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WP2 - Deliverable D2.1 – Report
Power Generation System Architecture and Requirements

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Change History

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V1	31.01.2023	First Version	William Resende	Dirk Kastell
V2	05.02.2023	- updates on document structure as per feedback from project coordinator - fixed grammar and text errors - corrected tables and figures definitions	William Resende	Dirk Kastell

List of Acronyms and Abbreviations

Abbr.	Description	Abbr.	Description
2-PC	Two-phase cooling	MTBF	Mean Time Between Failure
A/C	Aircraft	MTC	Motorised turbo-compressor(s)
AM	Additive Manufacturing	NM	Nautical mile
BoP	Balance of Plant	OCV	Open circuit voltage
BPP	Bipolar plate	OEM	Original Equipment Manufacturer
CCM	Catalytic coated membrane	PAX	Passengers
CA	Consortium agreement	PFSA	Perfluorosulfonic acid
CFD	Computational fluid dynamics	PGS	Power Generation System
CL	Catalyst layer(s)	POD	PGS Unit
DCE	Dissemination, Communication and Exploitation	PPS	Propulsion Power System
DMU	Digital mock-up	PEM	proton exchange membranes
EASA	European Union Aviation Safety Agency	PEMFC	Proton Exchange Membrane Fuel Cell
EOL	End of Life	PM	Particulate matter
FC	Fuel Cell	RAC	Ram Air Channel(s)
FL250	Flight level 250 (= 25,000 ft)	RH	Relative humidity
GHG	Greenhouse gas	SAF	Synthetic aviation fuel
GT	Gas turbine	SLM	Supporting layer manufacturing
HX	Heat exchanger(s)	SoA	State of the Art
IP	Intellectual property	SRIA	Strategic Research and Innovation Agenda
IPN	Interpenetrating polymer networks	TMS	Thermal Management System
IPR	Intellectual property rights	TEFO	Total Engine Flame Out
ISA-35	International Standard Atmosphere	TO	Take-Off
KPI	Key Performance Indicator	ToC	Top of Climb
KSO	Key Strategic Orientations	TOGA	Take-Off and Go-Around
L2	Liquified hydrogen	TRL	Technology Readiness Level
MEA	Membrane Electrode Assembly	VOC	Volatile organic compounds
MCU	Motor control unit	ZEROe	Airbus initiative towards zero emission aircraft

1. Executive Summary

- As indicated in the deliverable plan, this first deliverable of the consortium BRAVA contains the requirements cascade from product level to sub-system level.
- The approach used was a typical V-systems engineering approach, using high level product requirements (like range, number of passengers, etc) and use that to cascade it down to the subsystem level
- The document contains the requirements broken down to subsystem level for WP3 (Thermal Management System), WP4 (Stack), WP 5 (Air supply system) and WP 6 (power generation system). The next step to be included in the next deliverables are the requirements for each component.
- The aircraft product target is designed for 100 passengers and 1.000 nautical miles and fly at 25.000 ft. Safety and certification requirements like bird strike, in-flight restart and negative G operation have been considered in constructing the system architecture. Considering all requirements, each propulsion system needs to be sized to provide 2.100 kW mechanical shaft power.
- The power generation system PGS is sized to provide 2.240 kW per unit.
- The total stack power (including the power required to power the ancillary components) will amount to 2.640 kW. This amount of power is distributed in several strings of stacks connected in series and parallel requiring a total of 16 stacks per PGS. Each stack is rated at 165 kW for the take-off scenario
- Given the target efficiency sizing point, the expected total heat rejection per PGS is 1.926 kW thermal.
- As the aircraft is required to fly at 25.000ft the required compressor pressure ratio is 5,8 at top of climb and sized for maximum air flow of 1.756 g/s per PGS.

7. Acknowledgments

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