Customer Driven.
Community Focused.℠

Final Deliverable – 6

Fielded Assets

Prepared for the

Austin SHINES Project

Federal Agency

U.S. Department of Energy

Award Number

DE-EE30007177

Project Period

Start: February 1, 2016 / End: March 31, 2020

Final Deliverable - 6
Fielded Assets

Document Purpose

The following report provides information of the fielded Distributed Energy Resource (DER) assets, which were deployed by the utility. It includes tables and images of the Energy Storage Systems (ESSs) at grid-scale, commercial and residential levels and co-located solar PV. These descriptions serve as verification of installation, for testing grid performance and the ability for the grid to host high penetrations of solar generation. Detailed utility data will remain confidential, such as location and other interconnection components.

Table of Contents

Table of Figures

Table of Tables

Section 1 **Grid-Scale Assets**

In Table 1-1, the high-level metrics of both grid-scale assets are provided. Under controls, DUC stands for Direct Utility Control, where the systems were sent signals via an on-site holistic controller. The Kingsbery (KB) Energy Storage System (ESS), is located within the Kingsbery Substation. The KB ESS site layout may be seen in Figure 1-1, where the La Loma community solar farm resides adjacent.

Table 1-1 Grid-Scale Asset Metrics

Site ID	Control	Install Date*	ESS Power (MW)	ESS Energy (MWh)	Battery Model	Inverter Model (Power Rating)	Solar Feeder Capacity (MW)	Solar Feeder Type
KB	DUC	6/8/2018	1.5	3	LC Chem	Parker-Hannifin 1.5 MVA	2.6	Community Solar
MU	DUC	11/8/2019	1.75	3.2	Samsung (7 Aggreko Y.Cubes)	Parker-Hannifin 7 per Y.Cube each at 250 kVa	4.9	Distributed Rooftop

**Note: Install Date refers to completion of Final Acceptance Testing of the systems*

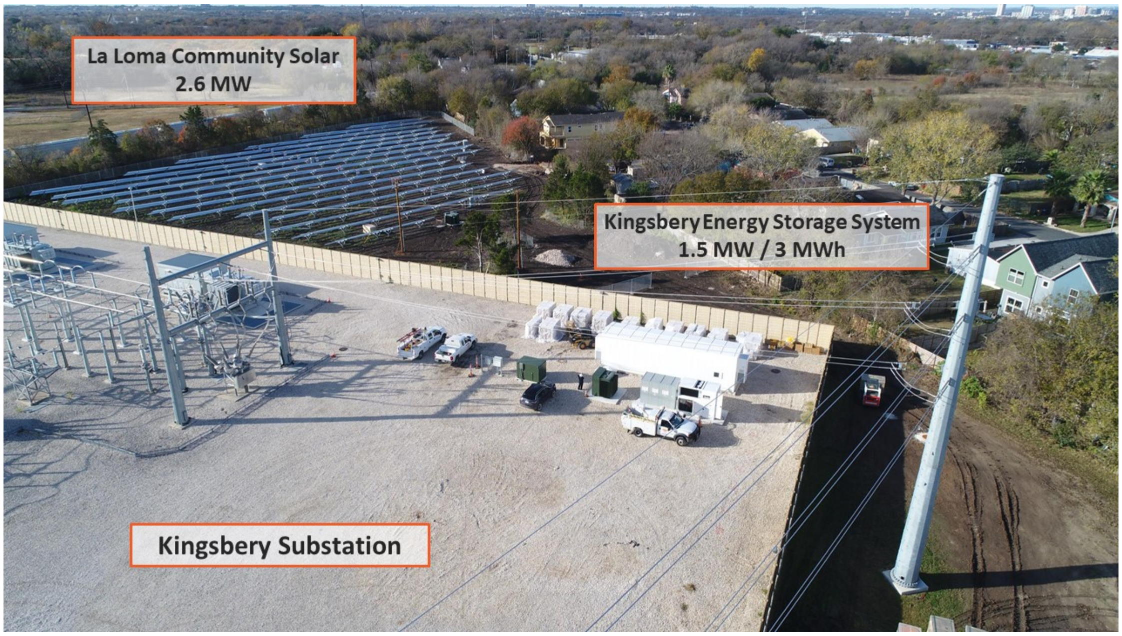

Figure 1-1 Aerial KB ESS site view (image taken on 12/11/2017)

The major components of KB ESS are illustrated as a simplified one-line diagram in Figure 1-2.

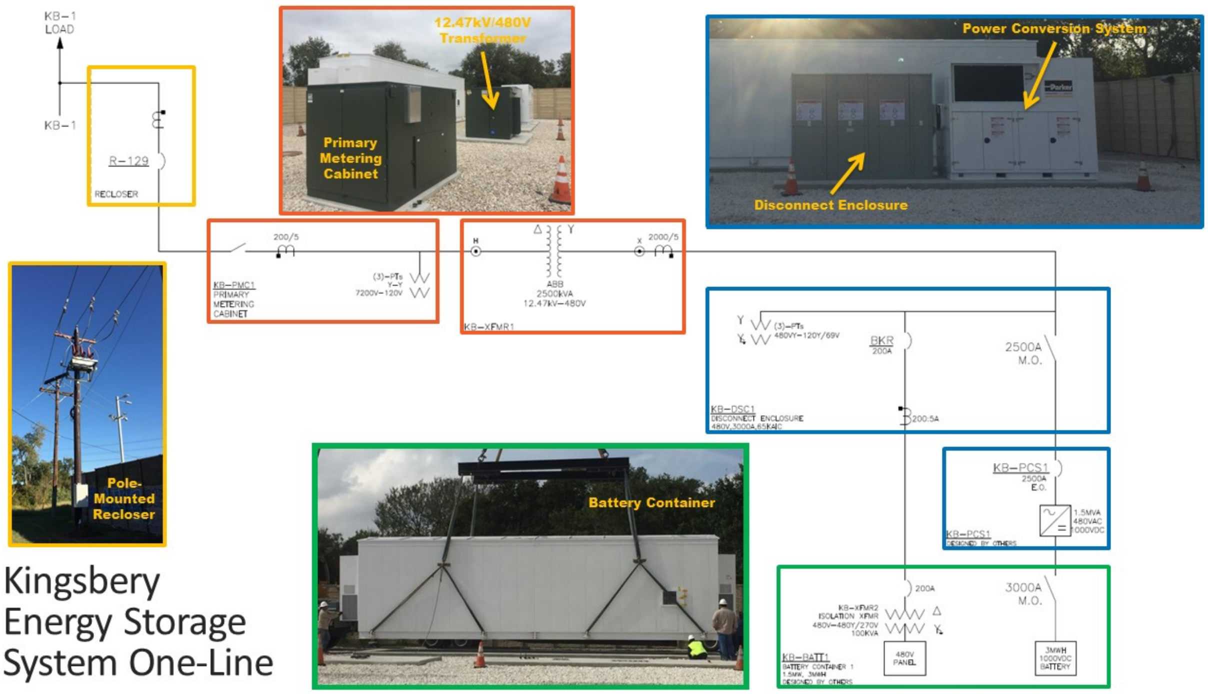

Figure 1-2 KB ESS One-Line Illustration with Equipment

Figure 1-3, offers another view of the KB equipment, after the security fence was place around the ESS, so personnel can enter through a dedicated entrance and be contained within this area of the substation.

Figure 1-3 KB ESS site view after fencing for substation partitioning installed (image taken on 1/19/2019)

The Mueller (MU) ESS site, in Figure 1-4, is incorporated within the Mueller neighborhood of Austin and contains 7 individual battery storage containers.

Figure 1-4 Aerial MU ESS site view (upper left image taken on 6/18/2019)

These containers are all interconnected to the same pieces of equipment, shown in Figure 1-5, where a modular design approach was taken.

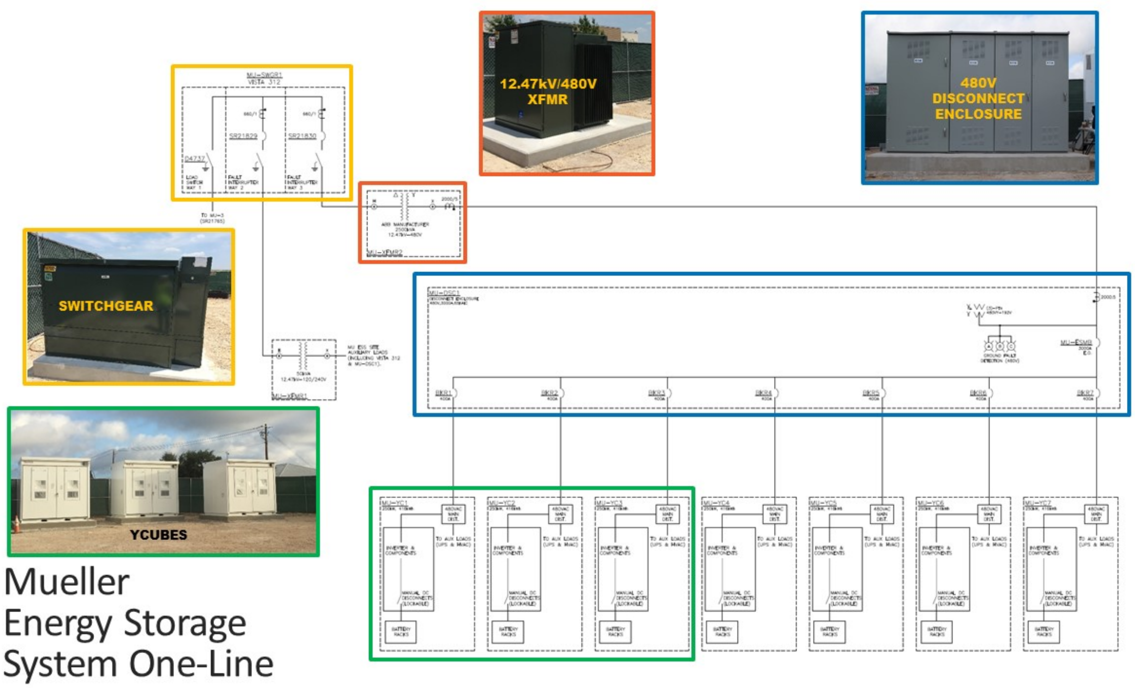

Figure 1-5 MU ESS One-Line Illustration with Equipment

In addition to the electrical design, the neighborhood and its developer have guidelines which were applied to this system. As of May 2020, the site is completing construction to the perimeter and aesthetic components, however the ESS are operational and performed during the demonstration phase of the project. Figure 1-6 again shows this aerial view of MU ESS plus architectural renderings of the final design.

Figure 1-6 Aerial MU ESS site view (upper left image taken on 6/18/2019)

As the system sits next to commercial properties and adjacent to residential walking paths, there will be two types of signage. The first will display safety related information for first responders, emergency personnel, or utility workers. The second will be educational signage place near the oval planter, seen in the lower image of Figure 1-6. Here you can also see vertical bars, which extends to a gate, crossing the service entrance driveway. Community members may see through these bars and into the MU site. Figure 1-7 illustrates another rendering of this viewing area.

Figure 1-7 Rendering of street-facing component to MU ESS system, where the community may look inside.

The street level perspective, of the modular ESS containers looks like the viewpoint of Figure 1-8.

Figure 1-8 Street view of MU ESS battery containers (image taken on 6/25/2018)

Section 2 **Commercial Assets**

In Table 2-1, the high-level metrics of all commercial assets are provided. All three were installed indoors and a part of the third-party aggregation control use case. However, unlike the residential systems, these commercial assets partitioned their availability between the ESS vendor's demand charge reduction application and SHINES DUC holistic controls. Stem, the vendor, were the priority controller while the utility was able to test outside the peak demand usage window. The peak demand windows varied per site and respective customer's electrical usage. Figure 2-1 shows a Site A's installation with battery modules exposed.

Table 2-1 Commercial Asset Metrics

Site ID	Control	Install Date	Power (kW)	Energy (kWh)	Battery Model	Inverter Model (Power Rating)	Solar Capacity (kW)
A	Aggregated/DUC	2/21/2018	72	144	Panasonic	Vendor/Proprietary	100
B	Aggregated/DUC	2/21/2018	72	144	Panasonic	Vendor/Proprietary	60
C	Aggregated/DUC	2/21/2018	18	36	Panasonic	Vendor/Proprietary	57

Figure 2-1 Left: Site A ESS (image taken on 12/27/2017); Right: Site B ESS (image taken on 1/15/2018)

Site A comprised of two of these 4 tower systems, side by side, where the second one was located off to the left. Site B was similarly located inside a mechanical room, and Figure 2-1 shows the same size system of Site A, however the 8 total towers were situated back-to-back. The final Site B enclosed installation stands alone on a single concrete pad mount. Figure 2-2 depicts Site C, the smallest of the three commercial locations and consisted of a single "tower".

Figure 2-2 Site C ESS installation (image taken on 8/10/2018)

All three customers reported positive feedback as a result of participating in the project and adopting this technology into their buildings.

Section 3 **Residential Assets**

In Table 3-1, the high-level metrics of all residential assets are provided. Not every site contained a battery, and this was because the residential systems were testing many different control use cases, amongst a mix of DERs. They can be represented by the following breakdown:

- Aggregated storage installations
    - 6 homes with stationary battery storage systems (10 kWh each + existing solar PV)
    - 1 Electric Vehicle as Vehicle-to-Grid, or V2G (Site 25)
- 12 Direct Utility Controlled (DUC) solar PV via Smart Inverters
- 6 Autonomously controlled solar PV via smart inverters

Table 3-1 Residential Asset Metrics

Site ID	Control	Install Date	Battery Model	Inverter Model (Power Rating)	Solar Capacity (kW)
1	DUC	3/8/2018		Fronius Primo 10.0	9.99
2	Aggregated	7/1/2017	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	3.43
3	DUC	3/5/2018		Fronius Primo 7.6	6.66
4	Aggregated	9/12/2017	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	6.5
5	DUC	9/20/2017		Fronius Primo 6.0	6.37
6	DUC	1/26/2018		Fronius Primo 7.6	6.615
7	Autonomous	1/12/2018		Fronius Primo 6.0	6.25
8	Aggregated	9/29/2017	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	6.1
9	DUC	1/8/2018		Fronius Primo 6.0	6.37
	DUC	3/8/2018		Fronius Primo 6.0	6.37
11	DUC	1/22/2018		Fronius Primo 7.6	7.25
12	Aggregated	11/29/2017	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	4.56
13	Aggregated	1/19/2018	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	3.67
14	Autonomous	2/15/2018		Fronius Primo 6.0	6.25
15	DUC	1/10/2018		Fronius Primo 7.6	6.615
16	Autonomous	1/9/2018		Fronius Primo 6.0	6.3
17	Autonomous	3/21/2018		Fronius Primo 6.0	6.25
18	Autonomous	9/13/2017		Fronius Primo 6.0	6.25
19	DUC	2/20/2018		Fronius Primo 7.6	6.5
	Aggregated	4/25/2018	LG RESU10H 9.8kWh 400V	SolarEdge SE7600A	7.2
21	DUC	2/16/2018		Fronius Primo 7.6	6.84
22	DUC	3/7/2018		Fronius Primo 7.6	7.8
23	Autonomous	3/2/2018		Fronius Primo 6.0	6.27
24	DUC	1/24/2018		Fronius Primo 6.0	6.25
25	Aggregated	11/14/2018	2018 Nissan Leaf 10kW/28kWh	Princeton CA-10 Power Systems fast charger	n/a

Residential sites and their various equipment are represented in the following figures. Figure 3-1 shows Site 2, with aggregated holistic control of both the battery and solar systems. Figure 3-2 shows a smart inverter installed for autonomous solar PV control. And Figure 3-3 depicts a different smart inverter model for DUC solar PV control, with the left portion of the figure showing the inside and right showing the fully enclosed installation.

Figure 3-1 Site 2 ESS Aggregated ESS + solar PV control installation (image taken on 1/25/2018)

Figure 3-2 Site 14 Autonomous solar PV control installation (image taken on 3/12/2018)

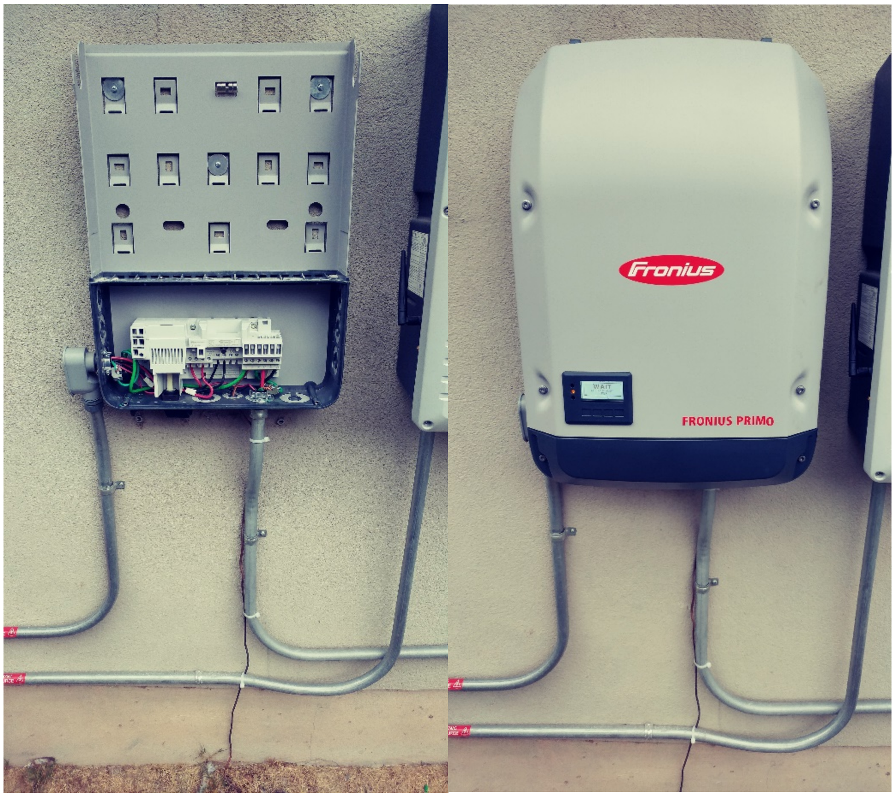

Figure 3-3 Site 19 DUC solar PV control installation (image taken on 3/12/2018)

Last, Site 25 represents the Electric Vehicle (EV) installed in the partnering residential aggregator lab. This vehicle and associated equipment were developed to test Vehicle-to-Grid (V2G) capabilities, in which the car's battery system can provide bi-directional flow of energy back into the "grid". Figure 3-4 shows the car itself at the aggregator lab.

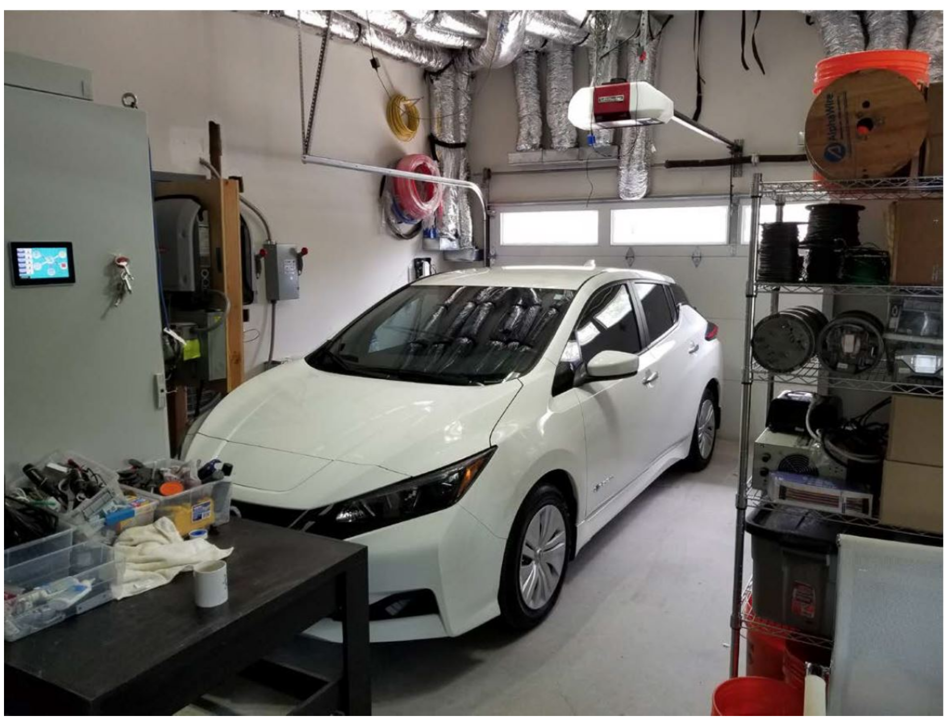

Figure 3-4 2018 Site 25 V2G, Nissan Leaf Electric Vehicle (image taken on 8/15/2018)

Figure 3-5 depicts the EV with the fast charger, allowing for the V2G charging. This installation added battery capacity while parked, for the residential aggregator ESS fleet by 10kW and 28kWh.

Figure 3-5 Site 25 V2G, Princeton CA-10 Power Systems fast charger (image taken on 11/14/2018)

It is the first V2G system installed in Austin, and possibly in Texas. The aggregator implemented “opt-out” local control switch for immediate charging needs. Finally, the charger is robust and designed more for commercial settings than residential, however given the lab test setting the inclusion of this scope of work was largely beneficial for lessons learned through deploying this asset.