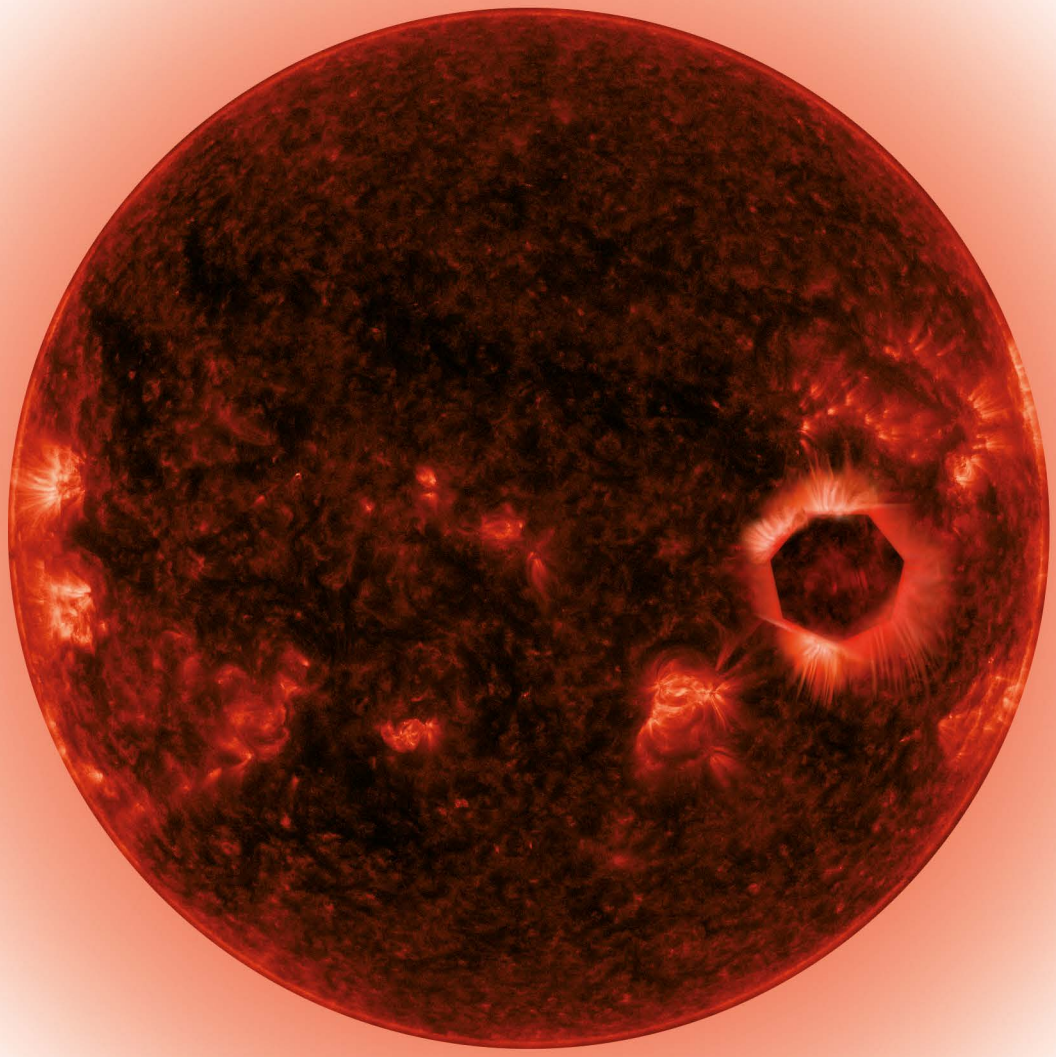
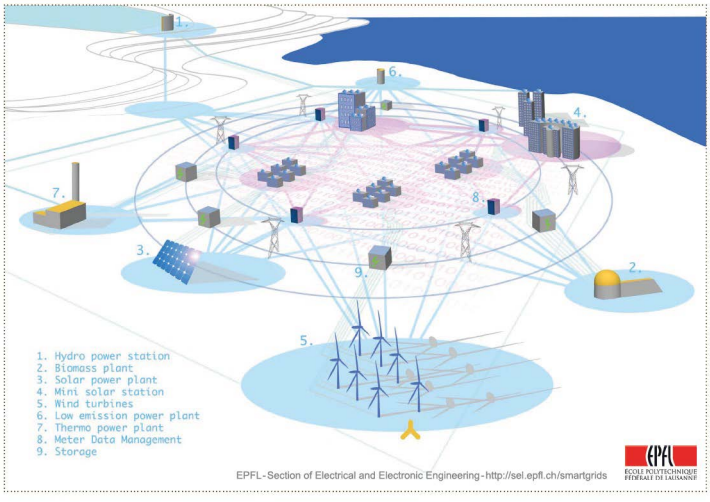
DOCTORAL
SCHOOL

ENERGY



EPFL

Energy conversion has and will shape the evolution of mankind. In a number of ways it is absolutely essential for human existence. The EPFL doctoral program in Energy (EDEY) provides an educational and research environment that inspires students to develop the ability to contribute to the advancement of science and technology through creative research in several fields of energy.



Smart Grids: a new electrical infrastructure for the massive integration of renewable energy resources

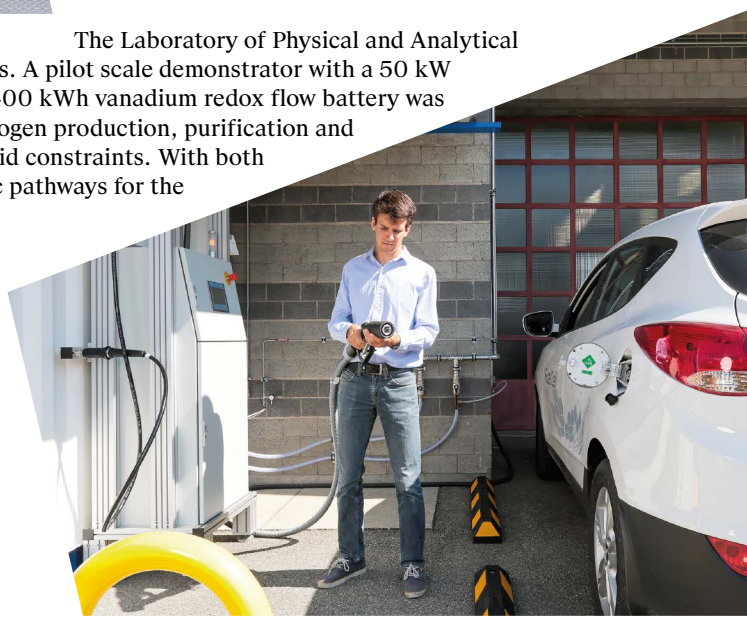
Future generations will rely on energy made available exclusively by renewable energy resources. The inherent stochastic behavior of these resources is posing new challenges to researchers.

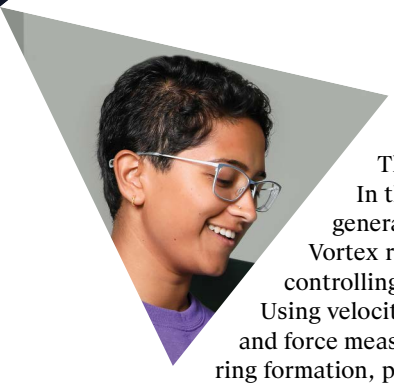
Smart Grids are expected to shape the next generation of the power systems enabling the vast penetration of renewables. This will be realized by integrating new technologies in energy conversion and storage systems together with new approaches in the control and planning of advanced electrical and energy systems.

The electrification of road transport is one of the key approaches to decarbonize our economy and improve air quality. Two technologies, battery electric vehicles and hydrogen fuel cell vehicles, are expected to address the needs of private users as well as freight transportation. Thus, the fossil fuel based infrastructure is expected to be replaced by electric charging and hydrogen refueling stations. On the one hand, electric charging stations are triggering new challenges to manage MW peaks in the power demand and to use local production from renewables. On the other hand, hydrogen is a new fuel which can either be transported from large plants or produced on-site, resulting in various configurations in terms of storage and compression capacity.

The Laboratory of Physical and Analytical Electrochemistry uses his expertise to develop Grid to Mobility systems. A pilot scale demonstrator with a 50 kW alkaline electrolyzer, a high pressure hydrogen cascade and a 200kW/400 kWh vanadium redox flow battery was built. This system is operated and monitored to fully characterize hydrogen production, purification and compression systems as well as buffered charging stations to reduce grid constraints. With both models and experiments, Yorick Ligen proposes and analyzes energetic pathways for the conversion of grid electricity to mobility.

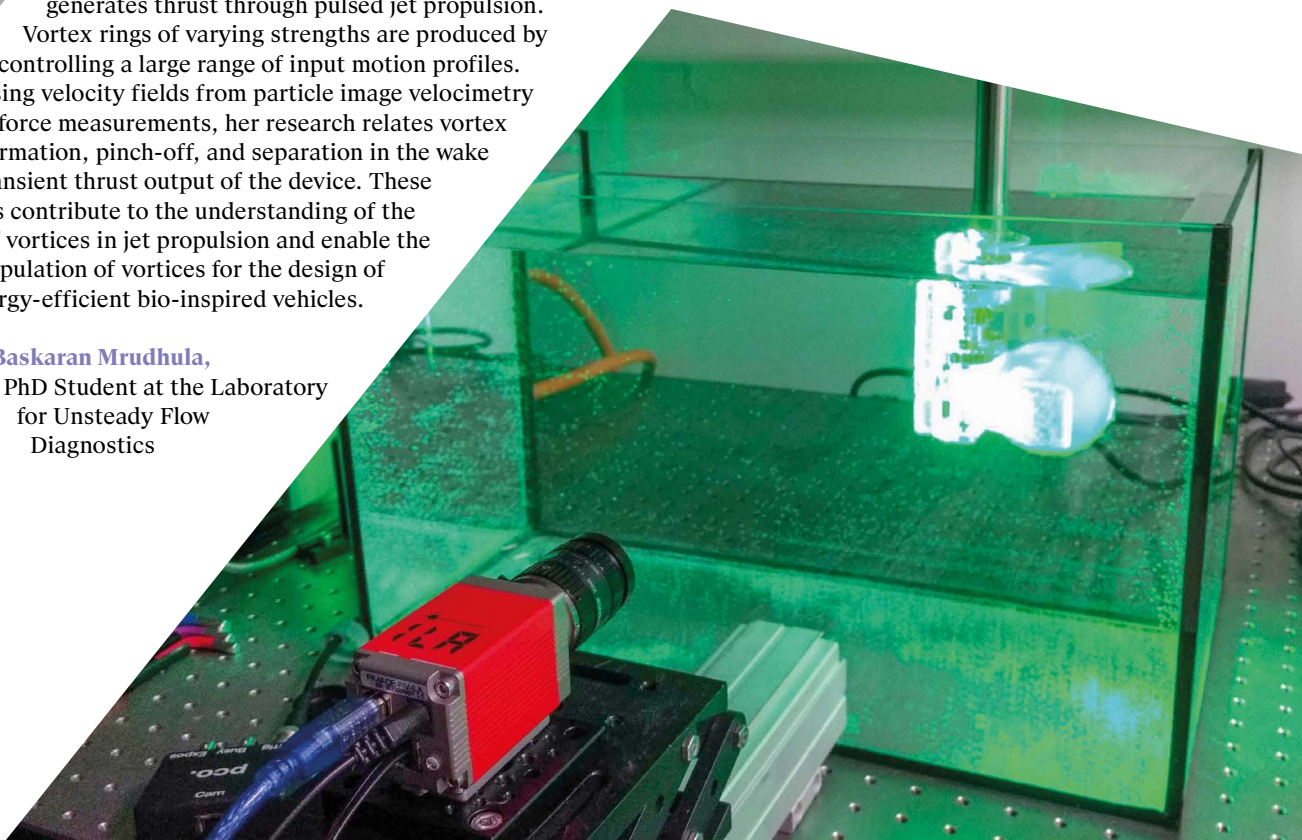
Yorick Ligen,
PhD student at the Laboratory of Physical and Analytical Electrochemistry





Jellyfish are among the most energy-efficient swimmers: their evolved physiology and propulsive motion offer them the advantage of being able to generate large amounts of thrust at low energy costs. These organisms optimally harness vortices and inspire designs for vehicles for underwater transport. In the first year of her doctoral research, Baskaran Mrudhula designed a robust vortex propulsor that generates thrust through pulsed jet propulsion. Vortex rings of varying strengths are produced by controlling a large range of input motion profiles. Using velocity fields from particle image velocimetry and force measurements, her research relates vortex ring formation, pinch-off, and separation in the wake to the transient thrust output of the device. These findings contribute to the understanding of the role of vortices in jet propulsion and enable the manipulation of vortices for the design of energy-efficient bio-inspired vehicles.

Baskaran Mrudhula,
PhD Student at the Laboratory for Unsteady Flow Diagnostics



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Power Systems Group	STI-SCI	Dr. Rachid CHERKAOUI	https://desl-pwrs.epfl.ch/
Power Electronics Laboratory	PEL	Prof. Drazen DUJIC	https://pel.epfl.ch/
Laboratory of Physical and Analytical Electrochemistry	LEPA	Prof. Hubert GIRAULT	https://lepa.epfl.ch/
Laboratory of Photonics and Interfaces	LPI	Prof. Michael GRAETZEL	https://lpi.epfl.ch/
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Thermal Engineering for the Built Environment Laboratory	TEBEL	Prof. Dolaana KHOVALYG	https://tebel.epfl.ch/
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We look forward to your eagerness to learn and discover!

EPFL's reputation has been earned by forming multi-disciplinary engineers capable of solving complex problems by applying innovative approaches. Following this path, the EPFL-EDEY PhD studies are open to candidates characterized by multidisciplinary attitudes and who are motivated to grow within a unique learning environment in which new methodologies and technologies meet in the challenging area of Energy Sciences for the 21st century.

Need more information? Visit us at

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and find out about the current opportunities, application instructions and deadlines and more.

Contact: edey@epfl.ch

Cover picture: courtesy of SOHO (ESA & NASA)