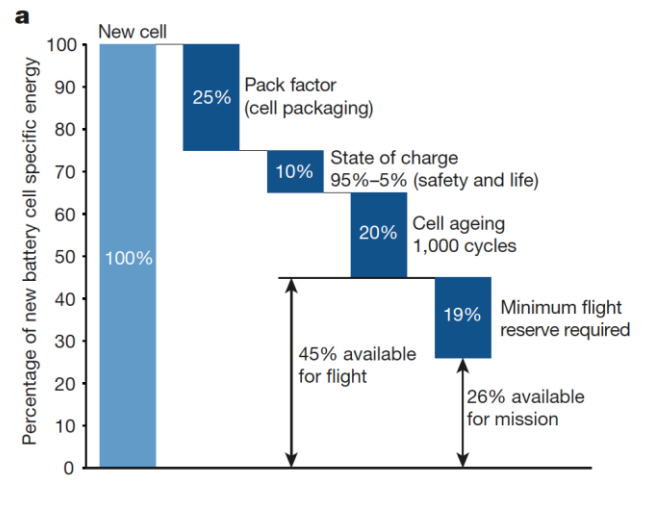
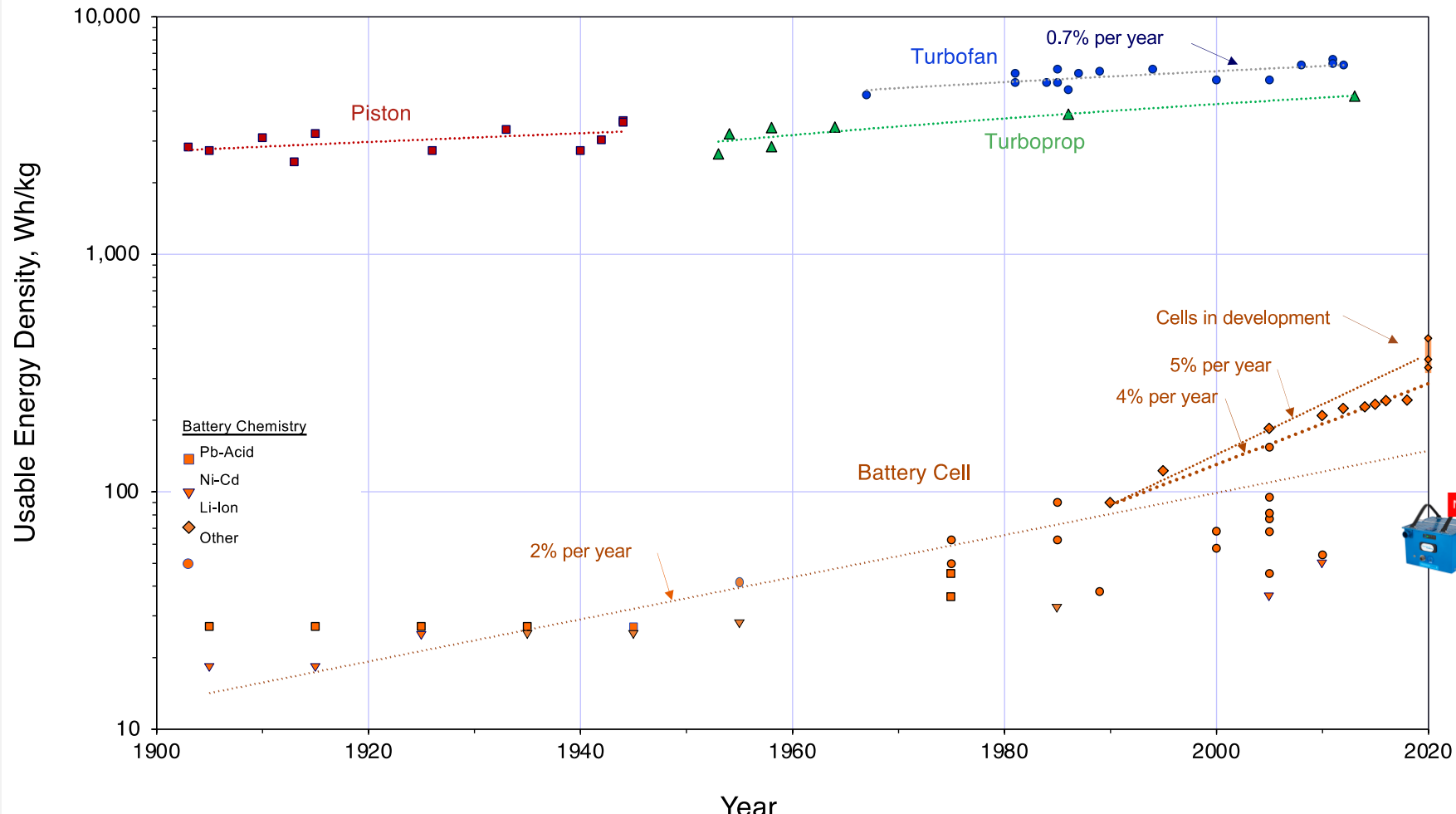


# History of aircraft specific energy for propulsion

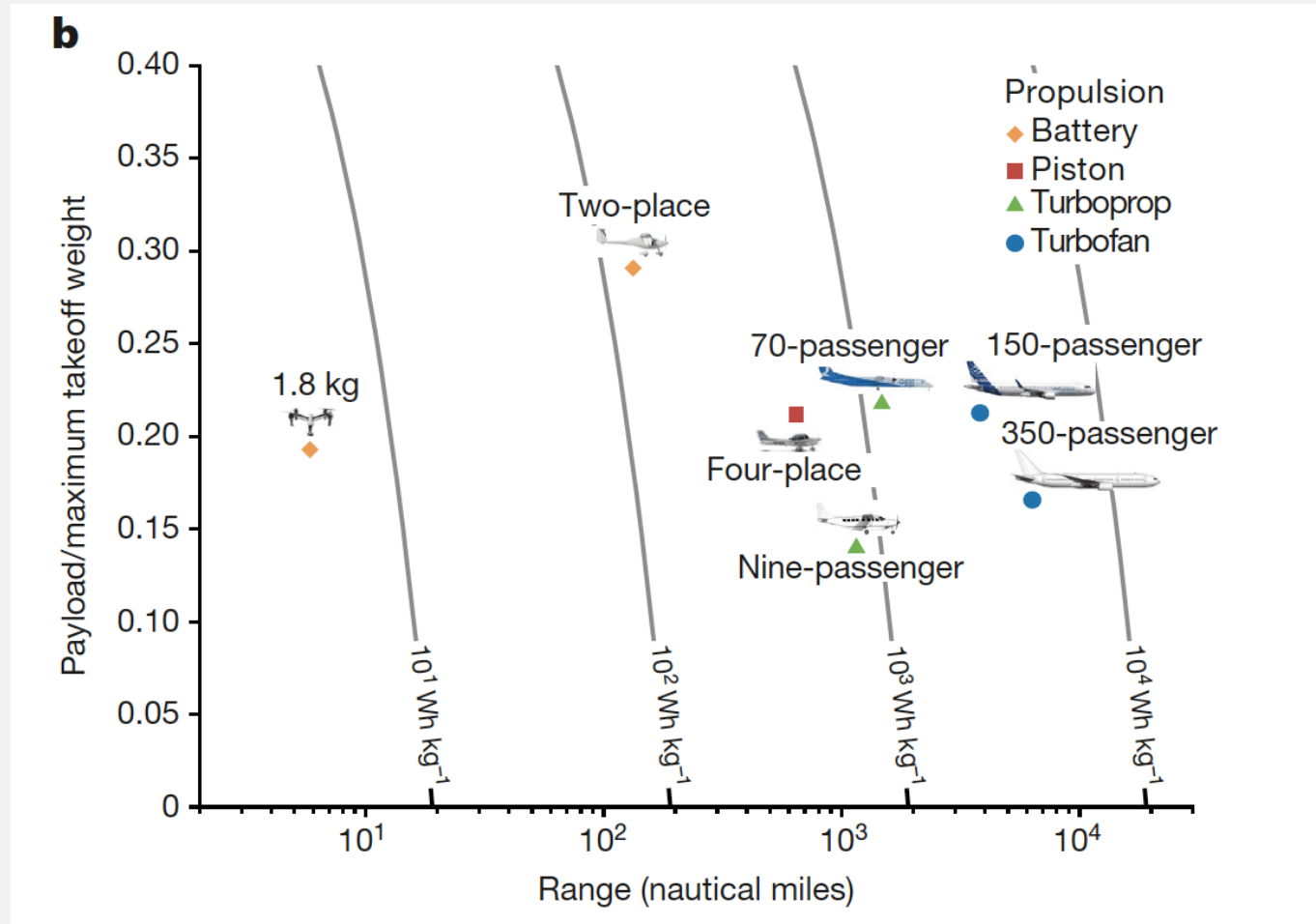


Largest currently certified aviation battery



Source: Venkatasubramanian Viswanathan, Alan H. Epstein, Yet-Ming Chiang, Esther Takeuchi, Marty Bradley, John Langford & Michael Winter, "The Challenges and Opportunities of Battery-powered Flight", *Nature*, 26 January 2022

# Ideal range & some real-world examples



Assumes  $L/D = 20$ , structural mass fraction = 40%

	Alpha	Alpha Electro
Power	60 kW	60 kW
MTOW	550 kg	550 kg
Mstrut	51% (279 kg)	51% (279 kg)
Mfuel	9% (45 kg)	16% (90 kg)
Mpay	41% (230 kg)	33% (181 kg)
Range	324 mi	75 mi
Endurance	186 min	60 min
Useful work (N x m = J)	1.175 GJ	214 MJ



Source: Venkatasubramanian Viswanathan, Alan H. Epstein, Yet-Ming Chiang, Esther Takeuchi, Marty Bradley, John Langford & Michael Winter, "The Challenges and Opportunities of Battery-powered Flight", *Nature*, 26 January 2022

Source: Langford & Hall, *Electrified Aircraft Propulsion*, NAE Bridge, 2020

# So, How Does Electrified Propulsion Buy Its Way On?

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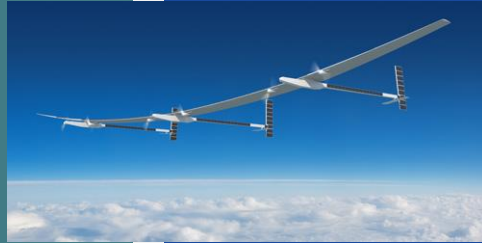
## Market Unlocks

- Noise restrictions
- Emissions controls



## Niche markets

- Short-range CTOL (Trainers)
- HALE pseudo-satellites
- Urban air mobility



## Performance through Integration

- Distributed propulsion
- Boundary Layer Control
- Hybrids

