CLIMATE-PROOFING FOR RESILIENT WATER INFRASTRUCTURE

TECHNOLOGY DESCRIPTION

TECHNICAL DESCRIPTION

Resilient infrastructure can significantly reduce but may not fully eliminate climate-related disruptions to the Water Utility's service. ***Climate-proofing*** can improve the reliability of service and increase asset life, by addressing the extent to which climate change translates into risks to water infrastructure. The critical characteristic of climate-resilient infrastructure is that it is *planned*, *designed*, *built* and *operated* in a way that anticipates, prepares for, and adapts to changing climate conditions[1]. For critical water sector assets, it involves assessing *exposure* and *vulnerability*, developing risk management plans and systematically de-risking (building resilience in) the Water Utility. Thus, enabling it to withstand, respond to, and recover rapidly from disruptions caused by extreme climatic conditions. Climate-proofing will be a continual process throughout the life of the asset.

Comprehensive and proactive risk management requires making trade-offs between risk minimization and cost – particularly when it would be more expensive and technically challenging to prepare for events that are <u>may not</u> occur. While resilience indicates that major risks have been considered and managed; thus, achieving an acceptable level of performance based on available projections. It also assumes that the capacities to withstand and recover from shocks are in place – even if the extreme shock has a 1 in 100 recurrance interval.

CURRENT TECHNOLOGY READINESS LEVEL

The **T**echnology **R**eadiness **L**evel (TRL) is a method of estimating the current state of *maturity* of the technology under investigation. The score represents the current status or extent to which Antigua and Barbuda's water infrastructure has been climate-*p*roofed and is resilient to the changing climate.

Phase	TRL		
Research	1	Basic principles	
Research	2	Concept and application formulation	
Research	3	Concept validation	
Development	4	Experimental pilot	
Development	5	Demonstration pilot	
Development	6	Industrial pilot	
Deployment	7	First implementation	Industrialization detailed scope
Deployment	8	A few records of implementation	Release version
Deployment	9	Extensive implementation	

*C*limate-*p*roofing is estimated at **Phase 2, Level 5** – *technology validated* at some of the Utility's water treatment facilities and results have been evaluated. In response to past climatic events, the APUA – Water Business Unit has acknowledged the existing threats that climate change poses to coastal reverse-osmosis facilities, pumping stations and distribution lines. Further, concerted efforts have been made in *preparation for* and in the *aftermath of* severe storms, and management has an awareness of the broader steps that must be taken to achieve resilience – but would benefit from a formal *p*lan.

[1] OECD 2018, *Climate-resilient Infrastructure: OECD Environment Policy Paper No. 14*, OECD Environment, Paris.

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CLIMATE RATIONALE OF THE TECHNOLOGY

In Antigua and Barbuda, population centres and critical infrastructure are often located in coastal areas, making them susceptible to the impacts of tropical weather systems and sea-level rise. A recent 2019 project funded by the Caribbean Development Bank (CDB) as part of the ACP-EU-CDB NDRM[2] assessed the existing climate-related vulnerabilities in APUA's infrastructure and presented an *Investment Plan for climate-resilient water supply services.* This document reiterates evidence presented in previous studies and highlights the comprehensive de-risking is necessary to address every stage of Antigua and Barbuda's water supply process. Thus, managing physical assets – reverse osmosis desalination facilities, pumping stations, pipelines etc. – will be part of the Utility's global and dynamic process to streamline overall operations and provide a more reliable service.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

***C*limate-*p*roofing** will address APUA's reverse osmosis desalination facilities, pumping stations and distribution pipelines. Critical investments will require years of costly infrastructural work to retrofit, relocate and improve current equipment and buildings. Full deployment of this technology will be phased, with **Phase 1** – a period of sixty (60) months for development of the *C*limate *C*hange *R*isk *M*anagement *P*lan and to address institutional and financial reform with a budget of approximately USD 2 000 000 | XCD 5 376 400; **Phase 2** – an additional thirty-six (36) months to retrofit desalination facilities with an estimated budget of USD 5 000 000[3] | XCD 13 441 000; and **Phase 3** – to complete works on piping networks, relocating pipelines to accommodate storm surges, flooding and erosion and moving pumps and/or pumping stations to higher elevations etc. The budget for **Phase 3** is undetermined.

AMBITION FOR TECHNOLOGY READINESS LEVEL

The proposed goal for **t**echnology **r**eadiness after a ten (10) year period is to achieve **Phase 3, Level 8**. This represents deployment at each of the six (6) reverse osmosis facilities to address the most critical climate risks in an effort to prevent extensive disruption to supply following a major climate event. Complete *c*limate-*p*roofing will be a continuous process of prioritizing investments to address the full array assets.

EXPECTED IMPACTS OF THE TECHNOLOGY

***C*limate-*p*roofing** is expected to lessen service disruptions by improving functionality and reliability of the Water Utility's operations, promote quicker on-streaming of network service following disasters, improve the operation of the single production facility on Barbuda, increase asset life and ensure a greater return on the State's capital investments, reduce operation and maintenance costs and pave the way for a phased *water tariff increase* – thus promoting greater financial self-sufficiency of the Water Business Unit.

[2] African Caribbean Pacific – European Union – Caribbean Development Bank National Disaster Risk Management
[3] Budgeted amount assumes that the GoAB will match the investment (i.e., USD 5 000 000 in co-financing) to account for routine development costs.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

The *P*ublic *U*tilities *A*ct (1973) gives APUA the mandate to provide piped, potable water to meet the demands of Antiguan and Barbudan consumers. The Water Utility maintains responsibility for State-owned treatment facilities and distribution infrastructure, and also regulates the operations of private entities contracted to produce and supply additional volumes of water. A complementary policy that would assist with technology deployment is the Integrated Water Resources Management (IWRM) Policy which strategically outlines the freshwater deficit that exists across Antigua and Barbuda, and validates the nation's dependence on reverse osmosis desalination for potable water; thus, providing evidentiary support for the large capital investments necessary to install, operate, maintain and *further* *c*limate-*p*roof desalination facilities. Collectively they provide social, economic and environmental guidelines that will support deployment activities.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

Key institutional arrangements necessary to enhance implementation are the development of a comprehensive *C*limate *C*hange *R*isk *M*anagement *P*lan and proposing strategic plans for *t*ariff reform and reducing *n*on-*r*evenue *w*ater. The *R*isk *M*anagement *P*lan would encompass all the climate related water risks, the scope will address activities to *c*limate-*p*roof the Water Utility's infrastructure, as well as the development of a *G*roundwater *R*echarge *M*ap for the Christian Valley watershed [4] The *R*isk *M*anagement *P*lan will build on the Water Business Unit's medium-term business development strategy and encompass the full range of operational and financial risks.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The consultancy cost associated with development of the comprehensive *R*isk *M*anagement *P*lan is estimated at USD 65 000 | XCD 174 750. While a thorough financial assessment and development of the strategic plan for *t*ariff *r*eform will cost approximately USD 82 500 | XCD 221 775.

[4] **G**roundwater **R**echarge **M**ap is necessary for deployment of Stormwater Reclamation and Reuse.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

https://tech-action.unepdtu.org/country/antigua-and-barbuda/