



# How to Successfully Build an Electric Narrowboat

A talk by Caroline Badger



# Ortomarine – History & Pedigree

- Electrical engineering roots
- Exclusively build all-electric and hybrid boats





# Ortomarine – History & Pedigree

- Electrical engineering roots
- Exclusively build all-electric and hybrid boats
- 3 all-electric trip boats built for charitable trusts
- 11 parallel hybrids built to date
- Currently building our 11<sup>th</sup> serial hybrid
- 1 x conversion from diesel to serial hybrid (hire boat)
- Have built over 40 boats since 2015

## By 2025 we expect that:

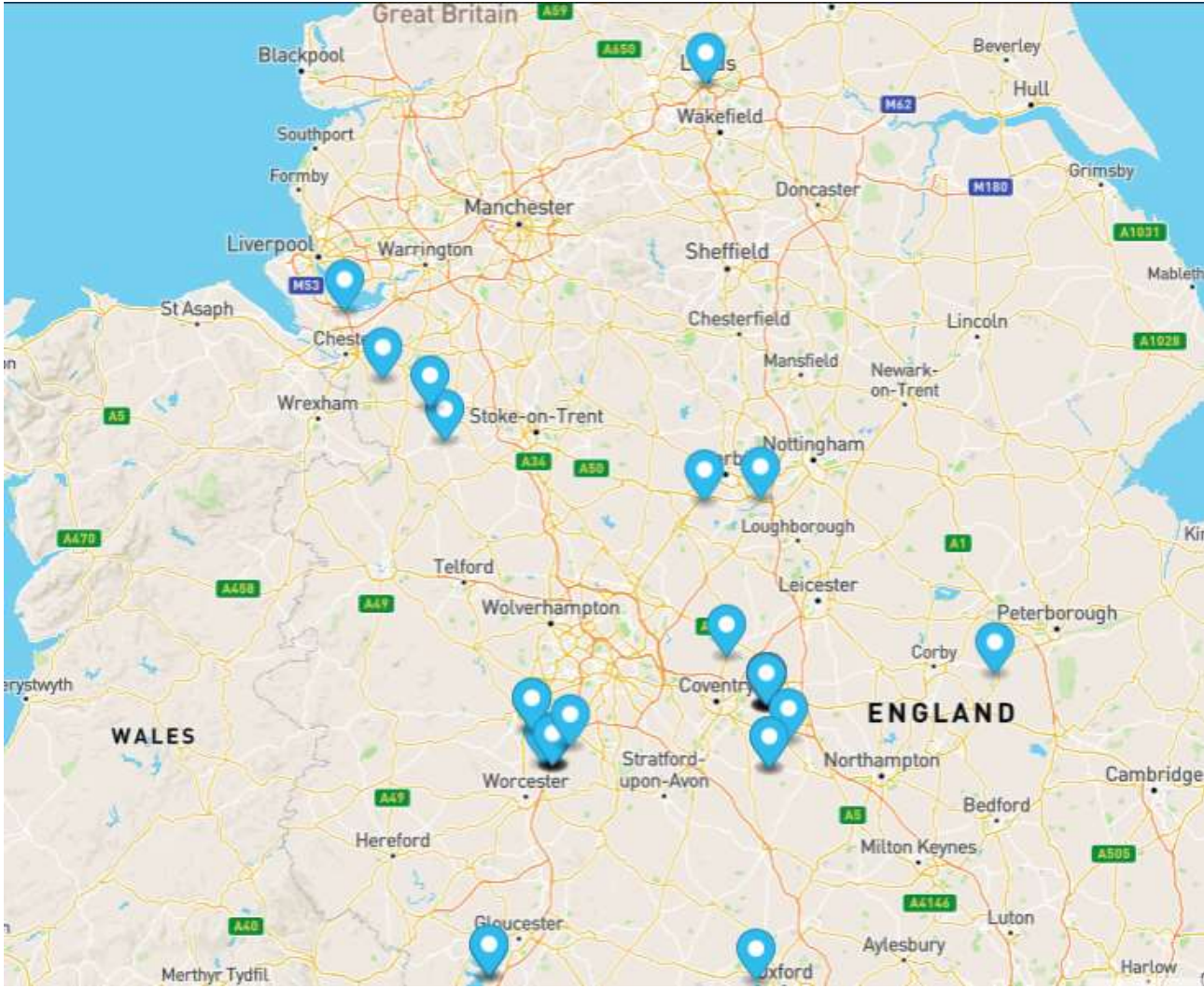
- i. All vessels operating in UK waters are maximising the use of energy efficiency options. All new vessels being ordered for use in UK waters are being designed with zero emission propulsion capability. Zero emission commercial vessels are in operation in UK waters.
- ii. The UK is building clean maritime clusters focused on innovation and infrastructure associated with zero emission propulsion technologies, including bunkering of low or zero emission fuel.



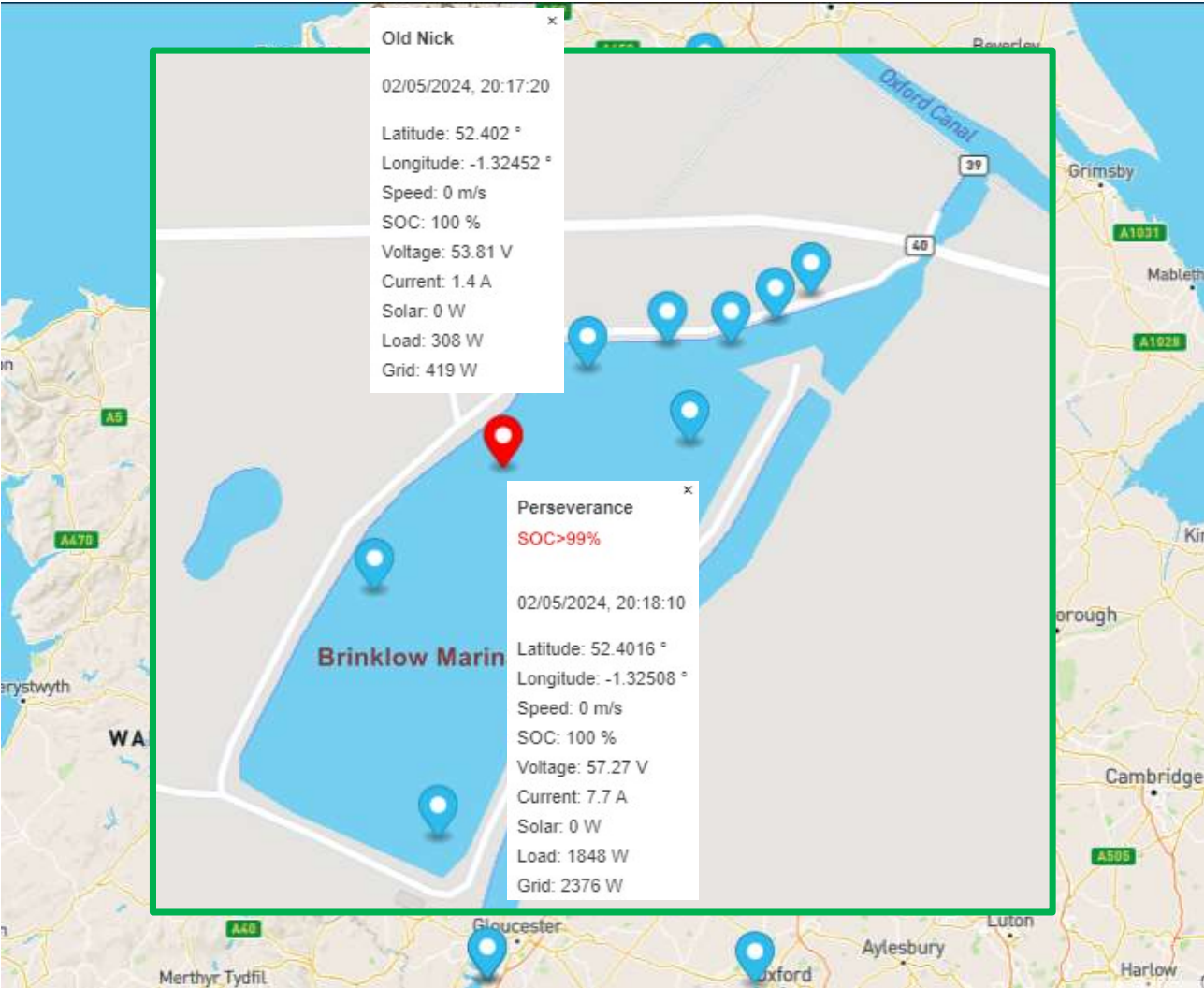
Clean  
Maritime  
Plan



# electrik@=

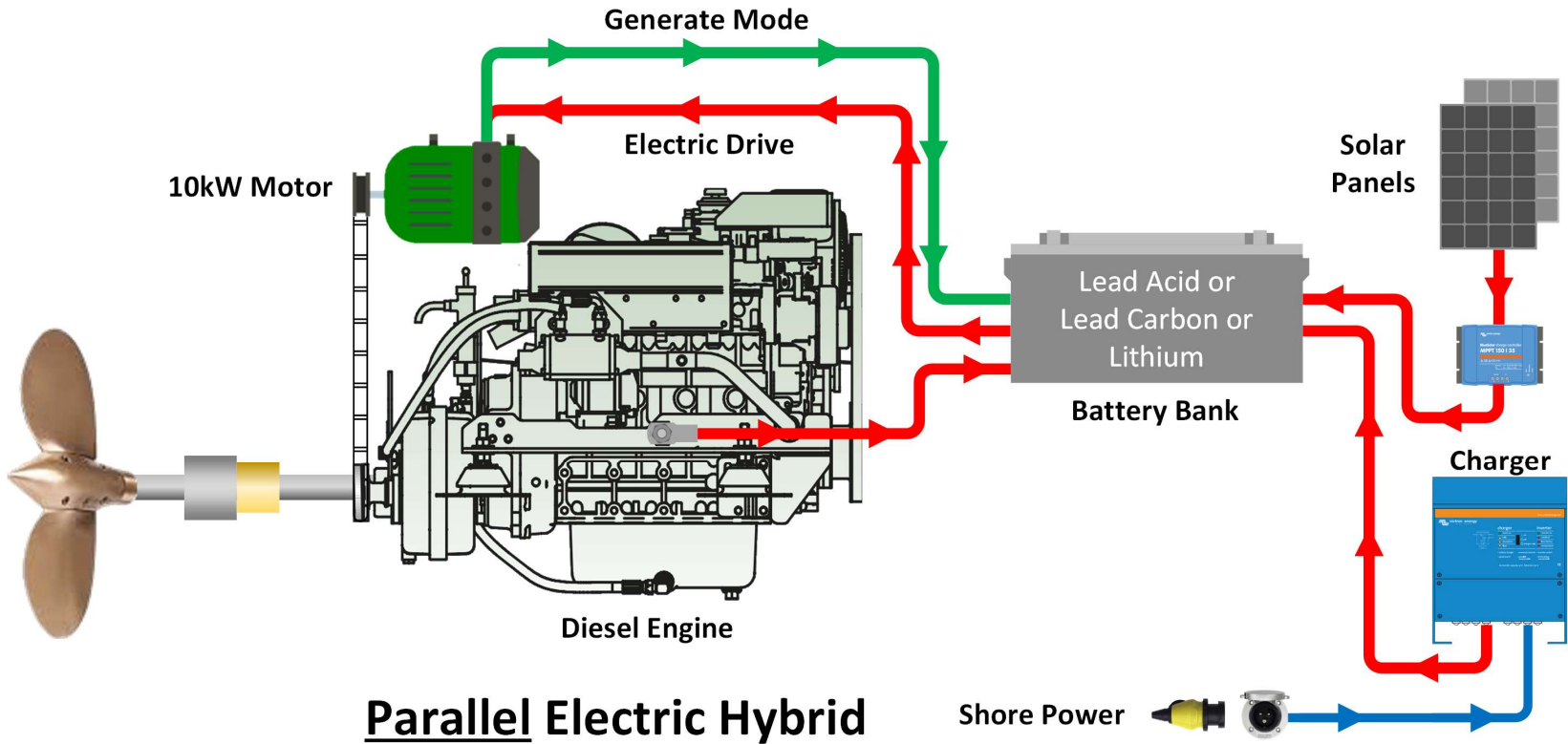


# electrik@





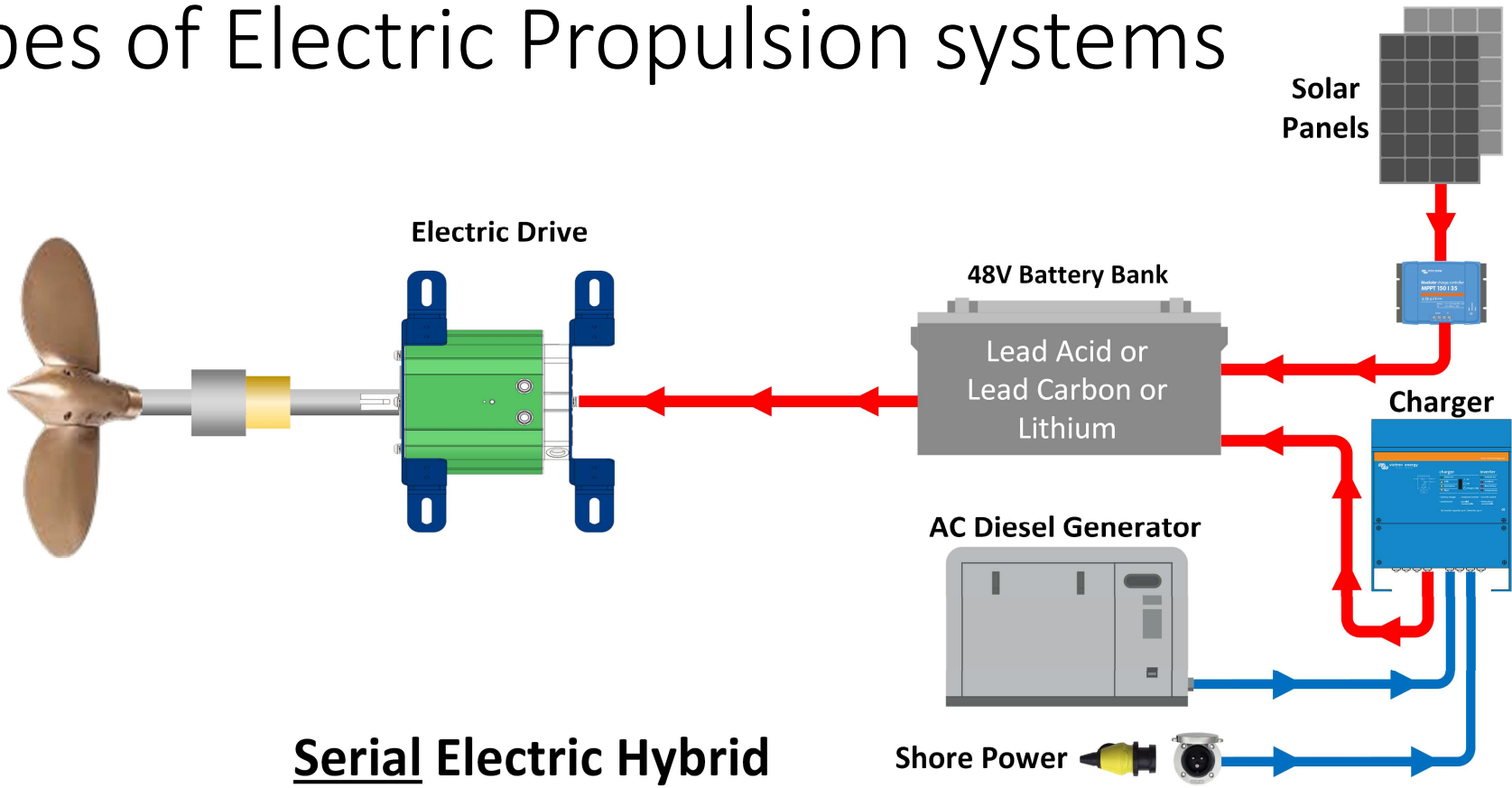
# Types of Electric Propulsion systems



Parallel Electric Hybrid



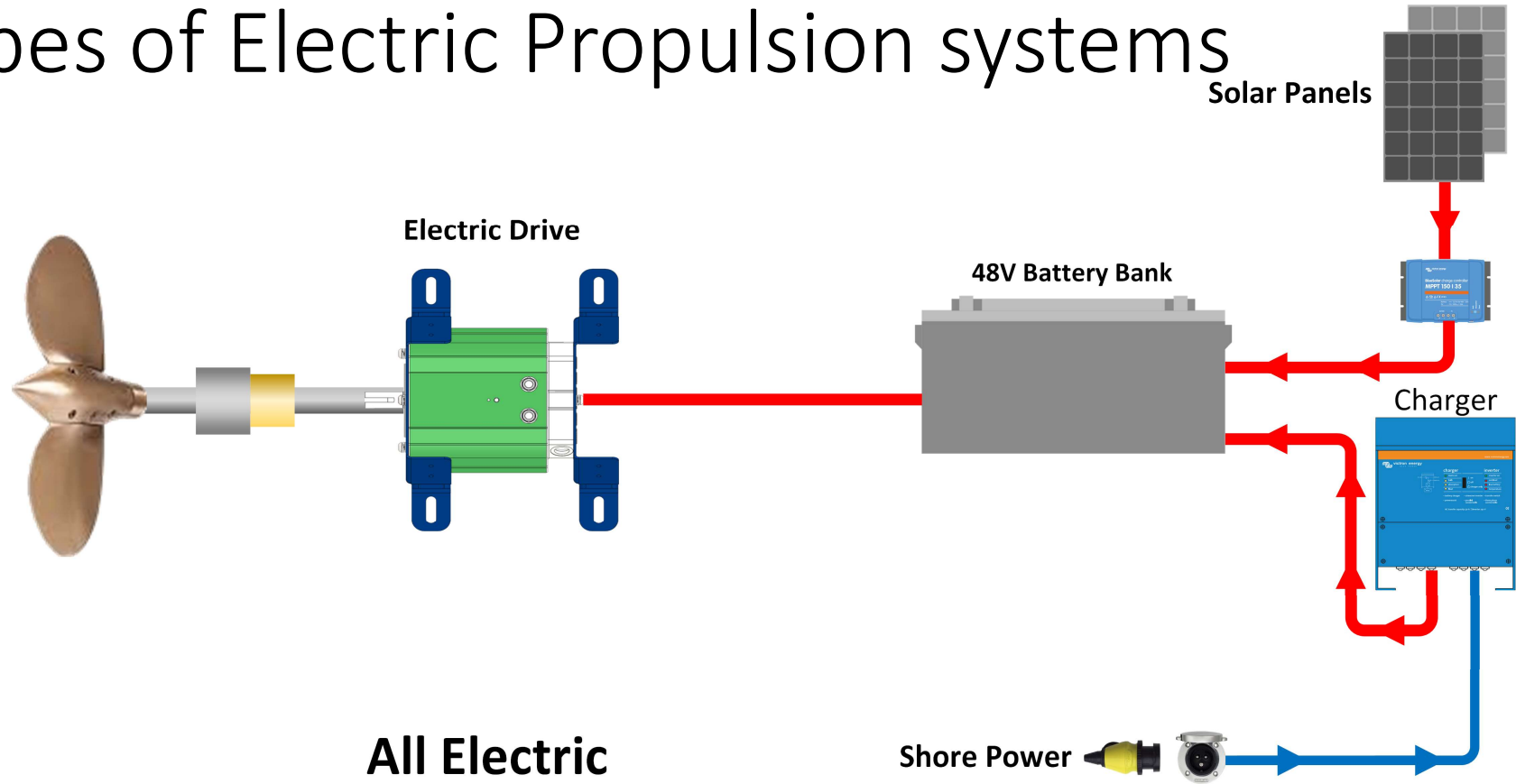
# Types of Electric Propulsion systems



Serial Electric Hybrid



# Types of Electric Propulsion systems



**All Electric**

Shore Power





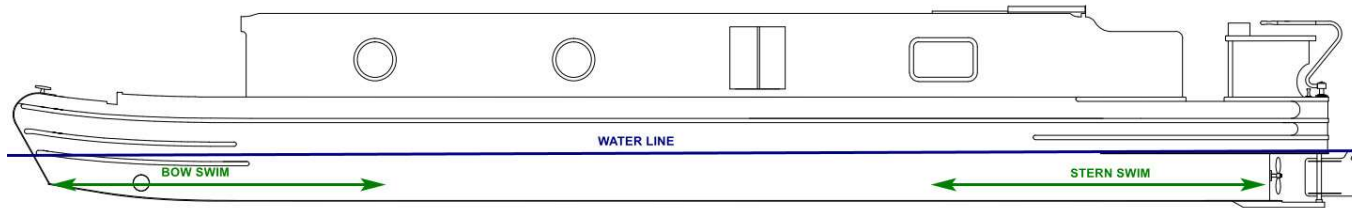
# Electric Narrowboats

- Ideal vessel for electric propulsion:
  - Weight not an issue
  - Slow speed of travel
  - Large roof area for solar panels
- Assessing customer's expectations - Vital
  - Cruising style – continuous cruisers or seasonal second home
  - “White knuckle waters”
  - Efficiency v Speed
  - Domestic living



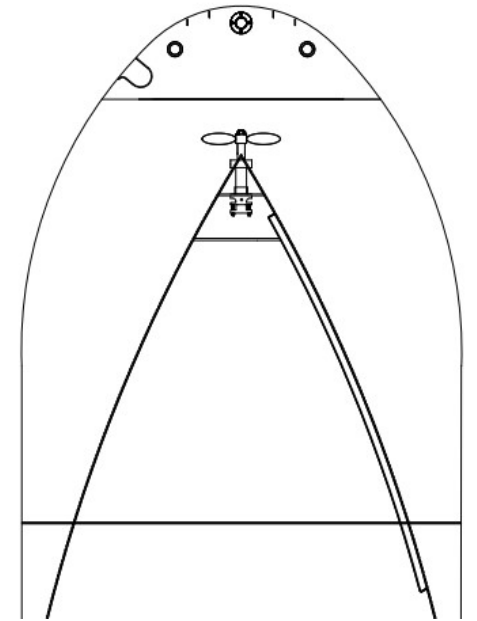
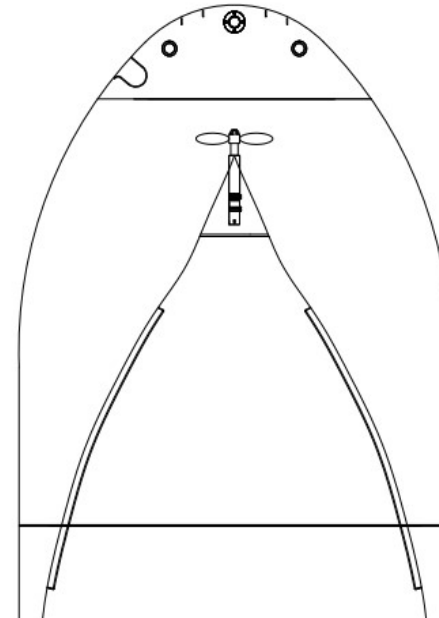
# Hull Design & Draught

- Old work boats – optimum design
- Explanation of swims.



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- Stability & internal space v efficiency





# Hull Design & Draught

- Old work boats – optimum design
- Explanation of swims
- Stability & internal space v efficiency
- Poor state of the canal network & lack of funding for dredging



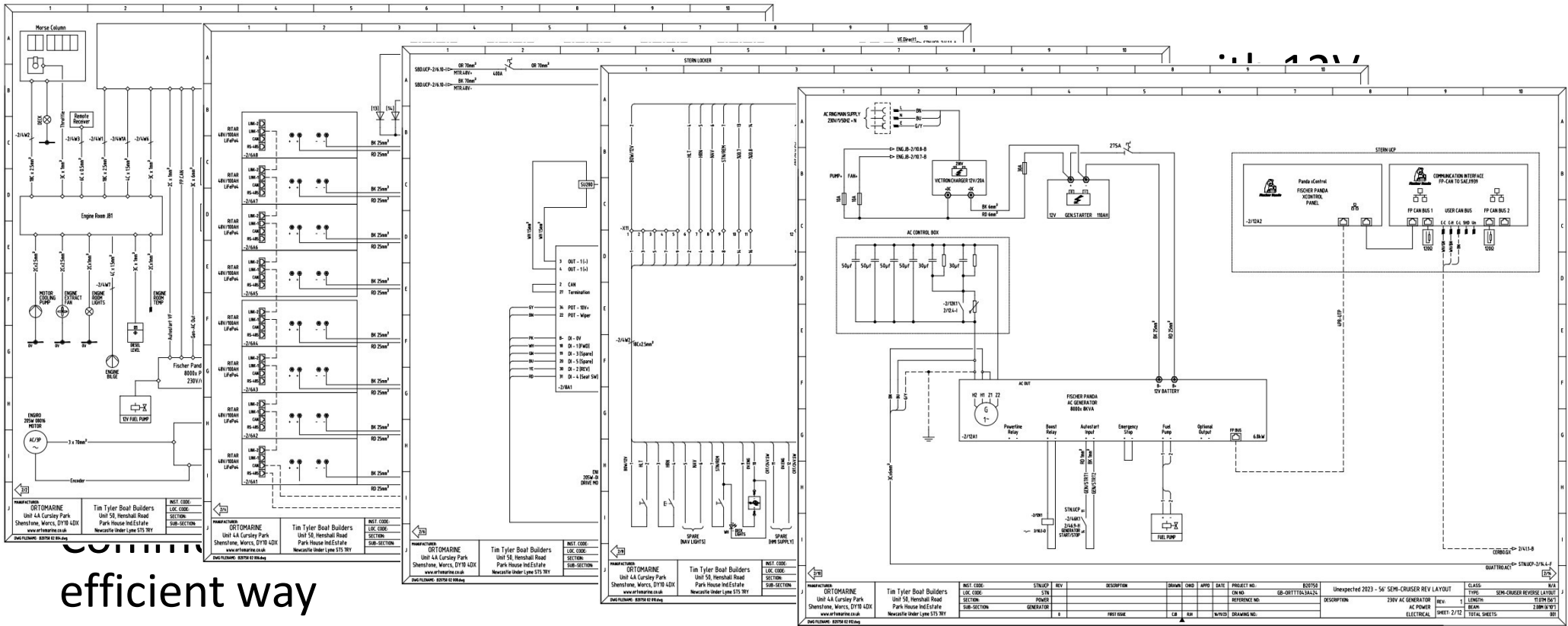


## Equipment Choice – Serial Hybrid & All Electric

- Motor – type & power rating
- Batteries – type & bank size
- Inverter/charger – type & size
- Solar panels - type & array
- Generator (serial only) – type & size
- Heating – diesel, solid fuel, all-electric or combination



# System Design, Data & Comms – VITAL



efficient way



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**Domestic**

74%  
76%  
322  
228L

**Propulsion**

**Main drive**

**Brushless Thrusters (Bow/Stern)**

**Ortomate**

**GPS**

**WiFi**

**Power Sources**

**Battery Management**

<b>Carbo GX</b> SOC 67.0% DC Voltage 49.19V DC Current 0.0A Batt. Temp 15.5°C	<b>VE CAN</b> Battery Idle <b>0.00 [H-M]</b> Consumed AH <b>0.0</b> 48V DC (800Ah) Inverting	<b>Modbus (RS-232)</b> Voltage 49.14 Min 3.273 Current 0.00 Max 3.277 u1 SOC 70.3 Diff 0.004 Voltage 49.12 Min 3.274 Current 0.00 Max 3.277 u2 SOC 67.0 Diff 0.003 Voltage 49.10 Min 3.275 Current 0.00 Max 3.277 u3 SOC 65.1 Diff 0.002 Voltage 49.19 Min 3.273 Current 0.00 Max 3.277 u4 SOC 67.4 Diff 0.004
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**Ortopilot**



# Sample Ortomate Screens

11/04/24 THU 16:12  
NB Unexpected

Going Green with **Ortomarine**

Solar Yield Power Hot Water  
Alarms Cruise Generator

Cabin 19.89°C Cabin 66.7% Hot Water 19°C Eng. Room 25°C Diesel 209/225L Water 112/600L

Eng. Room Light ON Bilge Pumps Deck Lights ON

11/04/24 THU 16:13  
NB Unexpected  
48.8000.110.230

Generator 0.0 kW AC Loads 0.0 kW  
AC Input 0.0 kW

Quattro 8kVA Current Limit Off

Solar Charger 0.2 kW Battery 50.3V SoC 83%  
Today: 3.1 kWh Yesterday: 1.1 kWh MPPT Active

Bow Thruster 0.0 kW Propulsion 0.0 kW DC Power 0.1 kW

11/04/24 THU 16:13  
NB Unexpected

Standby

Battery 12.60 V Coolant 14.0 °C 0.0 V  
Previous 1:03 h:m Winding 13.0 °C 0.0 A  
Total 10:30 h:m Exhaust 15.0 °C 0.0 Hz  
Service 42 h Engine 0 RPM 0.0 kW  
Avg\_Load 0 %

Gen.Enable Remote Mode  
Auto-Start Gen. Enabled  
Top-Up Auto-Start Enabled  
Man.START Top-Up Active

11/04/24 THU 16:14  
NB Unexpected

Going Green with **Ortomarine**

Solar Yield Modem Model: RUTX50  
Network Provider: EE  
Current Active SIM: sim1  
Signal Strength: -38dBm  
Select SIM 2

Alarms GPS Longitude: -2.1192057°  
GPS Latitude: 52.2666664°  
Altitude: 46.0m

Cabin 19.90°C Hot Water Generator Water 112/600L

Eng. Room Light ON Bilge Pumps Deck Lights ON

Cerbo GX VE.CAN  
SOC 92.0%  
DC Voltage 50.29V  
DC Current 10.8A  
Batt.Temp 14.5 °C

RITAR ModbusRTU

48V/800Ah DC

Victron 8kVA Quattro  
DC Voltage 50.22V  
DC Current -0.8A  
AC kW [In] 0.00kW  
AC kW [Out] 0.01kW  
Inverting

Voltage	50.34	Min	3.354
Current	1.32	Max	3.357
#1 SOC	93.3	Diff	0.003
Voltage	50.34	Min	3.353
Current	1.41	Max	3.354
#2 SOC	92.2	Diff	0.001
Voltage	50.33	Min	3.351
Current	1.32	Max	3.354
#3 SOC	92.1	Diff	0.003
Voltage	50.33	Min	3.353
Current	1.35	Max	3.356
#4 SOC	92.0	Diff	0.003
Voltage	50.26	Min	3.356
Current	1.36	Max	3.358
#5 SOC	91.8	Diff	0.002
Voltage	50.23	Min	3.353
Current	1.37	Max	3.355
#6 SOC	92.0	Diff	0.002
Voltage	50.27	Min	3.354
Current	1.37	Max	3.356
#7 SOC	92.3	Diff	0.002
Voltage	50.22	Min	3.353
Current	1.31	Max	3.356
#8 SOC	92.6	Diff	0.003



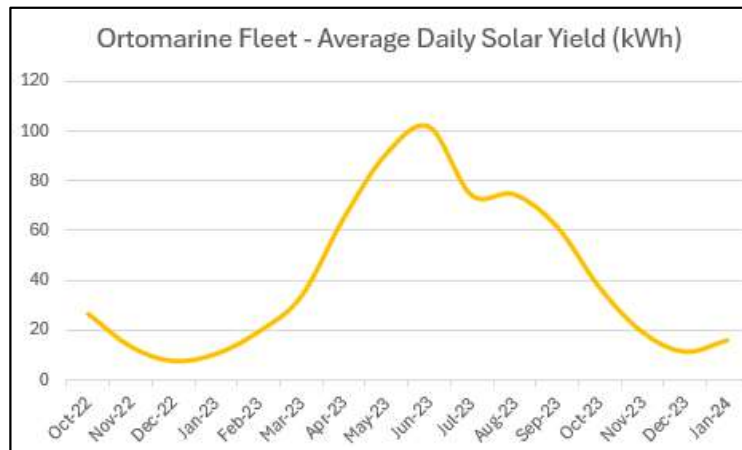




# Useful experience & data gathered

- Trials event data
- Real life liveaboard data
- Running costs of generator v shore power cost
- Solar Bell

Genset Rating:		8 kVA	12 kVA
Fuel Consumption Litre/Hr	@ 80% load	1.8	2.8
	@ 30% load	0.7	1.1
Cost per hour	@ 80% load	£2.16	£3.36
	@ 30% load	£0.84	£1.32
Cost per kW	@ 80% load	£0.34	£0.35
	@ 30% load	£0.35	£0.37
<i>Based on Red Diesel £/l</i>		£1.20	





# Conversion from Diesel to Electric

- Budget
- Ollie Owl - £40K conversion costs





# Conversion from Diesel to Electric

- Budget
- Ollie Owl - £40K conversion costs
- Engine room & cabin space
- Battery choice & ballast
- Existing electrical system
- Motor and generator cooling





# Conversion from Diesel to Electric





## Alternative forms of power

- Wind
- Hydrogen
- Heat Pumps

## Shore Power – Charging Points

- Not like car charging
- Most marinas have 16A shore hook up points
- Occasional 32A shore power points (more in future)
- Must occasionally plug into shore power for battery maintenance



## How to choose a boat builder

- Depends on choice of type of electric propulsion
- Parallel Hybrid usually Hybrid Marine, many experienced boat builders
- Serial Hybrid & All-electric, ask about experience – how many built?
- Confidence in electrical design – ask to see example schematics, single line diagrams, documentation provided to existing customers
- Customer testimonials
- After sales service
- Owner's group?
- ***Already found a preferred builder, but not experienced with electric propulsion installations? We're here to help!***



# Collaboration with Aqua Narrowboats



*Watch out for No 58  
"Thistledown"*

**electrik@**

**Come & talk to us for more information  
and to see our demo system ...**



Free  
phone  
charging  
available  
😊

**Thank you & enjoy the show!**