Embraer Unveils 9- To 50-Seat Sustainable Aircraft Concepts

Energia concepts (clockwise from front right): hybrid-electric E9-HE, all-electric E9-FE, hydrogen-turbine E50-H2GT and hydrogen-electric H19-H2FC. Credit: Embraer

Embraer has unveiled a series of 9- to 50-seat sustainable aircraft concepts designed to revitalize regional connectivity as digitalization enables more people to live and work away from major cities.

The family of Energia-branded concepts are aimed to enter into service between 2030 and 2040.

With all-electric, hybrid-electric or hydrogen-fueled propulsion for low emissions and noise, the four aircraft concepts fit between Embraer's planned Eve urban air taxi and its proposed 70-90-seat regional turboprop and existing 100-150-seat E-Jet E2 series.

"This is not a launch. The concepts provide direction on our thinking on aircraft size and range over the next 10-20 years," said Arjan Meijer, president and CEO of Embraer Commercial Aircraft. The unveiling will trigger discussions with potential partners and customers on which direction to take. "We cannot bring every concept to market. We need to focus," he told Aviation Week.

Embraer has focused on smaller concepts because it believes the technology to improve sustainability will be available first for shorter-range aircraft. Entry into service dates for each concept are based on the company's assessment of the readiness of the propulsion technology.

"We don't want just to do a theoretical exercise," said Rodrigo Silva e Souza, Embraer's vice president of marketing. "We want to bring those solutions to life as soon as they are available. So we will take this time to understand with suppliers and customers the technical and economic viability of the solutions."

First in line is the 9-passenger 500-nm-range Energia Hybrid (E9-HE), aimed at entry into service in 2030. This has parallel hybrid-electric propulsion. Batteries provide electric power for takeoff and a small diesel-cycle piston engine powers cruise propulsion on 100% sustainable aviation fuel (SAF).

The Energia Hybrid (E9-HE). Credit: Embraer

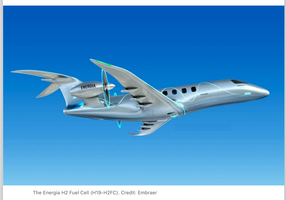
The propellers are mounted on the rear fuselage to provide a clean, low-drag wing and to reduce noise, said Silva e Souza. Electric motors will be air cooled to reduce thermal-management complexity. The E9-HE is expected to reduce CO_2 emissions by 90% with SAF and external noise by 60%.

Next is the 9-seat Energia Electric (E9-FE). This has fully electric propulsion for zero emissions but a reduced range of 200 nm and a later entry-into-service date of 2035. The E9-FE has swappable batteries in the nose for reduced turnaround time, plus reserve batteries mounted in the rear fuselage.

The Energia Electric (E9-FE). Credit: Embraer

The aerodynamically efficient configuration has a sailplane-inspired high wing for low drag and contra-rotating propellers mounted on top of the fin for low noise. External noise is reduced 80%, which Silva e Souza said is key to using those smaller airports close to city centers that today have noise restrictions.

Also aimed at entry into service in 2035, the Energia H2 Fuel Cell (H19-H2FC) is a 200-nm-range 19-seater using fuel cells and liquid hydrogen (LH_2) for propulsion. LH_2 tanks are housed in the rear fuselage and a small battery assists with power transients. Again, the concept has rear-mounted engines for a clean wing. The design has zero CO_2 emissions and 70% lower noise, Silva e Souza said.



The Energia H2 Fuel Cell (H19-H2FC). Credit: Embraer

The largest of the four concepts, the Energia H2 Gas Turbine (E50-H2GT) has 35-50 seats and an entry-into-service target of 2040. The aircraft has dual-fuel propulsion, the turbine engines burning 100% hydrogen up to a range of 350 nm. SAF will be used for reserves or range extension up to 500 nm. SAF would be stored in the wing and the amount of LH_2 carried would be customized to operators' specific needs. When flying on hydrogen, CO_2 emissions are zero. Noise is reduced 60%, again using rear-mounted engines.

The Energia H2 Gas Turbine (E50-H2GT). Credit: Embraer

Of the four concepts, the E50-H2GT has the latest readiness date because of the technology development required to improve the efficiency of the turbine engines. "For smaller airplanes, we see that the fuel-cell efficiencies will be more ready in a certain timeframe, and for bigger planes we see the efficiency of gas turbines will be more applicable," Silva e Souza said.

For both hydrogen-fueled concepts, entry into service is pushed later by the availability of green hydrogen and ground infrastructure. "To use either fuel cell or hydrogen combustion, we understand this will be widely available later down the road. And that's why, for this size of aircraft, the target entry into service probably should be a little later," he said.

Timeframes will be informed by technology demonstrations. Embraer is already flying an all-electric testbed, a modified EMB-203 Ipanema, and plans to fly a hydrogen-propulsion demonstrator by 2025-26. "These will be key building blocks to evolve our understanding and down-select the technology. But starting next year we will be working with suppliers and customers to understand the requirements and the potential viability of those airplanes," Silva e Souza said.

Embraer's timescales are more conservative than those of startups targeting the same regional market. Sweden's Heart Aerospace aims to have an all-electric 19-seater in service by 2026 and ZeroAvia plans to have a hydrogen-electric conversion for 19-seaters on the market by 2024.

"For us, it is not about just showing nice concepts that may not be viable. It is about growing our business. We see that as an opportunity and therefore we don't want to be unrealistic. We must be bold, but consider the realistic viability of the solutions," Silva e Souza said

Battery energy density will have to improve significantly, at least threefold, to enable the all-electric E9-FE, Embraer believes. "We see other companies talking about earlier entry to service targets. But we are confident about our views on the viability of our proposals," he said.

"There are few companies with the expertise we have in developing, certifying and supporting aircraft," he said. "We understand that the concepts we are unveiling are actually viable by the timeframe we are presenting. Companies presenting more aggressive targets are probably being overoptimistic."

As for its larger aircraft, Embraer expects them to evolve to dual-fuel propulsion over time, the 70- to 90-seat turboprop by 2045 and the 100-150-seat E-Jets by 2050. "The availability of green hydrogen between now and 2050 is a huge challenge, both production and logistics," says Silva de Souza.

"That's also the reason why we believe we need to apply these new technologies to the smaller aircraft segment first, get our larger aircraft 100% SAF ready, and really see if the hydrogen market is going to develop as we all hope it will."

Graham leads Aviation Week's coverage of technology, focusing on engineering and technology across the aerospace industry, with a special focus on identifying technologies of strategic importance to aviation, aerospace and defense.