

WHySE Compass Landmark 3

FEED - Front End Engineering Design



FEED the Horse

Dragon sat on the veranda with Horse and Dog, looking at the drawings in front of him.

"Dog," he said, "Horse reckons we need a FEED."

Horse raised his head. "We do, too."

Horse was new to the table: the independent go-getter. He and his company build the systems.

Dragon snorted softly. "I thought we start. Now we're planning again."

Dog placed the compass on the table. "That's exactly why we're talking about it."

"Because I'm impatient?" asked Dragon.

"Because you want to invest," said Dog. "And because Horse is supposed to deliver later on what's clearly laid out today."

Horse nodded. "I need clear tasks, boundaries and drawings that I can work with."

Dragon tapped the cover sheet. Written there in large letters was: **FEED**.

"Front-End Engineering Design," he read. "Sounds like a lot of paperwork."

Dog smiled. "It's more like the moment when a project comes of age."

What does FEED stand for?

FEED stands for **Front-End Engineering Design**. You could say it is the preliminary technical planning that takes place before the final investment decision and before detailed planning.

FEED is the phase in which a good idea is developed into a robust project. No plant is yet being built in detail. However, the key technical, economic, safety and organisational issues are clarified to such an extent that a decision can be made.

In an H₂ project, for example, this might mean: Which production technology is suitable? Where will the storage, compressors, trailer filling stations, grid injection points or end-use facilities be located? What permits are required? Where are the interfaces with electricity, gas, water, heat, biomethane, CO₂ or customers?

FEED is not just another file to be filed away. FEED forms the working basis for everyone who will later bear responsibility: management, investors, project management, regulatory authorities, engineering partners, procurement and operations.

Where does FEED fit into the project development process?

FEED forms part of the broader **Front-End Loading** process, or **FEL** for short. FEL describes the early stages of project development prior to the final approval of major investments. In many industries, this is divided into several stages. The terminology varies depending on the company and sector. The concept is similar:

First, an assessment is made as to whether an idea makes sense in principle. Then, the technically and economically most suitable solution is identified. Subsequently, this solution is developed in sufficient detail to enable an investment decision to be prepared.

FEED typically comes at the end of this early project development phase. This is preceded by concept development, feasibility studies, site selection, a comparison of alternatives and a rough cost estimate. During the FEED phase, these elements are consolidated into a clear project scope.

Dragon furrowed his brow. "So FEED is the final major test before I approve the funding?"

Dog nodded. "A necessary test. It doesn't make the decision for you. It makes clear exactly what you're deciding on."

Why is FEED important for hydrogen?

H₂ projects involve many interrelated aspects. Power supply, grid connection, water quality, gas quality, safety, approvals, certification, off-take agreements, logistics and operations are all interlinked.

If these issues are resolved too late, costly delays ensue. Then there's planning, re-planning, renegotiation and recalculation. Or the project fails to secure funding.

FEED helps to identify precisely delays at an earlier stage. During this phase, the project is described in technical terms, risks are assessed, costs are narrowed down, deadlines become more reliable, and responsibilities are clarified.

For Dragon, FEED is important because he wants to know whether the project is financially viable. For Horse, FEED is important because he will be responsible for implementing it later.

A good FEED answers questions such as these:

- ✓ What plant is being planned?
- ✓ What capacity, operating mode, media flows?
- ✓ What interfaces are there?
- ✓ What safety considerations are required?
- ✓ What permits and certifications are expected?
- ✓ What cost category is achievable? What risks remain unresolved?

What does a FEED typically include?

Depending on the type of project, a FEED contains various documents. In H₂ projects, these include: process description, mass and energy balances, block flow diagrams, process flow diagrams, preliminary layout planning, technical specifications, interface lists, operating philosophy, permitting strategy, cost estimate, schedule, risk overview and procurement strategy.

Safety studies also form part of this phase. These include a HAZOP, the Hazard and Operability Study. This is explained in WHySE Compass Landmark 1, because Monkey thought it was cough syrup.

Dog looked at Dragon. "When we talk about safety in the FEED, HAZOP isn't just window dressing. It's a key building block."

Horse added: "And it helps me later on. The sooner the critical points are identified, the more efficiently I can build."

What is the quality of a cost estimate in FEED?

Costs are a key in FEED. They help determine whether a project continues, is adjusted or is put on hold.

The **AACE International Recommended Practice 18R-97** describes how reliable cost estimates are in various project phases. For planning close to FEED phase, AACE provides a rough guideline: the actual costs may be around **10 to 20 per cent lower** or **10 to 30 per cent higher** than the estimate.

Dog picked up a pen.

“Dragon, if it says 10 million euros here, that means the plant is expected to cost somewhere in that range. Perhaps closer to 8 to 9 million. Perhaps closer to 11 to 13 million.”

Dragon looked up. “So no pinpoint accuracy?”

“Exactly,” said Dog. “A robust cost estimate isn’t a price tag. It’s a basis for decision-making.”

Horse nodded. “And for that, I need clear assumptions: quantities, quotations, interfaces, risks, reserves and outstanding issues.”

Dog smiled. “Exactly. A figure without assumptions is just a figure.”

Dragon leaned back. “So I’m not getting a crystal ball.”

“No,” said Dog. “You’re getting a pair of binoculars.”

Common Misconceptions

A common misconception is: **FEED is detailed planning.**

No, FEED prepares the ground for detailed planning. It lays the foundations so that work can later proceed in a targeted manner.

A second misconception is: **FEED delays the project.**

FEED takes time. In parallel, it can minimise detours later on. Anyone who jumps into implementation too early in a complex H₂ project takes unresolved issues with them onto the construction site. There, they usually end up costing more.

A third misconception is: **FEED is only for large corporations.**

Smaller projects also benefit from an appropriate FEED. The scope must be tailored to the project. Clear, robust preliminary planning is required.

What comes after FEED?

FEED is typically followed by the decision: should the project be invested in, adjusted, put on hold or terminated?

If the project goes ahead, this is often followed by the Final Investment Decision, or FID for short (see WHySE Compass Landmark 2). Thereafter, detailed engineering, procurement, construction, commissioning and, later, operation begin. In many projects, an EPC partner is also brought on board or selected after FEED. EPC stands for Engineering, Procurement and Construction (another milestone in the WHySE Compass).

Horse shuffled the drawings together. "FEED stops me from having to guess later on."

"Exactly," said Dog.

Dragon glanced at the cover page once more. "And if the FEED is sound?"

Dog picked up the compass from the table. "Then you'll know whether your project is ready for the next stage."

If you only want to remember one sentence

FEED is the phase in which an idea is transformed into a robust technical, economic and safety-related project scope.

Plain-language translation

When someone in the H₂ project talks about FEED, they usually mean:

We're now thoroughly examining what we really want to build, what it will cost roughly, what risks we can see, and whether the project is mature enough for the next decision.

Sources and references

- **AACE International Recommended Practice No. 18R-97:** Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries.
- **Construction Industry Institute (CII):** Publications on Front End Planning / Front End Loading, particularly regarding the importance of early project definition for costs, deadlines and project success.
- **Project Management Institute (PMI):** *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, as a reference for project phases, scope, risk and decision-making criteria.

Note:

This landmark describes FEED in general terms. It is not a substitute for project-specific project development or a thorough review of the entire project.