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Need for Device Energy API and Protocol Standards

Additional submitted attachment is included below.

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By way of introduction, Whygrene is a small virtual powerplant startup that features an optional blockchain system for tracking renewable energy generation. The blockchain can be used to prevent double counting, for generating granular RECs or, in combination with a source of real time information on grid carbon intensity, for Scope 1 and 2 emissions tracking for ESG reporting. We would like to second comments from David Meyers (Polaris) and Kimberly Beltran (Sonoma Clean Power) about the need for data and integration, and specifically address a research program that we believe would lead to reduced integration complexity and real time data availability, as Kimberly mentioned at the conclusion of the workshop.

With respect to integration, the problem today is that every manufacturer of a smart energy appliance or a DER device has their own HTTP API for monitoring and control that is only accessible through the manufacturer's website. There are no standardized APIs for specific device classes like HVAC equipment, solar PV, or EV chargers. This increases the complexity of integrating a smart energy appliance or DER device into a virtual powerplant platform. Virtual powerplant developers need a bespoke integration for each manufacturer's device. In addition, the virtual powerplant platform does not have real time (second or less) access to the data, since the data needs to be collected from the device by some unknown, manufacturer specific protocol, usually over the site WiFi or LTE, sent up to the manufacturer's website, then downloaded through the HTTP API to the virtual powerplant platform.

There are a few interoperable networking protocol alternatives that do not involve device specific HTTP APIs. The IEEE 2030.5 protocol is required by California Rule 21 in solar inverters and home batteries but many manufacturers don't provide access to it directly, and it is not required for smart thermostats, hot water heaters, pool pumps and other flexible load devices. The CTA 2045 protocol was designed to control hot water heaters, pool pumps, and other such high load devices that, unlike HVAC systems, historically weren't or were only marginally externally controllable, but not DERs. "Smart home" devices like smart plugs and smart appliances that do not use WiFi or LTE may use the Zigbee Smart Energy profile or a Bluetooth profile, but often the device manufacturer layers an HTTP API on top of the protocol requiring the virtual powerplant operator to go through the manufacturer's website anyway.

In addition, mostly these devices and protocols are not designed for energy control but rather for "lifestyle management": tasks such as "ensure that the lights are on, the temperature is at 72 degrees, and the music is playing when I get home from work". Until recently, for a consumer to utilize a smart home device required purchasing the device with software targeting one of four smart home platforms: Apple Homekit, Google Home, Amazon Smart Home, or Samsung Smart Things, then using the platform's configuration app to activate the device and to integrate it into the consumer's smart home network. The Thread/Matter standard released last year is supposed to increase the interoperability of devices between smart home platforms, but Matter is really only about communication and mostly oriented in design toward lifestyle management anyway. Matter has an energy profile but it is currently unimplemented.

A related problem is the proliferation of smart phone apps and webapps to control these devices. Each manufacturer has a separate app for their devices talking through their proprietary HTTP API to their website, requiring a consumer with devices from multiple manufacturers to download multiple apps. This makes signing up for a virtual powerplant service extremely confusing and difficult for the consumer, as several of the CCA presenters mentioned at the workshop, since that results in the consumer needing to download yet another app to their cellphone.

In the late 1980's, in the networking equipment market, there were multiple different manufacturer specific network protocols (DECnet, Novell networking, etc.), so equipment from one manufacturer did not talk to that from another manufacturer without an interoperability box between them. The agreement among networking equipment manufacturers to standardize on the Internet protocol stack through the Internet Engineering Task Force (IETF) in the early 1990's during the commercialization of the Internet is what made today's globe spanning Internet possible. The situation today with automated energy monitoring and control is reminiscent of networking in the late 1980's. Every manufacturer has their own proprietary API that only talks to their website, or they hide the use of an interoperable protocol like the Matter energy profile behind an API.

We believe the goal should be that flexible load devices and DERs have common, interoperable APIs specific to their device class, which allow straightforward integration with virtual powerplant platforms and provide data as close to real time as possible, with appropriate security. In addition, if a consumer signs up for a virtual powerplant service, there should be an easy way to transfer control of the devices to the virtual powerplant service's app, so that the consumer doesn't need to deal with an app for every device. Our recommendation is to start a standardization action for flexible load and DER devices (including car chargers and EVs) to develop interoperable APIs for specific classes of devices. In order to enable real time, event-based data access and control, the API should be based on the IoT protocol standard MQTT. This would allow devices to report data as it is being generated and for control actions to be targeted at specific devices. The APIs themselves can be designed at a higher level using the AsyncAPI event-based API standard. AsyncAPI is compatible with the client-server API standard OpenAPI 3.0 and uses the same lightweight JSON schema declaration language. Another part of the standardization action should include defining the procedures to hand over control of the device from a manufacturer-specific app to the virtual powerplant app.

The standardization action could be conducted through the recently formed Virtual PowerPlant Partnership (VP3) launched this spring by the Rocky Mountain Institute, or some other industry standardization body such as MESA or SunSpec Alliance. Alternatively, the IETF might be interested in taking up the problem, though in the past they have mostly focused on communication protocols. To be really effective, the market leading manufacturers in each device class need to be signed up and have their technical people attending and contributing to the design, as well as the virtual powerplant providers, and interoperability events need to be organized where devices are tested against the latest version of the standard to ensure interoperability. Additionally, when developed, the specification documents need to be freely distributed and not put behind a paywall. This ensures that all participants in the ecosystem can get access without having to pay or join whatever organization developed the standard (this is, for example, an issue for the Matter and Thread specifications).