

## Preliminary Notes on Sustainability Certification Systems for Biogas to Biomethanol<sup>1</sup>.



### ISCC

International Sustainability & Carbon Certification (ISCC) is a global certification system in the sense that ISCC certification can take place in European countries and abroad and that sustainable biomass and biofuels can then be sourced from these countries and sold within Europe under the RED. ISCC has applied for recognition with the European Commission to be an acceptable system for the entire European Union, meaning that – if recognized - any European Member State could adopt it as a national system.

ISCC<sup>2</sup> is one of the leading certification systems for sustainability and greenhouse gas emissions. In 2010, it received the worldwide first official state recognition by the German authorities. In July 2011, the European Commission recognized ISCC as one of the first certification schemes to demonstrate compliance with the EU Renewable Energy Directive's (RED) requirements. ISCC certification can be applied to meet legal requirements of sustainability and traceability of feedstock's in the bioenergy markets. Guidelines are laid down in "GHG Emissions Calculation Methodology and GHG Audit"<sup>3</sup> and "Mass balance calculation methodology"<sup>4</sup>.

### Certification Bodies.

A certification body (CB) is an independent company, which conducts audits according to the rules of a certification system, and if the audit is successful, can issue a certificate. CB's should be external to the economic operator and certification system, and independent from the activity being audited. In Germany, CB's are approved and supervised by the Federal Agency for Agriculture and Food. A CB can cooperate with different certification systems. A list<sup>5</sup> of recognized ISCC certification bodies is published and we are in contact with CB's on that list.

### Bio Natural Gas Certificates

Biomethane (Bio natural gas) plays a key role in creating a low-carbon economy in the EU. However, to release the European potential of biomethane it is vital that it can be traded across national borders. It is with that aim that six national biomethane registries 25. November 2013 have decided to establish cooperation among them and signed a Letter of

---

<sup>1</sup> These Preliminary Notes contain specific notes on Certification Systems as well as more general information on "Biogas to Biomethanol" intended for our associates and business partners.

<sup>2</sup> <http://www.iscc-system.org/en/>

<sup>3</sup> <http://danskbiomethanol.dk/papers/C65BAB6B.pdf>

<sup>4</sup> <http://danskbiomethanol.dk/papers/50375892.pdf>

<sup>5</sup> <http://www.iscc-system.org/en/certification-process/certification-bodies/recognized-cbs/>



Intent<sup>6</sup> which lays down the basic understanding about the planned joint activities. These six registries are:

Austria: Biomethan Register Austria ([www.agcs.at](http://www.agcs.at))

Denmark: Energinet.dk ([www.energinet.dk](http://www.energinet.dk))

France: Gaz Réseau Distribution France ([www.grdf.fr](http://www.grdf.fr))

Germany: Biogasregister ([www.biogasregister.de](http://www.biogasregister.de))

Switzerland: VSG (Federation of Swiss Gas Industry) ([www.erdgas.ch/biogas/](http://www.erdgas.ch/biogas/))

United Kingdom: Green Gas Certification Scheme ([www.greengas.org.uk](http://www.greengas.org.uk))

Biomethane is the only renewable resource capable of flexible production, and which can be used in the heating, power and vehicle fuels sector. Biomethane can be either upgraded biogas from anaerobic digestion or syngas from gasification of biomass, being 100% renewable.

Energinet.dk - the Danish registry - is a driving force in this cooperation and Denmark has been a pioneer in the certification of biogas<sup>7</sup> <sup>8</sup>. Since 2011, we have been in regular contact with [energinet.dk](http://energinet.dk). Energinet.dk has produced a guide for supply of upgraded biogas to the gas system<sup>9</sup>.

### **Biogas feedstock**

Towards 2020, it is a policy objective that up to 50% of livestock manure in Denmark must be used for energy production<sup>10</sup>. It is also a political objective to use the surplus straw in energy production, but nevertheless power plants discontinue their use of straw<sup>11</sup> due to technical complications and the overall use of straw is declining.

Since autumn 2012 an EUDP supported full-scale demo plant for pre-treatment and feeding of straw with new compression technique in Aarhus University biogas plants straw and manure have, however, proved particularly successful and straw can completely replace the previous use of energy crops.

Straw and manure are listed in *Proposal for the Directive of the European parliament and of the council amending Directive 98/70 / EC Relating to the quality of petrol and diesel fuels and amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources*, Annex IX, Part A. Feedstock's whose contribution towards the target referred to in Article 3(4) shall be considered to be four times their energy content<sup>12</sup>.

---

<sup>6</sup>[http://european-biogas.eu/wp-content/uploads/files/2013/11/2013.11.25\\_ggg\\_press-release\\_biomethane-registries.pdf](http://european-biogas.eu/wp-content/uploads/files/2013/11/2013.11.25_ggg_press-release_biomethane-registries.pdf)

<sup>7</sup> <http://www.energinet.dk/EN/GAS/biogas/Sider/Biogas.aspx>

<sup>8</sup> <http://www.energinet.dk/EN/GAS/biogas/Gascertifikater/Sider/default.aspx>

<sup>9</sup><http://www.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Gas/Pixi%20opgradering%20og%20salg%20af%20bionaturgas.pdf>

<sup>10</sup>[http://www.ens.dk/sites/ens.dk/files/undergrund-forsyning/vedvarende-energi/bioenergi/biogas-taskforce/biomasse\\_til\\_biogasanlaeg\\_endelig\\_version3\\_2\\_0.pdf](http://www.ens.dk/sites/ens.dk/files/undergrund-forsyning/vedvarende-energi/bioenergi/biogas-taskforce/biomasse_til_biogasanlaeg_endelig_version3_2_0.pdf)

<sup>11</sup> <http://ing.dk/artikel/kraftvaerker-dropper-dansk-halm-vi-importerer-trae-i-stedet-113233>

<sup>12</sup> [http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/com\\_2012\\_0595\\_en.pdf](http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/com_2012_0595_en.pdf)



## **Methanol**

The methanol industry spans the entire globe with over 90 methanol plants – and by volume, methanol is one of the top five chemical commodities shipped around the world. Each day more than 75 million liters of methanol are used as a transportation fuel. Methanol is a truly global commodity. In 2013, global methanol demand reached 65 million metric tons driven in large part by the resurgence of the global housing market and increased demand for cleaner energy.

The fastest growing markets for methanol are in the energy sector, which today represents about 40 % of methanol demand<sup>13</sup>. In China methanol has replaced 8 % of other fuels for transportation<sup>14 15</sup>. Methanol has proven to be an excellent transportation fuel in internal combustion engines and a preferred fuel in fuel cell powered vehicles.

Most methanol is produced with natural gas as a feedstock and mostly using steam reforming in a low pressure methanol synthesis process developed by ICI in the 1960s and today continued almost unchanged by Johnson Matthey Catalysts / Johnson Matthey Davy Technologies<sup>16</sup>.

## **The Biogas to Biomethanol Process.**

At a meeting<sup>17</sup> Agro Food Park early 2012 energinet.dk pointed to renewable liquid energy in transport as a priority and the Danish CEESA group has even more specifically identified methanol as the main liquid transportation fuel in the long term (*Coherent Energy and Environmental System Analysis. A strategic research project financed by The Danish Council for Strategic Research Programme Commission on Sustainable Energy and Environment*<sup>18 19</sup>) Both the Commission and the Government encourage industry to go into this market and offer preferences to companies that perform the task without the use of food and feed.

There are several roads to methanol. We (Agro Industries A/S) have examined three routes carefully.

1. ETL. One possibility proposed by the CEESA group and the Danish Methanol Association is by ETL (Electricity To Liquid) processes. It is a most elegant way. It was thoroughly investigated together with Karsten Ree's group in Grenaa. The road was not found viable in Denmark due to PSO and other energy taxes.

---

<sup>13</sup> [http://www.methanex.com/investor/documents/667945\\_AR\\_000.pdf](http://www.methanex.com/investor/documents/667945_AR_000.pdf)

<sup>14</sup> <http://www.fueelfreedom.org/blog/chinas-growing-methanol-economy-2/>

<sup>15</sup> <http://www.methanolfuels.org/on-the-road/demonstration-projects/>

<sup>16</sup> <http://danskbiomethanol.dk/papers/ici%20methanol%20process.pdf>

<sup>17</sup> [http://danskbiomethanol.dk/papers/M%C3%B8dereferat%20Energinet\\_dk%20230312.pdf](http://danskbiomethanol.dk/papers/M%C3%B8dereferat%20Energinet_dk%20230312.pdf)

<sup>18</sup> [http://www.ceesa.plan.aau.dk/digitalAssets/32/32603\\_ceesa\\_final\\_report\\_samlet\\_02112011.pdf](http://www.ceesa.plan.aau.dk/digitalAssets/32/32603_ceesa_final_report_samlet_02112011.pdf)

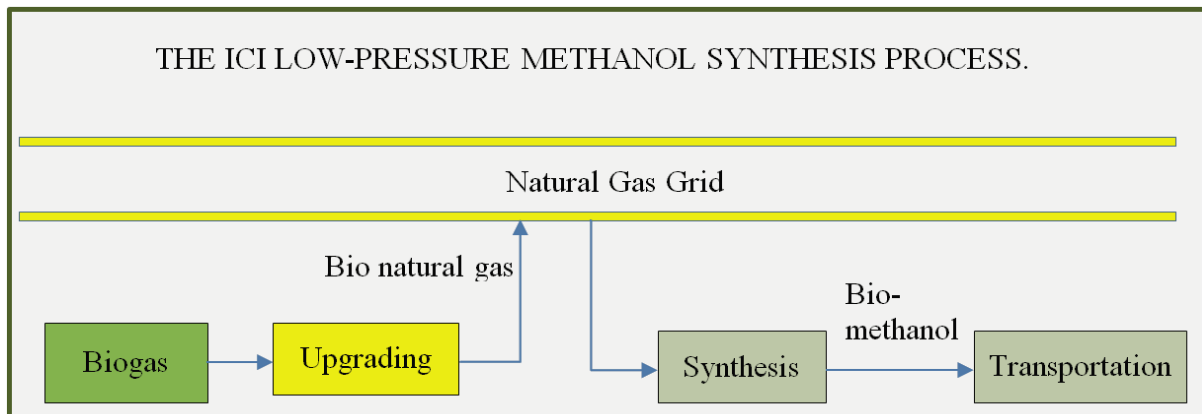
<sup>19</sup> [http://www.ceesa.plan.aau.dk/digitalAssets/34/34648\\_ceesa2050-rec-291111.pdf](http://www.ceesa.plan.aau.dk/digitalAssets/34/34648_ceesa2050-rec-291111.pdf)



2. BTL. Gasification of wood chips. This traditional BTL (Biomass To Liquid) we have examined at length with Babcock & Wilcox Vølund A/S. In Sweden, this may be a feasible option, but not in forest poor Denmark.
3. GTL. Waste through biogas. Instead, we found an unconventional way by waste from rural and urban areas through biogas (Gas To Liquid). This road is profitable and has significant capacity in Denmark.

### Life Cycle Assessment (LCA)

Contracted by the Danish Energy Agency, Rune Duban Grandal, Department of Chemical Engineering, Biotechnology and Environmental Technology, University of Southern Denmark did carry out a Life Cycle Assessment (LCA) of biogas to methanol. According to private communications with Rune Duban Grandal, this analysis may quite easily be adapted varying related processes. The university has March 2014 published a study of carbon footprint assessment: *Carbon footprint of bioenergy pathways for the future Danish energy system.*<sup>20</sup>



The EUDP project Green Synthetic Fuels (GreenSynFuels)<sup>21</sup> two technology concepts were derived for methanol intended for fuel cells. Concept 1: Methanol/DME Synthesis based on Electrolysis assisted Gasification of Wood - a variant of our dual line biorefinery project in Grenaa. Concept 2: Methanol/DME synthesis based on biogas temporarily stored in the natural gas network. Concept 2 is illustrated above and the concept to be applied at ESØ.

### A Danish Project at ESØ.

At an industrial site rented by the waste management company ESØ 90 I/S south of Tarm, Western Jutland a Danish project is planned comprising a gas plant with an associated methanol plant. The project is intended to be built and operated by the *Danish Biomethanol ApS*. The gasworks is designed to have a capacity of 9 million cubic meters of bio natural gas (biomethane). The methanol plant converts same amount of bio natural gas to 10 million liters of bio-methanol per annum. There will be a significant industrial symbiosis between the two

<sup>20</sup>[http://www.ens.dk/sites/ens.dk/files/undergrund-forsyning/el-naturgas-varmeforsyning/Energianalyser/nyeste/carbon\\_footprint\\_of\\_bioenergy\\_pathways\\_for\\_the\\_future\\_danish\\_energy\\_system\\_-\\_final\\_280314\\_1.pdf](http://www.ens.dk/sites/ens.dk/files/undergrund-forsyning/el-naturgas-varmeforsyning/Energianalyser/nyeste/carbon_footprint_of_bioenergy_pathways_for_the_future_danish_energy_system_-_final_280314_1.pdf)

<sup>21</sup><http://www.risoe.dk/rispubl/NEI/NEI-DK-5533.pdf>



works. The biogas unit will digest animal manure and straw as demonstrated at Foulum, University of Aarhus. The resulting biogas will be upgraded to biomethane by an amine process and injected into the natural gas grid in cooperation with HMN Naturgas I/S<sup>22</sup>. The methanol works will process bio natural gas into biomethanol using the ICI low pressure methanol synthesis process.

An environmental application is filed to Ringkøbing-Skjern Kommune (municipality). Ringkøbing-Skjern Kommune has, however, allocated biomass in the region of ESØ<sup>23</sup> for biogas to be sold to near-by Arla Food factory with the support of the municipal utility "Ringkøbing-Skjern Forsyning A/S" (Jydske Vestkysten 19. July 2014<sup>24</sup>). This may affect the expected production start at ESØ in 2018.

### **Biomethanol Market.**

As predicted by CESSA Group methanol will towards 2050 be a major liquid source replacing fossil transportation fuels, but already in 2020 the mandate to phase out fossil fuels is tightened, the market for methanol will grow strongly. The application will be in low- and high-blends with gasoline. High blends are defined as mixtures of gasoline and bio-methanol with less than 70 % gasoline.

According to a business plan for *Danish Biomethanol ApS* "Farmers Gasoline BP 01-1e" marketing of biomethanol will be outsourced to a new company "*Biofuel Trading A/S*". This company may have several principals and trade more products.

In order to (1) prepare for the sale of bio-methanol from the forthcoming works at ESØ and to (2) meet the increasing market demand for liquid biofuels, the sales company "Biofuel Trading A/S" will start business without delay.

For said purpose the biomethanol will be purchased / subcontracted from a third party. Also the bio natural gas feedstock will be purchased in the form of biogas certificates supplied from third parties most likely assisted by Danske Commodities A/S<sup>25</sup>.

### **Distribution**

The distribution will in the short and long term be made through third party providers of transportation fuel. In the long run also own filling stations will be used in a proposed partnership with Go On Gruppen A/S<sup>26</sup>.

---

<sup>22</sup> <http://www.naturgas.dk/grongas/gronenergi/>

<sup>23</sup> [http://domino.rksk.dk/internet/Agenda\\_internet.nsf/f5b85552fee088b1c12572c000302ecc/46e3e0af1fc47c2cc1257cfc0027ca9d/\\$FILE/Tre%20biogasanl%C3%A6g%20ved%20Skjern%20-%20stillingtagen%20til%20bem%C3%A6rkninger%20fra%20debatfasen.pdf](http://domino.rksk.dk/internet/Agenda_internet.nsf/f5b85552fee088b1c12572c000302ecc/46e3e0af1fc47c2cc1257cfc0027ca9d/$FILE/Tre%20biogasanl%C3%A6g%20ved%20Skjern%20-%20stillingtagen%20til%20bem%C3%A6rkninger%20fra%20debatfasen.pdf)

<sup>24</sup> <http://www.danskbioethanol.dk/papers/RKSK%20Gasnet%20og%20offentlighed%20-%20JV%2019-07-2014.pdf>

<sup>25</sup> <http://danskecommodities.com/Certificates>

<sup>26</sup> <http://www.goon.nu/om-goon/om-goon>



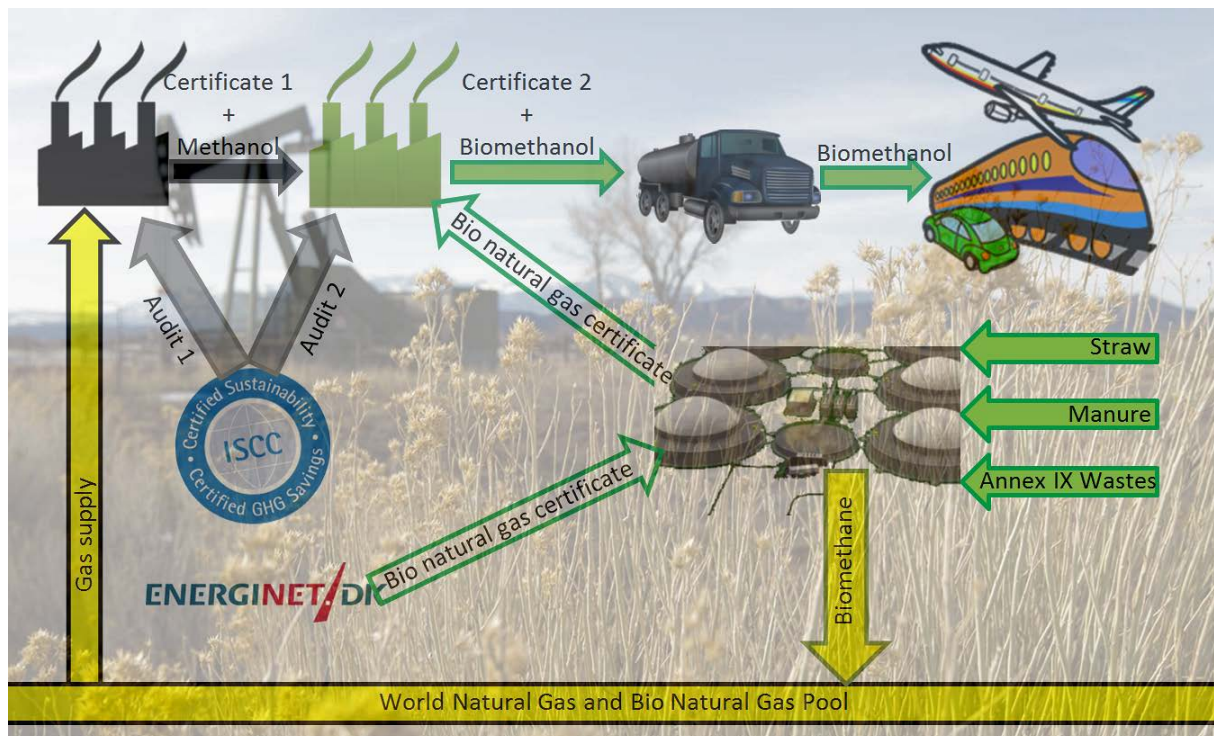


### Commitment to the Energy Agency

The Danish Energy Agency has prepared a manual for the manufacture and trade of biofuels and related sustainability reporting (DEA's handbook on evidence of biofuels sustainability<sup>27</sup>). EU member states do have equivalent procedures. The trade must leave a paper trail - Chain of Custody. Relevant documents can remain in the chain, but sustainability information must be passed on to the next stage and finally certified by an independent expert examiner. Deloitte Statsautoriseret Revisionspartnerselskab<sup>28</sup> is supposed to act as our examiner in case.

### The Essence

For a given lot bio-methanol, the underlying ICSS certificate shall contain information on GHG savings in accordance with the RED<sup>29</sup> and be acceptable to the Danish Energy Agency.



The world's inventories of natural gas and bio natural gas provide a common pool. It is an international political intention to increase the share of bio natural gas. There is political will to eliminate trade barriers. One way of doing this is to verify greenhouse gas emissions in the production (certificate 1) and subtracting the emissions resulting from the natural gas itself by the use of bio natural gas certificates (certificate 2). This allows separate actors symbolized by the *black* and the *green* factory. The demo works at ESØ has no *black*, but only one *green* factory fed directly from the national grid and with one audit and one ISCC certificate.

It August 17, 2014.

<sup>27</sup> [http://www.ens.dk/sites/ens.dk/files/klima-co2/co2-kvoter/vejledning-virksomheder-kvoteordningen/rapportering-co2-udledning/H%C3%A5ndbog%20efter%20h%C3%B8ring\\_060711\\_version%201%201%201\\_300512%20\(2\).pdf](http://www.ens.dk/sites/ens.dk/files/klima-co2/co2-kvoter/vejledning-virksomheder-kvoteordningen/rapportering-co2-udledning/H%C3%A5ndbog%20efter%20h%C3%B8ring_060711_version%201%201%201_300512%20(2).pdf)

<sup>28</sup> <http://www2.deloitte.com/dk/da.html>

<sup>29</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0029&from=EN>