



# **NAS Patuxent River Energy Incentive Contest**



# Definitions for Contest



## ➤ **MBTU = Mega British Thermal Unit**

- What: A standard unit to measure energy
- Why: We need an apples-to-apples comparison of different units of energy.  
I.E. How do we compare a barrel of oil to a kilowatt of electricity?
- How: Convert each unit to MBTU by using a standard formula  
I.E. a MWH (Mega Watt Hour) of electricity is converted to a MBTU by multiplying each MWH by 3.414

## ➤ **“EUI” = Energy Use Intensity**

- What: A standard unit to measure energy concentration between facilities of similar use
- Why: We need an apples-to-apples comparison of energy consumption for different sized facilities.  
I.E. How do we compare a big building with medium energy use to a small building with high energy use?
- How: Take the consumption in standard MBTU's and divide by the facility square footage: Consumption (MBTU) / Thousands of Square Feet (KSF)

## ➤ **“Benchmark Score”**

- What: a standard way to measure energy concentration between all facilities (similar or not)
- Why: we need an apples-to-apples comparison of energy consumption for facilities that have different uses (e.g. how do we compare an industrial machine shop to an office building?)
- How: lookup “**Category Benchmark**” determined by DoN independent study of consumption - result is “expected” energy in (MBTU / KSF); plug into the following formula: **Benchmark Score** = 1 – (EUI / **Category Benchmark**)
- NOTE: if a benchmark score is above zero, the facility is performing better than “expected”; a benchmark score below zero means the facility is performing worse than “expected”

***Although not without issues, “Benchmark Score” is the fairest way to measure a contest.***



# 25 Benchmarked Building Categories

(from CNIC Goals 4.0)



1. Clubs & Dining Facilities
2. Communications Facilities
3. Community Facilities
4. Data center
5. Family Housing
6. Fuel & Liquid Dispensing & Storage Facilities
7. Gate / Guardpost / Watch Tower
8. Land, Waterfront and Coastal Operations Facilities
9. Maintenance Facilities
10. Medical Facilities
11. Office
12. Parking & Open Structures
13. Power / Heat Generation
14. Primary & Secondary Schools
15. Production Facilities
16. Public Safety & Base Services
17. RDT&E Facilities
18. Stand-alone Retail
19. Supermarket
20. Training Facilities
21. Transient & Visitor Housing
22. Unaccompanied Personnel Housing
23. Utility Infrastructure
24. Warehouse
25. Water, Sewage and Waste Facilities



# CNIC Benchmarking Scores



- Commander Navy Installations Command (CNIC) has created EUI benchmarks for each of the 25 categories in each of the 16 climate zones
  - Aligns all Navy Category Codes to 25 Benchmark Building Categories
    - Allows comparison of like use facilities
  - Climate zones – normalizes for regional temperature and humidity based on commercial standards
    - Supported by American Society of Heating, Refrigeration, and Air-Conditioning Engineers. (ASHRAE) (based on ASHRAE standard 90.1)
    - Supported by International Energy Conservation Code (IECC)
- By comparing a raw EUI to CNIC benchmark, we can compute a “**benchmark score**”
  - A “**benchmark score**” shows individual facility progress towards its benchmark – and any “**benchmark score**” can be compared to any other “**benchmark score**”
    - Yellow: 0 = “expected”
    - Red: below 0 (negative) = below “expected”
    - Green: above 0 (positive) = above “expected”



# BLDG Benchmark Score Calculation Methodology



- $Building\ Benchmark\ Score = 1 - \frac{Actual\ EUI}{Benchmark\ EUI}$
- $\lim_{Actual\ EUI \rightarrow 0} Building\ Benchmark\ Score = 1$
- $\lim_{Actual\ EUI \rightarrow \infty} Building\ Benchmark\ Score = -\infty$
- “Large negative” → unfavorable energy consumption: building is using more energy than other buildings in the same category
- Zero is meeting benchmark EUI
- Positive number → favorable energy consumption: closer to 1, the better
- One is net zero
- Above one is energy generation!

