

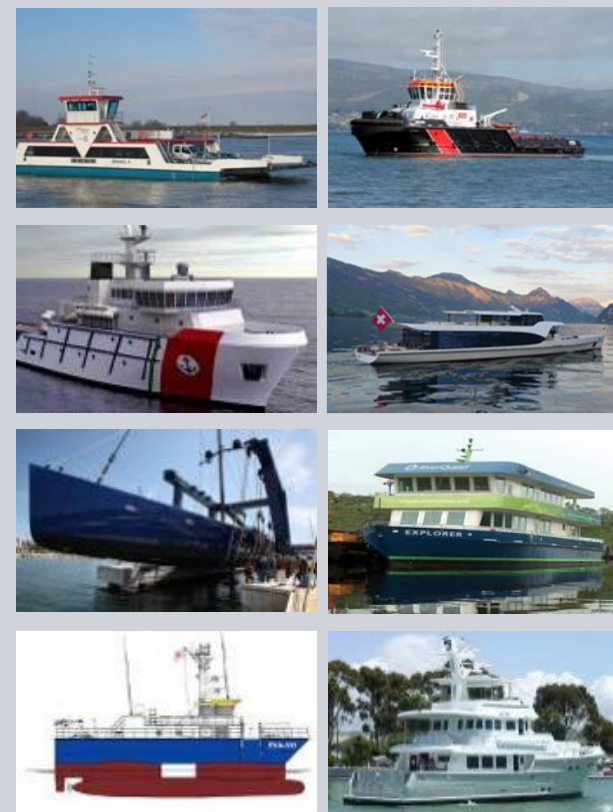
# **Silent, elegant and efficient:**

## **The intelligent response to increasing demands, the ELFA® Marine Hybrid System**

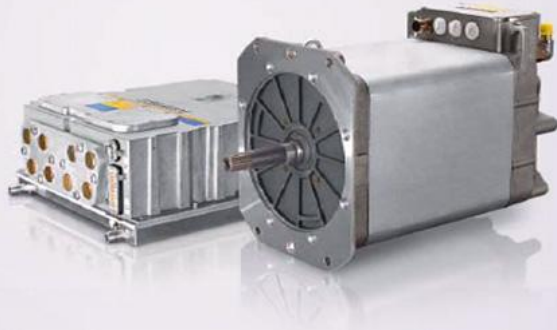
Presentation Colombia Mar 2013

Cartagena, Colombia

Marzo 14, 2013



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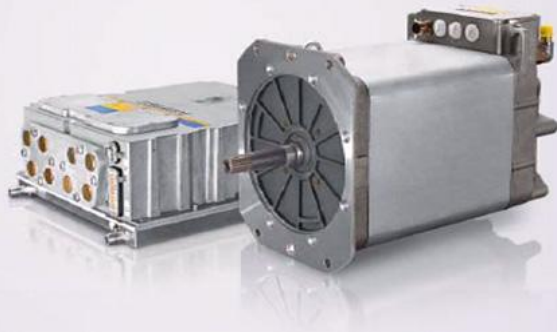
- **Perspective and competence**
  - Marine hybrid concept and advantages
  - The ELFA product range
  - ELFA packages for the boating industry
  - Operation experience
  - ELFA components in detail

## Perspective and competence in hybrid applications

- Over 100 years of experience in drive technology
- Competence in marine, industrial, train, mining and road applications
- Years of experience incorporated directly in the ELFA System
- Close to our customers
- Over 50 hybrid bus projects in Europe, North and South America and Asia
- Various installations of ELFA into yachts prove the system capabilities
- Over 10 mio hours recorded on ELFA system



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## Market trends and increasing governmental requirements

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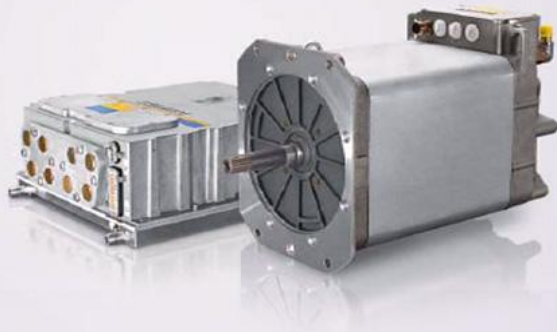
- Global trend toward greener propulsion systems also in the marine industry
- Increased global and local pressure for CO<sub>2</sub> reduction
- Increased requirements for noise reduction
- Increased requirements for maneuverability and control
- Increase requirements for innovations in drive control



**Siemens ELFA offers a reliable solution to these requirements with a proven technology, today!**

\*Examples of green logos and activities

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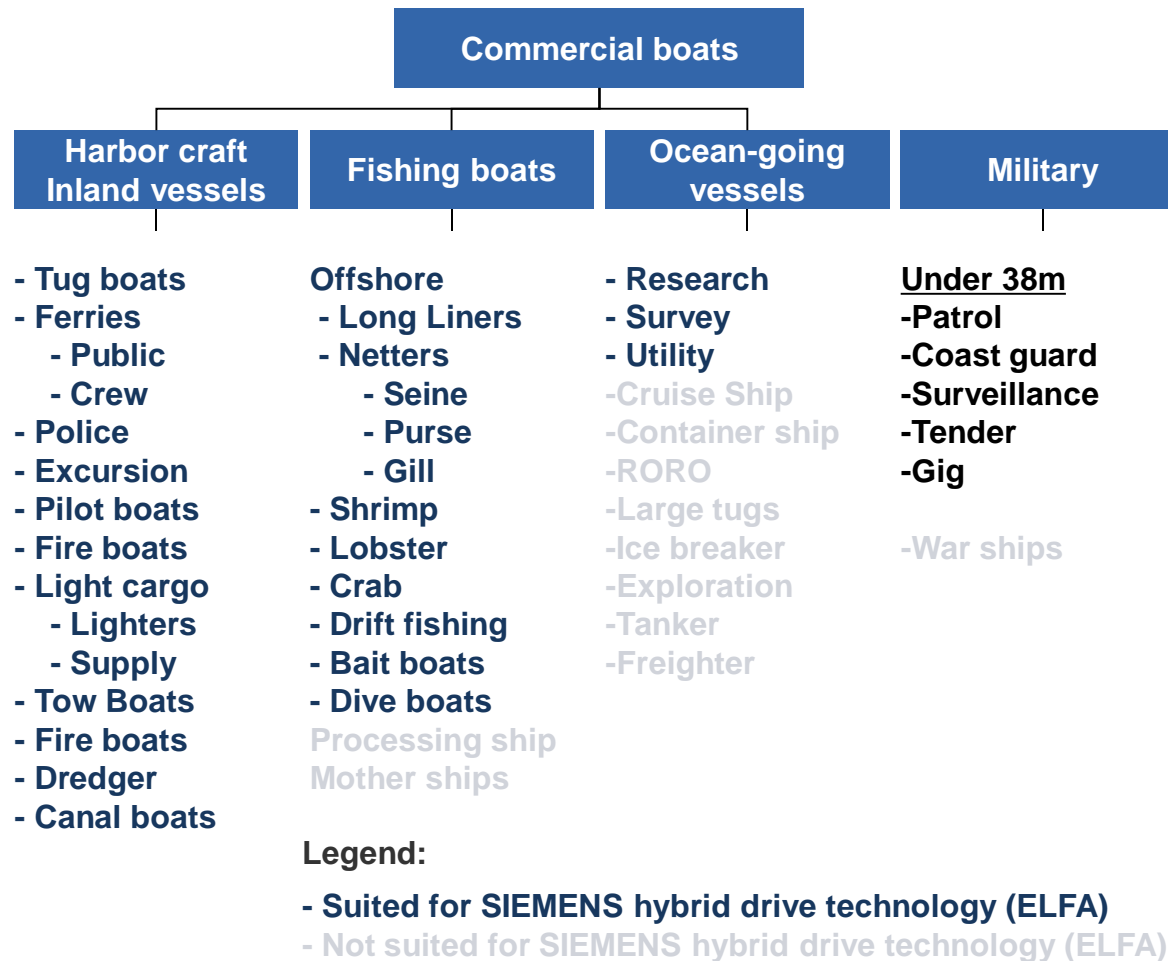


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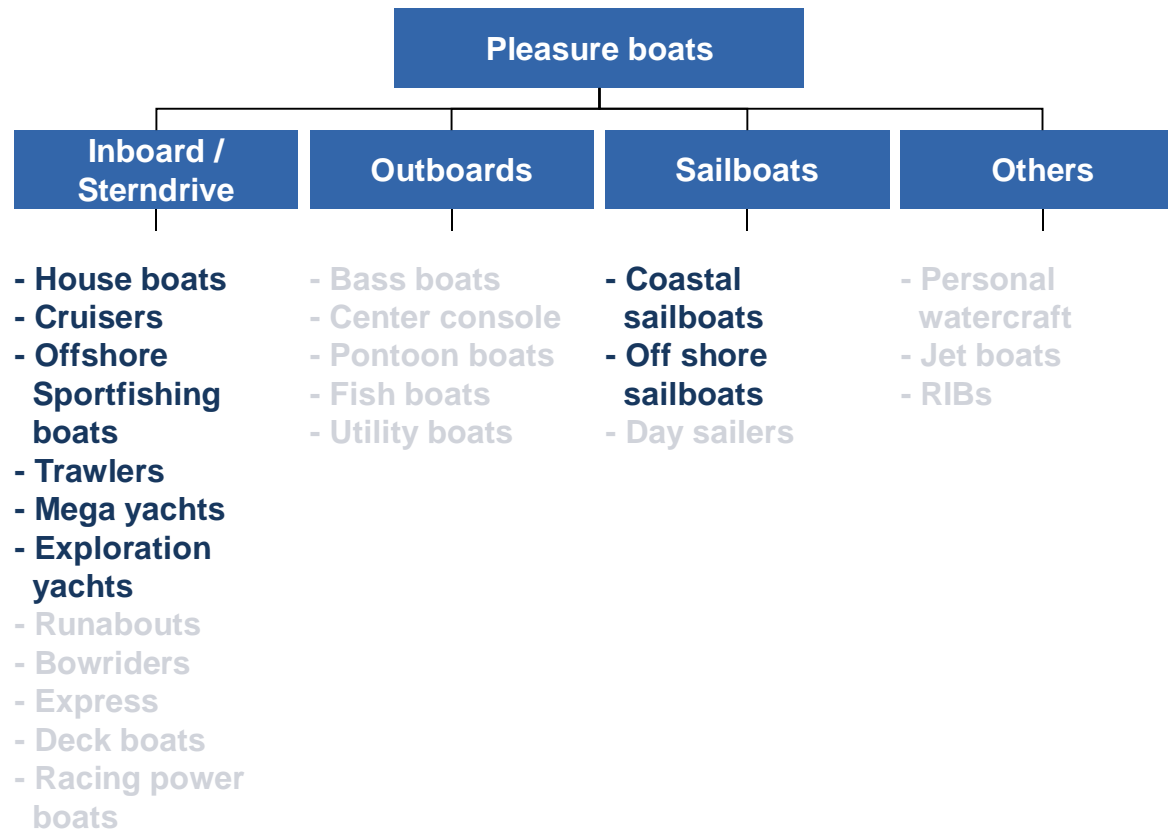
# Boat types and compatibility with Siemens hybrid systems

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# Boat types and compatibility with Siemens hybrid systems

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## Legend:

- Suited for SIEMENS hybrid drive technology (ELFA)
- Not suited for SIEMENS hybrid drive technology (ELFA)





## Basic ELFA product overview

### Drives and Generators



Synchronous drives  
100kW, 140kW, 180kW



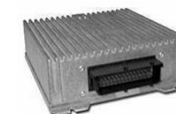
PEM drive 160kW, 260kW

### Converters



Mono Inverter  
ELFA 2nd generation IP 69k

### Controls and Software



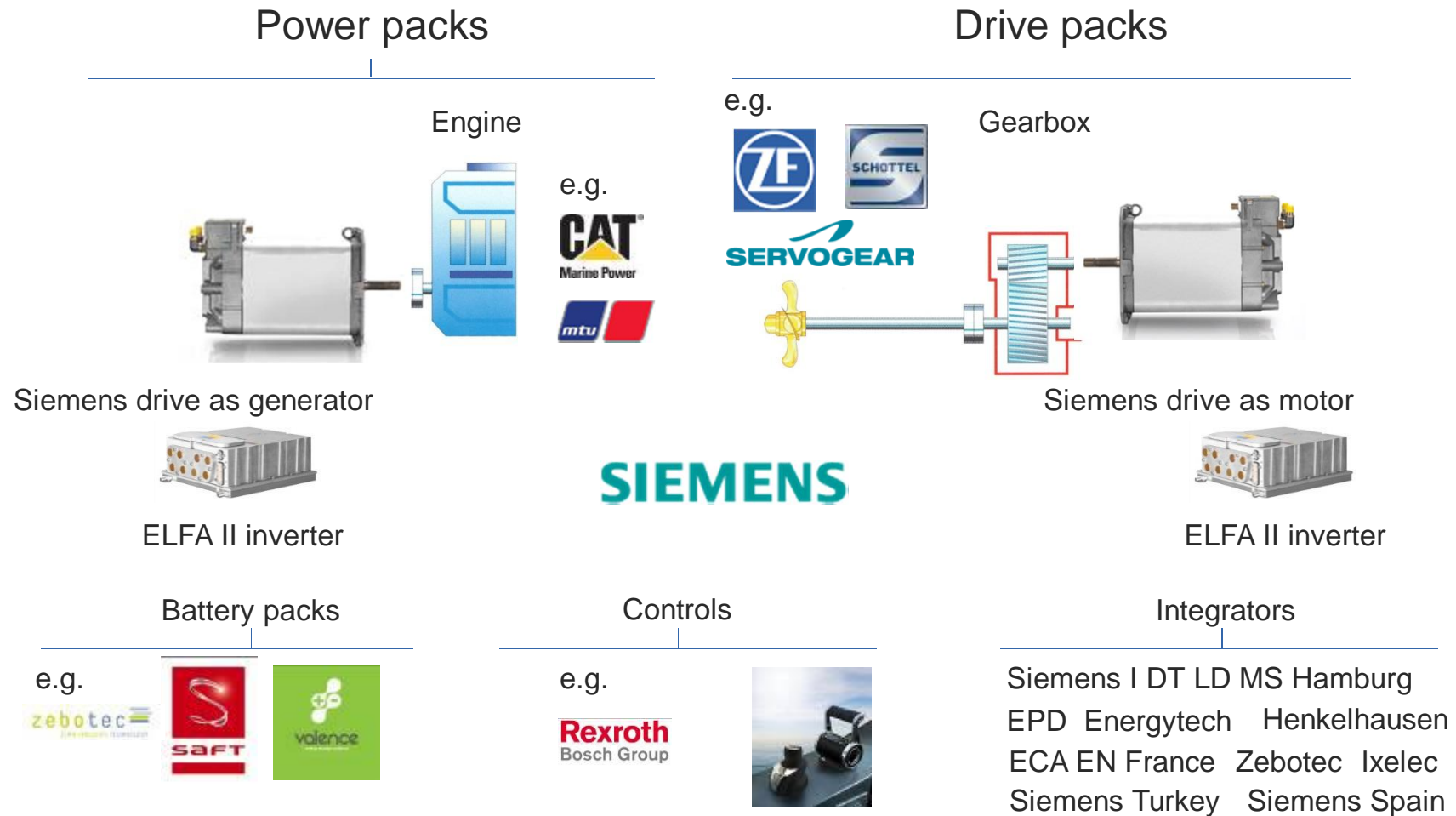
DICO



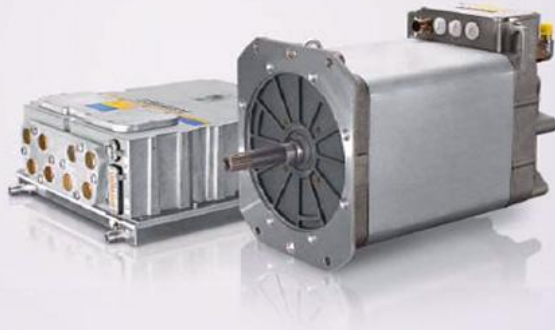
Control software

# The ELFA hybrid system – Drive- and power-packs, controls, batteries

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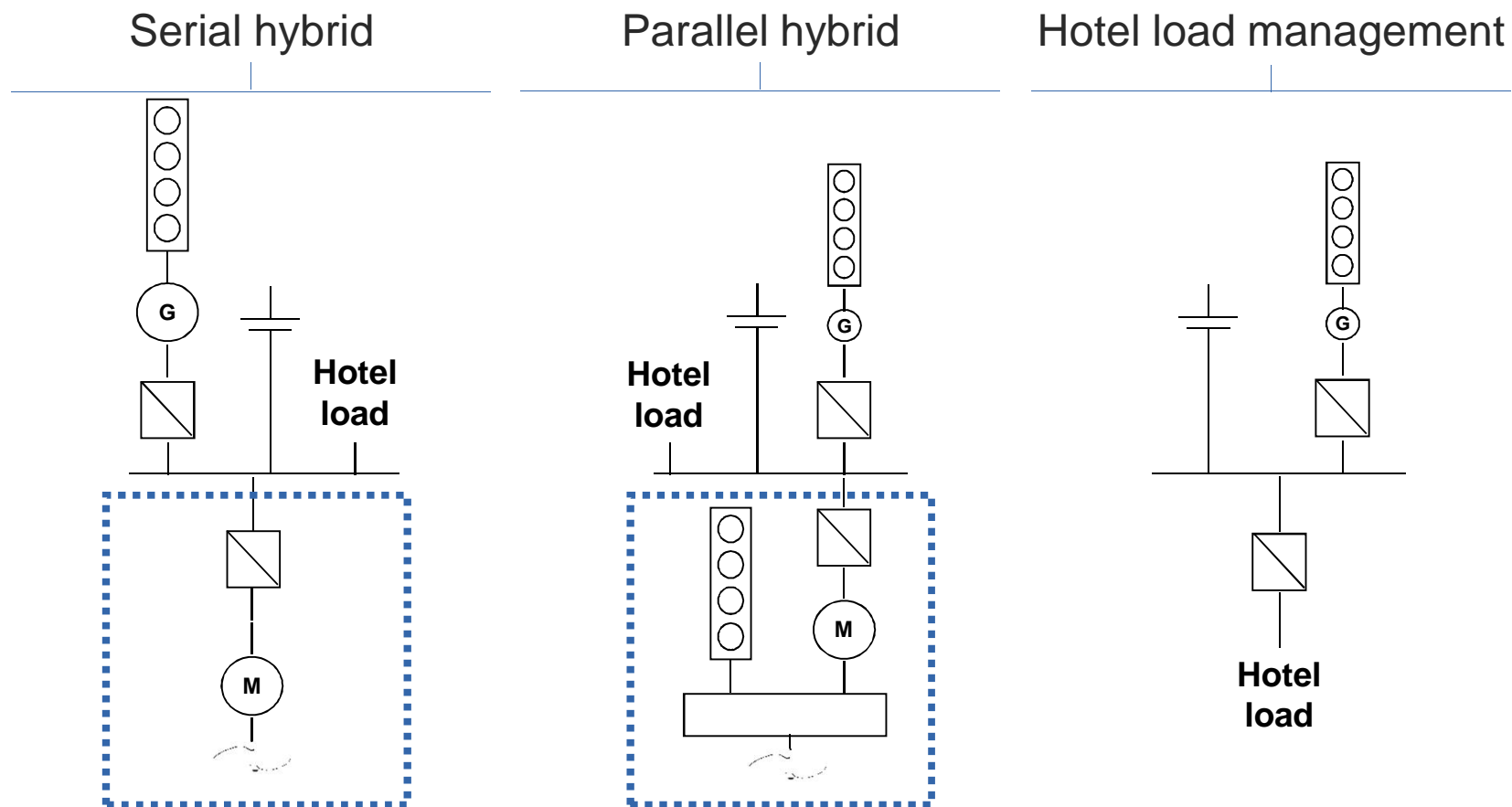


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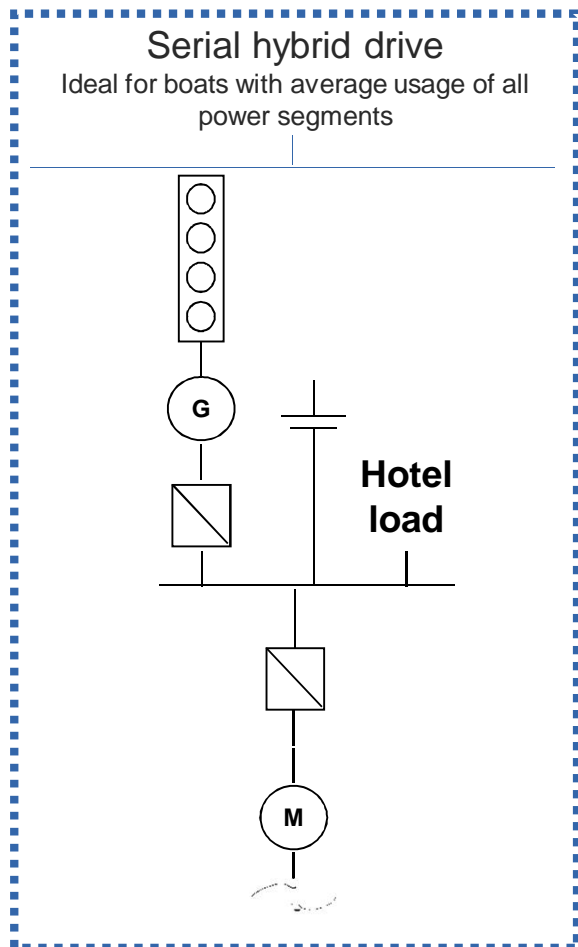
## Standard ELFA packages



# Standard ELFA packages

## Serial hybrid for boats with 80-360kW per propeller

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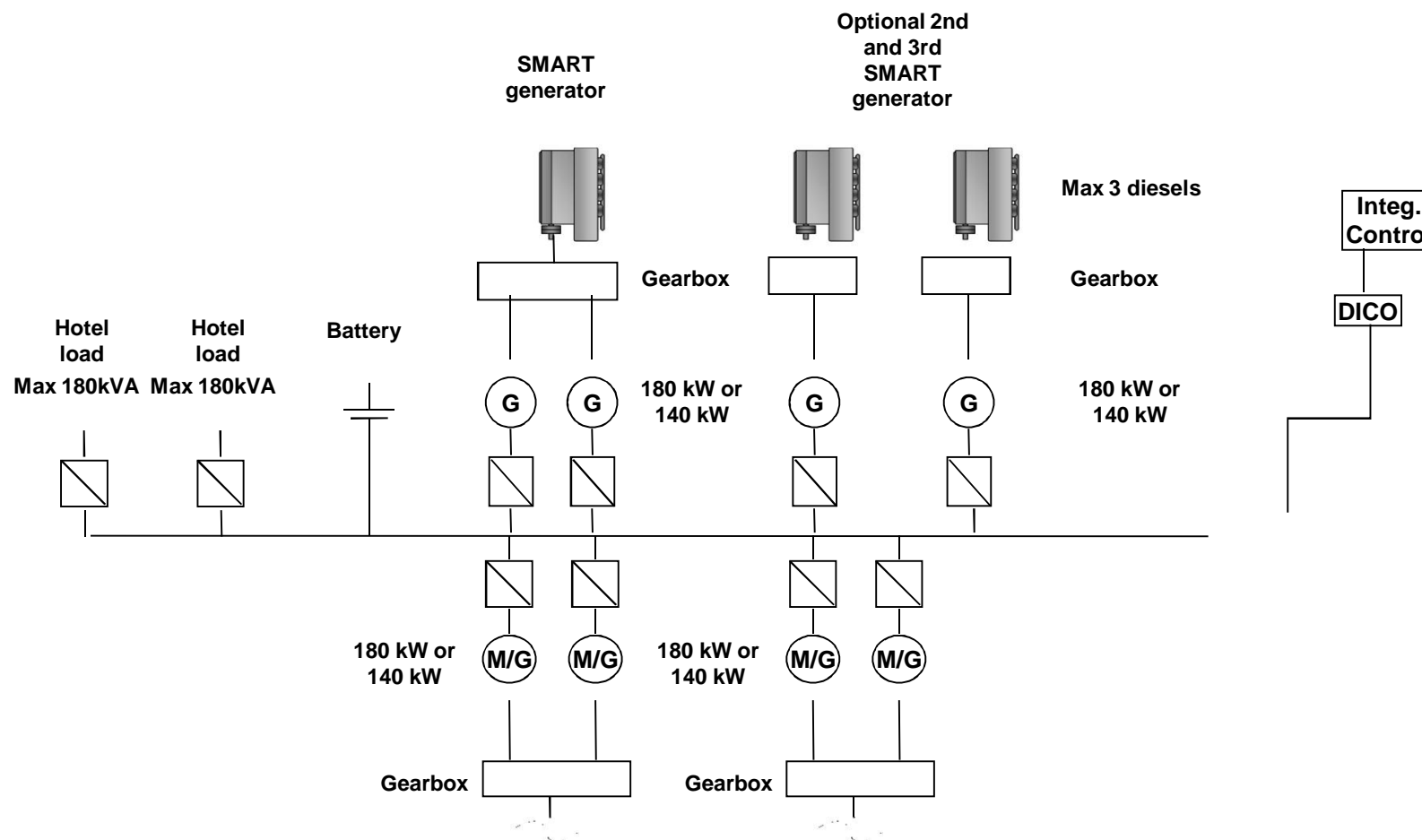
### Serial hybrid drive packages

Serial Hybrid fits into boats with average usage of all power segments of the drive system.

Packages fit in all boats < 360 kW, especially displacement boats such as trawlers, passenger ferries, smaller cruisers and large sailboats

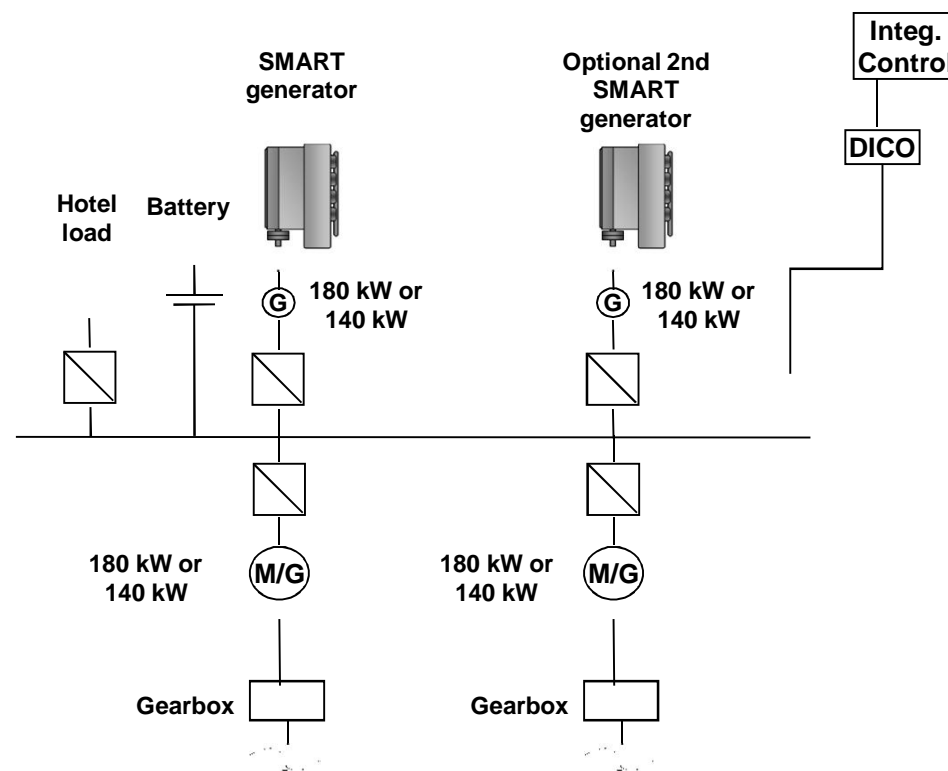


## Serial Hybrid

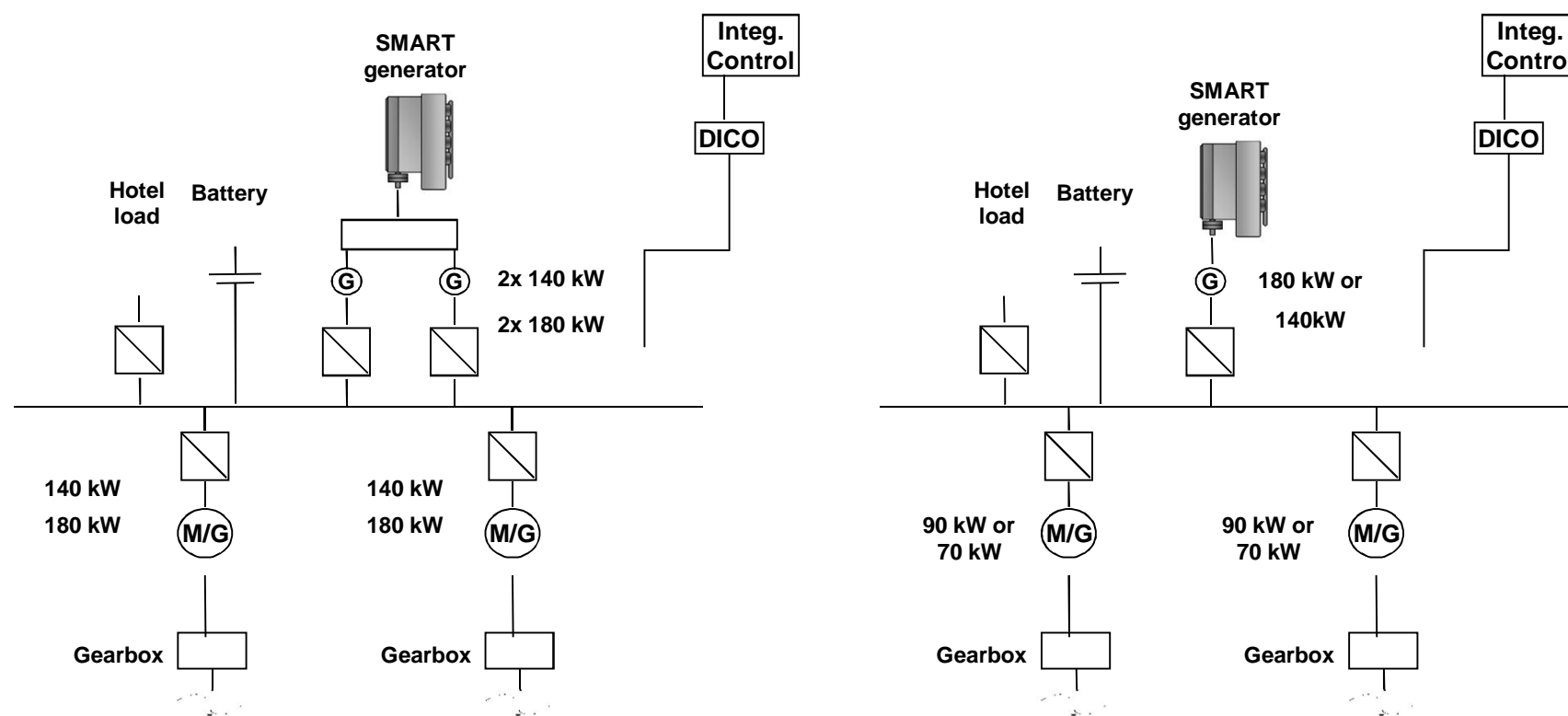




## Serial Hybrid



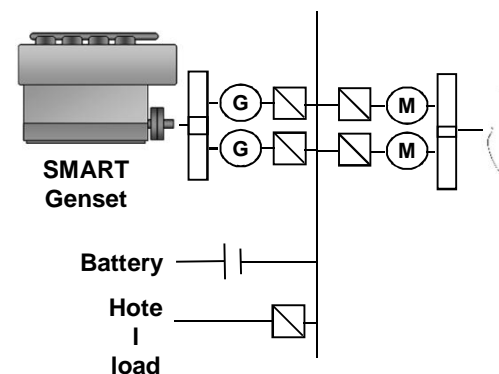
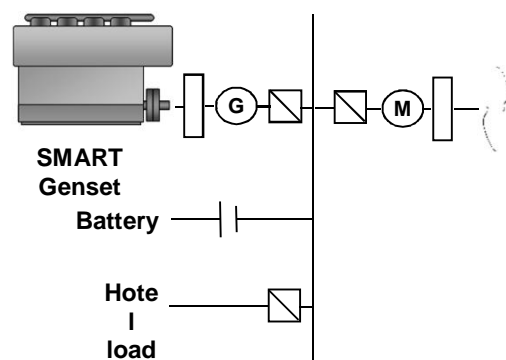
## Serial Hybrid



# Standard hybrid drive product packages (Detailed)

Sail/Powerboat – One prop

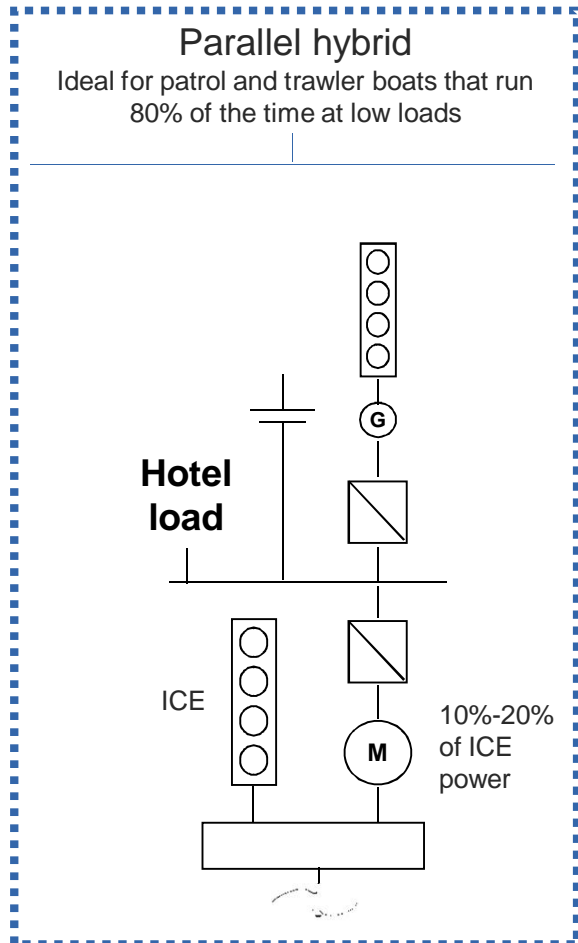
1x80-180 kW - 2x135-180kW



## Standard ELFA packages

### Parallel hybrid for boats with 230-2000kW per propeller

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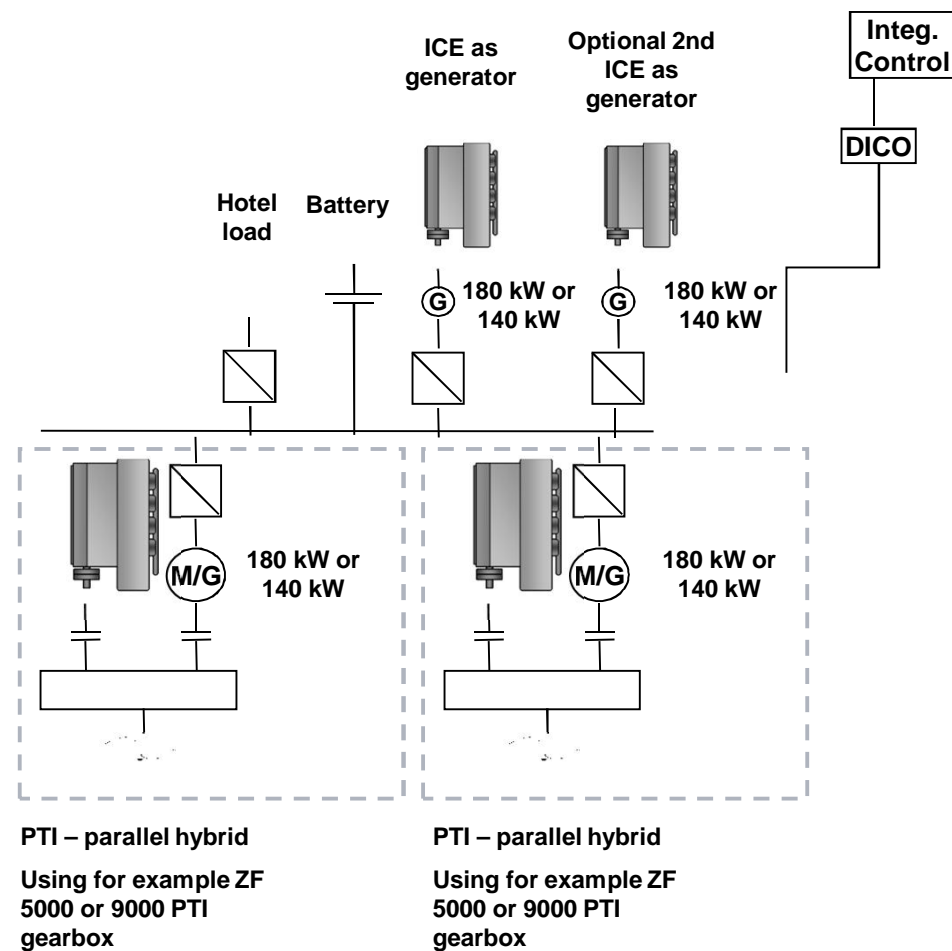
Parallel hybrid drive packages  
Electric drive with **10-20%** power  
of ICE

Parallel Hybrid fits into boats with  
long trolling and cruising speed  
intervals

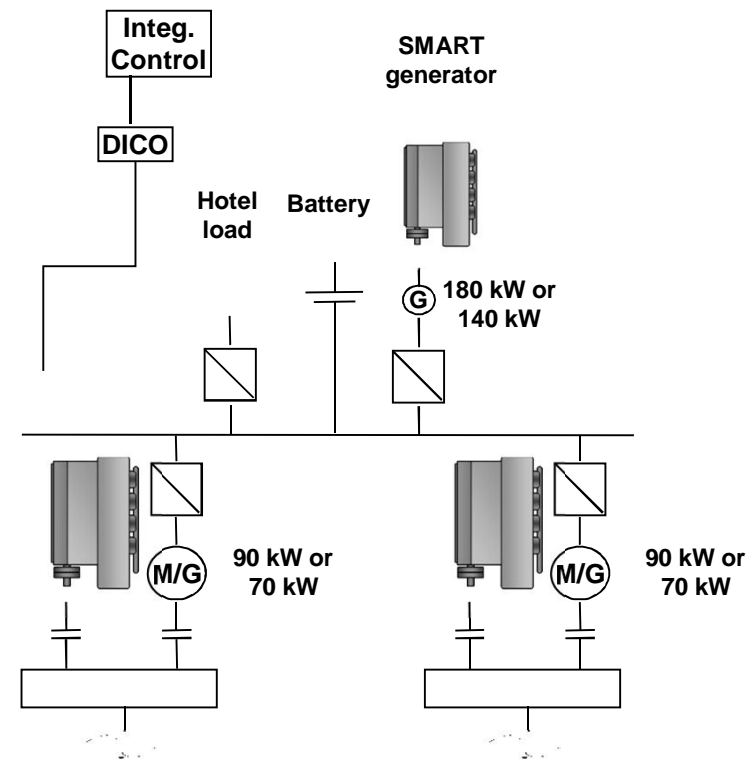
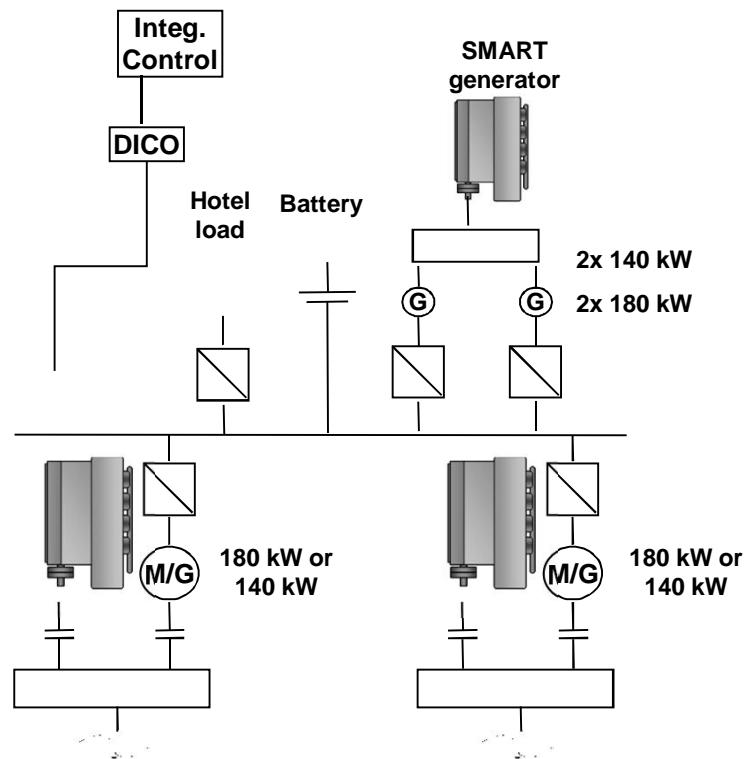
Packages fit in boats > 230 kW



## Parallel Hybrid

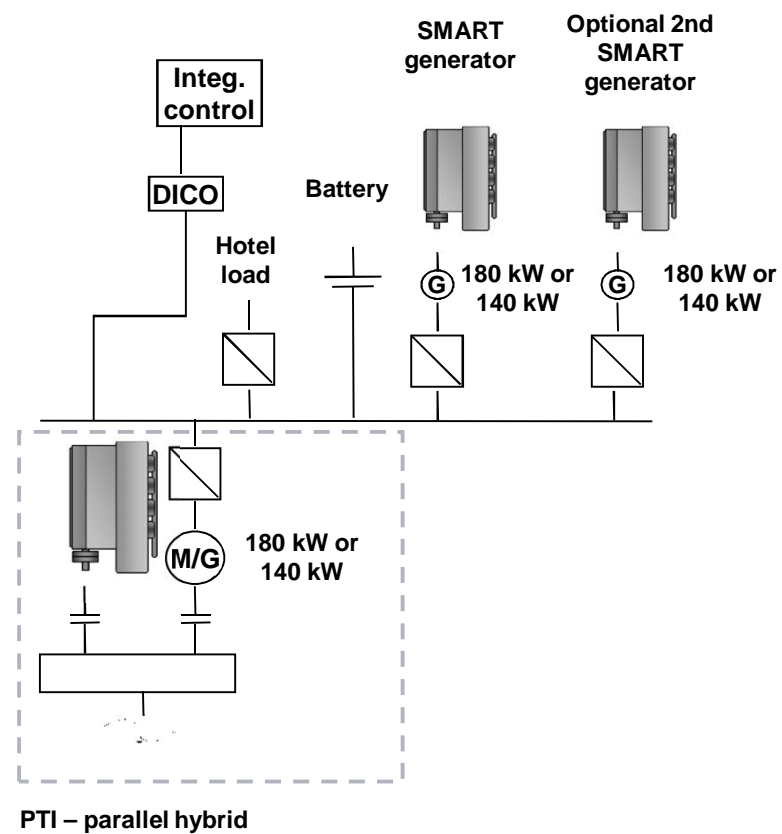
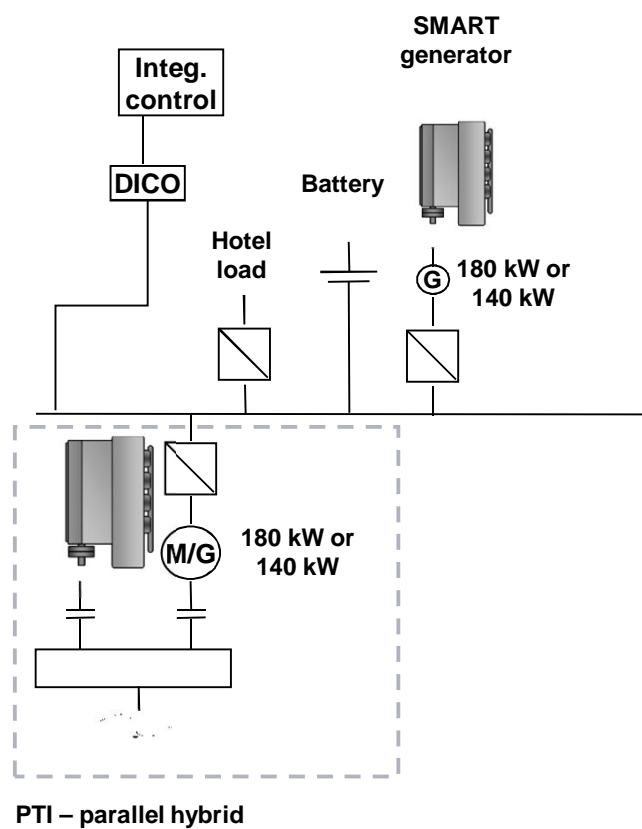


## Parallel Hybrid





## Parallel Hybrid



## The ELFA hybrid drive advantages

### Boat owner / operator

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- Green propulsion
- Noticeably more quiet propulsion
- Lower running costs
- Lower maintenance costs
- Better maneuverability
- Better performance
- Plenty of load for hotel appliances
- Proven technology
- Future safe

### Boat builder

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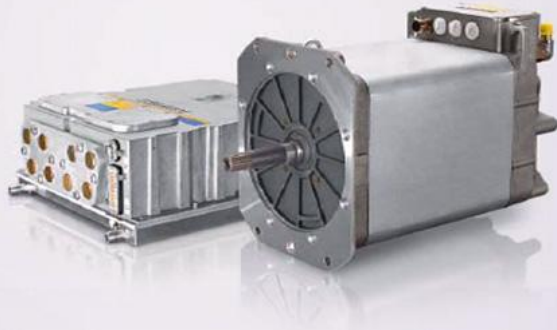
- Design freedom - more space
- Weight distribution freedom
- Improved propulsion system
- High power hotel supply
- Possible access to governmental support – Green funding
- Future safe

### Integrator

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- Access to marine hybrid technology
- Pretested system with defined functions
- Access to partners for hybrid systems

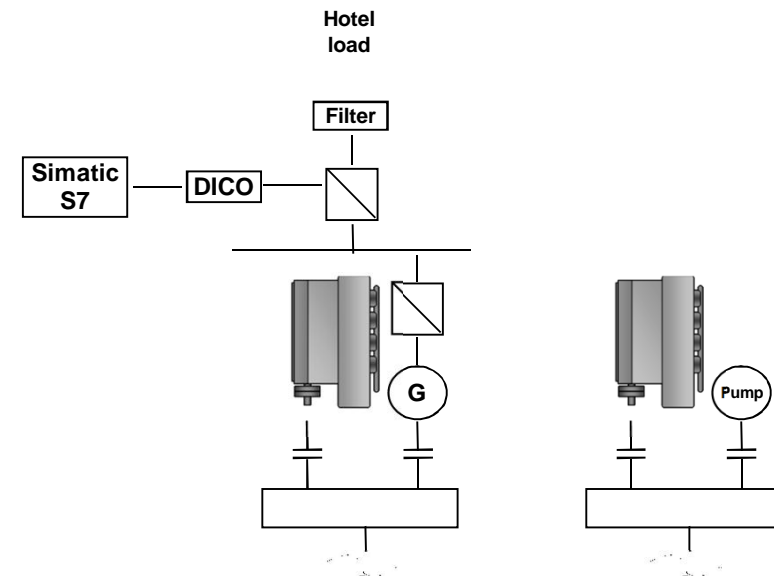
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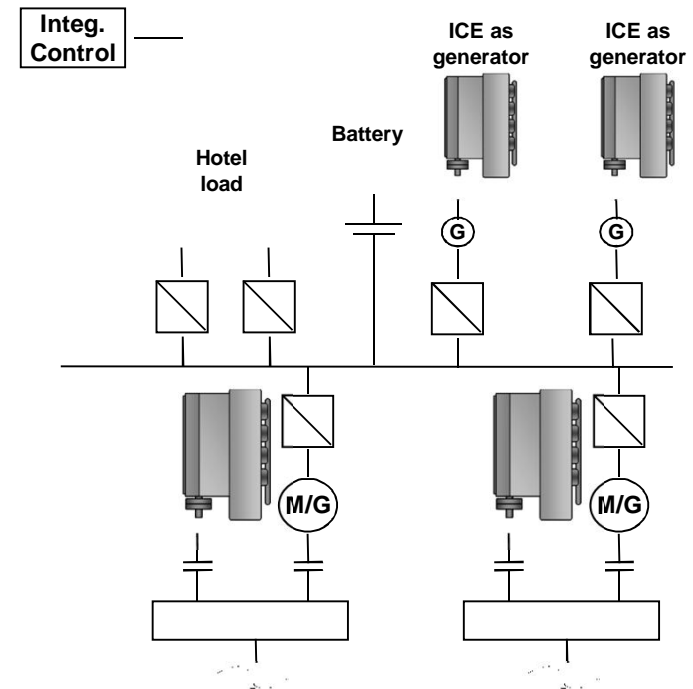
## Hybrid drive configuration example – Spain – In operation since 2011

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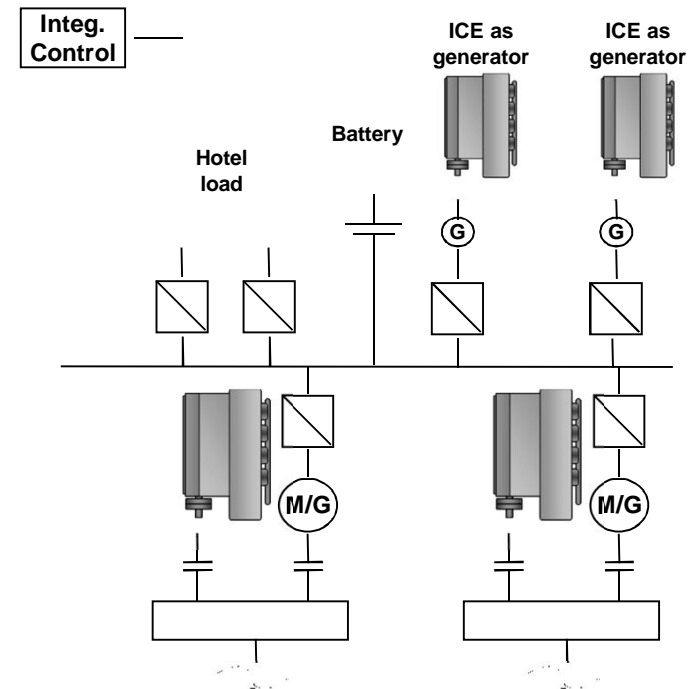
# Hybrid drive configuration example – Megaride – Launch 2013

**SIEMENS**



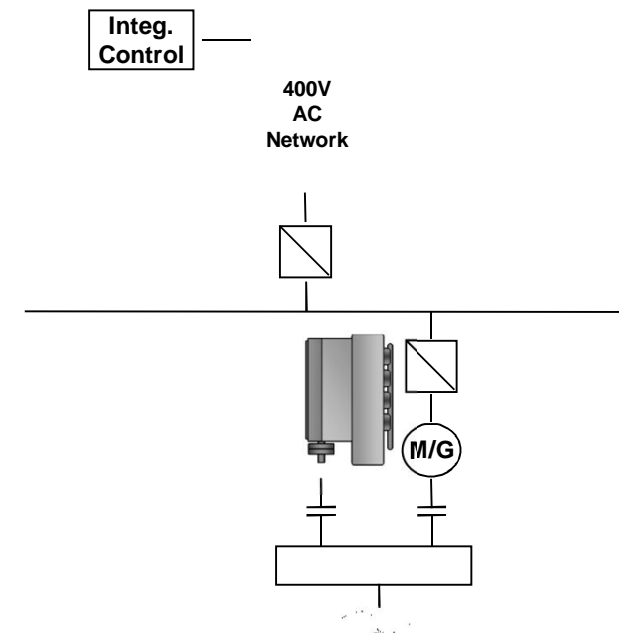
# Hybrid drive configuration example – Columbus Yachts – Launch 2013

**SIEMENS**



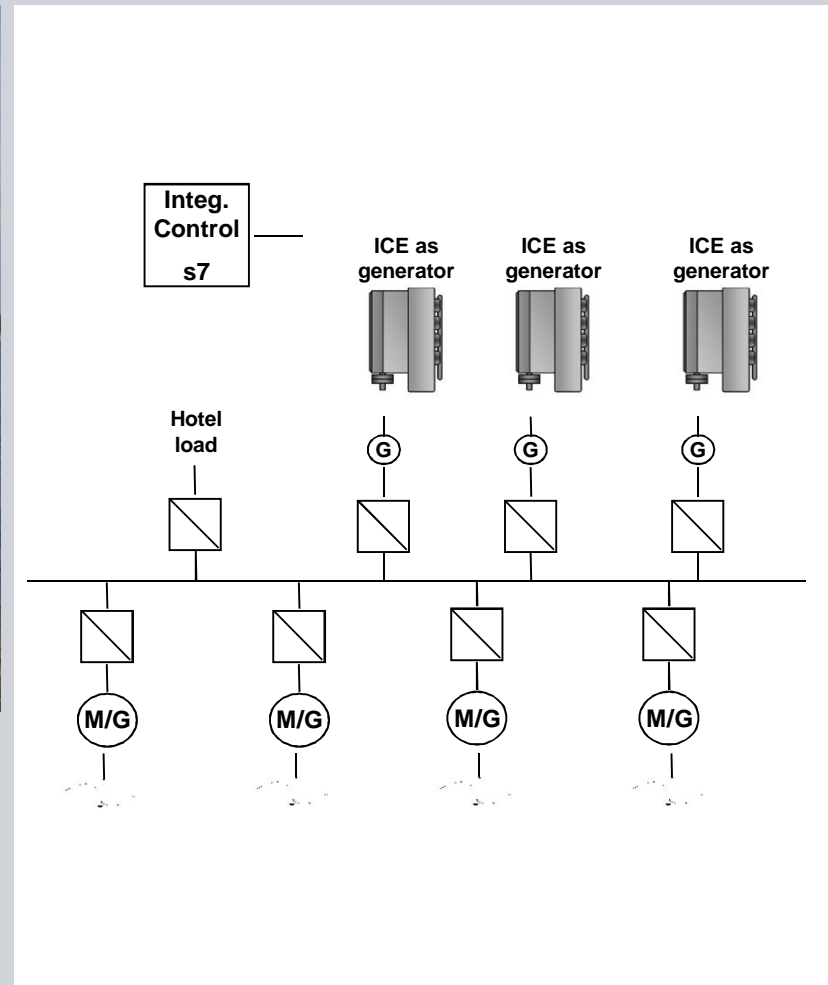


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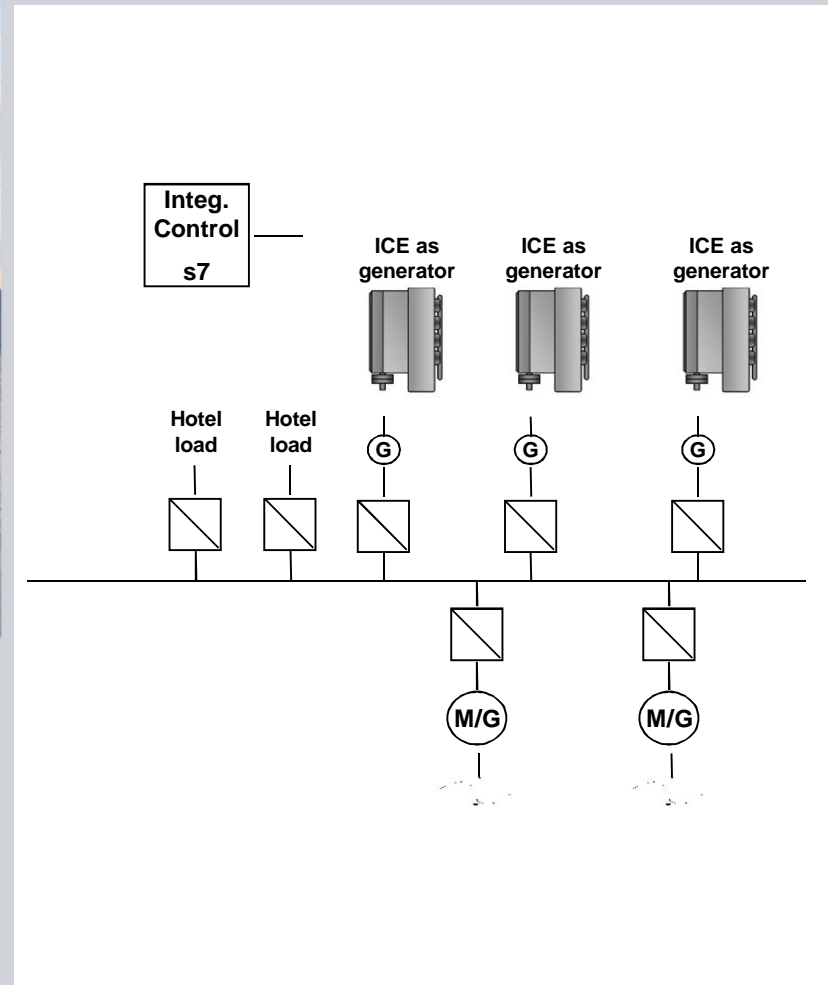
# Hybrid drive configuration example – Ferry Grave in operation since 2009

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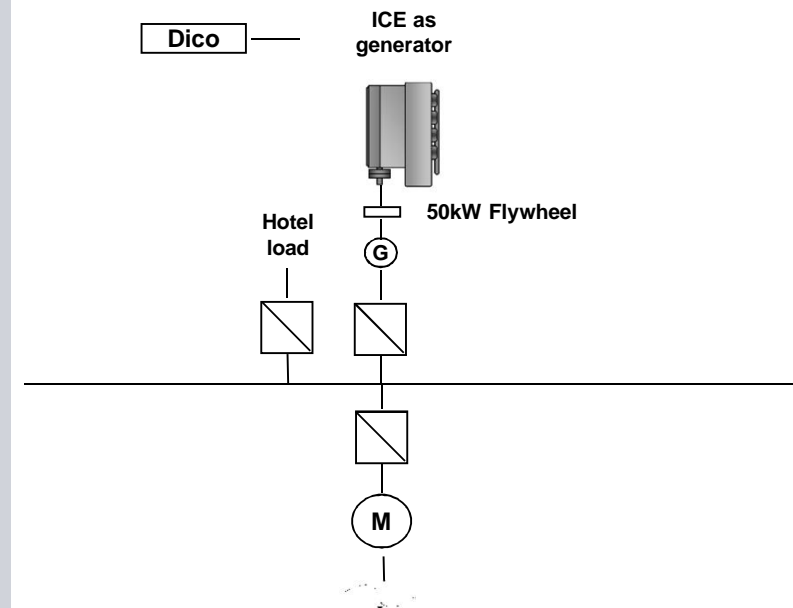
# Hybrid drive configuration example – Saphir – In operation since 03/2012

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# Hybrid drive configuration example – O-foil – Holland – Launched 02/2013

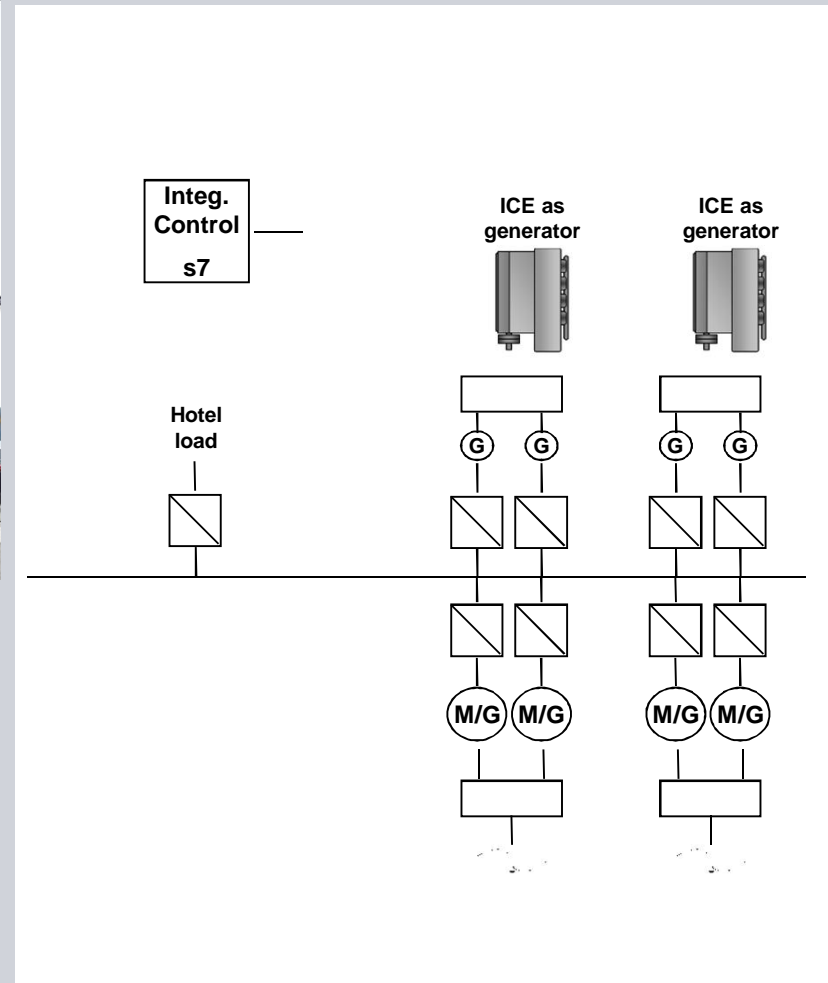
**SIEMENS**





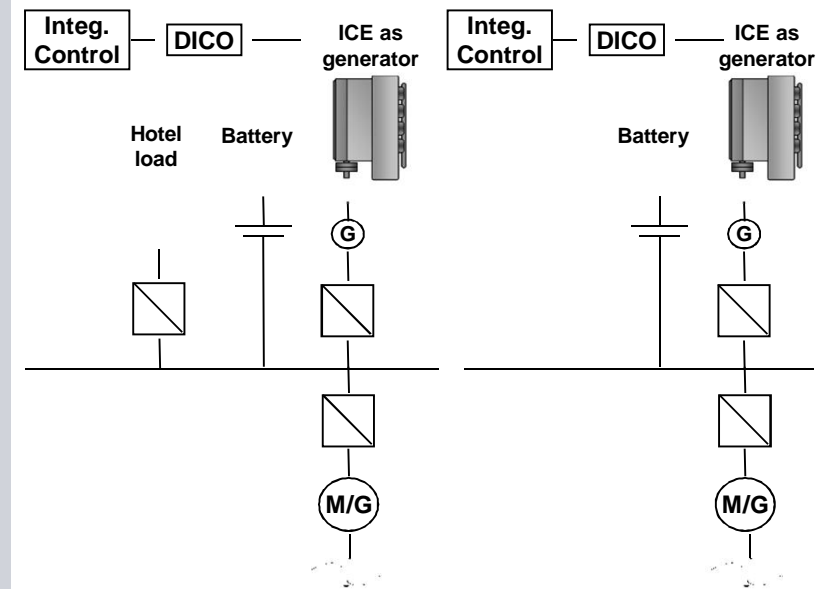
# Hybrid drive configuration example – Wally project – Launched 05/2012

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# Hybrid drive configuration example – Energytech Marine – Launch 2013

**SIEMENS**





# Hybrid drive configuration example – Zebotec – Cobalt boats – In operation since 2011

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## Cobalt 233 ZET





powered by zebotec Drive Systems

Der Cobalt 233 ZET wird aussergewöhnlich schnell und leistungsfähig von einem elektrischen Antrieb (Zebotec) angetrieben. Zusammen mit der Brennstoffzelle (Fuel Cell) bildet das Zebotec-System ein einzigartiges Antriebssystem für die Cobalt 233 ZET. Das System ist auf die besonderen Anforderungen der Cobalt 233 ZET ausgelegt und ermöglicht eine maximale Leistung von 30 kW.

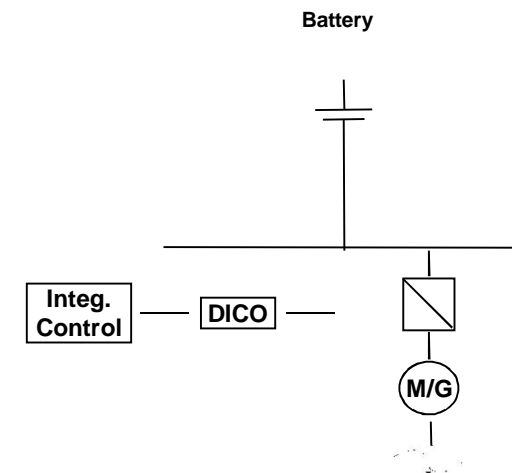
Cobalt 233 ZET	
Länge	ca. 23 m
Breite	ca. 3,5 m
Leistung	ca. 30 kW
Leistung	30 kW
Grösse	ca. 30 m³
Maximale	ca. 1 x 1 m

eMobility ist stark klar

Der elektrische Antrieb (Zebotec) ist ein elektrischer Antrieb, der die Cobalt 233 ZET mit einer elektrischen Leistung von 30 kW antreibt. Das System ist auf die besonderen Anforderungen der Cobalt 233 ZET ausgelegt und ermöglicht eine maximale Leistung von 30 kW.

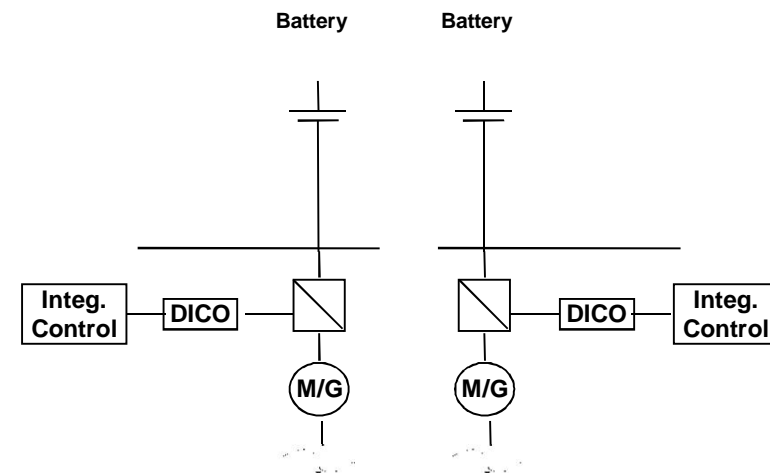




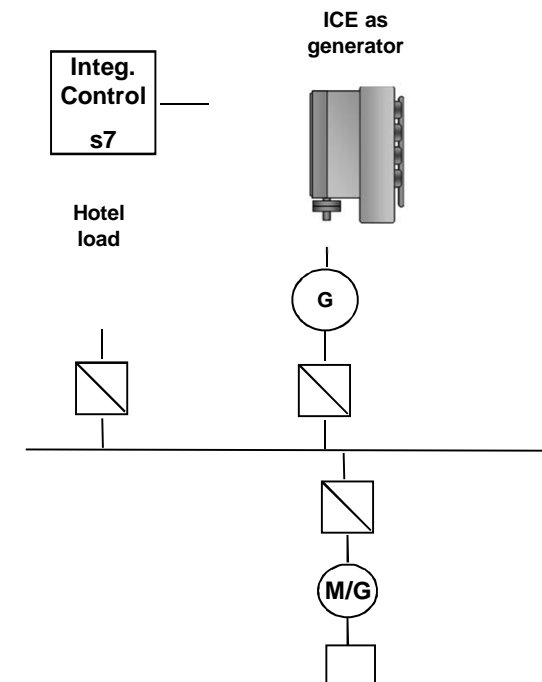
## Hybrid drive configuration example – Long island boats – Launched 02 / 2013

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## LNG-electric drive configuration – River transport boats – acquisition ongoing

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## Electric vessel in Norway



**2x500 kW Propulsion**  
**5.5 MWh battery bank**

# Siemens Experience Globally with Hybrid Bus Technology

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## How can we support the waterborne segment?

### Turnkey Solutions

- Project specific solutions via our Siemens internal integrator in Hamburg
- System access is also possible via an external integrator
- Simple to multiply system. Just a one time set up fee for series production

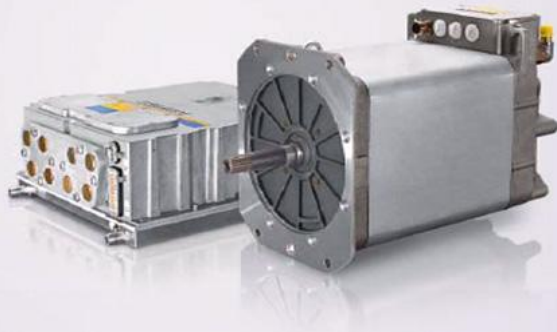
### Pretested and preconfigured systems

- The Siemens marine hybrid system allows for various types of applications in the marine environment
- Standard systems are pretested in our systems test lab in Nürnberg
- Configuration adaptation possible to meet different propulsion needs.

### Components and functionalities

- Very compact, water cooled inverters and motors
- Standardized controls
- Drive and generator capabilities
- Provision of on board network (0-500V 56/60 Hz)

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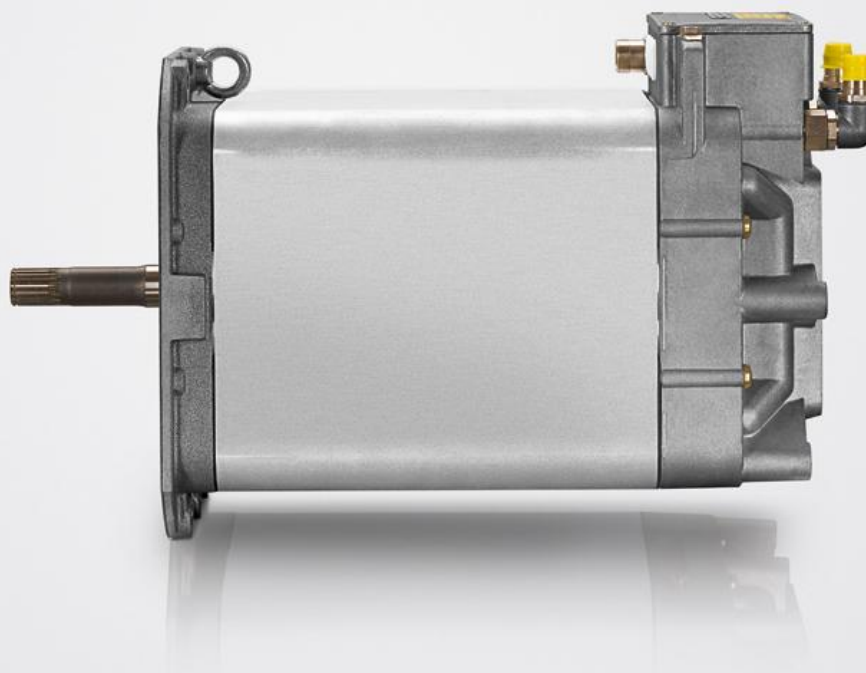


## ELFA drives and generators





## ELFA drives and generators



## ELFA Inverter

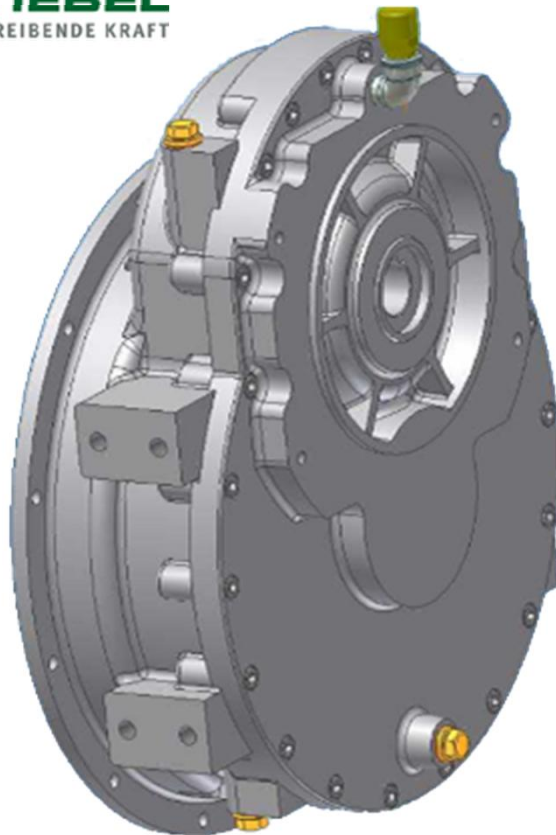


## ELFA Inverter



# Stiebel Stepup gearbox for 1FV5139 140kW and 1FV5168 200kW

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**For 1FV5139 140kW - 6 and 12 o'clock**

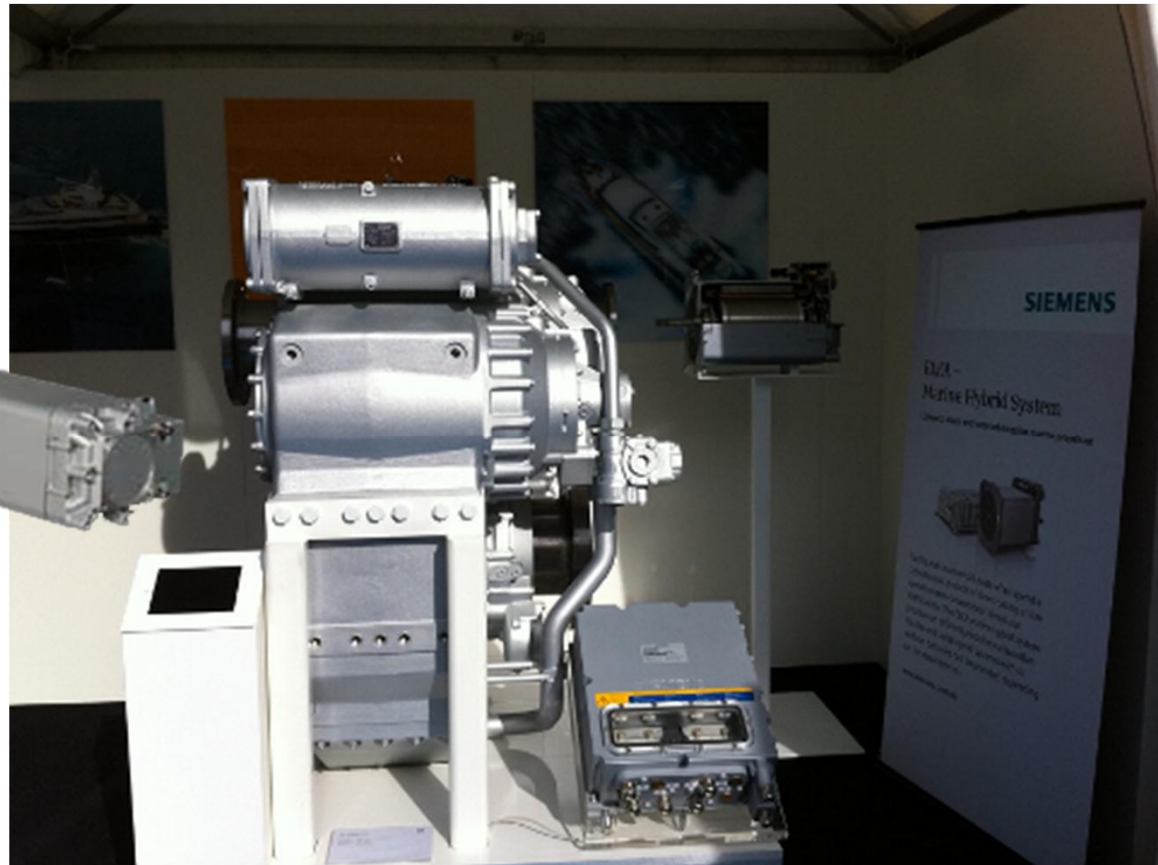
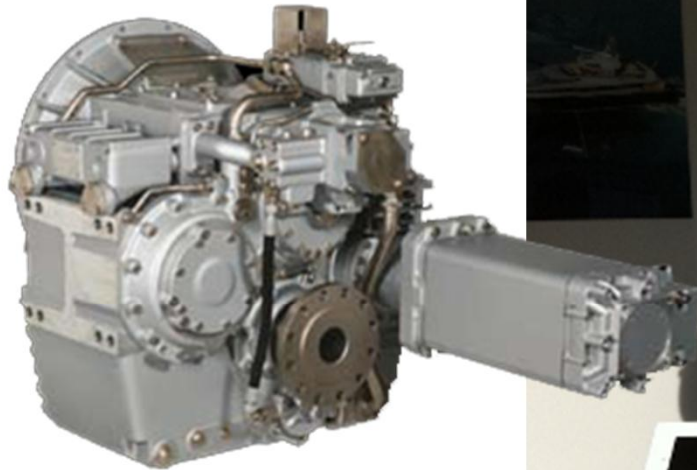


**For 1FV5168 200kW – 6 o'clock**

**DICO**

## ZF Parallel hybrid gearboxes - Series 5000, 9000 and 23000 – Launch of 2000 and 3000 expected

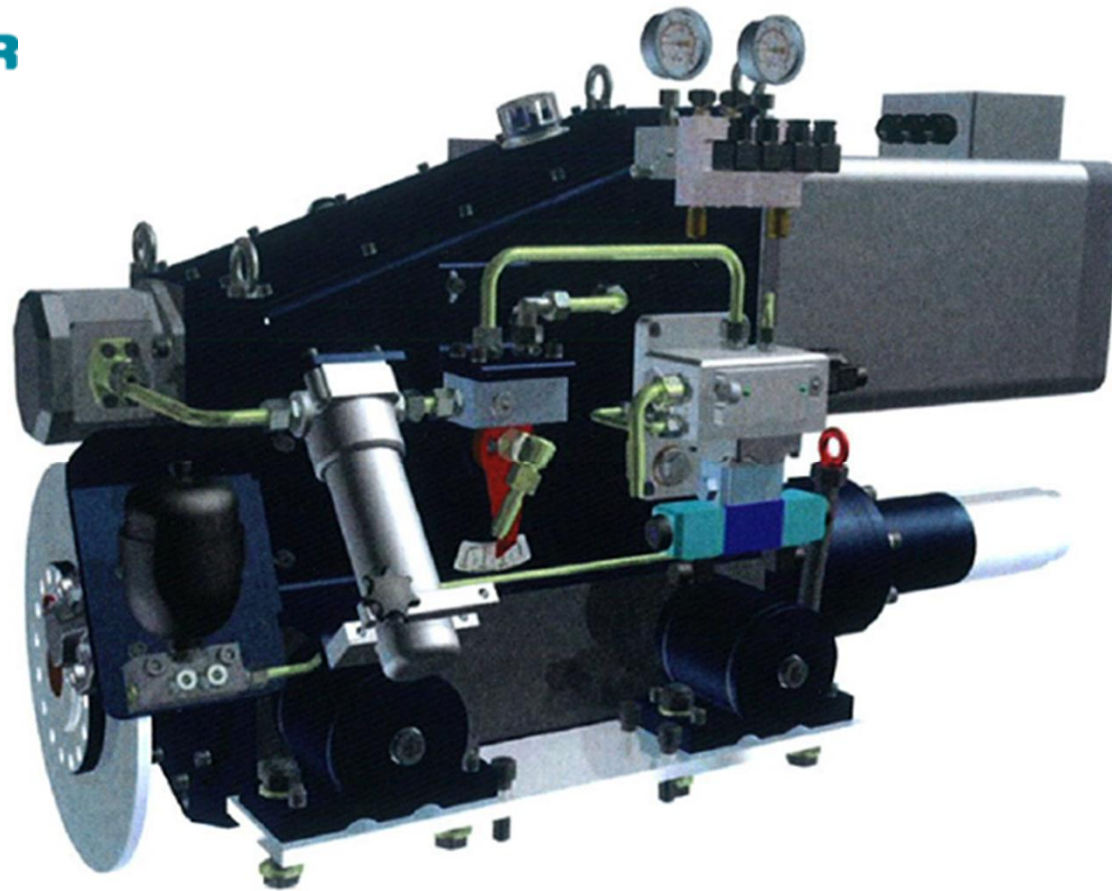
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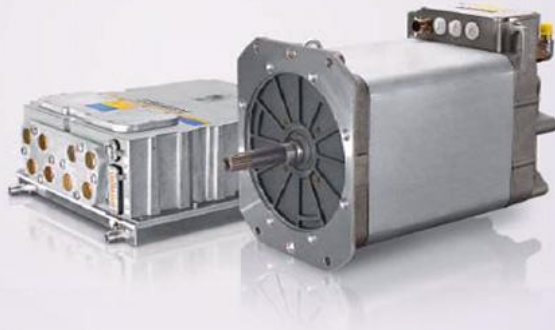


## Servogear Hybrid CPP Propulsor

  
**SERVOGEAR**



**Thank you for your attention!**



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