5.1 Denmark (DK)

5.1.1 *Main messages from the Commission assessment of the NPF*

In its original assessment of the Danish NPF, the Commission concluded:

The Danish NPF addresses most of the requirements of Article 3. It presents the current state of alternative vehicle uptake and infrastructure and derives targets for future recharging points and CNG refuelling points (road). It discusses LNG refuelling in maritime ports and H2 refuelling points (road). It does not establish targets for LNG refuelling points for heavy-duty vehicles. The government in Denmark is committed to achieve the goal of becoming a low-emission society, independent of fossil fuels by 2050. The Danish government seeks to promote a market-driven (i.e. determined by market players) development of infrastructure deployment and to limit public financial aid, so that greater pressure on public finances can be avoided. Technology neutrality is emphasised in the NPF.

For electricity, the Danish NPF is relatively well-balanced in terms of future targets and the description of policy measures. Notwithstanding, the latter is fundamentally based on current rather than planned measures. The NPF estimates that the EV share (of all vehicles on the road) will remain below 1% until 2020. The prospects of shore-side electricity supply in Danish maritime ports are not good. The only policy measure mentioned in the NPF is tax relief for electricity. However, this incentive was not sufficient to make the investment in shore-side electricity supply attractive in the context of the Nordhavn expansion of the Port of Copenhagen. At the opposite extreme lies the status of electricity supply for stationary airplanes. Denmark considers itself a leader in this matter. Notwithstanding, communication f the number of ground power units installed in the three largest airports would facilitate the assessment.

For other alternative fuels, the NPF is not comprehensive.

The NPF highlights the lack of market momentum for private ownership of CNG cars. The NPF does not contain any future estimates for CNG vehicles. Although the sufficiency index for CNG refuelling points is adequate, it seems that Aarhus, in particular, could benefit from CNG infrastructure deployment for two reasons: it is the second-largest city in the country and it is located along the TEN-T Network between Aalborg and Vejle.

In terms of LNG for road transport, no infrastructure targets are given.

There appears to be a lack of policy measures targeting LNG in the Danish maritime ports.

At present, Denmark foresees insignificant market uptake for hydrogen vehicles before 2025.

The support measures defined in the Danish NPF are unlikely to have a high impact on removing market barriers.

The NPF does not provide any information on stakeholder engagement and cooperation with other Member States.

5.1.2 *Overview of requirements' fulfilment from Annex I of the Directive*

Table 5.1.2-1 Checklist Table

Part of the Directive 2014/94/EU	Requirement	Mode of Transport / Alternative Fuel (provided in the NIR)	Yes / No
ANNEX I: 1. Legal measures	Information on legal measures, which may consist of legislative, regulatory or administrative measures to support the build-up of alternative fuels infrastructure, such as building permits, parking lot permits, certification of the environmental performance of businesses and fuel stations concessions.	Road / Electricity, CNG, hydrogen	Yes
ANNEX I: 2. Policy measures supporting the implementation of the national policy framework	Information on those measures shall include the following elements: • direct incentives for the purchase of means of transport using alternative fuels or for building the infrastructure, • availability of tax incentives to promote means of transport using alternative fuels and the relevant infrastructure, • use of public procurement in support of alternative fuels, including joint procurement, • demand-side non-financial incentives, for example preferential access to restricted areas, parking policy and dedicated lanes, • technical and administrative procedures and legislation with regard to the authorisation of alternative fuels supply, in order to facilitate the authorisation process.	All / All	Yes
	• consideration of the need for renewable jet fuel refuelling points in airports within the TEN-T Core Network	Air / Biofuels	Yes
ANNEX I: 3. Deployment and manufacturing support	• Annual public budget allocated for alternative fuels infrastructure deployment, broken down by alternative fuel and by transport mode (road, rail, water and air).	Road, rail, combination / All	Yes
	• Annual public budget allocated to support manufacturing plants for alternative fuels technologies, broken down by alternative fuel and by transport mode.	Road / CNG	Yes
	• Consideration of any particular needs during the initial phase of the deployment of alternative fuels infrastructures.		No
ANNEX I: 4. Research, technological development and demonstration	• Annual public budget allocated to support alternative fuels RTD&D, broken down by fuel and by transport mode.	Road, combination / Hydrogen, AFs in general	Yes
ANNEX I: 5. Targets and objectives	• Estimation of the number of alternative fuel vehicles expected by 2020, 2025 and 2030	Road, water maritime, rail / All	Yes
	• Level of achievement of the national objectives for the deployment of alternative fuels in the different transport modes (road, rail, water and air)	Road, water maritime, rail / All	Yes
	• Level of achievement of the national targets, year by year, for the deployment of alternative fuels infrastructure in the different transport modes	Road, water maritime / All	Yes
	• Information on the methodology applied to take account of the charging efficiency of high power recharging points	All / Electricity	No
ANNEX I:6 Alternative fuels infrastructure developments	Changes in supply (additional infrastructure capacity) and demand (capacity actually used)	Road, water maritime / All	Yes

The checklist shows that almost all the requirements of Annex I from the Directive are covered.

Regarding the combination of AF/AFV/AFI with transport mode, electricity is covered for all modes; CNG, hydrogen and LPG for road transport; LNG for road and maritime transport; biofuels for air transport; all the other combinations are either absent or not applicable.

The Danish NIR reports around 50 measures. Under the Policy and Deployment & Manufacturing sections it was possible to identify six AF/transport mode clusters of measures, of which five were assessable.

5.1.3 *Quantitative assessment: Vehicles and infrastructure*

Table 5.1.3-1 National AFV estimates and AFI targets established in the NIR at the horizon 2020, 2025 and 2030 and their comparison with the NPF situation

Alternative fuel / Transport mode		2018		2020		2025		2030	
		AFV	AFI public	AFV	AFI public	AFV	AFI public	AFV	AFI public
Electricity / road	NIR	16,118	3,648	35,675	5,419	109,805	9,848	331,749	29,437
	Change NIR vs NPF [%]			16.50%	80.65%	67.33%			
	Attainment [%]			45.18%	67.31%	14.68%	37.04%	4.86%	12.39%
CNG / road	NIR	578	17	862	17	1,522	17	2,153	17
	Change NIR vs NPF [%]				-15.00%				
	Attainment [%]			67.05%	100.00%	37.98%	100.00%	26.85%	100.00%
LNG / road	NIR	0	0	0	0	0	3	0	3
	Change NIR vs NPF [%]								
	Attainment [%]								
LNG / water (maritime)	NIR	3	2	3	2	4	2	4	2
	Change NIR vs NPF [%]								
	Attainment [%]			100.00%	100.00%	75.00%	100.00%	75.00%	100.00%
H2 / road*	NIR	85	8	316	7	889	7	954	7
	Change NIR vs NPF [%]								
	Attainment [%]			26.90%		9.56%		8.91%	
LPG / road	NIR	12	4	8	4	3	2	0	0
	Change NIR vs NPF [%]								
	Attainment [%]								
Shore-side electricity supply / water (maritime)	NIR		2		4		11		11
	Change NIR vs NPF [%]								
	Attainment [%]				50.00%		18.18%		18.18%

Legend:

	not applicable
	the value could not be computed
NA	no value/information provided/available in the NIR

*The values for hydrogen refuelling points are shown for informational purposes only and should not be interpreted as Denmark's targets, for the Danish government officially excluded hydrogen from its NPF and NIR.

5.1.3.1 Road transport

5.1.3.1.1 Electricity

Vehicles

Denmark recorded 16,118 battery-electric and plug-in hybrid electric vehicles in use in 2018 (of which 15,205 were passenger cars, 905 were LCVs and 8 were buses and coaches) (see Table 5.1.3-1). The Danish NIR EV estimates are 35,675 for 2020 and 109,805 for 2025, which are respectively 16.50% and 67.33% higher than in the NPF. This reflects a higher policy ambition. Denmark had not provided 2030 EV estimates in the NPF but the NIR presents estimates: by 2030, the Danish NIR expects that 88.7% of the 331,749 EVs in use will be passenger cars, 10.7% LCVs, 0.1% HCVs and 0.5% buses and coaches. In addition, the Danish NIR provides an estimate of 2,510 electric PTW in 2030, compared to 1,386 in 2018.

The 2018 ***attainment*** of future EV estimates is 45.18% for 2020 and 4.86% for 2030. According to the assessment methodology described in Section 2.1, the 2018 situation corresponds to a ***slow progress*** towards reaching the envisaged EV estimates. The calculated ***average annual growth rate*** corresponding to the period 2016-2030 for EV fleet evolution planned by Denmark is equal to 27%.

Infrastructure

Denmark recorded 3,648 publicly accessible recharging points in 2018 (Table 5.1.3-1). The NIR target for the publicly accessible recharging points for 2020 is 5,419. This is 80.65% higher than the target in the NPF. Denmark had not provided targets for publicly accessible recharging points for 2025 and 2030 in its NPF. This has now been modified in the NIR: 9,848 and 29,437 points respectively in 2025 and in 2030. Over the period 2020-2030, the share of publicly accessible high power (>22kW) recharging infrastructure is targeted to remain constant at a value of 62%.

The Danish NIR indicates that information on the number of private recharging points is unavailable.

The 2018 ***attainment*** of future publicly accessible recharging infrastructure targets is 67.31% for 2020 and 12.39% for 2030. According to the assessment methodology described in Section 2.1, the 2018 situation corresponds to an ***adequate progress*** towards reaching these envisaged targets. The calculated ***average annual growth rate*** corresponding to the period 2016-2030 for publicly accessible recharging infrastructure evolution planned by Denmark is equal to 21%.

Ratio

Based on the DK NIR, the following table shows the ratio between vehicles and publicly accessible recharging points (i.e. sufficiency index) for the pair electricity/road. It can be seen that in 2030 the foreseen sufficiency index is not far from a value of 10 that, considering the planned 62% high power share, can be regarded as adequate.

Sufficiency Index		2016	2017	2018	2020	2025	2030
Road	Electricity	6.05	4.17	4.42	6.58	11.15	11.27

Information on charging efficiency

Information is not available in the Danish NIR.

5.1.3.1.2 CNG

Vehicles

Denmark recorded 578 CNG vehicles in use in 2018, of which 130 were passenger cars, 138 LCVs, 156 HCVs (including refuse collection vehicles in many cities) and 154 buses and coaches (Table 5.1.3-1). By 2030, the Danish NIR expects that 37% of the 2,153 CNG vehicles in use will be passenger cars, 17% LCVs, 4% HCVs and 42% buses and coaches.

The 2018 ***attainment*** of future CNG vehicles estimates is 67.05% for 2020 and 26.85% for 2030. According to the assessment methodology described in Section 2.1, the 2018 situation corresponds to an ***adequate progress*** towards reaching the envisaged CNG vehicles estimates. The calculated ***average annual growth rate*** corresponding to the period 2016-2030 for the CNG vehicle fleet evolution planned by Denmark is equal to 13%.

Infrastructure

As Table 5.1.3-1 shows, the Danish government plans that the 17 publicly accessible CNG refuelling points in 2018 remain in use until 2030. The AFI (CNG/road) public target for 2020 provided in the NIR is 15.00% lower than in the NPF.

The 2018 ***attainment*** of future publicly accessible CNG refuelling infrastructure targets is constant and equal to 100% for 2020, 2025 and 2030. According to the assessment methodology described in Section 2.1, the 2018 situation corresponds to a ***fast progress*** towards reaching these envisaged targets. The calculated ***average annual growth rate*** corresponding to the period 2016-2030 for publicly accessible CNG refuelling infrastructure evolution planned by Denmark is equal to 1%.

Ratio

Based on the DK NIR, the following table shows the ratio between vehicles and publicly accessible refuelling points (i.e. sufficiency index) for the pair CNG/road. It can be seen that the sufficiency index is well below the indicative value of 600 (see Section 2.1.5) for the whole implementation period.

Sufficiency Index		2016	2017	2018	2020	2025	2030
Road	CNG	25.93	32.00	34.00	50.71	89.53	126.65

5.1.3.1.3 LNG

Vehicles

Three years after the notification of the Danish NPF, LNG road vehicles had not been deployed in Denmark yet. The Danish NIR provides a value of zero for the future estimates of LNG road vehicles. However, since the notification of its NPF, Denmark has been observing LNG developments in neighbouring countries and expects future transit traffic of LNG vehicles.

Infrastructure

The Danish NIR notes that refuelling a LNG vehicle on Denmark's part of the TEN-T network is currently not possible. As it can be seen in Table 5.1.3-1, Denmark plans for the possibility of three LNG refuelling points to be deployed by 2025 (probably around Aalborg, the Triangle Region and Copenhagen). According to the NIR, such deployment will be facilitated by market-driven developments.

Because there were no LNG refuelling points in Denmark at the end of 2018, this assessment did not compute 2018 ***attainment*** and ***progress*** values.

Ratio

Since there are no LNG vehicle estimates in the DK NIR it is not possible to compute the sufficiency index.

5.1.3.1.4 Hydrogen

Vehicles

The Danish NIR indicates that 85 hydrogen-powered vehicles (all of them passenger cars) were in use in 2018. This number is expected to reach almost 1,000 units by 2030, of which 21 would be HCVs, 276 buses and coaches and the rest passenger cars.

The 2018 ***attainment*** of future hydrogen vehicle estimates is 26.90% for 2020 and 8.91% for 2030. According to the assessment methodology described in Section 2.1, the ***progress*** obtained by Denmark from 2016 until 2018 for hydrogen vehicles deployment is 1.81% of the overall planned deployment during the period 2016-2030.

Infrastructure

The Danish NPF did not include hydrogen infrastructure provisions. Data reported on hydrogen in the NPF and the NIR are presented here for informational purposes though.

The Danish NIR indicates that eight hydrogen refuelling points (all of them 700 bar and publicly accessible) were available in 2018, of which seven remained at the time the NIR was notified.

Because the Danish government officially excluded hydrogen for its NPF and NIR, no ***attainment*** and ***progress*** values have been computed.

Ratio

Because the Danish government officially excluded hydrogen for its NPF and NIR, no sufficiency index has been computed.

5.1.3.1.5 Biofuels

Vehicles

Information is not available in the Danish NIR.

Infrastructure

As in the Danish NPF, the Danish NIR does not provide further information on infrastructure requirements for biofuels, as these are expected to be distributed through existing conventional fuels infrastructure.

5.1.3.1.6 LPG

Vehicles

The Danish government expects that LPG for transport is fully phased out by 2030. Thus, the future number of LPG vehicles in use declines and is expected to reach zero by 2030.

Because the Danish government expects the phase-out of LPG, no ***attainment*** and ***progress*** values have been computed.

Infrastructure

Given the expectation of an LPG phase-out by 2030, the number of publicly accessible LPG refuelling points halves by 2025 and further reduces to zero by 2030, according to the NIR.

Because the Danish government expects the phase-out of LPG, no ***attainment*** and ***progress*** values have been computed.

Ratio

Based on the DK NIR, the following table shows the ratio between vehicles and publicly accessible refuelling points (i.e. sufficiency index) for the pair LPG/road (see Section 2.1.5). The 2030 value could not be computed since LPG will be phased out.

Sufficiency Index		2016	2017	2018	2020	2025	2030
Road	LPG	4.50	3.50	3.00	2.00	1.50	

5.1.3.2 Rail transport

5.1.3.2.1 Electricity

Vehicles

The Danish NIR expects the number of electric locomotives to increase from 253 units in 2018 to 353 by 2030. This number is however similar to the 345 figure reported for 2016.

Infrastructure

According to the NIR, the full electrification of the 57 km Esbjerg-Lunderskov route in 2017 and the 45 km Køge-Næstved route in 2019 allows electric trains to circulate on these electrified

routes. In addition, the 60 km high-speed Copenhagen–Ringsted line inaugurated in 2019 was also built as an electrified railway.

5.1.3.3 Waterborne transport (maritime)

5.1.3.3.1 Electricity

Vessels

The Danish NIR expects the number of electric seagoing ships to increase from 3 units in 2018 to 5 by 2030.

Infrastructure

According to the NIR, shore-side electricity supply installations are available for use in all the Danish ports by vessels requiring a rather limited power supply. However, the availability of shore-side electricity supply installations for use by vessels requiring substantial power supply is uncertain and remains, on economic grounds, not widespread yet. The Danish NIR does not provide specific information on the threshold between 'limited and substantial' power supply. The NIR mentions that shore-side electricity supply will become available in the ports of Skagen, Hirtshals and Frederikshavn in next three years. As it can be seen in Table 5.1.3-1, the number of recharging points providing shore-side electricity supply in the Danish maritime ports is expected to increase from two in 2018 to eleven by 2030. Denmark is likely to reach its 2020 target given that shore-side electricity supply became available also in the Port of Faaborg and the Port of Grenå in 2019 (in the latter, with a 2 MW capacity).

The 2018 ***attainment*** of future targets for shore-side electricity supply for seagoing ships in maritime ports is 50% for 2020 and 18.18% for 2030. According to the assessment methodology described in Section 2.1, the ***progress*** Denmark obtained from 2016 until 2018 for shore-side electricity supply deployment in maritime ports is 60% of the overall planned deployment during the period 2016-2030.

5.1.3.3.2 LNG

Vessels

The Danish NIR expects the number of LNG seagoing ships to increase from three units in 2018 to four by 2030.

The 2018 ***attainment*** of future LNG seagoing ships estimates is 100% in 2020 and 75% in 2030. According to the assessment methodology described in Section 2.1, the ***progress*** obtained by Denmark from 2016 until 2018 for LNG seagoing ships deployment is 0% of the overall planned deployment during the period 2016-2030.

Infrastructure

As it can be seen in Table 5.1.3-1, there were two LNG refuelling points in Danish maritime ports in 2018. This entails that Denmark's second LNG facility has become operational in the port of Hou since the notification of the NPF (and while Frederikshavn was mentioned in the NPF, no update on LNG availability in this port is provided in the NIR). According to the NIR, the future number of LNG refuelling points in Danish maritime ports is expected to remain

unchanged. Accordingly, no LNG supply targets before 2030 are given for the two maritime ports that are part of the TEN-T Core Network (Aarhus and Copenhagen). Notwithstanding this, the Danish NIR reports the expectation that the Directive's minimum requirements will either be met by market-based developments or by regulatory initiatives, if necessary.

The 2018 ***attainment*** of future LNG refuelling infrastructure targets in maritime ports is 100% in 2020, 2025 and 2030. According to the assessment methodology described in Section 2.1, the ***progress*** obtained by Denmark from 2016 until 2018 for LNG refuelling infrastructure deployment in maritime ports is 100% of the overall planned deployment during the period 2016-2030.

5.1.3.4 Waterborne transport (inland)

Not applicable since Denmark has no inland ports in the TEN-T Core Network.

5.1.3.5 Air transport

5.1.3.5.1 Electricity

Airplanes

The Danish NIR considers that the deployment of hybrid-electric or fully-electric airplanes by 2030 remains highly uncertain.

Infrastructure (for stationary airplanes)

As in the NPF, the Danish NIR indicates that the airports that account for more than 97% of passenger flights are equipped with devices that enable electricity supply for stationary airplanes.

5.1.3.5.2 Biofuels

Airplanes

Information on flights / airplanes powered by biofuels is not provided in the Danish NIR.

Infrastructure

The Danish NIR gives some consideration to the need for renewable jet fuel refuelling points in airports within the TEN-T Core Network. In Denmark, there was no sustainable aviation fuel production in late 2019. The NIR does not quantify sustainable aviation fuel production by 2030, though it expects it to increase towards 2030.

5.1.4 ***Measures assessment***

As in the NPF, a relevant series of measures is mentioned in the Danish NIR. For the Policy and Deployment & Manufacturing support measures, this results in five assessable AF/transport mode clusters.

5.1.4.1 Legal measures

The Danish NPF had only mentioned one legal measure on advanced biofuels blending, which is no longer mentioned in the NIR. The Danish NIR contains now seven legal measures, representing a significant increase.

Whereas two of the legal measures described in the NIR have already expired, another one refers to the presentation of a proposal for an Act amendment (related to the implementation of the provisions stipulated in the Energy Performance of Buildings Directive (2018/844/EU)). The rest are existing measures (all of them affecting road transport).

Considering all the legal measures, they appear, if fully implemented, to be fit to support the realisation of the AFV/AFI objectives as presented in the NPF and revised in the NIR. The level of ambition of the legal measures has generally increased in the NIR compared to the NPF.

5.1.4.1.1 Legislative & Regulatory

All the legal measures described in the Danish NIR can be categorised as legislative and regulatory measures and include the following ones:

- Norms & requirements: zero- and low-emission parking benefits and stricter energy requirements for the taxi fleet.
- Permits: quotas of permits for zero-emission taxis and access to bus lanes for low-emission vehicles.

5.1.4.1.2 Administrative

The Danish NIR does not provide specific information on administrative measures.

5.1.4.2 Policy measures

In its NPF, the Danish government had signalled the willingness to re-examine public support if conditions varied considerably on various policy issues. The Danish NIR contains nine policy measures, which represents no change in the number of measures compared to the ones identified in the NPF (adopted or existing at the time). In contrast to the NPF, the abolition of the public service obligation tax and public procurement for alternative fuel vehicles are no longer mentioned.

5.1.4.2.1 Measures to ensure national targets and objectives

Road transport

Of all the policy measures described in the Danish NIR, six can be categorised as measures to ensure national targets and objectives. None of these target AFI. All of them, with one exception, involve taxation: tax reductions or exemptions for alternative fuels or for vehicle registration. Although most of them were present also in the NPF, changes on two relevant acts have taken place since then: Act No. 687 in 2017 and Act No. 1730 in 2018. According to the Danish NIR, the energy tax benefits electricity and hydrogen while the CO_2 tax favours in addition biofuels and natural gas (including biogas). Moreover, reductions in the ordinary electricity tax can be expected until 2025 from the 89.2 øre/kWh level in 2020.

Regarding taxation for vehicle registration, the Danish NIR distinguishes between the registration and the motor vehicle tax. Fuel cell-powered vehicles will be exempted from both until 2021, fully subject to the motor vehicle tax from 2022 and gradually subject to the registration tax between 2022 and 2025. For BEVs[1], the NIR further distinguishes between a special battery allowance and a tax-free allowance. The Danish NIR considers that in practice BEVs valued at DKK 400,000 (around €60,000), or less, paid no registration taxes in 2019 and 2020. The registration tax will be gradually phased in for BEVs, PHEVs and CNG vehicles. Under current policy, BEVs will be subject to the full registration tax in 2023 (and not in 2020 as the NPF had stated).

Waterborne transport

The Danish NPF mentioned the reduction of the electricity tax for shore-side electricity supply. Although a few of the policy measures target alternative fuels and can be considered to potentially affect water transport, no concrete policy measures targeting water transport are listed in the Danish NIR.

5.1.4.2.2 Measures that can promote AFI in public transport services

Of all the policy measures described in the Annex of the Danish NIR, two can be categorised as measures that can promote AFI in public transport services. Both of them are existing measures: one dealing with electric buses at local level and the other with electric railway vehicles at regional level.

Buses

The Danish NIR mentions that electric buses have been trialled in many routes in Copenhagen and Frederiksberg since 2016. Moreover, over 40 new electric buses were expected to be introduced in Denmark in the year in which the NIR was notified (2019).

Rail transport

According to the Danish NIR, further electrification of the railways is pursued, including the Fredericia-Aarhus, Aarhus-Lindholm and Roskilde-Kalundborg routes. To this end, the Banedanmark's Electrification Programme is being implemented with the objective of electrifying much of the country's railway network, according to the NIR.

5.1.4.2.3 Measures that can promote the deployment of private electro-mobility infrastructure

The NIR lists a measure to support the deployment of private electro-mobility infrastructure, namely the low rate of industry process electricity tax (0.4 øre/kWh) for commercially recharged EVs. It seems that this measure was expected to expire at the end of 2019 but has been extended until 2021.

5.1.4.3 Deployment and manufacturing support

5.1.4.3.1 AFI deployment

[1] We deduce that the NIR uses 'EVs' to refer to BEVs only, in contrast to PHEVs, and 'gas vehicles' to refer to CNG vehicles.

The Danish NIR contains 11 AFI deployment support measures[2], which represents a significant increase compared to the four measures identified in the NPF. Nine of the eleven can be considered measures that have already expired. The measures cover various alternative fuels and transport modes, including for instance funds to support e-bike use and to supply harbour buses with green biodiesel. The total estimated budget for AFI deployment reported in the NIR amounts to 140 million € for the period 2016-2025.

5.1.4.3.2 Support of manufacturing plants for AF technologies

The Danish NIR contains one measure that had been mentioned in the NPF to support manufacturing plants for AF technologies. The measure, to be implemented between 2021 and 2030, is backed by a ca. 286 million € fund with the aim of supporting the use of biogas in transport and industrial processes.

5.1.4.3.3 Consideration of any particular needs during the initial phase of the deployment of alternative fuels infrastructures

Information is not available in the Danish NIR.

5.1.4.4 Quantitative assessment of Policy and Deployment & Manufacturing measures

Table 5.1.4-1 presents an analysis of all the Policy and Deployment & Manufacturing measures, carried out according to the assessment methodology described in Section 2.2. As it can be seen, the electricity/road cluster is the only having a high score. None of the clusters identified can be considered comprehensive. Support measures continue to be irrelevant or not assessable for LNG/road and for LNG/water (maritime) (for instance, it seems that the Danish NIR does not consider LNG retrofit for vessels to be an option).

In terms of expected impact of these measures to support the realisation of the AFV/AFI objectives as presented in the NPF and revised in the NIR, the measures for the pair electricity/road have a medium impact, those for the pairs CNG/road, biofuels/road, hydrogen/road and electricity/rail result to have a low impact.
Compared to the NPF, the level of ambition of the Policy and Deployment & Manufacturing measures has increased for all the assessable pairs.

[2] In terms of railway electrification, if a distinction is made between vehicles (which is included in the part on policy measures) and infrastructure, then a 12th measure can be identified, though information on budget is not available.

Table 5.1.4-1 Quantitative assessment of Policy and Deployment & Manufacturing support measures

AF	Transport mode	Score	Comprehensiveness		Impact		Ambition (NIR vs NPF)
Electricity	Road	H	N		**M**		+
CNG	Road	M	N		**L**		+
LNG	Road						
	Water - maritime	X					=
Biofuel	Road	M	N		**L**		+
H2	Road	M	N		**L**		+
Electricity	Rail	M	N		**L**		+

Legend: Score: H = high; M = medium; L = low; X = not assessable. Comprehensiveness: C = comprehensive; N = Not comprehensive. Ambition level: '+' means 'higher'; '=' means 'comparable'; '-' means 'lower'.

5.1.4.5 Research, Technological Development & Demonstration

The Danish NIR contains 19 RTD&D projects of relevance: 3 supported in 2019, 8 in 2018, 4 in 2017 and 4 in 2016. This represents a significant increase compared to the six RTD&D projects identified in the NPF. The NIR does not provide specific details[3] about each of these projects, which does not allows us to either make direct comparisons with the projects listed in the NPF or to cluster them. The NIR states that the vast majority of these projects focus on hydrogen, with a couple of them dealing with electricity for maritime transport and bioethanol. The total estimated budget for RTD&D projects reported in the NIR amounts to 36 million € for the period 2016-2019, mainly channelled through the Energy Technology Development and Demonstration Programme, the Innovation Fund and the EU framework schemes.

5.1.5 *Additional information on alternative fuels infrastructure developments*

The Danish NIR provides information on the changes in fuel use (see Table 5.1.5-1[4]). As it can be seen, biofuels are expected to remain the dominating alternative fuel in road transport throughout the period, followed by electricity. No real increase in LNG use in maritime transport is expected.

[3] These can presumably be searched via the website Energiforskning.dk.
[4] Adapted from the original table notified by Denmark.

Table 5.1.5-1 Changes in fuels use in transport sector (2016-2030)

MODE OF TRANSPORT	FUEL	Fuels use [%]			Estimated fuels use [%]		
		2016	2017	2018	2020	2025	2030
Road	Gasoline	35%	35%	34%	33%	33%	35%
	Diesel	59%	59%	60%	61%	60%	57%
	Electricity	0%	0%	0%	0%	1%	2%
	Biofuels	6%	6%	6%	6%	6%	6%
	Other AF	0%	0%	0%	0%	0%	0%
	Total Road	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Maritime	Marine gas oil	0%	0%	0%	0%	1%	1%
	Marine diesel oil	100%	100%	100%	100%	99%	99%
	LNG	0%	0%	0%	0%	0%	0%

*Note: Since the values for 'other AF' provided in the NIR are zero and CNG use in Denmark is dominated by biomethane, it is unclear whether the biofuels figures include biomethane.

5.1.6 *Summary of the assessment*

Tabular overview

Table 5.1.6-1 Overview of the NIR assessment

		Indicators	Alternative fuel / transport mode					
			Electricity / road	CNG / road	LNG / road	LNG / water (maritime)	H2 / road*	LPG / road
AF Vehicles / Vessels		Past situation (2016)	10,573	363	0	3	69	18
		Situation (2018)	16,118	578	0	3	85	12
		Estimate (2030)	331,749	2,153	0	4	954	0
		Future share (2030) [%]	8.97%	0.06%	0.00%		0.03%	0.00%
		Estimate attainment (2018 vs 2030) [%]	4.86%	26.85%		75.00%	8.91%	
		Progress (2018)	slow	adequate		0.00%	1.81%	
Publicly accessible AF Infrastructure		Past situation (2016)	1,749	14	0	1	10	4
		Situation (2018)	3,648	17	0	2	8	4
		Target (2030)	29,437	17	3	2	7	0
		Target attainment (2018 vs 2030) [%]	12.39%	100.00%		100.00%		
		Progress (2018)	adequate	fast		100.00%		
Sufficiency Index		2016	6.05	25.93			6.90	4.50
		2018	4.42	34.00			10.63	3.00
		2020	6.58	50.71			45.14	2.00
		2025	11.15	89.53			127.00	1.50
		2030	11.27	126.65			136.29	
Measures	Legal measures	Ambition (NIR vs NPF)	+	+	+	=		
	Policy measures + Deployment & manufacturing support	Score	H	M		X	M	
		Comprehensiveness	N	N			N	
		Impact	M	L			L	
		Ambition (NIR vs NPF)	+	+		=	+	
	RTD&D	Ambition (NIR vs NPF)						

Legend:

	not applicable
	the value could not be computed
NA	no value/information provided/available in the NIR

*The values for hydrogen are shown for informational purposes only and should not be interpreted as Denmark's policy goals, for the Danish government officially excluded hydrogen for her NPF and NIR. For this reason, we do not report our assessment on the measures for hydrogen.

The Danish NIR covers the whole AFID period (2016-2030). Compared to the NPF that did not meet several of the requirements of Article 3 of the Directive, the Danish NIR almost fully addresses the requirements of Annex I of the Directive, with the exception of: a) information on the methodology applied to take account of the charging efficiency of high power recharging points; b) information on any particular needs during the initial phase of AFI deployment.

The main outcomes of the technical assessment of the Danish NIR on vehicles/vessels estimates and infrastructure targets can be summarised as follows:

Road transport

- **Electricity** – Denmark recorded 16,118 electric vehicles and 3,648 publicly accessible recharging points in 2018. With reference to the objectives of the DK NPF as updated by the NIR, Denmark is progressing adequately in terms of infrastructure and slowly in terms of EV deployment. The NIR increases the level of ambition compared to the existing objectives in the NPF and provides a new set of vehicle estimates and infrastructure targets until 2030. The calculated Danish sufficiency index deteriorates slightly over time but is considered still adequate[5]. The Danish NIR expects that, by 2030, the stock of electric HCVs will reach 208 units and two-thirds of the electric buses in use will be fully electric.
- **CNG** –The Danish NIR does not foresee a further expansion of the 17 CNG refuelling infrastructure recorded in 2018, while CNG vehicle stock is expected to grow from 578 units in 2018 to 2,153 units in 2030 (an increasing stock of CNG passenger cars, LCVs and buses/coaches and a declining number of HCVs), which would lead to greater utilisation of the existing CNG refuelling points. By 2025, the Danish NIR expects the stock of CNG buses to be overtaken by electric buses. With regards to CNG road vehicle deployment, Denmark is progressing adequately. Concerning the progress of infrastructure deployment, this is obviously fast, as the new 2030 target declared in the DK NIR has been already achieved in 2018.
- **LNG** – In contrast to the NPF, the Danish NIR provides future targets for LNG refuelling infrastructure deployment (three by 2025). The NIR does not foresee deployment of road vehicles powered by LNG.
- **Hydrogen** –The NIR reports future values for the stock of vehicles but does not include official hydrogen infrastructure provisions. Furthermore, the NIR mentions measures for supporting the market and expects some market-driven uptake of vehicles and refuelling points.
- **Biofuels** – The Danish NIR expects the share of biofuels use in road transport to remain constant at 6% until 2030.
- **LPG** –The NIR notes that LPG will essentially play no role in the future Danish transport system.

[5] The DK NIR expresses doubts about the appropriateness of maintaining the 'ten-to-one ratio' assumption.

Rail transport

- **Electricity** – The Danish NIR reports recent railway electrification. It also expects the strong decline in electric locomotive stock that took place between 2016 and 2017 to be reversed by 2030.

Waterborne transport (maritime)

- **Electricity** – The Danish NIR expects the number of battery-powered seagoing vessels to increase from three units in 2018 and 2020 to five in 2025 and 2030. The number of maritime ports providing access to shore-side electricity supply is expected to grow from two in 2018 to eleven in 2025 and 2030.
- **LNG** – Concerning LNG vessels, no real uptake is expected in the Danish NIR. The number of maritime ports providing access to LNG is reported by the NIR as remaining stable with two ports, making it uncertain whether LNG will be available in the two ports that are part of the TEN-T Core Network.

Air transport

- **Biofuels** – The Danish NIR expects sustainable aviation fuel production to start in the future.

As in the NPF, the Danish NIR continues to provide a reasonable amount of **measures** to support the uptake of alternative fuels for transport. The number of legal measures and deployment & manufacturing support measures has increased in the NIR compared to those reported in the NPF, while the number of policy measures has not. Regarding the combination of Policy and Deployment & Manufacturing measures, six clusters were identified for as many AF/transport mode pairs. Five clusters were assessable, with the pair electricity/road obtaining a high score and the other four a low score. No cluster could be considered comprehensive. Support measures continue to be irrelevant or not assessable for LNG/road and for LNG/water (maritime). In terms of expected impact of these measures to support the realisation of the AFV/AFI objectives as presented in the NPF and revised in the NIR, the measures for the pair electricity/road have a medium impact, those for the pairs CNG/road, biofuels/road, hydrogen/road and electricity/rail result to have a low impact. The level of ambition of Policy and Deployment & Manufacturing support measures has increased in the NIR for all the assessable pairs, however the NIR does not report support measures for publicly accessible recharging infrastructure, increasing the uncertainty on how the future targets will be attained. In the absence of LNG support measures, the Danish NIR seems to rely on developments in the private sector and other neighbouring markets. Although the government of Denmark officially excluded hydrogen from its plans, the prominence of this alternative fuel in support measures, particularly RTD&D funding, is noteworthy.

5.1.7 *Final remarks*

The Danish NIR provides a comprehensive report on the efforts to implement the Directive. These efforts are mostly in line with the provisions of Annex I to the Directive. All alternative fuels are addressed in the Danish NIR. Denmark has a clear ambition to foster the large-scale electrification of road transport, railways, maritime transport and airports. The estimated extension of shore-side electricity supply in ports should support the greening of the waterborne sector. The Danish NIR includes a significant amount of measures to promote the uptake of zero- and low-emission vehicles, including a significant number of R&I projects on hydrogen and fuel cell technologies. Denmark should provide further information on some of those measures in future reporting to be able to fully assess their impact.

With regard to electricity for road transport, the NIR estimates approximately 332,000 electric vehicles on the road in 2030, representing about 9% of the fleet by that time. However, taking into account the current situation and expected trend development, this level of ambition does not appear to be fully compatible with the pace of deployment of electric vehicles considered necessary for a full transition to carbon neutrality by 2050. Moreover, attention needs to be paid also to infrastructure deployment. No information on charging efficiency is provided. The NIR estimates around 11 shore-side electricity supply facilities by 2030. Five electric seagoing ships are estimated to be in operation by 2030. The NIR indicates that the airports accounting for more than 97% of passenger traffic provide electricity supply for stationary airplanes. The NIR lacks sufficient information on the share of the electrified rail network.

Regarding hydrogen for road transport, there was already a small fleet of FCHVs and eight hydrogen-refuelling stations in Denmark in 2018. No targets are set for future deployment by 2025 and 2030. More information in future reporting on further development of vehicles and infrastructure uptake would be beneficial.

Regarding natural gas for transport, Denmark plans to keep the number of CNG refuelling points at a constant number of 17 until 2030. It estimates 1,522 CNG vehicles by 2025 and 2,153 CNG vehicles by 2030. The NIR does not provide estimates for LNG vehicles. However, the number of three LNG refuelling points planned for 2025 and 2030 seems sufficient taking into account the extensiveness of the Danish TEN-T Core road Network, provided that the refuelling points are widely distributed along the network. On the other hand, LNG refuelling points are already installed in the two Danish ports, although they are not part of the TEN-T Core Network.

As regards LPG, there were 12 LPG vehicles in 2018. The number is to decrease to zero by 2030.

Denmark should provide more information in future reporting on efforts to promote the use of renewable fuels in transport, and particularly in aviation.

5.1.8 *ANNEX - Description of the Member State*

On a surface area of 43,100 km², Denmark has a population of 5.781 million people in 2018, which makes up for a population density of 134 inhabitants/km².

Number of main urban agglomerations

- 4 urban agglomerations > 50,000 inhabitants

In 2018, Denmark achieves a per capita gross domestic product at market prices of €52,010, which represents a per capita gross domestic product in purchasing power standards of 128 if expressed in relation to the EU-28 average set to equal 100.

Length of the road networks

The length of the road TEN-T Core Network in Denmark is 813 km. The total road network length is 74,674 km, of which 1,329 km are motorways.

The following lengths of the TEN-T Road Corridors are present in Denmark: 7% (456 km) of the Scandinavian – Mediterranean Corridor.

Through the TEN-T Road Corridors, Denmark is connected with the following Member States:
- Germany (through the Scandinavian – Mediterranean Corridor),
- Sweden (through the Scandinavian – Mediterranean Corridor)

Number of registered road vehicles

At the end of 2018, Denmark accounts for 3,237,751 registered road vehicles of which 2,594,469 are categorized as passenger cars, 389,461 as light goods vehicles, 42,663 as heavy goods vehicles and 13,158 as buses and coaches. The motorisation rate is 449 passenger cars per 1,000 inhabitants.

Number of ports in the TEN-T Core Network

- 2 maritime ports in the TEN-T Core Network (Aarhus, Copenhagen)
- No maritime ports in the TEN-T Comprehensive Network
- No inland ports

Number of airports in the TEN-T Core Network

- 1 airport in the TEN-T Core Network (Copenhagen – Kastrup)

3 airports in the TEN-T Comprehensive Network