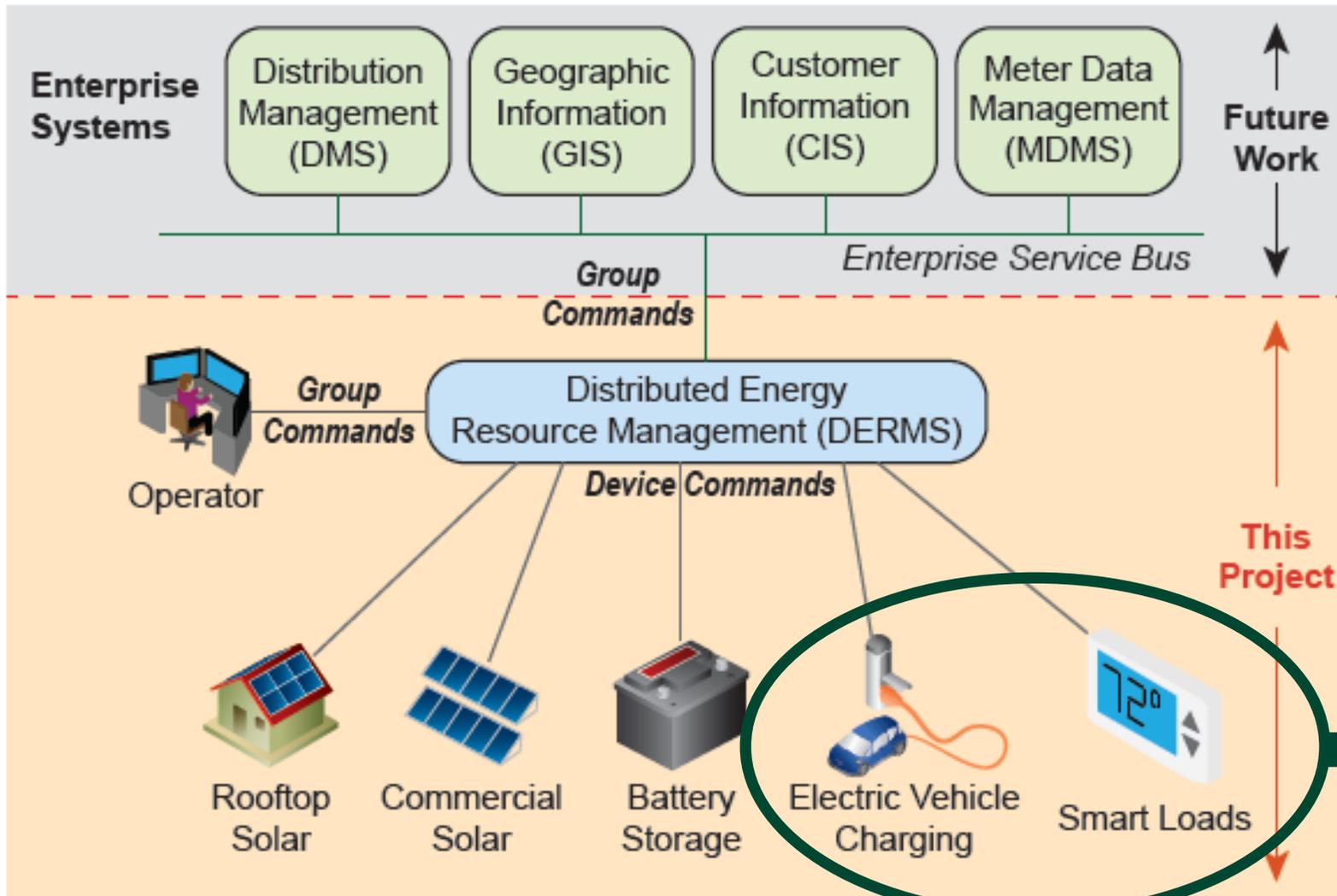# About SkyCentrics

- Leader in open standards IoT communication: CTA-2045, OADR, Volttron
- Certified OADR 2.0b cloud VEN to AO Smith water heaters and Ecobee tstats
- Pentair pool pumps and controllers coming under our OADR cloud next month
- Large appliance ecosystem for CTA-2045
    - AO Smith – Water Heaters
    - Pentair – Pool Pumps and controllers
    - Mitsubishi – Mini-Splits
    - Siemens – EVSE
    - Emerson thermostats
- SkySnap IoT sensor & control gateway with OADR & Volttron

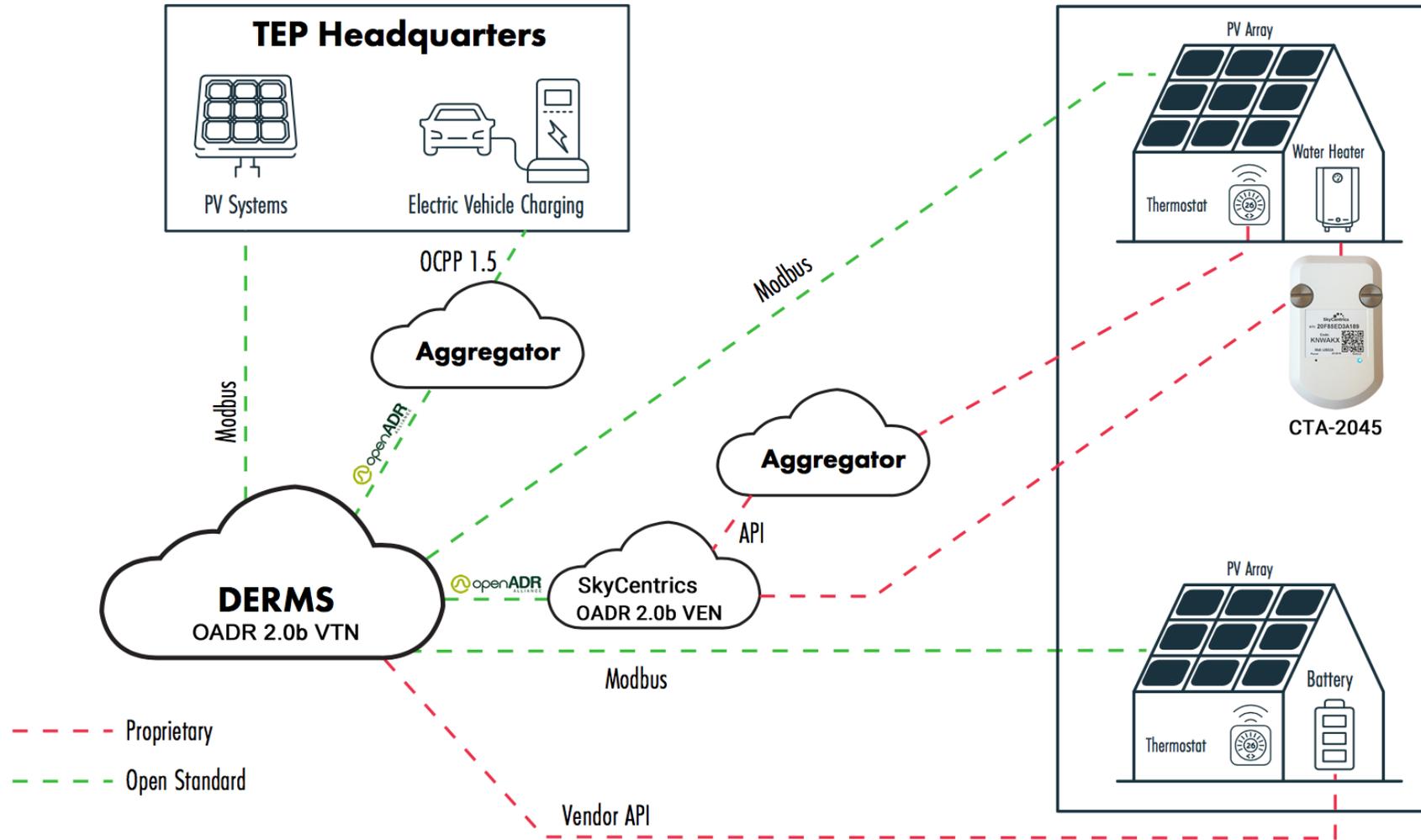# Project RAIN: Resource Aggregation and Integration Network
Tucson Electric Power - EPRI – AO Smith - Ecobee

- Examine and evaluate technologies for coordinating distributed energy resources (DER) using a mix of OADR, CTA-2045, and Modbus

- Role of DERMS
  - Translate commands among languages used by DER
  - Aggregate DER into smaller units to meet grid operator needs
  - Simplify instruction set to most meaningful for system operations
  - Optimize command distribution for fairness and efficiency

Architecture Overview 1

Architecture Overview 2

Resource ID management system

This is a single-screen interface that allows TEP/EPRI to monitor devices of different types and manage their resource IDs that are used to target individual assets from the VTN via OpenADR.

Mapping of OADR levels 0-3 to CTA-2045*

Table 1 – Proposed mapping of device responses to OpenADR SIMPLE signal command levels

DEVICE	'LOAD-UP' ('0')	'SHED' ('1')	'CRITICAL SHED' ('2')	'GRID EMERGENCY' ('3')
WATER HEATER	Heat water to max temp.	Avoid heating, maintain lower water tempature	Avoid heating, maintain minimum water tempature	Turn off WH for length of event
HVAC	Lower setpoint 6°F (Load-up)†	Relax setpoint 3°F	Relax setpoint 6°F	Turn off HVAC for length of event
EV CHARGER	Charge normally	Limit charge rate to 60%	Limit charge rate to 30%	Stop charging (0%)
PV	Curtail PV to 0 kW, 60% VAR absorption‡	100% kW, 30% VAR injection‡	100% kW, 60% VAR injection‡	100% kW, 100% VAR injection‡
BATTERY	Charge at 60% rated power	Discharge at 30% rated power	Discharge at 60% rated power	Discharge at 100% rated power

† Assumes a cooling mode; in the event of cooler ambient temperatures, setpoint would be raised

‡ Percentages are of max reactive power capability (typically 50% of kVA rating)

* Tuckson Electric Power Project RAIN – October 2018 Update

Principal Conclusions: Phase 1

- DERMS & DER integration are not 'Plug & Play'

- DERMS targeted on single resource

- Systems focus on sending commands – optimization 'primitive'

- Next Stage of Field Testing
    - Controller functionality
    - Device capabilities
    - Multi-technology/device grouping and basic optimization

Adding 'default behavior' to DERMS*

	Default Behavior	Load Up	Load Shed
PV	MPPT	Power limit	MPPT
Batteries	Standby	Charge	Discharge
EV Chargers	Unrestricted charging	Unrestricted charging	Limit charge rate
HVAC	Normal usage	Pre-heat/pre-cool	Setpoint offset
Water Heater	Normal usage	Increase water temp	Avoid heating

Introducing the concept of a "default" behavior to DERMS control

* Tuckson Electric Power Project RAIN – February 2019 Update

Principal Conclusions: Phase 2

- Consistent communication with customer devices is possible
- PV and battery systems behaving as expected
- Customer behavior will play a significant role
- DERMS logic different between types of load, especially in 'default' mode
- Open standards help but DER and management systems are not 'Plug & Play'
- Batteries difficult without reliable control and State of Charge (SOC) data

The value of grid connected water heaters:
Lots of storage and no negative impacts to customers

Baseline

Flexible, reliable Demand Response

Solar

Wind
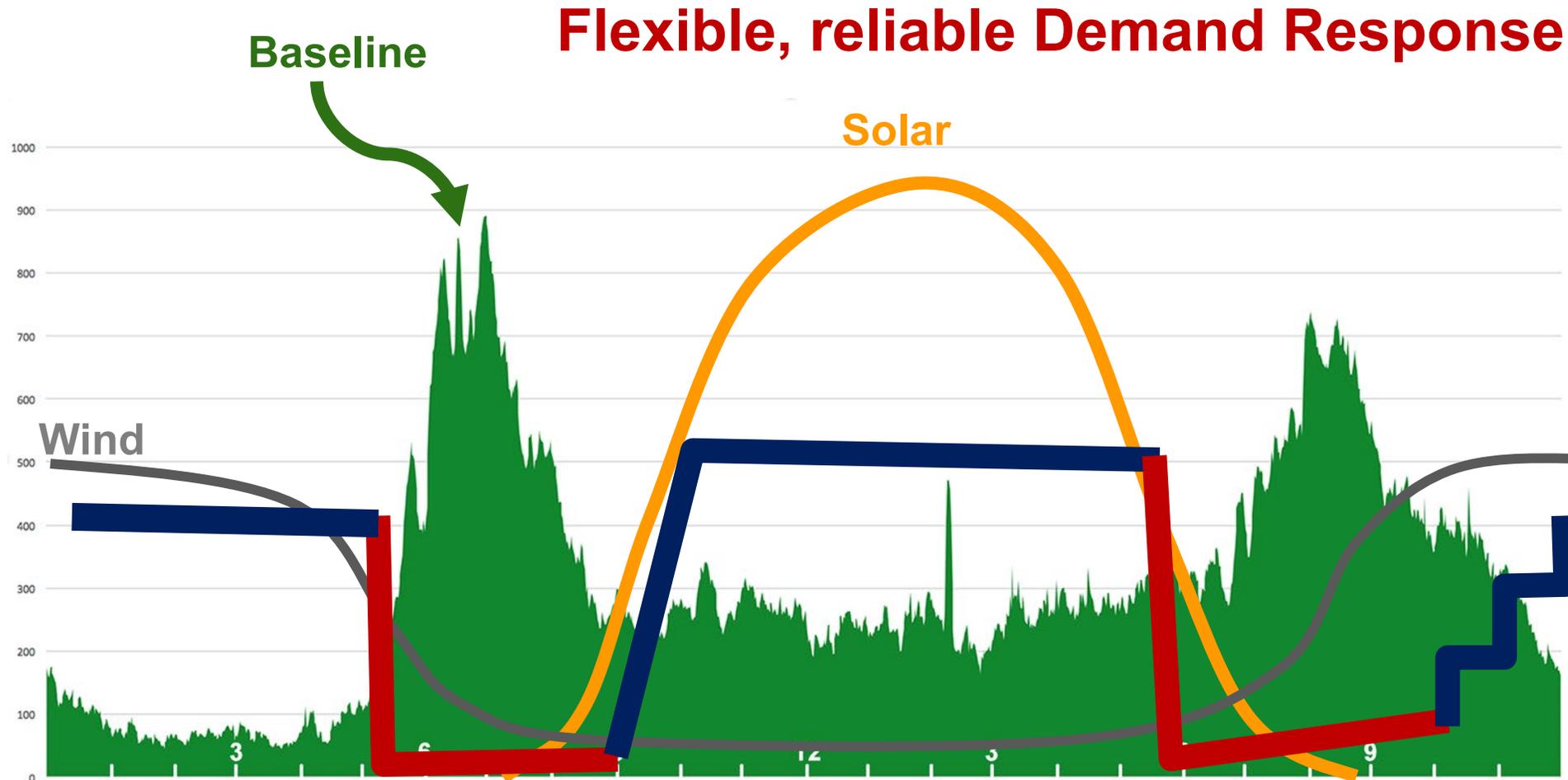
Open Standards: OADR & CTA-2045 play well together

- Designed for grid control

- Avoids vendor lock-in and stranded assets

- Customer choice of devices

- Consistent integration and management experience

- Easy investment decision for OEM

- Additional up-front cost balanced by flexibility for lower lifetime cost

- Adoption & Regulation: AHRI 1380, Energy Star, CA Title 24 JA13, WA SB 1551

CTA-2045 – Open Standard for Smart Grid

- Open Standard: single connector, multiple appliances
- Factory installed or retrofit kit
- Built for customer control
- Built for utility demand response
- Swappable Plug & Play hardware
- Flexible communications
- Ecosystem of category leading brands
- Adopted by major utilities

Research & Regulation

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Consumer Technology Association CES

USNAP ALLIANCE

energy ENERGY STAR

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Washington State Legislature

Manufacturers

A.O.Smith
Electric Resistance and Heat Pump Water Heaters

MITSUBISHI ELECTRIC COOLING & HEATING
Mini-split Air Conditioners

PENTAIR
Pool Pumps

SIEMENS
EV Chargers

EMERSON
Water Heater Switch

Islandaire The perfect fit.
PTAC Air Conditioners

Utilities

conEdison

Bonneville POWER ADMINISTRATION

Southern Company

DUKE ENERGY

Portland General Electric

JACKSON ELECTRIC MEMBERSHIP CORPORATION

openADR ALLIANCE

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