Energy Initiatives
at
Marine Corps Base Hawaii

August 2012

Leadership in Energy & Environmental Design (LEED)

$8.8M Youth Activities Center Completed Jun 2011 – LEED Gold Certificate Received!

$39.8M BEQ (150 rooms) Completed May 2012 - LEED Gold Pending – Includes 471KW PV Carports

Physical Fitness Center Under Construction at Camp Smith

FY2011 MCON P-006 PHYSICAL FITNESS CENTER
PHYSICAL FITNESS CENTER and ATHLETIC FIELD IMPROVEMENTS
CAMP SMITH, HAWAII and MARINE CORPS BASE HAWAII, KANEOHE, HAWAII

- Design-Build for LEED Gold
- Solar PV on roof and Carports = 100% of Bldg load
- Water-source heat pump provides hot and chilled water
- Solar pre-heat for HW system
- 60 Ton chiller with Turbocor Compr
- VFDs
- DDC
- Tubular Skylights with Daylighting sensors/controls

Net Zero Home, 485 Nimitz

Historical home renovation with Net-zero energy enhancements completed Sept 2010:

- Exterior insulation wrap
- Insulated vinyl siding
- Window film
- Additional attic insulation
- Attic radiant barrier
- 21 SEER A/C and 0.95 EF water heater
- Home Energy Management System.
- Photovoltaic panels provided by a grant from the US Department of Energy provide 10.6kW of peak power

First Known Historic Net Zero Home in Hawaii and the USMC

Existing PV Power Sites

Bldg 1045 Amorphous BIPV Solar Panels (Bldgs 1033 & 1027 Similar) 32 kW Each

BEQ 7022 Polycrystalline Solar Carports 471 kW

Bldg. 268 BIPV Solar Shingles 26 kW

Amorphous PV-LED Street Lighting

1st Street/Hangar 104

Reeves Road

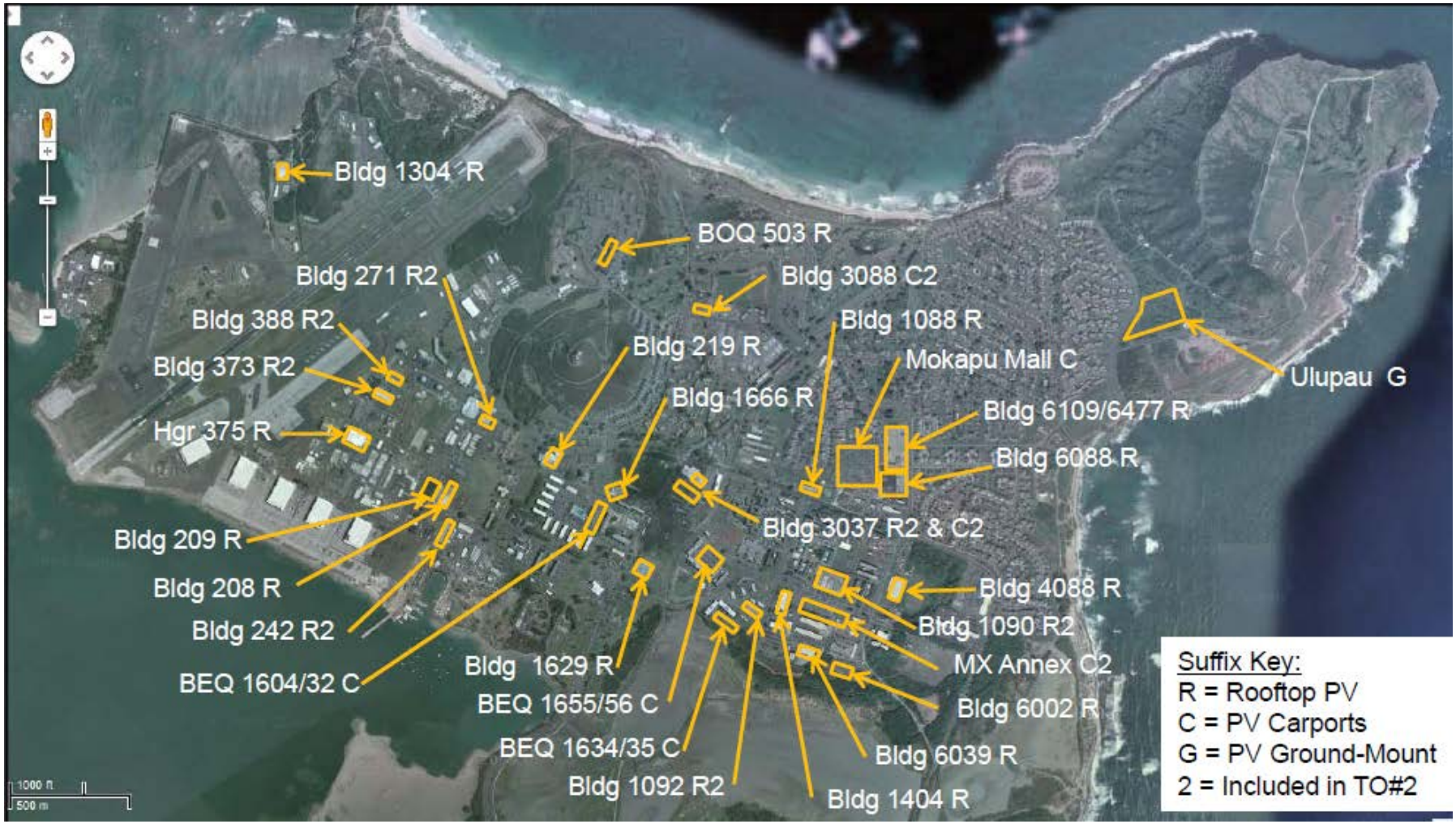
- 35 Watt LED Luminaires
- Motion Sensor Dimming
- 1st Street/Hangar 104:
  - 25 Ft Pole (1 ea), 270º wrapped with thin-film PV
  - Lithium iron phosphate (LFP) battery
- Reeves Road:
  - 15 Ft Pole (27 ea), fully-wrapped with thin-film PV
  - Absorbed Glass Mat (AGM) lead-acid batteries (31% cheaper, but 67% shorter life compared to LFP)

LED Outdoor Lighting

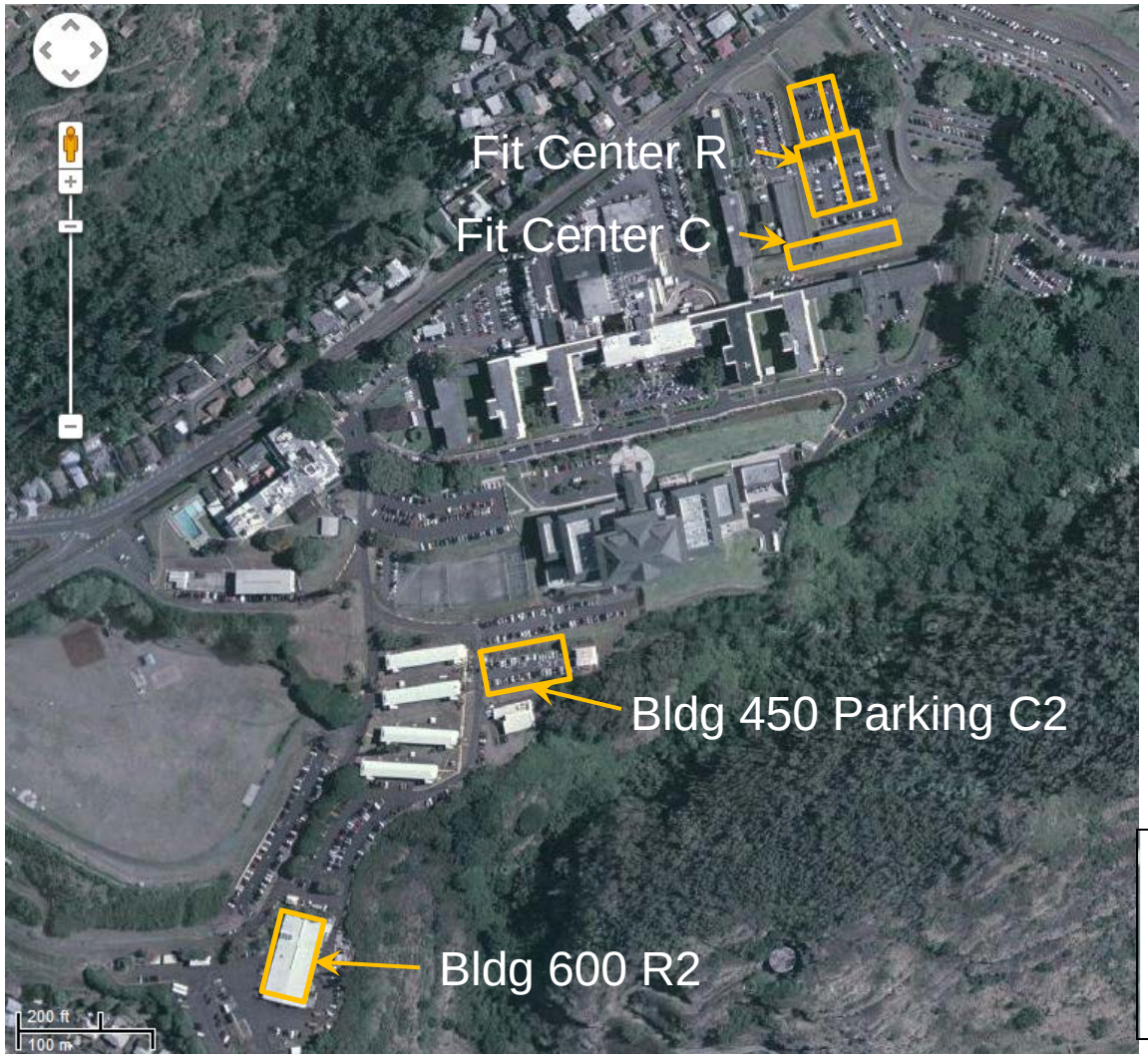
Parking and Street LED Lighting

Airfield LED Lighting

Proposed MCBH Kaneohe Bay Solar Power Sites



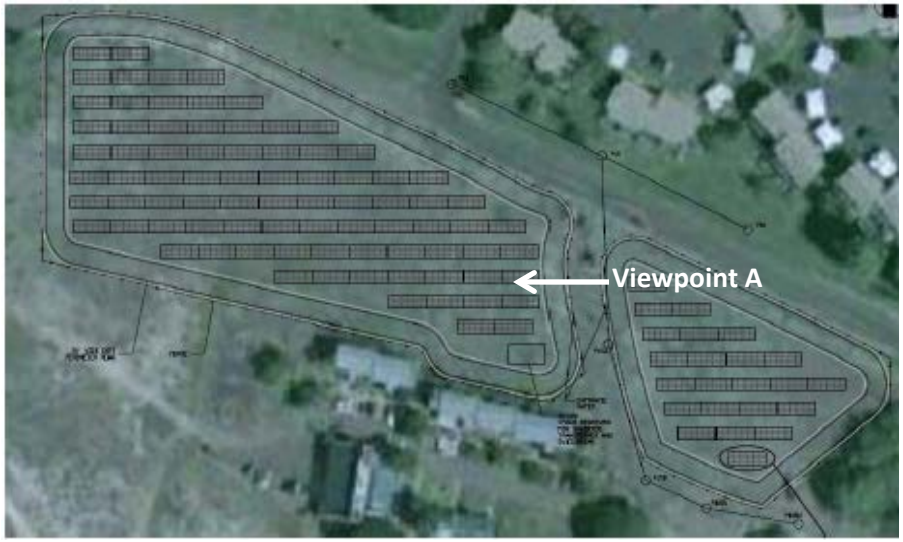
Proposed MCBH Camp Smith Solar Power Sites



Suffix Key:
R = Rooftop PV
C = PV Carports
G = PV Ground-Mount
2 = Included in TO#2

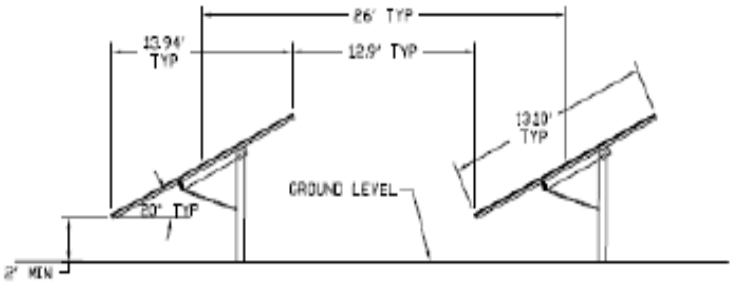
Proposed Puuloa Net Zero Solar PV Power

Puuloa TF, Ground-Mount



A

- Approximately 3.75 Acres total
- Structural support fixed at 20º tilt, 180º azimuth
- Enclosed in chain-link fence(s) w/lockable gate(s)
- Pad-Mounted Transformer and Inverter(s)
- 230kW-DC for net zero
- 655kW-DC, maximum
- HECO Feed-In Tariffs $.189/kWh <=500kW

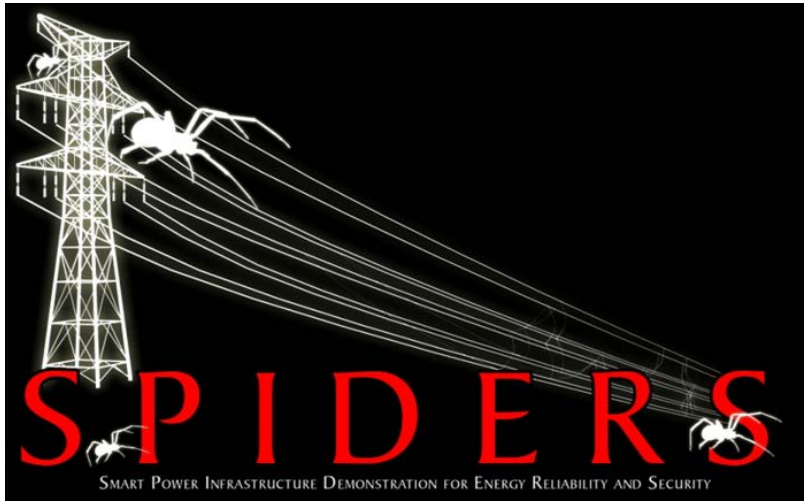


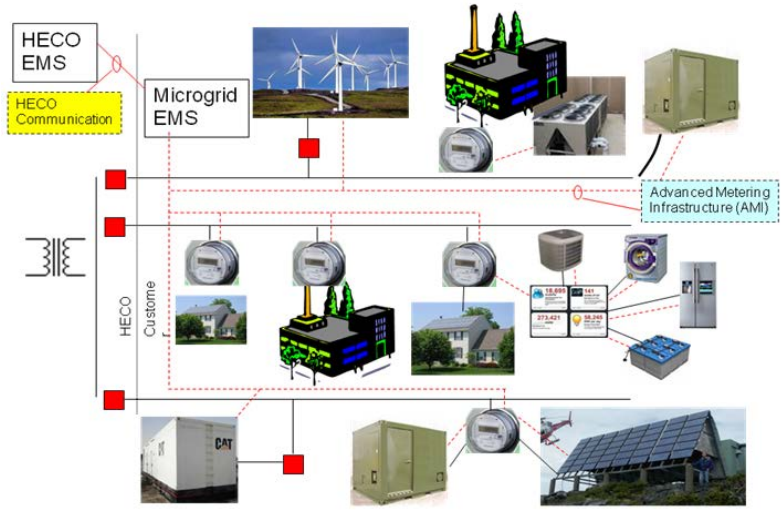
Proposed Bio-Fuel Power Plant Enhanced Use Lease

~2.3 Acre Site at MCBH Kaneohe Bay, Adjacent to Mokapu/Main Substation, WRF, and MCX Gas Lanes

- Phase II – to Nov 2012
  - Industry Forum 1 Aug
  - RFQ Solicitation
  - Best Value Selection
- Phase III – Nov 2012 to Jun 2013
  - Review/Approve Business & Leasing Plan
  - Complete NEPA Documentation
  - Notify Congress; Obtain Approval to Execute Lease
  - Determine Value of In-Kind Consideration
  - Sign Lease

Camp Smith Smart Grid

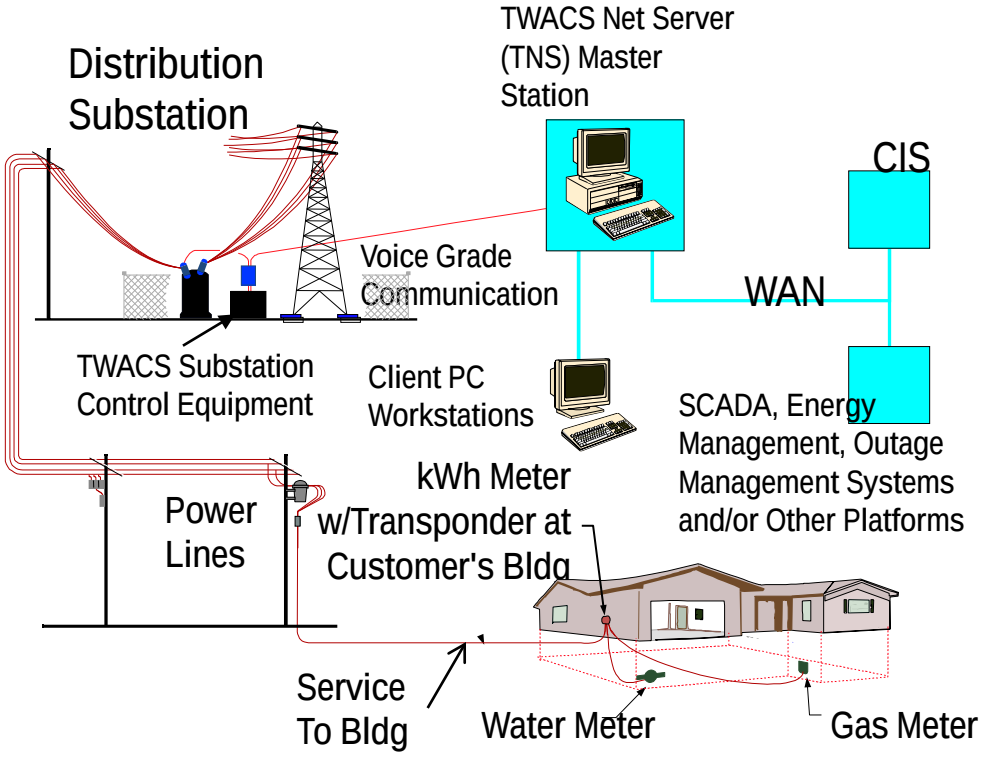


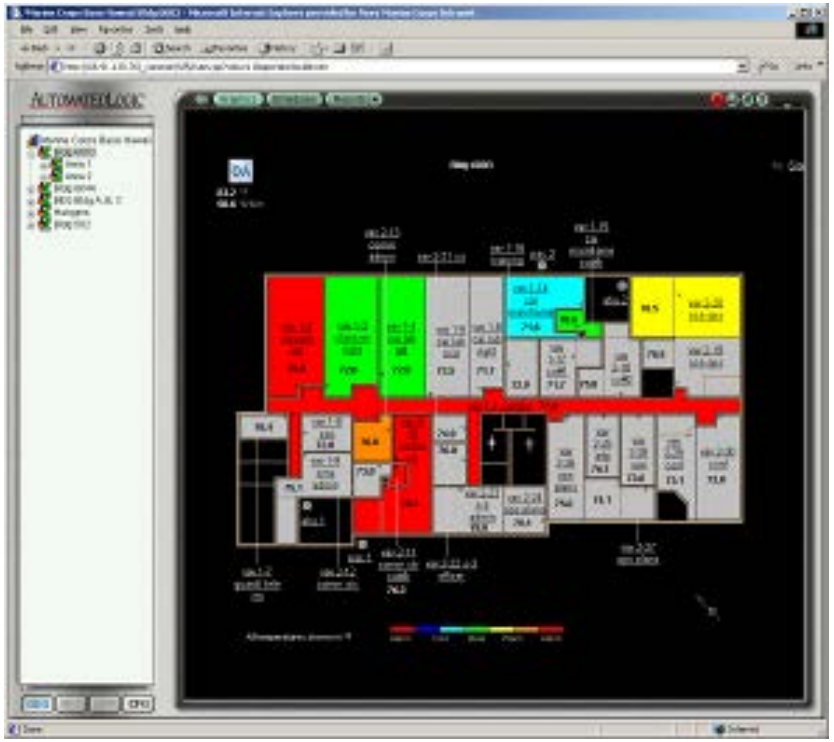


- Existing and new conventional DERs
- New Solar DERs
- Plug-In Electric Vehicles
- Bi-Directional Chargers
- Two-Way Communication
- Cyber Security
- Energy Storage
- Smart Metering
- Demand Response
- Peak Shaving

Camp Smith Smart Grid JCTD Project

Automated Energy/Water Remote Measurement and Control





365 Buildings Monitored Remotely by Smart Meters by March 2013

65 Buildings Monitored and Controlled Remotely by Direct Digital Controls

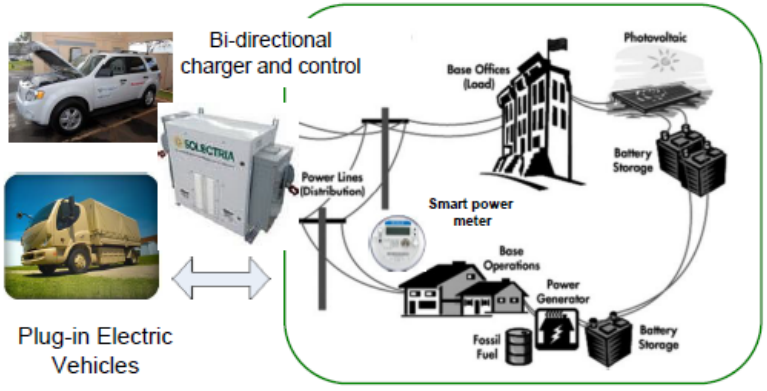
Use of Bio-Fuels

- E-85 Dispenser/Storage in use since Nov 2010
- All 88 Flex-fuel vehicles now using E-85 Ethanol

- Converted All Diesel to B-20 Bio-diesel in Feb 2011
- All diesel vehicles now using only B-20

DOD Electric Vehicle Study

- Assessment of PEV Charging Infrastructure
  - Electrical Grid Capacity & Load, Charging Station Locations, Communications, and Overall Cost
- Assessment of PEV V2G Ancillary Services
  - ISO/Utility/Installation potential and Cost-Benefit for Specific V2G Activities and Operation, V2G Technology and Infrastructure, Overall Cost
  - Battery Right-Sizing for PEVs within the Installation Assessing Mobility and V2g Services
- Anticipated Benefits
  - ROI > Fueled Vehicles
  - Installation Energy Storage
  - Peak Shaving/Demand Reduction
  - Supports DOD ability to meet fuel, GHG, and vehicle mandates

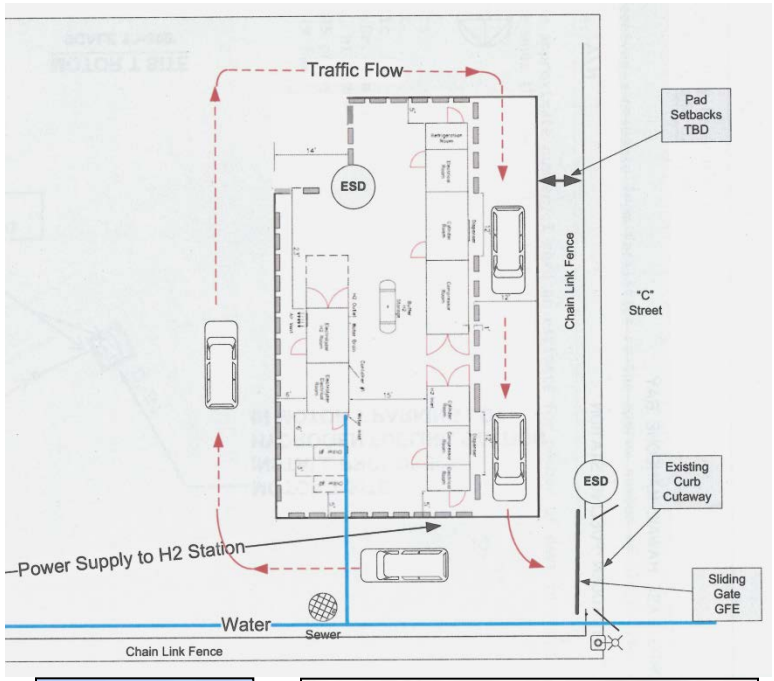


DoD Installation - Grid Ancillary Services

DOD Vehicle-to-Grid Program

- Request for Interest (RFI) responses were due 6 Aug 2012
- Procurement of up to 1,500 Fully-Electric and Plug-In Hybrid Vehicles (PEVs) with Vehicle-to-Grid (V2G) capability
- Implement in 3 Stages:
  1) Management Plan & RFQ
  2) Up to 500 V2G PEVs at up to 7 DOD Installations
  3) Up to 1,500 V2G PEVs at up to 30 DOD Installations
- Approx. 24 months for Stages 1 and 2
- MCBH is a prime candidate, including K-Bay and Cp Smith

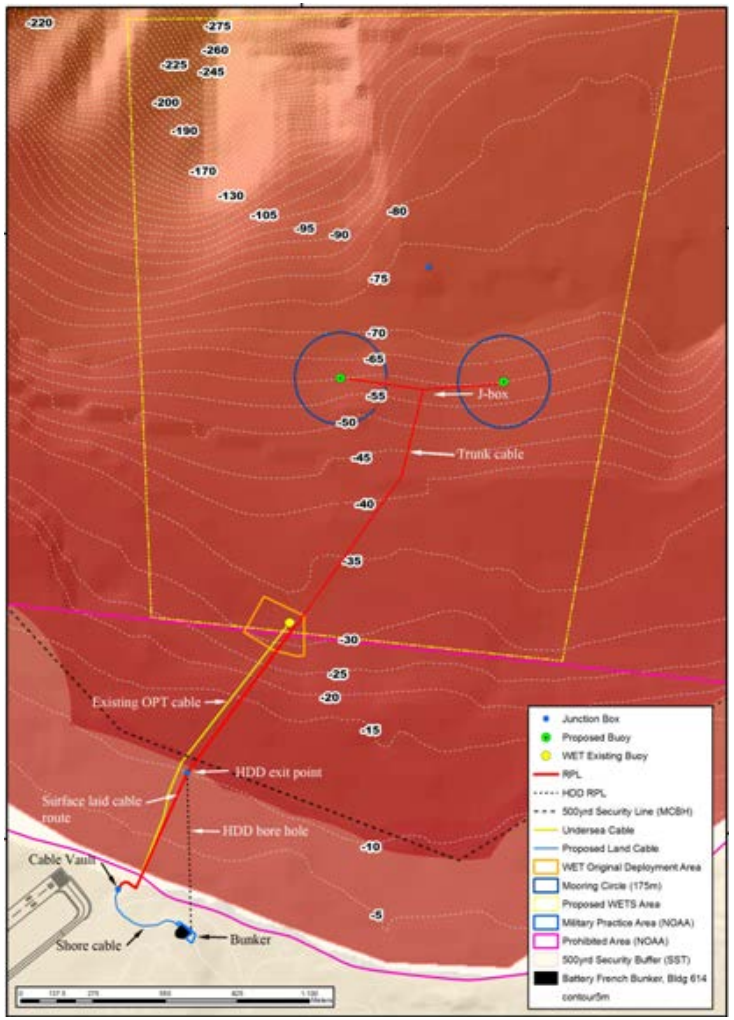
Hydrogen Fueling Station



5 Hydrogen Fueled Vehicles and counting

- **H2 Production Unit**
  - 12 kg per day electrolyzer.
  - 350 Bar Fast-Fill Dispenser
  - Multiple fills of 5 kg @350 bar
  - Compressor
  - Storage, 40 kg @ 450 bar
  - Controls
- **700 bar Upgrade Unit**
  - Allows 3 consecutive 700 bar fast fills
  - Pre-cools hydrogen to -20°C
  - Additional 54 kg of hydrogen storage @ 875 bar
- **Hydrogen Transport Trailer**
  - Deliver additional H2 from Hickam to KBay
  - Capacity of 70 kg @ 233 bar

Wave Energy Test Site (WETS)



Stakeholder Roles & Responsibilities:

- MCBH (provides offshore test area and onshore shelter, connection to grid)
- NAVFAC (ESC/PAC/HI)
  - Permits
  - Infrastructure (one 30m/250KW mooring, two 60m/0.4-1.0MW moorings, power/data cables to shore, data collection facility)
- DOE (grant funding for one developer to test at 30m berth and environmental monitoring support $s to HINMREC)
- Wave Developers (install & operate devices, collect data, provide power to grid, remove device)

Energy/Water Evals & RCx

- Mandated by EISA 2007
- Cover facilities that consume 75% of annual energy use
- Audit 25% of these facilities annually

Facility Dynamics ENGINEERING

- First 2 years accumulated results:
  - 74 No cost/low cost measures identified totaling $133K, saving $538K/year & 2.1MWh/year
  - 49 Efficiency Improvement/Repair projects generated totaling $4.6M, saving $571K/year & 2.2MWh/year
  - Hands-on training for MCBH Maintenance Personnel
  - Building tune-ups for improved efficiency
- 2 Year Cost of Evals & RCx has been $1.3M for 1.3MSF
- 6.0M total cost/1.1M annual savings = 5.4 year payback

Completed/Ongoing Initiatives

- Day lighting with lighting controls In Hangars and Warehouses

- Night-Sky-Friendly Outdoor Lighting, many with motion sensors, so they are normally “off”, or dimmed.
- Solar Hot Water on all residential buildings w/o central A/C
- Waste heat recovery pre-heat for buildings w/hot water and central A/C systems

- ESPC projects totaling $20.4M financed investments that are yielding 77,500MBTU energy savings and $2.5M/year in guaranteed cost savings

Marine Corps Base Hawaii

“Lean and Green”

Support for Our Fighting Marines