Energy Factors in Commercial Building Finance

**Energy / “Green” Impacts on Mortgage Valuation**
- Rental income
- Vacancy rates
- Utility costs
- Utility cost volatility

**Potential Intervention Points**
- Appraisals
- Underwriting methods & requirements
- Property Condition Assessments

**Potential Outcomes**
- Property Valuation
- Interest rates
- Loan-to-Value limit
- Debt Service Coverage limit

Lawrence Berkeley National Laboratory
Paul Mathew, Staff Scientist
(510) 486 5116 ; pamathew@lbl.gov
Project Summary

Timeline:
Start date: October 2015
Planned end date: September 2018

Key Milestones
1. Complete new analysis based on additional data for specific sectors. 6/30/18
2. Development of prototype energy risk ratio for lenders. 6/30/18

Budget:
Total Project $ to Date:
- DOE: $800,000
- Cost Share: $0

Total Project $:
- DOE: FY18 TBD
- Cost Share: $0

Key Partners:

<table>
<thead>
<tr>
<th>UC Berkeley Haas School of Business</th>
<th>Institute for Market Transformation</th>
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<tbody>
<tr>
<td>Silicon Valley Bank</td>
<td>Colorado Lending Source</td>
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<tr>
<td>Northmarq</td>
<td>Wegowise</td>
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<tr>
<td>Community Preservation Corporation</td>
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Project Outcome:
Ensure that commercial mortgages fully account for energy factors in underwriting and valuation and thereby serve as a scalable channel for energy efficiency.
- **Demonstrate impact** of energy factors on commercial mortgage valuation;
- **Develop interventions** to fully incorporate energy in commercial mortgage valuation;
- **Disseminate best practices** within the commercial mortgage community.

This project directly addresses CBI strategy #3 in the BTO MYPP.
Team

Phil Coleman  Paul Mathew  Nancy Wallace  Paulo Issler

Baptiste Ravache  Kelly Sun  Emily McLaughlin

DOE Managers: Holly Carr, Cindy Zhu
Challenge

Energy directly affects Net Operating Income (NOI) used in mortgage valuation. Current practice does not fully account for energy factors in calculation of NOI:

- Usually based on historical average cost data, if available
- Does not account for energy use and price volatility during mortgage term

Energy efficiency is not properly valued and energy risks are not properly assessed and mitigated.

\[ \text{NOI} = \text{gross rents} - \text{gross expenses (insurance, energy, water, etc.)} \]

Energy Use Volume

- Electricity kWh/kW, fuel therms, etc.
  - Driven by bldg. features, operations, climate

Energy Use Volatility

- +/- change over mortgage term
  - Driven by bldg. operations, weather variation

Energy Price

- $/kWh, $/kW, $/therm
  - Set by rate structure

Energy Price Volatility

- +/- change over mortgage term
  - Driven by rate structure, forward prices

Commercial mortgages are a $2.5+ Trillion market and could be a significant channel for scaling energy efficiency.
Goal:
Energy factors are **fully and routinely** incorporated in commercial mortgage valuation, accelerating demand for buildings with lower energy risk.

**Approach**

- **Show that energy matters**
  - FY16-18
  - Analysis of energy impacts on mortgage valuation

- **Develop and pilot interventions**
  - FY17-18
  - Case studies on actual mortgage loans

- **Disseminate best practices**
  - FY17-18
  - Protocols and tools for lenders and owners

- **Institutionalize**
  - Long term
  - Industry Standards

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**Fully aligned with CBI logic model:**

- **Objective:** Accelerate market adoption
- **Short-term outcome:** Market has tools and data to understand, manage and value EE
- **Mid-term outcome:** Array of stakeholders incorporate EE into financial transactions
Approach: Analyze impact of energy on default rate

Mortgage Default Rate = \( f (\text{EUI, ElecPriceGap, CouponSpread, LTV, Region}) \)

Empirical analysis combining
• Mortgage loan data (TREPP)
• Energy use data (Benchmarking disclosure, Wegowise)
Approach: Case studies on specific loans

Collaborate with lenders to:
1. Demonstrate impact of energy use and price on specific mortgage loans
2. Develop recommendations

Approach
- Compile info from Appraisals, PCAs, other sources.
- Estimate source EUI variations.
  - Simulation and empirical approaches
- Compute elec price gap using forward curves.
- Compute default risk impact due to source EUI and elec price gap.
Case studies

San Jose Office

Denver Office

San Francisco Multi-family

Denver Hotel

Sonoma Office
Impacts: The link between energy and default

- The coefficient estimates for BOTH the *Electricity Price Gap* and *Source EUI* are significant at better than the .05 level of statistical significance.
  - The higher the *Source EUI* (the more energy usage per square foot) the higher the likelihood of default.
  - The higher the *Electricity Price Gap*, (the larger the difference between the actual and the expected electricity prices since the loan origination), the higher the likelihood of default.
Impacts on specific loans: energy use

Example: Denver Office

Facilities Management factors:
- HVAC schedule
- Thermostat setback
- Supply air temp control
- VAV min flow control
- Economizer controls
- Lighting controls

Levels: good, avg, poor

Occupancy factors:
- Occupant density
- Occupant schedule
- Plug load density
- Plug load controls

Levels: good/low, avg, poor/high

<table>
<thead>
<tr>
<th>Case</th>
<th>Fac mgmt factors</th>
<th>Occ Factors</th>
<th>Source EUI var (%)</th>
<th>Default risk var (bp)</th>
<th>Default risk var rel. to TREPP avg (%)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Good</td>
<td>Good/Low</td>
<td>-54%</td>
<td>-248</td>
<td>-31%</td>
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<td>4</td>
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<td>Poor/High</td>
<td>+4%</td>
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<td>5</td>
<td>Poor</td>
<td>Good/Low</td>
<td>+64%</td>
<td>+158</td>
<td>+20%</td>
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<tr>
<td>6</td>
<td>Poor</td>
<td>Ave</td>
<td>+76%</td>
<td>+181</td>
<td>+23%</td>
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<tr>
<td>7</td>
<td>Poor</td>
<td>Poor/High</td>
<td>+132%</td>
<td>+268</td>
<td>+34%</td>
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</table>

Example: Denver Office
Compare to TREPP average default rate of 800bp
Impacts on specific loans: energy price

Mean: +330 bp
1 Std dev: -159 - 501 bp
## Impacts: Five case studies

<table>
<thead>
<tr>
<th>Building</th>
<th>Source EUI variation (%)</th>
<th>Default rate variation (bp)</th>
<th>Default rate variation relative to TREPP avg (%)</th>
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<tr>
<td>Denver Office</td>
<td>-54% to +132%</td>
<td>-248 to +268</td>
<td>-31% to +34%</td>
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<td>Sonoma Office</td>
<td>-40% to +183%</td>
<td>-161 to +331</td>
<td>-20% to +41%</td>
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<td>San Jose Office</td>
<td>-62% to +119%</td>
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<td>Denver Hotel</td>
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<td>San Francisco Multi-family</td>
<td>-20% to +26%</td>
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### Wholesale price region

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<tr>
<th>Wholesale price region</th>
<th>Default rate variation (bp)</th>
<th>Default rate variation relative to TREPP avg (%)</th>
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<tr>
<td>Denver area</td>
<td>+159 to +501</td>
<td>+20% to +63%</td>
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<tr>
<td>Northern California</td>
<td>-49 to +705</td>
<td>-6% to +88%</td>
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"These results showing the impact of energy on default risk are clearly meaningful. I don't currently consider energy efficiency when making a loan and seeing this makes me think I would want to ask about it”

"I would like to apply these findings but would want an easy way to use it. A simple score or ratio for energy risk would be good. In fact, I would be interested to pilot test it."

Keith Hanley, Silicon Valley Bank
Progress

Show that energy matters

- Demonstrated statistically significant link between energy and default, based on empirical data.
- Continuing to build evidence with new data sources

Develop and pilot interventions

- Developed method and analyzed impacts for five case studies.
- Confirmed interest in and initiated development of energy risk score.

Disseminate Best practices

- Extensive engagement with finance stakeholders – many new to energy efficiency. (see next slide)
Stakeholder Engagement

- Direct engagement with three lenders on actual loans
- Discussions with over 40 stakeholders since project inception
- Participation in new ASTM task force on property condition assessments (PCA)
  - Revising PCA standard to include energy performance
- Publications
  - Two technical reports
  - Articles in trade publications: TREPP, Scotsman Guide
  - ACEEE Summer study paper (forthcoming)
- Presentations
Remaining Project Work

Show that energy matters

- Extend default risk analysis with new data sources
  - Energy cost ratio for benchmarking dataset
  - Wegowise multi-family data (~45,000 records)

Develop and pilot interventions

- Complete development of energy risk score.
- Apply score to actual loans from project partners

Disseminate Best practices

- 1:1 discussions with 4-5 lenders
- Conferences: ACEEE Finance Forum, ACEEE Summer study, Better buildings Summit, Greenbuild
- ASTM PCA standard

Near term outcome:
- Enough evidence for lenders to take notice and consider energy risks
- A viable score-based method for assessing energy risk in underwriting
Thank You

Lawrence Berkeley National Laboratory
Paul Mathew, Staff Scientist
(510) 486 5116  pamathew@lbl.gov
REFERENCE SLIDES
Project Budget

**Project Budget:** Intended as 3-year project, FY16-18. $400K per year for FY16-17

**Variances:** No FY18 funds to date. FY17 carryover used for FY18 work to date

**Cost to Date:** 704K

**Additional Funding:** None

### Budget History

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<th>FY2016 – FY 2017 (past)</th>
<th>FY 2018 (current)</th>
<th>FY 2019 – TBD (planned)</th>
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# Project Plan and Schedule

## Project Schedule

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## Past Work

- Literature review
- Scoping Report
- Demonstrate impact of energy factors to lenders
- Develop draft scope for EE module for PCAs
- Identify pilots
- Document underwriting pilot case studies
- Document PCA pilot case studies

## Current/Future Work

- Complete new analysis with additional data
- Development of prototype energy risk ratio for lenders