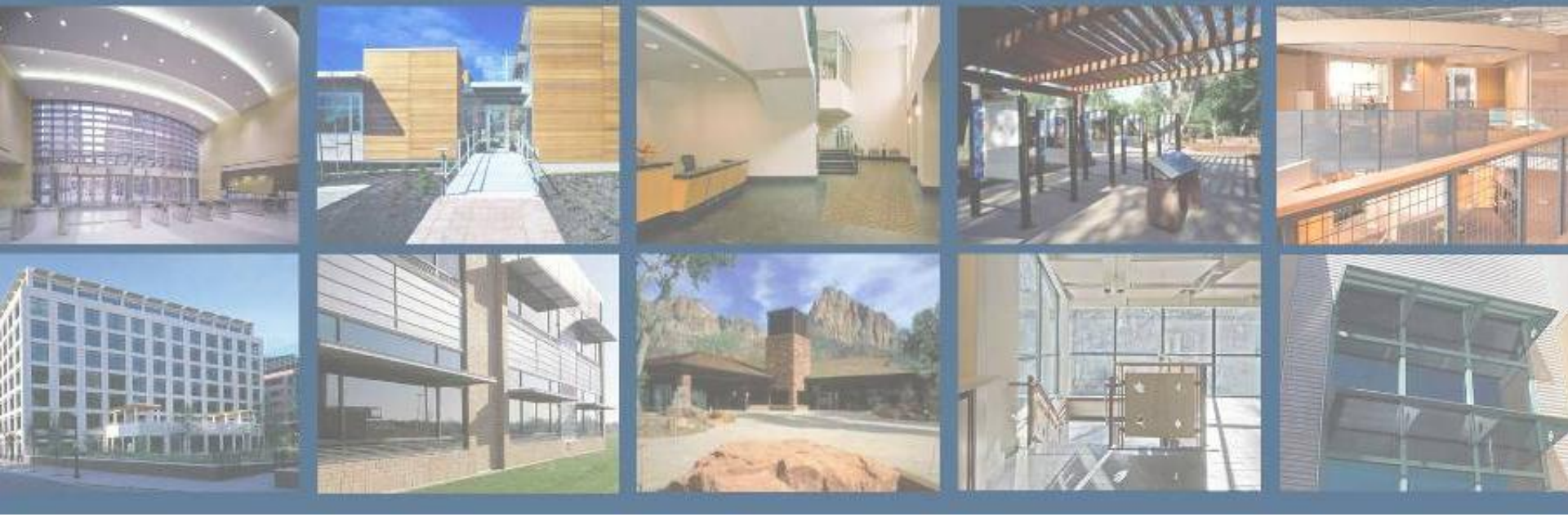
Real Performance for Real Buildings (RPRB)

2014 Building Technologies Office Peer Review

New Project for FY14



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NREL

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

The Components

RISK OF REALIZATION

DESIGN
for real performance

OPERATIONS BEST PRACTICES

MANAGE
real performance

Real Performance for Real Buildings

Project Summary

Timeline:

Start date: October 1, 2013

Planned end date: September 30, 2014

Key Milestones

Guides to help HPB buildings **perform as expected**; 9/30/14

1. Maintain performance in **operations**
2. Reduce performance risk in **design**

NREL Budget:

Total DOE $ to date:

$200,000 for Operations: ~1/2 spent

$200,000 for Design: ~1/3 spent

Total future DOE $: $0

Target Market/Audience:

Operations: HPB owners and operators

Design: HPB designers and modelers

Key Partners:

Operations	Design
LBNL	Arup
NASA	HDR Architecture
GSA	Energy Studio
McKinstry	Engineering Economics, Inc.

Project Goal:

Develop **deployable resources to assist** building decision-makers in understanding and replicating the benefits of **using measureable energy performance targets** to better connect design and operations.

Roles and Deliverables for FY14

RISK OF REALIZATION

NREL

Developing a general process to prepare the design and owner's team to meet an energy performance goal

- Collect real performance data of technologies and pairs of technologies
- Produce whole-building energy impact ranges through energy modeling
- Develop a process to use for determining appropriate technologies that will reduce the risk of realizing energy performance

DESIGN

OPERATIONS BEST PRACTICES

NREL/LBNL

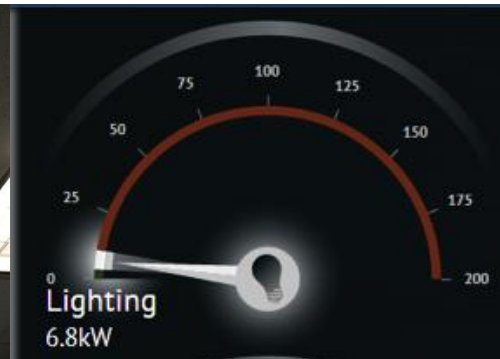
Highlight specific strategies that can help building owners and operators achieve energy performance goals

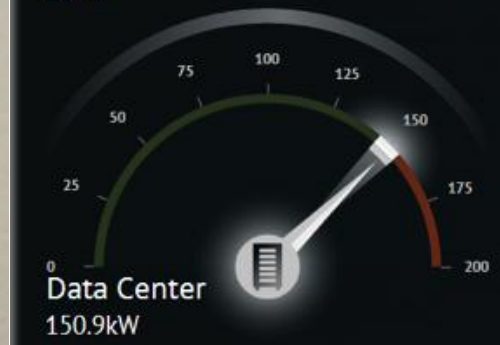
- Share actions that can be taken by owners and operators to meet energy performance goals
- Include current data on occupant behavior, plug loads, and building operational strategies that demonstrate how adjustments to these areas can impact overall building energy performance
- Develop action-focused case studies based on sample buildings

MANAGE

Approach - Design

Key Issues: Designers can help owners prepare for the challenges of meeting an energy goal by assessing the risk of the design. What process should a design team follow in design to evaluate performance risk?





Risk of Realization

- **What is the risk that these technologies will realize energy savings?**
  - Advisory Group defines technologies for risk assessment
  - Likely: Daylighting, VAV controls, GSHP, envelope, occupancy vs. vacancy sensors, etc.
  - Collect real performance data based on existing resources and industry input
- **Quantifying risk with energy modeling tools**
  - Produce a whole-building energy impact range for each identified technology
  - Compare to real performance data or industry survey information
  - Use these to start reference models by climate and building type
  - Explore adding Open Studio features to understand risk impacts
  - Potential risk of realization
- **Connect energy savings risk in design elements/technologies with Cx, Operations, RCx rules and guidelines**
  - Directs design teams to technologies more likely to realize energy savings
  - Understand and prepare for common risk mitigation strategies
  - Market-facing instructions/guidance for risk of realization process

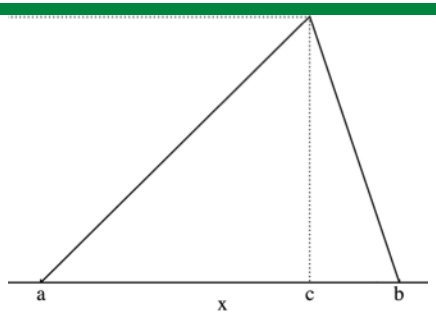
Approach - Design

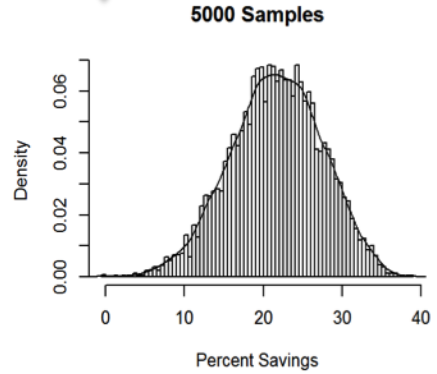
Approach:

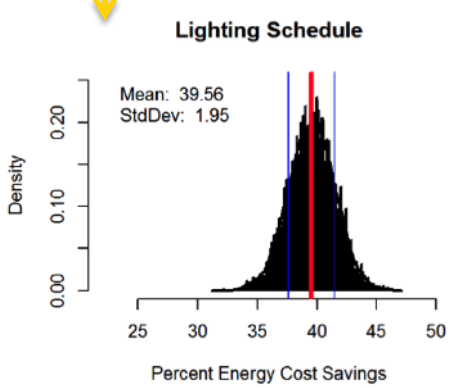
- Focus on risks that an owner can mitigate
- Start with NREL's experience with the risks of various HPB technologies
  - Define a general risk types and probability distributions (likelihood of occurrence and impact on energy performance)
- Assemble an advisory group of HPB designers and commissioning to provide example and feedback
- Create a resource that presents a high-level risk analysis process and example results
- Develop a deployment plan to inform owners and designer about risk analysis

Distinctive Characteristics:

- Use of an advisory group
  - Feedback loop to test our ideas and collect real-world examples
  - Inherent users and champions of resources
  - Assistance deploying resources







Progress and Accomplishments - Design

Progress:

- Identified system experts for focus group, emphasis on designers and commissioning agents
- Ongoing roundtable discussions to select technology metrics and ranking methods
- Focus group currently ranking the technologies for which they are most experienced

Resource outline:

- Present unmitigated and mitigated EUI (or subsystem) distributions
- Prioritize technologies and mitigation strategy results based on least variance
- Guide decision to use one system versus another depending on
  - Extent to which the risk to be mitigated
  - Risk tolerance
  - Potential savings

Designers and Commissioning Agents
Peter Alspach, Arup
James Bates, HDR Architecture
Amanda Bogner, Energy Studio
Dru Crawley, Bentley Systems
Joe Deringer, SuPerB
David Eldridge, Grumman/Butkus Associates
Zack Rogers, Daylighting Innovations
Ralph Schmitt, Engineering Economics, Inc.
Clarence Waters, University of Nebraska-Lincoln
Brody Wilson, Group14

Operations Best Practices

HOW CAN WE ALIGN BUILDING ENERGY PERFORMANCE WITH EXPECTATIONS?

- **A small set of new net zero are meeting energy performance goals.**
  - RSF, UC-Merced, Aspinal Courthouse, Bullitt Center, SMUD East Campus Operations Center
  - Use these as an example

- **How did they do that? How can these strategies work for regular, old existing buildings?**
  - Specific actions by operators and owners
  - Key features, connectivity, information, data

- **Action-focused data and resources to capture what we already know is important.**
  - Energy performance goals, plug loads, data centers, occupant engagement, submetering, commissioning
  - a GO-TO person

Approach - Operations

Key Issues: What steps do owners and operators need to take to ensure their building actually operates as a HPB?

Start with existing frameworks/programs that suggest WHAT to do

- Soft Landings
- LEED v4

Assemble and provide guidance on HOW to meet the basic requirements

- Decision trees that take owners through the critical decision points, unique to HPBs
- Leading to descriptive examples of how to act on the decision
  - Use example from NREL's campus experience
  - Build on those examples using focus group experience
  - Select focus group examples that best illustrate critical action
  - Present example contract language, images, and how-to menu giving the makeup of HPB operations

Distinctive Characteristics:

- Use of expert, field experience; each are pioneering elements of the recipe
  - Inherent users and champions of resources
  - Assistance deploying resources

Progress and Accomplishments - Operations

Lessons Learned: The audience is widely varied. For example, the person responsible for setting an energy goal might be the owner, commissioning agent, or energy consultant.

Accomplishments:
Replication of the Energy-Performance-Based Acquisition Process (FY13 project) is occurring. Uptake of the operations best practices is being seen by organizations such as GSA and NASA.

Market Impact:

- 25 organizations repeatedly participating on advisory group calls
  - Contributing their approaches to HPB design and operations
  - Following up with questions on how to use our approach
- > 5 known organizations replicating the Energy-Performance-Based Acquisition Process (NASA, Army, GSA, University of Chicago, UCSF, and more) and asking questions about HOW TO OPERATE their HPBs
- NASA requested a net-zero energy roadmap focused on building-level, operations-based practices

Progress and Accomplishments - Operations

Roundtable 1: Kickoff

Owners/Operators	Project Examples
Jim Dewey, City of Santa Barbara	City of Santa Barbara, public works building
John Elliott, UC Merced	UC Merced, COB
Matt Ellis, Army	Fort Carson, barracks
Jake Gedvilas, NREL	NREL, Research Support Facility
Rodney Martin, NASA	Ames, Sustainability Base, N232
Scott Poll, NASA	
Len Pettis, California State University	CSU, San Luis Obispo, Science Facility Building
Kevin Rodgers, University of Chicago	University of Chicago, dormitory
Jason Sielcken, GSA	Wayne Aspinall Federal Building
Darrell Smith, Microsoft	Microsoft, headquarters
Scott Williams, Target	Target prototype
Designers and Energy Consultants	
Porus Antia, Stantec	SMUD, headquarters
Matt Ganser, Carbon Lighthouse	
Anna Morton, dbHMS	University of Chicago, dormitory
Rob Peña, U of Washington and the Integrated Design Lab	Bullitt Center
Zack Rogers, Daylighting Innovations	NREL, campus
Phil Saieg, McKinstry	

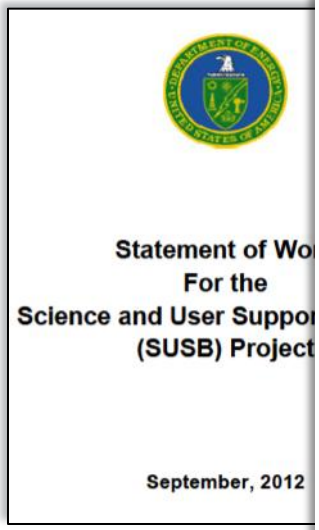
Progress and Accomplishments - Operations

Roundtable 2:
Energy Goals

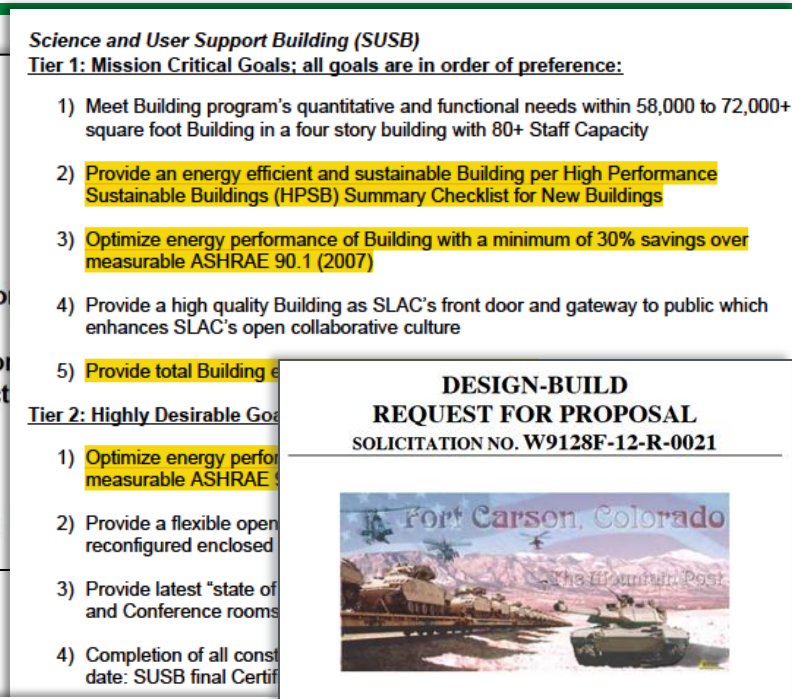
High-level takeaways

- Set design goal to be measured in operations
  - Disaggregate
  - Use source energy
  - Include these assumption in a calculation appendix for the design team
- Roll-up goal to single number for contract
  - If goal is set through benchmarking or calculation then OK to use a single value
  - If goal is determined through general means such as case study comparison then use a tiered goal or write-in value with minimum requirement

Examples collected →


Statement of Wo
For the
Science and User Suppo
(SUSB) Project

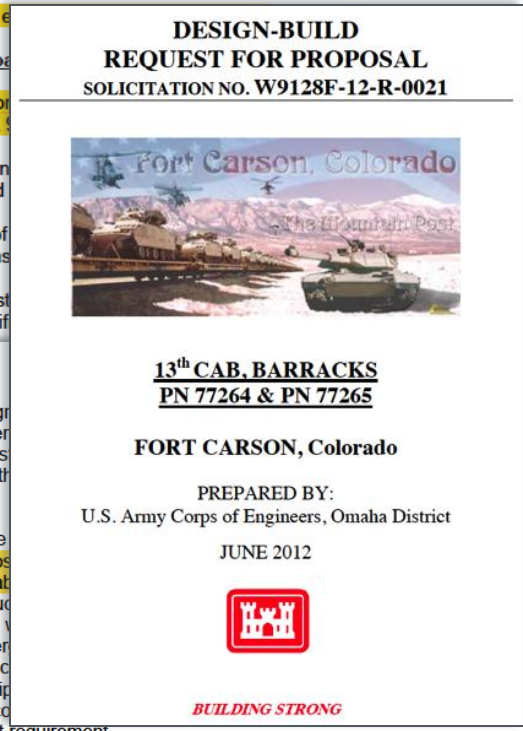
September, 2012


Science and User Support Building (SUSB)
Tier 1: Mission Critical Goals; all goals are in order of preference:

1) Meet Building program's quantitative and functional needs within 58,000 to 72,000+ square foot Building in a four story building with 80+ Staff Capacity
2) Provide an energy efficient and sustainable Building per High Performance Sustainable Buildings (HPSB) Summary Checklist for New Buildings
3) Optimize energy performance of Building with a minimum of 30% savings over measurable ASHRAE 90.1 (2007)
4) Provide a high quality Building as SLAC's front door and gateway to public which enhances SLAC's open collaborative culture
5) Provide total Building e

Tier 2: Highly Desirable Goa

1) Optimize energy perfo measurable ASHRAE
2) Provide a flexible open reconfigured enclosed
3) Provide latest "state of and Conference rooms
4) Completion of all const date: SUSB final Certif


DESIGN-BUILD
REQUEST FOR PROPOSAL
SOLICITATION NO. W9128F-12-R-0021

13th CAB, BARRACKS
PN 77264 & PN 77265

FORT CARSON, Colorado

PREPARED BY:
U.S. Army Corps of Engineers, Omaha District

JUNE 2012

BUILDING STRONG

5.2.2. **Submission Requirements:**

The Government encourages the Offeror to propose desig reduction. Proposed systems must conform to the require systems that are expected to exceed 1% of the CCL in cos LCCA should be included in the proposal and must show t period.

In the CLIN Pricing Schedule, page 00 11 00 - 4, complete *Renewable Energy Statement* provided below. The propos greater than or equal to 40%, excluding the use of renewab from sources that are not depleted by use. Examples inclu thermal (water heating), and bioenergy systems based on organic waste, or landfill gas. Other examples include ener employ collection panels and/or heat transfer mechanical c storage systems (such as hot water tanks) and Thermal-sip proposed percentages must be supported by a life cycle co award, the proposed percentages shall become a contract requirement.

Building Energy Efficiency Statement: *EXCLUDING all proposed renewable energy sources, this project will achieve an energy consumption at least ____% less than the consumption of a baseline building meeting the minimum requirements of ASHRAE Standard 90.1-2007.*

Renewable Energy Statement: *This project will include renewable energy systems that produce an amount of energy that will offset _____% of the annual energy consumption of a baseline building meeting the minimum requirements of ASHRAE Standard 90.1-2007.*

Progress and Accomplishments

Setting and Requiring Energy Performance Targets

- SMUD Headquarters new net zero energy construction
- Expert group member: Porus Antia, Stantec energy analysis group manager
- Working to educate owners about the benefits of net zero energy

"50% of getting to net zero energy is the owner and the operator"

→ Provide examples of how owners can support aggressive energy performance through incentive structures and how operators can respond to energy performance by considering design intent such as MELs budgets

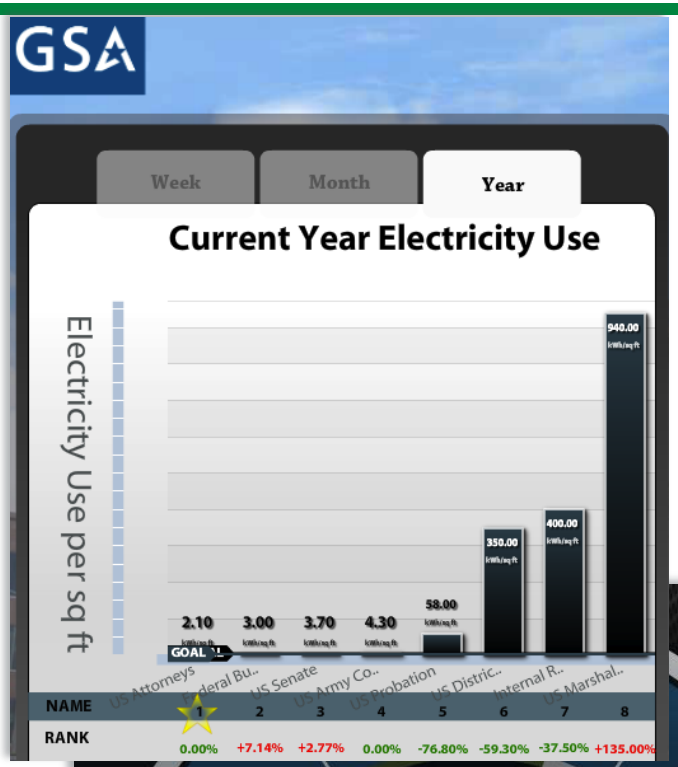
Progress and Accomplishments - Operations

Roundtable 3:
Energy Information Systems

High-level takeaways

- Procure dashboard (characteristics for specification)
  - Energy goal must be displayed
  - Expected performance ranges must be shown
  - Variable time resolution for daily and annual goal comparison
  - End use resolution with exclusion of non-critical, non occupant-affected loads
  - High resolution for plug loads
- Identify party responsible for action
  - Retain design engineer or hire consultant to oversee procurement, implementation, and initial use
  - Identify “green team” a liaison between the energy manager and occupants

Examples collected →



Progress and Accomplishments - Operations

Roundtables 4-6 (future):

EIS follow up

MELs and datacenters

Occupancy and occupant engagement

Resource outline

- Online resource to connect relevant DOE and external (focus group) sources of information to be housed in CBRD
- Purpose statement: Aggressive EUIs are being achieved. How?
- General HPB operations process linked by project phase
  - Present a storyline for all HPB operations key actions (above and beyond current practice)
  - Link to existing frameworks (e.g., LEED v4, Green Globes)
- Unique sections/pages for topics that create a base recipe that can be used by all HPB owners and building types; examples of unique twists given to generate motivation and confidence to take action
  - Setting and requiring energy targets
  - Procuring an EIS
  - Procuring MELs
  - Datacenters
  - Occupancy and occupant feedback
  - Closing the loop with action plans

Progress and Accomplishments

Procuring Miscellaneous Electric Loads (MELs)

- NASA Ames Sustainability Base
- Expert group member: Scott Poll, NASA researcher
- Working to contractually require settings for MELs
  - From vendor
  - Within organization

*"Some of the operations changes needed are very **common sense** but just need to become common practice"*

→ Provide example contact language supporting fine-grained accounting of MELs

Next Steps and Future Plans – Ops and Design

Next Steps and Future Plans:

Operations

Remaining tasks:

- Continue advisory group call series through May
- Collect further details for each example project to be used
- Further develop deployment partner relationships
- Complete operation best practice guide

Low risk for guide completion; moderate risk for deployment plan

Design

Remaining tasks:

- Incorporate expert feedback on system risk into energy models
- Complete risk-based modeling for the 20 technologies identified
- Further develop deployment partner relationships
- Transfer risk analysis process and example results into simple guidance

Low risk for guide completion; moderate risk for deployment plan

Continue outreach efforts that show how to use an energy goal in design and operations

REFERENCE SLIDES

Project Budget

Budget History					
FY2014 (RPRB-Operations)		FY2014 (RPRB-Design)		FY2015 (RPRB-planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$200k	$0	$200k	$0	$0	$0

Variances: RPRB-Design is underspent according to a uniform monthly distribution but the analysis process in April-May will require a focused effort with a higher spending rate

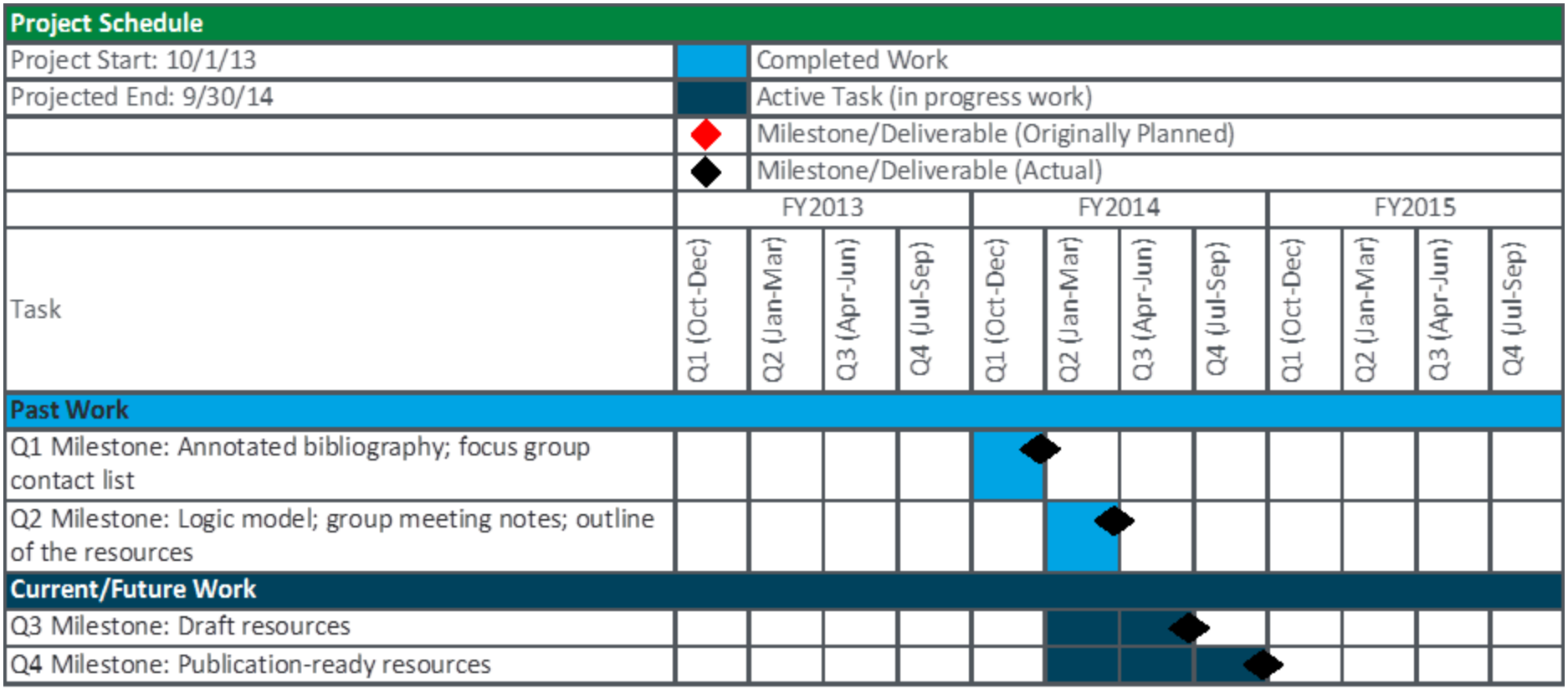
Cost to Date:

RPRB-Operations: ~1/2 spent

RPRB-Design: ~1/3 spent

Additional Funding: None

Project Plan and Schedule-Operations



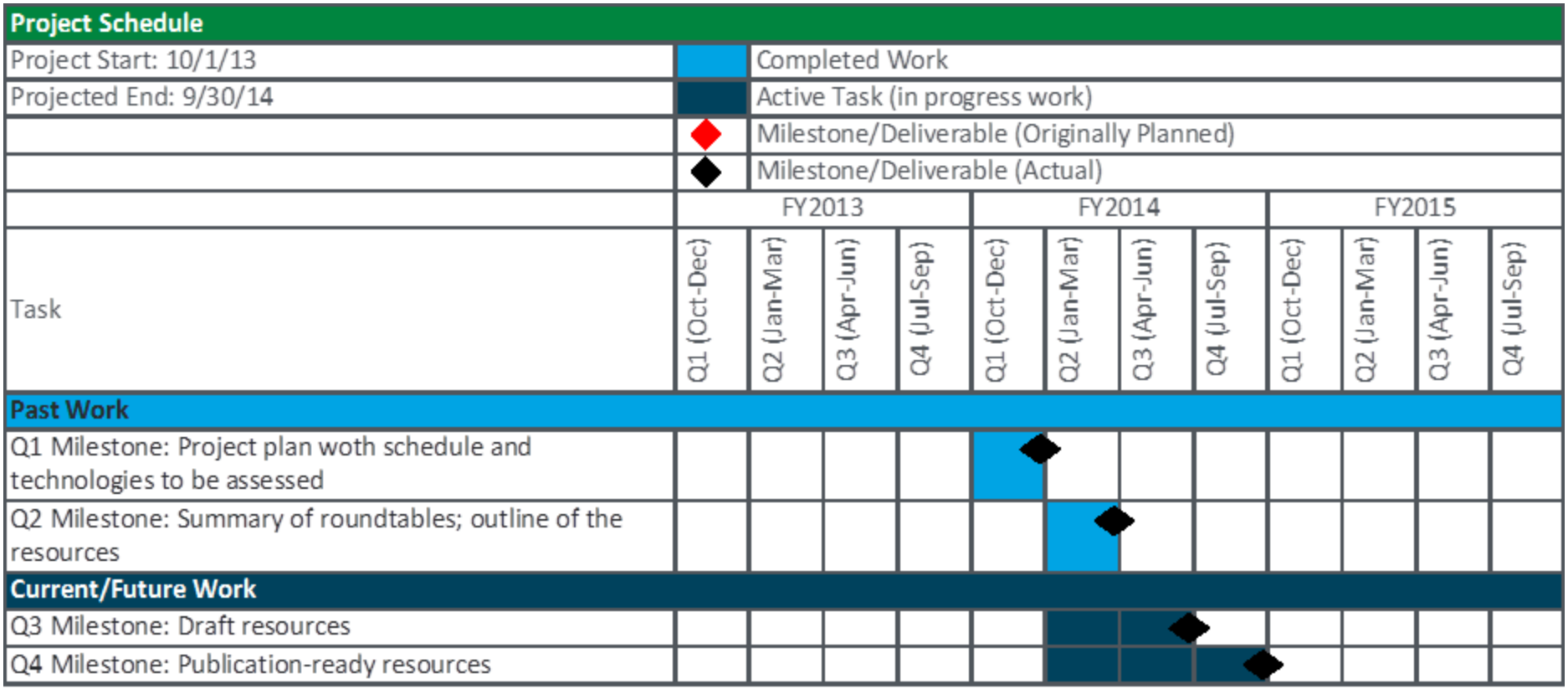
Go/no-go decision points:

Q1, Focus group assembles and represents a diverse group of experts

Q3, DOE approval of draft resources

Q4, DOE approval of resources for publication

Project Plan and Schedule-Design



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