Air Force Civil Engineer Center

Integrity - Service - Excellence

Shelter Energy Efficiencies JOCOTAS

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AFCEC/CXXM
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AGENDA

- Current efforts
- Andersen AFB, Guam results
- Ellsworth AFB, SD, winter results
- Future plans

Advanced Energy Efficient Shelters

- Current AF Efforts
  - Completed joint installation of 15 shelters (8 AF, 7 Army at ASAB, Kuwait), summer 2013
  - Completed tropical testing, Andersen AFB, Guam, summer 2014
  - Completed winter testing Ellsworth AFB, SD, winter 2014/2015

Advanced Energy Efficient Shelters
AF Technologies

Evaluating technologies, not shelter manufacturers!

- AF Technologies
  - Two shelter types; Standard BEAR SSS (barrel), Utilis (gable)
  - Shade Flys
  - Photovoltaic covered shade flys (4kW and 5kW peak power)
  - Insulated Liners
  - LED Lights
  - ECUs (currently using IECU for demos)
  - Thermal coatings, covers for ECUs and ducts
  - Insulated vestibules with flys, hard doors

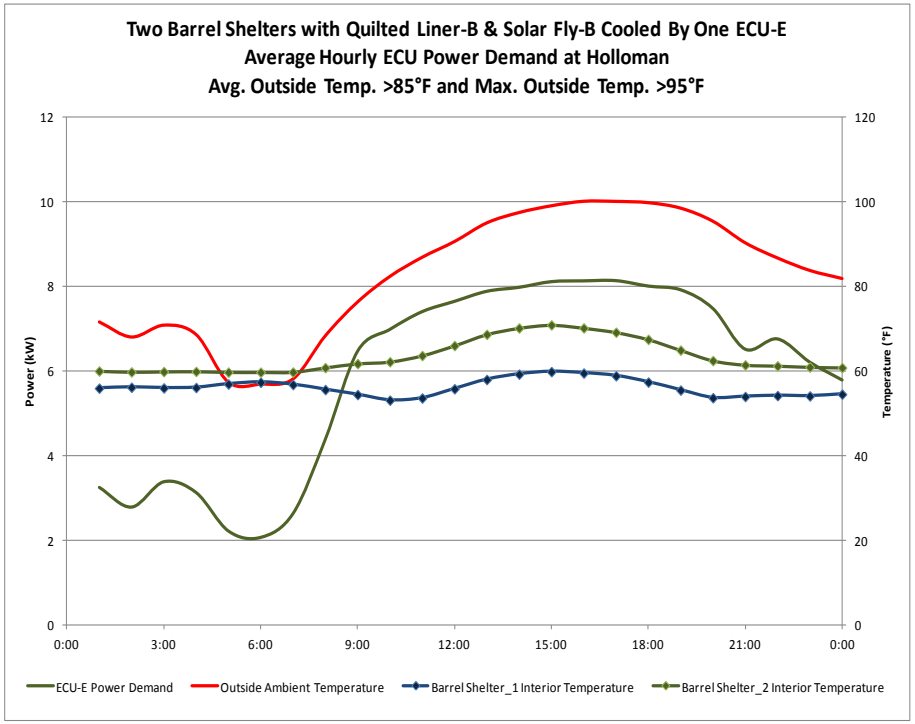
Advanced Energy Efficient Shelters
Comparison

ECU/duct improvements from Ft. Irwin to ASAB, Kuwait

Advanced Energy Efficient Shelter System

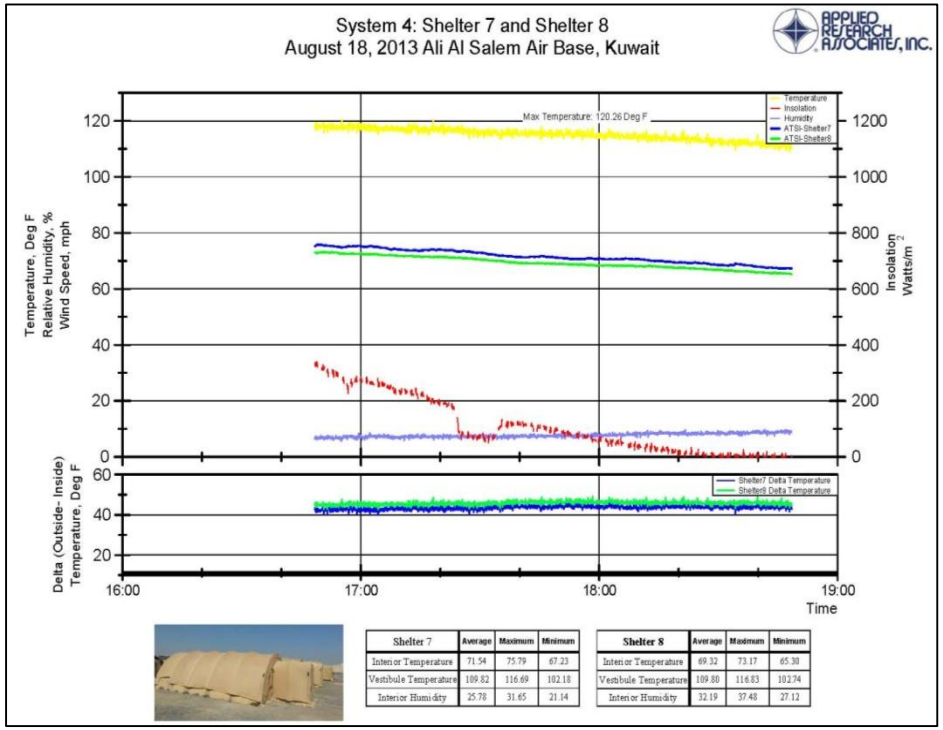
Results Comparison

Ft. Irwin/Holloman



Temperatures peaking at 100ºF, temperature delta between 35ºF and 39ºF

ASAB, Kuwait



Shelter 7	Average	Maximum	Minimum
Interior Temperature	71.54	75.79	67.23
Vestibule Temperature	109.82	116.69	102.18
Interior Humidity	25.78	31.65	21.14

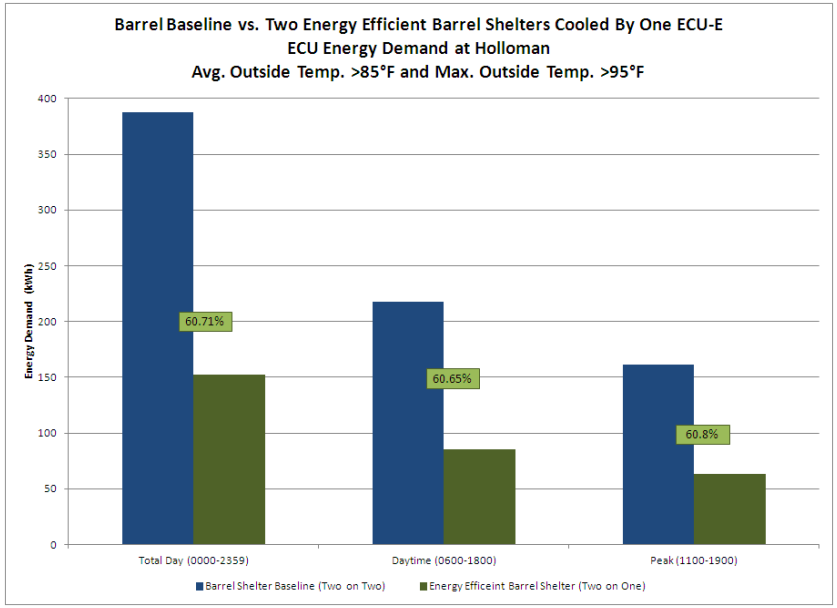
Shelter 8	Average	Maximum	Minimum
Interior Temperature	69.32	73.17	65.30
Vestibule Temperature	109.80	116.83	102.74
Interior Humidity	32.19	37.48	27.12

Temperatures peaking at almost 120ºF, temperature delta well over 40ºF (shelter temperatures in mid 70s)

Advanced Energy Efficient Shelter System

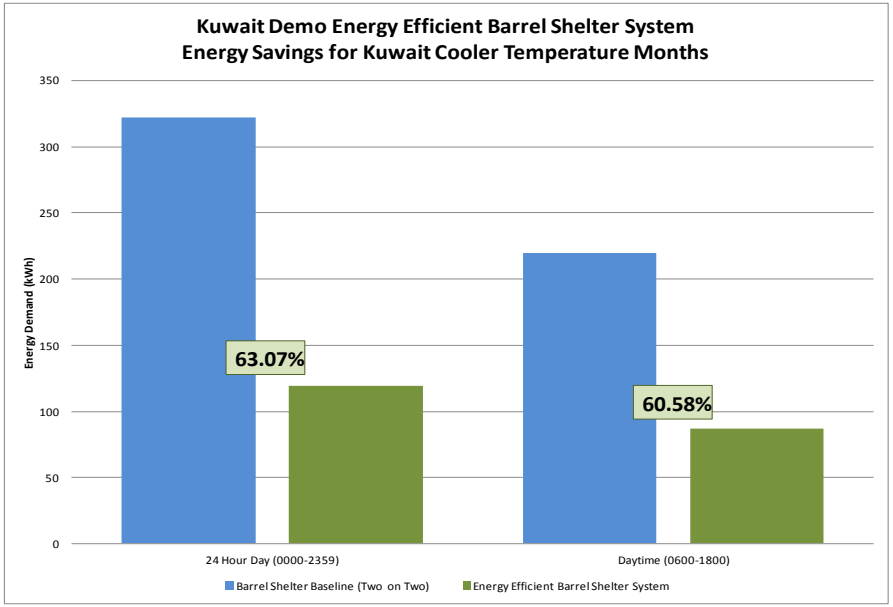
Results Comparison

Ft. Irwin/Holloman



Energy saving achieved higher than 50% target

ASAB, Kuwait

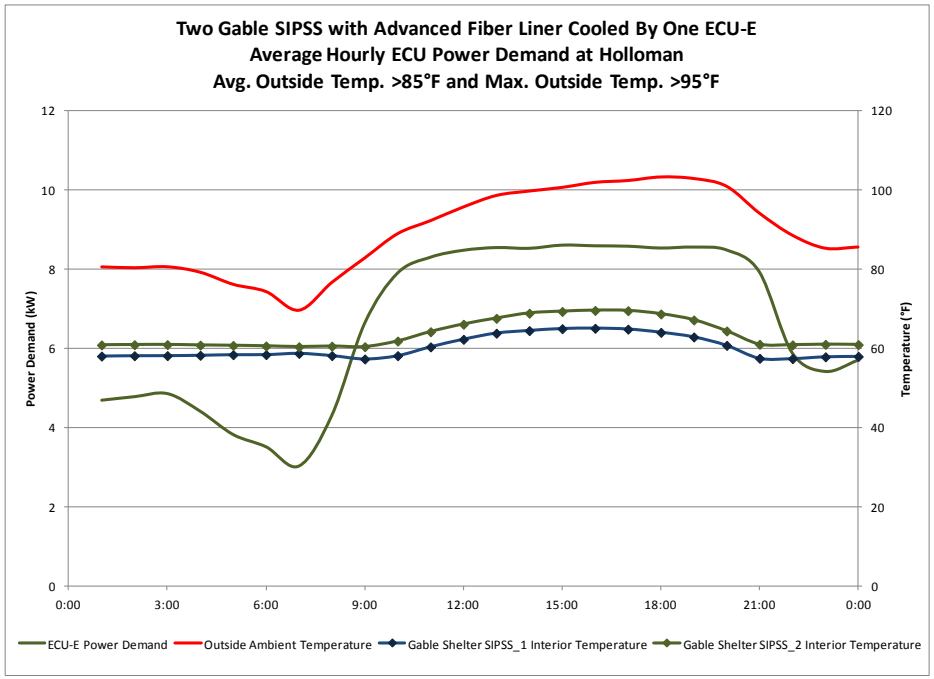


Savings maintained from Ft. Irwin for similar temperatures while improving temperature deltas.

Advanced Energy Efficient Shelter System

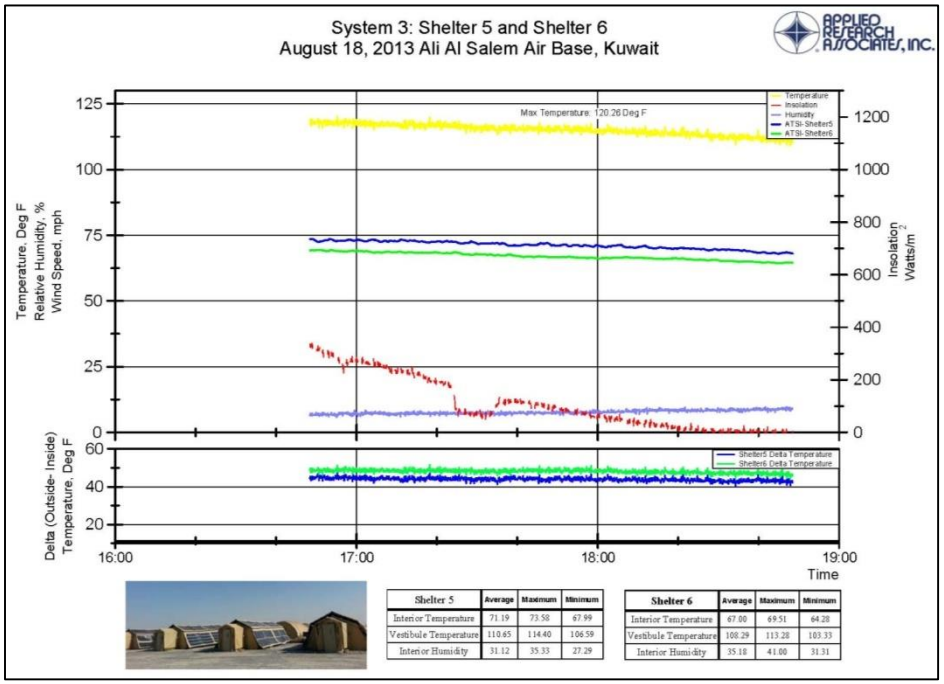
Results Comparison

Ft. Irwin/Holloman



Temperatures peaking at slightly over 100°F, temperature delta between 35°F and 39°F

ASAB, Kuwait



Shelter 5	Average	Maximum	Minimum
Interior Temperature	71.19	73.58	67.99
Vestibule Temperature	110.65	114.40	106.59
Interior Humidity	31.12	35.33	27.29

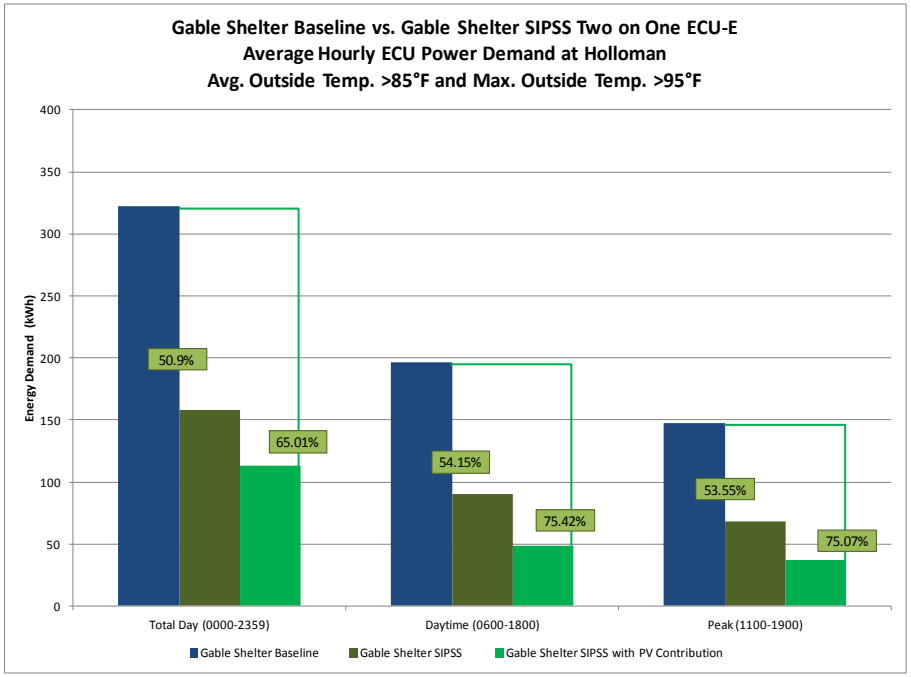
Shelter 6	Average	Maximum	Minimum
Interior Temperature	67.00	69.51	64.28
Vestibule Temperature	108.29	113.28	103.33
Interior Humidity	35.18	41.00	31.31

Temperatures peaking at almost 120°F, temperature delta well over 40°F (shelter temperatures below 75°F!)

Advanced Energy Efficient Shelter System

Results Comparison

Ft. Irwin/Holloman



Energy savings achieved higher than 50% target

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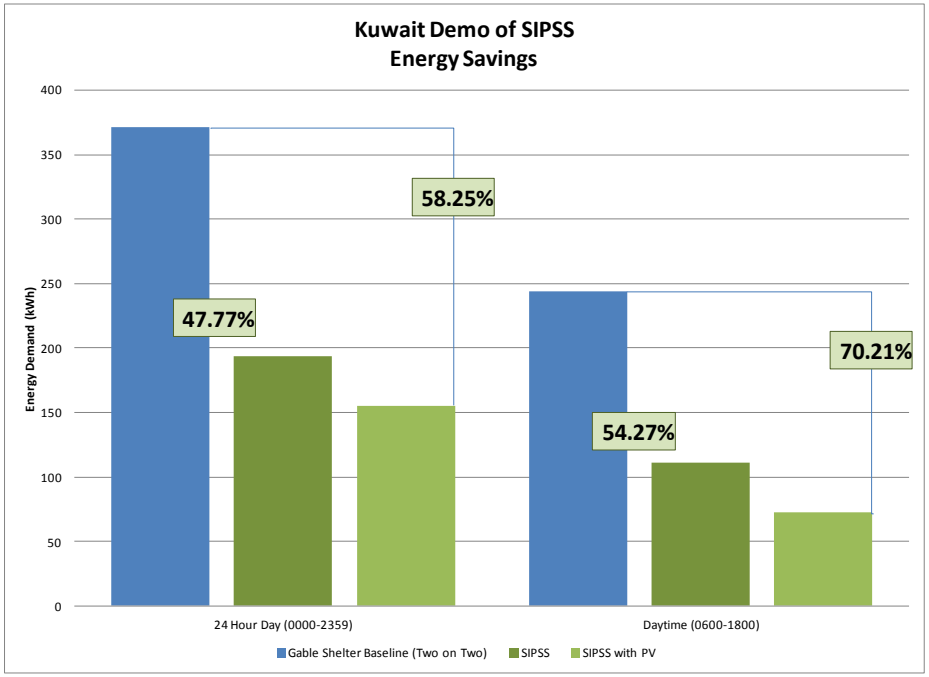
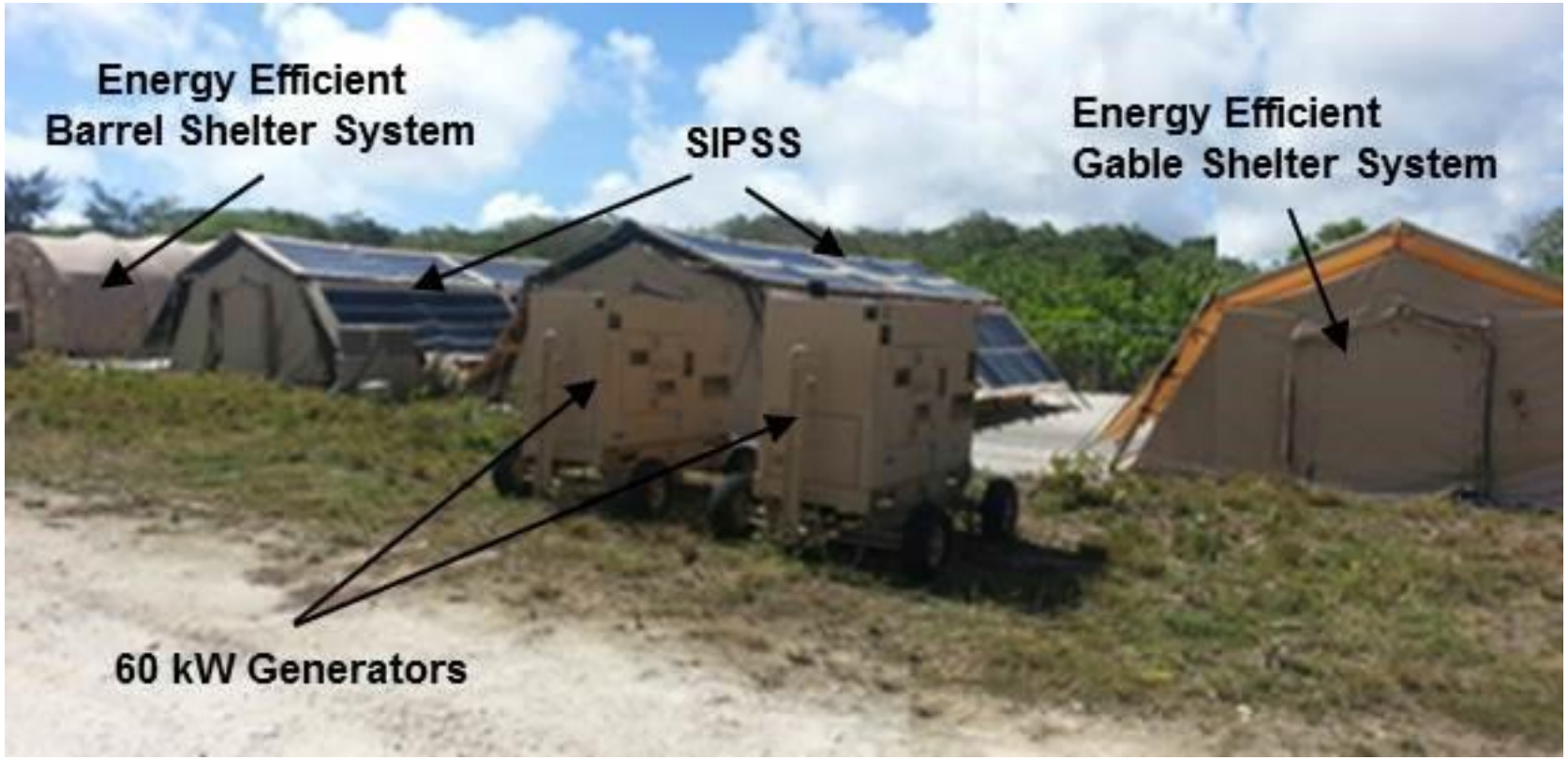


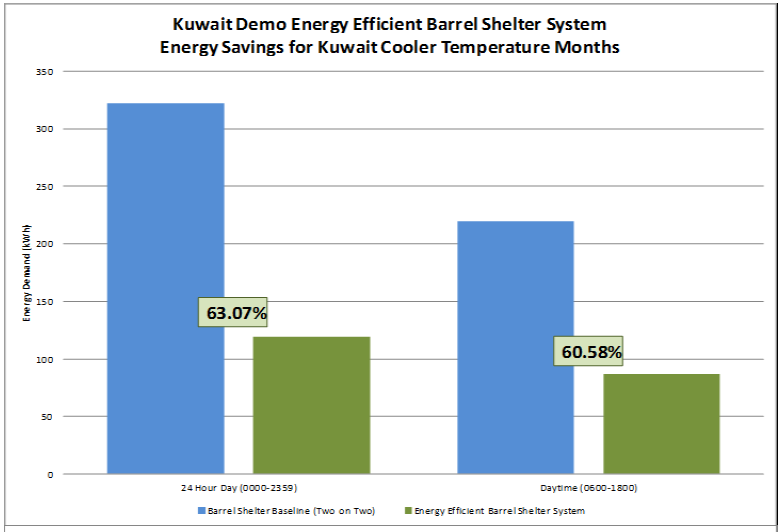
Energy saving achieved slightly missed the 50% target for total day; however thermostats were set to max cooling, and shelter temps were below 75°F (troops said they were cold). Raising thermostat would improve savings.

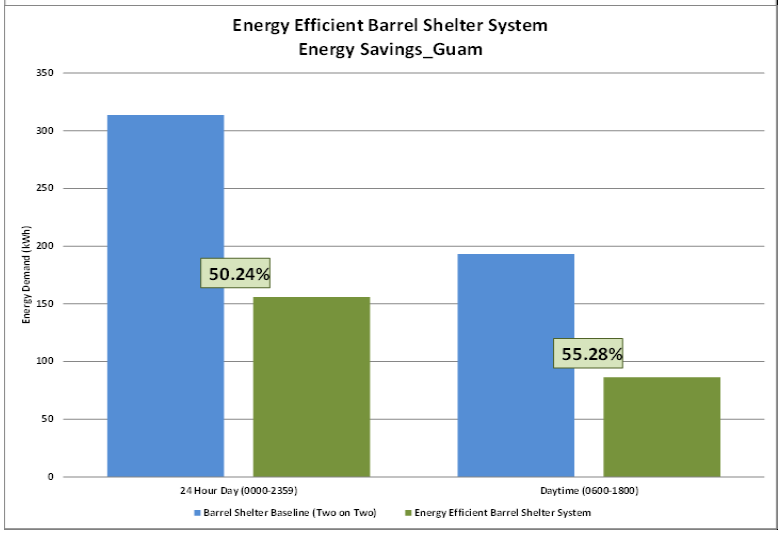
Advanced Energy Efficient Shelters
Andersen AFB, Guam, Results

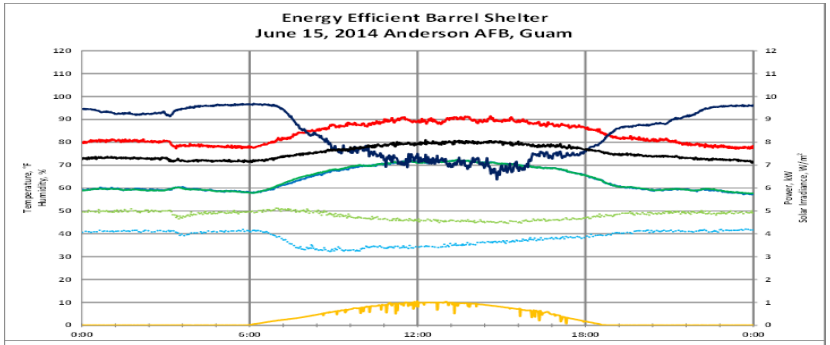


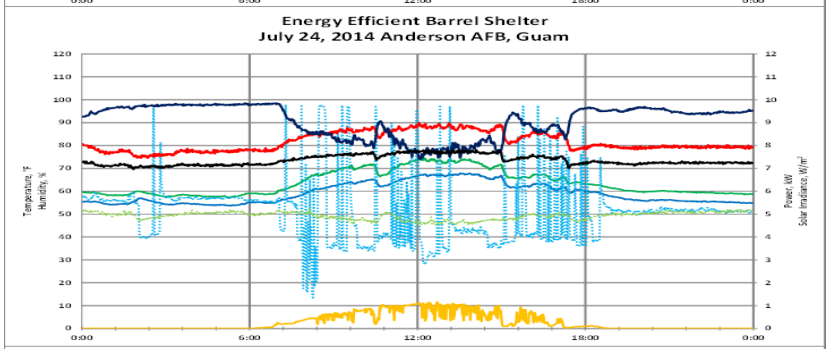
Advanced Energy Efficient Shelter System

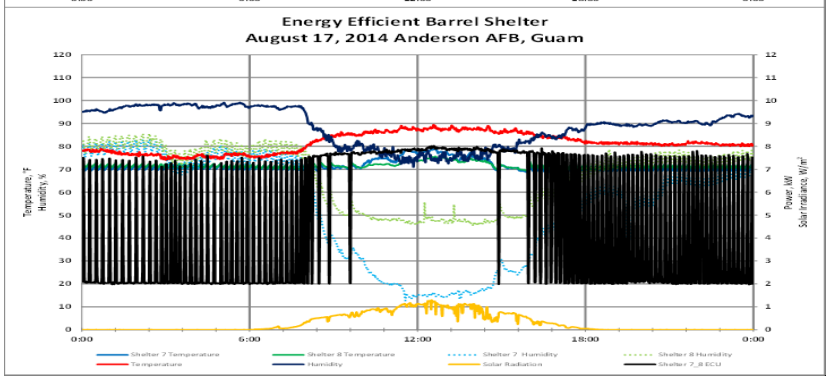
Andersen AFB, Guam, Results











Advanced Energy Efficient Shelter System

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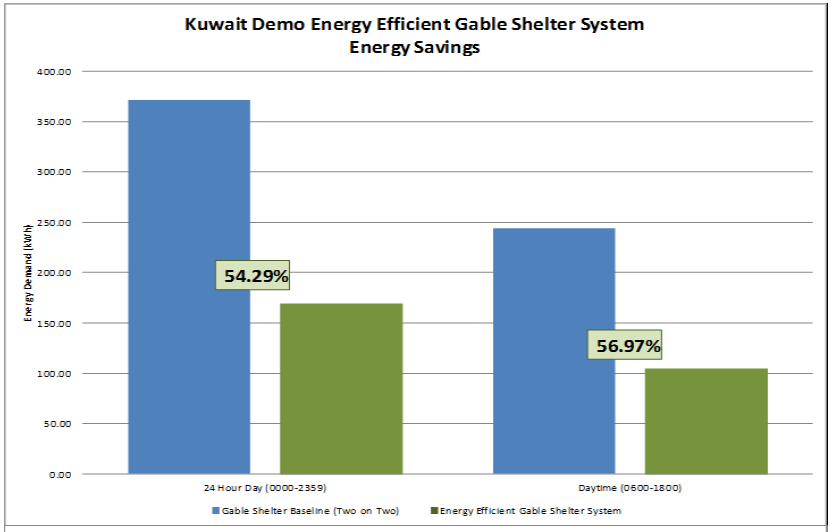
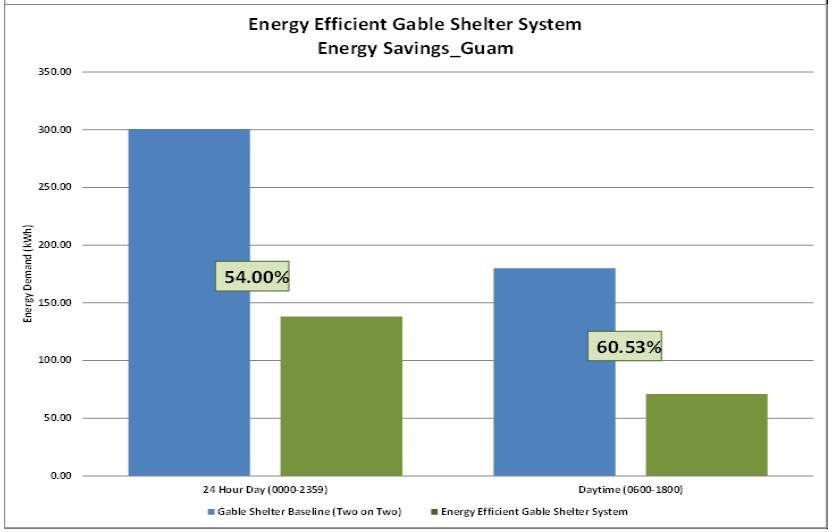
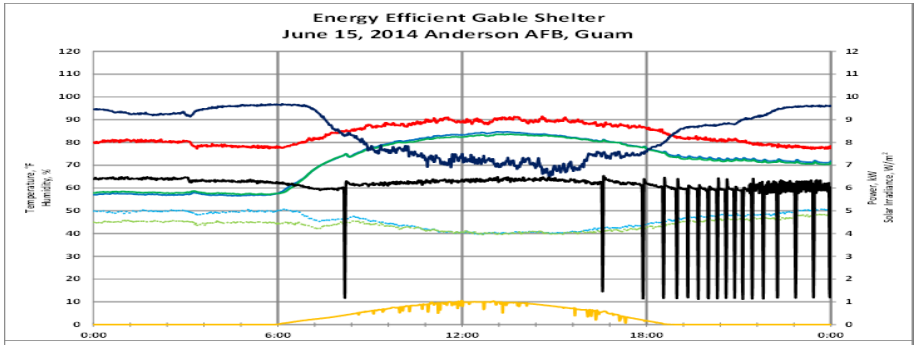
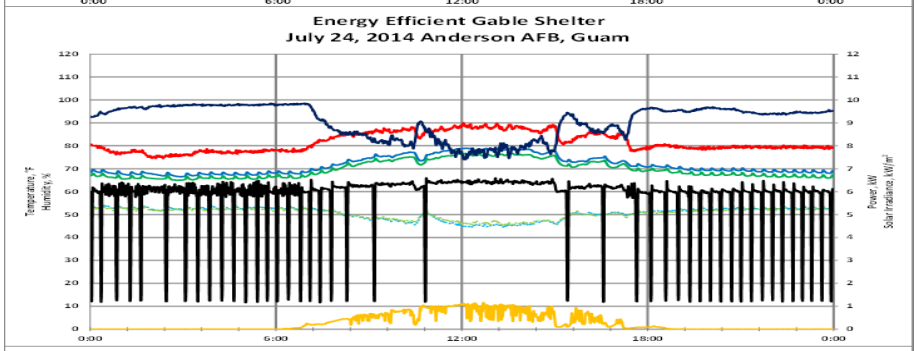
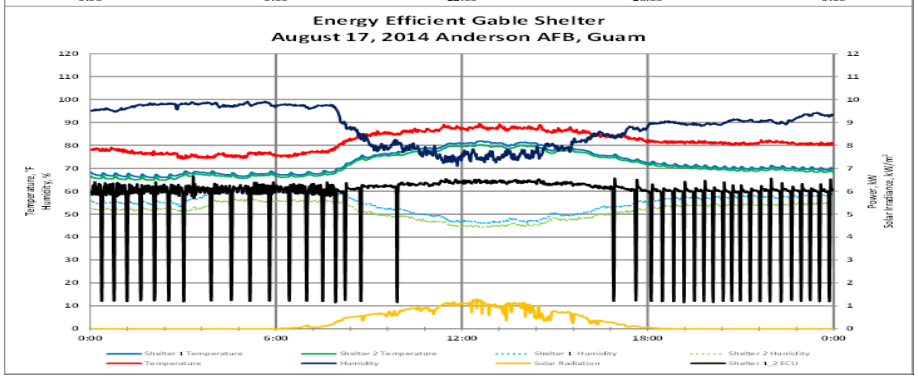








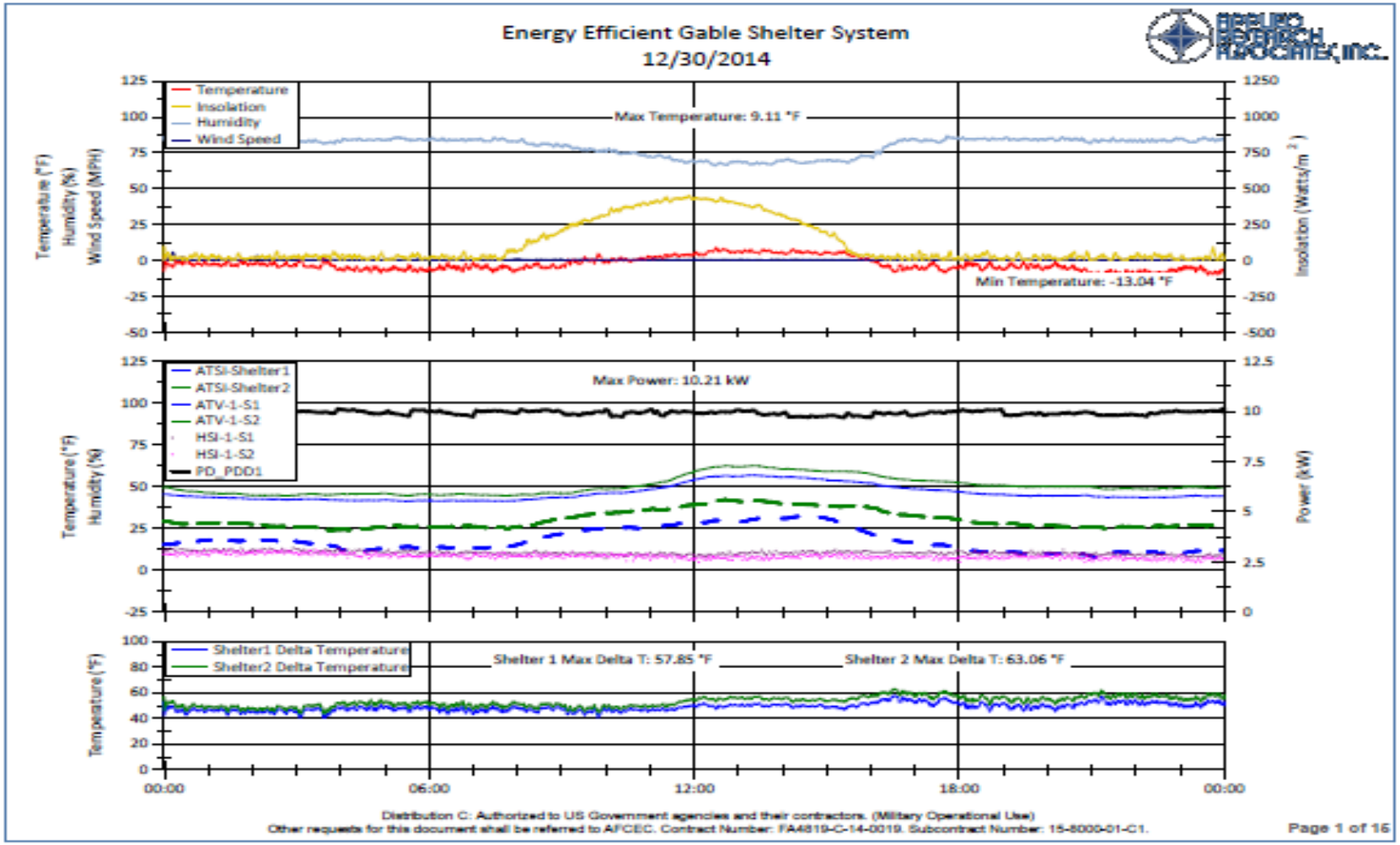


Advanced Energy Efficient Shelters

Ellsworth AFB, SD, Winter Results

Advanced Energy Efficient Shelter System

Ellsworth AFB, SD, Winter Results



IECU

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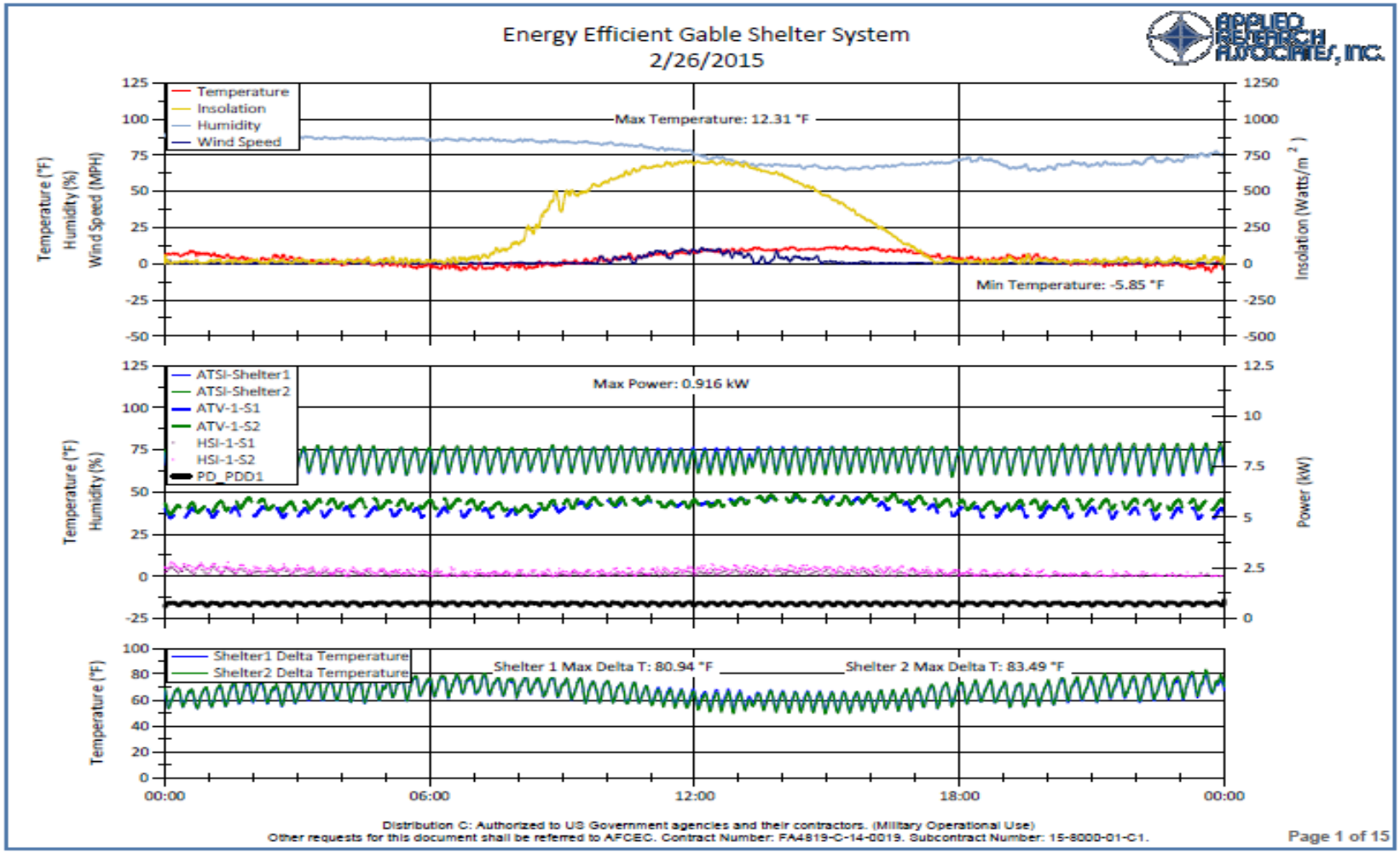
Ellsworth AFB, SD, Winter Results



130K BTU Fuel Fired Heater

Advanced Energy Efficient Shelters
Future Plans

- **Future Efforts**
  - **Final joint test with the Army; set up in process at Holloman AFB, NM**
    - **4 shelters shipped from Ellsworth AFB, SD**
    - **2 new shelters with latest technologies; new thermal reflective outer fabric/fly/duct covers, floors, liner, doors**
    - **Minimum of 4 configuration changes to thoroughly evaluate effectiveness of new technologies, particularly new fabric for application to both small and medium/large shelters**
  - **Develop requirements document for new BEAR Energy Efficient Shelter following completion of Holloman testing**
    - **Funded in BEAR modernization plan beginning in FY18**

Questions