



Penguin ZPA

The High-Speed Craft Specialists
Designer. Builder. Owner. Operator.



Case Study on “The Solar Retrofit of Penguin Redeem”

30 August 2019

The Penguin Group

- An integrated Designer-Builder-Owner-Operator of aluminium high-speed vessels
- Shipyards in Singapore and Batam
- Ship owner and operator in Singapore and Malaysia
- Financially conservative

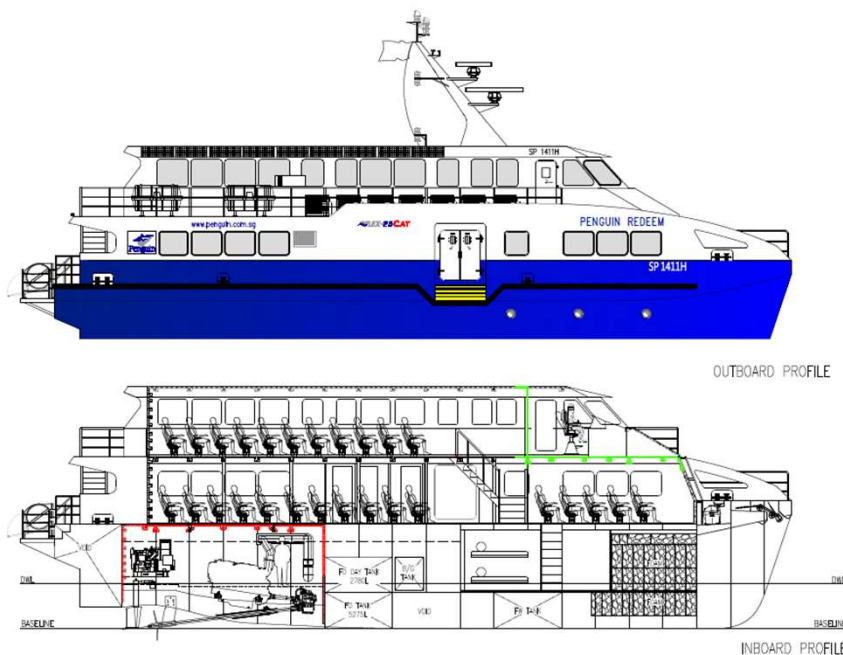


HOME OF THE  FLEX

2
COMMERCIAL IN CONFIDENCE


Penguin®

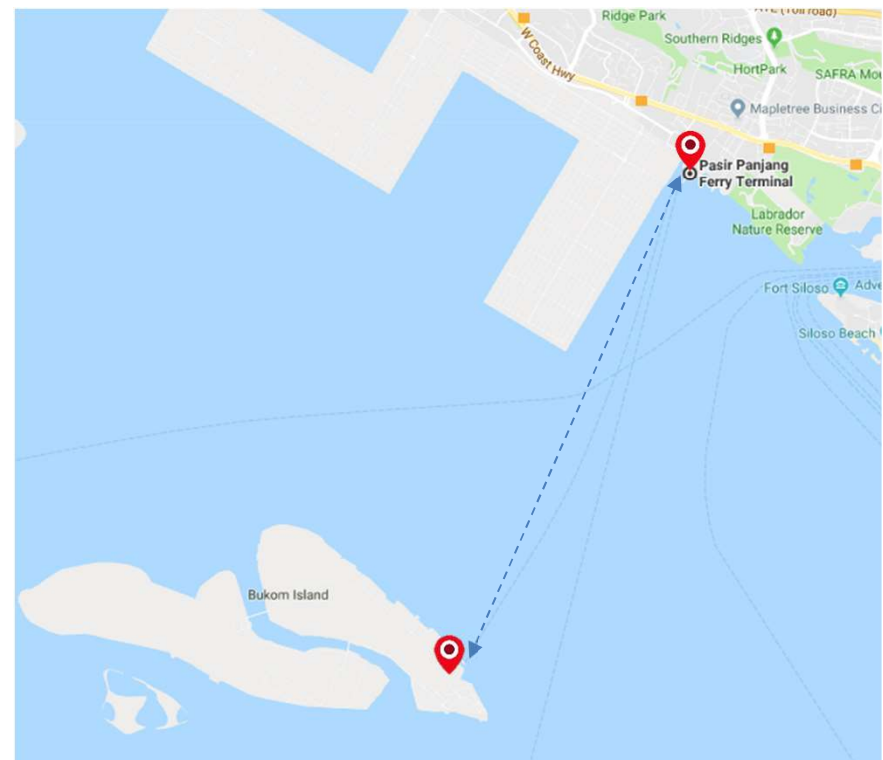
Penguin Redeem: Principal Particulars



Length Overall	Breadth Moulded	Depth Moulded	Loaded Draft
26.3m	8.5m	3.7m	1.63m
Passenger Capacity	260 pax		
Engines	2 x CAT C32 ACERT (1450 BHP)		
Propulsion	2 x Fixed-Pitch Propellers		
Maximum Speed	> 20 knots @ 100% MCR and full pax		
Notation	Bureau Veritas ⚓ Hull • Mach, Lightship / Fast Passenger Vessel Singapore Port Limit		

Penguin Redeem: Operating Profile – Day Time

- Shuttling Shell's employees and subcontractors between Pasir Panjang Ferry Terminal and Pulau Bukom Ferry Terminal.
- Peak hours:
 - 5:30 am to 8:30 am
 - 5:30 pm to 8:30 pm
- Distance: 3.3 nm
- Travelling time: 15 mins one-way
- No. of round trips a day: 6



Penguin Redeem: Operating Profile – Overnight

- Berthed at Pulau Bukom from approx. 9 pm to 5 pm with 6-7 crew living aboard.
- Electricity is required overnight to power “hotel load” for air-con, lighting, electric stove and washing machine:
 - Diesel consumption: Approx. 100 litres / night
 - GHG emissions: Approx. 200-300 kg / night
 - Additional running hours: Approx. 3,000 hrs / year
 - Inefficient operation of generator

Penguin Redeem: Solutions Contemplated for Overnight Ops

- Turn off all power
- Utilise shore power
- Utilise a smaller generator
- Utilise solar power

Penguin Redeem: Solar Power Inspired by “Surya Namaskar”



Southeast Asia's first pure solar boat

Zero emission, zero fuel consumption

8m, 10 kW motor, 15 knots, 25 sqm of solar panels

Sailed 756 nm from Bali to Flores and back

Penguin Redeem: Solar Power for Overnight Ops

- Zero diesel consumption: Saving approx. 100 litres / night
- Zero GHG emission: Eliminate approx. 200-300 kg / night
- Reduced running hours: Saving approx. 3,000 hrs / year
- Improve generator lifespan and reduce consumables (e.g. lubes, additives and filters)



A quieter vessel

Penguin Redeem: Solar Retrofit Considerations

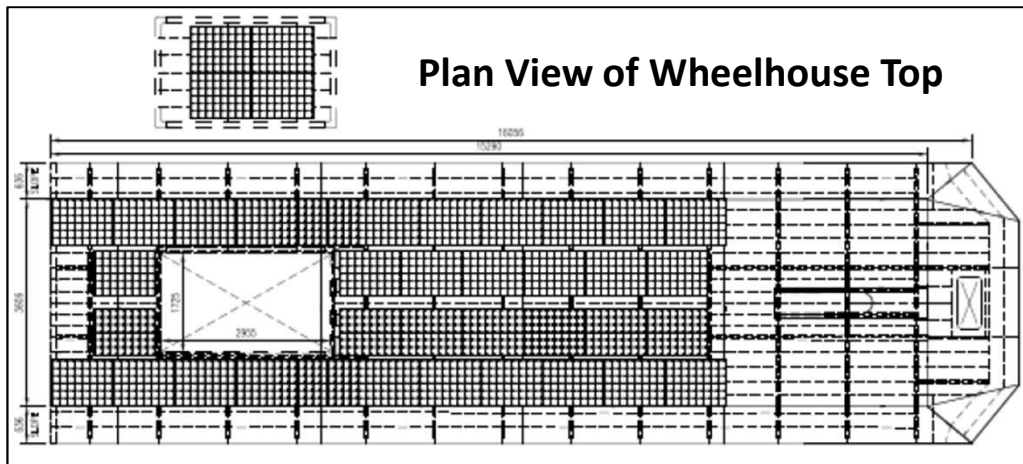
- Harvesting of energy
 - Available free surface area
 - Number and placement of solar panels
 - Solar panel weight, cost, size, power output
 - Effectiveness during various weather conditions
- Storage of energy
 - Type of batteries: Lead acid vs Li-polymer vs Li-ion
 - Battery weight, cost, size, storage capacity
 - Safety concerns
- Return on Investment



Penguin Redeem: Solar Panel Arrangement



Solar array on the roof



Penguin Redeem: Time and Costs

- As a fully integrated Designer-Builder-Owner-Operator, we utilised our in-house design, project and ship management resources to execute the solar retrofit project.
- We are thankful for the support from our project partners, Azura Marine and Z-Power.
- Total project duration: Approx. 2 months
- Payback period: < 5 years
- Total vessel weight attributed to solar retrofit: < 700 kg (< 1% of lightship weight)

Penguin Redeem: Youtube Video Courtesy of Azura Marine





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CALM
AND
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PENGUINS

Crew Boats • Security Boats • Fire Boats • Wind Farm Vessels • Passenger Ferries

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