upgrading nursing-home facilities. In fact, care work and caregivers are largely detached from activities directed toward children, older adults, and people with disabilities. Regardless of the six domains analyzed, no plan mentions decent pay or working conditions for workers in care services. All of this suggests that most NAPs are under-costed.

Bangladesh’s NAP stands out as one of the stronger examples of integrating care-related interventions into national adaptation planning. It includes relatively detailed measures across health, education, and shelter systems and emphasizes the need for adaptation activities that respond to the needs of specific population segments that require care, such as children, older adults, and persons with disabilities. Even so, and consistent with the broader global pattern, Bangladesh’s NAP does not explicitly address ECEC or LTC as formal systems requiring investment and resilience planning. For these reasons, we chose to apply our methodology to Bangladesh data in Section 5 to show how—by complementing its existing measures in health, education, and shelter provision—the integration of ECEC and LTC would strengthen adaptation preparedness and population resilience.

We turn next to a discussion of how comprehensive care services infrastructure can be adapted to climate change and our proposed methodology for estimating the costs of climate-resilient social and physical infrastructure.

3. What is a comprehensive care services infrastructure in the context of climate change?

As noted earlier, a comprehensive care services infrastructure meets the needs of care recipients with quality, ensures decent jobs for care workers, while simultaneously relieving the workload on unpaid caregivers and contributing to their well-being. Ideally, it builds on formal professional services across the entire range of care sectors (education, health, and others) with universal coverage through affordable, accessible, and high-quality services. This is not the case in most countries, where planning, financing, and delivery of services are fragmented. By contrast, a comprehensive care services infrastructure operates along a complex and integrated continuum of paid and unpaid care, and direct and indirect care,[8] catering to different population groups (the young, the elderly, those with disabilities, etc.). For example, while care for small children is provided primarily through unpaid direct and indirect care by parents and family members, in many countries it is complemented by the state or private markets through paid (for the most part) direct care by formally employed center-based ECEC workers as well as direct and indirect care by informally employed domestic workers. Care for ill people is often provided through formal paid health care facility-based services, but complemented in important ways by direct and indirect unpaid care support by family members or paid care by domestic workers. Care provisioning takes place in a variety of settings, including crèches and kindergartens, schools, summer camps, tutoring centers, hospitals and clinics, adult daycare centers, LTC care homes, community centers, and private family homes.

In the context of climate change, we argue that a comprehensive care services infrastructure is one that is resilient to climate disasters.[9] Defined by the Intergovernmental Panel on Climate Change (IPCC 2014), climate resilience is the "capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance, responding or reorganizing in ways that maintain the systems' essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation."[10] At the intersection of care and climate change, resilience refers to the capacity of a comprehensive care services infrastructure to prepare for, withstand, and recover from climate-related shocks and stresses.

Having a comprehensive care services infrastructure in place would contribute substantially toward reduced vulnerability and increased resilience of care-dependent groups and their unpaid and paid caregivers to climate change. This is because formal care systems carry the potential to act as vital safety nets during and after a climate shock. Formal care services ensure that care-dependent groups have access to professional support even when unpaid family care arrangements are compromised under climate shocks. For instance, during heat waves, elderly people living alone may

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[8] Direct care is provided from the caregiver to the care receiver through personal interaction, such as a parent feeding a child or helping with homework, a teacher conducting a class with students, a doctor examining a patient, a personal care worker accompanying an elder person on a doctor's visit. Indirect care, on the other hand, entails activities complementary to direct care, but without face-to-face contact with the care receiver, such as domestic and subsistence work (washing, cooking, household management, water collection, food production and processing for own consumption). Indirect care activities provide inputs to direct care, by providing a hygienic and functional environment for its conduct or inputs such as water, food, or clean laundry.

[9] Beyond a universal care services infrastructure, a comprehensive care system also entails other components: labor market regulations for care-supporting workplaces, social protection systems to eliminate vulnerabilities associated with care needs and caregiving, and policy coordination toward an integrated care system across multiple actors and intervention areas including care services sectoral policies, labor market and social protection policies and macroeconomic policies. In less developed rural or urban settings, where indirect care activities such as water and energy provisioning, or food production and processing remain labor-intensive arduous tasks, investments in time-saving physical infrastructure stand out as an important component of comprehensive care systems. For discussion of comprehensive care systems, see ECLAC (2022) on Care Society, Esquivel (2014) and U.N. (2024) on transforming care systems, Ilkkaracan 2016 and 2025 on Purple Economy, and United Kingdom Women's Budget Group (Diski 2022) on Caring Economy.

[10] Page 1772 (Appendix II).

experience acute health risks such as dehydration or heat stroke. Family carers, who already shoulder significant responsibility, may themselves face injury, illness, or burnout during prolonged climate events. If family carers are not nearby or are themselves affected by the event, the existence of a responsive formal care system becomes lifesaving.[11] Analysis of the 2003 heat wave that took 15,000 lives in France, mostly elderly, and many of them preventable, identified the lack of service coordination and low priority of the impacted population among policymakers as a direct cause of the death toll (Michelon et al. 2005). This shows that it is not just the existence of care services—given that France already had well-developed, publicly funded care services—but also the way they are deployed and coordinated, as well as their reach. Hence the need for comprehensive services infrastructure.

Similarly, floods or wildfires can render home-based care unfeasible due to displacement of families, separation of family caregivers from dependents, or damage to housing. In these situations, having well-established formal care centers or services that can be rapidly deployed is essential. Having a comprehensive care system in place establishes a solid basis upon which both paid and unpaid caregivers (and, where appropriate, also care recipients) can train, plan, and prepare for climate shocks. To be resilient, a comprehensive care services infrastructure itself needs to be adapted to climate change, which involves adapting both physical infrastructure and services.

Adaptation of physical infrastructure. Similar to other physical infrastructure, a climate-resilient comprehensive care infrastructure must ensure that the physical environments in which care is provided—both institutional care facilities and home-based settings—can withstand and respond to climate-related hazards. This includes retrofitting existing buildings, incorporating projections of damage to care infrastructure under various climate scenarios, and developing new infrastructure using climate-resilient and inclusive design principles. In low-income settings, the bulk of the costs will be in developing new infrastructure, whereas in higher-income settings—at least those that have more developed formal care arrangements—most of the costs will be in retrofitting.

In many contexts, adaptation efforts include nature-based solutions (NbS), which lower adaptation costs and are more sustainable than built infrastructure, by integrating local ecological processes, community stewardship, and Indigenous knowledge and materials (IUCN 2016, p. 12). The methodology we propose in Section 4 prioritizes NbS (including passive cooling techniques) over energy-hungry active cooling infrastructure (such as air conditioning). NbS can include urban tree cover, green roofs and walls,[12] vegetated buffer zones around care homes or playgrounds to reduce heat and air pollution, or community

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[11] See for example check box 3.13 on p.119 of the Global Disability Inclusion Report Accelerating Disability Inclusion in a Changing and Diverse World (UNICEF 2025).

[12] Green roofs may not necessarily better than cool roofs (painted roofs), because they can create urban heat islands effects at night (when trees release CO2). Our costing methodology considers these trade-offs.

gardens that offer cooling, food security, and social cohesion.[13] NbS are particularly relevant in densely populated or heat-prone areas where built infrastructure alone may not sufficiently mitigate environmental burdens (Cascone et al. 2019). We recognize, however, that NbS on their own may not be enough to cope with rising heat, so we follow a pyramidal approach: NbS as the base, prioritized wherever possible, then passive cooling strategies of the built infrastructure, and lastly, active cooling, with a priority on renewable power use for these.

Because most care is delivered in homes, climate resilience of domestic spaces is not a peripheral issue but is central to maintaining care provision. Climate-proofing domestic spaces is essential for protecting both caregivers and care recipients. This includes access to cooling and heating during extreme temperature events, safe storage for medical or mobility equipment during floods or power outages, access to backup power or communication tools for emergencies, information sharing on and support for low-cost adaptations and safety checks for at-risk households. Moreover, preventing breakdown at the household level is often cheaper than emergency response (Multi-Hazard Mitigation Council 2019).

To support the continuity of care under disrupted conditions, infrastructure adaptation can include mobile care units that reach displaced or stranded individuals during climate events, especially in rural or underserved areas. The health care climate adaptation literature points out that care facility adaptation should also consider the possible need for reserve space or buildings in the vicinity of care facilities for the care workforce to reside in when a disruption prevents commuting (Guenther and Balbus 2014). Technologies such as digital platforms that enable remote monitoring, telecare, or psychosocial support for both paid and unpaid caregivers and care recipients can reduce dependence on fixed infrastructure and enhance responsiveness, especially where traditional facilities are inaccessible or overwhelmed.

Adaptation of services. Care services must also be adapted to climate change, which involves not only planning and preparedness but also training, institutional capacity, and continuous learning for the paid care workforce and unpaid caregivers and care recipients, discussed in turn below.

Planning and preparedness. A key intervention is the development of a buffer care workforce (i.e., a flexible pool of trained care workers) who can be mobilized during emergencies to fill gaps caused by absenteeism, facility damage, or increased care

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[13] The Green, Cool & Care project in Austria emphasizes co-designed interventions like living walls and green social spaces that support both residents of elder homes and care workers (Halbmayer et al. 2021). An audit tool developed for residential aged care facilities for Australia recommends NbS such as shade trees or permeable vegetated surfaces to protect vulnerable populations (Boulton et al. 2023).

responsibilities.[14] Health systems widely use the concept of “surge capacity,” preparing for sudden increases in demand by ensuring adequate staff, systems, supplies, and space (the 4S framework) (Echeverri et al. 2024; Guenther and Balbus 2014; Zurynski et al. 2024). Interventions also include psychological support for staff to maintain service quality during crises (Zurynski et al. 2024). Estimates of a buffer workforce can be based on analysis of time-series data on care services utilization and staff absenteeism data during past climate events or from previous disasters or public health crises, to the extent that such data exists.[15] Another source of data is population-based registries of care-dependent individuals, used in social protection and disaster preparedness programs. Early warning systems and disaster risk response frameworks can incorporate such social registries, which maintain updated lists of vulnerable populations. Geographic information systems (GIS) enable mapping of care service disruptions and caregiver concentrations. These tools can be adapted to anticipate and plan for the increasing need for care workers in response to climate disasters.

Beyond a buffer workforce, additional workforce planning requirements may entail establishing dedicated units with staffing for climate planning and preparedness. Such specialized staff can be assigned responsibility for conducting the capacity-building and monitoring activities discussed next, as well as being trained to respond to staffing gaps during a crisis.

Capacity building for climate preparedness. Most climate adaptation plans currently emphasize institutional preparedness, but home-based and community-based care, which is largely reliant on unpaid labor, remains insufficiently supported. Recognizing the interdependence of paid and unpaid caregivers, a climate-resilient care services infrastructure must invest in joint capacity building and preparedness training across the full care continuum. Climate risk preparedness must extend beyond professional care workers to include unpaid family caregivers, who often play the primary role in home-based or community-based care. For example, disaster preparedness in ECEC settings cannot be effective unless parents and guardians are aligned with ECEC staff on evacuation plans, communication protocols, and emergency contacts. In addition to coordinating between paid and unpaid caregivers, preparedness programs must also engage those on the receiving end of care, especially children and youth, older adults, people with disabilities, and those with chronic illnesses.

Care plans and protocols can be tailored to specific climate hazards, along with coordination mechanisms that align care protocols across paid and unpaid caregivers and

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[14] We recognize that governments may be reluctant to have idle capacity because of having to pay the staff despite it being crucial to successful service delivery (e.g., examples include Covid, flu seasons, among others). However, as others have shown (Cantelmo et al. 2019; IMF 2019, Hallegatte et al. 2019), short-term fiscal tightness runs contrary to long-term fiscal sustainability because crises are more costly to recover from than spending more up front to prevent them.
[15] In many settings, data are non-existent. In these situations, hypothetical proxies—such as 5% or 10%—can be used.

care recipients, including voluntary registries of individuals at high risk, to enable proactive outreach, evacuation, or continuity-of-care planning during climate emergencies. Tailored training programs for paid care workers (formal and informal) and unpaid family caregivers should reflect local needs, including joint preparedness planning that promotes collaboration between formal institutions and informal care networks, reinforcing shared responsibilities and crisis protocols.

Finally, establishing designated administrative bodies or focal points within relevant government sectors (e.g., health, education, social protection) and inter-agency mechanisms can help to coordinate care resilience efforts, facilitating participatory monitoring processes, ensuring that care workers, family caregivers, care recipients, and community organizations can provide feedback and shape the adaptation process, conducting regular audits, scenario-based stress tests, and after-action reviews following climate-related disruptions, with lessons integrated into future planning and training.

Implementing the interventions described in this section requires investment for both physical infrastructure adaptation and human resources, including expert planners, facilitators, trainers, and administrators, as well as structured frameworks, methodologies, and digital tools for planning, coordination, and monitoring care system preparedness. The next section proposes a methodology for estimating the resource requirements of the interventions highlighted here.

4. Methodology

Our proposed methodology consists of three stages. First, we determine the costing simulation scenarios at the intersection of climate projections and care services parameters. The former corresponds to projections of different temperature changes reflecting various climate impacts, while the latter allows for variation in the quantity and quality of care services provisioning (coverage rates, staffing ratios, and other quality measures). Second, we assess the need for care services under different scenarios and the financing requirements for investment. Our methodology for assessing needs and costs rests on the conceptual elements of two complementary care services costing frameworks, the ILO Care Policy Investment Simulator (hereafter known as the ILO Tool) and the UN Women/ILO Policy Support Tool for Public Investments in Care Services.[16]

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[16] The ILO Care Policy Investment Simulator helps build tailor-made care policy investment packages for more than 100 countries for four types of care policies: child care-related paid leave (maternity, paternity and parental leave); breastfeeding breaks; ECEC services; and LTC services. The ILO-UN Women Policy Tool provides a methodological guide to assess the care services coverage gaps (measured in terms of additional care receivers or care workers to achieve given coverage and service quality targets); public investment requirements and tax revenue generation; job generation outcomes in care services; gender distribution of new employment creation; and other economic and social returns to public investments in care services sectors. The care services sectors covered by the tool entail ECEC, primary and secondary education, health care and LTC services. While the ILO Tool has built in national data to provide estimation results, the ILO-UN Women Tool presents a methodological guide to be applied by local research teams. The ambitious 'high-road to care' simulation scenario for 45 countries featured in ILO (2018), based on Ilkkaracan and Kim (2019), provided coverage and staff pay parameters

The assessment entails two components: first, direct service needs are assessed on the basis of the estimated population with care needs (small children for ECEC, children and adults with difficulties performing activities of daily living for LTC), and the number and qualifications of care services staff (including direct care providers, administrative, support, and training staff) corresponding to different care provisioning parameters. We use the parameters specified in the existing ILO/UN Women costing tools, such as target coverage rates or care recipient-to-care worker ratios, adapted to the country context where necessary. Second, the needs assessment entails determining the infrastructure (building), energy, and other input needs corresponding to different climate projections. For each of these components—labor inputs and non-labor inputs—relevant unit costs are applied [wage rates, energy prices, building cost per square meter (m^2), etc.]. The unit costs are obtained from existing literature and data sources on a given country. If the prevailing wage rates for care workers are low, they can be upgraded in line with decent work standards as proposed in the existing care services costing tools.

Third, we run sensitivity checks given the uncertainty surrounding climate impacts in various countries, and because the availability of input data on costings (such as wage rates and unit costs of non-labor inputs) can also vary greatly depending on the country. This is in addition to stress testing policy parameters that may vary beyond the main scenarios chosen in the first stage. Appendix 1 provides the formulas for the most important parameters.

Below, we explain each stage of the methodology and how it can be applied in low- and lower-middle-income countries most in need of climate adaptation and care investment. While the methodology described here is generic, we apply it to data from Bangladesh to show where and how the specific country context matters, and which parameters may need to be adjusted.

Stage 1: Determining the costing simulation scenarios

Climate change projections determine the assessment of care services' needs and estimation of associated costs through two channels: the type of physical infrastructure and inputs (primarily energy) needed for climate resilience, and the need for care service providers (the number and qualifications of care workers).

The scenarios are costed with respect to a baseline of business as usual, that is, a system of care relying mostly on existing provision, whether unpaid informal care provided by families or unmet needs by those who do not have care arrangements, mostly for long-term care needs in any particular country. The current system of informal and formal

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based on best performing countries. The ILO-UN Women Policy Tool universal care services parameters are based on this earlier study.

provision of care is assumed to carry on to the projected year (in this case, 2035, see below), with no additional improvement and expansion other than to follow population and GDP trends. Climate projections are then added to this baseline by choosing a reference point for a given climate period, for example, the 1990-2000 period, or today's climate (mid-2020s), depending on the context. This is meant to capture a minimum climate change scenario that would be achieved with significant mitigation efforts (see below for scenario 3a).

It is important to note here that plans the country has already made to adapt overall infrastructure, such as roads and electricity, to enable better access to the communities where care is provided, are not costed in this exercise. We assume these plans are covered elsewhere so we do not cost any overarching infrastructure and urban planning. The same goes for improvements to education and health systems, which may interact with ECEC and LTC services. While necessary and often lacking in low-income countries, these are also beyond the scope of this paper.

The costing simulation is conducted under the following four scenarios, corresponding to different climate change assumptions and different care services parameters (see Table 1).

1. **Central scenario:** The central climate scenario depends on the projections for the country in question. The official projections in a country's NAP, for example, should serve as a reference, relative to the baseline of today's climate. For this exercise, we use the IPCC Representative Concentration Pathway (RCP) 4.5 as a mid-range climate change projection scenario under the assumption of moderate mitigation to model possible future changes.[17] While RCP scenarios provide a useful global benchmark, adaptation decisionmaking is typically hazard-specific. We therefore interpret the various climate scenarios through their implications for heat stress, flooding, and health shocks, which directly affect care demand, workforce needs, and infrastructure resilience. The central scenario for care services coverage and quality targets for ECEC and LTC aims for sufficient comprehensive coverage rates and relatively high-quality service parameters (discussed further below).

2. **(a) Minimum and (b) maximum care services scenarios:** Here, the climate projection of the central scenario is taken as a constant, while changing the parameters of ECEC and LTC services provisioning, allowing for variation in coverage rates of the base population, staffing ratios and composition (namely, the share of educators in ECEC staff or personal care workers in LTC staff). Wage rates and unit costs can also be

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[17] The IPCC scenario assumes an RCP of 4.5 (reflecting the level of radiative forcing) if climate policies are implemented at least in a moderate manner. Under such a scenario global temperature is estimated to increase by 2.0-2.5°C into 2100 compared to pre-industrial levels. This would entail significant sea level rise (but less than higher emission scenarios), extreme weather events such as more frequent heat waves and heavier rainfall.

modified to reflect different quality targets, depending on the country. The difference of the minimum and maximum care services scenarios from the central scenario shows the incremental costs of more limited versus more comprehensive care services coverage and quality parameters under the same climate change scenario.[18]

3. (a) Minimum and (b) maximum climate change scenarios: These two scenarios take the care services parameters of the central scenario as a constant, while changing climate projections to allow for better or worse mitigation scenarios than the one assumed in RCP 4.5. The maximum (worst) climate impact projection is based on RCP 8.5, which is the business-as-usual scenario of very limited or no mitigation. Each RCP scenario contains a range of temperature rise estimations with different probabilities. In the maximum (worst) climate scenario, we assume P90 of RCP 8.5, reflecting the upper bound estimate for temperature change.[19] As the minimum (best) climate impact projection, we take P10 of RCP 4.5, assuming similar (moderate) mitigation as in the central scenario but allowing for lower-bound temperature rises.[20] In some countries, this scenario may correspond to a stable climate compared to the reference period of the 1990s and 2000s, and could be used to illustrate the difference in adaptation investment required between that period and the central scenario. The difference of the minimum and maximum climate change scenarios from our central estimates shows the incremental costs of physical infrastructure and energy input costs under changing climate projections, while maintaining the same care services parameters.

4. Maximum climate change and care services scenario: In this scenario, maximum care provisioning occurs (best coverage rates, staffing ratios, qualifications, and wages) with physical infrastructure (building) and energy costs adapted under the worst climate projection. The change from the central scenario shows the total incremental costs of adapting care services to better parameters and also adapting physical infrastructure and energy cost for a worse climate projection than the central projection. This scenario illustrates how to achieve the dual objective of providing high-quality care that is climate resilient at the same time as being the climate adaptation strategy that is most effective, given that comprehensive care services act as climate protection mechanisms for all the reasons mentioned earlier.

A period of 10 years has been chosen to reflect the urgency of adaptation measures while leaving time for the system to be planned, set up, and run smoothly. For illustrative

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[18] As explained in the previous section, improving care staffing provision (staffing ratios and/or qualifications and wages) can also be seen as a climate adaptation strategy which allows for flexibility in determining the right balance between social and physical infrastructure measures in any specific context.

[19] P90 of RCP 8.5 stands for 90th percentile temperature rise under RCP 8.5, a high-end warming outcome that only 10% of model results exceed.

[20] P10 of RCP 4.5 stands for 10th percentile temperature rise under RCP 4.5, a low-end warming outcome that only 10% of model results fall under.

purposes, we consider 2035 as the reference year, in line with the ILO Tool.[21]

Table 1. Costing simulation scenarios

Costing simulation scenario	Climate change projection	Care service provisioning parameters
1. Central	RCP 4.5 (mid-range IPCC scenario or official mid-range scenario for the country)	ILO Care Policy Tool
2a. Minimum care services provisioning	Same as central	Lower coverage rates, worse staffing ratios and qualifications than central
2b. Maximum care services provisioning	Same as central	Higher coverage rates, better staffing ratios and qualifications than central
3a. Minimum climate change	P10 of RCP 4.5 (low-end warming outcome)	Same as central
3b. Maximum climate change	P90 of RCP 8.5 (high-end warming outcome)	Same as central
4. Maximum care services provisioning & maximum climate change	Same as maximum climate change	Same as maximum care services provisioning

Stage 2: Assessing the need and costs for care services under different scenarios

For this exercise, we adapted the ILO Tool, as it entails a methodology for estimating both social and physical infrastructure costs (hereafter labor inputs and non-labor inputs, respectively) and has already been applied to Bangladesh, albeit without climate adaptation considerations. Hence, this section explains how we can modify and adapt the ILO Tool methodology to take account of climate adaptation needs.

Component 1: Assessing services needs and costs (labor inputs)

Regarding services needs, the initial step is to estimate the population by age groups to the reference year (2035). This will determine the basis for potential care recipients for ECEC (child population aged 0-5) and LTC services (such as typical age groupings of 65 years and older, and children aged 0-14 and adults 15-64 with marked differences in disability prevalence). Projections of population by age are derived from global projections from the U.N. World Population Prospects 2024 edition (UNDESA 2024). The main demographic determinants of population trends that are influenced by climate change (and thus climate policies), as well as socioeconomic policies, are fertility, mortality, and migration.[22]

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[21] The ILO tool can be adapted to project scenarios to 2040 or 2050 though with less accuracy (especially on GDP forecast).

[22] As climate change effects on population are uncertain, even in the near future (10-15 years), sensitivity analysis of various derivations of the central projection could yield important costing changes. However given the implications that demographic

Once population by age groups is estimated, the policy targets for care services coverage rates determine the number of people with care service needs. The policy targets for staffing ratios and qualifications, on the other hand, determine the required number of care workers by different categories. We take ratios and qualifications from the ILO Tool for ECEC and LTC services.

a. Labor input needs for ECEC services

ECEC services are assessed for early childhood educational development (ECED) for the 0-2-year age group and pre-primary education services for the 3-5-year age group, often distinguished at this age cut-off in many systems. The ILO Tool sets the policy targets for coverage (i.e., enrollment) rates for each age group, but this can be varied in country applications. Coverage difference between the minimum, central, and maximum scenarios can be set with respect to meaningful targets in other regions, for example, with the maximum scenario reflecting coverage rates in the more generous Northern European countries (around 60% and 100% respectively for the younger and older age groups) (ILO Tool).

ECEC staffing requirements are disaggregated by educators (including main educators and assistant educators), administrative support staff, and training staff. The need for ECEC staff in each group is determined in terms of staffing ratios (child-to-educator ratio) and staff qualifications mix.

Policy-target pay levels for care workers are a defining feature of the simulation scenario as they affect decent work conditions for the care services workforce and have implications for service quality. The target wages for different categories of care workers can be set with respect to different references, such as wages in similar occupations, average earnings, or the minimum wage, assuming wage costs for formal employment. The central scenario sets target wages according to the qualification level of each staff group, following the method used in the ILO Tool, but should be updated with country-specific data. In ECEC services, the primary assumption is that the main educators have the same qualifications and are paid at the same level as primary school teachers, in line with international standards of practice. As a lower bound and following the ILO Tool, the less qualified assistant educators are paid slightly above the national minimum wage. For simplicity, all staff are assumed to be employed full-time year-round as in the ILO Tool.[23]

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changes have on GDP prospects, the costing impacts are not straightforward and beyond the scope of the paper. U.N. projections consider low/high fertility and low/high migration, among other variants, but they are not directly determined by the IPCC climate scenarios, though they are used by IPCC in their socioeconomic pathways. We note that most of the U.N. population projections by age group did not differ much until after 2040 (UN DESA 2024).

[23] This does not preclude part-time employment, simply that the costings and staffing requirements are measured in full-time equivalent. That said, we assume full-time coverage to reflect the prevalence of full-time working patterns in most lower-middle income countries, and to give children the best educational and playful opportunities, in line with universal child care systems in other countries (see De Henau 2022b for more details).

b. Labor input needs for LTC services

Unlike ECEC services for which the ILO Tool user chooses "childcare needs" by selecting the enrollment rates of the whole relevant child population, LTC needs are estimated using disability prevalence data by age group in each country. The population projections to 2035 by three age groups—0-14, 15-64, and 65+—set the basis for estimating the need for LTC services. A straightforward indicator of disability prevalence is the proportion of healthy life expectancy (HALE) to total life expectancy for various age groups (Ferrari et al. 2024). Such data are available for all countries from the WHO Global Health Observatory and are therefore used as the main method in the ILO Tool.

Since not all people with a disability need LTC support, the ILO Tool estimates the relevant fraction for each age group, calibrated on countries with data on both disability and difficulty in performing activities of daily living (see De Henau, 2022a, for detailed explanations). These crude estimates—a constant fraction of country-specific disability rates—should be modified, however, where better country-specific data are available, or using a range of estimates in the sensitivity analysis to illustrate the uncertainty surrounding long-term care needs and their intensity. We use the minimum and maximum care scenarios to represent a lower-bound and an upper-bound needs based on the various sources available, and the central scenario using a mid-range prevalence of needs between the two extremes. These specific bounds will depend on the country's context and data availability (see Section 5 and Appendix 2 for the application to Bangladesh data).

A more complex estimate is the potential impact of climate trajectories on morbidity and disability prevalence for a given age group, which would impact the need for LTC services. Existing research on the net impacts of climate change on morbidity is inconclusive because of the counteracting effect of secular improvements in health policies and reach. For example, while climate change increases the risks of unsafe water because of flooding from increased precipitation and coastal surges, socioeconomic improvements in access to safe water may counter that effect. Isolating the two is difficult in climate attribution empirical studies, as explained in the 2021 Global Burden of Disease Report (GBD 2021 Risk Factors Collaborators 2024). In the same vein, although greenhouse gas emissions continue, and with them global warming, air quality (such as the dangerous particulate matters PM 2.5 linked to respiratory problems and chronic morbidity) has improved between 1990 and 2021. If this trend continues, health improvements in that dimension (and resulting lower care needs) might counteract, to some extent, worsening conditions due to other climate impacts, such as heat waves or cyclones (Romanello et al. 2022).[24] Our different care and climate scenarios cater to some

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[24] Another highly uncertain impact of current climate trajectories is on mortality. Higher mortality in the care recipient population will reduce care needs and thus investment requirements (all else equal). But higher mortality among care providers will increase needs. These will be counteracted by improvements in life expectancy.

extent for these potential impacts in the sense that higher staffing ratios can be used as climate adaptation policy (to cope with staff exhaustion during heat waves), or that physical adaptation of building will prevent such exhaustion and/or worsening of care recipients' health. The potential impacts of worse climate projections are considered as part of our sensitivity analysis.

For a given prevalence of LTC needs by age group, the ILO Tool assumes a fixed proportion of care staff to reflect intensity of care needs (in terms of time required), in line with observed ratios in a selection of Organisation for Economic Co-operation and Development (OECD) countries for which data were available. This would take into account traveling time between houses, as well as provision for sickness, training, and holiday absences. Ratios are adapted for lower-middle-income countries where multigenerational households are more widespread, and time-saving related to household tasks can be achieved. Given that the minimum care scenario already accounts for a lower-bound of needs, we apply the same staffing ratios used in the central scenario, whereas the maximum care scenario increases staff provision slightly to improve quality and reach, but also to cater for the potential surge or disruption linked to the country's specific climate impacts.

As in the case of ECEC services, we distinguish between two groups of LTC workers, broadly by their level of qualification, reflecting different degrees of expertise with needs complexity, for example, to tackle more personal care tasks (activities of daily living or ADL) versus more instrumental, household tasks (instrumental activities of daily living or IADL).[25] The main LTC personal care workers are paid at the same proportion of nurses' wages as that of countries with established care systems and qualified personnel, such as Norway, Denmark, and Sweden (De Henau, 2022a). Assistant LTC workers are paid just above the minimum wage. As discussed for teacher wages as reference wages in ECEC services, it is important to decide whether nurses' wages are an adequate LTC wage benchmark for a specific country context. Finally, we add an element that reflects preventative care assessments as is done in the Danish system, whereby district health workers pay regular visits to the elderly population and assess their social and health needs and future development. The number of visiting health workers per person aged 65+ is calculated to reflect a three-hour visit twice a year.[26]

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[25] Estimates for Europe—where good data exists on the differences between personal care needs (ADL) and household tasks needs (IADL)—shows that difficulties with IADL could be twice or three times as prevalent as difficulties with ADL (Eurostat n.d.). Data from the European Health Interview Surveys wave 2 (circa 2014) and wave 3 (circa 2019) on difficulties with personal care and household tasks among the over 65s.

[26] In Denmark, visits are undertaken by district nurses. Of course, any qualified health worker relevant to the country context could be mobilized. We assume they are paid at the same level as nurses. Also, although visits in Denmark are for the 75+ age group, we calculate visits for the 65+ age group, to reflect the lower life expectancy of lower-income countries.

Component 2: Assessing non-labor inputs and costs

We assume that ECEC services are center-based while LTC services are home-based (see sub-section b below for the justification of the latter). For non-labor inputs (overhead costs), the different climate scenarios imply variation of building and input costs (primarily energy). The guiding principle in the methodology for estimating the costs of climate-resilient buildings and required energy inputs is to prioritize durable solutions at low cost, but without compromising effective, higher-quality solutions (e.g., to achieve given thermal comfort), taking into account environmental costs and repair risks in equal measure to the direct financial costs of installation and operation. For example, prioritizing passive cooling strategies through design, building orientation, natural ventilation, and cooling surfaces may not provide sufficient cooling effects, especially during extreme heat waves, compared to more expensive air conditioning (AC) systems. However, they will reduce energy needs and thus should be considered first, before adding layers of power-hungry energy provision (Otoo et al. 2024).[27]

Many studies have examined the physical properties of various design solutions (e.g., orientation, space/volume and shapes, as well as materials); they can roughly be grouped as those focusing on achieving weather event/disaster resistance and those examining cooling techniques (including energy requirements). The costing method uses the studies discussed in Appendix 2 to derive a range of plausible optimal solutions and their costings.

a. Non-labor input needs for ECEC services

Required non-labor ECEC services inputs entail physical space for ECEC centers, as well as energy, food, and overhead costs (materials, delivery, and other costs). One way of simulating building and energy costs of a typical center is to fix the number of children per center (in many countries it revolves around 50 children per center) and then decide on the surface area for each child, often based on local norms and standards, for both indoor and outdoor spaces, including WASH facilities and offices (De Henau 2022b). However, as climate-resilient building requirements change depending on climate projections, the building cost per m^2 will vary across climate scenarios (discussed below). Building unit costs are heavily dependent on the country context, and whether in rural or urban areas, with technical reinforcements to cope with floods, cyclones, as well as heat waves (in terms of building envelope and orientation).

The bulk of energy consumption will depend on the extent to which active cooling

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[27] Note that technical suggestions (and their costings) for the best materials or the most efficient building techniques should not ignore the importance of consulting local residents and take account of their perceptions and preferences for comfort. Studies have shown that doing so increases the likelihood of buy-in, and thus positive response to ECEC or LTC service offer (Alam et al. 2024; Sohaana and Rahman 2021; Ahmad et al. 2024; Barthelt and Bleich 2023).

techniques are used, which are likely to be needed to a greater extent in hot-humid zones. We consider a central estimate of energy consumption per m^2 that reflects the likely energy consumption increase of a typical well-designed building in the next 10 years, based on RCP warming trajectories. By contrast, the minimum climate scenario broadly takes the consumption intensity of today's climate for the same building (P10 of RCP 4.5). The maximum climate scenario reflects the potential increase in energy demand required to maintain thermal comfort if the top range of the worst climate scenario (P90 of RCP 8.5) were encountered in terms of temperature and heat index rises.

In line with current trends, we assume such energy demand will be met with solar electricity production, which, in the case of many hot countries, is easily achieved through year-round intense solar radiation. Our costing exercise assumes a constant solar electricity price, but this should be determined by each country's context. As excess production of electricity from solar panels can be sold back to the grid, costs might be reduced further, but we ignore these in our cost calculations.[28]

The other main item in the overhead costings of ECEC services is food provided to children attending daycare facilities. We include food in the costing of child care provision as it is a key element of the effective nurturing apparatus of young children and fundamental for early child development, especially for those of more deprived families.[29] Again, this exercise focuses on costing universal provision of services (and facilities), rather than on discussing the appropriate funding mechanisms, including user fees, which also heavily depend on the country's tax and social security benefits system, which is beyond the scope of the current study.

If we assume half of the daily food intake of children will be consumed in the premises (the other half is the evening meal at home), we can calculate the fraction of the typical cost per recommended daily food intake for children of that age, which can be derived from household expenditure surveys or specific country studies.[30] The remainder of the ECEC non-labor costs are a mix of maintenance, delivery, and materials costs, assumed to be a fixed proportion of total non-labor (overhead) costs calibrated to match the proportions in De Henau (2022a).

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[28] One can assume that such excess energy sale constitutes a benefit, in the same way that avoiding having to repair a building after a cyclone constitutes a benefit rather than making construction costs fall to zero because of the avoided damage. However, when considering financing options for building costs, profits from selling excess energy should definitely be accounted for.

[29] As LTC services are mostly provided at home, in households composed of people not needing care as well, our method does not attempt to overhaul normal food provision (but we note that meals-on-wheel types of delivery could be factored in at additional cost for those living alone). Where LTC recipients receiving home-based care require support for food purchases, such costs would be more appropriately be addressed through means-tested social assistance programs and are therefore treated as outside the scope of care investment calculations.

[30] Children under 6 need about half the adult intake (Faizan & Rouster 2023).

b. Non-labor input needs for LTC services

The determination of non-labor input requirements in the case of LTC services depends on whether service provisioning is home-based or center-based, as in ECEC. As noted above, we opted for LTC provision at home. Because most elder care is delivered in homes, climate resilience of domestic spaces is not a peripheral issue; it is central to maintaining care provision. If LTC in homes is not addressed, it can lead to overloaded health systems; preventing breakdown at the household level is also cheaper than emergency response. Below we explain the difference of adaptation costings for residential care homes, daycare centers, and private homes.

If LTC services are provided in residential settings, akin to ECEC centers (but with overnight accommodation), the assessment of required inputs and buildings' operational and construction costs would follow the same method as for ECEC centers (including food, electricity, and climate-resilient construction price per m^2). The question would then be about how many m^2 per person and how much of the accommodation or hotel costs (as it is termed in the LTC literature) should be financed by the state versus the recipients (as non-care recipients still need to eat and sleep somewhere).

LTC services can also be provisioned at adult daycare facilities using a similar approach to ECEC centers, in which care recipients could spend the best of their daytime activities and socialize, with the support of dedicated care workers. In the context of tackling global warming effects, some consideration is needed for optimal LTC options between cooled daycare centers where LTC clients can spend the hottest hours away from their private homes or cooling every private home of LTC clients.

Costing comparisons should consider the trade-off between building a limited number of AC-powered daycare LTC centers and retrofitting every private home of LTC recipients. The same trade-off could be considered, for example, for cyclone resistance, making daycare centers the new climate-resistant shelters. However, if private homes are destroyed by cyclones and need rebuilding, little gain is made from focusing on climate-resistant daycare centers for people in need, since this would entail greater costs overall. And this is even without considering that people with LTC needs may also require care workers to accompany them to those daycare centers, or could simply not be moved. Hence, we follow the home-based LTC services delivery model in the ILO Tool and focus on adapting private homes instead.[31]

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[31] Residential settings for those with 24-hour care needs are also increasingly blended as private homes with nursing care, especially in more densely populated areas, so the difference of 'systems' is not that relevant anymore. The main criteria are the proximity of care workers to the living space of care recipients and the extent to which some economies of scale can be produced (including for eating), which is already happening in village communities or apartment blocks.

Even in the case of LTC services provisioning at home (domiciliary care), questions remain about what share of the physical adaptation of private homes for climate resilience should be publicly funded as part of the public investment in LTC versus privately funded by families. Since the premise of this study is to expand and upgrade formal care services provision to alleviate excessive informal care burdens on families, which climate change exacerbates, we assume that the entire cost of making LTC recipients' houses climate resistant will be covered under public care investments, including multi-person households.

The average size of the LTC recipient house depends on the country context and is assumed to be constant across all scenarios. However, our exercise assumes the same energy per m^2 as for ECEC centers, which varies between the minimum and maximum climate scenarios.[32]

The costs of building climate-resilient homes for LTC recipients are not easily distinguishable from the costs of retrofitting existing homes, in part because many houses in low and lower-middle-income countries need rebuilding entirely, as their basic structure is not adequate. The costing calculations for the public investment requirements thus consider the whole cost of building from scratch, albeit only those homes in which someone with LTC needs lives.

The last element of LTC overhead costs is the administrative costs, which are based on the ILO Tool, estimating them as a share of wage costs. This accounts for the local management of the service (administration, information technology, insurance, personal protective equipment), bearing in mind that part of the administrative costs will be covered by the ministry in charge or the local municipality with large economies of scale. The administrative overhead costs are assumed to be a fixed proportion of staff costs across all scenarios, following estimates based on U.K. data on home care services (see Appendix to Bedford and Button 2022).[33]

c. Costing calculation overall

The last costing element of climate-resilient care services provision is the support structure of the system as a whole to plan and prepare for climate-related adverse events and conditions (oversight of training, awareness-raising, alert systems, including

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[32] It is likely that active cooling solutions will be running at night (at least in the room of the care recipient) but not in ECEC centers. By contrast, comparatively more daytime energy might be expended in ECEC centers owing to a higher density of occupation (which influences the effectiveness of cooling devices). Because these two aspects may compensate one another, we assume similar energy per m^2 for both types of services, with plausible variations being captured in the sensitivity analysis.

[33] Unlike for ECEC where some admin or management or support staff costing is calculated as additional staff per facility, separately from the remaining overhead costs, the LTC overhead costs do include both staff support and non-labor inputs. Therefor it seems appropriate to make them vary with staff costs to reflect how support and management staff wages are likely to be linked to LTC workers' wages as well as the number of care recipients.

coordination across care workers in ECEC, LTC, and family caregivers). It is possible to estimate this using data on administrative/governance costs as a proportion of total health spending in the country.[34] With all these components calculated, the derivation of total annual investment at the level of the country is simply an arithmetic exercise of adding all elements together for each scenario. Appendix 1 contains the exact equations and steps.

Stage 3: Sensitivity analysis

The process of determining the inputs and parameters for the various scenarios discussed in Stage 1 rests on a series of assumptions, which induces variability in estimates. One source of variability is the use of proxy data. For example, if data on the local policy context is unavailable, comparable data from neighboring/similar countries or international standards can serve as proxies. Another source of variability for our estimates is the uncertainty surrounding input data, such as disability prevalence, reference wages, or energy costs. A third issue is the uncertainty of both climate trajectories and the impact of those projections on care needs and health risks.

We run a series of sensitivity analyses to tackle both policy and data uncertainty. The four scenarios already give a sense of the range of costings that are influenced by some of the main parameters. The sensitivity analysis, however, provides a more systematic analysis, by varying one variable at a time, enabling broader discussions about the main contributors to overall costs. Most factors have linear contributions to the overall costs, given the arithmetic, additive nature of the costing calculations.[35] It is therefore straightforward to extrapolate costings from any combination of changes in these parameters.

5. The costs of implementing a climate-resilient comprehensive care services infrastructure in Bangladesh

This section discusses the results of applying the methodology explained in Section 4 to data from Bangladesh. The country is one of the most vulnerable countries to climate change, affected by floods, cyclones, and higher-than-average global warming, with high levels of year-round humidity (Bangladesh NAP 2022; World Bank 2024). Strikingly, 80% of the land is flood plain, and 60% of the population lives in flood-prone areas (Letsch et al. 2023). Bangladesh has both a substantial share of young people and an aging population who require care (DHS 2022). As noted earlier, its NAP already considers

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[34] For example, European countries—with well-developed health systems—spend about 1.5% (U.K., Sweden) and 5% (France, Germany, Denmark) of total public health care on governance of health systems (Eurostat n.d.): Code HC7 (governance spending) divided by total current spending (within public and compulsory social security financing scheme), averaged over years 2014-2023.

[35] The only multiplicative effect is when changing both wage rates and staffing ratios (quadratic).

adaptation planning and preparedness measures for many sectors (including health and education), but LTC and ECEC services are almost nonexistent.[36] Current public spending on formal ECEC services stands at only 0.02% of GDP (World Bank 2020). Formal LTC services are virtually absent, despite growing care needs as the population is aging (Akter et al. 2025).

Appendix 2 provides further details on the main climatic aspects of the country and near-term warming projections relevant to the climate scenarios of the investment simulation. Appendix Table 2A.1 summarizes relevant socioeconomic information, while Appendix Tables 2A.2 and 2A.3 give the overall data for the parameters of ECEC and LTC services calculations, respectively, along with a brief justification for various choices. Appendix 3 provides more extensive results of the various calculation stages, while Appendix 4 provides additional results for the sensitivity analysis.

Results for ECEC investment costings

As explained in Section 4, the main cost elements can be grouped by labor inputs and non-labor inputs, with some kept constant and some varying across scenarios.

Table 2 shows the main labor input parameters and resulting staffing requirements that contribute to overall staff costs. The three elements that vary are enrollment rates of children in each age group, the staffing ratios, and the qualification mix of ECEC educators (main and assistant educators). The parameters of the central scenario are based on the ILO Tool.

Under the central scenario, total labor costs are estimated at 1.06% of GDP. The combination of a higher qualification mix, lower child/staff ratios, and higher enrollment contributes to doubling total staffing costs from 0.9% to 1.87% of GDP, between the minimum care and maximum care scenarios (see discussion below).

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[36] While there are some private ECEC initiatives mostly funded by NGOs, the government aims to develop a program of free pre-primary school enrollment for children a year away from entering primary school, with high attendance but under low-quality staffing (World Bank 2020).

Table 2. ECEC labor input costing results for Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Labor input parameters						
Share of children 0-2 in ECED	50%	50%	60%	50%	50%	60%
Share of children 3-5 in pre-primary	90%	90%	100%	90%	90%	100%
Child/staff ratio (ECED)	5.0	5.0	4.2	5.0	5.0	4.2
Child/staff ratio (pre-primary)	15.0	20.0	12.5	15.0	15.0	12.5
Share of main educators in ECED	50%	40%	67%	50%	50%	67%
Share of main educators in pre-primary	67%	50%	92%	67%	67%	92%
Weighted wage ECEC educators (% GDP per capita) *	84%	77%	111%	84%	84%	111%
Labor input results						
No ECEC educators per facility	7.1	6.4	8.7	7.1	7.1	8.7
No total ECEC staff per facility	9.1	8.4	10.7	9.1	9.1	10.7
No of facilities in country (new or retrofitted)	262,000	262,000	300,000	262,000	262,000	300,000
Total ECEC educators in country	1,856,000	1,681,000	2,598,000	1,856,000	1,856,000	2,598,000
Total other staff	536,000	535,000	615,000	536,000	536,000	615,000
Total all ECEC staff	2,392,000	2,216,000	3,213,000	2,392,000	2,392,000	3,213,000
Total staff cost (% of GDP in 2035)	1.06%	0.90%	1.87%	1.06%	1.06%	1.87%

*Weighted average of ECEC worker wages for main educators and assistant educators.

Note: Other labor input parameters that are kept constant across scenarios include the number of children per facility (ECEC center), opening hours and weeks, working hours of each staff category, number of support (non-educator) staff per facility, training cost per staff (see appendix Table A2.3 for details on the actual figures). Staffing figures are rounded to the nearest thousand people.

Table 3 focuses on the non-labor costs of ECEC service provision, adapted to climate change. The main elements of variation between the scenarios are the building unit costs and energy unit consumption. Energy unit prices, food costs per child, ECEC facility area per child, and proportion of other overhead costs in total non-labor input costs are kept constant.

Table 3. ECEC non-labor input costing results for Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Non-labor input parameters						
Building costs per m2 (average rural/urban, USD per year)	9.2	9.2	9.2	9.2	9.8	9.8
Energy demand (kWh/m2 per year)	40	40	40	30	60	60
Total non-labor input costs (% GDP 2035) per year	0.42%	0.42%	0.48%	0.41%	0.46%	0.52%
of which (in % of total non-labor costs)						
Construction	*34%*	*34%*	*34%*	*35%*	*34%*	*34%*
Energy	*8%*	*8%*	*8%*	*6%*	*10%*	*10%*
Food	*25%*	*25%*	*25%*	*25%*	*23%*	*23%*
Other non-labor	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*

Note: Other non-labor input parameters that are kept constant across scenarios include the unit price of energy, food cost per child, and ECEC facility area per child, as well as the proportion of other non-labor costs in total non-labor costs. Building costs are annualized. See Appendix 2 and Table A2.3 for details on the actual numbers.

Non-labor costs are considerably lower than labor costs at 0.42% of GDP under the central scenario. Under the maximum care scenario, the costs increase to 0.48% of GDP, driven by the higher number of facilities (see Table 2). The higher unit building costs and energy demand for the maximum climate projection increase the costs by 0.05 percentage points over the minimum climate projection (from 0.41% to 0.46% of GDP) which is a small difference, despite energy costs being doubled between the minimum and the maximum climate scenarios, and building costs slightly increased in the maximum climate scenario. We discuss this further in the sensitivity analysis.

Table 4 presents the overall ECEC annual investment required under each scenario. The central scenario in Column 1 would require an annual investment of 1.48% of GDP in 2035 (that is 1.46% above the baseline current ECEC spending in Bangladesh of 0.02% of GDP). The minimum and maximum care scenarios in Columns 2 and 3 would cost 1.32% and 2.35% of GDP, respectively, as lower and upper bounds of the ECEC investment ambition of the country, with scenario parameters based on existing benchmarks and standards, as discussed in Section 4, but reflecting two extremes of decent-though-minimum quality and high-quality, state-of-the-art provision. In all scenarios the proportion of staff costs remains high, between two-thirds and 80% of the total costs, which is expected from services that are known to be labor intensive.

Table 4. Overall ECEC annual investment requirement in Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Total ECEC investment (% GDP in 2035)	1.48%	1.32%	2.35%	1.47%	1.52%	2.40%
Total additional investment (% GDP 2035)*	1.46%	1.30%	2.33%	1.45%	1.50%	2.38%
% of total that is labor input costs	72%	68%	80%	72%	70%	78%
% of total that is non-labor input costs)	28%	32%	20%	28%	30%	22%

* Additional investment is total investment from which projected current spending (0.02% of GDP) was subtracted. For the interested reader, Appendices 2 and 3 provide all steps and calculations in the costings

The total number of staff required in ECEC facilities would amount to between 2.2 million and 3.2 million between the lower and the higher care scenarios. This includes the existing staff looking after children aged 5 enrolled in pre-primary classes, which would see their working conditions (lower staff ratio) and pay improved. Clearly, hiring, training, and paying so many people is a huge investment that shows the ambitious scale of the program, even under less comprehensive care parameters of the minimum care scenario. By comparison, just under 360,000 primary teachers and head teachers worked in government schools in Bangladesh in 2024 (Shuvo 2024). The systems are barely comparable given the huge difference in staffing ratios, with around 40 children per teacher in primary schools (UNESCO UIS n.d.).

This ambitious investment would also improve the employment and earnings prospects of many of the 13 million mothers of those young children, who are currently combining child care with unpaid domestic work or low-paid employment (estimated from BBS 2022 and UNDESA 2024).

Results for LTC investment costings

Table 5 shows the main labor input parameters that contribute to the scenario variation in total staff costs for LTC investment and estimated costs. The parameters driving the variation in costs are similar to those for ECEC: LTC needs per aggregate age group, staffing ratios, and the qualification mix of LTC workers (see appendix Table A2.3 for details on the actual figures).

The labor costs for LTC services range from 0.6% of GDP to 1.8% of GDP, a threefold increase between the minimum and the maximum care provision scenarios (and a similar increase in terms of the number of LTC staff required). The difference between these two scenarios is driven by a combination of a threefold difference in LTC needs for working-age adults and children; a 50% difference in needs for the older age group; a 20% increase in staffing ratio; and a doubling of the proportion of main LTC workers.

Staffing requirements for the whole country are substantial, ranging from 1.4 million and 3.8 million LTC workers in the minimum and maximum care scenarios—far exceeding the entire public-sector health workforce of under 250,000 (including nurses, doctors, and community health workers). That said, health coverage in Bangladesh is far from universal as the system is mostly private and unregulated. Only 2.5% of the population has health insurance (O'Leary et al. 2023). Twice as many doctors and nurses work in the private sector compared to the public sector, along with a flurry of other unregulated or untrained healers that are difficult to account for (MHFW 2024).

One could argue that the maximum LTC scenario overestimates the staffing requirements to address care needs by increasing both the reach to cover more people and the staffing proportions to improve the quality of support. Increasing both may not be necessary, given that a wider reach likely includes people with more moderate care needs and thus less intense staffing requirements on average. However, given the uncertainty surrounding how provision may be affected by climate change, as well as uncertainty around the correct assumption of care needs estimates in the population in the central scenario, the maximum care scenario may be sufficient to address all care needs on average. Note that this more generous staffing provision is still below that of a country with well-established universal care provision, such as Norway, which has similar proportions of elderly and working-age adults with care needs as Bangladesh (and estimated in the ILO Tool with better national data than Bangladesh).[37]

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[37] Norway is a good benchmark to use for LTC spending in the ILO Tool because its simulated total spending based on parameters calibrated to national data (which already reflects a well-staffed, high-quality, universal and free provision) corresponds well to its actual total annual spending.

Table 5. LTC labor input costing results for Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Labor input parameters						
Share of pop. 65y+ needing care	16.0%	12.8%	19.2%	16.0%	16.0%	19.2%
Share of pop. 15-64y needing care	3.8%	1.8%	5.8%	3.8%	3.8%	5.8%
Share of pop. 0-14y needing care	1.0%	0.5%	1.4%	1.0%	1.0%	1.4%
Recipient-to-carer ratio (0-64y)	4.0	4.0	3.3	4.0	4.0	3.3
Recipient-to-carer ratio (65y+)	3.0	3.0	2.5	3.0	3.0	2.5
Share of main LTC workers (% of LTC workers)	50%	33%	67%	50%	50%	67%
Weighted wage LTC worker (% GDP per capita) *	74%	67%	82%	74%	74%	82%
Labor input results						
Total staff in LTC	2,301,000	1,423,000	3,805,000	2,301,000	2,301,000	3,805,000
Total all staff costs in country (% GDP)	0.99%	0.56%	1.79%	0.99%	0.99%	1.79%

* Weighted average of main and assistant LTC workers' wage rates.

Note: Other labor input parameters that are kept constant across scenarios include working hours and pay level of each staff category, training cost per staff, and cost of health workers' visits (see appendix for details on the actual figures). Staffing figures are rounded to the nearest thousand people.

These less generous staffing ratios more than compensate for the slightly higher wage rates as a proportion of GDP per capita than Norway,[38] which results in overall staff spending of 1.8% of GDP, remaining well below Norway's spending levels at about 2.4% of its GDP.[39]

Table 6 shows the costings for retrofitting and building climate-resilient homes (including energy provision) of those with LTC needs. The variation in costs is driven entirely by the two parameters allowed to vary between scenarios: building unit costs and the intensity of energy demand. A third element—overhead/administrative costs—also varies between scenarios as a fixed proportion of staff costs, which themselves vary.

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[38] Inclusive of employers' social security contributions, Bangladesh's average wage cost rate in proportion of its GDP per capita is 91% and Norway's is 74%.

[39] In other words, this means that calibrating Norway's staffing provision and wage costs to the parameters used for Bangladesh results in both countries spending similar proportions of their GDP on staff costs (indeed, 1.8% of their respective GDP).

Table 6. LTC non-labor input costing results for Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Non-labor input parameters						
Building cost per m2 of home (average rural/urban, USD per year)	4.8	4.8	4.8	4.8	5.1	5.1
Energy needed (kWh/m2 per year)	40	40	40	30	60	60
Non-labor costing results						
Total cost per house per year (% GDP per capita)	8%	8%	8%	7%	10%	10%
Total cost per year of retrofit (% GDP)	0.33%	0.19%	0.47%	0.31%	0.40%	0.56%
Total cost per year of overhead admin (% GDP)	0.20%	0.11%	0.36%	0.20%	0.20%	0.36%

Note: Other non-labor input parameters that are kept constant across scenarios include unit price of energy, average area of the dwelling, as well as the proportion of admin overhead cost to staff costs (see Appendix Table A2.3 for details on the actual figures).

Finally, Table 7 summarizes the total investment requirements for LTC and its main components. The central scenario in Column 1 entails an annual investment of 1.52% of GDP by 2035, of a similar magnitude to the ECEC investment.[40] The ILO (2022) estimates that investing in universal child care and long-term care services could generate 299 million jobs in care and non-care sectors by 2035. This would require annual investments of $5.4 trillion, or 4.2% of GDP, by 2035, but since tax revenue is expected to increase due to higher employment rates and incomes, the net investment required is lower at $4.2 trillion, or 3.2% of GDP (ILO 2022). Similarly, De Henau et al. (2019) find that investing in free universal child care for pre-primary children in Türkiye, Uruguay, and South Africa would generate substantial direct, indirect, and induced employment effects. This would require annual investments equivalent to 3%-4% of GDP, although the net fiscal cost could be reduced by up to half through higher tax revenues generated by increased employment and earnings.

The minimum and maximum care scenarios entail a much wider range of investment as a percentage of GDP than for ECEC, between 0.86% and 2.62% of GDP (nearly 2 percentage points difference compared to 1 percentage point in the ECEC investment). It

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[40] However, the basis for estimating needs is different between ECEC and LTC: high enrollment rates of all children under 6 in ECEC versus low proportion of people with LTC needs of a much higher population across all age groups. The costs of physical adaptation of LTC recipients' homes (construction and energy) are almost double that of ECEC facilities as total ECEC facilities are far fewer (even if of greater area per occupant) than LTC recipients' homes, which by far compensates for the slightly lower unit cost of the latter. As for other overhead costs (admin, maintenance, etc.), the difference between the spending of 0.2% of GDP for LTC and 0.14% for ECEC, could be reconciled by the portion of ECEC staff costs that are for admin purposes (rather than cooking or maintaining buildings), which could be seen as spending on one of the two additional staff per ECEC facility, or 0.08% of GDP. See Appendix 3 for details.

is worth noting that the care scenarios also implicitly entail variation in retrofitting costs as these are proportional to care needs by design and vary between the three care scenarios (following the number of homes with LTC recipients, with constant unit costs of energy and construction). By contrast, varying the unit costs of physical infrastructure elements between the climate scenarios while maintaining constant care needs and labor inputs results in little difference, as was the case for ECEC, reflecting the lower proportion of overhead costs in total costs.

Table 7. Overall LTC annual investment requirement in Bangladesh

	Central	Min care	Max care	Min climate	Max climate	Max both
Total investment per year (% GDP)	1.52%	0.86%	2.62%	1.49%	1.58%	2.71%
Total investment per year w/o retrofit (% GDP)	1.19%	0.67%	2.15%	1.19%	1.19%	2.15%
% staff costs in total investment	65%	65%	68%	66%	63%	66%
% of home retrofit in total investment	22%	23%	18%	21%	25%	21%
% of admin overhead in total investment	13%	13%	14%	13%	13%	13%
% non-staff costs in total investment	35%	35%	32%	34%	37%	34%

Note: In the case of LTC investment no current spending is assumed therefore the additional investment equals total investment.

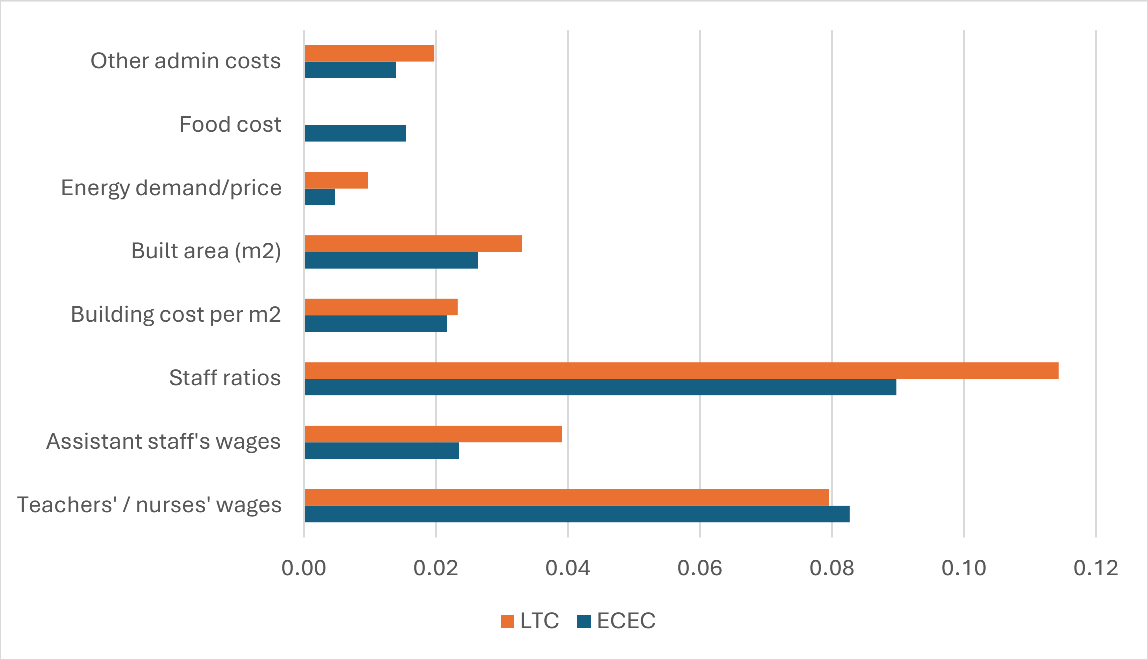
A final note about LTC investment is whether to account for retrofitting (or new building) of houses where LTC recipients live. Given the difficulty to adjudicate, Table 7 also presents the total investment without any physical infrastructure costings, with overheads only reflecting admin costs. This would reduce the central estimate from 1.52% of GDP to 1.19% of GDP and from 2.62% to 2.15% of GDP in the maximum care scenario.

Sensitivity analysis of results

As discussed in Section 4, the three main sources of variation of total costs pertain to policy ambition (targets), climate impacts on the main variables (and uncertainty of climate scenarios and probability of occurrence), and data uncertainty (e.g., average size of houses, average energy consumption today, average wages of teachers, average cost of a cyclone-resistant building). While further studies can make these sources of variation more precise, we provide a summary overview of potential ranges of costings by varying the main factors that enter the costing calculations, respecting plausible ranges encountered in the literature.

Figure 1 shows the percentage point impact on spending of varying the most relevant cost components by 10% (as a percent of GDP). These effects are linear in each component and thus symmetrical (a 10% increase has the opposite effect in percentage points of spending than a 10% decrease).

Figure 1. Percentage point change in total spending (as a % of GDP) per 10% change in each variable



As already noted, the staffing parameters (ratios and wage rates) are the most important elements of the costing variability. For every 10% increase in the reference wages of each system (teachers for ECEC and nurses for LTC), the increase in total annual spending is around 0.08 percentage points of GDP. It is straightforward to extrapolate any increase or decrease in each of the parameters. For example, if teacher wages were increased by 50%, total spending in ECEC would rise by 0.42 percentage points (= 50%/10%*0.083), from 1.48% to 1.90%. By contrast, if energy unit prices or demand per m^2 were increased by 100%, total spending would increase by only 0.05 percentage points in ECEC, from 1.48% to 1.53%, and by about 0.1 percentage points for LTC, from 1.52% to 1.61%. This shows that adapting care services to climate change by improving the physical properties of buildings and energy consumption, even when faced with harsher conditions, will not jeopardize the investment, as it represents a small fraction of total costs. Appendix 4 provides additional figures to illustrate the linearity of the costings as a function of the main relevant parameters.[41]

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[41] These linearities are also useful in case the central scenario did not estimate the right starting point. For example, if the basic energy requirement of the modelled building is not 40kWh/m^2 but is double that, spending can be derived directly from that figure. Even in terms of plausible range, it is worth noting that the more extreme climate scenario for which we have estimated a doubling of energy consumption, as a result of a doubling of the number of days with the heat index above 35˚C

Finally, another source of uncertainty that sensitivity analysis could tackle is the variation in population projections, which further research could examine using U.N. population prospects variants (including migration patterns linked to climate change). While internal migration may affect local risks and local resource requirements, our results are aggregated to national levels. More granular analysis of care needs could be made in any country with adequate data available. Further research could examine the interaction between infrastructure adaptation broadly and specific local building and energy needs of care centers and homes of care recipients, as well as the climate impacts of urbanization and deforestation on staffing and building requirements.

6. Conclusion

This paper has made the case that investing in a comprehensive care services infrastructure is central to climate resilience, requiring systematic integration of care services sectors into adaptation planning and finance. Climate-resilient care services systems ensure continuity of essential services during extreme weather events, supporting the adaptive capacity of households, care recipients, and care workers.

Our core contribution is a methodology for costing the elements of a climate-adapted comprehensive care services infrastructure. Key elements include the integration of workforce requirements to respond to rising care needs during extreme weather events and to support adaptation planning, training, and administration, as well as physical infrastructure requirements of climate-resilient buildings such as ECEC centers and the homes of LTC recipients. Existing care costing tools and associated studies typically enable identification of different scenarios based on coverage and quality of care services. Climate finance estimations, on the other hand, differentiate financing scenarios based on climate projections as well as services quality and coverage. This paper bridges the care and adaptation costing literatures and proposes an integrated approach.

Our methodology necessarily involves several assumptions which reflect normative and context-specific decisions regarding the scope of public responsibility for care provision rather than purely technical costing assumptions. The methodology is designed to make such decisions transparent by identifying and reporting cost elements separately, allowing alternative configurations of public support. By enabling country-specific inclusion or exclusion of cost components, the methodology supports adaptation finance assessments that are sensitive to the national context.

(and number of nights above 26°C) is an upper bound of energy demand indicators. Applying Wang et al.'s (2010) method calculating by how much energy demand would increase with mean air temperature rises (described in Appendix 2), the max scenario increase in energy demand compared to the minimum climate scenario (equivalent to today's climate more or less) would only be 50%, not 100%.

Although our focus is on ECEC and LTC services, other care sectors, such as health care, education, care and support services for school-age children, and social services, are also important for resilience to climate change. Further research could apply and adapt the methodology of this paper across these other sectors, drawing on existing ILO and UN Women tools, which incorporate health care and education.

Application of our methodology to Bangladesh data shows that the scale of investment required to build climate-resilient care services infrastructure is substantial. Estimated costs for ECEC amount to 1.48% of GDP in the central scenario, rising to 2.40% under the maximum care and climate change scenario, while LTC services require 1.52% and 2.71% respectively. Even under the minimum care scenario (which assumes mid-range climate change projections as in the central scenario, but lower care services coverage and qualification parameters), the required investment is 1.32% of GDP for ECEC and 0.86% of GDP for LTC. The combined annual investment in both care sectors would amount to between 3% and 5% of GDP, which is about a tenth to a fifth of the value of unpaid caring activities, when priced at minimum wages, using time-use data from the 2021 Bangladesh time-use survey (BBS and UN Women Bangladesh 2023).[42]

These findings imply a major change in public spending in the case of Bangladesh, where current expenditure on ECEC is only 0.02% of GDP, and LTC receives no public funding. Consequently, identification of financing sources remains an important area for further research, building on the growing body of literature at the intersection of financing for climate change, development, and gender equality.

While the estimated investment requirements may appear large, evaluations of fiscal space for financing climate-resilient care services infrastructure should incorporate consideration of multiple economic returns to investing in care sectors in the short and medium term (beyond their social returns and contributions to climate adaptation), rather than focusing solely on upfront expenditure requirements. As noted earlier in the paper, the economic returns to public investments in care sectors are substantial, generating employment and expanding fiscal space. The application of our methodology to Bangladesh shows that direct employment in care service provision in ECEC is estimated to range between 2.2 to 3.2 million workers, while for LTC the range is between 1.4 and 3.8 million workers. Beyond employment in the care sectors, additional employment would be generated indirectly through overhead expenditure (for example, food provision and manufacturing), as well as direct employment in the construction or retrofitting of child care facilities and homes of LTC recipients. A ballpark estimate using the ILO Tool for Bangladesh shows that about 1.4 to 2.2 million additional jobs could be generated indirectly from the increase in demand for the inputs of both ECEC and LTC services.

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[42] Both men and women aged 15+ spent on average 0.8 hours per day on direct caregiving activities (excluding domestic chores), which projected to the 2035 adult population would add up to 117 million hours per annum. Priced at minimum wage (43% of GDP per capita), this would amount to $213 billion, or 26% of GDP in 2035.

Higher employment and earnings not only boost economic activity but also generate fiscal revenue through increased consumption and income taxes, contributing to the partial self-financing potential of care investments (Ilkkaracan and Kim 2019; De Henau 2022b; Onaran and Oyvat 2023). Moreover, expanded access to employment and earnings can enhance households' adaptive capacity to climate change, particularly by improving their ability to undertake adaptation-related expenditure. This dynamic reinforces a virtuous cycle linking care investments to climate resilience.

Overall, this paper demonstrates that treating care services infrastructure as integral to climate adaptation takes earlier arguments on care investments one step further: Care investments are also strategic investments in climate resilience. Recognizing and financing care systems as climate-resilient physical and social infrastructure is therefore a critical step toward more effective, sustainable, and inclusive adaptation strategies.

References

Afrin, Sadiya, Md. Mehedi Hasan Khan, and Md. Aminul Haque. 2025. "Factors Affecting the Active Aging Situation in Bangladesh." *Frontiers in Public Health* 13 (March): 1517482. https://doi.org/10.3389/fpubh.2025.1517482.

Ahmad, Mumtahin, Chowdhury Shuvra, and Raisa Nanziba. 2023. "A Socio-Ecological Resilience Approach for Coastal Community: A Case of Southkhali, Bagerhat." Paper presented at Architecture and Civil Engineering (ICPACE 2023). *Proceedings of International Conference on Planning*, October 1.

Akter, Shimpi, Md Ikbal Hossain, Humayun Kabir, Sopon Akter, and Masuda Akter. 2025. "Aging in Bangladesh: A Wake - Up Call for Elderly Care Solutions." *Health Science Reports* 8 (2): e70529. https://doi.org/10.1002/hsr2.70529.

Alam, Md Jahangir, Rebeka Ahsan, Firoza Akhter, and Ajoy Paul. 2024. "Earthquake Resistant Non-Engineered Building Construction for Rural Area in Bangladesh." Paper presented at 14th World Conference on Earthquake Engineering (14WCEE). July. https://www.researchgate.net/publication/382086646_EARTHQUAKE_RESISTANT_NON-ENGINEERED_BUILDING_CONSTRUCTION_FOR_RURAL_AREA_IN_BANGLADESH.

Antonopoulos, Rania, Kijong Kim, Thomas Masterson, and Ajit Zacharias. 2010. "Investing in Care: A Strategy for Effective and Equitable Job Creation." SSRN Scholarly Paper No. 1659726. Social Science Research Network, August 16. https://doi.org/10.2139/ssrn.1659726.

Barthelt, Christian, and Renate Bleich. 2023. *Into Action 2019 RISK Award Coastal Resilience Bangladesh*. Munich Re Foundation. https://www.munichre-foundation.org/content/dam/munichre/foundation/publications/risk-award/MRS_IntoAction_10_final.pdf/_jcr_content/renditions/original./MRS_IntoAction_10_final.pdf.

BBS. 2022. *Population and Housing Census 2022 Preliminary Report*. Bangladesh Bureau of Statistics (BBS). https://objectstorage.ap-dcc-gazipur-1.oraclecloud15.com/n/axvjbnqprylg/b/V2Ministry/o/office-bbs/2024/12/b75caf30f6024098a84bc0f4813f6e64.pdf.

BBS and UN Women Bangladesh. 2023. *Report on Time Use Survey 2021*. Bangladesh Bureau of Statistics (BBS). https://objectstorage.ap-dcc-gazipur-1.oraclecloud15.com/n/axvjbnqprylg/b/V2Ministry/o/office-bbs/2024/12/64ff58e91f3d464eab44804f48a44cb6.pdf.

Bedford, Sarah, and Daniel Button. 2022. *Universal Quality Social Care: Transforming Adult Social Care in England*. New Economics Foundation, Women's Budget Group. https://neweconomics.org/2022/02/universal-quality-social-care.

Bhattacharya, Amar, Vera Songwe, Eléonore Soubeyran, and Nicholas Stern. 2024. *Raising Ambition and Accelerating Delivery of Climate Finance: Third Report of the Independent High-Level Expert Group on Climate Finance*. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2024/11/Raising-ambition-and-accelerating-delivery-of-climate-finance_Third-IHLEG-report.pdf.

Boulton, Chris, Claudia Baldwin, Tony Matthews, and Silvia Tavares. 2023. "Environmental Design for Urban Cooling, Access, and Safety: A Novel Approach to Auditing Outdoor Areas in Residential Aged Care Facilities." *Land* 12 (2): 514. https://doi.org/10.3390/land12020514.

Cantelmo, Alessandro, Giovanni Melina, and Chris Papageorgiou. 2019. "Macroeconomic Outcomes in Disaster-Prone Countries." Working Paper No. 2019/217. Preprint, IMF. https://www.imf.org/en/publications/wp/issues/2019/10/11/macroeconomic-outcomes-in-disaster-prone-countries-48704.

CARE. 2026. *Violence and Flooding Trigger Displacement in Mozambique*. February 3. https://www.care.org/media-and-press/violence-and-flooding-trigger-displacement-in-mozambique/.

Cascone, Stefano, Julià Coma, Antonio Gagliano, and Gabriel Pérez. 2019. "The Evapotranspiration Process in Green Roofs: A Review." *Building and Environment* 147 (January): 337–55.

De Henau, Jerome. 2022a. "Costs and Benefits of Investing in Transformative Care Policy Packages: A Macrosimulation Study in 82 Countries." ILO Working Paper 55. Preprint, ILO. https://www.ilo.org/publications/costs-and-benefits-investing-transformative-care-policy-packages-1.

De Henau, Jerome. 2022b. "Simulating Employment and Fiscal Effects of Public Investment in High-Quality Universal Childcare in the UK." *International Journal of Child Care and Education Policy* 16 (1): 3. https://doi.org/10.1186/s40723-022-00096-y.

De Henau, Jerome, and Susan Himmelweit. 2021. "A Care-Led Recovery From Covid-19: Investing in High-Quality Care to Stimulate and Rebalance the Economy." *Feminist Economics* 27 (1–2): 453–69. https://doi.org/10.1080/13545701.2020.1845390.

De Henau, Jerome, Susan Himmelweit, Zofia Łapniewska, and Diane Perrons. 2016. *Investing in the Care Economy: A Gender Analysis of Employment Stimulus in Seven OECD Countries*. International Trade Union Confederation, Women's Budget Group. https://oro.open.ac.uk/50547/1/care_economy_en.pdf.

De Henau, Jerome, Susan Himmelweit, and Diane Perrons. 2017. *Investing in the Care Economy: Simulating Employment Effects by Gender in Countries in Emerging Economies*.

International Trade Union Confederation, Women's Budget Group. https://oro.open.ac.uk/50548/1/care_economy_2_en_web.pdf.

Devercelli, Amanda E., and Frances Beaton-Day. 2020. *Better Jobs and Brighter Futures: Investing in Childcare to Build Human Capital*. World Bank. https://openknowledge.worldbank.org/entities/publication/385821d3-bce3-5640-b140-48e27b58296b.

Diski, Rebekah. 2022. *A Green and Caring Economy: Final Report: UK Feminist Green New Deal Report*. Women's Budget Group. https://wbg.org.uk/wp-content/uploads/2022/11/A-Green-and-Caring-Economy-Report-FINAL.pdf.

Echeverri, Lina, Flavio Salio, Richard Parker, et al. 2024. "Applying the Surge Capacity Components for Capacity-Building Purposes in the Context of the EMT Initiative." *International Journal of Environmental Research and Public Health* 21 (12): 1712. https://doi.org/10.3390/ijerph21121712.

ECLAC. 2022. *The Care Society: A Horizon for Sustainable Recovery with Gender Equality*. ECLAC. https://www.cepal.org/en/publications/48362-care-society-horizon-sustainable-recovery-gender-equality.

Elson, Diane. 1992. "Male Bias in Structural Adjustment." In *Women and Adjustment Policies in the Third World*. Palgrave Macmillan, London. https://doi.org/10.1007/978-1-349-11961-5_3.

Esquivel, Valeria. 2014. "What Is a Transformative Approach to Care, and Why Do We Need It?" *Gender & Development* 22 (3): 423–39. https://doi.org/10.1080/13552074.2014.963303.

Eurostat. n.d. "Statistics | Eurostat." Eurostat. Accessed December 4, 2025. https://ec.europa.eu/eurostat/databrowser/explore/all/all_themes.

Faizan, Unaiza, and Audra S. Rouster. 2023. "Nutrition and Hydration Requirements in Children and Adults." In *StatPearls*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK562207/.

Ferrari, Alize J., Damian Francesco Santomauro, Amirali Aali, et al. 2024. "Global Incidence, Prevalence, Years Lived with Disability (YLDs), Disability-Adjusted Life-Years (DALYs), and Healthy Life Expectancy (HALE) for 371 Diseases and Injuries in 204 Countries and Territories and 811 Subnational Locations, 1990–2021: A Systematic Analysis for the Global Burden of Disease Study 2021." *The Lancet* 403 (10440): 2133–61. https://doi.org/10.1016/S0140-6736(24)00757-8.

Field, Christopher B., Vicente R. Barros, D. J. Dokken, et al., eds. 2014. *Summary for Policymakers*. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC. https://www.ipcc.ch/site/assets/uploads/2018/03/ar5_wgII_spm_en-1.pdf.

Floro, Maria S., and Georgia Poyatzis. 2018. "Climate Change, Natural Disasters and the Spillover Effects on Unpaid Care: The Case of Super-Typhoon Haiyan." In *Feminist Political Ecology and the Economics of Care*, 1st ed. Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315648743-5/climate-change-natural-disasters-spillover-effects-unpaid-care-maria-floro-georgia-poyatzis.

Folbre, Nancy. 2007. "Measuring Care: Gender, Empowerment, and the Care Economy." *Journal of Human Development* 7 (2): 183–99. https://doi.org/10.1080/14649880600768512.

GBD 2021 Risk Factors Collaborators, Michael Brauer, Gregory A. Roth, et al. 2024. "Global Burden and Strength of Evidence for 88 Risk Factors in 204 Countries and 811 Subnational Locations, 1990–2021: A Systematic Analysis for the Global Burden of Disease Study 2021." *The Lancet* 403 (10440): 2162–203. https://doi.org/10.1016/S0140-6736(24)00933-4.

Guenther, Robin, and John Balbus. 2014. *Primary Protection: Enhancing Health Care Resilience for a Changing Climate*. U.S. Department of Health and Human Services. https://toolkit.climate.gov/sites/default/files/SCRHCFI%20Best%20Practices%20Report%20final2%202014%20Web.pdf.

Gultekin, Derya, Ipek Ilkkaracan, Ayşe Aylin Bayar, and Pınar Ozcanlı-Baran. 2025. "Investing in the Care Services Sectors for Employment Generation and Gender-Inclusive Growth: The Case of Turkey." *New Perspectives on Turkey* 72 (May): 90–114. https://doi.org/10.1017/npt.2024.32.

Halbmayer, Katharina, Jutta Hollands, Sara Alasu, et al. 2021. "GREEN: Cool & Care—Research and Development of Greening Measures in Nursing Homes in Austria. Technical and Social Interconnections." *Sustainability* 13 (20): 20. https://doi.org/10.3390/su132011469.

Hales, Simon, Sari Kovats, Simon Lloyd, and Campbell Campbell-Lendrum, eds. 2014. *Quantitative Risk Assessment of the Effects of Climate Change on Selected Causes of Death, 2030s and 2050s*. WHO. https://www.who.int/publications/i/item/9789241507691.

Hallegatte, Stephane, Jun Rentschler, and Julie Rozenburg. 2019. *Lifelines: The Resilient Infrastructure Opportunity*. World Bank. https://openknowledge.worldbank.org/entities/publication/c3a753a6-2310-501b-a37e-5dcab3e96a0b.

Hammill, Anne, Julie Dekens, and Angie Daze. 2020. *The National Adaptation Plan (NAP) Process: Frequently Asked Questions*. NAP Global Network.

https://napglobalnetwork.org//wp-content/uploads/2020/08/napgn-en-2020-NAP-Process-FAQs.pdf.

Housing and Building Research Institute, Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh. 2017. *Standard Guideline for Rural Housing in Disaster Prone Areas of Bangladesh*. Housing and Building Research Institute, Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh. https://preparecenter.org/wp-content/uploads/2020/10/24BD02-Publication-housing-guidelines-1.pdf.

Ilkkaracan, Ipek. 2016. "A Feminist Alternative to Austerity: The Purple Economy as a Gender-Egalitarian Strategy for Employment Generation." In *Economics and Austerity in Europe*. Routledge.

Ilkkaracan, Ipek. 2021. *A Guide to Public Investments in the Care Economy Policy Support Tool for Estimating Care Deficits, Investment Costs and Economic Returns*. With Seth Anuradha and Valeria Esquivel. ILO-UNW. https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2021/Policy-tool-Care-economy-en.pdf.

Ilkkaracan, Ipek. 2025. "The Purple Economy Framework: Advancing Gender Equality and Care Justice Beyond Neoliberalism and Conservative Backlash." In *la Rivista delle Politiche Sociali: Italian Journal of Social Policy*. Futura Editrice. https://www.futura-editrice.it/prodotto/rps-n-2-2025/.

Ilkkaracan, Ipek, Ayşe Aylin Bayar, Luiza Nassif Pires, Tom Masterson, and Ajit Zacharias. 2022. *Investing in Early Childhood Education and Care Services in Jordan: An Assessment of Costs and Returns*. UN Women Country Office in Jordan, Istanbul Technical University, the Levy Economics Institute in New York. https://www.levyinstitute.org/wp-content/uploads/2025/05/jordan_rpr_5_25.pdf.

Ilkkaracan, Ipek, and Kijong Kim. 2019. *The Employment Generation Impact of Meeting SDG Targets in Early Childhood Care, Education, Health and Long-Term Care in 45 Countries*. ILO. https://www.right-to-education.org/sites/right-to-education.org/files/resource-attachments/ILO_impact_SDG_ECCE_2019_EN.pdf.

Ilkkaracan, Ipek, Kijong Kim, and Tolga Kaya. 2015. *The Impact of Public Investment in Social Care Services on Employment, Gender Equality, and Poverty: The Turkish Case*. ILO. https://www.ilo.org/publications/impact-public-investment-social-care-services-employment-gender-equality.

Ilkkaracan, Ipek, Kijong Kim, Tom Masterson, Emel Memiş, and Ajit Zacharias. 2021. "The Impact of Investing in Social Care on Employment Generation, Time-, Income-Poverty by Gender: A Macro-Micro Policy Simulation for Turkey." *World Development* 144 (August): 105476. https://doi.org/10.1016/j.worlddev.2021.105476.

ILO. 2018. *Care Work and Care Jobs: For the Future of Decent Work*. ILO. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40dgreports/%40dcomm/%40publ/documents/publication/wcms_633135.pdf.

ILO. 2023. *Mainstreaming Care Work to Combat the Effects of Climate Change*. ILO. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40americas/%40ro-lima/documents/publication/wcms_888607.pdf.

ILO. n.d. "ILO Global Care Portal." ILO. Accessed July 14, 2025. https://webapps.ilo.org/globalcare/?language=en#simulator.

IMF. 2019. *Eastern Caribbean Currency Union: Selected Issues Paper*. IMF Staff Country Reports. No. 063 (February). https://doi.org/10.5089/9781498300100.002.A001.

IPCC. 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change: Annex II: Glossary*. Edited by R. K. Pachauri and L.A. Meyer. IPCC. https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf.

IPCC, R. K. Pachauri, and L.A. Meyer. 2007. *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Appendix 1: Glossary*. IPCC. https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg2-app-1.pdf.

IUCN. 2016. *Nature-Based Solutions to Address Global Societal Challenges*. IUCN. https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf.

Kim, Kijong, Ipek Ilkkaracan, and Tolga Kaya. 2019. "Public Investment in Care Services in Turkey: Promoting Employment & Gender Inclusive Growth." *Journal of Policy Modeling* 41 (6): 1210–29. https://doi.org/10.1016/j.jpolmod.2019.05.002.

Letsch, Lucia, Shouro Dasgupta, and Elizabeth J. Z. Robinson. 2023. *Policy Brief Tackling Flooding in Bangladesh in a Changing Climate*. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2023/08/Tackling-flooding-in-Bangladesh-in-a-changing-climate.pdf.

Lewis, Daniel, and Kath Ballard. n.d. *Disability and Climate Change: Understanding Vulnerability and Building Resilience in a Changing World*. CBM. https://www.disabilityrightsfund.org/wp-content/uploads/Disability_and_Climate_Change.pdf.

Michelon, T., P. Magne, and F. Simon-Delavelle. 2005. "Lessons of the 2003 Heat-Wave in France and Action Taken to Limit the Effects of Future Heat-Waves." In *Extreme Weather Events and Public Health Responses*, edited by Wilhelm Kirch, Roberto Bertollini, and Bettina Menne. Springer. https://doi.org/10.1007/3-540-28862-7_13.

Ministry of Environment, Forest, and Climate Change, Government of the People's Republic of Bangladesh. 2022. "National Adaptation Plan of Bangladesh (2023-2050)." Ministry of Environment, Forest, and Climate Change, Government of the People's Republic of Bangladesh, October. https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/npfblock/903c6d55_3fa3_4d24_a4e1_0611eaa3cb69/National%20Adaptation%20Plan%20of%20Bangladesh%20%282023-2050%29%20%281%29.pdf.

Ministry of Health and Family Welfare (MHFW), Government of the People's Republic of Bangladesh. 2024. *Bangladesh Health Workforce Strategy 2024*. Ministry of Health and Family Welfare (MHFW), Government of the People's Republic of Bangladesh. https://hsd.portal.gov.bd/sites/default/files/files/hsd.portal.gov.bd/page/e620d076_40f0_4f38_a87a_7897e006a91d/Bangladesh%20Health%20Workforce%20Strategy%202024.pdf.

Multi-Hazard Mitigation Council. 2019. *Natural Hazard Mitigation Saves: 2019 Report*. A. National Institute of Building Sciences. https://nibs.org/wp-content/uploads/2025/04/NIBS_MMC_MitigationSaves_2019.pdf.

Munnelly, Carly, Anna-Maria Tammi, and Raphaelle Martinez. 2023. *The Need for Climate-Smart Education Financing: A Review of the Evidence and New Costing Framework*. Save the Children & Global Partnership for Education. https://www.globalpartnership.org/node/document/download?file=document/file/2023-12-climate-smart-education-financing-review-evidence-costing-framework.pdf.

National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ORC Macro. 2001. *Bangladesh Demographic and Health Survey 1999–2000*. Dhaka, Bangladesh, and Calverton, Maryland: NIPORT, Mitra and Associates, and ORC Macro. https://dhsprogram.com/publications/publication-fr119-dhs-final-reports.cfm.

National Institute of Population Research and Training (NIPORT) and ICF. 2022. *Bangladesh Demographic and Health Survey 2022 - Final Report*. National Institute of Population Research and Training (NIPORT) and ICF. https://dhsprogram.com/pubs/pdf/FR386/FR386.pdf.

O'Leary, Lauren, Shouro Dasgupta, and Elizabeth J. Z. Robinson. 2023. *Impacts of Climate Change on Health in Bangladesh*. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2023/10/Impacts-of-climate-change-on-health-in-Bangladesh-Policy-brief.pdf.

Onaran, Ozlem, and Cem Oyvat. 2023. *The Employment Effects of Public Spending in Infrastructure, the Care Economy and the Green Economy: The Case of Emerging Economies*. ITUC. https://www.ituc-csi.org/IMG/pdf/public_spending_infrastructure_en_v2.pdf.

Otoo, Christopher, Tao Lu, and Xiaoshu Lü. 2024. "Application of Mixed-Mode Ventilation to Enhance Indoor Air Quality and Energy Efficiency in School Buildings." *Energies* 17 (23): 6097. https://doi.org/10.3390/en17236097.

Parry, Martin, Osvaldo Canziani, Jean Palutikof, Paul van der Linden, and Clair Hanson, eds. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC. https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg2_full_report.pdf.

Puig, Daniel, Anne Olhoff, Skylar Bee, Barney Dickson, and Keith Alverson, eds. 2016. *The Adaptation Finance Gap Report*. UNEP. https://unepccc.org/wp-content/uploads/2019/04/adaptation-finance-gap-report-2016.pdf.

Romanello, Marina, Claudia Di Napoli, Paul Drummond, et al. 2022. "The 2022 Report of the Lancet Countdown on Health and Climate Change: Health at the Mercy of Fossil Fuels." *The Lancet* 400 (10363): 1619–54. https://doi.org/10.1016/S0140-6736(22)01540-9.

Romanello, Marina, Maria Walawender, Shih-Che Hsu, et al. 2024. "The 2024 Report of the Lancet Countdown on Health and Climate Change: Facing Record-Breaking Threats from Delayed Action." *The Lancet* 404 (10465): 1847–96. https://doi.org/10.1016/S0140-6736(24)01822-1.

Shuvo, Ariful Hasan. 2024. "What Our School Teacher Salaries Say about Our Education." *The Business Standard*, September 23. https://www.tbsnews.net/features/panorama/what-our-school-teacher-salaries-say-about-our-education-881386.

Sohaana, Anika Imraana, and Md Arifur Rahman. 2021. "Challenges in Sustaining Resilience in the Coastal Settlements of South-Eastern Bangladesh: Achieving Self-Sustenance through Architectural Synthesis." *Architecture Papers of the Faculty of Architecture and Design STU* 26 (4): 3–17. https://doi.org/10.2478/alfa-2021-0020.

Stock, Petra. 2026. "Day and Night, There's No Relief: Five Ways This Heatwave Is One of Australia's Worst on Record." Environment. *The Guardian*, January 30. https://www.theguardian.com/environment/2026/jan/31/day-and-night-theres-no-relief-five-ways-this-heatwave-is-one-of-australias-worst-on-record.

Tesfaye, Amensisa Hailu, Jason Prior, and Erica McIntyre. 2025. "Impact of Climate Change on Health Workers: A Scoping Review." *Journal of Public Health*, February 13, 1–19. https://doi.org/10.1007/s10389-025-02418-z.

Trelegan, Kendall, Laura Martinez, and Caren Grown. 2026. "Care Services Support Effective Climate Adaptation: Mapping Care within National Adaptation Plans and Nationally Determined Contributions." *Brookings*, May 11. https://www.brookings.edu/articles/care-services-climate-adaptation-naps-ndcs/.

UN Women. 2023. *The Climate-Care Nexus: Addressing the Linkages Between Climate Change and Women's and Girl's Unpaid Care, Domestic, and Communal Work*. UN Women. https://www.unwomen.org/sites/default/files/2023-11/working-paper-the-climate-care-nexus-en.pdf.

UN Women and ILO. 2021. *A Guide to Public Investments in the Care Economy Policy Support Tool for Estimating Care Deficits, Investment Costs and Economic Returns*. UN Women and ILO. https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2021/Policy-tool-Care-economy-en.pdf.

UNDESA. 2024. "World Population Prospects 2024." UN Population Division, UN Department of Economic and Social Affairs population Division. https://population.un.org/wpp/downloads?folder=Standard%20Projections&group=Most%20used.

UNDP. 2015. *Human Development Report 2015: Work for Human Development*. UNDP. https://hdr.undp.org/system/files/documents/global-report-document/2015humandevelopmentreport1.pdf.

UNEP. 2023. *Adaptation Gap Report 2023: Underfinanced. Underprepared. Inadequate Investment and Planning on Climate Adaptation Leaves World Exposed.* UNEP. https://www.unep.org/resources/adaptation-gap-report-2023.

UNEP. 2025. *Adaptation Gap Report 2025: Running on Empty. The World Is Gearing up for Climate Resilience — without the Money to Get There*. Edited by H. Neufeldt, A. Hammill, T. Leiter, et al. UNEP. https://doi.org/10.59117/20.500.11822/48798.

UNESCO. n.d. "UIS Data Browser." UNESCO. Accessed February 4, 2026. https://uis-data-browser-frontend-9qoly6dvy-ixt1.vercel.app/index.

UNFCCC. 2009a. *Investment and Financial Flows to Address Climate Change*. UNFCCC. https://unfccc.int/resource/docs/publications/financial_flows_update_eng.pdf.

UNFCCC. 2009b. "Potential Costs and Benefits of Adaptation Options: A Review of Existing Literature." UNFCCC. FCCC/TP/2009/2. https://unfccc.int/resource/docs/2009/tp/02.pdf.

UNFCCC. 2022. *Report of the Adaptation Committee*. UNFCCC. https://unfccc.int/sites/default/files/resource/sb2022_05_adv.pdf.

UNFCCC. n.d.-a. "Nationally Determined Contributions (NDCs)." UNFCCC. Accessed February 12, 2026. https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs.

UNFCCC. n.d.-b. "Parties to the United Nations Framework Convention on Climate Change." Accessed February 4, 2026. https://unfccc.int/process/parties-non-partystakeholders/parties-convention-and-observer-states?field_national_communications_target_id%5B514%5D=514.

UNICEF. 2024. *Learning Interrupted: Global Snapshot of Climate-Related School Disruptions in 2024*. UNICEF. https://www.unicef.org/media/170626/file/Global-snapshot-climate-related-school-disruptions-2024.pdf.

UNICEF, Alexandre Cote, and Lena Morgon Banks, eds. 2025. *Global Disability Inclusion Report Accelerating Disability Inclusion in a Changing and Diverse World*. UNICEF (on behalf of the Global Disability Inclusion Report steering group). https://www.globaldisabilitysummit.org/wp-content/uploads/2025/03/GIP03351-UNICEF-GDIR-Full-report_Proof-7.pdf.

UNICEF EAPRO. 2022. *Early Childhood Development and Climate Change*. UNICEF EAPRO. https://www.unicef.org/eap/media/12801/file/UNICEF%20EAPRO%20ECD%20and%20Climate%20Change%20Advocacy%20Brief%20doc.pdf.

United Nations. 2024. *Transforming Care Systems in the Context of the Sustainable Development Goals and Our Common Agenda*. UN System Policy Paper. United Nations. https://unsdg.un.org/resources/transforming-care-systems-un-system-policy-paper.

Wang, Xiaoming, Dong Chen, and Zhengen Ren. 2010. "Assessment of Climate Change Impact on Residential Building Heating and Cooling Energy Requirement in Australia." *Building and Environment* 45 (7). https://doi.org/10.1016/j.buildenv.2010.01.022.

WHO. n.d. *2023 WHO Review of Health in Nationally Determined Contributions and Long-Term Strategies: Health at the Heart of the Paris Agreement*. WHO. https://cdn.who.int/media/docs/default-source/climate-change/9789240074729-v2.pdf?sfvrsn=f4c8b157_4.

Wignarajah, Dharshan, Morgan Richmond, Sean Stout, Guillermo Martinez, Ken Schell-Smith, and Rajashree Padmanabhi. 2023. *State and Trends in Climate Adaptation Finance 2023*. Climate Policy Initiative & Global Center on Adaptation. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/12/State-and-Trends-in-Climate-Adaptation-Finance-2023_.pdf.

World Bank. 2020. *The Landscape of Early Childhood Education in Bangladesh*. No. AUS0001357. World Bank. https://documents1.worldbank.org/curated/en/720311583471084983/pdf/The-Landscape-of-Early-Childhood-Education-in-Bangladesh.pdf.

World Bank. 2024. *Climate Risk Country Profile: Bangladesh*. World Bank. https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/16813-WB_Bangladesh%20Country%20Profile-WEB.pdf.

World Bank. n.d. “Population Estimates and Projections.” World Bank DataBank. Accessed February 4, 2026. https://databank.worldbank.org/reports.aspx?Code=SP.DYN.TFRT.IN&Id=fdaa1724&Report_Name=Population&populartype=series.

Zurynski, Yvonne, Georgia Fisher, Shalini Wijekulasuriya, et al. 2024. “Bolstering Health Systems to Cope with the Impacts of Climate Change Events: A Review of the Evidence on Workforce Planning, Upskilling, and Capacity Building.” *The International Journal of Health Planning and Management* 39 (3): 781–805. https://doi.org/10.1002/hpm.3769.

Appendix 1. Formulae

Here are the equations of the costing steps for each type of service:

ECEC services

The child population to be enrolled in ECEC services N is given by:

$$N = \sum_{J}^{n} \left(p_i e_{r_j} \right)$$

where

P_j = Population in age group j in the projected year

er_j = target enrollment rate for age group j

n = Number of age groups (in this case 2 groups for age 0-2 and 3-5)

Staffing requirement per facility is derived as follows:

Weekly hours of contact time H_j for each age group j:

$$H_j = \frac{N_j}{N} * Cf * O_j \qquad (1)$$

With

$\frac{N_j}{N}$ representing the share of children in age group j enrolled in total ECEC population N enrolled

Cf is the number of children per facility (total of both age groups) and

O_j is the number of weekly opening hours (hours of children of each age group present) in ECEC facilities.

Number of full-time-equivalent (FTE) educator staff E_j looking after each age group j in the facility:

$$E_j = \frac{H_j}{CS_j} * \frac{(1+x_h)}{h_{ft}} \qquad (2)$$

With

CS_j representing the child/staff ratio of age group j

x_h represents the extra hours for non-contact time (including holiday, sickness and admin), measured as a percentage of contact time.

h_{ft} is the number of full-time working hours in a typical week, fixed at 40 in the current exercise for all workers.

The number of training staff TS is a fixed proportion of the number of educators in the facility E.

The number of management and support staff MS per facility is a fixed proportion of the number of children per facility.

The wage cost of each staff type (including training staff and support/management staff) is the annual wage plus employer pension and social security contributions.

The average annual wage cost W_j^{ave} of educators employed for each age group j is based on the target annual wage cost of each educator staff category, namely target wage cost for main educators (W^{me}) and assistant educators (W^{ae}), and weighted according to their respective shares in each age group j:

$$W_j^{ave} = W^{me}\left(E_j^{me} \,/\, E_j\right) + W^{ae}\left(E_j^{ae} \,/\, E_j\right) \qquad (3)$$

The average wage cost per FTE educator of each age group is then multiplied by the total number of (main and assistant) educators of each age group E_j in the facility to find wage costs for educators. Wage costs of training staff, and of management and support staff are also added to find the total wage costs (TWC):

$$TWC = \left(\sum_{j=1}^{n} \left(W_j^{ave} E_j\right)\right) + W^{TS}TS + W^{MS}MS \quad (4)$$

The number of facilities in the country (F) is the total number of children to be enrolled according to the policy target enrollment rates for each age group (e_j) and the child population for each age group (P_j), divided by the number of children per facility (C_f).

$$F = \frac{\sum_{j}^{n} (p_j e_j)}{c_f} \qquad (5)$$

Overhead costs per facility OHC_f are multiplied by the number of facilities (F) and added to the total wage bill per facility to find total ECEC costs:

$$Total\ ECEC\ Costs = \left(OHC_f \ \times F\right) + TWC \qquad (6)$$

LTC services

LTC service costs entail only staff costs and management overheads as services are assumed to be provided in the LTC recipients' homes. However, we add building and energy costs per home of care recipient as part of the climate adaptation scenarios.

Total staff for LTC services consists of four categories: main LTC workers (MLTC), assistant LTC workers (ALTC), training staff (TS) and nurses (N). Required LTC workers (the sum of the first two categories) per 100 population of age group j (measured in full-time equivalent) $RLTC_j$:

$$RLTC_j = \frac{D_j}{RS_j} \qquad (7)$$

where

D_j = Prevalence of needs for each age group j (No. of people with LTC needs per 100 population in group j)

RS_j = Recipient-to-care staff ratio for each age group j

Total LTC services staff would be the sum over all age groups of required LTC workers per 100 population per age group j ($TLTC_j$) times population in each age group (Pop_j):

$$Total\ LTC\ services\ Staff = \sum_{j=1}^{3}(TLTC_j\ Pop_j) + TS + N \qquad (8)$$

Average wage of LTC workers W_{LTC}^{ave} is a weighted average of the target wage rates of different categories of LTC workers:

$$W_{LTC}^{ave} = MLTC\ /\ TLTC\ \times\ 75\ \%\ of\ nurses\ wages\ +\ ALTC\ /\ TLTC\ \times\ fraction\ of\ min\ wage \qquad (9)$$

Where $TLTC = MLTC + ALTC$

$$Total\ LTC\ Staff\ Wage\ Bill = (W_{LTC}^{ave}\ \times TLTC) + (W^{TS} \times TS) + (w^{N} \times N) \qquad (10)$$

$$PLTC = Total\ LTC\ receiving\ population = \sum D_j Pop_j \qquad (11)$$

The total overhead costs, assuming one recipient per home, are given by:

OC = (building and energy costs + admin costs) per LTC recipient

$$Total\ Overhead\ Costs =\ OC\ \times PLTC \qquad (12)$$

$$Total\ LTC\ Costs = Total\ LTC\ Staff\ Wage\ Bill + Total\ Overhead\ Costs \qquad (13)$$

Appendix 2. Bangladesh

This appendix provides background information on Bangladesh that influence the application of the costing methodology and then proceeds to explain the assumptions and data issues for the calculations of a climate adapted care services infrastructure.

Background characteristics

Temperature and rainfall trends

Bangladesh has a warm, humid, subtropical monsoon climate shaped by its low-lying deltaic topography at the confluence of the Ganges, Brahmaputra, and Meghna rivers and its long coastline along the Bay of Bengal (World Bank 2024).[43] Over the past few decades, both minimum and maximum temperatures have gone up across the country (0.20°C and 0.18°C per decade), leading to more hot days and nights (World Bank 2024). Bangladesh's NAP indicates an acceleration of warming since the early 1990s, with average temperature increases of 0.39°C in the 1990s, 0.53°C in the 2000s, and 1.06°C between 2011 and 2019 (Bangladesh NAP 2022). Winters are becoming noticeably milder, while pre-monsoon and monsoon seasons are getting hotter. Rainfall trends are more uneven. Between 1971 and 2020, data show increases in some western regions, especially during monsoon and post-monsoon months, and decreases in parts of the east during pre-monsoon months (World Bank 2024). These changes are accompanied by more intense rainfall events, longer dry spells, and sea-level rise of around 1.7 mm per year along the coast (1901-2010), as well as warming and acidification of the Bay of Bengal (Bangladesh NAP 2022).

The World Bank and Bangladesh NAP both predict that these trends will intensify over the coming decades, with flooding, erosion, cyclones, and heat waves estimated as the critical issues (HBRI 2017; World Bank 2024; Bangladesh NAP 2022). Under a range of pathways from low to very high emissions (SSP1-2.6 and SSP5-8.5)[44], mean annual temperature in Bangladesh is expected to rise by about 0.44-0.69°C by the 2030s and 1.3-2.0°C by the 2050s relative to the baseline (1981-2010) (Bangladesh NAP 2022). Annual rainfall is expected to increase slightly overall—by 0.1%-1.4% in the 2030s and 2.4%-3.5% in the 2050s (Bangladesh NAP 2022). These changes, combined with

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[43] Examining the technical solutions to address current and future climatic conditions is essentially dependent of the climate zone in question. Given that Bangladesh is a hot-humid climate zone and flood- and cyclone-prone country, we have concentrated on examining solutions in our costing calculations to cope with these risks, thereby neglecting techniques that deal with hot-dry climate cooling solutions or insulation for cold winters. Ignoring cold winters is not necessarily a problem here, as most of the lower and middle-income countries that are worst affected by climate change will tend to be in warm zones. For example, for cooling, the main difference between hot-humid and hot-arid climate zones will be that the latter can see much improvement in thermal comfort from some passive cooling techniques that would not work well in humid climates, such as passive evaporative cooling (Nahar et al. 2003; Hu et al. 2023).

[44] SSP or Shared Socioeconomic Pathways were developed for the IPCC's Sixth Assessment Report, superseding the Representative Concentration Pathways used in the Fifth Assessment Report. They differ from RCPs in that they add socioeconomic variables, including population growth, GDP development, and technology adoption, among other variables. SSP2 roughly corresponds to RCP4.5 and SSP5 roughly corresponds to RCP8.5.

ongoing sea-level rise, imply more frequent and severe flooding, storm surges, flash floods, urban waterlogging, and coastal inundation—especially in low-lying coastal belts where simulations based on the SSP5-8.5 scenario suggest that up to around 18% of coastal area could be inundated by the mid-century under high-emissions sea-level scenarios (Bangladesh NAP 2022).

Socioeconomic trends

Bangladesh has both a relatively young and an aging population. The total fertility rate decreased from 6.7 to 2.2 children per woman between 1960 and 2023 and is expected to further decline to 2.0 in 2030 and 1.8 in 2050 (World Bank data n.d.). Data from the Bangladesh Bureau of Statistics show that the proportion of people aged 60 years or older increased from 7.7% in 2015 to 9.5% in 2023 and is projected to reach one in five by 2050 (Afrin et al. 2025). The World Bank estimates that the old-age dependency ratio has risen from about 5.8 elderly per 100 working-age people in 2000 to nearly 10.2 in 2025 and is projected to almost double to 20.3 in 2050 (World Bank data n.d.).

According to the most recent Multiple Indicator Cluster Survey (MICS), the average household size in 2025 was 4.1 people. Children were present in most households: approximately 74% of households had at least one child under the age of 18; 79% of these children lived with both parents and 15% with their mother only (BBS 2025).

Using Demographic and Household Surveys, Table A2.1 shows a range of key socioeconomic and demographic characteristics of Bangladesh, by rural and urban residence, and changes between 2000 and 2022-23.

Table A2.1. Main household characteristics in Bangladesh (2000-2023)

	1999-2000			2022-2023		
	All	Urban	Rural	All	Urban	Rural
Mean household size (number)	5.2	5.2	5.2	4.1	4.1	4.2
Households with 3 generations (%)	24	20	25	28	23	29
Households with members aged 65+ (%)	20	16	21	25	20	27
Households with only members aged 65+ (%)	0.6	0.2	0.7	1.4	0.8	1.6
Total fertility rate (women aged 15-49)	3.3	2.5	3.5	2.3	2.1	2.4
Under 5 mortality (per 1000)	94	81	97	32	31	33
Life expectancy at birth (years)[a]						
Men	63.7			70.9		
Women	63.5			73.8		

Sources: DHS 2022 and DHS 1999-2000 (downloaded from https://www.statcompiler.com/en/); and BBS 2023.

[a] WHO data shows that the proportion Healthy Life Expectancy (HALE) in total life expectancy at age 60 is stable in Bangladesh, fluctuating around a 0.5 percentage point margin over 20 years. This means our assumption of a stable ratio of HALE / LE to derive disability rates by 2035 is plausible.

Table A2.2 shows average characteristics of the housing stock in urban and rural areas over time. Access to electricity and improved water and sanitation have improved over time, so that most households, rural and urban, are covered.

Table A2.2. Main household characteristics in Bangladesh (2000-2023)

	1999-2000			2022-2023		
	All	Urban	Rural	All	Urban	Rural
Access to electricity (% hh)	21	81	32	99	100	99
Access to improved water (% hh)	96	99	96	99	99	99
Access to improved sanitation (% hh)	36	64	29	80	86	78
Access to smartphone (% hh)				70	83	66

Sources: DHS 2022 and DHS 1999-2000 (downloaded from https://www.statcompiler.com/en/); and BBS 2023.
Note: "hh" stands for households.

Costing assumptions and data for ECEC and LTC services

Table A2.3 presents the data, by source, for the parameters and targets for personnel and physical infrastructure for ECEC and LTC out to 2035 that are used in the four scenarios described in Section 4. We start with services salaries, then explain building costs, expand on energy costs, and wrap up with food costs.

Table A2.3. Parameters of simulation scenario for ECEC and LTC services (in 2035)

Parameters of simulation scenario common to both ECEC and LTC services						
GDP per capita	Data source: IMF World Economic Outlook					
GDP per capita (2024 USD)	4259					
Energy costs	Source: Estimates based on literature review					
	Central	**Min Care**	**Max Care**	**Min Climate**	**Max Climate**	**Max Care & Climate**
Energy needed kWh/m^2 per year of indoor area (family home or ECEC center)	40	40	40	30	60	60
Unit price of energy (solar) (USD per kWh)	0.05					

Parameters of simulation scenario for ECEC services						
Population	Data source: U.N. World Population Prospects					
0-2 ECED	9,330,000					
3-5 Pre-primary	9,395,000					
ECEC targets varying by scenario	Source: ILO Tool					
	Central	**Min Care**	**Max Care**	**Min Climate**	**Max Climate**	**Max Care & Climate**
Coverage rate						
0-2	50%	50%	60%	50%	50%	60%
3-5	90%	90%	100%	90%	90%	100%
Child/educator ratio						
0-2	5	5	4.2	5	5	4.2
3-5	15	20	12.5	15	15	12.5
Share of main educators in ECEC staff						
0-2	50%	40%	67%	50%	50%	67%
3-5	67%	50%	92%	67%	67%	92%
ECEC targets constant by scenario	Source: ILO Tool					
Other staff (in % of children)	4%					
Training staff (in % of ECEC educators)	0.6%					
Contact time	40 hours/week; 5 days/week; 52 weeks/year					
No of children per facility	50					
Pay main ECEC educators	100% of primary school teachers' wages (primary school teachers' wages at 110% of GDP per capita)**					
Pay assistant ECEC educators	120% of minimum wage ***					
Pay other staff	50% of main ECEC educator wages					
ECEC area per child	10 m^2/child					
Building Cost for ECEC centers (per m^2)*	Source: Estimates based on literature review					
	Central	**Min Care**	**Max Care**	**Min Climate**	**Max Climate**	**Max Care & Climate**
Urban	450	450	450	450	481	481
Rural	200	200	200	200	214	214
Food costs for ECEC Centers	Source: Islam et al. (2023)					
Food cost per day per adult (USD)	1.01					
Other overhead costs of ECEC Centers	Source: ILO Tool					
% of building+ food costs	50%					

Parameters of Simulation Scenario for LTC Services						
Population	Data source: U.N. Population Estimates					
0-14	48,452,000					
15-64	129,908,000					
65+	16,771,000					
LTC services costs varying by scenario	Source: ILO Tool for staffing requirements; WHO and national data for disability prevalence and care needs					
	Central	**Min Care**	**Max Care**	**Min Climate**	**Max Climate**	**Max Care & Climate**
% pop 15-64y needing care	3.8%	1.8%	5.8%	3.8%	3.8%	5.80%
% pop 65y+ needing care	16.0%	12.8%	19.2%	16.0%	16.0%	19.20%
% pop 0-14y needing care	1.0%	0.5%	1.4%	1.0%	1.0%	1.4%
Recipient-to-carer ratio 15-64y	4.00	4.00	3.33	4.00	4.00	3.3
Recipient-to-carer ratio 65y+	3.00	3.00	2.50	3.00	3.00	2.5
Share of personal care workers (% of LTC workers)	50%	33%	67%	50%	50%	67%
LTC services costs constant across scenarios	Source: ILO Tool					
Pay level of personal care workers	75% of nurses' wages					
Pay level of other LTC workers	120% of minimum wage ***					
Pay level of nurses	130% of GDP per capita **					
No. visiting nurses per person aged 65+	0.0029					
No. training staff (per LTC staff)	0.0040					
Other admin cost	20% of staff costs (overhead U.K.)					
Building Cost for LTC recipients' homes* (USD per m^2)	Source: Estimates based on literature review					
	Central	**Min Care**	**Max Care**	**Min Climate**	**Max Climate**	**Max Care & Climate**
Urban	120	120	120	120	128	128
Rural	200	200	200	200	214	214
Total area of average house (m^2)	50					

* Costings of construction are in 2024 USD prices using the standard exchange rate and inflation conversion factors.

** Wage data for teachers and nurses are taken from the official civil servants' pay scales, inclusive of allowances, as reported in MoPA (2023). Grade 10 is used for nurses and a weighted average of Grade 10 and 11 for primary teachers (to include one head teacher at Grade 10 for six teachers at Grade 11).

*** The minimum wage stood at 43% of GDP per capita in 2024.

For ECEC services in Bangladesh, we examined the literature on teacher qualifications, salaries, coverage ratios and other indicators. Available data from the public-sector pay scale and additional allowances for teachers reveal that teachers were paid just about the level of GDP per capita in 2025 (MoPA 2023 and PiHR 2025). While Bangladesh pays its teachers poorly compared to other South Asian countries, it is moving toward upper-middle status (Government of Bangladesh 2024). For our simulations, it is therefore possible to increase teacher wages without changing much of it relative to GDP per capita and ensuring decent wages somewhere between 100% and 150% of GDP per capita. We have used the official wage levels as the main estimate for our scenarios (for the main educators), and we vary the pay upwards in our sensitivity tests below.[45]

Our estimates for LTC services use data from various sources. Disability rates in Bangladesh are estimated with WHO data used in the tool; these were about 32% of the 65+ and 12% of the working-age population, which would translate into care needs prevalence of 19% and 6%, respectively, using a fixed proportion of care needs among the disabled of 60% and 50% for each age group, respectively, as explained in Section 4.[46] However, country-specific disability statistics based on functional limitations (hearing, walking, seeing, and self-care (BBS 2022) showed lower figures for self-care, the best proxy for determining needs for assistance with personal care (activities of daily living or ADL): 2% of the 18-64-year-old population had difficulties with self-care in 2021, and 13% of the 65+ age group. These two extremes represent the upper-bound and lower-bound of care needs, and the central scenario takes the mid-range values.

Building, energy, and food costs

Our assumptions for adapting building, energy, and food costs in Table A2.3 require more explanation and a brief discussion of the literature that underpins our decisions. Tables A2.4 and Table A2.4b highlight estimates from various studies of building costs of houses and schools (respectively), using vernacular or modern techniques, from which we derive our estimates.

Building guidelines

HBRI (2017) provides technical guidelines adapted to various locations (coastal regions, haor basin, flood plains, and hills) facing different risks related to salinity, storm surges, cyclone winds, floods, and mudslides. The main characteristics of a disaster-proof house, with some variation, entail a rectangular house, ferrocement pillars and bearing walls, a house on an elevated plinth (of at least 2 feet but which can vary), bracing of the roof,

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[45] Depending on the country's minimum wage and teacher wage (both in % of GDP per capita), the wage gap between the two groups of educators may appear very large, but this can be adjusted to reflect not just differences in qualifications but also differences in pay across rural and urban settings. By varying the proportion of each group in ECEC staff, the user is able to achieve a more balanced staffing average that can reflect different policy priorities.

[46] See De Henau (2022a) for more details on calculations and data sources. The ILO Tool assumes that disability rates of children aged 0-14 is a fixed fraction (a quarter) of disability prevalence of working-age adults, based on multiregional data from WHO (2011). The fixed proportions of 50% and 60% of care needs among disabled are derived from available data on both disability and care needs prevalence from some European countries.

often with corrugated iron sheets. Standard recommended practice for effective protection against natural disasters includes adding a surrounding semi-outdoor structure for coastal plains subject to cyclones, an emergency story under the roof (not standing), and accessible ramps. Hilly houses would be mostly built on stilts. BRAC (2022) and Alam et al. (2024) offer very similar technical specifications, though focusing on flood protection.

Table A2.4a. Average cost per m^2 for building disaster-proof houses in Bangladesh (USD 2024 prices)

Study	**Type of house**	**Typical built area (m^2)**	**Cost per m^2**	**Region**	**Comments**	**Additional features**
Alam et al. 2024	Reinforced mud house	Not mentioned	54	Pahartoli (Chittagong)	Prices may be outdated	
	Reinforced masonry	Not mentioned	92	Pahartoli (Chittagong)		
	Reinforced non-engineered RCC	Not mentioned	141	Pahartoli (Chittagong)		
Bhattacharjee and Mukherjee 2017	Floating bamboo home (prototype)	196	78.4	Near Dhaka	Issue is that it’s too isolated from community	Solar panels (for fan) and permaculture
Barthelt and Bleich 2023	RISK award bamboo floating village and school	54 (one hexagonal unit)	74	Southeast coastal	Not built yet, resists 200km/h wind and 3m flooding (buoyant)	100% solar panel energy sufficiency + food production for resale
Prosun 2011	Floating twin house	46 (per unit)	128	Dhaka slums	Built	Solar panels and permaculture
Urban Development Programme, BRAC 2022	Low-income climate-resilient houses	Variable sizes (22-70 m^2)	Variable (44-117)	Various	Reduced cost by cutting on materials and some protection (around 25% reduction)	
BRAC-UNEP 2021	Climate-resilient brick house and shelter	66	182	Near Dhaka (prototype)	Permanent living but can also host 40 refugees during weather event	
Ashbridge 2014	Bamboo house	39	127		Mixed bamboo but earth/ concrete for elevated plinth and CI roof	
Harun-or-Rashid et al. (2022)	Cyclone-resistant house (prefabricated)	37.21	133 (excl. cost of land)	Coastal modelled	Resists winds of up to 280km/h	

Notes: RCC stands for reinforced cement concrete (also called ferrocement). Cost per m^2 from different studies/sources has been adjusted for USD 2024 prices.

Table A2.4b. Examples of schools' building costs (USD 2024 prices)

Project name	Type of house	Typical built area (m^2)	Cost per m^2	Region	Comments	Additional features
METI rural handmade school 2024	Mostly bamboo and earth two story	325	108	Pahartoli (Chittagong)	Aga Khan Award in architecture 2007	Currently hosting 430 pupils (So quite overcrowded)
Arcadia Education project 2019	Floating bamboo school	274	285	South Kanarchor (West of Dhaka)	Aga Khan Award in architecture 2019	
Archello school plus mosque 2022	Earth, concrete and bamboo two stories with natural ventilation	785	201	tbc		About 200 pupils (nursery and primary) + mosque
Barthelt and Bleich 2023	RISK award bamboo floating school	54 (one hexagonal unit)	74	Southeast coastal	Not built yet, resists 200km/h wind and 3m flooding (buoyant). Several hexagonal units would be needed for a whole school	100% solar panel energy sufficiency + food production for resale
Evidence on Demand and U.K. DFID efficiency costings for schools 2014	Government school efficiency costs per NUA per m^2	n/a	486	Various	Calculates potential cost per net useful area (NUA—learning space) improvements	About how to improve current constructions
Hossain et al. 2023	Four-story RCC primary school design (BSc archi/ engineering)	1268	417	Savar (west of Dhaka)	Student project but real site survey to replace existing one-story school	

Note: Cost per m^2 from different studies/sources has been adjusted for USD 2024 prices.

Based on the studies reviewed in Table A2.4a and b, building costs are assumed to vary between \$100 and \$500 per m^2 (in 2024 prices), depending on size, location and quality standards. According to the most recent Bangladesh Sample Vital Statistics report from 2023, the average dwelling size in Bangladesh was about 33 m^2, although based on bedroom space per person only (BBS 2023). Our main estimates assume 50 m^2 homes, which are still below some of the prototypes in Table A2.4. The average size of LTC recipient house is set at 50 m^2, assumed constant across all scenarios. Our central estimation assumes a weighted average of rural and urban costings of \$200 and \$450 per m^2 for ECEC facilities and \$120 and \$200 per m^2 for LTC recipients' homes, respectively, with 70% of centers built in rural areas to reflect the population distribution described earlier. As these are upfront costs and the ILO care tool estimates annual spending requirements, we convert these figures into an annual equivalent, akin to a periodic mortgage repayment or rental expense, based on thirty years of life and depreciated at the rate of inflation for simplicity (De Henau 2022b). Although these costings represent the national average (differentiated only by rural and urban areas), it should be possible to adapt to more local data, including tailoring the building requirements to more precise climate risks. For example, 60% of households are exposed to high-risk floods (Letsch et al. 2023), and the Bay of Bengal makes up 5 to 6% of global tropical cyclone activity (Qiu et al. 2025). In the absence of more granular data, our cost variability is reflected in the sensitivity analysis, although the increment in building costs for cyclone protection is reflected in the max climate scenario.

Energy usage

Some of the largest infrastructure costs are for energy usage, and the type of energy used has important implications for mitigation of and adaptation to climate change. Most studies agree that solar energy is the best way forward, as Bangladesh has ample sun irradiation all year and does not use enough solar capacity (less than 5% of total energy produced in country) (Kabir et al. 2024). Studies also confirm that the space available on homes' and schools' rooftops to fit solar panels is sufficient to power the energy requirement for effective cooling (Kabir et al. 2024; Alam and Masrafy 2023). Switching at scale to solar-powered energy for active cooling is greener and even cheaper than the current reliance on fossil fuels (Alam 2023; Nur-E-Alam et al. 2022). The current grid in Bangladesh is not only often saturated, especially during peak cooling demand (heat waves), but also relies on imported fossil fuel, which not only further damages GHG emissions and pollution but also makes the country less energy independent. Another advantage of solar energy is that it can also be connected to the grid for resale or stored in batteries for use during non-sunny periods and at night (Kabir et al. 2024; Rocha et al. 2024; Feng et al. 2019).

While solar energy may be the most desirable solution, it is not without issues such as the need for rare metals. Moreover, AC cooling remains polluting to some extent, even though some new water-based refrigerant AC technology is less harmful (GIZ 2021; Biardeau et al. 2020). Complementary passive cooling techniques must also be considered. While less energy-hungry cooling techniques, such as natural ventilation, solar shading and solar-powered electrical fans, high thermal mass of building envelopes, and reflective surfaces, can be effective at achieving some degree of thermal comfort, they are far less effective in hot-humid climates such as Bangladesh than in hot-dry climates. Therefore, active cooling techniques may remain the dominant strategy in the near future.

In terms of energy prices, Chowdhury and Aziz (2023) and Alam (2022) put rooftop PV solar energy production costs at about $0.05 per kilowatt per hour (kWh), below grid electricity prices from fossil fuels (about $0.1 per kWh). This cost is the "levelized cost of energy" (LCOE), a metric that takes into account discounted lifetime costs (investment, operation and repairs). This can be used as a rough estimate of costings for electricity cooling systems per m^2 of indoor space, applicable to both houses and ECEC centers and LTC daycare centers.[47] Our energy costings are based on a selection of examples that give a range of the Energy Performance Index (EPI), the energy demand per m^2 of living space, between 28 and 59 kWh/m^2 per year.[48] It is worth noting that in practice, the lifetime cost could also be zero, given the resale potential of solar energy achieved in the simulations by Kabir et al. (2024).

Considering the studies summarized above, our costing exercise considers a central estimate of energy consumption per m^2 that reflects the likely energy consumption increase of a typical well-designed building in the next 10 years, based on RCP warming trajectories. The minimum climate scenario broadly takes the consumption intensity of today's climate for the same building (P10 of RCP 4.5). The maximum climate scenario reflects the potential increase in energy demand required to maintain thermal comfort if the top range of the worst climate scenario (P90 of RCP 8.5) is encountered in terms of temperature and heat index rises.

One issue to examine further is the impact of a faster global warming scenario on energy demand, especially for cooling needs (the worst-case scenario). For example, a comparison of SSP5-8.5 with SSP2-4.5 sometime in the future could provide a sensitivity range for energy costings. The literature supplies some guidance for understanding energy demand in the worst-case scenario. Jihan et al (2025) found broadly similar relative differences in warming magnitudes between SSP5-8.5 and SSP2-4.5 for the period 2031-2040, around 20% to 30%. By contrast, Kamruzzaman et al. (2023) projected lower temperature anomaly differences between the two scenarios, at about 6% for the period 2015-2044 (and 45% for the period 2045-2074) compared to the same reference period. Both studies used the World Bank Climate Knowledge Portal (n.d.) (but only the latter study corrected for data bias and averaging across several climate circulation models). In both cases, the uncertainty range (interpercentile range P10-P90)

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[47] It is likely that active cooling solutions will be running at night (at least in the room of the care recipient) but not in ECEC centers. By contrast, comparatively more daytime energy might be expended in ECEC centers owing to a higher density of occupation (which influences the effectiveness of cooling devices). Because these two aspects may compensate one another, we assume similar energy per m^2 for both types ECEC and LTC physical infrastructure, with plausible variations being captured in the sensitivity analysis.

[48] We rely on two main studies: Alam and Masrafy (2023) and another study for a simulated house in Kerala, India (Mujeebu and Bano 2022), provide information of the total EPI, which is what we need for our costing estimates. Alam and Masrafy (2023) report an EPI of 59 kWh/m^2 per year but does not examine any efficiency improvements to the house. By contrast, Mujeebu and Bano (2022) focus on achieving energy efficiency improvements through various passive and active techniques, including better AC devices, and manage to reduce the EPI of their simulated house from 74 to 28 kWh/m^2 per year.

overlapped widely in the earlier years of their projections (including the 2031-2040 period of interest in this paper).

Wang et al. (2010) compared the actual cooling energy demand change for a typical Australian house simulated in five climate zones of the country and with three different energy ratings, corresponding roughly to current average houses (two-star), newly constructed average houses (five-star) and newly constructed high-energy efficient houses (seven-star), each with specific features to adapt to local climate. This study is relevant to our paper because one of the zones included—Darwin—has a similar hot-humid climate to Dhaka. The findings show that the seven-star house model in Darwin consumed 56% less energy than the two-star house in the current climate (1990 as reference year), respectively 277 megajoules per square meter (MJ/m^2) and 628 MJ/m^2. The energy is entirely for cooling purposes. This efficiency gain remained mostly the same across the projection years in the mid-term future (to 2050). The most interesting finding for our purposes is that the increase in energy demand (in kWh/m^2) is linear in degrees of global warming (for Darwin only but not the other cities). For every degree of global warming, energy demand was estimated to rise by about 32% for their model seven-star house and 30% for a five-star house.

Data from the World Bank Climate Knowledge Portal (n.d.) has a series of global warming indicators for Bangladesh by year. Taking mean air temperature as a proxy for global warming, temperature is projected to increase by 0.53°C between the reference period of 1995-2014 and 2031-2040 in the SSP2-4.5 scenario and by 0.71°C in the SSP5-8.5 scenario. Therefore, assuming that Darwin, Australia, can proxy the same energy demand/global warming relationship for Bangladesh found in Wang et al (2010), the rise in energy demand by 2035 would be 17% in SSP2-4.5 and 23% in SSP5-8.5, a difference of 34%.

We next convert these temperature increases into energy demand based on the house models applied to Bangladesh using the EPI values discussed above. We apply the figures from Wang et al. (2010) to the energy requirement of the modeled house estimated and adapted from Mujeebu and Bano (2022), at about 28.1 kWh/m^2, which can be standardized to 1. Compared to this figure, the energy demand by 2035 for the SSP2-4.5 scenario would be 1.17 and 1.23 for the central estimate of SSP5-8.5, a difference of 5%. For our sensitivity tests below, we use a range of 24% and 40% energy increase per warming degree (adapted from findings by Wang et al. (2010) for the five-star house to the seven-star house with central increase of 32% per warming degree and compare the minimum and maximum relevant decile of each scenario (P10 for SSP2-4.5 and P90 for SSP5-8.5). The EPI by 2035 would range between 0.97 for P10 in SSP2-4.5 for the lower-bound of energy increase rate of 24% per warming degree and 1.53 for P90 of SSP5-8.5 using the upper-bound of energy increase rate at 40% per warming degree. This is a maximum difference of 57% between the two.

Another indicator of energy demand increase is the change in the number of days with heat index above an extreme value, such as 35°C during the days, as well as the number of nights with minimum temperature above 26°C, which are strongly correlated with heat exhaustion and strokes in humans, as well as indicators of cooling demand (Mahmud et al. 2024). The heat index takes account of both temperature (maximum air temperature) and humidity as a more accurate description of how people feel and how it affects their health, compared to dry-bulb temperatures. Hot nights are also problematic as the body cannot recuperate effectively from the heat of the day. The World Bank Climate Knowledge Portal shows that, compared to the reference period (1995-2015) central estimate, the number of days with HI > 35°C will be 10% higher in P10 of SSP2-4.5 and 112% higher in P90 of SSP5-8.5 by 2031-2040, that is, a doubling of the number of uncomfortable hot days. The same data shows that hot nights with minimum temperature above 26°C will increase by 92% in SSP5-8.5 P90 (and remain stable in P10 of SSP2-4.5). This difference in hot days and hot nights is larger than the difference in simulated energy demand increase using the Wang et al (2010) method, so we also use this wider gap to infer energy consumption in our simulations of max climate and min climate scenarios, i.e., a doubling of energy consumption.

Food costs

The last item to explain in Table A2.3 is food costs for ECEC services. Islam et al. (2023) have calculated the ‘cost of recommended diet’ (CoRD) for adults in Bangladesh and found a daily cost of $0.87 for the whole country ($0.9 for urban and $0.84 for rural areas). This is about $1.01 in 2024 prices. We adapt this amount for children’s intake (half the adult intake and for half the daily meals).

Appendix 2. References

Abdel, Hana. 2022. “Shahabuddin Foundation School Complex / Archeground.” ArchDaily, June 27. https://www.archdaily.com/984296/shahabuddin-foundation-school-complex-archeground.

Afrin, Sadiya, Md. Mehedi Hasan Khan, and Md. Aminul Haque. 2025. “Factors Affecting the Active Aging Situation in Bangladesh.” *Frontiers in Public Health* 13 (March): 1517482. https://doi.org/10.3389/fpubh.2025.1517482.

Alam, Md Jahangir, Rebeka Ahsan, Firoza Akhter, and Ajoy Paul. 2024. “Earthquake Resistant Non-Engineered Building Construction for Rural Area in Bangladesh.” Paper presented at 14th World Conference on Earthquake Engineering (14WCEE). July. https://www.researchgate.net/publication/382086646_EARTHQUAKE_RESISTANT_NON-ENGINEERED_BUILDING_CONSTRUCTION_FOR_RURAL_AREA_IN_BANGLADESH.

Alam, Md. Ziaui, and Sahriar Emon Masrafy. 2023. “Net Zero Energy Buildings in Bangladesh: An Investigation of Solar Panel Feasibility and Potential.” *European Journal of Electrical Engineering and Computer Science* 7 (2): 15–19. https://doi.org/10.24018/ejece.2023.7.2.499.

Alam, Shafiqul. 2022. “For Security and Affordability, Bangladesh Must Shore up Renewable Energy.” *IEEFA.* https://ieefa.org/resources/security-and-affordability-bangladesh-must-shore-renewable-energy.

Alam, Shafiqul. 2023. “Towards a Rooftop Solar Transition in Bangladesh.” *IEEFA.* https://ieefa.org/resources/towards-rooftop-solar-transition-bangladesh.

Archnet. 2019. “Arcadia Education Project.” https://www.archnet.org/sites/19009.

Ashbridge, Jo. 2014. *CSEB / Bamboo House: A Prototype.* Bob Books Ltd. https://www.humanitarianlibrary.org/sites/default/files/2014/02/CSEB%20Bamboo%20House.pdf.

Barthelt, Christian, and Renate Bleich. 2023. *Into Action 2019 RISK Award Coastal Resilience Bangladesh.* Munich Re Foundation. https://www.munichre-foundation.org/content/dam/munichre/foundation/publications/risk-award/MRS_IntoAction_10_final.pdf/_jcr_content/renditions/original./MRS_IntoAction_10_final.pdf.

BBS. 2022. *Report on National Survey on Persons with Disabilities (NSPD) 2021.* Bangladesh Bureau of Statistics (BBS). https://reliefweb.int/report/bangladesh/report-national-survey-persons-disabilities-nspd-2021-december-2022-enbn.

BBS. 2023. *Bangladesh Sample Vital Statistics 2023.* Bangladesh Bureau of Statistics (BBS). https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/6a40a397_6ef7_4

8a3_80b3_78b8d1223e3f/2025-06-23-04-04-02e049844b479c3e811a22b3e3e7f744.pdf.

BBS. 2025. *Progotir Pathey, Bangladesh Multiple Indicator Cluster Survey 2025, Preliminary Report*. Bangladesh Bureau of Statistics (BBS). https://www.unicef.org/bangladesh/en/media/12191/file/MICS%20Preliminary%20findings%202025.pdf.pdf.

Bhattacharjee, Shimantika, and Nandan Mukherjee. 2017. "Floating Houses: A Design for Flood Resilience Innovations in Bangladesh." Paper presented at Passive Low Energy Architecture: Design to Thrive (PLEA). July 5. https://www.researchgate.net/publication/318340170_Floating_Houses_A_design_for_flood_resilience_innovations_in_Bangladesh.

Biardeau, Léopold T., Lucas W. Davis, Paul Gertler, and Catherine Wolfram. 2020. "Heat Exposure and Global Air Conditioning." *Nature Sustainability* 3 (1): 25–28. https://doi.org/10.1038/s41893-019-0441-9.

BRAC. 2022. *Low-Cost Climate Resilient Urban Housing: BRAC's Experiences.* https://www.researchgate.net/publication/360073344_LOW-COST_CLIMATE_RESILIENT_URBAN_HOUSING_BRAC'S_EXPERIENCES.

Chowdhury, Shahriar Ahmed, and Shakila Aziz. 2023. *Barriers and Opportunities for Scaling Up Rooftop Solar PV Systems in Bangladesh.* Centre for Energy Research United International University. https://www.eeas.europa.eu/sites/default/files/documents/2024/Final%20Report-%20Barriers%20and%20Opportunities%20of%20Rooftop%20Solar-%202024.03.07.pdf.

De Henau, Jerome. 2022a. "Costs and Benefits of Investing in Transformative Care Policy Packages: A Macrosimulation Study in 82 Countries." ILO Working Paper 55. Preprint, ILO. https://www.ilo.org/publications/costs-and-benefits-investing-transformative-care-policy-packages-1.

De Henau, Jerome. 2022b. "Simulating Employment and Fiscal Effects of Public Investment in High-Quality Universal Childcare in the UK." *International Journal of Child Care and Education Policy* 16 (1): 3. https://doi.org/10.1186/s40723-022-00096-y.

Evidence on Demand. 2014. *Final Report: Efficiency Analysis of Classroom Infrastructure for Primary Education in Bangladesh.* Evidence on Demand and UK DFID. https://assets.publishing.service.gov.uk/media/57a089afed915d622c000355/PEDP_Final_Report_V13May2014.pdf.

Feng, Wei, Qianning Zhang, Ji Hui, et al. 2019. "A Review of Net Zero Energy Buildings in Hot and Humid Climates: Experience Learned from 34 Case Study Buildings." *Renewable and Sustainable Energy Reviews* 114 (109303). https://doi.org/10.1016/j.rser.2019.109303.

GIZ. 2021. *Energy Efficiency in Public Buildings in Bangladesh: Assessment of Best Available Technologies*. GIZ. https://www.green-cooling-initiative.org/fileadmin/Publications/GIZ2021_Energy_Efficiency_in_Public_Buildings_in_Bangladesh_BAT_Assessment.pdf.

Government of Bangladesh. 2024. *White Paper on State of the Bangladesh Economy Dissection of a Development Narrative.* Dhaka, Bangladesh. https://bdplatform4sdgs.net/wp-content/uploads/2025/02/Final-Draft_Unedited_0911-hrs_Compiled-Report-without-Front-and-Back-Cover.pdf.

Harun-Or-Rashid, G. M., Juan Jose Castro, Mithun Chakrabartty, and Md Kamruzzaman. 2022. "Proposal of Resilient Housing Features for the Disaster Affected Community of Bangladesh." *Sustainability* 14 (21): 14061. https://doi.org/10.3390/su142114061.

Hossain, Imran, Ashifur Rahman Abir, Maksudul Hassan, and Dibya Lok Paul. 2023. "Structural Analysis and Design of a Primary School Building (4 Story) in Savar Upazila, Dhaka." East West University. http://103.133.167.11:8080/bitstream/handle/123456789/3906/Imran_Hossain.pdf?sequence=1&isAllowed=y.

Housing and Building Research Institute (HBRI), Ministry of Housing and Public Works. 2017. *Standard Guideline for Rural Housing in Disaster Prone Areas of Bangladesh.* Housing and Building Research Institute (HBRI), Ministry of Housing and Public Works. https://preparecenter.org/wp-content/uploads/2020/10/24BD02-Publication-housing-guidelines-1.pdf.

Hu, Ming, Kai Zhang, Quynh Nguyen, and Tolga Tasdizen. 2023. "The Effects of Passive Design on Indoor Thermal Comfort and Energy Savings for Residential Buildings in Hot Climates: A Systematic Review." *Urban Climate* 49 (May): 101466. https://doi.org/10.1016/j.uclim.2023.101466.

Islam, Saiful, Abira Nowar, Md. Ruhul Amin, and Nazma Shaheen. 2023. "Cost of Recommended Diet (CoRD) and Its Affordability in Bangladesh." *Foods* 12 (4): 790. https://doi.org/10.3390/foods12040790.

Jihan, Md Akik Tanjil, Shamsunnahar Popy, Shafiul Kayes, Golam Rasul, Al Shafi Maowa, and Md Mustafijur Rahman. 2025. "Climate Change Scenario in Bangladesh: Historical Data Analysis and Future Projection Based on CMIP6 Model." *Scientific Reports* 15 (1): 7856. https://doi.org/10.1038/s41598-024-81250-z.

Kabir, Md Ahsan, Md. Mahadi Hasan, Tasnim Hossain, Adil Ahnaf, and Hasan Monir. 2024. "Sustainable Energy Transition in Bangladeshi Academic Buildings: A Techno-Economic Analysis of Photovoltaic-Based Net Zero Energy Systems." *Energy and Buildings* 312 (114205). https://doi.org/10.1016/j.enbuild.2024.114205.

Kamruzzaman, Mohammad, Shahriar Wahid, Shamsuddin Shahid, et al. 2023. “Predicted Changes in Future Precipitation and Air Temperature across Bangladesh Using CMIP6 GCMs.” *Heliyon* 9 (5). https://doi.org/10.1016/j.heliyon.2023.e16274.

Mahmud, Iffat, Wameq Azfar Raza, and Syed Shabab Wahid. 2024. *An Unsustainable Life: The Impact of Heat on Health and the Economy of Bangladesh.* International Development in Focus. World Bank. https://documents1.worldbank.org/curated/en/099111024033034518/pdf/P168901-70ed6ce2-aaea-42b2-afab-8484b7b75125.pdf.

Maliha, Zeba. 2024. “METI at Dinajpur: An Eco-Friendly Handmade School in Bangladesh.” *The Financial Express,* March 2. https://thefinancialexpress.com.bd/lifestyle/others/meti-at-dinajpur-an-eco-friendly-handmade-school-in-bangladesh.

Ministry of Environment, Forest, and Climate Change, Government of the People’s Republic of Bangladesh. 2022. “National Adaptation Plan of Bangladesh (2023-2050).” Ministry of Environment, Forest, and Climate Change, Government of the People’s Republic of Bangladesh, October. https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/npfblock/903c6d55_3fa3_4d24_a4e1_0611eaa3cb69/National%20Adaptation%20Plan%20of%20Bangladesh%20%282023-2050%29%20%281%29.pdf.

Ministry of Public Administration (MoPA), Government of Bangladesh. 2023. “Statistics of Government Servants, 2023.” Ministry of Public Administration (MoPA), Government of Bangladesh. https://mopa.gov.bd/sites/default/files/files/mopa.gov.bd/mopa_report_publication/55cb4721_9435_4a9d_afdf_0d7b591a6f97/STATISTICS-2023-compressed.pdf.

Mujeebu, Muhammad Abdule, and Farheen Bano. 2022. “Energy-Saving Potential and Cost-Effectiveness of Active Energy-Efficiency Measures for Residential Building in Warm-Humid Climate.” *Energy for Sustainable Development* 67 (April): 163–76. https://doi.org/10.1016/j.esd.2022.01.011.

Nahar, N. M., P. Sharma, and M. M. Purohit. 2003. “Performance of Different Passive Techniques for Cooling of Buildings in Arid Regions.” *Building and Environment* 38 (1): 109–16. https://doi.org/10.1016/S0360-1323(02)00029-X.

Nur-E-Alam, Mohammad, Mohammad Khairul Basher, Iftekharuzzaman, et al. 2022. “Rooftop PV or Hybrid Systems and Retrofitted Low-E Coated Windows for Energywise and Self-Sustainable School Buildings in Bangladesh.” *Solar* 2 (4): 540–58. https://doi.org/10.3390/solar2040032.

PiHR. 2025. “Salary Scale in Bangladesh (2026).” HR Software. *PiHR,* August 8. https://mypihr.com/salary-scale-in-bangladesh/.

Prosun, Prithula. 2011. “The LIFT House: An Amphibious Strategy for Sustainable and Affordable Housing for the Urban Poor in Flood-Prone Bangladesh.” University of Waterloo. https://static1.squarespace.com/static/5df95ab752eb4b313e3d0616/t/5e7c0d0e8d49b07838ae2b75/1585188191805/prosun_prithula.pdf.

Qiu, Jiangchao, Sai Ravela, and Kerry Emanuel. 2025. “From Decades to Years: Rising Seas and Cyclones Amplify Bangladesh’s Storm-Tide Hazards in a Warming Climate.” *One Earth* 8 (4): 101273. https://doi.org/10.1016/j.oneear.2025.101273.

Rocha, Helder R. O., Rodrigo Fiorotti, Danilo M. Louzada, Leonardo J. Silvestre, Wanderley C. Celeste, and Jair A. L. Silva. 2024. “Net Zero Energy Cost Building System Design Based on Artificial Intelligence.” *Applied Energy* 355 (C). https://www.sciencedirect.com/science/article/abs/pii/S0306261923017129.

“STATcompiler.” n.d. Accessed February 12, 2026. https://www.statcompiler.com/en/.

UNEP. 2024. “In Bangladesh, Brick Houses Provide Shelter from the Storms.” UNEP, December 23. https://www.unep.org/news-and-stories/story/bangladesh-brick-houses-provide-shelter-storms.

United Nations Department of Economic and Social Affairs Population Division. 2019. “Household Size & Composition.” https://population.un.org/household/?_gl=1*t8ncys*_ga*MjA2ODg0MjEwMi4xNzYyOTcyODU4*_ga_TK9BQL5X7Z*czE3NzAwNjUzNzYkbzEzJGcxJHQxNzcwMDY1MzgyJGo1NCRsMCRoMA..

Wang, Xiaoming, Dong Chen, and Zhengen Ren. 2010. “Assessment of Climate Change Impact on Residential Building Heating and Cooling Energy Requirement in Australia.” *Building and Environment* 45 (7). https://doi.org/10.1016/j.buildenv.2010.01.022.

WHO. 2011. *World Report on Disability.* WHO. https://www.who.int/publications/i/item/9789241564182.

WHO. n.d. “Healthy Life Expectancy (HALE) at Age 60 (Years).” The Global Health Observatory. Accessed May 19, 2026. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-hale-healthy-life-expectancy-at-age-60.

World Bank. 2024. *Climate Risk Country Profile: Bangladesh*. World Bank. https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/16813-WB_Bangladesh%20Country%20Profile-WEB.pdf.

World Bank. n.d.-a. “Bangladesh - Mean Projections (CMIP6) | Climate Change Knowledge Portal.” Climate Knowledge Portal, World Bank. Accessed February 12, 2026.

https://climateknowledgeportal.worldbank.org/country/bangladesh/climate-data-projections.

World Bank. n.d.-b. “Population Estimates and Projections.” World Bank DataBank. Accessed February 4, 2026. https://databank.worldbank.org/reports.aspx?Code=SP.DYN.TFRT.IN&Id=fdaa1724&Report_Name=Population&populartype=series.

Appendix 3. Detailed costing results

Tables A3.1, A3.2, and A3.3 provide the main elements of the costing calculations for both ECEC and LTC, with ECEC costings split between staffing costs and physical facilities costs. Costing values are in real-term 2024 USD (or USD million for total costs).

Table A3.1. Staff costs steps for ECEC

	Central	**Min care**	**Max care**	**Min climate**	**Max climate**	**Max both**
Population 0-2 enrolled	4,664,771	4,664,771	5,597,725	4,664,771	4,664,771	5,597,725
Population 3-5 enrolled	8,455,442	8,455,442	9,394,936	8,455,442	8,455,442	9,394,936
total in ECEC	13,120,213	13,120,213	14,992,660	13,120,213	13,120,213	14,992,660
Weekly hours contact 0-2 per facility	711	711	747	711	711	747
weekly hours contact 3-5 per facility	1289	1289	1253	1289	1289	1253
No. FTE staff ECED per facility	4.4	4.4	5.6	4.4	4.4	5.6
No. FTE staff pre-prim per facility	2.7	2.0	3.1	2.7	2.7	3.1
No. FTE ECEC staff per facility	7.1	6.4	8.7	7.1	7.1	8.7
No. FTE aux/man staff per facility	2	2	2	2	2	2
No. training staff per facility	0.04	0.04	0.05	0.04	0.04	0.05
No. all staff in ECEC facility	9.1	8.4	10.7	9.1	9.1	10.7
Total No. of facilities in country	262,404	262,404	299,853	262,404	262,404	299,853
Total staff ECED in country	1,156,863	1,156,863	1,665,883	1,156,863	1,156,863	1,665,883
Total staff pre-prim in country	698,983	524,237	931,978	698,983	698,983	931,978
Total staff ECEC in country	1,855,846	1,681,101	2,597,860	1,855,846	1,855,846	2,597,860
Total aux/man staff in country	524,809	524,809	599,706	524,809	524,809	599,706
Total training staff in country	11,135	10,087	15,587	11,135	11,135	15,587
Total all staff in country	2,391,790	2,215,996	3,213,154	2,391,790	2,391,790	3,213,154

Wage assistant educator (USD p.m.)	181.27	181.27	181.27	181.27	181.27	181.27
Weighted wage ECED staff (USD p.m.)	286.06	265.10	368.64	286.06	286.06	368.64
Weighted wage pre-prim. staff (USD p.m.)	321.69	286.06	438.55	321.69	321.69	438.55
Weighted wage ECEC educators (USD p.m.)	299.48	271.63	393.72	299.48	299.48	393.72
Weighted wage ECEC educators (% GDP per capita)	84%	77%	111%	84%	84%	111%
Wage aux./man. staff (USD p.m.)	195.42	195.42	230.46	195.42	195.42	230.46
Wage cost ECED staff (per staff) (USD p.m.)	317.52	294.26	409.19	317.52	317.52	409.19
Wage cost pre-prim. (USD p.m.)	357.07	317.52	486.80	357.07	357.07	486.80
Wage cost aux./man. Staff (USD p.m.)	216.92	216.92	255.81	216.92	216.92	255.81
Wage cost training staff (USD p.m.)	433.84	433.84	511.63	433.84	433.84	511.63
Total ECED staff costs in country (USDm per year)	4,408	4,085	8,180	4,408	4,408	8,180
Total pre-prim staff costs in country (USDm per year)	2,995	1,997	5,444	2,995	2,995	5,444
Total ECEC staff costs in country (USDm per year)	7,403	6,083	13,624	7,403	7,403	13,624
Total aux/man staff costs in country (USDm per year)	1,366	1,366	1,841	1,366	1,366	1,841
Total training staff costs in country (USDm per year)	58	53	96	58	58	96
Total all staff costs in country (USDm per year)	8,827	7,501	15,561	8,827	8,827	15,561

Note: Cost values are in USD 2024 prices. “FTE” stands for full-time equivalent, “pm” for “per month” and “USDm” for USD million.

Table A3.2. Overhead and total costs for ECEC

	Central	Min care	Max care	Min climate	Max climate	Max both
Building costs per facility (USD per year)	4,583	4,583	4,583	4,583	4,894	4,894
Energy cost per facility (USD per year)	1,000	1,000	1,000	750	1,500	1,500
Food costs per facility (USD per year)	3,280	3,280	3,280	3,280	3,280	3,280
Materials/delivery/other costs (33% of total)	4,432	4,432	4,432	4,307	4,837	4,837
Total overhead costs per facility (USD per year)	13,295	13,295	13,295	12,920	14,511	14,511
No. of facilities in country (new or retrofitted)	262,000	262,000	300,000	262,000	262,000	300,000
Total building and energy costs of ECEC facilities (USDm per year)	1,463	1,463	1,675	1,397	1,675	1,918
Total overhead costs (USDm per year)	3,483	3,483	3,988	3,385	3,802	4,353
Total ECEC investment (USDm per year)	12,310	10,984	19,549	12,212	12,629	19,914

Note: Cost values are in USD 2024 prices. “USDm” stands for USD million.

Table A3.3. Costing steps for LTC

	Central	Min care	Max care	Min climate	Max climate	Max both
No. of adults care recipients (15-64y)	4,943,539	2,396,868	7,490,211	4,943,539	4,943,539	7,490,211
No. of elderly care recipients (65y+)	2,677,200	2,141,760	3,212,640	2,677,200	2,677,200	3,212,640
No. of children care recipients (0-14)	460,952	223,492	698,412	460,952	460,952	698,412
Total homes with care needs (no overlap)	8,081,692	4,762,120	11,401,263	8,081,692	8,081,692	11,401,263
No. of FTE LTC workers for 15-64y	1,235,885	599,217	2,247,063	1,235,885	1,235,885	2,247,063
No. of FTE LTC workers for 65+	892,400	713,920	1,285,056	892,400	892,400	1,285,056
No. of FTE LTC workers for 0-14y	115,238	55,873	209,524	115,238	115,238	209,524
Total FTE LTC workers	2,243,523	1,369,010	3,741,643	2,243,523	2,243,523	3,741,643
No. visiting nurses (health workers)	48,377	48,377	48,377	48,377	48,377	48,377

No. training staff	8,974	5,476	14,967	8,974	8,974	14,967
Total staff in LTC	2,300,874	1,422,863	3,804,987	2,300,874	2,300,874	3,804,987
Weighted wage LTC worker (USD p.m.)	263.48	236.08	291.43	263.48	263.48	291.43
Weighted wage LTC worker (% GDP per capita)	74%	67%	82%	74%	74%	82%
Wage nurses (USD p.m.)	460.93	460.93	460.93	460.93	460.93	460.93
Weighted wage cost LTC worker (USD p.m.)	292.46	262.04	323.49	292.46	292.46	323.49
in % GDP per capita	82%	74%	91%	82%	82%	91%
Wage cost nurse (USD p.m.)	511.63	511.63	511.63	511.63	511.63	511.63
Wage cost trainer (USD p.m.) (Same as ECEC)	433.84	433.84	511.63	433.84	433.84	511.63
Total staff costs LTC worker (USDm per year)	7,874	4,305	14,525	7,874	7,874	14,525
Total staff costs nurses (USDm per year)	297	297	297	297	297	297
Total staff costs training (USDm per year)	47	29	92	47	47	92
Total all staff costs in country (USDm per year)	8,218	4,630	14,914	8,218	8,218	14,914
Total cost of retrofit (USDm per year)	2,748	1,619	3,876	2,546	3,283	4,632
Total cost of overhead admin (USDm per year)	1,644	926	2,983	1,644	1,644	2,983
Total LTC investment (USDm per year)	12,609	7,176	21,773	12,407	13,144	22,528

Note: Cost values are in USD 2024 prices. “FTE” stands for full-time equivalent, “p.m.” for “per month,” and “USDm” for USD million.

Appendix 4. Sensitivity analysis

For ease of reading, below are additional figures to complete the sensitivity analysis described in the main text. These figures provide a straightforward visual link between changing the values of the main parameters (compared to the main scenario), and total investment costings in % of GDP. Equations to read the slope are in each graph.

Figure A4.1. Total investment (% GDP) by % change in staffing ratios

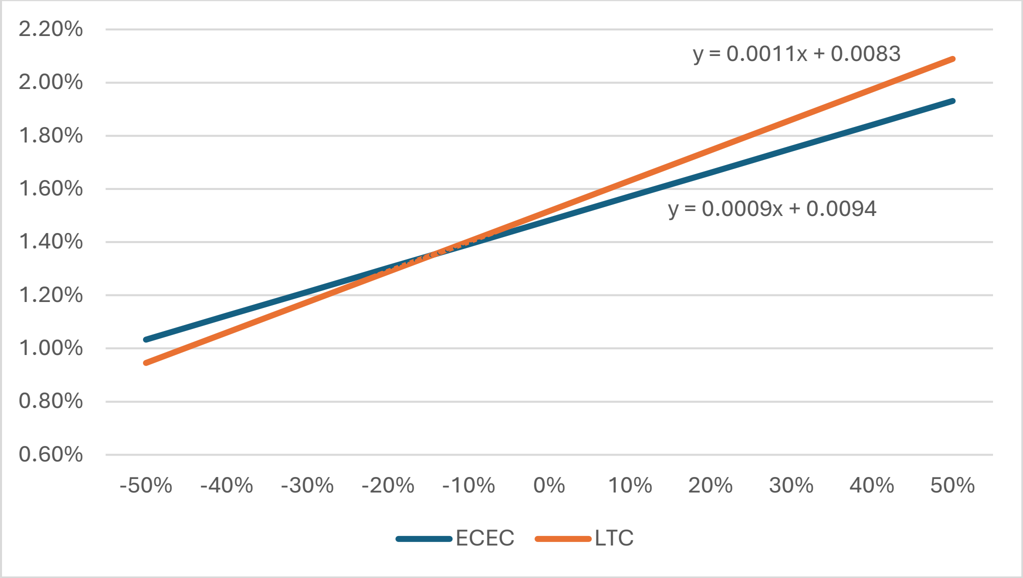


Figure A4.2. Total investment (% GDP) by % change in teacher/nurses' wages

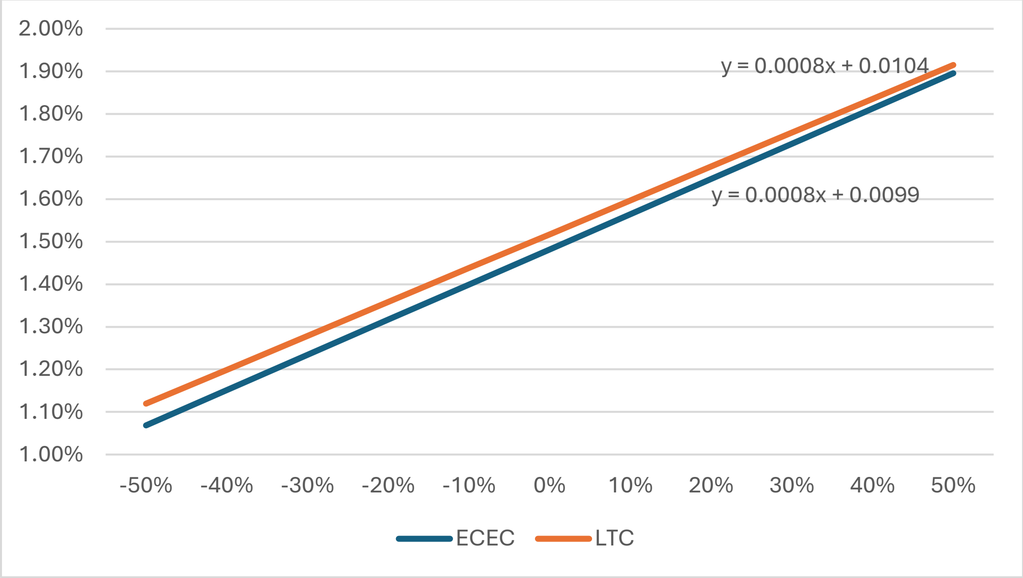
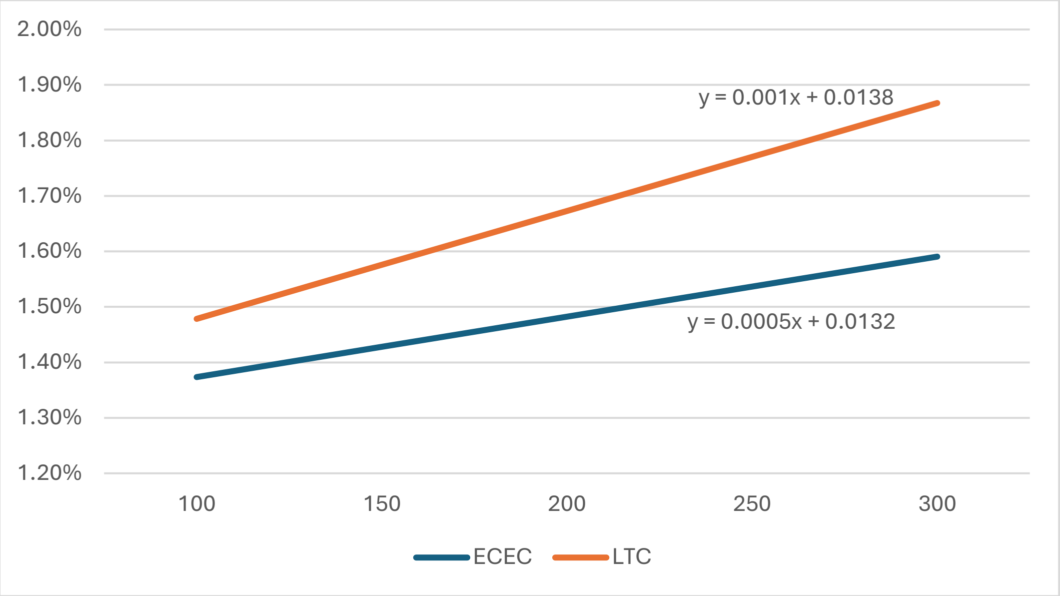


Figure A4.3. Total investment (% GDP) by building cost per m^2 (USD-rural)



Note: Cost for urban dwellings and centers are assumed a constant ratio of rural costs.

Figure A4.4. Total investment (% GDP) by level of energy demand (kWh/m^2)

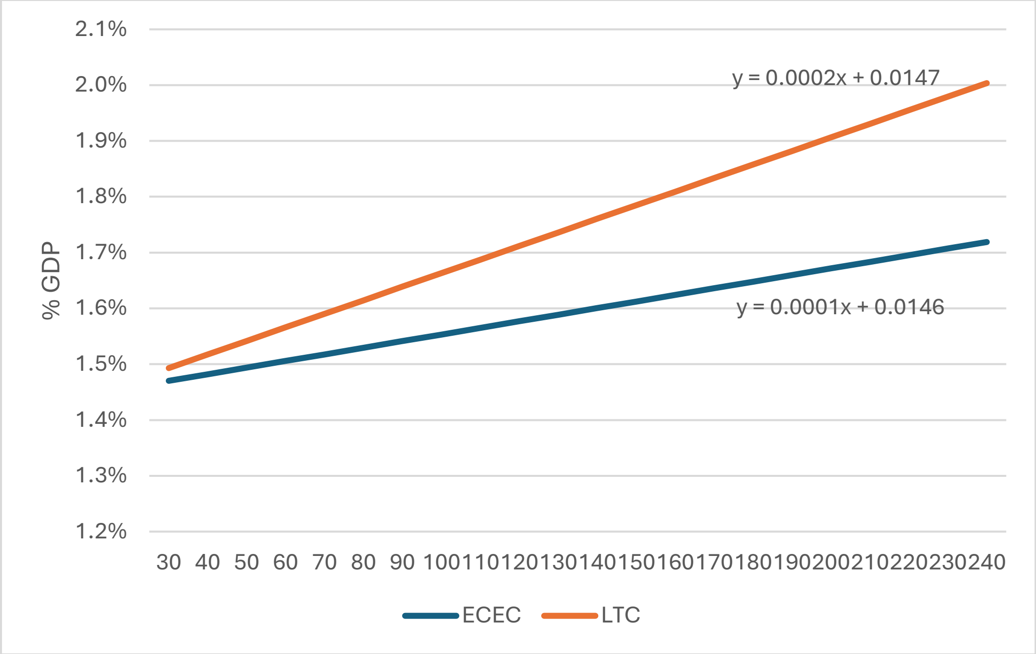
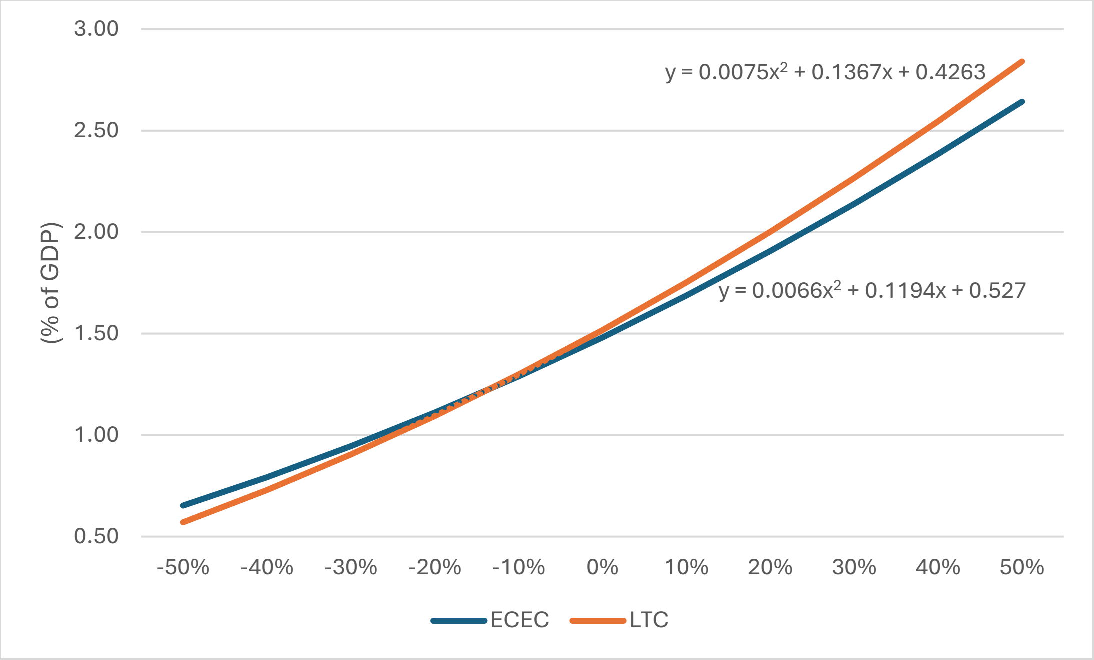


Figure A4.5. Total investment (% GDP) by % change in all four parameters simultaneously



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1775 Massachusetts Ave NW
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