

# Mitsubishi Gas Engine Generator set Introduction

Mitsubishi Heavy Industries Engine Systems Asia Pte. Ltd.

# Organization of Engine & Energy division

Mitsubishi Heavy Industries  
(MHI)



Transportation Systems



LNG Tanker



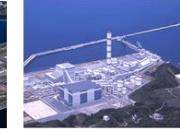
Aircraft



H-IIA Rocket



GTCC Power Plant



Conventional Power  
Plant



Chemical Plant



CO2 Recovery  
Plant

Growth Strategy Office

Mitsubishi Heavy Industries Asia Pacific(MHI-AP)

① Mitsubishi Heavy Industries Engine & Turbocharger(MHIET)

② MHIES-A (Singapore)



Generator Set(MGS)



Bare Engine (Land & Marine)



Service and Parts



Design  
Engineering



Assembly &  
Testing



Onsite  
Installation



Aftersales  
Service



Parts &  
Accessories



⑤ MHIES-V  
(Vietnam)

④ MHIES-P  
(Philippines)





③ MHIES-I  
(Indonesia)



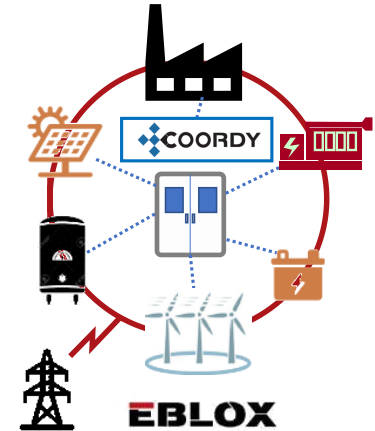
- ① Mitsubishi Heavy Industries Engine & Turbocharger, Ltd.
- ② Mitsubishi Heavy Industries Engine System Asia Pte. Ltd.
- ③ PT. MHI Engine System Indonesia
- ④ MHI Engine System Philippines, Inc.
- ⑤ MHI Engine System Vietnam Co., Ltd.

# Line up of Mitsubishi GenSets



Fuel	Gen-set Model		Output(kW)					
			0	500	1000	1500	2000	
Diesel	MGS							
Bio Diesel								
Gas	MGS-G		 <div>5001,500</div>					
Bio Gas								
			50Hz			60Hz		
Genset Model		MGS0500G	MGS1000G	MGS1500G	MGS0450G	MGS1200G		
Output	kW	500	1000	1500	450	1200		
Engine model		GS6R2-PTK	GS16R2-PTK	GS16R2-PTK	GS6R2-PTK	GS16R2-PTK		
Speed	min <sup>-1</sup>	1500	1000	1500	1200	1200		
Gen. Eff.	%	40.2	44.0	41.0	42.7	42.7		
Hot water	%	19.6	13.5	12.7	20.4	11.7		
Exhaust heat	%	21.3	19.6	21.0	20.3	21.5		
Total Eff.	%	81.1	77.1	74.7	83.4	75.8		
NOx emmission at O <sub>2</sub> =0%	ppm	200	200 with de-Nox system	320	200	320		

## Triple Hybrid System [EBLOX]



## 【 Hydrogen engine Gen-set 】



Under Development



## 【 CO<sub>2</sub> Capture system 】

Under Verification

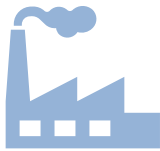




# Line up of Mitsubishi GenSets



IPP



Plant



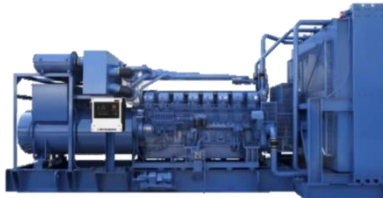
Hotel



Stadium



Hospital



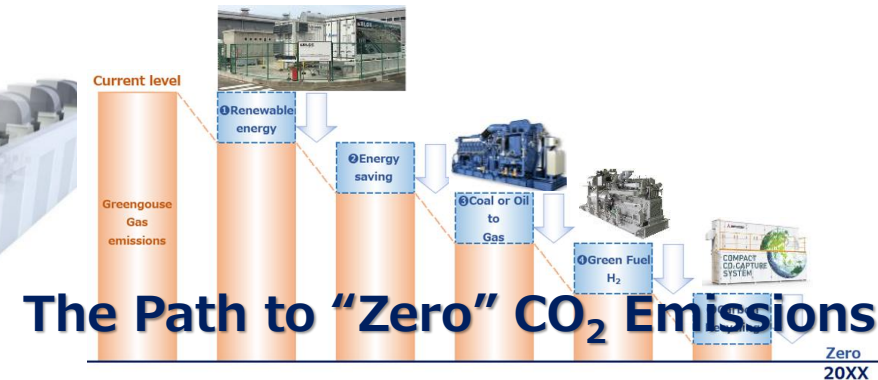
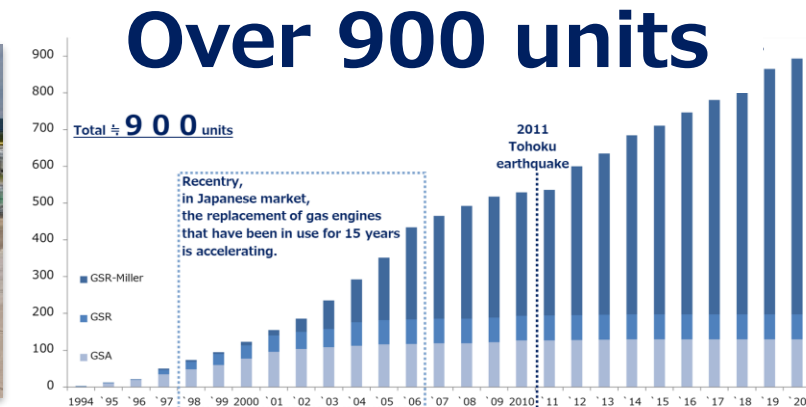
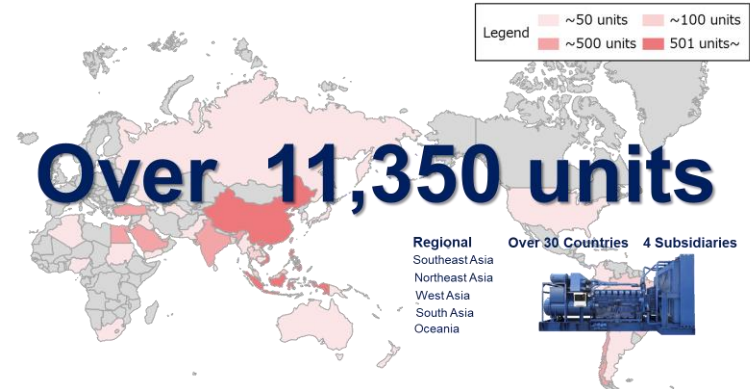
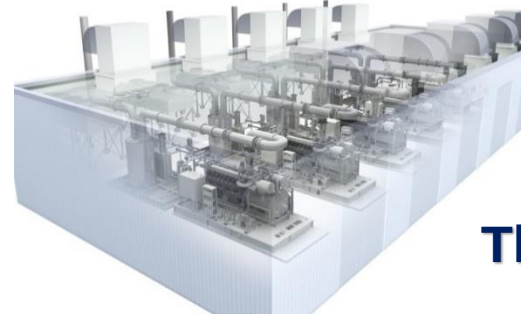
Diesel, Biodiesel



Gas, Biogas



Hydrogen



# Application of Gas GenSets



Commercial buildings  
Residential buildings  
Hospital, Airport, Data Centers



Alternate unreliable  
grid power  
Factory



Grid parallel  
Independent power supply  
Mega factory



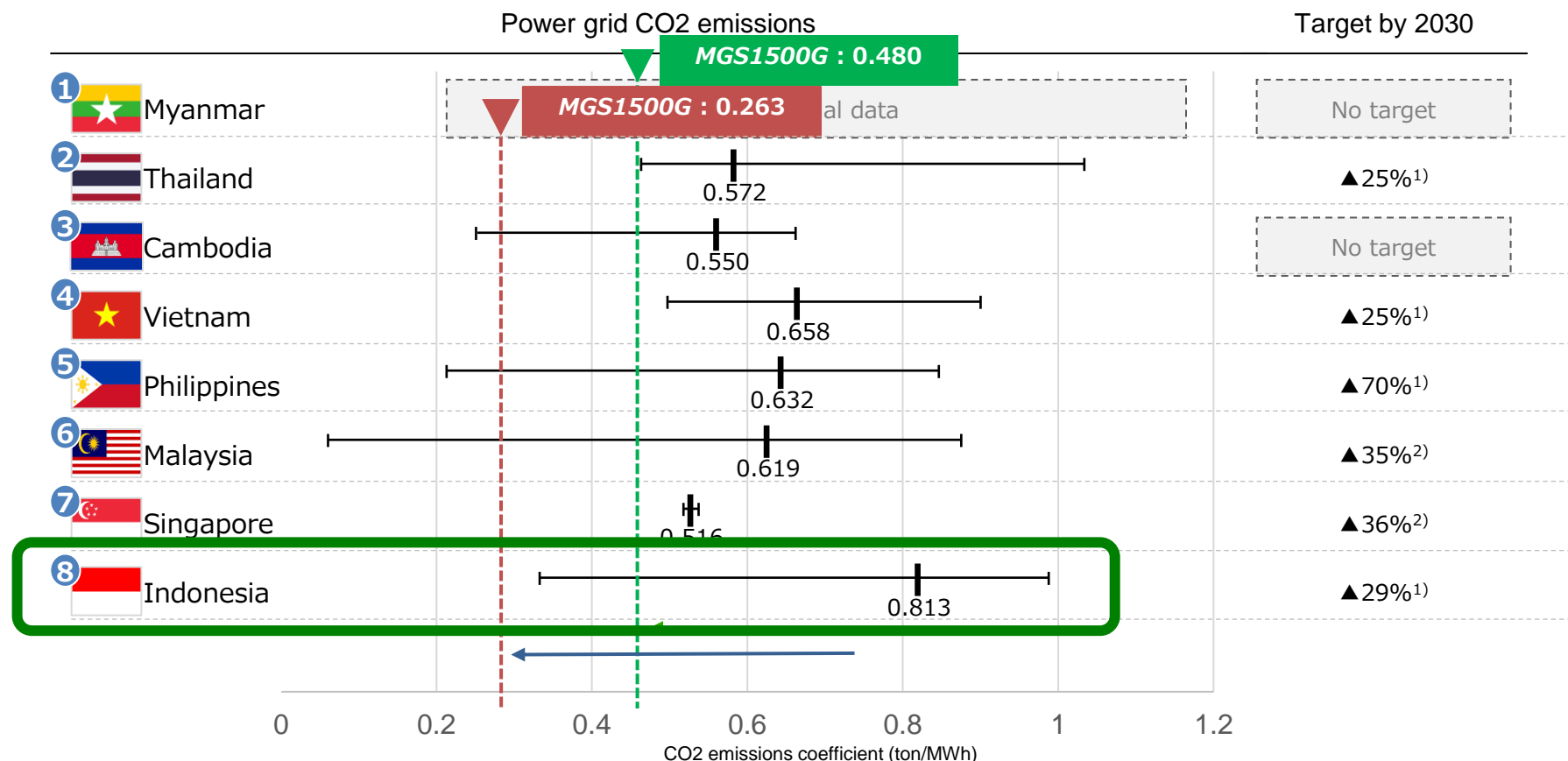
Engine Type		GS16R2-PTK
Generator Output	kW/set	1,000kW
Unit	set	5
Client	-	Urban Area District Heating
Location	-	Tokyo, Japan

Engine Type		18KU30GSI
Generator Output	kW/set	5,500kW
Unit	set	6
Client	-	IPP
Location	-	Indonesia

Engine Type		GS16R2-PTK
Generator Output	kW/set	1,500kW
Unit	set	50
Client	-	IPP
Location	-	Russia

# Gas GenSets Cuts CO2 Emissions

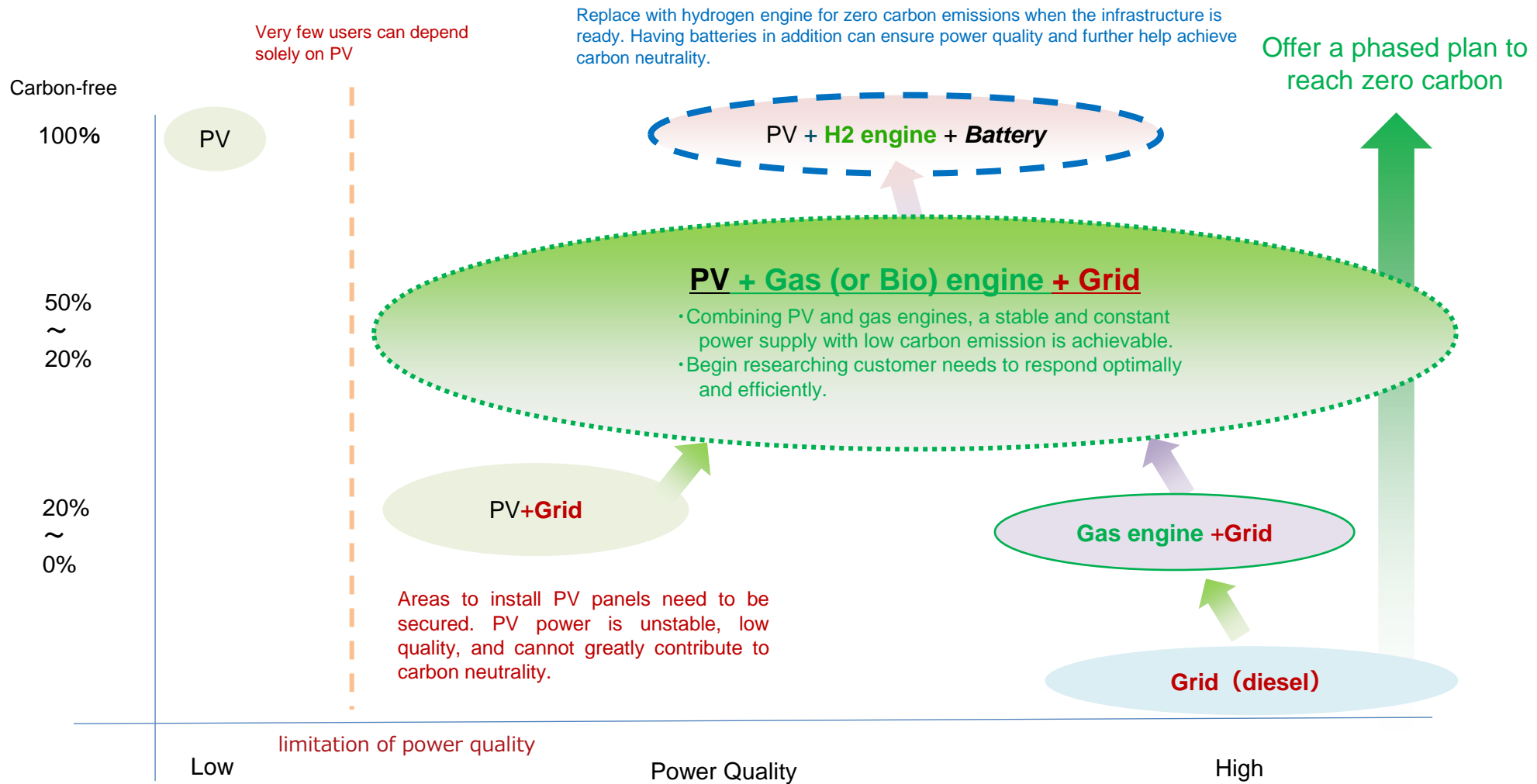
CO2 emission rates in Southeast Asia are higher than in Japan. Because of its high electrical efficiency, gas engine gensets can drastically contribute to cut CO2 emissions.



1. Compared with BAU (no additional effort made to reduce emissions); 2. Compared with 2005 (real GDP)

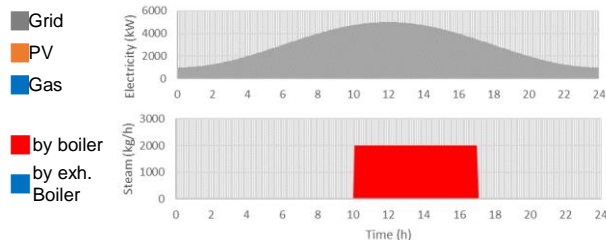
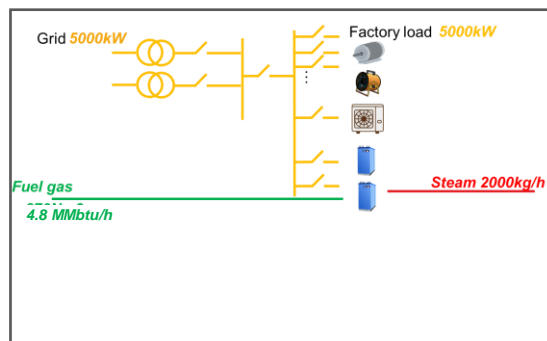
Source: <https://www.iges.or.jp/>

# Gas GenSets Offers a Solution for the Journey to Net Zero

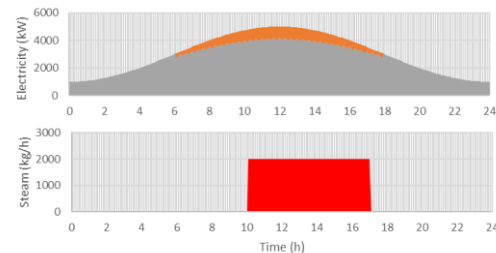
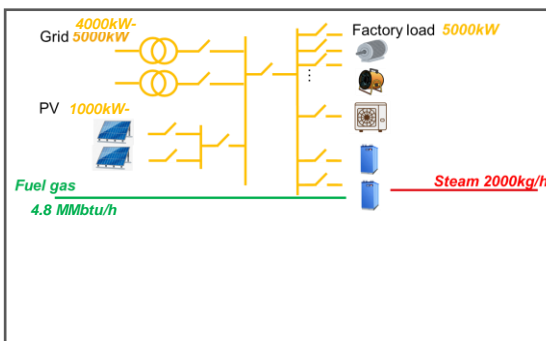


# CO2 Reduction Rate in PV and Gas GenSet CHP Solution

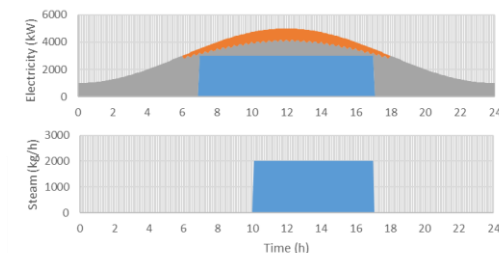
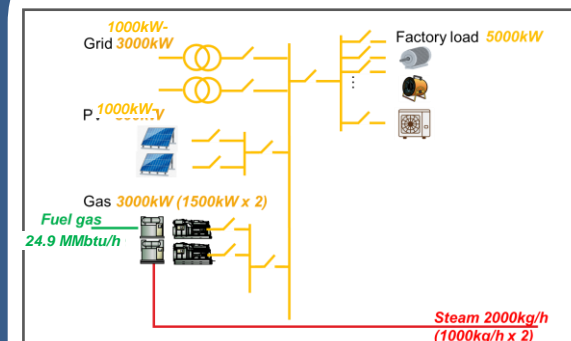
## Grid + Gas-fired boiler



## Grid + PV + Gas-fired boiler



## Grid + PV + Gas GenSet CHP



### Daily Energy consumption

Total Electricity consumption	kWh		72,100	72,100	72,100
Electricity from Power grid	kWh	(A)	72,100	64,363	34,063
Electricity from PV	kWh		0	7,737	7,737
Electricity from Gas engine	kWh		0	0	30,300
Total fuel gas consumption	MMbtu	(B)	33.38	33.38	252.17
Fuel gas consumption for Boiler	MMbtu		33.38	33.38	0.00
Fuel gas consumption for Gas engine	MMbtu		0.00	0.00	252.17

### Daily CO2 emission

CO2 emission from power grid	t/day	(A) * (C)	47.4	42.4	22.4
(C) CO2 emission rate: 0.658t/MW					
CO2 emission from fuel gas	t/day		1.8	1.8	13.3
(D) CO2 emission rate: 52.91kg/MMbtu		(B) * (D)			
<b>Total CO2 emission</b>	t/day		<b>49.2</b>	<b>44.1</b>	<b>35.8</b>

**CO2 reduction rate**

%

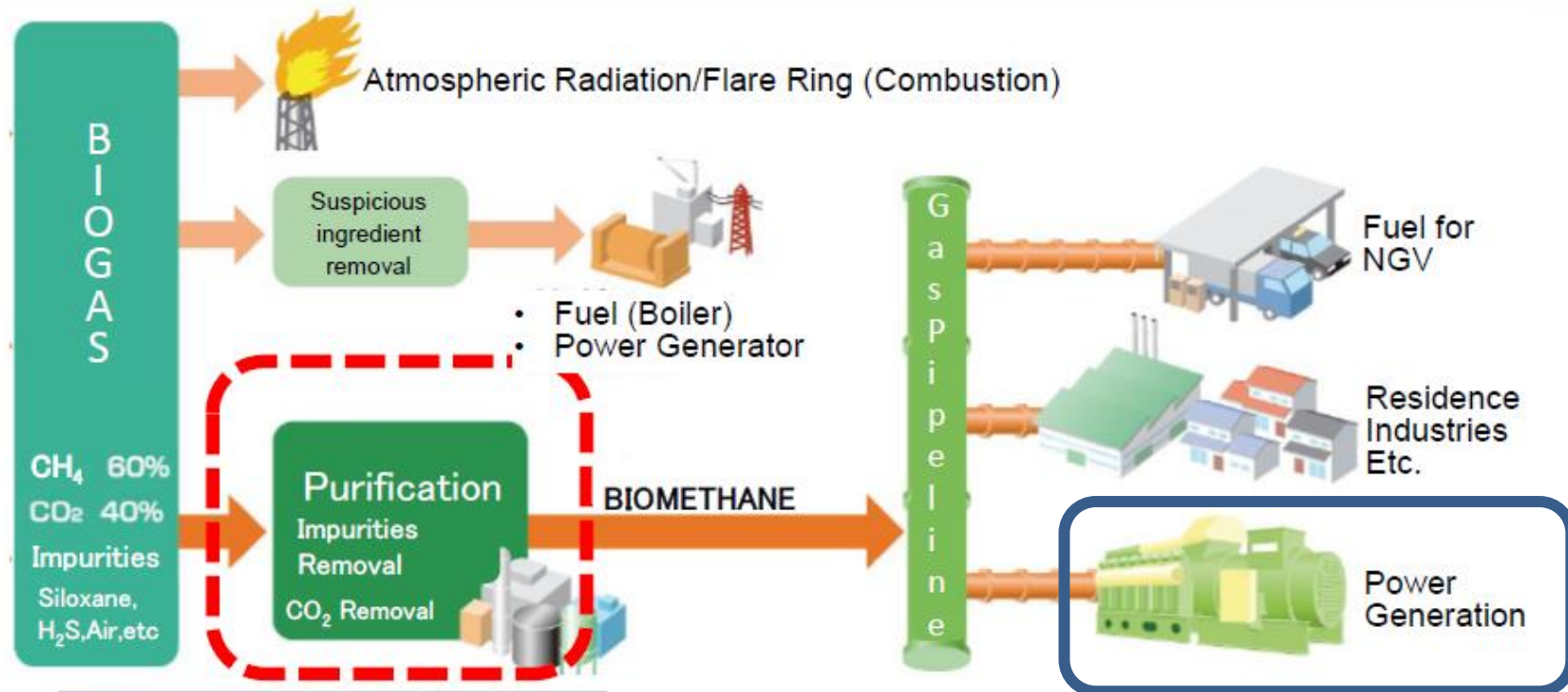
**0.0**

**Δ 10.3**

**Δ 27.3**



# Utilization of Biogas (PT Osaka Gas Indonesia)



Biogas Purifier in Thailand  
made by Osaka Gas since 2015

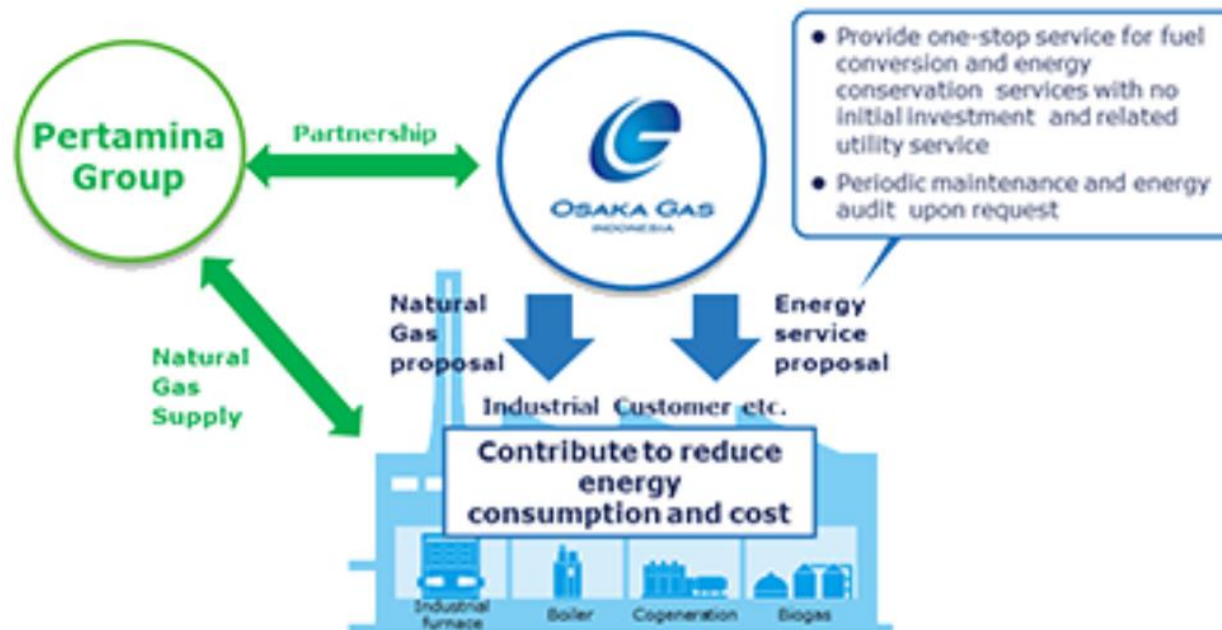


Pipeline injection  
since 2010

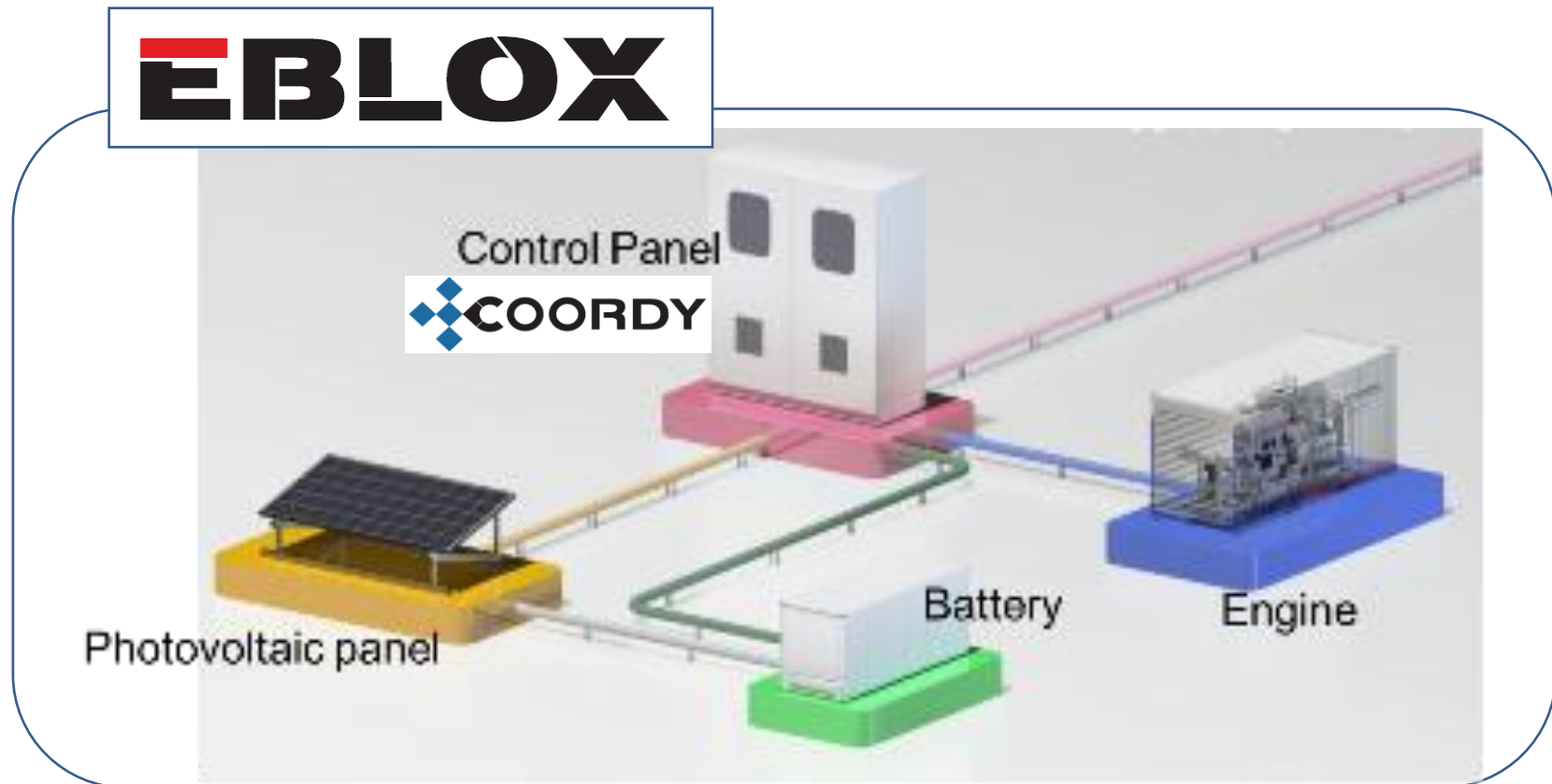


NGV Station

- ◆ Provide one-stop service for fuel conversion and energy conversion services with no initial investment and related utility service
- ◆ Periodical maintenance and energy audit upon request
- ◆ Apply potential subsidy with JCM by Japanese government

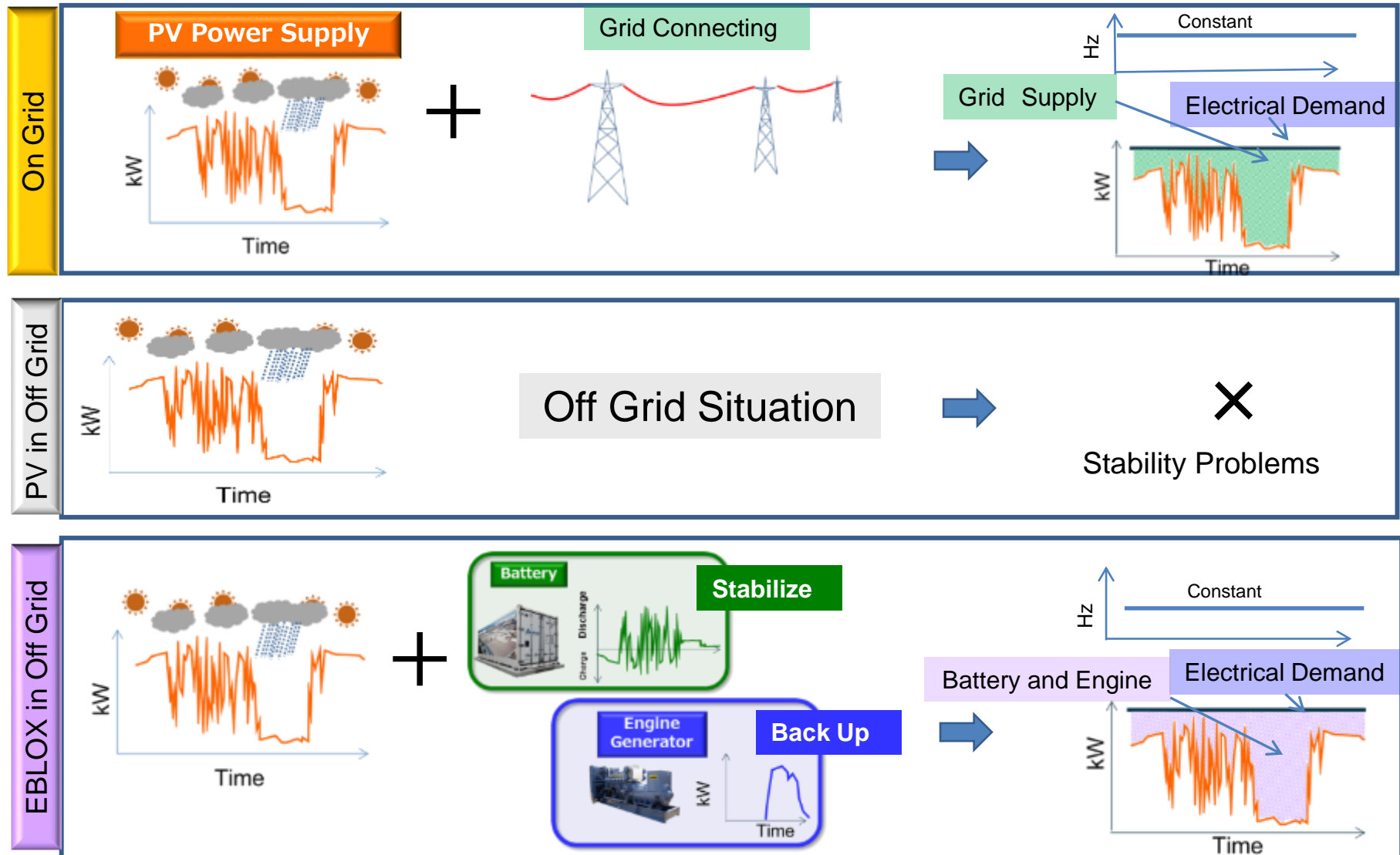


- ◆ MHIET has developed a “triple hybrid” autonomous power supply system that combines renewable energy such as solar power with a reciprocating engine generator and storage battery, allowing for optimal stabilization control in island mode operation.



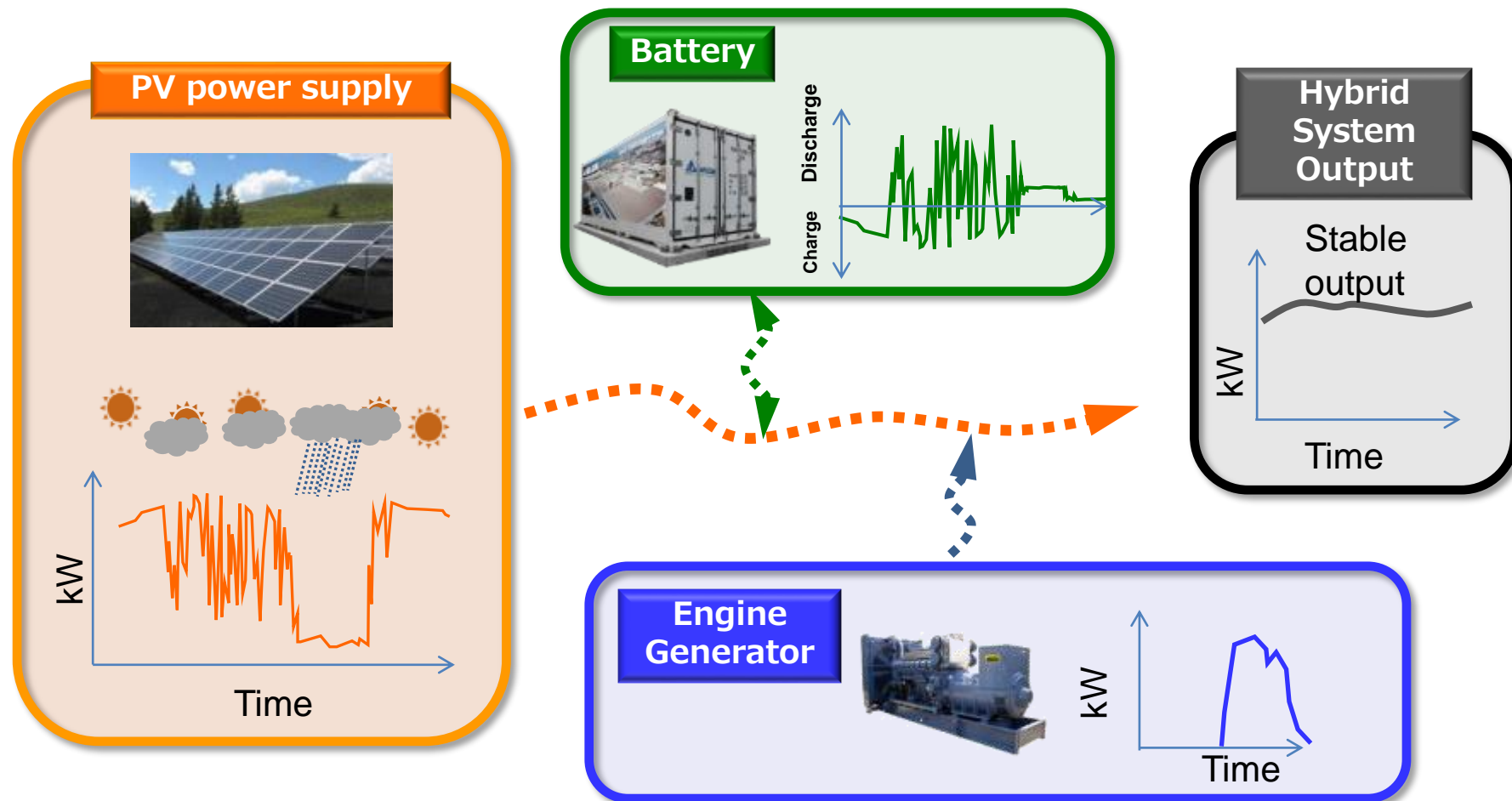
**Triple Hybrid Power Generation system**

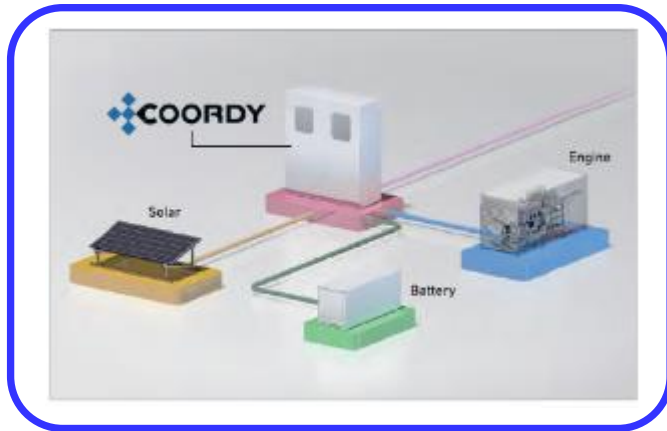
## ◆ Off grid solution



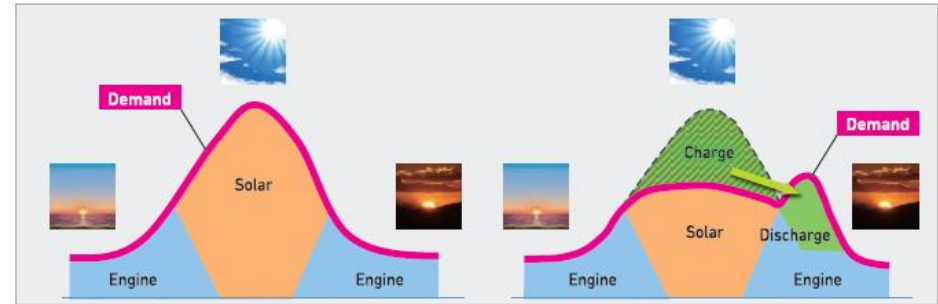


- ◆ PV power output is fluctuated with the influence of clouds.
- ◆ Battery stabilizes the fluctuation of the PV output with charging and discharging effectively.
- ◆ Engine is operated without interruption of supplying power.

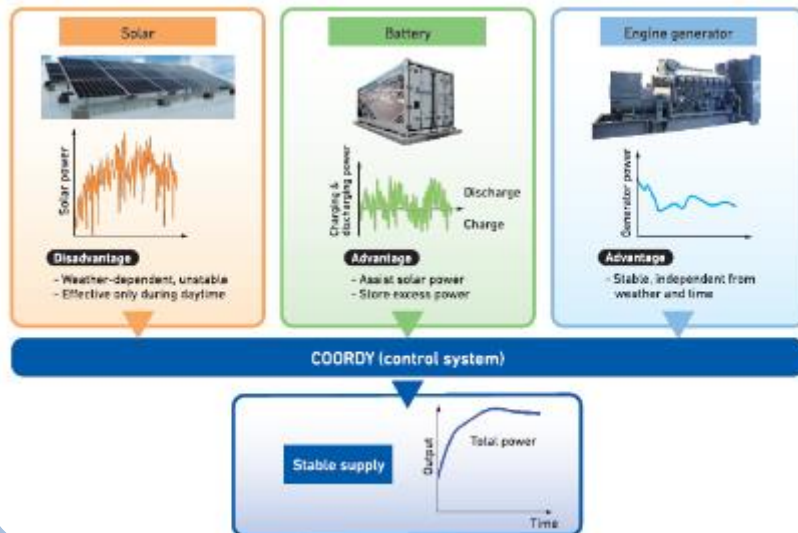




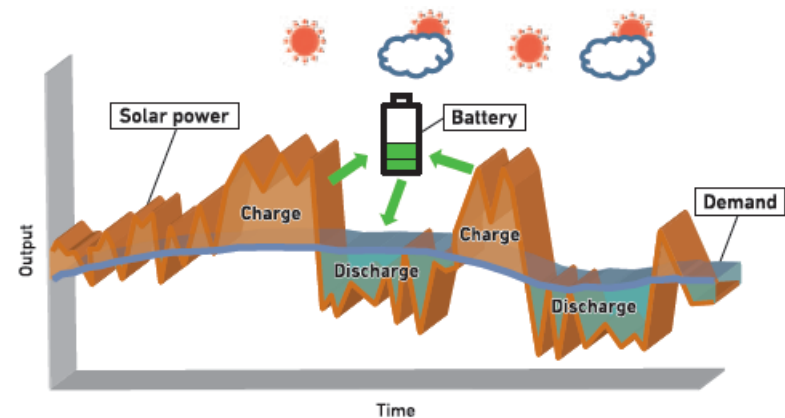
## 2. Power Resources Management

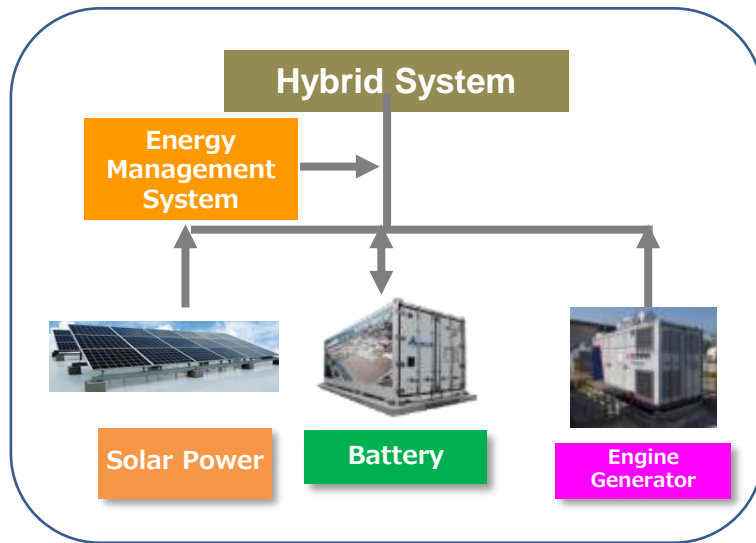


## 1. Grid Stabilization



## 3. Optimum Control of Battery





Power supply  
for Mining



New industrial park



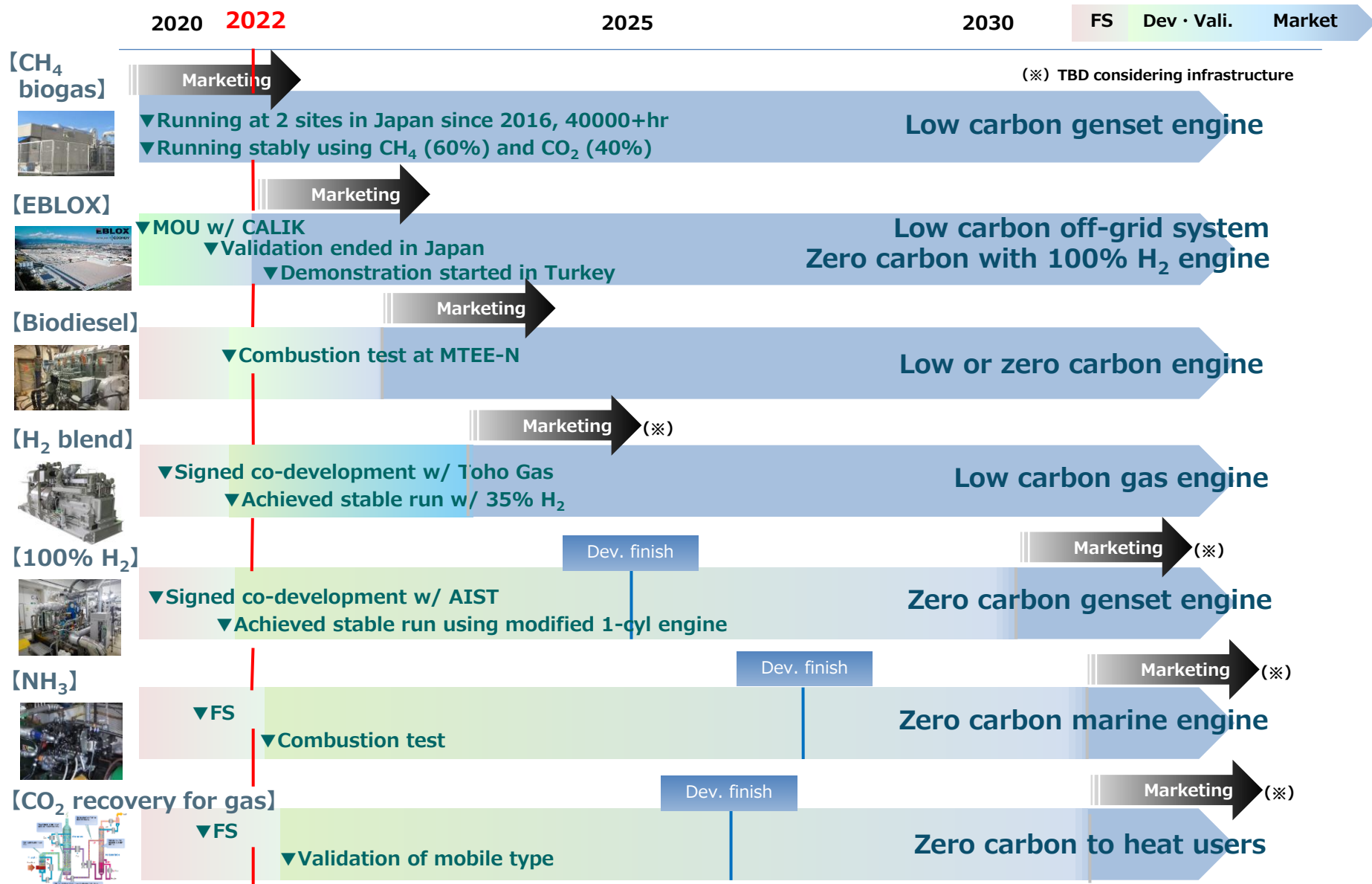
Small Town in Off-grid Area



Remote Islands



# Product Development for Carbon Neutrality





**MOVE THE WORLD FORWARD**

**MITSUBISHI  
HEAVY  
INDUSTRIES  
GROUP**