



# UNIVERSIDAD TECNICA FEDERICO SANTA MARIA

Tesis de Magister

## Design and Sizing of an Energy Storage System for a Hybrid Tugboat

Tesis para optar al título de  
Magister en Ciencias de la Ingeniería Electrónico

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# Agradecimientos

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# Resumen

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# Capítulo 1

## Simulation results

The last step here, is to simulate the power train, related with all the elements inside, as battery bank, power converters, electric motor, etc.

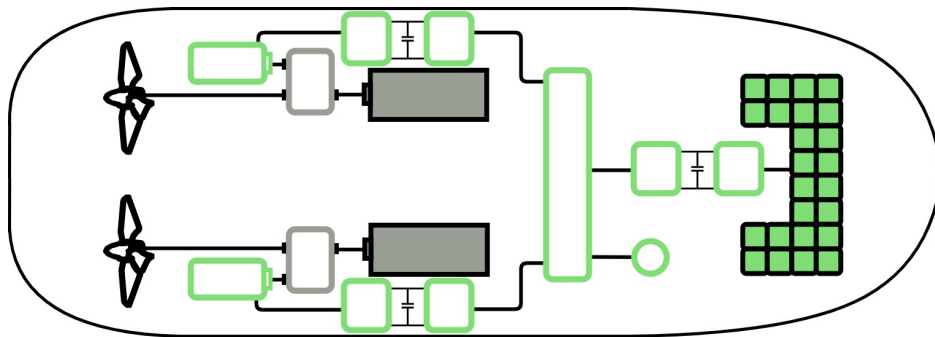


Figura 1.1: PowerTrain

### 1.1. Battery Cell

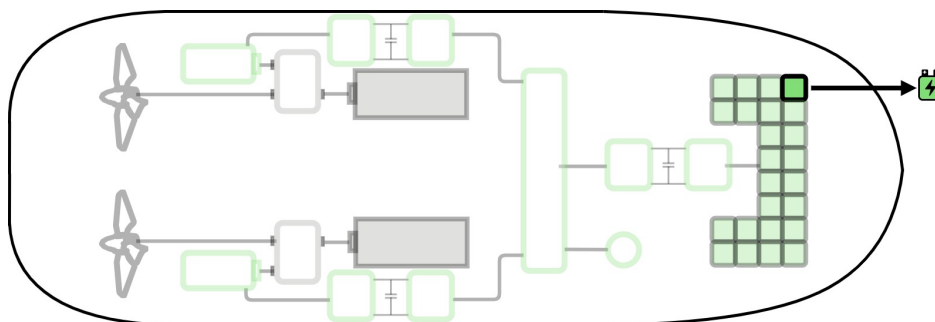


Figura 1.2: BattCell in power train.

The battery bank's design parameters are used to select a cell for electrical modeling with a Shepherd model of order 0. Technical details of the chosen cell, U27-36XP from Valence, are used to find model parameters that closely match its real discharge curve. The model shows good

similarity to the actual performance, as illustrated in Fig. 12. This enables the extrapolation of results to model a battery bank and predict its behavior across various operating profiles.

## 1.2. Battery Bank

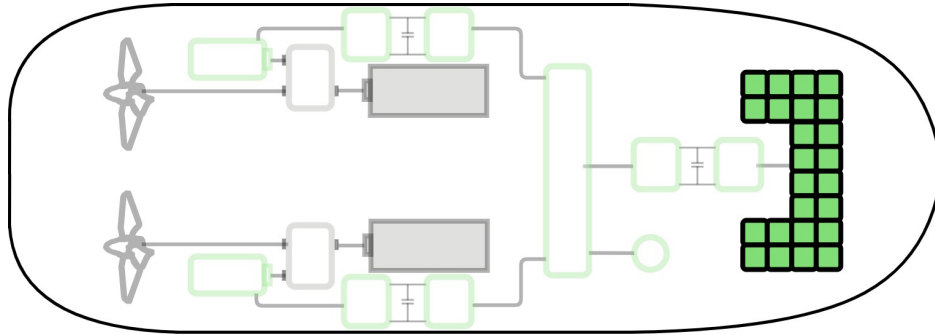


Figura 1.3: BattBank in power train.

## 1.3. Electric Motor

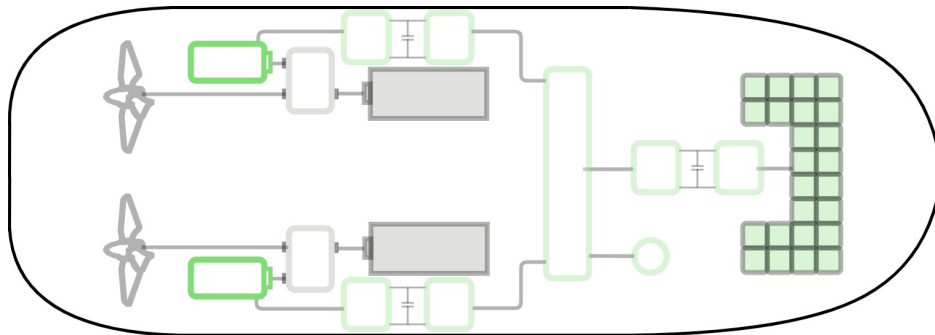


Figura 1.4: ElectricMotor in power train.

## 1.4. Diesel Propulsion Engine

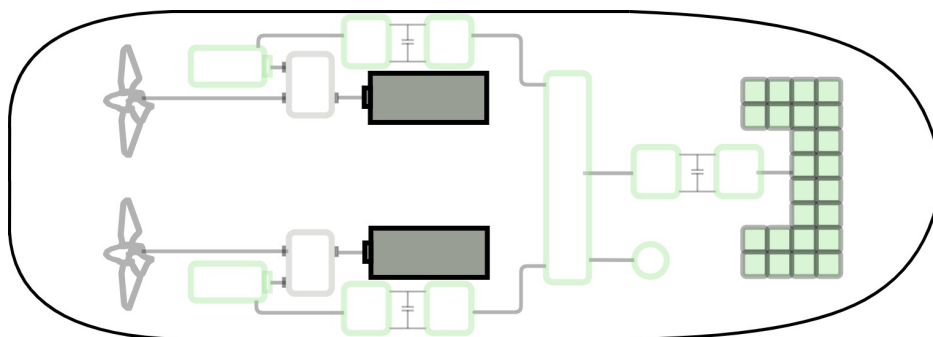


Figura 1.5: Diesel Propulsion Engine in power train.

## 1.5. Propeller

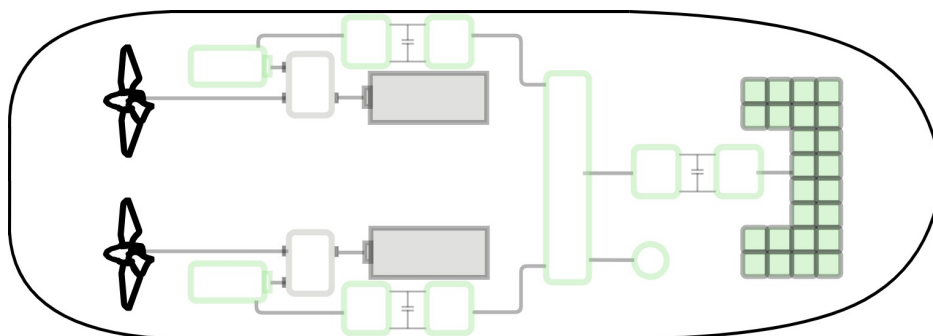


Figura 1.6: Propeller in power train.

- Explicación - Curva hélice - Simulaciones de Potencia

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