

# **HYBRID ENERGY SYSTEM INSTALLED ON WORK-VESSEL KOKAKU & KAKURYU**

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THE WORLD DREDGING CONGRESS AND EXPOSITION XXI

THE HYATT REGENCY MIAMI

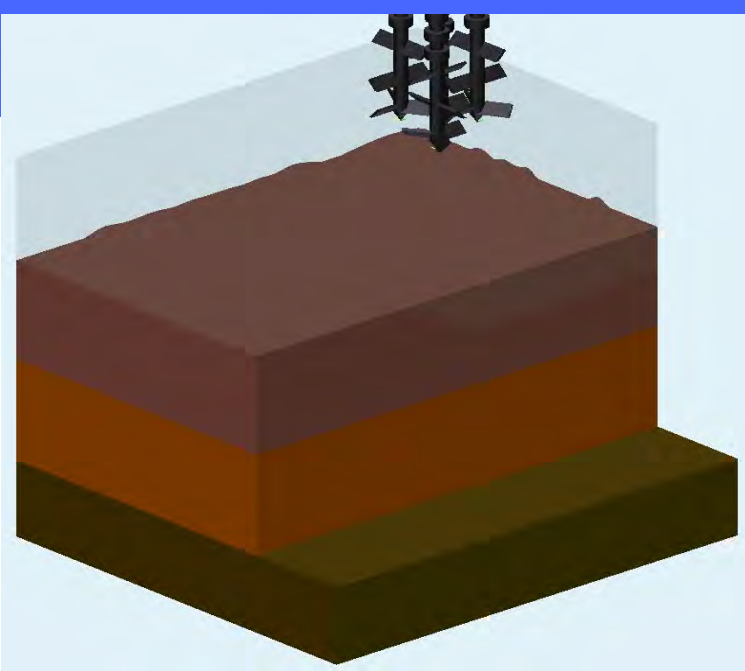
# ***CONTENTS***

- Cement Deep Mixing (CDM) introduction
- Effort to reduce burden on the environment in CDM method
- Our vessels with Vessel Hybrid Energy System introduction
- Component of the Work Vessel Hybrid Energy System
- Automated Generator Start - Stop System

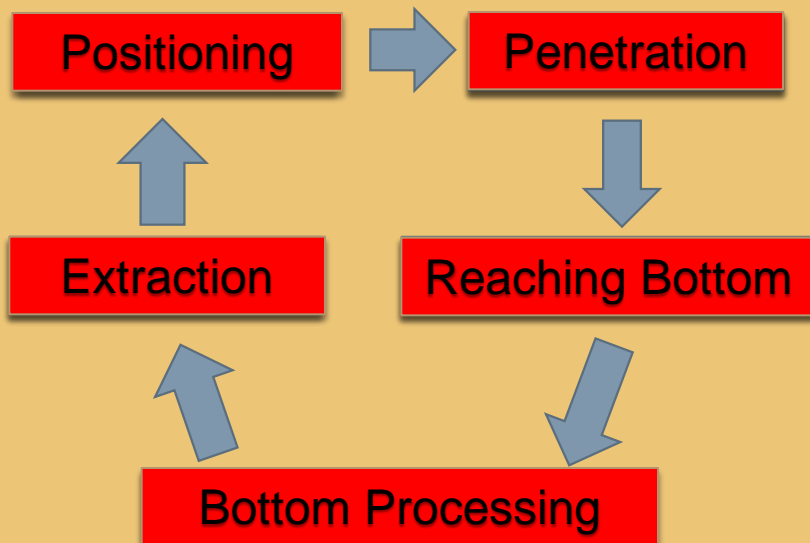
***CEMENT DEEP MIXING  
(CDM) METHOD***

# ***CEMENT DEEP MIXING METHOD***

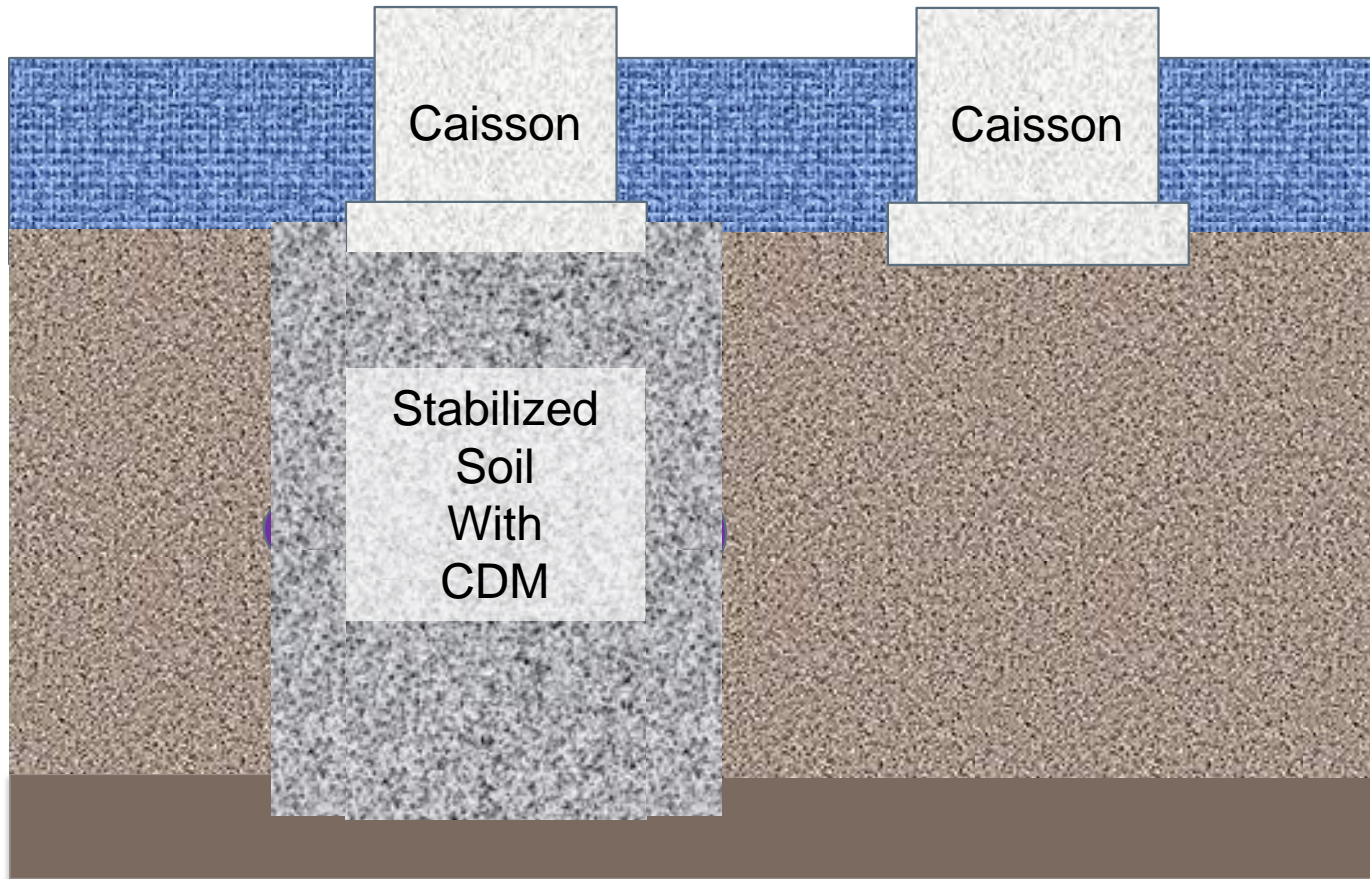
- A method of deep mixing soil stabilization
  - Mixing soft soil and stabilization agent
- KOKAKU : CDM work vessel



Cyclic work process

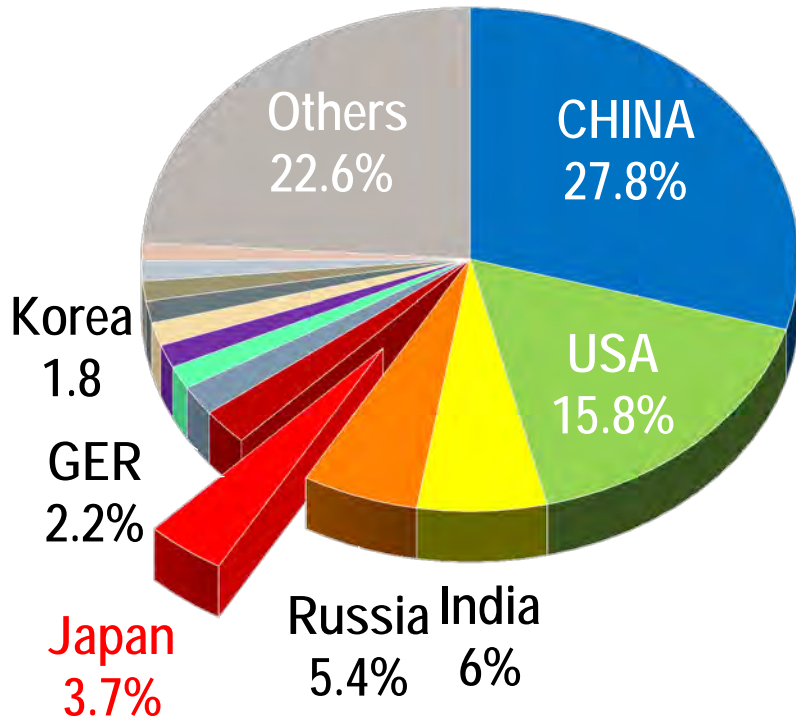


# ***CEMENT DEEP MIXING METHOD***



***EFFORT TO REDUCE BURDEN  
ON THE ENVIRONMENT  
IN CDM METHOD***

# Total emission : 32.6 billion tons



Construction Industry in Japan

**12,000,000 tons**



## HYBRID ENERGY SYSTEM

Increased energy efficiency

Use of Natural Energy

# ***WORK VESSELS WITH HYBRID ENERGY SYSTEM***

## ***1.KOKAKU***



# 黄鹤

KOUKAKU



The background of the slide features a large, blue and red industrial vessel, the KOUKAKU, on a body of water. The vessel has a tall, complex structure with various cranes and platforms. The name 'KOUKAKU' is visible on the side of the vessel. In the top right corner, the Chinese characters '黄鹤' (Yellow Crane) are displayed in a large, stylized font with a yellow and grey gradient. Below the characters, the name 'KOUKAKU' is written in a smaller, grey font. The overall scene is set against a light blue sky and water.

**KOKAKU**

黄鹤

KOUKAKU

- “黄鹤” = “Yellow Crane”
- CEMENT DEEP MIXING VESSEL
- SPECIFICATIONS
  - Length : 70m (230 ft.)
  - Width : 32m (105 ft.)
  - Draft : 4.5m (15 ft.)
  - Tower : 61m (200 ft.)
  - Improve area : 5.5m<sup>2</sup> (59 ft.<sup>2</sup>)
  - Improve depth : 52m (171 ft.)
  - Torque : 7.5 ton-m  
(54,233 lb.-ft.)
  - Axis : 4



「黄鶴」  
こうかく

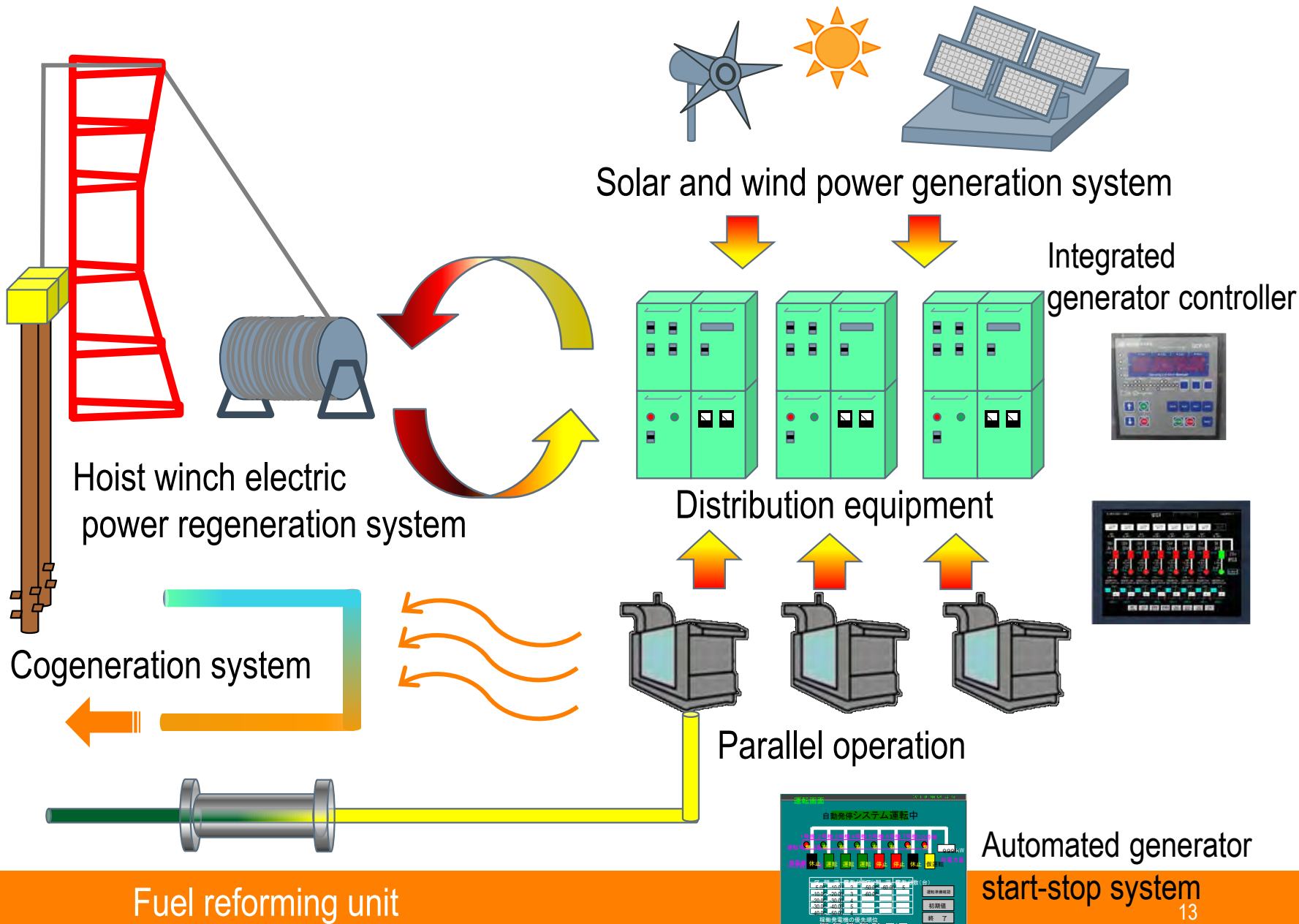
環境配慮型深層混合処理船

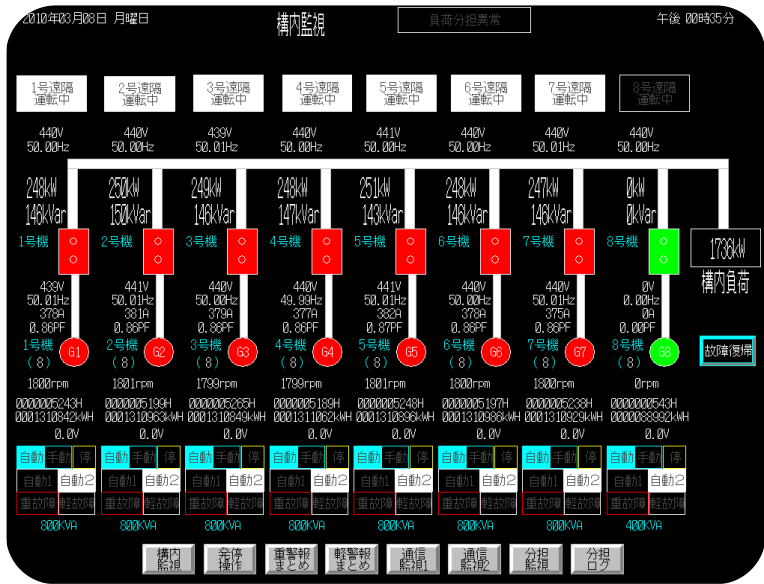
KOUKAKU soil improvement vessel

- 環境配慮型深層混合処理船「黄鶴」の特長
- エネルギーの高効率化と自然エネルギーの利用による  
作業船ハイブリットシステムを採用
- 発電機負荷を監視し、発電機の運転台数を制御する負荷制御システム
  - 昇降ウインチ電力回生システム
  - 発電機の排熱を利用したコージェネレーションシステム
  - 太陽光と風力を併用した自然エネルギー発電システム
  - 太陽光発電の効率を高める太陽光追尾システム

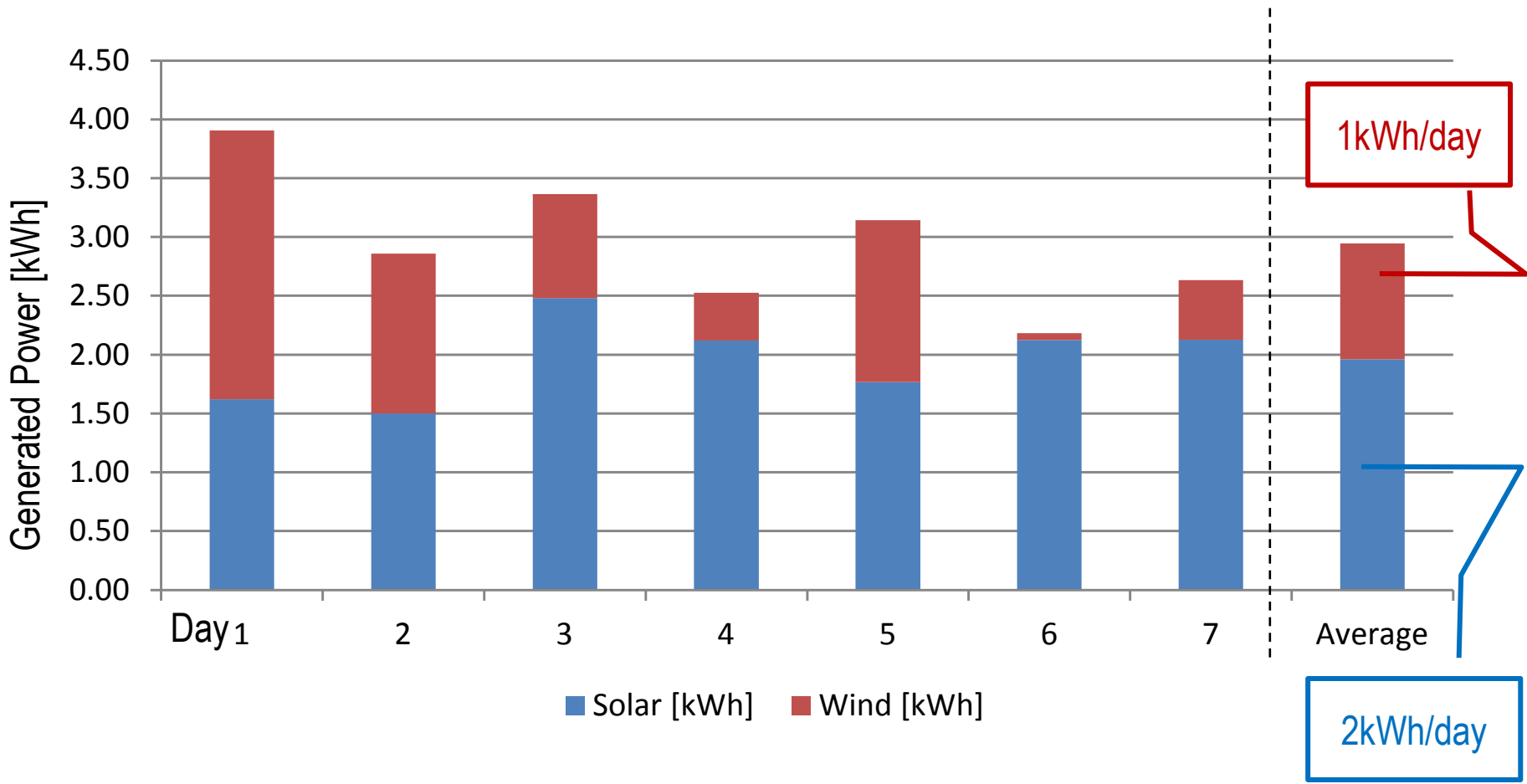
***COMPONENT OF THE WORK  
VESSEL  
HYBRID ENERGY SYSTEM  
ON KOKAKU***

# HYBRID ENERGY SYSTEM ON KOKAKU





# GENERATED POWER BY SOLAR AND WIND



# ***WORK VESSELS WITH HYBRID ENERGY SYSTEM***

## ***2.KAKURYU***



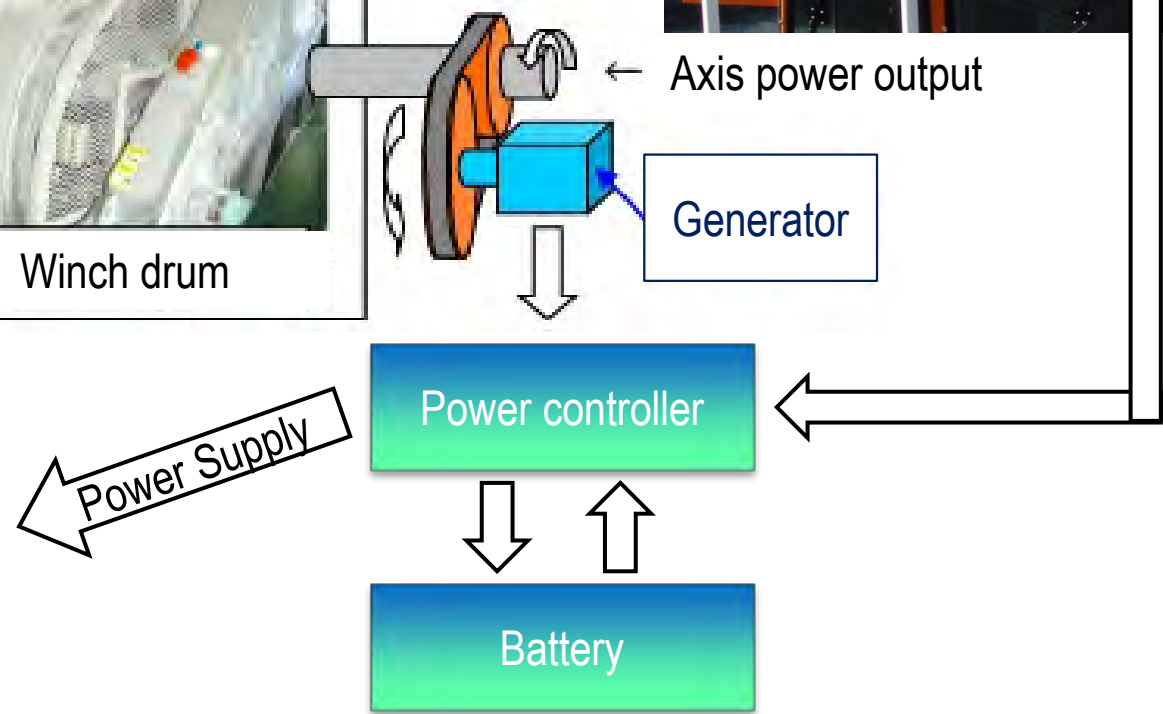


# KAKURYU

- “鶴隆” = “Prosperous Crane”
- Pile driving vessel
- SPECIFICATIONS
  - Length : 76m (249 ft.)
  - Width : 30m (98 ft.)
  - Draft : 6m (20 ft.)
  - Jib Length : 59m
  - Load rating :600ton
  - Leader length : 80m (263 ft.)
  - Leader tilt angle :  $\pm 25^\circ$
  - Pile load rating :100ton
  - Pile diameter :  $\Phi 0.6$  to 2.5m  
( $\Phi 2$  to 8 ft.)

***COMPONENT OF THE WORK VESSEL  
HYBRID ENERGY SYSTEM  
ON KAKURYU***

# HYBRID ENERGY SYSTEM ON KAKURYU



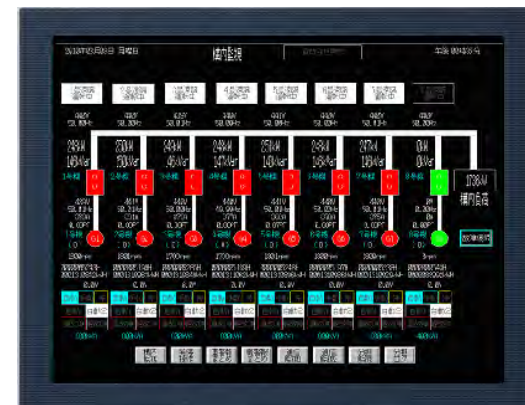
- Lights
- PCs
- Low voltage equipments and so on

***AUTOMATED GENERATOR  
START-STOP SYSTEM (KOKAKU)***

## Portable Generators



800KVA : 5units  
400KVA : 1unit



### Problem

Load monitoring  
Operating generators



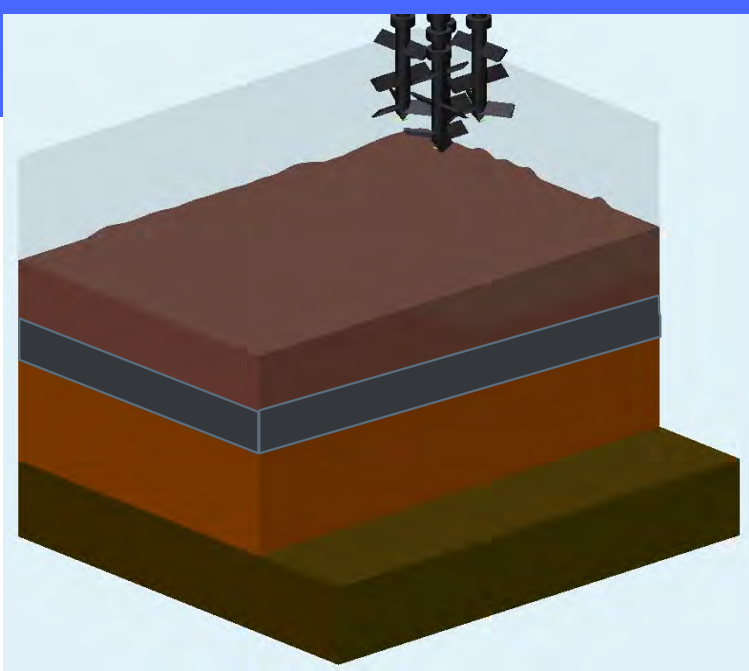
Great burden for operators

### Past method

Number of a generators required in a peak load

### Breakthrough

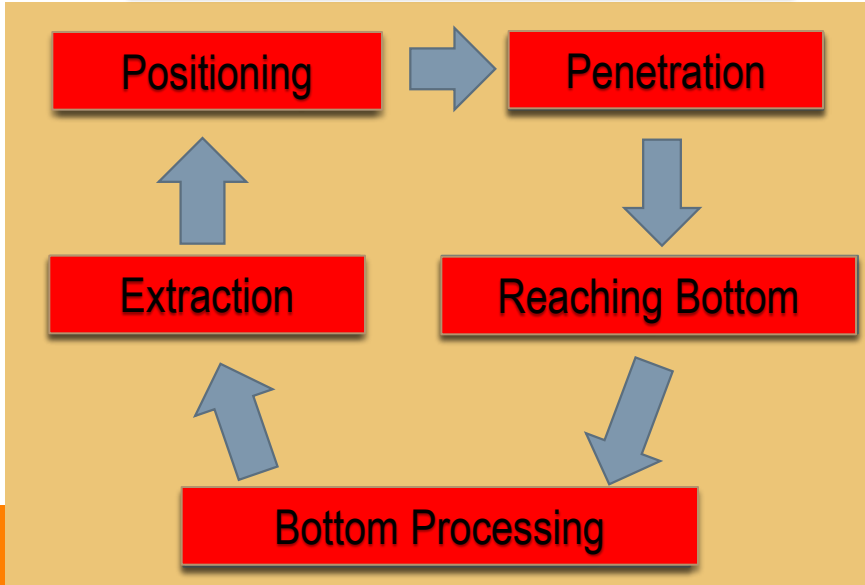
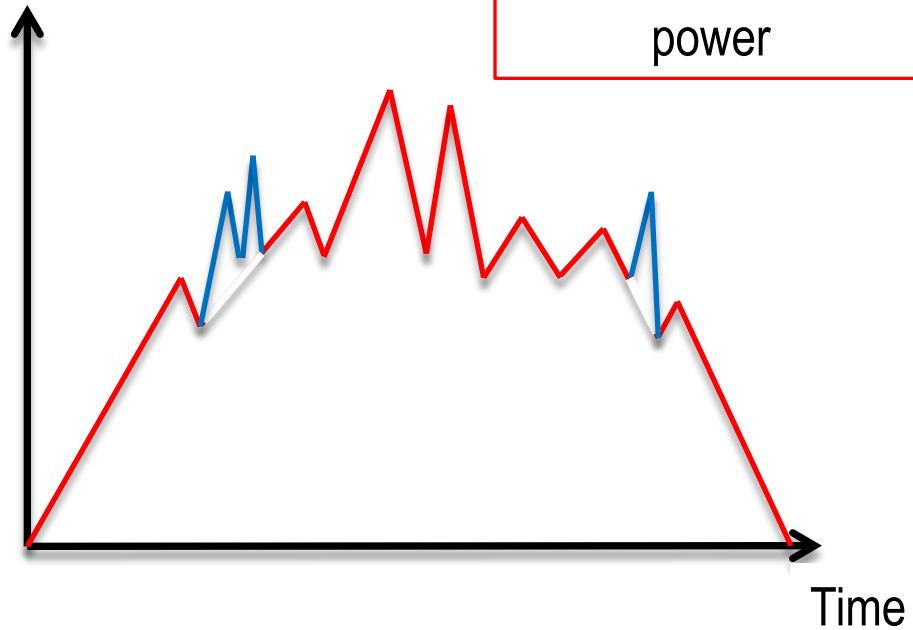
Automatic operation of the parallel running generators according to power demand



Cyclic work process

Electricity Consumption

Instantaneous power

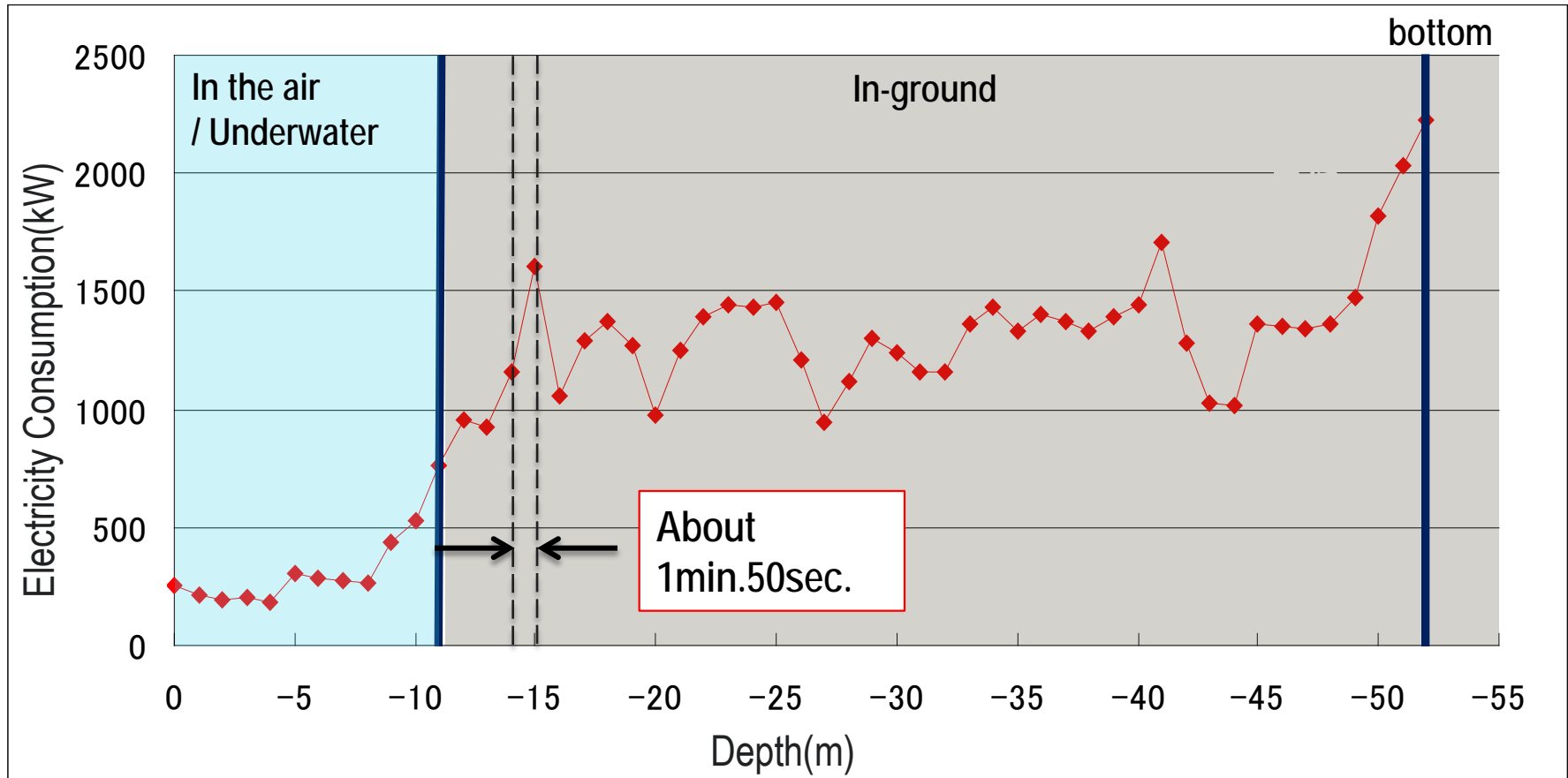


Features

The load changes greatly during construction work

The load increases sharply even at a shallow depth

# CONTROL PLAN

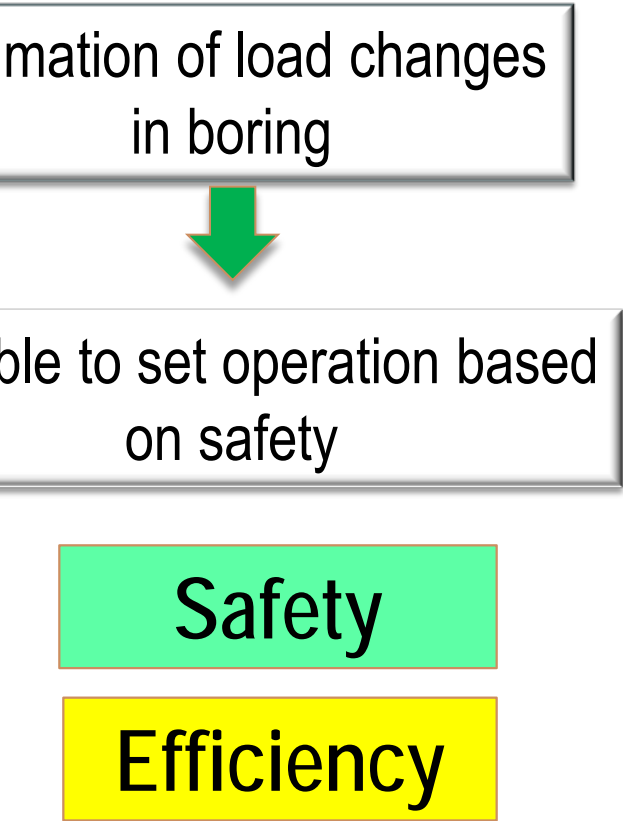
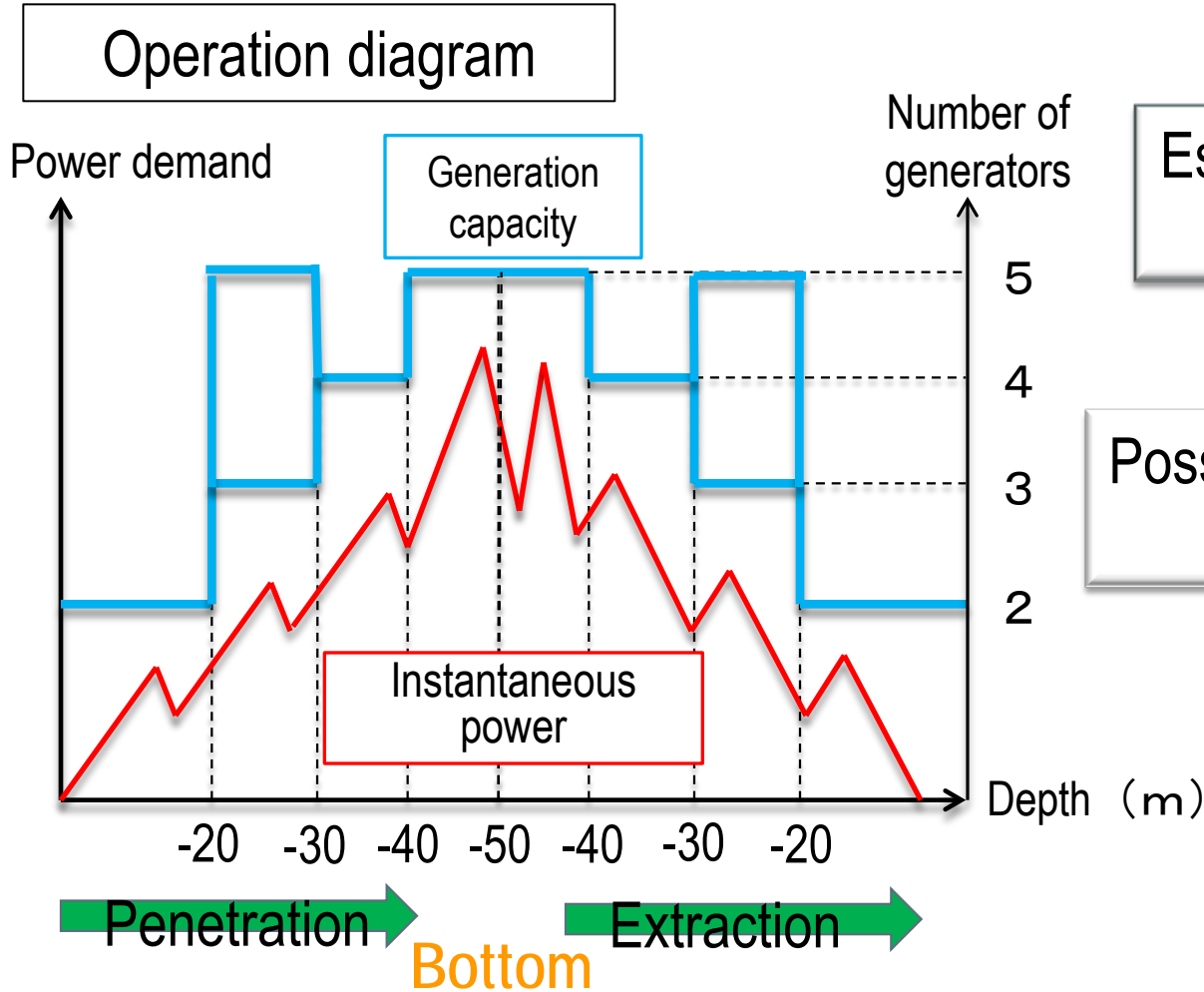


**Automatic load-tracking method is dangerous**



# CONTROL PLAN

## Switching of number of parallel running generators by ground depths



Tendency of the load variation

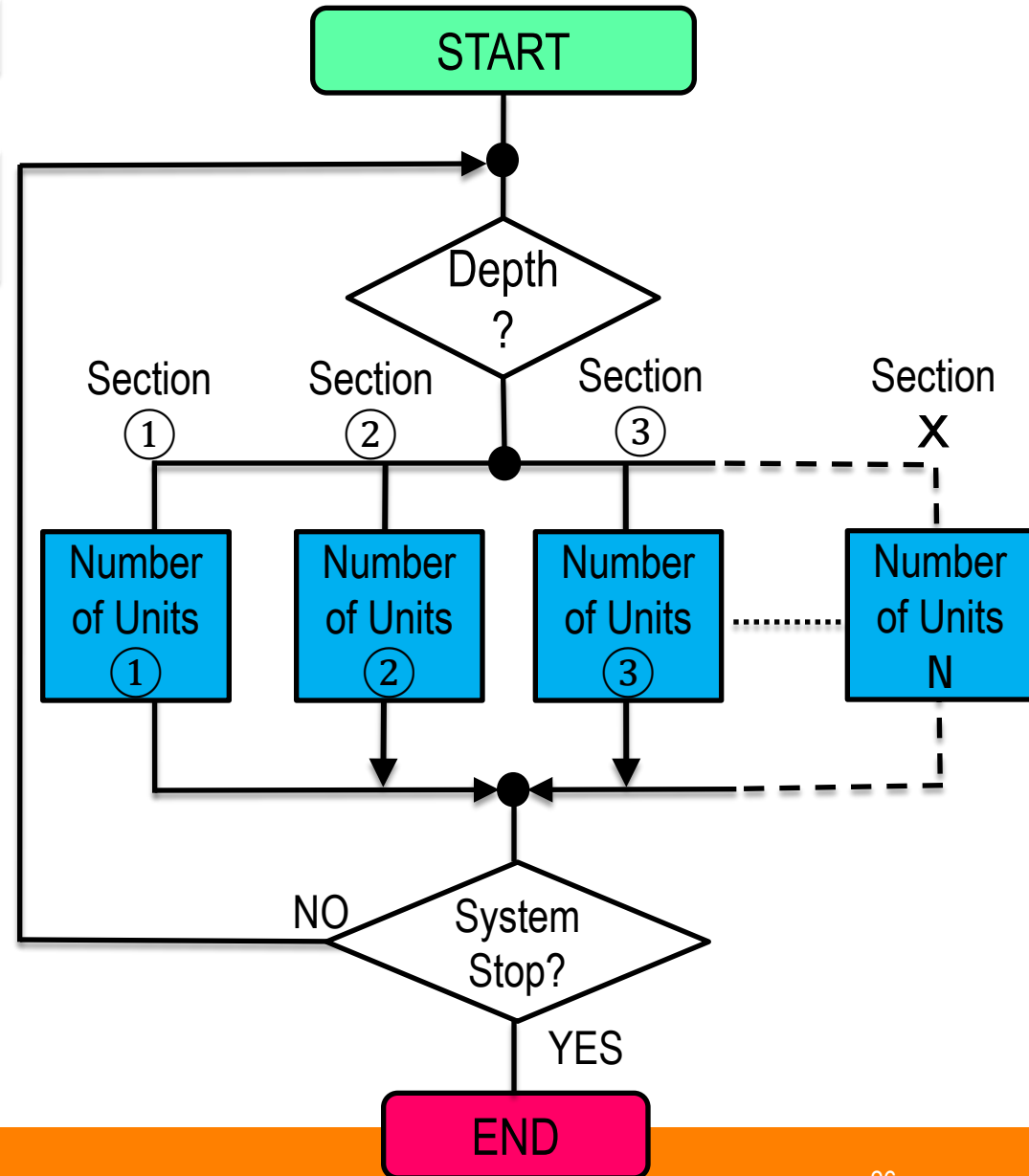


Decision of number of running generators by depths



### Initial Settings

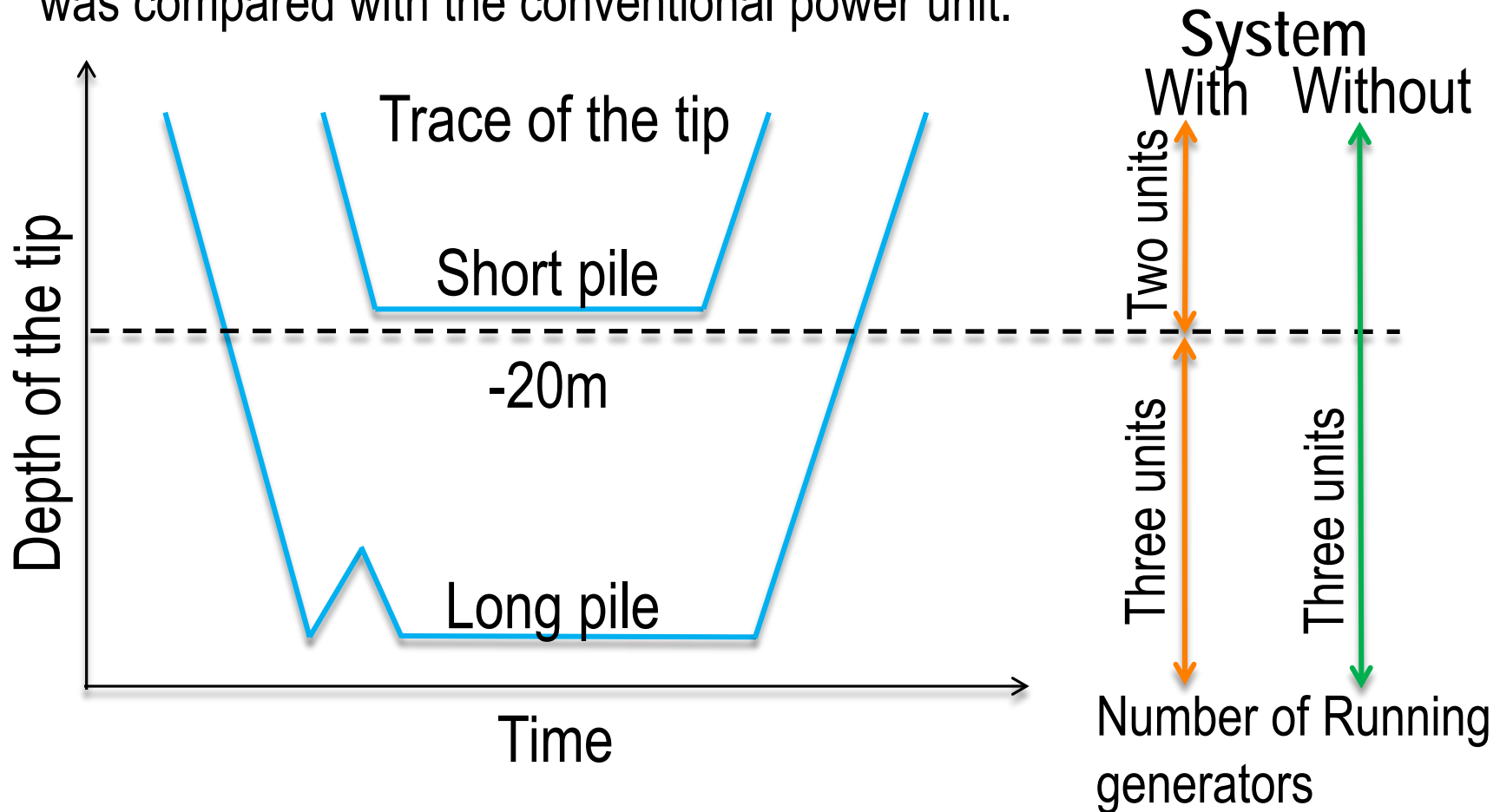
Section① (e.g. -5m~-10m)	Number of running units ① (e.g.2units)
Section②	Number of Units②
Section③	Number of Units③
⋮	⋮
Section X	Number of Units N



# FIELD TEST

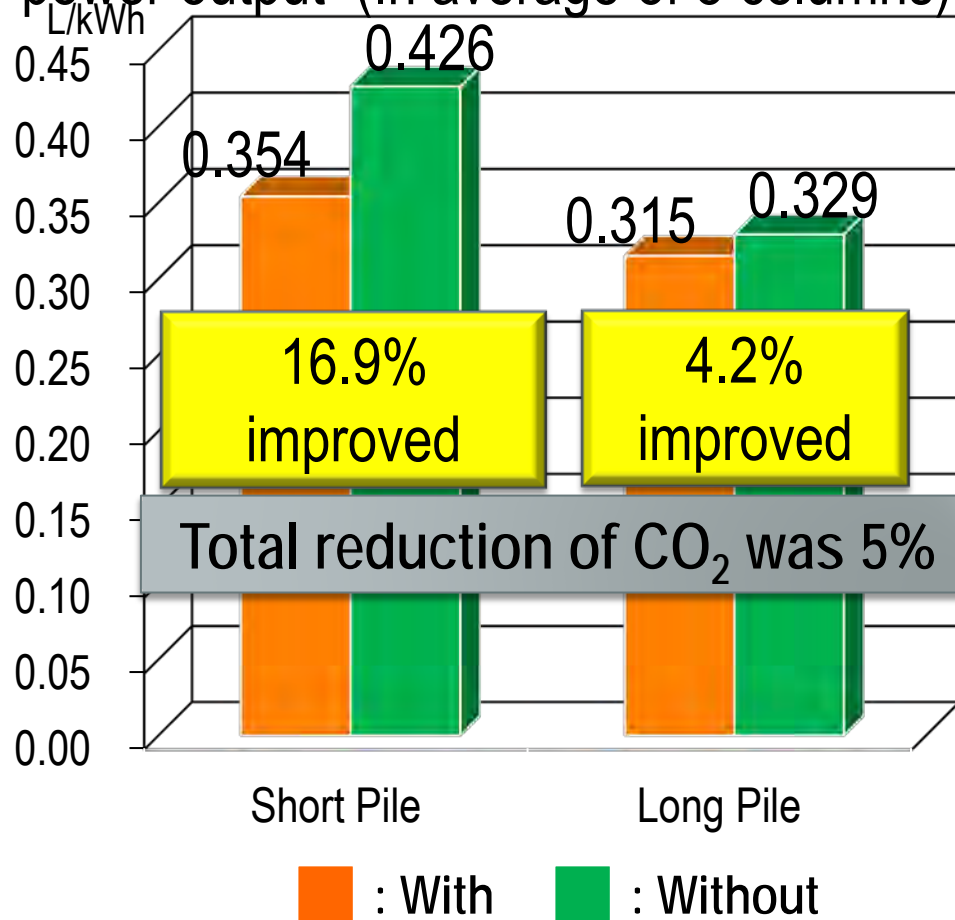
Test site : Tokyo Bay in 2011

Test method : The fuel consumption (L/kWh) of the hybrid energy system unit was compared with the conventional power unit.



## Result

Fuel consumption comparison per power output (In average of 8 columns)



## Remark

- Improvement varies with conditions
- Economic effects of CO<sub>2</sub> reduction and improved fuel economy

## Future prospects

To consider the configuration of the maximum effect while ensuring safety.

***HYBRID ENERGY SYSTEM  
INSTALLED ON WORK-VESSEL  
KOKAKU & KAKURYU***

**Toshiyuki Hori (保利 敏之)**  
**SHINKO CONSTRUCTION Co., Ltd.**

**The World Dredging Congress and Exposition XXI**

**The Hyatt Regency Miami**

***THANK YOU FOR YOUR  
KIND ATTENTION***

ご清聴ありがとうございました

# ***QUESTION?***

***✘ I AM NOT GOOD AT LISTEN TO / SPEAK IN ENGLISH***