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COMMISSION STAFF WORKING DOCUMENT
EXECUTIVE SUMMARY OF THE IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive
on the deployment of alternative fuels infrastructure

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1. GENERAL CONTEXT

1. The White Paper “Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System”¹ found that without the significant uptake of alternative fuels, we cannot achieve the targets of the Europe 2020 strategy and our climate goals for 2050. It therefore announces that the Commission will develop “a sustainable alternative fuels strategy including also the appropriate infrastructure” (Initiative 24) and ensure “guidelines and standards for refuelling infrastructures” (Initiative 26).
2. Based on the consultation of stakeholders and expertise gathered, the Commission has identified the alternative fuels which have already shown a potential for long-term oil substitution.
3. Deployment of alternative fuels is hampered by (1) the high price of vehicles, (2) poor consumer acceptance, and (3) lack of recharging /refuelling infrastructure, caused by multiple market failures.
4. Previous initiatives have addressed fuel production, vehicle technology, and marketing, but neglected the build-up of the necessary infrastructure.
5. Ex-post analyses of projects and policy actions have pointed out the lack of recharging/refuelling infrastructure, and the inability of market forces to fill this gap, as a fundamental barrier. Without removing this barrier, all other efforts risk to remain ineffective.
6. Three alternative transport fuels are particularly affected: electricity, hydrogen, and natural gas (LNG and CNG). The other main alternatives to oil – biofuels and liquefied petroleum gas (LPG) – are less concerned.

2. PROBLEM DEFINITION

7. The Impact Assessment finds that on the basis of projected market developments, the infrastructure for electric, hydrogen and natural gas (LNG and CNG) vehicles is likely to remain insufficient for what broad market take-up would require. This ‘minimum’ network is defined below.

Electric vehicles (EVs)

8. A minimum network for EVs should ensure:

¹ COM(2011) 144 final

- the critical mass of production needed to achieve economies of scale;
 - the projected deployment of EVs of approximately 6-8% of vehicle sales in 2020.
9. The above criteria suggest a benchmark number of 4 million EVs on the road in the EU by 2020, less than half of the sum of the targets announced by Member States.
10. EVs will be mostly deployed in urban areas, and therefore be distributed across the EU according to the urbanisation of Member States. Market tests have shown that each EV needs two recharging points (at home and at work), and about 10% of all should be publicly accessible to address range anxiety.

Hydrogen vehicles

11. For hydrogen, a first step towards market opening would require linking existing and planned refuelling stations.

LNG in vessels and CNG and LNG in vehicles

12. The 83 maritime ports of the TEN-T Core Network are the primary locations for the use of LNG in shipping. Equipping with LNG also the inland waterway and road transport corridors and assuring enough number of refuelling stations for CNG vehicles would provide sufficient coverage in these transport modes as well.

3. ROOT CAUSES

13. The Commission has identified two main root causes:
- Existing recharging/refuelling equipment cannot be connected and is not interoperable in all related alternative fuel vehicles/vessels. The technology necessary for the construction of a network is substantially mature. However, currently the standards are not common EU-wide, **thereby discouraging potential infrastructure investors, car manufacturers and consumers. This leads to the fragmentation of the internal market.**
 - Investment uncertainty hinders the deployment of recharging/refuelling infrastructure for electricity, hydrogen and natural gas (LNG and CNG). The business case for providers of alternative fuels infrastructure is not yet established. **The co-ordination failure among vehicle manufactures, infrastructure providers, national authorities and final users must be addressed. Initiatives that are specifically addressed at promoting infrastructure appear necessary to break this deadlock.**

4. ANALYSIS OF SUBSIDIARITY

14. The right for the EU to act in the field of transport is set out in Articles 90-91 of the TFEU, in Title VI.
15. An EU initiative in this field would be necessary since Member States do not have the instruments to achieve pan-European coordination in terms of technical specifications of infrastructure and timing of investments.
16. Vehicle and equipment manufacturers need to produce on a large scale for a single EU market, and they need to be able to rely on consistent developments across Member States. Similarly, consumers and transport users are interested in pan-European mobility.

17. The proposed action only addresses two transport modes (road and waterborne) for which the development of a minimum necessary network cannot be achieved without EU support. These sectors represent more than 80% of the modal split in freight and passenger transport. In these sectors, alternative fuels are functional to the reduction of oil dependence, GHG and pollutant emissions.

5. OBJECTIVES OF EU INITIATIVE

18. The EU has agreed on binding targets on the share of renewable energy in transport fuels (10% by 2020), and on a reduction of the CO₂ intensity of the road transport fuels (-6% by 2020). The 2011 White Paper announced a reduction of 60% of CO₂ emissions by 2050 requiring also a significant uptake of alternative fuels.

19. The general objective of this initiative is to ensure, within the current economic climate, the provision of a sufficient infrastructure network, contributing thereby to achieve the take-up of the alternative fuel vehicles' and vessels' market announced in the White Paper.

20. The general objective can be translated into more specific goals (Table 1)

Table 1: Problem tree: mapping problems and objectives

Problem Based on planned investments of Member States and, the alternative fuel infrastructure for electricity, hydrogen and natural gas (LNG and CNG) is likely to remain insufficient to enable the uptake of alternative fuels.	General objective The general objective of this initiative is to ensure, within the current economic climate, the provision of a sufficient infrastructure network for alternative fuels, contributing thereby to achieve the take-up of the alternative fuel vehicles' and vessels' market announced in the White Paper.
Problem driver 1 Existing recharging/refuelling equipment cannot be connected and is not interoperable	Specific objective 1 To make sure that recharging/refuelling equipment can be connected and are interoperable
Problem driver 2 Investment uncertainty hinders the deployment of recharging/refuelling infrastructure for electricity, hydrogen and natural gas (LNG and CNG)	Specific objective 2 To ensure that investment uncertainty is reduced to a level breaking up the existing 'wait and see' attitude amongst market participants

21. The following operational objectives have been defined:

- (1) All recharging stations for EVs, hydrogen and natural gas (LNG and CNG) refuelling for road transport vehicles, and LNG refuelling facilities for waterborne vessels can be connected, and are interoperable.
- (2) The number of recharging points for EVs reaches the values set out in Table 1, with at least 10% publicly accessible.

Table 2: Minimum number of EVs charging points in each Member State (in thousands)

MS	Number of charging points	Number of publicly accessible charging points
BE	207	21
BG	69	7
CZ	129	13

DK	54	5
DE	1503	150
EE	12	1
IE	22	2
EL	128	13
ES	824	82
FR	969	97
IT	1255	125
CY	20	2
LV	17	2
LT	41	4
LU	14	1
HU	68	7
MT	10	1
NL	321	32
AT	116	12
PL	460	46
PT	123	12
RO	101	10
SI	26	3
SK	36	4
FI	71	7
SE	145	14
UK	1221	122
HR	38	4

- (3) Existing hydrogen refuelling stations are connected via the TEN-T Core Network with a maximum distance of 300 km between stations by 2020.
- (4) LNG refuelling facilities for waterborne vessels are available in all maritime ports of the TEN-T Core Network by 2020.
- (5) LNG refuelling facilities for waterborne vessels are available in all inland ports of the TEN-T Core Network by 2020.
- (6) LNG refuelling stations for road transport vehicles are available along the TEN-T Core Network with a maximum distance of 400 km between stations by 2020.
- (7) CNG publicly accessible refuelling points are available, with maximum distances of 150 km, to allow the circulation of CNG vehicles Union-wide by 2020.

6. POLICY OPTIONS

22. The Commission undertook an extensive consultation of stakeholders on various policy options. A pre-screening of possible options was carried out on the basis of

the following criteria: consistency with general, specific and operational objectives, technology neutrality and feasibility.

23. The Commission has identified three policy options besides the ‘no policy change’ baseline scenario and analysed them in-depth.

6.1. Policy Option 1

24. Policy Option 1 represents the future without any additional policy intervention to change current trends (‘no policy change’ scenario). It takes into account all current legislative and policy initiatives, national announcements for the deployment of infrastructure, and the continuation of previous EU and Member States’ programmes and incentives.

6.2. Policy Option 2

25. The EU will issue recommendations on the application of standards for alternative fuels infrastructure. It will issue recommendations setting out basic criteria and indicative targets for the deployment of infrastructure for electricity, hydrogen and natural gas (LNG and CNG).

6.3. Policy Option 3

26. The EU will set out requirements for alternative fuels infrastructure for Member States. It will also set out basic criteria for minimum infrastructure coverage, together with binding targets for the most mature fuel technologies (electricity, and LNG for waterborne transport). For hydrogen and natural gas (LNG and CNG) for road transport, the targets would be indicative.

6.4. Policy Option 4

27. The EU will set out requirements for alternative fuels infrastructure for Member States. At the same time it will set out basic criteria for minimum infrastructure coverage, together with binding targets for electricity, hydrogen, LNG and CNG in road and LNG in waterborne transport.
28. Under any Policy Option, EU legislation would not specify requirements beyond the minimum number and the technical standards. Member States would thus decide on the regulatory framework, territorial localisation, and other implementation measures.

7. ASSESSMENT OF IMPACTS

Economic impacts

29. These Policy Options aim to provide a fundamental condition for market up-take of alternative fuel vehicles and vessels, but cannot ensure it without the concurrence of the other initiatives that are part of the overall strategy.
30. The assessment is based on modelling results quantifying the ‘direct’ or ‘stand-alone’ benefits of the policy proposal, and on evidence from other studies on the wider impact, when it is seen in combination with other existing and forthcoming initiatives to promote alternative fuel vehicles.
31. The ‘stand-alone’ costs of the infrastructure deployment are shown on Table 3.

Table 3: Estimated investments costs under each Policy Option²

	Number of additional charging points/fuelling stations	Policy Option 2	Policy Option 3	Policy Option 4
	<i>thousands</i>	<i>Million €</i>		
Electricity				
(Total)	8,000	3,984	7,968	7,968
of 90% private	7,200	1,872	3,744	3,744
of 10% publicly accessible	800	2,112	4,224	4,224
Hydrogen	0.143	-	-	230
LNG for vessels	0.139	1,140	2,085	2,085
LNG for trucks	0.144	-	-	58
CNG for vehicles	0.654	-	-	164
Estimated investment costs of infrastructure deployment		5,124	10,053	10,505
Estimated retrofitting costs		-	45 – 50	90 – 100
Estimated total investments costs		5,124	10,103	10,605

32. **Member States could ensure implementation through a variety of measures** (e.g. building codes, conditions for parking lots permits, certification of the environmental performance of businesses, facilitating cooperation between LNG companies and port authorities) **without necessarily involving public spending.**
33. The approach for the **cost-benefit analysis** does not take into account the benefits of reduced oil dependency, increased competitiveness and better functioning of the internal market. Nonetheless, even under the Policy Option 4, comparing the benefits of choosing infrastructure deployment to the costs of other possible policies results in **higher than 1.5 ratios in all Member States.**
34. The main macroeconomic effect would be on reduced oil consumption and avoided fuel expenditure. Avoided fuel use increases progressively over the decades 2010-2030 from about 610 million € per year in 2020 to about 2.3 bn € per year in 2030 under Policy Option 2, 1.7 bn € per year in 2020 to 4.6 bn € per year in 2030 under Policy Option 3, and 4.2 bn € per year in 2020 to 9.3 bn € per year in 2030 under Policy Option 4. The estimated aggregate energy security benefit also increases gradually.
35. The main difference in macroeconomic impacts between Policy Option 2 and 3 consists in the different probability of achieving the same results through

² The unit cost per smart private charging point can be estimated to be around 520 € while for a publicly accessible charging point it is approximately 5,280 €. The cost of hydrogen refuelling station is 1.6 million €. The unit cost of a small-scale bunkering facility is 15 million €, while the cost estimate used for LNG fuelling station is 400,000 €.

recommendations or mandates. Policy Option 2 is considered much less effective for the following reasons:

- Many Member States have ambitious plans but have not undergone obligations. This leaves consumers and investors with uncertainties and holds back market uptake;
- The deadlock between the various market players needs to be removed. **This can only be done if there is a credible commitment, which Member States' plans, voluntary industry agreements and EU recommendations are not providing. Market participants are aware of past non-binding initiatives in this field that failed to produce the intended result (e.g. Biofuels Directive³).**

36. The difference between Policy Option 3 and 4 is the smaller likelihood of deployment of a hydrogen refuelling network in Policy Option 3. The high potential gains of Policy option 4 should be assessed against the relatively small additional investment costs.

Social impacts

37. The Impact Assessment finds that investment into the build-up of infrastructure would be mostly placed in Europe, with direct economic benefits for the sectors involved in the infrastructure build-up.
38. Additional employment, with a wide range of job qualifications, will be created through investment into the areas of construction, manufacturing, electricity, information and communication technology, advanced materials, computer applications. In automotive and refining sectors, shift to new qualifications will preserve employment on the long term.

Environmental impacts

39. Large environmental benefits can be realised from deploying alternative fuels. The reduction is marginally higher in Policy Option 3 relative to 4, due to increased emissions from LNG trucks in Policy Option 4 in the medium-run.
40. Under Policy Option 2, NO_x emissions decrease by 1.4% by 2020, by 2.0% in Policy Option 3, and in Policy Option 4 by 2.8%. Particulate matter emissions follow a similar pattern. External costs for noise are reduced as well.

Conclusions of the assessment of impacts

41. The analysis of impacts shows that investing in a minimum recharging/refuelling network is the most efficient way to promote alternative fuel vehicles. While infrastructure alone has no major direct impact, an intervention on the refuelling/recharging network can have large positive effect in combination with other initiatives targeted at the introduction of cleaner vehicles.

³ The Biofuels Directive 2003/30/EC established a reference value of a 2% share for biofuels in petrol and diesel consumptions in 2005 and 5.75% in 2010. Member States were required to set indicative targets for 2005, taking this reference value into account. The reports issued in 2009 as well as the Renewable Energy Roadmap (COM/2006/848) highlighted “the slow progress Member States were making and the likelihood that the EU as a whole would fail to reach its 2010 target. The Roadmap explained possible reasons for this, which included the merely indicative nature of the national targets and the uncertain investment environment provided by the existing legal framework.” The Commission therefore proposed a more rigorous framework and legally binding targets for 2020, as part of the Climate and Renewable Energy Package.

42. Under Policy Option 4, the benefits in terms of lower oil consumption amount to about 84.9 bn € and lower impact on the environment to around 15.4 bn €. Hence, the benefits clearly outweigh the approx. 10 bn € needed for a minimum network.

8. COMPARISON OF OPTIONS

43. Effectiveness: The objectives are fully achieved under Policy Option 4 for all alternative fuels considered in the IA. Policy Option 3 differs only in the coverage of fuels. Policy Option 2 has the greatest risk of not satisfactorily delivering.
44. Efficiency: The least cost can be associated to Policy Option 2, which is however a result of lower effectiveness in the achievement of objectives. While the costs of Policy Option 4 are higher than of Policy Option 3, the potential benefits can outweigh this difference.
45. Coherence: Policy Option 2 would likely result in lower investments. This outcome would particularly penalise the environmental dimension. Policy Option 3 achieves the most comprehensive limitation of trade-offs across the economic, social and environmental fields. Policy Option 4 would represent a more risky option, which can be considered to place more emphasis on the environmental dimension with respect to the economic one.

9. CONCLUSION

46. **Policy Option 2 is discarded**, since it compares unfavourably with both Policy Options 3 and 4.
47. Policy Options 3 and 4 have many elements in common. Preference is given to Policy Option 3 which better takes into account the present economic constraints.
48. However, Policy Option 4 is not discarded as its suitability is mostly influenced by existing technological prospects that can change rapidly. This would increase its efficiency.
49. **The overriding necessity of giving clear signals to the markets would rather give larger merits to Policy Option 4.** If chosen, such a decisive step on EU level could accelerate the market development of alternative fuels in general and ensure that investments have a larger impact on economic growth in Europe.
50. Rapid implementation of the necessary actions, with market comforting targets, can also strongly enhance the momentum for the EU 2020 strategy.

10. MONITORING AND EVALUATION

51. Monitoring and reporting will be needed, building on existing reporting channels and additional information collection through existing Joint Undertakings, Technology Platforms, and expert groups.
52. Member States would most likely need to set up national plans on the build-up of alternative fuels infrastructure.
53. The Commission would submit reports on the implementation and impacts of this Directive to the European Parliament and the Council.
54. The reports would also review the requirements in view of the technical, economic and market developments, and propose adjustments as appropriate.