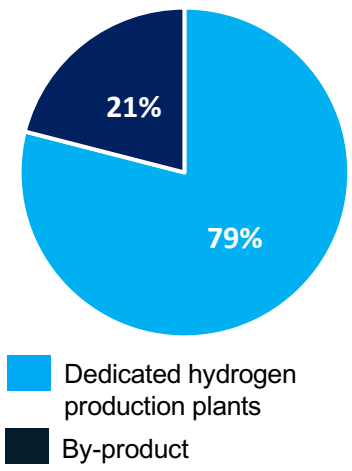
Green Hydrogen Fund (GHF)

Accelerating decarbonization in Europe by financing the development of green hydrogen hubs across Germany

The fund seeks to address the challenge of slow transition to net-zero climate strategies by investing in green hydrogen ecosystems. The fund provides a strong platform for growth and value creation for investors willing to balance impact, risk, and return objectives.

Challenges

Sources of hydrogen production, 2020



Hydrogen is the most plentiful element in the universe. On Earth, it can be found mostly bonded to oxygen in the form of water or in other gases, known as hydrocarbons. Hydrogen gas, H2, burns hot and clean making it an attractive tool in the race to net zero. At the same time, isolating hydrogen from other elements is not an easy task.

Today, the cheapest way to produce hydrogen is via chemical processes that break up natural gas. This releases a lot of carbon dioxide. Another method is to use electricity to split water molecules in a process called electrolysis. Although there is no by-product, a lot of electricity is needed, and if this power comes from burning coal or gas, it negates the zero-emissions goals of using hydrogen.

In 2020, the global hydrogen demand of 90 Mt was met almost entirely by fossil fuel-based hydrogen, with 72 Mt H2 (79%) coming from dedicated hydrogen production plants. Despite the rapid adoption of new hydrogen technologies, the challenge exists today to accelerate decarbonization and transform our energy usage.

Opportunities

Green hydrogen generation is based on renewable energy sources such as wind and sun. Today, hydrogen is being employed in the chemical sector to make petroleum products. It is also being utilized in steel manufacturing, a sector that is under intense pressure to decarbonize. Hydrogen has also a plethora of other applications, including powering automobiles and having the potential to become the fuel for the next generation of aircrafts.

Upstream hydrogen value chain	**Storage solutions (systems, materials, etc.), transportation, micro-liquefication, distribution.**
Downstream hydrogen value chain	**Diversification of services and uses (land or rail mobility), logistics, aircraft refueling system.**
Circular economy	**Recovery of hydrogen dissipated during liquid hydrogen refueling, other initiatives.**

Proposed Solution

We propose to create a tranched private equity fund that will create an SPV with the aim of investing in the green hydrogen supply hubs across Germany. The fund will be financed by equity investors with layered fund structure. Segregation into tranches allows each investor to optimize balance of risk, environmental impact, and return.

The SPV will provide financing to a specific set of operators who will meet the investment criteria. In particular, the operators should have experience in building green hydrogen facilities and expertise in the field of implementing green hydrogen technologies. The fund is expected to exist for 15 years with an optional extension of 2 years. The investment period will cover 2 years. It is expected that 3 years will be required to allocate the funds and construct specific projects. Over the course of 10 years, the investors are expected to receive a target return on investment. After 15 years of fund life, fund investors are expected to exit, but an optional extension of 2 years may be considered.

Fund Investment Profile

Fund Type	**Tranched Private Equity Fund**
Fund Size	**€100M**
Fund Life	**15 years**
Target IRR	**Blended**
Fees	**2 & 20**
Target investors	**Impact investors, international financial institutions, accredited investors**
Investment criteria	**Min. commitment of €1M**

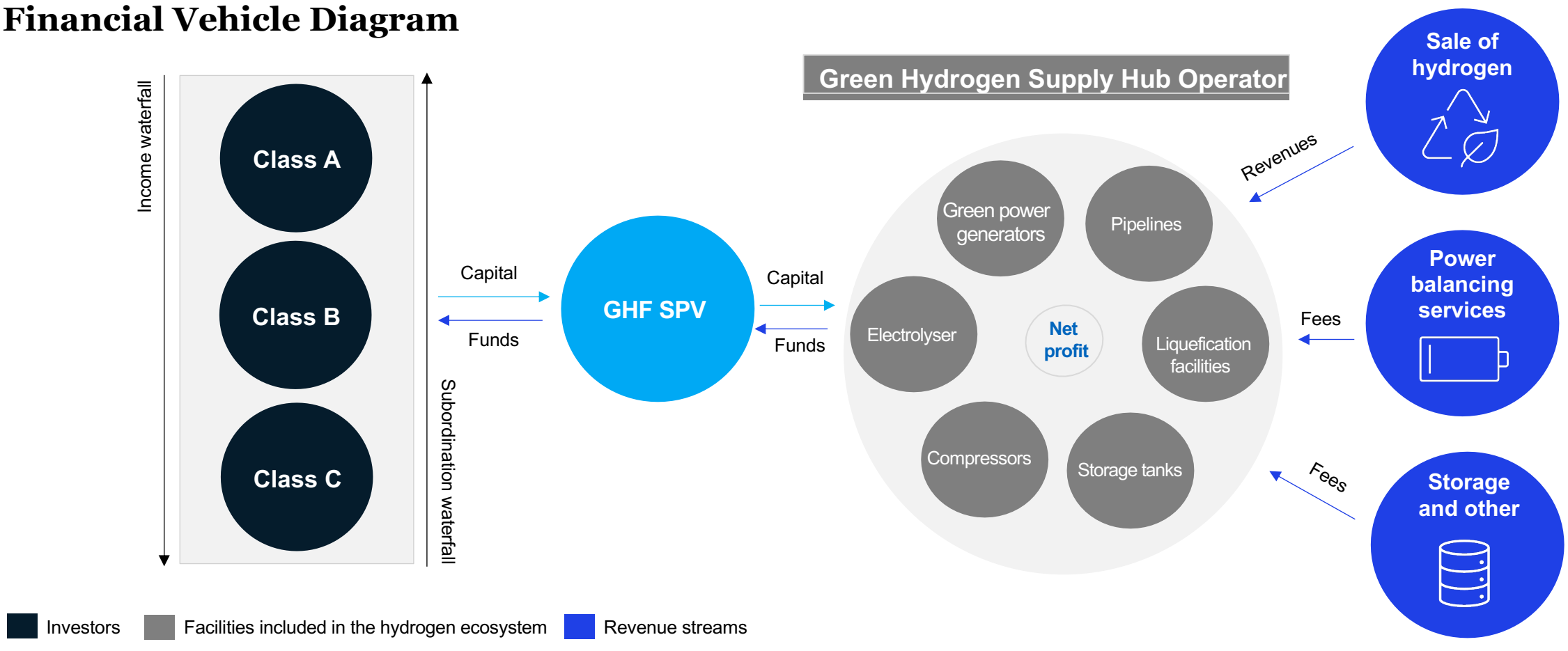
Mechanisms for revenue generation:

1. **Hydrogen production**
   Sale of hydrogen will be the primary revenue driver (through an offtake contract or a local industrial complex (or some form of market).
2. **Power balancing services**
   Real-time balancing flexibility provision to local industry players. Constraint management payments generation through alleviation of wind & solar curtailment.
3. **Storage, distribution, and other**
   Ancillary revenues including storage and distribution fees.

Novelty of the proposed solution

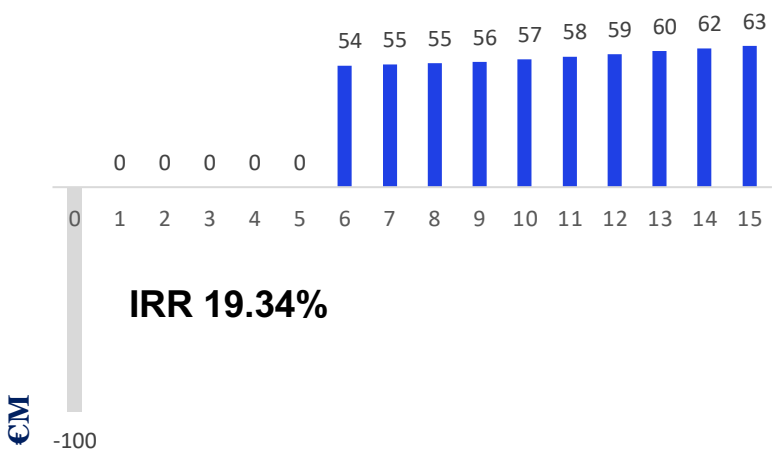
The proposed fund is unique as it provides the opportunity to close the gap between accelerating growth in the demand for green hydrogen adoption and the lack of investment mechanisms that could balance investors' desires to preserve and grow capital, as well as to have a positive environmental and social impact.

Financial Vehicle Diagram

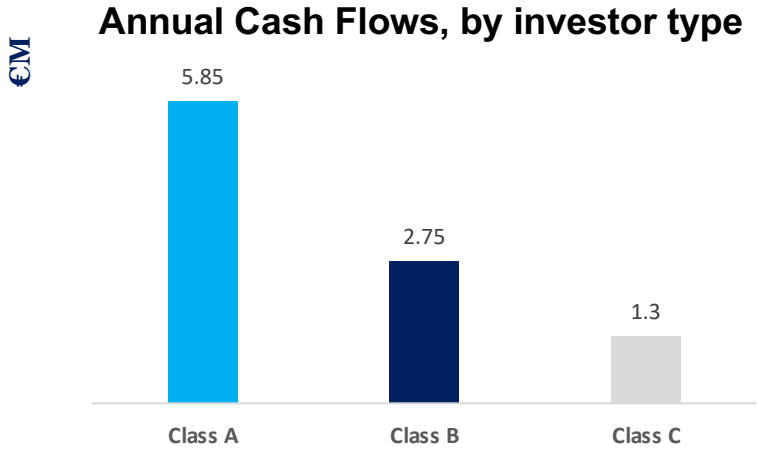


Financial Projections & Key Assumptions

Annual Cash Flows from Project



Annual Cash Flows, by investor type



Investor	Investment size	Equity Return p. a.
Class A	€65M	9%
Class B	€25M	11%
Class C	€10M	13%

Assumptions

Initial outlay (Electrolyser)	70	M EUR
Other infrastructure	30	M EUR
H2 Production	10368	kg/day
Price as of Jan. 27	14.99	EUR/kg
Annual Cash Inflow	55.9	M EUR
Annual green hydrogen contribution	24	MW
# Years	10	
Total green hydrogen capacity	240	MW
% of Germany target of 5 GW	4.80%	

* the calculations of cash inflows are based on the data about 24-megawatt electrolyser supplied by ITM Power.
** costs include CAPEX, OPEX, and storage costs.
*** we make no assumptions about co-location: all the energy from the renewable electricity generator flows to the electrolyzer and nowhere else.

Target Geography and Scalability

Geography: Germany. Creating regionally integrated hydrogen value chains is the best way to grow the nascent hydrogen industry. Steel, cement, and aviation are examples of local sectors that may generate scale, promote cost synergies, use infrastructure, and decrease capital requirements. Germany is an excellent example since it already has various facilities for future electrolysis conversion, pipeline infrastructure for transport and storage, and proximity to large-scale industrial and transportation centers for end markets. Furthermore, the North Sea is adjacent to world-class renewable energy potential, allowing for green hydrogen production and access to mature hydrocarbon resources.

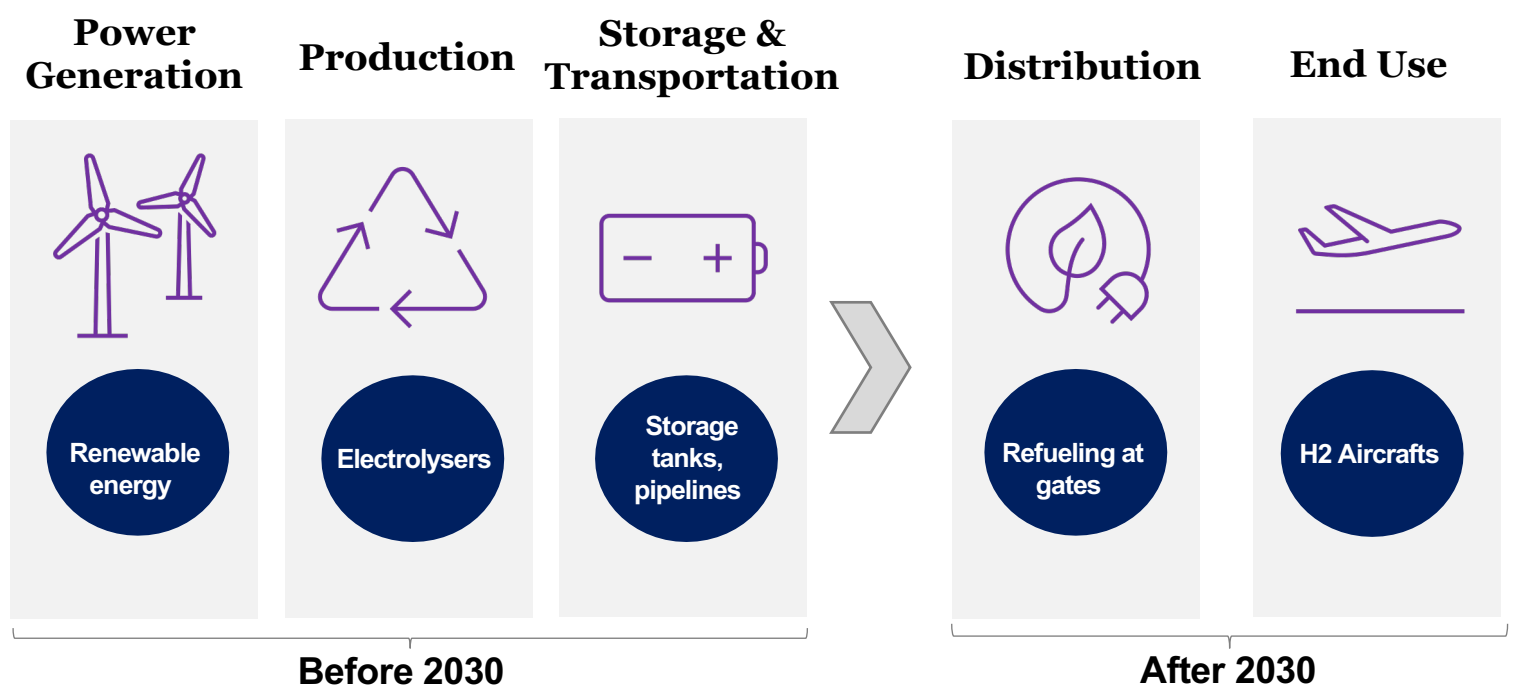
Scalability:
It is expected that the initial investment will be made in projects developed in Germany. However, there is a great potential for global scale, conditional on the success of the fund. In 2020, global electrolyser capacity stood at 0.3 GW. Following analysts' estimations, global electrolyser capacity could reach almost 17 GW by 2026. In July 2020, the EU announced headline targets for electrolyser capacity of 40GW by 2030. These are being underpinned by individual country level targets for 2030 e.g. 5GW in Germany, 6.5 GW in France, 3-4 GW in the Netherlands and 4GW in Spain.

Example of Green Hydrogen Supply Hub Solution

Turning Berlin Airport Into a Hydrogen Ecosystem

Aviation industry is one of the biggest contributors to the greenhouse gas emissions and is under pressure to alter that. Recently, IATA approved a target of achieving net zero emissions by 2050. Initiatives like this encourage plane makers to come up with radically new aircrafts that will eventually cater to growing appetite for zero-emissions travel. For example, Airbus has already announced 2035 to be the year, when the hydrogen-powered planes will operate commercial flights.

The introduction of hydrogen and its widespread use will present challenges for airports since it will change the way their infrastructures are developed. While it may be a long time before green airplanes become prevalent, manufacturers and airports are under increasing pressure to scale up shorter-term efforts to reduce their CO_2 footprint.



Environmental Impact & Metrics

The suggested solution addresses several sustainable development goals declared by the UN:

- **SDG #7** (affordable and clean energy): through the promotion of sustainable and clean energy and access to green electricity.
- **SDG #9** (industries, innovation and infrastructure): through the facilitaiton and standardization of green hydrogen technologies.
- **SDG #13** (climate action): by contributing to the decrease in the CO_2 emissions and increase in the share of sustainable energy sources.

Megawatt of green hydrogen produced	Electrolyser capacity target contribution	Tons of carbon dioxide exhaust emissions saved
24	4.8%	40,000
annually, based on the electrolyzer capacity	based on Germany's 2030 target of 5 GW	per year, on average per 1 green hydrogen hub

Risks		Mitigation
Risks Associated with the Pipeline of Projects	The operators, which will receive financing from the fund, may fail to execute the project pipeline expansion plan effectively. Delays and cost overruns may also emerge as a result of a number of factors, many of which may be beyond the control.	The management of the fund should consider establishing sound investment criteria, which will allow determining the most creditworthy operators that will be in charge of green hydrogen hub operations.
Regulatory risk	Due to the nascent nature of the industry and developing green hydrogen regulation, delays or denial of required regulatory approvals by relevant government authorities.	The management of the fund should ensure that practices are aligned with current industry regulations and enable it to achieve the strategy. Understanding of regulator expectations and potential challenges may also benefit the fund.
Market risks	In case of high inflation, there is consequently a risk that the running operating costs would increase while the yields may not be adjusted accordingly. Similarly, interest rate hikes may lead to higher equity return premium and lower discounted cash flow.	Depending on the stage of investment, the fund may consider utilizing various hedging strategies to preserve unallocated capital or decrease the losses from unfavourable changes in the market conditions.

Sources: IEA, Bloomberg, IRENA, S&P Global Platts, ITM Power, Airbus, S&P Global Market Intelligence, United Nations, World Economic Forum.