Open DC Grid Project

2021 April

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Agenda

❖ CANVERTER/OwnTech – Jean Alinei / Luiz Villa

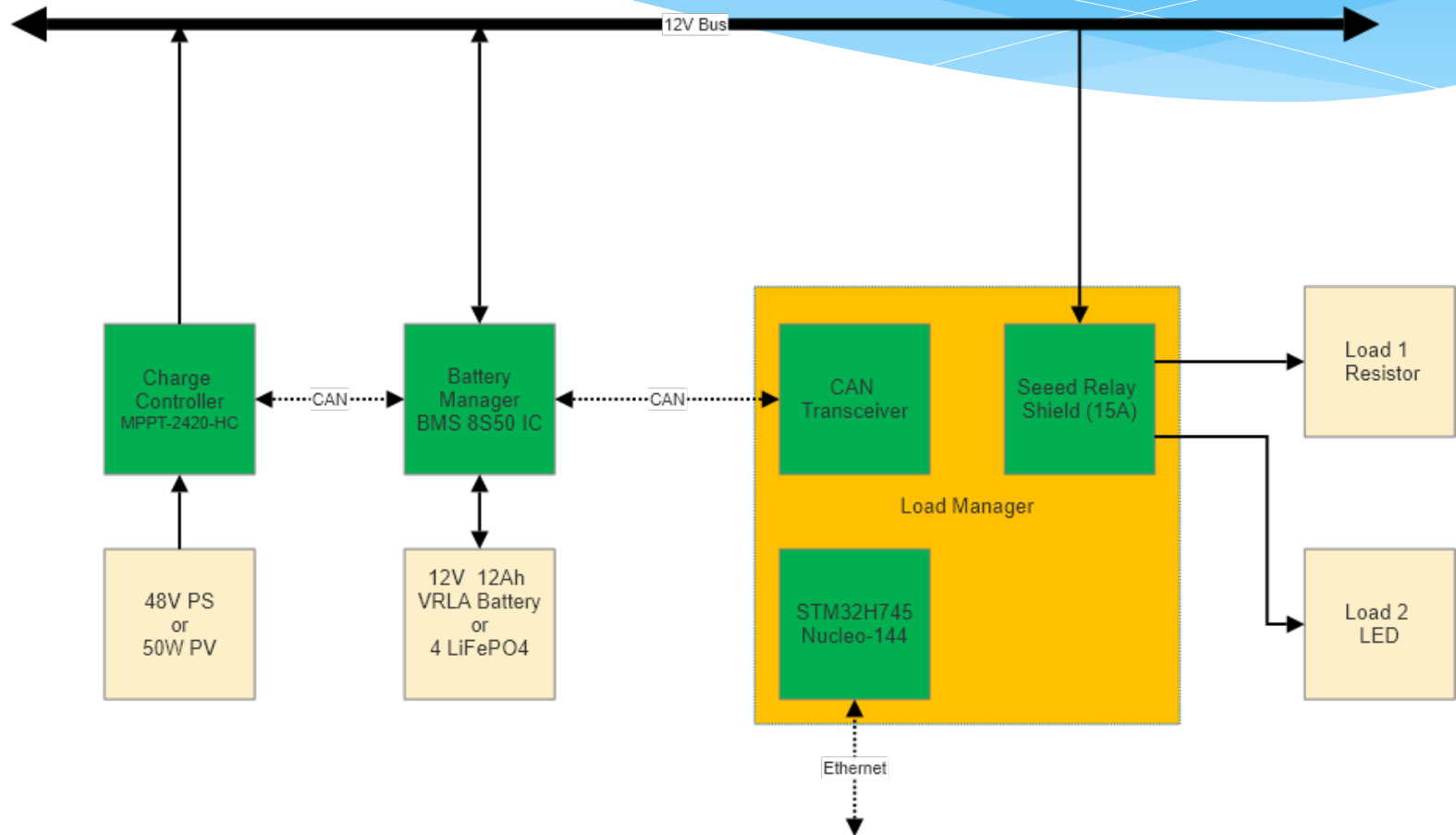❖ ODG Test Microgrid

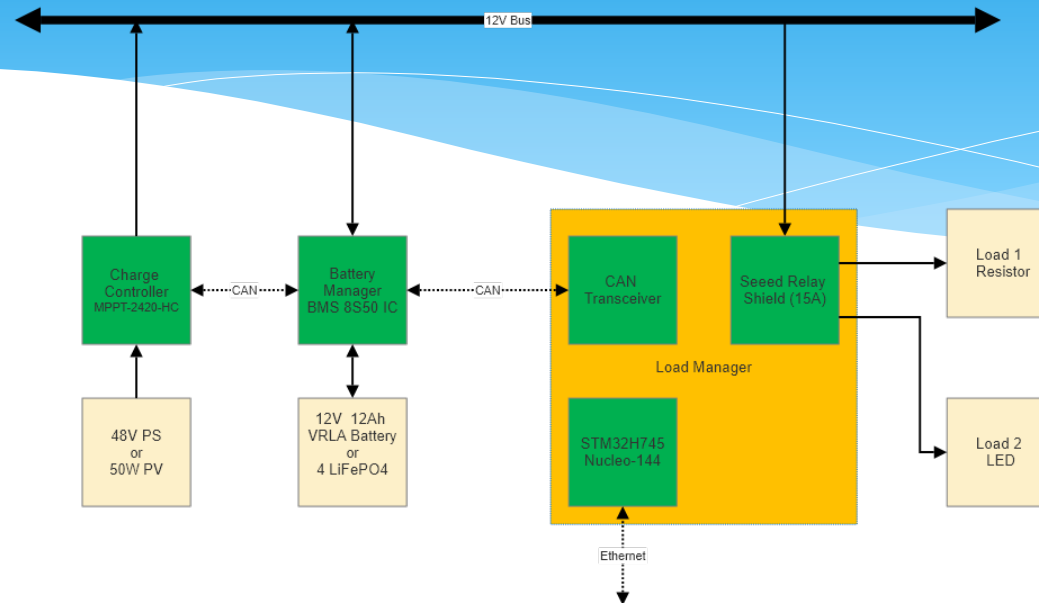❖ Related Standards / Industry Developments

CANVERTER/OwnTech

Visit Jean Alinei / Luiz Villa presentation.

# ODG Test Microgrid

Microgrid Configurations – Expected Behavior

CC	BS	LM	Voltage	Notes
off	off	off	0	Null grid
on	off	off	12	CC activates bus for dumb loads
off	on	off	battery	BS activates bus for dumb loads
off	off	on	0	No power source
on	on	off	battery	CC charging battery
on	off	on	12	CC powers loads if sufficent power available
off	on	on	battery	BS powers loads if sufficent power available
on	on	on	battery	BS charge or discharge depending on load

Libre.Solar MPPT-2420-HC
Charge Controller / Microgrid Bridge
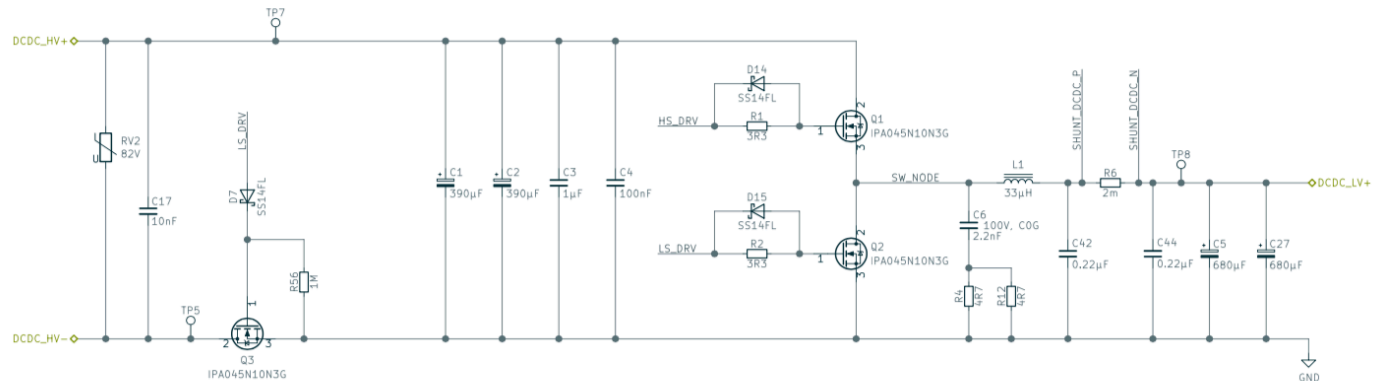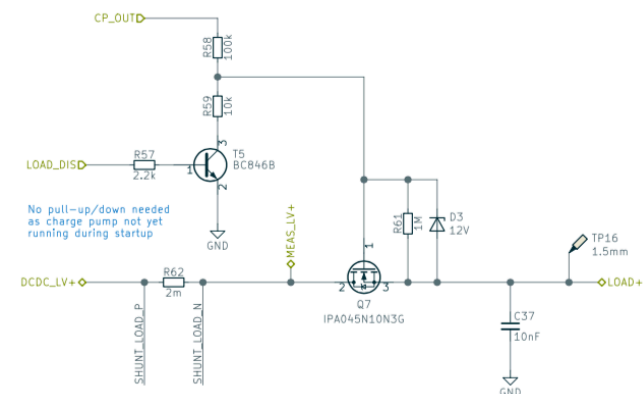
Libre.Solar BMS-8s50-ic
Battery Management System
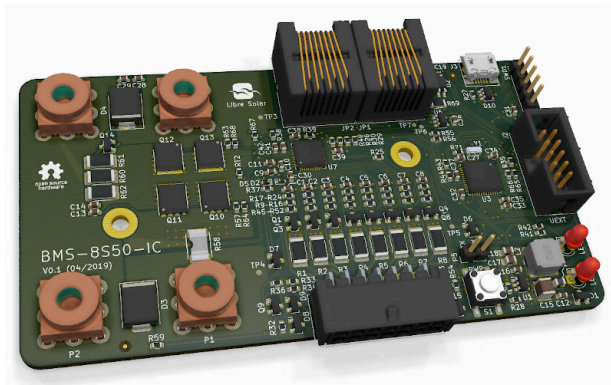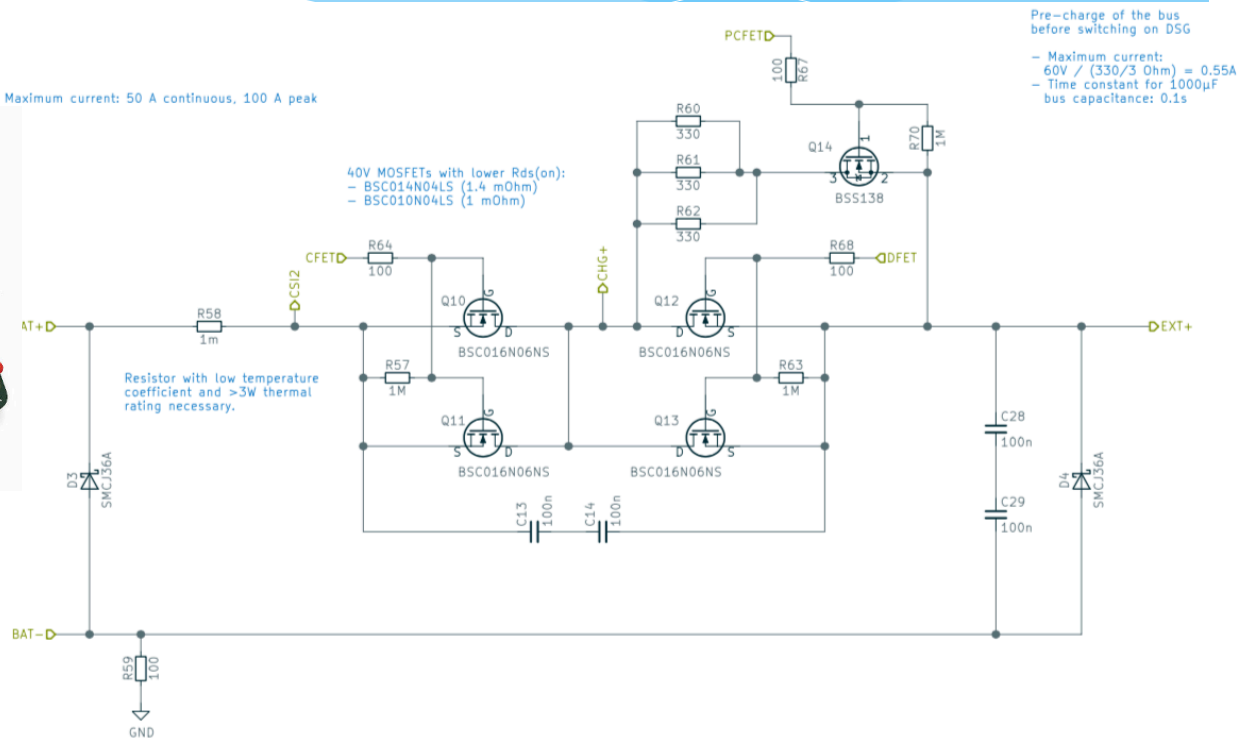
Droop Control Basics

(a)

(b)

From Han
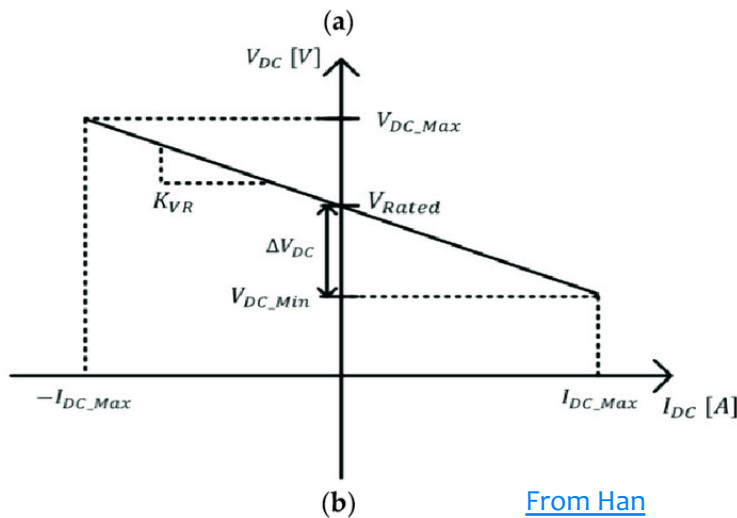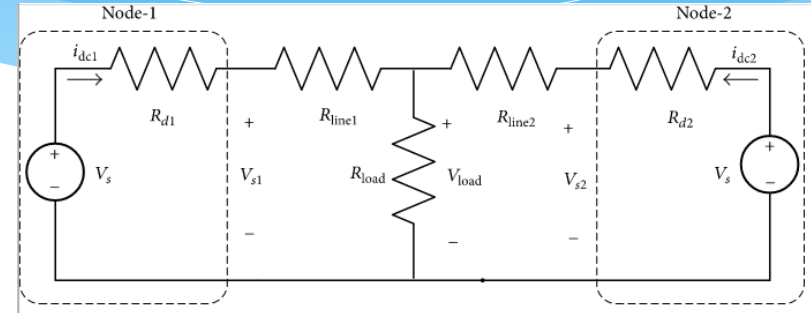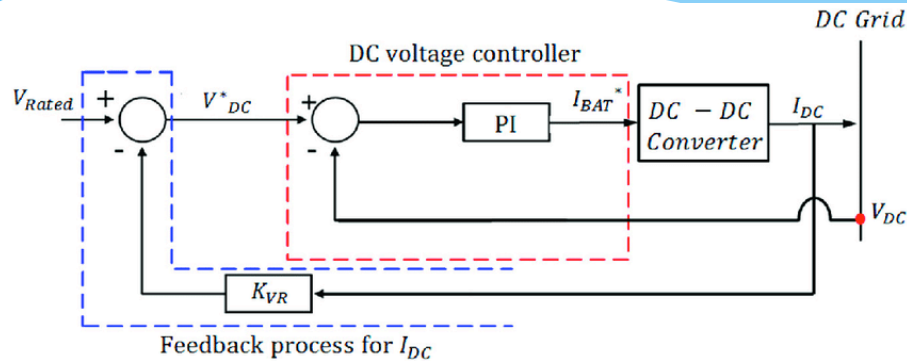
$$v_{sj} = v_s - i_{\text{dc}j}R_{dj} \quad \text{where } j = 1, 2,$$

$$v_{\text{load}} = v_s - i_{\text{dc}1}R_{d1} - i\text{dc}_1 R_{\text{line}1}$$

$$v_{\text{load}} = v_s - i_{\text{dc}2}R_{d2} - i\text{dc}_2 R_{\text{line}2}.$$

$$\frac{i_{\text{dc}1}}{i_{\text{dc}2}} = \frac{R_{d2} + R_{\text{line}2}}{R_{d1} + R_{\text{line}1}} \approx \frac{R_{d2}}{R_{d1}}.$$

From Rashad et al.

Battery vs. droop-controlled source

Terminal Voltage

54V
52V
50V
48V — OCV
46V
44V
42V
40V

Charge   Dischg.
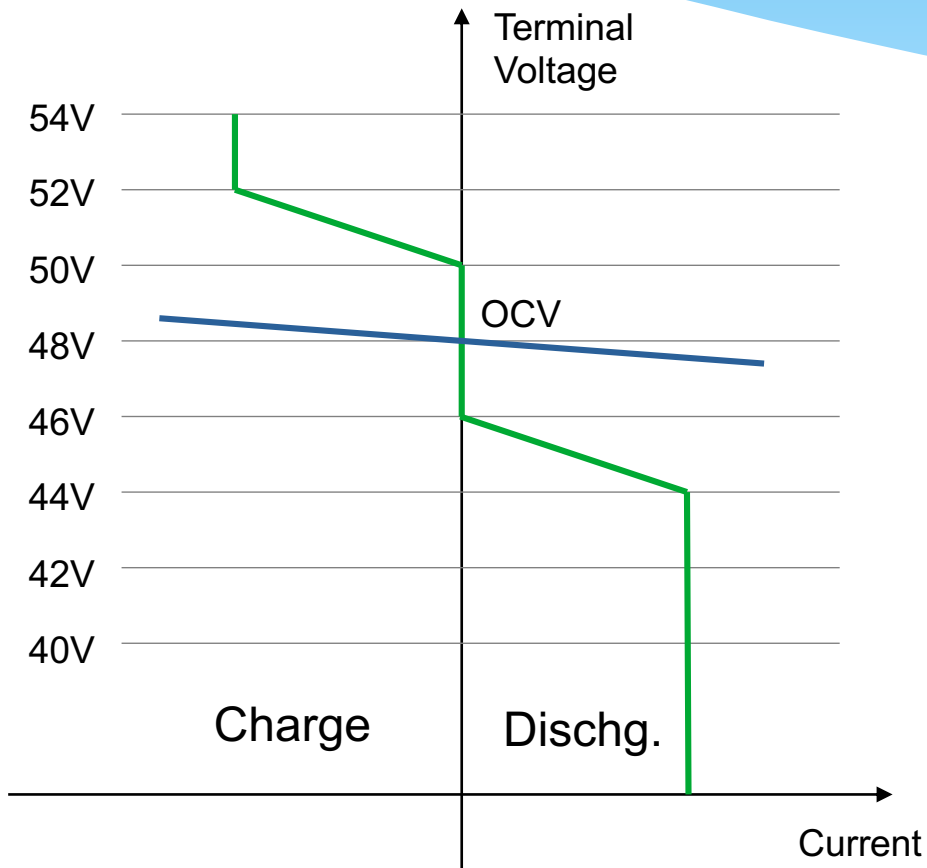
Current

Battery equivalent circuit

OCV — Ri — Terminal Voltage
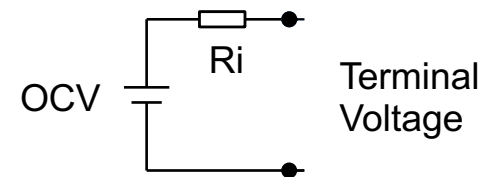
—— Actual battery
e.g. Ri = 10-50 mΩ

—— Droop-controlled source
e.g. Ri = 100 mΩ

Droop Control in Test Microgrid?

R_{cc} = TBD?
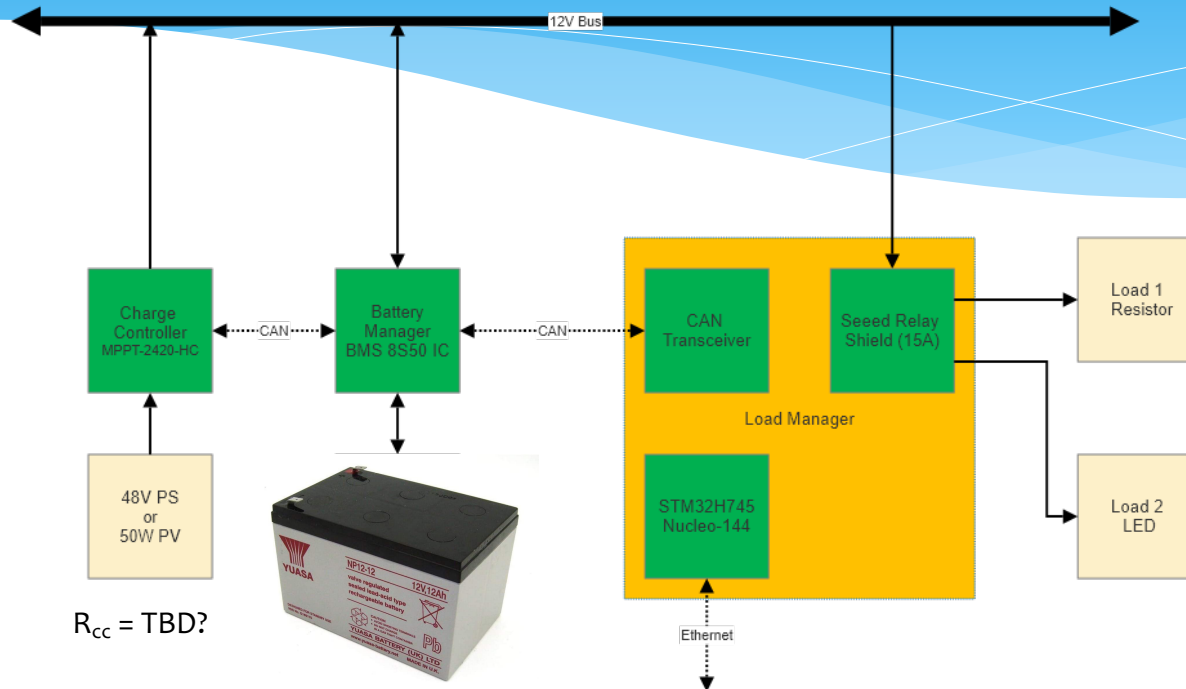
$R_{bms} = R_{bat} + R_{ds(Q10)} + R_{ds(Q12)} \approx .045\ \Omega$

$$\frac{I_{bms}}{I_{cc}} \approx \frac{R_{cc}}{R_{bms}}$$

Fast response, no provision for priorities.
(MPPT-2040-HC does not currently support droop on 12V side.)

Message-based Control

* Devices communicate with CAN messages
* Virtual grid manager allocates power
  * Manager is SW only, no HW required
  * Any source is potential manager
  * First source assumes manager role
  * Manager role can move on disconnect
* Price used to assign priorities
  * Potentially virtual only - no actual money
  * May or may not reflect real world $

Grid Manager
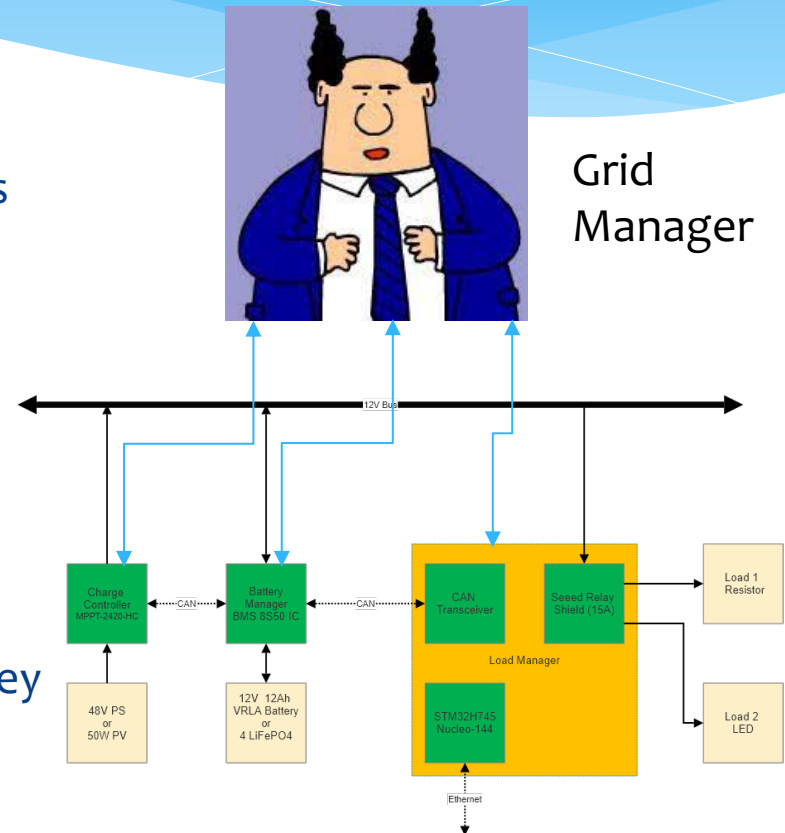
Message Protocols

Load Requests Power	LPD				ODG		
	Source	Dest	Message		Source	Dest	Message
	GM	All	Price		Load	GM	Request buy W1 watts at price P
	Load	GM	Request W1 watts		GM	Load	Grant or fail
	GM	Load	Grant W2 watts				
					GM	Load	Renegotiate

CC/BM Sources Power	LPD				ODG		
	Source	Dest	Message		Source	Dest	Message
	CC	GM	Price		CC	GM	Request sell W1 watts at price P
	GM	CC	Price		GM	CC	Grant W2 <= W1 watts or fail
	CC	GM	Power Wcc watts				
	GM	CC	Power Wbm watts		GM	CC	Renegotiate

Related Standards / Industry Developments

- [P2030.10](#)
  - Recirculation response in work
- [LFEnergy](#)
  - [Microgrid SIG](#) architecture focus on [Hyphae](#)
  - Spring summit Apr 14 - Jim/Martin presentation on ODG, Zephyr
- [Zephyr Developer Summit – June 8 – June 10](#)
  - Mini-conference on Zephyr-driven power electronics planned
- [OwnTech – Open Digital Power](#)
  - [Presentation to ODG April 13](#)
- [P2030.10.1](#)
  - Getting ready for ballot – no recent activity
- [GOGLA](#) Interop activities - ?
- [OpenPAYGO Link](#) - ?
- [Angaza Nexus Channel](#) / Nexus Channel Core - ?
- [Open Connectivity Foundation](#) / [IoTivity](#) - ?

Next Meeting / Feedback

* Next Meeting
  * 11 May 2021 – 1400 UTC
  * Zoom – Meeting ID 87518284403 password: opendcgrid
* Sharing Portals
  * Web site: https://open-dc-grid.org/
  * GitHub: https://github.com/open-dc-grid