The shifting business concepts of Danish Centralised Co-digestin Plants

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A bit of history,
and where we are today with the economics

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This is where it all began

Dead lobsters at Gilleleje Harbour in 1986. News that Politicians skillfully exploited for serious farmer bashing.

This led to the first fresh water action plan.
– later II and III.

De døde hummere i Gilleleje som i 1986 gav anledning til den debat, der resulterede i en vandmiljøplan til 12 milliarder kroner. Et eksempel på tv-mediets magt i specielle situationer.

Peer Pedersen/Polfoto.
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6 months storage of manure, later 9 – large investments in storage facilities

Stop for liquid spills from dung dumps and silage

Only spreading manure during the growing season

Farmers were furious – investments of DKK 3 billion. (40 mil € 40 years ago)

But many eventually realized that it was common sense and good farming practice

Well, that is not entirely true

The 1973 oil crisis kicked of some development.

**The first tentative experiments with biogas,
were carried out in the 1970s by progressive farmers.**

**But all beginnings are difficult. The State contributed
The STUB program, which was intended to support development.**

There were many failed projects that gave biogas a tarnished image for many years to come.

Ikke blot bilfri søndage med gabende tomme motorveje, men også energisparekampagner, slukkede gadelygter og afbrudte lysreklamer i næsten mørkelagte bykerner var de mærkbare og højst uvante signaler om, at nye og mere alvorlige økonomiske tider syntes at ligge forude oven på danskernes historiske forbrugsfest i 1960'erne og de tidlige 1970'ere.

John E. Jacobsen/Scanpix.
Licens: Begrænset anvendelse

In the mid-eighties, North Jutland County launched the project Village Energy, under which three small joint facilities were built in North Jutland.

**Joint in the sense that several farmers supplied manure to them,
which then supplied a village with energy. (heat and power)**

**These plants were rebuilt several times and gradually improved, but only one
of them is still in operation, namely the plant in Vegger.**

**At the same time, there were still people working with farm facilities. Particularly Nordvestjysk Folkecenter for Renewable Energy worked with a plant concept,
which was called the Blacksmith's Plant because the idea was that every blacksmith should be able to build such a plant.**

The Blacksmith concept was commercialized, and the company Dansk Biogas built a number of plants like this. Originally, blacksmith plants were built with horizontal reactors, but it was the vertical ones as later gained ground.

Dansk Biogas later became Xergi, which is now owned by Nature Energy

In continuation of the Fresh Water Plan I, a desire to Investigate how far we could get with building bigger centralised plants emerged.

1986/87: Coordination board for centralised plants was formed, who Initiated the Demonstraton program for centralised biogas plants.

-40% in support for new demonstration plants

-Additional support for slurry tanks established in connection with Centralised biogas plants.

-Follow-up program to exploit the gained experience.
-later came to include also farm facilities.

That was when I entered the schene ☺

In the early years, there were plenty of problems

-processes
-pumps
-stirrers
-heat exchangers
-floating layer
-foam
-engines

But especially since biological purification of the gas for sulfur became widespread more stability in operations accurred, and significantly improved economic performance became the order of the day

FIGURE 5.4
Biogascleaner QSR desulphurization plant at Nature Energy Maansson in Brande, Denmark.
PHOTO *Biogasclean.*

Danish plant builders

Bigadan

Nature Energy (Xergi)

Lundsby Biogas

Combigas

Until 2012, all plants produced electricity and district heating.

The Heat Supply Act's requirement for a rest-in-itself principle was a major problem.

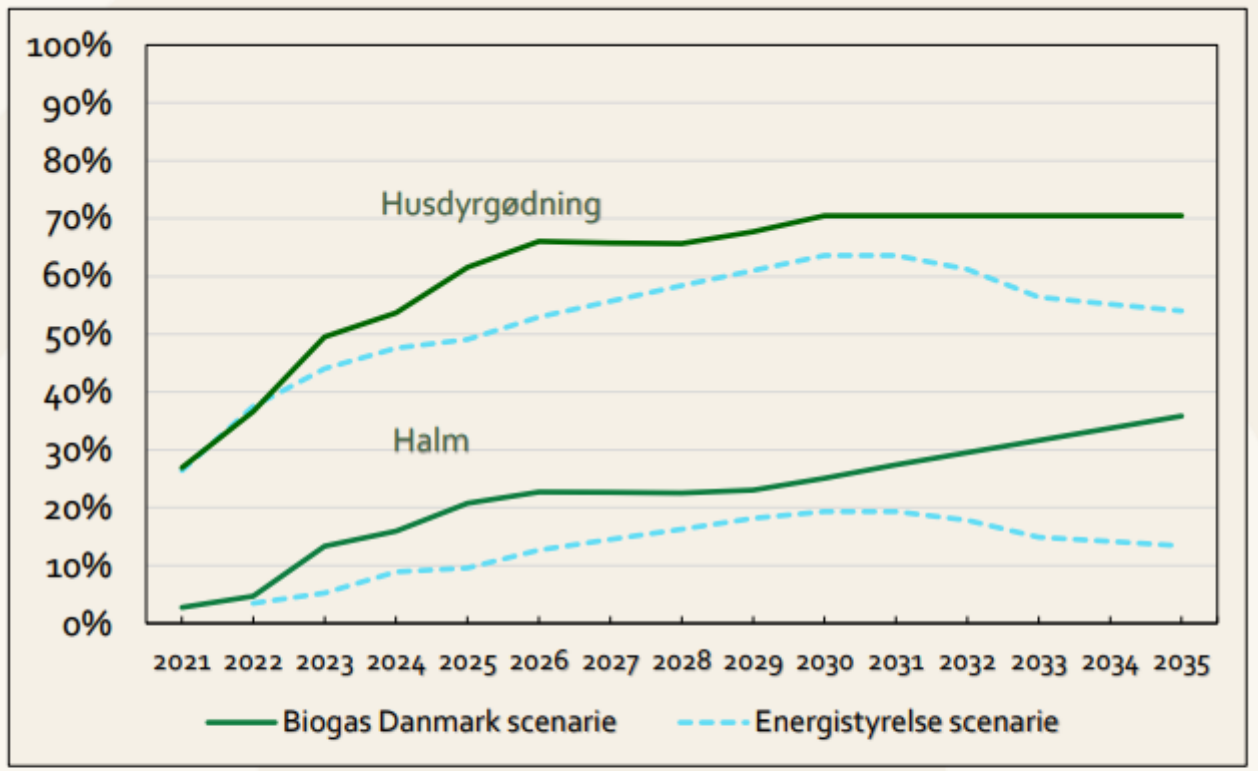
If the plants made money, they would have to hand it over to heat consumers. I.e. that a result of zero became an objective in itself. In the case of deficits, on the other hand, one could increase the price of heating, i.e. a completely wrong incentive structure.

But in 2012, sales of upgraded biogas to the natural gas grid were opened with subsidies.

That made things really get going.

Prognosis for the use of manure and straw for biogas Production.

Pt. 50% of manure
Approx 15% of straw



Figuren viser hvor stor en andel af de samlede ressourcer af husdyrgødning og halm, der nyttiggøres til biogasproduktion i de to scenarier.

Forskning viser, at når halm og dybstrøelse afgasses i biogasanlæg, tilbageføres hovedparten af det langsomt omsættelige kulstof til landbrugsjorden. Dermed lagres der samme mængde kulstof på langt sigt, som hvis halmen blev nedmuldet direkte i jorden.

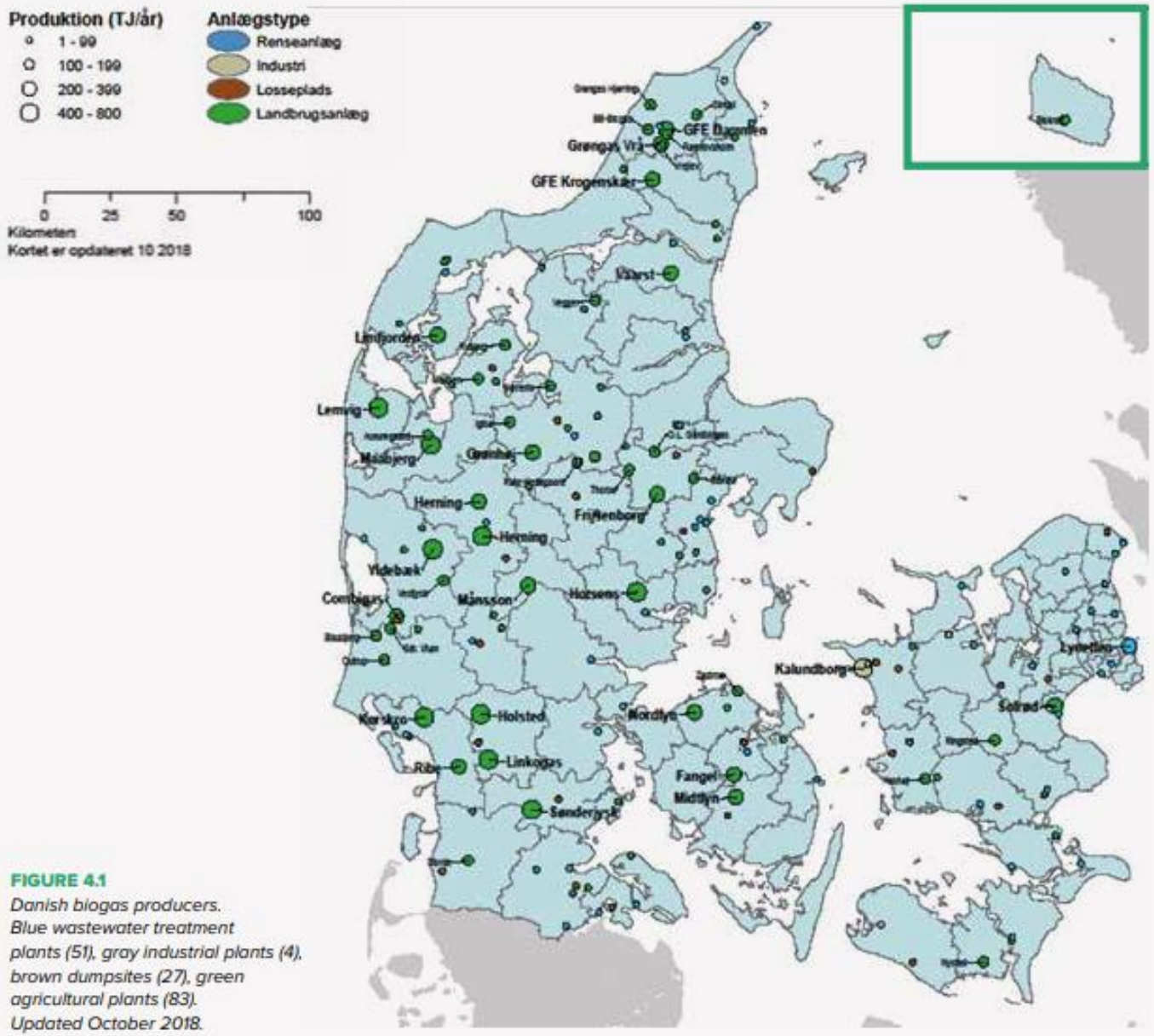


FIGURE 4.1

Danish biogas producers. Blue wastewater treatment plants (51), gray industrial plants (4), brown dumpsites (27), green agricultural plants (83). Updated October 2018.

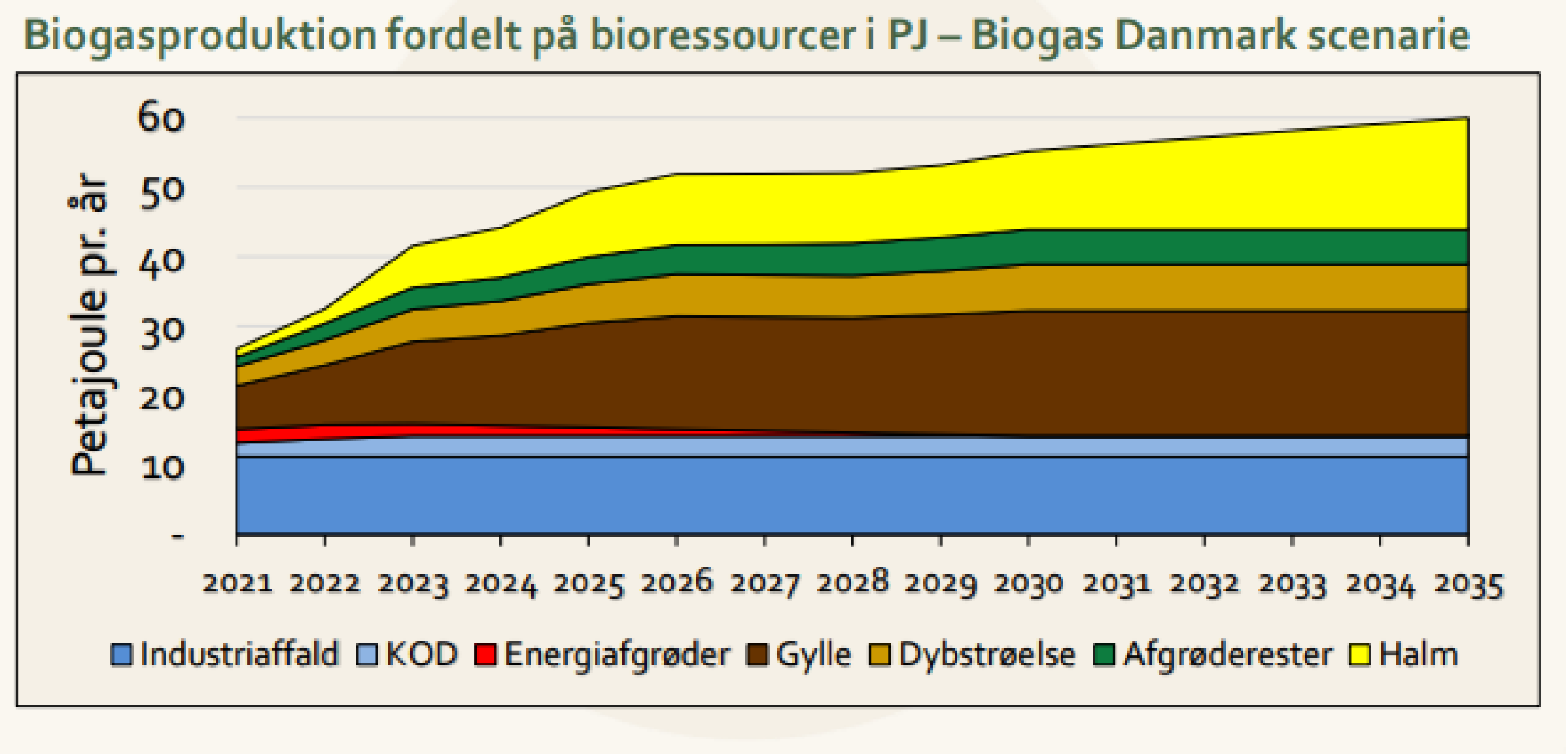
Status

We now have about 200 biogas plants in Denmark

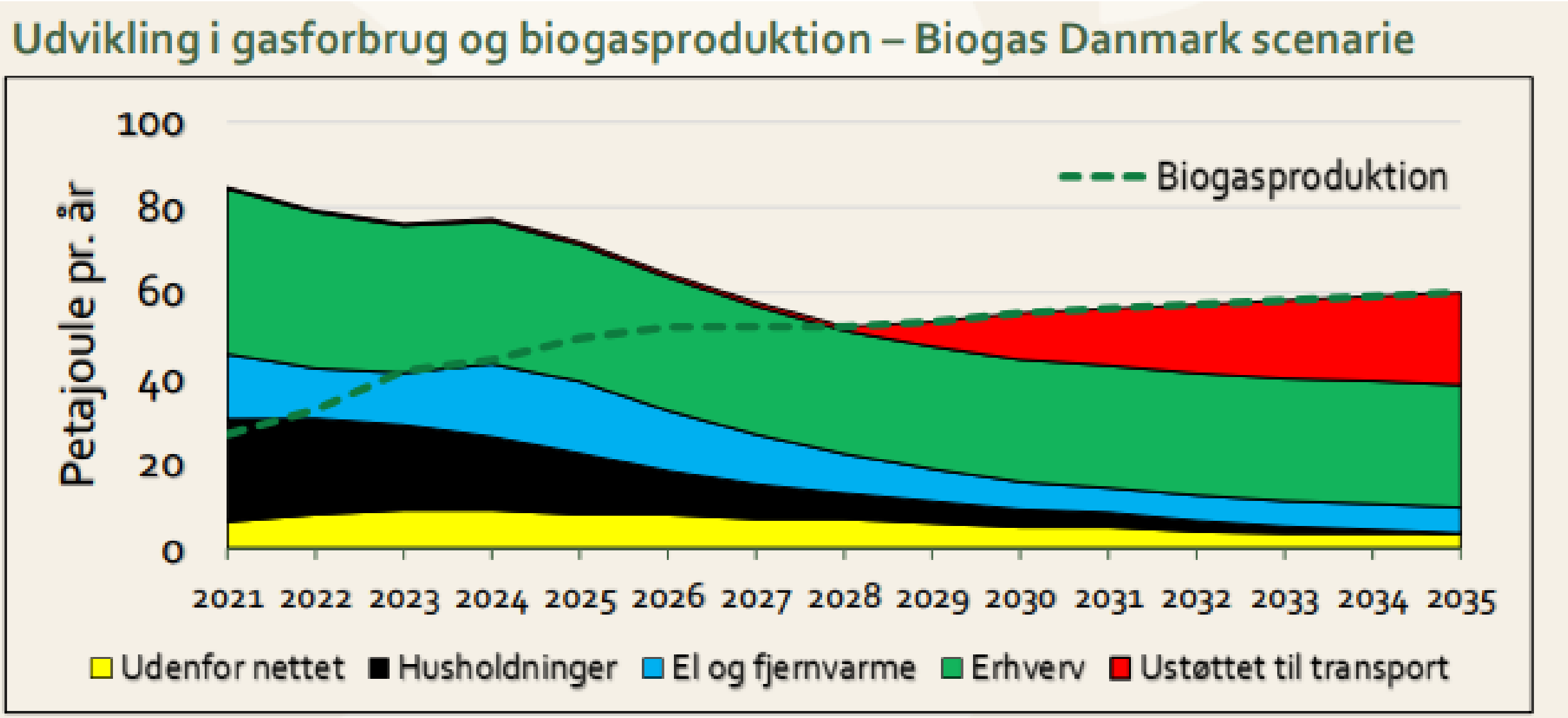
We now use approx. 50% of animal manure for biogas, so there is great potential for more

In September, 60% of the gas in the natural gas grid was biogas.

The potential is at least a double



Distribution of biomass ressources used for biogas production



Development of gas consumption and the production of biogas.

So if the politicians want to, we can fill the natural gas grid with biogas in 5 years.

BUT – The money interests behind the electricity sector and investors in wind farms completely dominate the agenda in Denmark.

Everything that can must be electrified and gas phased out. All politicians run along this narrative.

But it's stupid. When all gas coming out of the gas grid in 5 years is GREEN, there are no longer green arguments for phasing out gas in Denmark.

This means that there is no reason to replace gas boilers in private homes with heat pumps, and not even there, where today gas-fueled CHP is operating.

And the gas-consuming industry is also green when we get there.

And then we are independent of Putin.

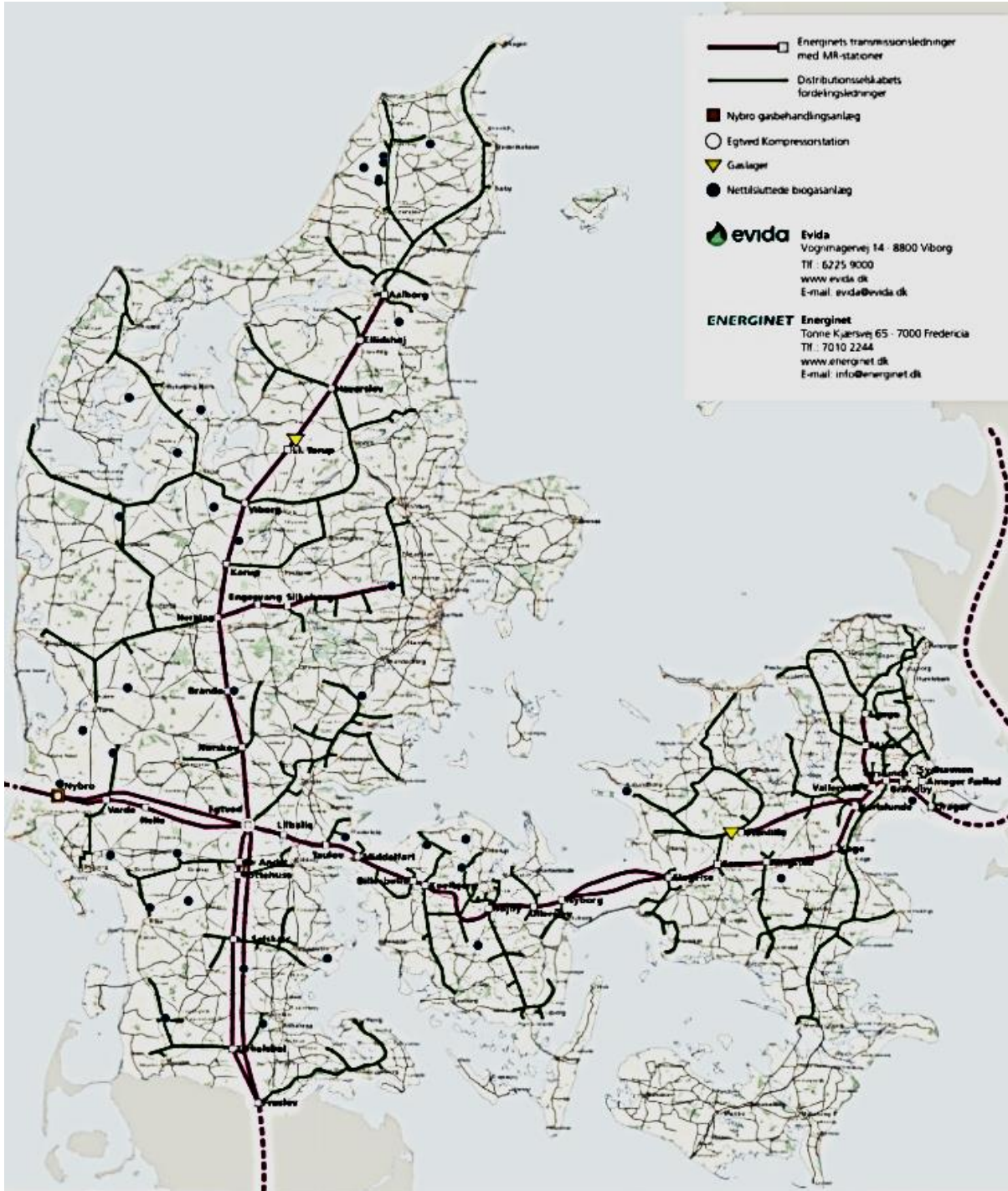
Furthermore, the wise men who designed the Danish natural gas grid had a lucky hand.

We have a widespread gas grid in virtually the entire country.

The technology is there. We could set up tank-stations along the natural gas grid, allowing cars, trucks and tractors in the future to drive on biogas.

No, no, it should all be electric cars. So far only with the effect that wealthy people can buy completely or partially tax-free luxury cars as long as they have a charging cable in the trunk.

And imagine how many mast forests and grid reinforcements that would not be needed if politicians would listen and think.



So the potential is there.

But someone might now ask where the biomass will come from?

The Danish Technological Institute has worked a lot on this in recent years.

To a large extent with straw, but also green residual biomass from agriculture.

The fundamental question is:

Can we extract some biomass from agriculture for biogas production, excluding actual energy crops (maize, beets and grasses) without jeopardising the yield of general agricultural products.

The aftermath of seed grass outlay after spring barley harvested with high stump

Sugar beet leaves

Harvesting leaves of winter rape seed in the autumn

Catch crops

Well, is it economic ?

Yes, it is, or at least can be. But of course it depends.

In the projects shown, up to 5,000 kg of dry matter per hectare has been harvested. Depending on the crop, mostly in beets and seedgrass, at least in Rapeseed (1,500 kg)

Biogas plants should be able to pay at least DKK 1. per kilogram dry matter.

In other words, a considerable extra profit per hectare.

The problem is that it can be difficult to harvest in wet years.

Links to small videos with recovery of residual biomass from agriculture for biogas

Rationel bjærgning og håndtering af halm og efterafgrøder til biogasproduktion - YouTube

Ioetop til biogas – YouTube

Biomasse fra vinterraps til biogas - YouTube

Subsidies for biogas production 2019-2023

	min	max	
Electricity fixed	**0,11**	**0,17**	**€/kwh**
Electricity variable	**0,06**	**0,14**	**€/kwh**
Upgrading	**0,11**	**0,17**	**€/GJ**
Proces	**0,05**	**0,13**	**€/GJ**

From 2023 new scheme is introduced for new plants

Tender. Projects now have to give an offer as to which level of subsidies they need.

The aim is to induce more competition and thus reduce subsidies.

We do not know the subsidy levels, but most likely lower than till now

Some examples:

Ribe Biogas A/S:
Finished building in 1990, 40 % investment grants

Originally the largest Danish plant, 400 ton biomass/day.

Now 1,100 ton/day

Ribe Biogas	2017	2018	2019	2020	2021	2022	
Profit (mil €)	2,5	1,0	1,3	2,1	4,5	*9,3*	?
Fixed assets (mil €)	8	10	12	12	12	12	

Nature Energy Korskro

Finished building in 2018

2,000 ton biomass/day

Nature Energy Korskro	2017	2018	2019	2020	2021	2022
Profit (mil €)		0	-1	0	6	1
Fixed assets (mil €)		27	27	27	27	27

Ølgod Bioenergi Aps

Finished building in 2020

200 ton biomass/day

Ølgod Biogas	2017	2018	2019	2020	2021	2022
Profit (mil €)				-0,1	0,9	2,4
Fixed assets (mil €)				7,3	7,3	7,3

Thank you for listening