



# Zukunft der Luftfahrt

Dipl.-Ing. Morell Westermann

Keynote Speaking, Future Research & Corporate Foresight



2008



2018



# EVIAATION ALICE









1903 – 60 Sekunden  
250 Meter



1969 – 66 Jahre später  
10.000 km





2000 – Dronen



2016 – Volocopter

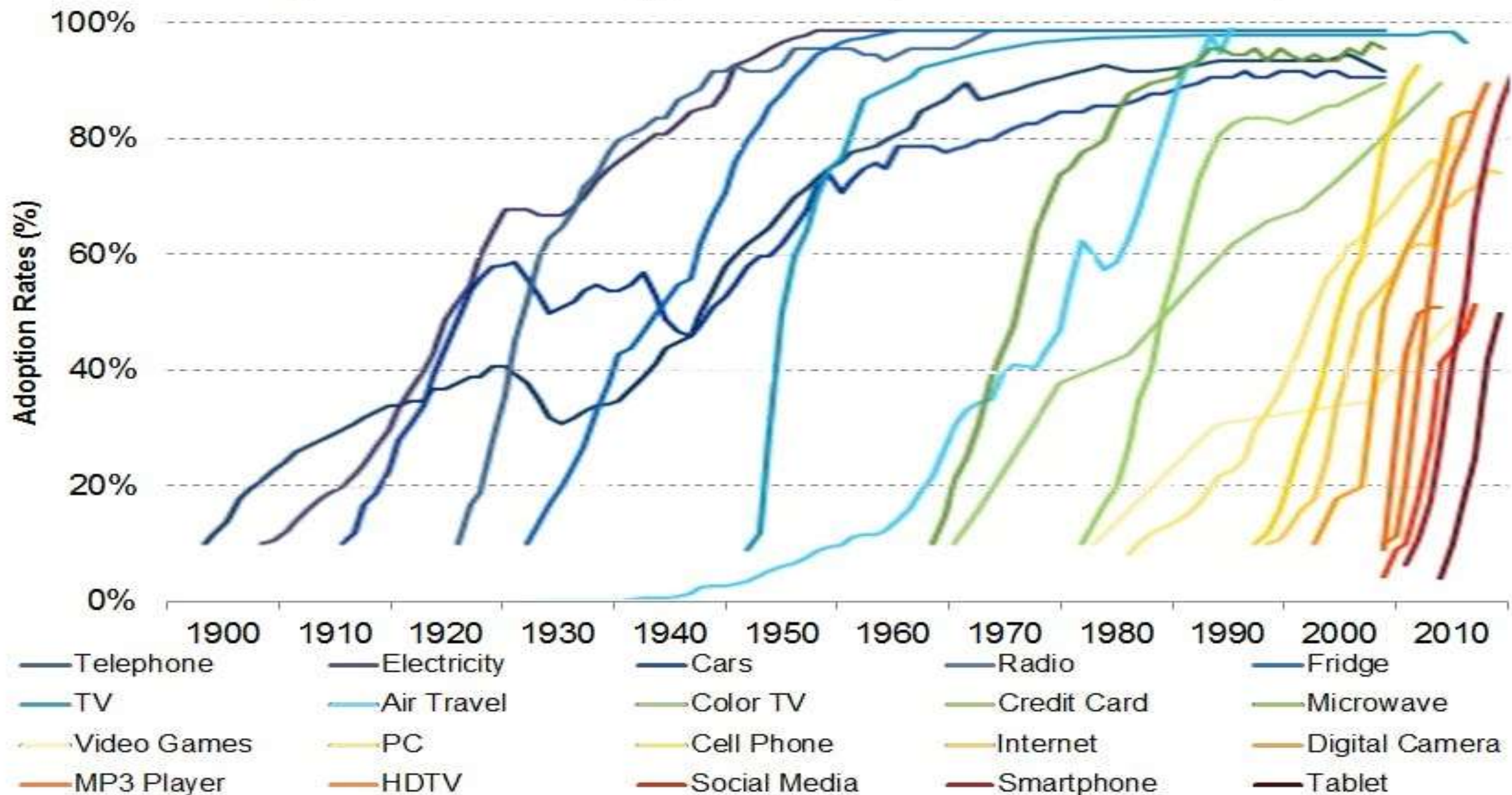


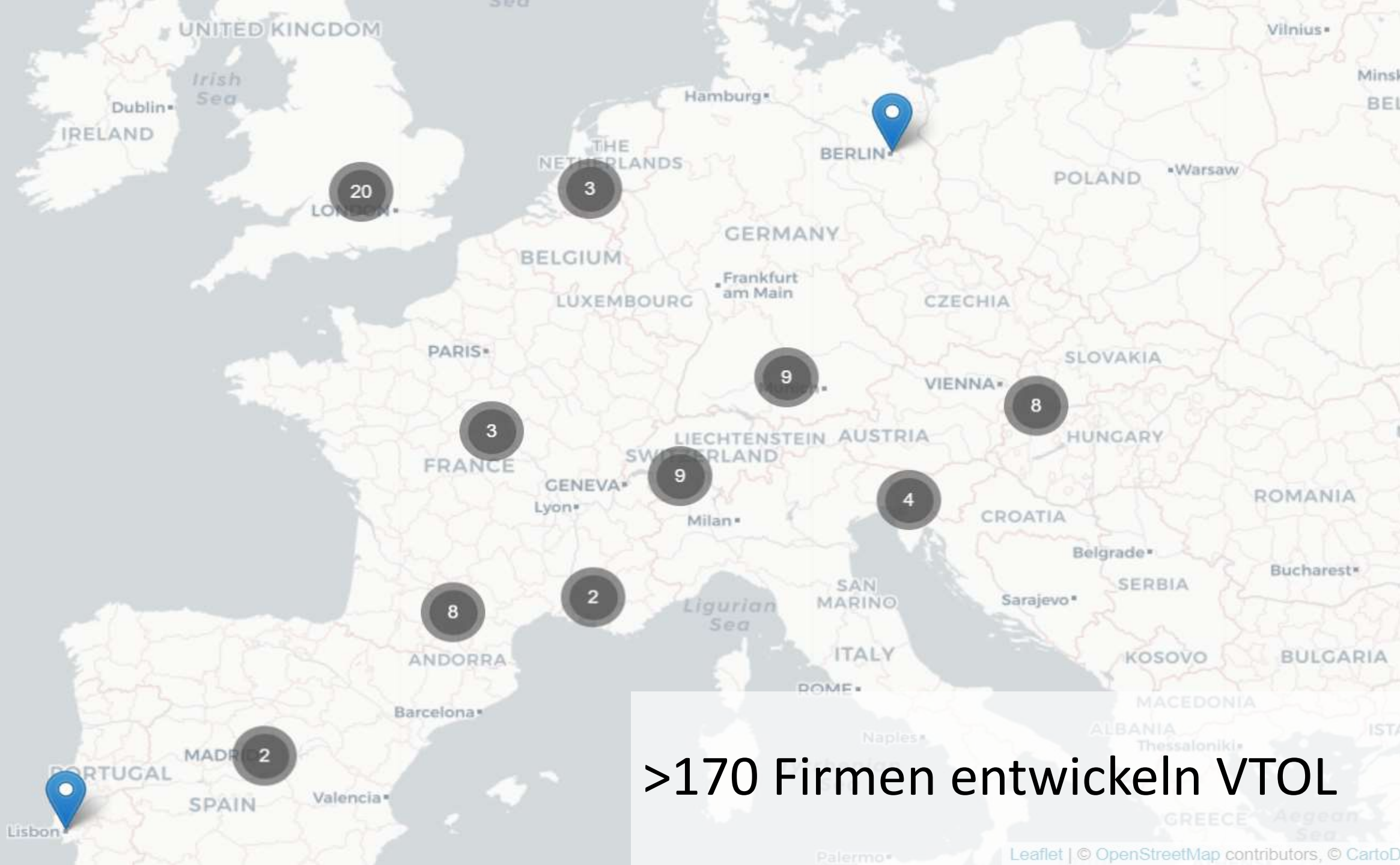
2019 – Lilium



2020 – Serienprodukt

# Adoption of Technology in the US (1900 to the Present)





>170 Firmen entwickeln VTOL



EVA X01



Flexcraft



JAXA Hornisse



Jetoptera  
Personal  
Drone



HopFlyt  
Venturi



Moller M200  
Skycar



Moller M400  
Skycar



Pop.Up Next



Neoptera  
eOpter



Ray Civil VTOL  
Aircraft



Skyls  
Airspeeder



SAMAD  
Starling Jet



Hoversurf  
Formula



Samson Sky  
Switchblade



Vickers WAVE  
eVTOL





Rolls-Royce  
eVTOL



Sabrewing  
Draco-2



Flyter 120-420



Flyter 720-200



NFT ASKA

### Wingless eVTOLs



Alauda  
Airspeeder



Bartini Flying  
Car



Boeing Cargo  
Air Vehicle  
(CAV)



Dekatone  
Flying Car



UrbanAero  
CityHawk



EAC Whisper



PAL-V



SkyPod



PAVX



Astro Elroy



Vertical  
Aerospace  
eVTOL



Koncepto  
Millenya



Varon Vehicles  
V200



Ghost X V 2.2



Imaginative  
Onyx





FlytCycle  
Aerospace



DaVinci ZeroG



Hoversurf  
Hoverbike



Flike



Kalashnikov  
Hover Bike



Neva AirQuad  
One



Trek  
Aerospace  
FlyKart 2



TAMU  
Harmony



Cartivator  
SkyDrive



PSU Blue  
Sparrow



Georgia Tech  
Hummingbuzz



Assen Aero A1



VIMANA AAV



Sting VTOL



Terraflugia  
Transition



Dufour aEro2



Zenith Altitude  
EOPA



Verdego Aero  
PAT200



Terraflugia TF-  
2



PteroDynamics  
Transwing



Terraflugia TF-  
X



Airbus  
CityAirbus



AeroMobil 4.0  
STOL



VRCO  
NeoXCraft



AeroMobil 5.0  
VTOL



AIRIS AirisOne



XTI Trifan 600



ASX MOBi-  
ONE



Aurora  
Lightning  
Strike XV-24A



Autonomous  
Y6S



DeLorean  
Aerospace  
DR7



DIGI Droxi



Airbus Vahana



Boeing PAV



Bell Nexus Air Taxi



Kittyhawk Cora



Ehang 184



Joby Aviation S4



KittyHawk Flyer



Lilium Jet



Volocopter 2X



Workhorse SureFly



Opener BlackFly



Aston Martin Volante



Karem Butterfly



EmbraerX



Pipistrel 801 eVTOL



Jaunt Air Mobility eVTOL



Skai by Alaka'i Technologies

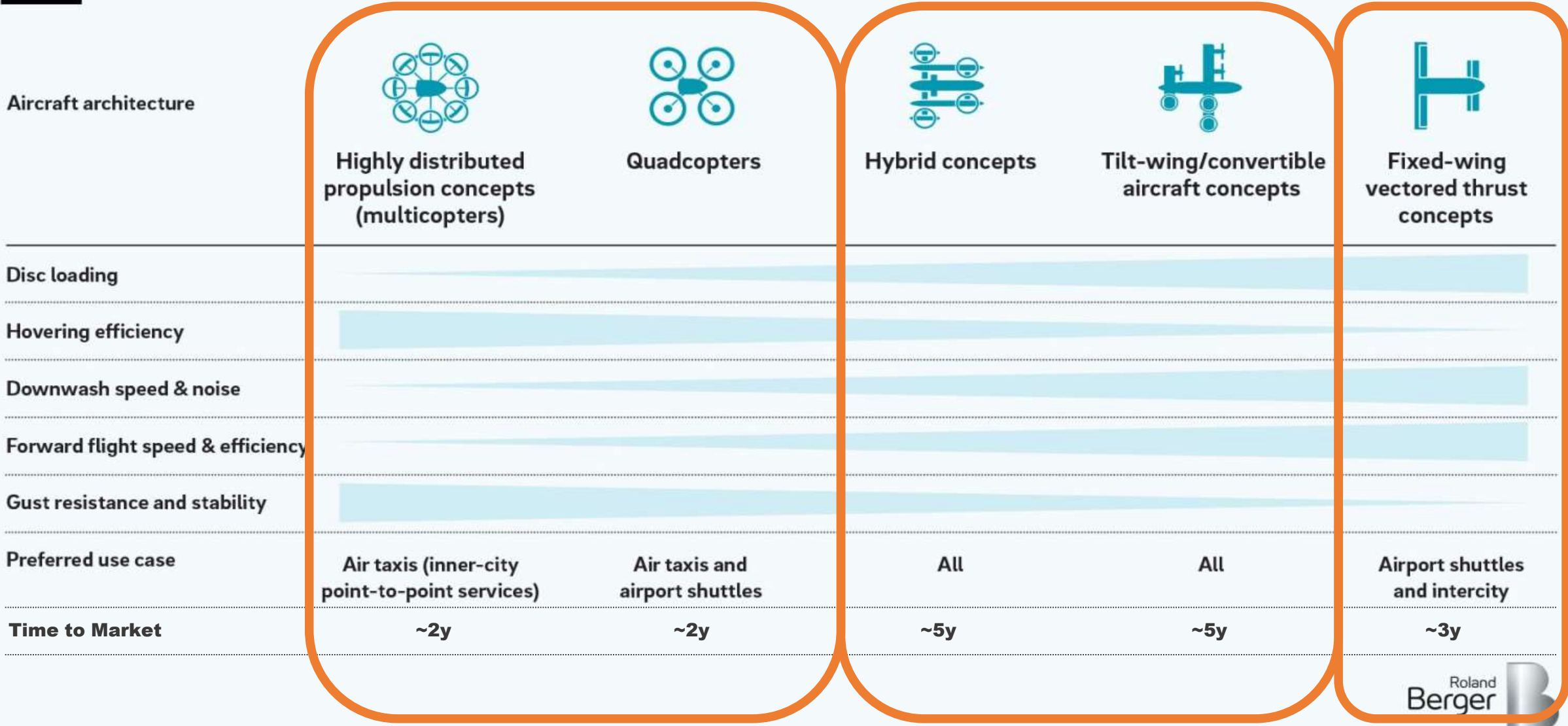


Beta Technologies Ava



LIFT Hexa

# Strengths, weaknesses and potential applications of five electric aircraft architectures



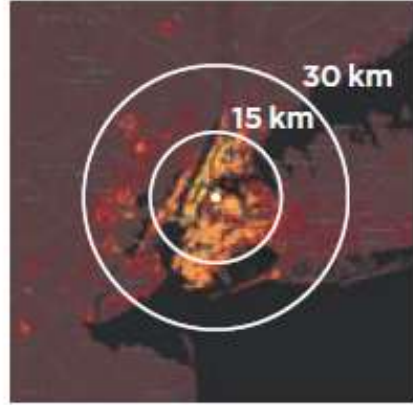
ABC 7 Los Angeles

SECURITY

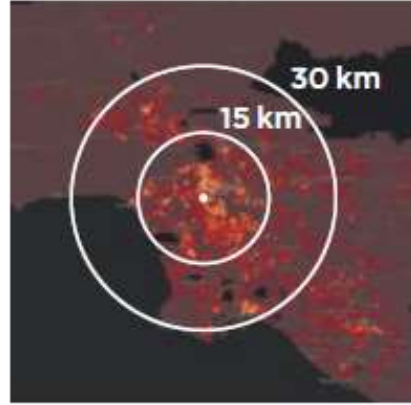
abc NEWS

# GIS population density of selected cities of our top 100 city list

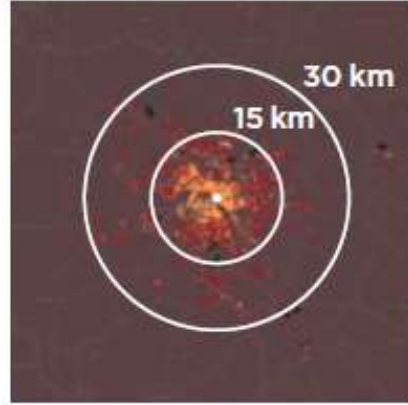
**New York City**  
(18 m population)



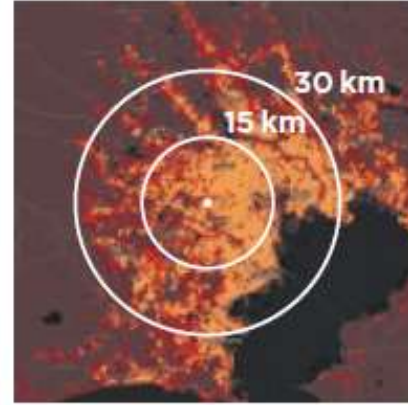
**Los Angeles**  
(12 m population)



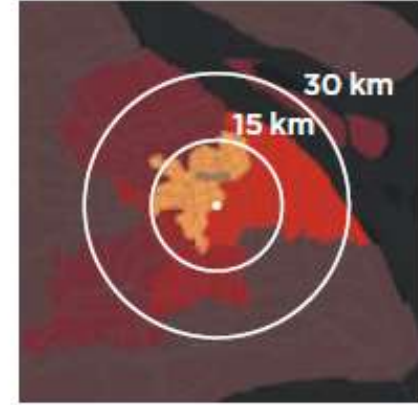
**Paris**  
(11 m population)



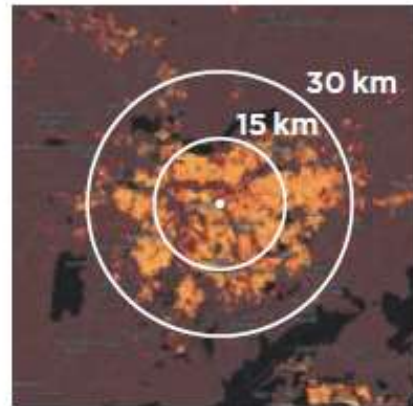
**Tokyo**  
(38 m population)



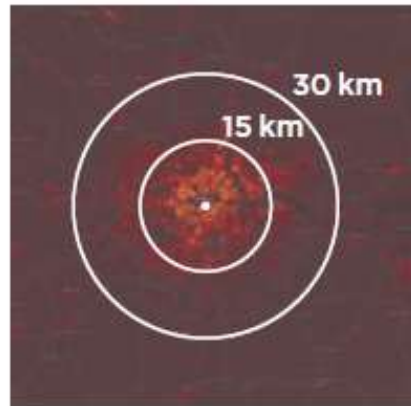
**Shanghai**  
(24 m population)



**São Paulo**  
(21 m population)



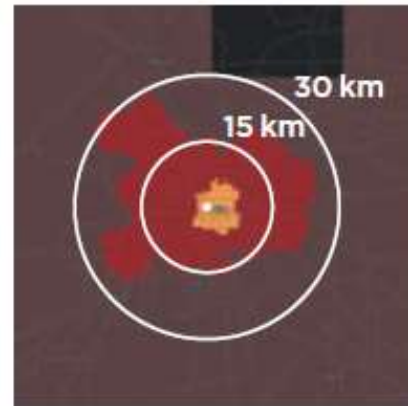
**London**  
(10 m population)



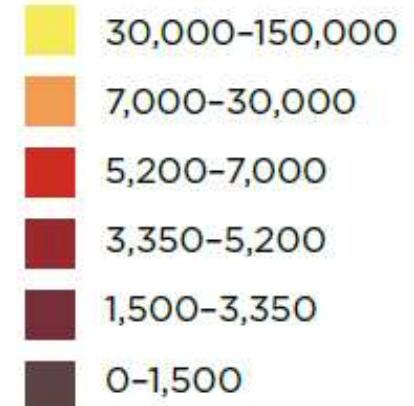
**Mumbai**  
(21 m population)

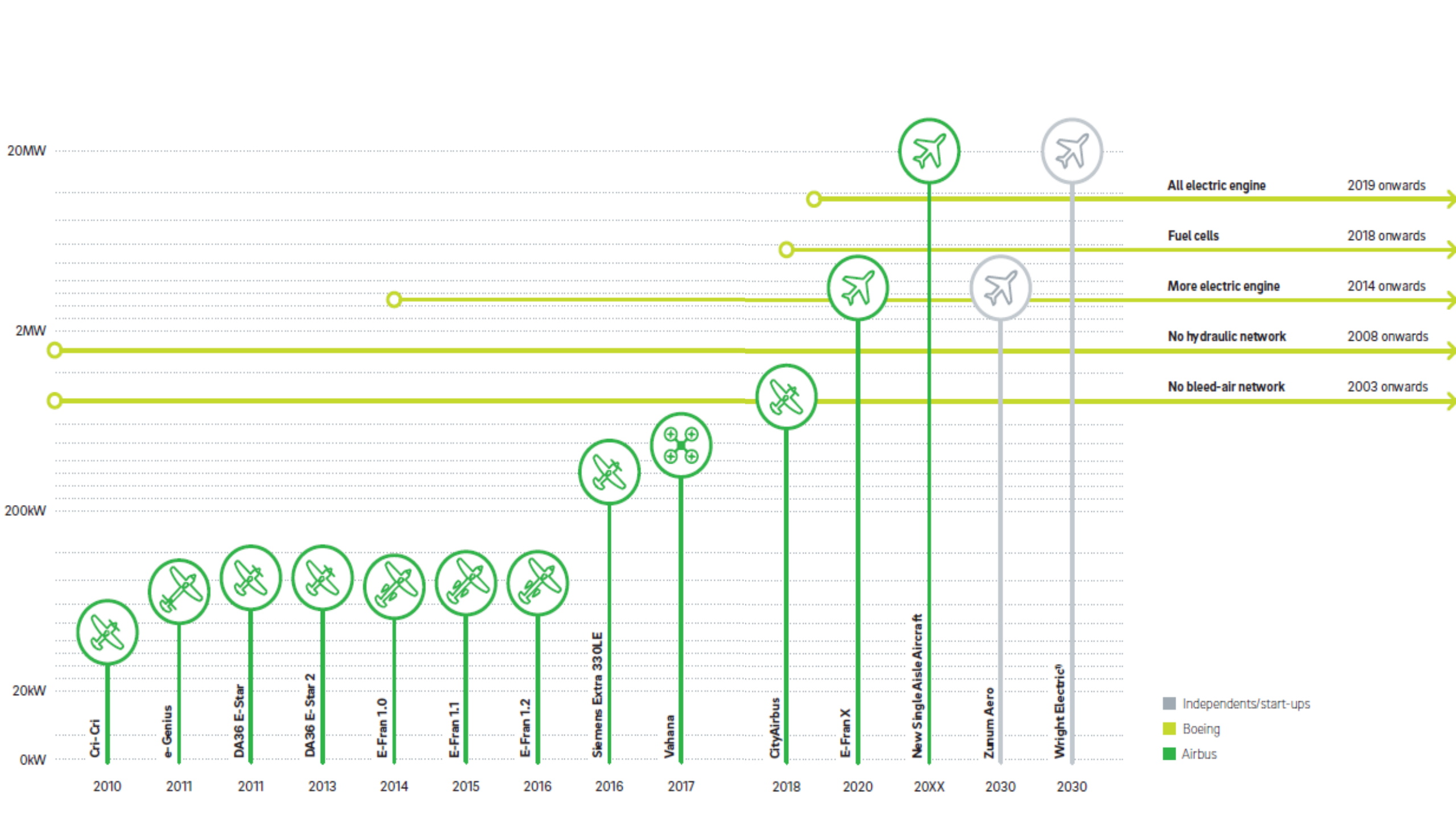


**Beijing**  
(22 m population)



**Population Density**  
(in ppl/km<sup>2</sup>)











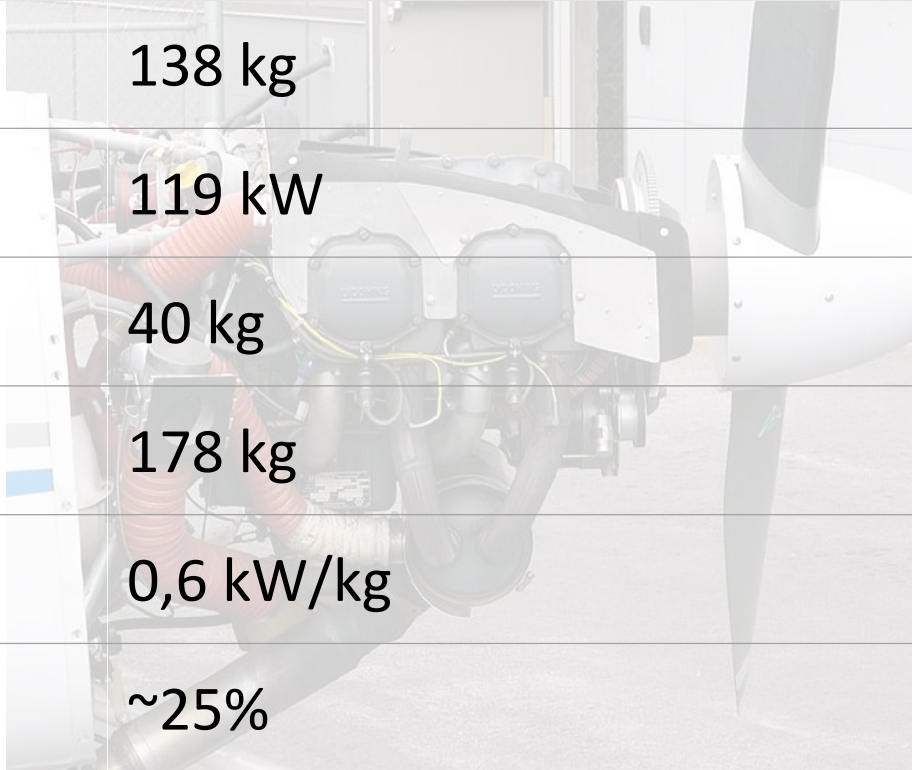
PISTON TYPE CERTIFIED

VELIS  
ELECTRO

S5-P11101

# Heute ca 250 Wh/kg

	Lycoming Kolbenmotor	Siemens e-Motor
Gewicht (kg)	138 kg	50 kg
Leistung (kW)	119 kW	260 kW
Treibstoff (für ca 1h)	40 kg	550 kg (75kWh)
Gewicht Antrieb	178 kg	600 kg
Leistungsgewicht	0,6 kW/kg	0,4 kW/kg
Wirkungsgrad	~25%	~77%

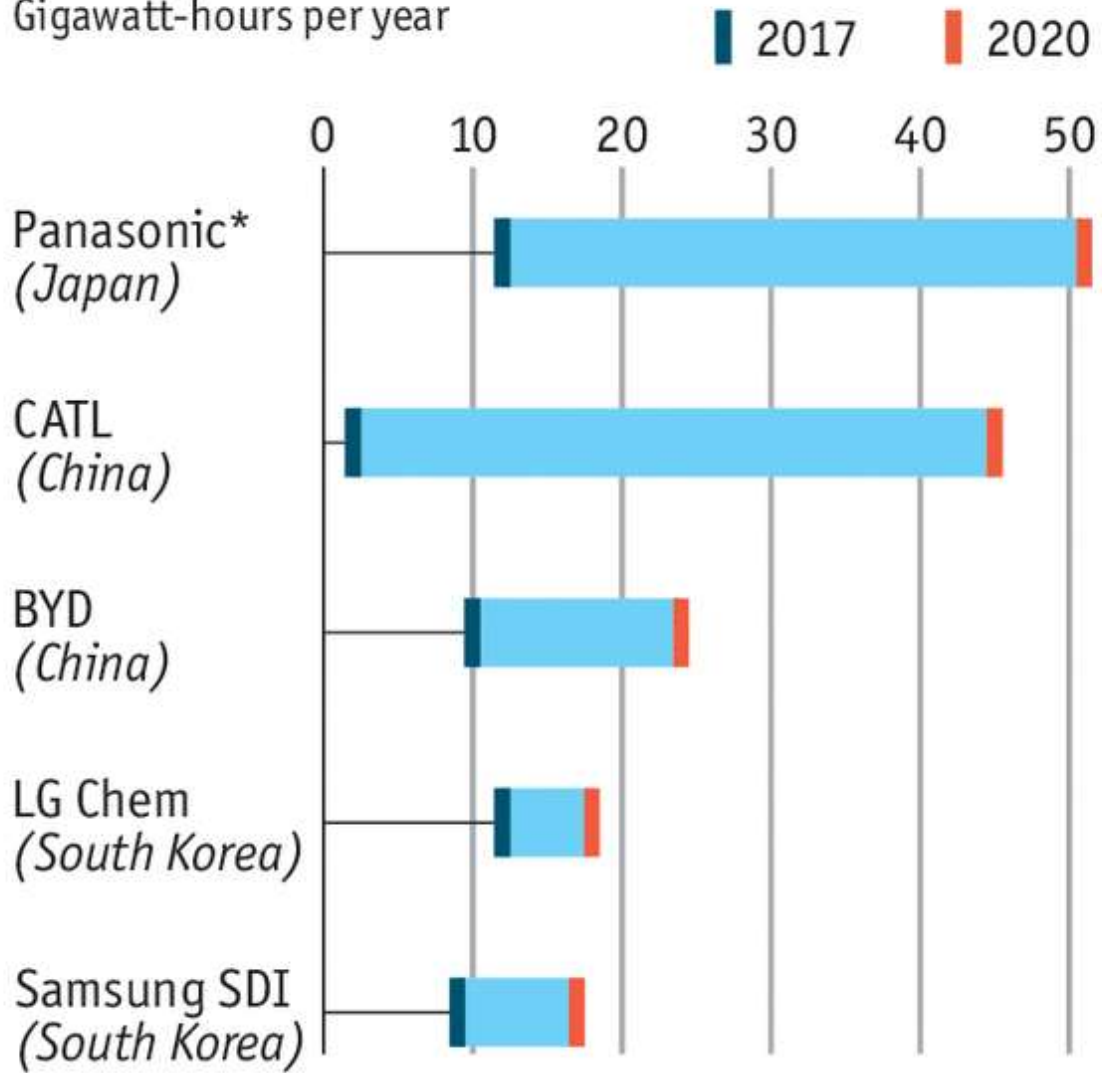


# Die magischen 500 Wh/kg

	Lycoming	Siemens
Gewicht (kg)	138 kg	50 kg
Leistung (kW)	119 kW	260 kW
Treibstoff (für ca 1h)	40 kg	<b>350 kg (75kWh)</b>
Gewicht Antrieb	178 kg	<b>400 kg</b>
Leistungsgewicht	0,6 kW/kg	<b>0,6 kW/kg</b>
Wirkungsgrad	~25%	~77%

## Manufacturing capacity

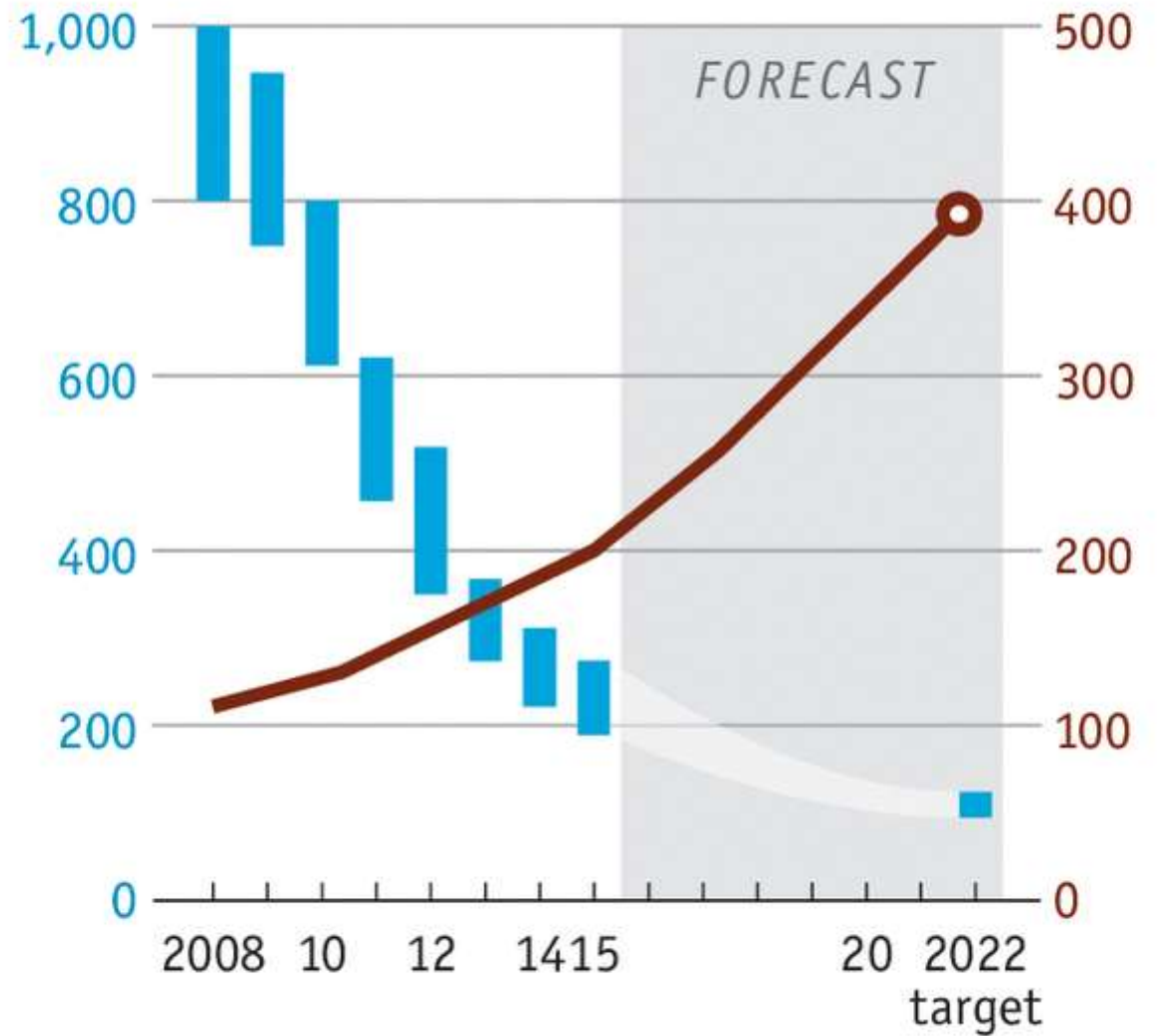
Gigawatt-hours per year



Sources: Cairn ERA; US Department of Energy

## Battery cost

Worldwide, \$/kWh

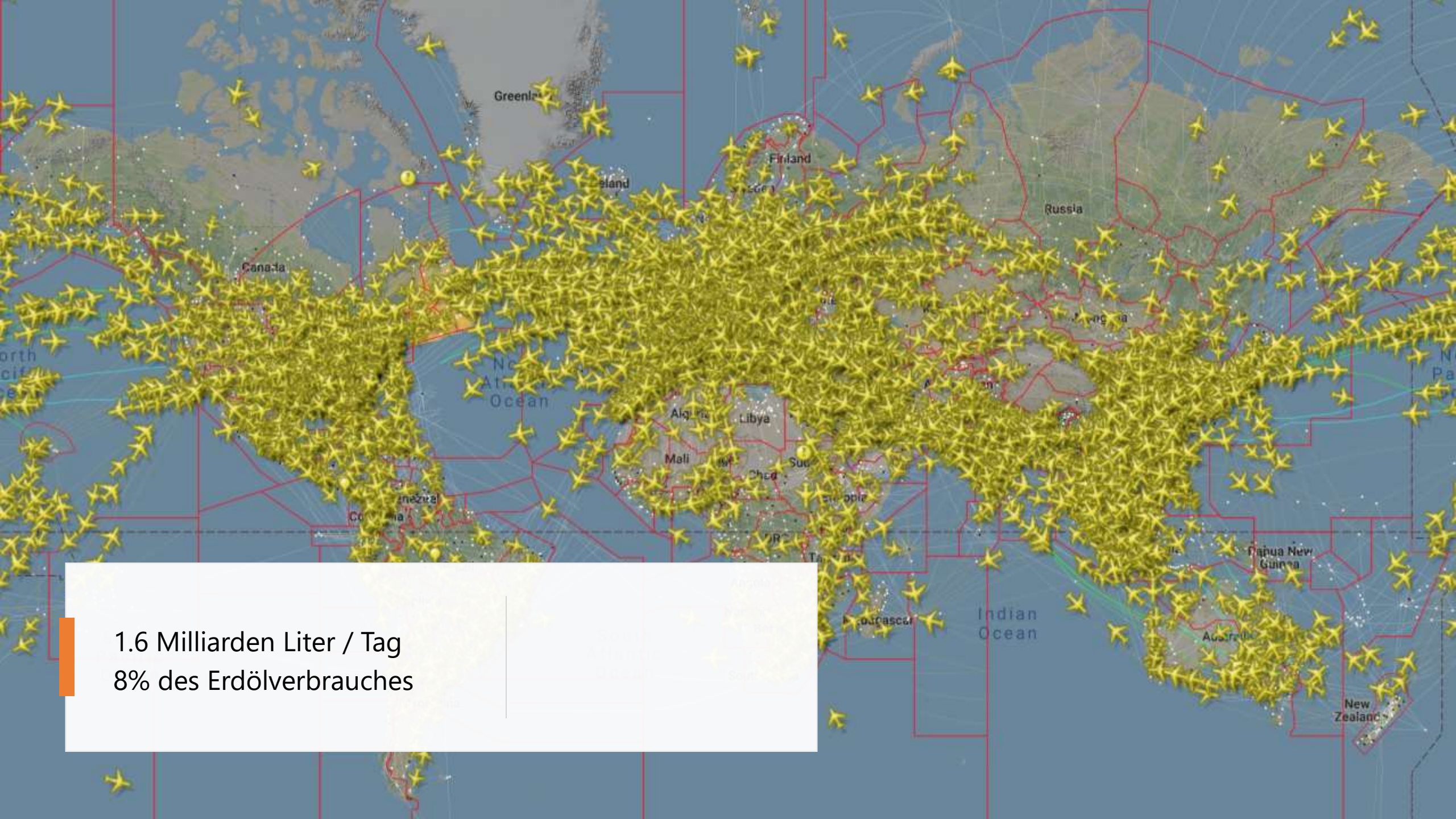


## Battery energy density

Watt-hours per litre

FORECAST

\*Includes Tesla gigafactory



1.6 Milliarden Liter / Tag  
8% des Erdölverbrauches







CO<sub>2</sub>

H<sub>2</sub>O

H<sub>2</sub>

SYN FUEL

SYN FUEL



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# BAEDALEAN

Autonomous flight control for the electric personal aircraft of the near future



# efuel aviation

Technologie

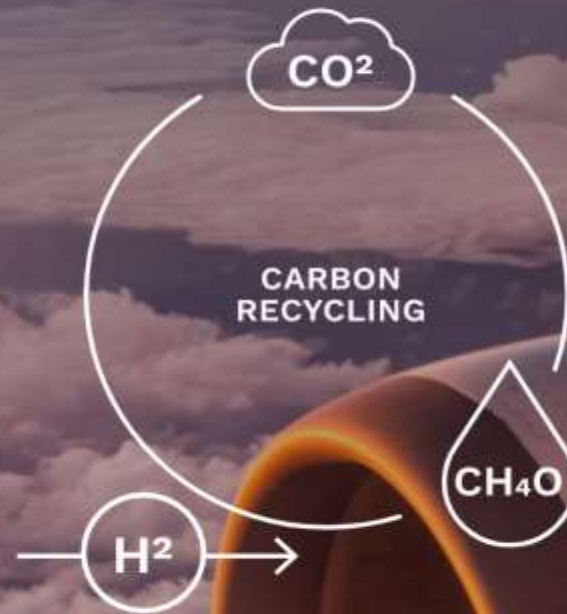
Potenzial

Angebot

Unternehmen

DE EN

Renewable fuel  
made from carbon









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