



**Smart. Simple. Sustainable.**  
We decarbonize your fleet.

**KEYOU**  
emission-free technology.



## CLEAN ENGINES. REAL SUSTAINABILITY.

### OUR OFFER MOBILITY WITHOUT CO<sub>2</sub>

KEYOU is a successful clean mobility company based in Munich. With the help of our KEYOU-inside system, we convert existing diesel commercial vehicles into climate-neutral hydrogen vehicles. And thus enable our customers to be emission-free, efficient, and economical – without compromising on performance, capacity, or range. In addition to conversion and a climate-neutral "second life" for existing vehicles, we offer a "Hydrogen Mobility as a Service" approach giving customers a fully comprehensive hydrogen mobility solution – from vehicle conversion and provision of fuel to service and maintenance. "Zero Emission Mobility" thus becomes a reality with KEYOU.



Hydrogen – the fuel of the future



Conversion of engine and vehicle



H<sub>2</sub> Mobility as a Service

## HUGE MARKET FOR EXISTING VEHICLES

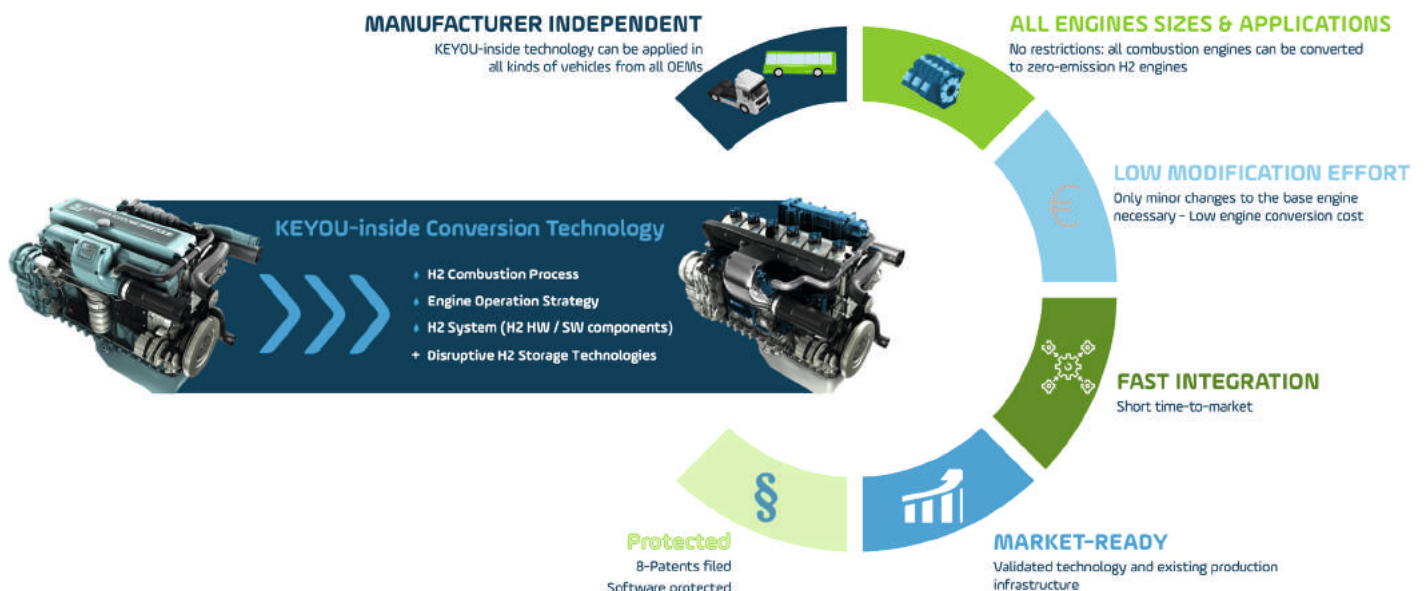
Everyone talks about the future of mobility and new vehicles but what about existing vehicles? This is where we see the priority need: creating a green solution for existing trucks and buses.

## AS ALWAYS. BUT GREEN.

The vehicle industry is challenged to develop technologies that can be easily and quickly integrated into existing engine platforms. Moreover, it should make existing diesel or gasoline engines clean and more efficient. KEYOU shows how a highly efficient hydrogen engine can be developed. With the help of lean combustion, intelligent operating strategy, and hydrogen-specific components, thus achieving the balancing act between economic efficiency, zero-emission, and maximum performance.

>99 %

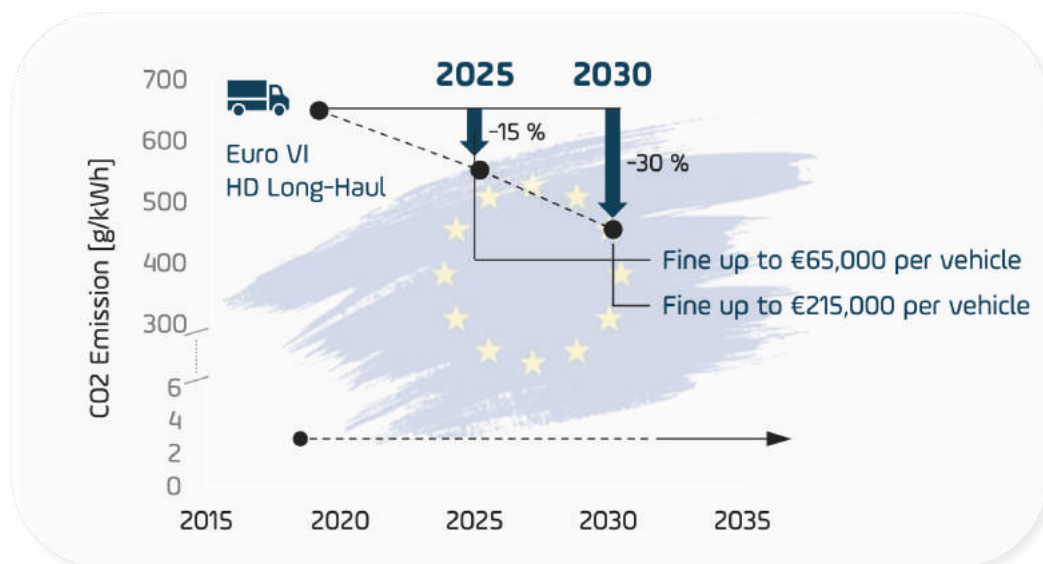
of commercial vehicles driving on EU roads are Diesel-based.



## STRICT CO2 REGULATIONS H2 MOBILITY WILL COME

### CO2 limits - EU targets create facts

On the road to complete decarbonization in 2050, the EU Commission has set statutory CO2 emission targets for road-based commercial vehicles for 2025 and 2030.



### Target achievable with efficient drive technology

These goals can only be achieved with state-of-the-art technology, with alternative and sustainable drive technologies that convince end consumers, fleet operators and manufacturers alike. ZERO EMISSION - this not only means locally emission-free, it also means that production and recycling must be environmentally friendly.

### KEYOU-inside – meets ZERO EMISSION requirements 100 %

At around 0.1 g CO2/kWh, hydrogen engines with KEYOU-inside fall far below the zero emission limit set by the EU. You can therefore operate your truck under the "ZERO EMISSION" label in the future.

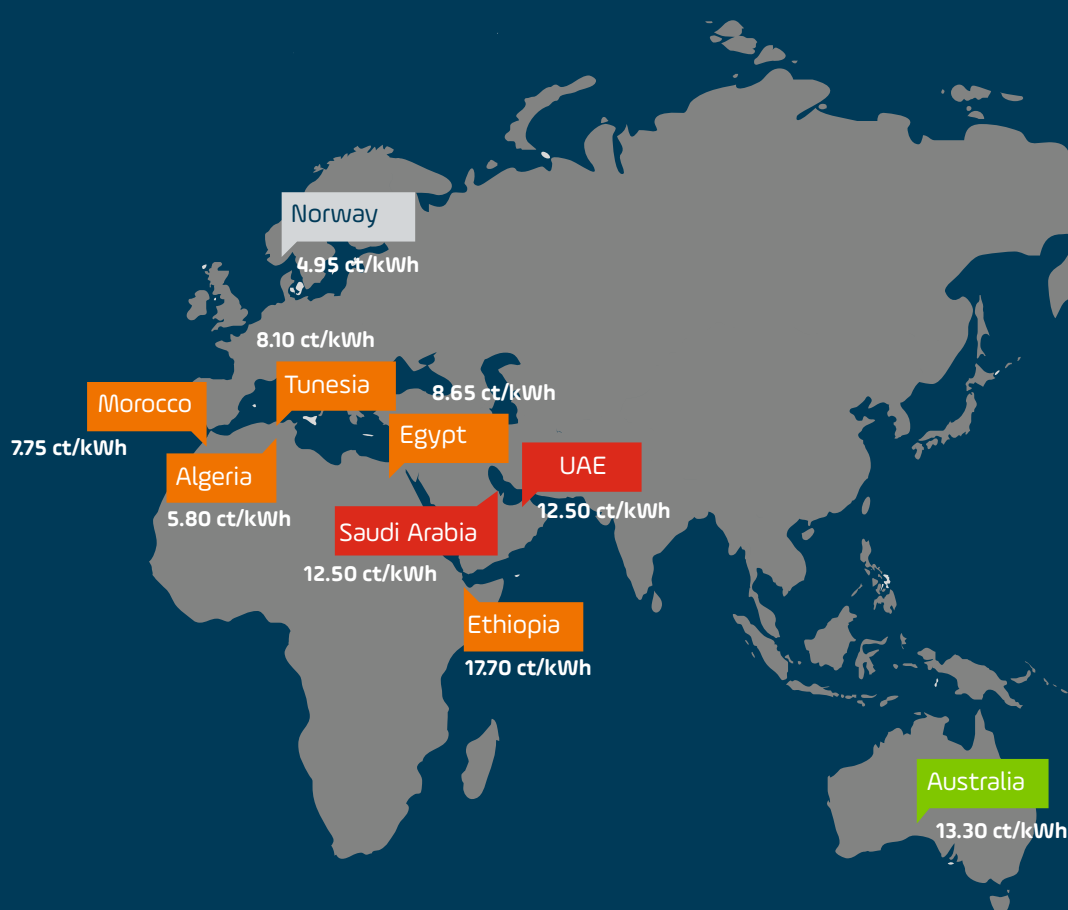




"Zero-emission commercial vehicle" means a commercial vehicle without an internal combustion engine or with an internal combustion engine that emits less than 1 g CO<sub>2</sub>/kWh according to Regulation (EC) No. 595/2009 and its implementing measures, or that emits less than 1 g CO<sub>2</sub>/km according to Regulation (EC) No. 715/2007 and its implementing measures."

**Better carbon footprint with KEYOU-inside:**

- Avoids costs for CO<sub>2</sub> certificates
- Reduces CO<sub>2</sub> fleet balance
- Reduces your company's carbon footprint



Hydrogen: hype or hope? In fact, hydrogen already plays a crucial role in the energy transition. Especially because green hydrogen imported into Europe will be cheaper than all types of domestically-produced hydrogen by the time imports to the continent begin in 2024.

## HYDROGEN STRATEGY CLIMATE NEUTRAL EUROPE

The priority for the EU is to develop renewable hydrogen, produced using mainly wind and solar energy. Renewable hydrogen is the most compatible option with the EU's climate neutrality and zero pollution goal in the long term and the most coherent with an integrated energy system.

### IMPLEMENTATION PHASES OF EU HYDROGEN STRATEGY





## HYDROGEN WINS THE RACE AT THE PUMP

**Domestic electricity generation  
based renewable energies**



**40-60 ct / kWh**

**Production & import of  
green hydrogen**

1-3 ct / kWh Renewables MENA  
4-8 ct / kWh MENA & Norway  
Cross-border price



**15-18 ct / kWh**

## Hydrogen up to 4x cheaper than electricity

In its transition to a fully clean and sustainable energy economy, Europe will need to import large quantities of renewable energies. Hydrogen, produced by renewable electrolysis in the most favorable regions close to Europe, can be distributed to European refueling stations at attractive prices.

## SMART EVOLUTION INTO CLEAN MOBILITY

Everyone knows it, and everyone appreciates it: the reliable and powerful combustion engine. The downsides of mature diesel or gasoline engines are high emissions and damage to the environment. But there's a simple solution to solve this.

### INNOVATIVE CONCEPT

We developed a proprietary low-temperature lean combustion concept that results in obtaining the highest performance with the lowest emissions.

### HYDROGEN SYSTEM

The engine control system optimizes the management of the injection, air-charging, and ignition sub-systems, which have all been tailored for H<sub>2</sub> burn. Some key mechanical components were improved for high durability.

### MAXIMUM PERFORMANCE

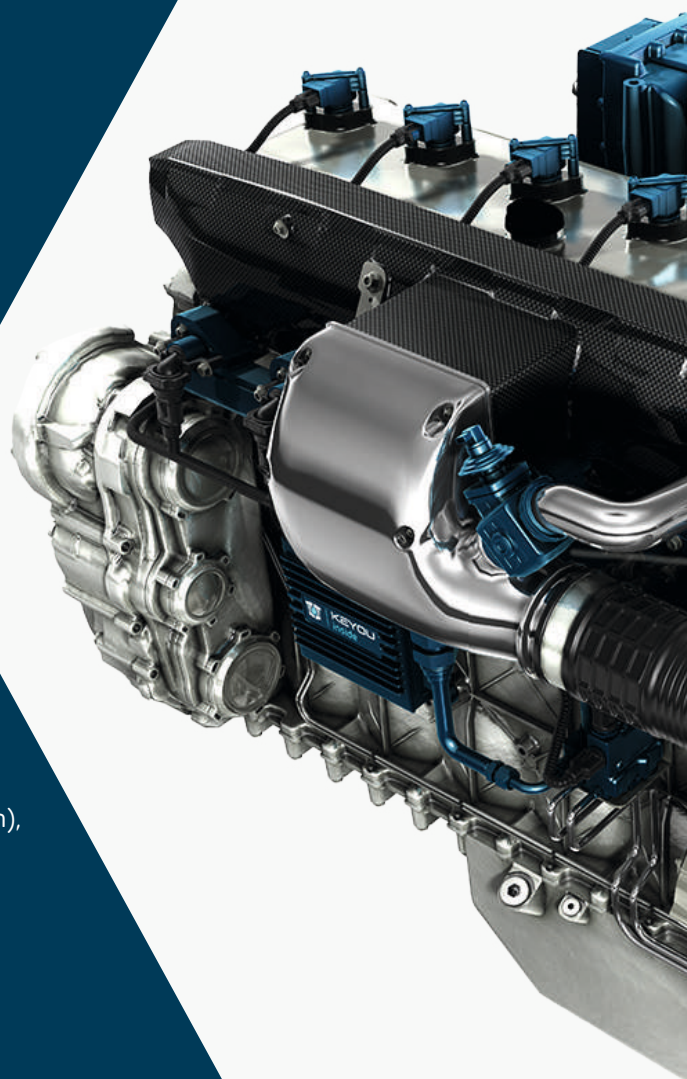
A smart engine operating strategy with the selected setup takes advantage of the H<sub>2</sub>-fuel properties allowing: high power densities (27 kW/L), high low-end torque (90% of maximum torque at 900 rpm), and high brake efficiency (peak of 44.5%).

### ZERO EMISSION

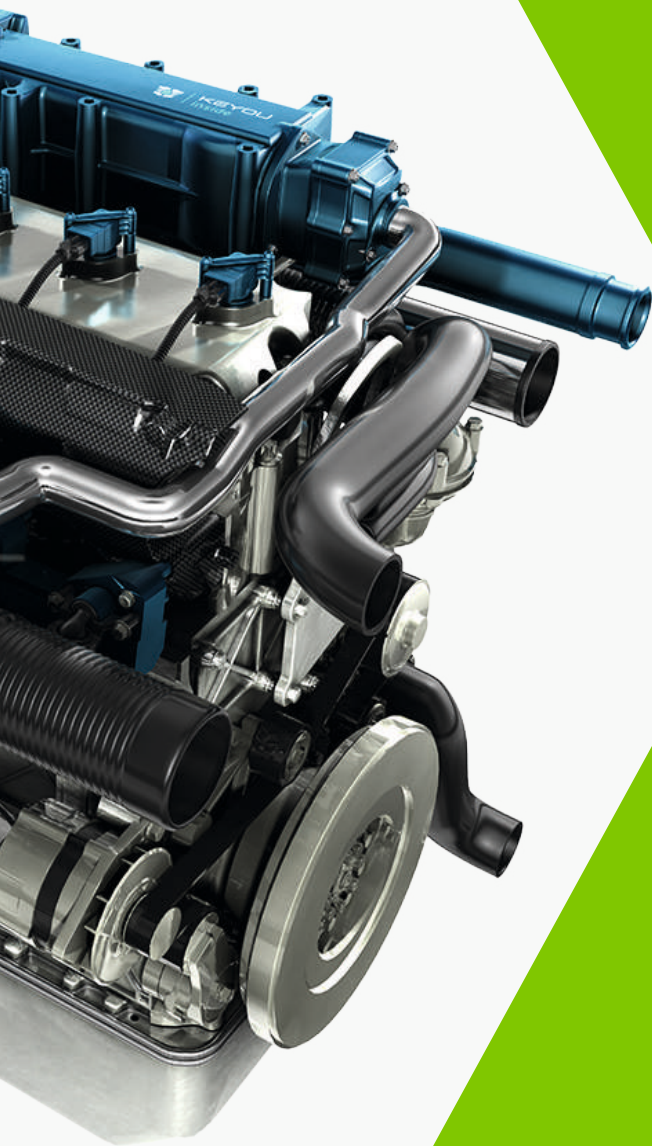
H<sub>2</sub> combustion emits water vapor. Traces of CO<sub>2</sub> originating from the lubricating oil are close to zero, as are NO<sub>x</sub> emissions due to the low combustion temperature achieved.

### ROBUST & COST-EFFECTIVE

Built on top of a mature diesel engine base platform, KEYOU's H<sub>2</sub>-Engine offers the same high reliability and durability as Diesel engines. Due to the low modification effort and the fast integration of new components, the extra cost to pay is low.



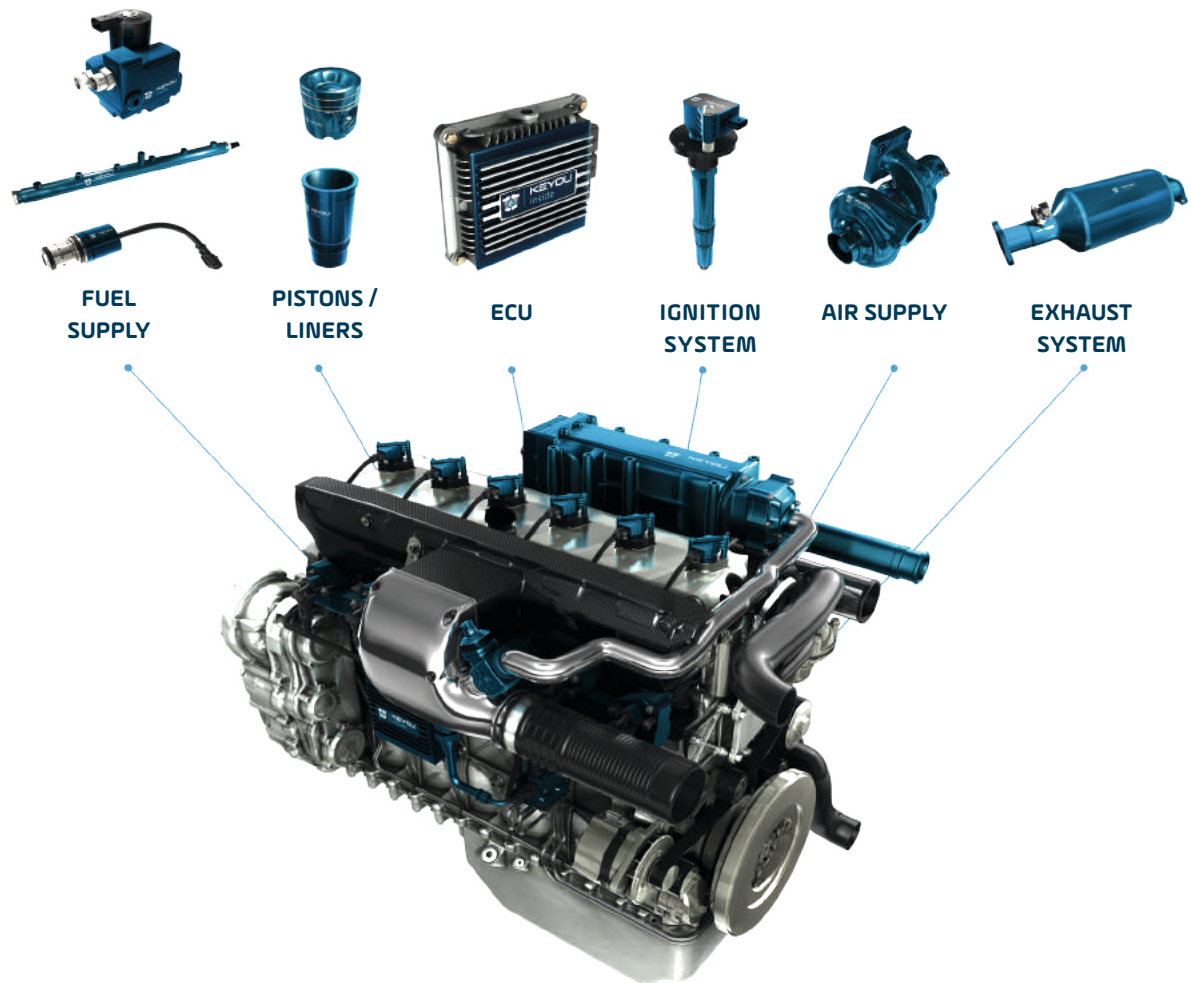




## A NEW GENERATION OF HYDROGEN ENGINES

Past hydrogen engines have been clean but delivered low performance and involved complex adaptation work. KEYOU changes the paradigm by transforming existing diesel engines into hydrogen engines in the most effective way, by smartly utilizing the same base components and just upgrading the core sub-systems necessary for an optimal hydrogen combustion operation. The result is that hydrogen engines are now at the same level as diesel engines in terms of performance, robustness, and cost but without harmful emissions.

## THE NEW HYDROGEN ENGINE FINE-TUNED SYSTEM



The transformation of a Diesel engine into a H<sub>2</sub> engine involves the integration of a new fuel supply, a properly matched air supply and the addition of an ignition sub-system. Moreover, some key mechanical components such as the piston-liner require a proper adaptation, and the exhaust is highly simplified. Finally, a dedicated electronic control unit with embedded operation software manages the whole system in the best possible way.



# MAXIMUM PERFORMANCE ZERO EMISSION

## From concept to reality.

Today the public demands clean cities and affordable public transport. With KEYOU-inside for hydrogen engines, emission-free commercial vehicles are within reach, becoming a reality on our streets. This emission-free technology combines all advantages of already existing drive systems.

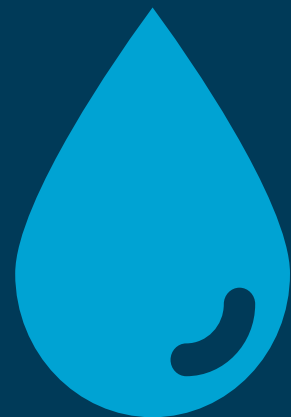
## KEYOU-INSIDE CONVERSION TO H2 ENGINES

### Sustainable. Clean. Uncompromising.

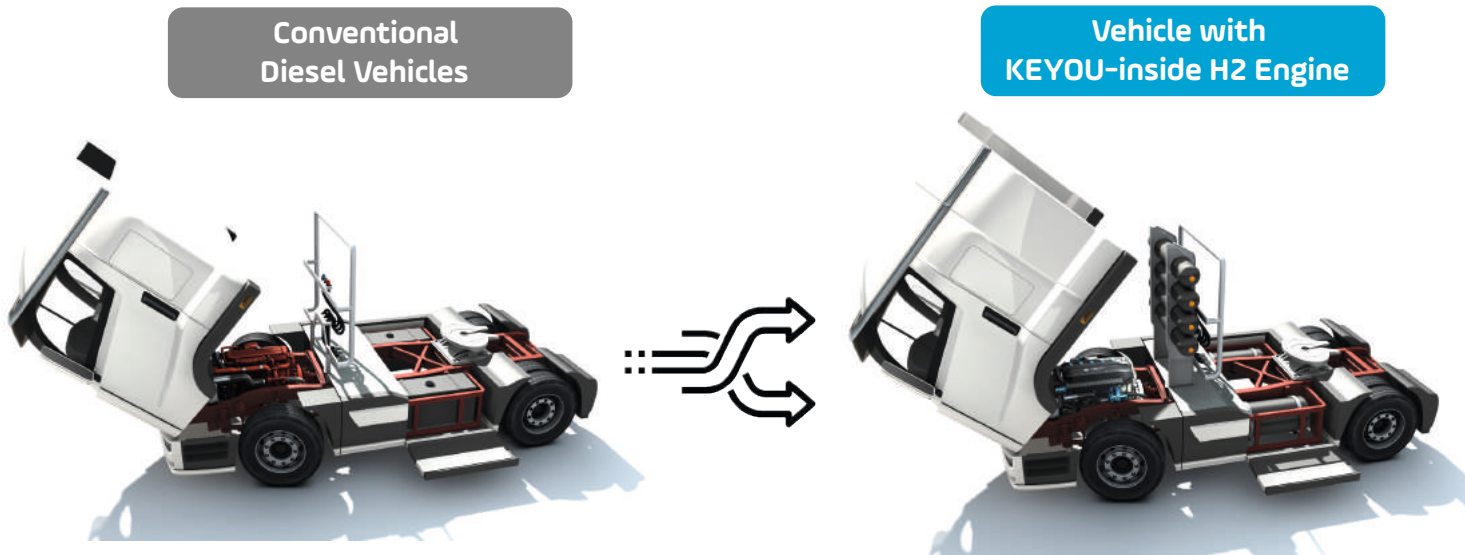
KEYOU-inside combines hydrogen as a sustainable fuel with the proven and economical combustion engine technology to create a quantum leap in drivetrain development. For the first time, there is an emission-free, cost-efficient, and powerful engine – a technology without compromises!

### KEYOU-inside for your truck means:

- + Similar driving ranges
- + High performance
- + High availability
- + Fast refueling
- + Proven suitability for everyday use
- + Convincing cost efficiency
- + Long service life
- + Zero emissions



## EXISTING VEHICLES BECOME GREEN



### "SECOND LIFE" FOR EXISTING VEHICLES WITH KEYOU CONVERSION TECHNOLOGY

Most vehicles used by fleet operators, whether in logistics or urban transport, still consist of classic diesel trucks and buses. There is a great willingness to switch to CO<sub>2</sub>-neutral drive technologies. However, companies still encounter obstacles on the way to decarbonizing their fleets. In many cases, the solutions currently on offer are not economically competitive and are only economically viable with the help of subsidies. New technologies are breaking old habits, causing additional high transformation and conversion costs in many places. In many cases, a solution for existing vehicles is missing. To achieve the climate protection goals in the commercial vehicle sector, we need a solution for existing vehicles. This is where KEYOU comes into play.

The innovative KEYOU-inside technology offers fleet operators the conversion of conventional diesel vehicles to CO<sub>2</sub>-free hydrogen vehicles, which are considered zero-emission according to the EU standard ("Zero CO<sub>2</sub>"). The advantage for the end customer: The complete retrofit solution, which includes an H<sub>2</sub> tank system and the conversion of the engine, offers a diesel-equivalent cost structure, billed in a "pay-per-use" model (€/km). The benchmark here is and remains the diesel. The advantages of the hydrogen engine and KEYOU's retrofit approach allow fleet operators to continue their proven business model while guaranteeing a "second life" for existing vehicles. Thus ensuring the continued use of an investment already made.

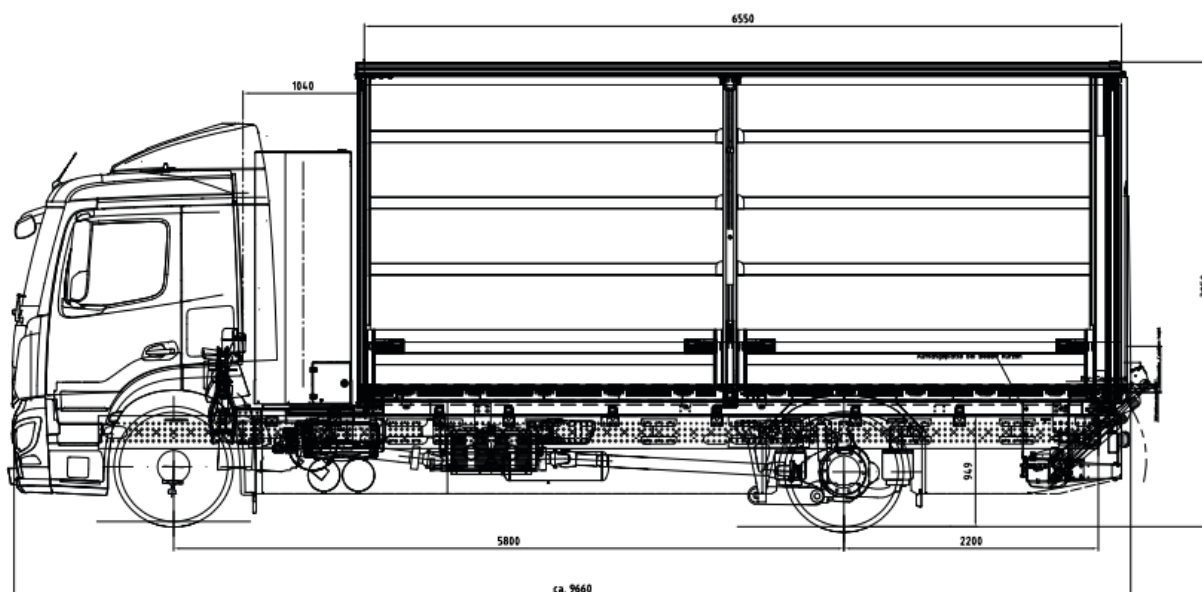


## CLEAR ADVANTAGE FOR THE CONVERSION WITH KEYOU-INSIDE

With our hydrogen expertise, technology and conversion know-how, we can solve the major challenges facing the commercial vehicle sector and offer a cost-effective mobility solution with zero CO2 emissions - especially for existing vehicles. Our entry fleet consists of eight converted 18-ton trucks that will be delivered to the first pioneer customers by the end of 2023.

### THE 18-TON TRUCK WITH KEYOU-INSIDE HYDROGEN ENGINE

|  |   |
|--|---|
| Cylinder                               | 6   |
| Displacement                           | 7.8 Liter   |
| Air Supply                             | Turbo   |
| Power                                  | 210 kW  |
| Maximum Torque                         | 1,000 Nm  |
| Fuel Supply / Combustion Concept       | Port Fuel Injection (PFI) / KEYOU Lean Burn                                       |
| EAT                                    | Not required (Emissions < EU VI)  |
| Consumption (H2 / 100 km)              | ca. 7.5 kg  |
| Range (350 bar tank)                   | ca. 350 km (Hexagon Purus storage system with 278 kg H2)                          |
| Clutch and Transmission                | Allison 3200PR / Single Disc Clutch   |
| Driver's Cab                           | M Driver's Cabin Classic Space, steel-sprung                                      |
| Axle load distribution                 | 7.5 t / 11.5 t  |
| Vehicle Dimensions (L x W x H)         | 9,850 mm x 2,550 mm x 3,950 mm  |
| Wheelbase                              | 5,800 mm  |
| Turning Radius                         | 21.10 m   |
| Permitted Total Weight                 | 18,000 kg   |
| Gross Vehicle Weight / Maximum Payload | 8,675 kg / 9,325 kg   |
| Vehicle Body                           | Amari curtainsider flatbed with tail lift<br>Bear BC 1500, 1,500 kg load capacity |
| Internal dimensions body (L x W x H)   | 6,500 mm x 2,500 mm x 2,700 mm  |



\* The basis for KEYOU's 18-ton truck: a chassis from the Mercedes-Benz Actros

## FASCINATING & CO<sub>2</sub>-FREE OUR H<sub>2</sub> TRUCK FOR PIONEER CUSTOMERS

More than ever, climate protection needs companies that act responsibly, seek innovative solutions and want to be pioneers. KEYOU offers the ideal solution. The modern 18-ton H<sub>2</sub> truck is based on a Daimler Actros chassis, equipped with a 7.8-liter engine from a renowned manufacturer and converted into a highly efficient, CO<sub>2</sub>-free hydrogen engine with the help of our sophisticated KEYOU-inside technology. The result is an attractive vehicle that qualifies as "zero emission" according to EU standards.



## 2X CONVINCING VEHICLE & H<sub>2</sub> ENGINE

The KEYOU hydrogen engine is characterized by its extremely smooth operation and significantly lower noise level compared to a truck diesel engine. The engines meet Euro VI emissions standards without the need for expensive and vulnerable exhaust aftertreatment technology. Another advantage is that while electric trucks spend several hours at the charging station, refueling with hydrogen takes only about 15 minutes; the current tank configuration with 27 kilograms of hydrogen gives a range of about 350 kilometers. Depending on the customer's requirements, the installation space also allows for extensions, in which case ranges of up to 600 kilometers are possible.

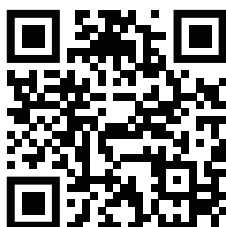




READY FOR  
THE ROAD



BECOME A  
**H2 PIONEER**

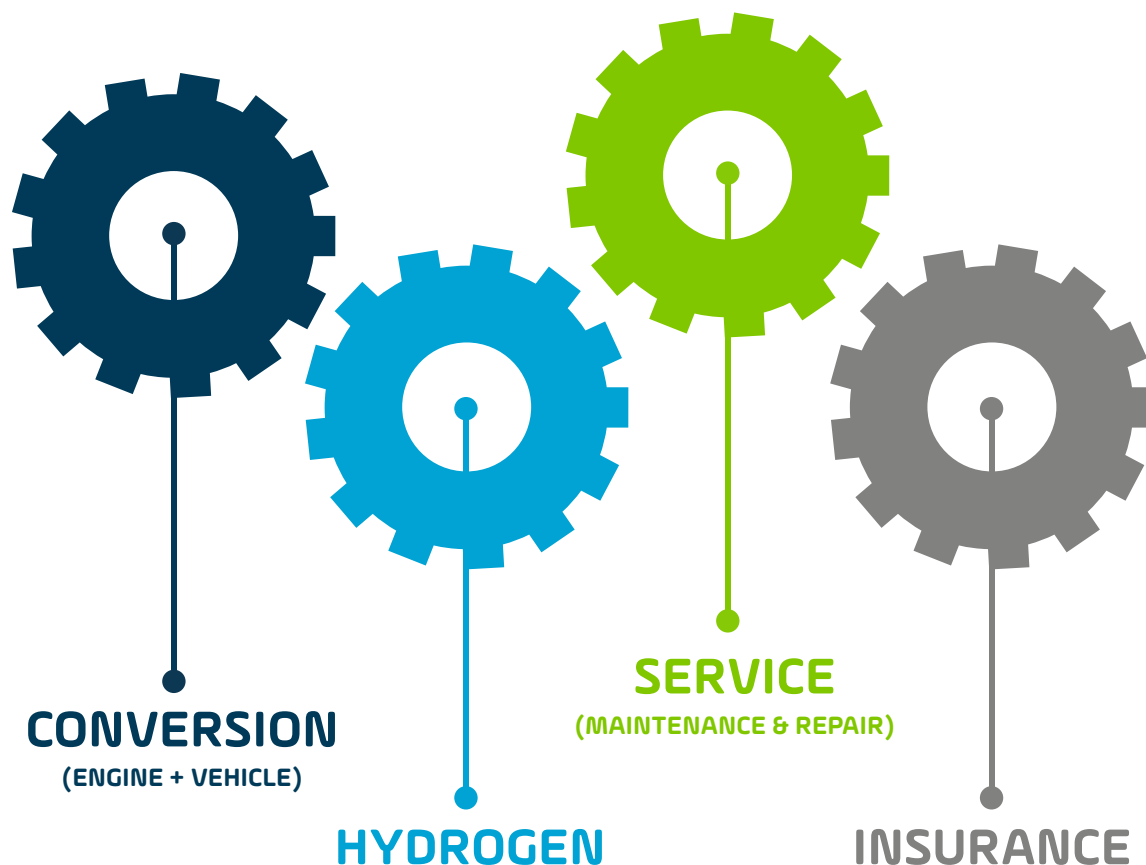


Not experienced with hydrogen? Do you want the latest technology without the risk? Do you want to drive CO<sub>2</sub>-free, but keep an eye on your TCO? That's why we've developed an attractive pay-per-use model for you. In other words, with our H<sub>2</sub> Mobility as a Service approach, you get an all-inclusive package consisting of a modern H<sub>2</sub> vehicle, fuel, service & maintenance, and insurance. Want more information? Just scan our QR code!

## WHAT WE OFFER

# H2 MOBILITY AS A SERVICE

In addition to engine and vehicle conversion and a CO<sub>2</sub>-free "second life" for existing vehicles, KEYOU offers fleet operators a comprehensive hydrogen mobility solution with its "Hydrogen Mobility as a Service" approach: The total solution offered in a pay-per-use model ranges from the conversion of the vehicle and engine to the provision of the fuel, the corresponding insurance and an attractive service and maintenance package.



KEYOU makes it easy for its customers to get started with hydrogen mobility by offering an all-inclusive package. In contrast to the usual purchase or leasing business, KEYOU rents out the converted trucks and charges a flat rate per kilometer ("pay-per-use"), depending on the annual mileage. In addition to vehicle rental, this also includes maintenance & service, insurance, and even hydrogen. All service and warranty work is carried out by KEYOU or its partner workshops.



## FULFILLING CUSTOMER NEEDS WITH THE RIGHT H2 SOLUTION

Transformation, mobility revolution, CO2 regulations – fleet operators are facing enormous challenges. It is not enough to "just" satisfy customers and the climate; economic success must also be guaranteed. The simpler the solution and the fewer the drawbacks of an alternative powertrain, the more willing an operator will be to decarbonize his fleet.

The right technology at the right time. With our intelligent KEYOU-inside technology, we focus on converting new and existing vehicles focusing on decarbonizing existing fleets. We do not plan to manufacture vehicles and engines ourselves. Instead, KEYOU uses proven chassis and engines that have been adapted accordingly. Through our partner network, we guarantee the usual standards of service and maintenance. By converting existing engines into powerful and highly efficient hydrogen engines, we not only provide an easy way to decarbonize our customers' fleets but also meet sustainability standards.

A simple "pay-per-use" model simplifies the otherwise complicated billing process, while the rental concept lowers the barrier to entry and allays any reservations customers may have about a new technology. Clear agreements on hydrogen supply and a fair price per kilometer driven mean a high degree of planning security for the end customer. With the "H2 Mobility as a Service" package, fleet operators can continue to operate their current business model with a diesel-equivalent cost structure – but with CO2-free trucks.

## A PERFECT FIT FOR ALL KINDS OF APPLICATIONS

### Engine know-how. Conversion technology. Hydrogen expertise.

KEYOU-inside allows conversion for all kinds of applications, whether truck or bus, 18- or 40-ton truck. In principle, any vehicle with a conventional combustion or gas engine can be converted to a zero-emission hydrogen engine. For its market entry, KEYOU is concentrating on the medium and heavy commercial vehicle segment, which has been one of the biggest polluters in the EU so far. Step by step, further engine platforms will be added to the development portfolio so that KEYOU can serve additional customer segments. The maritime sector and rail represent potential applications for the future.





## INNOVATIVE STRENGTH FOR SUSTAINABLE MOBILITY

### Vision

Hydrogen produced from renewable energies is essential for the transition to a new, more sustainable energy paradigm and greener future. KEYOU's vision is to enable a sustainable and competitive mobility solution by converting existing commercial vehicles to hydrogen.

### Company

KEYOU is YOUR KEY to innovative sustainable energy and clean mobility solutions. Founded in 2015 with the H2 engine at its very core, KEYOU has actively contributed to the reawakening of the automotive industry to this technology.

### Founders

They have known each other for a long time and share a common vision: Thomas Korn, Markus Schneider, and Alvaro Sousa are three engineers, each of them with over 20 years of experience in research and development of alternative drives. With KEYOU, the three founders are pursuing a common goal: affordable and clean mobility based on the sustainable and energy-rich fuel of the future – hydrogen.



**Thomas Korn**



**Markus Schneider**



**Alvaro Sousa**





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