

# **Deployment of Alternative Fuels Infrastructure Implementing the EU Directive 2014/94/EU on the Alpine territory**

*An overview from the Working Group Transport of the Alpine Convention*

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## Colophon

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## Introduction: the Mandate

During the XIII Alpine Conference held in Torino (21<sup>st</sup> November 2014), the Ministries of the Contracting Parties asked the Working Group Transport (WGT) of the Alpine Convention to carry out a well-defined set of activities aimed at ensuring the movement of intra-Alpine and transalpine transport by increasing the efficiency of transport systems and promoting environmentally-friendly modes of transport (objective d). Among them, activities aimed at promoting the modal shift from road to rail have a preminent – but not exclusive – role. Under the point concerning innovative logistics, a relevant and integrative aspect regards the ***“Analysis of innovative logistics solutions such as rolling highways or solutions for other sustainable long distance alpine crossing, also taking into account the directive on the deployment of alternative fuels infrastructure”***. The delegated experts of the WGT of the Alpine Convention agreed to start the work in this field, under the coordination of the Italian delegation, by undertaking a general overview in the Alpine countries, and realizing a short introductory report, to be submitted and approved at the XV Alpine Conference at Innsbruck (4<sup>th</sup> April 2019).

The **aim** of this report is to provide a general overview about the state-of-the-art of the development of alternative fuels in Alpine countries, taking into account implementation reports of EU Member States in this area as well as the latest developments in this field in non-EU Member States. Some selected best practices, projects and initiatives, carried out at European level, have been also highlighted, in order to facilitate an exchange of best practices and ideas, as well as a more coordinated and coherent development. Finally, the report introduces open challenges and next steps for possible further actions to be undertaken at Alpine and national level by decision-makers and private transport operators.

## Overview: the European framework

In 2015, **transport** was responsible for 27% of the global energy use and for about 26% of the total European Union (EU) greenhouse gas (GHG) emissions. Compared to 1990, this figure is 23% higher. During this period, international air transport has shown the highest increase in GHG emissions: +105%<sup>1</sup>. Anyway, road transport still generates most of the emissions (ca 73% of total transport emissions). This trend makes road transport responsible for about 20% of all GHG emissions produced in the EU<sup>2</sup>. Moreover, transport is responsible for the emissions of other pollutants that affect directly the human health, such as particulate matters and nitrogen oxides (PM<sub>x</sub> and NO<sub>x</sub>). In 2018, the EU has formalized an infraction procedure for high concentrations of such pollutants in several critical environmental areas: some of them are located within the Alpine Space. In this framework, the dissemination of more sustainable fuels and renewable energy sources is a crucial factor encouraged by the EU. Nevertheless, transport remains mainly dependent from oil, with oil-derived fuels accounting for 95% of total energy consumption of the field. According to the last data available, the fraction of renewable energy is still low: about 3% of the road transport fuels are biofuels, while electricity (1.3%) plays an even minor role<sup>3</sup>.

Alternative mobility solutions improve the availability of fuel supply and at the same time open routes for improving sustainability. **Alternative fuels (AFs)** have prominent advantages for reducing the emissions of GHGs and pollutants. Furthermore, they help alleviating the dependence on fossil fuel consumption in the transport sector. However, the switch from current to AFs requires a fuel infrastructure change, since most of the AFs are not drop-in fuels. It is expected that AFs will play a more prominent role in the next decades in view of the EU objectives of gradually substituting fossil fuels with fuels of renewable origin, growth and jobs, competitiveness, transport decarbonisation and the diversification of the energy sources. However, there is currently a lack of attractiveness of fuel alternatives for users and businesses, and no clear market signals concerning the potential of the different AFs. This is also visible when analyzing the diffusion of AFs. In 2012, alternatively fueled vehicles represented 3.4% of the EU car fleet. In 2015, the share of renewable energy in transport in the EU reached 6.7% and it rose up to 7.1% in 2016. These figures are expected to grow in the next years, to achieve the European goal of 10% by 2020. Currently, only Austria, Finland and Sweden have already reached this percentage<sup>4</sup>. On the other hand, the use of AFs in heavy-duty vehicles, maritime and aviation modes is still negligible.

In order to guarantee a further development of AFs, a solid and integrated **policy** framework is required. The most relevant documents produced in last years at the EU level are presented below.

### **White Paper: Roadmap to a single European transport area - towards a competitive and resource efficient transport system, COM(2011) 144 final**

This document, which was published by the European Commission (EC) in March 2011, includes many targets to reduce GHG transport emissions and to develop a resource efficient transport system, e.g. by:

- Halving the use of ‘conventionally-fueled’ cars in urban transport by 2030, phase them out in cities by 2050; achieve essentially CO<sub>2</sub>-free city logistics in urban centers by 2030;
- Shifting 50% of medium distance intercity passenger and freight journeys from road to rail and waterborne transport;

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<sup>1</sup> EEA, 2018. Greenhouse gas emissions from transport. Online at: <https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-10>

<sup>2</sup> EEA, 2017. Monitoring progress of Europe's transport sector towards its environment, health and climate objectives. Online at: <https://www.eea.europa.eu/publications/monitoring-progress-of-europe2019s-transport>

<sup>3</sup> REN21. Renewables 2018. Online at: [http://www.ren21.net/wp-content/uploads/2018/06/17-8652\\_GSR2018\\_FullReport\\_web\\_-1.pdf](http://www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_-1.pdf)

<sup>4</sup> EEA, 2017. Monitoring progress of Europe's transport sector towards its environment, health and climate objectives. Online at: <https://www.eea.europa.eu/publications/monitoring-progress-of-europe2019s-transport>

- Shifting 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors;
- Establishing the framework for a European multimodal transport information, management and payment system by 2020;
- Moving towards full application of “user pays” and “polluter pays” principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments;
- Elaborating a “technology roadmap”, including a sustainable AFs strategy and the appropriate infrastructure;
- Setting a regulatory framework for innovative transport;
- Developing a strategy for near-‘zero-emission urban logistics’ (horizon 2030) under consideration of interdependences with land use planning;
- Establishing multimodal freight corridors for sustainable transport networks and promoting eco-innovation in freight transport.

### **Comprehensive European Alternative Fuels Strategy, COM (2013)17**

This communication of the EC gives an overview about the potential role of AFs. The main conclusions in this document are: “The increasing demand for energy for transport and the need to break transport's dependency on oil can only be met by the comprehensive mix of AFs. The growing interest for natural gas – for maritime and inland-waterways, for long distance road haulage applications, and light duty vehicles - as well as electricity for short distance road transport - indicates that it would be possible, in the short to medium term, to both increase the European supply of energy for transport as well as reduce dependency on imported oil. At the same time, accelerating the development of advanced biofuels – which have potential for all transport modes, but are the only option for aviation - and the progressive build-up of electricity and hydrogen supply networks to provide area wide coverage for road transport are essential for rapid market development. In parallel, research and development of critical components for electric propulsion such as batteries, should deliver significantly improved range, performance, durability and reduced costs for a competitive market offer. This Communication and the accompanying legislative proposal (see directive 2014/94/EU below) catalyze the transformation of Europe's energy supply for transport. With the requirements to establish national policy frameworks for AFs and the build-up of infrastructure with common technical specifications, the EU will complete the policy measures on the development of AFs, from research to market penetration, by ensuring availability of the fuels in the market. No public spending is required for the build-up of AFs infrastructure if the Member States use the wide range of measures available to mobilize private investments cost-efficiently. Union support will be available from TEN-T funds, Cohesion and Structural Funds together with the European Investment Bank lending. A broad basis among industry, policy and civil society should be maintained for the future development of AFs, using the existing European expert groups with participation from industry, civil society, and the Member States. The Commission will continue to support the Member States, review progress and propose any necessary changes and adjustments taking into account technological and market developments.”

Fuel	Mode	Road-passenger			Road-freight			Air	Rail	Water		
	Range	short	medium	long	short	medium	long			inland	short-sea	maritime
LPG												
Natural Gas	LNG											
	CNG											
Electricity												
Biofuels (liquid)												
Hydrogen												

Table 1: Coverage of transport modes and travel ranges by the main AFs. Source: EU Alternative Fuels Strategy, 2013

## Directive 2014/94/EU on the deployment of alternative fuels infrastructure

This Directive (henceforth referred to as “DAFI”) was adopted by the European Parliament and the Council on 29<sup>th</sup> September 2014 following the inter-institutional negotiations. Its objectives are briefly described in the article 1: “This Directive establishes a common framework of measures for the deployment of alternative fuels infrastructure in the Union in order to minimize dependence on oil and to mitigate the environmental impact of transport. This Directive sets out minimum requirements for the building-up of alternative fuels infrastructure, including recharging points for electric vehicles (henceforth, EVs) and refueling points for natural gas (LNG and CNG) and hydrogen, to be implemented by means of Member States' national policy frameworks, as well as common technical specifications for such recharging and refueling points, and user information requirements.” Furthermore, the article 3 requires that “each Member State shall adopt a national policy framework (strategy frame) for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure.”

In synthesis, the final Directive requires Member States to develop national policy frameworks (NPFs) for the market development of AFs and their infrastructure by November 2016<sup>5</sup>, it foresees the use of common technical specifications for recharging and refueling stations and it paves the way for setting up appropriate consumer information on AFs, including a clear and sound methodology to compare prices. Referring to the contents, DAFI “establishes a common framework of measures for the deployment of AFs infrastructure in the EU in order to minimize dependence on oil and to mitigate the environmental impact of transport. This Directive sets out minimum requirements for the building-up of AFs infrastructure, including charging stations for EVs and refueling points for natural gas and hydrogen, to be implemented by means of Member States' national policy frameworks, as well as common technical specifications for such charging and refueling stations, and user information requirements”. This Directive shall foster low-emission fuels such as electricity, hydrogen, compressed natural gas (CNG/Bio-CNG) or liquefied natural gas (LNG/Bio-LNG). The required coverage and the timing by which this coverage must be put in place are presented in Table 2.

Action	Coverage	Timings
Electricity in urban/suburban and other densely populated areas	Appropriate number of publically accessible points	By end 2020
CNG in urban/suburban and other densely populated areas	Appropriate number of points	By end 2020
CNG along the TEN-T core network	Appropriate number of points	By end 2025

<sup>5</sup>At the end of 2017, the assessment was carried out by most of the European countries, except for Greece, Malta, Romania and Slovenia (EC, 2017. Detailed Assessment of the National Policy Frameworks. Online at: <https://publications.europa.eu/en/publication-detail/-/publication/d80ea8e8-c559-11e7-9b01-01aa75ed71a1>)



Electricity at shore-side	Ports of the TEN-T core network	By end 2025
Hydrogen in the Member States who choose to develop it	Appropriate number of points	By end 2025
LNG at maritime ports	Ports of the TEN-T core network	By end 2025
LNG at inland ports	Ports of the TEN-T core network	By end 2030
LNG for heavy-duty vehicles	Appropriate number of points along the TEN-T core network	By end 2025

**Table 2:** Required coverage and timings of the different AFs

### **Alternative Fuels Infrastructure Action Plan, COM (2017, 652)**

In the course of publishing the second Mobility Package on 8<sup>th</sup> November 2017, the Commission launched the Alternative Fuels Infrastructure Action Plan, in which it assessed the NPFs that the Member States had to hand in by November 2016 (see previous subsection). From what it had received, the Commission concluded that the planning in the single NPFs is insufficient for the deployment of AFs infrastructures for an interoperable backbone infrastructure on the TEN-T core network and urban nodes. Only eight of the 25 NPFs were considered sufficient. The largest risks were identified with regard to charging infrastructure for EVs, LNG for maritime shipping and road transport as well as for hydrogen. In the communication, the Commission suggests the Member States consolidate their NPFs, integrate stakeholders in the process and foster cross-border cooperation and be more active in the Sustainable Transport Forum. Furthermore, Member States are urged to specify their targets for the deployment of LNG/Bio-LNG infrastructure and to increase efforts with regard to shore side electricity supply for inland and maritime shipping as well as electricity supply to stationary airplanes at airports.

In addition, the Commission increased European funding for AFs infrastructures on the TEN-T core network and urban nodes. The means for ‘New technologies and innovation in all transport modes’ that are part of the CEF Blending Call were raised from €140 million to €490 million and the deadline for submitting applications was extended until April 2018. In the wake of this increase, European Flagship Projects were launched on four corridors: Atlantic, North Sea Mediterranean, North Sea Baltic and Scandinavian Mediterranean. These were intended to focus on large cross-border projects generating multiplier effects so that they could serve as models for other following projects. Infrastructures for electricity, CNG/LNG and hydrogen were on an equal footing.

### **European Parliament resolution of 25 October 2018 on deployment of infrastructure for alternative fuels in the EU: time to act! (2018/2023(INI))**

On 25<sup>th</sup> October 2018, the European Parliament passed a resolution on the deployment of AFs infrastructure. MEPs demand to globally step up efforts and call on the Commission to bring forward a revision of DAFI, while maintaining the current definition of AFs as listed in Article 2. As part of such a revision, MEPs demand to have the system of NPFs replaced by a more concrete and enforceable framework as the current approach has not yielded satisfactory results, i.e. a comprehensive network of AFs infrastructures across the EU. The paper suggests an annual evaluation of Member States implementation and extends the scope from the TEN-T core network to the TEN-T comprehensive network. Furthermore, the resolution requests that hydrogen infrastructure shall be made mandatory with deployment requirements as for CNG/Bio-CNG, LNG/Bio-LNG and electricity. Lastly, MEPs call on the Commission to provide more of European funding through different instruments at its availability.

## The state-of-the-art of the Alpine countries

### 1) Austria

#### The Austrian policy framework

In Austria, responsibilities for AFs, energy and infrastructure build-up are spreading across at least three different national-level ministries. There is a variety of relevant transport and energy strategies, as well as key partners at all governance levels.

DAFI build-up driven by companies and supported by public funds is well under way (or in the case of CNG already fulfils DAFI requirements). Hence, the purpose of DAFI implementation in Austria is not to build a policy framework from scratch, but rather to reinvigorate existing initiatives on AFs market development in the transport sector and infrastructure build-up, gaining commitments from national, regional and local policy levels, identifying necessary additional measures as well as placing DAFI implementation into the broader context of decarbonisation.

#### Austrian-wide on-line consultation on DAFI implementation and regional workshops

In 2015, AustriaTech on behalf of the Ministry for Transport, Innovation and Technology (BMVIT) implemented a broad participation process on DAFI implementation. The objective of national-level infrastructures and regional workshops as well as the online consultation was three-fold:

- to establish a common understanding that the core of DAFI focuses on decarbonisation with measures in Austria consequently aiming at mitigating the environmental impact of transport – a perspective that goes well beyond the build-up of AFI;
- to state clearly that the Austrian NPF for the development of the market as regards AFs in the transport sector and the deployment of the relevant infrastructure will build on existing national, regional and local strategies;
- to clarify that the NPF will summarize the results of thorough stakeholder consultation as well as planning at different governance levels;
- to establish and confirm a common understanding of necessary policy and administrative measures needed to further clean transport and especially clean vehicles, a process which is on-going at the time of writing.

Embedding DAFI implementation in general transport policy is crucial when decarbonisation of transport is seen as the underlying objective of DAFI. The Transport Ministry considered including the planning procedures of municipalities and regions essential for a successful Austrian implementation. Therefore, the implementation process took care to involve these governance levels many months before the beginning of the actual legislative process.

The Austrian process of DAFI implementation started with an online consultation titled “Clean Power for Transport”<sup>6</sup> conducted by AustriaTech together with the Austrian Association of Cities and Towns from March until May 2015. AustriaTech used an online survey tool, accompanied by a policy brief<sup>7</sup> on the directive, as well as an accompanying document with all questions (in order to allow a consolidated reply per city, region, company, association) and asked regions, cities, associations, companies and citizens to give their views on nine questions, three of which asked to rate measures to support the market development of AFs in transport.

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<sup>6</sup> SmartMobility Austriatech. Online at: <http://www.smart-mobility.at/energieeffizienter-verkehr-2015/>

<sup>7</sup> Bmvit – Austriatech, 2015. Online at: [http://www.bmvit.gv.at/verkehr/elektromobilitaet/downloads/policybrief\\_austriatech.pdf](http://www.bmvit.gv.at/verkehr/elektromobilitaet/downloads/policybrief_austriatech.pdf)

## Information on refueling stations for AFs and loading infrastructure for EVs

In general, in Austria a lot of information about refueling stations for AFs and loading infrastructure for electric mobility is available. On the website of the Austrian Automobile and Touring Club (ÖAMTC), a tool to find all refueling stations for AFs and loading stations is available<sup>8</sup>. The website presents information on ethanol, bio-diesel, CNG, Liquefied Petroleum Gas (LPG), and hydrogen. On this website, in cooperation with e-tankstellenfinder.at, information about loading stations for EVs is provided. Furthermore, a lot of information on loading stations for electro-mobility is provided at several other websites. The main issues are related to the reliability of such information, due to the lack of standardization, as well as the adoption of different definitions (related for example to “public access” of loading stations). Hence, an important step to implement the DAFI is to establish standardized information (see article 3, point 8). In the following sections, more detailed information about each AF is provided.

### ○ CNG and LNG

CNG has already a high availability in Austria with approx. 160 refueling stations for public use and in addition company owned fueling stations for their vehicles<sup>9</sup>. At national level, there are 3,611 vehicles: 2,433 passenger cars, 999 duty vehicles and 171 busses. In addition, 3,584 bivalent cars (gasoline/CNG) circulate in Austria, thereof 807 duty vehicles (data on 31<sup>st</sup> December 2017)<sup>10</sup>. These figures are significantly higher compared to 2008, when there were 1,414 CNG and LPG vehicles all over Austria. Moreover, the number of stations is particularly high compared to the size of the country and it is well above the European average<sup>11</sup>.

LNG is in an early pilot phase. The first LNG refueling station has been opened in late 2017 in Ennschafen, under the management of the RAG Oil Company, which manages also two CNG stations located in Kremsmünster and Gampern. The company plans to enlarge its network of LNG infrastructures, opening in the next future other refueling points along the major transport routes in Tyrol, Upper Austria, Styria and the Vienna area<sup>12</sup>. Overall, further 8 LNG fueling stations are planned in the whole Austria.<sup>13</sup>

In a stakeholder-workshop during the DAFI implementation process, the experts agreed that LNG has ecological advantages, but under current conditions the introduction of a dense supply chain seems not be enough economically efficient in Austria. Some energy companies (RAG, Snam, Engie) are investing to build small-scale facilities to minimize costs of supply-chain for LNG and Bio-LNG. Some experts for inland waterway navigation are rather optimistic for LNG supply for ships and elaborated a “Masterplan for LNG on Rhine-Main-Danube Axis”<sup>14</sup>.

In Austria, some groups promote the advantages of LNG, e.g. the group energy initiative Austria (<http://www.eaustria2020.com>). Moreover, contributions from universities were taken into account<sup>15</sup>.

### ○ LPG

In Austria, only 212 LPG vehicles were circulating at the end of 2017, while 52 refueling stations are available all over the country in 2018. The biggest share of vehicles is constituted by urban busses in Vienna (191), but the public transport company Wiener Linien started replacing the LPG buses by Euro VI diesel buses. Some years ago, there were some initiatives to convert taxis or light duty vehicles to LPG, but now hybrid and battery electric vehicles (BEVs) have replaced these initiatives. As follow up to this version of the report, reasons for declining of LPG use should be clarified.

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<sup>8</sup> ÖAMTC. Online at: <http://www.oeamtc.at/portal/tanken+2500++1004854+11027>

<sup>9</sup> ERDGAS. Online at: <https://www.erdgasautos.at/tanken/tanken-in-oesterreich/>

<sup>10</sup> BUNDESANSTALT STATISTIK ÖSTERREICH, Direktion Raumwirtschaft, Kraftfahrzeuge, Gerda Fischer

<sup>11</sup> IEA-AMF. Advanced Motor Fuels. Online at: [http://iea-amf.org/content/publications/country\\_reports/austria](http://iea-amf.org/content/publications/country_reports/austria)

<sup>12</sup> IEA-AMF. Advanced Motor Fuels. Online at: [http://iea-amf.org/content/publications/country\\_reports/austria](http://iea-amf.org/content/publications/country_reports/austria)

<sup>13</sup> ERDGAS: <https://www.erdgasautos.at/tanken/kraftstoff-erdgas/>

<sup>14</sup> proDANUBE International. Online at: <http://www.prodanube.eu/activities?id=49>

<sup>15</sup> [http://www.tugraz.at/fileadmin/user\\_upload/Events/Eninno2014/files/lf/LF\\_Simmer.pdf](http://www.tugraz.at/fileadmin/user_upload/Events/Eninno2014/files/lf/LF_Simmer.pdf).

## ○ Hydrogen

Four hydrogen refueling stations with public access are in service, some others have limited public access<sup>16</sup>. 21 hydrogen driven vehicles are registered in Austria (August 2018). Also for railways hydrogen and fuel cells are an alternative to diesel propulsion. The Zillertalbahn <sup>17</sup> is realizing the implementation of trains driven by hydrogen in fuel cells and the Austrian federal company (ÖBB) is also interested in this technology and joins research programs.

In the road map of A3PS Austrian Association for Advanced Propulsion Systems<sup>18</sup> to fuel cell and hydrogen, it is written that “Fuel cells (FC) have great savings potential for pollutants and CO<sub>2</sub> emissions – implying the usage of renewable generated hydrogen. In addition, local hydrogen production (without importing energy) is possible. A big chance for the introduction of fuel cell vehicles are synergies between the production of fuel cell vehicles and hybrid electric vehicles (e.g. between Toyota’s fuel cell vehicle Mirai and Toyota’s hybrid electric vehicles). The market introduction of fuel cell vehicles by OEMs (e.g. OMV) started in selected regions in 2014. Austrian companies, research institutions and universities are engaged in the fields of technologies.”

Moreover, a Fuel Cell & Hydrogen Cluster Austria was founded to carry out projects on fuel cells and hydrogen. As follow-up of this report, some of the projects developed within this cluster can be presented. An obstacle for a faster dissemination of hydrogen on the market can be the high costs of refueling infrastructure, the Austria fuel supplier OMV calculated for the stakeholder-workshop on hydrogen in the DAFI consultation process an economic benefit after 10 – 15 years. Therefore, public support is necessary.

## **Action Package to promote electromobility with renewable energy**

Based on their successful e-mobility initiatives of the Climate and Energy Fund, the Klimaaktiv mobile program, the former Austrian Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW, now Federal Ministry for Sustainability and Tourism) together with the BMVIT, joined forces and started the package on 1<sup>st</sup> March 2017. Auto-importers and two-wheeler importers, as well as sports retailers, are partners in funding e-vehicles. The aim is to accelerate the market launch of electro mobility significantly and, in particular, to expand the promotional offerings from the corporate and municipal sector to private individuals. In total, €72 million of funding were available in 2017 and 2018. Additionally, some Austrian Federal States (“Länder”) joined in with extra funding. The package focused on funding e-vehicles, such as e-bikes, e-scooters, e-cars and light duty vehicles, as well as busses. Furthermore, charging infrastructures and investments in e-mobility management, e-fleets and e-logistics were funded. Regulatory framework conditions were set, procurement by the public sector was extended to EVs and research and development was encouraged. Established funding institutions of both ministries were used for administering the action package. As a result of the action package, the number of newly registered e-cars (BEVs) has increased significantly passing from about 4,000 in 2015 to 18,000 in August 2018<sup>19</sup>. Together with the Netherlands, Austria is leader in the EU about the share of e-cars among all newly registered cars.

A new Action Package to promote electro-mobility (*mission 2030 E-Mobilitäts offensive*) has been established for the years 2019 and 2020, with a support of €93 million: €25 million will be provided by the Federal Ministry for Sustainability and Tourism, €40.5 million by the Federal Ministry for Transport, Infrastructure and Technology and €27.5 million by automobile and two-wheel importers, together with sports retailers<sup>20</sup>. Individuals can obtain attractive funding for e-cars and charging infrastructures: up to €3,000 flat-rates per e-car and up to €1,000 per e-scooter. Business, municipalities, administrations are furthermore supported when investing in e-vehicles or infrastructures: €3,000 per e-car, €60,000 per e-bus and up to €500 per e-cargo bike. Charging stations are supported up from €200 to public accessible fast loading stations (more than 43 KW) to €10,000. In addition to

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<sup>16</sup> Mein H2.LIVE. Online at: <https://h2.live/>

<sup>17</sup> Zillertalbahn. Zug – bus – dampf. Online at: [www.zillertalbahn.at](http://www.zillertalbahn.at)

<sup>18</sup> A3PS, 2015. Eco-Mobility 2025plus Roadmap. Online at: [https://www.a3ps.at/sites/default/files/images/downloadfiles/a3ps\\_roadmap\\_eco\\_mobility\\_2025plus\\_0.pdf](https://www.a3ps.at/sites/default/files/images/downloadfiles/a3ps_roadmap_eco_mobility_2025plus_0.pdf)

<sup>19</sup> Bmvit, 2018. ELEKTROMOBILITÄT IN ÖSTERREICH ZAHLEN & DATEN. Online at:

[https://www.bmvit.gv.at/verkehr/elektromobilitaet/downloads/oesterreich2018\\_de\\_3q.PDF](https://www.bmvit.gv.at/verkehr/elektromobilitaet/downloads/oesterreich2018_de_3q.PDF)

<sup>20</sup> More information are available at <https://www.bmvit.gv.at/verkehr/elektromobilitaet/downloads/emoboffensive.pdf>

BEVs, plug-in hybrid electric vehicles (PHEVs) are also funded. Financial support is related to electricity (or hydrogen) based on 100% renewable energy sources.

## 2) France

### Background

The French public policy on transport uses energy transition as a strategic focus, in particular via the framework set out in the Act on Energy Transition for Green Growth (AETGG). Its art. 40 provides a definition of the strategy for the development of clean mobility, attached to the French Multiannual Programme for Energy (PPE - Strategic orientation document applied to Energy).

The strategy for the development of clean mobility includes improving energy efficacy of the vehicular fleet, modal shift, developing collaborative modes of transport, increasing road-haulage loading rates, developing low emission vehicles and deploying the related fueling infrastructure.

Regarding AFs, the State wishes to encourage diversity in the transport energy mix on a short to medium term regardless of mode and, in particular, by promoting electro-mobility, NGV (as a transitional solution allowing for the development of bio-NGV) and bio-NGV. On the longer term, research and development should generate additional solutions such as third generation biofuels and hydrogen-powered mobility.

On 15<sup>th</sup> December 2016, a first draft of the strategy for the development of clean mobility was presented to stakeholders. Its review is part of the MPE consultation process, launched by the end of that year. This first draft presents elements drawn from a situational analysis of the development of AFs. It offers a number of scenarios consistent with the objectives set by the AETGG, on AF demand (provisional at this stage). It recaps on the on-going efforts and suggests new actions. All of these features, discussed in this paper, will serve to draw up the national action framework called for by European Directive 2014/94/EC.

### Information on refueling stations for AFs and loading infrastructure for EVs

- LPG

All over the French territory, an amount of ca 1,900 refueling stations of LPG are available<sup>21</sup>.

- Hydrogen

19 hydrogen-refueling stations exist in France, 5 of which located in the area of Paris. Eight of them are not public accessible<sup>22</sup>.

- Electromobility

On 31<sup>st</sup> December 2014, there were close to 10,000 publicly accessible charging points. The Government has set itself the target of nearly 20,000 additional publicly accessible charging points by the end of 2016. The AETGG provides for at least 7 million charging points to be installed on parking spaces by 2030.

Under the national strategy for the development of electromobility, the French State appraised and approved two projects for the national deployment of charging points for EVs and PHEVs. Working through ADEME, the French Environment and Energy Management Agency, the State financed €50M in projects initiated by local and regional governments, for the construction of charging infrastructure. Under the 'Investment for the Future' programme, the State will also support manufacturers by co-financing projects of national scope.

The Green Paper – a reference guide for local governments and economic players has been updated and its technical section supplemented. It lists recommendations on how to simplify charging point access, streamline their use and form, register each charging point on a national website and generalize interoperability. This new

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<sup>21</sup> MyLPG.eu. Online at: <https://www.mylpg.eu/stations/france/>

<sup>22</sup> TÜV SÜD. Online at: <https://www.netinform.net/H2/H2Stations/H2Stations.aspx?Continent=EU&StationID=453>

technical guide for the design and lay-out of charging point infrastructure for EVs and PHEVs, updated in January 2015, provides recommendations on standards for mains sockets (slow speed, high speed), their design, maintenance, electronic payment and roaming.

o CNG and LNG

In France, the use of LNG as marine fuel has already been enshrined in a National Orientation Scheme, pursuant to the commitments made by the Minister of Ecology, Sustainable Development and Energy.

As for road infrastructure, France offers close to 300 NGV stations, mostly private (245 private stations, 40 multi-stakeholder stations publicly accessible, 2 stations dedicated specifically to public access). The French geography of refueling stations is evolving and a number of projects are being implemented. They target the deployment of LNG (around 15 stations already in operation) and CNG fueling stations, dedicated mostly to road-haulage professionals who see NGV as the most promising alternative to diesel fuel. Marseille VOS is an important dedicated port hub for supply, storage and distribution of LNG for transport.

### **Scenarios on the demand for AFs**

Two contrasting scenarios about the evolution of energy needs in the transport sector are proposed: a lower-end and a higher-end scenario on the trend in energy needs. Both are based on the following criteria:

- Technical and economic uncertainties;
- Requirements for secure procurement, in particular, instant balance between electricity offer and demand;
- Objectives set looking to 2020 and 2030;
- Environmental impacts.

Each of these two scenarios includes a different trend in electric and gas consumption by road-haulage professionals.

### **Actions for the development of AFs and the deployment of related infrastructures**

The draft strategy for the development of clean mobility recaps on on-going actions for the development of AFs. It also presents new proposals.

On-going actions:

- B8 diesel fuel sale authorization and market offer since 1<sup>st</sup> January 2015 in France;
- Publication of a decree setting the lists of conventional and of advanced bio-fuels as well as the rules applicable to double-counting;
- With a view to future generalization, use of the results from the experimentation in the Rhône-Alpes Region on infrastructure installation to boost the use of gas as fuel;
- Publication of a National Orientation Scheme for the deployment of LNG as marine fuel;
- Publication in 2016 of the development plan for the storage of renewable energies via carbon-free hydrogen;
- Support of pilot operations to install electric mains at port berths for vessels.

New actions (some of which call for prior validation of the strategy):

- Authorization for ED95 fuel which contains 95% of ethanol of agricultural origin, to be used for heavy duty vehicles of captive fleets, starting in January 2016;

- SP95-E10 petrol to be taxed less in order to encourage use of fuel with a high bio-fuel content of agricultural origin;

In 2016, the drafting of the national action framework under the Directive on the deployment of AFs infrastructure to be submitted to the EC before 18 November 2016 (see below) included:

- In the light of the national action framework on AFs, and of the appraisal of previous programs, to define proposals for re-launching a program to support local authorities in their electrical charging network projects;
- To study financing conditions for infrastructures required by carbon-free vehicles;
- To encourage deployment of B10 diesel market fuel providing the corresponding European standard is adopted in 2016.

### **Link between the strategy for the development of clean mobility and the national action framework required under DAFI**

The strategy for the development of clean mobility provides the basis, particularly in terms of demand, that will enable the future action framework for the development of a market for AFs and the deployment of corresponding infrastructure, as set out in DAFI.

This framework was drafted in 2016 with stakeholders and particularly with local and regional governments. It will involve defining territories and priority networks for recharging or refueling infrastructure. The following parameters will be taken into account:

- feedback on existing infrastructure, whether for NGV (i.e. on-going experience in the Rhône-Alpes Region) or for hydrogen as in Germany;
- individual and collective needs in AFs;
- investment costs;
- the types of fuels (electric; LNG; CNG; Biomethane; LPG; hydrogen) for which network connection constraints vary.

## **3) Germany**

The German road transport sector is currently still dominated by oil-based fossil fuels. Biofuels and LPG are established alternatives. In 2017, the share of AFs based on renewable energy sources was 5.2%, remaining constant compared to 2016.<sup>23</sup>

### **Information on refueling stations for AFs and loading infrastructure for EVs**

#### ○ Electromobility

So far, EVs are being charged predominantly at home. In mid-2018, 13,500 recharging points were publicly accessible in Germany<sup>24</sup>. The Ordinance on Charging Infrastructure, which entered into force on 17<sup>th</sup> March 2016, contains minimum requirements regarding the deployment and operation of publicly accessible electric vehicle recharging points plus clear and binding rules governing charging plug standards, thus transposing the provisions of Directive 2014/94/EU. The German Federal Ministry of Transport and Digital Infrastructure (BMVI) has launched a funding guideline on charging infrastructure that seeks to increase the number of

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<sup>23</sup> Umwelt Bundesamt - UBA. Online at: <https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen?sprungmarke=verkehr#verkehr>

<sup>24</sup> BDEW- Bundesverband der Energie- und Wasserwirtschaft e.V.

publicly accessible normal charging points to 36,000 and the number of fast charging points to 7,000 until 2020. The volume of this funding guideline amounts to €300 million, of which roughly €70 million had been approved for funding charging infrastructure as of the first two calls that were launched on 15<sup>th</sup> February 2017 and 14<sup>th</sup> September 2017, respectively. In addition to the federal program, the Bavarian state government has set up its own state support program in order to promote the development of a Bavarian-wide charging infrastructure.

#### ○ CNG and LNG for road transport

As far as CNG is concerned, the existing infrastructure of roughly 880 CNG stations in 2018 already provides coverage that complies with the Directive. Therefore, no further infrastructure build-up had been planned in the NPF. With regard to LNG for road transport, the NPF establishes the goal to cover the TEN-T core network for use of LNG-powered vehicles, i.e. less than ten stations will be needed. The first LNG refueling point for heavy road haulage vehicles have commenced operation at the end of 2016.

In order to support heavy road vehicles powered by AFs, the German parliament approved the removal of tolls applied to AFs trucks (first country in Europe). The planned regulation will enter into force on the first of January 2019. In addition, new public incentives fostering the purchase of LNG trucks are in force (€12,000 for each LNG truck).

Ships are supplied with LNG in seaports and inland ports by means of "truck-to-ship" bunkering. There are currently no LNG terminals in German ports but facilities for refueling with LNG are currently in place in the waterborne transport sector, including at the ports of Mannheim, Brunsbüttel, Bremerhaven, Hamburg and Rostock, although the ships are still bunkered from a truck. An LNG terminal has not yet been installed in Germany. Nonetheless, a funding guideline equipping and/or converting conventionally-fueled maritime ships with LNG propulsions has been launched on 17<sup>th</sup> August 2017 as part of the Mobility and Fuel Strategy. The latter aimstoprovideinformationandorientationonthecurrentstatus,opportunities and challenges of AF options and innovative drives by funding pilot projects in this sector<sup>25</sup>. In the area of LNG for shipping, the approach consists of increasing demand for the fuel and subsequently scaling up infrastructure deployment.

#### ○ Hydrogen

The infrastructure for hydrogen is currently being deployed. In November 2018, 53 refueling points had been completed and were in operation. An initial network of around 100 refueling points will be established in Germany by 2020 regardless of the number of fuel cell electric vehicles (FCEVs) on German roads. The NPF states the target of 400 refueling stations until 2025. However, this number will depend on the uptake of FCEVs.

## 4) Italy

### Background

The Ministry of Transport and Infrastructure (MIT) - in consultation with the Ministry of Economic Development (MISE) - had the formal responsibility of preparing a legislative decree of "transposing" the DAFI, which defines the Italian National Strategic Plan for the development of the AFs infrastructure. The National Plan should provide clear indications about the following actions:

- develop a legislative framework and proposals for updating;
- define the objectives to be pursued about environmental standards the security of supplies;
- identify the most suitable financing solutions to the Italian national context;
- determine the most appropriate approach for the development of hydrogen mobility;

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<sup>25</sup> BMVBS (2013), p. 6



- analyze the costs and benefits for the country system;
- be consistent with the guidelines for the development of European TEN-T corridors and with the priorities identified by the Fuel Cells Hydrogen Joint Undertaking (FCH JU).

As envisaged by such Directive, the Plan covers the supply infrastructure, storage, distribution and supply of LNG, CNG, hydrogen and the electricity recharging systems for electric vehicles. The final version of the plan (“Quadro Strategico Nazionale”) has been approved through the Legislative Decree Decreto Legislativo 16 dicembre 2016, n° 257. It specifies where, how and when carrying out an adequate number of refueling infrastructures for road (cars, buses and trucks), rail (tram and trains) and water transport (ferries) will be implemented.

Furthermore, the last National Energy Strategy (*strategia energetica nazionale*, SEN) has been approved, giving the priority for LNG mobility for trucks and ships, Bio-methane and electric mobility for buses and vans in towns and metropolitan areas. In accordance, MIT is supporting the purchase of new trucks powered by AFs with significant incentives. Finally, in March 2018, a new inter-ministerial decree boosting the implementation of bio-methane has been approved<sup>26</sup>.

### Information on refueling stations for AFs and loading infrastructure for electric vehicles

#### ○ LNG and CNG

Italy is the country with the stronger CNG network in Europe, more than 1,000 public facilities.

Referring to the LNG, a Strategic National Plan was approved in 2015, forecasting around 35 LNG refueling stations for trucks within 2020, starting from the current facilities already in operation in 29 locations, above all in the Center-Northern Italy. New LNG hubs are scheduled in the harbors of Livorno and Ravenna. The public gas-company SNAM scheduled to build 8 new small-scale facilities as specialized hub to generate bio-CNG and bio-LNG for road transport. At the alpine level, the bio-LNG refueling station of Gera Lario has been opened in Valtellina; the refueling station of Sadobre along the Brenner corridor has been opened in October 2018 and the refueling station of Bainasco (Turin) has been opened in November 2018. In terms of vehicles, more than 1,000 LNG trucks are registered. This data is influenced by the high growth of this sector in the first part of 2018: +105% in terms of new registered LNG trucks compared to the previous year (504 new units in 2018 compared to 280 in 2017). LNG trucks now represent ca 5.4% of the total Italian HGV fleet (compared to 3% in 2017) and are expected to reach 1,000 units by early 2019.<sup>27</sup> To this aim, MISE is implementing a special public fund to boost the startup of the LNG infrastructure network. In last years, the Italian Government supported the purchase of new LNG and CNG trucks with dedicated incentives (€20,000 per each LNG truck – €8,000 per each CNG truck). Incentives are also in force for CNG vans in 3 regions of the Alpine Space (Lombardy, Piedmont and Veneto).

#### ○ LPG

The Italian government has traditionally promoted the use of LPG through fiscal incentives, initially to provide an outlet for surplus volumes of LPG from the large domestic refining industry, though Italy has since become an importer of LPG. In this respect, currently there are about 4,600 LPG stations all over Italy.<sup>28</sup> In recent years, environmental concerns have been the main driving force behind LPG policies. The Italian government and local authorities encourage LPG use through a mixture of policies, including favorable fuel taxes, incentives for clean vehicles and traffic regulations. LPG currently enjoys a substantial excise tax advantage. The Italian government also encouraged LPG and other clean fuels through vehicle incentives. Grant schemes for the conversion of an existing vehicle or the purchase of an OEM LPG vehicle have been in place for several years. In May 2014, grants were reintroduced for the purchase of LPG and other AF vehicles on condition their CO<sub>2</sub>

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<sup>26</sup> Decreto interministeriale 2 marzo 2018 - Promozione dell'uso del biometano nel settore dei trasporti

<sup>27</sup> Federmetano 70. Online at: <https://www.federmetano.it/2018/07/11/mezzi-pesanti-alimentati-a-metano-liquido-e-la-mappa-distributori-ling/>

<sup>28</sup> MyLPG.eu. Online at: <https://www.mylpg.eu/stations/italy/>

emissions do not exceed 120 grams per km for businesses and 95 g/km for private motorists. Many LPG vehicles also benefit from a lower annual vehicle road tax, which depends on engine power and CO<sub>2</sub> emissions<sup>29</sup>.

○ Electromobility

The National Plan for electric vehicles charging infrastructures was signed on 29<sup>th</sup> July 2014. The plan develops the charging network to get to over 130,000 public charging stations by 2020, and has been framed in cooperation with the major sector stakeholders, including manufacturers, grid operators, utilities, fleets, local authorities, and industrial associations. The following incentives were introduced:

- Electric vehicles are exempt from the annual circulation tax (ownership tax) for a period of five years from the date of their first registration. After this five-year period, they benefit from a 75% reduction of the tax rate applied to equivalent petrol vehicles in many regions.
- Non-financial policy measures: free parking, access to restricted areas (such as city centers)
- Financial support at purchase (once-only support): total funds €120 Mio.

As a partial result of this plan, in 2018 about 2,800 normal power and 600 high power charging infrastructures are public available all over the country (2.35% of the entire EU), while other ca 7,000 existing charging points are private.

Four regions of the Alpine Space (Lombardy, Piedmont, Trentino-Alto Adige and Veneto) support the purchase of Full-Electric and Hybrid vehicles with dedicated incentives. For instance, the Autonomous Province of Bolzano supports both private citizens and companies in purchasing EVs offering facilities up to €4,000. A similar approach has been adopted by the Autonomous Province of Trento in 2017, investing €20 million in facilities for the purchase of e-vehicles in the next 5 years.

○ Hydrogen

For the Italian institutional stakeholders, the hydrogen for mobility will be relevant referring to a long-term horizon, above all for urban mobility. In the field of city logistics and passenger LPT, the hydro-CNG technology can show positive development perspectives, in the mid-long term.

The initiative "Mobilità Idrogeno Italia" brings together key stakeholders in the field of mobility in hydrogen and fuel cells within H2IT, the Italian Association of hydrogen and fuel cells. The strategic Committee of such initiative aims to assist the public competent authorities in establishing a national plan for the development of hydrogen refueling infrastructure for transport by 2025. Currently, two refueling stations for hydrogen are active in Italy, in Bolzano and Milan. Further fueling stations for hydrogen vehicles are planned in Trento, Verona and Carpi (along the A22 highway), as well as in Taggia (Liguria) close to the IT-FR border.<sup>30</sup>

## 5) Slovenia

The Slovenian Ministry of Infrastructure strongly supports the use of electric vehicles. Slovenia is one of the first countries in the EU, which has covered the motorway network with high-speed bottling plant for electric vehicles. Precisely, 26 fast charging stations were set up in 2015 along Slovenian highways by the company SODO, thanks to the project "Central European Green Corridors".<sup>31</sup>

In the context of network interoperability, it is ensured and enabled hosting system. Fast bottlers have a high standard of technology, which ensures the compatibility with most electric vehicles on the market. On the universal charging stations can be all the batteries of electric cars for mass sale recharged to 80 percent capacity in under half an hour.

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<sup>29</sup> WLPGA (2014), Autogas Incentive Policies.

<sup>30</sup> TÜV – SÜD. Online at: <https://www.netinform.net/H2/H2Stations/H2Stations.aspx?Continent=EU&StationID=453>

<sup>31</sup> SODO – Electricity distribution system operator. Online at: <https://en.sodo.si/fast-charging-stations/about-cegc-project>

In Slovenia, transport consumes about 40% of the energy, while it is almost exclusively on imported petroleum products. With the use of AFs, especially electricity and natural gas, it can be possible to improve safety and reduce the negative effects on the environment and health, as well as to increase the quality of life in urban centers.

Transport development strategy until 2030 and with a view to 2050 in addition to the development goals of transport infrastructure also includes the implementation of the vision of sustainable mobility of the population and the care economy. It provides for the electrification of transport, which is aimed at the greening of transport and the transition to a carbon-free society and to reduce dependence on fossil fuels. The introduction of alternative low-carbon fuels with a focus on electric mobility is a priority in the guidelines for the preparation of long-term development strategy in the field of energy - energy concept Slovenia.

- Electromobility

Regardless of the plans and needs of Slovenia and its capital, the number of electric vehicles (EVs) on the streets and parking lots in Ljubljana will gradually increase. Besides global reduction in GHG emissions, electromobility also brings important local benefits such as the reduction of road noise and air pollution. The Ljubljana municipality administration is aware of both advantages of electromobility and risks of a passive approach to massive introduction of electric vehicles.

Therefore, the City of Ljubljana decided to elaborate and adopt a “Sustainable Electromobility Plan” (SEP) which explains the advantages of electromobility, highlights the links between EVs and the supporting infrastructure, and puts forward strategic starting points and proposals for fast, safe and organized adoption of electromobility in Ljubljana. In addition, several workshops were organized and promotional materials were distributed among the citizens in order to promote electromobility and raise public awareness of its advantages. SEP has been elaborated and discussed at a workshop in July 2012, which has been organized with the goal to collect public responses to SEP and in general to the municipal plans related to electromobility. In May 2013, the Plan has been accepted by the City Council and hereby, electromobility became a part of the strategy for a better quality of life in the city. The measures have also been presented to representatives of other major Slovenian cities in order to encourage them to introduce similar actions in their cities.

SEP provides a framework for sustainable development of electromobility in Ljubljana by introducing strategic electromobility measures and enhancing synergies between them. A single point of contact will provide a direct interface between citizens, businesses and public services, thus accelerating a balanced evolution of electromobility in the city. The dissemination activities will raise public awareness of the advantages of electromobility, stimulate the use of environmentally friendly vehicles and eliminate the barriers currently discouraging citizens to use new technologies in personal transport. The successfully implemented measures will result in an increased share of electric vehicles on the streets of Ljubljana and consequently in reduced negative impacts of transport on the citizens’ quality of life. A successful implementation will also contribute, on a local level, to tackle the global climate change.

- LNG

In 2017-18, 4 new LNG refueling stations for trucks were launched between Ljubljana and Maribor. The Ljubljana facility was officially launched with the presence of the European Commissioner for Transport, Violeta Bulc. The LNG infrastructures in Slovenia can be very relevant to support the growing freight traffic East-West, allowing the development of AFs for the transport of goods by road.

- Hydrogen

Among AFs, hydrogen still plays an ancillary role: a refueling station for hydrogen was opened in Lesce, in Upper Carniola, in 2013. However, it was then closed and currently it is not operative. Nevertheless, a new

station is now planned to be located in Lower Styria, in the city of Velenje in order to encourage the use of this AF.<sup>32</sup>

## 6) Switzerland

As a non-EU-Member State, Switzerland is not bound to DAFI, nevertheless as a central Alpine country and in the perspective of fulfilling the CO<sub>2</sub> emission reduction targets, Switzerland is implementing the so-called energy strategy 2050<sup>33</sup> which includes electromobility and alternative fuels/propulsion systems for the mobility sector<sup>34</sup>.

The Swiss Confederation is taking a number of different measures to promote electromobility in Switzerland. As electric vehicles do not need conventional fuels, they are not subject to mineral oil taxes and surcharges. In addition, they are exempt from vehicle duty (4% of the value of the vehicle). Since taxes on vehicles in Switzerland are levied by the cantons, subsidies in this area come under cantonal authority. Almost all the cantons offer either a short-term or a permanent reduction in vehicle tax for particularly fuel-efficient, low-emission vehicles. In some cases, these vehicles are granted full exemption from the vehicle tax. Furthermore, electric vehicles benefit from the current CO<sub>2</sub> emission regulations for cars. Support is also available for research, pilot and demonstration projects, model projects and information as well as advisory services.

In May 2015, the Federal Council issued a report on electromobility, which specifies additional measures for improving the conditions for electric-powered vehicles in Switzerland<sup>35</sup>. As part of the first package of measures for the Energy Strategy 2050, the Council is proposing measures to speed up the market penetration of electric cars, such as a further tightening of the CO<sub>2</sub> regulations for cars to reduce emission levels to 95 g CO<sub>2</sub>/km by 2020. An increased cooperation among different stakeholders is essential in order to accelerate the market penetration of electric-powered cars. Therefore, a roundtable on promoting e-mobility was organized on 28<sup>th</sup> May 2018 by Federal Councilor Doris Leuthard. The stakeholders (automotive sector, energy providers, public authorities, trade associations, etc.) agreed to develop a joint e-mobility roadmap and signed the final roadmap jointly on December 18, 2018: the target of electric-powered cars is 15% market share of newly registered cars by 2022<sup>36</sup>.

### Information on refueling stations for AFs and loading infrastructure for electric vehicles

- Natural gas/biogas/synthetic CO<sub>2</sub>-neutral methane

Switzerland has a nationwide network of around 140 natural gas fuel stations. This network will be extended by the industry to meet demand.

- Electromobility

The Federal Council recently introduced improved guidelines for constructing a fast-charging infrastructure for electric-powered cars along Switzerland's motorways. To achieve this, the Federal Roads Office (FEDRO) has brought together the owners of motorway service areas (cantons), concession holders, associations and other stakeholders from the private sector. However, the development of a fast-charging infrastructure is not a task for the public sector. This is why the Swiss Confederation does not intend to remain involved in the implementation

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<sup>32</sup>H2tools. Hydrogen tools. Online at:

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiXjr203bDeAhUJBiwKHXr7DQAOQFjAAegOICBAC&url=https%3A%2F%2Fwww.h2tools.org%2Fsites%2Fdefault%2Ffiles%2Fdata%2Fsource%2FInternational%2520Hydrogen%2520Fueling%2520Stations.xlsx&usq=AOvVaw2qHwTw1dkOIX2E1GNe86k4>

<sup>33</sup> <http://www.bfe.admin.ch/energiestrategie2050/index.html?lang=en>

<sup>34</sup> General information: <http://www.bfe.admin.ch/energieeffizienz/07032/07033/index.html?lang=en>

<sup>35</sup> Admin.ch, 2015. Bericht in Erfüllung der Motion 12.3652 Elektromobilität. Masterplan für eine sinnvolle Entwicklung. Online at: <http://www.news.admin.ch/NSBSubscriber/message/attachments/39400.pdf>

<sup>36</sup> Admin.ch. Online at: <https://www.admin.ch/gov/de/start/dokumentation/medienmitteilungen.msg-id-70904.html>

process (not even in the form of a public-private partnership). Fast charging points are now in operation at 24 out of the 59 motorway service stations in Switzerland (15 more are planned)<sup>37</sup>.

In addition, from 1<sup>st</sup> January 2018 on, fast charging points may be installed and operated at roadside rest areas. FEDRO has started an application process for approximately 100 rest areas in five lots. The cost of providing enough power is financed in advance by FEDRO. The operators pay these investments back from their revenue. Together with the fast charging stations at motorway service stations resulting from private initiatives, Switzerland will have one of the densest fast charging networks for national and transit traffic in the near future.

Until the end of 2019, the Swiss Federal Office of Energy (SFOE) is promoting a dialogue with stakeholders (cantons, cities, municipalities, associations, grid operators, vehicle manufacturers, researchers, etc.) in the charging infrastructure sector in order to resolve issues relating to data, regulation, coordination and planning, and to develop new solutions. The aim is to extend the support for coordinating and for planning to a more wide-ranging charging infrastructure beyond the network of motorways. Follow-up projects have already been launched (e.g. a guideline for e-mobility infrastructure in buildings, national data infrastructure to provide open data on charging infrastructure, a guideline for municipalities).

- Hydrogen

The Swiss Confederation is supporting a wide variety of research and development projects, together with pilot and demonstration projects. For example, from 2011 through 2017, the SFOE funded a pilot project involving fuel cell buses and the first hydrogen fuel station in the Swiss city of Brugg<sup>38</sup>. More fuel stations have been built with federal support, including in particular the first public 700 bar facility<sup>39</sup>, while others are in planning. As part of this effort, the industrial production of hydrogen, its distribution to a commercial fuel station, and its use in hydrogen fueled cars and trucks have been demonstrated with SFOE support. A private sector initiative has emerged aiming at rolling out a hydrogen supply chain that includes production plants, a nationwide fuel station network, and commercially available vehicles for freight and passenger transport.<sup>40</sup> In addition, the Swiss Confederation is promoting a dialogue with stakeholders in this area in order to identify the existing obstacles (safety factors, approval processes, market issues, etc.) and to understand how using this technology could best be backed.

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<sup>37</sup> Admin.ch. Online at: <https://www.astra.admin.ch/astra/de/home/themen/elektromobilitaet/schnellladenetz-nationalstrassen.html>

<sup>38</sup> More info available in the “Desk Research Report for environment-related freight transport issues in the Alpine area” implemented in its final draft by the Working Group on 'Environmental Indicators and the Impacts of Traffic Management Systems and other Measures on the Alpine Environment' (EnvALP), April 2018.

<sup>39</sup> Coop. Die erste öffentliche Wasserstofftankstelle der Schweiz. Online at: [https://h2energy.ch/wp-content/uploads/2017/06/Factsheet\\_Tankstelle\\_D.pdf](https://h2energy.ch/wp-content/uploads/2017/06/Factsheet_Tankstelle_D.pdf)

<sup>40</sup> Förderverein H2 Mobilität Schweiz. Online at: <https://h2mobilitaet.ch/>

## Best practices

### European initiatives

In the recent years, many projects and initiatives of interest have been carried out, financed by the EU through specific funds coming from different transport-related programs, firstly the CEF (Connecting European Facilities) Programme for Transport. Some of them are still ongoing, or just recently started, but they certainly show the growing interest about topics related the diffusion of AFs across EU and the need of a balanced infrastructure among Member States. A non-exhaustive list of most well-known initiatives is listed here.

#### ○ GAINN – Gas Innovation Network

The GAINN (GAs INnovation Network) project participates in the European tender for the granting of funds under the CEF<sup>41</sup>. The main objective is to promote the development of LNG as fuel and related infrastructure in the Mediterranean, through the creation of feasibility studies, design and pilot initiatives. The project involves a consortium of port authorities, ship-owners, gas suppliers and infrastructure providers from Italy, France, Malta, Spain, Portugal, Slovenia, Croatia and Cyprus. The coordinator of the project is the Spanish Port Authority of Valencia; In Italy, the initiative is coordinated by the MIT, in collaboration with the Italian Naval Registry (Registro Italiano NAvale, RINA).

#### ○ GasHighway project

The project<sup>42</sup> aims to promote the uptake of gaseous vehicle fuels (biomethane and CNG), by creating a network of refueling stations for biomethane and CNG spanning Europe from the north, Finland and Sweden, to the south, Italy (the "GasHighWay"). This objective is reached by involving refueling stations owners, operators of vehicle fleets, existing and potential biogas producers and municipal and regional authorities. The project activities include:

- promoting the implementation and expansion of distribution systems for gaseous vehicle fuels by e.g. mapping the optimal locations for gas refueling stations and supporting the expansion of networks of gas refueling stations;
- promoting the uptake of gas vehicle fleets by offering information and support to operators of potential gas vehicle fleets - providing information and support to potential and existing biogas producers in order to boost the investment projects;
- creating a roadmap for the European GasHighWay, and - raising the awareness on the use of these AFs.

#### ○ Hyfive project

HyFIVE is an EU FP7 project including 15 partners who deploy 110 FCEVs from the five global automotive companies who are leading in their commercialization (BMW, Daimler, Honda, Hyundai and Toyota). Refueling stations configured in viable networks are developed in three distinct clusters by deploying six new stations linked with 12 existing stations. The project's scale and the pan-European breadth allow to tackle all of the final technical and social issues which could prevent the commercial roll-out of hydrogen vehicle and refueling infrastructure across Europe. Research tasks ensure that these issues are analyzed and that the learning is available for the hydrogen community across Europe.

#### ○ LNG Blue Corridors

LNG Blue Corridors is an international research and demonstration project that intended to improve the knowledge and awareness of LNG for medium and long-distance transport. 12 LNG Blue Corridors unites/mobilizes the critical mass (expertise of industrial partners and research institutes) in LNG transport and infrastructure technology. It also represents the first phase in the staged roll out of LNG refueling stations and a

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<sup>41</sup> European Commission. CEF Transport. Online at: <https://ec.europa.eu/inea/connecting-europe-facility/cef-transport>

<sup>42</sup> European Commission. Intelligent energy Europe. Online at: <https://ec.europa.eu/energy/intelligent/projects/en/projects/gashighway>

broad market development for heavy-duty vehicles running with LNG. The project's aim is to establish LNG as a real alternative for medium & long distance transport - first as a complementary fuel and later as an adequate substitute for diesel. To accomplish its objective it has defined a roadmap of LNG refueling stations along four corridors covering the Atlantic area, the Mediterranean region and connecting Europe's South with the North and its West and East. In order to implement a sustainable transport network for Europe, the project has set the goal to build approximately 14 new LNG or L-CNG stations, both permanent and mobile, on critical locations along the Blue Corridors whilst building up a fleet of approximately 100 Heavy Duty Vehicles powered by LNG. The project, whose duration is between 2013 and 2017, is carried out by 27 partners from 12 EU Member States.

○ Project “Crossing borders”

The Research & Development project Crossing Borders connects the four e-mobility regions Munich, Salzburg, Vienna and Bratislava and builds on development results of the R&D project EMPORA as well as on the transnational project VIBRATE. The EC TEN-T funded project Central European Green Corridors (CEGC) builds on the knowledge generated in Crossing Borders. The aim of the project is to develop and test intelligent, cross border e-mobility systems and services in the project corridor from Bratislava via Vienna to Munich. The focus of the project lies on the deployment of more than 20 high power recharging stations in the project corridor. These stations will be integrated into cross border roaming and CRM systems. This enables customers to use cross border e-mobility services. The project, whose duration is between July 2013 and June 2016, is carried out by 13 project partners from Austria, Germany, Slovakia and France.

○ Project “Central European Green Corridors” (CEGC)

The project creates a multi-modal, cross-border network along TEN-T corridors by demonstrating high power recharging points for EVs to enable long distance driving along the TEN-T network in Austria, Slovenia and Slovakia, including the cross border sections to Germany and Croatia.

CEGC is driven by the emerging need for decarbonisation and electrification of EU road transportation and by the related interoperability and synergy opportunities. The project aimed to deploy infrastructure in Central Europe, making driving of EVs a viable alternative to vehicles with internal combustion engines. CEGC focuses on the roll out of the technologies ready for mass market deployment in the short term (high power charging for EVs) and additionally carry out studies examining the preparation required for the roll-out that will be ready in the mid-term (future customers, clean energy for transport, network planning) thereby opening the market for an even larger customer base in the future.

The project wanted to deploy 115 high power charging stations in Austria, Croatia, Germany, Slovakia, and Slovenia to create a recharging network with country-wide coverage in Austria, Slovenia and Slovakia. A limited number of the high power charging stations will provide connections from this network to major cities in Croatia (Zagreb) and Germany (Munich). At each charging station, service for vehicles with AC/Type 2, DC/Combo 2 as well as DC/CHAdeMO interfaces will be provided, thus being compatible with most EVs with high power charging technology on the market. All charging stations will form one interoperable network. The project, whose duration is until 2015, was carried out by VERBUND AG (in the role of coordinator), Bayern Innovativ, BMW, Municipality Zagreb, Government of Slovenia GreenWay, Nissan, OMV, Schrack, Smatrics, Renault, Volkswagen, ZSE.

○ EMILIA – Electric Mobility for Innovative Freight Logistics in Austria<sup>43</sup>

The project focused on innovative freight logistics for urban environments, specifically geared towards the significant use of EVs and has the following objectives:

- To optimize vehicle technologies to increase range and lower costs;
- To develop new logistics concepts and planning methods;

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<sup>43</sup> Emilia Electric Mobility, 2015. Online at: [https://dts.ait.ac.at/projects/select/wp-content/uploads/sites/11/2015/12/elocot\\_emilia\\_boschidarganev.pdf](https://dts.ait.ac.at/projects/select/wp-content/uploads/sites/11/2015/12/elocot_emilia_boschidarganev.pdf)

- To demonstrate the technological feasibility and cost effectiveness of the use of EVs in urban logistics;
- To open innovation to actively involve external stakeholders.

Logistic concepts in the project focus on food delivery, parcel delivery services and pharmaceutical logistics, through the development of sustainable logistics for regional produce (Linz), optimization of delivery runs for e-mobility (Linz, Vienna – inner cities), city Hub near a shopping high street (Vienna), E-Commerce / Home-Delivery in inner city (Vienna) and refrigerated logistics(e.g., for pharmaceuticals in Vienna).

- eMPROVE

The flagship project aims at innovative solutions for the industrialization of electrified vehicles, increasing both energy and cost efficiency and is also supported by the Austrian climate and energy fund<sup>44</sup>.

- EVA+ (Electric Vehicles Arteries in Italy and Austria)

The project aims to develop e-mobility in the cross-border territory between Italy and Austria focusing in particular on the four Core Network multimodal corridors. Specifically, it aims to encourage long-distance e-mobility travels in both countries, providing fast charging infrastructures along highways and in main strategical centers.<sup>45</sup>The project is expected to introduce ca 180 new fast charging points in Italy and 20 in Austria. These infrastructures will ensure the compatibility with most types of EVs on the market. Moreover, informative systems will be developed to allow customers searching “for the nearest charging station, and learn about the growing network of charging infrastructures”<sup>46</sup>.

In addition to the described activities, further projects related to AFs can be found in the Annexes I, II and III of the report “Desk Research Report for environment-related freight transport issues in the Alpine area” implemented by the Working Group on “Environmental Indicators and the Impacts of Traffic Management Systems and other Measures on the Alpine Environment” (EnvALP). They refer either to specific fuels or to the technical development of the vehicles.

## Other initiatives

- National Plans and Programs

The Klimaaktiv mobil program of the Austrian Federal Ministry of Environment (see also page 12) is targeting the reduction of GHG emissions. It offers funding and consulting programs, awareness-raising initiatives, partnerships as well as training and certification initiatives to the target groups like companies, public authorities and others. The program supports businesses and municipalities in their transition to e-mobility (e.g. e-cars, range extenders, plug-in hybrids, electric commercial vehicles, e-buses and trolley buses) and alternative vehicles powered by biofuel and biomethane. In particular, e-busses for passenger transport ( $\leq 5$  tons gross vehicle weight) and light duty E-vehicles ( $\leq 3.5$  tons gross vehicle weight) receive a funding rate of €20,000 by using electricity from 100% renewable energy sources. The Klimaaktiv mobil program grants additional financial support for e-charging stations, from €200 up to €10,000 in dependency of the technical specification.

In Germany, “The National Hydrogen and Fuel Cell Technology Innovation Program (NIP)” is continuing to provide financial assistance to R&D projects and to the market activation by means of capital grants for the procurement of vehicles with fuel cells and/or the respective hydrogen refueling infrastructure. The Federal Ministry of Transport and Digital Infrastructure has so far provided around €250 million for the period from 2016 to 2019. For instance, funding calls support the procurement of passenger cars, light duty vehicles and busses using fuel cell systems (40% of additional CAPEX compared with conventional vehicles) and of public hydrogen refueling infrastructure (60% of CAPEX). Also funding of R&D is ongoing. As an example, Deutsche

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<sup>44</sup> IESTA. Institute for Advanced Energy Systems & Transport Applications. Online at: [http://www.iesta.at/IESTA\\_Projektreferenzliste.pdf](http://www.iesta.at/IESTA_Projektreferenzliste.pdf)

<sup>45</sup> EVA+ Electric Vehicles Arteries in Italy and Austria. Objectives. Online at: <https://www.evaplus.eu/objectives>

<sup>46</sup> This text cites the report “Desk Research Report for environment-related freight transport issues in the Alpine area” implemented in its final draft by the Working Group on ‘Environmental Indicators and the Impacts of Traffic Management Systems and other Measures on the Alpine Environment’ (EnvALP), April 2018.



Post will develop the next generation of their Street Scooter delivery vans with fuel cell system. This will increase their range to 500 km and enable them to operate between conurbations.

## Trucks and alternative fuels/propulsion systems

### ○ Iveco Stralis Natural Power - LNG

This truck has been designed by the Italian Engineering Techno-Centers finalized to the road freight transport, distribution and logistics, particularly for medium and long distance in its LNG version<sup>47</sup> (*long haul logistics*). The autonomy of vehicles used for medium and long range operations is around 1600 km (100% by LNG), with double cryogenic LNG tank, assuring the same performance than a similar diesel truck, thanks to engines since to 460 horsepower.

The advantages of this type of vehicles are multiple, both from the point of view of environmental sustainability and profitability for customers. Natural gas is an environmental friendly fuel (-95% consumption of PM<sub>10</sub>; -75% NO<sub>x</sub> compared to diesel). Furthermore, the use of these technologies allows a reduction of CO<sub>2</sub> emissions from 10% up to 100% in case of use of bio-methane. Finally, the reduction of noise by an average of 5 decibels compared to the diesel version makes it a more suitable vehicle for night trips.

### ○ Hyundai Motor Co: fuel cell trucks for Switzerland<sup>48</sup>

Hyundai Motor Co. will build 1,000 commercial fuel cell electric trucks to be operated in Switzerland beginning in 2019, to be completed by 2023 operated by Coop Cooperative which is also part of “H2 Mobility Switzerland Association”. Hyundai will work with Swiss hydrogen company H2 Energy to build an infrastructure that will support hydrogen refueling stations across the country.

### ○ Scania: trucks with several alternative drives<sup>49</sup>

Scania has begun a comprehensive launch of a full range of products with AFs and powertrains for Euro 6. Scania developed a hybrid truck for urban distribution combining electric and biodiesel operation. The hybrid solution, developed by Scania itself, allows an 18-ton distribution truck to operate solely on electric power for up to two kilometers.

### ○ Hybrid, electric and natural gas trucks in use by Meyer Logistics<sup>50</sup>

For several years, Meyer Logistic has been using natural gas trucks with low particle and noise emissions for daily operation in Berlin. In 2011, the first hybrid vehicle was going into operation for the customer of the supermarket chain REWE in Cologne. In Berlin two 18-tons trucks with full-electric drive (E-Force-One) are used for the daily operation. The trucks are in use for contribution logistics in inner cities and conurbations.

### ○ Electric truck BMW & Scherm Group

BMW and Scherm Group developed an experimental 40-ton-electric-truck for material transport on public road traffic. The BMW Group is the first automobile manufacturer in the EU who uses a 40-ton-electric-truck.

## Refueling stations

### ○ Refueling Station in Piacenza (Italy)

ENI inaugurated in April 2014 in Piacenza its first plant in Italy that delivers LNG for refueling heavy trucks. The refueling station in Piacenza is the first one of a series that ENI will carry out over the next four years, along the main national road networks. ENI actively participates with other partners coming from different countries

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<sup>47</sup> 400 hp with the same performance of diesel version.

<sup>48</sup> <https://www.trucks.com/2018/09/21/hyundai-fuel-cell-electric-trucks-switzerland/>

<sup>49</sup> Scania Deutschland. Online at: [http://www.scania.de/about-scania/media/press-releases/2015/q4/nachhaltige\\_transportloesungen.aspx](http://www.scania.de/about-scania/media/press-releases/2015/q4/nachhaltige_transportloesungen.aspx) (downloaded on 14.12.15)

<sup>50</sup> Meyer Logistik. Online at: <http://www.meyer-logistik.com/#fuhrpark> (downloaded on 14.12.15)

to the European project "LNG Blue Corridors", which has among its objectives the development of refueling stations equipped with fuels producing lower environmental impacts along four major trade routes crossing Europe, from North to South.

- Hydrogen refueling station in Bolzano (Italy)

It is the first refueling station installed in Italy, located in the Bolzano South station along the Modena - Brenner motorway (A22) for the production and distribution of hydrogen from renewable energy, therefore producing clean fuel for busses and cars. The hydrogen production facility is able to replace 525,000 liters of gasoline or 440,000 liters of diesel per year, with an annual reduction of about 1,200,000 kg of CO<sub>2</sub> emissions per year.

## Recommendations

The Alpine area is a strategic region that can help ensuring continuity and interoperability of AFs infrastructure among Member States located in the Alps and beyond. However, as this report shows, the Alpine countries seem to follow different strategies and have focused their attention more on a specific range of fuels, rather than implementing a more comprehensive strategy. The deployment of AFs infrastructure is at very different stages in European Member States as well, and the national and/or regional structures vary considerably. This is also a consequence of the fact that the Alpine countries have also different “starting points” and technological/industrial expertise, which certainly play a relevant role in deciding overall transport strategies.

The implementation of the Directive 2014/94/EU is improving the standardization of the national policies finalized to boost the development of the AFs infrastructures and refueling stations, increasing the presence of the AFs vehicles in the road network (above all, LNG for trucks and electric/hybrid and CNG for cars, vans and buses). So far, most of efforts have been addressed to passenger transport, despite a few business-cases exceptions referred to freight transport (e.g., innovation on trucks).

Despite these general considerations, it is clear that alternative energy sources require dedicated investments and infrastructures, as necessary conditions to unleash their potential and prove their advantages over conventional fuels both in terms of consumptions and environmental impacts. More targeted interventions at policy level, as well as more coordinated public and private initiatives are needed. The following lines summarize some recommendations in order to implement the AFs for transport in the Alpine Space, due to their expected positive impact in the reduction of PM<sub>10</sub>,/PM<sub>2,5</sub> NO<sub>x</sub> and CO<sub>2</sub> emissions.

- **To ensure the implementation of harmonized standards for the main alternative fuels, as set out by the Directive 2014/94/EU “Alternative Fuels Infrastructure ” (DAFI);**
- **To establish an EU-wide (including CH and FL) minimum coverage of refueling infrastructure for the main AFs which are technologically viable and with market potential to facilitate economies of scale for market introduction, above all CNG facilities and electric charges in urban areas and LNG infrastructures along the TEN-T Network;**
- **To individuate carefully the location of recharging and refueling points to best accommodate the initially small vehicle or vessel numbers and to create maximum impact in early stages of deployment. To this end, coordinated roll-out of vehicles and infrastructure will be necessary;**
- **To differentiate road tolls according to the polluter-pays principle, by granting lower values to alternatively fueled vehicles (e.g. LNG, CNG, Electric and Hydrogen), especially but not only along the transalpine road axes;**
- **To envisage a transit priority to alternatively fueled vehicles along the transalpine road axes where traffic dosing systems or similar measures are in operation;**
- **To encourage investors and operators of refueling stations to offer AFs (Bio-CNG and Bio-LNG included, synthetic fuels), apart from fossil based petrol and diesel, on the basis of an analysis of market-demand and/or the technical (including safety) and financial implications involved;**
- **To organize promotional campaigns to encourage citizens and operators to switch to more eco-friendly vehicles;**
- **To promote actions to improve the public perception of safety of AFs as fuels for transport and ensure that differences are explained properly;**
- **To ensure appropriate access to information by the consumer on the location of refueling possibilities for different fuels.**