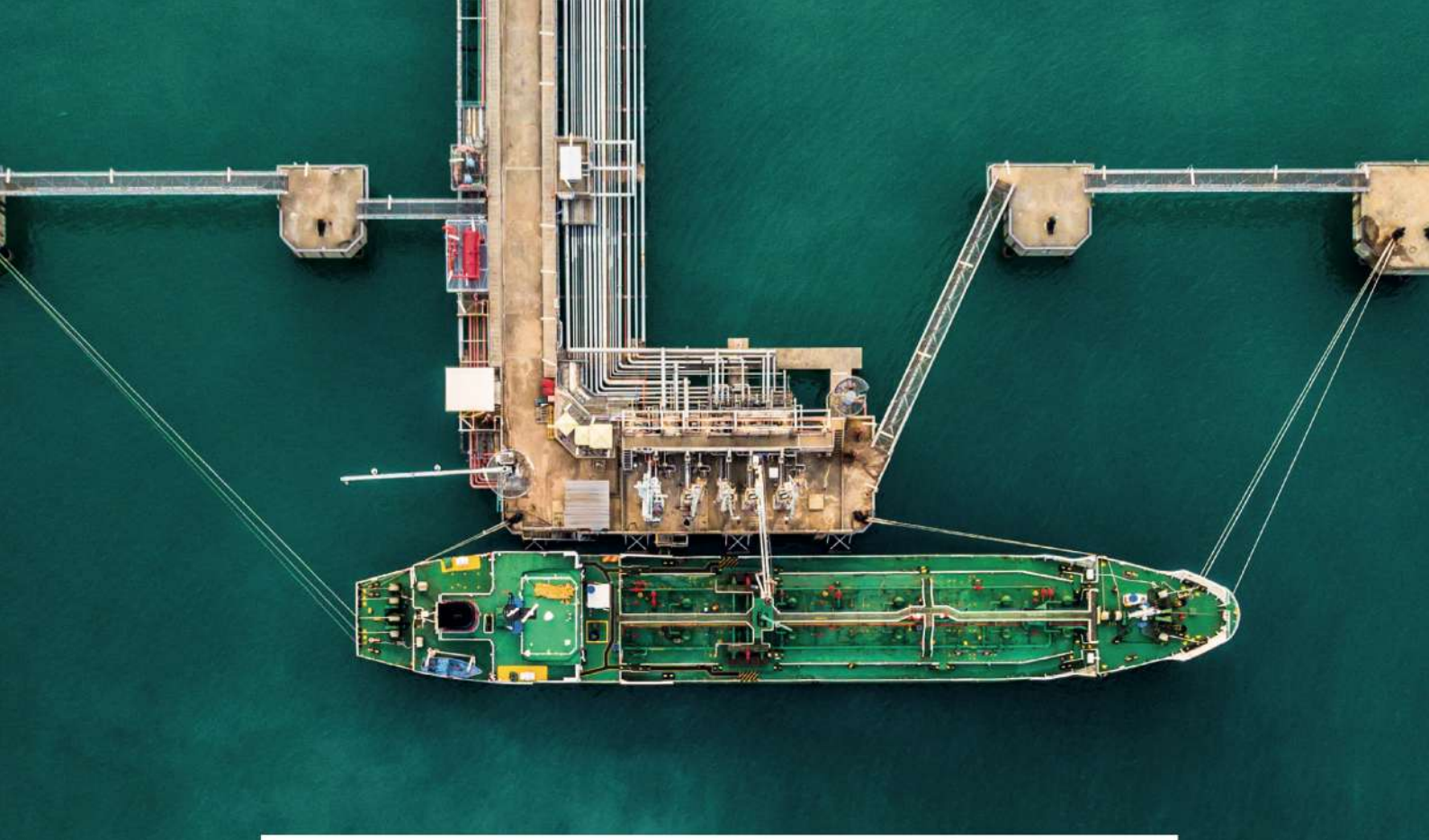


KEY QUESTIONS FOR ALTERNATIVE MARINE FUEL PRODUCERS

Guide for Project Development and Stakeholder Engagement

INTERNATIONAL MARITIME ORGANIZATION

GREENVOYAGE 2050

Global Industry Alliance LOW CARBON SHIPPING

GreenVoyage 2050 | Global Industry Alliance LOW CARBON SHIPPING

About this guide

PURPOSE

This document provides a list of questions, primarily aimed at start-up fuel producers, intended to serve as guidance in the development of such alternative fuel projects. This document applies to both those developing their own technology and those licensing technology from other companies. Recognizing critical stakeholders for project viability, this non-exhaustive list of questions aims to guide the fuel producer in understanding the information most likely to be requested.

HOW TO USE THIS GUIDE?

This guide is intended as a reference tool rather than a step-by-step process. Users are encouraged to consult the sections most relevant to their project stage, stakeholder discussions or information needs, while recognising that all five parts together provide the information typically expected by investors, offtakers and other key stakeholders.

- Understanding local context: These sections provide additional considerations from a country-specific/local context perspective.
- Prepare supporting evidence: Each section indicates the information and evidence typically expected.

WHO IS THIS GUIDE FOR?

Fuel producers
looking to produce fuels for the maritime sector

Potential offtakers
e.g. shipping companies

Investors
e.g. banks, financial institutions, private equity

FIVE PARTS OF THE GUIDE

1 Fuel project overview
What is being developed?
- Vision & ambition
- Fuel product
- Feedstock
- Partners & markets

2 Project execution
Can the project be delivered?
- Lifecycle & execution
- Team & experience
- Location & infrastructure
- Planning & permitting

3 Technical feasibility
Will it work safely at scale?
- Technology readiness
- Scale-up requirements
- Key technical risks
- Health & safety

4 Sustainability & regulatory
Is it sustainable and compliant?
- Carbon intensity (WTW)
- Product life cycle
- Traceability & certification
- Political and regulatory

5 Commercial feasibility
Is there a viable business case?
- Market demand
- Offtake agreements
- Cost & price analysis
- Financial strategy

A credible and investment-ready fuel project

Published in 2026 by the
GreenVoyage2050 Programme Coordination Unit
International Maritime Organization
4 Albert Embankment, London SE1 7SR
United Kingdom
GreenVoyage2050@imo.org

© Copyright 2026 International Maritime Organization (IMO)

Copyright Notice

All rights reserved. Permission to print or save the document or excerpts of it is only granted for private, non-commercial use, without any right to resell or redistribute them or to compile or create derivative works therefrom. Any copyrights within the document remain with the original rights holder. Enquiries should be directed to the address above.

Disclaimer

This guide is the result of a structured process developed by the Global Industry Alliance to Support Low Carbon Shipping (Low Carbon GIA), based on its experience, and is used by some members of the Alliance for suitable steps in alternative fuel projects. However, this guide neither warrants nor represents that its application in such projects will lead to a commercial fuel. The questions therein are for guidance only and do not cover every aspect that might be required.

The information in this guide does not imply the expression of any opinion whatsoever on the part of IMO or any organization that provided inputs. The views expressed in this guide are those of the author(s) and do not necessarily reflect the views or policies of IMO or any organization that provided inputs.

Users of this guide should be aware that references to IMO instruments may become outdated following the adoption of more recent instruments. Users are therefore invited to consult their national maritime administration or the IMO website for information on the status of referenced instruments.

Links and references to third-party websites do not imply any official endorsement of or responsibility on the part of IMO for the opinions, ideas, data, or products presented at these locations, or guarantee the validity of the information provided.

IMO, the GreenVoyage2050 Donors, or members of the Low Carbon GIA shall not be liable to any person or organization for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided. The contents of this document do not prejudge any future policy developments at IMO.

List of abbreviations

CAPEX	Capital Expenditure
CCS	Carbon Capture and Storage
DAC	Direct Air Capture
EU RED	European Union Renewable Energy Directive
FAME	Fatty Acid Methyl Ester
FEED	Front End Engineering and Design
FID	Final Investment Decision
FMEA	Failure Modes and Effects Analysis
FOAK	First of a Kind
GHG	Greenhouse Gases
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HoT	Heads of Terms
HVO	Hydrotreated Vegetable Oil
IP	Intellectual Property
IRR	Internal Rate of Return
LCA	Life Cycle Analysis
LoI	Letter of Intent
MEPC	Marine Environment Protection Committee
MoU	Memorandum of Understanding
NOAK	N^{th} of a Kind, e.g., Second of a Kind
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PPA	Power Purchase Agreement
RFNBO	Renewable Fuel of Non-Biological Origin
TRL	Technology Readiness Level
VLSFO	Very Low Sulphur Fuel Oil
WtW	Well to Wake

Acknowledgment

This Guide is the product of a collaboration between the IMO GreenVoyage2050 Programme and the Global Industry Alliance to Support Low Carbon Shipping (Low Carbon GIA).

Particular thanks are due to the entire GIA membership, as well as key industry stakeholders who were invited to contribute to this work and provided important input and support. Additional thanks are due to the International Sustainability & Carbon Certification Association (ISCC) and the Roundtable on Sustainable Biomaterials (RSB) for their input in the development of this document.

Background

Shipping, like other sectors, is working toward reducing carbon emissions, aligned with a net-zero target by 2050 as agreed in the IMO GHG Strategy. To reach this level of ambition, the deployment of alternative zero- and near-zero-GHG-emission fuels across the maritime sector will be required. The use of such fuels will depend on demonstrating that they can be produced sustainably and at scale. There are many ways to decarbonize, and many technologies are emerging, each with different feedstocks and processing methods. Additionally, non-energy and smaller start-up companies may increasingly play a role in shaping this transformation.

However, alternative marine fuel projects are capital-intensive, may be perceived as having a high degree of technological risk, require large infrastructure quickly, and face rising interest rates and costs, all of which can threaten their feasibility. All stakeholders required to make an alternative fuel project successful will need to assess and evaluate a project's technology readiness (maturity), investment readiness (business viability), and community readiness (local acceptance), and therefore must address economic, technological, and regulatory challenges to scale successfully.

Purpose of this document

This document provides a list of questions, primarily aimed at start-up fuel producers, intended to serve as guidance in the development of such alternative fuel projects. This document applies to both those developing their own technology and those licensing technology from other companies. Recognizing critical stakeholders for project viability, this non-exhaustive list of questions aims to guide the fuel producer in understanding the information most likely to be requested. The main critical stakeholders identified are:

- the potential offtaker (in this case, a shipping company); and
- the investor(s) (e.g. financial institutions, banks, private equity, etc.).

Some aspects will be particularly important to the investor/financier, while others are more relevant to the potential offtaker/shipping company. Accordingly, these are notated in the document.

The fuel producer will need to consider to what level of detail information can be shared or placed into the public domain and what information to share under a non-disclosure agreement (NDA) recognising that counterparties will only want to go to the NDA level if they have reasonable expectations that the project is of interest to them (both in view of the effort to agree an NDA, as well as safeguarding the integrity of any confidential information shared, whether intentionally or unintentionally).

The further along a technology's development pathway, the more information is available; similarly, the level of detail in the information will be a function of the project stage (Proposal, Final Investment Decision (FID), built). There needs to be management of the expectation of how much information is available and, importantly, the reliability of the evidence provided (e.g. expected or proven performance, estimated costs, contracted, etc.).

The document contains five main parts, for consideration by the fuel producer, as outlined below. Whilst the sections can be considered sequentially, it is important for the producer to be aware that an understanding of all questions will be necessary to convince both investors and offtakers that the project is worth considering further.

Part 1: Fuel project overview: Summary of project attributes
Part 2: Project Execution: Current project lifecycle stage of the project, execution plan, project team, location, and location-specific aspects
Part 3: Technical Feasibility: Technology readiness level and scale-up
Part 4: Sustainability and Regulatory Considerations: GHG reduction potential and market acceptance
Part 5: Commercial Feasibility: Market potential, project economics, and financial viability
Annex 1: Project Lifecycle
Annex 2: Consolidated list of questions



Part 1: Fuel project overview: Summary of project attributes

The purpose of this part is to establish the basic facts of the project, its intended production process and resource requirements, and to understand the overall intentions of the fuel producer. In particular, it is important to highlight the project's key goals, especially the benefits to potential investors and offtakers.

The fuel producer and its vision, project ambitions, and partners

1. What is the overall ambition and intention of the fuel producer?
2. What are the specific objectives of this project, and how does it align with the vision of the fuel producer?
3. What project partners does the fuel producer have, and what are their roles in the project?

Country-specific perspective:
In countries with a high proportion of state-controlled industries, it will be important to demonstrate that the project has support from the local government (as well as regional and national authorities, where applicable).

Project Unique Selling Point

This is particularly important from an investor's perspective, as they need to quickly understand why they should invest in this project vs competing alternatives. From an offtaker's perspective, the key areas of interest here are price, sustainability credentials, volume, and timing.

4. What differentiates this project from others from the perspective of technological innovation (with relevant IP protection), access to feedstock, cost competitiveness, speed to market, scale, sustainability credentials, access to market, government support, fuel properties, job creation, energy security? (Note: this is a non-exhaustive list of unique aspects of the project to be considered).

Country-specific perspective:
Investors and offtakers may perceive a higher degree of risk for a project in a developing country, and thus, the fuel producer needs to strongly justify what makes this project unique, why it has chosen that geography, and how, in particular, it has the right expertise and partnerships in the country to make it a success. The producer could consider contrasting this with issues faced in more developed nations, such as greater bureaucracy, higher labour or feedstock costs.

Properties of the fuel product

It is important to clarify what the fuel can be used for, as this directly affects the fuel's ability to be sold, which is of key interest to both investors and offtakers. In particular, whether the fuel meets a relevant fuel property specification and whether engine testing has been carried out are of most interest to both investors and offtakers.

5. What is the main fuel product?
6. Is the fuel a drop-in fuel (can it directly replace gas or fuel oils in conventional machinery) with similar chemistry?
7. Does the fuel meet a marine fuel specification, and if so, which one?
8. Which engine type(s) is the fuel suitable for?
9. Has the fuel been tested in a marine engine, and if so, what were the results?
    a. Were any blend limits identified?
10. Has any Original Equipment Manufacturer (OEM) feedback been provided on the engine tests?
    a. Were any potential impacts on engine warranties identified?

Evidence typically sought:

- In-house fuel property testing results
- Independent fuel property testing results (from accredited laboratory)
- Engine testing results (at laboratory or with OEM)

Note:
In the context of these questions, OEM refers to the engine manufacturer. The importance of getting OEM support should not be underestimated, particularly for fuels that the market has not widely adopted. An example would be drop-in biofuels, for which some of the upper blend limits (with fossil fuels) have not been clearly defined. Furthermore, for such fuels, additional rounds of engine testing may be needed to ensure they do not invalidate OEM engine warranties. Early engagement with OEMs to understand testing requirements is highly recommended.

Main feedstock characteristics, type of fuel, and target market

The questions in this section aim to provide a high-level overview of the fuel type, its feedstocks, and end-use markets. Gaining a clear picture of this early on in conversations is of utmost interest to both investors and offtakers alike.

11. Would the fuel be classed as a biofuel, e-fuel, a blue fuel, or recycled carbon fuel?
12. What are the main feedstocks required?
13. Which are the target sectors for your products?
14. Which are the target geographies for your products?

Note:

- Biofuel: Fuel whose energy is primarily derived from biomass feedstock. This can include crop-based biofuels (e.g. corn ethanol), as well as residual biomass (e.g. forestry residues)
- E-fuel: Fuel whose energy is primarily derived from renewable electricity. Green hydrogen is often an intermediate product in producing e-fuels (e.g. e-methanol, e-ammonia)
- Blue fuel: Fuel derived from a fossil energy source, where carbon capture and sequestration m(CCS) is used to partly abate the GHG emissions. Example: blue ammonia, where the feedstock hydrogen is produced from the reforming of natural gas with CCS
- Recycled carbon fuel: Fuel whose energy is primarily derived from hard-to-avoid fossil waste, e.g. the fossil fraction of municipal solid waste

- Note that these are generic definitions, and jurisdiction-specific definitions should be checked to ensure that the feedstocks are compliant with the target market's policy requirements

Proposed plant production process and location

The following is basic information that all stakeholders will want clarity on. In particular, investors will want to understand why a plant is of a particular scale and why the desired location was chosen (and what its advantages are). Offtakers will want to understand how the plant's scale can meet their offtake requirements and whether the relevant agreements are in place to enable the plant to produce the stated amount of fuel.

15. Provide an overview of the process, giving details on the size of each process step, the required inputs, and technology choices. A block flow diagram and/or a table are formats that are easy for relevant stakeholders to understand. A table example has been given below.

Production Stage (e.g. feedstock cultivation/collection, pre-treatment, etc.)	Technology used (e.g. gasification, alkaline electrolysis)	Input (e.g. feedstock, energy, land)	Required quantity/ volume and quality (include unit)	Expected sourcing (indicate whether "natural resource at site", "produced on site", or "offsite". For those outsourced, indicate approximate distance)	Availability Is the availability of the required quantity confirmed?
e.g. feedstock cultivation		e.g. water	500l/day seawater	Natural resources at the site	Yes
Carbon capture		CO_2	400kg/day	Produced offsite – carbon capture from industry 10km away	No – CC not yet operationalised

16. Provide a rationale for the scale of the proposed plant, e.g. for a demo plant, it is only enough to make X tonnes of fuel for testing, e.g. for a commercial plant, it is the minimum scale we expect for a certain return on investment.
17. Provide an overview of the feedstock sourcing strategy.
    a. What agreements are in place for these feedstocks?
18. Provide a description of the desired location of the plant and what makes it an ideal place to produce fuel (e.g. existing infrastructure, costs, proximity to market, etc)?
19. How will the fuel be transported from the production site to the commercial port?
20. Does the port have the relevant storage capabilities for your chosen type of fuel?

Note:
There are many factors (a non-exhaustive list of examples is provided below) that, depending on the overall production process, will impact the expected yield and eventual volume of the final product. While the shipping company and investor may not focus in detail on each of these influencing factors, the fuel producer should be able to demonstrate an understanding of all those that are relevant and their impact on potential yields. Some factors may also result in non-eligibility for certification (e.g., previous land use, which may correlate with the fuel's overall GHG intensity). The fuel producer should also be able to demonstrate any risk mitigation strategies to address any fluctuations in production volumes.

All Fuels	Biofuels	E-Fuels
- Seasonal variations - Climate conditions - Extreme weather events (natural disasters, flooding, earthquakes, etc.) - Maturity of production processes - Integration of production technologies - Age of equipment over time	- Use of fertilizers - Soil fertility - Erosion - Previous use of land (e.g. risk of contamination)	- Land topography and orientation - Shading/reflecting objects - Quality of irradiation and its variability - Dust emission on solar panels - Risk of turbulence - Production over time (lifespan of equipment)

🔍 **Evidence typically sought** (can be in-house or produced by an engineering contractor):
- Plant block flow diagram/process flow diagram, with process description
- Plant mass and energy balance

📍 **Country-specific perspective:**
Investors and offtakers will be cautious about major infrastructure investments in countries without a significant track record with similar technologies; thus, the plant scale chosen should reflect the state of the industry in that country. For example, if no previous (fossil) fuel production facilities are in place in the country, the chosen scale of plant should be somewhat reflective of this lack of in-country experience with similar infrastructure (or the fuel producer could show a step-wise ramp-up in plant capacity expansion).

Part 2: Project Execution: Current project lifecycle stage of the project, execution plan, project team, location, and location-specific aspects

Project lifecycle stage and execution plan

Understanding which stage in the project lifecycle a project is in is of utmost importance to both financiers and offtakers. The further along a project is in its lifecycle (see definitions below), the more progress it has made in developing the technical, commercial, and financial aspects of the project. The more progressed it is, the more certain a project is regarding these aspects; e.g., costs are at a higher level of certainty, and commercial agreements are more likely to be/are moving towards binding agreements.

The type of financier that will be interested in the project is dependent on the project lifecycle stage:

- Given that the capital for the development stages (feasibility, pre-FEED, and FEED) is at risk (given the outcome of that project stage is unknown), raising capital for these stages is challenging, and typically, only investors who can accept a relatively high level of risk are able to provide capital for these stages

- At final investment decision (FID), depending on the TRL of the technology, less risk-averse financiers may be able to participate, such as banks. This is particularly the case for commercialised technologies (TRL9) and, in certain circumstances (with the right risk mitigation strategies in place), first-of-a-kind commercial technologies (TRL8). The participation of banks is particularly important, given that they provide access to lower-cost capital (i.e., debt) than equity investors do.

For offtakers, progression through the project lifecycle stages provides greater certainty regarding the volumes, timing, and potentially the pricing of the fuel produced by the proposed project. The more advanced a project, the more likely an offtaker is to sign a binding offtake agreement. For example, during feasibility, an offtaker may only sign an MoU or LoI, but during the FEED stage, the offtaker may aim to secure a binding contract.

Note that the roles of financiers and offtakers are equally important in helping a project reach a final investment decision, as financiers will not provide the requisite capital for FID unless a binding offtake with a creditworthy counterparty is in place.

1. State which project lifecycle stage the project is currently in (pre-feasibility, feasibility, pre-FEED, FEED, detailed design).
2. Give an overview of the activities needed to complete the current lifecycle stage and subsequent stages.
3. Provide an overview of the project timeline, showing the approximate duration for each project lifecycle stage.
4. What barriers are holding the fuel producer back from progressing to the next lifecycle stage?

Note:
The project lifecycle stage definitions and typical sources of finance for different project lifecycle stages are shown in Annex 1: Project Lifecycle

🔍 **For evidence typically sought,** refer to Annex 1: Project Lifecycle. The 'Activities' row refers to the engineering-related pieces of evidence expected. Note that other evidence (technology, commercial, financial, and sustainability) has been covered elsewhere in the document.

Project team

Financiers are likely to provide capital to a project only if they believe the project team has the right skills and experience to execute it. Offtakers, likewise, will only engage in offtake discussions if they have the confidence that the team can successfully execute the project.

For project developers, experience in developing major energy infrastructure projects is a must, as well as a track record in raising capital for similar projects. For those also developing their own technology, a team with a track record and relevant (industrial) experience in scaling up (chemical) processes is key.

5. Provide an overview of the team's experience in relation to:
    a. Technology scale-up (for technology developers)
    b. Project development and execution
    c. Raising finance
6. Does the proposed project need to bring in any expertise to help fill in any gaps in knowledge and experience?
7. What credentials does the team have relating to developing the project in the proposed geography?
    a. Is there a sufficient workforce presently available, who are adequately skilled or can be trained?

🔍 **Evidence typically sought:**
- Team CVs/profiles, clearly demonstrating relevant experience

📍 **Country-specific perspective:**
Showing that the fuel producer's team has the right expertise and track record in the country, with boots on the ground in that country, will significantly increase the credibility of that project.

Location-specific aspects – Infrastructure, local experience, workforce, planning and permitting, social considerations

Understanding the chosen site, location-specific aspects such as labour, and the current status of the project with respect to planning and permitting is crucial for both investors and offtakers, as it provides confidence that the fuel producer can address these location issues as the project develops. In particular, a shortage of local labour can increase the costs of or delay a project.

Obtaining local support is a crucial part of developing a project, as large energy infrastructure projects often face significant delays or implementation blockers from local residents/stakeholders who may be unhappy if they have not been sufficiently involved during the development process.

8. Provide a brief overview of the location of the proposed plant and why the site is an ideal location (consider access to feedstock, cost of feedstock, access to transport, etc.)
9. For each of the stages listed in Part 1 Q15, does any infrastructure involved in the production process already exist? And if so, what? What is required to be built from scratch?
    a. Existing infrastructure (incl. production facilities as well as storage and distribution to customers)
    b. Required to be built (incl. production facilities as well as storage).

Note:
Investors will want to ensure that the overall process and infrastructure investments are cost-effective, i.e. that sufficient volumes can ultimately be produced to justify expenditure. This may also apply to steps of the production process, which can be more costly than others. E.g. liquefaction plants are costly, and where possible, a fuel producer could consider whether infrastructure can be cost-shared to reduce overall risk.

10. Is there already experience in the overall production process, including feedstock cultivation?
11. Is there experience in the selected location?
12. Have rights to use/lease the land been secured?
13. Has planning permission for the project been granted?
14. Has permitting clearance for the project been granted?
15. What are the expected social impacts of such a project? Are there impacts on the community, including food security or land access? Does the project expect to generate jobs for the local community?
16. Is there public acceptance, or known opposition, for such a project?

🔍**Evidence typically sought**:
- Agreements relating to rights to rent/lease the land
- Planning permission documents, e.g. planning consent (or evidence of progress through the process, e.g. communications with relevant local authorities)
- Permitting licenses (or evidence of progress through the process)

Part 3: Technical Feasibility: Technology readiness level and scale-up

Technology risk is a key area of concern for both investors and offtakers. Investors will want some reassurance that the technology will deliver the project volumes of fuel at the anticipated production cost, in order to deliver their desired return on investment. Offtakers will want comfort that the technology can deliver the desired volume of fuel, at the right time, at the right price, with the right sustainability credentials.

Thus, the purpose of this part is to give stakeholders comfort that the relevant testing/prototyping has been carried out, and in particular, whether the technology is really ready for the proposed plant scale. Jumping from small scales (e.g., pilot) directly to large scales (e.g., first commercial) is often seen as a concern, and therefore significant reassurance/evidence would need to be provided if this is the chosen approach.

The following technology readiness level (TRL) definitions[1], and link to the plant 'stage', have been indicated in the table below.

Table 1 Technology Readiness Level Definitions

TRL	Definition	Plant 'Stage'/Scale
1	Basic principles observed and reported	Idea conceptualisation
2	Technology concept or application formulated	
3	Analytical and experimental critical function or characteristic proof-of-concept	Lab scale
4	Technology basic validation in a laboratory environment	
5	Technology basic validation in a relevant environment	Pilot scale
6	Technology model or prototype demonstration in a relevant environment	Small demonstration
7	Technology prototype demonstration in an operational environment	Large demonstration
8	Actual technology completed and qualified through test and demonstration	First-of-a-Kind Commercial (FOAK)
9	Actual technology qualified through successful mission operations	Nth-of-a-Kind Commercial (NOAK)

Current technology readiness

1. Are you developing your own technology to be used in the project in question, or will you be licensing the technology?
2. Indicate which typical stages have been completed based on the TRL in Table 1.

[1] https://www.ukri.org/councils/stfc/guidance-for-applicants/check-if-youre-eligible-for- funding/eligibility-of-technology-readiness-levels-trl/

3. What production volumes were completed for that stage, and for how long (i.e. how many hours was the facility run for)?
4. For each step of the process, indicate the current technology/process readiness level.
5. For each step of the process below TRL9, outline the plan to increase the current technology readiness, and what key milestones will signify a higher TRL

🔍 **Evidence typically sought**:

- Provide in-house data for the TRL of each stage, for example, data on process performance from existing facilities (non-exhaustive list):
  - Fuel production volumes over time
  - Fuel product quality over time
  - Feedstock consumption over time
  - Energy consumption over time
  - Catalyst lifetime
- Examples of other plants using this technology, and associated evidence of performance
- 3rd party validation of the technology is also highly recommended, for example if an independent technology due diligence assessment has been performed

📍 **Country-specific perspective:**

Deploying a non-commercially mature technology (TRL less than 9) anywhere in the world has major challenges in terms of getting appropriate investor and offtaker support. In developing countries, these challenges are increased due to an increased level of perceived risk (e.g., political). Arguing why there are advantages of deploying this technology in a developing country vs a developed country may help this justification, for example, by citing access to more abundant or cheaper feedstock, labour, or land.

Scale-up required for the proposed project

6. Indicate the stage of technology proposed for the project based on the TRL in Table 1.
7. Outline the key technical risks for scaling this technology to the TRL desired as a result of this project, and the mitigation strategies you plan to adopt.
8. For pilot/demo-scale plants only – what is the purpose of the pilot/demo plant?
   a. E.g. is it to be used for fuel certification purposes, or engine testing?
9. For pilot/demo-scale plants only – what aspects of the plant will help de-risk the scale-up to full commercial scale? Does the demo plant include all the features (e.g. recycle loops) that a larger commercial-scale plant will have? Does it represent one module of a multi-module commercial scale plant?
10. For commercial-scale plants, does the technology come with any performance guarantees? (This applies regardless of whether the fuel producer is developing the technology, or whether the technology is licensed in from a 3rd party technology licensor).

🔍 **Evidence typically sought**:

- Risk register/risk mitigation plan
- Documentation relating to performance guarantees

Health and safety considerations

11. Is there any expected impact on public health, particularly in the vicinity?
12. Are there particular safety hazards that need to be addressed? If so, have adequate safety procedures been developed?
13. What safety studies have been carried out? (e.g. HAZID (Hazard Identification Study), HAZOP (Hazard and Operability Study), FMEA (Failure Modes and Effects Analysis)).

🔍 **Evidence typically sought**:

- Safety studies, e.g. HAZID (Hazard Identification Study), HAZOP (Hazard and Operability Study), FMEA (Failure Modes and Effects Analysis)

Part 4: Sustainability and Regulatory Considerations: GHG reduction potential and market acceptance

Environmental, sustainability, traceability, and policy considerations

Understanding the types of feedstock and their sustainability credentials is important in understanding whether the fuel can be sold into the target market based on policy requirements, whether offtakers can use this fuel to meet their own obligations, and what sustainability-related claims they may be able to make.

In addition, understanding whether the fuel can deliver the required GHG emissions reductions is another crucial part of the equation. Not only do investors and offtakers want to understand if the fuel can meet the GHG reduction requirements of the target market, but they also want to understand the robustness of the GHG/LCA analysis, in particular with respect to whether independent analysis and/or certification has been carried out.

In addition to GHG performance, alternative fuel projects should demonstrate that feedstock use does not create unintended social or environmental harm. This includes managing indirect land use change (ILUC) risks, accounting for potential displacement emissions (e.g., from wastes or residues already in use), and ensuring safeguards for food security, biodiversity, and community rights. Such risks can be addressed through recognised sustainability certification and independent verification, which provide credible evidence alongside LCA and regulatory compliance.

1. For biomass feedstocks:
    a. Is the feedstock considered a crop?
    b. Is the feedstock a waste or residue?
        i. If so, does the feedstock meet the relevant jurisdiction's definitions (e.g. EU RED Annex IXa or Annex IXb definitions)?
        ii. If so, can it be demonstrated that its use does not displace existing waste applications (e.g. energy, chemicals, animal feed) in a way that could create indirect land use change or increase emissions elsewhere?
2. For e-fuels:
    a. What is the source of the CO_2? (e.g. biogenic, fossil, or from the air (DAC))?
    b. What is the source of the hydrogen?
    c. For green hydrogen and its derivatives:
        i. What is the origin of the electricity used to make the hydrogen?
        ii. How is the electricity being sourced (grid connection with certificates, grid connection with PPA, behind the meter)?
        iii. Will the electricity meet the additionality, temporal correlation, and geographical correlation rules set out by the relevant jurisdiction's regulations (e.g. EU RFNBO delegated act)?
3. For blue fuels:
    a. What is the source of the hydrogen?
        i. Assuming production from natural gas reforming with CCS, what percentage of CO_2 from the natural gas reforming step is assumed to be captured and stored?
4. For recycled carbon fuels:
    a. What is the source of the carbon?

b. What are the counterfactual uses (the use of the carbon if not used for fuel production) of the carbon sources, and are these expected to change over time?

5. What is the carbon intensity of the fuel (gCO_2e/MJ) on a Well-to-Wake (WtW) basis?
    a. What impacts the carbon intensity value?
    b. What is the contribution of each step of the production process to the overall WtW GHG value?
    c. Has direct land use change or indirect land use change been considered in the calculation?
    d. Has the above been carried out in accordance with the IMO 2024 LCA Guidelines (Resolution MEPC.391(81) – 2024 Guidelines on Life Cycle GHG Intensity of Marine Fuels)?

Country-specific perspective:
Different countries have varying perspectives when it comes to considering which feedstocks are acceptable. Countries whose economies rely strongly on certain types of crop-based feedstocks (e.g., palm, sugarcane, corn) may consider these feedstocks to be more acceptable than in those countries without such feedstocks. The key here is to understand the market into which the fuel will be sold and its specific requirements.

6. Has a full Life Cycle Analysis of the production process been conducted?
    a. If yes, please provide details (methodology, disaggregated values, default or actual values, expected value)
    b. If no, indicate expected range of GHG impact (gCO_2e/MJ)
    c. What other impacts were considered? (e.g. water, air pollution, etc.)
    d. Has the above been carried out by the fuel producer, or has an independent analysis been carried out?

Note:
Well-to-Wake (WtW) analysis and Life Cycle Assessment (LCA) are both methods for evaluating the environmental impact of a product or process, but they have different scopes. WtW focuses on the energy use and greenhouse gas (GHG) emissions from fuel production to its use in a vessel (well-to-tank + tank-to-wake), while LCA considers the entire life cycle, including manufacturing, transportation, use, and disposal of both the fuel and the vehicle. LCA analyses can also be expanded to cover non-GHG impacts, such as water and air pollution. Indirect Land Use Change (ILUC) occurs when increased demand for biofuels indirectly drives the conversion of land elsewhere, for example, when food or feed crops are displaced, leading to deforestation or cultivation of new land. ILUC can release significant greenhouse gas emissions and undermine the sustainability of alternative fuels. Credible safeguards, such as demonstrating yield increases, using genuinely unused or degraded land, or applying displacement assessments for wastes and residues, can minimise this risk.

7. What systems are in place to ensure full traceability of the feedstock and fuel along the supply chain? How will the project demonstrate Chain of Custody to provide assurance that the product sold (e.g. UCO-based fuel) is delivered and not substituted with other sources?
8. Is the fuel certified to meet the relevant sustainability criteria of the target market? (e.g. for the EU, Renewable Energy Directive sustainability criteria)?
    a. If not, will it be certified?
    b. Specify any risks that the fuel might not meet sustainability criteria

c. Is the production certified under an international voluntary scheme (e.g. ISCC/RSB)?
d. If yes, which scheme?
e. If no, is there any concern that the project will not be able to meet the sustainability criteria defined for the target market?

Note:
Certification of fuels is crucial for ensuring compliance with environmental regulations and verifying overall sustainability standards. Without certification, access to key fuel markets may be significantly restricted, and may hinder the ability to secure long-term offtake agreements.

9. How will different WtW GHG values of the fuel be priced?
10. Are there penalties in place that provide an upper limit of the WtW GHG values?
11. Are there any other potential environmental issues which may be of concern (e.g. noise, biodiversity, etc.)?

🔍 **Evidence typically sought**:
- In-house GHG analysis and/or full LCA
- 3rd party GHG analysis and/or full LCA
- Sustainability certification from an accredited institution, e.g., ISCC or RSB

Political and regulatory landscape

Demonstrating a solid understanding of the policy landscape to investors is crucial for a fuel producer, for policy often determines the market size and pricing. Additionally, demonstrating the level of certainty in policy is also important (in terms of market size, pricing, product eligibility), as this is often an area that investors express concern over (for example, if a change in government may lead to a change in policy). For offtake discussions, having an understanding of policy and subsequent pricing will be extremely useful for pricing negotiations.

12. What existing regulations and policies impact the viability of the project?
13. Does the project align with national energy policies or goals (e.g. renewable energy targets)?
14. Are there potential subsidies, taxes, or carbon credits that could improve economic viability (e.g. Inflation Reduction Act, EU funding, national-level subsidies, etc)?
15. Do these policies/subsidies provide sufficient price certainty, both in terms of actual value and duration?
16. Are there any extreme circumstances in the region that may impact project viability (e.g. politics, conflict, etc.)?
17. Is there a need for new regulations/permitting framework to cover production and distribution?
18. What regulations apply to fuels being sold into the target market(s)?

📍 **Country-specific perspective:**
Policies and regulations in the field of low-carbon maritime fuels are globally at a relatively low level of maturity, with a few exceptions (e.g., EU, UK). However, the fuel producer still needs to demonstrate that they understand what policies and regulations are under development in that country, and that they are fully engaged with local officials on this.

Part 5: Commercial Feasibility: Market potential, project economics, and financial viability

The purpose of this part is to understand the overall context/landscape of the fuel project, from a commercial, financial, political, and social perspective. The questions revolve around market demand, potential offtake, costs, regulatory levers, and social impacts.

Market analysis and offtake

Particularly for investors, it is important to demonstrate that the fuel producer has a solid understanding of the market for the product that it proposes to produce, in terms of market size, use cases (for all products made by the plant, not just the main fuel), and the competitive landscape. All too often, projects do not demonstrate a solid understanding of this and as a result fail to obtain offtake, which means that projects do not progress.

1. What is the current market demand for the main fuel product, and how is this likely to grow in the future?
2. Are there other viable markets, besides maritime, for the main product (as a fuel)? (e.g. fuel for other transportation, electricity production, etc.)? What are they, and how might they change over time?
3. Are there opportunities to aggregate demand across these markets to lower costs and strengthen the business case for investment?
4. Are there other use cases/non-fuel markets for the main product (if not used as a fuel)?
5. Besides the fuel, what are the other by-products? What are their use cases/market opportunities? For those other markets, what is the current supply? Are there other alternatives?
6. Who are the main competitors? How does this fuel production method compare? What is the position among other competing products on the market?
7. Have potential offtakers already been identified?
    a. If yes, are there any foreseen barriers for the conclusion of an agreement? Are there solutions to overcome such barriers?
    b. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU)/Letter of Intent (LOI)
        - Head of Terms
        - Binding contract
    c. In the offtake agreement, what type of pricing formula is being considered (indexed, cost plus, etc)? Are you structuring the pricing to cover potential variations in production costs?

Note:
Offtake agreements are critical for investment and can often be the most challenging part in securing investment for full-scale project development. Even if offtake agreements have not been finalized, the fuel producer should be able to demonstrate all the market opportunities available for their fuel product, and identify where potential customers are located, likely demand volumes, and whether they are willing to pay a premium for the fuel product. Given the large investments required for new infrastructure, a typical time horizon for offtake agreements for new fuels is understood to be approximately 10 years. At present, financing entities are requiring

around 50% offtake to be secured for 10 years or more. There are differing levels of maturity of not only offtake agreements, but all kinds of commercial agreements. The below provides a high-level description of each, listed in order of increasing maturity and certainty: Memorandum of Understanding (MoU) / Letter of Intent (LOI): Non-binding, preliminary agreements that outline the intent of the parties and key areas to be investigated as part of a proposed transaction. These can contain some legally binding clauses, e.g., confidentiality. Head of Terms (HoT): Non-binding agreement that goes into more detail than an MoU/LoI and typically sets out key aspects of the agreement (e.g., for an offtake price range, volumes, timing, location, etc). Binding contract: A legally enforceable contract, with all aspects of the agreement complete. Projects are more likely to get interest in offtake if the project has sufficiently progressed through the project lifecycle (i.e., projects in pre-FEED or FEED are more likely to have interest than those in feasibility). Furthermore, if a project has demonstrated that it can produce fuel more cost competitively than its peers, this may also increase the likelihood of offtaker interest.

🔍 **Evidence typically sought**:
The below gives an indicative level of offtake agreement maturity that might be expected at different project lifecycle stages:

- Memorandum of Understanding (MoU) / Letter of Intent (LOI): Feasibility study, early stages of pre-FEED
- Head of Terms (HoT): pre-FEED, early stages of FEED
- Binding contract: towards the end of FEED

Showing offtake interest from multiple parties is highly desirable, particularly to investors, as it helps to mitigate revenue risk.

In addition, independent 3rd party validation of the market size and pricing can also be useful to investors.

📍 **Country-specific perspective:**
For processes that produce several co-products, it will be highly important to show that there is a market/there are offtakers for all of the products, in the country in question. At the time of writing, the majority of markets do not have policies that support the use of such low-carbon co-products (e.g., SAF, green plastics), and thus the importance of securing offtakers (who may be willing to do so voluntarily) for these becomes increasingly important.

Cost and price analysis

Delivering a cost-competitive project is critical from an investor's perspective and will form a substantial part of their investment decision. In particular, showing that the project can outcompete its peers and has relevant agreements in place for cost-competitive supply of fuel and energy will be critical.

On the other hand, fuel producers may not want to disclose detailed cost information to potential offtakers (or would prefer to provide limited information), as it may put the fuel producer at a disadvantage in the offtake negotiation discussions. Rather, the fuel producer should think whether the price or pricing formula put forward for these discussions is sufficient to provide enough margin

over and above their own internal cost of production (to deliver a sufficiently attractive return on investment, see section on **Fout! Verwijzingsbron niet gevonden.**).

8. What is the levelised cost per tonne of fuel produced (USD/t VLSFO equivalent)?
9. Which are the major contributors to the cost?
10. Has a sensitivity analysis been carried out? What were the variables that had the greatest impact on levelised cost?
11. What discount rate was assumed for the levelised cost calculation? How does it relate to the available sources of capital in the country/region where the project is based?
12. What are the maintenance requirements for the facilities involved, and how has this been taken into account in the calculation of annual fuel production volumes?
13. How does this cost compare to the fossil incumbent?
14. How does this cost compare to other low-carbon alternatives?
15. Describe what opportunities exist to further reduce the cost of fuel from the project, to increase its competitiveness.
16. Are there any agreements already in place for the feedstock supply?
    a. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU)/Letter of Intent (LOI)
        - Head of Terms
        - Binding contract.
17. Are there agreements already in place for the supply of energy for the project?
    a. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU) / Letter of Intent (LOI)
        - Head of Terms
        - Binding contract.
18. Are there inputs that will change prices due to increased demand (e.g. using straw for power generation increased straw prices)?
19. Is there a currency exchange risk (for example, production costs in local currency, product sold in USD), and if so, how will it be managed?
20. Will the product be sold linked to an existing price index, for example, Brent or Henry Hub, or a fixed price? Or do you propose to consider a cost-plus arrangement?
21. Is there a premium for quality (better cold flow/stability, etc)?
22. How is the product priced in different markets (for the road could be a regulated market)?

Note:
Companies will need to consider the benefits and risks of different pricing models when determining how to price their products. For example, Hydrotreated Vegetable Oil (HVO) is a higher-quality product than FAME, making it more suitable for road use, and products that meet the EU 9A standard may be priced higher than those meeting the 9B standard. Bio-methane can be priced based on natural gas prices (like the Henry Hub) plus a "bio" premium, which is determined by its carbon intensity or production cost and profit margin.

Typically, fuel producers favour cost-plus contracts, wherein the price is linked to the cost of production plus a certain margin. This allows the producer to maintain a certain level of profitability, even if internal costs increase.

Country-specific perspective:
Demonstrating that cost assumptions have been made specific to that location is highly important. For example, construction costs (part of CAPEX) and labour (part of OPEX) should reflect local conditions and the accessibility (or otherwise) to appropriate skilled labour.

Evidence typically sought:
- In-house levelised cost modelling (may not be disclosed to offtakers)
- Independent 3rd party cost analysis (e.g. as part of a diligence report on the project/technology) (may not be disclosed to offtakers)
- Feedstock supply agreements
- Energy supply agreements

Financial considerations

Questions relating to financial aspects of the project will vary depending on which stakeholder group is being addressed, as investors and potential offtakers will each have distinct priorities and concerns regarding the financial details.

These questions will primarily be of interest to the financiers, as demonstrating a solid return on investment, and showing a plan to raise the remaining finance for the project (it is unlikely that only one source of finance will cover the entire amount required at FID, nor for the different development stages of the project), will form a key part of their decision making process.

As per the cost considerations above, the fuel producer may not want to disclose information (or would prefer to provide limited information) relating to the rate of return and financial viability to potential offtakers, as it may disadvantage them in their offtake negotiations. However, showing that the fuel producer has a solid plan in place to raise finance will likely be worth disclosing, as it gives potential offtakers confidence that the project can achieve FID in a timely manner and deliver the volumes of fuel proposed.

23. Has a discounted cash flow financial analysis been performed for the project?
    a. If yes, what was the internal rate of return (IRR) of the project?
24. What are the major factors that contribute to the financial viability of the project? Has a sensitivity analysis been carried out? What could be done to improve them?
25. How do you plan to finance the remaining development (pre-FID) stages of the project?
    a. State the expected mix of capital (grants, equity, etc), both in terms of quantities and expected sources
    b. How certain is it that you will have access to this capital?
26. How do you expect to raise the requisite finance for FID?
    a. State the expected mix of capital (debt, equity, grants, etc), both in terms of quantities and expected sources
    b. How certain is it that you will have access to this capital?
27. If you are developing your own technology, what is your plan to raise capital to scale it up?

Note:
For FOAK (First of a Kind) commercial projects: Debt is usually the lowest cost source of capital and hence should be prioritised/form the majority, especially for FID (Final Investment decision).

However, debt providers (typically banks) are risk-averse and want to see the following before even considering providing debt (non-exhaustive list):

- Secure supply of sustainable feedstock
- Long-term offtake contracts in place, with multiple creditworthy parties
- The use of mature technologies, provided by reputable developers, OR technology risk insurance/performance guarantees in place
- Mitigation of project-to-project risk (e.g. if the project relies on a separate hydrogen project for hydrogen supply)

For demo scale projects: Debt is typically extremely hard to obtain for demo scale or pilot scale projects, as it is difficult to demonstrate to banks how they can have certainty that the loan will be repaid.

Questions from an Investor Perspective	Questions from a Shipping Company/Offtaker Perspective
- What are the capital and operational costs? - Are there additional costs, e.g. development expenditure, engineering and design costs? - Are there any costs associated with securing licenses and permits? - What is the production cost (including cost of inputs, technology, and infrastructure)? - What is the payback period? - What is the payment risk (e.g. default, credit)?	- What is the target selling price? - How does this compare with the market price? - How does the cost of this product compare with market alternatives? - How might this price fluctuate and depending on what key factors? - What level of funding has been secured?

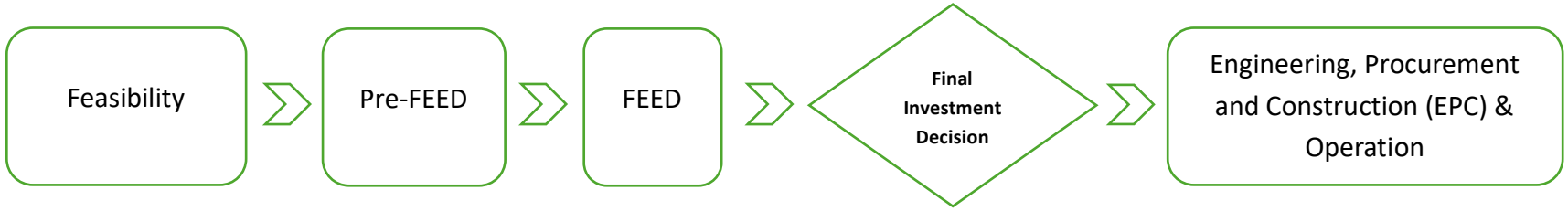
Note:
The split of questions between investors and offtakers suggested here is typical, based on the respective interests of each party; however, there will be cases where both sets of stakeholders may want to understand answers to both sets of questions.

🔍 **Evidence typically sought**:

- Project discounted cash flow model (may not be disclosed to offtakers)
- Evidence of interest from potential investors (e.g., Letter of Intent)

📍**Country-specific perspective**:
The discount rate should reflect the cost of capital in that particular region. Typically, the discount rate is higher in developing countries to reflect a higher level of perceived financial risk (e.g., higher interest rates on loans). Here, international development finance can be advantageous (e.g., from a development bank) provided that that entity is prepared to provide finance below the cost of a commercial loan (which is not always the case

Annex 1: Project Lifecycle



What are these project lifecycle stages?
Before a decision to invest in a project is taken, there are several stages of study that a project will typically go through, in order to define technical, commercial, financial, sustainability, planning, and execution aspects. This applies to both mature technologies (TRL8+) and those still in development (TRL7 and below).

These stages are defined by the Front End Loading (FEL) process. This is a structured process that defines and develops the project before a decision is taken to invest in the project (Final Investment Decision). These stages are Feasibility (FEL-1), pre-FEED (FEL-2), and FEED (FEL-3). FEED refers to Front End Engineering and Design.

This is a stage-gated process wherein a decision is taken before moving from one stage to the next.

Why is this process needed?
The philosophy behind this process is to minimize risks and control costs as early as possible in a project lifecycle, as it is typically much more expensive to make changes to a project later on in its lifecycle.

As a project progresses from Feasibility through to FEED, the level of definition increases, allowing stakeholders to progressively have more certainty about the project and its risks.

Table 2 Project Lifecycle Stages for a commercial plant (TRL 8+)

Project stage	Feasibility	Pre-FEED	FEED	Final Investment Decision (FID), and subsequently, Plant Construction
Objectives	What options exist for the project? Does the project make sense technically, commercially, and environmentally?	What could be some boundaries for this project? What are the main technical, commercial, financial, and environmental risks?	Is this project going to deliver a return on my investment? Am I confident enough in the technical, commercial, sustainability, and project execution risks to put in the money for investment?	A decision is taken to put in the requisite level of finance to build the plant
Activities (non-exhaustive)	Developing a preliminary business case and conducting a high-level technical and economic viability assessment	Developing conceptual designs, creating preliminary layouts, and generating initial equipment lists	Comprehensive project definition, including technical specifications, cost estimates (typically with an accuracy of +30%/-20%), and a defined contracting strategy	Detailed engineering, procurement of plant equipment, and construction
Approx funding needed (m USD)[2]	0.2 – 0.5	1 – 3	10 – 30	Depends on plant scale and technology type, but could be greater than 1billion
Timeframe	3 – 6 months	6 – 9 months	9 – 12 months	2 – 3 Years
Typical sources of finance	Grants, equity	Grants, equity	Grants, equity	Debt, equity

[2] The numbers presented in this table are only here to be representative for scale and will change depending on the location, fuel, and other factors.

The objectives and activities of the different lifecycle stages are similar to those noted in Table 2 for a commercial-scale plant. However, it is critical to note that the overall objective of a pre-commercial plant (TRL5-7) is very different to that of a commercial scale plant. Often, pilot and demo plants are designed primarily to de-risk technical uncertainties (e.g., produce enough fuel for demonstration purposes, prove that the catalyst can run for X hours), rather than to deliver a return on investment. In fact, pilot and demo plants often will not break even and will not deliver a return on investment. Investors who fund such plants are typically venture capital or strategic investors, who have a long term rationale for such investment (e.g. VC = how will it help the technology in the long run, to deliver a return on investment when it reaches commercial scale), and will typically invest in the technology developer itself rather than the pilot or demo plant (e.g. in the case of a VC, this allows them to effectively invest in the IP and gain upside on the company's valuation as it progresses).

Table 3 Project Lifecycle Stages for a pilot or demo scale plant (TRL5-7)

Project stage	**Feasibility**	**Pre-FEED**	**FEED**	**Final Investment Decision (FID), and subsequently, Plant Construction**
Objectives	What options exist for the project? Does the project make sense technically, commercially and environmentally?	What could be some boundaries for this project? What are the main technical, commercial, financial and environmental risks?	Am I confident enough in the technical, commercial, sustainability of a project execution risks to put in the money for investment?	A decision is taken to put in the requisite level of finance to build the plant
Activities (non-exhaustive)	Developing a preliminary business case, and conducting a high-level technical viability assessment	Developing conceptual designs, creating preliminary layouts, and generating initial equipment lists	Comprehensive project definition, including technical specifications, cost estimates (typically with an accuracy of +30%/-20%), and a defined contracting strategy	Detailed engineering, procurement of plant equipment, construction

Project stage	Feasibility	Pre-FEED	FEED	Final Investment Decision (FID), and subsequently, Plant Construction
Approx funding needed (m USD)[3]	0.1 – 0.2	0.5 – 1	5 – 10	Depends on plant scale and technology type. Indicatively, pilot (<50), demo (<200)
Timeframe	3 – 6 months	3 – 6 months	6 – 9 months	1 – 2 Years
Typical sources of finance	Grants, equity	Grants, equity	Grants, equity	Equity, grants

[3] The numbers presented in this table are only here to be representative for scale and will change depending on the location, fuel, and other factors.

Annex 2: Consolidated list of questions

Part 1 – Fuel project overview: Summary of project attributes

1. What is the overall ambition and intention of the fuel producer?
2. What are the specific objectives of this project, and how does it align with the vision of the fuel producer?
3. What project partners does the fuel producer have, and what are their roles in the project?
4. What differentiates this project from others from the perspective of technological innovation (with relevant IP protection), access to feedstock, cost competitiveness, speed to market, scale, sustainability credentials, access to market, government support, fuel properties, job creation, energy security? (Note: this is a non-exhaustive list of unique aspects of the project to be considered).
5. What is the main fuel product?
6. Is the fuel a drop-in fuel (can it directly replace gas or fuel oils in conventional machinery) with similar chemistry?
7. Does the fuel meet a marine fuel specification, and if so, which one?
8. Which engine type(s) is the fuel suitable for?
9. Has the fuel been tested in a marine engine, and if so, what were the results?
    a. Were any blend limits identified?
10. Has any Original Equipment Manufacturer (OEM) feedback been provided on the engine tests?
    a. Were any potential impacts on engine warranties identified?
11. Would the fuel be classed as a biofuel, e-fuel, a blue fuel, or recycled carbon fuel?
12. What are the main feedstocks required?
13. Which are the target sectors for your products?
14. Which are the target geographies for your products?
15. Provide an overview of the process, giving details on the size of each process step, the required inputs, and technology choices. A block flow diagram and/or a table are formats that are easy for relevant stakeholders to understand.
16. Provide a rationale for the scale of the proposed plant, e.g., for a demo plant, it is only enough to make X tonnes of fuel for testing, e.g. for a commercial plant, it is the minimum scale we expect for a certain return on investment.
17. Provide an overview of the feedstock sourcing strategy
    a. What agreements are in place for these feedstocks?
18. Provide a description of the desired location of the plant and what makes it an ideal place to produce fuel (e.g. existing infrastructure, costs, proximity to market, etc)?
19. How will the fuel be transported from the production site to the commercial port?
20. Does the port have the relevant storage capabilities for your chosen type of fuel?

Part 2 – Project Execution: Current project lifecycle stage of the project, execution plan, project team, and location-specific aspects

1. State which project lifecycle stage the project is currently in (pre-feasibility, feasibility, pre-FEED, FEED, detailed design)

2. Give an overview of the activities needed to complete the current lifecycle stage and subsequent stages.
3. Provide an overview of the project timeline, showing the approximate duration for each project lifecycle stage.
4. What barriers are holding the fuel producer back from progressing to the next lifecycle stage.
5. Provide an overview of the team's experience in relation to:
    a. Technology scale-up (for technology developers)
    b. Project development and execution
    c. Raising finance.
6. Does the proposed project need to bring in any expertise to help fill in any gaps in knowledge and experience?
7. What credentials does the team have relating to developing the project in the proposed geography?
    a. Is there a sufficient workforce presently available, who are adequately skilled or can be trained?
8. Provide a brief overview of the location of the proposed plant and why the site is an ideal location (consider access to feedstock, cost of feedstock, access to transport, etc.)
9. For each of the stages listed in Part 1 Q15, does any infrastructure involved in the production process already exist? And if so, what? What is required to be built from scratch?
    a. Existing infrastructure (incl. production facilities as well as storage and distribution to customers)
    b. Required to be built (incl. production facilities as well as storage).
10. Is there already experience in the overall production process, including feedstock cultivation?
11. Is there experience in the selected location?
12. Have rights to use/lease the land been secured?
13. Has planning permission for the project been granted?
14. Has permitting clearance for the project been granted?
15. What are the expected social impacts of such a project? Are there impacts on the community, including food security or land access? Does the project expect to generate jobs for the local community?
16. Is there public acceptance, or known opposition, for such a project?

Part 3 – Technical Feasibility: Technology readiness level and scale-up

1. Are you developing your own technology to be used in the project in question, or will you be licensing the technology?
2. Indicate which typical stages have been completed based on the TRL in Table 1?
3. What production volumes were completed for that stage, and for how long (i.e., how many hours was the facility run for)?
4. For each step of the process, indicate the current technology/process readiness level.
5. For each step of the process below TRL9, outline the plan to increase the current technology readiness, and what key milestones will signify a higher TRL.
6. Indicate the stage of technology proposed for the project based on the TRL in Table 1?
7. Outline the key technical risks for scaling this technology to the TRL desired as a result of this project, and the mitigation strategies you plan to adopt.
8. For pilot/demo-scale plants only – what is the purpose of the pilot/demo plant?

    a. E.g. is it to be used for fuel certification purposes, or engine testing?
9. For pilot/demo-scale plants only – what aspects of the plant will help de-risk the scale-up to full commercial scale? Does the demo plant include all the features (e.g. recycle loops) that a larger commercial-scale plant will have? Does it represent one module of a multi-module commercial scale plant?
    a. Investors will want to know this as it is one of the main reasons for investing in a pilot/demo plant – how it will help the technology reach the next scale.
10. For commercial-scale plants, does the technology come with any performance guarantees? (This applies regardless of whether the fuel producer is developing the technology, or whether the technology is licensed in from a 3rd party technology licensor).
11. Is there any expected impact on public health, particularly in the vicinity?
12. Are there particular safety hazards that need to be addressed? If so, have adequate safety procedures been developed?
13. What safety studies have been carried out? (e.g. HAZID (Hazard Identification Study), HAZOP (Hazard and Operability Study), FMEA (Failure Modes and Effects Analysis)).

Part 4 – Sustainability and Regulatory Considerations: GHG reduction potential and market acceptance

1. For biomass feedstocks:
    a. Is the feedstock considered a crop?
    b. Is the feedstock a waste or residue?
        i. If so, does the feedstock meet the relevant jurisdiction's definitions (e.g. EU RED Annex IXa or Annex IXb definitions)?
        ii. If so, can it be demonstrated that its use does not displace existing waste applications (e.g., energy, chemicals, animal feed) in a way that could create indirect land use change or increase emissions elsewhere?
2. For e-fuels:
    a. What is the source of the CO_2? (e.g., biogenic, fossil, or from the air (DAC))
    b. What is the source of the hydrogen?
    c. For green hydrogen and its derivatives:
        i. What is the origin of the electricity used to make the hydrogen?
        ii. How is the electricity being sourced (grid connection with certificates, grid connection with PPA, behind the meter)?
        iii. Will the electricity meet the additionality, temporal correlation, and geographical correlation rules set out by the relevant jurisdiction's regulations (e.g., EU RFNBO delegated act)?
3. For blue fuels:
    a. What is the source of the hydrogen?
        i. Assuming production from natural gas reforming with CCS, what percentage of CO_2 from the natural gas reforming step is assumed to be captured and stored?
4. For recycled carbon fuels:
    a. What is the source of the carbon?
    b. What are the counterfactual uses (the use of the carbon if not used for fuel production) of the carbon sources, and are these expected to change over time?
5. What is the carbon intensity of the fuel (gCO_2e/MJ) on a Well-to-Wake (WtW) basis?

    a. What impacts the carbon intensity value?
    b. What is the contribution of each step of the production process to the overall WtW GHG value?
    c. Has direct land use change or indirect land use change been considered in the calculation?
    d. Has the above been carried out in accordance with the IMO 2024 LCA Guidelines (Resolution MEPC.391(81) – 2024 Guidelines on Life Cycle GHG Intensity of Marine Fuels)?
6. Has a full Life Cycle Analysis of the production process been conducted?
    a. If yes, please provide details (methodology, disaggregated values, default or actual values, expected value)
    b. If no, indicate expected range of GHG impact (gCO_2eq/MJ)
    c. What other impacts were considered? (e.g., water, air pollution, etc.)
    d. Has the above been carried out by the fuel producer, or has an independent analysis been carried out?
7. What systems are in place to ensure full traceability of the feedstock and fuel along the supply chain? How will the project demonstrate Chain of Custody to provide assurance that the product sold (e.g. UCO-based fuel) is delivered and not substituted with other sources?
8. Is the fuel certified to meet the relevant sustainability criteria of the target market? (e.g. for the EU, Renewable Energy Directive sustainability criteria)?
    a. If not, will it be certified?
    b. Specify any risks that the fuel might not meet sustainability criteria
    c. Is the production certified under any international voluntary scheme (e.g. ISCC or RSB)?
    d. If yes, which scheme?
    e. If no, is there any concern that the project will not be able to meet the sustainability criteria defined for the target market?
9. How will different WtW GHG values of the fuel be priced?
10. Are there penalties in place that provide an upper limit of the WtW GHG values?
11. Are there any other potential environmental issues which may be of concern (e.g. noise, biodiversity, etc.)?
12. What existing regulations and policies impact the viability of the project?
13. Does the project align with national energy policies or goals (e.g., renewable energy targets)?
14. Are there potential subsidies, taxes, or carbon credits that could improve economic viability (e.g. Inflation Reduction Act, EU funding, national-level subsidies, etc)
15. Do these policies/subsidies provide sufficient price certainty, both in terms of actual value and duration?
16. Are there any extreme circumstances in the region that may impact project viability (e.g. politics, conflict, etc.)?
17. Is there a need for new regulations/permitting framework to cover production and distribution?
18. What regulations apply to fuels being sold into the target market(s)?

Part 5 – Commercial Feasibility: Market potential, project economics, and financial viability

1. What is the current market demand for the main fuel product, and how is this likely to grow in the future?

2. Are there other viable markets, besides maritime, for the main product (as a fuel)? (e.g. fuel for other transportation, electricity production, etc.)? What are they, and how might they change over time?
3. Are there opportunities to aggregate demand across these markets to lower costs and strengthen the business case for investment?
4. Are there other use cases/non-fuel markets for the main product (if not used as a fuel)?
5. Besides the fuel, what are the other by-products? What are their use cases/market opportunities? For those other markets, what is the current supply? Are there other alternatives?
6. Who are the main competitors? How does this fuel production method compare? What is the position among other competing products on the market?
7. Have potential offtakers already been identified?
    a. If yes, are there any foreseen barriers for the conclusion of an agreement? Are there solutions to overcome such barriers?
    b. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU)/Letter of Intent (LOI)
        - Head of Terms
        - Binding contract
    c. In the offtake agreement, what type of pricing formula is being considered (indexed, cost plus, etc)? Are you structuring the pricing to cover potential variations in production costs?
8. What is the levelised cost per tonne of fuel produced (USD/t VLSFO equivalent)?
9. Which are the major contributors to the cost?
10. Has a sensitivity analysis been carried out? What were the variables that had the greatest impact on levelised cost?
11. What discount rate was assumed for the levelised cost calculation? How does it relate to the available sources of capital in the country/region where the project is based?
12. What are the maintenance requirements for the facilities involved, and how has this been taken into account in the calculation of annual fuel production volumes?
13. How does this cost compare to the fossil incumbent?
14. How does this cost compare to other low-carbon alternatives?
15. Describe what opportunities exist to further reduce the cost of fuel from the project, to increase its competitiveness.
16. Are there any agreements already in place for the feedstock supply?
    a. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU) / Letter of Intent (LOI)
        - Head of Terms
        - Binding contract.
17. Are there agreements already in place for the supply of energy for the project?
    a. If yes, what is the level of 'maturity' of the agreement?
        - Memorandum of Understanding (MoU)/Letter of Intent (LOI)
        - Head of Terms
        - Binding contract.
18. Are there inputs that will change prices due to increased demand (e.g. using straw for power generation increased straw prices)?

19. Is there a currency exchange risk (for example, production costs in local currency, product sold in USD), and if so, how will it be managed?
20. Will the product be sold linked to an existing price index, for example, Brent or Henry Hub, or a fixed price? Or do you propose to consider a cost-plus arrangement?
21. Is there a premium for quality (better cold flow/stability, etc)?
22. How is the product priced in different markets (for the road could be a regulated market)?
23. Has a discounted cash flow financial analysis been performed for the project?
    a. If yes, what was the internal rate of return (IRR) of the project?
24. What are the major factors that contribute to the financial viability of the project? Has a sensitivity analysis been carried out? What could be done to improve them?
25. How do you plan to finance the remaining development (pre-FID) stages of the project?
    a. State the expected mix of capital (grants, equity, etc), both in terms of quantities and expected sources
    b. How certain is it that you will have access to this capital?
26. How do you expect to raise the requisite finance for FID?
    a. State the expected mix of capital (debt, equity, grants, etc), both in terms of quantities and expected sources
    b. How certain is it that you will have access to this capital?
27. If you are developing your own technology, what is your plan to raise capital to scale it up?