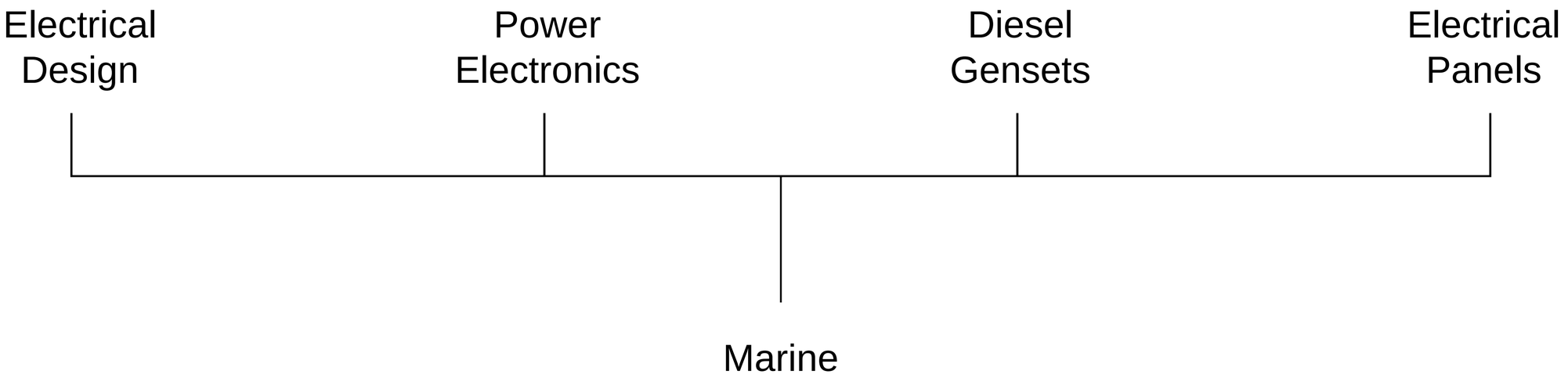
ENERGY SOLUTIONS

HYBRID POWER

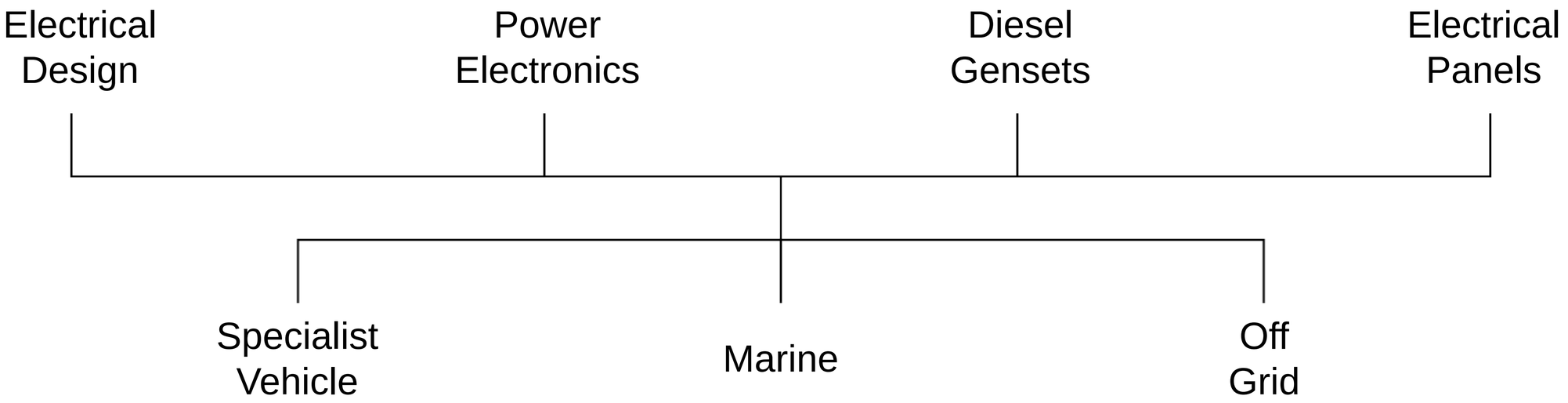
Lessons for Marine learned from construction

ENERGY SOLUTIONS



Where Energy Solutions started

ENERGY SOLUTIONS



Where we are now

ENERGY SOLUTIONS

1990’s
Low power – High cost
“Witchcraft”

2010’s
High Power – Low cost
“The norm”

The quiet force of change – DC / AC Inverters

ENERGY SOLUTIONS

- We are involved in multiple markets
- We are involved with most elements of a Hybrid Power System
- Inverters have become powerful, relatively cheap and readily accepted

So why talk about building sites?

ENERGY SOLUTIONS

The construction industry cares about carbon emissions

Carbon

ENERGY SOLUTIONS

The construction industry cares about carbon emissions and they only know diesel generators

Carbon

ENERGY SOLUTIONS

- Significant load variation
- Single phase loads
- Little or no overnight loads
- Seasonal variation

A typical site

- Three phase generator
- 80kVA – Because we always have!
- Run 24 / 7 – We can’t have the milk go sour

A typical solution

ENERGY SOLUTIONS

- Generators are not efficient at low loads
- Running excessive hours creates noise at night and extra maintenance

and the problem is?

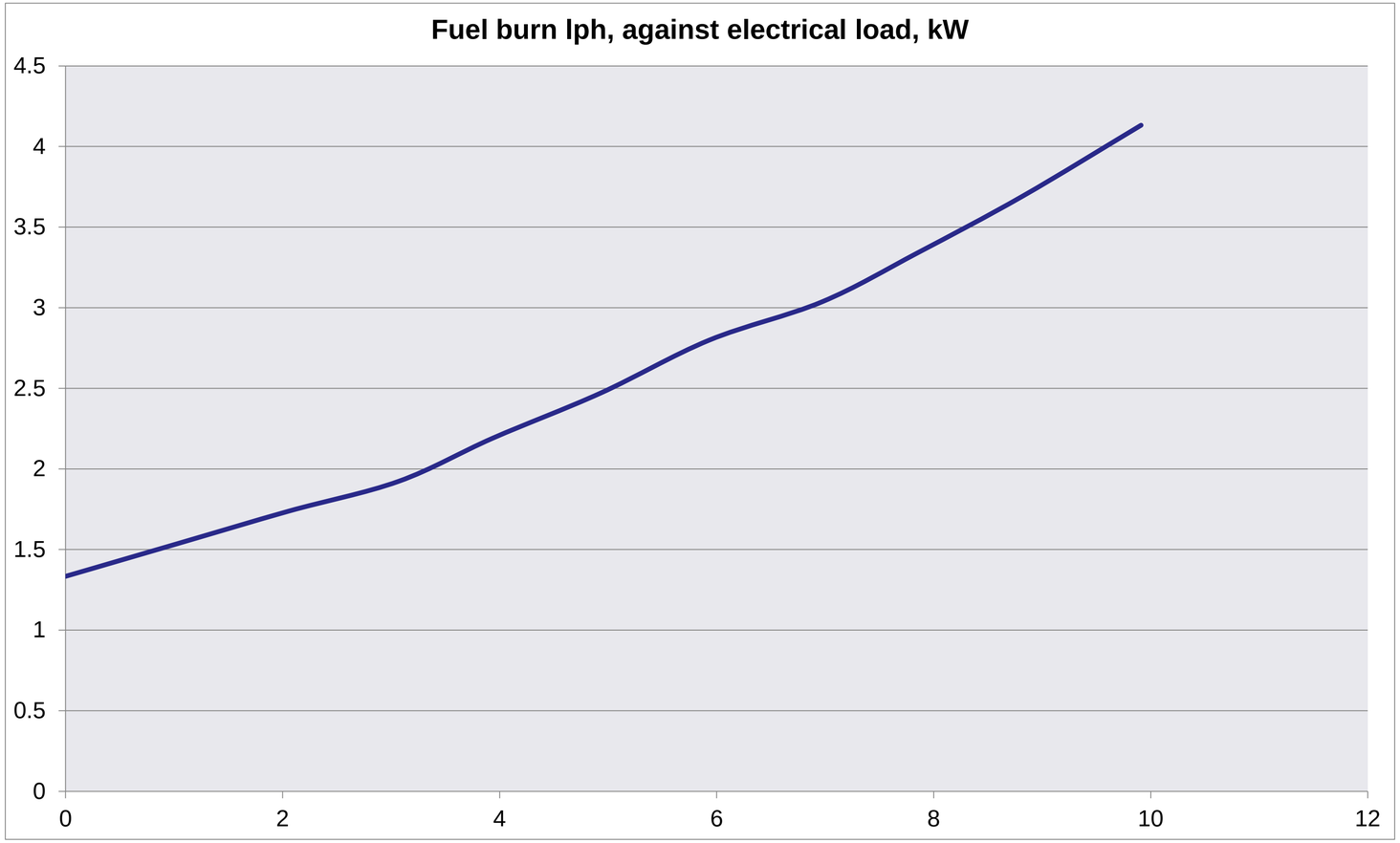
ENERGY SOLUTIONS

So we built a test rig:

- 300 kW programmable loadbank with100 watt steps
- 24 kW of DC-AC and AC-DC power conversion
- Flow monitoring for genset fuel

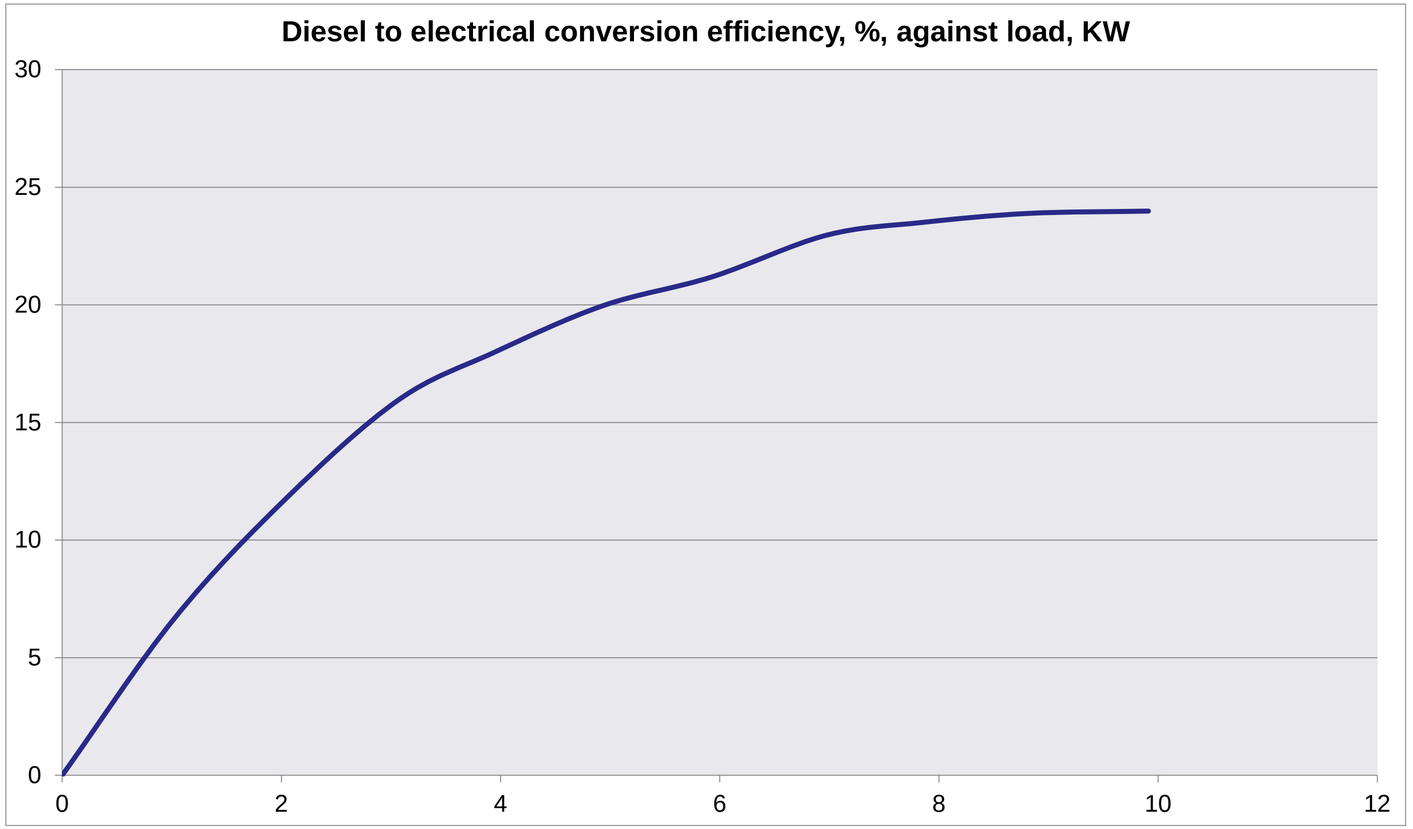
But how inefficient – and what help is hybrid?

ENERGY SOLUTIONS



Generator Efficiency

ENERGY SOLUTIONS



Generator Efficiency

ENERGY SOLUTIONS

Standard generator runs during day

Generator power used to charge energy store

Generator supplies high loads

Generator supplies low loads when running

The Construction Industry Solution

ENERGY SOLUTIONS

Standard generator stops at night

Energy store supplies low loads at night

The Construction Industry Solution

ENERGY SOLUTIONS

Generator 24/7

168 hours	Amount
Fuel Burnt	840 ltrs
Fuel Cost @ 0.60	£504
Servicing @ 0.40 (hr)	£67.20
Total	**£571.20**

Generator work hours only

66 hours	Amount
Fuel Burnt	330 ltrs
Fuel Cost @ 0.60	£198
Servicing @ 0.40 (hr)	£26.40
Total	**£224.40**

Savings per week	
Fuel Saving	510 Ltr
Money Saved incl servicing	£346.80
Carbon	1.4 tons

60% saving

The results are dramatic

ENERGY SOLUTIONS

WITCHCRAFT

Market stage

ENERGY SOLUTIONS

Marine systems generally include:

- Generator
- Battery store
- Power Electronics
- Electrical Panels & control system

The solution looks like a boat

ENERGY SOLUTIONS

Marine systems generally include:

- Generator
- Battery store
- Power Electronics
- Electrical Panels & control system

But

- Often miss the opportunity to be hybrid

The solution looks like a boat

ENERGY SOLUTIONS

Marine Hybrid electrical power:

- No new technology
- No new architecture
- Familiar products

- Lack of data on loads onboard lead to oversizing of generators

ENERGY SOLUTIONS

Marine Hybrid electrical power:

- No new technology
- No new architecture
- Familiar products

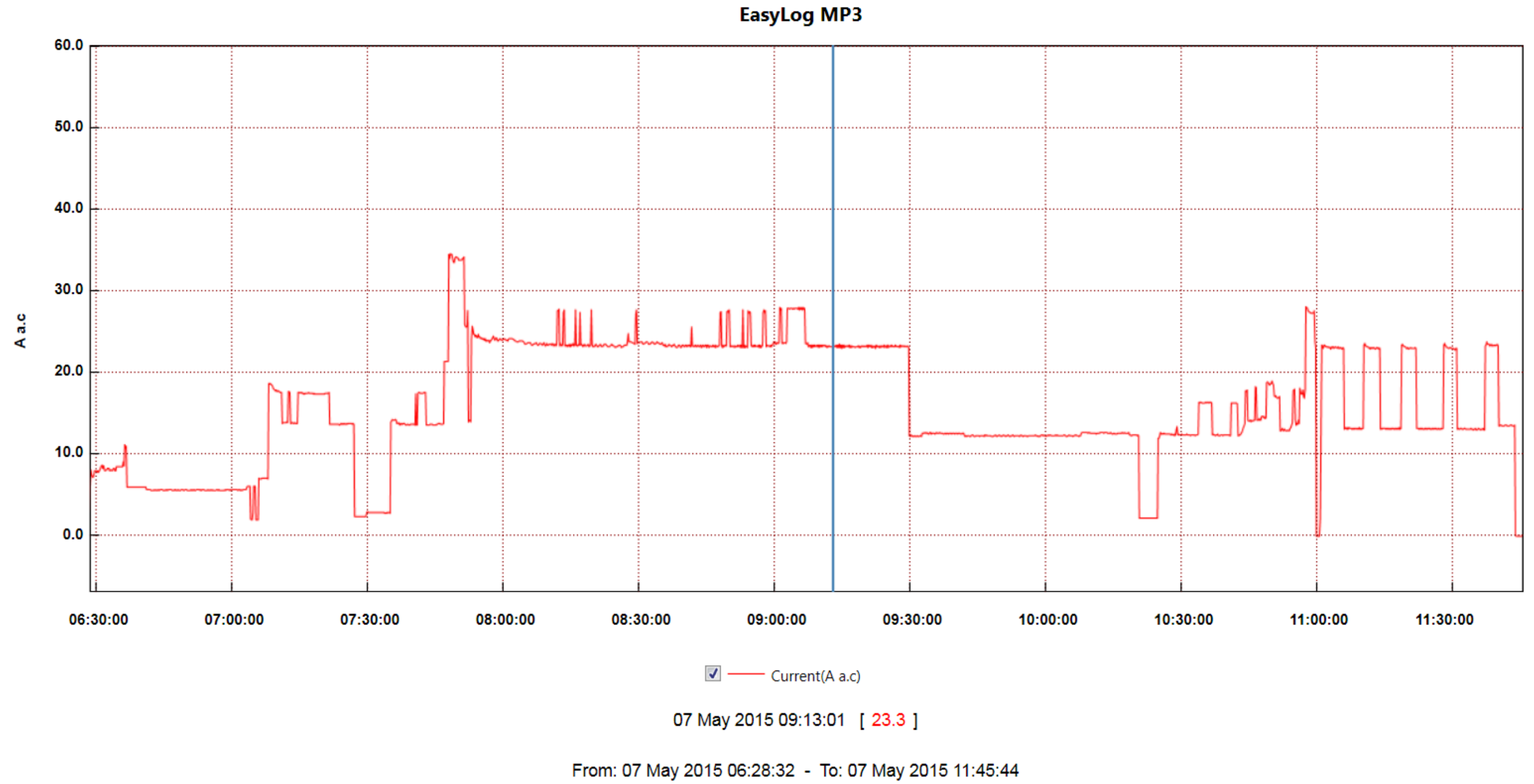
But

- Some components will need re-specifying

The Hybrid power opportunity

ENERGY SOLUTIONS

Typical large yacht usage:



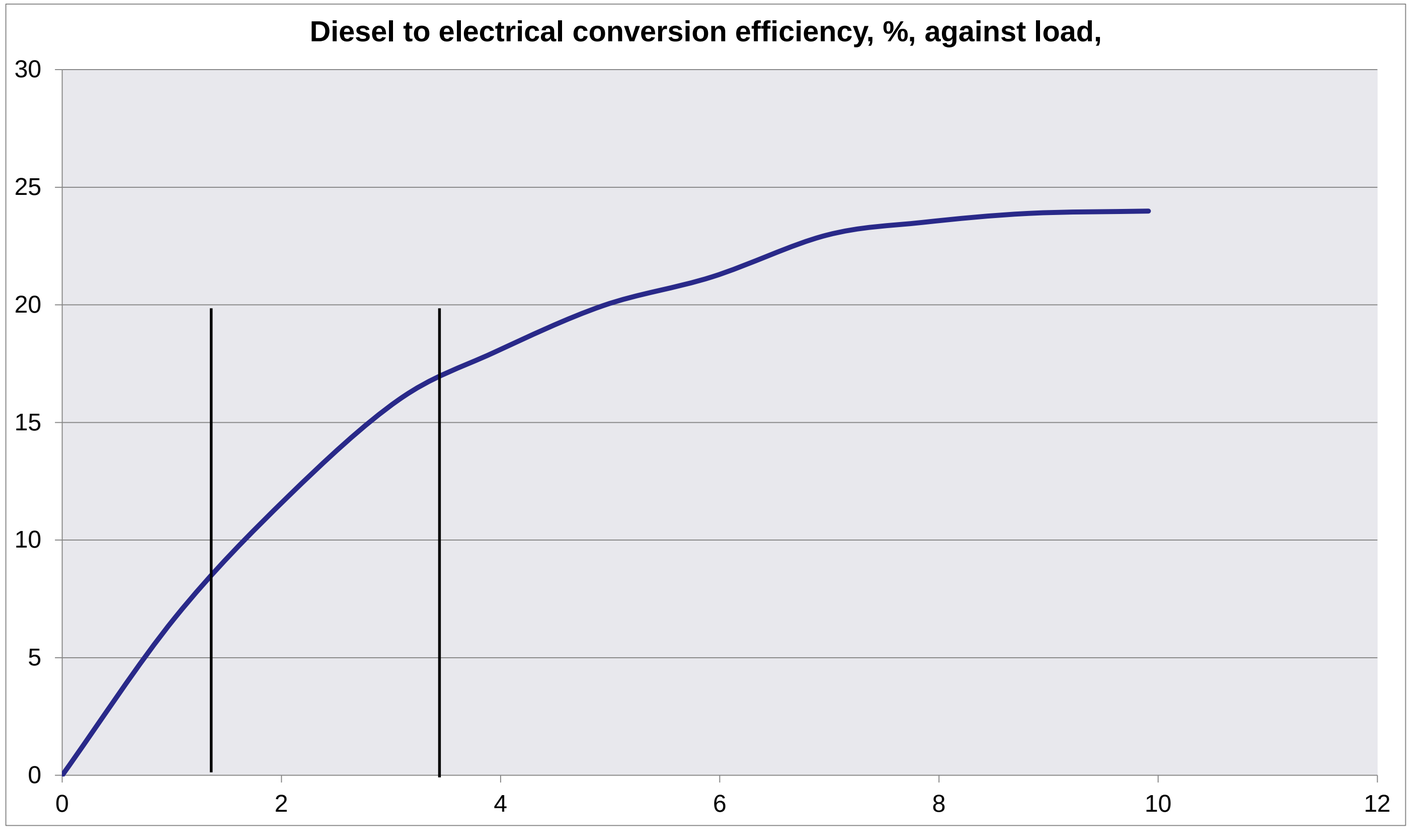
With the family and crew on-board, in the summer, in Turkey:

The average load was 16%.

The load never exceeded 35%

Battery Technology

ENERGY SOLUTIONS



The average load of 16% was at 31% of peak fuel efficiency

The peak load of 35% was at 70% of peak fuel efficiency

Generator Efficiency

ENERGY SOLUTIONS

Lead Acid Battery

- Low cost
- Heavy
- Large battery to gain efficiency
- Established technology

Lithium Battery

- Higher initial cost
- Lighter weight
- Efficient at most discharge rates
- Developing technology

The right battery?

ENERGY SOLUTIONS

- Hybrid is inevitable
- Hybrid propulsion can be complex but deliver significant savings
- Hybrid power is easy and uses system components already present

The immediate future for Hybrid

ENERGY SOLUTIONS

- Hybrid is inevitable
- Hybrid propulsion can be complex but deliver significant savings
- Hybrid power is easy and uses system components already present

Hybrid electrical power

- Utilises known equipment
- Can be achieved at 24 or 48 vDC
- Low cost - low risk
- Can be done now

The immediate future for Hybrid

ENERGY SOLUTIONS

Consider this change now, the results can be dramatic.

A Hybrid boat can start with Hybrid electrical power only.

Savings of 40% to 60% are typical for applications with a diversity of loads.

Time for the first step

ENERGY SOLUTIONS

Thank you