

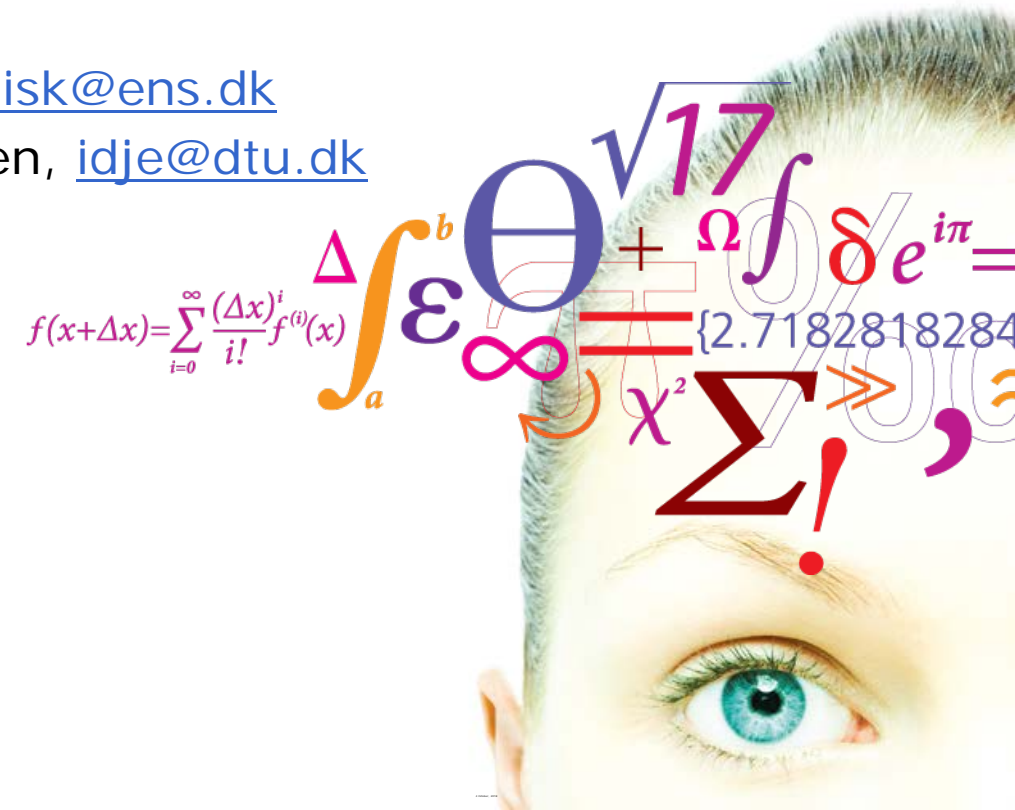
Recap on Value stacking to Tool stacking in Renewable Gas Regulation

Future Gas Annual meeting – November 2019



Lise Skovsgaard, lisk@ens.dk

Ida Græsted Jensen, idje@dtu.dk



Energy Agreement 2018 => low cost focus

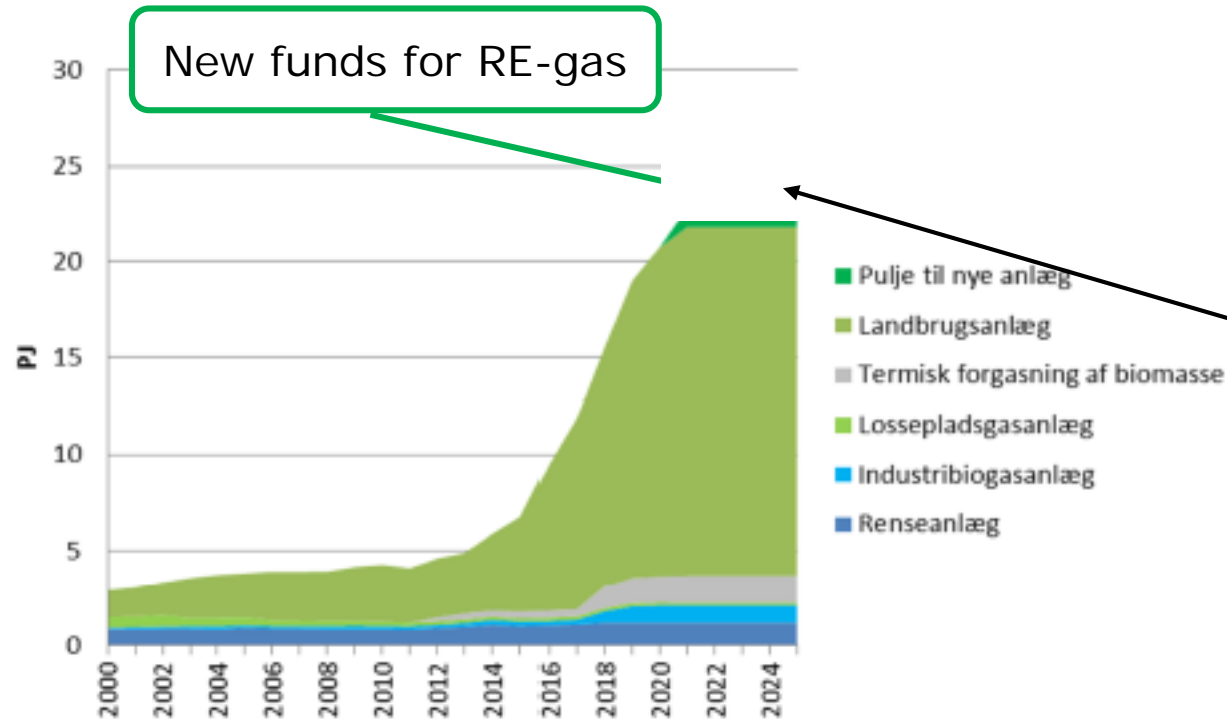


Overall principles

- Ambitious green transition – but at low costs
- Focus on harmonization of support

New *market oriented* support model

- ⇒ High interest in old support model
- ⇒ Expected biogas production by 2021 up to 25-30 PJ



Not really any funds left for the new model

- ⇒ Now what????

Now! New government – new focus



MORE CLIMATE ACTION =>

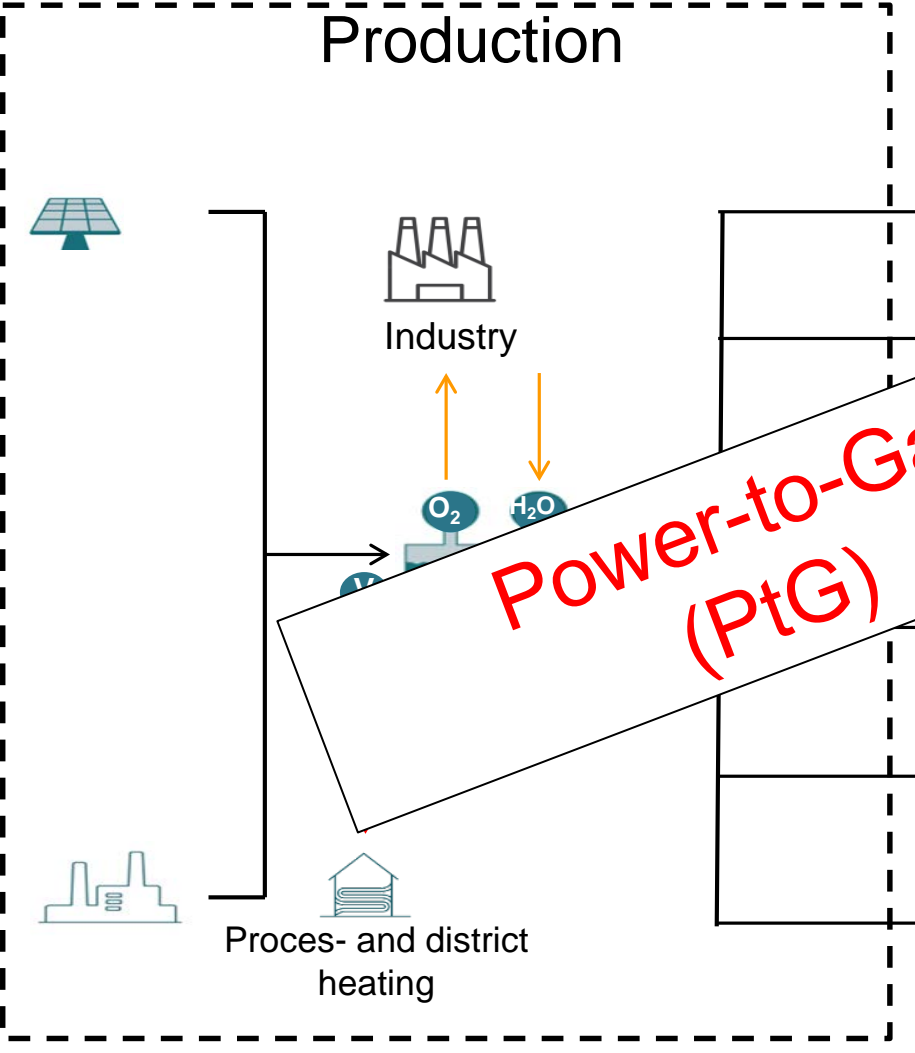
2030 goal: Carbon emissions reduced by 70%

=> Fossil fuels out – the sooner the better

=> Every idea counts



PtX Value Chain



Interesting because?

Still relevant with

- Value stacking and
- Tool stacking

RE-gas can provide

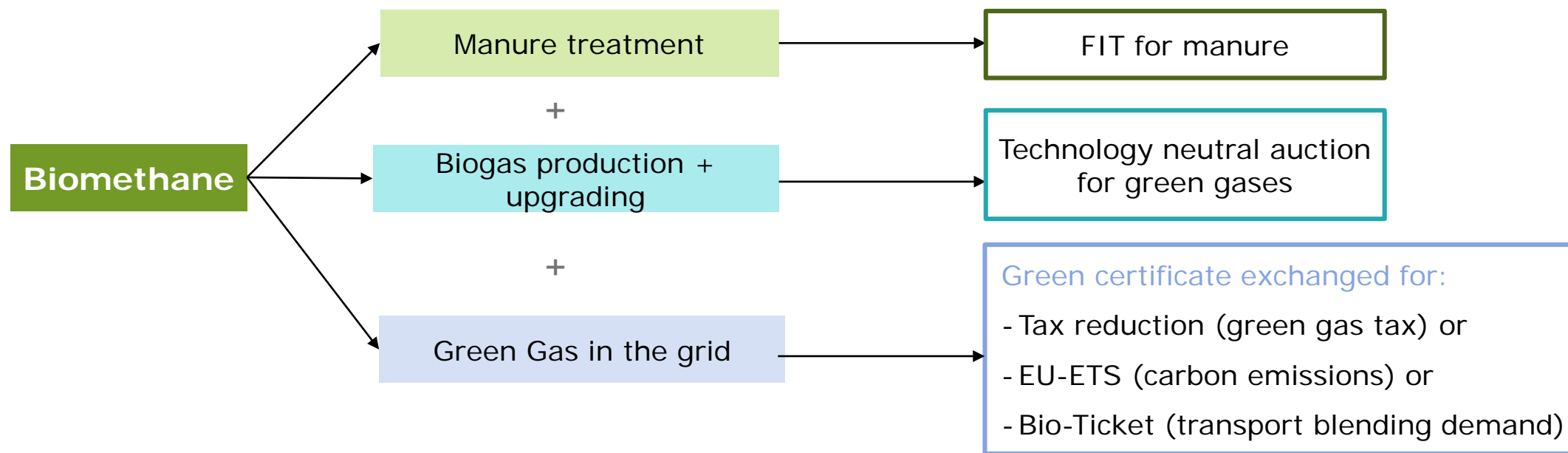
- Environmental (green gas)
 - smell
 - Nutrients
 - GHG
- Energy
 - flexible and storable
 - for transport
 - for high temperature
- Building block for
 - Liquid fuels (methanol, ammoniak etc.)
 - Fertilizers
 - Chemicals
 - Plastic.....

Model: Tool Stacking

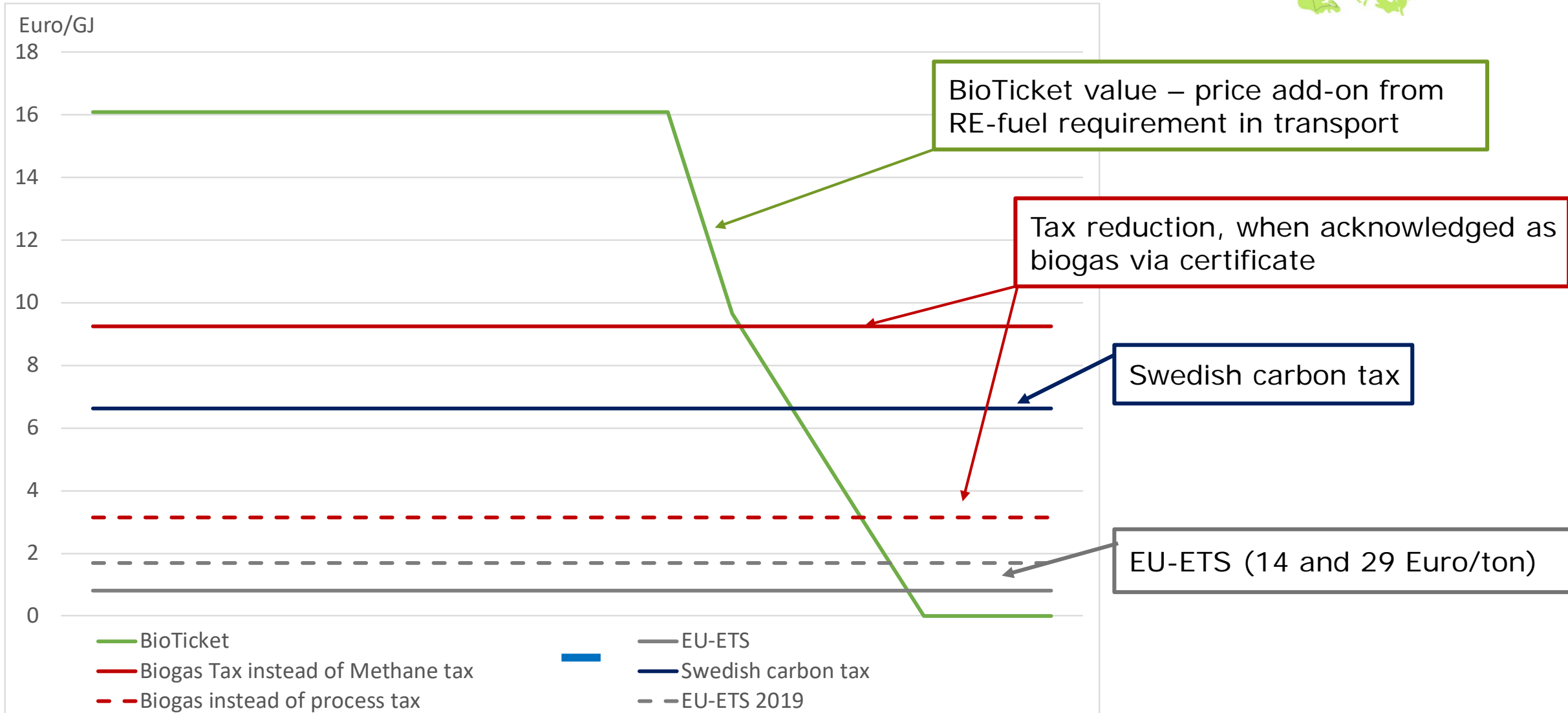
Several values:

- Energy (flexible, storable, high temperature and for transport)
 - Environmental (GHG, nutrients, smell)
 - Conversion options (liquid fuels, chemicals....)
- } => several tools

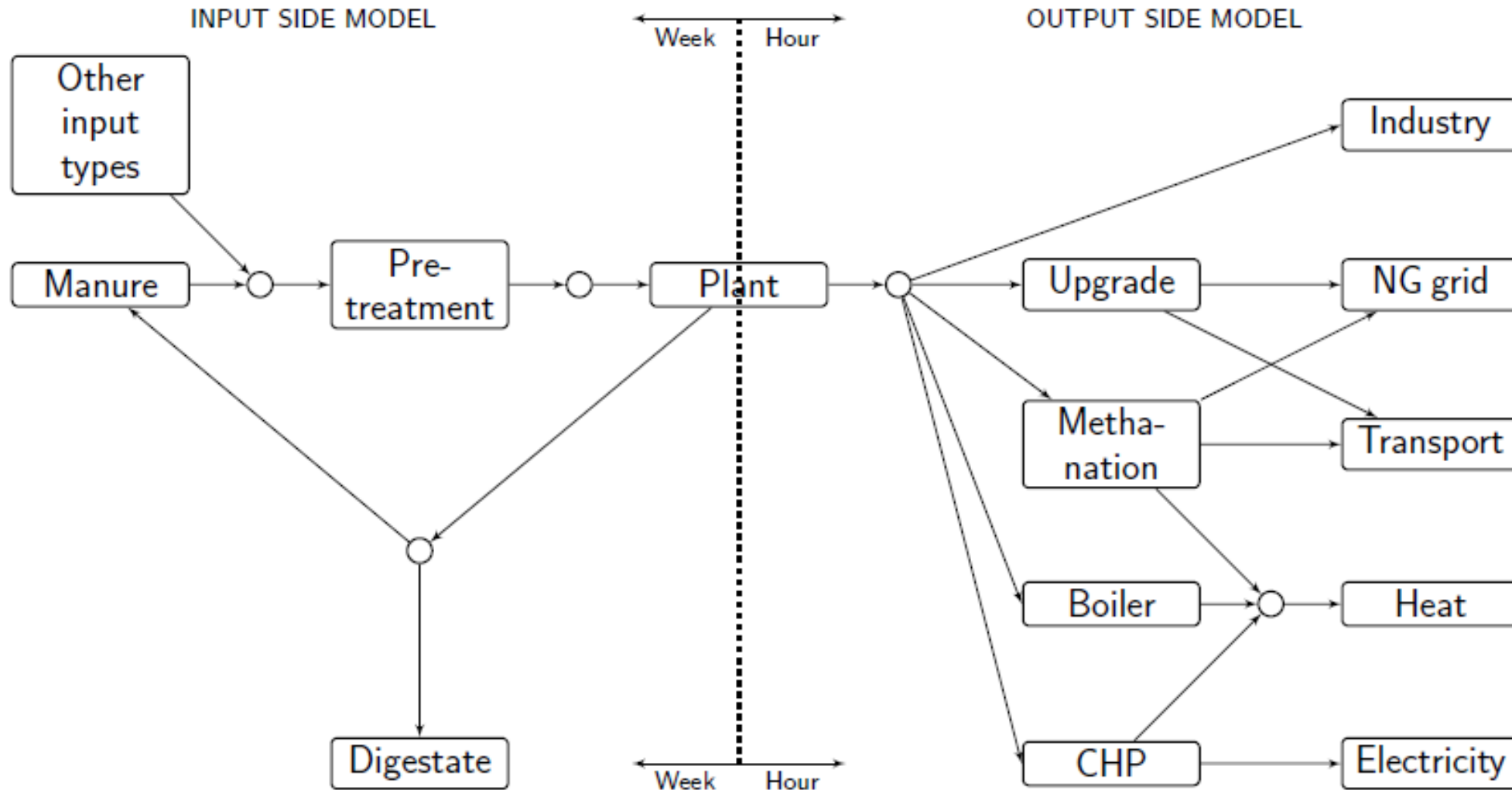
Example: Combination of semi-technology neutral auctions with other support tools



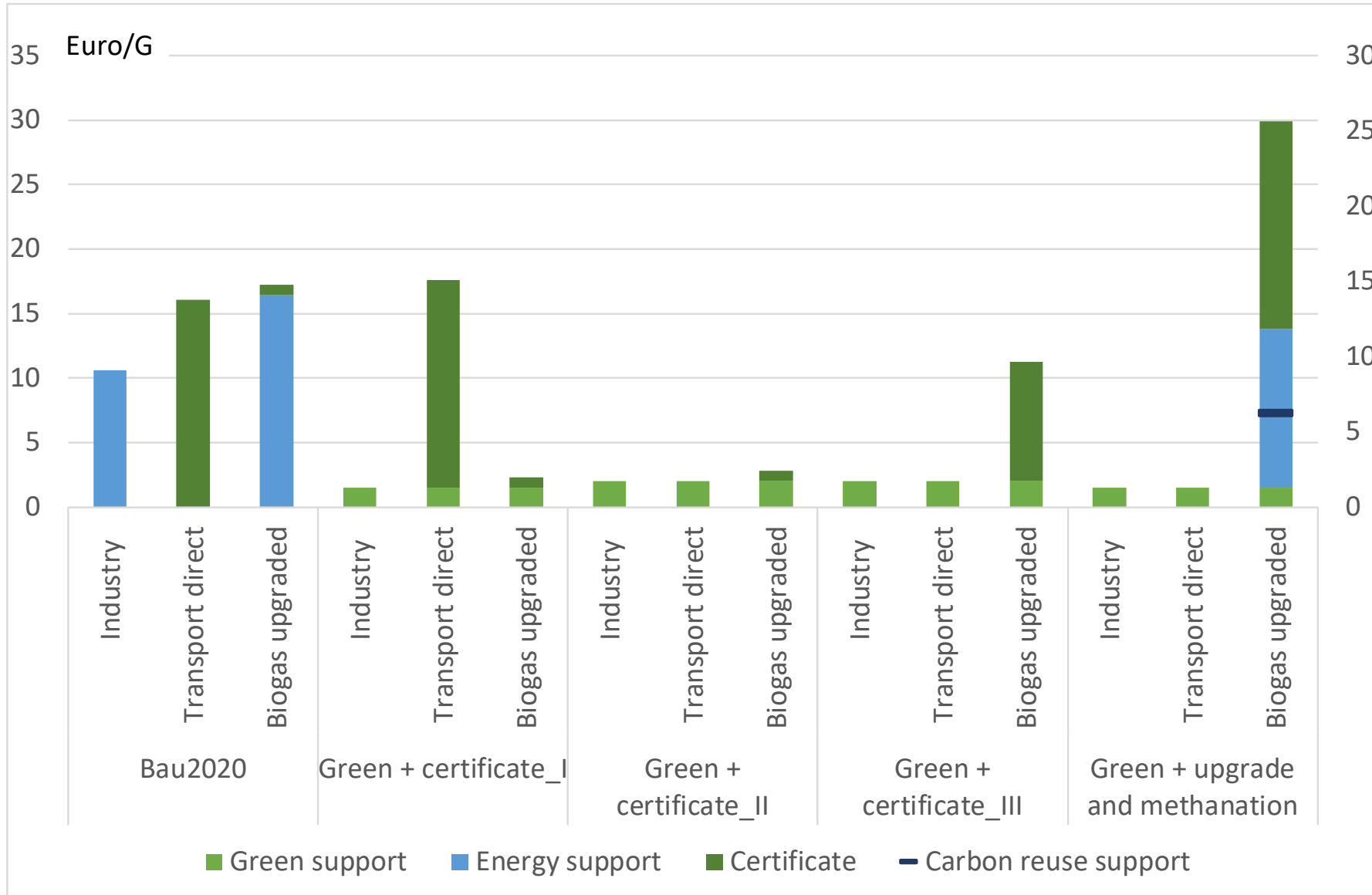
The Certificate value?



Model: Biogas value chain

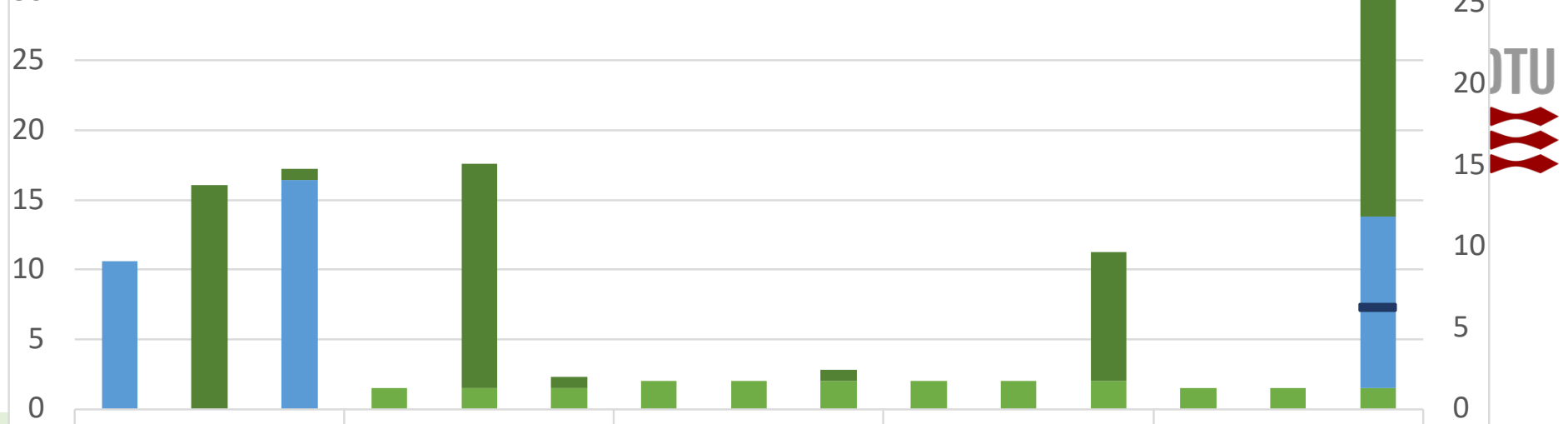


The significance of the green tariff



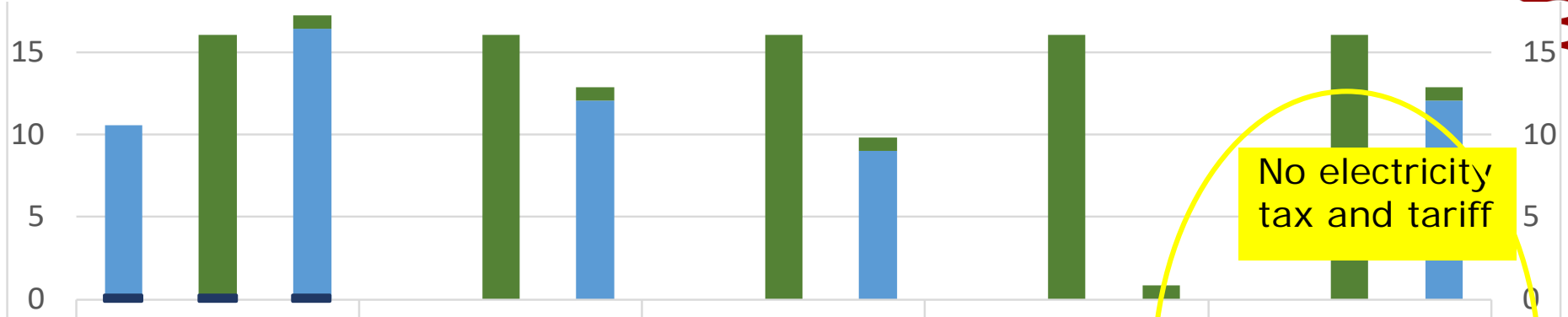
Will the green tariff dictate inputs?

Results



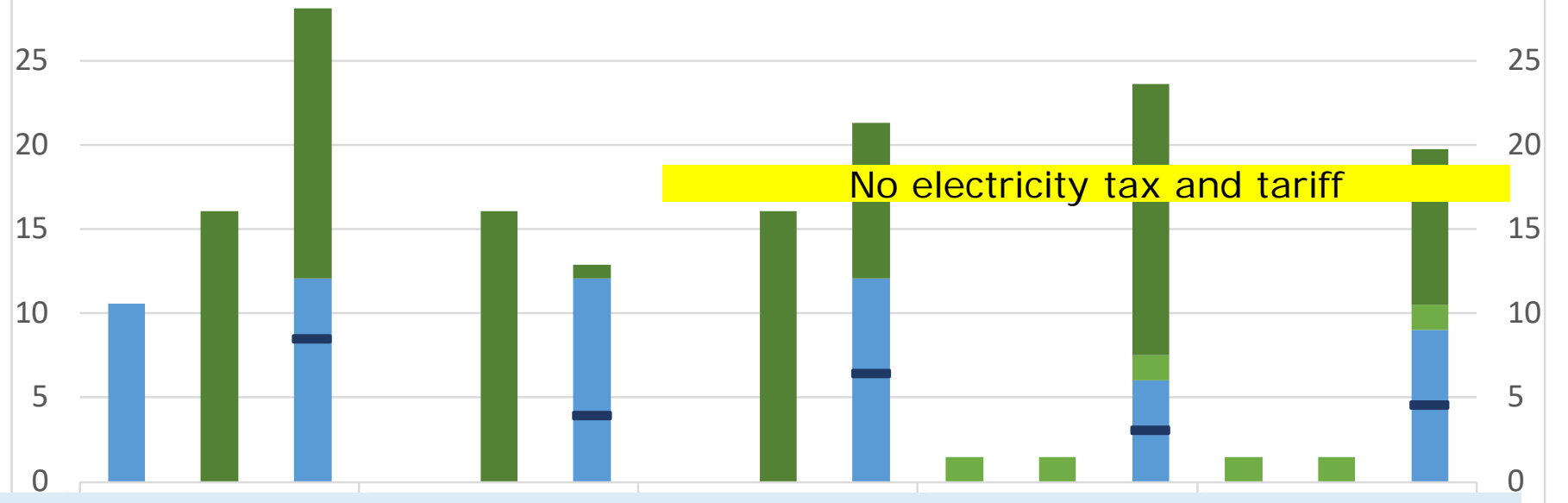
	Bau2020	Green + certificate_I	Green + certificate_II	Green + certificate_III	Green + upgrade and methanation
Manure treated, t tonnes	416,3	421,6	544,2	421,6	416,3
biomethane, GJ	524.046	552.361	323.246	516.872	524.046
Technology	Upgrading	Transport	Upgrading	Upgrading	Methanation
Profit, Mio. Euro	7,9	7,7	4,3	8,3	12,5
Net-support, Euro/GJ	16,4	6,4	18,7	9,1	14,8
Net-support, Euro/t. tonnes	20,7	8,3	11,1	11,1	23,8

Upgrade or transport?



	Bau2020	Upgrade or transport I	Upgrade or transport II	No support	Methanize
Biomethane, GJ	524.046	524.046	560.028	560.028	524.046
Technology	Upgrading	Upgrading	Transport	Transport	Upgrading
Profit, Mio. Euro	7,9	5,6	4,2	4,2	5,6
Total cost, Mio. Euro	8,6	8,6	8,7	8,7	8,6
Total income, Mio. Euro	16,4	14,1	12,9	12,9	14,1
Net-support, Euro/GJ	16,4	12,1	0,0	0,0	12,1

Upgrade or methanization



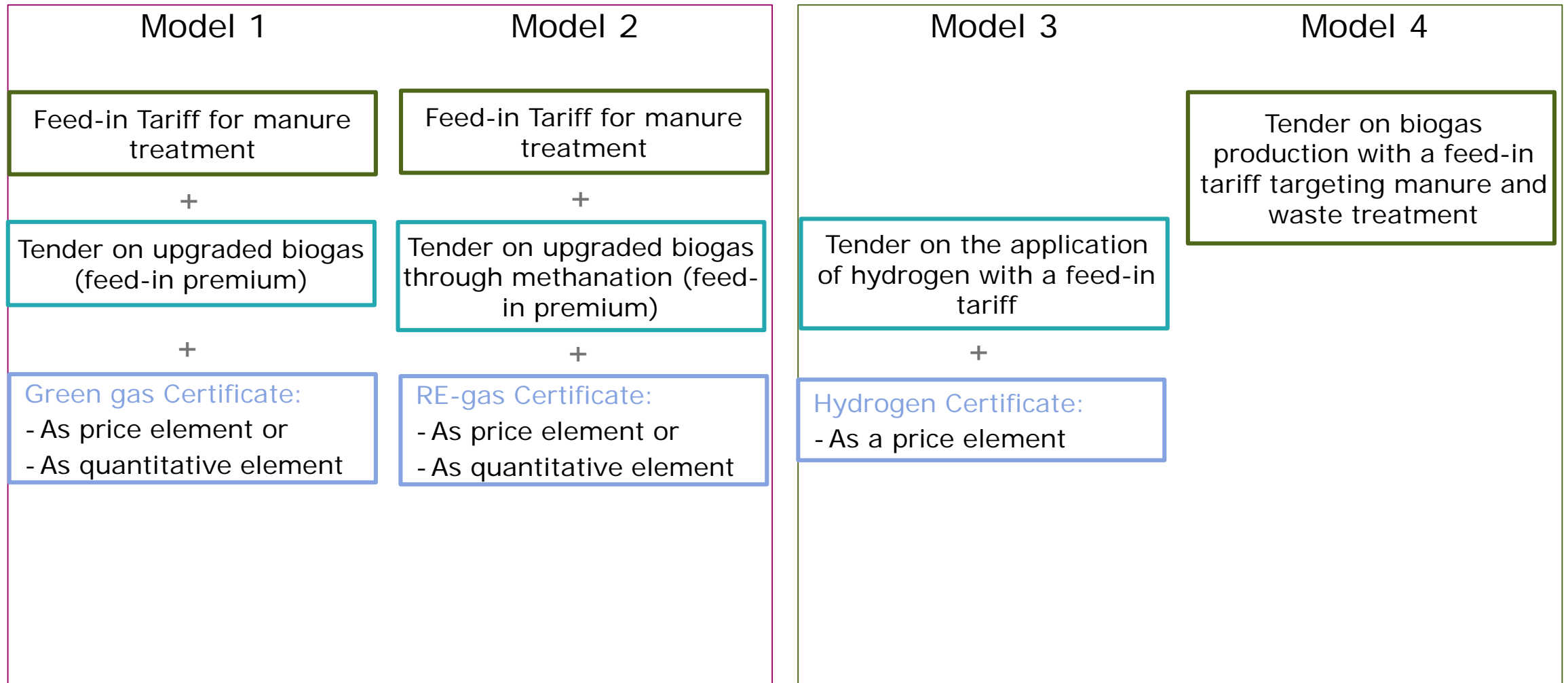
	Methanize		Carbon		
	Methanize I	2013	Methanize II	Reuse I	Carbon Reuse I
Biomethane, GJ	679.003	524.046	801.260	524.046	666.446
Technology	Upgrading Methanation	Upgrading	Upgrading Methanation	Upgrading	Upgrading Methanation
Profit, Mio. Euro	13,6	9,7	10,6	13,9	12,5
Total cost, Mio. Euro	13,4	8,6	15,2	8,6	12,0
Total income, Mio. Euro	27,1	18,3	25,8	22,5	24,5
Net-support, Euro/GJ	9,4	12,1	9,9	12,7	14,8

Conclusions from the calculations

1. Green tariff may affect – not dictate
2. Biogas may not have to be supported much if other value can be found through e.g. biotickets
3. Methanation is costly and require targeted support for reuse of carbon or similar

1. Unless the green value increases significantly
2. Biogas costs can potentially halve before 2030
3. However, green H₂ prices may fall significantly and change the picture

Regulatory models: Tool stacking

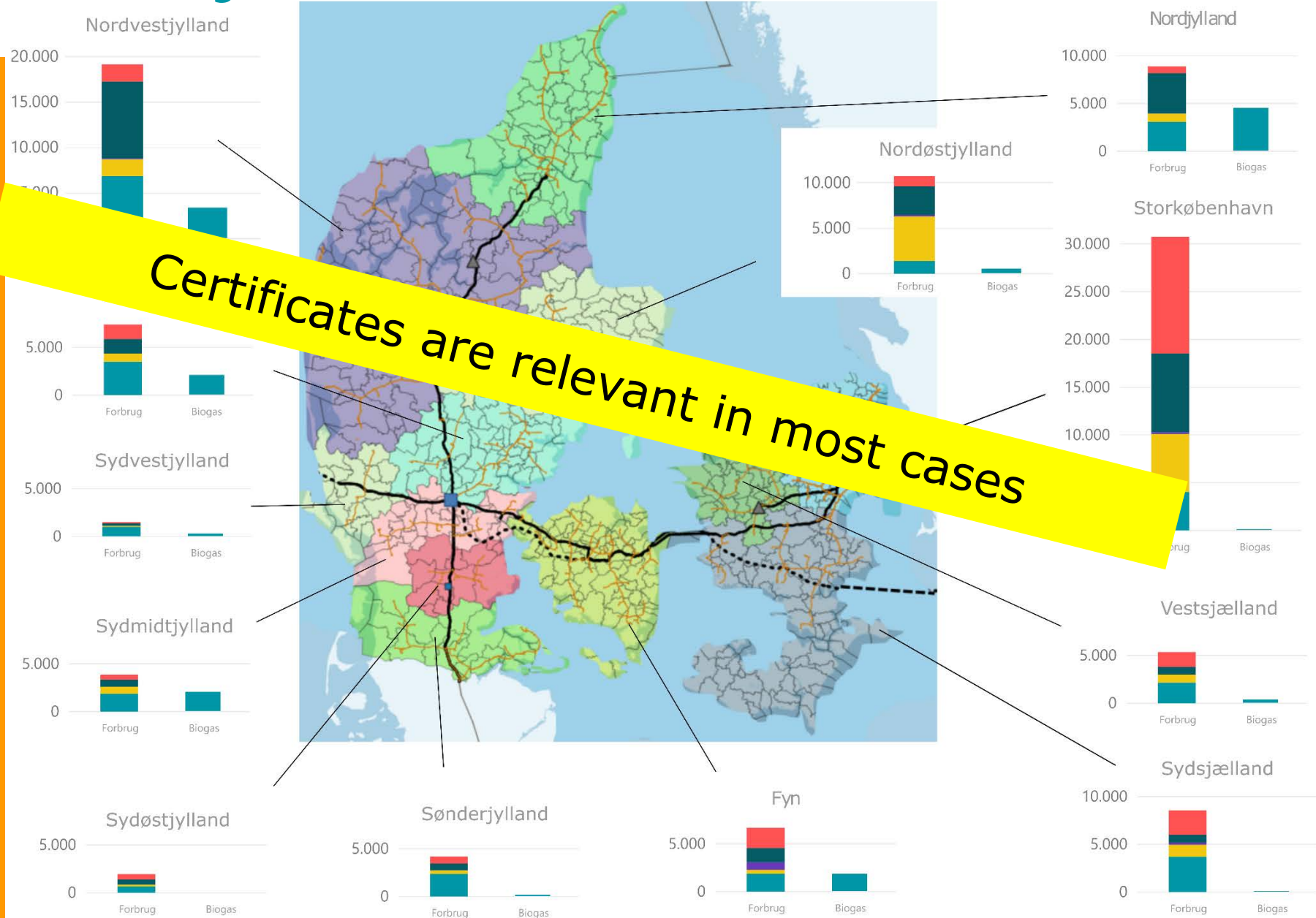


Gas consumption today

Overall conclusion

- Consumption will probably change a lot =>
- And several options are possible
- Certificates can pave the way for RE-gas produced and consumed different places in the system
- And even exported

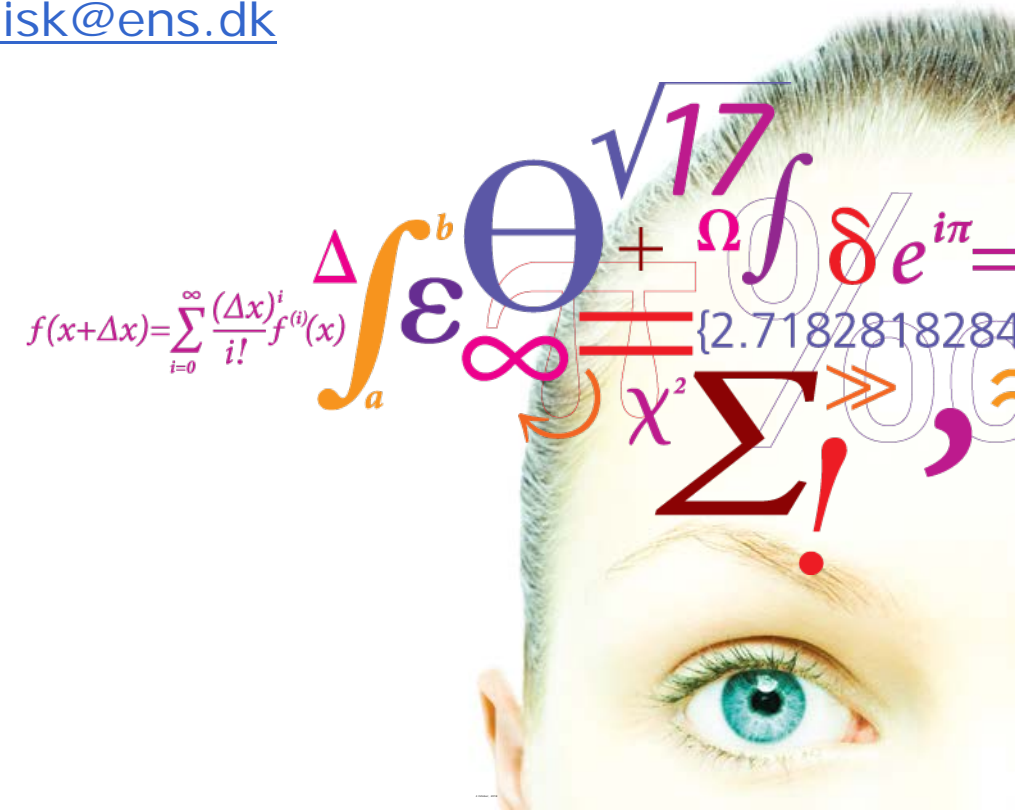
● Industri ● Service og Transport ● Landbrug og Fødevarer ● Forsyning ● Husholdning



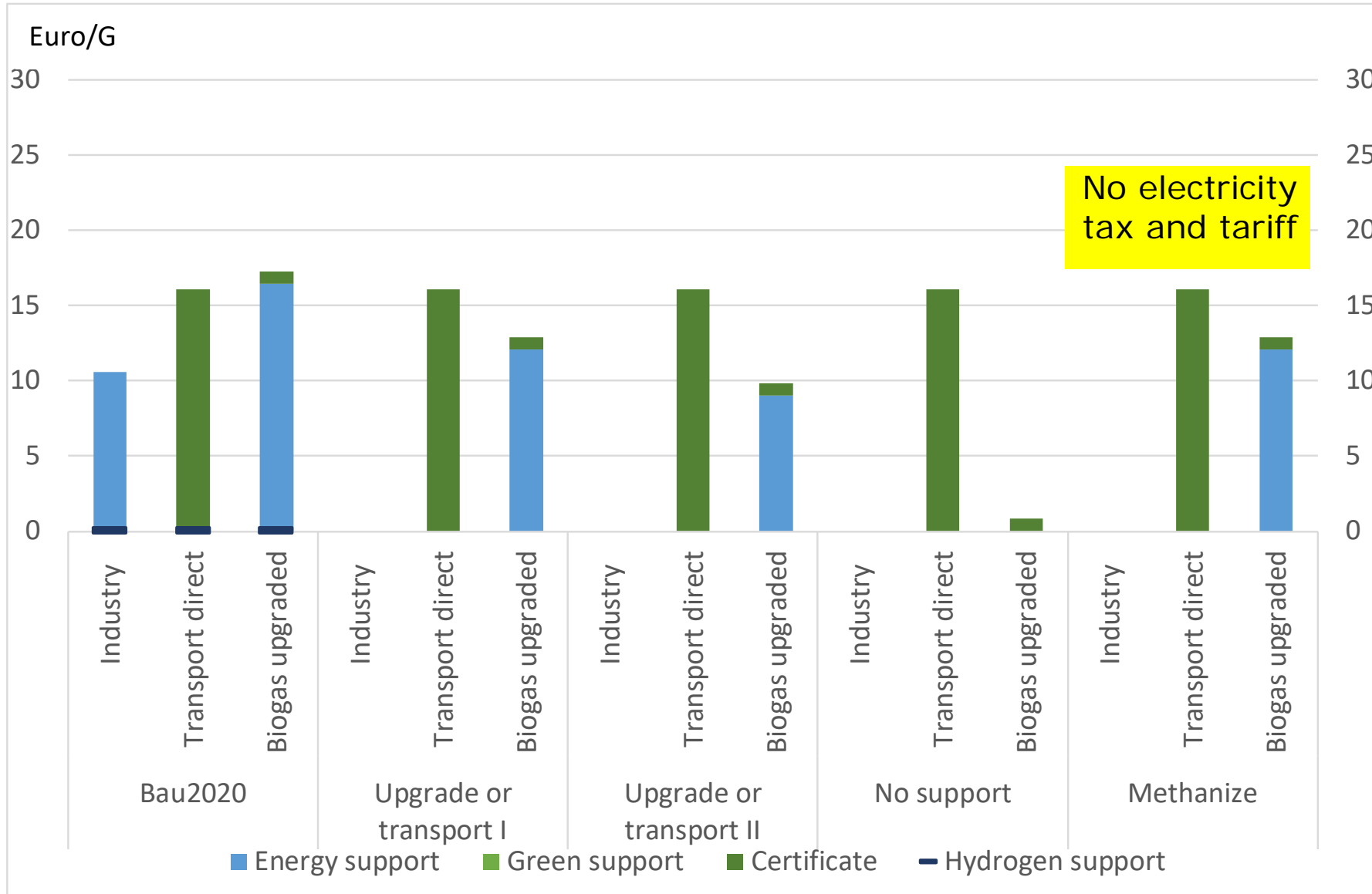
Certificates are relevant in most cases

Thank you for your attention

Lise Skovsgaard, lisk@ens.dk



Upgrade or transport?

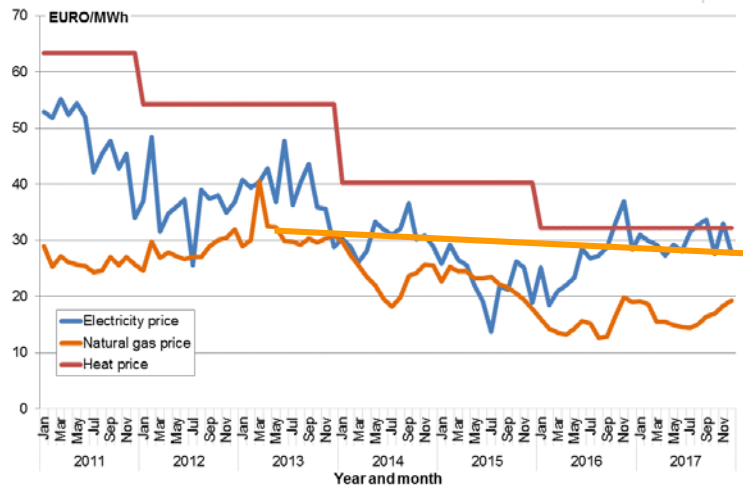
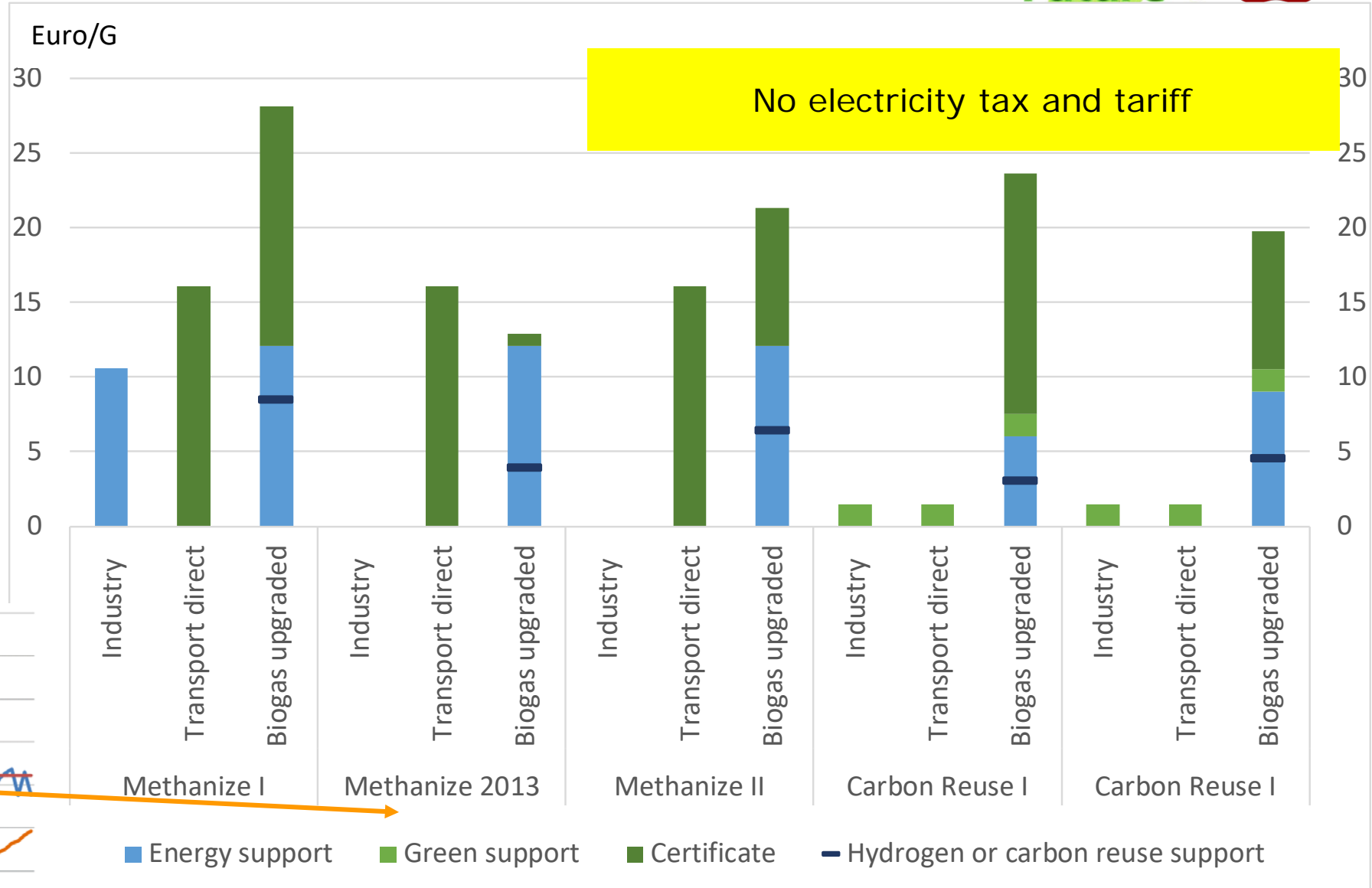


No electricity tax and tariff

Do we have to pay support at all?

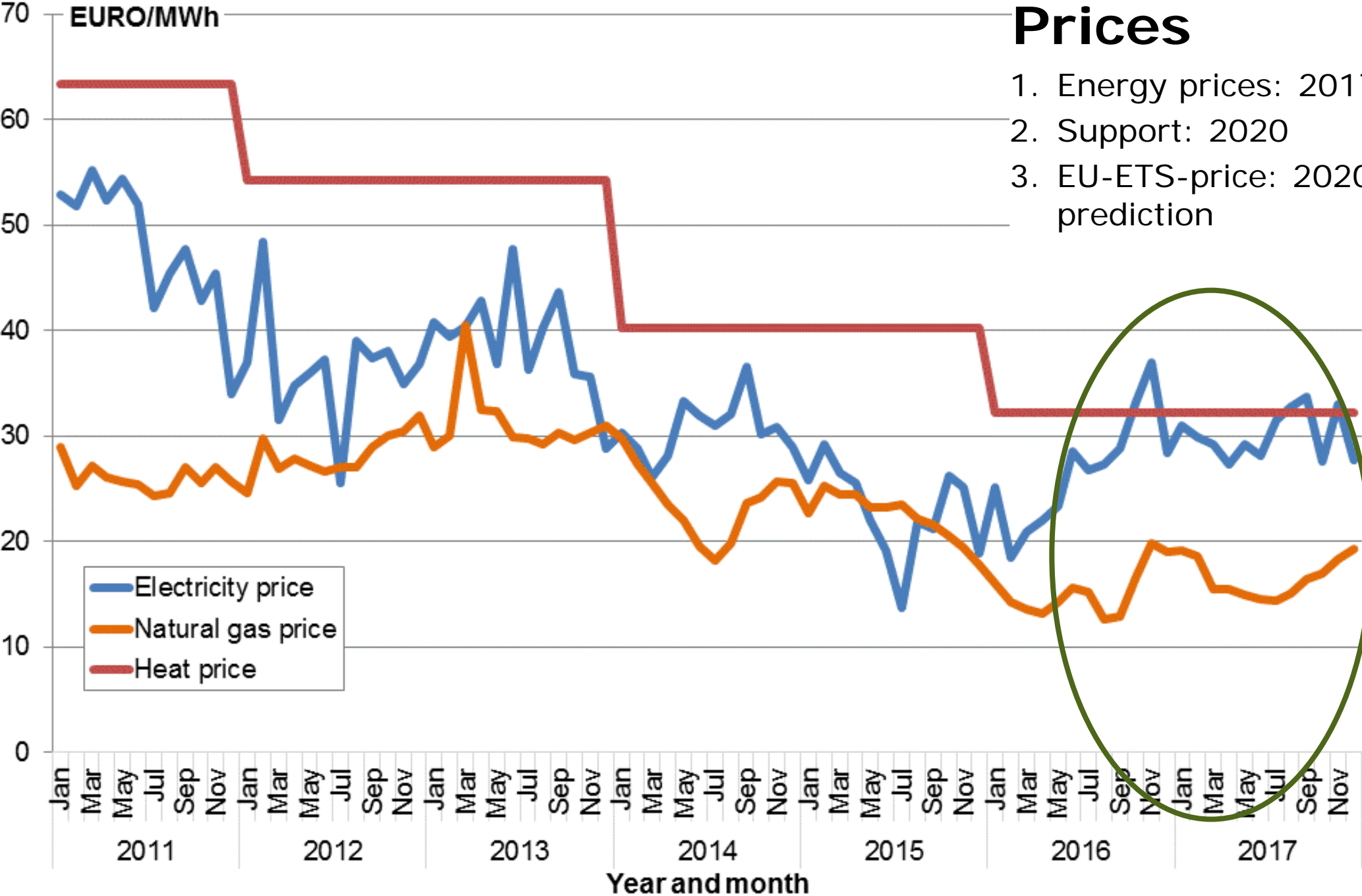
Upgrade or methanization

What will it take to get the model to methanize?



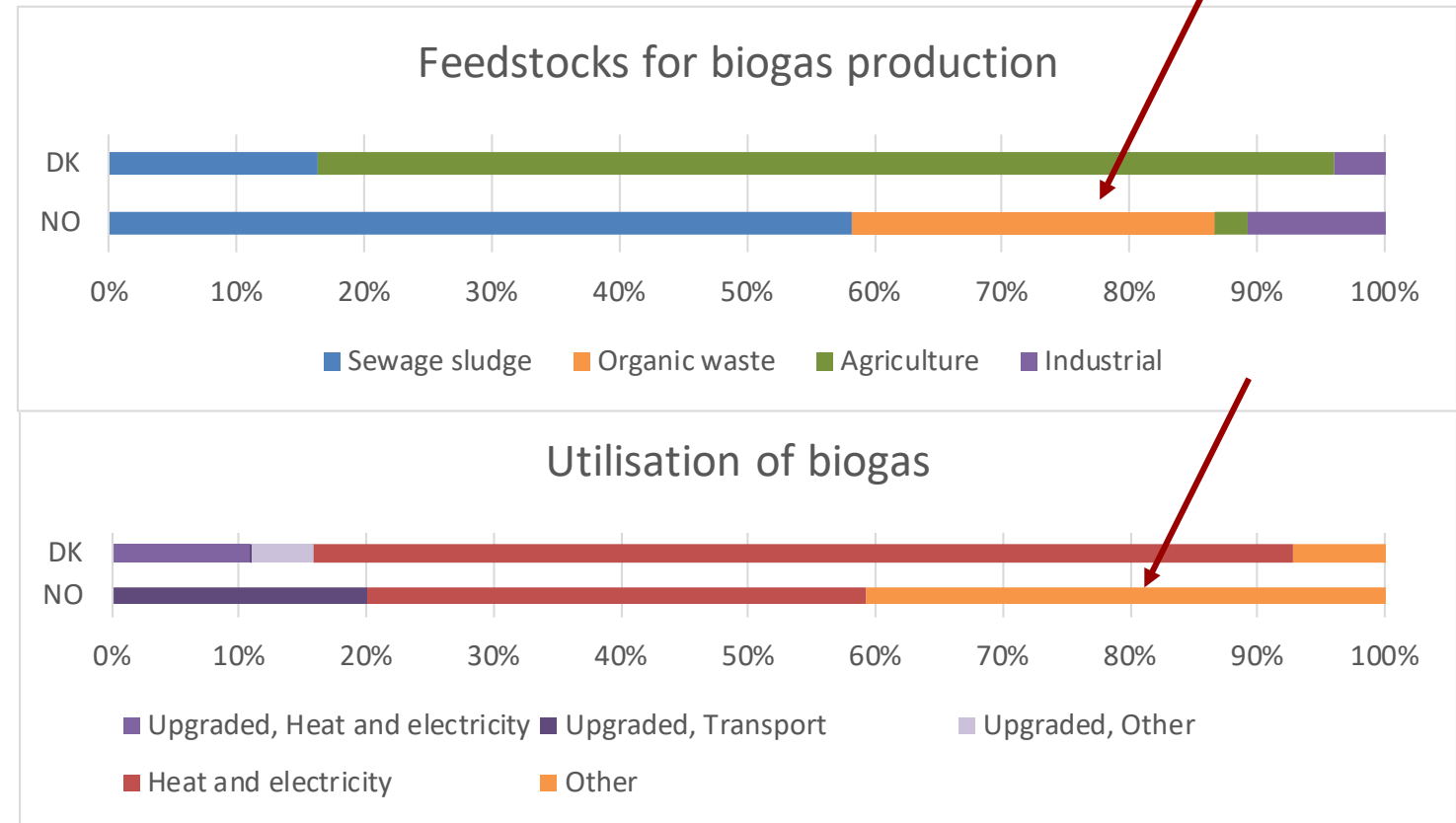
Prices

- 1. Energy prices: 2017
- 2. Support: 2020
- 3. EU-ETS-price: 2020-prediction



Inspiration from our neighbours

- **Norway**: Primary income: input side (waste treatment)
- Support focus:
 - input side (degasification of manure) => inspiration
 - Output side (no tax on transport)
- Notice: Risk of flaring



Inspiration from **Germany** and **Sweden**

- **Sweden**: Biomethane on the grid + biogas certificate => reduced carbon tax
- **Germany**: RE-gas on the grid + RE-certificate => support to electricity based on RE-gas

Green certificates
represents a "support" or
"tax reduction"
=> price add-on