
# Pioneer Project
# H2 Aspang railway

## Final report

Vienna, October 2021

Decarbonisation Track 2030

# Contents

# A) Project data

| General information on the project | |
|---|---|
| **Short title** | H2 Pioneer Project |
| **Implementation project** | 07/2019 to 04/2021 |
| **Use of hydrogen trains in passenger transport** | 11.09.2020 to 26.11.2020 |
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| **Project and cooperation partners ÖBB-internal** | ÖBB-Personenverkehr AG<br>ÖBB-Holding AG<br>ÖBB-Produktion GmbH<br>ÖBB Technical Services GmbH |
| **Project and cooperation partners ÖBB-external** | Alstom Transport Deutschland GmbH<br>Climate and Energy Fund<br>Austrian Institute of Technology GmbH<br>HyCentA GmbH<br>VERBUND Energy4Business GmbH<br>Shift2Rail Joint Undertaking |

# Executive summary

Alternative drive technologies are the only way to ensure climate-friendly mobility in the future: ÖBB has therefore tested a **hydrogen train** from the manufacturer Alstom in **regular passenger service** in the **H2-Aspang railway** pioneer project. The train needs to prove itself in particular on secondary branch lines that are not intended for electrification.

Around 90 per cent of passenger transport services in Austria already are already using electric traction for their operations. Around three quarters of the entire ÖBB network has already been electrified, and this is to increase to 85 per cent by 2030. **ÖBB** has set itself the ambitious goal of being CO2 neutral in the mobility sector by 2030. Numerous **research and development projects** as well as concrete implementation projects are being advanced to achieve this goal. In addition to experience with battery-electric buses (e.g. ÖBB-Postbus in Vorarlberg), battery-electric cars (e.g. the ÖBB Rail&Drive car sharing fleet), ÖBB has also gained experience in the test operation of the electrohybrid battery train "Cityjet Eco". The **Cityjet Eco** runs on electrified sections as a conventional electric drive with a pantograph; on non-electrified sections, **traction energy** is drawn **from the battery system**. This technology allows - depending on the topography - up to 80 kilometres of non-electrified track to be covered. In total, the Cityjet Eco was in operation for around two years and covered more than 50,000 kilometres in pure battery mode during this period.

In the course of the **H2 Aspang railway pioneer project**, ÖBB tested a hydrogen train of the type "Coradia iLint" from the manufacturer Alstom for the first time on a predestined, **non-electrified, mountainous route network in southern Lower Austria** on the inner and outer Aspangbahn as well as on the route between Vienna Neustadt and Puchberg am Schneeberg or Gutenstein. Compared to the previous area of operation (mainly northern Germany), the line features in Austria were characterised by small curve radii of up to less than 120m, gradients of up to 45‰ and height differences of more than 300m. The trial operation took place in regular passenger service from 12 September to 26 November 2020. The declared aim of the project was to gain **experience with the hydrogen train from a technical, operational and economic point of view**. It is no coincidence that the hydrogen train was tested on precisely these non-electrified routes, as the range of the prototype used is around 600 kilometres and is therefore able to replace a diesel vehicle. The future series production vehicles will have a range of around 1,000 km. So far, hydrogen trains have mainly been in operation on flat routes, for example in northern Germany and the Netherlands. Testing on geographically challenging routes in the south of Lower Austria has now put the hydrogen train through its paces on alpine routes as well.


*Fuel cell & ventilation*

## Setting of objectives & degree of achievement

| Project objective in relation to the project assignment | Achievement in % | Comments |
|---|---|---|
| Fixed-term rental of an Austrian-registered hydrogen train incl. maintenance and refuelling station | 100 % | Complete target achievement through three-month rental of a hydrogen train incl. maintenance and refuelling station as well as obtaining vehicle approval in accordance with §32a Railway Act (EisbG). |
| Gaining experience in commercial operation to present the business case & scaling of the hydrogen power train | 80 % | Acquire sufficient operational experience and data to present the business case & scaling. |
| Supplement electrification program | 100 % | Acquire sufficient operational experience and data to present the business case & scaling. |
| Use on diesel track under demanding geographical conditions (cf. result of Greentrain project) | 100 % | Complete target achievement through three-month deployment on diesel routes in the Greater Vienna area. Neustadt. |
| Development of hydrogen know-how in the ÖBB Group (holistic view: supply, fuelling, operation, workshop) | 90 % | Development of hydrogen know-how at ÖBB-PV, TS, PR and HO. |
| Compare successful reference project (media impact) Lower Saxony since 09/2018 with 2 pre-series vehicles in regular operation +50,000 km | 100 % | Media communication limited by COVID-19 pandemic, events held successfully within the bounds of possibility, considerable media interest. |

# B) Project content & results

## Exploratory project at ÖBB-Holding AG

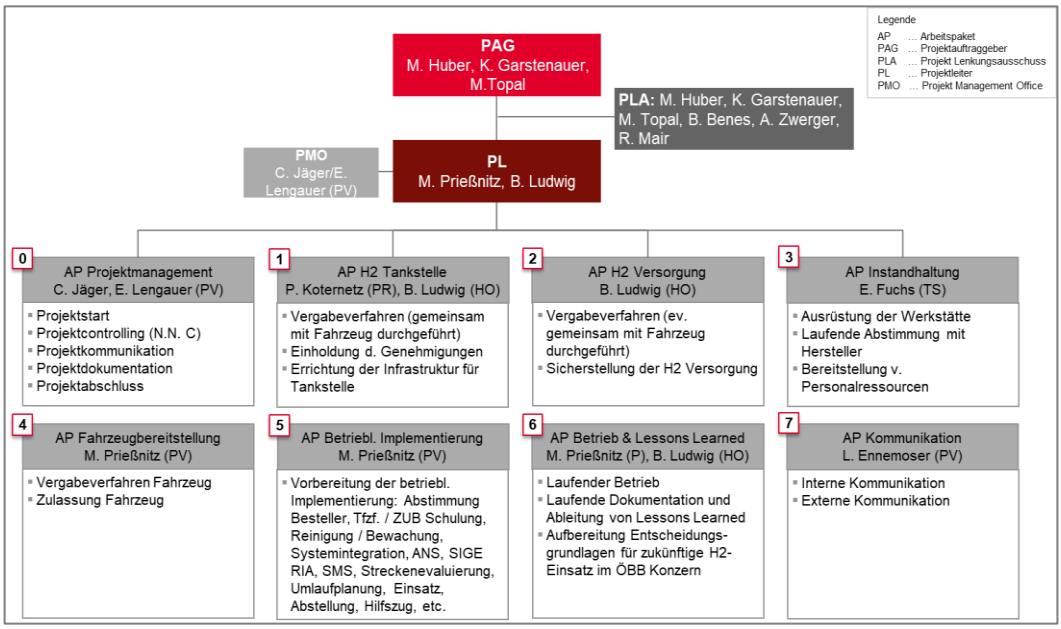
An **exploratory project** was held at ÖBB-Holding AG from 15.03.2019 to 31.05.2019 to sound out the **technical feasibility** of a pilot project for the use of hydrogen trains and hydrogen infrastructure on a suitable ÖBB-Infrastruktur AG line. The focus was on the technical feasibility, the economic and ecological evaluation and the assessment of the required hydrogen infrastructure.

- **Project Principal:** A. Matthä (CEO ÖBB), M. Topal (CTO ÖBB)
- **Project Manager** B. Ludwig (ÖBB-Holding AG)

## Implementation project ÖBB Holding AG & ÖBB Personenverkehr AG

An **implementation project** - led by ÖBB-Personenverkehr AG and ÖBB-Holding AG - was set up in spring 2019 based on the exploratory project. The project structure is shown in Figure 1 below.

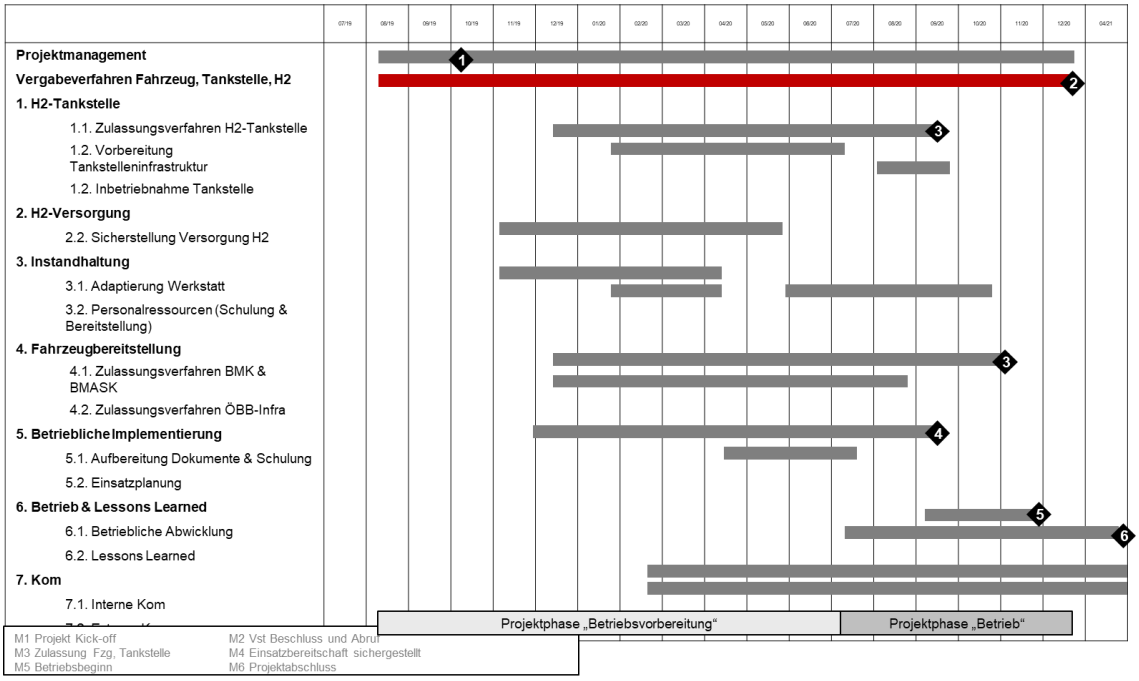
- **Project Principal:** M. Huber, K. Garstenauer (Vst. ÖBB-Personenverkehr AG), M. Topal (CTO ÖBB-Holding AG)
- **Project Manager** M. Prießnitz (ÖBB-Personenverkehr AG), B. Ludwig (ÖBB-Holding AG)




*Project structure*

## Time Schedule Implementation Project

Originally, the trial operation was scheduled to take place between April and July 2020. A **postponement became necessary** due to developments related to the **COVID-19 pandemic**, which was also accompanied by a reduction in the number of vehicles from two to one hydrogen train. Passenger services ultimately took place from 12.09 to 26.11.2020, with the time schedule detailed in Figure 2.




*Project time schedule*

## Project partner:

The following project partners contributed significantly to the success of the project:

- **Alstom Transport Deutschland GmbH**: Provision of the Alstom Coradia iLint train, hydrogen fuelling station as well as hydrogen supply
- **Climate and Energy Fund:** Promotion of the project
- **Austrian Institute of Technology GmbH:** Preparation of a study on hydrogen production for conversion of the Vienna Neustadt facility to hydrogen trains
- **HyCentA GmbH**: Preparation of a study on hydrogen production for conversion of the Vienna Neustadt facility to hydrogen trains
- **VERBUND Energy4Business GmbH**: Green certification of the hydrogen consumed in the project
- **Shift2Rail Joint Undertaking**: Support of the Project

# AP1 Hydrogen fuelling station

## AP 1 Setting objectives & contents

The fuelling station work package comprised all work steps to ensure the **commissioning of the hydrogen fuelling station** at the start of operation. This work package therefore included, in particular, securing the **approval** for the construction of the fuelling station, as well as all **infrastructural measures** necessary for the operation of the fuelling station. The work package therefore comprised the production of all infrastructural necessities for the operation and installation of the hydrogen fuelling station, primarily the following steps:

- Provision of a suitable, paved, fenced (approx. 10m x 10m) plot of land
- Provision of electricity & power supply (3-phase 400V, 50 Hz.125 A for operation of the refuelling station; 3-phase 400V, 50 Hz, 63A for winter refuelling with outside temperature <0 degrees, 3-phase 400V, 50 Hz, 32 A for the train during refuelling).
- Crane installation for setting up and dismantling the fuelling station
- All measures required for the approval
- Involvement of the stakeholders affected in the local area

*Construction of fuelling station*


*Hydrogen trailer & compressors*

## AP1 Results

A **temporary, mobile hydrogen fuelling station** from the manufacturer Alstom was used during the trial operation. This essentially consisted of a high-pressure pump to bring the liquid hydrogen up to tank pressure, an evaporator and a dispenser for vehicle refuelling. The **hydrogen** was supplied in **cryogenic form** via a truck-mounted liquid hydrogen trailer, which also served as a storage tank. The hydrogen fuelling station had already been successfully operated at various sites in Germany before the project in Vienna Neustadt. The construction of the fuelling station in Vienna Neustadt was on **property owned by ÖBB**, which is why the permit was also covered by the Austrian Railway Act. The temporary construction of the petrol station was thus subject to a declaration in accordance with §40 Railway Act (EisbG) and was therefore exempt from approval. An expert opinion from TÜV Süd was also commissioned for the part relating to gas pressure for the §40 declaration.

As **safety measures**, electrical equipment in the immediate vicinity of the fuelling station was dismantled or deactivated, and the installation area of the fuelling station was paved (concreted) with gas- and liquid-proof, non-combustible material. Furthermore, a barrier (fence) and a crash barrier were erected. Shafts leading into the subsoil were installed as "cable shaft covers made of GG class D 400kN". In addition, the construction of the petrol station took into account any installations (e.g. gas lines, power lines) as well as sufficient distance to other buildings. A corresponding **alarm and operation plan** was drawn up for the fuelling station, which includes a detailed sketch of the location as well as special hazard

warnings (such as the danger of cold burns caused by cyrogenic liquid hydrogen). The alarm and operation plan was provided to the fire brigade accordingly and also deposited locally at the petrol station as well as in a plan box at the fire brigade service station of the site. The **blue-light organisations** and the **municipal authorities of the city of Vienna Neustadt** were informed about the project at an early stage, and an inspection by representatives of the local fire brigade also took place during the commissioning.

The hydrogen used was provided by **Air Products** - in **liquid hydrogen trailers** filled with liquid hydrogen. These were vacuum-insulated tanks, which are subject to dangerous goods legislation. Liquid hydrogen was drawn from the tank during the refuelling process. This was then compressed to 450 bar via a pump, subsequently evaporated via heat exchangers and temporarily stored in a high-pressure cylinder bundle. The gas pressure tanks in the vehicle (fuel gas tanks) are fed from the high-pressure cylinder bundle via the dispenser. Overfilling of the fuel tanks in the train is prevented by a data interface between the train and the fuelling station as well as safety devices in the vehicle.

*Hydrogen trailer & compressors*


*Compressor*

## AP1 Conclusions

- Simple approval of the fuelling station by §40 - Persons pursuant to Railway Act (EisbG), as located on railway property.
- Early involvement of blue-light organisations and local stakeholders is beneficial.

# AP2 Hydrogen supply

## AP2 Setting objectives & contents

The hydrogen supply work package comprised all work packages that ensured a **supply of hydrogen** for the start of operations. It should be noted that the necessary tender procedure for the hydrogen supply was undertaken in conjunction with the vehicle tender procedure (AP 4.1.). Another priority of the hydrogen supply work package was the **green certification** of the hydrogen consumed, as the supply of green hydrogen could not be guaranteed in this project due to the lack of availability of green, cryogenic hydrogen in Europe.

## AP2 Results

Finally, the rental of the vehicle was accompanied by the hydrogen supply; the hydrogen required was provided by **Alstom** via **Air Products**. The **green certification** of the required hydrogen was performed by **VERBUND Energy4Business GmbH.**

## AP2 Conclusions

- Strongly limited availability of green liquid hydrogen in Europe.
- Green certification of hydrogen possible together with partner.
- Delivery of hydrogen by rail currently not possible.
- A supply of liquid hydrogen is most likely out of the question for scheduled operations due to availability and energy efficiency.

# AP3 Maintenance

## AP3 Setting objectives & contents

The maintenance work package includes all work packages that ensure that **maintenance** is possible **on hydrogen trains**. The maintenance itself was provided by the vehicle manufacturer **Alstom** (**ECM I, II, III and IV function**), while **ÖBB-Technische Services** provided **personnel support** for maintenance as required.

The **provision of the infrastructural framework** conditions for the maintenance of the hydrogen train and the provision of the required areas was an essential goal of the work package. Among others, the following infrastructural measures were requested:

- Adaptation of the workshop incl. provision of areas for maintenance work (2 x roof work stand 6m, crane (2 tonnes for fuel cell work), crane 100kg for general roof work as well as adaptation of the work pit).
- Provision of a hoist
- Provision of spare parts storage (storage container, 40 feet, frost-protected)
- Provision of office workstations for employees of the vehicle manufacturer
- Provision of operational materials
- Provision of connections (3-phase 400V, 50 Hz, 32 A)

## AP3 Results

The workshop was adapted for the maintenance of the vehicle corresponding to the above specifications of the vehicle manufacturer and the areas necessary for maintenance were provided.

The **scheduled maintenance steps (light maintenance)** could be completed through structural upgrades and provisioning in the workshop. The need for a truck-mounted crane to replace fuel cell components was known in advance - accordingly, the necessary steps were evaluated at an early stage. Complications and delays could as a result be avoided.

The installation of hydrogen-specific safety equipment such as explosion-proof lighting and heating, hydrogen sensors incl. alarm system and ventilation system in the hall was dispensed of due to the **time limitation of the trial operation**. As a consequence, no work was possible on the hydrogen components in the hall (this was done outside in the case of unscheduled demand).

### AP3 Conclusions

- Concepts are required that enable employees to work safely on and around hydrogen-powered vehicles.
- Evaluations are required as to whether or under what conditions hydrogen-powered vehicles and e-powered vehicles (especially vehicles that are supplied with energy via the overhead line) are able to be serviced in the same facilities.
- A modular design of the components conveying hydrogen promotes ease of maintenance.

## AP4 Provision of vehicles

### AP4 Setting objectives & contents

The vehicle provision work package comprised the **tender procedure** for the implementation of the trial operation with an approved hydrogen train incl. maintenance, fuelling station and hydrogen supply. This was also associated with the **network approval** of the hydrogen train by **ÖBB-Infrastruktur** AG and the granting of the **vehicle approval** in Austria by the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK). The content of the work package is presented in detail below:

- Tendering procedure for the rental of a hydrogen train approved in Austria incl. maintenance, refuelling station, hydrogen supply
- Tendering procedure for the lease of a hydrogen train approved in Austria incl. maintenance, refuelling station, hydrogen supply
- All steps for a network approval of the hydrogen train by ÖBB-Infrastruktur AG and the vehicle approval in Austria by the Federal Ministry of Transport, Building and Urban Affairs (BMK).
- Transfer and return of the vehicle to/from Vienna Neustadt
- Conclusion of liability insurance

It was contractually agreed in advance that the **manufacturer** would be responsible for **obtaining approval** for the hydrogen train on the Austrian route network. On 28.10.2020, the BMK finally issued the **type approval and operating permit in accordance with § 32a of the Railway Act (EisbG)** as amended.

The approval of **ÖBB-Infrastruktur AG** for the use of the hydrogen train on the rail network of ÖBB-Infrastruktur AG was granted on 28 February 2020

The following measures, among others, were necessary to obtain access to the network:

- **Test runs with tight curve radii:** The hydrogen train was transferred to Austria in December 2019 in order to obtain this evidence. The measurement runs to verify the wheel-rail forces were performed over two days:
    - Test runs at the Breitenstein infra-measuring station
    - Measurement and test runs at Söchauer Berg (min. arc radius 120m). This measurement run also checked the turning angle of the running gears and the load on the air springs.

The measurement runs were accompanied by **experts from ÖBB-Infrastruktur.** The hydrogen train was also presented to several stakeholders (blue-light organisations, traffic operations inspectorate and VOR) as part of these measurement runs.

## AP4 Results

The following results were achieved in the work package:

- **Framework agreement / rental agreement** incl. two supplementary agreements for the trial operation of a hydrogen train
- Successfully completed **test & measurement runs**
- Documentation of the measurements (t**est reports**)
- **Network approval** for hydrogen trains on the Austrian railway network
- **Vehicle Licensing** in Austria for hydrogen train

## AP4 Conclusions

- Network access route network ÖBB-Infrastruktur AG was achieved to the highest satisfaction of all project participants.


*Project team (not complete)*

# AP5 Operational implementation

## AP5 Setting objectives & contents

The Operational Implementation work package comprised all components necessary for the vehicle to be able to run in regular passenger transport operations and be ready for use. The following steps were necessary in this regard:

- **Train driver - training:** A sufficient number of train drivers needed to be trained before the start of the vehicle operation. All documentation required for this (service aids, operational guidelines) needed to be prepared in advance. The transfer of the training content was ensured by a total of four train driver instructors, who had already received vehicle familiarisation training in advance.
- **On-board train attendant - training:** A sufficient number of on-board train attendants needed to be trained before the start of the vehicle operation. All documentation required for this (service aids, operational guidelines) needed to be prepared and the training courses provided. The provision of training was ensured by an on-board attendant instructor who had already received vehicle training in advance.
- **Cleaning and security:** Here, too, the employees of the cleaning and security company were trained in the necessary vehicle specifics.
- **Ensuring system integration:** The vehicle was integrated into the necessary system landscape in order to ensure both scheduling and the maintenance management (ECM III function).
- **Evaluation of operational safety relevance** (risk analysis/RIA) safety management/SMS, route evaluations): All operational safety-relevant evaluations for the operation of the hydrogen train were performed here. The risk assessment was based on the manufacturer's comprehensive risk analysis. In addition, a safety assessment regarding accident risks of hydrogen-powered vehicles was ordered from the TÜV-Süd testing facility.
- **Schedule and deployment planning:** A comprehensive evaluation of the schedules for the hydrogen train was undertaken in order to ensure timely refuelling of the vehicle in any case, but also to ensure an extensive test of the vehicle. The vehicle schedules were chosen in such a way that the train could be parked overnight in the service facilities in Vienna Neustadt in order to avoid damage caused by vandalism.
- **Worker protection:** An inspection of the vehicle by representatives of the Transport Work Inspectorate (VAI), preventive physicians and ÖBB safety experts had already taken place in December 2019 to ensure occupational health and safety. Prior to the immediate start of operations, a second inspection including the preparation of the required SIGE document took place.
- **Blue-light organisations:** Two inspections were conducted with representatives of the local fire brigade to ensure that the emergency services along the route are informed about the use of the hydrogen train, especially with regard to preparation for emergencies or unforeseen events. An updated operational fact sheet was prepared in cooperation with them.

- **Positioning and parking concept:** Suitable parking areas for the hydrogen train were to be assured, preferably in the vehicle hall, to prevent vandalism (especially graffiti). In addition, security was arranged by the company Mungos for the parking hours during the night.
- **Auxiliary train:** Immediately after the transfer of the vehicle in August 2020, the training of the auxiliary train staff also took place.
- **Passenger Information System (FIS):** All necessary FIS data for integration into the vehicle FIS were recorded by PV-D in order to display correct information (timetable etc.) in the vehicle.

### AP5 Results

The following results were achieved in the work package:

- (Operational) readiness of the vehicle for use
- Project / use of hydrogen train coordinated and agreed with the contractor
- Sufficient number of trained drivers available
- Documentation for train drivers (DB, guidelines) available
- Sufficient number of trained attendants available
- Hydrogen train incorporated into the necessary IT systems
- Risk analysis (RIA) undertaken and completed
- Vehicles "incorporated" in SMS
- Route evaluation with hydrogen train successfully completed
- Schedules planned for hydrogen train and coordinated and agreed with manufacturer
- ANS and SIGE evaluation available

### AP5 Conclusions

- High level of cooperation within ÖBB, with blue-light organisations, purchasers and vehicle providers during operational implementation.
- The high level of support from all the agencies involved also resulted from the high level of interest in the innovative vehicle and tank installation technology.

# AP6 Operation & lessons learned

## Setting objectives & contents

The Operation & Lessons Learned work package ensured that the hydrogen train could be used in passenger service. The findings were documented, evaluated and conclusions drawn on an ongoing basis. The clear objective here was to derive conclusions and **recommendations for action** on how a **possible future use of hydrogen trains** on the Austrian route network could be achieved. Operational, economic and technical aspects were all taken into consideration.

## AP6 Vehicle deployment

The **vehicle transfer** from Salzgitter/Germany to Vienna Neustadt was performed by the RCA on 19.08.2020. Immediately afterwards, the **process of operational implementation** of the vehicle began: Vehicle inspections by the Austrian Railway Authority (VAI) and blue-light organisations took place in addition to the training of drivers, on-board attendants and technicians. Passenger service commenced after the **official opening event at Vienna Central Station** on 11.09.2020. The operation was completed as scheduled on 26.11.2020.

| Planned operating days | Actual operating days | Actual kilometres |
|---|---|---|
| 76 | 50 | Ca. 14,700 Km |

## AP6 Vehicle breakdowns and punctuality data

A total of **19 standstill days** were recorded during the entire trial operation due to **vehicle downtime.** One standing day due to scheduled maintenance on 16.11.2020, as well as the standing days after an EC accident on 19.11.2020, are not taken into account here. The majority of the downtime was due to technical defects of the prototype as well as the long delivery time of the replacement components required for repair (complicated by the COVID 19 pandemic). In regular operation, the vehicle showed no significant deviations from the scheduled timetable

## AP6 Experiences of train drivers

The **training** of the train drivers took place from 19.08.2020 to 10.09.2020 over a **period of 16 hours** (theory), the practical part of which was completed during the evaluation runs of the four test routes. A total of **20 train drivers** were instructed by 4 instructors who had already been familiarised with the specifications of the vehicle in advance.

The drivers were of the opinion that current timetable with the hydrogen train could be maintained without difficulty.

It was emphasised that the hydrogen train represents an interesting technological development in terms of **smoothness, curvature and, above all, noise development**. The refuelling process with the prototype fuelling station is currently judged to be too cumbersome and lengthy for real operation - a fixed **fuelling facility with larger tanks** (or a higher range of the vehicle in order to have to refuel less frequently) is desirable.

### AP6 Digression: Legal considerations for the production and supply of hydrogen on railways

**Mag. Andreas Netzer** (ÖBB-Infrastruktur AG) was asked by the project team to provide an outlook on the potential production and supply of hydrogen in the future. The relevant considerations are set out in the following.

**Are installations for supplying railway vehicles with energy for propulsion railway installations?**

Pursuant to Art 10 para 1 no 9 B-VG, the "transport in relation to railways" is the responsibility of the federal government in terms of legislation and enforcement. The federal government assumed this authority by enacting the Railway Act (EisbG) 1957 iddgF. Although neither coal bunkers and water stations for steam traction nor installations for traction current generation or supply nor, finally, fuelling stations for liquid or gaseous fuels for the propulsion of rail vehicles are specifically mentioned in this law, there has never been the slightest doubt, either in official practice or in the jurisprudence of the courts of public law, that these installations fall within the aforementioned scope of competence. More detailed explanations are available if required, but in essence it can be assured that an installation from which traction vehicles are supplied with electric current, solid, liquid or gaseous energy carriers will always be assessed as included in the railway sector. The main reason is that the supply is closely linked to the rail infrastructure, usually difficult or impossible to use for other modes of transport and also technically adapted to the railway operation in such a way that it appears to be dedicated to it alone or would only have to be made usable for other modes of transport or purposes by means of special additional facilities.
In this context, reference should also be made to § 10 Railway Act (EisbG). According to this legal definition, all structures are, among other things, railway installations which are used wholly or partly, directly or indirectly, for the operation of a railway or of railway vehicles on a railway. If installations of a structural nature - i.e. according to their purpose - are dedicated to and necessary for the operation of a railway, they are railway installations and thus fall entirely within the scope of the Railway Act (EisbG), even if they are only indirectly necessary for the operation of the railway or partially serve other purposes.

Even if installations that serve to supply energy to rail vehicles are *not* bound to be regarded as structures (as a rule defined as static constructions that are frictionally connected to the ground and intended to remain permanently, the technically flawless manufacture and/or erection of which is only possible with structural engineering expertise) (for example mobile energy supply installations for temporary operation at one location, which are housed in containers and can be easily transported to other locations), they are nevertheless to be qualified as so-called "fixed railway installations" to the extent that and for as long as they serve the operation of a railway. Thus they are also subject to the rules on the rights and obligations of the railway undertaking for proper and safe operation within the meaning of §§ 18 and 19 of the Railway Act for the duration of their use.

**Is the construction of such installations subject to other federal regulations in addition to the Railway Act (EisbG)?**

With regard to federal regulations, railway installations are as a rule also subject to other federal regulations due to the material accumulation principle:

a. either directly, insofar as federal laws provide for specific approval requirements that also need to be completed for railway installations (Environmental Protection Act (UVP-G), Water Management Act (WRG), Forestry Act (AWG), Monument Protection Act (DenkmalschutzG), etc.). The Trade, Commerce and Industry Regulation Act (Gewerbeordnung) is not applicable, the Railway Act (EisbG) in this regard systemically forms an exception as the more specific norm.
b. or indirectly, insofar as federal material must be referred to in terms of content by the railway authority itself in order to determine the state of technology within the meaning of § 9b Railway Act (EisbG), also for railway installations, in such a way that the eligibility for approval under railway law provisions (in this case, in particular § 31 Railway Act (EisbG)) can be determined. The federal regulations on pressure vessels and pipelines as well as for electromechanical installations should certainly be referred to here.

**Is the construction of such facilities also subject to statutory regulations?**
In principle, no. According to the established jurisprudence of the Constitutional Court, railway installations are not subject to any provincial approval requirements, as they come under the jurisdiction of the federal government. This applies in particular to the provisions of general building law and the associated local and supra-local spatial planning law of the states. The Constitutional Court has, however, in isolated cases deemed the applicability of provincial regulations to railway installations to be admissible. In this context, it is important to mention in particular the provisions of nature conservation law at the state level and, more recently, the provisions of tax law on land and development levies.

**What is the specific procedure for planning and constructing a railway undertaking's energy supply system for hydrogen?**
The easiest way to answer this question is to use a scorecard, which can be effectively used as a checklist:

a. *Is it part of a main line or a branch line?*
   This question is the basis for deciding jurisdiction: Should the facility serve as branch line alone and not, in addition, the operation of or on a main line, the responsibility would lie with the respective provincial governors. Should however the operation of a main line (= high-capacity line) also be affected, the responsibility lies with the Federal Ministry of Transport, Building and Urban Affairs (BMK). The latter is clearly the case for a facility at an HL network node such as Vienna Neustadt.
b. *Is the facility a structure within the meaning of § 10 Railway Act (EisbG)?*
   This question determines whether § 31 (on building permission) and, at most, the exceptional circumstances of § 36 Railway Act (EisbG) (building measures not requiring permission) are applicable. This question is to be answered in the affirmative if the installations are designed with fixed foundations or are designed for permanent operation, even in the medium term. However, due to the particular hazard potential of installations in which flammable and explosive gases are manipulated under high pressure, non-applicability of these provisions would only render the legal position of the company uncertain. It is therefore expressly advised from a legal point of view to construct the facilities as a building and, moreover, to seek a building permit under railway law from the Federal Ministry of Transport, Building and Urban Affairs (BMK). It is only when a rough plan in the form of a building design is available that the obligation

to obtain a building permit pursuant to § 31 Railway Act (EisbG) should be discussed in more detail with the authority and the further procedure planned.

**Is construction on railway property necessary?**
Legally, it is not necessary to do so. In principle, railway installations may be constructed on third-party property. This is generally not recommended, however, as railway facilities require enhanced legal security of existence and a threat to the operational interests of the railway through subsequent conflicts over the use of third-party property should be avoided as a matter of principle. Irrespective of this, installations such as the one discussed here must be secured to a special extent against unauthorised access, sabotage and acts of vandalism, so that it seems advisable to erect them in an area that is particularly protected by the prohibition of access under railway law.

**Does what has been stated only apply to the fuelling and refuelling facilities or is it also necessary for the generation facilities (electrolyser)?**
No. As in the case of a substation, the electricity to be supplied to the traction power supply can be purchased from the free market and delivered at a defined interface, the supply of the railway facility from a commercial hydrogen supply system (fixed installed gas supply line, road- or rail-bound tanker vehicles) is conceivable in principle. Similar to the traction power generation plants, however, the decision to generate the hydrogen by the railway undertaking itself (for example with cheaply available electricity from its own traction power grid) is conceivable and legally possible. In the latter case, the explanations given above also apply to the hydrogen production facility.

### AP6 Maintenance

The following are some basic implications for the maintenance and servicing of hydrogen trains in order to provide an outlook on the issues surrounding the maintenance of hydrogen trains.

In general, the maintenance and servicing **costs** for a hydrogen train are higher compared to the maintenance and servicing costs for an e-traction unit, as the **traction battery and the fuel cell system** (including the tanks) require **additional maintenance and servicing.** Particular attention is especially necessary for the fuel cell system (including tanks). Work on the hydrogen facility, **sensor/alarm equipment, explosion-protected (emergency) lighting, automatic (roof) ventilation** and **possibilities for the drainage of hydrogen** all need to be implemented in the servicing facility.

Workshops must be equipped with at least the following **special safety equipment** for the safe servicing of vehicles:

- Explosion-proof lighting, heating and ventilation system
- Hydrogen detection and warning system
- Automatic ventilation should hydrogen be detected

# AP7 Communication

## AP7 Setting objectives & contents

The Communication work package comprised the **internal and external communication of the project** and the implementation of related communication measures, which were elaborated within the framework of a communication concept.

## AP7 Results

The following results were achieved in the work package:

- Planning & production of **communication assets** (texts, moving image and photo material) used for a wide variety of communication measures on external and internal communication channels.
- **Coordination of communication activities** with sponsors, alternatively project partners
- Preparation of a comprehensive **Frequently Asked Questions catalogue**
- Coordination in the creation of the vehicle f**oiling design including a highly visible logo** on the train for the full duration of the **project of all project partners** (AIT, HyCentA, Shift2Rail, VERBUND)
- Preparation & implementation of the **press conference** on 11.09.2020 for the presentation of the hydrogen train and the subsequent first test drive with media representatives.
- Creation of a dedicated **website** with background information & timetable of the hydrogen train: https://www.oebb.at/en/neuigkeiten/wasserstoffzug
- ÖBB's customer magazine "**railaxed**" reported on the pioneer project in its Winter2020 issue.
- A **video interview**, reporting on a train driver's experience with the hydrogen train, was produced for internal communication. The project was also presented in internal communication with a report in the staff magazine "ÖBBbewegt" and intranet news.
- **Test drives** with the hydrogen train were organised for interested stakeholders, but could not be implemented in part due to the Covid-19 pandemic and the associated restrictions.
- The **media coverage** of the test operation of the hydrogen train was **predominantly positive** throughout the entire project phase. A total of around 60 articles have appeared in print newspapers. In addition, the project was reported in online media, in blogs and on TV. Altogether, more than 320,000 people were reached on the company's own social media channels @unsereoebb, resulting in more than 3,200 likes.
- **Communication and public relations management** with particular **focus on** further needs of **R&D** in the area of rail hydrogen systems (in particular the integration, system cost efficiency & regulatory needs) was communicated at the following events:
    - Canadian Smart Rail Technology Conference 2020, 23.11.2020 (Canada, https://events.cutric-crituc.org/railconference2020/agenda/speakers/872479 )
    - Wasserstoff auf Schiene – Österreichische Verkehrswissenschaftliche Gesellschaft, 23.11.2020 (Austria,
    - https://www.oevg.at/veranstaltungen/events/2020/wasserstoff-auf-schiene/?type=123 )
    - Österreichische Fachtagung für Photovoltaik und Stromspeicherung, 03.12.2020 (Austria, https://pvaustria.at/fachtagung-pv-speicher/ )
    - TÜV SÜD Wasserstoffgipfel, 21.05.2021 (Austria, https://www.tuvsud.com/de-at/presse-und-medien/austria/2021/tuv-sud-impulse-zukunftsperspektiven-von-wasserstoff-in-oesterreich )

- Oberbremsrätekonferenz, 02.09.2021 (Austria, https://www.oberbremsraetekonferenz.eu/ )
- Forum Verkehr: Infrastruktur, 14.09.2021 (Austria, https://www.imh.at/veranstaltungen/seminar/schienenverkehr-und-tsi/ )
- Österreichische Fachtagung für Photovoltaik und Stromspeicherung, 14.09.2021 (Austria, https://pvaustria.at/fachtagung-pv-speicher/ )

## AP7 Conclusions

- Strongly positive media response.
- Positioning of ÖBB as an innovation leader successfully implemented.
- Subjective assessments by ÖBB employees suggest an increased flow of passengers to the hydrogen train.
- The COVID 19 pandemic and the associated regulatory requirements, however, meant that no further events could be staged with the vehicle.

*VD Huber, GF Alstom DE/AT Nikutta, CEO Matthä, VD Garstenauer*

*Project team (not complete)*

# C) Conclusions & Recommendations

## Conclusion & recommendation use of hydrogen vehicles at ÖBB

The test operation has confirmed the fundamentally high reliability and equivalence with diesel vehicles. The **performance requirements** were met, the **schedule** could be adhered to and the Coradia iLint vehicle had sufficient hydrogen reserves at all times to cover delays and route interruptions without compromising passenger comfort. Despite the length and challenging topography, **the hydrogen train completed the routes with ease**. The future use of hydrogen vehicles needs to ensure an appropriate level of reliability. A complete conversion of the Vienna Neustadt facility results in a hydrogen demand of around 3,000 kg per day at the beginning of the lifetime and a hydrogen demand of 3,300 kg per day at the end of the lifetime (incl. additional degradation demand, additional seasonal consumption). Should a corresponding decision be made in favour of hydrogen, then a sufficient supply of green hydrogen needs to be assured.

## Conclusion & recommendation R&D requirements

The project provided evidence that the **vehicle technology is ready for series production** and meets the requirements even on geographically demanding routes and could therefore completely replace **diesel vehicles**.

The **hydrogen needed** to operate fuel cell vehicles only occurs in nature in bound form, for example in water or hydrocarbons. Hydrogen is therefore not a primary energy source, but must first be **produced** from or with other energy carriers in an **energy-intensive process**. Currently, most hydrogen production is achieved through reforming processes of fossil hydrocarbons (e.g. natural gas - methane) or is a waste product from chemical processes. Green hydrogen, i.e. hydrogen produced from renewable primary energy sources, such as electrolysis by splitting water into hydrogen and oxygen using renewable electricity, is currently only available to a very limited extent in Europe. This also highlights one of the main challenges of this technology: although the vehicle technology is already very advanced, **green hydrogen** for the operation of these vehicles is **not available in sufficient and economically feasible quantities**. It is clear, however, for future applications of hydrogen technology at ÖBB that hydrogen technology should only be used if it is green hydrogen. Hence, ÖBB supports and participates in different R&D programs such as the future Europe´s Rail Joint Undertaking addressing further hydrogen related R&D needs.

| | Conclusions | Recommended actions |
|---|---|---|
| Hydrogen supply | Strongly limited availability of green liquid hydrogen in Europe. Delivery of hydrogen by rail not possible for the project. | Developments for the cost-effective production of green hydrogen need to be expedited. A supply of liquid hydrogen is most likely out of the question for scheduled operations due to availability and energy efficiency. The use of hydrogen technology at ÖBB will only take place if it is technically and economically without alternative and if it is green hydrogen. |
| Hydrogen fuelling station | Simple approval of the fueling station by (§40). | Early involvement of the authorities, blue-light organisations and local stakeholders is beneficial. |
| | A reduction of the refueling time in series operation to at least the level of diesel refueling would be necessary. | Special attention is required for the handling of hydrogen tank installations when starting operations with hydrogen trains. |
| Vehicle technology | Future use of hydrogen trains requires measures to be implemented in the area of maintenance. | Concepts are required that enable employees to work safely on and around hydrogen-powered vehicles. |
| | | Evaluations are required to determine whether or under what conditions hydrogen-powered vehicles and e-powered vehicles (especially vehicles supplied with energy via the overhead line) should be serviced in the same facilities. |
| | | A modular design of the components conveying hydrogen promotes ease of maintenance. |
| | | A corresponding build-up of know-how at ÖBB is necessary for future use and the Vienna Neustadt facility needs to be adapted (workshops, operational facilities etc). |
| Vehicle registration | Network access route network ÖBB-Infrastruktur AG was achieved to the highest satisfaction of all project participants. | |

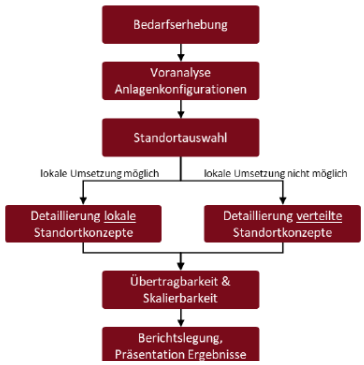
# D) Outlook - Decarbonisation Path 2030

The project provides essential input for achieving the goal of a **CO2-neutral vehicle fleet of Personenverkehr AG 2030**. The project provided important experience relating to vehicle and refueling station technology. An essential part of the operation of hydrogen trains is also the hydrogen supply. It is precisely this aspect that is addressed in a **study commissioned** by ÖBB-Holding AG and awarded to the **Austrian Institute of Technology GmbH** and **HyCentA GmbH** in autumn 2020. The objective of this project is outlined below:

The study entitled "Accompanying study for the H2 pioneer project" is intended to develop an implementation-oriented concept for the **local hydrogen supply of regional trains Nb-Fg, Nb-Pb, Nb-Gb** based on renewable energies at the Vienna Neustadt facility. This concept is to be technically elaborated and economically evaluated. The results of the study serve as a **basis for decision-making** for subsequent **planning for conversion** to hydrogen vehicles. If the evaluation is positive, the concept can be implemented at the Vienna Neustadt facility or along the inner Aspang railway. The local conditions (such as photovoltaic and wind generation potential, area required) should be taken into account in the analysis. In addition, the possibility of **scaling** the solution to **other locations** should be considered or discussed at the same time. The **modules of the supply concept** consist of**:**

- Renewable photovoltaic and wind power installations
- Electrolysis systems for the production of hydrogen
- Storage facilities for the hydrogen produced
- Logistics for transporting the hydrogen to the fueling station by rail
- Tank infrastructure for train refuelling

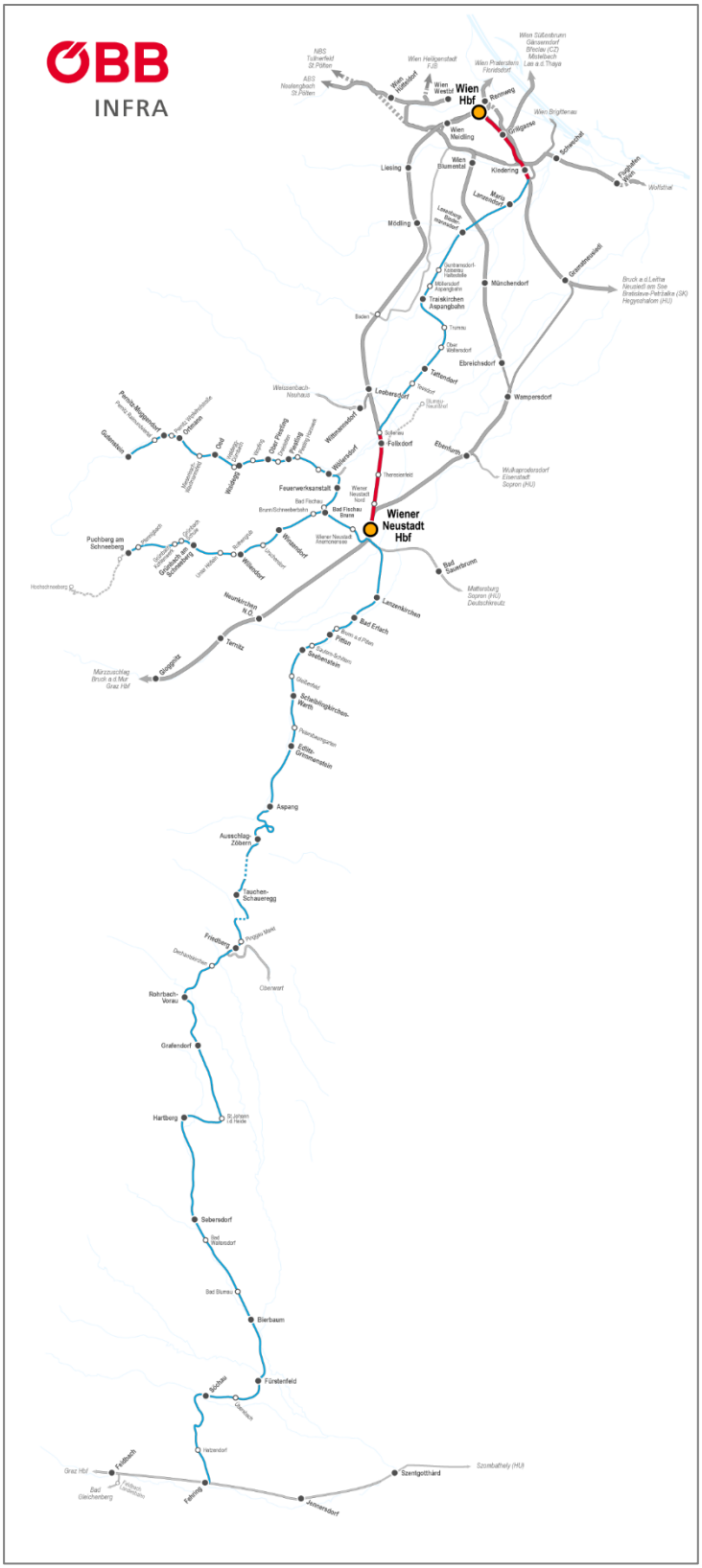
The completion of the study is scheduled for autumn 2021.




*Structure Support Study*

# E) Route network

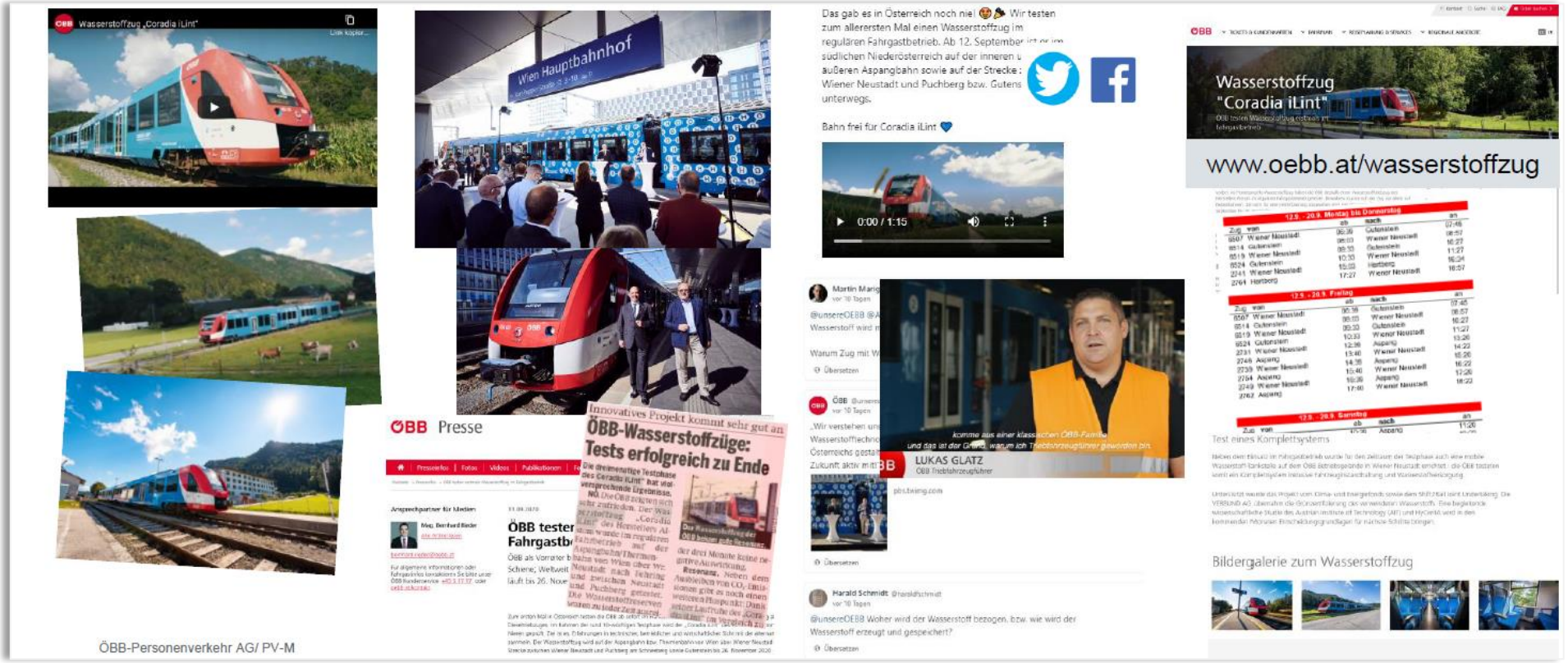
The vehicle was used on the following routes (light blue & red)




*(Route network)*

# F) Communication review

| Pictures & Videos | Press conferences & media | Social Media | Website |
|---|---|---|---|



| ÖBB´s intranet | ÖBB Railaxed magazine | ÖVG event 23. Nov. 2020 | Website |
|---|---|---|---|

OÖNachrichten

## *Wasserstoff im Portfolio*

Ständig ist von Wasserstoff als Energieträger der Zukun Wie kann man sich als Anleger schon jetzt an dieser Te tuligen? Franz E.

Der Wasserstoff als Energieträger hat Zukunft, davon gehen viele Experten aus. Es gibt auch eine Vielzahl von Studien, die diesem Gas eine große Zukunft prophezeien. Das Beratungsunternehmen Roland Berger geht davon aus, dass die Nutzung von Wasserstofftechnologien bis 2032 jährlich um 15 bis 17 Prozent steigen wird.

Heute präsentieren die ÖBB ihren ersten „Wasserstoff-Zug" in Wien, und vor wenigen Tagen hat die US-Firma Nikola eine weitreichende Partnerschaft mit General Motors bekannt gegeben. Nikola gilt als „Tesla für Lastwagen". Der Aktienkurs ist kräftig gestiegen, obwohl das Unternehmen derzeit noch keine nennenswerten Umsätze, geschweige denn Gewinn, macht.

Dass Wasserstoff auch für Anleger eine spannende Sache ist, davon war auch an dieser Stelle schon die Rede. Das Problem für Anleger: Wie investiert man in Wasserstoff?

Das ist derzeit gar nicht so einfach. Es gibt noch keine Fonds, die sich auf Wasserstoff konzentrieren und damit die Möglichkeit böten, das Risiko zu streuen. Denn das ist beim Kauf von Einzelaktien noch ziemlich groß. Die Wasserstoff-Technologie steht noch am Beginn ihrer Entwicklung. Derzeit „lebt" sie vor allem an der politischen Unterstützung, vom „Green Deal" der EU-Kommission angefangen bis hin zu nationalen Bestrebungen in vielen Staaten.

Wer Wasserstoff im seinem Portfolio haben will, muss also Umwege gehen. Ein Weg führt über die Nachhaltigkeits- und Umweltfonds. Damit sind auch meist Wasserstoff-Unternehmen [illegible] Es bietet sich auch die Einzelaktien jener zu [illegible] zwar in der Wasserstoffgie unterwegs sind, a[illegible] nach anders verdiene[illegible] Gruppe gehören etwa[illegible] Linde AG, die auch [illegible] stark vertreten ist, ode[illegible] sische Air Liquide. Die[illegible] nach die Wasserstoff[illegible] voran und haben gro[illegible] Sie machen derzeit ab[illegible] geschäft mit Industr[illegible] Art.

Wer langfristig denk[illegible] zeitig regional, kann [illegible] den beiden österreich[illegible] zernern voestalpine u[illegible] beteiligen. Mit an Bord [illegible] mens. Das ist zwar k[illegible] chisches Unternehmen [illegible] „regional" aber ein bi[illegible] zügiger auslegt, ist au[illegible] noch in Ordnung. Die[illegible] nehmen haben im Vo[illegible] lotprojekt zur Erzeug[illegible] nem Wasserstoff ge[illegible] das gut, dann könnte[illegible] pne mit diesem Ener[illegible] Stahlproduktion reu[illegible] so wie siees mit dem L[illegible] schon einmal geschaff[illegible] aber wirklich noch Zuk[illegible]

Ich weiß nicht, wie lieber Herr E. Aber blei[illegible] auch wenn es noch re[illegible] rig ist, Wasserstoff i[illegible] holen. Es zahlt sich a[illegible] aus. Das gilt finanziell[illegible] aus Gründen des Klim[illegible]

**Haben Sie Fragen zum Geld?** Die Wirtschaftso[illegible] Hermann Neumüller u[illegible] Dickstein antworten.
**E-Mail:** wirtschaft@na[illegible]

Kleine Zeitung
Samstag, 12. September 2020

**Video vom Wasserstofzug**
Kleine-Zeitung-App
kleinezeitung.at/wirtschaft



Blitzblau ist der Zug mit Wasserstoffantrieb, den die Bahn jetzt testet ÖBB

ÖBB TESTEN WASSERSTOFFZUG

## Erster Start in neue Bahn-Zeiten

Noch ist es ein Versuch, aber er zeigt den Zug der Zeit: Die ÖBB testen für zehn Wochen einen mit Wasserstoff betriebenen Zug. Der „Coradia iLint" ist vor allem im südlichen Niederösterreich im Personenverkehr unterwegs. Besteht der Stromer dort die „Bergprüfungen", könnte das Modell mittelfristig auf nicht elektrifizierten Strecken Dieselloks ersetzen. Spätestens 2030 wollen die ÖBB klimaneutral, also dieselfrei sein.

In Norddeutschland hat der „Coradia iLint" seit 2018 gut 180.000 Kilometer abgespult, so wie sein Zwilling in den Niederlanden. Die Serienfertigung läuft bereits: Alstom hat in Salzgitter inzwischen Aufträge über 41 Stück in den Büchern.

APA0197 5 CI 0284 WI Fr, 11. Sep 2020 Vos: gPWI

Bewährungsprobe für Wasserstoffzug: ÖBB starteten mehrwöchigen Test

**"Coradia iLint" von Alstom bis 26. November im Fahrgastbetrieb in Wien, Niederösterreich und der Steiermark unterwegs**

Utl.: "Coradia iLint" von Alstom bis 26. November im Fahrgastbetrieb in Wien, Niederösterreich und der Steiermark unterwegs =

Wien (APA) - Zum ersten Mal in Österreich testen die ÖBB im Planbetrieb mit Fahrgästen einen Wasserstoffzug anstelle eines Dieseltriebzuges. In der heute, Freitag, in Wien gestarteten rund zehnwöchigen Testphase muss sich der "Coradia iLint" des Herstellers Alstom bewähren. "Wir verstehen uns ganz klar als Pioniere beim Testen der Wasserstofftechnologie auf der Schiene", sagte ÖBB-Chef Andreas Matthä.

**Wasserstoff statt Diesel** soll künftig die Züge der ÖBB antreiben. Der zehnwöchige Test dafür startete gestern mit einer blauen Garnitur am Wiener Hauptbahnhof (u.). Bis 2030 wolle die Bahn weitgehend $CO_2$-neutral unterwegs sein, so Chef Andreas Matthä. Und die ÖBB zeigen noch mehr Umweltbewusstsein. An Bord der Rail- und Cityjets wird das ORF-TVthek-Angebot um Schwerpunkte zu Mutter Erde, Klimaschutz und Austrian World Summit erweitert (re.).

## ÖBB machen Tests mit Wasserstoffzug

WIEN (APA). Zum ersten Mal in Österreich testen die Österreichischen Bundesbahnen (ÖBB) im Planbetrieb mit Fahrgästen einen Wasserstoffzug anstelle eines Dieseltriebzuges. In der am Freitag in Wien gestarteten rund 10-wöchigen Testphase muss sich der „Coradia iLint" des Herstellers Alstom vor allem auf „geografisch anspruchsvollen" Strecken wie Nebenbahnen bewähren, die nicht für eine Elektrifizierung vorgesehen sind. Bisher waren Wasserstoffzüge vor allem in Norddeutschland und den Niederlanden im Einsatz. ©

# Pionierprojekt Wasserstoffzug in den Medien

## Öffis fahren auf Wasserstoff ab

Die Wiener Linien haben 2020 zum Jahr der Öko-Busse ausgerufen und erstmals ein Wasserstoff-Fahrzeug getestet. Auch die Bundesbahnen setzen mit einem Wasserstoffzug auf die H2-Strategie.

Zehn Wochen lang wird der „Coradia iLint" des Herstellers Alstom von den ÖBB auf Herz und Nieren geprüft. Zum Einsatz kommt der Wasserstoffzug auf der Aspangbahn bzw. Thermenbahn von Wien über Wr. Neustadt nach Fehring und auf der Strecke zwischen Wr. Neustadt und Puchberg am Schneeberg sowie Gutenstein. Bis 26. November läuft der Testbetrieb.

„Mit technologischen Alternativen gestalten wir die Mobilität der Zukunft aktiv mit", so ÖBB-Chef Andreas Matthä.

**Wiener Linien wollen eine H2-Busflotte aufbauen**

Pionierarbeit wollen auch die Wiener Linien leisten. Neun Tage testeten die Verschiebebetriebe im Juni auf der Linie 80A einen Wasserstoffbus von Solaris. Ab 2025 sollen auf der Strecke zehn H2-Busse zum Einsatz kommen.

Wurde der Bustank im Probebetrieb innerhalb von zwölf Minuten mit 35 Kilogramm Wasserstoff gefüllt, soll das im Regelbetrieb in acht Minuten möglich sein. Ein voller Tank soll für 400 Kilometer reichen.

Neben Fahrzeugen mit Wasserstoff-Antrieb testen die Wiener Linien übrigens auch Elektrobusse von Mercedes. Im Oktober soll der nächste Probelauf starten.

Pilotprojekt findet im Landessüden statt

## NÖ: Freie Premierenfahrt für ÖBB-Wasserstoffzug

**Das Fahrzeug wird zehn Wochen lang mit Fahrgastbetrieb getestet.**

**NÖ.** Bis 26. November ist der erste Wasserstoffzug des Landes, Coradia iLint, in NÖ unterwegs. Er verkehrt zwischen Wr. Neustadt und Puchberg am Schneeberg, von Wr. Neustadt nach Gutenstein, auf der Aspangbahn und der Thermenbahn von Wien über Wr. Neustadt nach Fehring.

„Wir verstehen und als Pioniere beim Testen der Wasserstofftechnik auf der Schiene", sagte ÖBB-Chef Andreas Matthä.


Das Projekt ist ein P
versuch: Denn bis 2
wollen die ÖBB $CO_2$-r
ral sein – unter ande
durch den gelunge
Umstieg von Diesel-
Wasserstoffantrieb.

## ÖBB starten Test mit Wasserstoffzug

**Wien** – Zum ersten Mal in Österreich testen die ÖBB im Planbetrieb mit Fahrgästen einen Wasserstoffzug anstelle eines Diesel-

12 WIENER ZEITUNG WIRTSCHAFT


Der Wasserstoffzug von Alstom fährt emissionsfrei.

## ÖBB testen Wasserstoffzug

Der Fahrgastbetrieb startet am 12. September. Bis 2030 soll Mobilitätssektor $CO_2$-neutral sein.

Von Michael Ortner

Von außen sieht er aus wie ein normaler Zug. Auf dem Dach aber steckt modernste Technik: Zwei Brennstoffzellen wandeln dort Wasserstoff und Sauerstoff in Strom um. Der Zug fährt emissionsfrei, geräuscharm und stößt nur Wasser aus.

Auf Bahnsteig 12 am Wiener Hauptbahnhof feierte der weltweit erste Wasserstoffzug am Freitag Österreichpremiere. „Wir betreten technologisches Neuland", sagt ÖBB-Vorstand Andreas Matthä bei

Für den Testbetrieb wurde von Deutschland extra eine mobile Wasserstoff-Tankstelle nach Wiener Neustadt transportiert. Dort soll der Zug betankt werden. Er muss sich im Testlauf vor allem auf „geografisch anspruchsvollen" Strecken beweisen. Bisher war der Wasserstoffzug nur im norddeutschen Flachland und den Niederlanden unterwegs.

**Bis 2030 dieselfrei**

Die ÖBB testen ihn anstelle eines Dieselzugs ab 12. September zehn Wochen lang im Fahrgastbetrieb.

ben zu ersetzen", sagt ÖBB-Vorstand Matthä zur „Wiener Zeitung". Laut ÖBB-Klimaschutzstrategie müssen rund 400 Dieselfahrzeuge durch klimafreundliche Antriebe ersetzt werden. 32 Millionen Liter Diesel sollen dadurch eingespart werden.

Stand jetzt sind 72 Prozent der ÖBB-Bahnstrecken elektrifiziert. Bis 2035 sollen es 89 Prozent sein. Dort, wo es aus wirtschaftlichen Gründen keinen Sinn macht, sollen alternative Antriebssysteme wie etwa Batterien oder eben Brennstoffzellen zum Einsatz

ziert. Alstom gilt als Pionier bei Wasserstoffzügen. Seit 2018 sind in Niedersachsen die weltweit ersten Triebwagen mit Brennstoffzellen im Einsatz. Die Kosten des Wasserstoffzugs seien laut Jörg Nikutta, Geschäftsführer von Alstom Deutschland und Österreich, „nur ein kleines bisschen höher" als die eines Dieselzugs.

Alstom hat aktuell rund 41 Aufträge für den Wasserstoffzug, Österreich sei jedoch die internationale Premiere. „Die ÖBB sind ein guter Partner. Nicht alle Länder sind schon so weit", sagt Ni-

Die Presse SAMSTAG, 12. SEPTEMBER 2020

## ÖBB testen den ersten Wasserstoffzug

Der Zug ist zehn Wochen auf zwei Strecken unterwegs.

**Wien.** Zum ersten Mal in Österreich testen die ÖBB im Planbetrieb mit Fahrgästen einen Wasserstoffzug anstelle eines Dieseltriebzuges. In der am Freitag in Wien gestarteten zehnwöchigen Testphase muss sich der „Coradia iLint" des Herstellers Alstom bewähren. „Wir verstehen uns ganz klar als Pioniere beim Testen der Wasserstofftechnologie auf der Schiene", so ÖBB-Chef Andreas Matthä.

Der Wasserstoffzug wird bis 26. November auf der Aspangbahn bzw. Thermenbahn von Wien über Wiener Neustadt nach Fehring und auf der Strecke zwischen Wiener Neustadt und Puchberg am Schneeberg sowie Gutenstein unterwegs sein. Bis 2030 wollen die ÖBB im Mobilitätssektor CO2-neutral unterwegs sein. (APA)

KLEINE ZEITUNG **PRIMUS**

**THEMA** Transport & Logistik

Alstom-Manager Jörg Nikutta und ÖBB-Chef Andreas Matthä (re.)

# Zug fährt mit Wasserstoff ab

**Die Zukunft der Bahnen soll dieselfrei werden. Wie das schon in der Praxis funktioniert, zeigt der Zughersteller Alstom bei den ÖBB.**

Von Claudia Haase

Die ersten zwei Testwochen im normalen Fahrgastbetrieb hat der ausgeliehene „Coradia iLint" bereits hinter sich. Bis Ende November wird der extra aus Niedersachsen nach Österreich chauffierte Zug noch rund um Wiener Neustadt und teilweise auch in der Steiermark für die ÖBB unterwegs sein. Das Besondere an dem Regionalzug ist weniger das rot-weiß-blaue Design, sondern der emissionsfreie Antrieb: Der „Coradia iLint" fährt mit Wasserstoff und lädt beim Bremsen auch Batterien auf.

Dieser „Coradia" ist nicht brandneu, spulte schon 180.000 Kilometer in Deutschland ab. Zwei seiner Art hat der Zughersteller Alstom in Salzgitter als Vorserienfahrzeuge gebaut, erzählt der für Deutschland und Österreich zuständige Alstom-Geschäftsführer Jörg Nikutta. Gerade werden die ersten 41 Serien-nachfolger gefertigt und schon 2022 bei zwei deutschen Regionalbahnen auf die Schienen gesetzt werden. Damit ist Alstom der erste Bahnanbieter, der diesen riesigen Markt aufrollt. Das große Ziel der Franzosen ist ehrgeizig: Sie wollen weltweit Nummer eins bei emissionsfreien Zügen werden.

**Für die Bahnen** dürften die Fahrzeuge hochinteressant sein. Nicht nur, weil die Klimadiskussion in den vergangenen Jahren massiv an Fahrt aufgenommen hat. Viele Bahnen wollen und können nicht alle Strecken elektrifizieren und müssen aber demnächst teilweise viele Jahrzehnte alte Diesel-Regionalzüge oder Rangierloks ausmustern. So auch die ÖBB. Für Bahnchef Andreas Matthä muss jede Neuanschaffung zum Ziel passen, 2030 klimaneutral zu sein. „Da müssen wir schlicht dieselfrei fahren," sagt er, „entweder mit Akkuzügen oder mit Wasserstoff." Batteriezüge gibt es schon, ihre Reichweite ist mit 60 bis 80 Kilometern sehr begrenzt. Auf Nebenstrecken oder im Labetrieb etwa in Häfen ist eine Alternative gefragt. „Coradia iLint" zapft 180 kg Wasserstoff. Der reicht für 1000 Kilometer. Alstom hat dafür eine mobile Tankstelle in W aufgestellt. Das samtkonzepts: ler nimmt Kund Versorgung ab, tung, erklärt Jens Sprotte.

**Die Wasserstoff-Tankstellen** sind aus seiner Sicht der wichtigste Schlüssel der Sektorkopplung. Dabei geht es um das Ineinandergreifen verschiedener Energiesektoren, wenn etwa mit Überschussstrom aus Windrädern oder Solaranlagen lager- und transportfähiger Wasserstoff produziert wird. „Elektrolyse vor Ort macht Wasserstoff so charmant", sagt Sprotte. Deshalb ist beim ÖBB-Test auch der Verbund, der massiv auf Wasserstoff setzt, mit an Bord.

Alstom will die Tankstellen allen Nutzern öffnen, arbeitet intensiv mit Logistikunternehmen oder dem weltgrößten Hersteller von Müllautos zusammen. Sprotte: „In größeren Mengen ist Wasserstoff preislich absolut wettbewerbsfähig."

# Wasserstoffzug hält Fahrplan ein

ÖBB testen umweltfreundliche Technologien in der Praxis

**Wiener Neustadt.** Die ÖBB suchen fieberhaft nach $CO_2$-neutralen Alternativen für ihre bestehenden Dieselstrecken. Nach dem Akkuzug „Cityjet eco" testet man derzeit eine mit Wasserstoff betriebene Garnitur im Regelverkehr, beispielsweise auf der Aspang- oder der Schneebergbahn. Bewähren müssen sich die alternativen Antriebsmethoden vor allem auf Nebenbahnen, die nicht für eine Elektrifizierung vorgesehen sind.

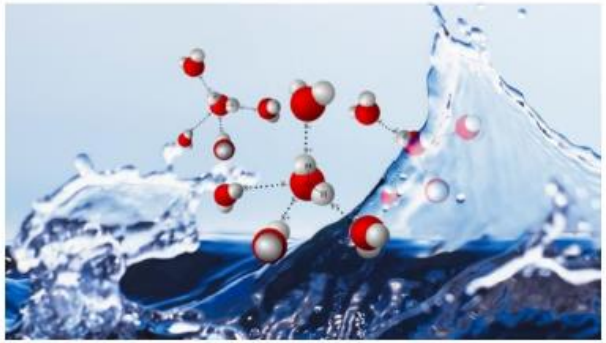
**Die Politik machte sich von der neuen Technologie am Bahnhof in Wr. Neustadt ein Bild**

Am Montag konnten sich der nö. Verkehrslandesrat Ludwig Schleritzko, Staatssekretär Magnus Brunner und Bürgermeister Klaus Schneeberger am Bahnhof in Wiener Neustadt selbst ein Bild von der neuen Technologie machen. Der Wasserstoff-Zug ist ein Prototyp mit 153 Sitzplätzen vom französischen Hersteller Alstom. Was Reichweite und Geschwindigkeit (bis 140 km/h) anbe-

teurer. Noch sind die Betriebskosten um ein Vielfaches höher als bei einem Dieselantrieb. Für die ÖBB dürfe man aber den Umweltgedanken und den Schadstoffausstoß nicht außer Acht lassen.

# Ampeln stehen für Mobilität auf Grün

Schiene



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**Nach dem Probeeinsatz des Akkuzuges der ÖBB ist nun in Niederösterreich ein Testzug mit Wasserstoffantrieb auf den Schienen unterwegs.**

ÖBB's social media channels (Twitter, Facebook and Instagram) have reached **320,000 people** & more than **3.200 likes**.


ÖBB