

# Micro-grid System to Reduce Carbon Emissions in Maldives

Toshiba Energy Systems & Solutions Corporation



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## Micro-grid System in Addu City, Maldives

#### The first Project of JFJCM\*

\* Japan Fund for the Joint Crediting Mechanism



# Background

- Demand increase of Addu atoll is 8-9% per year.
- Enhancing supply capability is necessary but the fuel cost of diesel generator is critical issue.
- On the other hand, renewable integration for carbon emissions is expected

# Project Outline

- Funded by ADB (Asian Development Bank) with JFJCM
- Installation of micro-grid system to reduce CO2 (=fuel cost)

# **Issue of the Project**

Renewables address the issue of demand increase?

# The answer is NO. Because.. Renewables save "kW" but need "⊿kW"



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# **Power Source Comparison**



#### Forgetting the initial cost, DG+RE+Battery is the best solution.

# **Key Products for Micro-grid**



EMS (Energy Management System)

Highly reliable technology based on Japanese central dispatching system



Supporting hydrogen control

#### **Batter** PV output (forecast) (schedule Discharge Discharge 0 Charge Charge 24 Hour



#### BESS (Battery Energy Storage System)

- Extreme long life rather than the other kind of Li-on batteries 85% remaining capacity after 15,000 cycles
- Proven safety by crash and nail penetration test



No fire!

# **EMS Functions**



# **Battery System**

#### Providing panels or containers according to the customers requirements



#### **Battery Life Cycle Evaluation**

# 85% remaining capacity after 15,000 cycles



#### **System Outline**

**µEMS controls diesel generators and battery system** to stabilize the system and to reduce the fuel cost



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# Challenges

#### Technical Challenges

 To keep the balance between supply and demand under the large amount of renewable integration (more than 20% PV ratio)

#### Operational Challenges

- Power dispatching by EMS automatically (change the traditional operation routine)
- Obtaining the knowledge of trouble shooting

#### Economical & Environmental Challenges

- Fuel cost reduction of diesel generators
- CO2 emissions

# **Current Status and Future Plan**

- EMS and Battery system have already been on site.
- Due to the COVID-19, we are looking for the timing to resume the project
- Site commissioning and training for operators are still remaining
- After the operation starts, project team will measure the reduction of fuel and calculate equivalent CO2 emissions
- This micro-grid system is very typical use case and can be applied for the other islands.





# Thank you.

