Distributed DC/DC architecture for an LVDC hydrogen production microgrid based on concentrated photovoltaïc sources

Kolja Neuhaus, Corinne Alonso

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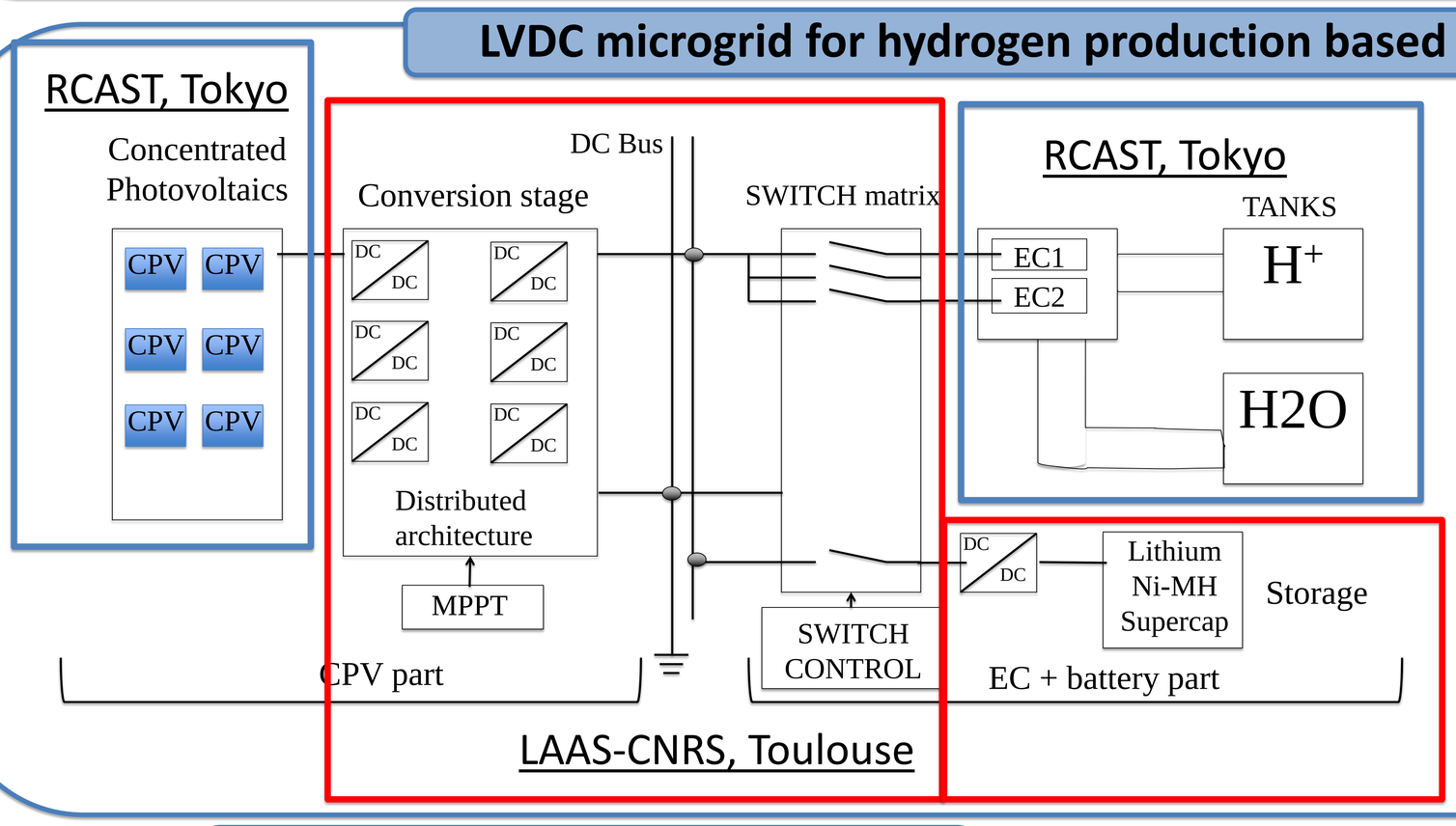
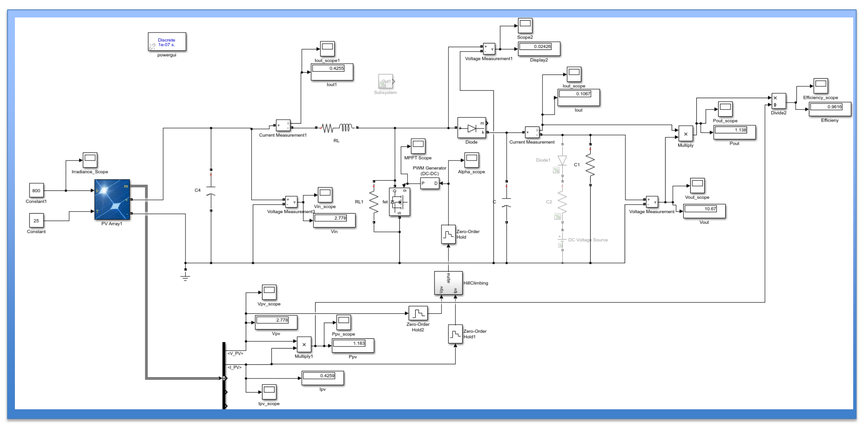
In the context of the decrease of fossil fuels and ecological transition, hydrogen production has been identified as a solution for storage consuption of renewable energies. High efficiency solar cells can be used in conjunction with solar concentration to further push the limits of photovoltaïc energy production. In order to maximize this production, high precision solar tracking in addition to optimized conversion devices are needed. In this study, a distributed DC/DC architecture is proposed with a Low Voltage DC microgrid, aiming to optimize energy flows between high efficiency concentrated photovoltaïc production and hydrogen production from electrolyzers.

LVDC microgrid for hydrogen production based on concentrated PV



Modelizing CPV, converters and batteries



The ADREAM platform
LAAS-CNRS, Toulouse, France

AC microgrid for energy production and consumption.
DC microgrid + storage : Lead-acid batteries + supercapacities

Concentrated PV + Tracking

High efficiency cells + fresnel lenses and concentrators

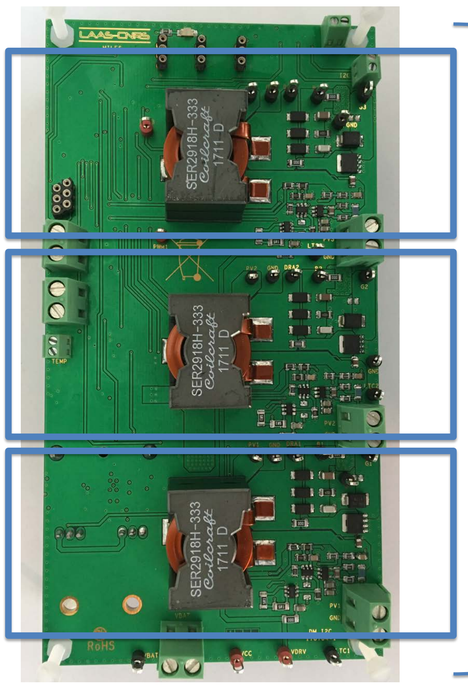
RCAST, Tokyo

2 axis Solar Tracker

TdAPS
(Time derived Astronomical Positioning System)

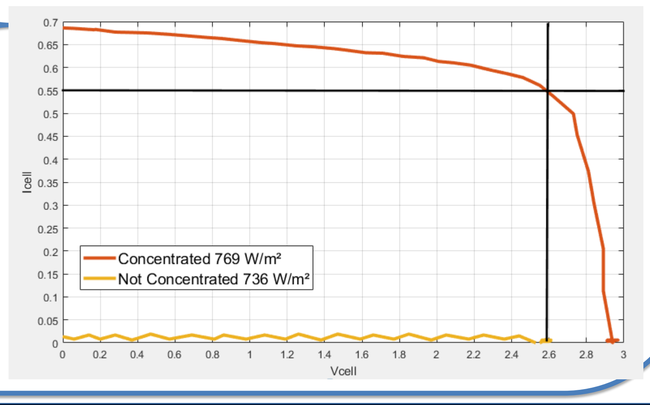
LAAS, Toulouse

Distributed converter architecture



One Single DC/DC Boost converter for each CPV cell + separate MPPT for each.

Exploiting different functionning points, optimizing energy flow



Perspectives

Experimental test with small size electrolyzer cells + CPV

Modelizing Electrolyzer cells in collaboration with RCAST, Tokyo (Equivalent circuit models, EIS)

Extrapolating results for bigger scale hydrogen production.