WEBINAR Q&A SUMMARY

Questions and Answers

Webinar: Advancements in LNG fleet efficiency and performance optimisation
Date: 15th July 2025
Time: 09:00 – 10:00am BST

Panellists:
Gavin Stevens (GS)
Keith Hutchinson (KH)

1. Keith: How do you quantify the trade-off between optimal hull forms for laden versus ballast conditions in LNGC design optimisation?

2. Keith: What's your methodology for incorporating future fuel uncertainty into fundamental design decisions made today for 25-year vessel lifecycles?

3. Keith: How do you resolve conflicts between EEDI optimisation and real-world operational efficiency when design assumptions prove incorrect?

4. Keith, why do most successful LNGC designs still emerge from adversarial commercial relationships where each party optimises their own margins rather than the whole system?

5. Keith, what's your approach to designing for regulatory uncertainty when IMO 2030 and 2050 targets may require mid-life modifications?

6. Keith and Gavin, when operational data contradicts design assumptions, who bears responsibility for the performance gap - the designer or the operator?
   GS: From the Shipowner's Contractual Perspective:
   In the context of a newbuild, performance warranties are typically embedded within the shipbuilding contract (SBC) and remain valid for a defined period post-delivery—commonly 2 to 3 years. These warranties are designed to safeguard the Owner against performance shortfalls that could result in financial losses, particularly when there is a mismatch between the SBC and the performance obligations the Owner assumes under the time charter party (TCP) with the Charterer. Key performance metrics include Fuel Oil Consumption (FOC), Boil-Off Gas (BOG) / cargo containment system, and vessel speed.

   Once the vessel enters operational service, the responsibility for maintaining performance in line with the TCP shifts to the Owner. Under the terms of the TCP, the Owner assumes the risk and obligation to ensure the vessel continues to meet the agreed performance standards, including FOC, BOG, and speed. If not, then Charterer will claim underperformance and if the claim is valid under TCP Owner will have to compensate charterer (the underperformance $$$ amount is then deducted from the TCP Charter hire) adversely impacting Owner profits ($$$).

It is essential to maintain a sufficient performance margin between the shipbuilding contract (SBC) and the time charter party (TCP) warranty provisions to protect the Owner from potential exposure. Where feasible—particularly in long-term charters—it is advisable to negotiate a review clause that allows for the reassessment and potential adjustment of performance warranties (between Owner and Charterer) after a defined period in service. While such clauses can be challenging to secure, they provide valuable flexibility in managing long-term performance risk.

7. What will change in the design process if compliance was equal weighted to cost?

8. Excellent presentation Keith much appreciated -- would like your personal views on the usage of scale in ship design commercial vessels of all kinds

9. Thanks Keith, very interesting. How do you think evolution in design process will ultimately impact the cost of building LNG ships and their initial asset value?

10. Why only traditional propulsion.? Any consideration for hybrid propulsion and benefits?
    GS: There are a handful of STAGE vessels in operation (Japan MHI). They were not widely adopted as engine technology / LNG ships evolved very quickly (past decade) with
    1) more efficient engines (1) XDF (2) MEGI / MEGA (MAN - no longer available) and
    2) larger tank capacities.
    I am not aware of any new (or pending) hybrid solutions that are commercially viable - being offered on the market by shipyards.
    SAYARINGO STaGE- Next Generation MOSS-type LNG Carrier with hybrid propulsion plant -,Mitsubishi Heavy Industries Technical Review Vol.53 No.2(2016)
    Riviera - News Content Hub - MAN ES cuts ME-GA from its two-stroke engine programme

11. Gavin: How do you quantify the ROI threshold for dual-fuel engine retrofits when bunker price volatility makes payback calculations unreliable?
    GS: I have only been involved in one potential engine refit (MEGI) project (Qatar).
    Sometime back a study was undertaken to convert the Q flex / Q Max (Qatar LNG Project).
    Only one vessel was converted to MEGI and the project was placed on hold.
    https://www.offshore-energy.biz/qatar-to-convert-q-max-vessel-to-use-lng-fuel)

    There are numerous ways to calculate ROI (every business has its own methodology)

    A typical methodology will include:

    - Scenario Analysis: Modeling various fuel price scenarios to identify beneficial conditions.
    - Sensitivity Analysis: Determining critical price points that impact payback periods.
    - Operational Flexibility: Considering the ability to switch fuels based on market conditions / bunkering locations.

- Long-term Contracts: Securing stable fuel supply contracts to reduce price fluctuations.
- Regulatory Compliance: Factoring cost savings to meet environmental regulations.
- Lifecycle Cost Analysis: Evaluating total ownership costs, including maintenance and operational savings.

This multi-faceted approach helps to make informed decisions despite fuel price uncertainties.

12. Gavin: What's MOL's position on methane slip from MEGI engines versus X-DF engines when calculating true well-to-wake GHG emissions?
GS: Methane slip is crucial in evaluating well-to-wake GHG emissions.
It is well documented that MEGI engines generally have lower methane slip than X-DF engines due to their high-pressure gas injection, which ensures more complete combustion.

However, we also consider the specific operational needs of each vessel. While MEGI engines offer lower methane slip, X-DF engines can be more flexible and cost-effective in certain situations. We evaluate both engine types based on fuel efficiency, operational flexibility, and regulatory compliance (and CAPEX).
MOL's mission is to minimize GHG emissions while maintaining operational efficiency and economic viability.

13. Specifically, for LNGC, Ship-Shore Compatibility is a major blocking point to any major innovative new design. Given existing terminal needs, how do you see the operability of any significant new design vessel?
GS: Ship-shore compatibility is crucial for LNG carriers (LNGCs). Existing terminal infrastructure often dictates new vessel design parameters.

Key considerations:

- Terminal Compatibility: Align new designs with terminal constraints like berth dimensions and loading arms. Engage terminal operators early to address potential issues.

- Standardization: Use industry standards for loading/unloading equipment to ensure broad terminal compatibility.

- Flexible Design: Incorporate adjustable manifolds, modular equipment, and adaptable mooring systems.

- Advanced Technology: Utilize dynamic positioning, automated mooring, and real-time terminal communication to enhance operability.

- Regulatory Compliance: Ensure designs meet international and local regulations for safety and environmental standards.

- Collaboration: Work closely with ship designers, owners, and terminal operators to address needs and issues early.

- Futureproofing: Design vessels to be easily retrofitted for future technologies and regulations.

- Experience share: Extensive compatibility (and modifications) work was undertaken when the Q-Flex and Q-Max vessels (2008+) were designed / and launched into service - highlighting the importance of thorough planning and collaboration.

14. Gavin: How do you balance boil-off gas reliquefication energy consumption against the commercial value of cargo preservation on long voyages?
    GS: Balancing BOG Reliquefication Energy Costs vs. Cargo Value: A Shipowner's Perspective:

    Balancing the energy cost of boil-off gas (BOG) reliquefication against the commercial value of preserving cargo is a valid and complex consideration. However, from the Shipowner's perspective, this is fundamentally a Charterer-driven decision.

    Modern LNG carriers—particularly non-steam designs—feature varying reliquefication plant configurations (full or partial) and operational requirements that are closely tied to vessel design. For example, on Q-Flex vessels, the reliquefication plant operates continuously to manage BOG, as the main and auxiliary engines run exclusively on heavy fuel oil (HFO). Without reliquefication, excess BOG must be safely disposed of via the gas combustion unit (GCU).

    Under a Time Charterparty (TCP), the Charterer assumes responsibility for all fuel costs—whether fuel oil, dual fuel, or gas—and issues Voyage Orders (VO). The Owner, acting as the carrier, has no commercial interest in the cargo itself. Our role is to ensure the vessel is operated safely, efficiently, and in full compliance with the agreed performance warranties, including fuel oil consumption (FOC), BOG rate, and speed.

    From our standpoint, the key metric is performance compliance. Exceeding the warranted BOG rate or fuel consumption can trigger performance claims ("silent P&L killers"). As such, our operational focus is on ensuring the reliquefication plant and related systems are run optimally to meet or exceed contractual benchmarks.

    That said, we fully recognize that for the Charterer—especially on long-haul voyages—the decision to operate the reliquefication plant involves a strategic trade-off. This decision weighs the energy cost of reliquefying BOG against the commercial value of retaining cargo, and is influenced by factors such as market pricing, voyage duration, and emissions regulations.

    In summary, while the Owner ensures the vessel performs to specification, the strategic use of reliquefication is ultimately a Charterer decision—balancing cost, cargo value, and regulatory compliance.

15. Gavin, you say efficiency is the "new fuel," but how do you respond to the idea that fleet utilisation data often shows companies still chase spot rates over optimised routing?
GS: While the phrase "efficiency is the new fuel" might sound aspirational, it's grounded in the evolving realities of LNG shipping. First, it's important to clarify that the number of LNGC Owners operating on the spot market is relatively small. Most LNG carriers are on time charters, where it's the Charterer—not the Owner—who issues the Voyage Order (VO) and manages vessel utilization. This means decisions around routing, scheduling, and deployment are largely driven by the Charterer's commercial and operational strategy.

    In this context, inefficiency directly translates to cost—not just in terms of fuel or time, but also in exposure to regulatory penalties, emissions trading schemes, and FuelEU Maritime compliance. With mechanisms like fleet pooling (which, like many, I'm still wrapping my head around it), the pressure on Charterers to optimize their fleet holistically—not just vessel by vessel—is only increasing.

    So while it may appear that some operators still chase spot rates over optimized routing, in the LNG sector this is less about Owners making short-term gains and more about Charterers balancing contractual obligations, market dynamics, and regulatory compliance. In fact, the growing complexity of these factors makes efficiency not just a competitive advantage, but a necessity.

    Ultimately, efficiency isn't about replacing commercial agility, it's about enabling smarter, more sustainable decisions across the fleet. And in that sense, it really is the "new fuel."
    Gavin: real time performance monitoring ----I really would like your views on ROI for this initiative ----my personal take is that am experienced hand can more easily work out with various two-dimensional parameters and sometimes I feel it's much better than having real time monitoring as it only leads to more confusion in implementing actions--your thoughts welcome.

16. Gavin : real time performance monitoring - I really would like your views on ROI for this initiative ----my personal take is that am experienced hand can more easily work out with various two-dimensional parameters and sometimes I feel it's much better than having real time monitoring as it only leads to more confusion in implementing actions--your thoughts welcome.
GS: Your perspective reflects the experience of someone who understands the nuances of vessel operations. Here's a balanced response that incorporates your views while also addressing the ROI and operational context:

    Your point about experienced hands being able to interpret two-dimensional parameters effectively is well taken—there's no substitute for seasoned judgment (i.e. The Ships Master) especially in the complex operational environment of LNG carriers. However, real-time performance monitoring (RTPM) offers a complementary layer of value that can significantly enhance decision-making, particularly when aligned with the operational realities of time-chartered LNGCs.

    Given that the Charterer issues the Voyage Order (VO) and the Master is responsible for safe and efficient voyage execution, RTPM serves as a bridge between strategic intent and tactical execution. The Master is already acutely aware of performance warranties—fuel oil consumption (FOC), boil-off gas (BOG), and speed—and will flag deviations. RTPM doesn't replace this; rather, it empowers both ship and shore teams to act proactively rather than reactively.

Key ROI Considerations for RTPM:

- Proactive Voyage Management:
  RTPM enables early detection of performance degradation (e.g., increased hull resistance or propeller inefficiency), allowing timely interventions like hull cleaning or propeller polishing, which are critical given the typical 5-year dry dock cycle of LNGCs.

- Compliance with Performance Warranties:
  Real-time data helps ensure the vessel stays within contractual limits, reducing the risk of penalties or disputes with Charterers.

- Enhanced Collaboration:
  RTPM facilitates a shared situational awareness between ship and shore, improving coordination on routing decisions, weather avoidance, and fuel optimization.

- Data-Driven Maintenance Planning:
  Trends in performance data can inform condition-based maintenance, potentially reduce unplanned downtime and optimize dry dock planning.

- Operational Transparency: For Charterers, RTPM provides assurance that the vessel is operated efficiently and in line with contractual expectations.

- Addressing the Risk of "Too Much Data":

Your concern about RTPM leading to confusion is valid—data overload can be counterproductive if not managed well. The key lies in intelligent filtering and contextualization of data. Well-designed RTPM systems should highlight only actionable insights, not flood the Master and/ or operators with raw metrics.

In summary, while master's can navigate performance issues with skill, RTPM enhances their capabilities by providing timely, actionable intelligence. When implemented thoughtfully, it supports—not supplants—the Masters expertise and delivers tangible ROI through improved efficiency (voyage prosecution) and maintenance planning (minimise downtime).
Experience Share: On the old LNG trades (when I was Junior Officer) each Master had his own way to prosecute the voyage (slightly different routing / some more cautious / some would like to keep some time up their sleeve / more tolerance on swell + weather)

……… even though the vessels were sister ships (or near too) the FOC performance varied (and in some cases by some margin!).

The performance warranties and margins were quite large back then (late 1990s/ 2000s) compared with today's TCPS………. where every margin is toughly negotiated and scrutinised. By having such systems and data we can use to this to feed back to the ship managers / masters to optimise (and to the newbuild / business development teams (for new projects / new TCPs).

17. Gavin, how do MOL's CII ratings compare with competitors despite your efficiency investments? Do they lag?
    GS: My fleet operates between ratings A to D at present. When benchmarking against our JV partners they have similar ratings.

    What kills Steam ship CII ratings is 'idle time at anchor' …….so we closely liaise with Charterer to best optimize voyages (idle periods where possible).

    My goal (and challenge) is to keep the fleet at C and above (Steams ships / Q flex will become very difficult 2026>>2033 when the 25-year firm TCP period ends).

18. Are pbcf and option on dual props? With opposite forces these were earlier ruled out for effectiveness. Is it right to understand MOl is it right to understand this is being tested and proven?
    GS: PBCFs are well proven on single props, and I have installed with great success on my steam fleet.

    We have run numerous studies, and I convinced Owners/ Charterers to install 2 PBCF on one Q flex (10 years ago).
    The performance (after some time in service) didn't show compelling results ……….and therefore it was decided not to proceed further with this modification.

    The current regulations change this …… as every small margin counts. Just recently we installed 2 PBCF on 100% MOL XDF vessel (during Dry Dock) and the results are still under review.

    We are revisiting the Q flex data, and we will reconsider installing across the wider two prop fleet.

    It must make commercial sense (CAPEX) and each asset has different payback periods / differing TCP terms (regarding modifications et al). Please ask me this question in 1-2 years' time and then I will be able to answer if two prop PBCF arrangement is proven (or not).

19. Do you use cool-downs before filling to reduce the boiling off of vapours?
    GS: Yes; ship staff will use their experience / 'cool down tables' to calculate rate of LNG / time to cool down the tanks to minimize BOG / thermal shock to the cargo tanks (i.e.

ambient temperature – such as departing dry dock and return to gassed- up condition for first cargo loading post dry dock / gas free operation to enter the cargo tank and to return back to gassed up).

20. History has shown LNG carriers experience long periods of idle. How is this incorporated at the design stage (Keith) and operational efficiency (Gavin)?
    GS: We have had times where some of my LNGC's have long periods of time Idle. There are several options (subject to Time charter party) available to minimize operations / reduce OPEX.

Warm Lay-Up:
A warm lay-up is a temporary deactivation of a vessel where the ship remains in a state of readiness for reactivation within a short period (typically weeks to a few months).

Key Characteristics:
1. Machinery and systems are kept operational or on standby.
2. Minimum manning is maintained onboard to ensure safety and maintenance.
3. BOG (Boil-Off Gas) management systems remain active, often using onboard reliquefication or gas combustion units.
4. Location is usually sheltered waters or designated lay-up areas with easy access to support services.

Use Case for LNG Carriers:
Warm lay-up is suitable when market conditions are expected to improve in the near term, and the vessel may be required back in service quickly.

Cold Lay-Up:
A cold lay-up involves a more extended period of deactivation, where the vessel is taken out of service and most systems are shut down.

Key Characteristics:
1. Main and auxiliary systems are fully deactivated.
2. Crew is reduced to a skeleton team.
3. Preservation measures are taken to protect machinery and cargo systems.
4. Reactivation time is longer (several weeks to months), and costs are higher.
5. cargo tanks will be empty or inserted.

Use Case for LNG Carriers:
Cold lay-up is considered when long-term inactivity is expected, and the cost of maintaining operational readiness is unjustifiable.

Long-Term Anchorage with Reduced Consumers:
This is a hybrid operational mode where the vessel remains anchored for an extended period but retains partial functionality, often for strategic or commercial reasons.

Key Characteristics:
1. Reduced power consumption by shutting down non-essential systems.
2. BOG management is maintained at a minimal level, often using only essential consumers (e.g., GCU or partial reliquefaction).
3. Crew remains onboard (could reduce to safe manning if additional crew onboard)
4. Used as a floating storage unit (FSU) or while awaiting employment or terminal access.

Use Case for LNG Carriers:
This approach is often used when the vessel is temporarily idle but may be called upon for short-notice operations, or when used as a floating storage solution.

21. How is boil off managed in the very unlikely event of a capsize? Operational optimisation and stability design reduces this risk significantly but assuming that it does happen either on an LNG tanker or even a smaller retrofit vessel that is poorly managed. What are the options available and is there a source for further information?

22. Very often there is no clear way to determine ROI for energy efficiency installations or retrofits except for teliq plant upgrades all hull related apertures and appendages are not proven and have significant exclusion clauses which seem disadvantageous. Your bv

23. Gavin, thanks for your presentation, regarding old (20y+) steam LNG vessels, what would be your recommendation in order to optimize such assets?
GS: There are very limited options available to improve vessel efficiency and compliance (LNG Steam ships).

To date we have already implemented the following measures:
- High-performance hull coatings
- Regular hull cleaning + propeller polishing (to improve fuel efficiency).
- Propeller Boss Cap Fins (PBCF) installations (subject to vessel's rudder arrangement).
- LED lighting to reduce onboard energy consumption.

Looking ahead, many steam-powered vessels are expected to come off long-term charters in coming years.

With tightening regulations—particularly around the Carbon Intensity Indicator (CII), maintaining compliance will become increasingly difficult, if not unfeasible.

The return on investment for major retrofits is often insufficient, and this limits the appetite to invest in such upgrades.

Steamships are becoming less attractive due to their lower fuel efficiency, higher fuel oil consumption, and associated CO_2 emissions, especially in the current market environment (Low rates).

As a result, I anticipate the following outcomes for these vessels:
- Increased scrapping activity, which is already underway. (I.e. Sell the asset (reinvest in new tonnage))
- Some vessels may continue trading in regions with less stringent regulations, particularly in parts of the Far East.
- A few may be repurposed as floating storage units (FSU).
- A small number could serve as donor vessels for FSRU (Floating Storage Regasification Unit) projects.

(2/3/4 are all subject to the economics working $$$)

24. Ultimately the traders who trade LNG and the underlying contracts for sale and purchase or spot trading contracts, need to enable operational flexibility when it comes to boil off management or optimisation more generally. A shipowner is quite hamstrung by the charter party as they are today, and the owner of the molecule needs to work more closely with the LNG owner or operator to take a wholistic approach to efficiency and that will require revisiting the contracts! Any thoughts?
    GS: You've raised a critical point.

    The current structure of LNG charter parties (older / current business models) often limits the operational flexibility required for optimal boil-off gas (BOG) management and broader efficiency strategies.

    From a shipowner's standpoint,

    We are frequently constrained by rigid contractual terms that do not reflect the dynamic nature of LNG operations or the evolving regulatory and commercial landscape and

    I want to stay within the performance warranties to ensure we do not receive any performance warranty claims – silent P&L killers ($$$).

    To truly optimize performance, whether in terms of fuel efficiency, emissions reduction, or cargo handling—there needs to be a more collaborative and integrated approach between the molecule owner (trader), the shipowner, and the operator.

    Off the top of my head; This could be:
    Revisiting charter party terms to allow for more adaptive voyage planning, speed optimization, and BOG utilization strategies.
    Aligning commercial incentives so that efficiency gains benefit all parties, not just one stakeholder.

    Ultimately, the LNG value chain is only as efficient as its most constrained link. Without contractual reform and closer cooperation, the industry could risk missing opportunities for decarbonization and cost savings.

25. How can we align commercial stakeholders—such as terminals and charterers—to optimize Boil-Off Gas (BOG) management, for example through coordinated Just-in-Time (JIT) arrivals and clear communication of tank pressure requirements from discharge terminals?
    GS: Aligning commercial stakeholders—such as terminals, charterers, and shipowners is essential for effective Boil-Off Gas (BOG) management. This requires a shift from 'siloed operations' to a more integrated, data-driven, and collaborative approach.

Key enablers I foresee:

1. Coordinated Just-in-Time (JIT) Arrivals

- Shared scheduling platforms: Implementing digital platforms that allow real-time sharing of vessel ETA, terminal readiness, and berth availability can significantly reduce idle time and unnecessary BOG generation
- Dynamic voyage planning: Charterers and operators should collaborate on speed optimization strategies that align with terminal discharge windows, minimizing the need for slow steaming or waiting at anchorage.

2. Transparent Communication of Tank Pressure Requirements

- Early and clear communication terminals regarding acceptable tank pressures and discharge rates allows ship operators to plan BOG management strategies more effectively.
- Standardized reporting protocols can help ensure consistency across terminals and reduce miscommunication.

3. Contractual Flexibility and Incentives

- Revisiting charter party terms to include clauses that support JIT arrivals, flexible speed profiles, and shared benefits from fuel and emissions savings
- Incentive mechanisms for efficient BOG handling—such as shared cost savings or emissions credits—can align interests across stakeholders.

4. Digital Integration and Data Sharing

- Real-time data exchange between vessels, terminals, and charterers (e.g., tank pressures, BOG rates, weather routing) enables proactive decision-making.
- Use of predictive analytics can help forecast BOG behavior and optimize voyage and discharge planning accordingly.

In conclusion:

Optimizing BOG management is not just a technical challenge, it's a commercial and operational coordination issue and would need a mighty huge effort by all parties for it to be even feasible (my opinion). By fostering transparency, revising contractual frameworks, and leveraging digital tools, stakeholders can unlock significant efficiency gains while supporting decarbonization goals.

26. In short, that means higher investment rather than less when designs move forward?

27. Have either of you looked at alternative propulsion systems such as gas turbine/CHP recovery? smaller footprint, fuel agnostic, high efficiency
    GS: No, I haven't.

28. Gavin: I work within the liner industry here DF LNG is becoming the norm --would like your views on membrane tanks type b / versus type C---I feel a little apprehensive with membrane tanks going into the future as container operations differ vastly from LNG ones with a lot more wear and tear involved.
    GS: My background spans both the tanker sector (LNG and LPG) and the cruise industry. I've sailed on a variety of LNG and LPG vessels equipped with different cargo containment systems.

    As LNG-fuelled propulsion gains traction—particularly within the liner segment—the selection of containment systems becomes increasingly critical. Container vessels have unique operational profiles, characterized by frequent port calls, dynamic cargo operations, and significant structural flexing.

    Your concerns regarding membrane tanks are well understood. While these systems are well-established in conventional LNG carriers, they are inherently more sensitive to mechanical stress and hull deformation. In the context of container ships, the increased structural dynamics could pose challenges to the long-term integrity and reliability of membrane containment systems.

    Key Considerations:

    Membrane Tanks

    Pros: High volumetric efficiency, lower weight, and better integration into the hull design for maximizing cargo space.

    Cons: More susceptible to sloshing damage and hull-induced stress; requires precise structural integration and insulation maintenance. May not be ideal for vessels with frequent port rotations and variable loading conditions.

    Type B Tanks

    Pros: Offers a good compromise between structural robustness and space efficiency. Better suited to handle hull flexing and dynamic loads.

    Cons: Slightly lower volumetric efficiency than membrane tanks, but generally more forgiving in high-wear environments.

    Type C Tanks

    Pros: Extremely robust, self-supporting, and well-suited for smaller LNG volumes or vessels with high structural stress. Easier to inspect and maintain.

Cons: Bulky and space-inefficient—less ideal for long-haul container ships where cargo space is at a premium.

My advice:
Gather as much information as possible:
What are your competitors doing?
What are the key industry trends (existing / new builds)?
Speak to your industry peers, classification, subject matter experts as each tank arrangement has it owns risks/ merit.
Risk assessment

Based on the above, make an informed decision on best system for your vessel / fleet needs. Once vessel is service monitor performance and ensure feedback loop back to your newbuild / business development team (for future newbuilds specifications / possible vessel 2nd hand acquisition).

29. What are the challenges with steam vessels conversions to FSUs? and what is the best approach for Client to seek such opportunities?
GS: Converting steam-powered LNG carriers into Floating Storage Units (FSUs) can be a viable second-life option, but it comes with a unique set of technical, commercial, and regulatory challenges. Understanding these is essential.

Key Challenges in Steam Vessel Conversions to FSUs

Aging Propulsion and Systems
Steam vessels are typically older, and while propulsion systems may be decommissioned for FSU use, auxiliary systems (e.g., cargo handling, reliquefication, safety systems) often require significant upgrades or replacements to meet modern standards.

Cargo Containment System Integrity
Cargo tanks on older vessels may have insulation degradation or sloshing damage. A full structural and thermal integrity assessment is essential before conversion.

Regulatory Compliance
FSUs must comply with updated IMO, class, and flag state requirements, which may differ significantly from those applicable during the vessel's original construction.

Mooring and Terminal Interface
FSUs require long-term mooring solutions and compatibility with shore-based infrastructure. This includes considerations for jetty design, loading arms, and emergency shutdown systems.

BOG Management
Steam vessels typically lack modern BOG handling systems. For FSU use, efficient BOG management—either through reliquefication, combustion, or export—is critical and may require new installations.

Commercial Viability
The cost of conversion must be weighed against the remaining service life of the hull and containment system. In many cases, the economics only work if the vessel is already owned or acquired at a low capital cost.

Lead times for key equipment / yard space for major works (if required).

Prudent Approach for Clients Seeking FSU Opportunities

Early Feasibility Assessment
Engage naval architects and marine engineers to conduct a technical and economic feasibility study, including hull condition, tank integrity, and conversion scope.

Identify Strategic Locations
Focus on regions with growing LNG demand, limited regasification infrastructure, or seasonal storage needs. Southeast Asia, South Asia, and parts of Africa are emerging hotspots.

Partner with Experienced Stakeholders
Collaborate with shipyards experienced in LNG conversions, as well as terminal developers and EPC contractors who understand the interface requirements.

Secure Long-Term Offtake or Charter
A long-term FSU charter or storage agreement is critical to justify the investment. Engage early with utilities, traders, or governments to structure such deals.

5. Consider Modular or Hybrid Solutions

In some cases, combining an FSU with a modular regasification unit (FSRU-lite) can enhance commercial appeal and operational flexibility.

32. Would converting significant numbers of older ships to FRSU contribute to evolution of carrier design by bypassing the terminal constraint issue?
GS: Converting older LNG carriers to FSRUs can help ease terminal constraints and support LNG market growth, especially in regions lacking infrastructure. While this doesn’t eliminate the need for new carrier designs, it encourages more flexible, modular approaches.

For Shipowners, it extends vessel life; for the industry, it offers faster deployment and adaptability. As FSRUs become more common, future carriers may be designed with conversion potential in mind—shaping the next generation of LNG transport solutions.

33. There is a very good matrix produced by DNV for cross checking energy efficiency measures across hull/EE/machinery /VPO software etc
GS: thanks, I will check it out.
34. wonderful discussion! we did run one steam turbine converted into diesel --a liner --we were changing liners every 2000 hrs 🙄
GS: Glad I'm not the shipowner 😊 signing off the OPEX.

35. Regarding my question on alternative propulsion - I was thinking more of new builds or conversions FYI

36. Membrane would have an advantage for future proof with option to be ammonia ..other than that risk versus reward ...much higher cool down rates and quantities due to much higher mass on b type tanks plus and minus to both ..mainly membranes much more sensitive to operator errors plus at renewal surveys much higher costs
GS: Thanks for your comment – could you clarify your question so I can respond more specifically.

37. Keith and Gavin, how do you value the strategic implications of CO2-negative Bio-LNG on ship development and fleet management?
GS: To date we have undertaken studies, however, to date my fleet has not carried any bio LNG (or Biofuel).

The emergence of CO_2-negative Bio-LNG presents a transformative opportunity for the maritime sector, particularly in the context of ship development and long-term fleet management strategies.
Strategic Implications for Ship Development

Futureproofing Newbuilds
Bio-LNG's compatibility with existing LNG infrastructure allows shipowners to design vessels today that are compliant with tomorrow's carbon regulations. Dual-fuel engines capable of burning both fossil LNG and Bio-LNG offer a clear pathway to decarbonization without requiring radical redesigns.

Design Optimization for Carbon Intensity
With the potential for negative lifecycle emissions, Bio-LNG can significantly improve a vessel's Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI) ratings. This could influence hull design, tank sizing, and propulsion system selection to maximize environmental and commercial performance.

Incentivized Innovation
The availability of CO_2-negative fuels may accelerate investment in onboard carbon capture, hybrid propulsion systems, and digital optimization tools, as shipowners seek to leverage carbon credits or regulatory incentives.

Implications for Fleet Management

Regulatory Compliance and Market Access
Bio-LNG can serve as a strategic lever to maintain compliance with tightening IMO and EU regulations, including FuelEU Maritime and ETS. This is particularly valuable for older LNG-capable vessels that may otherwise face early obsolescence.

Carbon Accounting and Commercial Advantage
Operators using Bio-LNG can differentiate themselves in charter markets by offering low- or negative-emission transport solutions. This could become a key commercial advantage.

Fuel Procurement and Supply Chain Strategy
Fleet managers will need to develop new procurement models and partnerships to secure reliable Bio-LNG supply, potentially through long-term offtake agreements or participation in green fuel consortia.
Conclusion:

Bio-LNG is not just a transitional fuel—it has the potential to be a strategic enabler of carbon-negative shipping, and I am closely monitoring.

The key will be to align vessel design, fuel strategy, and commercial positioning early, to fully capture the environmental and economic value this fuel offers.

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