
OwnTech
Open Digital Power

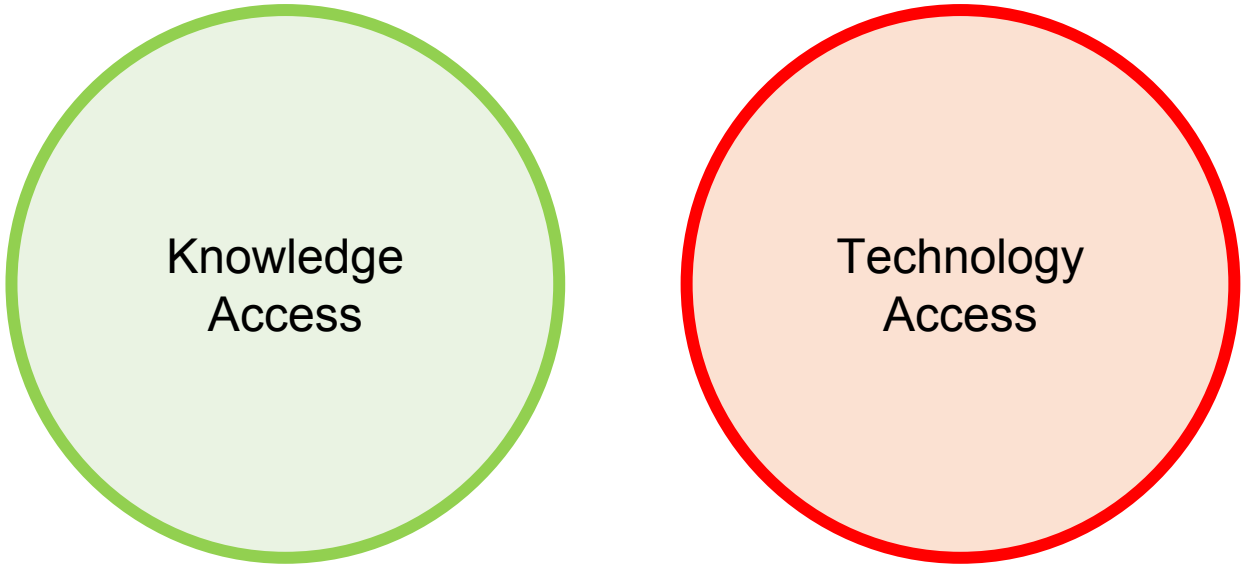

cnrs


LAAS
CNRS

# Table of content

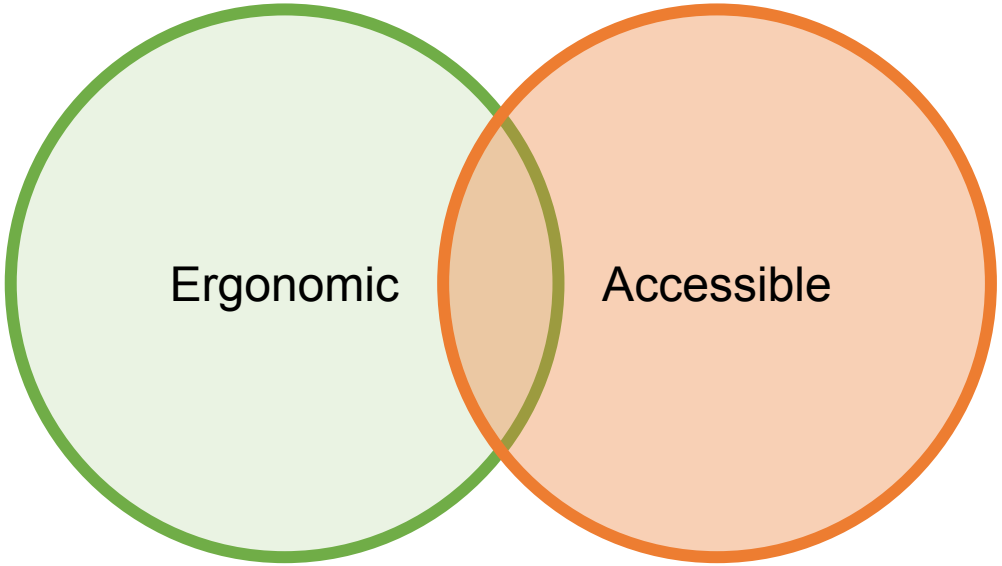
- OwnTech Values
- Power Electronics Ergonomics
- OwnTech solution Overview
- Development philosophy

# Our Values

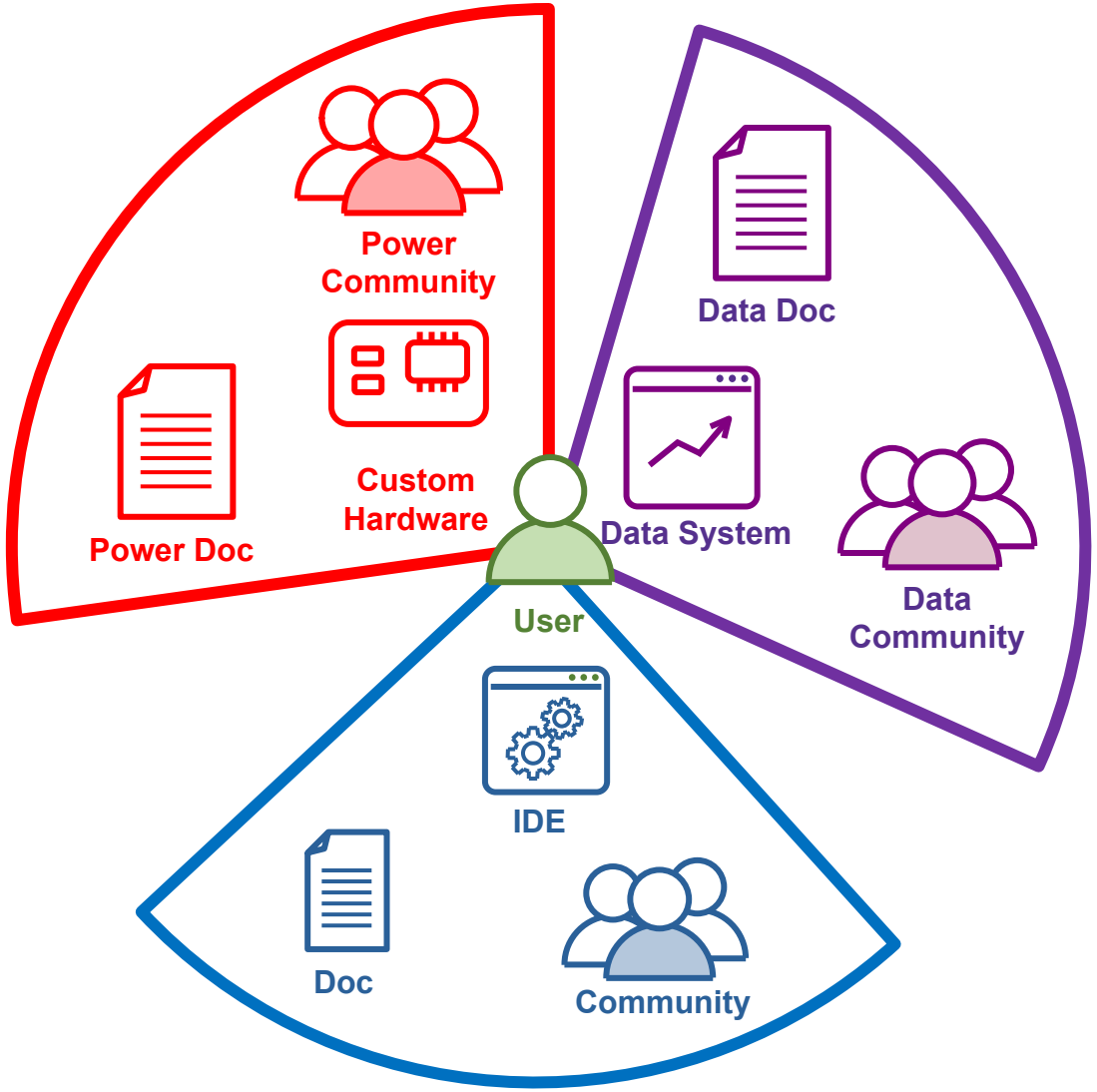

Knowledge Access
Technology Access
Autonomous Development
Local Independence
Decentralized Education
Local value creation
Bottom-up enabler
Decentralize action

# Democratize access to power electronics

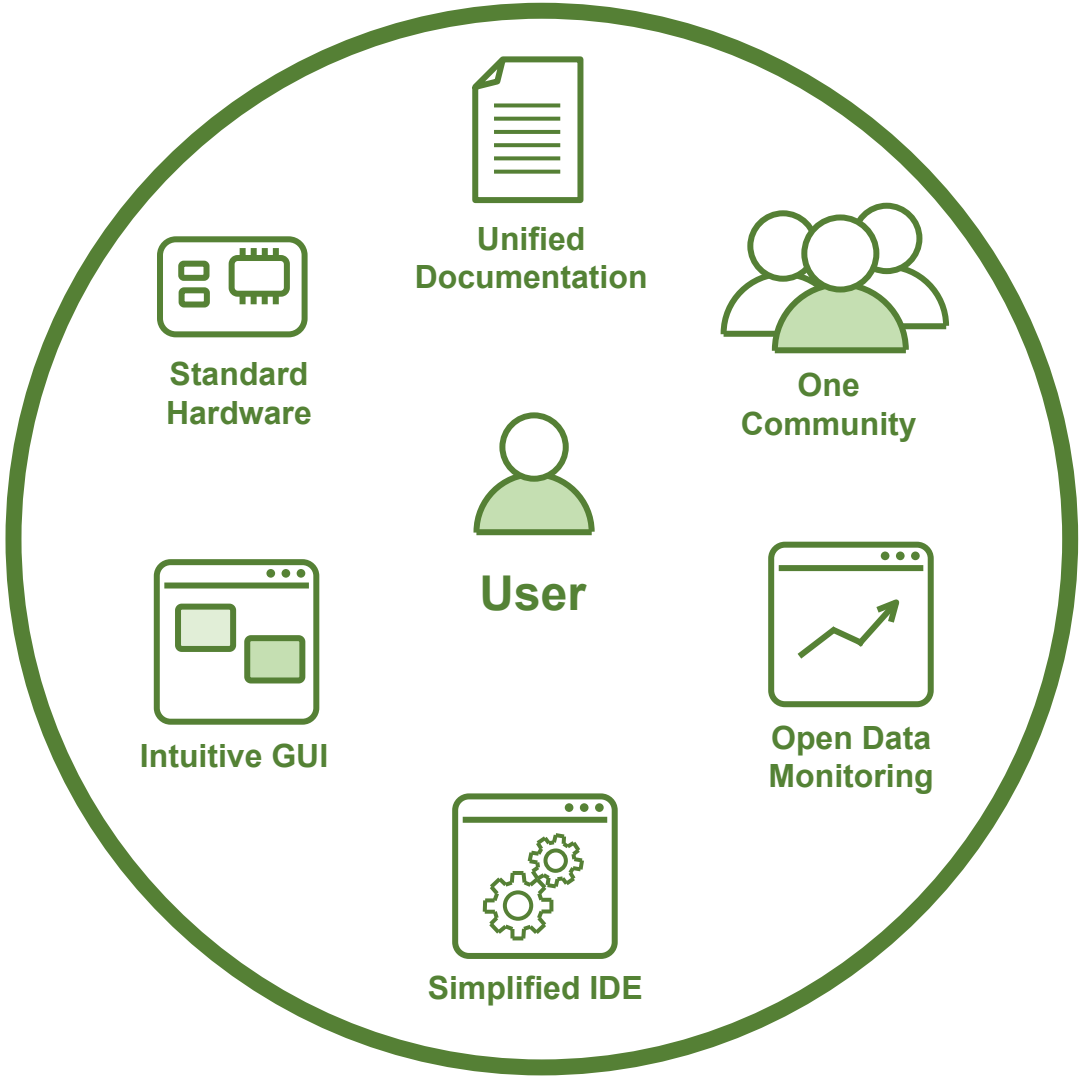
# Democratize access to power electronics



# Power Electronics User Experience



# Ergonomics: Integrate the experience



# Ergonomics: Know your community

General User

Beginner developer

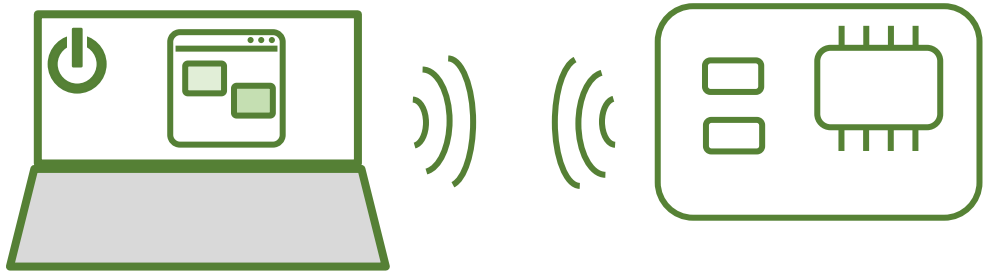
Experienced developer

Advanced developer

# Software defined power converters

**Beginner developer**

**Advanced developer**

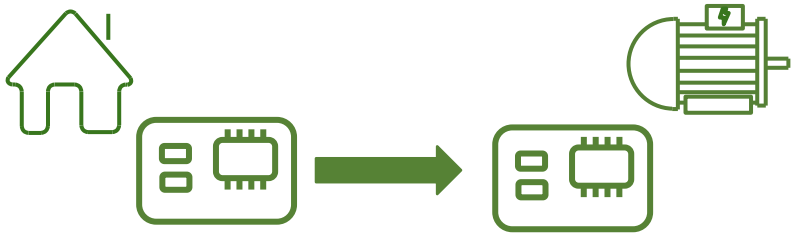


**Key Features**

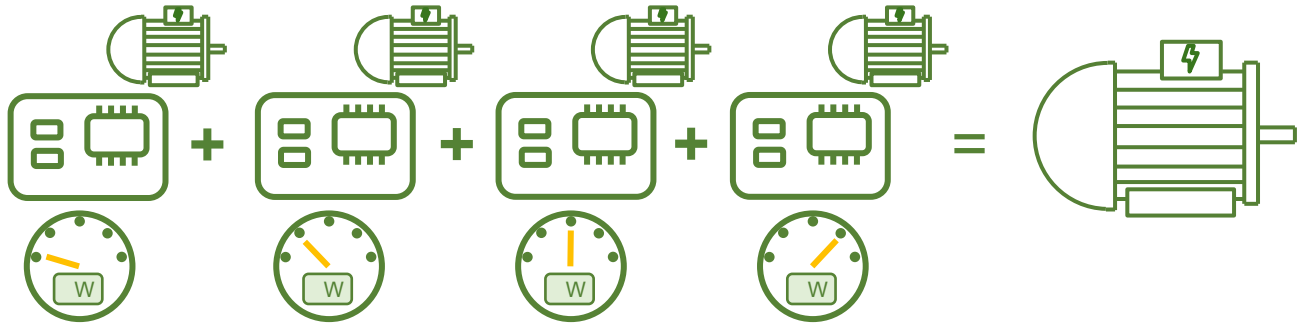
- Easy-to-use
- Fully safety-focused
- Reprogrammable
- Stackable

# Stackable and reprogrammable power hardware

**Beginner developer**



**Advanced developer**




## Key Features

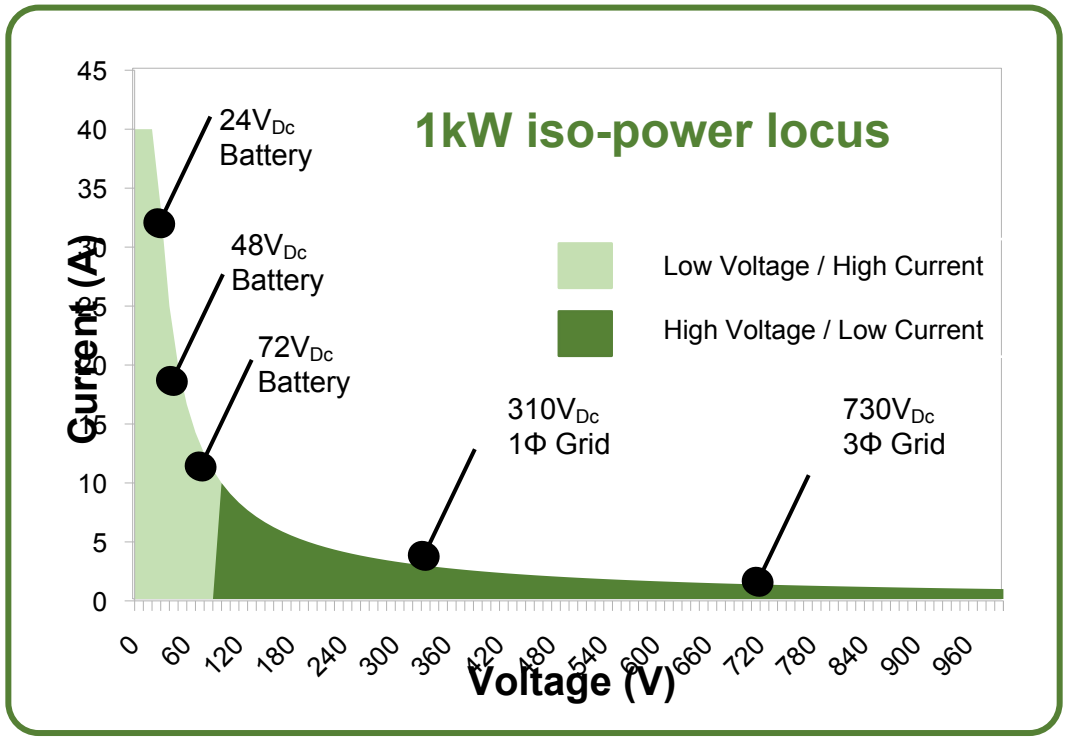
Easy-to-use

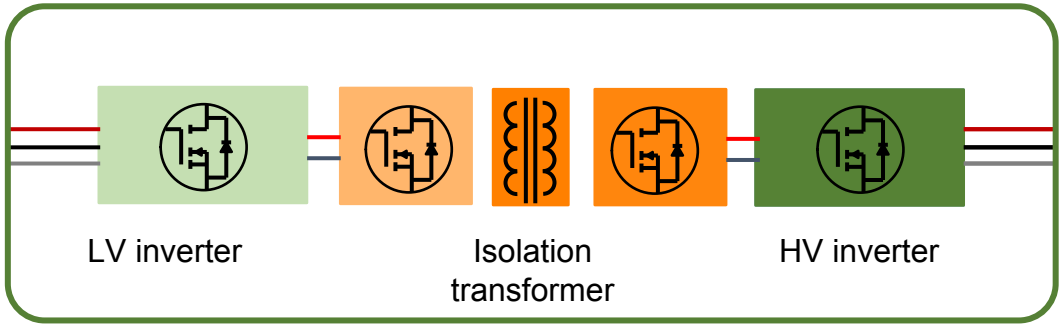
Fully safety-focused

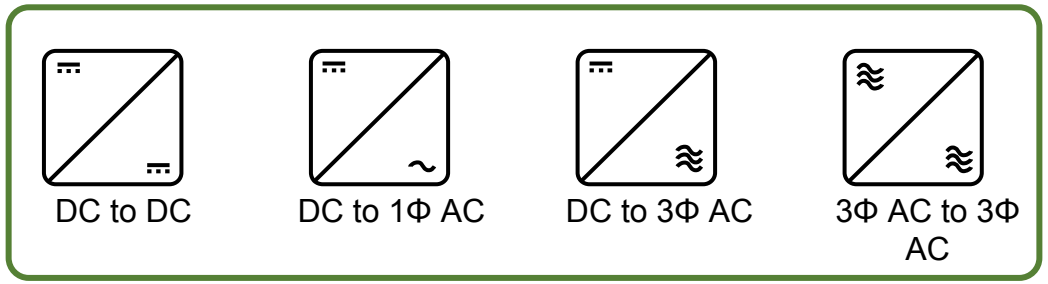
Reprogrammable

Stackable

# Ultra wide V-I range
# Software defined power converter



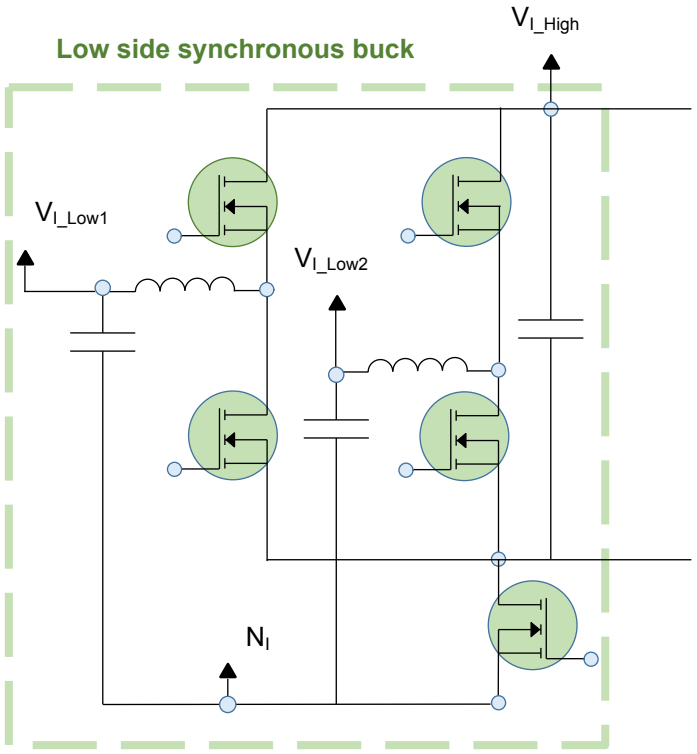

## Key Features

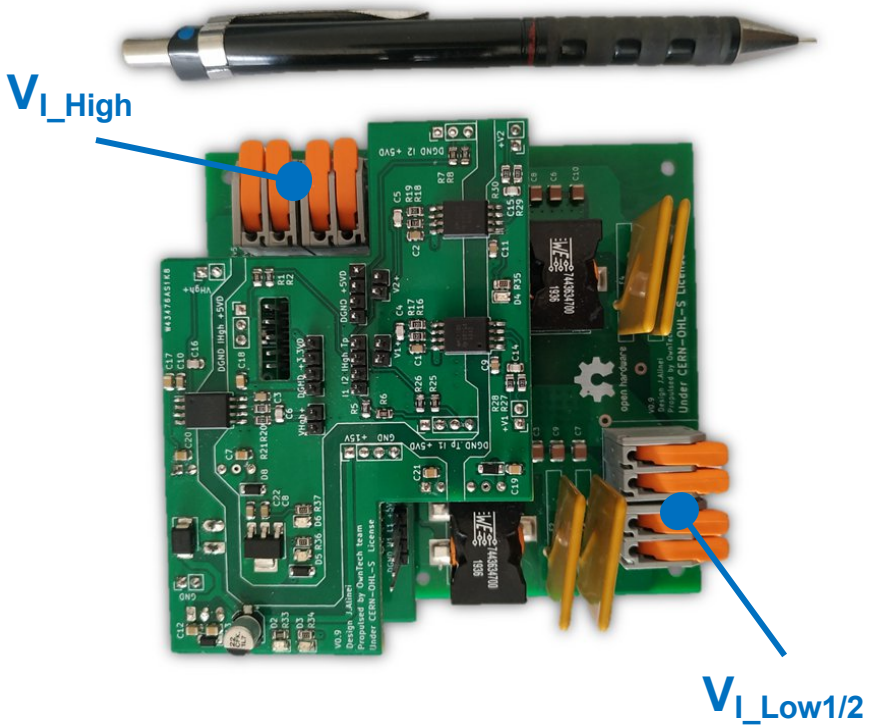
OwnTech converter operates in one of the mode above.
This conversion mode can be from

High side to Low side,
Low side to High side
Low side to Low side(1)
High side to High side(1)

(1) Except for 3Φ to 3Φ

# Low-Side Synchronous Buck



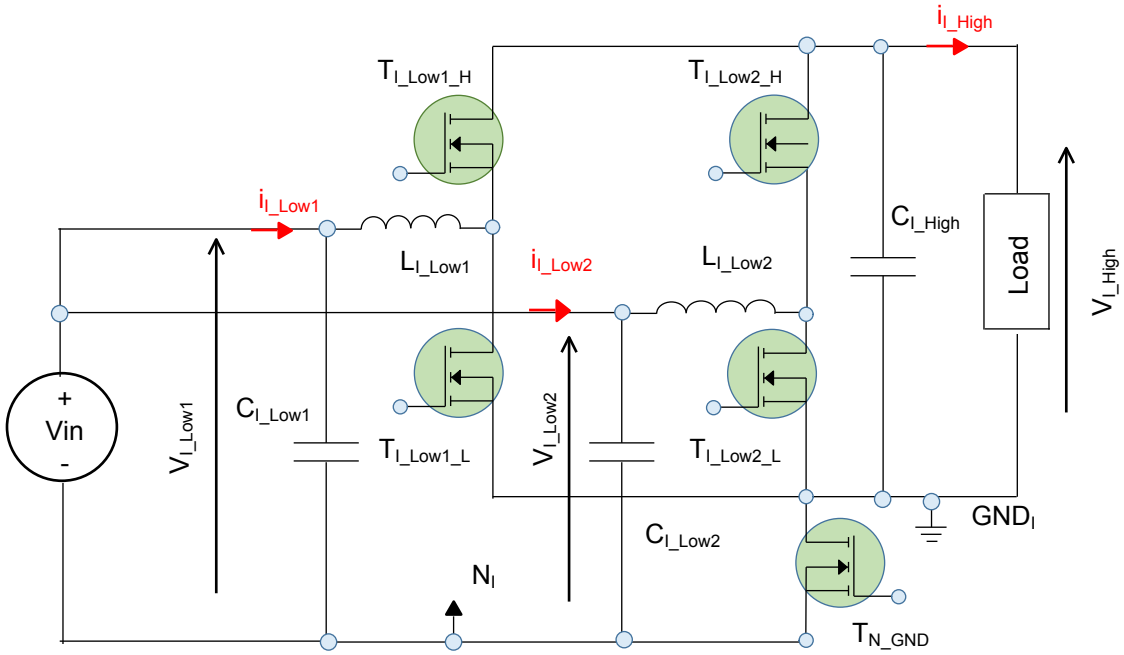




## Key Applications

- PV MPPT
- Battery charge/discharge
- Droop control
- DC-power micro-grid

| Variable | Value |
|---|---|
| $P_{Rated}$ | 300W |
| $F_{switch}$ | 200kHz |
| $I_{I\_Low}$ max | 16A |
| $V_{I\_Low1/2}$ range | 12 to 80V |
| $V_{I\_High}$ range | 60 to 90V |

# Low-Side Synchronous Buck DC-DC interleaved boost case




## Key Applications

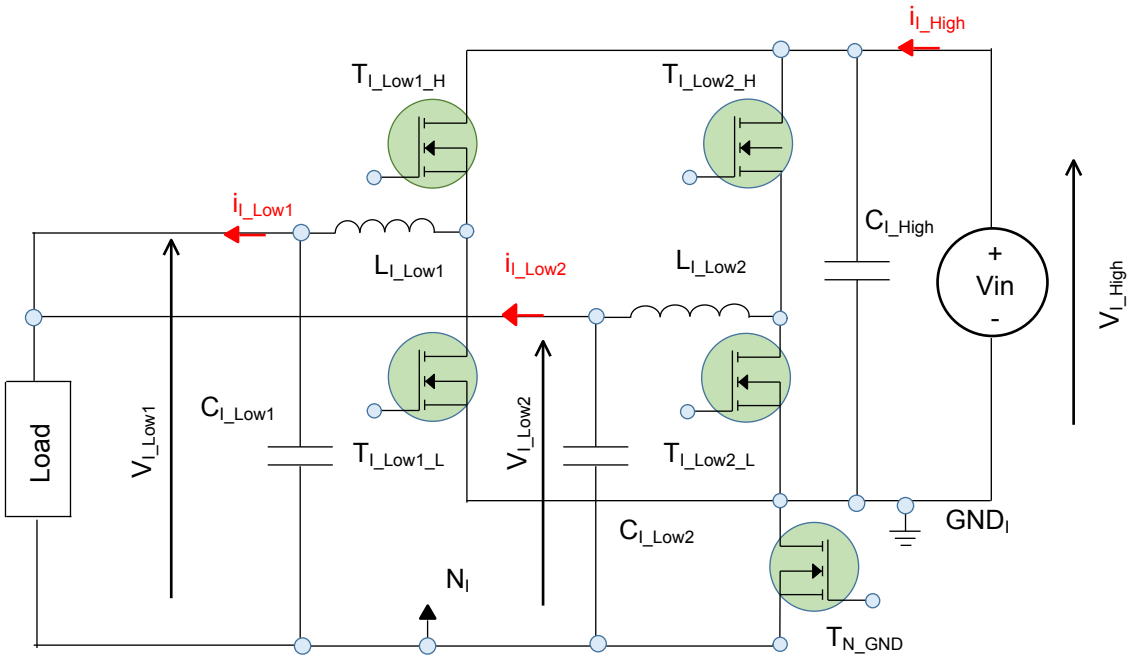
Battery charge/discharge

Stand-alone PV system

DC-power micro-grid

| Variable | Value |
|---|---|
| $T_{N\_GND}$ | ON |
| Function | Interleaved Boost |
| Vin | 24V |
| Vout | $V_{I\_High}$ |
| Vref | 50V |

# Low-Side Synchronous Buck DC-DC interleaved buck case




## Key Applications

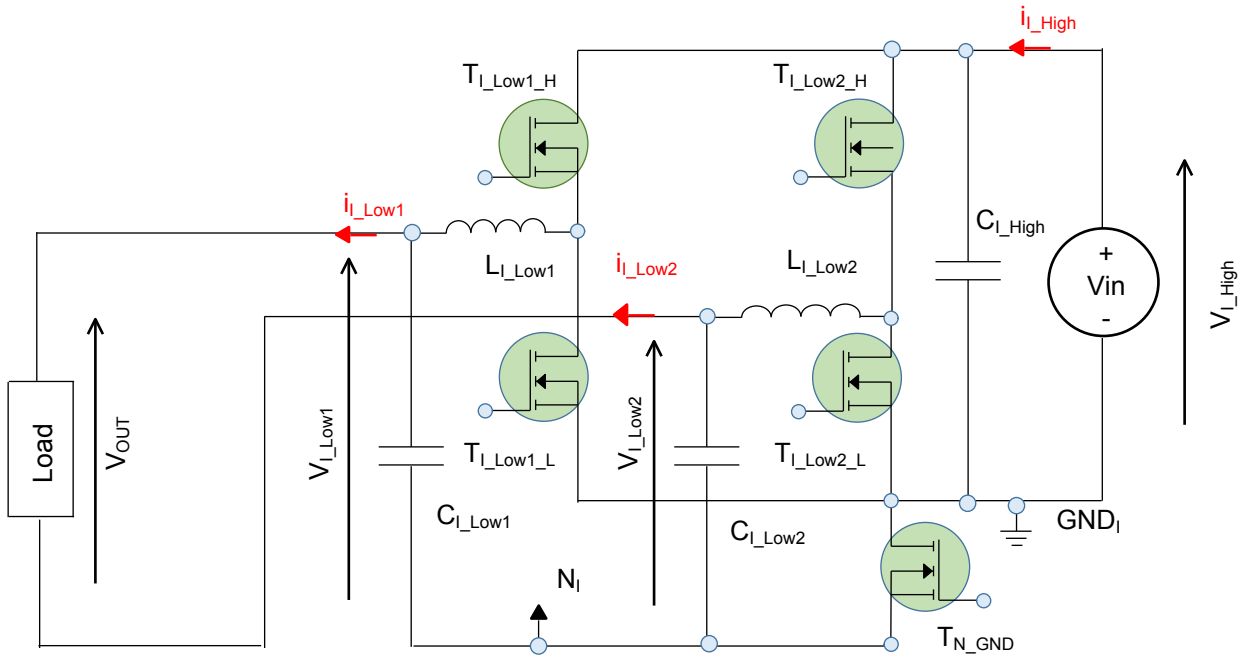
Battery charge/discharge

Stand-alone PV system

DC-power micro-grid

| Variable | Value |
|---|---|
| $T_{N\_GND}$ | ON |
| Function | Interleaved Buck |
| Vin | 50V |
| Vout | $V_{I\_Low1}$ and/or $V_{I\_Low2}$ |
| Vref | 24V |

# Low-Side Synchronous Buck
# DC-AC buck inverter case



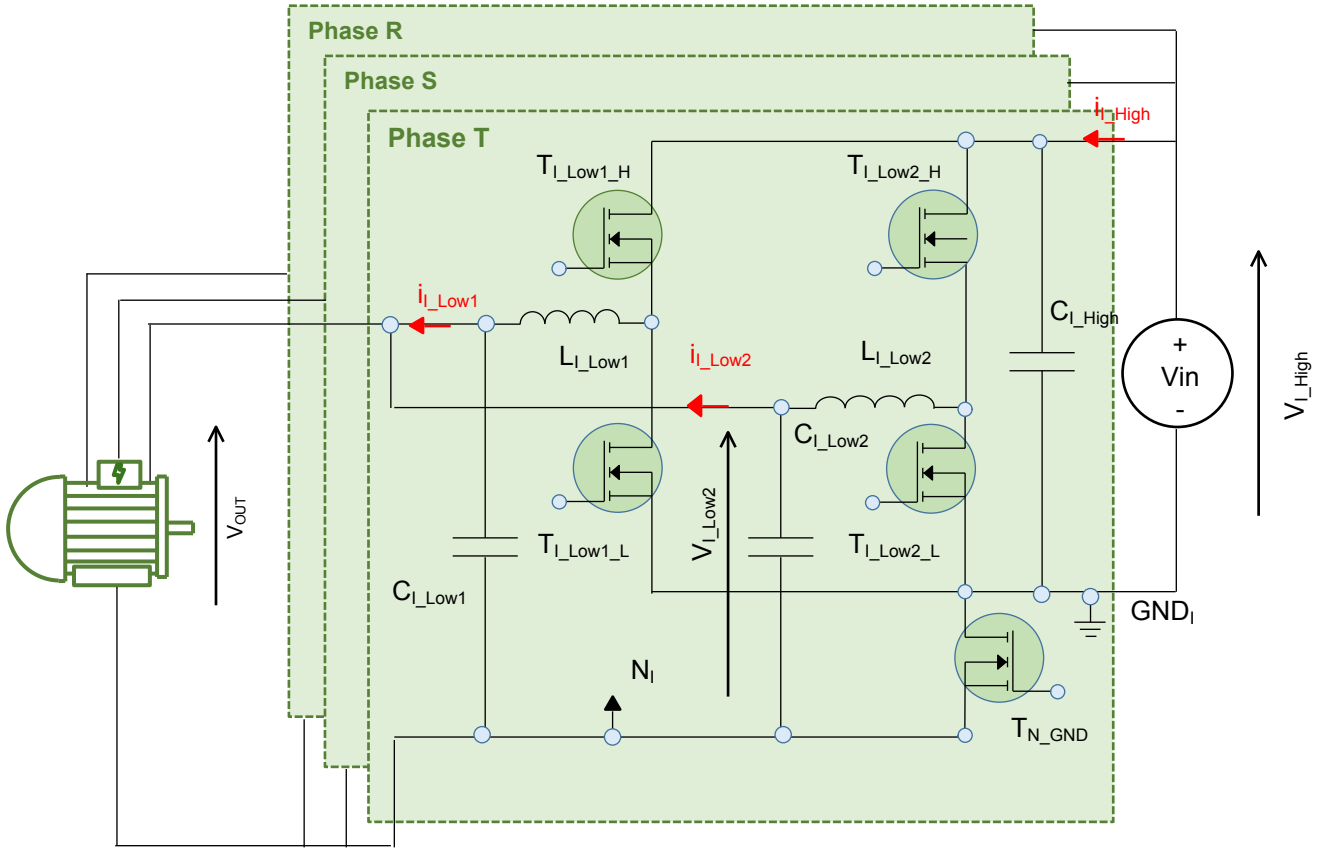

## Key Applications

Small mobility (1 of 3 phases)

Control system prototyping

| Variable | Value |
|---|---|
| $T_{N\_GND}$ | **OFF** |
| Function | Buck 1phase inverter |
| Vin | 110V |
| Vout | $V_{I\_Low1}$ - $V_{I\_Low2}$ |
| $Vref_{PK}$ | 55V |
| $Vref_{RMS}$ | 38.9V |

# Low-Side Synchronous Buck
# DC-AC buck inverter case




## Key Applications

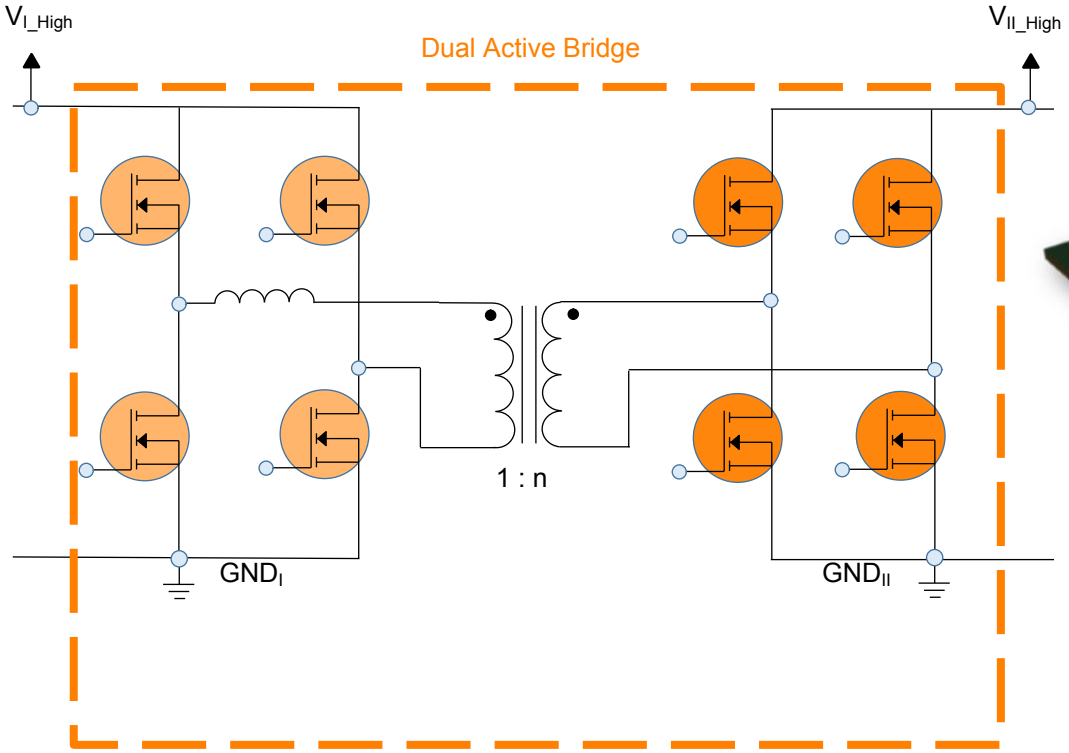
Small mobility (3 phases)

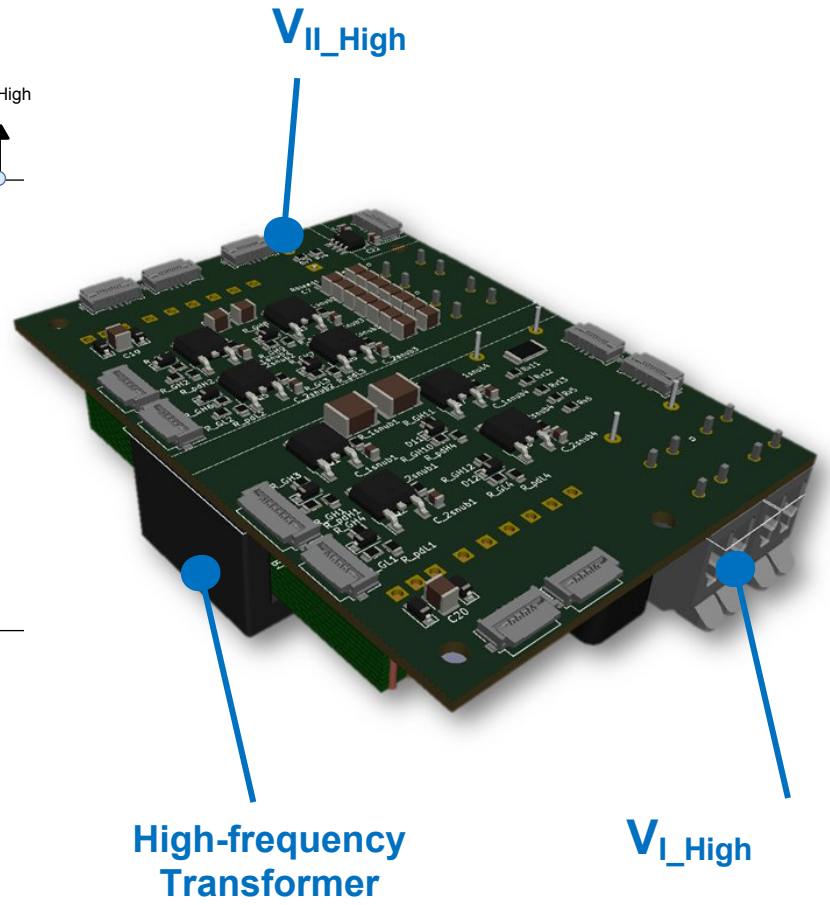
Control system prototyping

Motion control

| Variable | Value |
|---|---|
| $T_{N\_GND}$ | **OFF** |
| Function | Buck 3phase inverter |
| Vin | 110V |
| Vout | $V_{I\_Low1}$ - $V_{I\_Low2}$ |
| $Vphase_{RMS}$ | 38.9V |
| $Vline_{RMS}$ | 67.4V |

# Dual Active Bridge



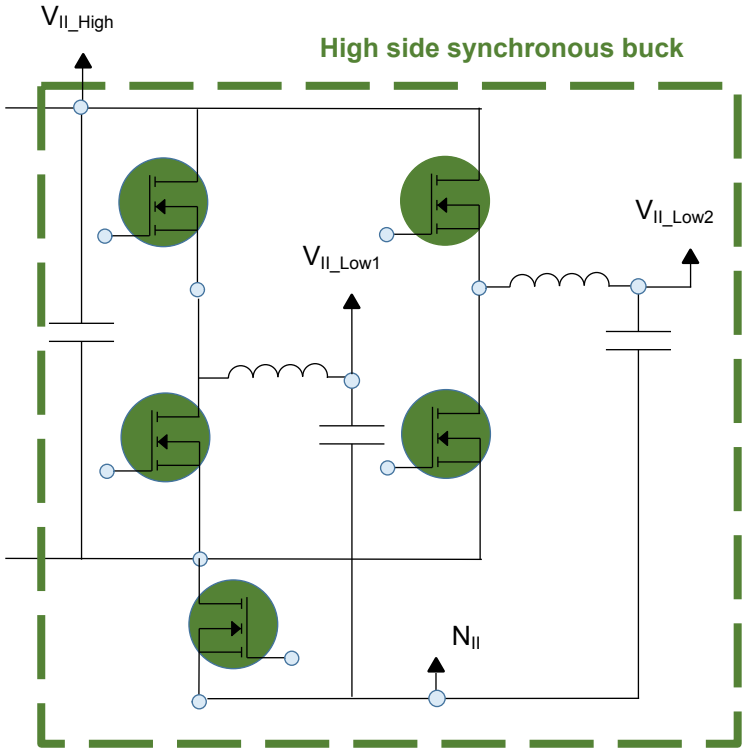

## Key Applications

Galvanic isolation

MVDC bus

| Variable | Value |
|---|---|
| $P_{Rated}$ | 300W |
| $F_{switch}$ | 200kHz |
| $V_{I\_High}$ range | 60 to 90V |
| $V_{II\_High}$ range | 350 to 450V |

# High-Side Synchronous Buck



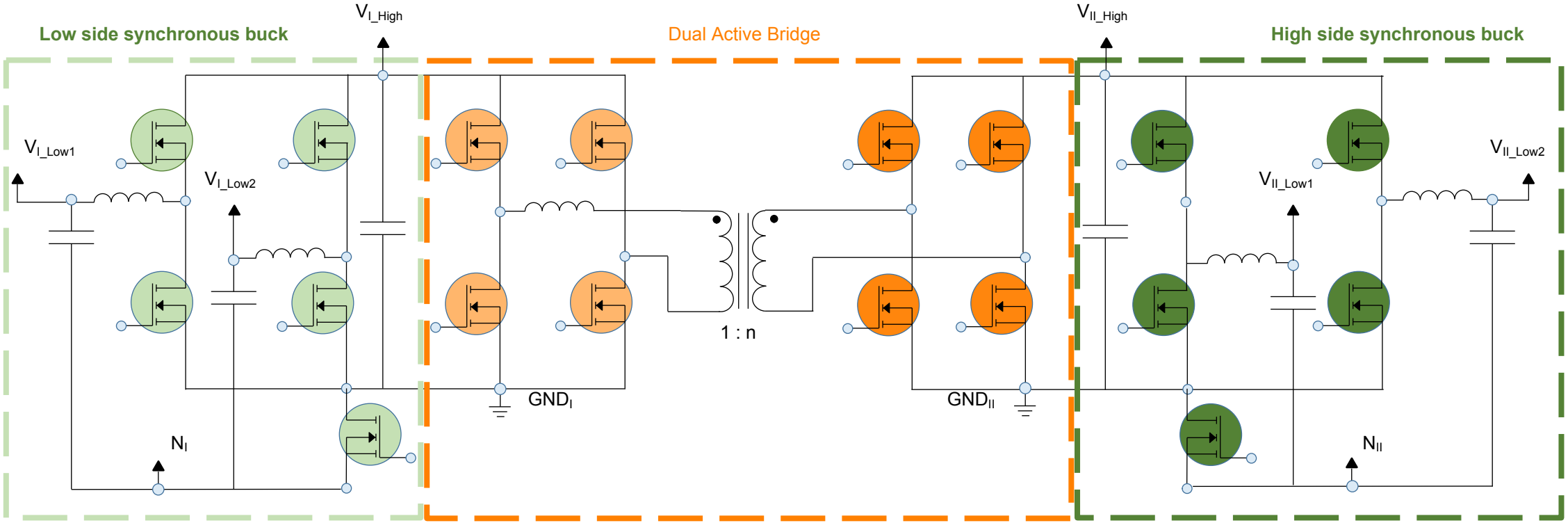

**Work in progress**

## Key Applications

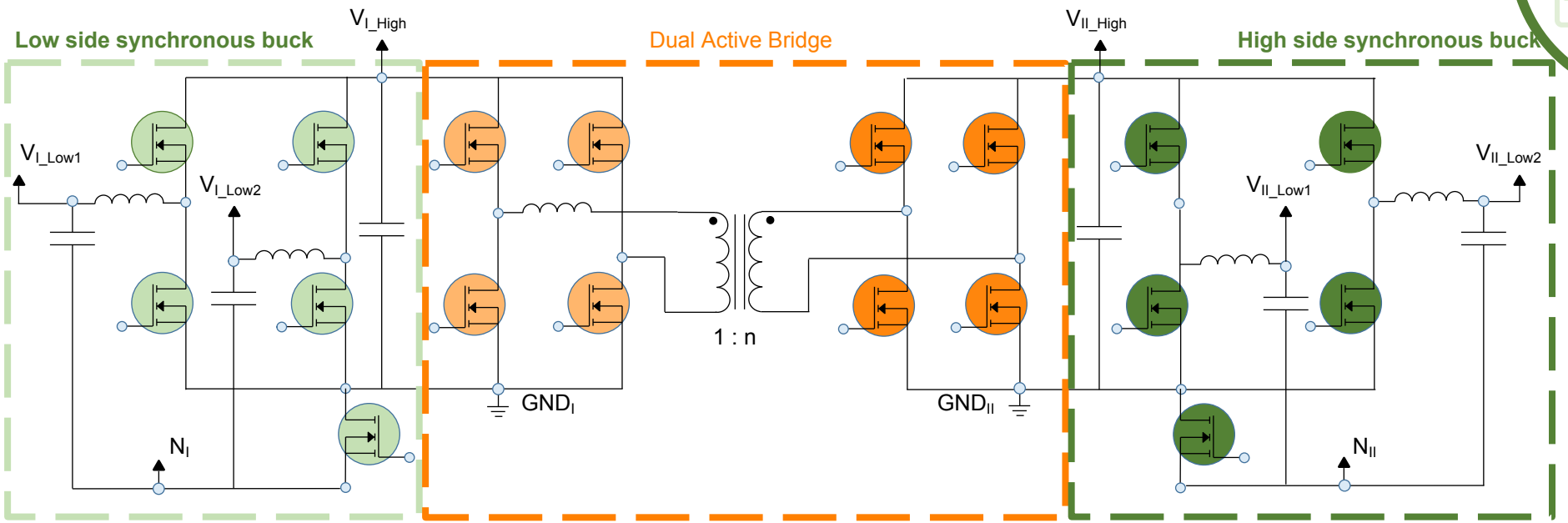
- PV MPPT
- 1-phase AC
- 3-phase motor control
- DC-power micro-grid

| Variable | Value |
|---|---|
| $P_{Rated}$ | 300W |
| $F_{switch}$ | 200kHz |
| $V_{II\_Low1/2}$ range | 350 to 450V |
| $V_{II\_High}$ range | 80 to 320V |

# Solid-State Transformer
# Power architecture



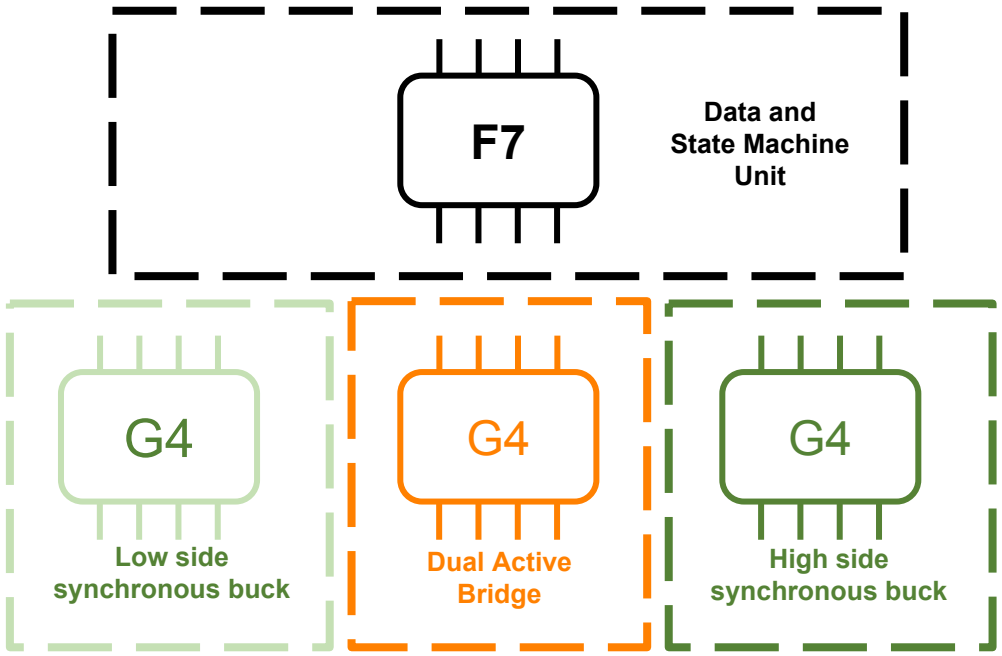
# Operating ranges for a single block




| Variable | Value |
|---|---|
| $P_{Rated}$ | 300W |
| $F_{switch}$ | 200kHz |
| $I_{I\_Low}$ max | 16A |

| Variable | Value |
|---|---|
| $V_{I\_Low1/2}$ range | 12 to 80V |
| $V_{I\_High}$ range | 60 to 90V |
| $V_{II\_High}$ range | 350 to 450V |
| $V_{II\_Low1/2}$ range | 80 to 320V |

# STM32 based digital architecture



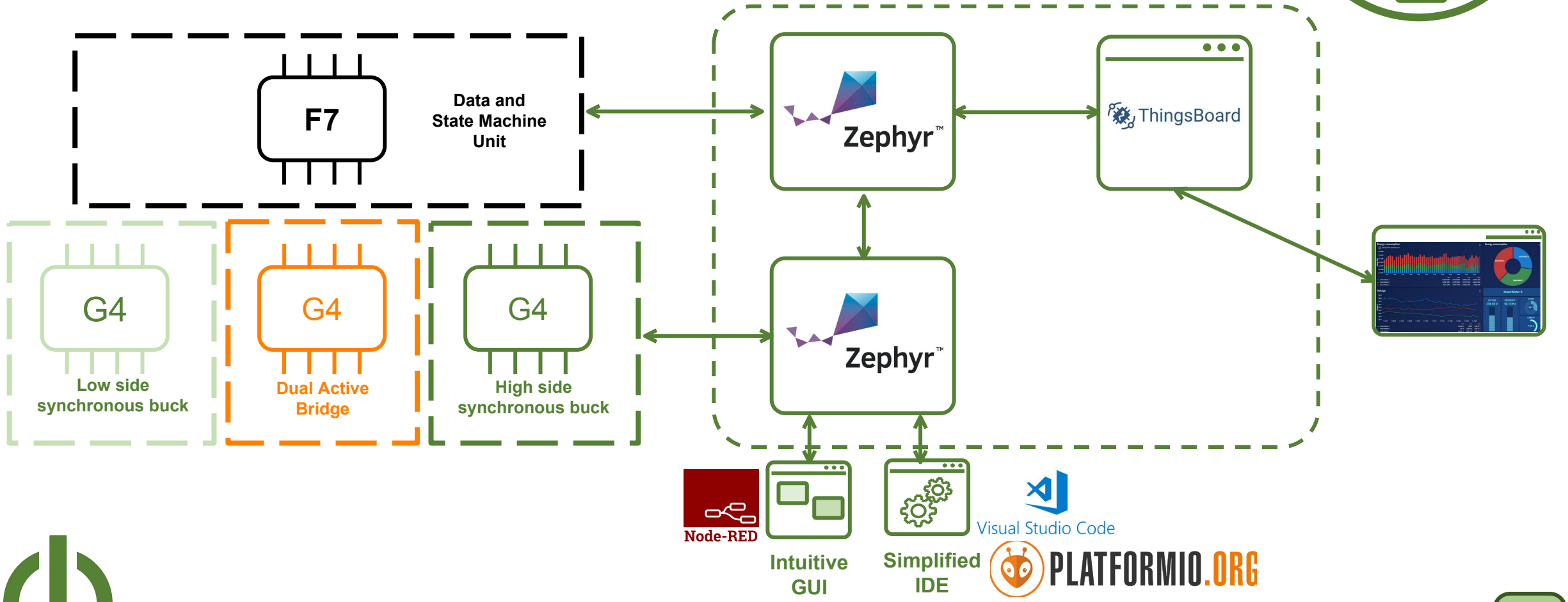

## Key features

Digital architecture easy to control and reprogram

Develop your own power application with ease

Thought with longevity and expansion in mind

# STM32 based digital architecture
# Open source solution



# DC Micro-Grid Use Case

F7

Data and State Machine Unit

CAN BUS

CAN BUS

CAN BUS

G4

G4

G4

Low side synchronous buck

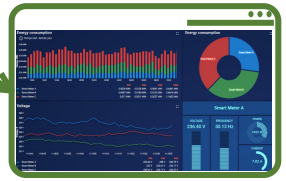
Low side synchronous buck

Low side synchronous buck

Zephyr™

Zephyr™

ThingsBoard



Node-RED

Intuitive GUI

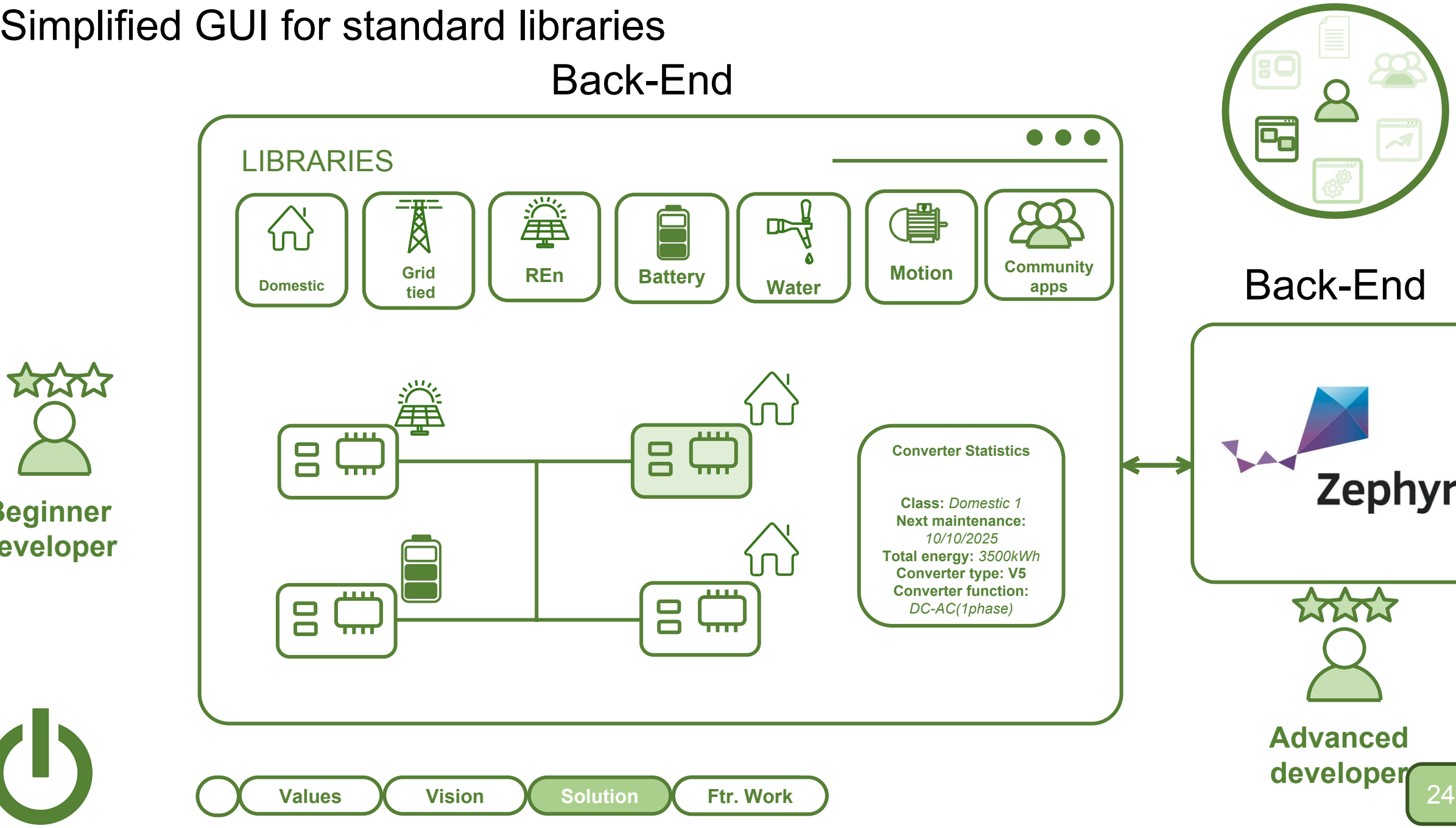
Simplified IDE

Visual Studio Code

PLATFORMIO.ORG

Values | Vision | Solution | Ftr. Work

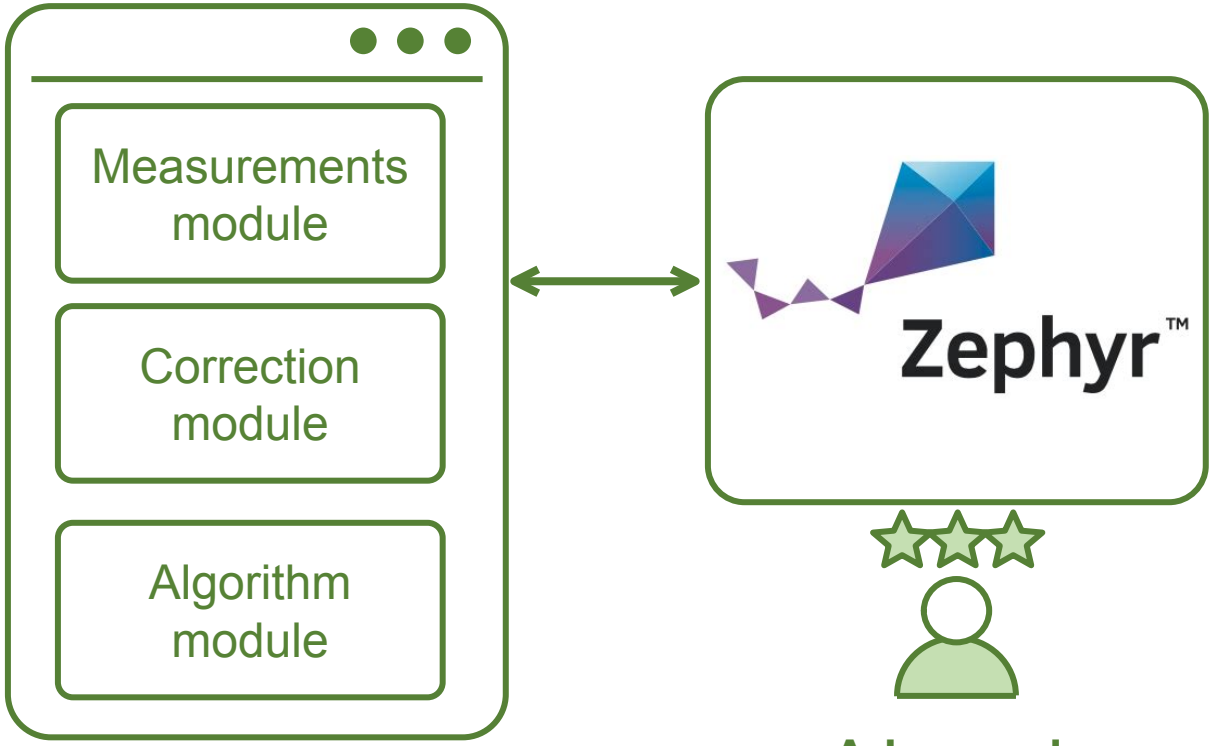
# Simplified GUI for standard libraries



# OwnTech IDE

## Simplified IDE

## Back-End




**Experienced developer**

**Advanced developer**

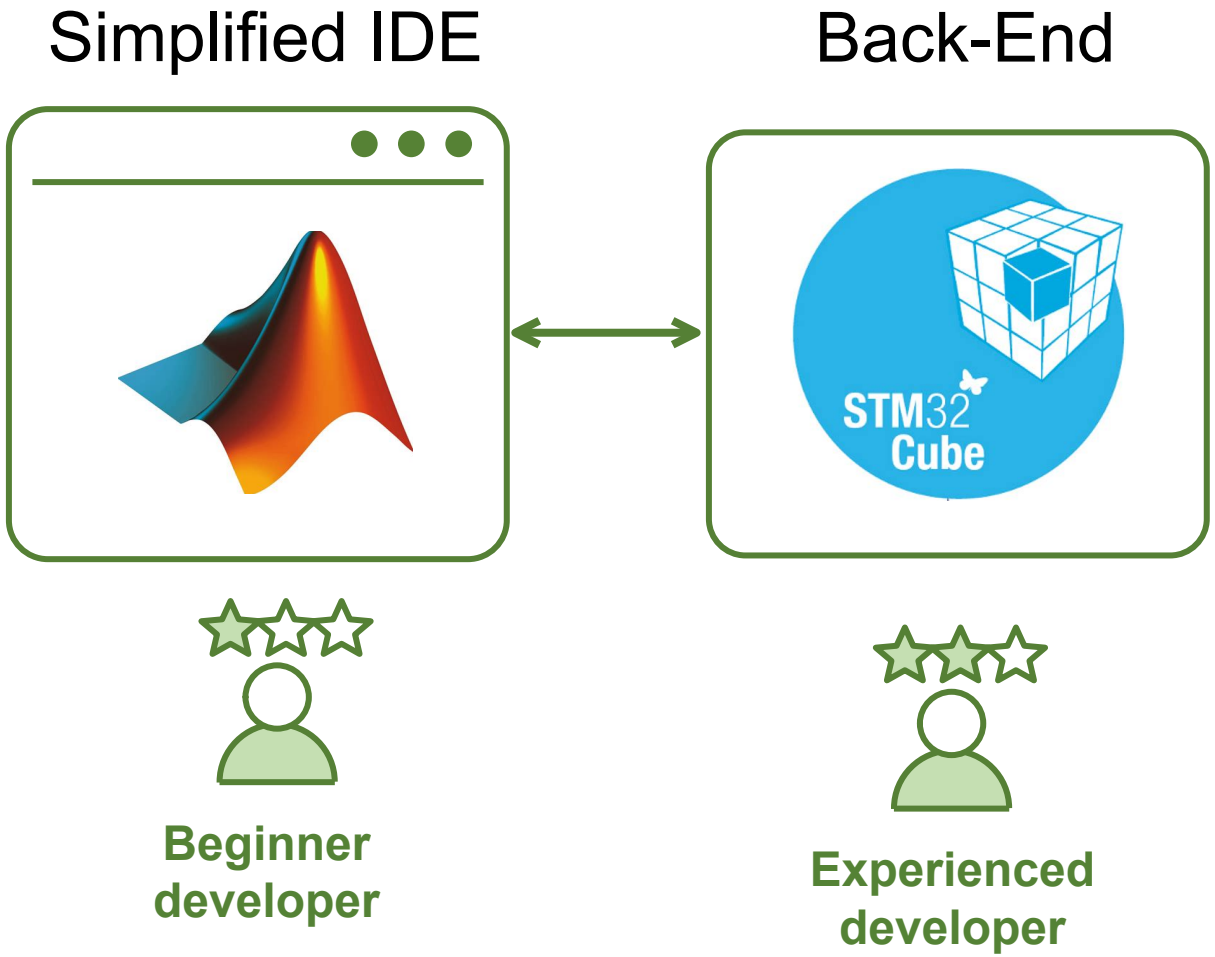
## Key features

STM32-based digital architecture

Simplified front-end for module-oriented development

Powerful Open-Source RTOS on back-end to simplify maintenance and provide community support

# Other IDEs

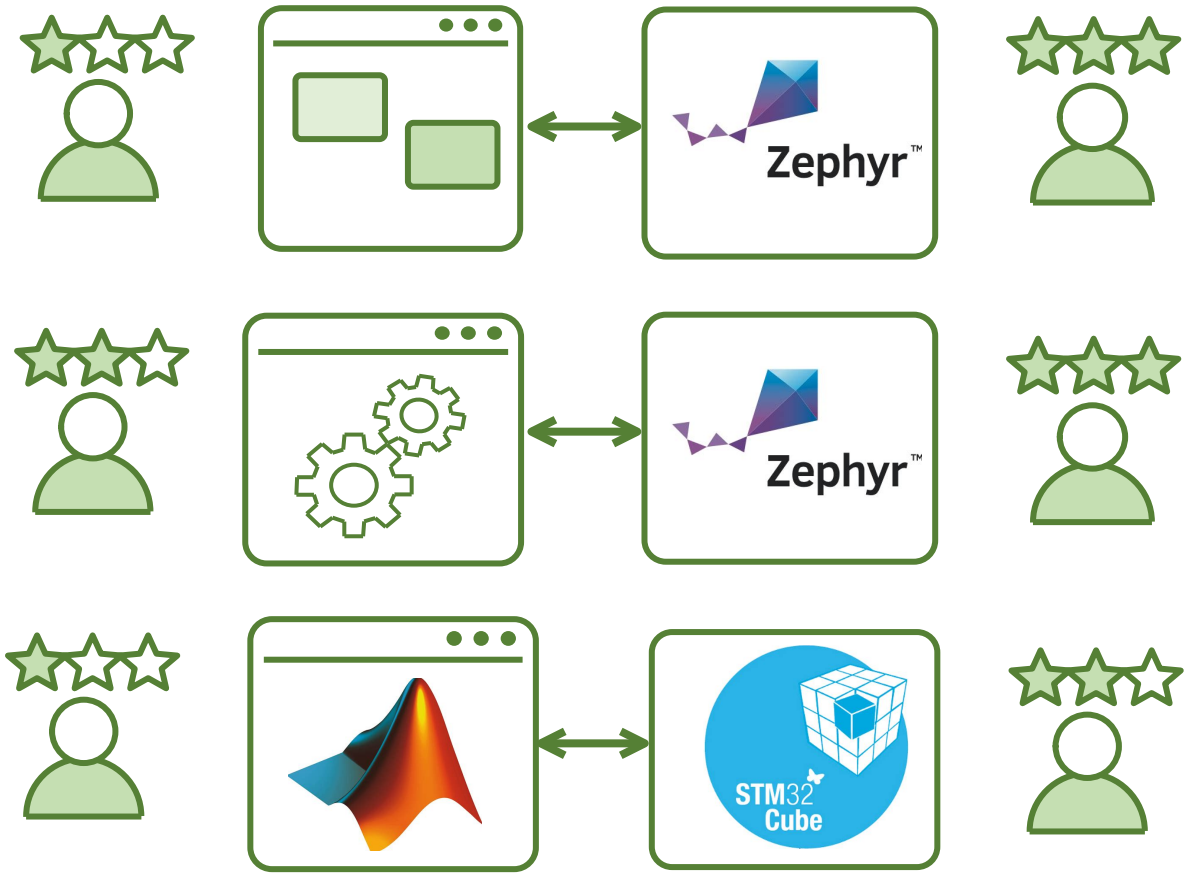



## Key features

Matlab based experience

Interface directly with STM32

# User interface summary




## Key features

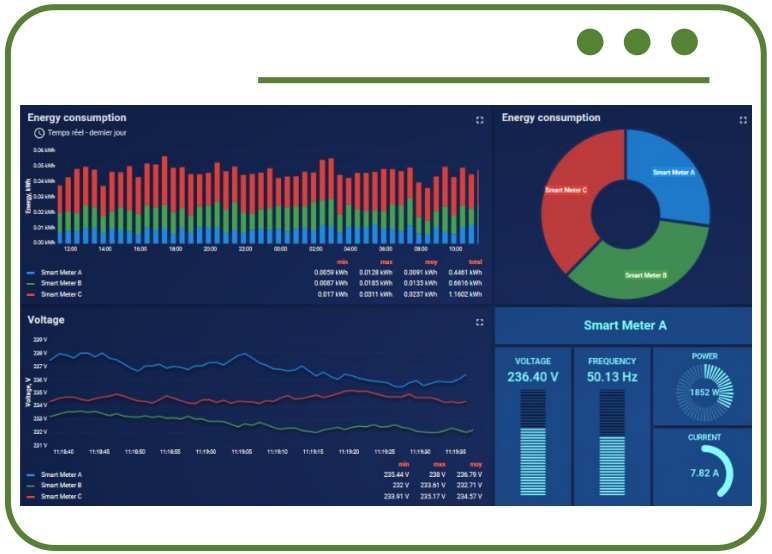
There are three possible interfaces

Two are totally open source

The third one is more compatible to current academic and industrial uses

# Simple and open data monitoring

## Front-End




## Back-End


**General User**

**Beginner developer**

**Experienced developer**

**Advanced developer**

## Key features

A highly intuitive FrontEnd

Easy to observe data and create dashboards

An open-source back end where advanced developers can collaborate

Advanced funcitons as pay-as-you-go and predictive maintenance

# Project status - Community

Unified Documentation

25%

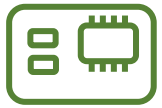
One Community

50%

- WordPress website recently created, ready to deploy communication material and documentation
- GitLab with design files, manufacturing files already online

- Engaged with researchers, developers, ready to give a hand as soon as the prototype is available
- Engaged with Zephyr-OS developers

# Project status



Standard Hardware

60%

One Community

50%

Intuitive GUI

10%

Open Data Monitoring

70%

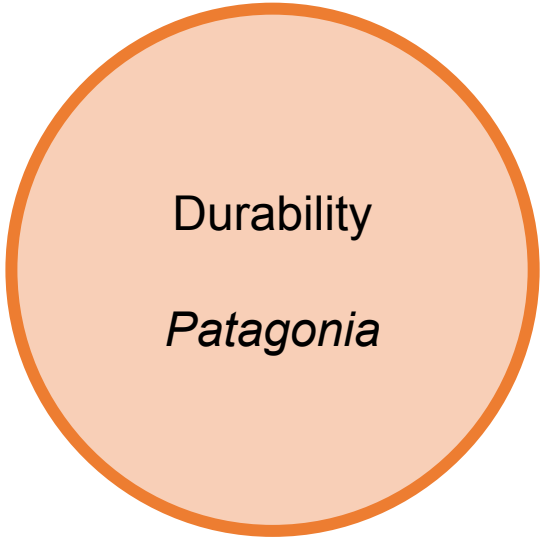
Simplified IDE

50%

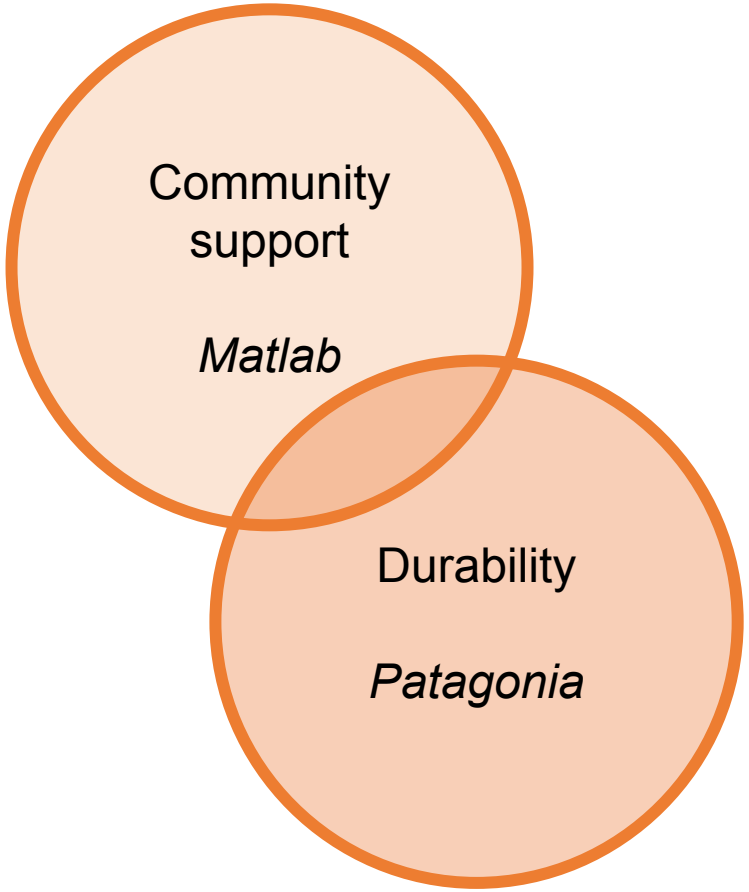
Unified Documentation

25%

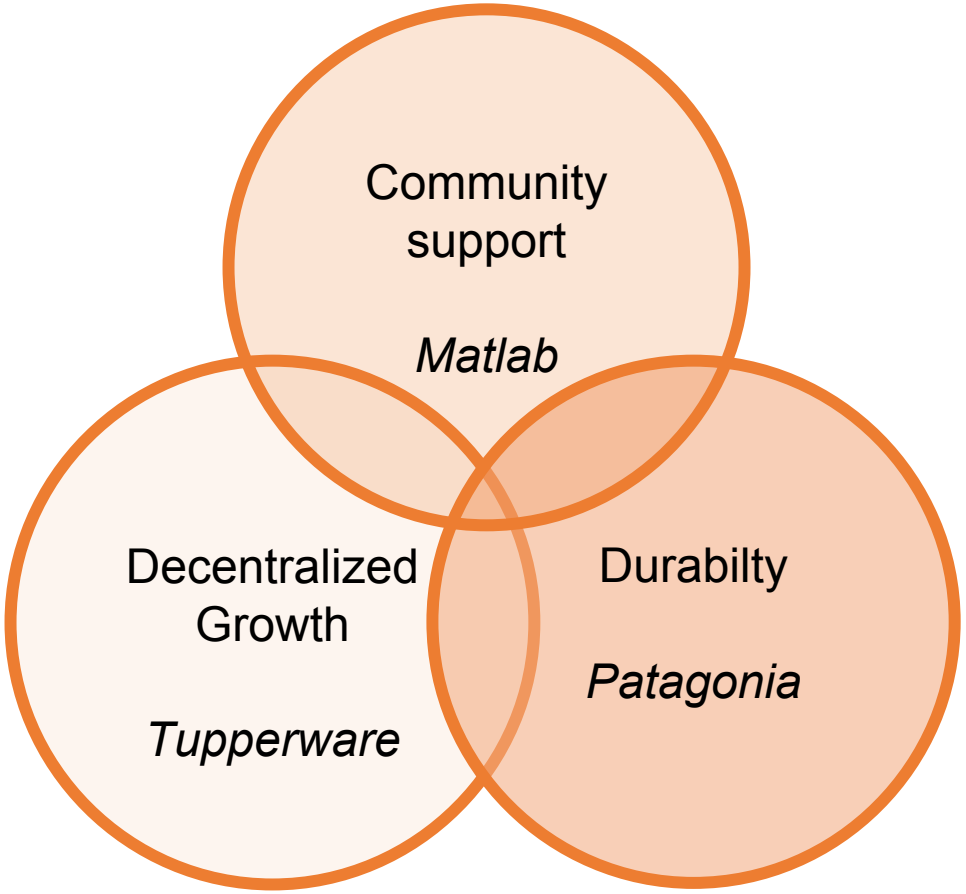
# Accessible: Make it durable



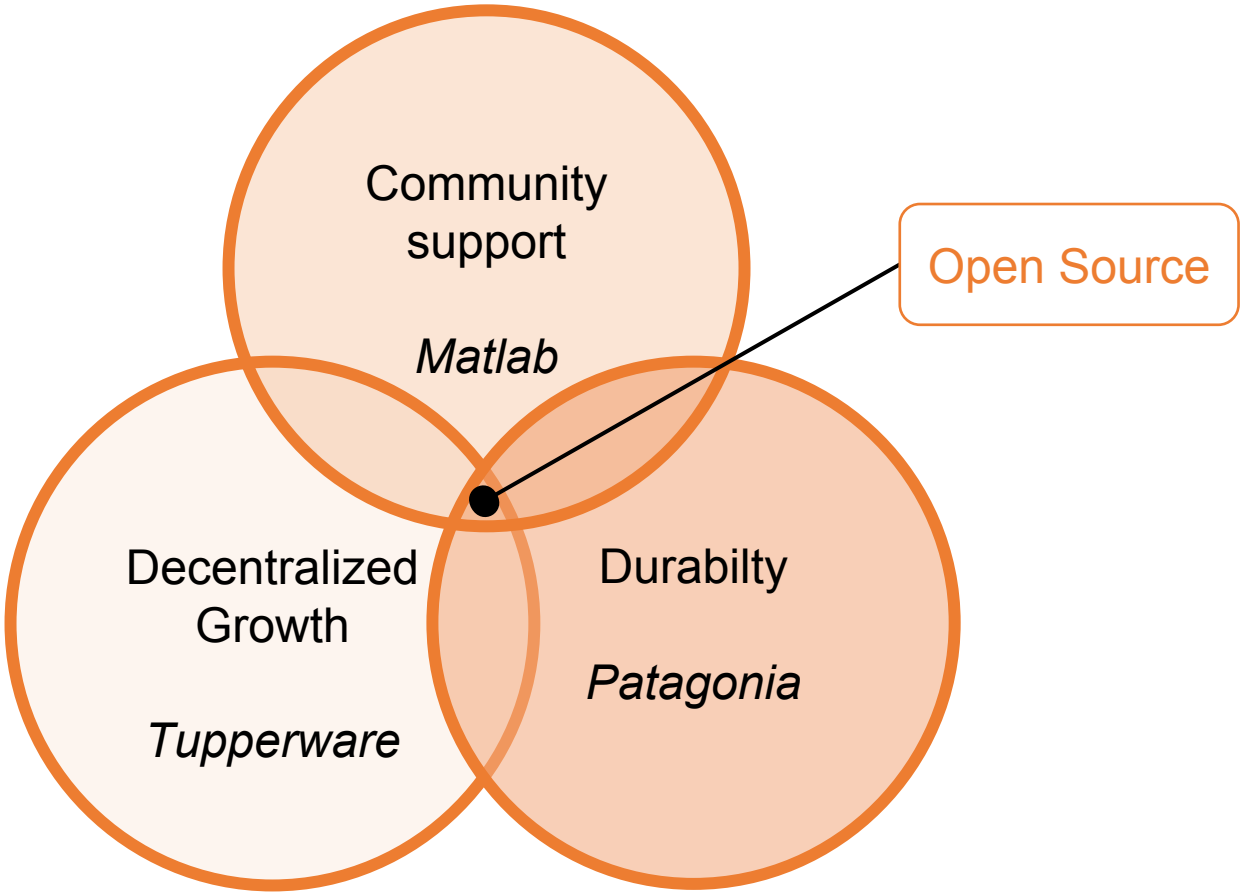
# Accessible: Long-term support



# Accessible: Decentralized growth



# Accessible: Open-source is the key



# Accessible: Our open-source licenses

Open-source Tool

**Hardware**

CERN-OHL-S-V2

**Documentation**

CreativeCommons SA-BY

**IDE + GUI**

Apache 2
GPL V2

**Dataware**

Apache 2

CopyLefted - Hosted by CNRS

Solution

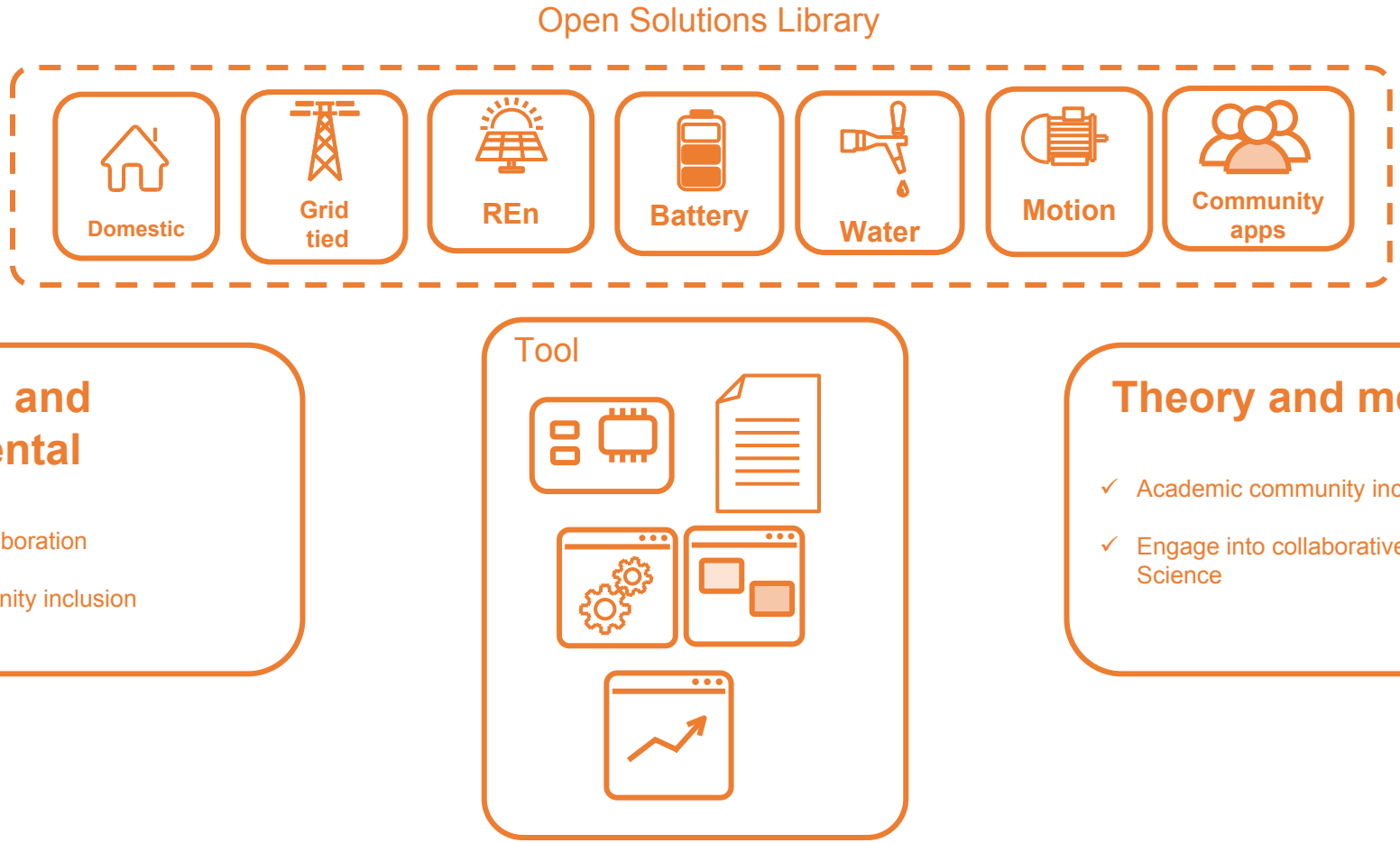

**My app**

Your license

## Open-o-meter - 8

- ✓ Design files are published
- ✓ Assembly instructions are published
- ✓ A bill of materials is published
- ✓ A contribution guide is published
- ✓ The published CAD files are in editable format
- ✓ The published assembly instructions are in editable format
- ✓ The published bill of materials is in editable format
- ✓ All this information is published under a license allowing commercial reuse

# Accessibility: Open Solutions Library



# OwnTech future: Foundation and SME

**OwnTech**
Foundation

Holds the PI for the Tool
Caretaker for the community
Hosts the shared data from the community

**OwnTech**
Inc.

Creates new solutions on demand
Enables industry transition towards open-source hardware

# Open CANVERTER project

## ERIGRID Transnational Access call

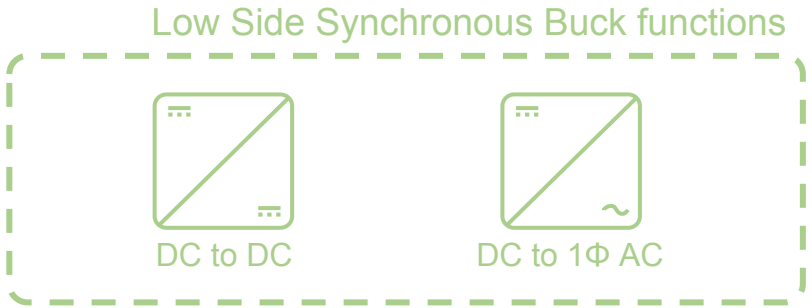
- ✓ EU funded project
- ✓ Open calls for access to micro-grid infrastructure in Europe
- ✓ The team has successfully participated in 3 previous TAs (Evalloggers, Spearhead and H2AI)

## Factsheet

- ✓ 2 to 3 weeks access
- ✓ National Technical University of Athens
- ✓ Late July to early August
- ✓ 4 participants
  - ✓ Guillermo Catuogno - Argentina
  - ✓ Martin Jager - Germany
  - ✓ Jean Alinei - France
  - ✓ Luiz Villa - Brazil/Portugal

## Objective

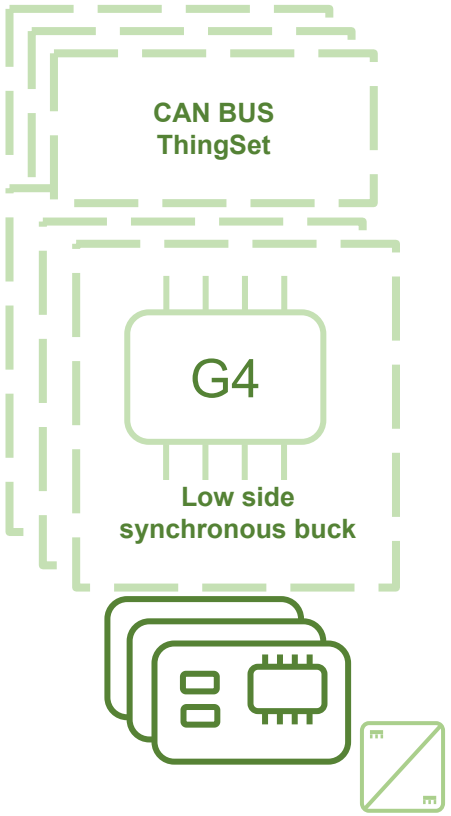
- ✓ **To test the use of ThingSet in order to coordinate power conversion for the three main functions of teh low side synchronous buck converter**



# Open CANVERTER project

## Experiment 1

- ✓ DC-DC power conversion
- ✓ 2 to 10 power converters connected in parallel



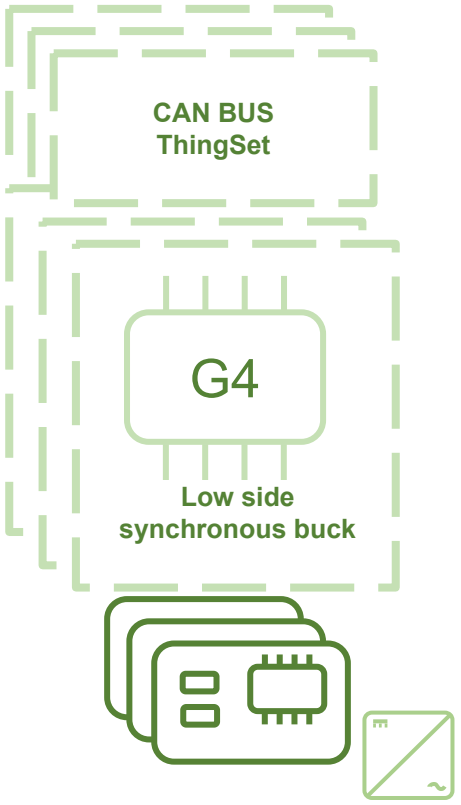

## Experiment 3

- ✓ DC-DC and DC-AC single phase power conversion connected to the same DC bus
- ✓ 2 to 5 power converters connected in parallel for each function
- ✓ Data acquisition and communication between the micro-grid and the RTDS system

+

## Experiment 2

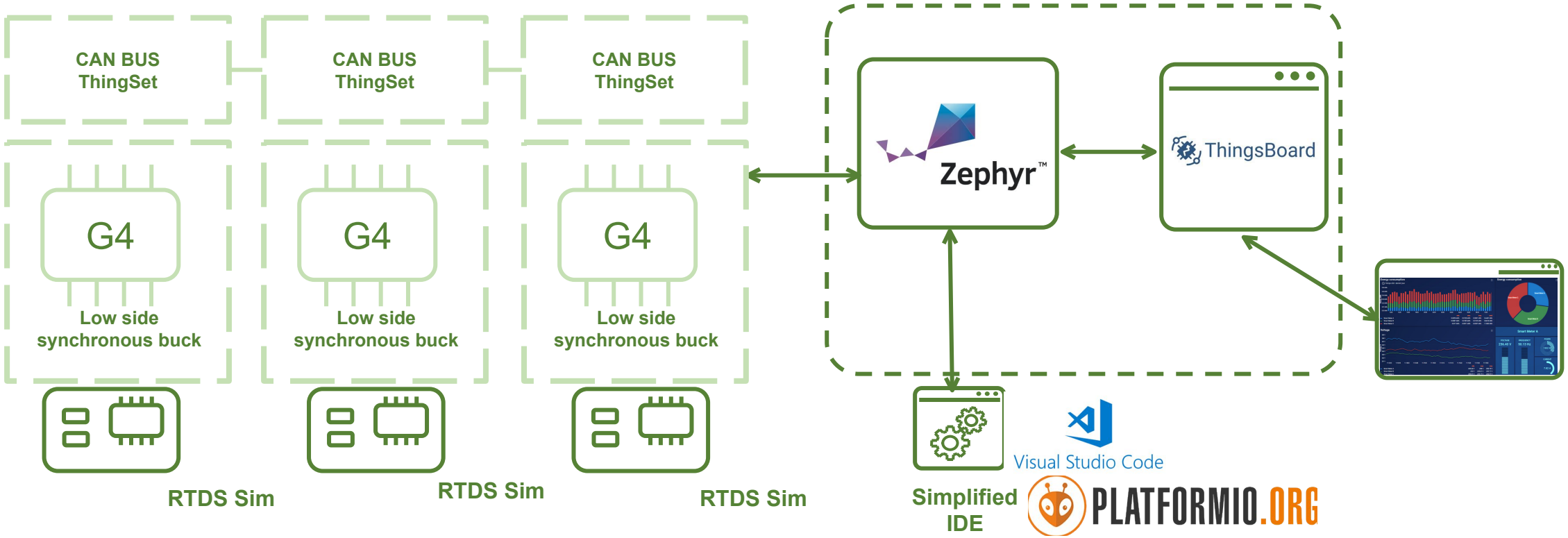
- ✓ DC-AC single phase power conversion
- ✓ 2 to 10 power converters connected in parallel



# General Open CANVERTER test setup

## Test setup description

- ✓ Converters connected in parallel to the same load
- ✓ Tests performed with an RTDS system simulating a power source
- ✓ A communication between ThingsBoard and the industrial RTDS system is currently under study



# Open CANVERTER Team





# Thank you!

Any questions?