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The E2e Project:

Evidence for Action on Energy Efficiency

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Draft Version

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ENERGY INSTITUTE AT HAAS

MIT CEEPR

MITei MIT Energy Initiative

Goals of Our Visit

- Introduce the E2e Project to CIBO and learn about energy efficiency issues that matter to CIBO members
- Present sample of E2e research
- Set the stage for research collaboration between CIBO/ CIBO members and E2e

E2e aims to Measure the Economic Returns to Energy-Efficiency

- **Who:** A research organization co-founded by MIT and UC Berkeley, global leaders in energy research

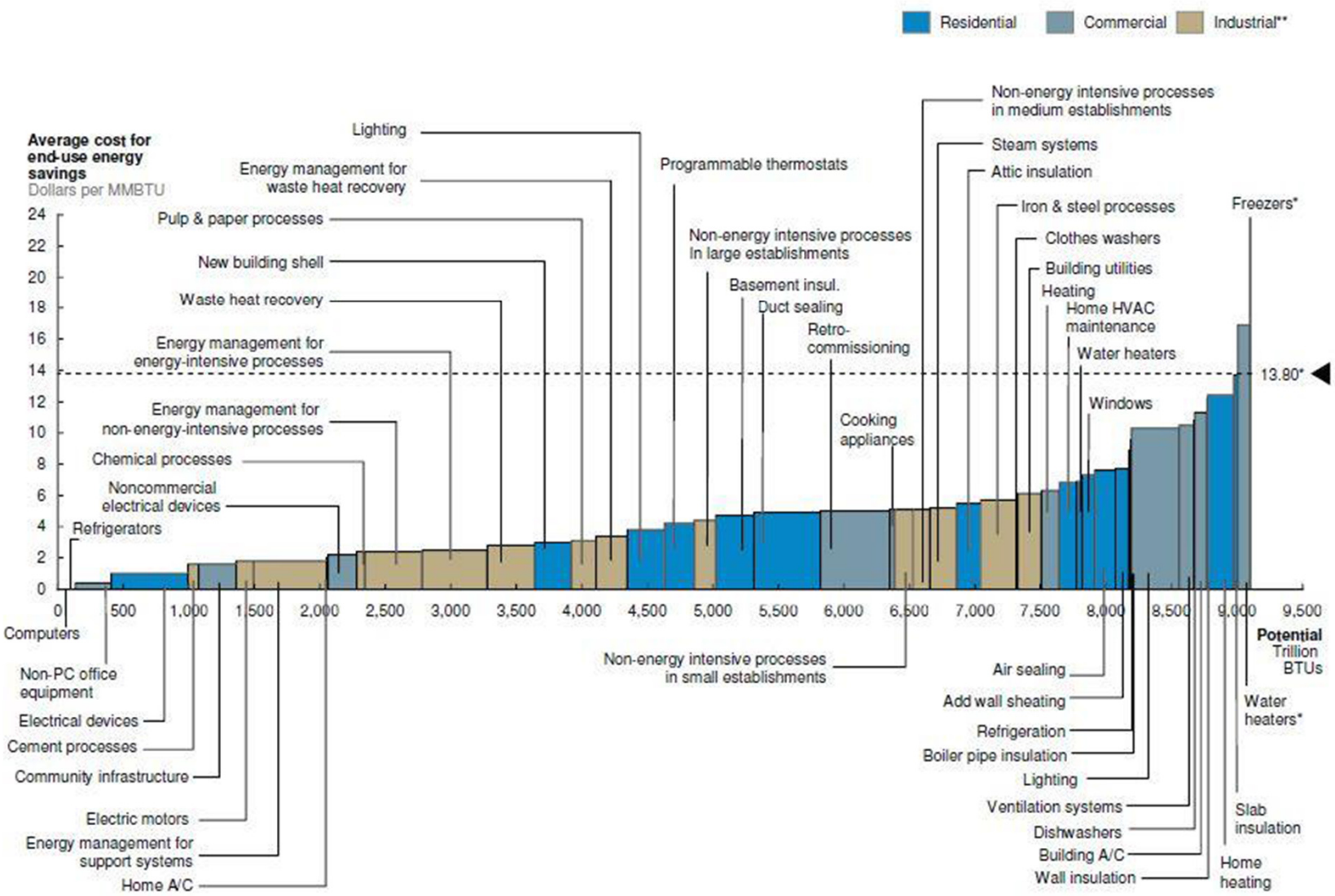
- **What:** Run field studies with partners to generate and disseminate " gold standard evidence" on the economic returns to energy-efficiency

- **Why:** Lots at stake
  - Immense faith placed on energy efficiency as a resource. However, it is well accepted that there is an "energy efficiency gap"
  - Ultimately, E2e's mission is to understand ***the causes*** for difference between the technically feasible and practically achievable in energy efficiency and solve the energy efficiency gap

Key E2e Questions Include

- Are consumers and businesses bypassing profitable opportunities to reduce their energy consumption?
  - What are the most effective ways to encourage individuals and businesses to undertake energy efficiency investments
  - What is their actual rate of return to such investments?
- How does the organizational structure impact EE decisions in commercial and industrial sectors?
- Which are the most important economic sectors and applications to target energy efficiency policies?

Study Suggests EE is a Vast, Underutilized Resource due to Barriers to Adoption



If Savings Exist, Let's Find Them—Using Rigorous Methods

- E2e works with partners in a range of sectors to:
  - Find underlying economic causes for efficiency differences or obstacles to adoption of more-efficient technology
  - Measure returns to efficiency
  - Use state-of-the-art research methods, especially randomized controlled trials (RCTs) and quasi-experimental methods to generate such evidence

Sample of Ongoing Research Projects

- **Home insulation in Michigan.** Work with federal weatherization program to measure returns from residential retrofits using a randomized-controlled trial (RCT)
- **Fuel economy in US.** Work with auto major to determine effect of fuel economy information on vehicle purchase (RCT)
- **Schools in California.** Work with utilities in CA to understand drivers of energy efficiency in schools (RCT and quasi-experimental methods)
- **Factories in India.** Work with industrial associations of chemical and textile factories to measure returns to industrial investments in energy-efficiency (RCT)

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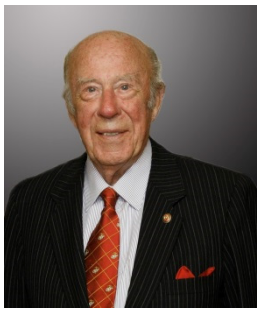

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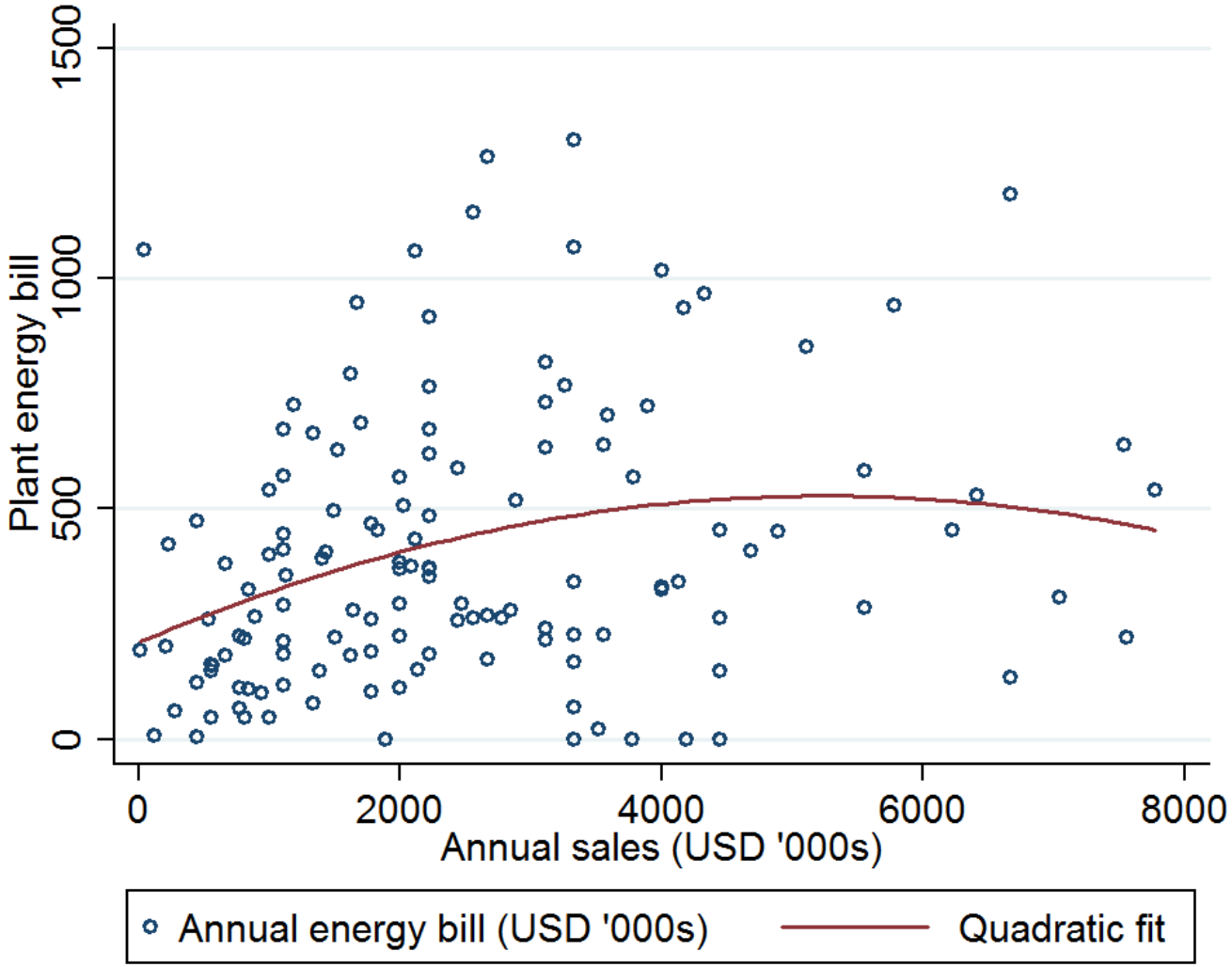
Example : Plant Efficiency Experiment in India

- More and less efficient plants differ in a thousand ways
  - Generally can't say plant X uses less energy because it has technology Y or benefited from policy Z
  - Goal of research design is to make such *causal* statements on solid ground: find the real reasons

	Treatment: Energy Audit	Control
Baseline survey	Recruit 400+ interested plants, get basic fuel and electricity consumption data	
Treatment Energy audit	Give 200 random plants energy audits	
Treatment: Energy manager	Give ~100 random plants managers to follow-up	
Endline survey	See what plants invested in and what energy they saved	

Plants Show a Huge Variation in Energy Bills



Similar Variation Observed in Detail: Boiler Efficiency, Motor Loading, etc.

Interventions Designed for the Most Likely Barriers

- **Lack of information.**
  - Energy audits give plants information on investments they could make and projected savings, for both thermal and electrical energy consumption
  - Economists argue informational problems or “market failures” a plausible reason for lack of efficiency

- **Lack of skill.**
  - Unskilled labor is cheap and abundant, but it is costly and difficult to run a boiler right or install a new system.
  - Energy managers stay on in plants for procurement, installation, training, etc.

Endline Survey and Analysis in Progress

- **Survey** covers economic and technical aspects of efficiency
  - Aggregate fuel and electricity consumption and bills
  - Investments, employment, inputs and outputs
  - Measures of efficiency of utility and process systems

- **Early findings** based on partial survey (230 plants) surprising
  - Treatment plants do invest somewhat more than control in equipment maintenance and upgrades
  - But treatment plants use *more* energy (in particular electricity) than control plants at the endline
  - Apparent response ("rebound") to efficiency is beneficial to plants but may confound policy-makers

What Would be the Shape of a CIBO – E2e Partnership?

- General template
  - Members benefit from economic analysis of returns to efficiency.
  - E2e analyzes data to produce publications that inform energy-efficiency research and policy debates.

- CIBO partnership motivated by simple observations
  - Heterogeneity in efficiency not unique to India. Past studies suggest scope for savings in industrial sector.
  - Anecdotally, CIBO members believe EE opportunities with positive payback are being by passed over

Next steps: Understand drivers of efficiency for CIBO members

- General examples that may be relevant:
  - **Incentive structure.** Plant managers and employees don't keep energy savings.
  - **Investment characteristics.**
    - **Risk.** Hard to agree on contract to guarantee savings.
    - **Covariance.** Energy use positively linked to profits: who cares to save when times are good?
  - **Market characteristics.**
    - **Competitiveness.** Relationship of efficiency to energy cost share and market competitiveness.
  - **Utility- or Process-Interactions**
    - **Energy does not stand alone.** Example of heat recovery in textile plants from corrosive dyeing liquor.

Next steps: Understand drivers of efficiency for CIBO members

- In-depth interactions between E2e and CIBO needed to pin down reasons for energy-(in)efficiency that can be tested
  - Visit with members and plants
  - Learn about the characteristics of membership
  - Analyze internal or external (EPA database) boiler data

- Goal for E2e to offer CIBO a concrete research plan by October board meeting
  - Rationale, sample of participants, proposed intervention and partners

Confidentiality is Absolute

- E2e researchers are experienced in handling confidential data and have often worked under non-disclosure agreements
  - Billing data from utilities
  - Bidding data from electricity auctions
  - Manufacturing micro-data from the census

- Detailed data a means to solid research results
  - Individual plant- or household-level data needed for statistical analysis
  - Publications do not contain any individually identifiable information

E2e Contact Information

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