Market

Articles of Association for Danish Methanol Association

§ 2 Purpose of the Association

§ 2.1 A methanol economy as described by Nobel Laureate George Andrew Olah in "Beyond Oil and Gas: The Methanol Economy" is the association's vision.

§ 2.2 The purpose is the promotion of the manufacture and use of methanol as an energy carrier in Denmark, and in particular to work for the conversion of biomass to methanol.

§ 2.3 Association's activities are of public interest.

Nobel Laureate George Andrew Olah was until his death March 2017 an honorary member of the Danish Methanol Association. The utilization of agricultural waste and residues was in mind during the formulation of § 2.2 in 2011. A future revision will most likely also mention other renewable energy sources.

Farmers Gasoline.
In May 2012 Agro Industries A/S published a folder “Renewable Methanol in Denmark” describing “Renewable Methanol – The Motor Fuel of the Future”. The publication compares E5 Regular with M15 and M85. A slogan “Agro Gasoline - Guaranteed ethanol free” was created as a precursor to the present brand Farmers Gasoline.

Figure 1
Fig. 1 illustrates future engine fuels. A7 with 7% alcohol intended for older cars, M30 for newer Non-FFV’s, M85 for factory-built Flex Fuel Vehicles (FFV) or cars with a Flex Fuel Kit. Mpure is chemically pure methanol intended for fuel cell cars. MD95 is diesel fuel with 95% methanol and 5% ignition improver.

The following year (2013) Agro Industries A/S quoted a 22 MTPD methanol and biogas demonstration plant to be erected at ESØ, Vardevej, Tarm by a start-up company “Danish Biomethanol ApS / Farmers Gasoline ApS”. The business plan included the sale of methanol blends from own pumps and jointly with Go’on Gruppen A/S from a common tank yard. Later Agro Industries A/S provided basic engineering for a 2,500 MTPD dual line plant at the Port of Aarhus with combined methane and wind power as feedstock.

New Fuel A/S

On January 14, 2015, New Fuel A/S was founded, dedicated to the production and sale of green methanol while Agro Industries A/S remained the administrator and sponsor of the Danish Methanol Association. The same year, New Fuel A/S was ISCC EU certified as a methanol producer and trader with address at the Equinor methanol factory, Tjeldbergodden, Norway.

Figure 2. Test car - now one year on 105 Octane M85.
From a German office operated by Connecting Markets GmbH, a market study 2017 was conducted that mapped a European market of one million tonnes of biomethanol. However, this market proved full of trade barriers. Sales of ship loads started 2018, but there were barriers to trade here too.

To overcome these barriers, an EUDP project “IEA-AMF Annex 56 Methanol as Motor Fuel” was initiated in 2018 with the Danish Technological Institute as partner. The project proved that an ordinary City Car can be turned into an FFV simply by installing a French Flex Fuel Kit. Now the test car has run smoothly for a full year on 105 Octane M85. The car got a little more horsepower and better torque with an overall better driving experience.

This pre-project is now being followed up with a petition for EUDP support of a fleet trial with 100 petrol cars, all with a Flex Fuel kit and to run on 105 Octane M85 a couple of years. In this new project “105 Octane M85 motor fuel from biogas, solar and wind”, the group of technology partners has expanded significantly.

Market Potential

The market for auto gasoline in Denmark in 2018 was 1.789.000 m³ gasoline (57 PJ). Part of this will, for technical reasons, continue unchanged. Some will be serviced by other electrofuels such as hydrogen and methane and a significant portion of direct battery power for increasing imports of electric vehicles (EV). The Danish Council on Climate Change assumes 500.000 EV’s by 2030. Finally, imports of electric cars with a small 15 kWh battery and an onboard fuel cell will be supplied with Mpure (chemically pure methanol). The fuel cells are being built at a new factory in Aalborg and we will also ensure the distribution of fuel to serve these customers. Again, we aim to serve our customers with a residual need estimated at 30 PJ (1.630.000 m³ 105 Octane M85) with an annual value at the pump close to DKK 14 billion.

Fig. 3 illustrates an elegant solution with blender pump serving both 105 Octane M85 customers with petrol cars and Mpure customers with fuel cell cars. This over ground containerized unit has two tanks. One with gasoline and another with pure methanol. 105 Octane M85 is mixed in the dispenser and Mpure is filled directly with a separate dispenser.

Introduction of E85 in France has in a few years increased the makes of FFV from just one to now ten makes making up (2019) a total of 37.000 FFV’s and 70.000 with approved Flex Fuel Boxes. Sales of Flex Fuel boxes has passed 2.000 pieces a month. The new EUDP-project will lead to the import of FFV’s in Denmark too. For example, The Ford Kuga Flexifuel is only available in Sweden and France today. Since 2016 the French consumption of E85 went up from 100.000 m³ to now 340.000 m³. Number of filling stations did double during the same period. The Danish market is one tenth and we assume same rate of expansion.
The introduction of Flex Fuel Kits in 2018 enabled French sales of E85 to explode with an increase of 55% in the first year and 84% the second (2019). The Danish market can start at the earliest by 2022. The forecast shown below is based on a more conservative estimate of an annual 33% increase. Exemption from energy tax will be a huge but also a necessary consumer incentive. An exemption means very little in tax revenue for the first few years.

Exports of methanol blends are limited by our feedstock, but implementation of this project opens system exports with a huge potential.

To ensure the potential the Minister of Transport on January 27, 2020 has been asked to implement a decree like the French arrêté allowing flex-fuel boxes tested in France at a recognized test facility and approved by French authorities also to be approved for use in Denmark and which also accredit a similar system in Denmark.

The Minister of Transport has been requested to finalize the necessary set of rules during the project and to cause an incentive for buyers by easing the energy tax on advanced green motor fuel. Such a similar easing has previously been introduced for methanol to produce electricity in fuel cells. Also, electricity and diesel are tax-favored compared to gasoline. Use of incentives is outlined by The Danish Council on Climate Change in scenario for transition to a low-carbon society.

Marketing Plan.

New Fuel A/S keeps stock Samoavej 1, Port of Aarhus with delivery to road tankers and at Tjeldbergodden for delivery of ship loads to larger customers with their own tank storage.

Figure 4

At the warehouse in Aarhus, a mixing station is put up for finished 105 Octane M85 complying with ASTM D5797, Standard Specification for Methanol Fuel Blends (M51 – M85) for Methanol-Capable Automotive

Danish Methanol Association, c/o Agro Industries A/S, Agro Food Park 13, DK-8200 Aarhus N, Denmark
Spark-Ignition Engines is established. The mixing station includes dosing systems for performance additives with corrosion inhibitor and lubricant.

The B2B sale will be FCA - Free Carrier Incoterms 2010 of REN-methanol to customers who manufacture the finished motor fuel themselves or uses blender pumps at the filling stations. Sales are expected to develop as forecast.

Under the trademark "Farmers Gasoline" owned by New Fuel A/S and with Silicon Valley based Propel Fuels Co. as a model, remote operated blender pumps are offered to accelerate market adoption of low carbon fuels and transportation – re. fig. 8.

In close collaboration with Go’on Gruppen A/S, 105 Octane M85 is distributed directly by road tankers to a retail filling station network and to dealers not manufacturing the finished blend themselves.

With New Fuel A/S as the main driver the marketing will be started with a Skanderborg Electrofuel Event 2020 scheduled for the autumn 2020 with the participation of the Minister of Transport, the Director of the European Automobile Manufacturers’ Association - ACEA and an international press corps. Electrofuel technology will be shown and demonstrated together with our technology partners residing in or neighboring Skanderborg Municipality.

For other members of the association, the development of a market will create demand and move the opportunity closer to erecting factories and securing sales of production.

Dispensers for the 105 Octane M85 are locked and require a special debit card or transponder to open. The transponder – an Orpak’s Automatic Vehicle Identification (AVI) solution - is unique for each vehicle and recognized by the dispenser only filling identified cars. The transponder option is associated with an automatic billing function - just “Fill and Drive”. This ensures that the company can provide the customer with the necessary information about the fuel in accordance with French model and that the car is equipped with a suitable Flex-Fuel box installed by an installer approved by the Flex-Fuel box manufacturer and that
the box is suitable with associated insurance against damage caused of fuel or box. Customers are offered the installation paid over their gasoline bill. The French Flex Fuel Kits are available 2019 in six versions dependent on the Euro standard, type of injection and the fiscal horsepower (CV) of the engine.

<table>
<thead>
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<th>Fiscal Power</th>
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<td>8-14 CV</td>
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Fig. 6 illustrates a Flex Fuel Kit.

The Danish Methanol Association is promoting 105 Octane M85 and Flex Fuel Kits acc. to French model, MD95 like Swedish ED85 and the Mpure to take advantage of the Danish lead on methanol fuel cells.
Security of supply

Bio-methanol

In "Perspectives for Production and Use of Biogas in Denmark", Nov 2018, the Danish Energy Agency expects a production of 19 PJ by 2020 and the gas is described as 55-65 vol% methane and 45-35 vol% carbon dioxide with a density of 0.72 kg/Nm³ respectively 1.98 kg/Nm³. With an average weight ratio of CH₄ carbon: CO₂ carbon of 1½: 1, methane production can be increased from 19 PJ to 29 PJ by hydrogenating the carbon dioxide, which several EUDP projects show the way to. By 2020, only 25-30% of animal manure is expected to be degassed in biogas plants. Including the remaining manure and other waste, there will be a realistic potential for 80 PJ biogas in 2035 - inclusive methanization - according to the DEA. At present our conversion capacity of one million t of methanol ~ 30 PJ biogas as feedstock - is enough to support the forecast fig. 5.

E-methanol

In an analysis Apr 2019, Energinet.dk shows that Power-to-X (PtX) has the opportunity to gain a significant scope in Denmark - even before 2030. Offshore Wind Outlook Nov 2019 by the International Energy Agency (IEA) is in line with Energinet.dk.

Yet today’s offshore wind market doesn’t even come close to tapping the full potential – with high-quality resources available in most major markets, offshore wind has the potential to generate more than 420 000 TWh per year worldwide. This is more than 18 times global electricity demand today. IEA 2019.

Whether the wind power is taken ashore via cables as electricity or in pipes as hydrogen, the potential seems unlimited.

Economy

Figure 7. Taxed like methanol for fuel cells (1,225 kr./l biomethanol) M85 will be 7,31 kr. per liter at the pump and 0,62 kr. per km.

<table>
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<tr>
<th>Vehicle, kg</th>
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<th>900</th>
<th>900</th>
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<tr>
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<tr>
<td>CO₂eq g/km</td>
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<td>36</td>
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</table>

Source: RDE, Calculated, Serenergy, EPA

Vehicle: Peugeot 107, Peugeot 107, Peugeot 107, Peugeot 107, Fiat 500e, VW e-Golf

Economics for 105 Octane M85 have been studied in the EUDP-project "IEA-AMF Annex 56. Methanol as motor fuel". With 10-year averages of international list prices and applicable tax rules, comparable consumer prices are calculated. For electricity the E.ON price as a City Member is applied.
Who we are.

There is reason to highlight Cris-Ni Management, which as a permanent member of the Danish Methanol Association since 2012 has been the association's fundraiser and a new member Elplatek, who has their own EUDP methanol project in the pipeline.

The International Starch Group has been involved since the association's foundation in 2011. It is a family-owned group and, as the name implies, extraction of starch from agricultural crops is a primary business area while methanol is still under development.

During this development, we have from time to time teamed-up with the Go'on Group A/S - an important member of the family-owned Hanssen group - so also in the upcoming EUDP project.

Figure 8. Propel Fuel Co. serves as a model for our mission to accelerate market adoption of low carbon fuels and transportation.