CLIMATE CHANGE ASSESSMENT

I. BASIC PROJECT INFORMATION

Project Title:	Kingdom of Cambodia: Greater Mekong Subregion Health Security Project Additional Financing
Project Cost:	$35.0 million
Location:	Cambodia
Sector:	Health
Theme:	Disease control of communicable disease, health system development
Brief Description:	The original health security project is supporting Cambodia, the Lao People's Democratic Republic (Lao PDR), Myanmar, and Viet Nam to build core health system capacities to respond to public health threats of national and international concern. Project investments support three outputs: (i) regional cooperation and communicable disease control in border areas improved, (ii) national disease surveillance and outbreak response system strengthened, and (iii) laboratory services and hospital infection prevention and control (IPC) improved. The proposed additional financing will support the Ministry of Health (MOH) in responding to the coronavirus disease (COVID-19). The additional financing project will extend the original project's investments for laboratory services and IPC to an additional 8 provincial hospitals and 73 district referral hospitals. Fourteen provincial hospitals will be equipped to provide emergency clinical care for COVID-19 patients, including upgraded oxygen supply. Surveillance, response, and risk communications capacity for COVID-19 and other communicable diseases will be strengthened nationwide. Activities under the additional financing will be delivered through existing project outputs 2, 3, and 4. **Output 2: National disease surveillance and outbreak response systems strengthened**. The project loan will finance (i) a nationwide program of trainings to strengthen subnational capacity for communicable disease prevention, detection, and response; (ii) outbreak response vehicles for provincial and national agencies, and (iii) health education campaigns to enhance communities' preparedness for COVID-19 and other communicable disease threats. The JFPR grant will finance computer hardware for central, provincial and district health agencies to enhance COVID-19 outbreak management and contact tracing efforts. It will support COVID-19 specific trainings for (i) surveillance staff on data management tools,[1] (ii) rapid response teams on outbreak management, and (iii) health and non-health staff on COVID-19 risk communications. **Output 3: Laboratory services and hospital IPC improved.** The project loan will support 8 provincial hospitals and 73 district referral hospitals not included under the original project. It will (i) equip laboratories in these 81 hospitals for communicable disease diagnostics and clinical management, including COVID-19 rapid testing; (ii) renovate laboratories in 62 of these hospitals; and (iii) install modern solid waste treatment systems to 42 hospitals, and (iv) supply autoclaves, washing machines, and other IPC equipment to hospitals where upgrading is required. Female and male hospital staff will be trained on laboratory and IPC practices. **Output 4: Emergency preparedness and response capacity for COVID-19 strengthened.** The JFPR grant will enhance COVID-19 clinical care capacity in 14 provincial hospitals. It will equip hospitals with (i) oxygen plants for onsite generation of oxygen supply, (ii) clinical equipment for provision of oxygen therapy, and (iii) an ambulance for the transportation of COVID-19 patients requiring emergency care. Female and male clinical staff will be trained on oxygen therapy and the management for COVID-19 patients. Staff will also be trained to identify and provide support and referral options to persons affected by gender-based violence and mental health issues linked to the pandemic. Technicians will be trained in operation and maintenance of oxygen plants and ambulances.

[1] Including the Event Monitoring System, Media Screening System, and WHO's 'Go Data" tool.

	The government has requested a concessional loan of $25.0 million from the Asian Development Bank (ADB)'s ordinary capital resources to help finance the project. The project will also include $5 million grant financing from the Japan Fund for Poverty Reduction (JFPR). The loan will be used to finance expenditures in relation to facility repair and maintenance at 62 hospitals; procurement of equipment and medical supplies for laboratories and intensive care units; and procurement of vehicles and consulting support to facilitate project implementation. The loan will also be used to fund training, workshops and community mobilization, project management, and project recurrent costs. The JFPR grant will finance information and communication technology and oxygen therapy equipment; ambulances; consulting services; and specified training, workshops, and community mobilization expenditures. The government will contribute $5.00 million of the total project cost. This comprises tax exemption for imported medical equipment, medical consumables, and vehicles. Recognizing the vulnerability of Cambodia to climate change and its impacts and supporting the implementation of Cambodia's updated National Determined Contribution (2020) under the Paris Agreement, Cambodia's Ministry of Health (MOH) states its intention to enhance climate change resilience of its communities, people, institutions, resources, built infrastructure, and investments, and considers this project a valuable vehicle to strengthen the health sector's resilience to climate change.

Source: Asian Development Bank.

II. SUMMARY OF CLIMATE CHANGE FINANCE

Project Financing		Climate Finance	
Source	**Amount ($ million)**	**Adaptation ($ million)**	**Mitigation ($ million)**
Asian Development Bank			
Ordinary capital resources (concessional loan)	25.00	0	4.58
Co-Financing			
Japan Fund for Poverty Reduction (project grant)	5.00	0	0
Counterpart Financing			
Government of Cambodia	5.00	0	0

Source: Asian Development Bank.

III. SUMMARY OF CLIMATE RISK SCREENING AND ASSESSMENT

A. Sensitivity of Project Component(s) to Climate or Weather Conditions and the Sea Level

The projected increase in average and extreme temperatures may affect health, comfort, and well-being of patients and staff during hospital operation, necessitating innovative engineering measures to control indoor air quality and temperatures. The projected increase in extreme climate events (especially heavy rains resulting in localized flooding) may cause operational disruption of facilities. Climate proofing measures will need to be incorporated into the design of project facilities, especially the 30 medical waste treatment facilities.

B. Climate Risk Screening

As indicated in the Cambodia Updated NDC (2020), Cambodia is considered one of the most vulnerable countries to the impacts of climate change. The country is particularly vulnerable to floods, droughts, windstorms, and seawater intrusion. According to the Global Climate Risk Index, Cambodia was ranked as the 12th most climate risk-prone country globally, showing the high-level of vulnerability to extreme weather events. Climate change may reduce the country's annual average GDP growth by 6.6% and absolute GDP by 0.4% in 2020, by 2.5% in 2030, and up to 9.8% in 2050. This may delay reaching upper middle-income status by one year. The Updated NDC recognizes human health as one of the sectors most affected by climate change.

Rising temperatures are likely to lead to increased frequency and intensity of extreme weather events in a fragile socio-economic context. The country's climate vulnerability results in loss and damage to human life, livelihoods, and the national economy, as well as the degradation of her natural resources. The country is particularly vulnerable to floods, droughts, windstorms, and seawater intrusion. According to a series of vulnerability assessments carried out in 2016, 17.5% of Cambodia's communes were 'highly' vulnerable (i.e., 288 communes) and 27.28% (449 communes) were 'quite' vulnerable to multiple climate change hazards.

Under a high emissions scenario, the mean annual temperature is projected to rise by about 4.2°C on average from 1990 to 2100. This will negatively impact the most vulnerable populations, especially children and the elderly, particularly through heatwaves. Higher temperatures and variable precipitation accelerate microbial growth, transmission, and virulence, and can lead to changes in the seasonal and geographic distribution of vector-borne and water-borne diseases. High temperature and precipitation changes can also result in lower food production in the tropics as well as heat-related diseases. Enhancing climate resilience in health service delivery is identified as one of five adaptation actions related to public health in Cambodia's updated NDC (2020).

Climate Risk Classification: medium. The project's exposure to more frequent and intense rains, storms and high temperatures will be exacerbated by climate change and variability; thus increasing the vulnerability of proposed facilities, patients, and staff.

Programs Climate Change Response. The proposed project supports low carbon and climate resilient development. From a climate perspective, the proposed project integrates climate-smart measures that include climate proofing and resource efficiency measures in the design of project facilities (see sections IV and V below).

C. Climate Risk and Adaptation Assessment

Considering future climate change projections and frequency and intensity of climate-related disasters from natural hazards highlighted above, investments in climate proofing of project facilities will need to be defined during detailed design. These measures include elevation of new structures (i.e., medical waste storage and treatment shelters) above high flood level; and indoor air quality and temperature control (building facades and windows, promotion of climate-friendly cooling of intensive care units and laboratories).

Most of the climate proofing measures also have climate mitigation co-benefits, especially those aiming at addressing indoor air quality and temperature control. The installation of 30 modern, microwave-based medical waste treatment systems will have greenhouse gas emission reduction benefits. The microwave-based systems allow for on-site conversion of bio-hazardous medical waste into ordinary municipal waste. The waste is sterilized using microwaves and converted into inert municipal waste, reducing its volume by more than 80% and its weight by 25%. As it uses microwave technology, the system does not need a steam generator, so no liquid effluent is produced. The systems will replace rudimentary on-site incinerators currently used in most targeted referral hospitals.

D. Climate Risk Screening Tool and/or Procedure Used

Climate risk screening and assessment was primarily guided by two reference documents, including Cambodia's Updated NDC (2020); and the Climate Risk Country Profile for Cambodia, developed by ADB and the World Bank.[2] [3]

IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

Adaptation Activities	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
Integration of climate proofing measures in the design of **62 laboratories** to be retrofitted, including indoor air quality and temperature control (through building insulation, climate-friendly cooling)	Prolonged high temperature periods	0	Estimated climate adaptation costs are 2% of civil works costs. However, these measures have climate mitigation co-benefits and attributed to climate mitigation finance (see
Integration of climate proofing measures in the design of **42 medical waste storage and treatment** facilities (7x7m shelters), including:	Flooding, storms	0	

[2] The General Secretariat of the National Council for Sustainable Development, Ministry of Environment, the Kingdom of Cambodia. 2020. *Cambodia's Updated Nationally Determined Contribution*. Phnom Penh. f

[3] World Bank and ADB. 2019. Climate Risk Country Profile: Cambodia. Unpublished.

Adaptation Activities	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
Elevation of ground floor above high flood level; Structures to withhold strong winds			Section V) and not accounted for here to avoid double counting.
Total		**0**	

Source: Asian Development Bank.

V. CLIMATE MITIGATION PLANS WITHIN THE PROJECT

Mitigation Activity	Estimated GHG Emissions Reduction (tCO_2e /year)	Estimated Mitigation Costs ($ million)	Mitigation Finance Justification
Integration of sustainable building design features promoting resource use efficiency in proposed **62 laboratories** including: Procurement prioritizing equipment and appliances with environmentally-friendly label, including AC, lighting, water saving appliances etc.	43	0.14	Initial investment costs for "greening" of healthcare facilities (HCF) are typically 2-10% higher than for standard HCF.[4] The climate mitigation finance estimate applied an assumption of 7% of costs for refurbishment works ($1.88 million for laboratories)
Installation of and training on modern, **microwave based medical waste treatment systems** in 42 referral hospitals, replacing rudimentary backyard incinerators or open fires.	1,924 (see Appendix 1)	4.44	Total costs of medical waste equipment accounted for in climate mitigation finance estimate.
Total	**1,967**	**4.58**	

AC = Air conditioning; GHG = greenhouse gas; tCO_2e = tons of carbon dioxide equivalent.
Source: Asian Development Bank.

[4] Zhang, Li & Wu, Jing & Liu, Hongyu. 2017. Turning green into gold: A review on the economics of green buildings. Journal of Cleaner Production. 172. 10.1016/j.jclepro.2017.11.188.

Appendix 1: GHG Emission Reduction Estimates

A. GHG emission reduction benefits from shifting from waste incineration to Sterilwave microwave-based system in 42 hospitals

Table A1.1: GHG emission reduction benefits from shifting from waste incineration to Sterilwave microwave-based systems in 42 hospitals

	Energy consumption		CO2 emission factor		Medical waste generation in 42 hospitals		Annual CO2e emissions	
		Unit		Unit		Unit		Unit
Sterilwave	0.8	MWh/t[a]	0.8	t CO2e/MWh[c]	767	t/a[f]	491	t CO2e/a
Incineration	50	L fuel/t[b]	3	t CO2e/t[d,e]	805	t/a[g]	2,414	t CO2e/a
CO2e Emission Reduction benefit							**1,924**	**t CO2e/a**

Notes:

a. Product specification (8kWh per cycle, 10kg of waste per cycle)

b. Approx. 5 liters of diesel fuel is added to incinerators for the burning of 100kg of waste.

c. Grid emission factor for Cambodia (https://www.adb.org/sites/default/files/institutional-document/296466/guidelines-estimating-ghg.pdf)

d. CO2e emissions per ton of waste incinerated, assuming 3kg of CO2e per kg of plastic. This is based on the molecular structure of polyethylene and polypropylene, which are the main plastics that syringes and plastic packaging are made of.

e. CO2 emissions per ton of diesel burned is approx. 3.17 tons

f. Assuming that 50kg of medical waste will be treated in the Sterilwave systems per day in each hospital, with 42 units installed (5 cycles per day, 10kg per cycle).

g. Assuming that 50kg of medical waste will be incinerated per cycle, including 2.5 L of fuel per cycle.

Source: Asian Development Bank.

B. GHG emission reduction benefits from energy-efficient retrofitting of laboratories

1. Large differences are observed in the operational GHG emissions of buildings, with average emissions of 50-90 $kgCO_{2eq}/m^2$ and year for standard buildings and 15-30 $kgCO_{2eq}/m^2$ and year for buildings applying advanced energy-efficiency measures. [5]

2. For this project, the following conservative assumptions were used:
   a. Operational GHG emissions without project (i.e. applying Business as Usual – BAU - building design standards): 50 $kgCO_{2e}/m^2a$;
   b. Operational GHG emissions with project (i.e. applying energy-efficient design standards): 30 $kgCO_{2e}/m^2a$; and
   c. Total floor areas are 2,150 m^2 for 62 laboratories.[6]

3. Green buildings achieving the Green Star (Australia, South Africa), LEED (USA, Philippines) or Green Building Council (India) certification have been shown to consume approx. 25 per cent less energy and 11 per cent less water, than non-green buildings. (https://www.worldgbc.org/benefits-green-buildings). Energy-efficient air condition technology can reduce annual operational energy demand in buildings by 25% over BAU levels.

[5] Martin Röck, Marcella Ruschi Mendes Saade, Maria Balouktsi, Freja Nygaard Rasmussen, Harpa Birgisdottir, Rolf Frischknecht, Guillaume Habert, Thomas Lützkendorf, Alexander Passer. 2020. Embodied GHG emissions of buildings – The hidden challenge for effective climate change mitigation. Applied Energy, Volume 258 (2020) 114107. https://doi.org/10.1016/j.apenergy.2019.114107.

[6] The 62 existing laboratories to be retrofitted range from 10 to 125 m^2 in the targeted referral hospitals, with a total estimated area of 2,150m^2. ICUs in the 14 referral hospitals range from 30 to 420m^2, with a total estimated area of 2,100m^2.

Table A1.2: Greenhouse Gas Emissions Reduction Benefits from Facility Retrofitting

Activities	Project Baseline without project (in tCO2e/ year) (A)	With Project Scenario (in tCO2e/ year) (B)	GHG emission reduction benefit (in tCO2e/ year) (C)= (A-B)	Remarks
Laboratories operational emissions	108	65	43	See assumptions and description above.

GHG = greenhouse gas; ICU = intensive care unit; tCO_2e = tons of carbon dioxide equivalent.
Source: Asian Development Bank.