CIMAC Circle 2013

at Marintec China

Integrated marine systems for the future

Hybrid Propulsion
- Potential and Future -

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Yasuhiro Itoh

Niigata Power Systems Co.,Ltd.

Engine System Technology Development

Driving force

Requirement of Enduser : Economy, Safety,Comfort

Legislation : Environment, Safety

Fuel Availability : Coal, Oil, Gas, LNG etc.

Key words

-Fuel economy, Energy efficiency, Exhaust emission, Global warming, Fuel diversification, Safety, Comfort, TCO

Development history / Challenge in automotive industry is a good benchmark to the large engine industry

-CRS, After treatment, Turbocharging, Electrification, Hybrid, Fuel cell etc.

➡ Topic : ***Hybrid Propulsion System on Tugboat***

Hybrid Propulsion for Tugboat

Why Tugboat?

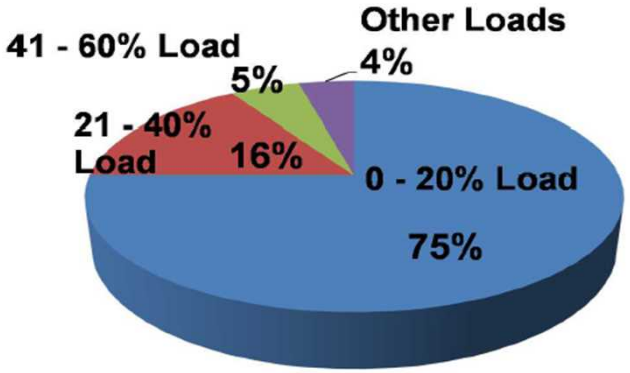
-Highly powered engine on small vessel

-75% of operating time under <20%load

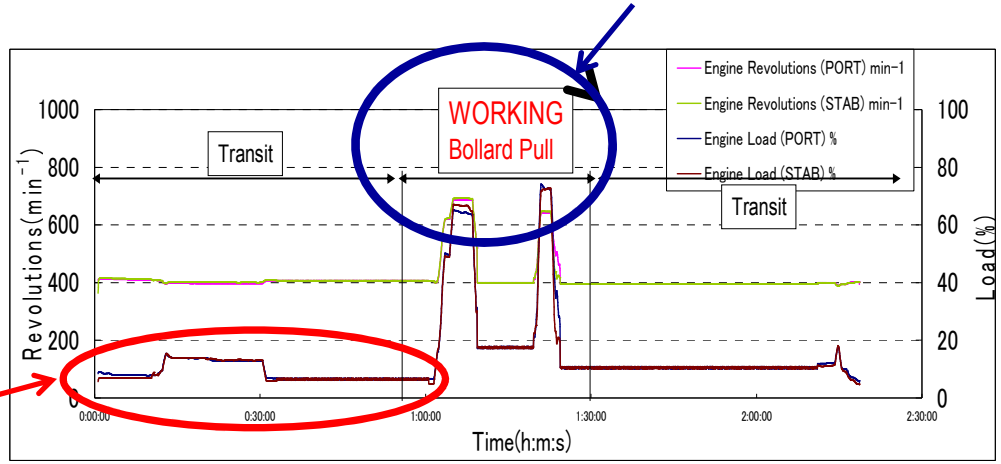
➔Energy wasted at the engine

➔Efficient energy management needed

www.tokyokisen.co.jp



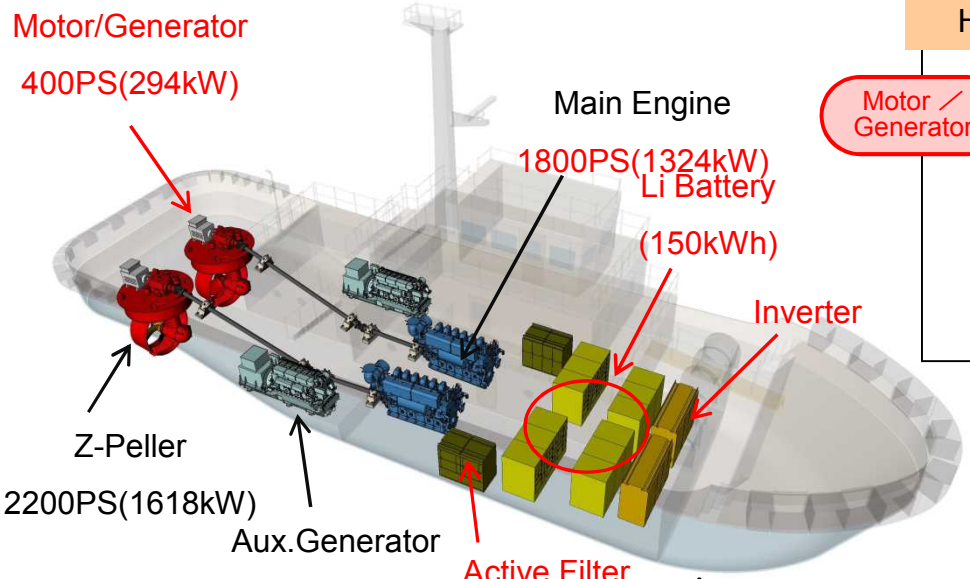
Hybrid, M/E + Motor assist

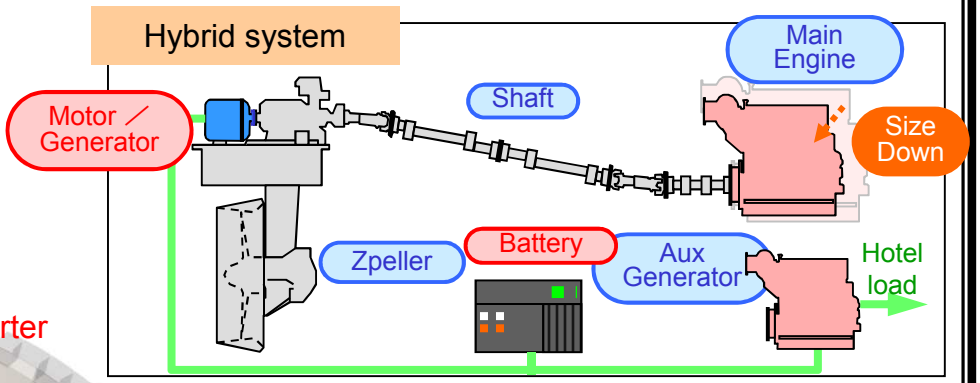


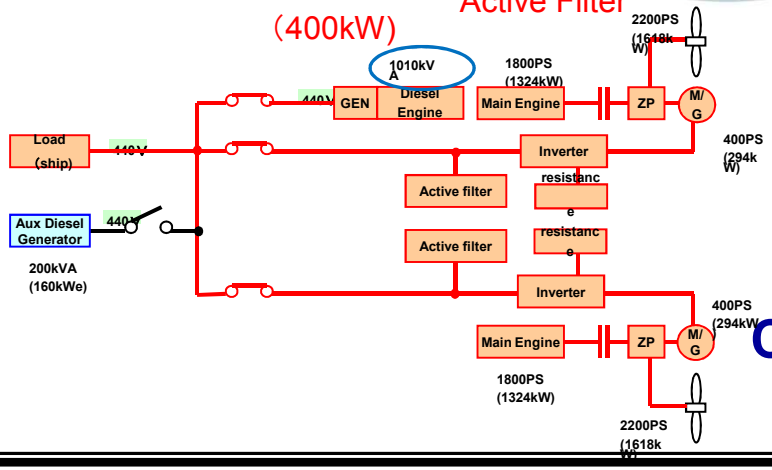
Motor driven, M/E shut down

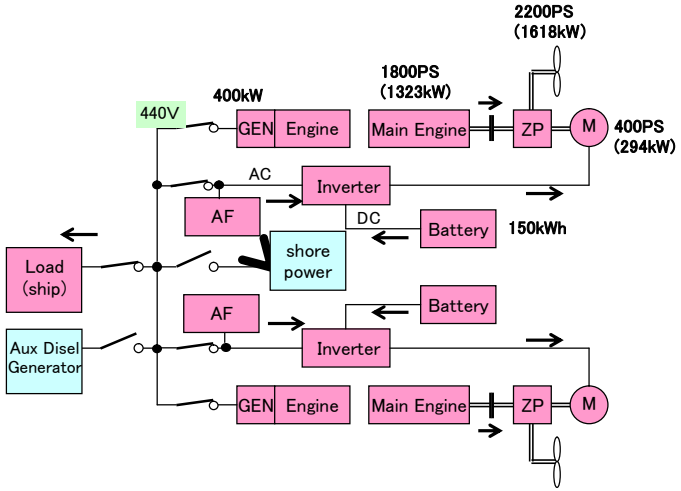
Hybrid Propulsion System

Case 1: Hybrid Propulsion with Battery (Li-ion) ; Plug-in









Case 2: Hybrid Propulsion without Battery

Case 1 „*Tsubasa*“ Plug-in HB Propulsion with Battery

Wing Maritime Service Corporation, Yokohama

NYK GROUP ClassNK OPRF IHI

Detail : “MTZ Industrial” Oct. 2013

The first Hybrid Tugboat in Japan : In service since March 2013

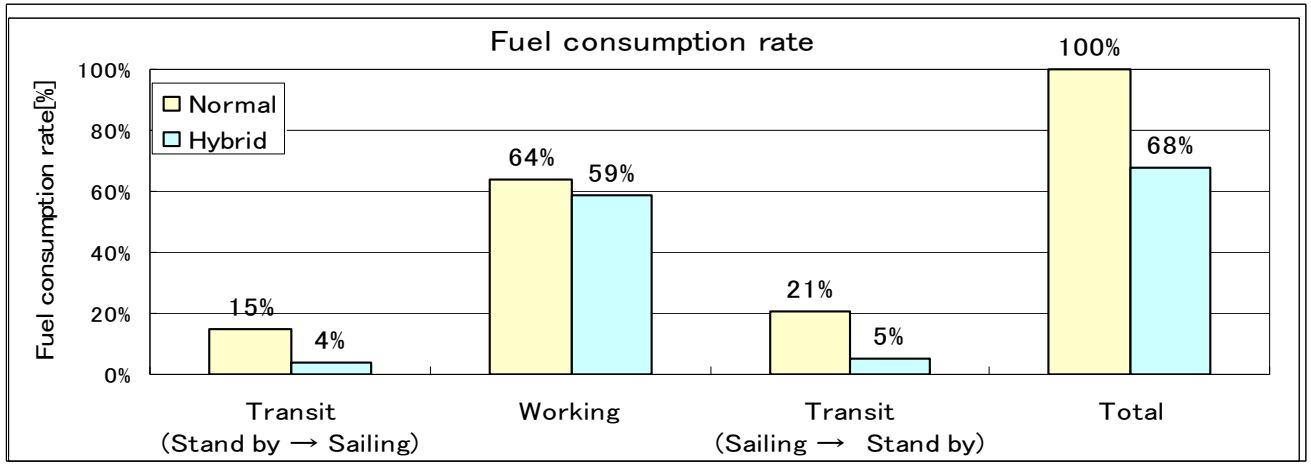
Result

Fuel - 32%

CO_2 - 27%*

NOx - 30%

*** CO_2 emission of plug-in included**



Case 2 „*Ginga*“ HB Propulsion without Battery

Tokyo Kisen Co., Ltd., Yokohama

In service since October 2013

On Hybrid propulsion system, a certain effect on energy saving and emission reduction including noise are verified

<u>Challenge</u> to the current system :

- **Initial cost, especially battery**
- **Suitable load pattern to maximize the effect of Hybrid, fuel and emission reduction**

Summary and Future Possibility

Proposal

Hybrid Propulsion could be applied to;
-the ship operated long period under low and/or idle speed
-the ship to which quick load acceptance is required
e.g. Tug boat, PSV, Short distance shuttle ferry etc.

For IMO-Tier III : Battery in ECA, Gas engine for generator, Gas engine for M/E

For future : Battery charged by renewable energy e.g. wind power, solar, tidal current etc.

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Thank you very much for your attention

Niigata Power Systems Co., Ltd.