The Future of Energy Efficiency:
Intelligent Buildings at the *Edge* of a Clean Energy Grid

Harvey Michaels, MIT Sloan Lecturer, Research Director
Energy Management Strategy
At BU Questrom Institute for Sustainable Energy
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hgm@mit.edu

**Qu: What’s Interesting about Buildings and the Energy they use?**

*Over time, the answer has changed:*

- **1975:** OPEC
  - Building Energy Efficiency

- **1990:** Soft Energy Path
  - Integrated Resource Planning

- **2005:** Smart Energy
  - Demand Response, AMI, Site Solar, ICT
  = Intelligent Buildings

$25 Billion/yr!!
**Going Forward:**
Intelligent Buildings are at the Center of a Climate Solution

- **1/3** - Buildings account for 1/3 of all GHG emissions.
- **2X** - Business-as-usual, building GHG’s will double by 2050.
- **Half** - Of emissions can be saved with positive NPV (at least).
- **All** - Buildings need to integrate with intermittent renewable energy.
- **Zero** - Alternatives to achieving deep gains in more than 1 billion homes/buildings - a challenging objective.

**Building Energy Management – 1970’s to Now**

- **1975** : OPEC → Building Energy Efficiency
- **2005** : Smart Energy → Demand Response, Site Solar, ICT
- **Next** : Climate Solution → At Scale, All Together

**Truth about Climate Change:**

*Its Real, Its Us,*

*Its Bad, Scientists Agree,*

*There’s Hope*

* A. Lieberwitz, Yale
Building Energy, Soft Energy, Smart Energy
At Scale, All Together =

Intelligent Building Energy Management

What is it?  Science and business innovations to optimize building energy use.

= Building Energy Efficiency
  + Building-to-Grid Systems
  + Carbon-free Site Energy
  + Smart People, Cities

Consumers at the Edge of a Connected Clean Energy Grid

➢ Climate Change-driven means:
  - DEALING WITH: Intermittent Supply and “Duck curve” demand
  - CHOOSING: Policy/customer preferences for Site Solar, EV’s, batteries, efficient, green, modern.

➢ THE PROSUMER:
  Decarbonization, Distributed Generation, Digitization
**DISRUPTIVE TECHNOLOGY at the Edge of a Connected Clean Energy Grid**

- **Internet of Things, comes with everything.**
  - Energy - sensible, controllable.
  - Enables Settings: *fault detection, thematic control, adaptive strategies*
  - Efficiency and grid stabilization - visible, transactable.

*Question: Internet of Things meets Grid of Things: Who owns, who controls?*

**UTILITIES at the Crossroads of Buildings, Climate, and Grid**

Distribution Utility Restructuring:
- From Monopolies → Markets

*Question: Where to get backup/insurance energy?*
- Utility grid, on-premise, microgrids (real, virtual)?

Most likely answer: *All of the Above*

- Utilities may compete post-monopoly as Comcast does:
  - FIOS, Dish/Direct, Apple TV/Amazon Fire/Netflix
  - Comcast Innovates → Xfinity, X1: *Its Still There*
  - Utilities who embrace change – *power of incumbency.*
All Together:
Building Energy Management → Full Service/Integrated:
- Building efficiency, DR/controls, Solar/batteries, energy
- Solar pull → Intelligent Buildings → Energy Efficiency

At Scale:
Business, City strategies that Solve the Climate Problem employ:
- No money down, guaranteed positive cash flow.
- Easy, quick, risk free, Guilt.

Make EM Costless, Riskless, Timeless, and Visible to all!

The Future of Intelligent Building Energy Management is bright!

Today’s $25 B building energy industry
- Needs to be/should be $100 B by 2020
- Needed To Solve the Solvable Climate Problem

Opportunity:
Develop much more effective building/climate strategies
- Building Efficiency so far shows some progress, but we need all of it.
- Today’s Prosumers want 3D’s: Decarbonization, Distributed Generation, Digitization