ELECTRIFIED DOMESTIC AIR TRAFFIC BY 2040?

The Sola Conference 2018

17 SEP 2018

Dag Falk-Petersen, CEO

AVINOR

44 airports

Norway’s Air Navigation Service Provider

Norway is totally dependent on aviation

AVINOR

Traffic growth % > Emission reductions %

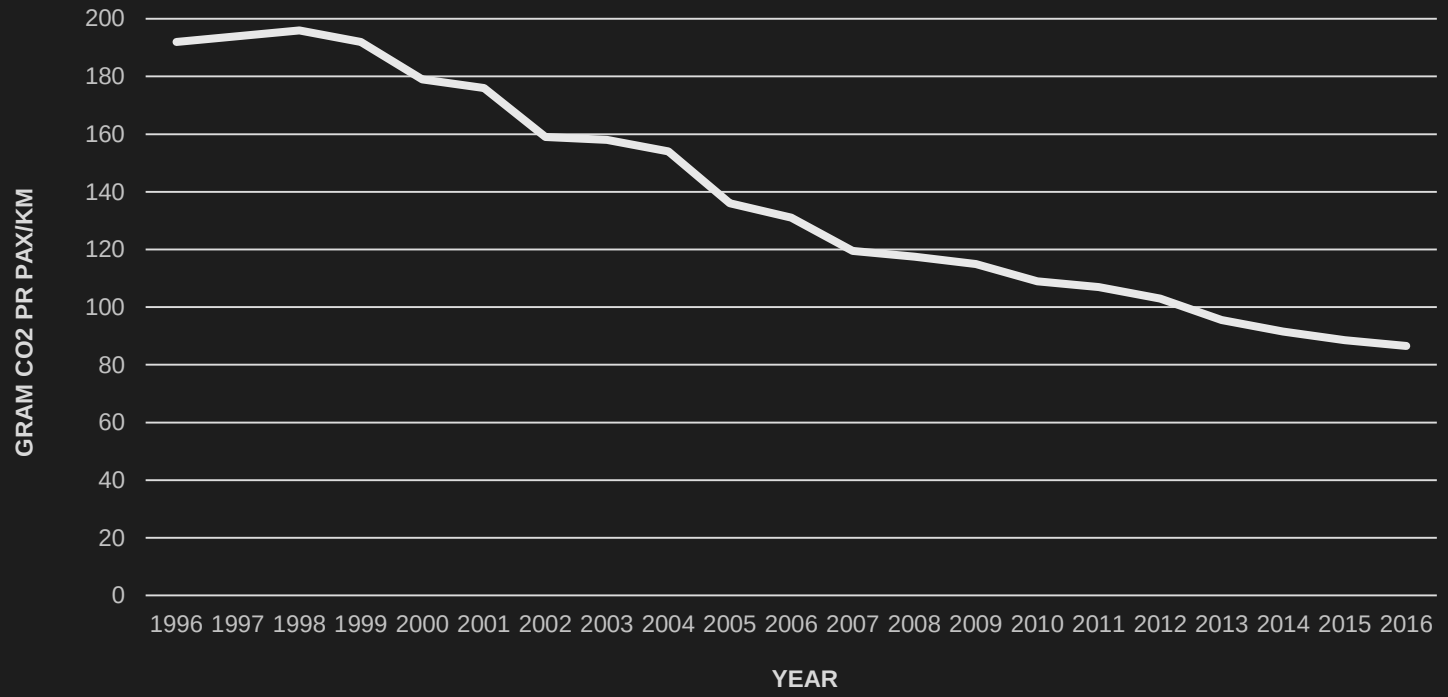

THE RIGHT THING TO DO
MAKES BUSINESS SENSE

AIRCRAFT CARBON EMISSIONS

AIRLINES INVESTING IN MORE ENERGY EFFICIENT AIRCRAFT

AVINOR

EMISSONS PR PAX KM HALVED 1996-2016



(Average SAS og Norwegian)

AVINOR

SUSTAINABLE JET BIOFUEL IS AN IMPORTANT PART OF THE FUTURE OF AVIATION

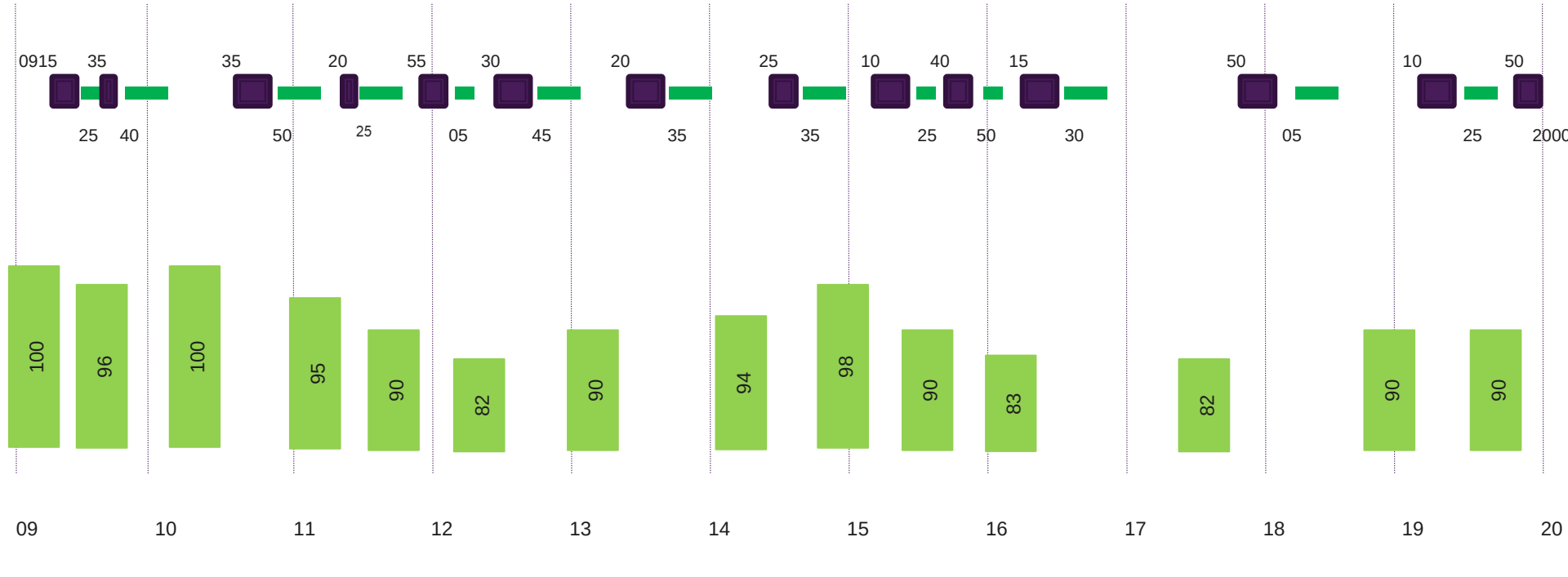
- JAN 2016: OSL #1 hub to offer jet biofuel to all airlines on a commercial basis
- Avinor 2030 goal: 30 % of aviation fuel sold in Norway should be sustainable jet biofuel
- Norwegian government looking into a drop in mandate of 1% from 1 JAN 2019

- Pipistrel Alpha Electro
- Demonstration and testing
- Range: 1 hour / ca 120 km
- Proof of concept?

- Wingspan: 10.6 metres
- Empty weight: 382.5 kg
- Maximum take-off weight: 560 kg
- Engine power: 50 kW (cont) 60 kW (max 1 minute)
- Cruising speed (optimal range): 85 Kts (157 km/h)
- Range: 70 NM (130 km) + 20 % reserve
- Battery: 21 kWh (20 kWh usable)
- Climbing ability: 1220 ft/min (6.1 m/s)
- Take-off ground roll: 169 metres
- Landing ground roll: 125 metres

Arendalsuka 13 AUG 2018

- *14 flights*
- *Total flight time 2:45*
- *Turnaround times down to 10 minutes*



Flight

Charging

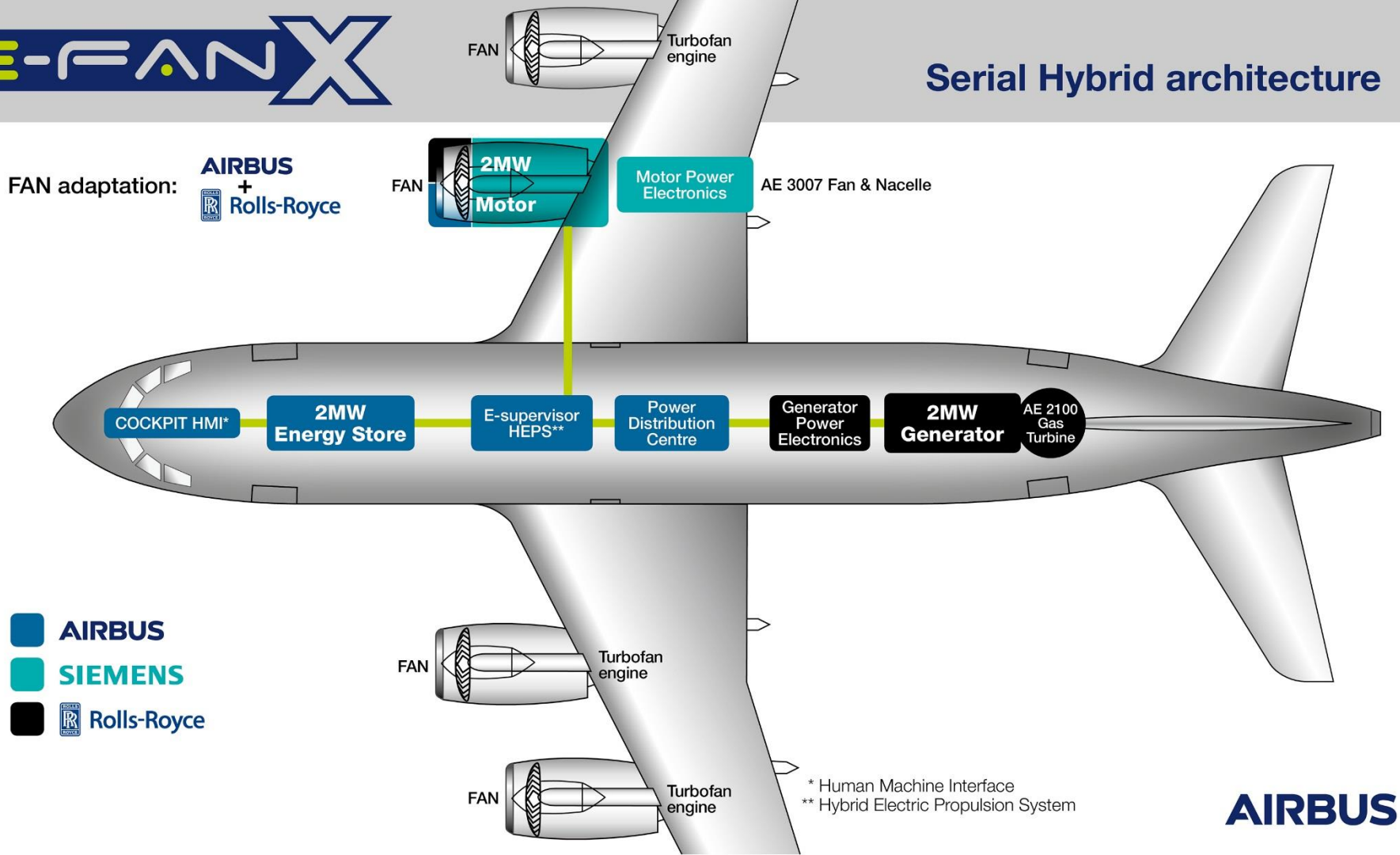
83 Battery capacity %

AVINOR


Leknes
Svolvær
104 km
109 km
Røst
Bodø
102 km
101 km
Mo i Rana


E-FAN X
AIRBUS
SIEMENS
Rolls-Royce

Serial Hybrid architecture



Hybrid electric aircraft
Range in 2030: 100 pax 1000 km

SIEMENS
Ingenuity for life

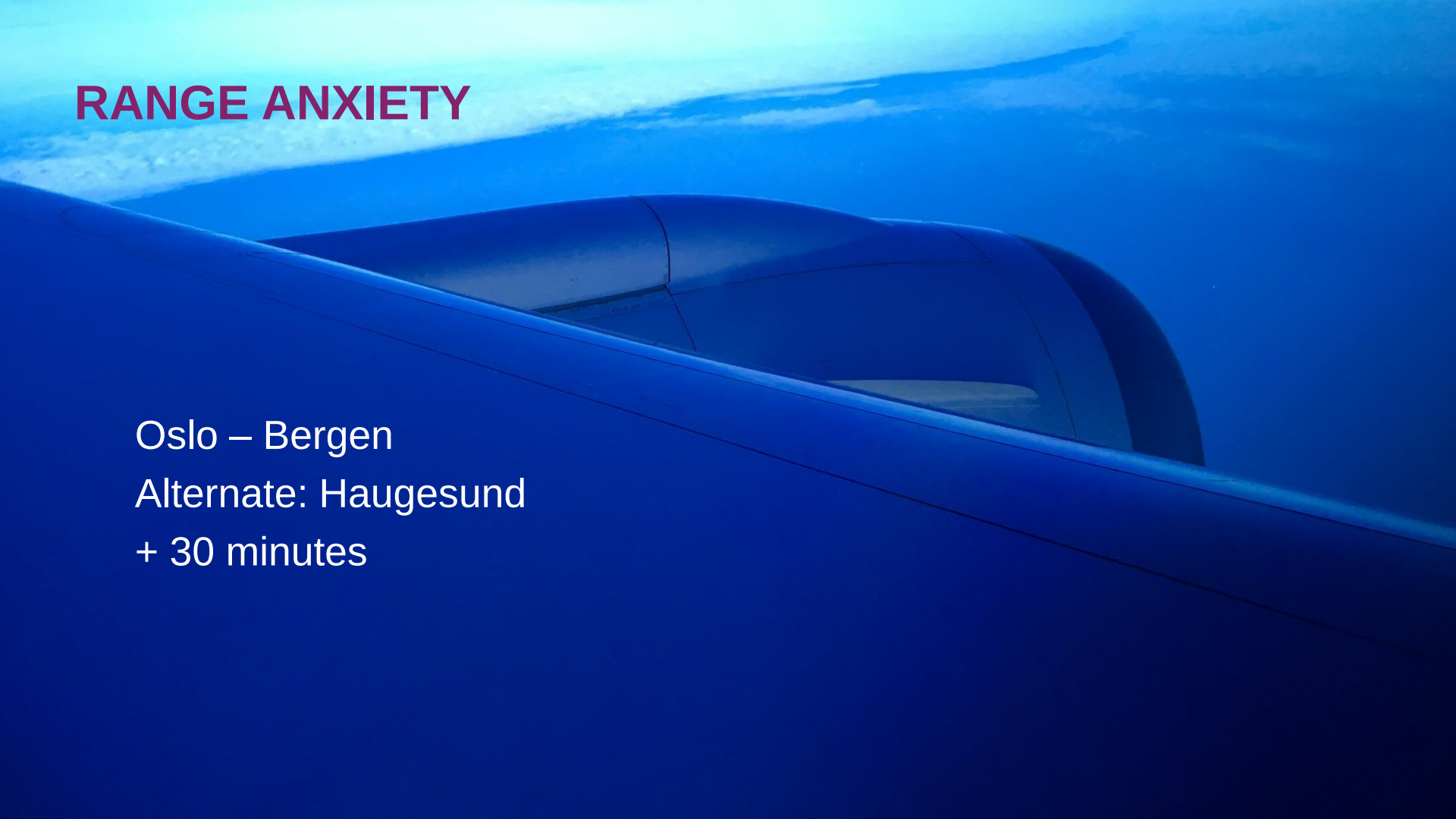
NASA X-57 Maxwell
Distributed Propulsion

NASA X-57 Maxwell
Distributed Propulsion

SAFETY

SAFETY

RANGE ANXIETY



Oslo – Bergen

Alternate: Haugesund

+ 30 minutes

COST REDUCTION = BETTER CONNECTIVITY

- Reduced costs?
- Shorter runways?
- Smaller aircraft with new business cases?
- New routes?
- Increased frequency?

CONSEQUENCES FOR AVINOR'S INFRASTRUCTURE?

- Mapping surplus electricity capacity on Avinor's airports
- Looking into innovative and flexible charging solutions
- Or will fuel cells/H2 be the preferred solution?


JOBY
AVIATION


AIRQUAD
NEVA
NEVA Aerospace © 2017 All rights reserved


DELOREAN AEROSPACE


Aurora
FLIGHT SCIENCES


LILIUM


AIRSPACE X


EMBRAER
UBER


AIRBUS


XTI
AIRCRAFT


Bell Helicopter
A Textron Company


AIRBUS


VOLOCOPTER


CARTER


EHANG

RELEVANT IN NORWAY?

- AIRBUS' A^3 Vahana
- 100% electric
- 8x 45 kW motors
- Full autonomy
- Cargo/1 pax (2 pax after 2020)
- Planned range: 80 km
- Charging and Battery swap
- Pic from first full scale flight FEB 2018

A^3 BY AIRBUS

NORWAY FIRST?

- Unique network of airports
- An established market for short flights with small aircraft (incl PSO routes)
- Broad support from Government, Parliament and other stakeholders
- 100% renewable electricity

➔ Aircraft producers are looking for a market and a customer – we have both


VISION:
ALL DOMESTIC TRAFFIC ELECTRIFIED BY 2040
AIR TRAVEL:
THE MOST ENVIRONMENTALLY FRIENDLY MODE OF TRANSPORT > 300 KM

CONCLUDING REMARKS

- Norway is totally dependent on aviation
- Green House Gas emissions must be mitigated
- Airlines investing in more energy efficient aircraft
- Sustainable aviation fuels are an important part of the solution
- Electric passenger aircraft will be a reality
- Providing better connectivity