

CROATIAN CNG MARKET DEVELOPMENT STORY

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ABSTRACT

The transport sector in Croatia is one of the most significant consumers of energy nowadays and it is obvious that in the near future a fastest-growing trend in consumption can be expected in this sector. It has a significant influence on Croatian environment, economy and society and therefore it is from crucial significance that its sustainable development is considered on the national level. In order to harmonize with the European Transport Policy, basically through the security of supply improvement by diversification of the energy sources, environmental protection and building up foundation for further bio fuels utilization, respectively bio methane, based on the initiative derived from the Energy Institute Hrvoje Požar, Croatian Ministry of Transport, Sea and Infrastructure has established the milestone for wider commercial development of the Compressed Natural Gas (CNG) infrastructure as one of the most available alternative fuel in Croatia by adopting a Strategy for Utilization of the Compressed Natural Gas Consumption in Croatian Road Transport Until Year 2020. With respect to proposed guidelines delivered from the Strategy, some of the energy companies present at domestic market has recognized market potential and they brought short and long term CNG refuelling stations network development plans along the Croatian roads. Public transportation fleet operators, waste collecting and management companies, bigger logistic companies, but even though smaller entrepreneurs and particular private customers has expressed great interest for partially switching their fleets to this more convenient fuel, primarily due to the fact that CNG can guarantee lowest expenditures, especially in this period of highly volatile market oil prices. The article aims to present chronology of the successful holistic approach as well as to announce forthcoming activities dedicated to the broader development of the natural gas vehicle market in Croatia as a national contribution to the integration into existing and planned European network of "blue corridors".

INTRODUCTION

The idea about commercialization of the compressed natural gas as one of the alternative fuels in Croatia is almost 15 years old. To be more precise, since the very first and until nowadays the only one CNG refuelling station has been commissioned up on the site of Zagreb's Gas Works Company in year 1994.

The station is serving, at the moment, around 150 vehicles with the CNG, which are mostly owned by the Gas Works Company. However, installed capacity of the station is significantly greater than currently stations loading factor and amounts up to 400 vehicles a day. Since the very first moment of its operation, the station has never reached nominal capacity due to the underdeveloped market of natural gas vehicles in Zagreb, respectively in Croatia.

Comprehensively reviewing historical Croatian CNG market development genesis, it was remarked lack of insufficiently elaborated aspect of market organisation, which is a crucial element for the successful project implementation.

The milestone of the project implementation has been followed up by the key thought that demonstration station should serve as promotion site for the new ecological, economical and safety acceptable fuel but without clearly strategy to expand CNG refuelling stations network to the larger extent. One of the reasons was lack of the positive practical experiences from the foreign markets, as leaders in this regard, which could additionally encourage market development.

Since meanwhile both national and international markets have been faced with tremendously fuel price rising, it was obvious that search for the alternatives have become imperative for the customers and operators of transport systems in general. Apparently, the time for CNG, as one of the alternatives with highly potential, has come.

Additional contribution to the adoption of alternative fuels introduction paradigm is an aspect of security of energy supply under which is defined diversification of energy sources as one of the key mechanism to achieve grater supply autonomy and less vulnerability of the systems. Energy import is highly unfavourable, since basically depends on foreign market conditions and it declines opportunities to self control of energy prices. The EU has recognised the importance of fulfilment of security of supply for sustainable development and therefore for a very first time in year 2000 proposed Green Paper: Towards a European Strategy for the Security of Energy Supply in terms of stimulating debate on geopolitical, economical and ecological aspects for increasing of security of energy supply. Introduction of alternative fuels is one of the measures assed as highly influential in this regard and therefore EU has proposed indicative aim of replacing petrol and diesel fuel with 23 % of alternatives.

From the Communication on Alternative Fuels for Road Transportation and on a Set of Measures to Promote the Use of Bio fuels (COM (2001) 547 Final) additionally is emphasised advantage of using these fuels and the Commission perceived three main potential alternative groups: natural gas (10% of total petroleum consumption), bio fuels (8%) and hydrogen (2%), whereof each of mentioned group of fuels has realistic potential to reach up to 5% of share or even more in the total volume of petroleum product consumption by 2020.

By reviewing recent best practice examples of CNG market establishing from surrounding countries, it was obvious conclusion that for more serious implementation of CNG it was necessary to make detailed organisational scheme which will comprise elements related to institutional – regulatory issues, technical and marketing issues which are perceived as fundamental and presents basic in market development.

In the light of this reflection, the team of Institute's experts presented in 2007 to the Ministry of Sea, Transport and Infrastructure proposal of a Strategy for Utilization of Compressed Natural Gas in Road Transport of Republic of Croatia Until 2020 [3]. The document represents a master plan which comprises not only the goals, but as well the additional action plan for the implementation of these goals.

Previous to the Strategy, comprehensive analysis under the umbrella of the National Energy Efficiency Programme in Transport – TRANCRO have been performed [4], [5], and [6].

REFLECTIONS ON A STRATEGY FOR UTILIZATION OF NATURAL GAS IN THE TRANSPORT OF THE REPUBLIC OF CROATIA UNTIL 2020

The main purpose of A Strategy for Utilization of the Natural Gas in the Transport of the Republic of Croatia Until 2020 is primarily focused on increasing the reliability of supply of fuels in transport by meanings of implementation of the natural gas as one of the feasible alternative fuel in the period 2007 – 2020. Bearing in mind current availability of natural gas in Croatia and the harmonization with the EU targets declared in *COM (2001) 547 Final*, special attention has been devoted to the analysis of the proposed shares of the natural gas substitution in total petrol and diesel consumption.

Considering the above mentioned key Strategy targets, shares of natural gas in the total fuel consumption of the transport sector have been constituted and calculated on the basis of energy share as follows: 1% of total petrol & diesel consumption should be substituted with natural gas by the end of 2010, 3% by the end of 2015 and 6% by the end of 2020. Since the only guidelines available at this moment are the targets set in the EU directives, shares in the Strategy are proposed by using more conservative approach, actually the one which better fits to the Croatian potential of the market development.

For the purpose of defining a mechanism which will provide the execution of a set of activities and finally the achievement of the declared Strategy targets, it is of crucial significance to actively involve top governmental bodies, hence the Government, in the realization of natural gas implementation in the transport by defining an Action Plan. The main role of the Action Plan is provision of convenient legislative, financial, regulatory and developing market conditions framework which can firstly highly attract investors and lately guarantee reasonable return of investment.

The Action Plan consists of the two groups of actions:

1. Harmonisation with the EU Transport Policy

- 1.1 Proposal for the legislation on promotion of the alternative fuels in the transport with indicative goal of 6% natural gas substitution in total fuel consumption, based on energy share according to the proposed shares from the Directive 2003/30/EC
- 1.2 The amendment of Law for Special Taxes on Passenger Cars, Other Motor Vehicles, Vessels and Aircraft, National Gazette 136/2002 – change on tax policy
- 1.3. Proposal for legislation which delivers obligation for the carriers of the public transportation service in regard that they have to ensure certain share of environmentally friendly heavy duty vehicles of capacity grater than 3.5 tons in total amount of new purchased or leased vehicles.

2. Implementation of the measures for the positive financial, regulatory and developing preconditions establishment

- 2.1. Data base design of all current fleets of public transport operators with data on their business performances in Croatia
- 2.2 Supporting NGV development by implementation of non- technical measures (free parking in cities, etc.)
- 2.3 Tax policy measures - Correction of fiscal costs of natural gas vehicles
- 2.4. Defining and launching up financial facilities
- 2.5. Drawing up legislation and regulations related to garages
- 2.6. Promotion on blue corridor development
- 2.7. Promotion on common procurement of vehicles
- 2.8. Marketing activities and education

According to the strategically goals, developed was CNG implementation scenario which is presented on the following chart.

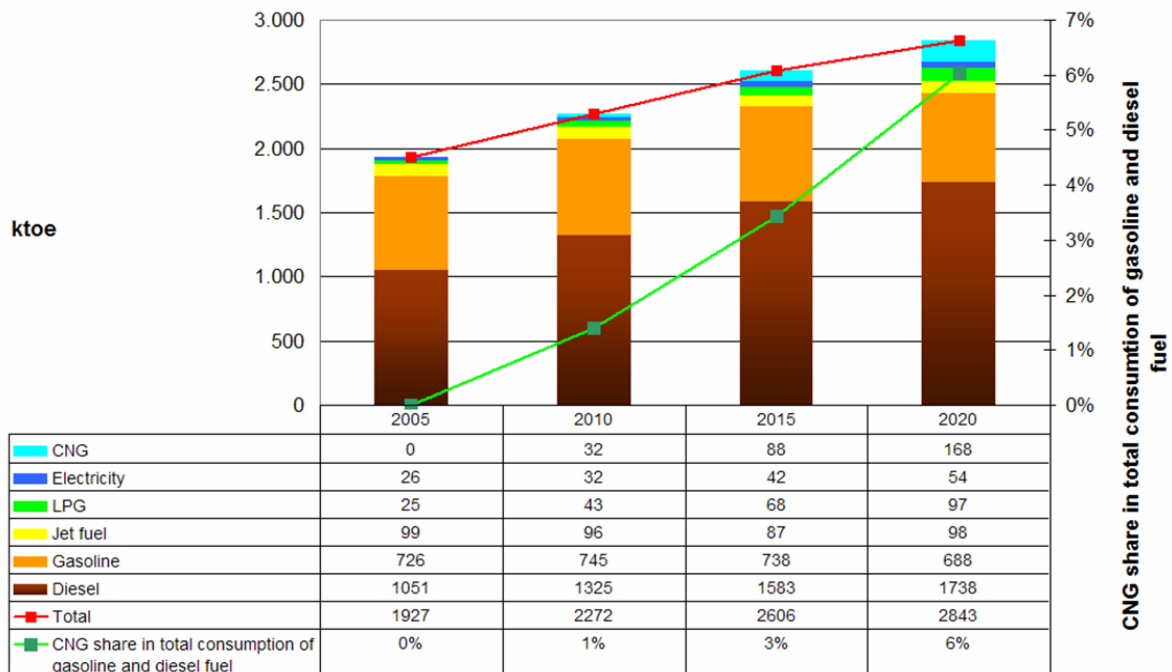


Figure 1 Structure of the final consumption of fuels in Croatian transport sector, according to the CNG implementation scenario

Converting strategic shares of the CNG into real amount of the energy leads to amount of 32 ktoe of equivalent energy, what equates to 39 millions m³ of natural gas equivalent in 2010; 88 ktoe, respectively 108 millions of the m³ in 2015 and 168 ktoe or 207 million m³ of the natural gas in 2020. For the purpose of scenario development, data from the reference list [7] and [12] has been taken.

Even though the proposal of the Strategy has not been ratified from the Croatian Parliament so far, facilitating circumstances is that majority of the actions from the related Action Plan have been adopted and/or implemented regardless formal Strategy adoption.

Deliverable from the task 1.1 of the Action Plan is already evident, since natural gas has been included into Green Paper on Energy Sector Strategy Update/Upgrade, launched in October of 2008.

In the document is clearly stated positive Governmental attitude toward promoting this alternative fuel in transport sector. This approach explicitly increase security of return on investments for the potential investor whether it will be national or international interested one. This is the key element for this Greenfield investment since the State is providing guarantee through the arranged institutional – legislative framework and positively business platform.

From the following chart, taken from the Green Paper it is obvious significant targeted share of the CNG in the total natural gas consumption in 2030.

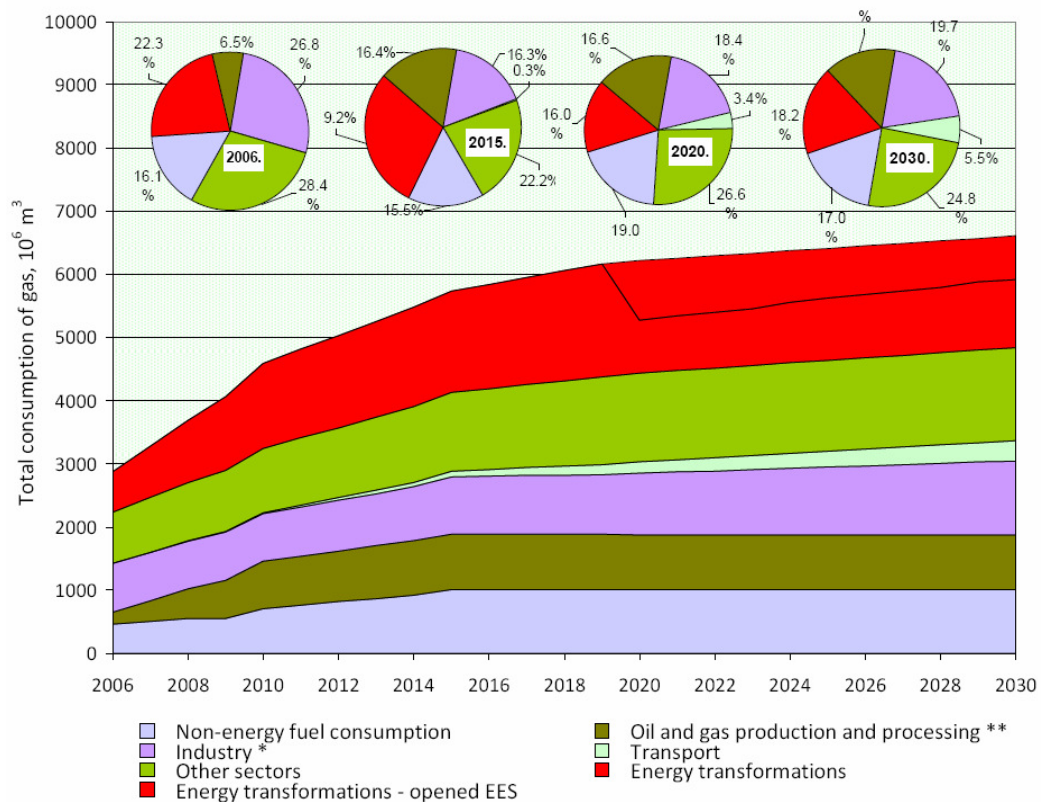


Figure 2 Projections of the total consumption of the natural gas until 2030 in Republic of Croatia, whereof CNG holds share of 6% in 2030

DETERMINATION OF THE POTENTIAL CNG CONSUMER CATEGORIES

In Croatia there is potential to introduce CNG into three vehicles categories in the road transport: cars, buses and freight vehicles. Eventually, each of mentioned categories has its own specificities, while biggest potential for CNG penetration is noted in category of cars, than freight vehicles, while smallest in terms of amount, but greatest regarding potential public awareness is noted in category of buses.

POTENTIAL CNG CONSUMPTION IN BUSES

It is important to emphasize importance of the CNG utilization within this category of vehicles since it is a sector which has a big influence on a public awareness and quite steady consumption which presents favourable investment climate for the potential investors. For the purpose of market research and CNG opportunities within this sector, Energy Institute Hrvoje Požar has provided several studies under which were determined possibilities for the CNG penetration.

In the year 2006 EIHP provided a feasibility study: **“Justification of the Natural Gas Utilization as the Motion Fuel in the Zagreb Municipal Service Holding Company GKG Ltd”** [14] as a help for the purpose in decision making process related to renewing of existing vehicles fleet with the new CNG ones. Under the holding company also operates the biggest bus operator of the public transportation in the country (**ZET**), which expressed interest for moving toward CNG solutions and optimizing their existing fleet portfolio with the new CNG buses.

The study has shown that there is enough proven space for the new CNG 90 buses, of more than 300 which are under the operation nowadays, and which should be introduced into the fleet on the modular principle. According to the results of the study, the ZET's directorate decide to procure 60 brand new CNG buses in year 2009. **Part of the procurement is already realised in the spring of 2009 and buses are already operating across the Zagreb's public area.**

The buses are currently refuelling at the only existing refuelling station in Zagreb, but very soon is expected that special CNG refuelling station is going to be commissioned on existing ZET's bus depot. The ownership of the station is still in negotiation phase, but it is very obvious that it will be given to the Zagreb's Gas Work Company, which is at the same time the owner of existing one station and it is also a part of the same Holding under which operates ZET.

As for the rest of the activities related to the research of opportunities for the CNG implementation within this sector, the Institute provided **A Pilot Project of the Partial Implementation of the Compressed Natural Gas Into the Public Transport – Evaluation of the CNG Utilization Potential in Public Transport in the County Centres and Other Bigger Cities in the Republic Of Croatia** [8]. The study goal was to determinate the potential for CNG use in sector of public transportation in all county centres and other bigger cities in Croatia. The Pilot project is also part of the Action Plan proposed in order to achieve the objectives of the Strategy.

Generally speaking regarding the possibilities of using natural gas in buses, we must emphasize that the primary distinction has been made between buses in the intracity and intercity traffic. It is important to bear in mind that the greatest potential for the use of CNG is hidden in the category of city buses, which arises as one of the main results of the Pilot Project [8].

The results of systematic study in the potential use of CNG in public transport were obtained by analysis that was based on surveyed data, received from 18, from a total 21 centres in the country, where services of arranged public urban transport exist. The total number of buses in the function of public transportation in Croatia in 2005 year was 1.380 from a total of 4.956 registered buses.

The criteria for selecting candidate lines for acceptance of buses with the CNG propulsion system arises from the fact that the city buses are mainly „island“ supplied by fuels and, accordingly with that, candidate lines are limited to buses autonomy. The total number of candidate lines of all public transport operators, with the objective potential to move to natural gas, amounts 296, with total annual travelled distance around 27 million kilometres.

Total number of buses that were operating on the potential candidate lines in 2007 was 365, which represents approximately 1/3 of buses from the total number in public urban transport.

Based on the results of the Pilot Project, from which follows the conclusion that 1/3 of buses in the function of public transport has the potential to move toward natural gas, has been modelled a long term CNG buses penetration in public transportation as it is shown on Figure 3.

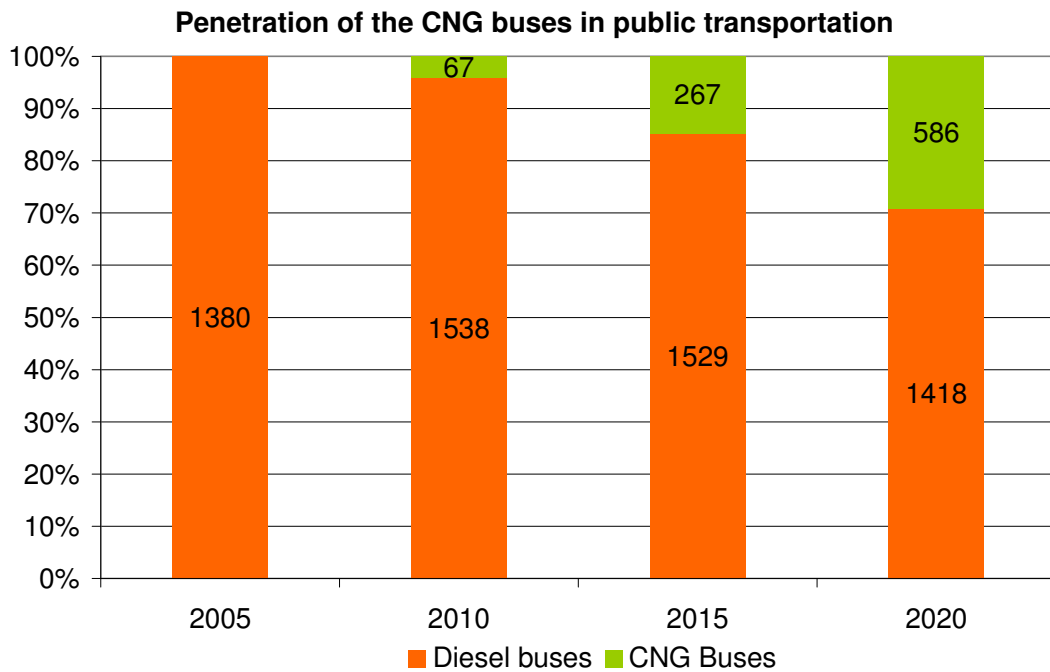


Figure 3 Number of buses in public urban transport with CNG engines

Despite the fact that the maximum proportion in the number of buses from the total potential number of CNG vehicles is almost irrelevant (only 0.8%, Figure 4), on the side of consumption of gas expressed in m^3 is seen a significant impact of buses in the overall structure of CNG vehicles (about 11% of the total expected consumption of gas). The reason for this relationship is significantly intensified bus annual consumption from other forms of transport (much higher annual travelled distance and specific consumption from personal cars).

Although, the real consumption potential part share in the expected total consumption is rather small, there is adopted opinion that the primary need is to orientate to this market segment, since it is the one of the main market developing drivers. This conclusion rests on the argument that public urban transport greatly influences on the awareness of citizens about the "new" environmentally acceptable fuels in transport (a large mobile advertisement surfaces).

For the supply of city buses with natural gas, 18 CNG filling stations are planned to be constructed and commissioned, mainly within the garages or service station stops, while also taking the possibility of later supply of private cars.

FREIGHT VEHICLES

Considering the use of gas in the category of freight vehicles, it is necessary to recognize that this is a category in which exist many possibilities of application. Particularly, in the mentioned category of vehicles are light vans under 3.5 tons capacity with gas and diesel engines, whose users are, in addition to private users, in the greater extent many companies.

Several renowned manufacturer of light delivery vehicles, present on the domestic Croatian market (IVECO, FIAT, MAN, MERCEDES, etc.), in a rule, offer for each conventional model equipped with petrol or diesel engines, identical CNG models of the vehicles. At the end of December 2008 was delivered first Iveco Daily CNG model of van.

CARS

It is noticeable that the dominant potential natural gas consumption is in this category of vehicles. Therefore, in terms of designing the network of filling stations, special attention has to be given to the selection of the optimal existing and future planned gas station for the reception of CNG-fillings, with aim to primarily meeting the needs to supply cars with natural gas.

Ultimately expected structure of the natural gas vehicles (NGVs) in 2020 according to the EIHP's study [14] could look like this: 96% of cars, 3% of commercial vehicles and 1% of buses.

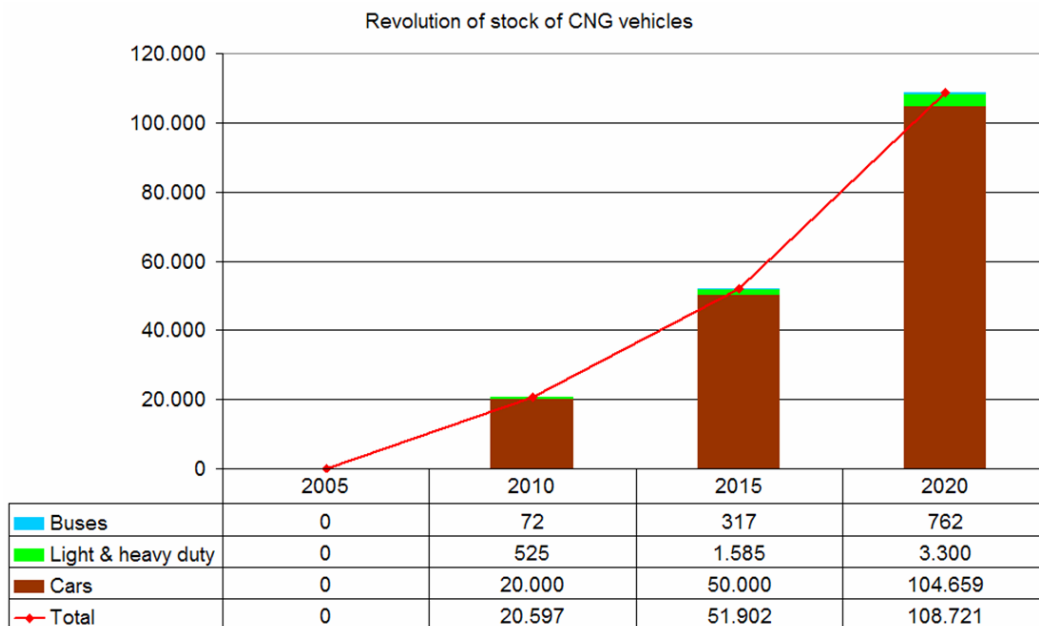


Figure 4 The forecast of the NGVs according to the consumption of natural gas

Based on the declared number of natural gas vehicles, it is possible to analyze the feasibility of yearly penetration of that amount of vehicles by taking into consideration previous trends in the annual procurement of new vehicles in the Republic of Croatia, the socio - economic conditions and finally, it is possible to make a benchmark analysis with surrounding countries, which since today, succeeded to organise the market for the successful acceptance of CNG vehicles.

Next figure shows the average yearly rate growth of stock of vehicles during the period of 2005 and 2006 in some European countries. Based on the exposed sample, it is rather intuitive to conclude that the average growth rate of the number of vehicles in these countries in the mentioned period equates to 33%.

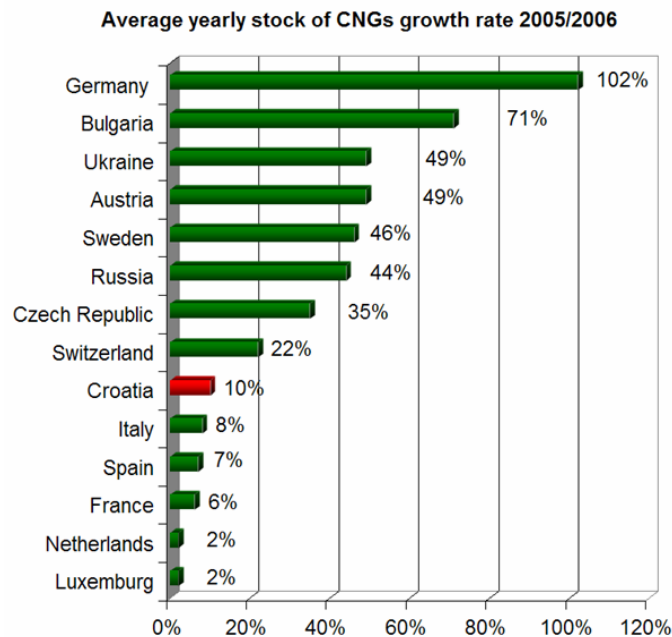


Figure 5 Growth rates of NGV vehicles in the various countries in the period 2005/2006 [9]

If we take look at the moment to the idea of achieving declared goals of the Strategy which are 1, 3, or 6% substitution of the total amount of petroleum products in transport with natural gas, through the implementation of natural gas in part of new personal cars, we see that 12% of the total amount of new sold

cars (supposed 90,000 newly purchased vehicles per year during the observed period [10]), or about 10.659 cars have to be in the category of natural gas vehicles up to 2020. With that aim there could be realized the placement of gas to meet a total of 6% substitution of mineral fuels. In this case, an average annual growth rate of the number of vehicles could be 18.00%, which represents a significantly conservative approach in relation to the growth rates of CNG vehicles in European countries (33% / per year).

A HIGH INTEREST OF ENERGY COMPANIES PRESENT AT THE DOMESTIC MARKET FOR ENTRY INTO COMMERCIAL CNG BUSINESS ON CROATIAN MARKET

Looking up on omnipresent justified trends of West European countries, interest in the commercial introduction of natural gas as one of the possible alternative fuels was expressed by two biggest energy companies present on the domestic market.

It is of course the national oil and gas company INA¹ and increasingly present Austrian energy company OMV.

The structure of the ownership on existing retail refuelling stations is shown on the following figure.

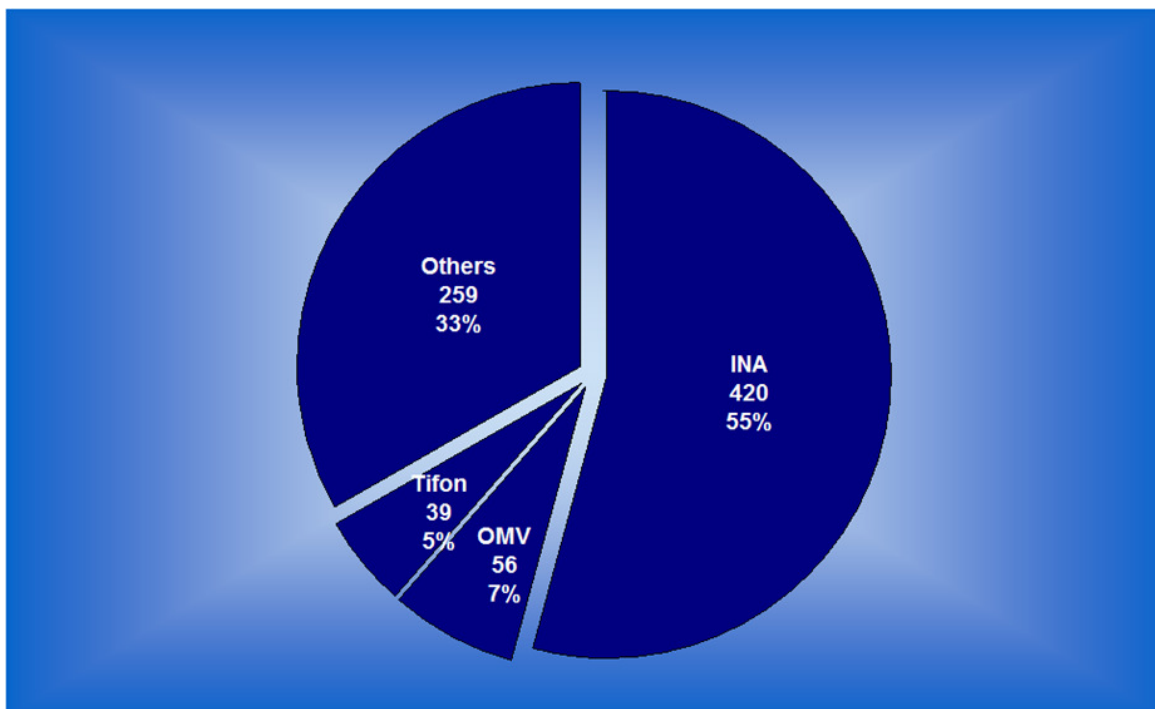


Figure 6 Ownership structures of the existing gas stations in the Republic of Croatia [11]

According to Austrian development programme "Bio - CNG 5 Punkte", OMV predicts the possibility of building several filling stations on the existing and planned petroleum stations in the period since 2010 – 2012 year.

INA, on the other hand, engaged a professional team from the Energy Institute Hrvoje Požar in order to provide a **Compressed Natural Gas Utilization Feasibility Study** [7]. Based on the study deliverables, INA is about to bring corporate CNG business development plan.

Due to the major presence of INA on the domestic market in continuation is shown an overview of the most important business development parts of the studies.

Apart from the mentioned key market players, Croatian natural gas transport system operator - Plinacro Ltd is also preparing for the commissioning of the first CNG station, but it will be used only for their own purposes and it will not be opened for the public purposes.

It is justified to believe that rest of the market present stakeholders are also interested for entering into CNG business.

¹ www.ina.hr

DEFINING THE CRITERIA FOR SELECTION OF THE EXISTING PETROLEUM STATIONS FOR ACCEPTANCE OF THE CNG FILLING STATIONS

After comprehensive analysis of potential INA's market share in terms of determination the number of petrol stations which are suitable for the reception of CNG filling stations, it was necessary to determine the exact list of petrol stations and assign to them spatial-time component of their construction.

In order to form an optimal selection of existing petrol station, there was defined the fundamental criteria for their selection.

The basic criteria for optimal selection of existing petrol stations for the reception of CNG filling stations are:

1. Selecting the most profitable of the existing petrol stations (according to the maximum sold amount of petroleum products) - taking into account the habits of existing and future customers. Consensual conclusion is that the selection criteria of existing petrol station, with the highest achieved ration in petroleum products sales, is justified because these filling stations actually reflects the existing habits but also the future habits of the customers. On the other hand, achieved ranking in fuel sales is in fact function of optimal micro-location at which the filling station is located.
2. The selection of locations in high-profit areas of urban centres. Development strategy of filling stations network primarily is based on coverage of high-profit-filling stations in urban areas because is expected that majority of gas consumption is exactly in larger towns and villages.
3. The selection of high-profit petrol station on connecting intercity roads. With aim to ensure sufficient autonomy movement of the user with a one gas-filled, or to connect major urban areas with a network of filling, it is necessary to detect optimal filling stations along the intercity traffic routes.
4. Preference sites that are located in the vicinity of gas pipelines - minimization of expenditures in capital costs (CAPEX reduction). Wishing minimization of maximum possible opportunity loss, caused by unnecessary investments in capital costs, the preferences are given to the filling stations that are already located in the vicinity of the gas distribution or transmission system (reduction of unnecessary investment in gas pipeline connection).
5. Equable spreading network of filling stations along the network of traffic roads in Croatia.

A brief overview to Figure 7 indicates centralization of maximum traffic density and also the maximum consumption of fuel in the areas of major cities, and thus the justification of the construction of a network of filling stations primarily in these areas. For long-term success of the project is essential to ensure optimal development of a network of filling stations along the entire network of traffic roads. Such approach forms foundation for the optimal geo strategically positioning of INA with a new product on the market.

Further is given a view of preliminary selected existing 112 INA's petrol stations that meet the criteria for acceptance of CNG filling stations.



Figure 9 Space organisations of INA's potential 115 CNG fillings up to 2020 in the environment of gas transport system

IMPLEMENTATION OF LEGISLATION WHICH FAVOURISES CNG VEHICLES WITHIN MUNICIPAL AUTHORITIES IN PUBLIC SECTOR PROCUREMENT PROCESS

As it was listed in the Action Plan, in order to foster CNG market development one of the significant steps is to introduce the CNG into public transportation fleets. We believe that such approach could increase public awareness and consumer sensitivity towards forthcoming cleaner and greener transportation fuels. Since the European Union is investing lot of effort to make cities greener and healthier for their citizens, it is evident that such approach is absolutely in the line with this positive mainstream.

In this respect, after reviewing the proposal from the Action Plan, Ministry of Economy Labour and Entrepreneurship propose to the Croatian Parliament Law on Bio fuels which delivers obligation for the carriers of the public transportation service in regard that they have to ensure certain share of environmentally friendly heavy duty vehicles in total amount of new purchased or leased vehicles. This obligation favours utilization of **bio methane**. The law was adopted on May 22nd, 2009.

According to the article No. 30 of the Law every user of the fuel in public transport and public sector, shall ensure that in each year, at least 70% leased or new bought vehicles or boats uses:

1. bio fuel mixed in diesel fuel or motor gasoline in the part of more than 5% or
2. Bio diesel in the form of pure bio fuel or
- 3. biogas in the form of pure bio fuel or**
4. hybrid drive, or
5. electric drive, or
6. hydrogen

The obligation referred in the article does not apply to motor vehicles or vessels owned or in use in the public sector for which, because of the technical specifications or special purpose, bio fuels cannot not be fuel.

The user of fuel in public transport or in the public sector is obliged to take an evidence of the number and type of leased or new bought vehicle or vessel and use of bio fuels in transport in accordance with the terms of measures to encourage use of bio fuels.

The Ministry will, to any user of fuel in public transport and public sector, give a registration number and manage with register of users of fuel in public transport and public sector in electronic form in an assigned manner.

FINANCIAL INCENTIVES

Another action from the Action Plan that has been implemented refers to the arranging of financial incentives for the CNG vehicles purchasing. In his regard, Croatian Fund for Environmental Protection and Energy Efficiency has announced launching of two financial facilities for promotion of green transport technologies introduction on the market for ongoing fiscal year 2009 as follows:²

1st Financial Facility

The Fund will encourage and stimulate all programmes and projects which will foster implementation of the clean vehicles by conducting and enhancing technical (engine efficiency improvement, replacement of conventional vehicle engines with more environmental friendly, decrease of roll and air resistance, drivers education) and organisational measures (toll fees, congestion charging, parking space control, parking fees, freight transport control in urban areas, urban traffic infrastructure control) in passenger and freight transport, and especially in field of alternative fuels introduction (**Compressed Natural Gas, Biogas**, Bio diesel, Bio ethanol, LPG and Hydrogen) as well as propulsion system equipped with batteries and fuel cells.

Utilisation of CNG and LPG is in headline of priorities since there is high readiness within stakeholders for their implementation realisation, such are those which use light duty vehicles within its business activities, provide public transportation service (city buses), taxi operators, driver schools and public companies (example: waste collecting operators – garbage trucks, etc.). The financial assets will be allocated as support for the new CNG/LPG refuelling stations commissioning as well as partial coverage of the retail price differences between conventional and EEV vehicle, and city buses propelled with CNG/LPG.

Public Invitation to tender is expected to be launched in second half of 2009, and it depends on realisation of the Fund's Incomes. The investment structure will be as follows: Interest Free loans and subsidiaries for trade associations, respectively financial aids (reimbursement free) for local & regional authorities, co-financing up to 40% of eligible costs except for Local Authorities on islands or in highland area for which is eligible up to 60% and finally for Special Care Areas is set up to 80%.”

According to preliminary Fund's budget allocation, there will be ensured around 3.000.000,00 kn (~405.405,00 Euros) for this purpose.

2nd Financial Facility

Furthermore, the Fund for Environmental Protection and Energy Efficiency together in collaboration with the Ministry of Sea, Transport and Infrastructure as well as with the Ministry of Economy, Labour and Entrepreneurship has announced for the fiscal year 2009 to start with the realisation of the Programme for Negative Transport Impact on the Environment Reduction – diminishing of the road vehicles pollutants from two categories: heavy duty and buses. The programme will offer supportive assets for yearly substitution of 1000 ecologically unacceptable vehicles within period 2009 – 2011. This action should provide significant pollution reduction and respectable financial savings. Within mentioned period there will be launched enough assets to support substitution of ~ 3000 freight vehicles powered on engines with unacceptable ecological standards (EURO 0,1,2,3) and school buses with ecologically friendly vehicles which standard is equal or greater than EURO 5 eco-standard (in Croatia is currently in force EURO 4 standard). The Fund will allocate subsidiaries to the legal entities in amount up to 50.000,00 kn (~ 6.757,00 Euros). For the Programme implementation the Fund has to assure 150.000.000,00 kn (~20.270.270,00 Euros).”

Public tender or Call (it is not decided yet the shape) will be published in second half of the 2009.

² (Source: Scope of the Working Programme of the Environment Protection and Energy Efficiency Fund for 2009 Fiscal Year; <http://www.fzoeu.hr/hrv/pdf/Program%20rada%20Fonda%20za%202009.pdf> , pages 37 & 38)

TECHICAL REGULATIONS

According to the list of prerequisite tasks from the Action plan that should be done before coming to the implement stage of the CNG market development, it was necessary to harmonize technical regulations for refuelling stations and CNG equipment at a whole. In this respect, working group for this purpose was established at the Ministry of Interior in order to analyse existing technical regulations which are currently on the force in other European countries and finally to adopt most suitable ones in Croatian legislative framework. After reviewing available standards, where most respectable ones are the one with the German/Austrian and Italian safety philosophy, consensually has been concluded that best fit for Croatian market could be transposed from the Austrian safety philosophy. Therefore, Austrian technical regulation for the CNG refuelling station G92 has been proposed for the implementation in Croatian regulatory repository. The Ministry has announced that harmonized edition of the mentioned regulation is expected to be adopted and will come into force until end of this year the latest.

EFFECTS OF CNG INTRODUCING ON AN EXISTING MARKET WITH A PRESENCE OF LPG

Even though there is a huge interest for the CNG market development in Croatia, there is, however, present on the market a Liquefied Petroleum Gas (LPG) with its biggest share in the group of existing and planned alternative fuels and as such represents rather "threat" for CNG development.

The fact is that the transport sector in the Republic of Croatia depends specifically on gasoline and diesel fuel [18]. Only in the last few years the situation has changed, thanks to propagation liquefied petroleum gas on the market. This was the first step towards the introduction of alternative fuels, but however, it is again petroleum product.

On the other hand, natural gas vehicles are not directly related to unpredictable situation on the oil market when it comes to the security of supply and prices stability, and in this case gives the possibility of diversification of sources of supply, and through the possibility of using biogas is a basis for the use and other renewable energy sources in transport (next to bio diesel or ethanol).

In respect to the current situation related to domestic natural gas presence in the Republic of Croatia, the fact is that natural gas participates in total consumption of primary energy with 27.4%, respectably 114.2 PJ.

Croatian total natural gas demand is by 68% assured from domestic sources from the inland natural gas fields, particularly from Panon and western Istrian offshore fields. Rest of demand is covered mainly from the Russian natural gas sources. So, while considering natural gas as one of the key energy sources in the Republic of Croatia is rather obvious lower dependence on import, therefore this energy form can be observed as relatively safe in terms of supply. On the other hand, Croatian dependence on crude oil import in 2007 year equated 82.6%, so the use of LPG is significantly more dependent on imports, and thus also more vulnerable in terms of supply.

Key role in initiating market of LPG has taken INA's daughter company PROplin Ltd and other oil companies, which have with direct investments aimed towards the development of the LPG network of fillings stations (165 in total). Evident is the significant increase in the number of these vehicles, which in the past ten years rose from just few of them up to 60-75 thousand in year 2008, and achieved part in representation on the market of about 5.3% of the total number of personal cars. The main driver in developing LPG vehicle market is coming from significant difference in the price of fuel, in favour of LPG (average price of gasoline in the 2007 year of Euro 95 petrol in the Republic of Croatia equated to 7.92 € per litre, while the price of LPG was 3.35 € / litre).

It is important to emphasize that the strategically approach to develop **natural gas vehicles market** in a transport has a task that **together with liquefied petroleum gas**, whose consumption in the last ten years increased on the market tremendously, encourage market development of natural gas vehicles too, in order to primarily increase the energy independence of Croatia as well as contributing to the quality of the environment, especially air.

CONCLUSIONS

Positive experiences in the process of the CNG market development in Croatia could be mainly acknowledge to the holistic approach that has been developed and applied for this purpose. The Institute has played significant role during strategically market development organisational platform definition.

The very first results are already seen nowadays on the streets of Croatian Capital, Zagreb: 60 CNG buses + 150 other vehicles are currently operating on the streets while there are also several projects in preparation. Achieved is a great interest from both public and private sector in respect to partially substitute their fleets with the CNG ones, while energy companies present on the market has brought their business plan for development of the CNG refuelling stations network.

However, there is a tremendous potential for the CNG placement on the market which is waiting to be transformed into reality. This potential is summarized in following paragraphs.

Within forthcoming decade 2010 – 2020 there is potential to place up to 207 millions m³ of the CNG on the market, according to the EIHP's studies research results. For this purpose there is a room for commissioning up to ~ 200 CNG refuelling stations. In order to fulfil strategically declared goal of 6% of the substitution of petroleum products with natural gas, until year 2020, portfolio of the CNG vehicles could look as follows: ~ 105.000 cars, ~ 800 buses and ~ 3.300 light & heavy duty vehicles.

The results from the CNG Feasibility Study shows that total investment cycle in CNG infrastructure could reach up to 129 millions €, while at the same time operators of the CNG stations, if there will be maximum one or two present on the market, could take advantage of the very favourable payback period from 3-11 years. Price competitiveness of the CNG toward other petroleum products is undoubtedly at the moment. It is possible to acquire 50% lower variable costs of the mobility comparing to the one achieved by gasoline and/or diesel fuel. The reason for that arise from the fact that natural gas itself is cheaper and currently there is no additional taxes for the natural gas, as the motion fuel, while it is applied for the petroleum products at the same time.

According to the optimistic scenario of the CNG market development in Croatia it is evident potential for employing additional 300 – 500 man power in this branch.

Additional ecological benefit which could be obtained from the CNG introduction on the market is obvious regarding potential CO₂ emissions reduction within 2010 – 2020 periods of time and it equates ~ 550 ktone less CO₂ polluted in the air.

Compressed natural gas is one of the three categories of alternative fuels (bio fuels, natural gas and hydrogen) which have the biggest potential to be commercialised in a recent future, primarily due to the pipeline infrastructure existence, on the majority of the country area.

By introducing CNG on the market in wider scale, Croatia is about fostering security of energy supply in transport sector what is actually one of the topic issues addressed in the Governmental Energy Strategy.

Finally, by developing CNG network of refuelling stations along Croatian territory another business and market opportunity will be opened; the one that relates to the utilization of bio methane in transport.

The Institute has also started with analysing options for CNG/BioMethane introduction on the market and establishing common language activities within railway and water transport sector representatives which have also a great potential in this regard.

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