FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

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NASA Net Zero Energy Buildings Roadmap

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http://www.nrel.gov/docs/fy15osti/60838.pdf

Hosted by:

FEMP
Federal Energy Management Program

FPL

Field Centers & Component Facilities

Sustain-able Design Policy Since 2003

Executive Order 13514 Goals

"… establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies…"
(Preamble)

"… implement high performance sustainable Federal building design, construction, operation and management, maintenance, and deconstruction including by:
(i) beginning in 2020 and thereafter, ensuring that all new Federal buildings that enter the planning process are designed to achieve zero-net-energy by 2030 …"
(Sec. 2. Goals for Agencies. (g)(i))

NREL RESEARCH SUPPORT FACILITY

360,000 SF

Office Building

Golden, CO

2010-2011

Image courtesy of RNL

NASA NZEBs Roadmap Structure

To guide NASA's incremental transition to developing and operating NZEBs as Agency standard practice

Strategic

- Established clear interpretation of EO 13514 sections related to NZEBs

Organizational Proficiencies

- Identified 6 key proficiencies essential to NASA's transition to NZEBs

Tactical

- Prioritized 57 tactics for Agency-level and building-level transition

Proficiency	Tactic Count	Purpose
NZEB Workflow	8	Integrate roadmap into current processes
Acquisition Process	12	Use energy performance-based acquisition
Energy Efficiency	20	Require overall efficiency and system focus
Renewable Energy	6	Phase-in renewables second to efficiency
Operations	9	Develop operation effort unique to NZEBs
Achieve NZEB	2	Deploy in design/construction & operation

Application of Executive Order 13514 For NASA

NZEB definition: annual operational, **site energy goal fo**r new buildings

- Step 1. Best-in-class energy efficiency (EE), demand-side energy use intensity (EUI)
  - 50% reduction versus AHSRAE Standard 90.1-2010 starting in 2020
- Step 2. Maximize zero-emitting roof/building-integrated RE
  - All buildings meet a minimum 20% of the RE requirement at this step
- Step 3. Maximize zero-emitting site/center RE
  - All low-load buildings should meet NZEB design at this step
- Step 4. Consider on-site generation from imported offsite RE
  - Evaluate current federal requirements and benefits beyond NZEB compliance, and perform a greenhouse gas LCA with guidance from EMD
- Step 5. Consider purchase of regional utility “green power”
  - Invest in newly installed offsite RE

NZEB Proficiencies for NASA

Capstone and Organizational Proficiency Categories	Purpose
CP1: Institutionalize NASA NZEB workflow	In 2014, transition the NZEB roadmap into a formal NASA process that integrates into current project planning, execution, and review processes.
OP1: Establish NZEB acquisition process	In a step-by-step approach, integrate elements of an energy performance-based acquisition process into current NASA acquisition processes; starting in 2017, all projects begin with a project structure that is conducive to achieving NZEBs.
OP2: Establish EE system best practices	A base level of energy efficiency is required by all new projects. Key system elements and performance requirements are identified that have been shown to be roadblocks to NZEBs in low energy building case studies. Each new construction project should select at least two system-level tactics that will result in a set of lessons learned that will ensure success on future projects.
OP3: Establish RE system integration process	In line with the NZEB definition and steps identified in this roadmap, RE systems can be time phased and emphasized second to energy efficiency. Once NASA has started to demonstrate proficiency in the energy efficiency categories of envelope, lighting, HVAC, and MELs, project resources should be directed toward integrating RE systems.
OP4: Establish NZEB operations plan	NZEB operation requires efforts that are not common in standard practice. The tactics identify efforts related to submetering, O&M practices, and occupant engagement.
CP2: Achieve NZEBs	As a capstone category, these tactics define agency-level metrics for tracking progress toward the EO 13524 NZEB goal.

CP-1: Institutionalize NASA NZEB Workflow

- Implement NASA NZEB Roadmap
- Annual Tracking of progress toward NZEB Goal
- Implement pilot projects to develop proficiencies in NZEB methods
  - Develop NZEB ongoing pilot review and lessons learned through their existing POE process
  - Standardized strategies and NZEB project workflows
  - NASA NZEB design guidelines
- Agency oversight for time-phased NZEB program rollout
  - Communicate successes
  - Understand status

OP-1: NZEB Acquisition Process

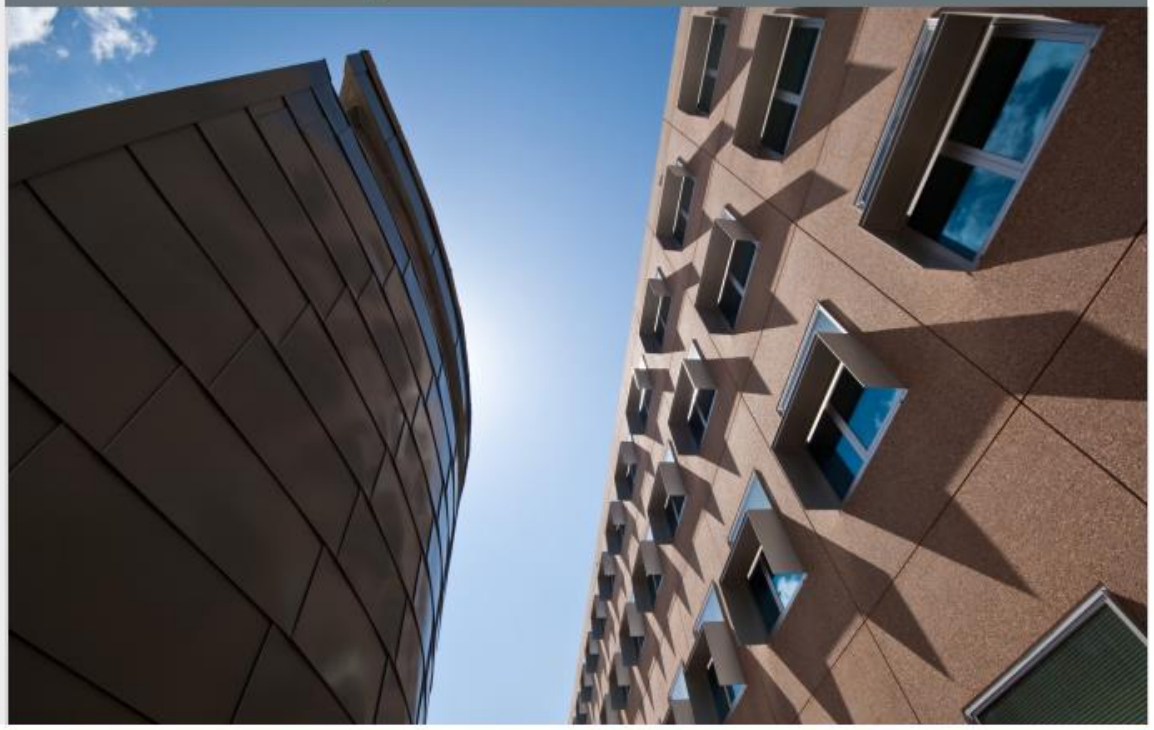
- Develop a standardized way to incorporate NZEB targets for EE and RE into new construction contracts
  - Integrated Project Delivery (IPD) Requirements
  - Energy-performance based Design-Build specs
- Emerging best practices for incentivizing NZEB Operations
  - Successful M+V required in design-build contract
  - 1 year of verified performance?
- Energy modeling tools to predict energy performance and drive design decisions

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

How-To Guide for Energy-Performance-Based Procurement

An Integrated Approach for Whole Building High Performance Specifications in Commercial Buildings



https://buildingdata.energy.gov/cbrd/energy_based_acquisition/

OP-2: Energy Efficiency Best Practices

- Target 50%+ demand side savings
  - www.ashrae.org/aedg
  - Note 30% savings over 90.1-2010 now required
- Focus on simple and passive solutions first
  - Massing
  - Orientation
  - Glazing amount and orientation
- Load reduction design next
  - Invest in a high quality thermal envelope
    - Continuous insulation system
    - Air barrier requirements WITH whole building airtightness testing
  - Solar gain shading
  - Expect to provide glare free daylighting across 75%+ floor space
  - Aggressive plug load reductions

OP-2: Energy Efficiency Best Practices

- Efficient Active Systems
  - Dedicated outside air with hydronic distribution
    - Demand controlled outside air with exhaust air energy recovery
    - Say NO to reheat
  - Full LED electrical lighting with fixture based sensor and controls
- Controls
  - Vacancy sensors throughout for lighting controls
  - What can be turned OFF at night?

DECOUPLED VENTILATION


RADIANT SLABS

OP-3: Renewable Systems Integration

- Balance efficiency costs with renewables cost
- PV ready building design
  - Expect to maximize roof area for PV
  - Minimize shading
  - Streamline installation
  - Plan for site based PV
    - Parking
    - Ground mounts
- Financing
  - Third-party owned?
  - On-site vs. off-site
  - Replacement RECs
- Allocation of new renewables to new buildings

Renewable Integration at NREL


THE HANDOFF


FUMBLE!

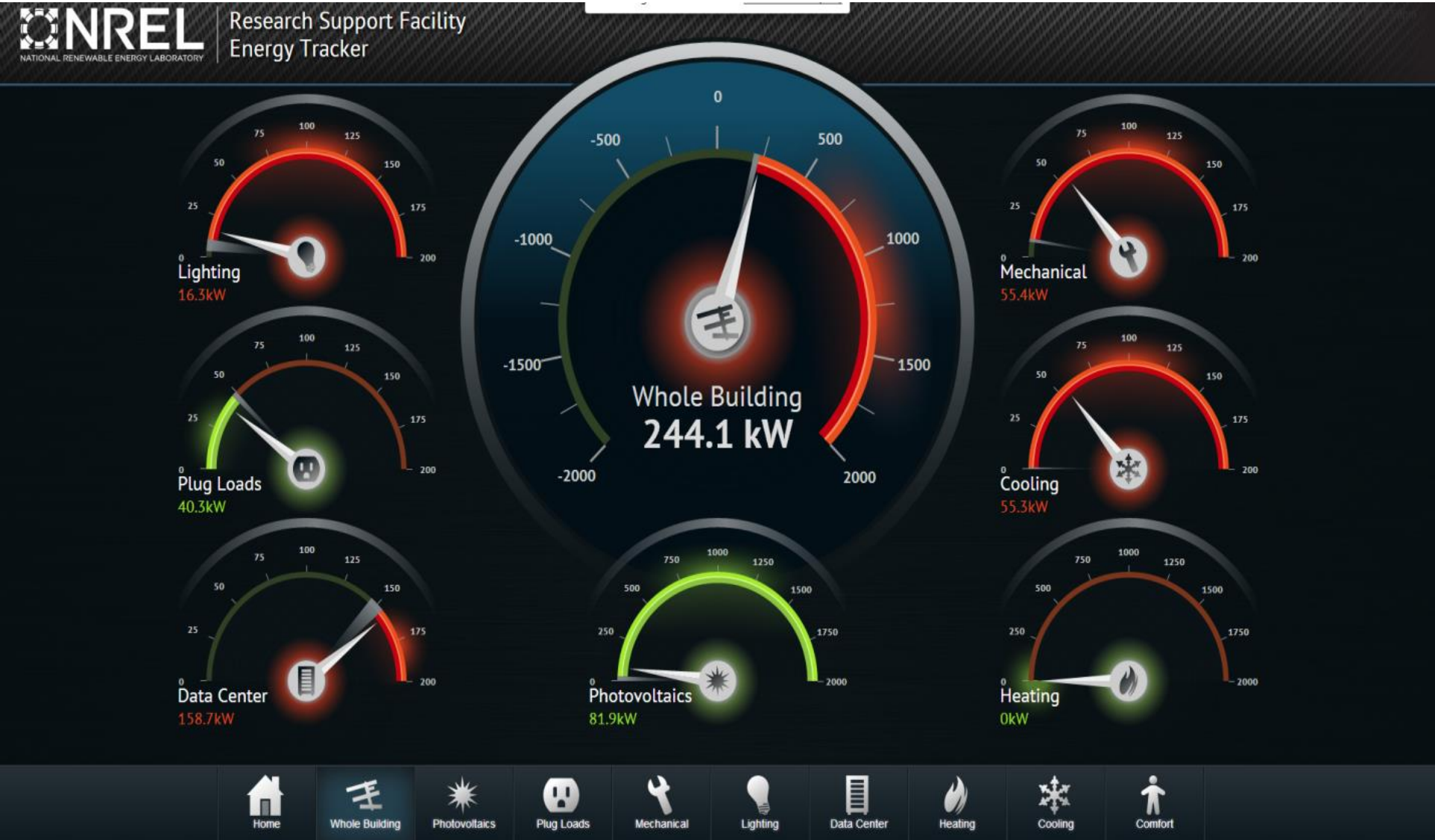
OP-4: NZEB Operations Plan

- Who is responsible for NZEB?
  - Reporting and “NZEB Commissioning”
- Dashboards and informatics that work
  - Submetering that is used real-time
- NZEB Occupants
  - Training
  - Occupant loads
  - Administer change management
- NZEB Contingency plan
  - 10-20% extra PV
  - Ongoing load growth management
    - Is it the most efficient way?
    - Do we have extra PV?
    - Plan for future PV for additional offsets

NZEB Dashboards

NZEB Dashboards

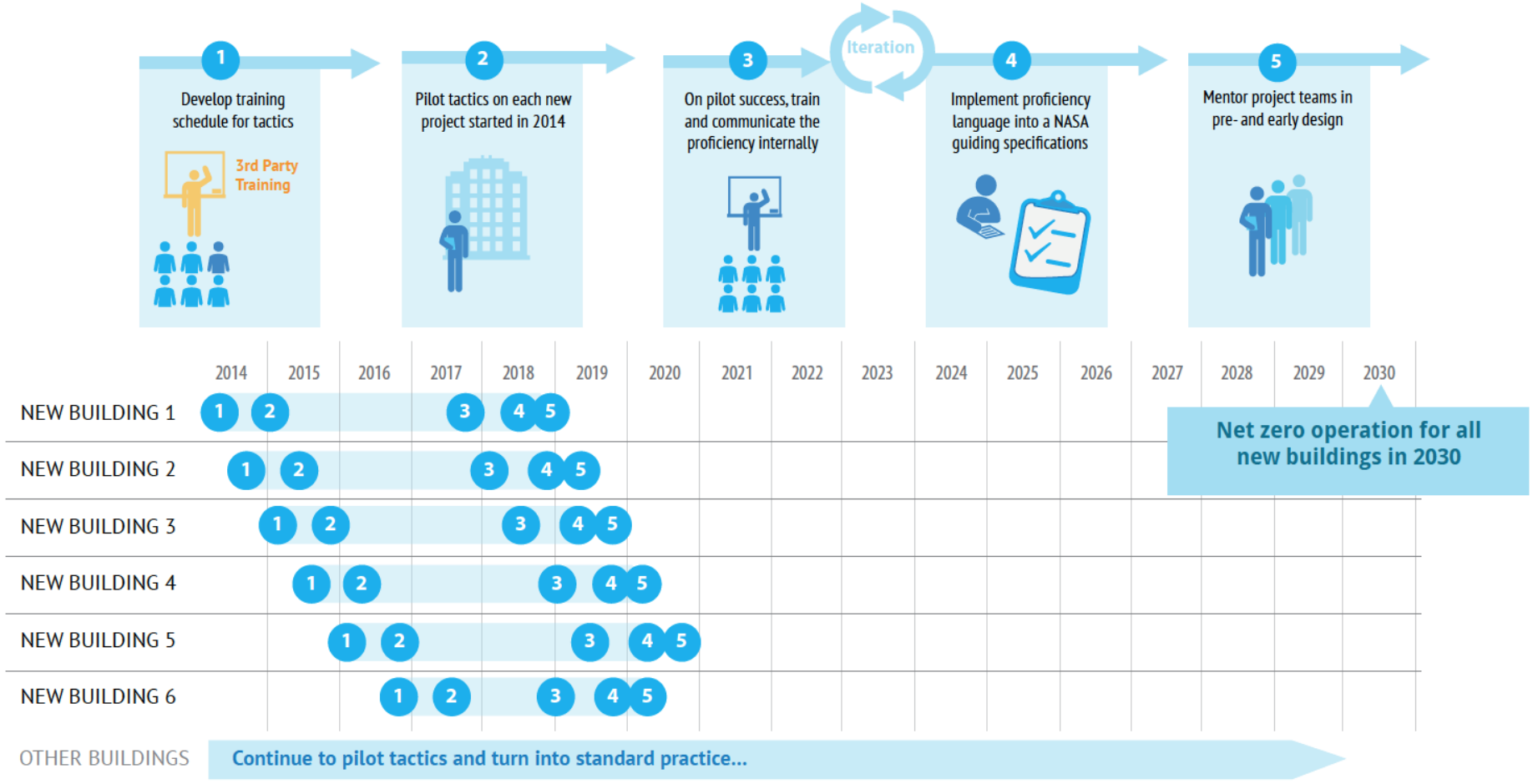
NZEB Dashboards



CP-2: Define Agency Metrics for Tracking Progress

- Time-phased rollout of NZEB method
  - NZEB procurement
  - NZEB design and construction
  - NZEB operations
- Successfully rollout of NZEB tactics :
  - Train,
  - then pilot,
  - then learn,
  - then institutionalize!

Time-Phased Approach



Thanks For your Time

And wish us luck!

NASA Net Zero Energy Buildings Roadmap

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- Questions?

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