



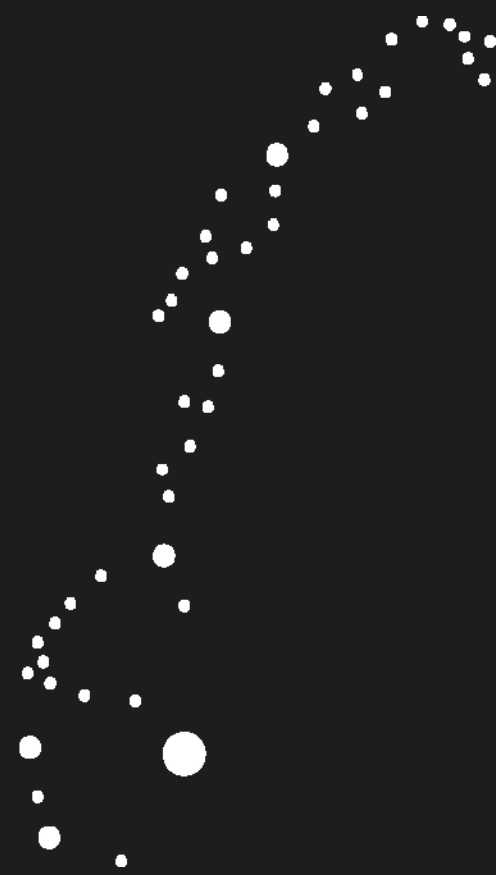
INTRODUCING AVIATION BIOFUELS INTO OSL's FUEL DISTRIBUTION INFRASTRUCTURE

IEA/GAFT WORKSHOP. Aviation Biofuels through Biomass Gasification
Trondheim, 25 MAY 2016

Olav Mosvold Larsen

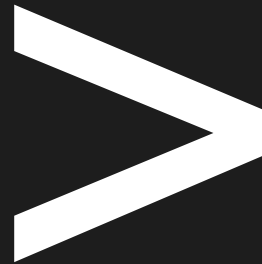
 AVINOR

- Avinor is responsible for Air Navigation Services (ANSP) and operate 46 airports in Norway
- Our modern society is totally dependent on aviation



WHY?

Traffic-
growth %

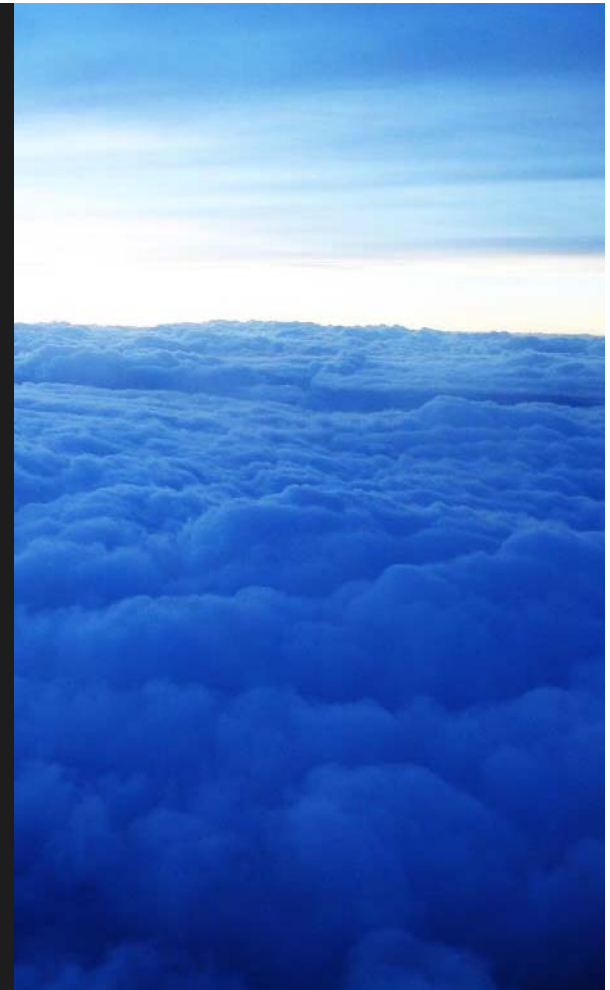


Emission
reductions %

AVINOR'S INVOLVEMENT IS ETHICALLY SOUND AND GOOD FOR BUSINESS

- Industry plays a vital role in reducing global carbon emissions
 - Airports can and must contribute

 - Companies not taking environmental issues seriously will fail
 - License to grow?
 - Third runway OSL?: Biofuels could be crucial for approval
 - Important for recruiting (HR)
- From risk management to business opportunity?



LONG TERM APPROACH AND ACTIVITIES

- The Norwegian aviation industry have been looking into sustainable biojet since 2007
- Biofuel certified for use in civil aviation since 2009
- Major study in 2011-2013. Conclusion: Possible, but risky
- Avinor to invest up to MNOK 100 in jet biofuels (2013-2022)
- Demoflights to the ZERO conference 11 NOV 2014
- Fruitful collaboration with AirBP and airlines
- OSL world's first to offer jet biofuel to all airlines on a commercial basis
- KLM/Embraer OSL-AMS campaign Q2 2016
- Several ongoing R&D projects



1.25 MILLION LITRES JET BIOFUEL AT OSLO AIRPORT

- From JAN 2016, OSL became the world's first hub to offer jet biofuel to all airlines on a commercial basis
- In Cooperation with Air BP, SkyNRG, Neste and airlines
- Thousands of bio jet flights have been carried out
- This is the next step
- Delivered to the main fuel farm and distributed through the hydrant and dispenser system
- Important piece in the logistics puzzle for cost effective bio jet fuel distribution
- EU ETS and domestic CO2-tax waived
- Premium cost split between the project partners



FIRST BATCH

- Approx 600.000 litres
- Based on Camelina from the ITAKA project in Spain
- Refined by Neste in Finland
- Shipped to Gävle in Sweden blended with fossil JetA1 (50/50) and stored there
- Transported to OSL by lorries
- Dropped into the fuel farm at OSL
- Distributed in the dispenser system
- Works very well
- No issues technically
- No issues with other airlines
- No issues with passengers



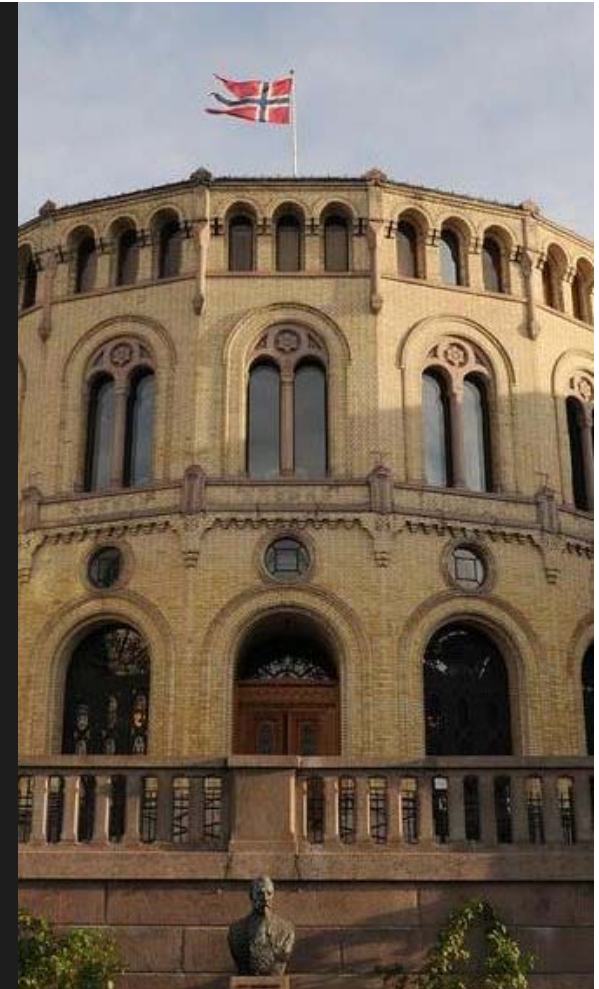
NO SAUDI ARABIA FOR BIOFUELS

- Utilize local comparative advantages = production in Norway
- Woody biomass most relevant in short and medium term
- Total realistic potential in Norway is estimated to 700-900 mill litres of biofuel (diesel+jet). Theoretical potential higher
- Biofuels can play an important part in forestry industry value chain
- Avinor cooperating with industry, NGOs and R&D partners
- Promote policy instruments that can facilitate sustainable biojet production in Norway



POLITICAL INTEREST AND PROCESS

- Jet Biofuel firmly placed on the political agenda in Norway
- Well known in government and parliament
- Eager forestry industry cluster with NGO support
- Several policy measures already in place (carrots and sticks)
- We are looking into and will lobby for the most appropriate measures and incentives

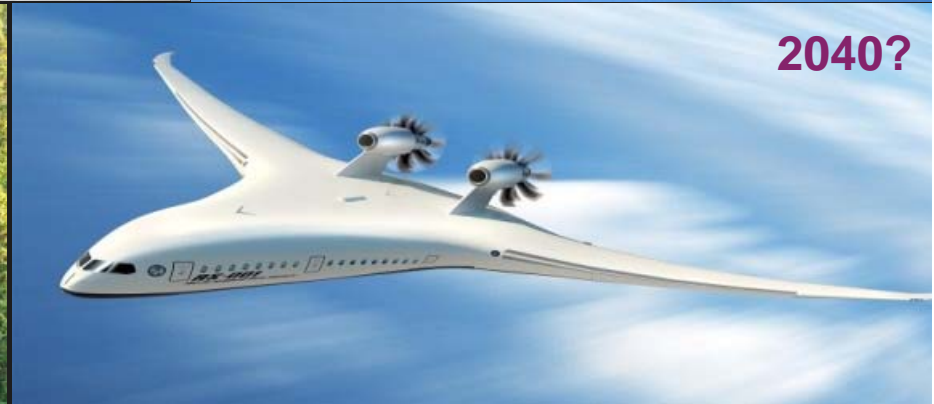


WAY FORWARD

- Avinor 2030 goal: 30 % of aviation fuel in Norway should be sustainable biofuel = Approx 400 mill litres
- Ramp up supply at OSL
- Support local/national production of sustainable jet biofuel
- Push for jet biofuel in Norway on several arenas
- Long term commitment



THE AVIATION INDUSTRY HAS DONE AMAZING THINGS BEFORE – AND WILL DO IT AGAIN



CARROTS AND STICKS

Proposal from Parliament in State budget 2016

- 25% discount in landing fees for flights on 25% biofuel in 2016 and 2017. Legal issues
- From 1 JAN 2018: mandatory drop in requirement (amount not yet disclosed)

Other policy measures for biofuels

- No domestic CO₂-tax (= NOK 1,08 pr litre)
- EU ETS waived
- Could newly introduced EUR 9 air passenger duty be waived?
- Several green technology programs in place (reducing CAPEX)
- Reasonable framework conditions for industry in Norway, but could be improved





FRA TRE TIL FUEL:

45 %

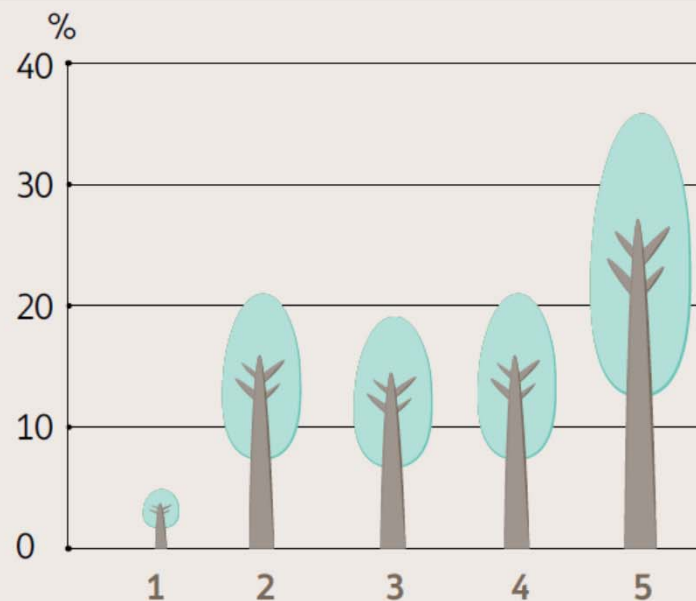
av stammen kan brukes til **energiformål** – som biojetfuel, biodiesel til tungtransport eller bionafta.

25 %

av treet, den innerste delen av stammen, blir gjerne brukt til **plank og limtre**.

30 %

av stammen kan brukes til **blant annet** papir, bygningsplater, bioplast, lim, maling, vanilje og legemidler.



1: Snau skogmark som skal forynges.

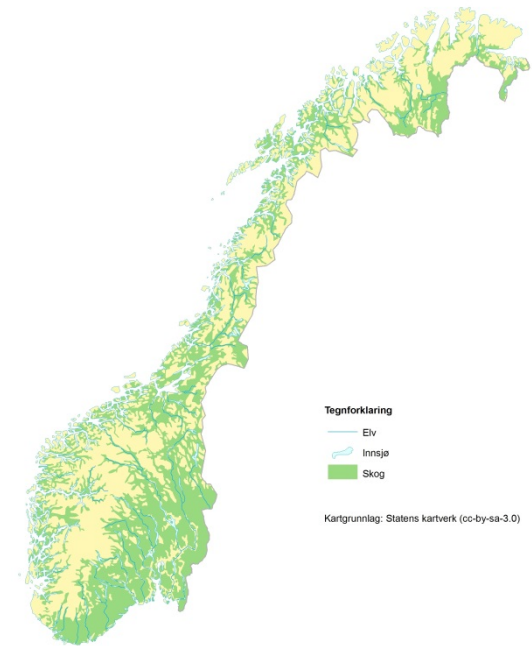
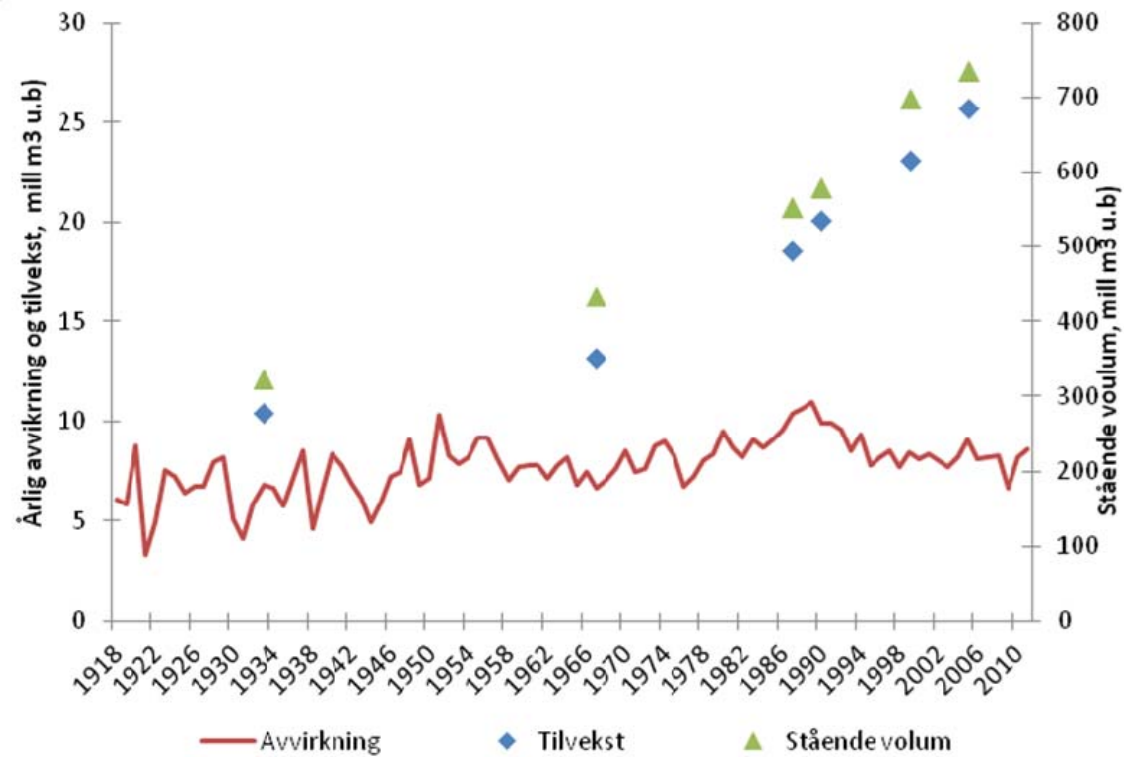
2: Ungskog; nyetablert skog.

3: Yngre produksjonsskog; med høy og økende tilvekst.

4: Eldre produksjonsskog; med høy tilvekst.

5: Gammel og hogstmoden skog; med lav tilvekst.

HVOR MYE SKOG?



Stående volum 2007-2011:
788 mill m3 u.b.

OMFANG

Regneeksempel 1

- 2 mill fastkubikkmeter biomasse fra skog (som er samme kvantum som før nedleggelsen ble brukt årlig på Tofte)
- Vil gi 140 millioner liter biojetfuel og 140 millioner biodiesel

Regneeksempel 2

- Reduksjon av utslipp fra luftfart med 10-15 % krever produksjon av 190-250 mill liter biojetdrivstoff
- Tilsvarende biomasse med energiinnhold på 6-8 TWh (2,7 - 3,6 mill m³)

