



ZE-Gen Market Deep Dive: The Maldives

Market report, 20 September 2024

Executive summary

Maldives current energy profile: Maldives relies on fossil fuel gensets for ~95% of electricity needs. The three main segments for gensets are powerhouses, resorts, and industries

- **National need for RE:** ↑ RE uptake (to 15% of capacity) is part of NDCs & crucial for reducing import bill of fuel (10% of imports)
- **Issues that have slowed RE uptake in the region:**
 - **Government delays** – Caused by mis-alignment of interests among stakeholders & complex bureaucracy
 - **Dependence on DFI funds & FDI** – Limited revenue sources for Government of Maldives (GoM) to self-fund RE projects
 - **Poor grid infrastructure** – Poor financial health of state utility companies to invest in grid modernisation
 - **Disperse geography** – Maldives consists of 1,100 islands with ~200 inhabited that are dispersed over 90,000 sq. km which ↑ logistics costs and overall cost of generation as grid interconnection is not always viable
- **Balance of payments crisis looming** – Maldives is undergoing a BoP crisis – avoiding GoM-related interventions is advisable in the short-term

Key segments for alternate solutions:

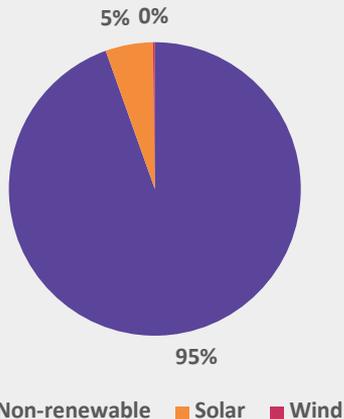
- Considerations for selection: account for ~50% of electricity generated, private enterprises (quicker decision-making), high WTP, experience with RE adoption, & high GHG reduction potential. ↑ Access to lower-cost finance to accelerate adoption of RE technologies.

	Type of use	Genset fleet size (# units)	Genset capacity (MW)	Daily use (hr)	National GHG emissions share (%)	Solution pathways
Resorts & hotels	Primary	~800	~160	18 – 24	~30 - 40%	RE + storage + diesel

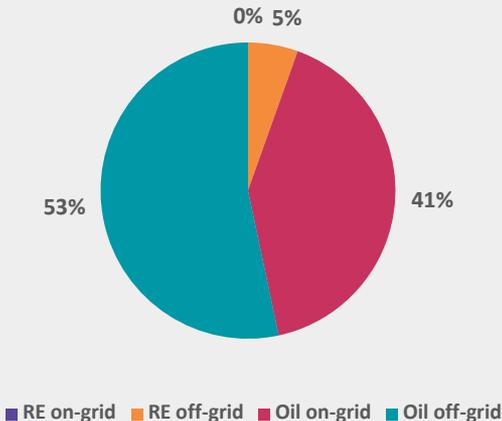
What is the as-is power situation in Maldives?

95% of electricity generated uses imported diesel (~10% of all imports) which is heavily subsidized by the government

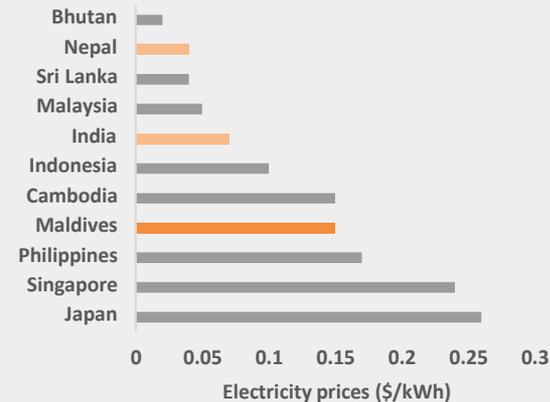
1025 GWh of electricity generated (~95% from diesel)



~60% of electricity generated off-grid



Diesel powered generation is not economically viable long-term



1

~687,000 MT of diesel imported; ~40% consumed for electricity

1

~99% of electricity generated from RE sources is off-grid

1

Maldives has the 5th most expensive electricity tariffs in Asia

2

In past 4 years, RE share has grown at 9.7%

2

Smaller, off-grid generation systems have 2-3x higher costs per kWh

2

Actual cost of generation is up to USD 1/kWh; electricity is heavily subsidized

Only 40% of the country is connected to the national grid; investment needed to modernize the grid and increase inter-connection



Coverage

- State-owned enterprise; operates in Greater Malé region (capital city)
- ~300,000 people served (60% of population)

- State-owned enterprise; operates in the Outer islands; services 150 islands (excluding resorts)
- ~200,000 people served (40% of population) through ~150 individual powerhouses

Capacity and services

- Installed capacity of 185 MW in ~33 islands
- Solely responsible for electricity generation and distribution
- Install, service, and maintain RE projects

- Installed capacity of 158 MW in ~150 islands
- Provides utility services like sewage and water

RE outlook

- Engaged with WB in ASPIRE & ARISE program to install RE
- Installed RE capacity of ~5 MW
- Flagship program, Avikatha, where customers can rent (~USD 7/kWp) roof to STELCO

- Engaged with ADB in the POISED program to install RE solution in the Outer Islands
- Installed RE capacity of ~14 MW

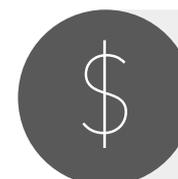
Common challenges



Poor financial health: Loss-making companies due to high cost of generation despite subsidies (65%)



Outdated grid: Lack of modern infrastructure (20+ years); generation losses ~12% (target 5%)

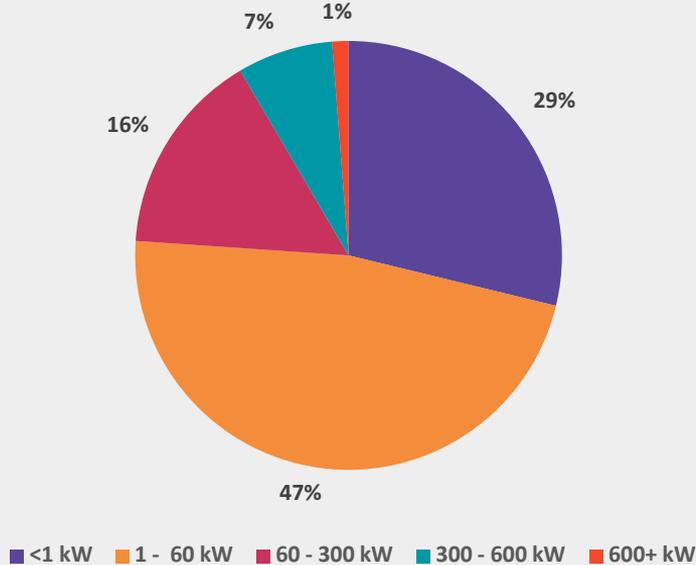


Investment needs: Require outsider funding to increase grid connectedness & storage to increase uptake of RE

All diesel gensets are imported to Maldives representing an annual outflow of USD 12 Mn

ZE Gen relevance: The amount spent on gensets represents the floor amount available for substitution with RE alternatives

1,100+ gensets were imported to Maldives in 2023



1

Chinese dominance: China accounts for 50% of all imports in gensets (by volume & value)

2

High paying capacity of purchasers: Gensets account for 2% (USD 12 Mn) of Maldives currency outflows

3

Consistent demand: In each of the last 3 years, Maldives has imported ~1,100 gensets annually. Till July 2024, they have already imported 660 gensets

4

Government's share: In 2023, genset import accounted for USD 600 K (5% import duty on value) and USD 960 K (8% GST collected on DG imports)

5

Cummins leads the market: Himoisa, Caterpillar & FG Wilson corner the rest of the market. Cummins appoints a dealer to distribute products & manage service (Electrify Maldives Pvt Ltd)

All major players rely on authorized dealers to sell products within a timeframe 4-5x shorter than a comparable RE solution

How are gensets sold?

New and second-hand gensets are primarily sold through dealers that serve customers on three touch points:

- Genset import & related services
- Installation-related services
- Servicing through AMC (in India brands like Cummins would service themselves)

Maldives has 10-15 genset suppliers; most focus on non-genset products as well



- Official dealer for Cummins
- Provides servicing & scheduled maintenance



- Official dealer for Himoisa
- Provides AMC
- Diversified business with interests in agri. inputs



- Deals in John Deere, FG Wilson & Perkins
- Diversified business with interests in marine gensets & RE components

Dealers bridge the logistical challenges & provide quality assurance

Key Step	Renewable Energy (Solar)	Diesel Generators (DG)
Initial Setup Time	2-4 weeks (small) to 3-6 months (large)	1-2 weeks (small) to 1 month (large)
Logistical Challenges	High (importing panels, batteries)	Low to Moderate (complex for larger sets)
Regulatory Approvals	Often requires more permits, approvals	Fewer regulatory hurdles
Maintenance Complexity	Requires specialized skills and spare parts	Routine and widely available servicing

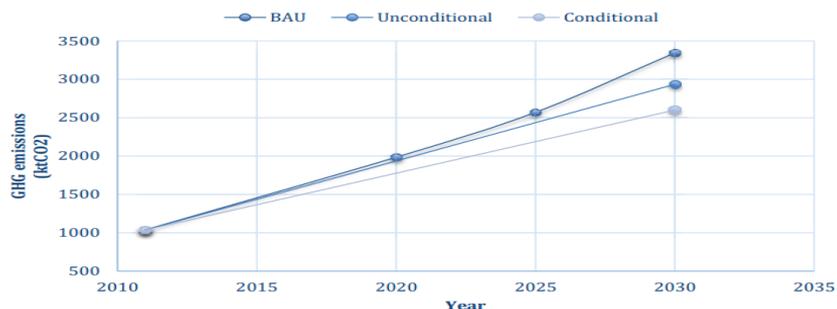
Relevance for ZE Gen

- **Potential logistical partners:** Dealers are often trading firms that have an expertise in international trade & willingness to deal in other products; they could potentially be partners for enterprises in importing RE components
- **Focus on servicing:** As RE solutions will be the primary source of power in remote islands, enterprises that have can compete with the DG supplier's servicing and logistical prowess have the right-to-win

Maldives' NDCs list ambitious targets for RE progress that might falter due to national currency crisis

ZE Gen relevance: Support through funding for RE deployment & capacity building are crucial for Maldives to meet NDC targets

Maldives' NDC target visualized; financing needed to reach targets



	2015 NDC	2020 Updated NDC
Target for 2030	1. 10% unconditional or 24% conditional GHG emission reduction	1. 26% conditional emission reduction or achieve net-zero in emissions by 2030
Quantitative sectoral targets	1. No targets	1. RE share of 15% 2. Reduce grid losses to 5%

- 1 Regression in NDC:** The 2020 NDC marks a regression in targets as it is fully conditional on international support and collaboration; 2015 target had an unconditional component as well
- 2 Energy sector in focus:** One of two focus sectors for the government in achieving NDC targets. Both private and public sectors are required to reduce emissions, and this sector has been emphasized in both editions
- 3 Ambitious quantitative targets:** Increasing RE uptake to 15% would involve installations of an additional ~100 MW of RE by 2030
- 4 Poor track record of meeting targets:** The government initially had a target of installing 50% RE by 2015 (actual 4.4%) which it could not meet; it also failed to meet its 2020 Net Zero target
- 5 Openness for collaboration:** Willing to collaborate with DFIs (with a successful track record) for climate financing, capacity building, and climate governance to meet NDC targets

GoM is committed to RE but is heavily dependent on DFI funding; investors also seek risk-mitigation through DFIs

Adding new and efficient diesel genset capacity

- FENAKA has open tenders its website for purchase of 20 gensets with a combined capacity of ~9 MW
- STELCO does not have open tenders but tenders for hybrid systems indicate focus on high efficiency gensets

DFI-backed RE installation tenders

- STELCO has launched a tender for solar + BESS installation through PPA or contractor finance model
- GoM (supported by WB) has launched a tender for 15 MWp of on-grid solar through DBFOOT model
- GoM (through POISED) has launched a tender for solar-diesel hybrid power plants in outer islands

BESS installation tenders

- Chinese firm, Sinosoar, signed an agreement to install 40 MWh of BESS in 24 islands under the ARISE program

Grid modernization efforts

- STELCO has open tenders for 132 kV grid infrastructure upgrades including cabling & constructing substations
- As part of “One Sun, One World, One Grid” Maldives has signed an MoU with India to establish interconnection transmission with undersea cabling and network augmentation to increase RE uptake
- Grid modernization target is to reduce losses to 5% from current ranges of 12-20%

Other technologies

- **Wind:** A China-funded project is looking to establish wind-solar hybrid systems (100 kW each) in 5 outer islands to provide energy and water
- **Waste-to-energy:** Planned installation of 9.5 MW of grid-connected WTE plants on 2 islands in Malé; limited information on progress
- **Dual-fuel generation:** Planned installation of LNG power plant (higher energy density & greater efficiency) installation in Malé region

Common challenges



Delays: Government projects are known to have longer timelines and frequent delays; delays are exacerbated by re-tenders and an inefficient civil servant body



Local presence: GoM-related bids require the installer to have **presence in Maldives and support project for 15 years**; this is a deterrent to international players



Low investor interest without DFI-backing & demand aggregation: WB offers a first-loss guarantee & escrow-facility which attracts investors

URA approval is key successful private sector installations in Maldives; collaborating with other agencies is advisable but not required

Agency/Body	Role	Enforcement Responsibilities	ZE Gen relevance
<u>Ministry of Climate Change, Environment and Energy (MCCEE)</u>	Primary government body for formulating and implementing environmental and RE policies.	<ul style="list-style-type: none"> <input type="checkbox"/> Enforces regulations related to renewable energy projects <input type="checkbox"/> Ensures compliance with national standards and environmental guidelines 	<ul style="list-style-type: none"> <input type="checkbox"/> Interventions by other DFIs involve MCCEE as a key local, implementation partner <input type="checkbox"/> Likely relevant in national-level interventions like grid upgradation
<u>Utility Regulatory Authority (URA)</u>	Regulates the utilities sector, including electricity generation and distribution.	<ul style="list-style-type: none"> <input type="checkbox"/> Ensures compliance with technical and safety standards for RE projects <input type="checkbox"/> Regulates tariffs and monitors energy service providers 	<ul style="list-style-type: none"> <input type="checkbox"/> Independently managed private power systems (DG & RE) require approval from URA for intervention <input type="checkbox"/> Relevant for an intervention focussing on resorts & hotels
<u>State Electric Company (STELCO)</u>	Main electricity provider	<ul style="list-style-type: none"> <input type="checkbox"/> Enforce grid connection standards for RE systems <input type="checkbox"/> Implement RE integration policies in grid operations <input type="checkbox"/> Monitor and report on RE contribution to the grid 	<ul style="list-style-type: none"> <input type="checkbox"/> Interventions by other DFIs involve STELCO & Fenaka as a key local, implementation partner
<u>Fenaka Corporation</u>	State-owned utility for outer islands	<ul style="list-style-type: none"> <input type="checkbox"/> Enforce RE policies in outer island operations <input type="checkbox"/> Implement and monitor RE projects in assigned islands <input type="checkbox"/> Ensure compliance with national RE standards in local projects 	<ul style="list-style-type: none"> <input type="checkbox"/> Influence is limited in private power systems; yet it is recommended to involve utility companies and gain buy-in as a service partner
<u>Local Councils</u>	Local governance bodies	<ul style="list-style-type: none"> <input type="checkbox"/> Enforce local-level RE regulations <input type="checkbox"/> Monitor compliance of small-scale RE projects <input type="checkbox"/> Report violations to relevant national authorities 	<ul style="list-style-type: none"> <input type="checkbox"/> Relevant authority for individual island-level power stations & RE setups in individual islands; limited influence on resorts & hotels
<u>Ministry of Construction & Infrastructure</u>	National planning and infrastructure body	<ul style="list-style-type: none"> <input type="checkbox"/> Enforce RE considerations in urban and infrastructure planning <input type="checkbox"/> Ensure compliance of large-scale RE projects with national development plans <input type="checkbox"/> Coordinate with other agencies on spatial aspects of RE policy enforcement 	<ul style="list-style-type: none"> <input type="checkbox"/> Low relevance on private RE installations; key stakeholders for national infrastructure projects that include grid connection

While promoting RE installation, GoM is also advocating for installation of higher efficiency gensets

ZE Gen relevance: Maldives' space constraints (need for high density energy) likely alternatives will be hybrid (at least in the near term)

Aspect	Details
Maldives Energy Act	Emission Standards and Efficiency Requirements: Sets stringent emission standards for diesel generators to minimize greenhouse gas emissions and pollutants. Requires regular maintenance and the use of high efficiency gensets
	Renewable Energy Integration: Encourages integration of renewable energy sources, such as solar, to reduce reliance on diesel generators. Incentives may be provided for adopting renewable technologies
	Licensing and Compliance: Entities using diesel generators must obtain licenses from the URA. Regular inspections and compliance checks are conducted to ensure adherence to standards
Utility Regulatory Authority Regulations	Permitting and Licensing: Oversees issuance of permits and licenses for diesel generators including hospitality and maritime sectors. Ensures compliance with emission and efficiency standards
	Monitoring and Enforcement: Responsible for monitoring compliance through regular inspections and audits. Non-compliance can result in penalties, fines, or revocation of licenses
	Incentive Programs: Offers incentives such as tax breaks, subsidies, or grants for users investing in renewable energy solutions or upgrading to efficient diesel generators
Maritime Authority Regulations	Marine Emission Standards: Regulates emissions from marine diesel engines, including sulphur content, nitrogen oxides (NOx), and particulate matter (PM) emissions
	Energy Efficiency Measures: Encourages the use of energy-efficient technologies and practices on boats to reduce diesel consumption and emissions, such as hybrid systems and energy recovery systems

Maldives offers subsidies on diesel amounting to USD 61 Mn (1% of GDP) & it is a drain on FX reserves; GoM keen to rationalize this spend

Segment	Subsidy Amount	Extent of subsidy
Residential Sector (Low-Income)	Up to 30% subsidy on diesel costs	Subsidy applies to essential household electricity generation using diesel gensets.
Small Businesses	15-20% subsidy on diesel costs	Limited to power generation for up to a certain capacity
Public Sector (Schools, Hospitals)	50% subsidy on diesel costs	Applies to all fuel usage for power generation in essential public services.
Fishing and Maritime Sector	20-30% subsidy on marine diesel	Subsidy applies to fuel used by fishing vessels and small maritime businesses.

ZE Gen
relevance



No subsidy for resorts & hotels: Resorts & hotels do not get any fuel subsidies from the government; despite consuming 1/3rd of fuel



Unsustainable subsidy: Fuel subsidy is a drain on GoM's budget & FX reserves; it might not survive the currency crisis



Subsidized electricity: GoM also subsidizes fuel costs of state utilities to lower end-user prices; reduction in subsidy might lead to new RE users

RE policy framework is developing with limited incentives for users & solution providers

ZE Gen relevance: GoM offers limited subsidies and incentives for RE installations especially for private sector; on the other hand, resorts & hotels enjoy autonomy in determining their power generation which will allow for faster decision making.

Target segment	Incentive	ZE Gen relevance
SMEs & households	<ul style="list-style-type: none">• 30% subsidy on solar panel installations	<ul style="list-style-type: none">• Limited relevance for ZE Gen as broad targets are large-scale resorts & hotels
Businesses & hotels	<ul style="list-style-type: none">• Up to 50% tax deduction on renewable energy investments	<ul style="list-style-type: none">• Beyond tax breaks, resorts & hotels get limited support for installing RE systems
RE solution providers	<ul style="list-style-type: none">• 100% import duty exemption on RE components	<ul style="list-style-type: none">• 100% duty exemption is a crucial incentive but limited financial impact as duty on gensets is 5%
Net-metering	<ul style="list-style-type: none">• Each segment (business, domestic & government) on each island has a cap on amount of capacity that can avail net metering• Part of the reason is the cap of 30% RE per island driven by grid limitation and low penetration of BESS	<ul style="list-style-type: none">• Limited relevance for target segments as hotels & resorts are mostly off-grid• 30% RE cap is caused by limitation of grid & lack of BESS; funding BESS ecosystem in Maldives is critical

What are key segments of intervention?

Given the high WTP & business case for switch, resorts & hotels are the ideal target

ZE Gen relevance: Our target segments in Maldives are prime-use gensets with the recommended target segment being resorts

Resorts & hotels (targeted)

Impact potential:

- ~160 MW of prime-use gensets

WTP:

- Have access to financing; lower-cost financing will accelerate adoption
- Able to effectively service debt

Likelihood to transition:

- Among the early adopters of RE (15 MWp of solar & 2.4 MWh of BESS) in Maldives with corporate mandates to be Net Zero

Industry (not targeted)

Impact potential:

- ~20 MW of prime-use gensets; chief operators are fish processing

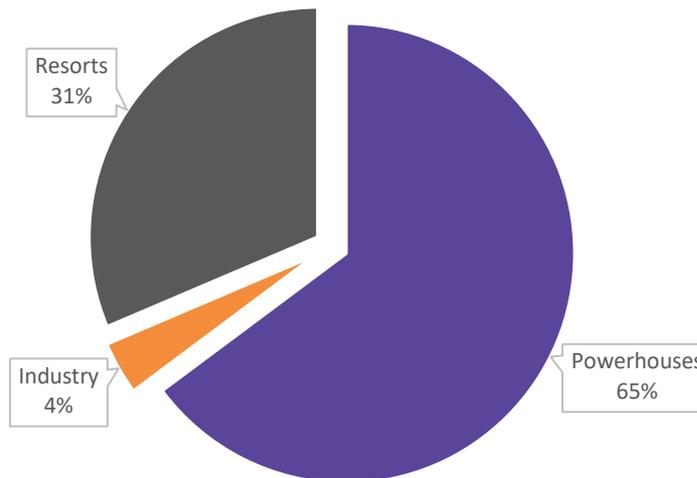
WTP:

- Low WTP as they do have diesel subsidies

Likelihood to transition:

- No mandates to transition

Installed genset capacity by user-segment (total capacity 520 MW)



Segments not considered

Considering that gensets serve as the primary power source in the Maldives, targeting the back-up gensets of **public institutions (like schools & hospital)** and **households** would not be as impactful

Powerhouses (not targeted)

Impact potential:

- ~340 MW of prime-use gensets

WTP:

- Would require concessional finance
- Uncertain ability to pay back debts

Likelihood to transition:

- Implementation delays due to re-tenders and bureaucratic inefficiencies
- Government mandates to install RE

The resorts & hotels segments represent an opportunity to transition 160 MW of prime use fossil fuel gensets

What do they use DG for?

- Lighting systems
- HVAC system
- Appliances

How do they use gensets?

Type of power	Primary source
Location	Off-grid
Genset capacity	100 – 750 kW
Business model	CAPEX
Installed fleet capacity	1.0 – 2.0 MW
Average runtime	18 – 24 hours
CO2 emissions	10 K kgCO2e/day
NOx emissions	2 kg/day
SO2 emissions	0.4 kg/day



What problems do they face?

- **High operational cost** – A typical five-star hotels consumes 4 – 8,000 liters of diesel per day spending USD 3,600 – 7,200 per day
- **External shocks** – Diesel prices are prone to external shocks with monthly bills increasing by 60-70% post Russia-Ukraine war
- **Inefficient generation** – Smaller, individual gensets cost 3x more to generate electricity
- **Pollution** – Generators affect the local flora & fauna of the surrounding region (affecting sales) & create noise which impacts the guest experience

What is the market size?

- **Immediately addressable market:**
~200 resorts & hotels
- **Potential market in the future:**
~800 guesthouses
- **Capacity that can be targeted:** 160 MW

What are the relevant policies?

- **One Island, One Resort** – Maldives' policy allows only one resort per island, thus, each resort independently generates its electricity
- **Limited oversight** – Resorts face little oversights to install RE solution beyond approval from URA
- **No subsidies** – Resorts do not get any share of the government's diesel subsidies

Resorts & hospitals are already transitioning; ZE Gen's intervention can hasten the transition & increase share of RE (beyond 40%)

What is the solution pathway?

- **Short-run:** Solution pathway currently involves using **solar + BESS** to replace a part of the DG installed capacity (<40% RE capacity)
- **Long-run:** Solution pathway will involve **ocean energy + solar + BESS** to target more DG capacity displacement. Ocean energy must become commercially viable for this pathway to be achieved



Why will they switch?

- **Cost savings:** Switching from diesel has significant cost savings potential for resorts
- **Non-economic reasons:** Corporates like Holiday Inn and Marriott have Net Zero goals which are added motivation to switch
- **Perception:** Perception as a “green” resort has positive impacts on sales

What are the challenges?

- **Space constraints:** Lack of space is a natural cap on RTS installation
- **Aesthetics:** Solar is perceived as unappealing to the aesthetics of the resort
- **Retrofitting:** Retrofitting RE solutions to older resorts will limit total RE capacity installed
- **Servicing:** Dispersed geography will lead to logistical challenges with servicing

How will they finance the switch?

- **Luxury hotels:** Likely to finance through self-financing or debt financing via direct CAPEX model
- **Mid-range hotels:** Have limited access to debt financing. Likely through adopt RESCO model
- **Guesthouses/family-owned shacks:** Limited access to financing; would require financing to make the switch

What is the total impact potential?



701,000 MT CO2e



250,000,000 liters diesel annually



USD 228,000,000 in savings

Aggregating hotel RE demands & increasing penetration of BESS are crucial interventions to increase amount of diesel displaced



Holiday Inn Kandooma Maldives (HPL group)
Serves ~320 guests @ full capacity



Kudadoo Maldives (Crown & Champa Resorts)
Serves ~60 – 80 guests @ full capacity

Features
of RE
systems

- 500 kWp of solar PV installed on the roof
- 20 kW of wave energy installed through a pilot project by Okinawa Institute of Science and Technology
- No battery back-ups

- 320 kWp of solar installations that generate 575 MWh per year
- Resort can be fully 100% RE (assuming for certain parts of the day and not 24/7)
- Solar installation was built into the design of the resort

Pain
points

- Solar is operational for 5-6 hours per day
- Wave energy system is facing consistency logistical & technical issues
- Batteries are expensive, would take up too much space, and perceived as having less than advertised life (3-4 years vs 10 years)

- Integrating solar panels without compromising the aesthetical value of the resort
- Regular maintenance of panels is a challenge given the remote location of the resort

Solution
provider

- SwimSol installed the solar PV system with providing contractor financing for 10 years
- Bill monthly basis usage with IoT-based monitoring and provide maintenance services

- Full installation cost was USD 2 Mn
- Installed by Swedish firm Solarwork & designed by a French firm at a cost of USD 1 Mn; logistical costs were a significant part of costs

ZE Gen
relevance

Working with hotel groups: Both resorts are owned by groups that have 10+ hotels & resorts in Maldives. Aggregating demand is critical to lowering costs & accelerating impact

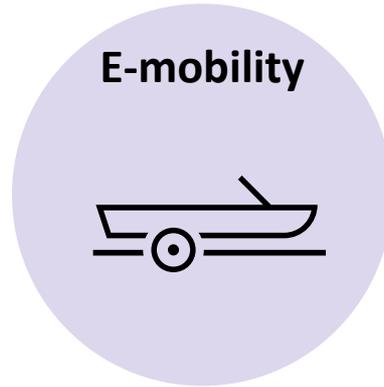
Increasing penetration of BESS: Larger establishments like Holiday Inn (~300 guests) require BESS to improve RE uptake; however, operators have negative perception of BESS (older installations have lasted only 3-4 years)

Service & maintenance: Hotels require regular service of RE systems; IoT-based monitoring is one way of enhancing outcomes. Partnering with utility companies of nearby islands is another

A secondary target for reducing fossil fuel usage in the tourism sector could be water transport

What are recent developments?

- Holiday Inn is looking at hybrid boats to replace a portion of fleet
- Indian firm NavALT has received an order for a 75-seater solar ferry (USD 650 K) from Maldives
- MTCC is working with European firms to start electrified ferries



How are boats used?

Use cases	Guest transportation, logistics
Business model	CAPEX
Estimate of numbers of boats	35 – 40 boats per hotel/1 boat per 10 rooms
Average petrol consumption in a week	3000 – 4000 liters

What are the solution pathways?

- **Short-term:** Hybrid solar boats that run on fossil fuels and solar
 - Not commercially viable or widely available in the Maldives yet
 - A few enterprises are piloting the technology
- **Long-term:** Hydrogen-fueled boats that use hydrogen as fuel for an IC engine or to run electric engines
 - Hydrogen-fueled boats would require feasibility studies to establish viability
 - Maldives would need a hydrogen fuel ecosystem

What can ZE Gen do?

- **Access to grant capital:** Fund international enterprises that are willing to supply boats to Maldives & provide services with grant capital
- **Pilot technologies in Maldives:** Establish proof-of-concept in Maldives by funding pilots

What is the impact potential?



164,000 MT CO2e



60,000,000 liters fuel annually



USD 55,000,000 in savings

What is the RE ecosystem in Maldives?

Solar PV is the ideal immediate target for funding; BESS enterprises need to be prioritized to increase overall penetration of RE

Technology	Market maturity of technology	Challenges	ZE Gen Relevance
 Solar (RTS & floating)	<ul style="list-style-type: none">• Maturity: RTS and floating solar are mature & commercially viable solutions• Capacity: 38 MW (96% of RE capacity)• Potential: Unlimited (subject to space)	<ul style="list-style-type: none">• RTS constrained by space• Floating solar is contingent on finding sheltered lagoons	<ul style="list-style-type: none">• Funding solar enterprises should be immediate target given broad acceptance from government and resorts
 Ocean (wave, tidal & OTEC)	<ul style="list-style-type: none">• Maturity: Pilot stage• Capacity: Limited capacity (tried by resorts & government)• Potential: 28 – 106 MW	<ul style="list-style-type: none">• Not a commercially available technology with prohibitive costs• Seasonality limits the use of tidal technology	<ul style="list-style-type: none">• A technology of the future; ZE Gen can fund enterprises that can run pilots for willing resorts.
 BESS	<ul style="list-style-type: none">• Maturity: Maturing technology; initial outlay can be prohibitive• Capacity: ~15 MWh (distributed across utilities and resorts)	<ul style="list-style-type: none">• Actual battery-life tends to be 3-4 years (lower than advertised)• Installation space is a challenge when retrofitting	<ul style="list-style-type: none">• Funding BESS enterprises is critical to improve maintenance capabilities and increase overall RE penetration (standalone solar effective for 6 hrs)
 Wind (Small-medium)	<ul style="list-style-type: none">• Maturity: Gaining maturity & commercial viability is uncertain• Capacity: 1.4 MW (3.7% of RE capacity)• Potential: 10-20 MW	<ul style="list-style-type: none">• Large-scale wind is infeasible due to variability and intermittency	<ul style="list-style-type: none">• Small-medium wind is seen as a supplemental technology to solar; should not be a funding priority

Aggregating demand and promoting enterprises to install IoT-enabled systems can alleviate logistics issues

Challenges



Import dependency for RE components

- Maldives' relies on imports for all critical RE components like PV cells (**2023 import value USD 11 Mn**), batteries, solar generators (**USD 140 K**) etc.
- Lower volumes lead to import delays & high import costs; containers leaving Maldives are often empty (**value of total imports is 20x greater than exports**)



Lack of grid infrastructure

- Less than **1% of RE installed is on-grid**; prevalent issue in smaller islands and resorts where connection to the grid is not always feasible
- Lack of grid infrastructure **increases the need for BESS** to increase RE uptake; in the absence of BESS it will **sustain a demand for fossil fuel gensets**



Skilled labor availability

- **Lack of skilled, local labor** is a persistent issue for RE installation in Maldives
- Dependence on foreign firms to establish a Maldives' base and provide after-service is costly; only feasible if there is a **large installed capacity**



Costly internal logistics

- Maldives is spread over 90,000 sq. km with businesses concentrated in Greater Malé region; **internal logistics via water transport are time consuming and costly**
- Service for RE systems take ~2 days after diagnosis for high-end customers



Unequal access to financing

- Access to financing from commercial banks is limited due to **high cost of capital** and lower appetite for RE projects due to **overall low volumes**
- Problem is more prevalent for **SMEs, households, commercial establishments like schools, and guesthouses/budget hotels**

What can ZE Gen do?

- Aggregating demand of RE components at a solution provider level can reduce shipping costs by increasing volumes

- Accelerating BESS enterprises in Maldives is key to increasing RE uptake

- Building the capacity of servicemen of utility companies can alleviate the issue and provide alternate revenue source for utilities

- Using IoT-enabled RE systems can help reduce diagnostic time
- Capacity building for Fenaka and resort engineers to perform basic maintenance

- Financing RE installations of guesthouses and budget hotels can be a long-term intervention in a partnership with local bank

Which enterprises can support ZE Gen's work in Maldives? (1/5)

Enterprise	Technologies	Experience delivering solutions for hospitality segment	Experience or physical presence in Maldives	Maturity
	Solar PV, floating solar, BESS, hybrid boats	✓	✓	Moderate
	Solar PV, floating solar, BESS	✓	✓	Moderate
	Solar PV, BESS	✓		Mature
	Ocean energy			Low

Which enterprises can support ZE Gen's work in Maldives? (2/5)

Enterprise	Technologies	Experience delivering solutions for hospitality segment	Experience or physical presence in Maldives	Maturity
	Ocean energy, BESS			Moderate
	RTS, BESS	✓	✓	Moderate
	RTS, floating solar, BESS, wind, green hydrogen		✓	Mature
	Ocean energy			Moderate

Which enterprises can support ZE Gen's work in Maldives? (3/5)



Enterprise	Technologies	Experience delivering solutions for hospitality segment	Experience or physical presence in Maldives	Maturity
	Solar PV, BESS		✓	Mature
	Solar PV		✓	Low
	Solar PV, BESS	✓	✓	Low
	Solar PV, BESS		✓	Mature

Which enterprises can support ZE Gen's work in Maldives? (4/5)

Enterprise	Technologies	Experience delivering solutions for	Experience or physical presence in Maldives	Maturity
 <p>Tendon Consulting and Services</p>	Ocean energy	✓	✓	Low
 <p>Navalt</p>	Hybrid boats		✓	Moderate
 <p>Pekat Solar</p>	Solar PV, BESS		✓	Mature
 <p>Solaroo® Your partner for cleaner energy</p>	Solar PV, BESS		✓	Moderate

Which enterprises can support ZE Gen's work in Maldives? (5/5)

Enterprise	Technologies	Experience delivering solutions for hospitality segment	Experience or physical presence in Maldives	Maturity
	Solar PV, floating solar, BESS		✓	Mature
	Marine e-mobility	✓		Mature
	Marine e-mobility	✓		Low
	Ocean energy	✓	✓	N/A: Piloted the wave energy installation for Holiday Inn

What is the cost of transition & how can it be financed?

DGs are 8x more expensive than the ideal solution of solar + storage; however, fuel savings are significant for users of smaller DGs

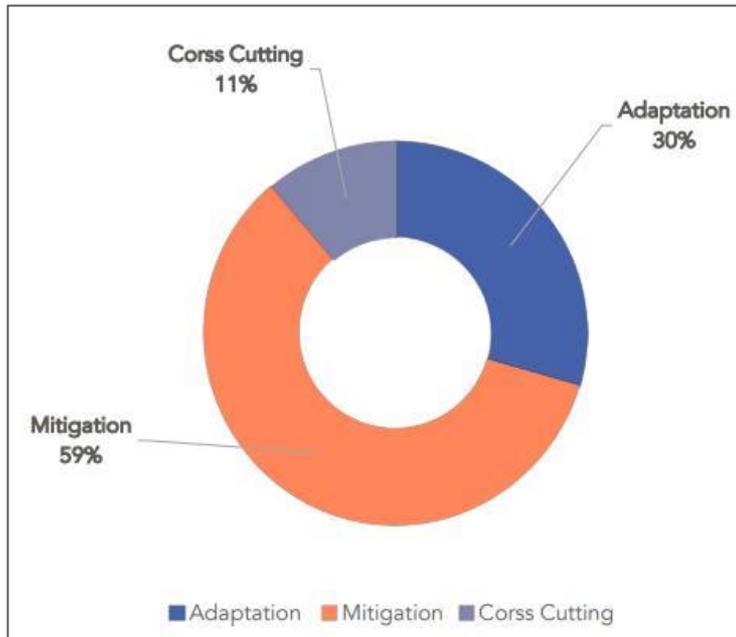
ZE Gen relevance: Resorts & hotels are willing to transition to RE to reduce fuel spends, however, initial outlay (especially battery costs are a major barrier). Access to lower cost financing will help accelerate the transition

Technology	Initial CAPEX (100 kW) (USD)	LCOE (USD/kWh)	Fuel Consumption
Diesel genset	20 – 30 K	0.23 - 0.40 (~ 0.70 in smaller islands)	~0.25 liters/kWh
Rooftop solar	120 – 150 K	0.10 - 0.15	N/A (no fuel required)
Floating solar	150 – 200 K	0.12 - 0.18	N/A (no fuel required)
Solar + storage	170 – 250 K	0.14 - 0.20	N/A (no fuel required)
Wave energy	300 – 700 K	0.25 - 0.50	N/A (no fuel required)

- 1 High initial outlay:** 100% dependence on imports for critical RE components lead to higher initial outlay. Initial outlay is the chief adoption barrier for resorts & hotels
- 2 High and volatile costs of diesel:** Import dependency and geopolitics of oil procurement increase volatility (70% increase in bills for hotels due to Ukraine-Russia war) in diesel prices
- 3 Stable and lower electricity costs:** RE solutions offer lower and stable electricity costs (2 – 7x lower); as well as de-risking from geopolitics of oil procurement
- 4 Natural cap on solar:** Space constraints (solar panels occupy 36x more space than comparable DG) on islands put a natural cap on the amount of solar PV that can be installed. In the short-run, diesel-solar-storage hybrid solutions are ideal
- 5 The promise of wave energy:** Wave energy and other ocean energy technologies will be critical for further uptake of RE once commercial viability is established

Maldives' climate financing is led by donor funding with limited private funding involvement

59% donor-funds are targeting climate mitigation



GoM keen to attract investments & build domestic financing capabilities

- 1 Call for investments:** Maldives' National Strategic Action Plan (2019 – 2023) suggested investments worth USD 1 Bn across value chain of generation, transmission, and distribution
- 2 BESS-focus:** Investments are now increasingly flowing towards BESS installation. 2023 BESS target of 30 MWh requires investment in the range of USD 60 – 90 Mn
- 3 Donor-financing:** Maldives' RE development goals are largely supported by donor financing via DFIs/MDBs/bilateral assistance. Between 2014-2017, climate mitigation funds totaled USD 200 Mn
- 4 Prevalence of grants and concessional loans:** 40% of distributed funds were grants and 35% were concessional loans
- 5 Limited participation of domestic banks:** Bank of Maldives is the critical player providing domestic credit

Only 1/8 prominent banks offers green loans; limited domestic financing for early stage or concessional capital

Landscape

Commercial lending

- 8 banks in the country; 3 of which are local & 5 are branches of foreign banks
- Bank of Maldives (BML) & Maldives Islamic Bank (MIB) have government ownership
- BML (49%) & State Bank of India (20%) lead the market share; with the rest distributed evenly among the other six

Details

- **Enterprise financing:** Banks do not have dedicated green facilities; capital can be accessed by solution providers at 10-14%
- **Financing for resorts & hotels:** SBI & ADB (private sector arm) provided some green loans to finance RE installation
- **Financing guesthouses:** All banks have dedicated financing for guesthouses (budget-hotels)

ZE Gen
relevance

Co-financing commercial lenders: Capacity building & co-financing commercial lenders (non-BML) for concessional on-lending to growth-mature RE enterprises

Early-stage capital

- **Limited access to early-stage capital:** There are few prominent VCs or early capital deployers in the Maldives
- **Dependence on foreign capital:** Local solution providers rely on self-financing or foreign early-stage capital to seed their enterprises

- **Call for partnerships:** GoM is exploring partnerships with financial services providers to develop a VC ecosystem & climate financing ecosystem

Early-stage capital access: Providing grant capital to early-stage enterprises in novel technologies like ocean energy & BESS to establish viability & grow operations

Carbon credits

- **Carbon Trading and Offsetting:** The Maldives is exploring the development of both domestic and international carbon trading mechanisms
- **Participation in International Markets:** Interest in participating in international carbon markets, particularly through mechanisms

- **Path to neutrality:** Carbon markets are key to Maldives' goal of reaching neutrality by 2030, however, they are at a nascent stage in Maldives
- **Likely users:** Resorts & hotels most likely early adopters of carbon markets (through exposure in other nations), however, this mechanism is unlikely to be useful in Maldives immediately

Tourism-financing facility: Co-financing banks to provide financing at lower than market rates for tourism sector seeking financing for RE investments

ZE Gen can collaborate with state-backed funds and companies as the national economic situation improves

ZE Gen relevance: MFMC & Green Loans are potential co-funding opportunities that can be supported with concessional debt

FRESA

- Operated by Ministry of Environment & hosted by Bank of Maldives

- One of the main components of GEF-funded Renewable Energy Technologies Development and Application Program
- Limited information available on the impact of FRESA

RED Fund

- Renewable Energy Development Fund (RED fund)
- Supports utility-scale renewable energy investments

- Limited information on the operationalization & impact of RED Fund

Maldives Green Fund

- Established by Ministry of Environment in 2019
- Capitalized through a Tourist Green Tax: USD 3 – 6 per day from resorts, hotels, guesthouses & tourist vessels

- In 2023, ~USD 65 Mn were collected as inflows
- Outflows were ~55% of inflows investing in sewage treatment, environmental rejuvenation, and small-scale RE (waste-to-heat)

MFMC

- Established in 2019, Maldives Fund Management Corp focused on increased private investment in sectors of interest & addressing limitations of local financial system

- Manages about USD 300 Mn in assets
- Has three dedicated funds focusing on tourism, infrastructure (includes power) & RE (solar is key focus)
- For tourism, funding includes sustainable development
- For RE, the focus is on commercially viable technologies

Green Loan Scheme

- Operated by the Bank of Maldives
- Lend individuals and businesses looking to invest in green technology and resources

- Offers loans up to USD 1.3 Mn for business customers payable over 20 years @ 10 – 12% interest
- Requires 15% equity contribution
- Applicable for personal consumers as well

Maldives has several DFI-funded energy transition programs that can be potential collaborators for ZE Gen for co-funding

DFI Program/Project	Financiers	Funding	Objectives
Solar Power Development and Energy Storage Solution	Asian Infrastructure Investment Bank	USD 20 Mn sovereign-backed loan for 31 years	Increase generation capacity from renewable energy sources and to facilitate the integration of renewable energy into Maldives' grid infrastructure
Accelerating Sustainable System Development Using Renewable Energy Project (ASSURE)	Asian Development Bank (ADB)	~USD 96 Mn	Improve energy security and sustainable transition of the power sector in Maldives and increase the share of renewable energy in Maldives' power generation mix
Preparing Outer Island Sustainable Electricity Development (POISED) Project	ADB, Strategic Climate Fund, Islamic Development Bank, European Investment Bank, Japan Fund for the Joint Crediting Mechanism	USD 127 Mn	Replace inefficient diesel-based power generation grids with hybrid systems, including solar PV and diesel with BESS and EMS, to reduce both - the cost of electricity and the emissions, as well as lower the subsidy burden on the government budget
Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE)	World Bank (WB), Clean Technology Fund	~USD 180 Mn	Enable private sector investment in PV infrastructure development; and diversify the investment base in Maldives through developing a local market and expertise in renewable energy
Accelerating Renewable Energy Integration and Sustainable Energy (ARISE)	World Bank (WB), Clean Technology Fund		Demonstrate the operational and economic feasibility of innovative renewable energy technologies and battery energy storage solutions (BESS)
South Asia Regional Energy Partnership (SAREP)	USAID	USD 10.5 Mn over 5 years	Enhance energy security, promoting clean energy transition, building climate resilience, and fostering regional cooperation to reduce reliance on fossil fuels and support sustainable development

POISED deployed patient capital to successfully deliver sustained impact by building the capacity of local stakeholders



Project objectives

- Transform the existing the electricity grids on the Outer Islands into a hybrid RE system
- Installation of EMS, energy storage, and improvements in distribution networks to reduce dependency on diesel
- Installation of solar-diesel hybrid systems on 160 islands

Project outputs

- Renewable-energy-ready grid systems developed for outer islands and greater Male region
- Enhanced capacity of MCCEE, STELCO, and FENAKA to implement renewable energy grid interventions

Impact

- Achieved fuel savings of up to **28%**, lowering electricity costs
- Increased the **number of businesses** with electricity access from **355 to over 2,100**
- Benefited around **117 K residents** with **enhanced energy availability**
- Expected to reduce greenhouse gas emissions by **approximately 1 Mn MT of CO2e annually**
- Installed over **10.5 MW of solar photovoltaic** capacity and improved energy management systems across 70 outer islands

Financing partners



Loan operationalization

- **Instrument breakdown:** Grants ~25% & concessional loans ~75%
- **Maturity Period:** 40 years
- **Grace Period:** 10 years
- **Interest Rate:** Set at **1% during the grace period**, transitioning to **2% annually** for the **first 10 years** after the grace, and **increasing to 4%** thereafter
- STELCO, Fenaka, & Ministry of Climate Change, Environment, and Energy are the key implementation partners

POISED provides caution against engaging directly with the GoM and the logistical challenges awaiting in Maldives



Key project risk mitigation levers

- **Sectored Island approach:** Project was designed in a way that it would not fail if funding for any phase ran
- **Managing operation risk by capacity building:** POSIED focused on enhancing the capabilities of local contractors through **comprehensive training programs** (designed in local language and focused on hands-on problem-solving) to manage implementation risk
- **Awareness building:** The PMU created awareness of RE systems among relevant stakeholders in the initial phases of the project by installing pilots to get stakeholder buy-in



Challenges faced

- **Reticence for RE projects:** Government stakeholders were weary of RE projects as previous large-scale RE projects had fallen through (2009 75 MW wind farm project)
- **Misperceptions of RE solutions:** Utility firms perceived that installing RE solutions would increase diesel genset generation costs as gensets would operate at lower capacities (lower-end of efficiency curve)
- **Constraints in finance:** Loans from Islamic Development Bank were re-allocated by government for other uses, and European Investment Bank's loans were stalled by the government
- **Limited local knowledge among foreign contractors:** Foreign contractors (despite partnering with local sub-contractors) lacked the local geographic knowledge to plan logistics in Maldives disperse geography with inadequate maritime transport
- **Coordination between different contractors:** Interfacing between different contractors (solar PV, BESS, diesel generators etc.) was a challenge which was compounded by language issues
- **Lack of capacity in local operators:** Utility company operators lacked adequate knowledge to manage new hybrid system



Learnings for ZE Gen

- **Caution when working with GoM:** Government of Maldives has a track record of re-allocation of funds, funding delays, and implementation delays; working directly is not advisable
- **Capacity building as key risk mitigation strategy:** Building capacity of local contractors and operators is key to project success
- **Strong local presence to overcome logistical issues:** Funding preference should be given to enterprises with a strong understanding of Maldives' logistical issues



Opportunities for ZE Gen

- **Co-funding POISED:** As the project timeline has been extended to 2026, providing co-funding to enhance reach of project could be an option allocate ZE Gen funds. Based on CIF's 2021 report, work has not commenced on 46% of planned capacity
- **Geographic location:** Planning interventions at hotels near POISED-impacted islands to utilize trained Fenaka/STELCO operators for service/maintenance
- **Funding all-in-one solution providers:** Ideal funding targets should be solution providers that can manage the end-to-end installation of RE systems including solar PV, BESS, EMS etc.

WB-headed ASPIRE & ARISE were successful in attracting foreign investors by deploying effective risk mitigation tools



Project objectives

- The objective of the ASPIRE project is to increase photo voltaic (PV) generation in Maldives through private-sector investment. Approved in 2020, the ARISE Project scaled up this process.
- Installation of 70% RE capacity for Maldives by the year 2030

Breakdown of funding tools

- USD 122 Mn of grant, guarantee, and loan for solar PV risk mitigation
- USD 36 Mn IDA guarantee
- USD 17 Mn CTF concessional loan with 40-year maturity for BESS
- USD 3 Mn CTF grant for technical assistance

Learnings from W's interventions

- WB's risk mitigation have resulted in successful bidders' utility-scale RE projects (~17 MW) in Maldives from (5 per project in 2014 to ~60 per project in 2022)
- Despite the high interest in bidding, projects fall through GoM requires Maldives' presence for 15 years to support project
- GoM has few protections for investors & has been known to not honour currency convertibility

Risk mitigation tools used to attract investors

- **Guarantees:** ASPIRE & ARISE offered risk-mitigation to private investors in the form of (MIGA/IDA) guarantees & first-loss guarantees
- **Escrow:** Payment security mechanism was set up through an established escrow account to cover any PPA payment delays
- **Currency convertibility:** USD denominated PPA and currency convertibility clause was established which reduced the foreign exchange risk in the case of repatriation of revenue

Relevance for ZE Gen

- **Working with GoM is challenging:** Engaging with GoM directly for projects is not advisable in even normal economic periods; for utility-scale or national interventions it is advisable to be part of a consortium
- **Attracting foreign investors:** Due to lack of protection from GoM, foreign RE developers will require protection in the form risk mitigation; this risk is relatively alleviated when engaging with international hospitality chains
- **Repatriation of funds:** ZE Gen would require risk mitigation for its own funds to avoid issues with repatriation down-the-line if engaging with commercial banks or local enterprises

U D's REP is potentially an excellent co-funding opportunity for ZE Gen given the overlap of sectors and intervention modes

 Program South Asia Regional Energy Partnership	 Agency USAID	 Committed capital USD 10.5 Mn over 5 years	 Target segments Private sector: tourism, fisheries, and agriculture
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Planned interventions	Details of the intervention
Capacity building for climate green bank	<ul style="list-style-type: none">• USD 86 K grant for Small and Medium Enterprise Development Finance Corporation (SDFC), an MSME-focused bank, to be accredited as a National Implementing Entity to directly access funds from Green Climate Fund• USD 300 K grant to SDFC to support climate-resilient interventions
Enterprise acceleration support	<ul style="list-style-type: none">• USD 204 K grant to FJS Consulting to identify and develop climate-smart solution to reduce climate change impact on tourism, fisheries, and agriculture related investments
Technical assistance to key ecosystem players	<ul style="list-style-type: none">• Provide technical assistance to improve regulatory environment, modernize utility services, and build capacity for energy sector professionals
Awareness creation to improve energy efficiency	<ul style="list-style-type: none">• Expand energy efficiency standards for the government to include water heating, water pumps, and ceiling fans• Improve energy efficiency by influencing consumer purchasing decisions

ZE Gen relevance: ZE Gen can co-fund with SAREP due to the similarity in intervention modes and target segments. SAREP is one of the few interventions focused on the private sector

How can ZE Gen intervene?

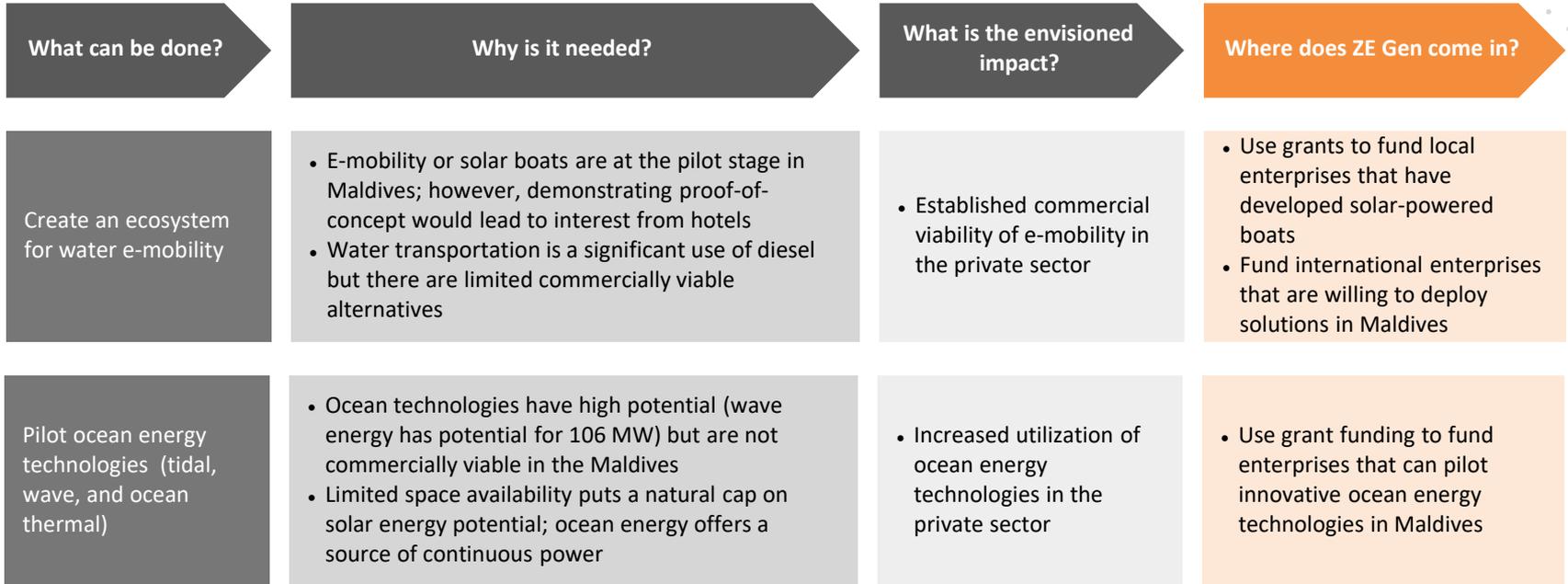
Acting as a demand & solution aggregator is needed to increase RE uptake pace. Partnering with USAID can be explored to increase impact

What can be done?	Why is it needed?	What is the envisioned impact?	Where does ZE Gen come in?
Aggregate the RE demand of hotels	<ul style="list-style-type: none">• Aggregation of RE demand through resort owners will increase the size of the project to make it attractive for foreign firms from countries like India and China to engage in Maldives• Firms like HPL Singapore own 10+ resorts in the Maldives; directly working with them will be an effective way to aggregate demand	<ul style="list-style-type: none">• Increased pace of RE uptake in the tourism sector• Well-established foreign firms delivering high quality solutions	<ul style="list-style-type: none">• ZE Gen can establish itself as a demand aggregator and use its international presence to attract foreign investors
Aggregate solutions that reduce fossil fuel usage of hotels	<ul style="list-style-type: none">• Maldives has an issue with market linkage, in that, awareness of RE solutions exists but full knowledge of benefits or access is limited at the operator level• Project experience with delays and challenges with different sub-contractors on the same project	<ul style="list-style-type: none">• Increased pace of RE uptake as there is a “one-stop-shop” for energy needs	<ul style="list-style-type: none">• Become a solution aggregator (hub-and-spoke model) that provides access to all needs for a hospitality customer like solar PV, BESS, and water e-mobility
Co-fund USAID’s SAREP	<ul style="list-style-type: none">• USAID’s SAREP has a similar mandate to ZE Gen with a focus on the private sector through increasing capacity of local institutions to access green finance and accelerate enterprises• Given overall low fund absorption capacity in Maldives, partnering with USAID could be an effective intervention	<ul style="list-style-type: none">• Further de-risking of USAID’s planned USD 10.5 Mn intervention	<ul style="list-style-type: none">• ZE Gen can partner with USAID on some aspects of SAREP’s intervention

Funding local-enterprises & tourism end-users are short-term interventions to increase the pace of RE uptake

What can be done?	Why is it needed?	What is the envisioned impact?	Where does ZE Gen come in?
Enhance the local RE ecosystem	<ul style="list-style-type: none">• Fund enterprises that have an established presence in Maldives (Renewable Energy Maldives) or those that are international but have locally registered Maldives operations (Swimsol)• Local players have better market linkage and ability to offer after sales support	<ul style="list-style-type: none">• Enhanced capacity of local players to service the RE needs	<ul style="list-style-type: none">• Fund enterprises with a local presence to install RE solutions• Use grant funding to train local engineers and service providers on installation, service, and maintenance
Directly fund the end-users	<ul style="list-style-type: none">• Luxury & mid-range resorts have some access to financing through own-funds or debt facilities; mobilizing funds takes time and high upfront costs limits the size of RE solution deployed• High cost of capital is key hurdle for RE adoption	<ul style="list-style-type: none">• Increased pace of RE uptake• Larger diesel displacement via larger capacity RE systems	<ul style="list-style-type: none">• Funding x% of the installation costs for luxury and mid-range resorts
Indirectly fund the end-users	<ul style="list-style-type: none">• Guesthouses and family-owned shacks have limited access to financing for RE solutions• Need to transition to RE is mixed as some have access to subsidies (likely to be pulled back given existing scenario)	<ul style="list-style-type: none">• Introduction of RE systems to smaller players in the hospitality sectors	<ul style="list-style-type: none">• Provide working capital financing to enterprises that can deploy RE solutions in budget hotels & guesthouses

Channeling grant funding to water transport and ocean energy can lead to high delta GHG emission pathways



Given the current scenario, co-funding DFI/MDB initiatives is the ideal target if the plan is to work with GoM

What can be done?	Why is it needed?	What is the envisioned impact?	Where does ZE Gen come in?
Utility companies buy-in as part of RE efforts	<ul style="list-style-type: none">• In the long-run, increase uptake of RE is a loss of revenue for the state utility firms; ensuring their buy-in is crucial• Utility firms have trained servicemen, stronger logistics, and local knowledge that can be leveraged; recurring AMC is a challenge for RE suppliers (especially international firms)	<ul style="list-style-type: none">• Buy-in from utility firms in the short-run could mean part of the after-sales is handled by them	<ul style="list-style-type: none">• Use grant funding to train the servicemen and engineers on RE installation and maintenance• Work with enterprises to establish utility companies as part of business model
Co-funding with DFIs/MDBs	<ul style="list-style-type: none">• DFIs (especially ADB and WB) have long-standing projects working with the government to install RE solutions, modernize grid, and introduce BESS• Overall fund absorption capacity is low in Maldives	<ul style="list-style-type: none">• Lower the cost of capital offered by DFIs further• Increase project duration & planned impacts	<ul style="list-style-type: none">• Co-fund the existing DFI/MDB initiatives to deepen the planned impact• Explore co-funding opportunities with private sector arms of DFIs
Fund the existing government programs	<ul style="list-style-type: none">• Maldives has a limited capacity for fund absorption (especially in the smaller islands); maxing out the existing programs by de-risking the initiatives or lowering cost of capital is an effective solution	<ul style="list-style-type: none">• Increased success of government programs like Avikatha (RTS scheme)	<ul style="list-style-type: none">• ZE Gen can come-in as a source of patient capital & capacity builder with appropriate risk mitigation tools (currency convertibility)

The highest impact solutions for Maldives are with the utilities to modernize the grid and reduce national dependence of diesel

What can be done?	Why is it needed?	What is the envisioned impact?	Where does ZE Gen come in?
Strengthen the RE ecosystem by modernizing the grid	<ul style="list-style-type: none">• Maldives has an old grid infrastructure which lack modern capabilities like energy management system and smart meters• The government and utility companies recognize that this prevents wide-scale adoption of RE but cannot lead wide-scale investments	<ul style="list-style-type: none">• Improve overall financial health of the state utility companies• Strengthen the grid to increase uptake of RE solution	<ul style="list-style-type: none">• Co-fund initiatives with other DFIs to modernize the grid• Aggregate grid modernization efforts to make it attractive for foreign firms
Enhance the uptake of RE solutions by increasing the availability of utility-scale BESS	<ul style="list-style-type: none">• The lack of utility-scale storage compounds the issues of a poor grid infrastructure as BESS is needed to handle the variability of RE solutions	<ul style="list-style-type: none">• Strengthen the BESS ecosystem in Maldives• Strengthen the grid to increase uptake of RE solution	<ul style="list-style-type: none">• Co-fund BESS initiatives with other DFIs• Fund BESS enterprises with a presence in Maldives to install and maintain BESS
Increase inter-connectedness between islands in an Atoll	<ul style="list-style-type: none">• The cost of electricity generation is nearly 2-3x higher on smaller islands (with smaller gensets); inter-connectedness will allow for more efficient generation• Inter-connectedness will additionally increase uptake of RE solutions in the long-run as connection	<ul style="list-style-type: none">• Lower cost of generation and higher efficiency even in the current diesel genset usage scenario	<ul style="list-style-type: none">• Co-fund grid interconnection investments of the utilities• Target installation of RE solutions in Atolls where demand can be aggregated

The Maldives is undergoing a BoP crisis which will impact government subsidies and national development projects

What is happening?

From All India Radio (gov.in),

MMA Reports Decline In Foreign Reserves In Maldives

From Firstpost Online,

Is the Maldives facing a currency crisis? Has it run out of dollars?

- Maldives is facing a shortage of usable dollars with supplies down 33% y-o-y
- Loans from external lenders India and China are due with China working on a grant package of USD 130 Mn and a grace period of 5 years

Insights: Grace period unlikely to solve the problem as the current governance and economic structure is unsustainable. Immediate impact to be felt on subsidy programs and long-term development programs

Why is Maldives in this situation?

1

Lack of revenue diversification

- 90% of tax revenue comes from **tourism-related taxes & import duties**
- Tourism accounts for **28% of GDP and 60% of FX receipts**

2

Deficit-funded growth

- Reliance on external aid and loans from nations like India/China & organizations like WB
- Funds supported a costly bureaucracy & civil servants body with monthly bill of USD 65 Mn/month

3

Unsustainable subsidies & imports

- Aid and loans used for funding mega-infra projects and for extending subsidies for fuel and **electricity (subsidized by 60-70%)**
- Fuel is heavily subsidized and accounts for **~10-15% of imports**

4

Susceptibility to external shocks

- Heavy dependence on tourism and fuel imports makes the economy susceptible to external events
- **Debt rose from USD 3 Bn in 2018 to USD 8 Bn in 2023** due to COVID-19 and Russia-Ukraine war

The BoP crisis prevents ZE Gen from funding grid modernization efforts which are the most impactful for long-term RE uptake

Implications



Avoid government projects

Advisable to not work with government on grid modernization or to take-up government supported tenders as development projects will stall & payments might be delayed



No grant funding

Avoid grant funding for government agencies or utility companies as it will likely be utilized for immediate needs to service debt or provide services



Subsidies to dry-up

Anticipated that diesel subsidies & limited RE subsidies that the government provides will be delayed or will dry-up



Tourism focus

Anticipated government push for tourism (measures like visa relaxation) to increase the flow of FX into the country and generate revenues for the government

Mitigation plan

Support local, private RE enterprises to install RE solutions
Why: Require alternate support to continue activities and likely to immediately work on small-scale projects than international enterprises

Target private hospitality sector players and replace their diesel usage
Why: Industry of national importance, faster decision making, and little impact of subsidy dry-up

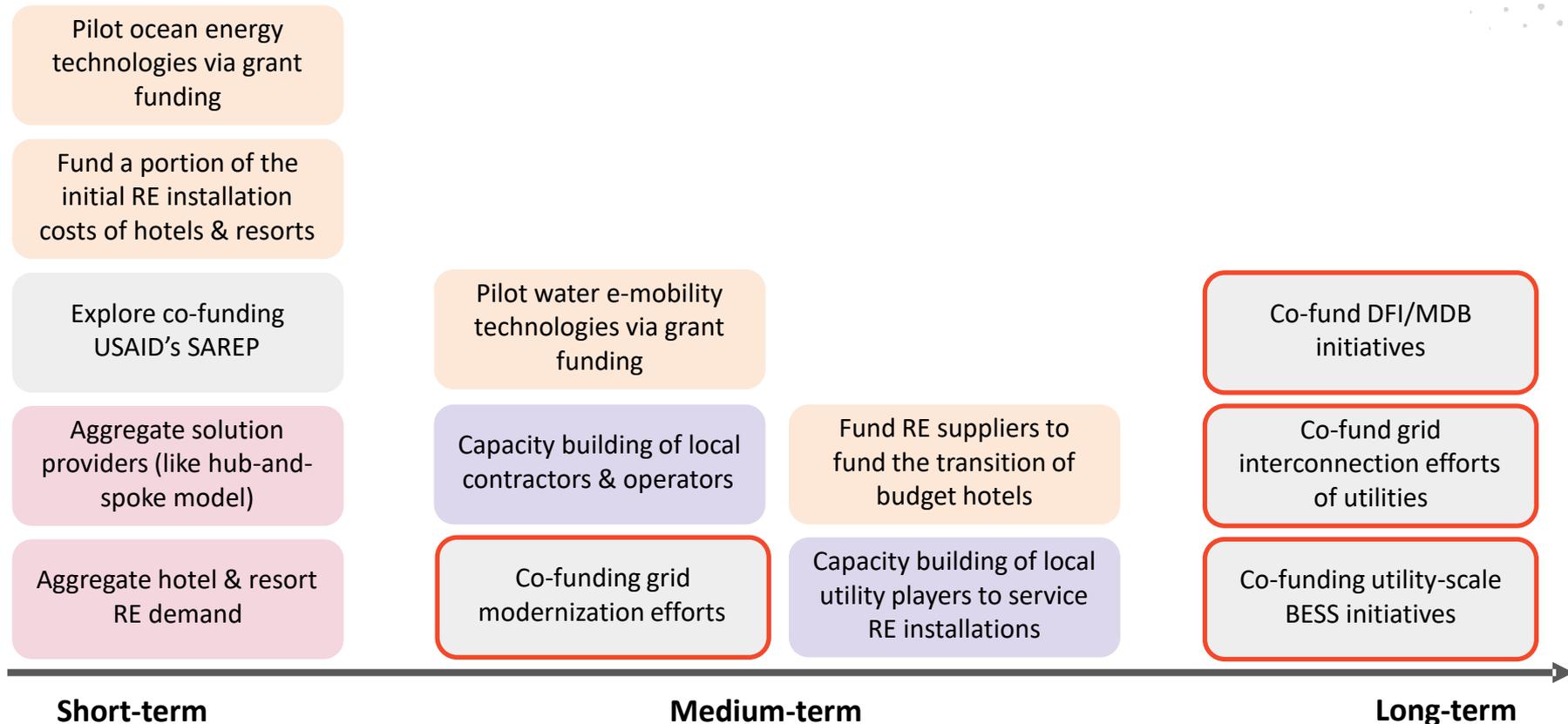
Co-fund government supported tenders to install RE solution once the crisis is under control
Why: Reduces national dependence on fuel imports and accelerates goal to RE targets

Co-fund state utilities' grid modernization efforts which includes increasing storage capacity, grid connectivity, and installing energy management systems
Why: High impact solution that is required to increase grid-connected RE solutions and overall uptake of RE

Short-term

Long-term

Targeting RE installation in hotels is ideal short-term intervention; in long-run ZE Gen can target utility-scale interventions



Abbreviations

Abbreviations

ADB	Asian Development Bank
AMC	Annual maintenance contract
ARISE	Accelerating Renewable Energy Integration and Sustainable Energy project
ASPIRE	Accelerating Sustainable Private Investments in Renewable Energy project
BESS	Battery energy storage solution
BML	Bank of Maldives
BoP	Balance of payments
DBFOOT	Design, build, finance, own, operate and transfer
DFI	Development finance institutions
DG	Diesel generator
FDI	Foreign direct investments
GHG	Greenhouse gases
GoM	Government of Maldives
MCCEE	Ministry of Climate Change, Environment and Energy
MIB	Maldives Islamic Bank
MTCC	Maldives Transport and Contracting Company
NDC	Nationally Determined Contribution
OTEC	Ocean thermal energy conversion
POISED	Preparing Outer Islands for Sustainable Energy Development project
RE	Renewable energy
SAREP	South Asia Regional Energy Partnership
SBI	State Bank of India
URA	Utility Regulatory Authority
WB	The World Bank
WTE	Waste-to-energy
WTP	Willingness-to-pay



THANK YOU