Approaches to Deep Energy Retrofits in the US Federal Government

GSA's National Deep Energy Retrofit

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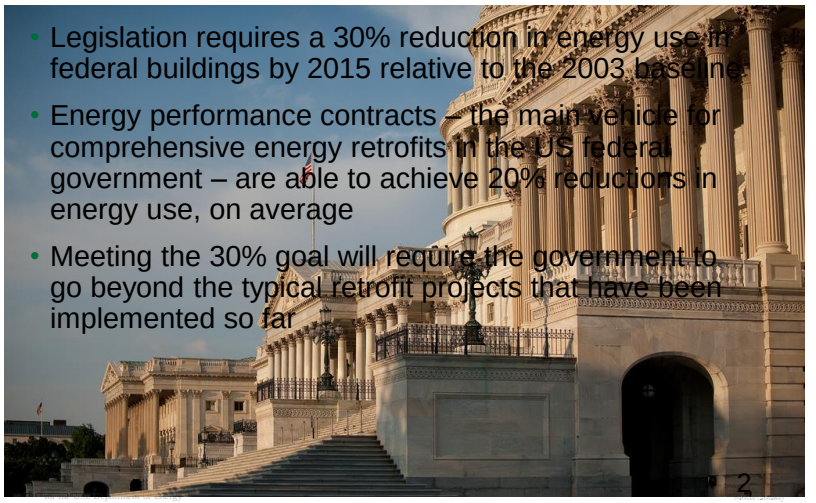
Why deep retrofits are important to US Government



- Legislation requires a 30% reduction in energy use in federal buildings by 2015 relative to the 2003 baseline
- Energy performance contracts – the main vehicle for comprehensive energy retrofits in the US federal government – are able to achieve 20% reductions in energy use, on average
- Meeting the 30% goal will require the government to go beyond the typical retrofit projects that have been implemented so far

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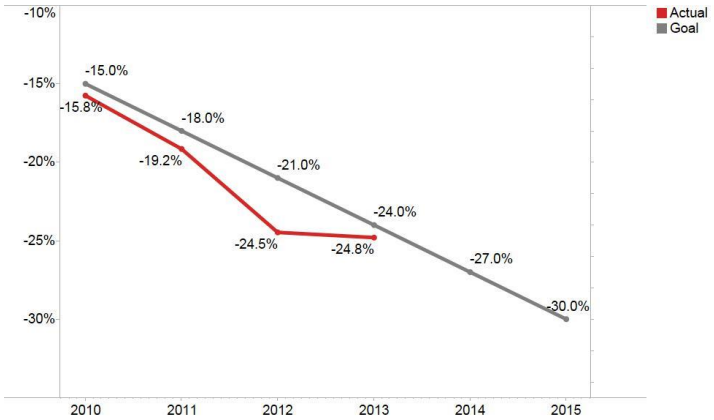
Two main models have emerged

- US Army
  - Combine energy project with building renovation
  - Use two contractors: one for energy measures (under an ESPC contract) and one for renovation tasks
  - Several challenges to marrying these two contracts
- GSA Approach
  - Use ESPC to implement comprehensive energy projects
  - Encourage ESCOs to dig deeper, using design charettes and centralized tech/contracting assistance

US General Services Administration (GSA)

- "The government's landlord"
  - 9,100 separate assets
  - 376 million square feet of space
- Energy use represents 3.7% of federal government (9.3% of civilian agencies)
- Average age of buildings is 48 years

GSA Energy Intensity % reduction from 2003



Goals of GSA's National Deep Energy Retrofit (NDER) project

- Retrofit plans that move a building towards net zero energy consumption
- Use of innovative technologies
- Use of renewable energy technologies
- Unstated objective: achieve deep(er) energy savings than in past projects

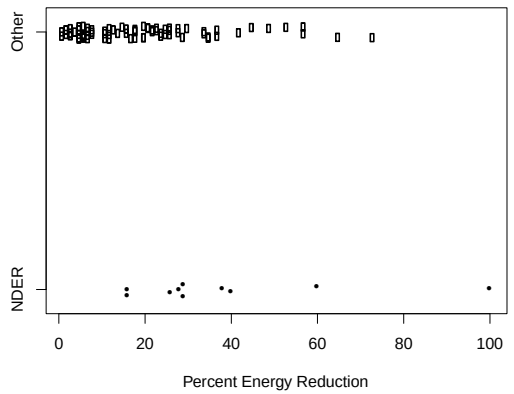
NDER Results

- 10 Task Orders (projects) awarded
- Total implementation price of $172 million
- 14.7 million square feet of floorspace
- Reduces GSA's energy use by 365 billion Btu per year

GSA did achieve deeper energy savings

- A sample of 70 non-NDER federal ESPC projects achieved an average of 18.5% savings
- **Average savings of 10 NDER was 38%, more than twice the other projects**
- Wilcoxon rank sum test shows the difference in means is statistically significant at the p=0.003 level

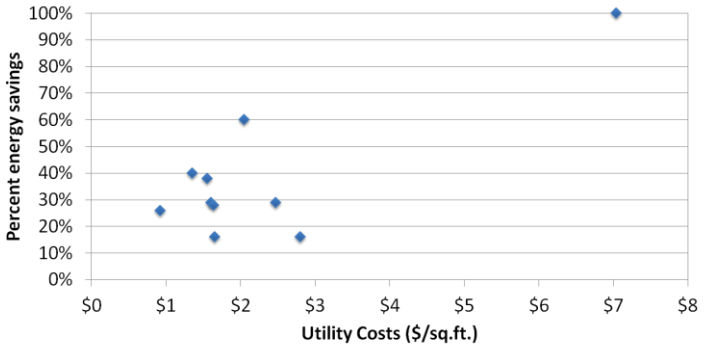
Percent energy reduction of NDER projects compared with other PPCC projects



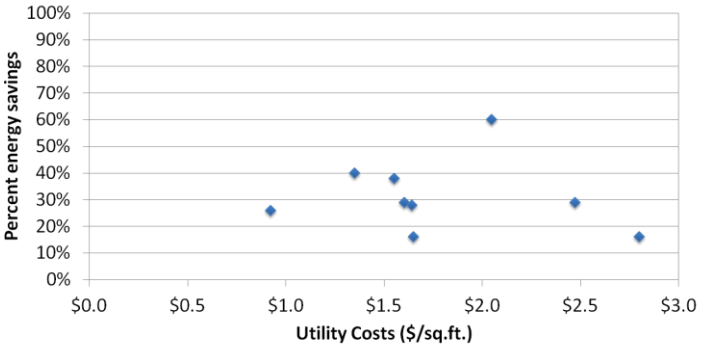
What are some potential drivers for deeper energy savings?

- Energy prices
- Baseline energy use index (EUI)
- Amount of "one-time savings"
- Is there some way to select buildings that present opportunities for deep savings?

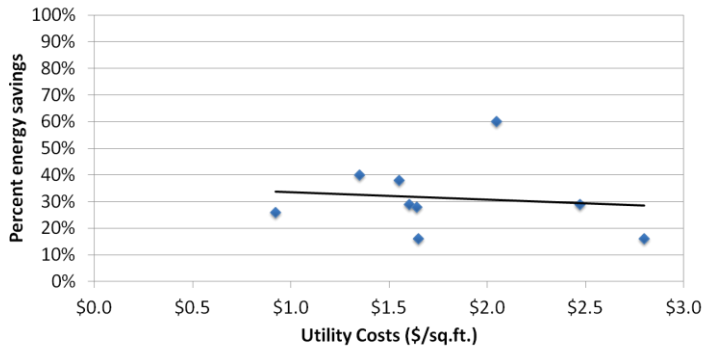
Percent savings appears related to baseline utility costs, but figure is misleading



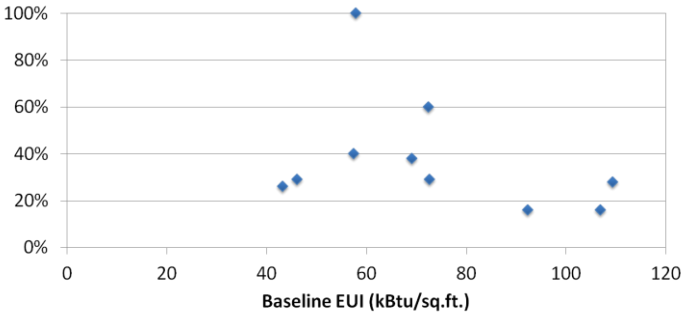
With high-leverage point removed, percent savings appears unrelated to baseline utility costs



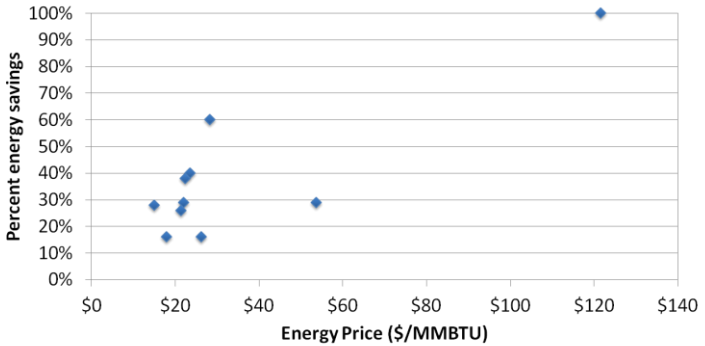
The relation is opposite to what we expect (though effect is not statistically significant)



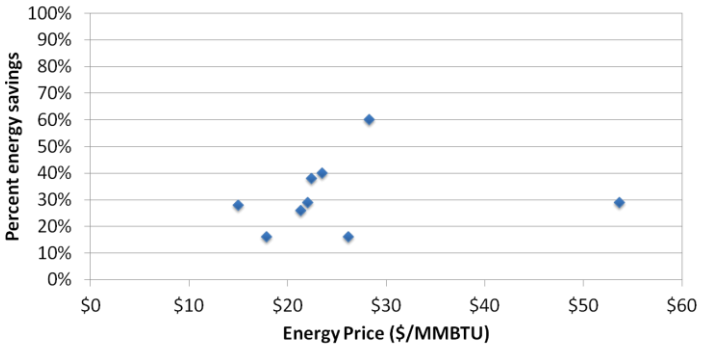
Percent savings appears unrelated to EUI as well



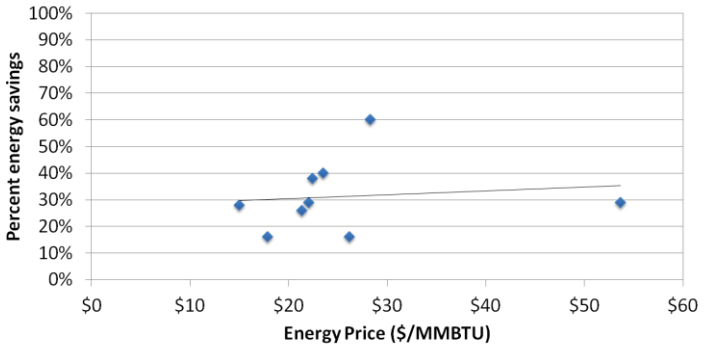
Percent savings appears related to baseline energy unit price, with outlier



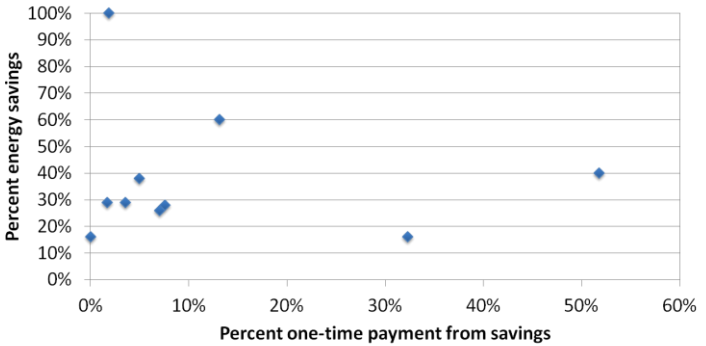
With outlier removed savings appears unrelated to baseline energy unit price



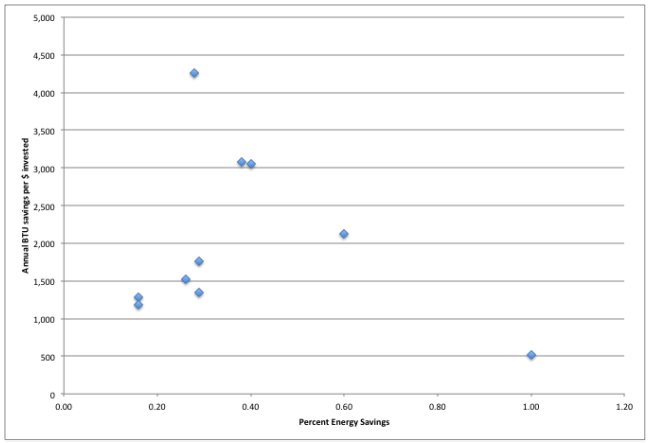
Percent savings increases with increasing energy prices, but regression not significant



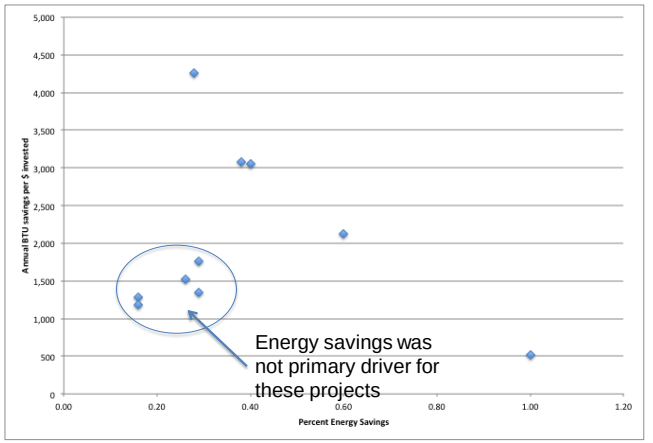
Amount of one-time payment also unrelated to percent savings achieved



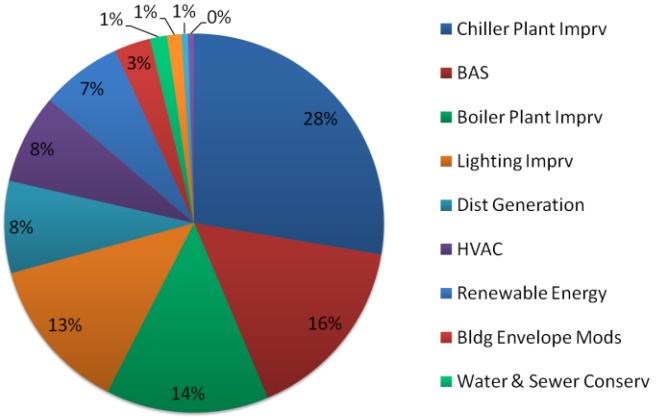
BTU/$ invested vs. percent Savings



Different classes of projects



Distribution of ECM Investment



ECMs – FEMP History vs. GSA NDER

FEMP ESPC Database	GSA NDER
HVAC (20%)	Chiller Plant Improvements (28%)
Lighting Improvements (16%)	BAS (16%)
BAS (15%)	Boiler Plant Improvements (14%)
Chiller Plant Improvements (11%)	Lighting Improvements (13%)
Renewable Energy (11%)	Dist Generation (8%)
Energy/Utility Distribution (8%)	HVAC (8%)
Distributed Generation (5%)	Renewable Energy (7%)
Boiler Plant Improvement (5%)	Bldg Envelope Mods (3%)
Water & Sewer Conservation (3%)	Water & Sewer Conservation (1%)
Electric Motors and Drives (2%)	Commissioning (1%)
Bldg Envelope Mods (1%)	Energy/Utility Distribution (1%)
Other (3%)	Electric Motors and Drives (1%)

Deep retrofits can be implemented across a wide spectrum of buildings/conditions

- What is not (necessarily) required to achieve deeper energy savings in ESPC
  - High energy prices
  - High energy consumption
  - Advanced ECMs
  - Large payments from savings in implementation period
  - O&M savings

What is required

- Buildings that have not undergone recent energy retrofit projects
- Emphasis from agency
- Thorough audit process to identify ECMs
- Integrated design approach
- Realization that deep retrofits cost more (in terms of energy savings per dollar invested)

Questions

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