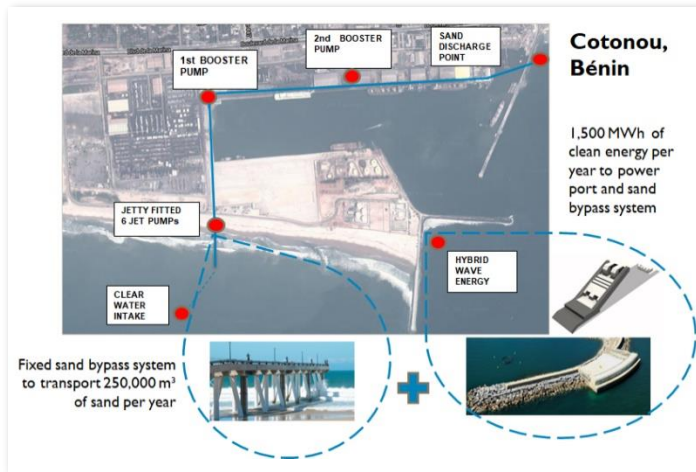


BESand - The Blue Energy Sand-Bypass System

With BESand, the Blue Energy Sand-Bypass System, IMDC offers a **UNIQUE, INNOVATIVE and FEASIBLE** solution to fight coastal erosion associated with the ongoing development of large commercial ports. In many cases port infrastructure intersects the littoral drift, which leads to erosion downdrift.

BESand's groundbreaking innovation is transferring wave energy back into sediment transport movement. This is achieved by an **integrated concept** consisting of a **multi-purpose breakwater**, a novel **hybrid Wave Energy Converter (h-WEC)** and a **sand-bypass system powered by blue energy**. Port infrastructure becomes thus part of the solution by creating strategic sediment reservoirs and by restoring the natural sediment supply.



The system is **FEASIBLE**, since the sand bypass system builds on existing concepts. The h-WEC concept addresses main barriers and obstacles in the wave energy sector, and is **LOW RISK**:

- Technology: builds on two well understood technologies, a water and an air turbine, which have been around for over a century
- Performance: the h-WEC allows energy harnessing over a wider range of metocean conditions
- Operations: the breakwater offers a solid foundation and access for maintenance and repairs

BESand will be **ADAPTED** and tailored to the site-specific context, to select the most durable and sustainable option. The scale of the port infrastructure, the site conditions, and the client's preference influence the choice of the system. BESand can be **SCALED** up to numerous ports in West Africa or even worldwide.

The main **IMPACT** of BESand is **limiting erosion impacts** of port infrastructure, while **limiting energy requirements, and related operating costs**. The figures in the tables show that based on typical, average numbers the BESand will generate 42 million USD **savings** for the sand bypassing over a 30 years lifetime compared to traditional dredging. Moreover, clean electricity production of three hybrid energy modules of 1,500 MWh per year at 0.20 USD per 1 kWh could result in another saving of 9.0 million USD and preventing 10,000 ton of CO₂ emissions in 30 years.

Period of operation	Total Volume Bypassed (m³)	Cost (million USD)	Unit Cost (USD/m³)
2025-2055 30 years	250,000 x 30 =7,500,000	CAPEX: 12 OPEX: 1,2 x 30 = 36	7.2

Beach Nourishment	Fill Volume (m³/ 30 years)	Unit cost (USD/m³)	Total cost (million USD)
Dredge and fill	7,500,000	12.0	90
BESand bypass	7,500,000	7.2	48

Next many social, economic and environmental **COBENEFITS** are associated with this solution, also reducing the COCED.

Several **FINANCING** instruments can be used such as PPP (involving port operators, government, donors), but also DBFM or other performance-based contracts, so that not only the construction, but also the operation and maintenance is taken care of.

BESand has a **HIGH LEVEL OF IMPLEMENTATION READINESS** as it blends already existing and proven concepts. The timeline for field studies, site conditions, feasibility studies (incl. CBA & SEIA), detailed design with numerical and physical modelling, EIA and permitting till tendering and construction is about 2 to 3 years, which means BESand could be operational in about 3 to 4 years.

