

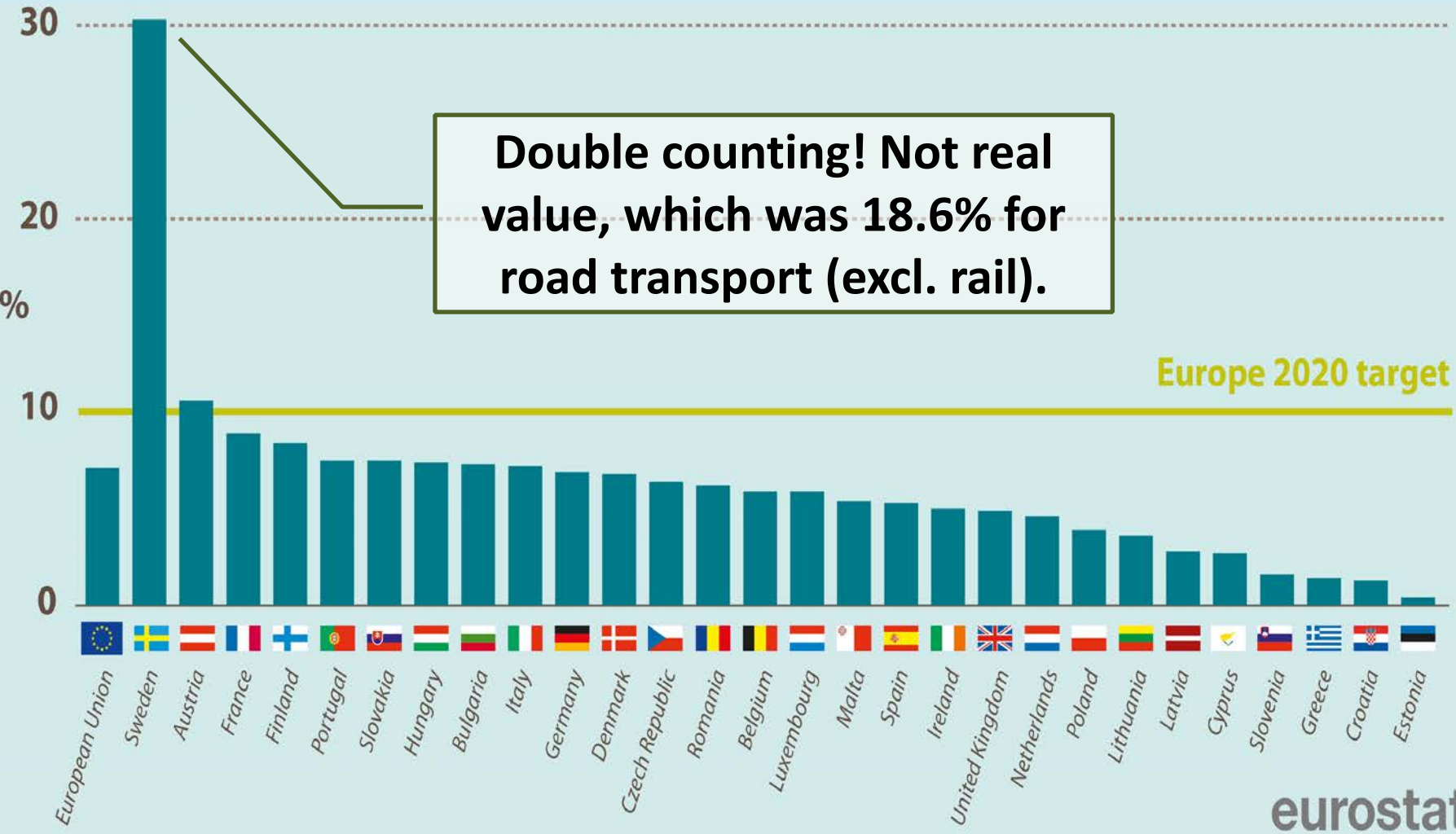
Country update Sweden

IEA Bioenergy Task 39 Business Meeting
7-9 April 2018

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Swedish Bioenergy Association



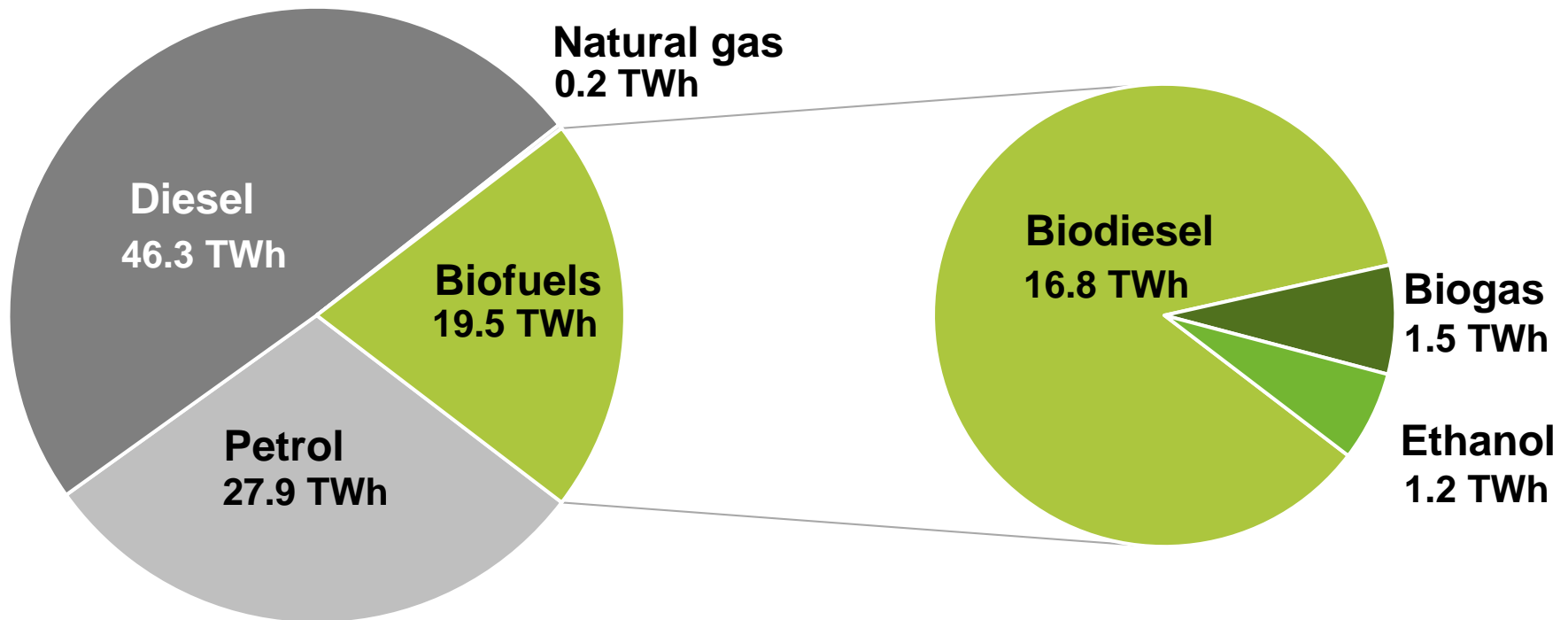
Share of renewable energy in transport 2016 (in % of gross final energy consumption)



Double counting! Not real value, which was 18.6% for road transport (excl. rail).

Europe 2020 target

Deliveries of transport fuels for vehicle operation to the Swedish market 2017, TWh



References: Statistics Sweden and Svebio, 2018

Gobigas plant is

decided to shut down

Process: Wood gasification
Product: 20 MW biomethane
CAPEX: €85 million (planned)
CAPEX: €200 million (real)
EBIT 2017: -€10 million

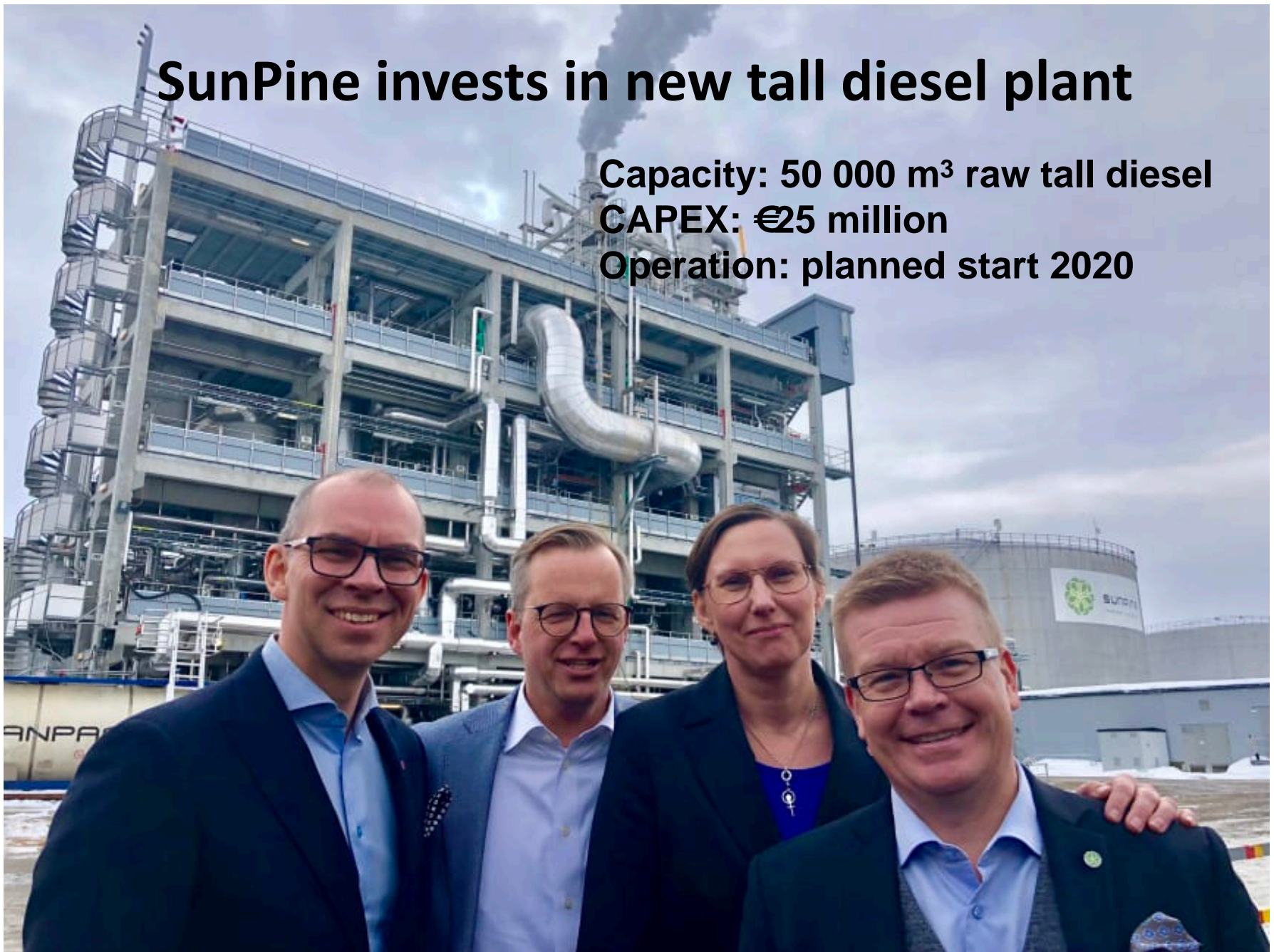
- Plant was for sale for €1 during 2017, no contract signed.
- Continuous operation Dec. - March at 100% capacity. Technical success.

SunPine invests in new tall diesel plant

Capacity: 50 000 m³ raw tall diesel

CAPEX: €25 million

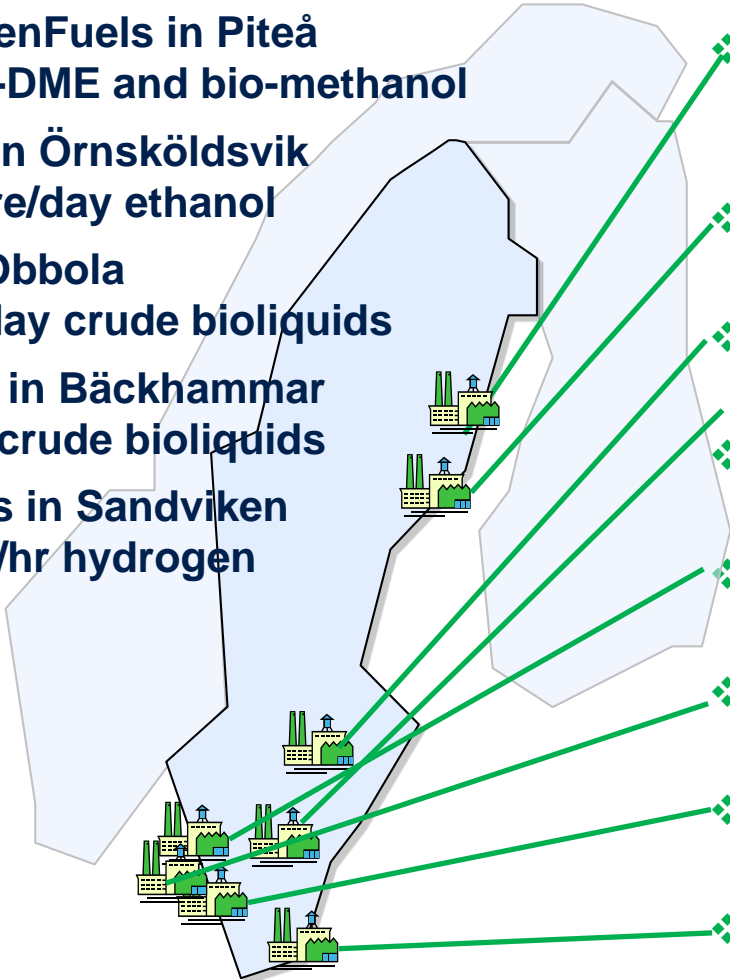
Operation: planned start 2020



Biofuel production plants in Sweden

Pilot and Demo plants

- ❖ **LTU GreenFuels in Piteå**
4 t/d bio-DME and bio-methanol
- ❖ **SEKAB in Örnsköldsvik**
3-400 litre/day ethanol
- ❖ **SCA in Obbola**
24 litre/day crude bioliquids
- ❖ **RenFuel in Bäckhammar**
3000 t/a crude bioliquids
- ❖ **AGA Gas in Sandviken**
550 Nm³/hr hydrogen



Commercial plants

- ❖ **SunPine in Piteå**
100 000 m³ raw tall diesel (and biocomponents for petrol)
- ❖ **Domsjö Fabriker in Örnsköldsvik**
20 000 m³ ethanol
- ❖ **Agroetanol in Norrköping**
230 000 m³ ethanol
- ❖ **Perstorp in Stenungsund**
148 000 m³ RME biodiesel
- ❖ **Göteborg Energi in Gothenburg**
20 MW biomethane (Gobigas)
- ❖ **St1 Refinery in Gothenburg (NEOT)**
5000 m³ ethanol
- ❖ **Preemraff Gothenburg**
200 000 m³ HVO (incl. SunPine diesel)
- ❖ **Ecobräsle in Karlshamn**
55 000 m³ RME biodiesel



Selected biofuel plants, there are e.g. additional biogas plants not shown.

Stagnant development in traditional biofuels

- **Ethanol:** three production plants, new development using bakery wastes by St1 and Agroetanol for fermentation to ethanol. SEKAB develops wood sugar into biochemicals and biojet. Weak ethanol market but possible development.
- **FAME:** two production plants, little development others than green methanol replacing fossil by Perstorp in one premium quality as raw material. Weak market currently.
- **Biogas:** few larger plants, however strong plant development by E.ON, Swedish Biogas, Strängnäs etc for new plants by 2020. Market though stagnant due to import competition and high costs. Gobigas plant verified technically but will close.

Strong second wave for “new” biofuels

- **Methanol:** pilot plant test by Holmen, demo plant underway by Södra in 2019 with separation from cooking liquors at pulp mill.
- **HVO Diesel:** strong market demand for HVO100, 200 kton plant by St1 in 2020 and increased capacity with 600% by Preem to 1.3 million m³ by 2023. SunPine new 50 000 m³ tall diesel plant. But market uncertainty due to restrictions for PFAD, TCO etc.
- **HVO Petrol:** new product with 15% HVO petrol in Petrol 95 by Circle K and up to 30% blend by Preem. Future outlook positive for more production but weak incentives for blending with coming reduction quota system.

New technologies taking important steps

- **Biofuels:** pilot plant by SCA developing proprietary technology organic catalysis(?) of lignin to biopetrol and biodiesel.
- **Biocrude:** pilot plant by RenFuel developing organic catalysis of lignin possibly to biocrude for HVO. Demo plant developed by Setra for 2020 with pyrolysis sawdust for HVO or biooil.
- **Projects:** Many projects like SCA with 300 000 ton and Domsjö Fabriker with 400 000 ton and Colabitoil with 500 000 ton, SunCarbon and RenFuel with 50 000 ton each etc.

However...

- **DME:** Piteå BLG Bio-DME plant probably for dismantling 2018. Lessons to be learnt on process of commercialization.

Reduction quota stabilizes but slows development

Reduction obligation from 1 July 2018 with 70% reduction to 2030. Petrol quota separate from diesel, yearly increased reduction, all fuels are taxed equally on energy content, a sanction (penalty) fee manages fulfillment.

Reduction	1 July 2018	1 Jan 2019	1 Jan 2020	1 Jan 2021
Petrol	2.6%	2.6%	4.2%	?
Diesel	19.3%	20.0%	21.0%	?

1. Long-term instrument for blending will stabilize the market.
2. Climate reduction will be valuable favouring tall oil based HVO as well as waste oils HVO but not RME.
3. Ambition levels will be key for market development.

Disruptive regulations transforming the market

- **Full tax exemption** on high-concentration biofuels from 1 Jan. 2018 until 2020 (state-aid approved), with full tax on fossil shares. What happens after 2020?
- **Bonus malus** legislation from 1 July 2018 on cars favouring electric and biogas up to €6000 bonus per vehicle and not biodiesel with malus on cars with high CO₂ emissions.
- **Environmental zones** legally possible from 2022, will favour petrol Euro 5 cars and electric and punish Euro 5 biodiesel cars.
- **Renewable Energy Directive II** will push from crop-based biofuels to cellulosic and waste-based and to electric cars.

Rapidly changing Swedish biofuel market

- HVO100 approved for many makes in heavy-duty, recently also for some car makes. Circle K starting changing E85 to HVO100.
- There is increased political pressure on banning diesel, PFAD as co-product is not allowed from 1 Jan 2019.
- No market development from E5 to E10, B100 and B7 stagnant, E85 is highly threatened, ED95 and B100 possibly stronger.
- Electric-charged vehicles are increasingly popular with currently 50 000 vehicles and a goal of 200 000 by 2020, 5000 charging points.
- Electric highways for trucks developing, two competing technologies with overhead electric wire and rail-bound electricity.

An aerial photograph of a port area at dusk. The sky is a mix of blue and orange, with scattered clouds. In the foreground, a large ship is docked at a pier, with its lights on. The water is dark blue. In the background, there are several industrial buildings, including a large white dome and several tall chimneys. The overall scene is a blend of nature and industry.

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18-20 SEPTEMBER 2018, GOTHENBURG, SWEDEN