Team

Dr. Luiz VILLA
Associate professor
University of Toulouse
PhD in power electronics

More than ten years of research on software defined power electronics in collaboration with industrial partners, NGOs and fablabs.

Jean ALINEI
M.Eng Grenoble INP -
Product design and
Innovation management

More than eight years of commitment in different non-profit organizations and fablabs centered on open source technology, capacity training and empowerment.
The Energy Pyramid

Simulation (h to min)

Communication (s to ms)

Hardware (us to ns)

Modeling
Forecasting
Energy Management

Dispatching
Protocols
Algorithms

Industrial Informatics
Real-time algorithms
Sensors
Power Electronics

Energy: Reimagining this Ecosystem through Open Source DevRoom
Energy: Reimagining this Ecosystem through Open Source DevRoom

Simulation (h to min)
- Modeling
- Forecasting
- Energy management
- Dispatching
- Protocols
- Algorithms
- Industrial informatics

Communication (s to ms)

Hardware (us to ns)
- Real-time algorithms
- Sensors
- Power Electronics

Technology:
- Everest
- GridSuit & PowSyBI
- Power Grid Model
- OpenSTEF
- CitrineOS
- Power Profiling
- OpenSCD
- OCPP
- ShapeShifter
- OpenSTEF
- SEAPATH
- FlexMeasures
- RTE OP Cost
- Perf
- Quartz Solar OS
- PyPSA
- Carbon Meas.
- Wind Power Failure
- RTE OP Cost
The Energy People

Today we have the bricks, tomorrow we’ll build pyramids.

We, the energy people, have the power to change the world!
Hardware is hard, until it isn’t...

**2005**
Arduino has made industrial informatics accessible to everyone

**2008**
Raspberry pi has made informatics accessible to everyone

**2015**
Micro:bit allowed children to learn how to code

**2023**
OwnTech will make power electronics accessible to everyone
Demand for power electronics is continuously growing while there is no technological mean to streamline training and foster innovation.

OwnTech proposes a community-based revolutionary compact, versatile, open-source and low cost technology for learning and prototyping power electronics.
OwnTech is a Technology Sandbox

OwnTech user-centric technology sandbox provides all elements to foster a community of users and developers

The OwnTech foundation ensures open and fair access to the technology sandbox

This fertile open sandbox produces impact

- Standard Hardware
- Intuitive IDE
- Unified documentation
- Open Data Monitoring
- Makers and fablabs
- New ideas
- New talents

Technology Sandbox: A combination of open-hardware, open-software and with community-based activities to foster bottom up innovation

The technology can be used for limitless amount of applications such as Smart Grids, electrical mobility, energy storage and much more

The open technology enables learning by doing and fosters community exchange

Energy: Reimagining this Ecosystem through Open Source DevRoom

2/3/2024
Power Hardware – Some basics

- **Power Electronics**
  - Power circuits that manage input-output power flows

- **Measurements**
  - Circuits that adapt sensors to industrial informatics

- **Feeder Circuit**
  - Small circuit that leeches some energy to power everything

- **Drivers**
  - Circuits that adapt control signals to power signals

- **Control**
  - Industrial informatics
  - Algorithms
  - Real-time algorithms

- **Communication**
  - Protocols

---

Energy: Reimagining this Ecosystem through Open Source DevRoom
The TWIST Board: Multi-disciplinary hardware education platform

- Power Electronics circuits
- Feeder circuit
- Driver Circuits
- Communication Circuit
- Measurement circuits
- SPIN Control Board

Energy: Reimagining this Ecosystem through Open Source DevRoom
The TWIST Board: stackable power

A standard power module
- 300W per module
- Compact 160x100mm form factor
- Optimized for fab'

As a stand alone module..
The same simple ergonomics.

Or in industrial 19” rack..

Adapts to any power rating
Adapts to any power functionality

300W
3kW
30kW

Use case example for Industry
Control engineers setting up their test benches in short periods of time. They are also seamlessly changing their models and reprogramming the converter to control their target application.

Use case example for Industry

Communication system on an RJ45 cable
- CANBus for Housekeeping
- RS485 for fast communication
- Analog ultra-fast communication
- Real-time Synchronization Pin

Energy: Reimagining this Ecosystem through Open Source DevRoom
The SPIN Board: Versatile control

A standard control module

- High Resolution PWM
- Flexible API
- 12bit ADC
- IoT ready

A standard software suite

- Matlab compatible
- C-Code based
- Zephyr OS based
- Modular and open

Use case example for Education

Instructors can easily upload their models to the spin board and test algorithms and control theory with students. Legacy hardware can still be used.

Use case example for Industry

Control engineers, after setting up their test benches with TWIST, can seamlessly transfer their algorithms to their custom power hardware.

Energy: Reimagining this Ecosystem through Open Source DevRoom
Our stack

**USER CODE**
Code that uses the APIs to deploy an algorithm

**TWIST API**
Calls the power electronics functions and safety

**Communication API**
Handles the communication

**SPIN API**
Calls all the microcontroller peripherals

**Task API**
Handles the creation of tasks

**Zephyr RTOS**
Real-Time Operating System

---

Energy: Reimagining this Ecosystem through Open Source DevRoom
The SPIN Board: Versatile control
OwnTech is open-source

Open Tool

TWIST et SPIN
CERN-OHL-S-V2

All changes have to be shared with the community

Documentation
CreativeCommons SA-BY

Share Alike – The documentation must keep its current licence

Can be sold, modified but must remain open-source

OwnDev + OwnPlot
GPL V2

Can be interfaced with open-source and proprietary libraries

Dataware
Apache 2

Can be interfaced with open-source and proprietary libraries

CopyLefted - Hosted by CNRS

Solution

Solutions
Licence of your choice

Open-source or proprietary

Open-o-meter - 8/8

- The design files are available
- Assembly instructions are available
- Component list is available
- Contribution guide is available
- CAD files available in editable format
- Assembly instructions available in editable format
- Component list available in editable format
- All information is available for commercial use

Energy: Reimagining this Ecosystem through Open Source DevRoom
A hybrid and validated legal structure

OwnTech Foundation
Under the aegis of the CNRS foundation
Holds the tool I.P.
Animates the community

OwnTech Start-Up SAS
Manufactures the hardware
Provides Services

LAAS-CNRS
Joint Research projects
New Open-Hardware developments
OUR ACTION

Create MOOC and tutorials for technological educational in energy and power electronics

Coordinate a global digital community to foster international collaboration

Organize training sessions and events to answer local energy uses cases

Energy: Reimagining this Ecosystem through Open Source DevRoom
Local energy production and consumption is a key to peer-to-peer energy systems. We will demonstrate how OwnTech can be used to illustrate these energy exchanges.

OwnTech proposes to open-source the power electronics dedicated to the neighborhood-level energy exchange and micro-grid design.
Open-Source Drive Train and charger

The Vhelio uses an assembly of proprietary components to build its drive train and battery.

OwnTech is working to open-source the power electronics dedicated to the drive train, BMS and battery charger to facilitate its maintenance, flexibility and long-term perennity.