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

Building Technologies Office Prioritization Tool

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The prioritization tool provides quantitative insight to decision-making

Vision: develop an analytical tool that considers building efficiency measures and technologies, and assesses and compares their potential value into the future

Uses:

- Inform programmatic decision-making
- Examine “what if” scenarios
- Create targets for FOAs
- Set programmatic goals
- Provide public with a comprehensive analytical tool

FY13 peer review completed March 2013

BTO review of outputs ongoing in April 2013 – no output review today

The analytical framework involves defining inputs, calculating, and generating outputs

Inputs

- Performance improvement
- Cost
- Market
- Lifetime

Analysis

- Stock and flow dynamics
- Technology diffusion
- Cost of Conserved Energy (CCE)
- Staging framework

Outputs

- CCE and annual energy savings
- Technical potential
- Full-Adoption potential
- BTO-Adoption adjusted potential
- Staged potential

$$U = S \times E^{-1} \times SD = S \times C$$

Consumption

Service Demand per unit stock

Efficiency

Equipment Stock

Total energy use

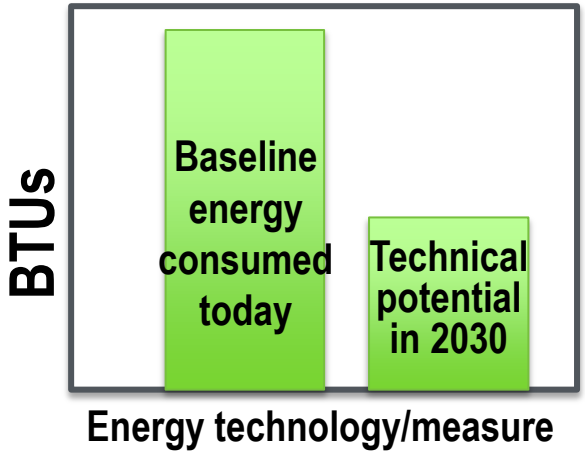
Outputs are viewed through different 'lenses'

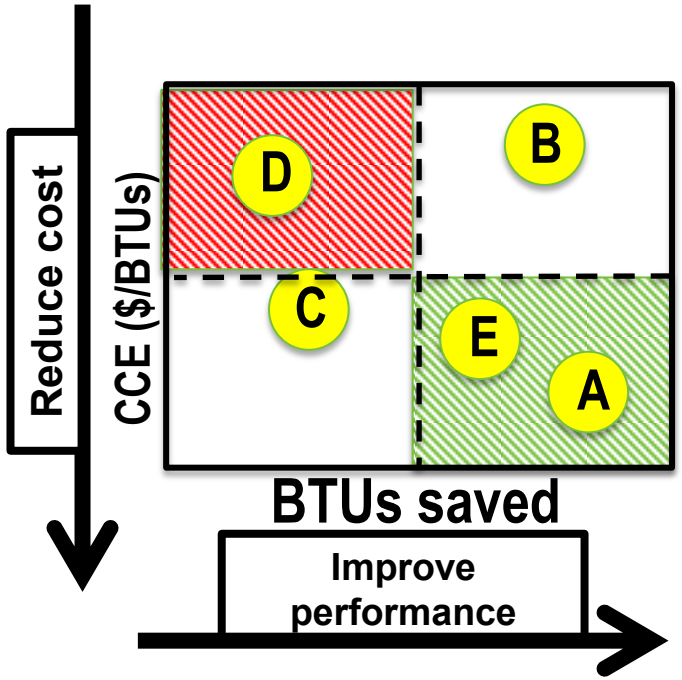
LENS 1: Imagine replacing all existing stock with the new measure overnight = **Technical Potential**

LENS 2: A 'stock and flow' model accounts for unit replacement, elimination or addition = **Maximum Adoption Potential (unstaged)**

LENS 3: To avoid 'double counting,' measures with lowest CCE "stage" first to capture their share of the market = **Maximum Adoption Potential (staged)**

LENS 4: Market penetration and BTO influence on acceleration can be examined using the *Bass Diffusion Model* to represent more "realistic" market diffusion = **Adjusted Adoption Potential**





Reviewing…

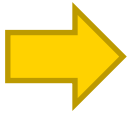
#1: How much energy is currently used for lighting and is expected to be used in the future?

Business As Usual (BAU)

#2: Imagine that every lamp was replaced with an LED lamp overnight. What would be the reduction in energy use?

Technical Potential

#3: What if we replaced every lamp at the end of its life with an LED lamp (or at an accelerated rate when it was cost effective to do so)? How much energy would be saved then?



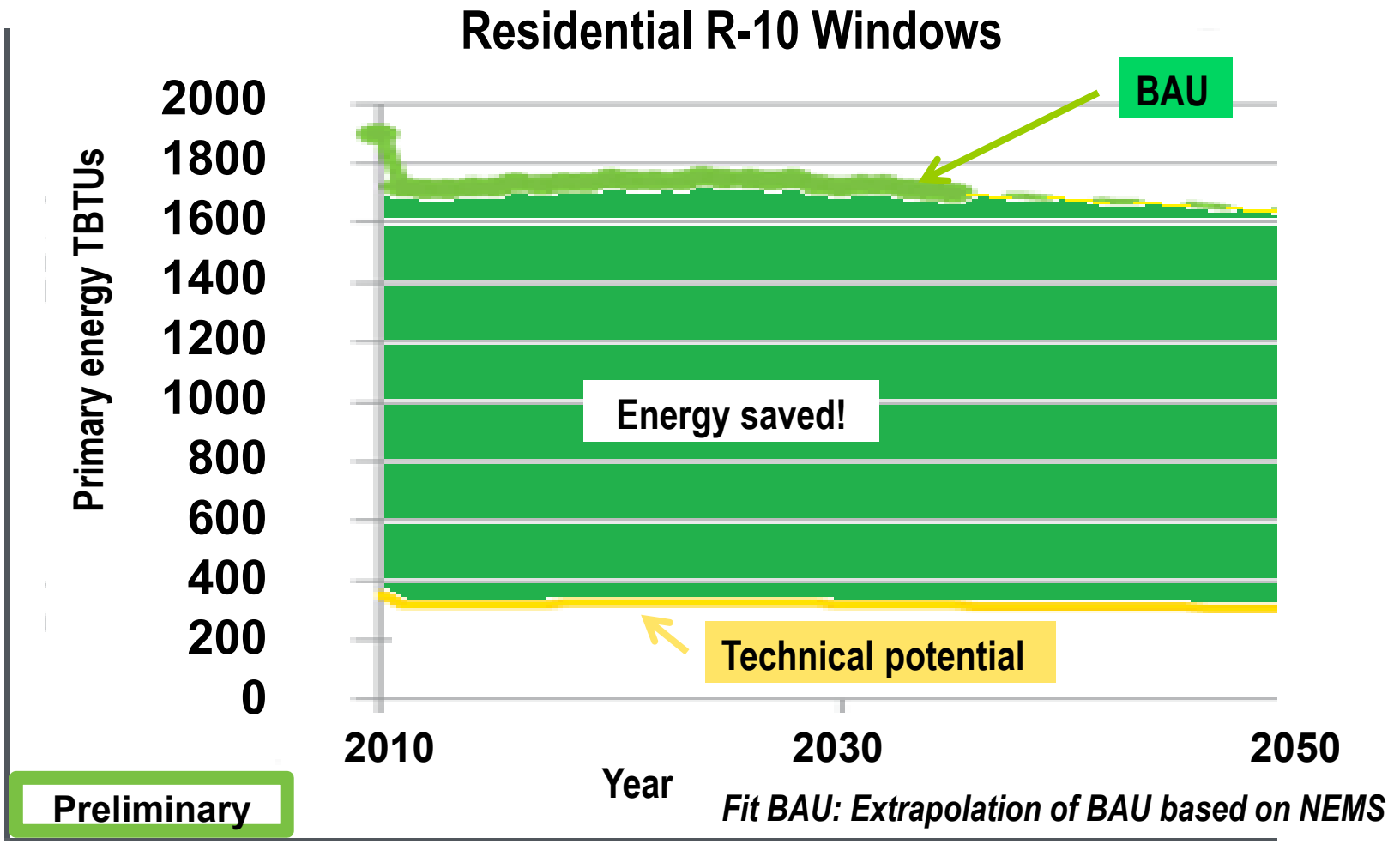
Maximum Adoption Potential

#4: Now we want as accurate a depiction as possible of the rate our LED lamps are adopted by the market, taking into consideration the impact of DOE's spending on R&D, deployment, or standards activity.

Adjusted Adoption Potential

Imagine replacing existing stock with the new measure overnight = **Technical Potential**

Accounts for market size and relative performance between measure and baseline, but does not account for cost effectiveness



‘Stock and flow’ accounts for replacement, elimination or addition = **Maximum Adoption Potential (unstaged)**

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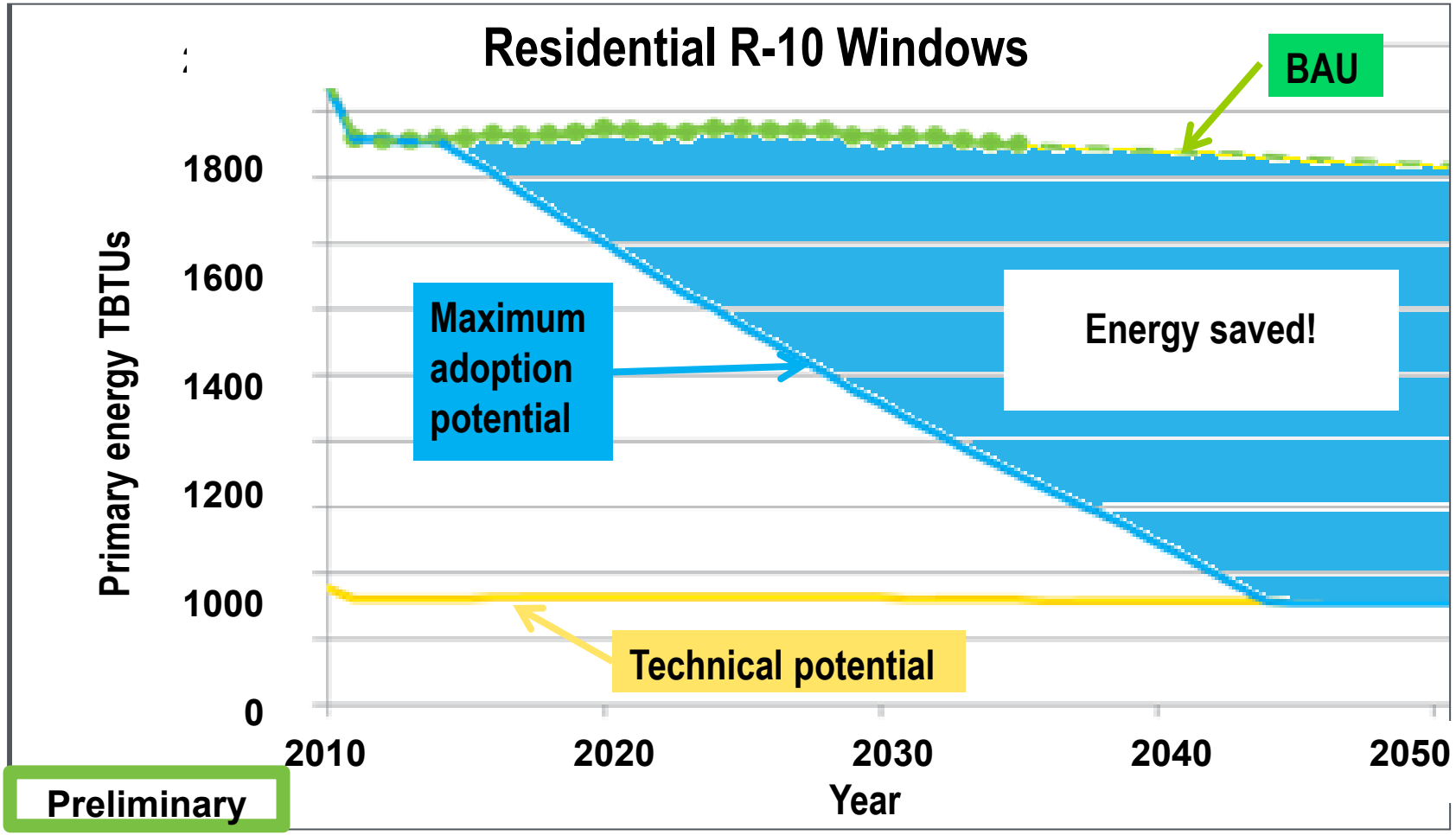
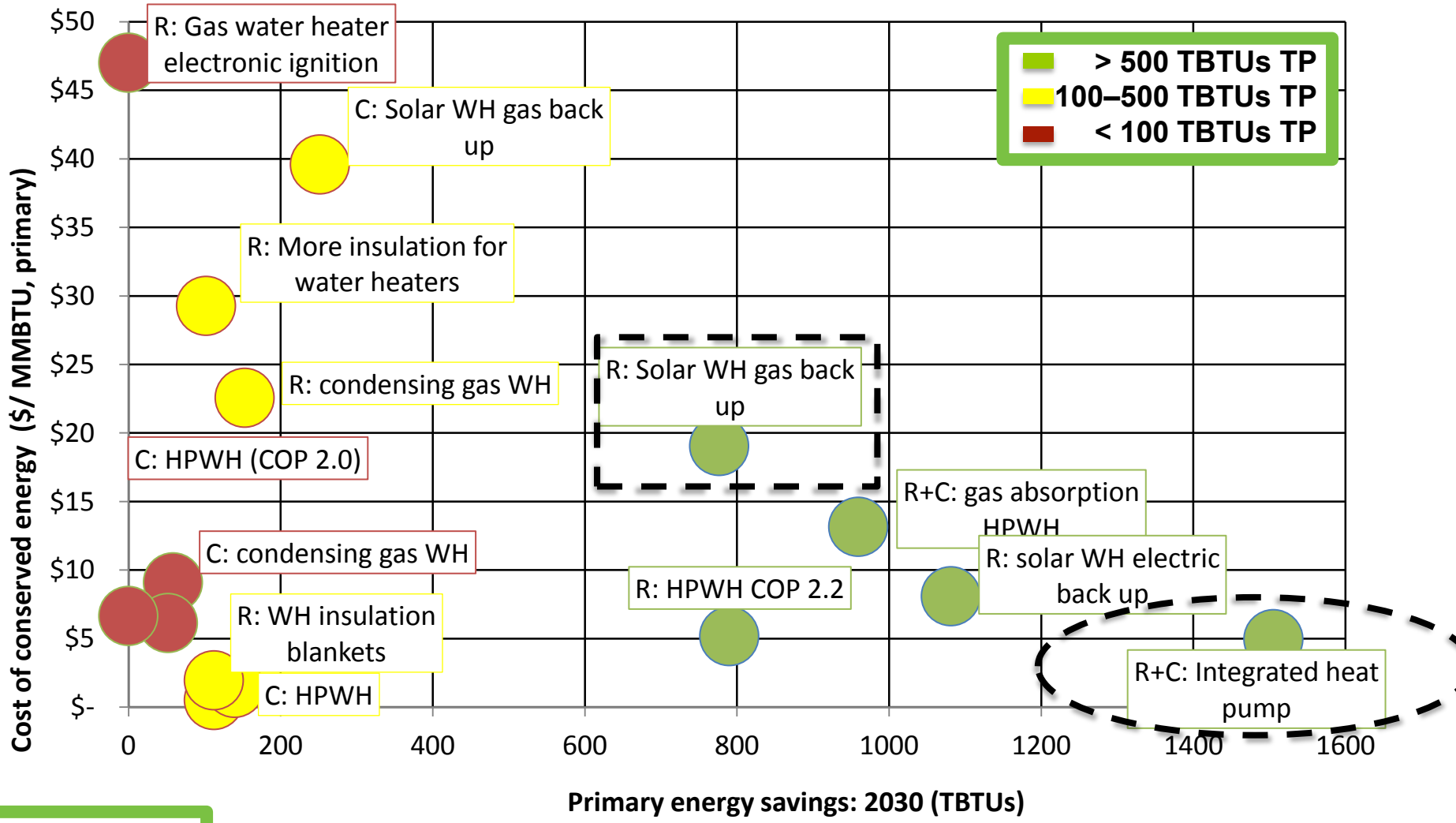
Stock turnover slowly brings energy use closer to technical potential



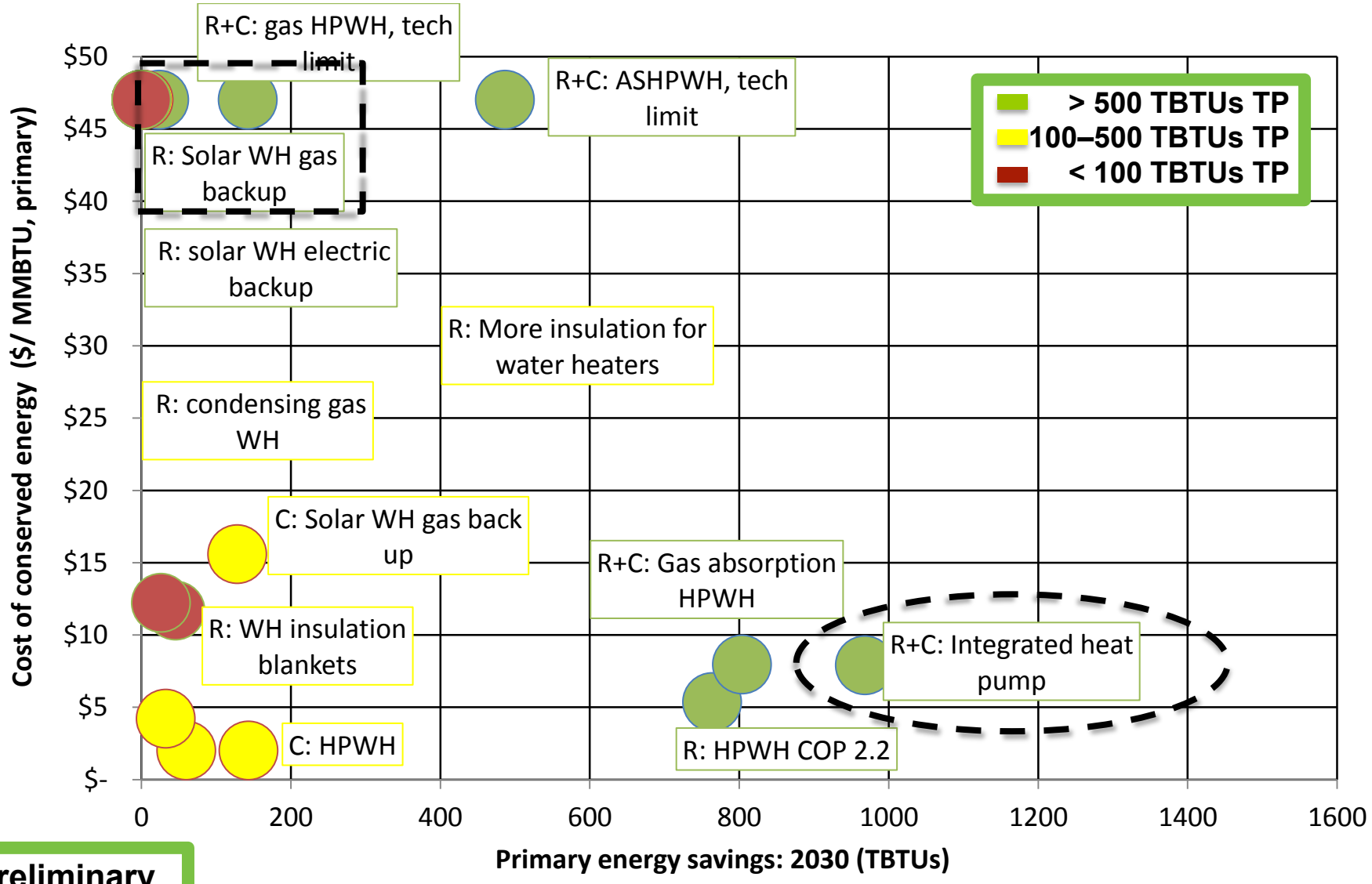
Staging is then used on ‘Maximum Adoption Potential’ to avoid double counting

FY13 output example: water heating maximum adoption potential, 2030 (unstaged)



Preliminary

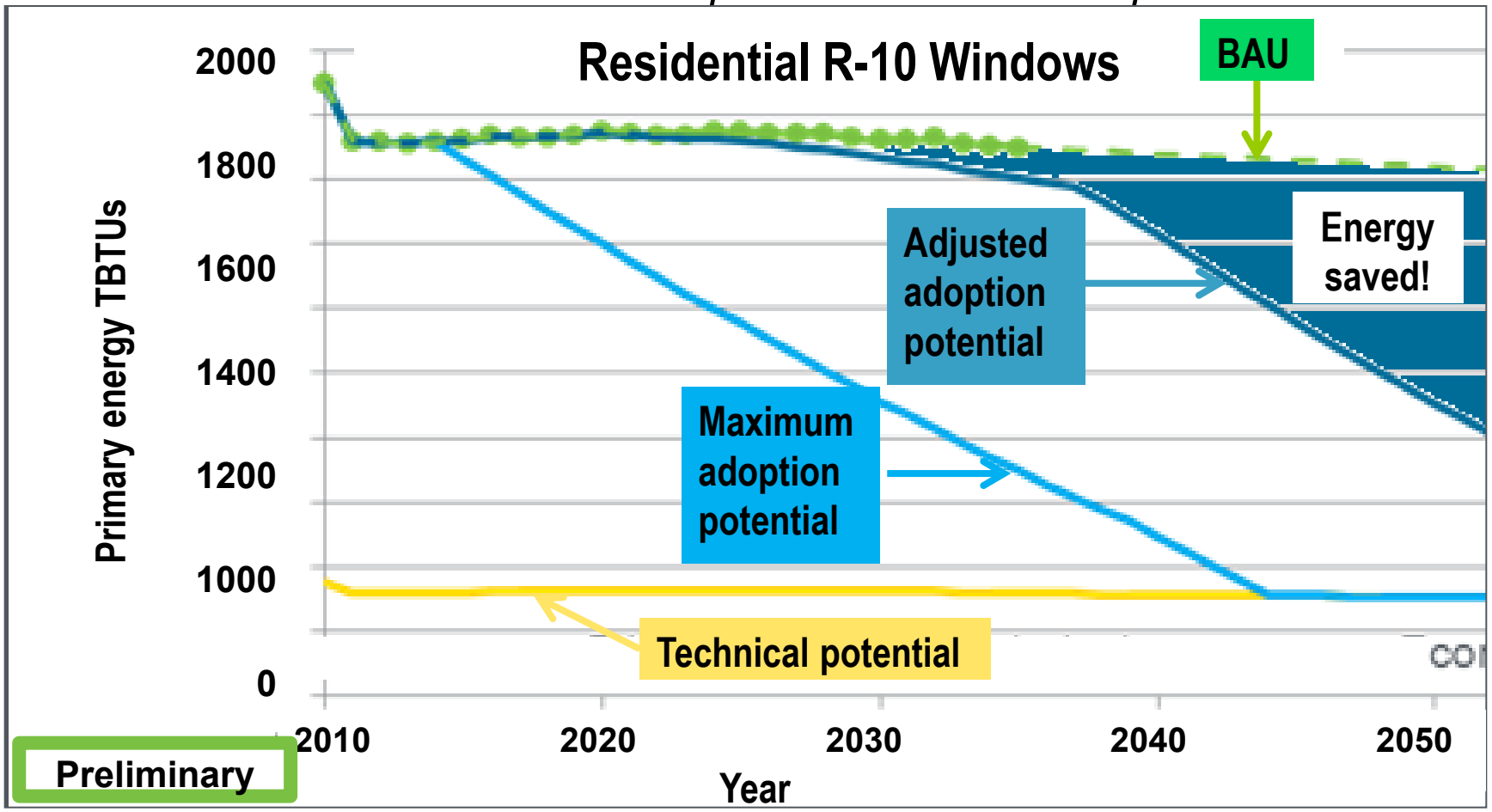
FY13 output example: water heating maximum adoption potential, 2030 (staged)



Preliminary

Market penetration scenarios can also be explored = **Adjusted Adoption Potential**

- *Bass Diffusion Model (p's and q's) accounts for market penetration*
- *Market acceleration can be further enhanced through BTO investment*
- *Standards/codes action initiates path towards full adoption*



The staged maximum adoption potential results can be used to formulate an 'economic potential' uber goal for BTO

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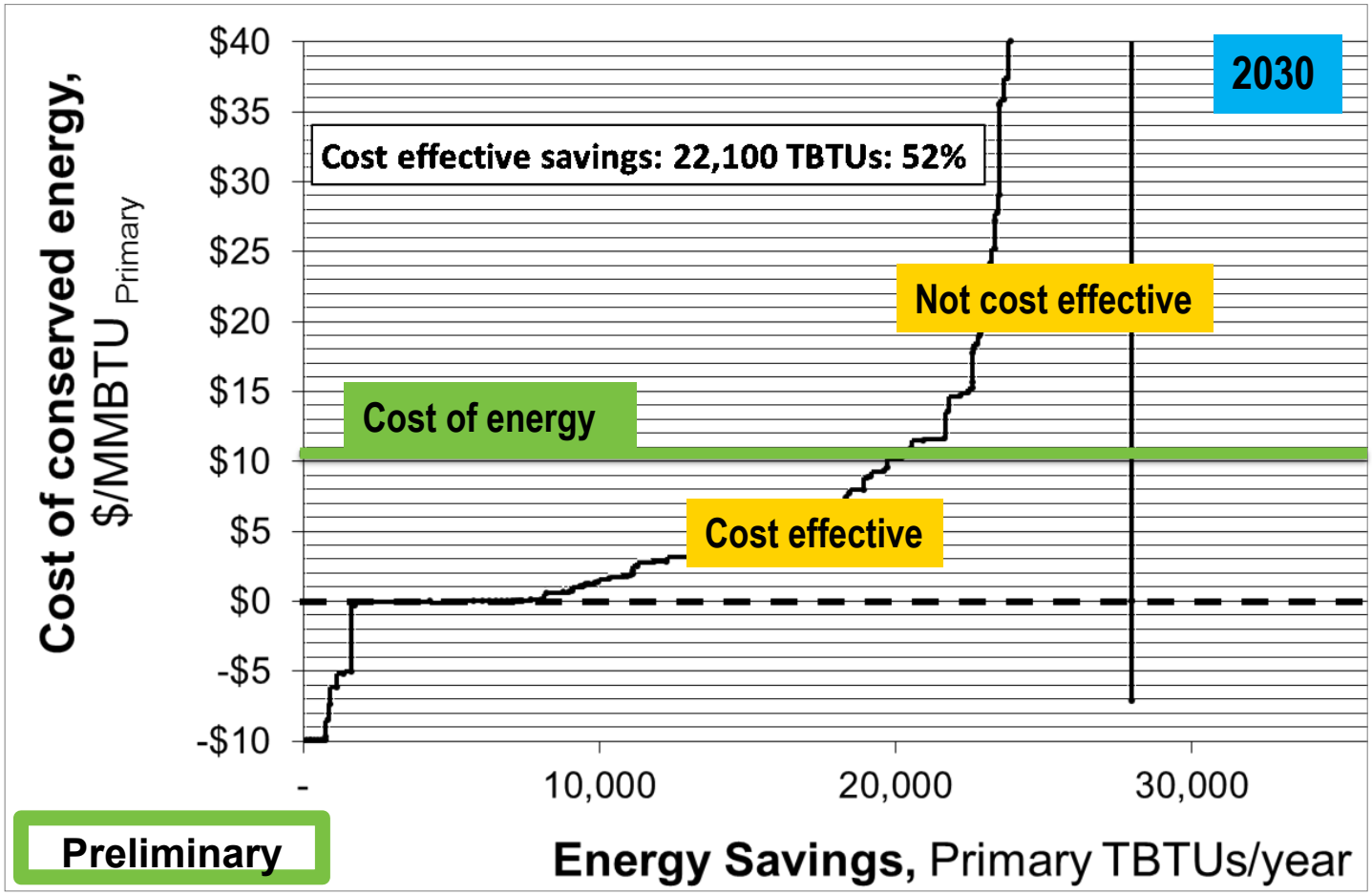
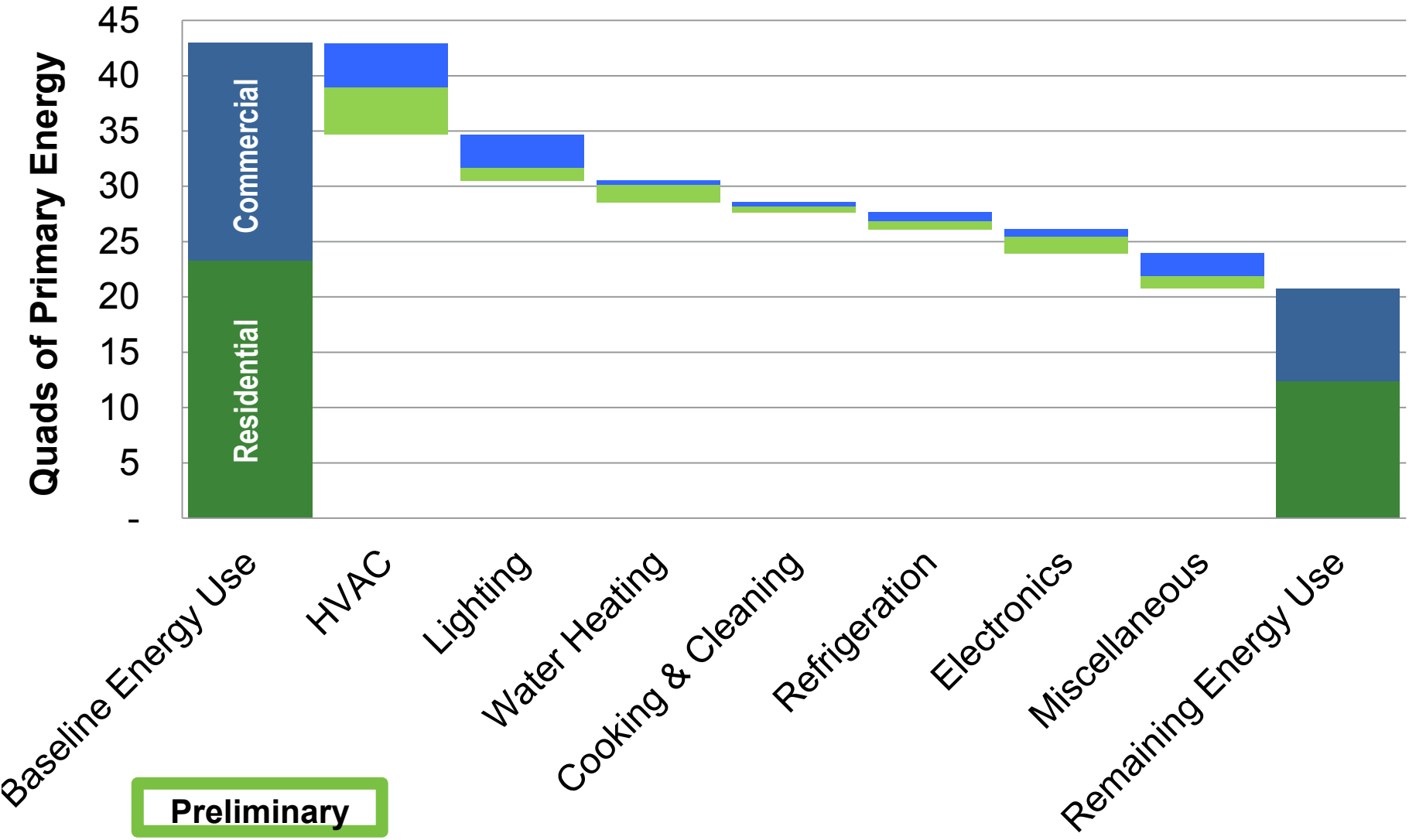
1. *Measures are plotted in order of increasing CCE: CCE and energy savings*
2. *Measures that fall below "cost of energy" line are cost effective*
3. *Compare cost effective savings to baseline to generate 'economic potential' goal*



The ‘uber’ goal can also be broken down by sector



The prioritization tool can be used for various purposes…

- Generate quantitative goals for sub-programs (e.g. 70% energy savings in lighting by 2030")
- Analyze outputs to identify gaps and opportunities (with critical eye)
- Conduct sensitivity analyses ("what if" scenarios) to "test realistic target ranges
- Inform programmatic decision-making
  - Focus on HITs: "high impact technologies"
  - Identify gaps and opportunities
  - Remove lemons: technologies with limited national impact
- Set FOA topic targets
  (e.g. thermal insulation R-value 8 at 0.08/ft^2/R)

New FY13 focus on Building Sensors, Controls and Transactions

The prioritization tool is 'evergreen' and will continue to be improved

- Prior/current activities:
  - Input/output peer review (improved interface/forms)
  - Four 2-hour classes for key stakeholders
  - Release of "A Tool to Prioritize Energy Efficiency Investments" Report and Nature commentary
  - Coordination with other federal building activities
  - Output review, planning, goal setting (ongoing NOW for FY14 AOP)
- Future activities:
  - Continual improvement (e.g. adjusted-adopted methodology)
  - RFI release to solicit broader public input (May 2013)
  - Professional recorded webinar (May 2013)
  - Publications/presentations/reports on outputs and implications (Summer 2013)
  - Public release of tool
  - Renaming?

Initial publications

COMMENT

...ive black ...ution of | ART New York exhibition explores the surreal side of technology p.279 | TECHNOLOGY In conversation with the creator of therapeutic robots p.280 | BIODIVERSITY Conservation triage may sometimes be necessary p.281

Lighting and heating for buildings account for almost 40% of the total energy consumed in the United States.

How to build a low-energy future

Advanced construction technologies promise huge energy savings, says **Philip Farese**. Investment is needed to bring them to market and to encourage their use.

In 2010, the United States used 98 quadrillion British thermal units (quads) of energy — about 20% of the world's total — on everything from transport to entertainment. A surprisingly large amount — 40 quads — went into buildings for uses such as space heating, cooling, lighting and computing. Assuming that business continues as usual, by 2030, the nation will require 43 quads of energy for buildings[1].

There is huge room for improvement without sacrificing an ounce of comfort. Much more should be invested in developing energy-saving technologies, in bringing them to market and in encouraging their use.

I, along with colleagues at the National Renewable Energy Laboratory (NREL) in Colorado and at the US Department of Energy (DOE), have reviewed more than 300 publications and sought the advice of 65 experts to determine how much US energy demand for buildings might be cut. We find that cost-effective technologies available now could reduce energy use in buildings by up to 30% by 2030, which is in line with others' findings[2].

Add in the affordable emerging technologies that are expected to be available in the next 5 years or so, and the potential reduction reaches 55%. Including all ▸

A Tool to Prioritize Energy Efficiency Investments

Philip Farese, Rachel Gelman, and Robert Hendron
National Renewable Energy Laboratory (NREL)

Available at:
http://www.nrel.gov/docs/fy12osti/54799.pdf

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Technical Report
NREL/TP-6A20-54799
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Peer reviewers (too many to name) from National Labs and Industry