

Biogas in Denmark

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THE DANISH GAS SYSTEM

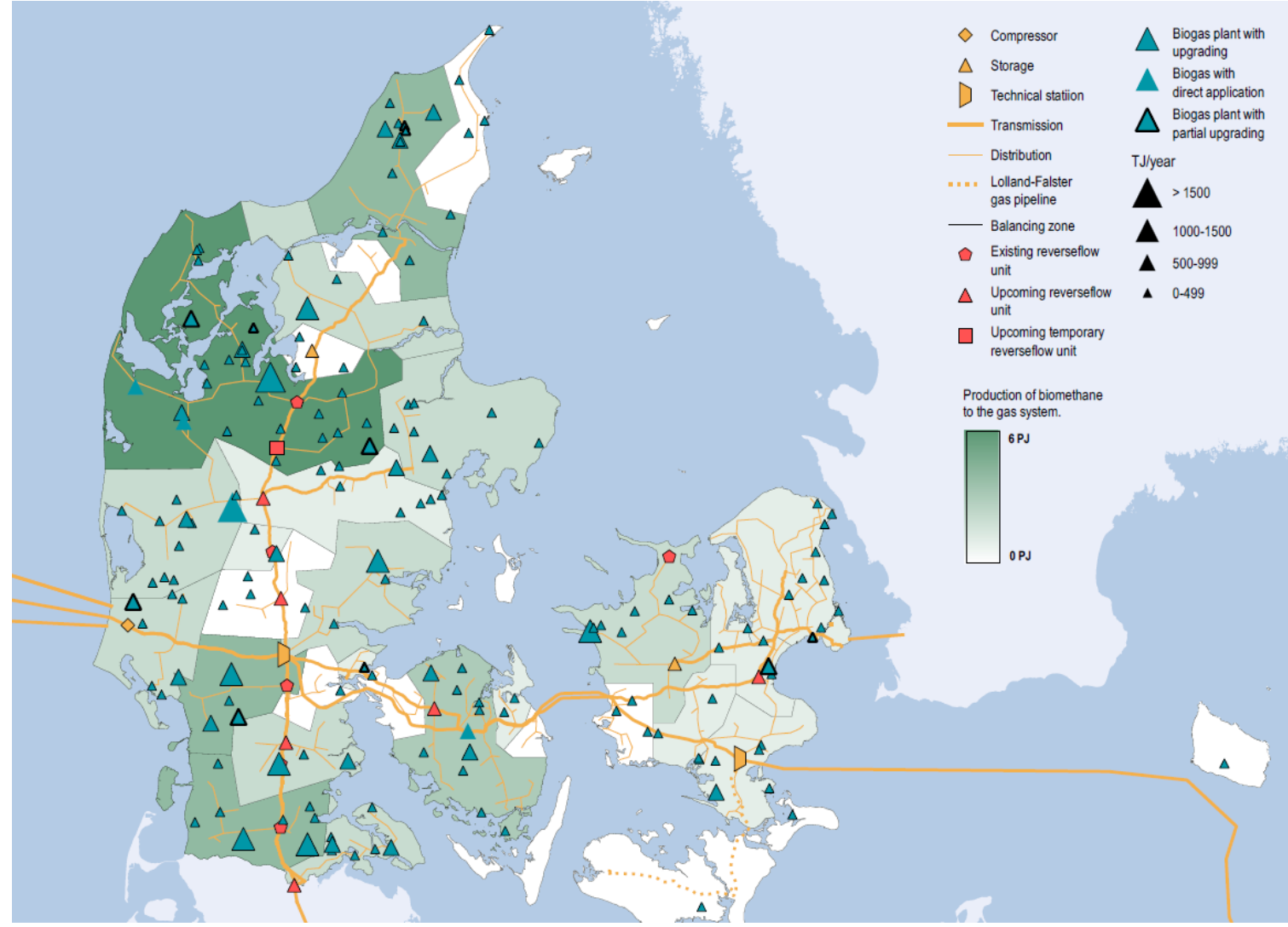
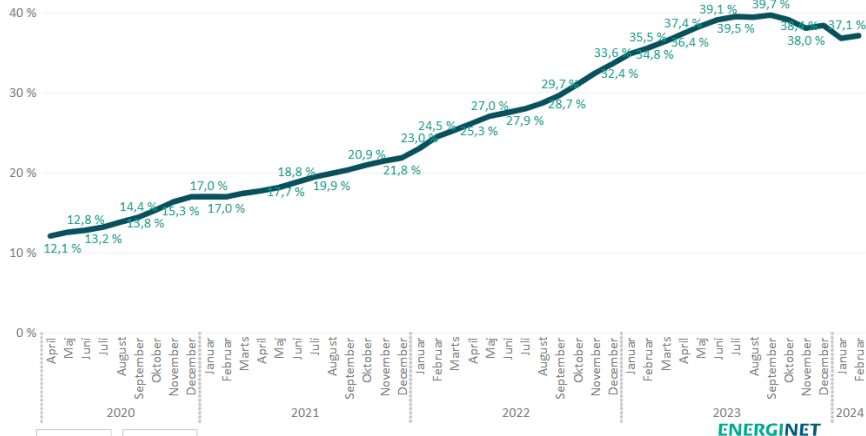
Increasing production of biogas and decreasing gas consumption

Increasing production of biogas

Increase since 2014.
2023 ≈ 38 % of total consumption.

Decreasing consumption

During the last 15 years gas consumption has decreased by 40% due to diminishing demand in gas for CHP.





GREEN GAS STRATEGY

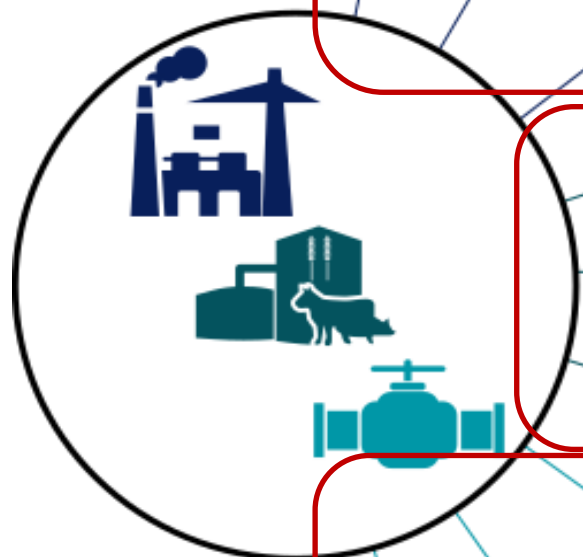
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- *Energy Agreement 2018*: Agreement of the Danish Parliament to prepare a Danish strategy for the Danish gas infrastructure and regulation in order to secure at continuous commercial utilization of the gas infrastructure within the green transition.
- The strategy is based on continuous work in parallel with the climate agenda
- Simultaneously with the electricity and PtX strategies
- Governmental ambition to have 100 pct. green gas in 2035 – **now 2030**
- https://ens.dk/sites/ens.dk/files/Naturgas/groen_gasstrategi_en.pdf





NINE FOCUS POINTS



Gas consumption in the future

- 1) Green gas must supplement the electrification and be used where it has the greatest value
- 2) Green gas in industry must support jobs in Denmark for the benefit of development and employment
- 3) Conversion to green gas must occur with consideration of competitive tariffs and on commercial terms

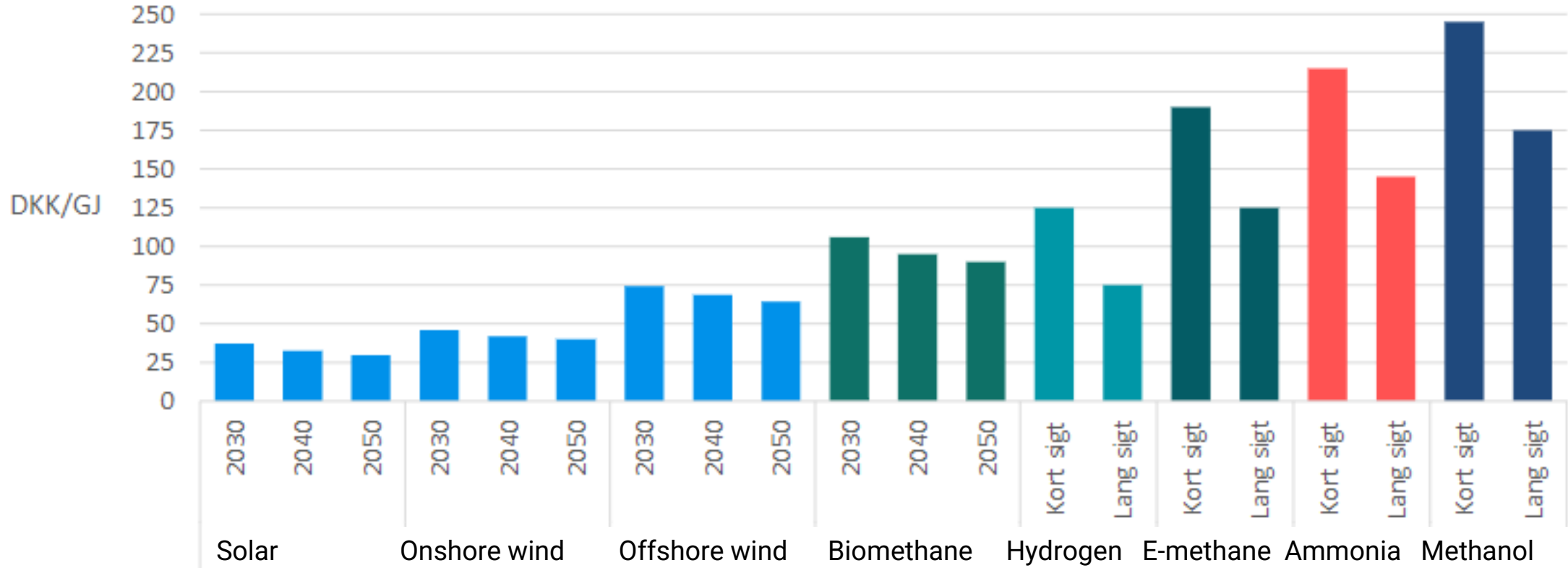
Production of green gases

- 4) Over time, green gas must cope with market conditions
- 5) Green gases must be produced sustainably
- 6) The development of green gas production and gas infrastructure must take place with the close involvement of the citizens concerned and take into account biodiversity and the environment

Gas infrastructure in the future

- 7) The gas system must support and be used for the green gases of the future
- 8) The gas system must be adapted and effectively support the energy system of the future and contribute with flexibility and security of supply
- 9) Denmark must work for the development of a well-functioning European market for green gases

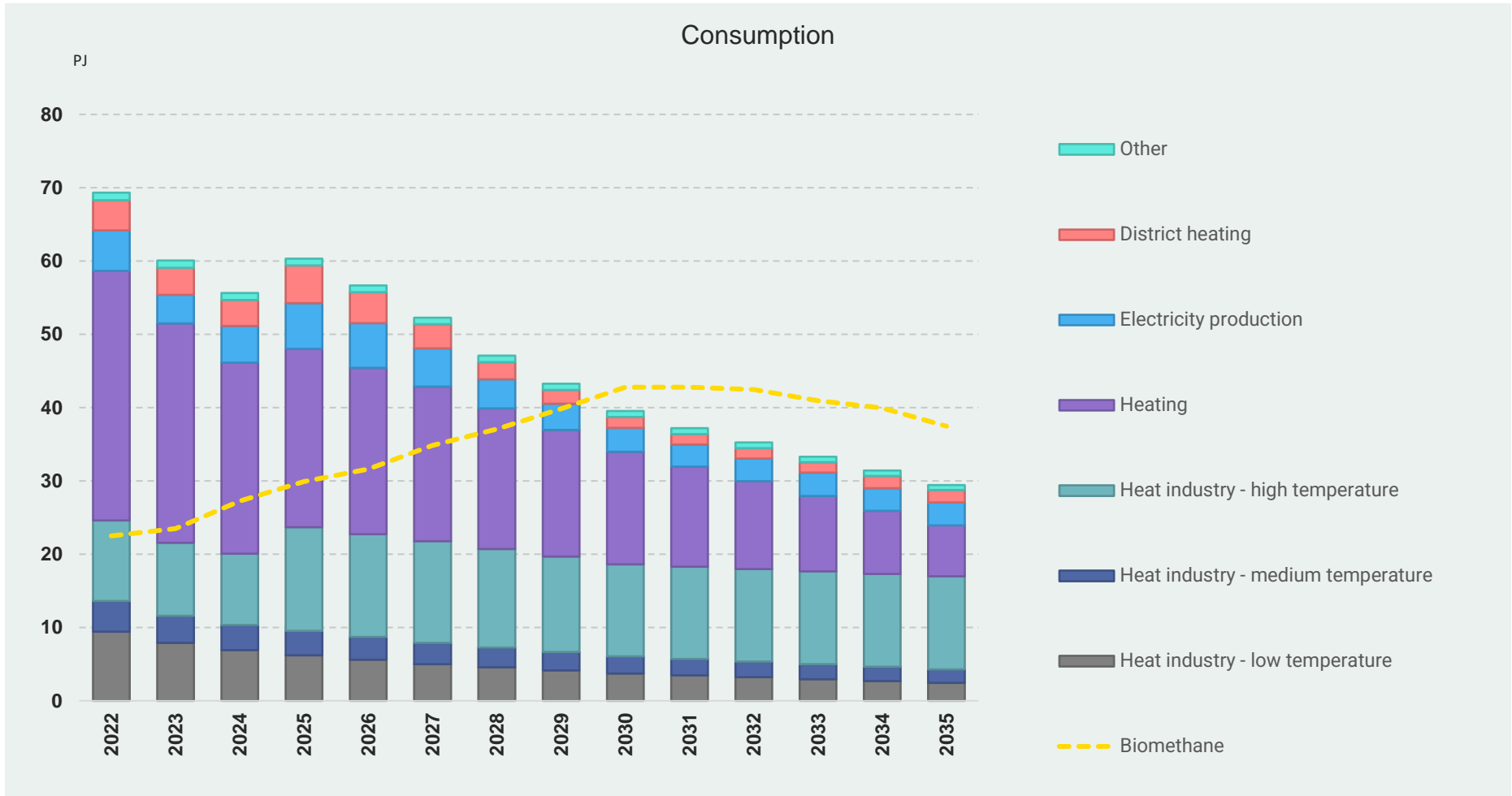
Technology Projections



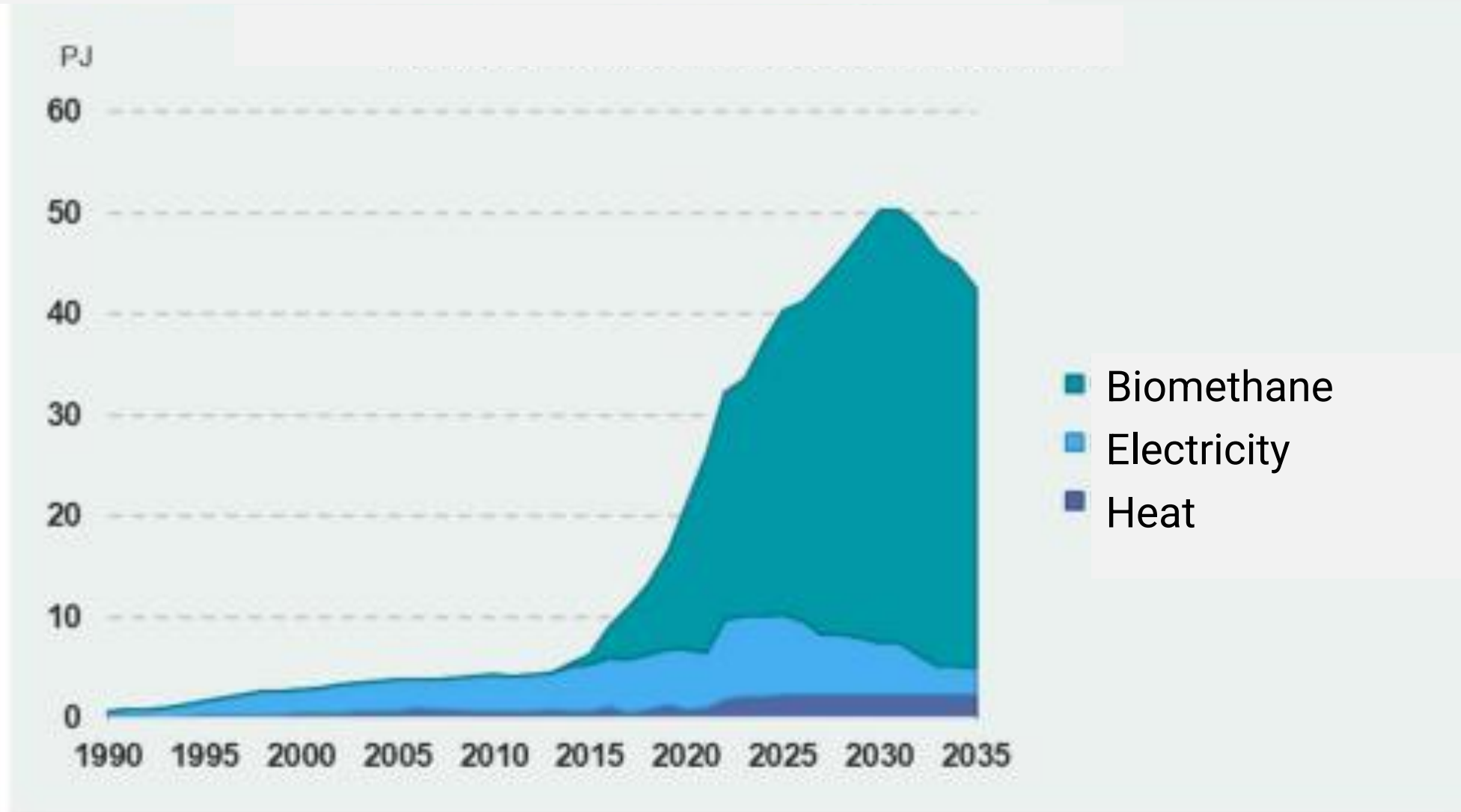
Levelised Cost of Energy (LCOE)

DEVELOPMENT IN BIOGAS PRODUCTION AND CONSUMPTION

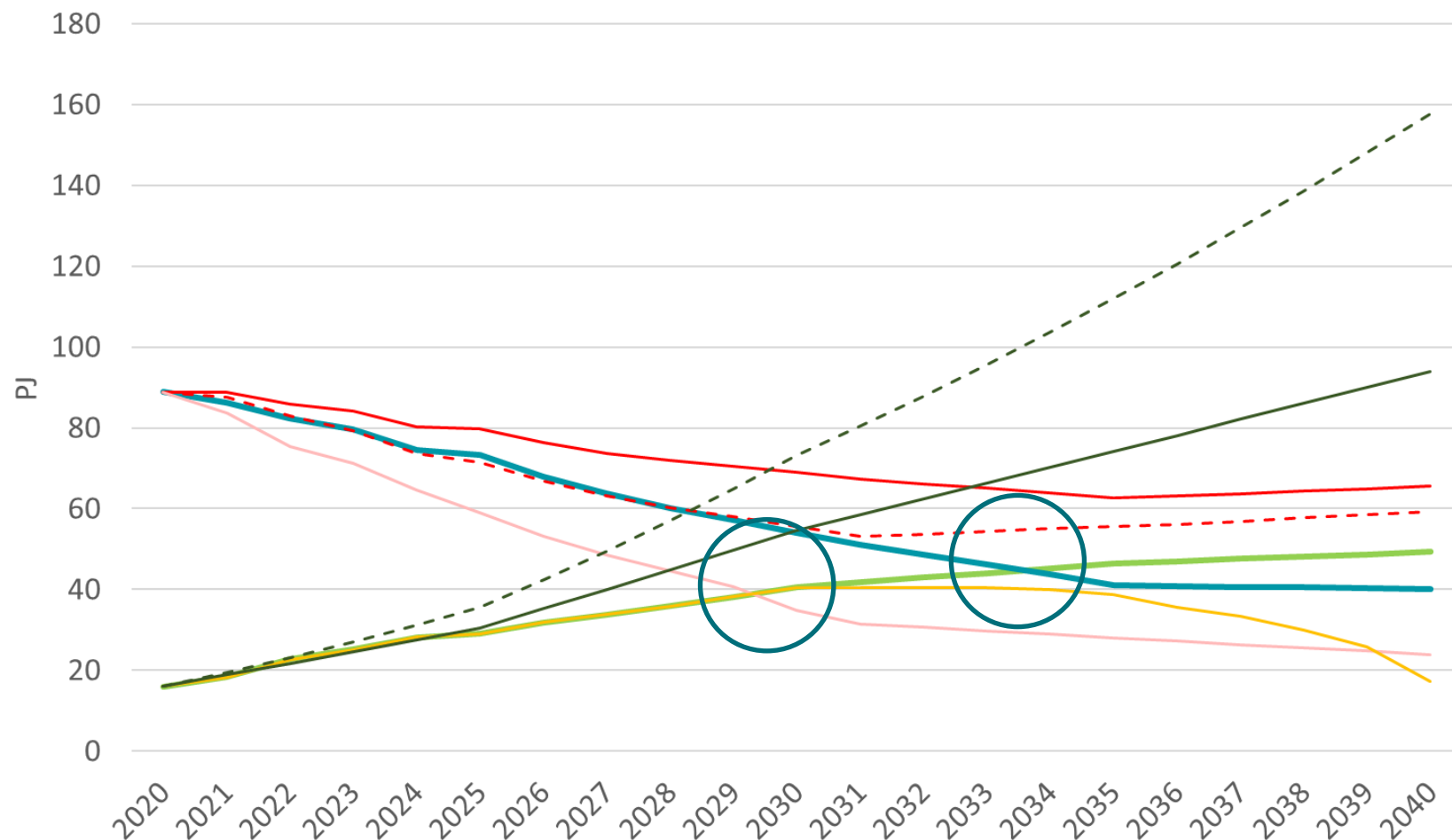
CLIMATE PROJECTION (KF23)



Biogasproduction



Greening the Gas Consumption - Scenarios



— AF21 - produktion
- - - Kombi scenarie
— Biomasse baseret biogaspotentiale

— AF21 - forbrug
— Lavt forbrug
- - - Biogaspotentiale med metanisering

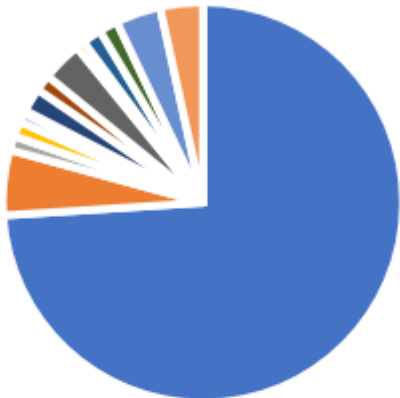
— Højt forbrug
— Støttet inkl. udbud



FEEDSTOCK - RESIDUES



Input biomass



Yield



- Manure
- Energy Crops
- Crop residues
- Straw
- Husk
- Olive residues
- Potato/beet pulp
- Fisheries residues
- Slaughterhouse waste
- Soapstock
- Melasse
- Glycerine
- Industrial waste
- Household pulp

Biomasses

Biogas			Gas produced	
2021-2022	Tonnes		mio. Nm3	
Manure	11.701.000	74%	335	31%
Energy Crops	833.000	5%	127	12%
Crop residues	184.000	1%	26	2%
Straw	193.000	1%	60	6%
Husk	121.000	1%	41	4%
Olive residues	36.000	0%	11	1%
Potato/beet pulp	306.000	2%	22	2%
Fisheries residues	212.000	1%	31	3%
Slaughterhouse waste	514.000	3%	75	7%
Soapstock	110.000	1%	49	4%
Melasse	247.000	2%	75	7%
Glycerine	240.000	2%	130	12%
Industrial waste	576.000	4%	41	4%
Household pulp	544.000	3%	62	6%
Grand Total	15.817.000		1.087	
Energy content PJ			25	
Methane yield, Nm3 pr. tonnes biomass			45	



BIOGAS POTENTIAL

	Potential (PJ/Year)			
	2020	2025	2030	2040
Manure/ Slurry	5	6	12	20 ⁶
Straw	1	5	15 ⁵	45 ⁵
Deep Litter	0,7	3	6	7
Waste Food Industry	8	8	8	8
Discarded Crops	0,3	0,4	0,6	0,9
Household organic waste	2	6	6	6
- heraf KOD	2	5	5	5
- have/park affald	0	1	1	1
Residuals from vegetal crops	1	2	7	7
- heraf roetoppe og andre toppe	0	1	3	3
- græs fra naturarealer ⁷	1	2	3	3
- randzoner og grøftekanter	0	0	1	1
I alt	16	30	55	94

Future resources	PJ
Sequential cropping	7,4
Residue from grass protein production	3,7



SUSTAINABLE BIOGAS PRODUCTION

Energy crops

- Current limit of 12 pct.

+ ban on use of maize from 2025

	2023/24	2024/25	2025/26
Decreasing limit	4		6
Energy crop limit (pct.)	9 (6)	4	4
Base deduction	50.000	50.000	36.000

Energy crops – future development

- How to further reduce the limit?
- Alternative energy crops?
- Research into synergy effects



SUSTAINABLE BIOGAS PRODUCTION

Methane loss regulation

- Recent report shows avg. 2.9% loss
- New rules:
 - Sources of leak must be identified and improved
- Annual examination of the plant from 3rd party

Methane loss - status

- Bi-annual workshops with 3rd party controllers
- Revision of guidance document
- Classification of leaks and other sources can be problematic

SUPPORT SCHEMES

EXPANDING FIRST, THEN DRIVING DOWN SUBSIDY COST

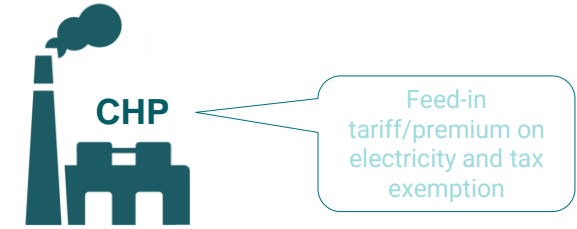
Support schemes (lasting 20 years)

- › Until 2012: support for CHP using biogas
- › 2012-2019: support in 20 years for upgraded biogas (biomethane) and direct applications
- › From 2020: Tenders for biomethane (12,96 billion DKK ≈ 1,7 billion Euro) over 20 years for biomethane

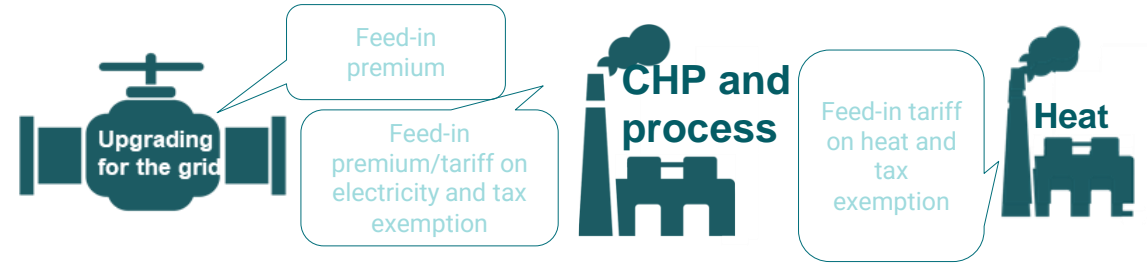
Indirect support

- › CO₂-reduction in transport using unsupported biomethane
- › CO₂ tax reduction for unsupported biometane – In process

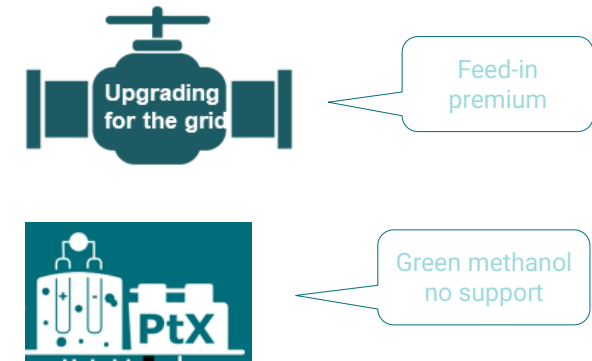
until 2012



from 2020



from 202X



Annual subsidies

Mio. Euro	2024	2025	2026	2027	2028	2029	2030
Tenders	43	0	0	10	10	12	12
Accumulated	43	43	43	53	63	75	87

Support scheme 2012 – Upgraded biogas

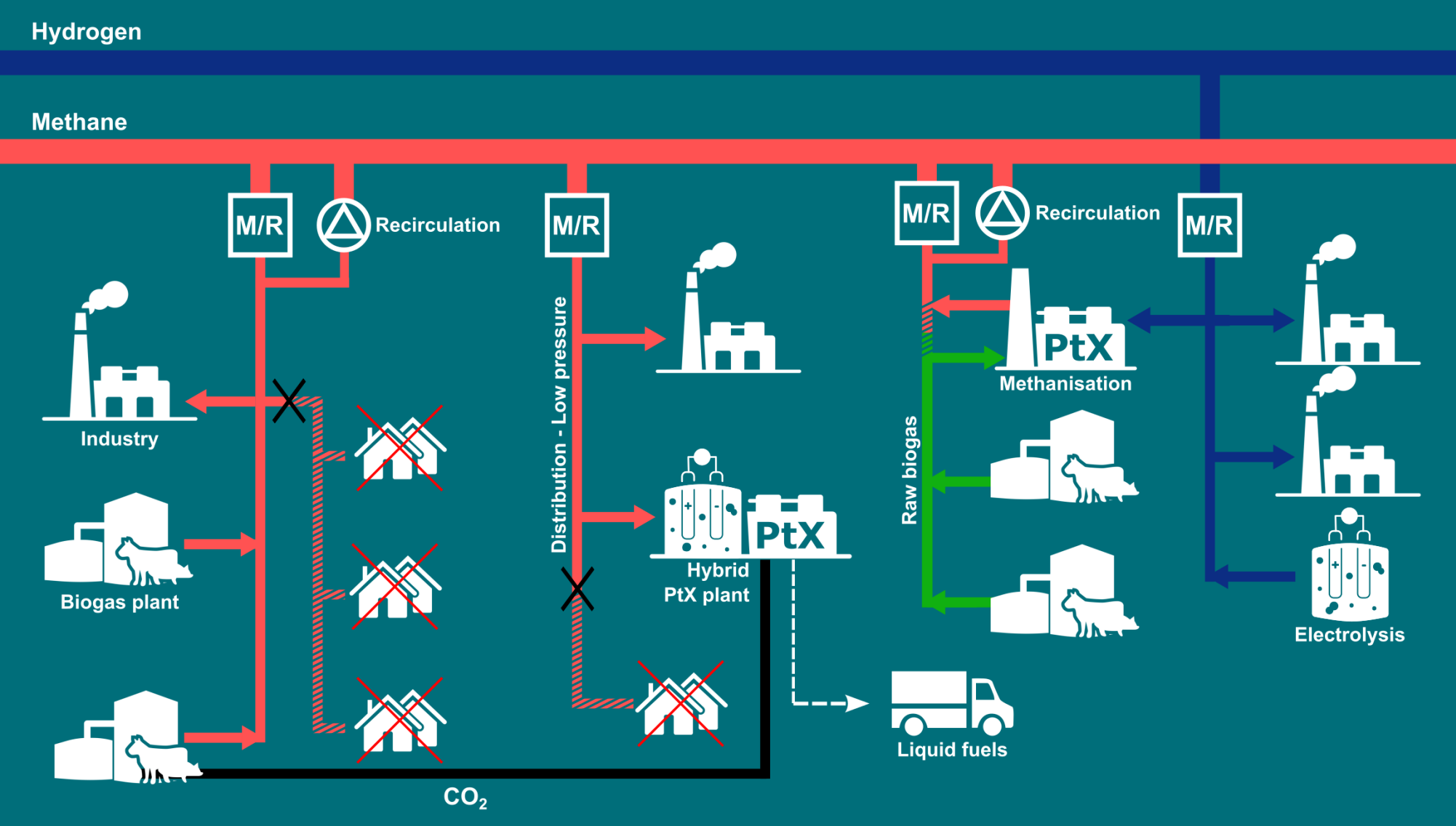
Support in 2022 for upgraded biogas:

- Base premium 11 Euro/GJ
- Contract for Difference Natural Gas adjusted 7 Euro/GJ
 - › CfD adjusted for a gas price 0 Euros/GJ due to high gas prices
 - › Higher gas price – less Cfd
 - › Lower gas price - higher CfD
- Early starters additional premium 2012-2019 – Faced out in 2019

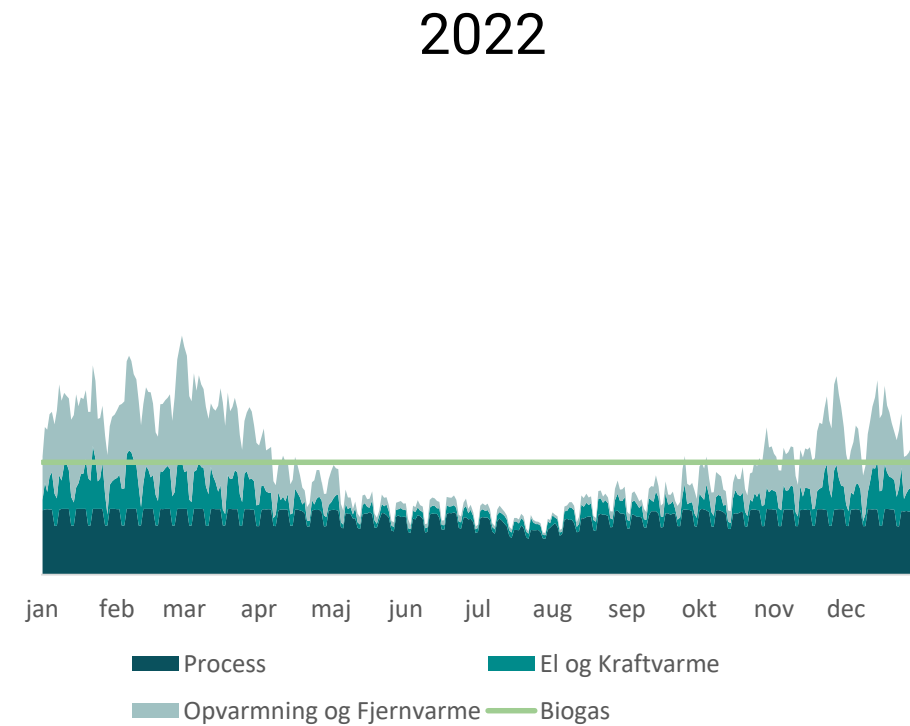
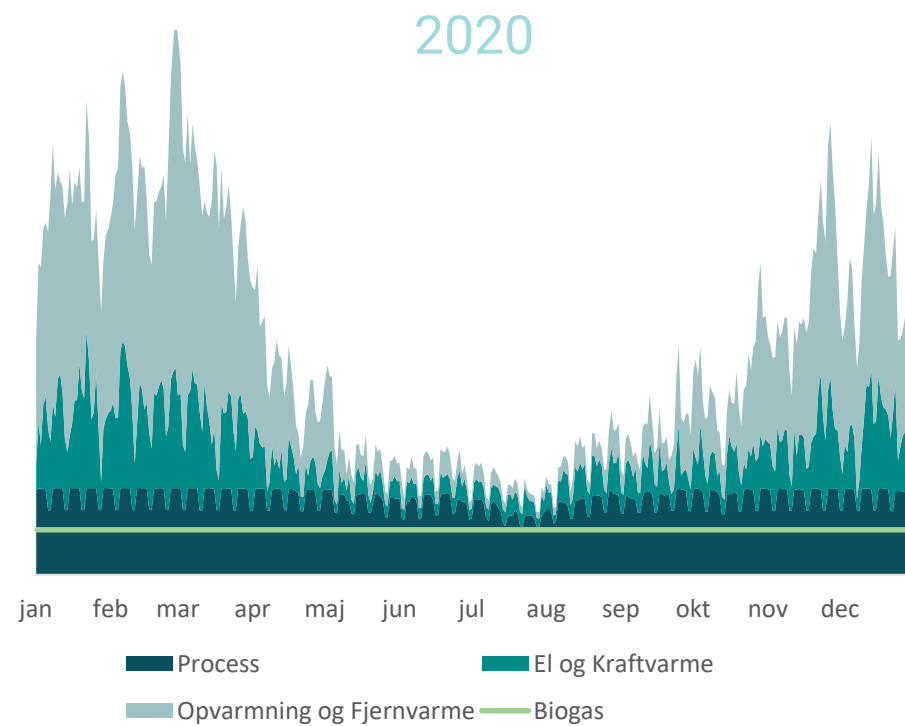
› 1,5 Euro/GJ -> 0 Euro

MODIFY THE GAS SYSTEM

HYDROGEN, BIOMETHANE, CO2 AND BIOGAS?

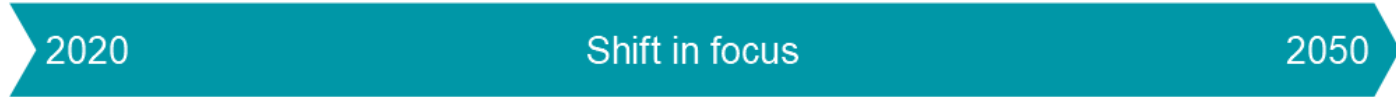


DSO bottlenecks biomethane

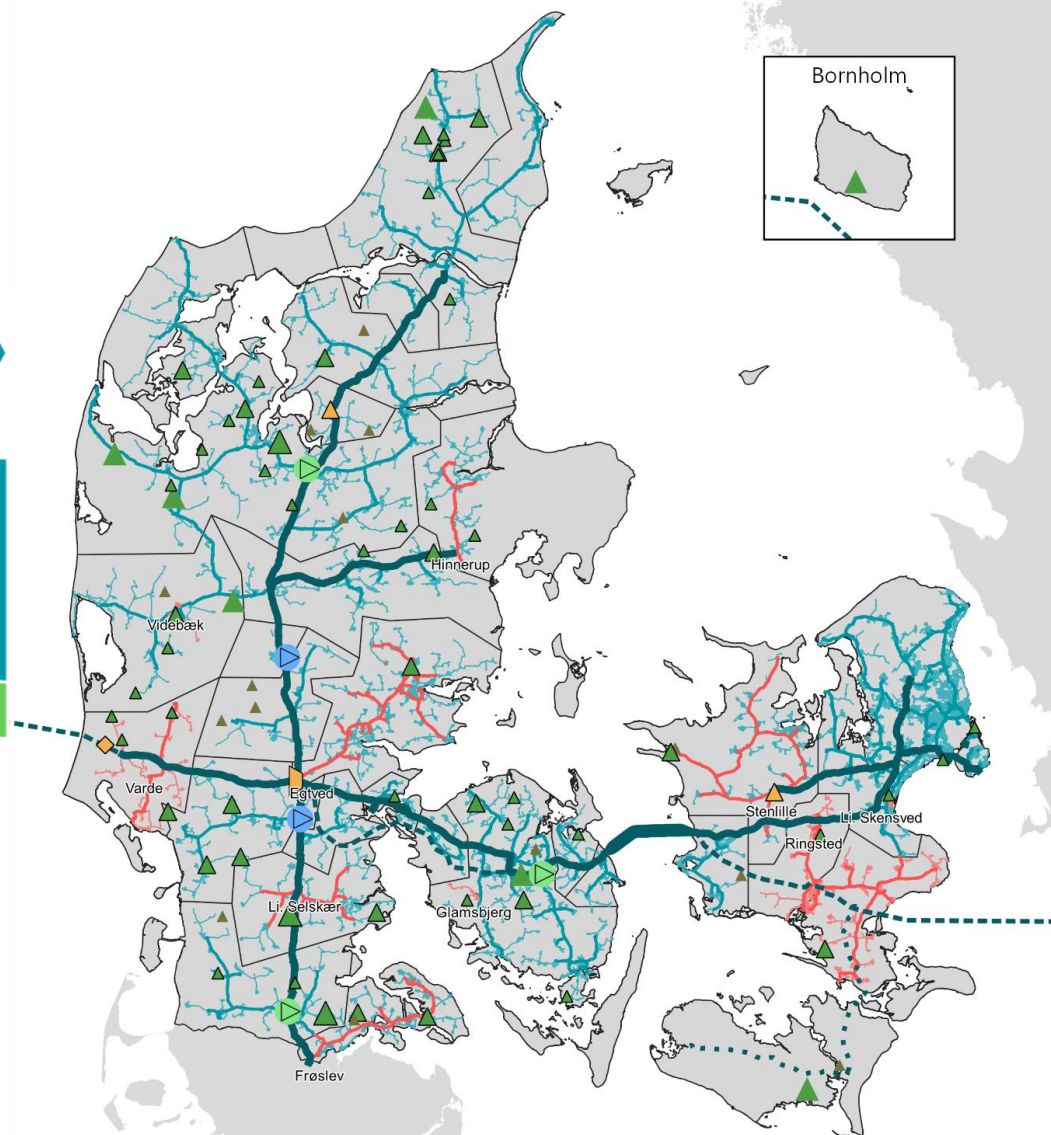


CHALLENGES AND OPTIONS

ADAPTING THE GAS-GRID(S)



- Adjusting the system to new flow patterns with decentral RE-gas production
- Modify the system for new gasses to transport
- Modify the support scheme
- Blending obligations
- Tax exemptions

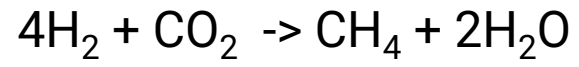


Tegnforklaring					
	Transmission		Kompressor		Tilbageføringsanlæg, Energinet
	Baltic Pipe		Lager		Tilbageføringsanlæg
	Lolland falster		Ilandføring		Idriftsættes snarest
	Fordelingsledninger		Biogasanlæg		Balancezoner (Evida)
	Distributionsledninger		u. opgradering 65-145 TJ		
	Begrænsning på nettet		u. opgradering 145-1400 TJ		
	Fordelingsledninger		m. hel/delvis opgradering <400 TJ		
	Distributionsledninger		m. hel/delvis opgradering 400-1000 TJ		
			m. hel/delvis opgradering 1000-1200 TJ		

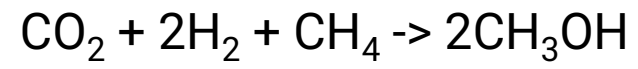
PTX



E-methane



Methanol



Questions?

