Launch of the Ampyx PowerPlane AP-1B1 (29 September 2012).

Ampyx PowerPlane AP-2A1 during flight (photo taken by its tail camera on 12 May 2015).

PowerPlanes AP-2A1 and AP-2A2 in the workshop of Ampyx Power (9 April 2014).

Status and Development Plan of the PowerPlane of Ampyx Power

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Ampyx Power develops the PowerPlane®, a novel wind energy technology that will eventually allow sustainable production of power at lower costs than fossil-fueled alternatives. It thus has the potential to trigger a paradigm shift in the electricity sector and can accelerate the transition to a renewable energy supply. The technology generates energy by flying a tethered glider-plane attached to a ground-based generator following a cross-wind pattern as the tether unwinds under high tension (plane spirals away from the generator), and rewinds under near-zero tension (plane glides back to generator). Ampyx Power currently operates 2 prototype PowerPlanes (incl. AP-2A1 and AP-2A2, about 20 kW net power production demonstrated) in a test-field in The Netherlands, for which it has obtained type registration and an exemption (license to operate) from the national authorities based on a thorough safety analysis, implementation of a safety system, pilot training and operations manual. The 5.5 m prototypes serve to demonstrate the principle of a fully automatic operation (power generation, → land → launch → power generation), as well as to raise technology readiness level for the certifiable commercial system prototype AP-3 (200 kW) and the to-be certified commercial version AP-4 (2 MW) concept. These systems shall be operational in the coming few years. The AP-3 is the pre-commercial system that is to demonstrate full autonomy, performance and cost predictability, reliability and safety. It also serves as learning platform to meet the challenges of site development, grid connection, maintainability and 24/7 operations. AP-3 is currently under development following stringent aeronautical design processes, airworthiness and safety standards, which we consider a necessity not only from perspective of certification, but also for commercial viability. The AP-4 shall operate at a Levelised Cost of Energy (LCoE) well below that of conventional wind energy, as predicted by extrapolation of flight data based on validated dynamic simulation over a range of wind speeds for typical sites, coupled to a structural mass model and cost model including capital and operational aspects. Performance efficiency and nominal operation at very high gee load is yet to be demonstrated. This is the topic of current work. Uptime and reliability can be analysed and improved by strict design rigour but have eventually to be demonstrated in the field and will undoubtedly need to improve over time as flight hours and operational experience accumulates. System sizing is done based on end-to-end modelling of design, performance and LCoE. This approach leads not necessarily to a system of optimal power production, but one of lowest energy price. It guides us with trade-offs such as tether diameter selection (air drag losses vs. wear and maintenance cost), tether length (land lease cost vs. cycle efficiency), wing area (total power vs. relative material cost). The presentation will address the current status of Ampyx Power technology, the roadmap forward to a commercial implementation and its rationale.

Ampyx Power
airborne wind energy