HyLAW

National Policy Paper - Denmark

Brintbranchen
Hydrogen Denmark

Main Authors: Jensen, Tejs Laustsen, CEO & Emma Møller Husted, Student Assistant

Contributor(s):

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1. Introduction and summary

1.1 HyLAW Summary and Methodology

HyLaw stands for Hydrogen Law and removal of legal barriers to the deployment of fuel cells and hydrogen applications. It is a flagship project aimed at boosting the market uptake of hydrogen and fuel cell technologies providing market developers with a clear view of the applicable regulations whilst calling the attention of policy makers on legal barriers to be removed.

The project brings together 23 partners from Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Norway, Poland, Romania, Spain, Sweden, Portugal, the Netherlands and United Kingdom and is coordinated by Hydrogen Europe.

Through extensive research, interviews and legal analysis, the HyLaw partners have identified the legislation and regulations relevant to fuel cell and hydrogen applications and legal barriers to their commercialization.

This National Policy Paper provides public authorities with country specific benchmarks and recommendations on how to remove these barriers.

1.2 Policy Summary at National level

Hydrogen technologies has been supported at national level in Denmark for 3 decades. The support has taken many shapes and forms during this timeframe. In the beginning, initial research funding for Universities was the main air of support and since then government policy has developed into research grants, special programs, demonstration programmes and a number of dedicated policy initiatives to support either the development or the roll-out of hydrogen technologies.

In the 1990's and early 2000's the political focus was on research, development and production of fuel cells. In the same period did Denmark begin to convert its energy sources from fossil fuels to greener alternatives. This meant heavy investments in primarily wind energy to produce more green electricity. The big amounts of green electricity available meant a shift in the political thinking regarding the use of hydrogen. The new political focus was on how to use the newly acquired green energy for transportation purposes. This meant a larger focus on converting green electricity to hydrogen for example trough electrolyzation.

As a consequence of the previous political focuses Denmark has the technology to produce and operate fuel cells and we have the capabilities to produce hydrogen on an industrial scale.

To exploit the theses capabilities, the political focus has turned towards storage of hydrogen and to link the hydrogen sector with other energy sectors. Among the attempts to link sectors are the use of hydrogen in biogas and the ambition to produce electro fuels and methanol from green hydrogen. A clear example of this is seen in the new Danish energy settlement from June of this year, in which parliament decided to develop a gas strategy to link different sectors and to create a commercially and marked based gas system[1]. Furthermore, the Danish TSO (Energinet) has conducted a system report for Danish Energy solutions in 2035[2], where electrolyzing is expected to be a major contributor to production of energy solutions including electro fuels, biogas and district heating.

[1] Danish Energy settlement 2018 https://efkm.dk/media/12222/energiaftale2018.pdf

[2] https://energinet.dk/systemperspektiv2035

A national climate plan is expected to be published shortly after the publication of this document and along with the implementation of the new energy agreement (a framework agreement whit many good opportunities for Hydrogen), but where much depends on the implementation.

The overall importance of Hydrogen in policy making is linked closely to two major policy issues. The buildup of renewable power production – mainly from wind turbines – and the desire to decarbonize the transportation sector and implement not only CO_2-neutral, but zero-emissions transport solutions.

As such – this national policy paper focuses on the opportunities within integrating the growing amount of renewable electricity into the energy system (hydrogen production) and the use of Hydrogen in the transportation system.

2. Hydrogen for Transportation

2.1. Overview and assessment of current legal framework

Basic information about hydrogen powered vehicles in Denmark

At the moment Denmark has a total of 83 operational FCEVs scattered over municipalities, public and private businesses and organizations and private owners. The FCEVs are able to drive to every corner of Denmark as 10 Hydrogen Refuelling Stations (HRS) are strategically placed all over Denmark and in operation. Two more are on their way. This makes Denmark the first country to a have a nationwide grid of HRS'. At the moment, Denmark does not have any busses, trucks or ships powered by hydrogen, but several bus projects are underway.

The overall framework conditions for hydrogen applications for transportation in Denmark are good. This is also the result after the HyLaw comparison with other European countries. However – there are areas with potential for improvements, and thereby for improving the opportunities for fossil- and emission free transportation.

Financial for cars

The financial framework for FCEVs in Denmark is overall good. The most important financial action is that FCEVs are exempted from the normally high registration tax. This applies until 2020 and is in contrast to all other types of vehicles including battery powered electric vehicles.

The exemption from the registration tax is still crucial as FCEVs continue to be more expensive than conventional vehicles and would be impossible to bring on the Danish market were they to pay the full taxes.

Hydrogen Denmark has earlier in 2018 examined what the daily users of FCEVs in Denmark consider up- and downsides of FCEVs in a user report. Among the top five downsides was the price at purchase – even with the current tax exemption. This will become an even bigger problem if the exemption from the registration fee is not extended beyond 2020. It is our assessment that long term security for the exemption from the registration fee will make FCEVs more affordable to potential buyers and it will emphasize to the public that FCEVs are a vehicle for the future.

FCEVs have a few additional financial benefits in Denmark. The most common benefit is free parking and in some cases parking sites are reserved for FCEVs and battery powered cars. The parking rules are administrated by the municipalities therefore the rules are not streamlined across Denmark. The trans-European analysis of the HyLaw project shows that Norway has the best potential opportunities with even an

exemption from VAT, and several lighter benefits, but apart from this the Danish position is good and among the best in Europe, although insecure. As such especially the security element and long-term government commitment have to be met. More can also be done with regard to the personal taxation of the use of company cars, where no benefit is given today.

HRS

Danish legal framework is acceptable but not perfect

As mentioned Denmark has an existing network of 10 Hydrogen refuelling stations and there is a well-established legal framework in place for establishing new HRSs in Denmark. Hydrogen Denmark finds the current legal structures acceptable as there are no problems with district plans and plans for urban development to build a better and bigger infrastructure for FCEVs in Denmark. While there are not any legal issues with building HRSs in Denmark there are operational issues which must be addressed.

The most pressing legal issue is the problems with payment by credit cards. Due to Measuring Instrument Directive 2004/22/EC (to be replaced by 2014/32/EU) about certification of measure instruments it is not possible to pay with credit card at any HRS in Europe due to the lack of measurement certification of the fuel. Since payment by credit cards is the most common method of payment in Denmark, this is a big problem because it complicates the refuelling process unnecessarily.

Furthermore, the commercial basis for the establishment of a better network of HRSs in Denmark is not yet established and as such there is a need for a support program in order to further improve the infrastructure.

Recommendations with regard to HRS's

- If Hydrogen is to become a mainstream fuel for transportation we need a more structured approach. As such Hydrogen Denmark recommends that the government lays the foundation for a hydrogen strategy where the number of HRSs will be increased extensively from the present number of 10 stations. As shown by HyLaw inspiration can be found from the German strategy and deployment of stations. This also means the allocation of more funds for HRS deployment and initial operation.
- Credit card payment must be implemented and as such MID must be made applicable for Hydrogen.

Registration, inspection and security for cars

FCEVs are approved by the Danish Road Safety Agency and registered at The Danish Motor Vehicle Agency as any other vehicles in Denmark. When a FCEV is registered at the proper authorities and receives its number plates it is dealt with as any other registered vehicle in Denmark. It has the same rights to drive in tunnels, on bridges and on ferries and there are no additional safety requirements than for conventional vehicles. All Danish motor vehicles including FCEVs are required to be inspected in authorized vehicle inspection centers. The only exceptions from this rule is the prelisted financial benefits. This means that the FCEVs are not allowed to use bus lanes as in other countries and that there are no discounts for FCEVs in tunnels, on bridges or on ferries.

Recommendations for cars

Hydrogen Denmark considers the process of implementing FCEVs in Denmark as on the right track. The legal and financial framework is overall in a good state, but more can be done to ensure a faster implementation of FCEVs. Therefore, we recommend that:

- The tax exemption from the high registration fee continues in the coming years. The best option would be a long-term guarantee from Folketinget (The Danish parliament) to except FCEVs from the registration fee. Such a guarantee would calm the market and give investors security for further developments in the market. This could alternatively be linked to a number of FCEV.
- A VAT exception like in Norway, the right to use bus lanes and discounts on bridges, tunnels and ferries stimulate a higher demand for FCEVs in Denmark.
- Initiatives must be streamlined and national. For instance, rules regarding parking needs to be national, in order for drivers of FCEVs not to have to check the parking rules every time they enter a new municipality.

HFC-Busses

As mentioned above Denmark does not have a single hydrogen bus at the moment however there are plans to implement fossil free busses in the coming years, but we will get back to that. The current rules for hydrogen powered busses are almost the same as for cars. They must be approved by the Danish Road Safety Agency and registered at The Danish Motor Vehicle Agency. When a hydrogen powered bus is registered at the proper authorities it is dealt with as any other registered vehicle in Denmark. It has the same rights to drive in tunnels, on bridges and on ferries and there are no additional safety requirements than for conventional busses. The HyLaw project analysis underlines that Denmark from an administrative point of view is well positioned among its European counterparts for the implementation of hydrogen busses.

In the coming years the diesel-powered busses in the Danish public transport will be replaced with fossil free busses. The busses in public transport are operated by private contractors who have won a public tender awarded by a municipality. In the coming tenders it will be a criterion to use fossil free busses. However, there are different criteria from tender to tender. For example, the city of Copenhagen has decided to have technology neutral tenders allowing hydrogen powered busses to compete with battery powered busses. The requirement is that the propulsion system is CO_2 neutral whereas the tenth largest city in Denmark, Roskilde, has chosen to demand battery powered busses in their tenders preventing the contractors to use hydrogen powered busses.

Currently the drive toward zero emission busses is driven by several – but far from all – municipalities. This makes the transition difficult and based on many different criteria which complicates the drive toward economy of scale.

Recommendations with regard to busses.

The government has previously awarded funds for battery electric busses. All future support programs must be zero emission in order to secure a leveled playing field among zero-emission technologies. This also goes with regard to the tendency in the public debate and among decisionmakers to favorize the battery powered busses, presumably due to lack of knowledge about the hydrogen technology. The lack of knowledge can lead other municipalities to take the same approach as the city of Roskilde.

For a broader implementation of renewables in the transportation sector and especially the adoption of hydrogen technologies to benefit the green transition based on the HyLaw experiences – we have the following recommendations:

- Technology neutral zero-emission tenders for busses and equal treatment of battery electric busses and hydrogen.
- Government support for zero-emission tenders and/or infrastructure and funding for municipalities for this specific purpose.
- National program and policy for the phase out of emission-busses and a timeframe for 100% zero emission busses in Denmark.

Maritime

At this point all new types of maritime vessels have to be type approved at The Danish Maritime Agency. New vessels bigger than 20 gross tonnage must be registered at The Danish International Ship Register. There is a structural barrier since the above mentioned is the only Danish regulation. Ships sailing under Danish flag is required to follow international standards where the most relevant for hydrogen proposed vessels are the IFG for vessels using fuels with flashpoints below 60 degrees Celsius.

Recommendations

The regulatory gap calls for a national strategy to implement hydrogen vessels in fleets operating under Danish flag. The maritime area is not very developed with regard to zero emission policy – not even for inland ferry service etc. A first and vital step would be developing a national strategy and based on the HyLaw project analysis, this vital experience in this policy process could be gained from Norway.

3. Hydrogen production

3.1 Overview and assessment of current legal framework

Conversion of renewable power – in Denmark manly from wind turbines – is the precondition for all hydrogen use in the green transition of the energy system. As such, the production of Hydrogen is essential for all applications and for implementing Hydrogen broadly in the energy system. Overall, the HyLaw project concludes that Denmark has good conditions for the production of Hydrogen, but there are a still number of initiatives that can be taken in order to ensure the best and widest implementation of green Hydrogen and hereby improving the green transition.

Different pathways to hydrogen

Hydrogen as a fuel can be produced using renewable sources when using electrolysis by means of electricity and water without any harmful emission. The Hydrogen produced by electrolysis does not contain impurities as water and oxygen are the only “pollutants”, therefore, a high degree of purity is easily achievable, and its quality can easily conform to the quality requirements for fuel cells.

Hydrogen can also be produced by reforming natural gas which has been the leading source of low-cost hydrogen gas for industrial use. The steam methane reformer uses the methane to produce H_2 and CO_2 and this Hydrogen may require a purification process to conform to further quality requirements for non-industrial use. This hydrogen is not emissions-free, hence not relevant from a Danish perspective to facilitate the green transition.

Another important step for the implementation of Hydrogen in the transport sector is to gain security for the fact that the hydrogen is produced from renewable energy. Hydrogen Denmark calls for a trans-European solution with certification of Hydrogen regarding both input and output. Such a certification would help to promote Hydrogen as a green fuel in the future.

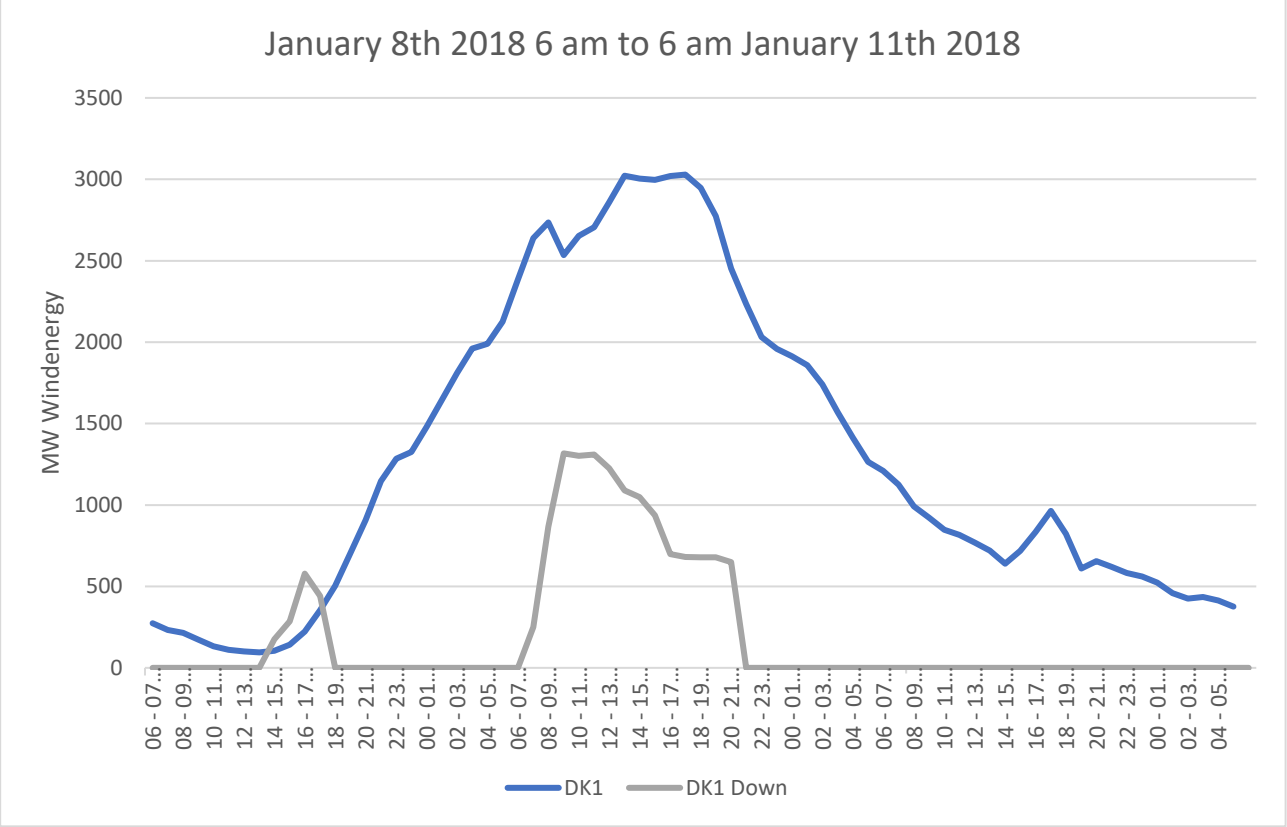
Electricity grid issues for electrolysers

There are no major barriers to connect electrolysing facilities to the electricity grid in Denmark. It is possible for electrolysers to be connected to the electricity grid. Cost and other conditions – i.e. also the price of Hydrogen - depend on the size of the electrolysing facility and the local DNO. The electricity in an electrolyser facility is classified as an industrial facility which make it possible be exempted from the electricity tax, which private consumers pay.

In the present situation electrolysing facilities also pay the PSO tariff (Public Service Obligation). However, the Danish government has decided to phase out the PSO with effect for electrolysing facilities in 2022, which will lower the operation cost of electrolysers. A continued payment of the PSO-tax would have been a significant barrier for the deployment of hydrogen technologies, but with the current agreement this barrier will be removed and will become less and less relevant in the relative short time until 2022.

However, the grid tariffs are a different matter. Today, they are ‘one size fits all’ – no matter what kind of consumption pattern the consumer has. This gives no reward for the flexibility that electrolysers can provide for the grid and this is not beneficial neither for the grid nor for the production of Hydrogen in Denmark.

This creates problems with regard to the continued integration of wind-power and other renewables in the grid. The reality is that curtailments are a growing challenge and either will continue to grow and major new grid investments will have to be made at the same time to accommodate this. The diagram below shows the production of wind in the western electricity grid (DK1). DK1 Down is the amount of energy lost when the wind turbines are curtailed.



As the diagram shows Denmark is losing a lot of otherwise potential renewable energy because our consumption of electricity is not adapted to the supply of electricity.

Overall the conclusions based on the HyLaw project and other studies such as System Analysis 2035 are that there are few barriers for Hydrogen production – and therefore also implementation – in Denmark, but there is never the less a need for action in order to let hydrogen producing facilities play the role that will be beneficial for the green transition and help integrate the growing amounts of renewable energy in the electricity grid.

Recommendations

- Grid-tariff reform – not least with regard to hydrogen production is needed. The current model provides world class security of supply but awards no award for flexibility. This needs to change and will be best done by an overall reform that will ensure rewards for flexibility. Inspiration can be found in the current Norwegian model.

- Immediate inclusion of hydrogen facilities in the grid connection agreements that applies for electric boilers. These electric boilers do not have to pay the tariff for being connected to the electricity grid, under certain conditions. This will not be a solution to the grid tariff problems but it will allow for an immediate discount awaiting more general tariff reform.

4. Gas Grid issues

As shown by the HyLaw project the overall gas grid issues (7.0) are generally good in Denmark. However, integrating Hydrogen in the existing infrastructure is not without complication and several barriers are present with regard to this issue.

This is mainly in regard to the production of synthetic methane and its use in the grid. Most relevant in connection with methanisation is already existing biogas facilities where the surplus CO_2 from the upgraded gas can be combined with hydrogen boosting the production of methane and at the same time enabling a storage facility for the renewable power energy in the gas grid.

This however is complicated by especially two factors.

Firstly, synthetic methane is not currently able to be certified as green by the Danish gas TSO. Therefore, integration into the grid is difficult as there is a legal limbo for the gas to be considered green. This obviously has connections to the question of certifying green hydrogen.

Furthermore, and partly connected to the certification issue as well, synthetic methane is not eligible for government support in the same way as it is the case for biogas. This is a major barrier, since integration is in itself not financially viable and without government support it is not feasible with a large-scale production even though the overall conditions are in place.

However, in order to save CO_2 and to be able to store renewable power as well as ensuring integration of the gas grid and the electricity grid, it would be very beneficial to ensure that Hydrogen could access the gas grid via methanisation.

Recommendations

- Synthetic methane produced from Hydrogen and CO_2 must be able to be certified as green gas.
- Synthetic methane produced from CO_2 and Hydrogen should be eligible for the same support as biomethane.