Open DC Grid Project

2021 October
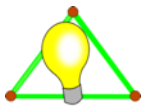
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Agenda

* 12V Interface

* Tactical Microgrid Standard

* Polaris – Open GC standard & implementation

* Related Standards / Industry Developments

12V Interface

* Is there really a need for 12V barrel-connector type standard?
    * Who (besides GOGLA) would use it and why?
* If we think there is a need, how would we create such a standard?
    * Publish on ODG?
    * Initiate a project at IEEE?
    * Some other standards body?
* What would we select for key parameters?
    * Voltage range?
    * Current?
    * Multiple connectors?
* What topics would be included:
    * Power quality
    * Conducted emissions
    * Smart grid functions

California's power grid operator warns of potential for rotating outages

Hispanic Heritage
SEPT. 15 - OCT. 15
KSBY6

Hispanic Heritage Month

Power Outages Hit China, Threatening the Economy and Christmas

High demand and soaring energy prices have forced some factories to shut down, adding further problems for already snarled global supply chains.
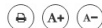
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Lebanon's national electricity grid collapses

India warns of possible power shortages

His comments come as China and European countries face energy crises that are disrupting global supply chains and sending prices soaring.

AFP • October 06, 2021, 07:44 IST

A+ A−

New Delhi: India is facing possible energy supply problems in the coming months due to coal shortages and a post-pandemic surge in demand, the power minister said in a report published Tuesday.

His comments come as China and European countries face energy crises that are disrupting global supply chains and

SPECIAL ★ ★ ★ ★ EDITION
DAILY NEWS
NEW YORK'S HOMETOWN NEWSPAPER

BLACKOUT
- 50 MILLION LOSE POWER
- CITY SWELTERS TO A HALT
- RUSH-HOUR CHAOS TODAY

Could the UK face blackouts this winter due to soaring energy prices?

CONSUMER | ENERGY | GAS | Monday 11 October 2021, 8:03pm

October 12, 2021

Polaris Energy Management Service
(aka Microgrid Controller)

* Manages power/energy flow between devices in a single admin domain
  * Energy managed indirectly via pricing
  * Power managed directly via APIs
* Defined by a collection of standards (RFCs?)
  * Architecture / overview
  * Separate for each wire protocol
* Implemented as portable service app + libraries
  * Essentially specialized web server like Apache
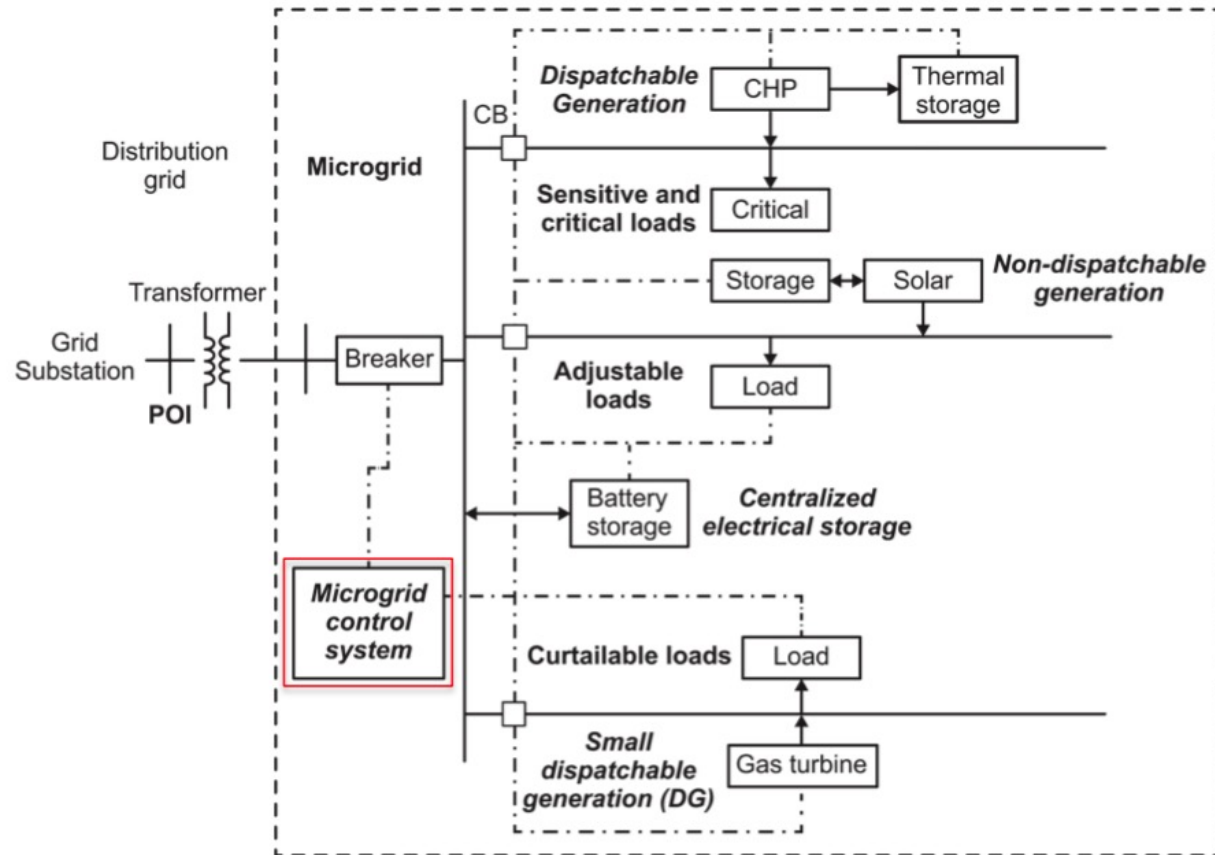
Polaris: Generic Use Case
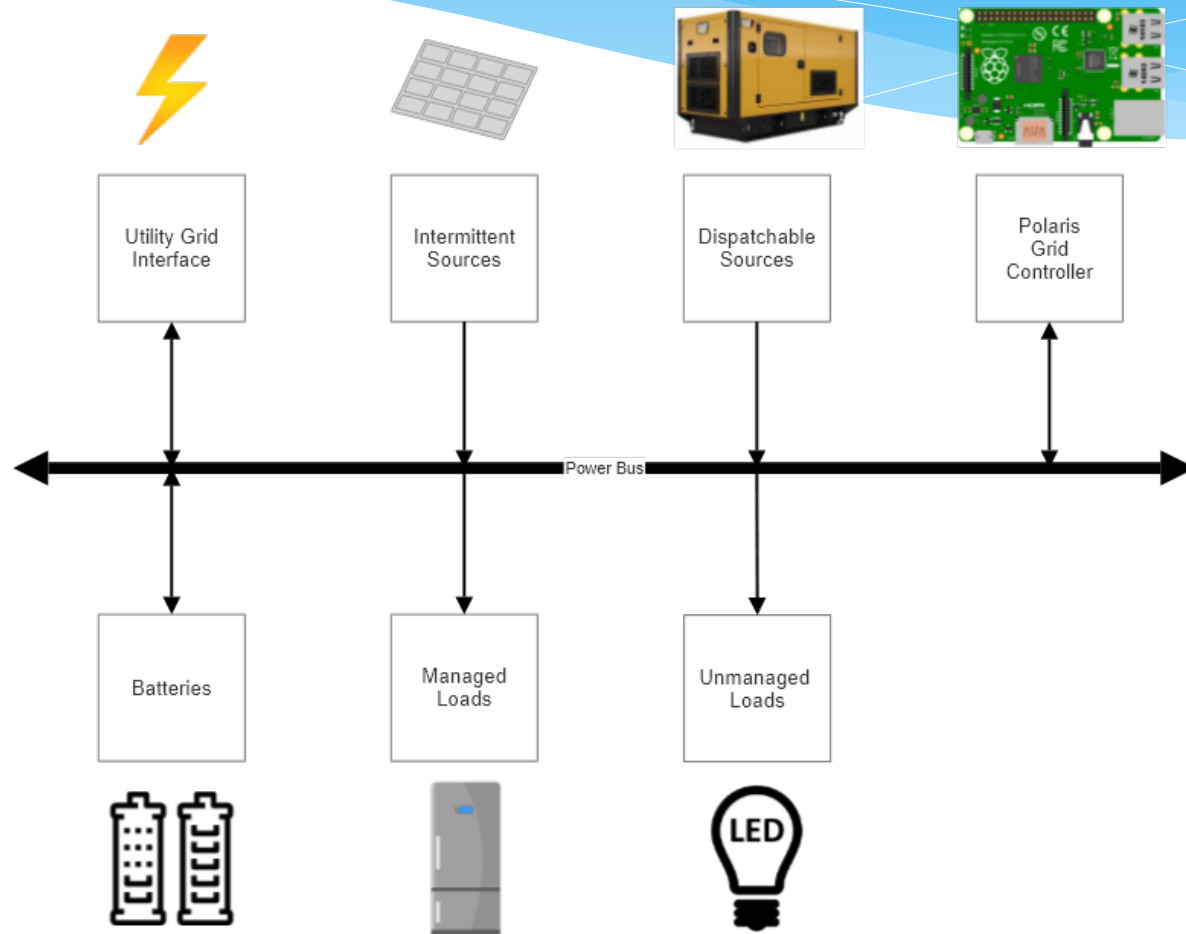
Polaris: IEEE 2030.7/8
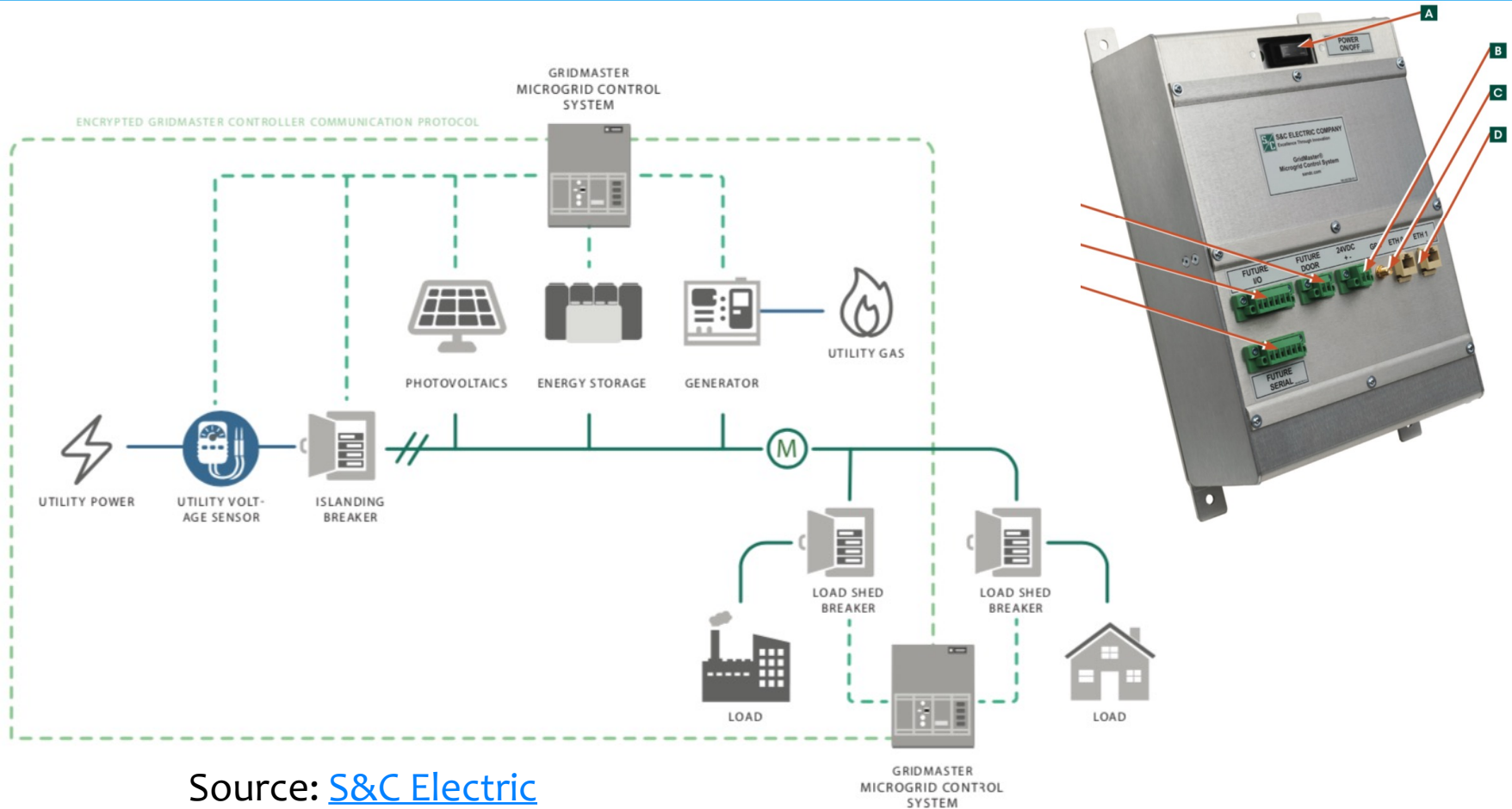

Figure A.1. IEEE 2030.8

Polaris: S&C Use Case
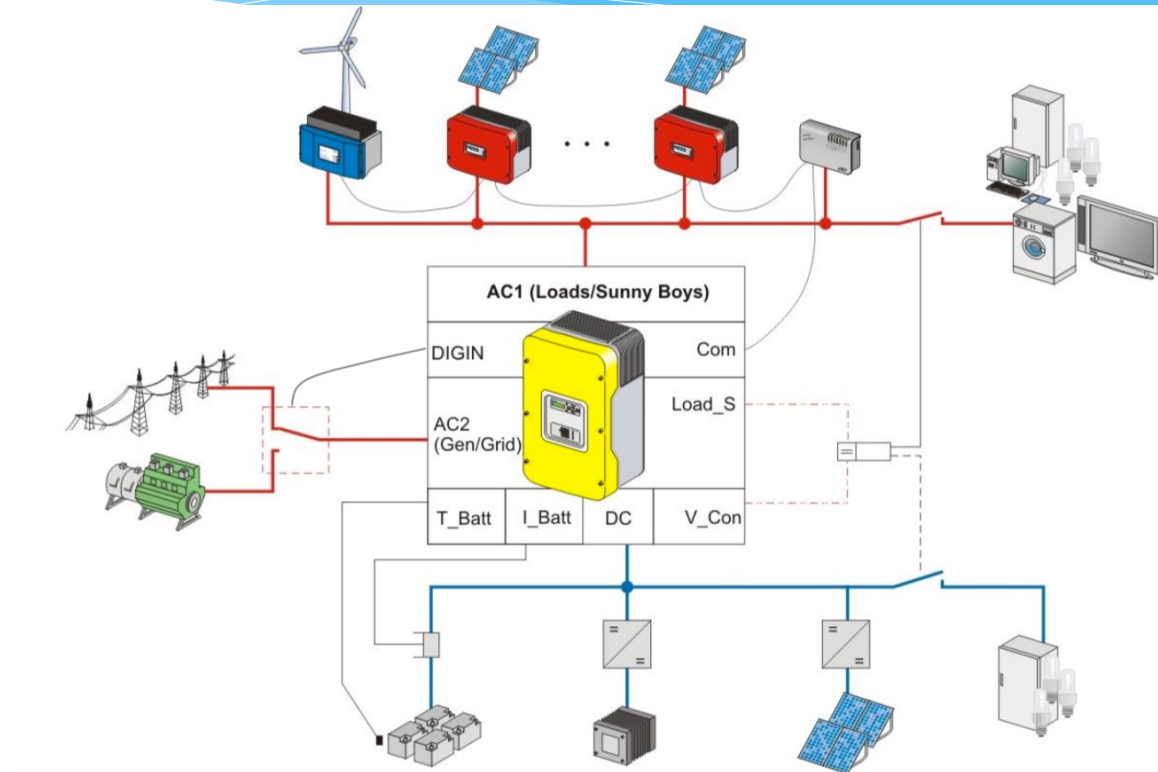

Source: S&C Electric

Polaris: SMA Sunny Island

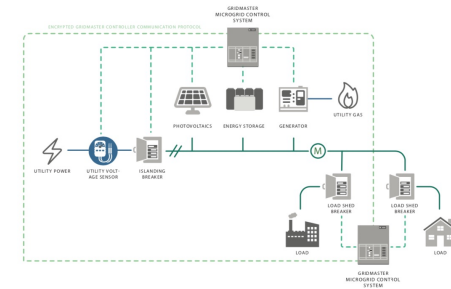
Source: SMA

Polaris: Broader Uses

Polaris: Requirements

* Open source software and standards document
* Implement basic microgrid functionality (per IEEE 2030.7)
* Support both AC and DC microgrids
* Be portable to run on a wide range of platforms
* Support existing hardware as much as practical with minimal special HW requirements
* Include a plug-in mechanism to extend it with more advanced functionality
* Communicate using (at least) standard IP-based protocol stacks, extensible to others
* Include APIs that allow it to play well with others such as IEEE 2030.5, OpenADR
* Strong security model: encrypted comms, certificate authentication, roll-based

Polaris: Desirable Features

* Plug and play for easy configurations
* Useable by non-experts
* Portable
  * Linux, Windows?, MacOS?
  * Zephyr (reduced functionality)
* Open APIs (OpenAPI 3.x)
* USB-PD Integration
* Hierarchically composable
* Fail-soft so grid functions w/o GC
* Hot standby GCs (all sources?)

Polaris: Major Functions

* Supervisory control functions
    * Price publication, dispatch, islanding transitions
    * Logging, reporting
* Local area control functions
    * Emergency load shedding, fault management
* Device level control functions
    * Voltage, frequency, reactive power, battery mgt

Polaris: Communications

* Multiple parallel stacks converge at entities
    * Any IP-based physical layer
    * Middleware: HTTP, CoAP, ThingSet, DDS?
    * Unrouted: LIN, CAN
* Cloud push/polling through NAT (router firewall)
* Supports USB-PD via vendor extensions
* Direct device control via drivers eg. Modbus

Polaris: Plug-ins

* Plug-in modules extend functionality
* Very similar to Apache modules (same interface?)
* Event Procedures
  * Triggered on puts to specific paths
  * Example: utility grid power valid?
  * Response: update grid status, publish subscribe
* Protocol bridges
  * Service maps protocol to local ports
  * Example: ModBus to HTML/CoAP
  * Can support polling to initiate events
  * Device "driver" for specific devices

Polaris: UI / Configuration

* UI: None! *Sort of..*
    * Interaction via APIs
    * Basic command line tools
    * Many GUI / Web presentations possible...
    * Not a project priority
* Configuration
    * APIs also manage configuration – basic REST/CRUD
    * Platform dependent: config files or non-volatile memory
    * Basic database interface for logging etc

Polaris: IOT Politics
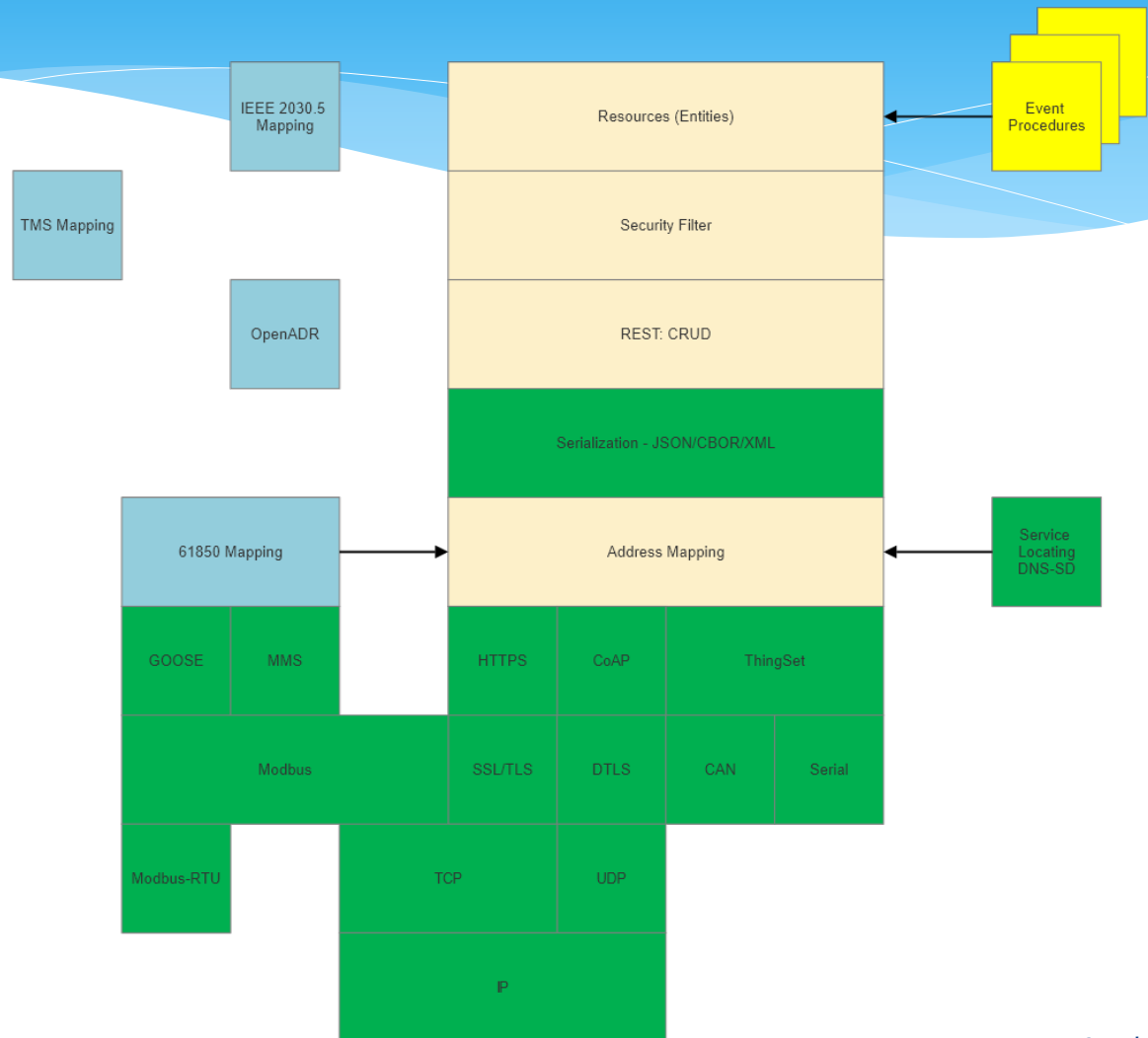
* *Consumer*
  * OCF (Open Connectivity Foundation)
  * Matter (aka CHIP)
* Power Systems
  * 2030.5 (SEP 2.0)
  * 61850
  * Modbus

Polaris: Plays Well with Others

* 2030.5
* OpenADR
* ThingSet
* TMS
* 61850

Polaris: Grid Stability

* Key goal is plug & play for many devices
* Easy cases assume dominant source eg. Battery
* Complex configurations similar to existing practice
    * Simulation via standard tools HOMER, Matlab/Simulink
    * Someday? Integrated support for open-source tools
* Key architectural questions:
    * How to define / recognize device properties
    * Detailed device models necessary? Registry?

Polaris: Global Politics

* Need a global standard
* TMS could be problematic…
    * Many countries may not like a MIL-STD
    * Compatible bridge should be possible

Polaris: Project Plan

* LFEnergy Project
* Standards publisher TBD
* Need funding for power engineering co-chair
* Need volunteers for coding
* Need committed test platform sites
  * OwnTech?
* Dualling implementations, common test suite
  * Rapid prototype in Scala
  * C version for Zephyr

Related Standards / Industry Developments

* P2030.10
    * Scheduled for REVCOM
* LFEnergy
    * Microgrid SIG architecture focus on Hyphae
* OwnTech – Open Digital Power?
* P2030.10.1
    * Initial ballot approved
* GOGLA Interop activities - ?
* OpenPAYGO Link - ?
* Angaza Nexus Channel / Nexus Channel Core - ?
* Open Connectivity Foundation / IoTivity - ?

Next Meeting / Feedback

* Next Meeting
  * 9 November 2021 – 1500 UTC
  * Zoom – Meeting ID 87518284403 password: opendcgrid
* Sharing Portals
  * Web site: https://open-dc-grid.org/
  * GitHub: https://github.com/open-dc-grid