



Concept Symposium 2018

Governing Megaprojects – Why, What and How

Electrification of Aviation and its impact on National Transport

Norway's geographical position in Europe and challenging domestic topography makes it totally dependent on aviation. At the same time, all sectors in society – including aviation – must contribute to reduce global emissions of greenhouse gases. The airlines are investing in new more energy efficient aircraft, and over the last two decades emissions per passenger kilometer have been halved. However, due to strong traffic growth the total aviation emissions have grown and are expected to continue to grow. Additional technological solutions are needed. Sustainable jet biofuel has been certified for use in aviation since 2009, production is increasing and production costs are reduced. This is promising for both long and short haul flights. Furthermore, over the last couple of years, electrification of aviation has also gained momentum. Airbus, Boeing, Siemens, Rolls Royce and many more are looking into novel solutions and technologies that could reduce aviation carbon and noise emissions significantly. The new technologies can also reduce costs and thus open new market opportunities for the airlines, and improve connectivity for the passengers. With a network of almost 50 airports, strong political backing and an abundance of renewable hydropower, Norway is well suited for electric passenger aircraft. Mr. Falk-Petersen's presentation will provide insights into why we believe that by 2040 all domestic air traffic in Norway will be electrified.



Dag Falk-Petersen
CEO
Avinor
Norway

The Concept Symposia on Project Governance

The Norwegian Ministry of Finance and the Concept Research Program hosts every second year a symposium on project Governance. Project governance, in brief, is concerned about investments and their outcome and long-term effects. In view of the problem at hand, the aim is to ensure that the best conceptual solution is chosen, that resources are used efficiently and anticipated effects realized. Resource persons from ministries, governmental agencies, academia, international organizations, and industry are invited. In order to facilitate professional exchange and direct communication between participants, the number of individuals is restricted. The aim is to initiate further international cooperation and research on important issues related to project governance.

<https://www.ntnu.edu/concept/concept-symposium>



ELECTRIFIED DOMESTIC AIR TRAFFIC BY 2040?

Concept Symposium 2018
SINTEF Technology and Society

Stavanger, 07 SEP 2018

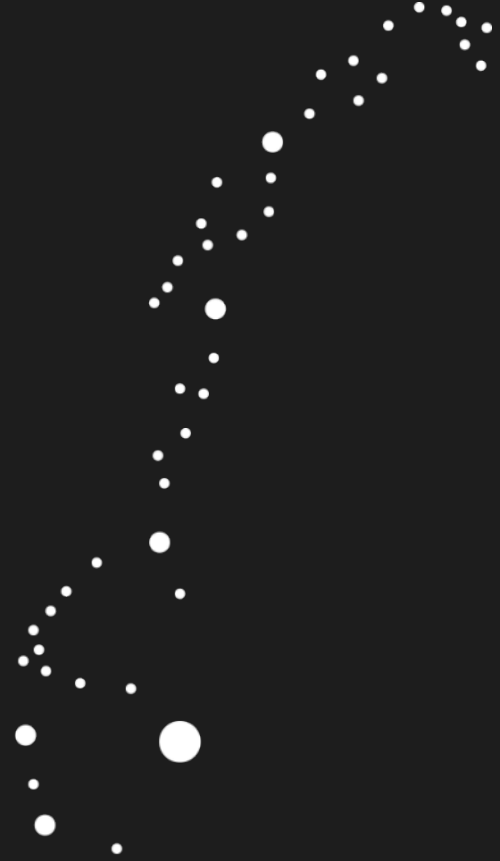


44 airports



Norway's Air Navigation Service
Provider

Norway is totally dependent on aviation

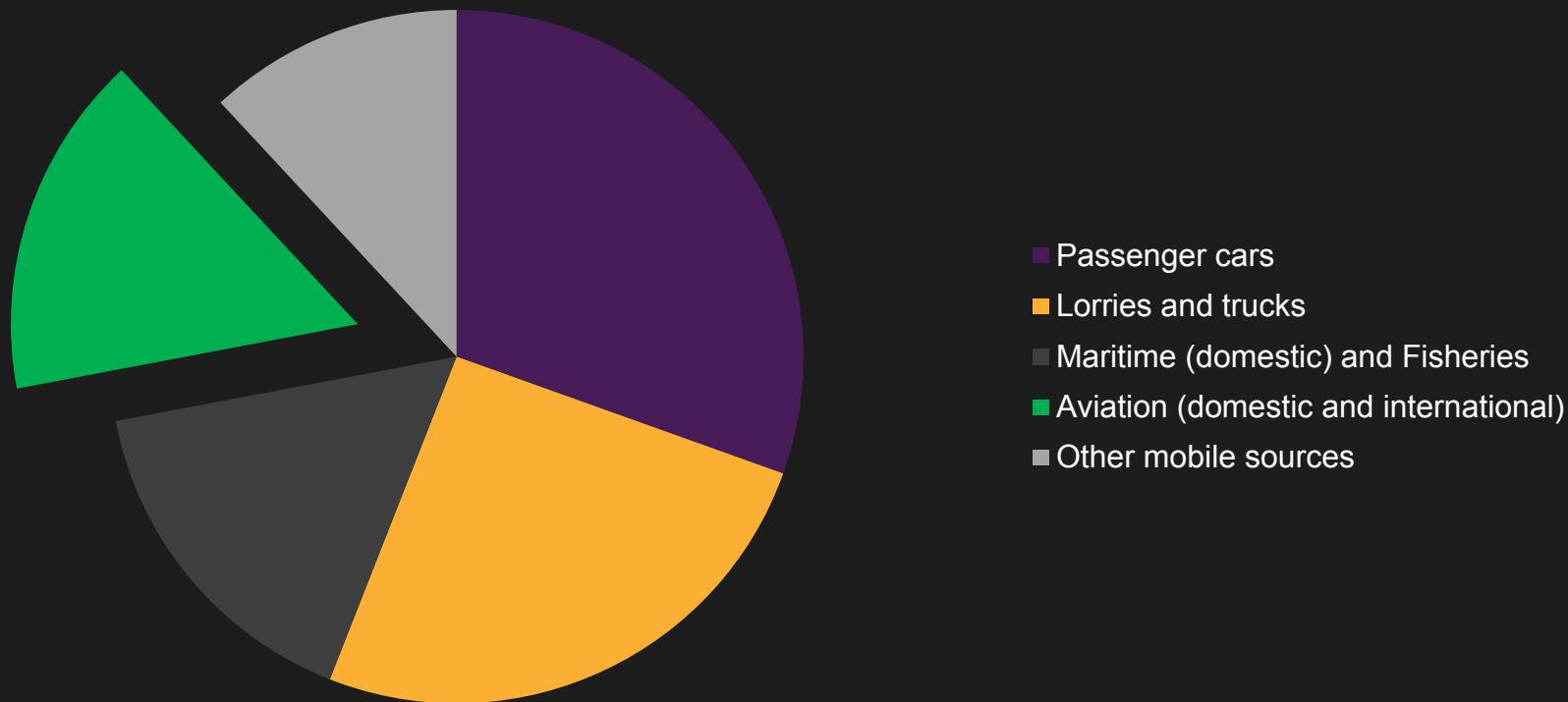


Traffic
growth %



Emission
reductions %

CARBON EMISSIONS FROM TRANSPORT IN NORWAY 2016



NIGHTMARE SCENARIO



- Passenger cars
- Lorries and trucks
- Maritime (domestic) and Fisheries
- Aviation (domestic and international)
- Other mobile sources



**THE RIGHT THING TO DO
MAKES BUSINESS SENSE**

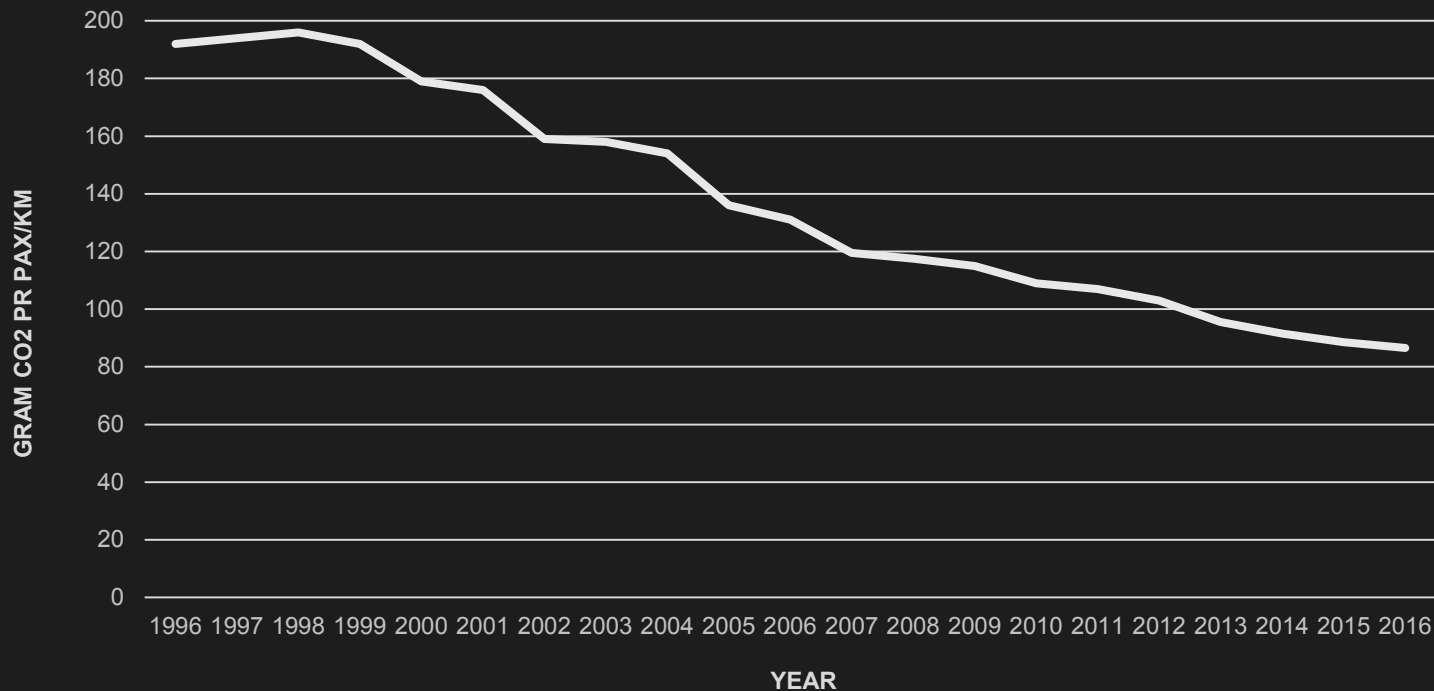


AIRCRAFT CARBON EMISSIONS

AIRLINES INVESTING IN MORE ENERGY EFFICIENT AIRCRAFT



EMISSONS PR PAX KM HALVED 1996-2016



(Average SAS og Norwegian)

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





Airbus E-Fan 1.1
Crossed the English Channel
in 2015



AVINOR



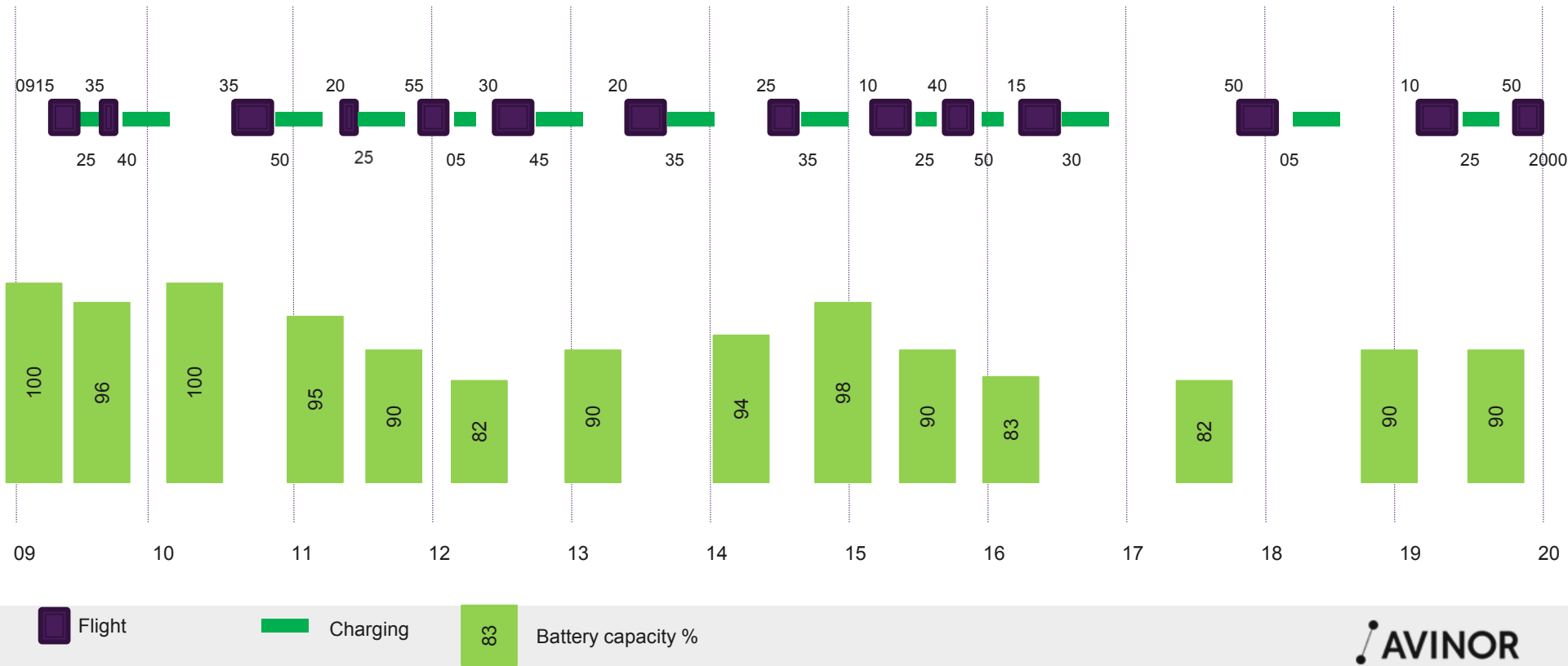
AIRBUS E-Fan
ZERO Conference NOV 2016



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

Arendalsuka 13 AUG 2018

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





ZUNUM

Leknes

Svolveær

104 km

109 km

Røst

102 km

Bodø

101 km

Mo i Rana



Hybrid electric aircraft

Range in 2030: 100 pax 1000 km



SAFETY

distributed electric propulsion system



SAFETY



RANGE ANXIETY



Oslo – Bergen

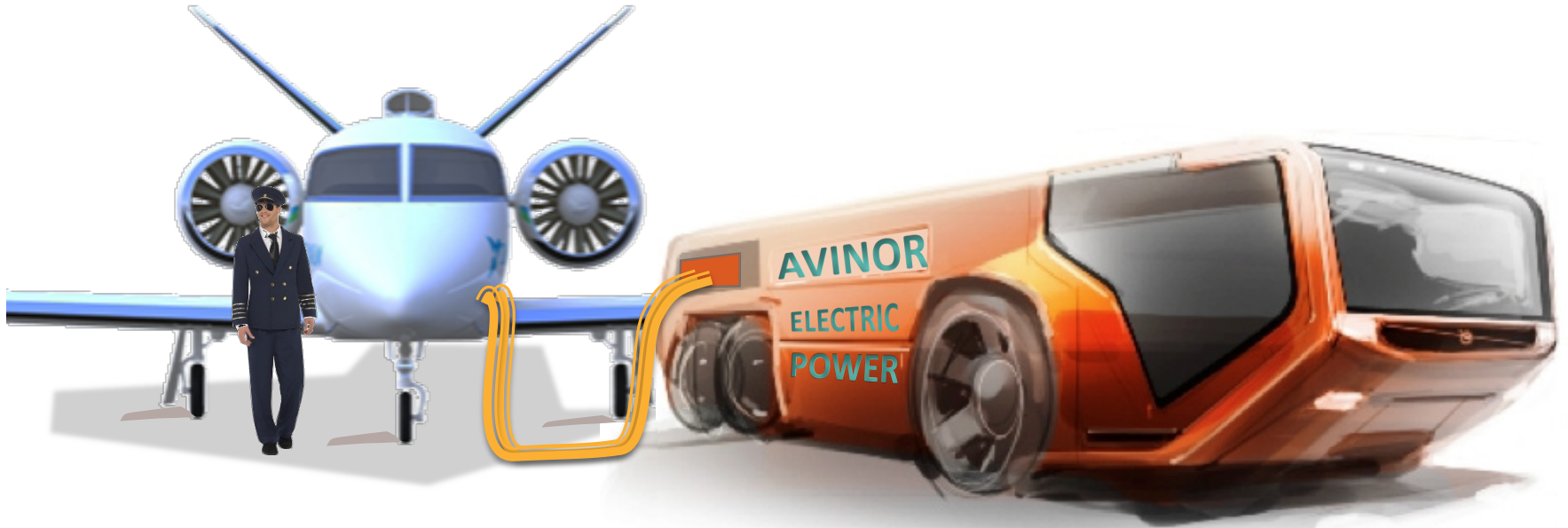
Alternate: Haugesund

+ 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?

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
- Sustainable aviation fuels are an important part of the solution
- Electric passenger aircraft will be a reality
- Providing better connectivity