BERKELEY LAB
Lawrence Berkeley National Laboratory

Environmental Energy Technologies Division Lawrence Berkeley National Laboratory

Home Energy Saver
A bit of Past, Present & Future

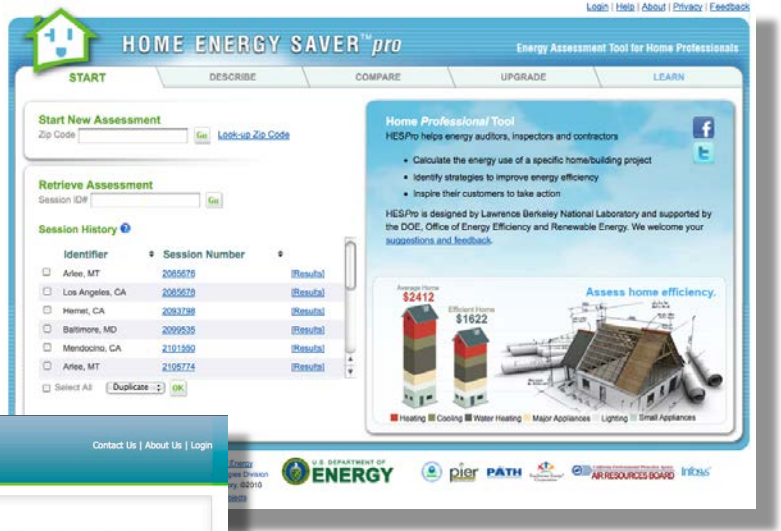
PG&E Visit, March 13, 2012

The Home Energy Saver

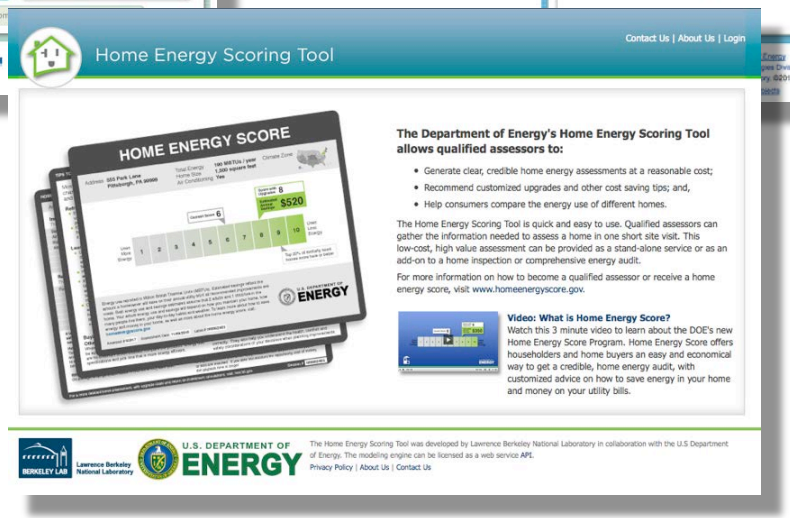
Web-based Energy Audit Tools & Services

Home Energy Saver - Consumer

Home Energy Saver - Pro



Home Energy Scoring Tool



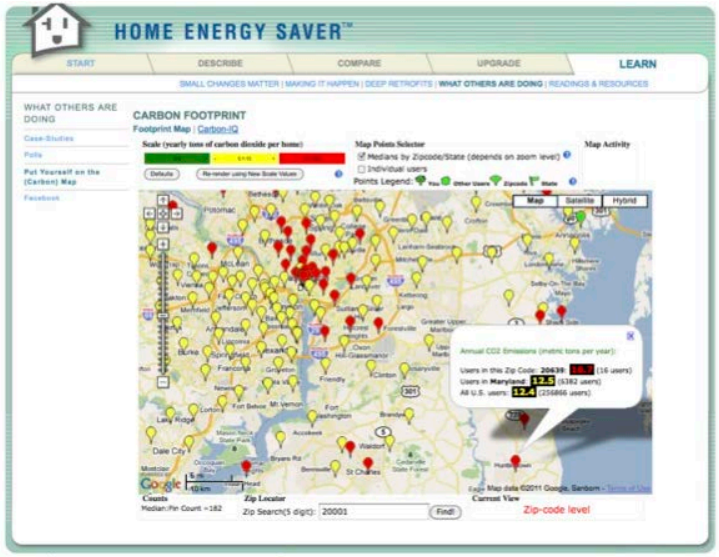
Key Milestones

- HES Consumer tool founded in 1994 by Evan Mills
- Partnership with the National Association of Rural Electric Cooperatives (NRECA) / Touchstone adopted HES as the official calculator for their ~30 million customers
- Licensing calculation engine to third-party software developers (started in 2009 with Microsoft)
- R&D100 award in 2010
- Launched Social Network for home performance pros in 2010 – (homeenergypros.lbl.gov)
- Expansion to multifamily and Weatherization & Intergovernmental Program applications: 2010-2013

Customer-facing Strategy

- Empower diverse users to apply state-of-the-art research & know-how to reduce home energy use, cost, and greenhouse-gas emissions
  - Do-it-yourself audit for consumers
  - More sophisticated tool for professionals
  - Asset rating for time-of-sale and other cross-home comparison situations
- Free user interfaces / Non-proprietary
- Customized experience (not “brochure-ware”)
- Reduce time required (and thus cost) for professional audits
- Serve diverse communities & building types
- Objective – Accurate – Transparent – Evolving

Home Energy Saver: Consumer

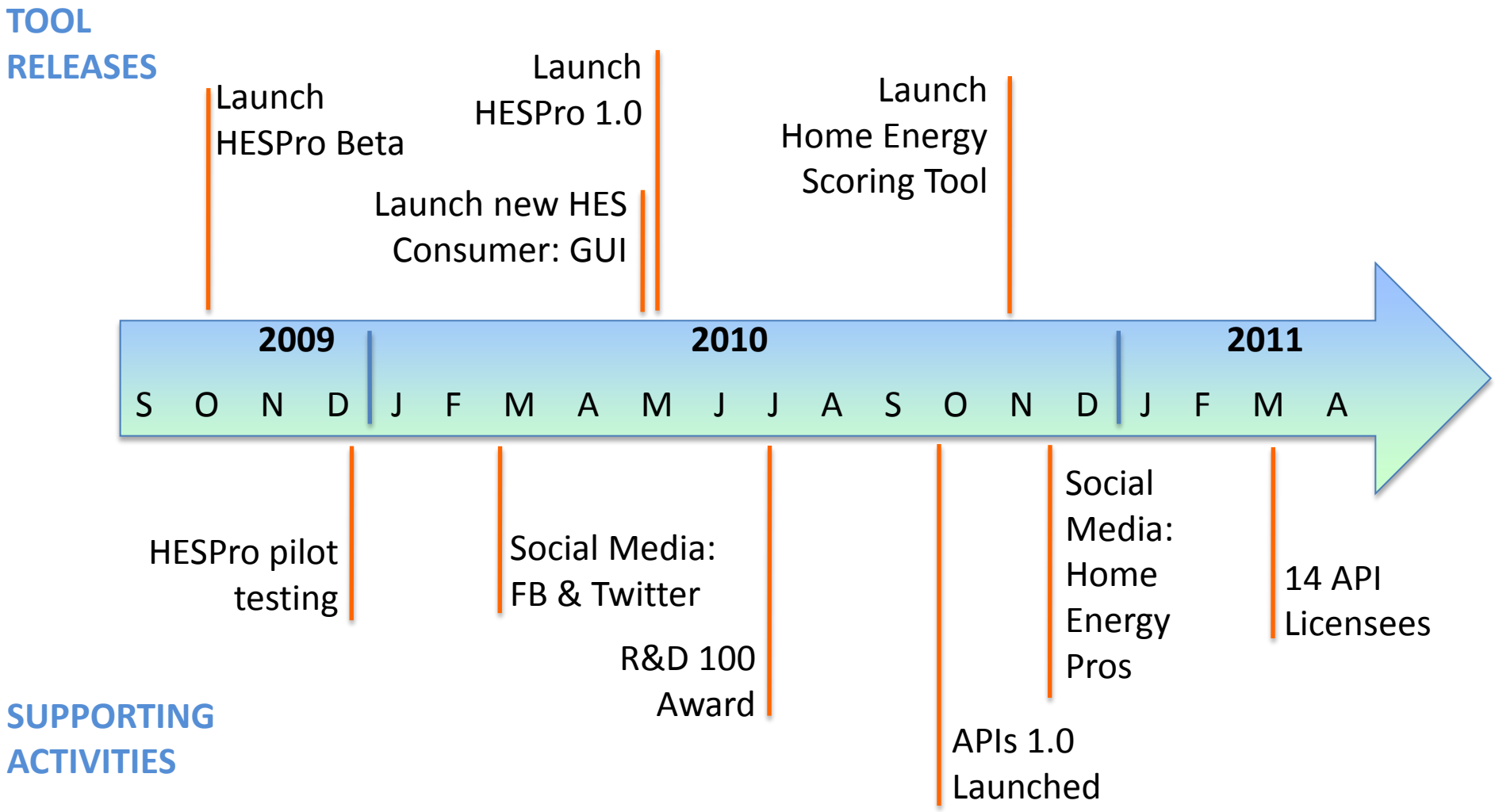


ENERGY STAR
PRODUCTS

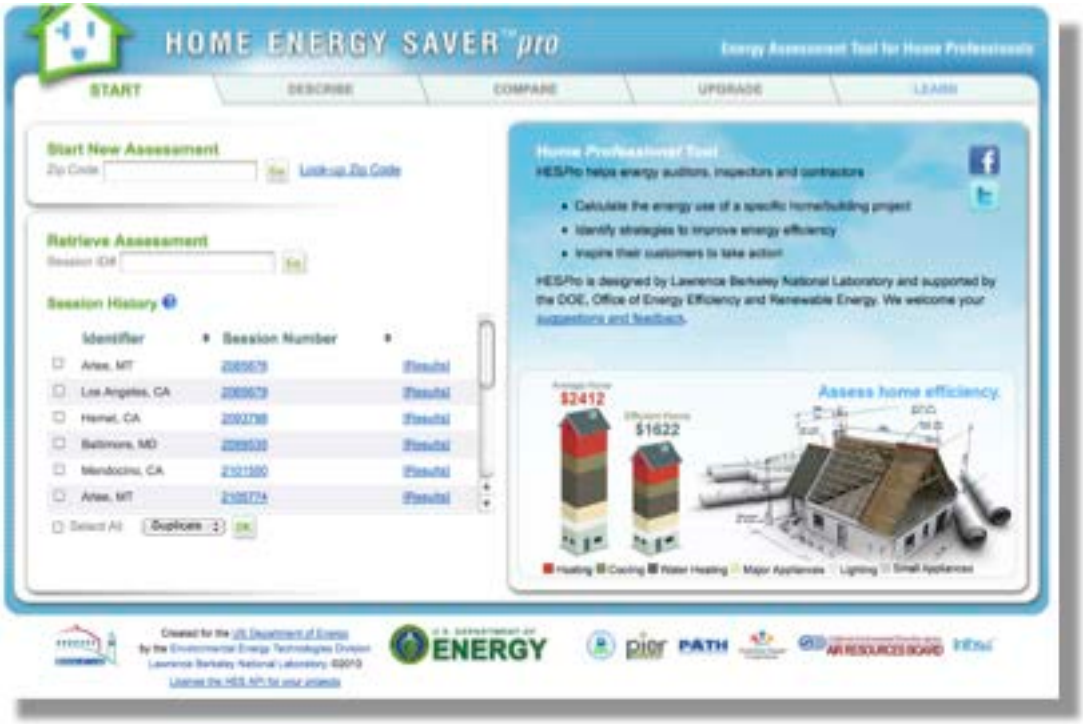
Appliance Rebates in Your State

Each state and U.S. territory designed its own rebate program, and all 56 plans have been approved by the U.S. Department of Energy (DOE). Learn about those programs, including their program start dates and specific eligibility criteria. (Note: This Web site is the only official DOE-sponsored Web site; be

Accomplishments under ARRA-BT



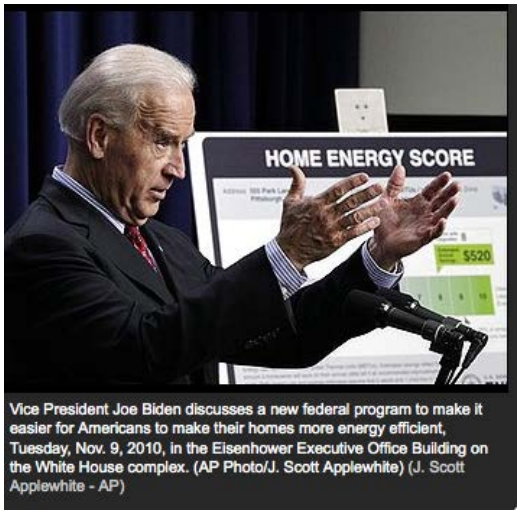
Home Energy Saver: Pro



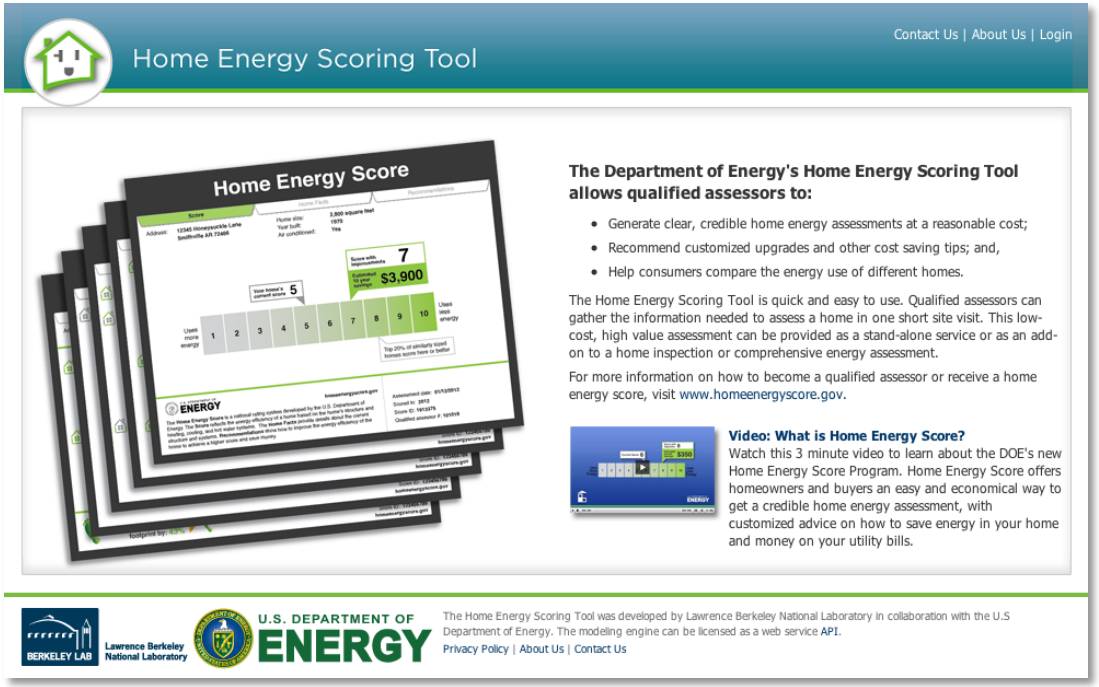
Not just a DOE-2 interface

Add/ Remove	Upgrade	Upgrade Choice & Description	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated Return on Investment	Avoided Emissions (lbs. CO_2)
☐	Check/Uncheck All Upgrades	**Total for Selected Upgrades:**	**$2261**	**$8192**	**$22610**	**4**	**27%**	**22916**
☑	Basement wall insulation	R-11	$530	$ 720	$5300	1	74%	5384
☑	Electric clothes dryer	Switch to gas dryer	$100	$ 160	$1000	2	62%	303
☑	Thermostat	ENERGY STAR-labeled program	$159	$ 320	$1590	2	50%	1616
☑	Duct Sealing	Reduce leakage to 6% of total ai	$403	$ 890	$4030	2	45%	4088
☑	Indoor lights	CFLs in high-use fixtures	$46	$ 88	$460	2	44%	846
☑	Wall insulation	R-11 wall + R-5 exterior foam	$520	$ 1196	$5200	2	43%	5278
☑	Gas furnace	AFUE=90 ENERGY STAR	$370	$ 1126	$3700	3	33%	3757
☑	Clothes washer	MEF=1.42 WF=9.5 ENERGY STA	$59	$ 180	$590	3	32%	428

Home Energy Scoring Tool

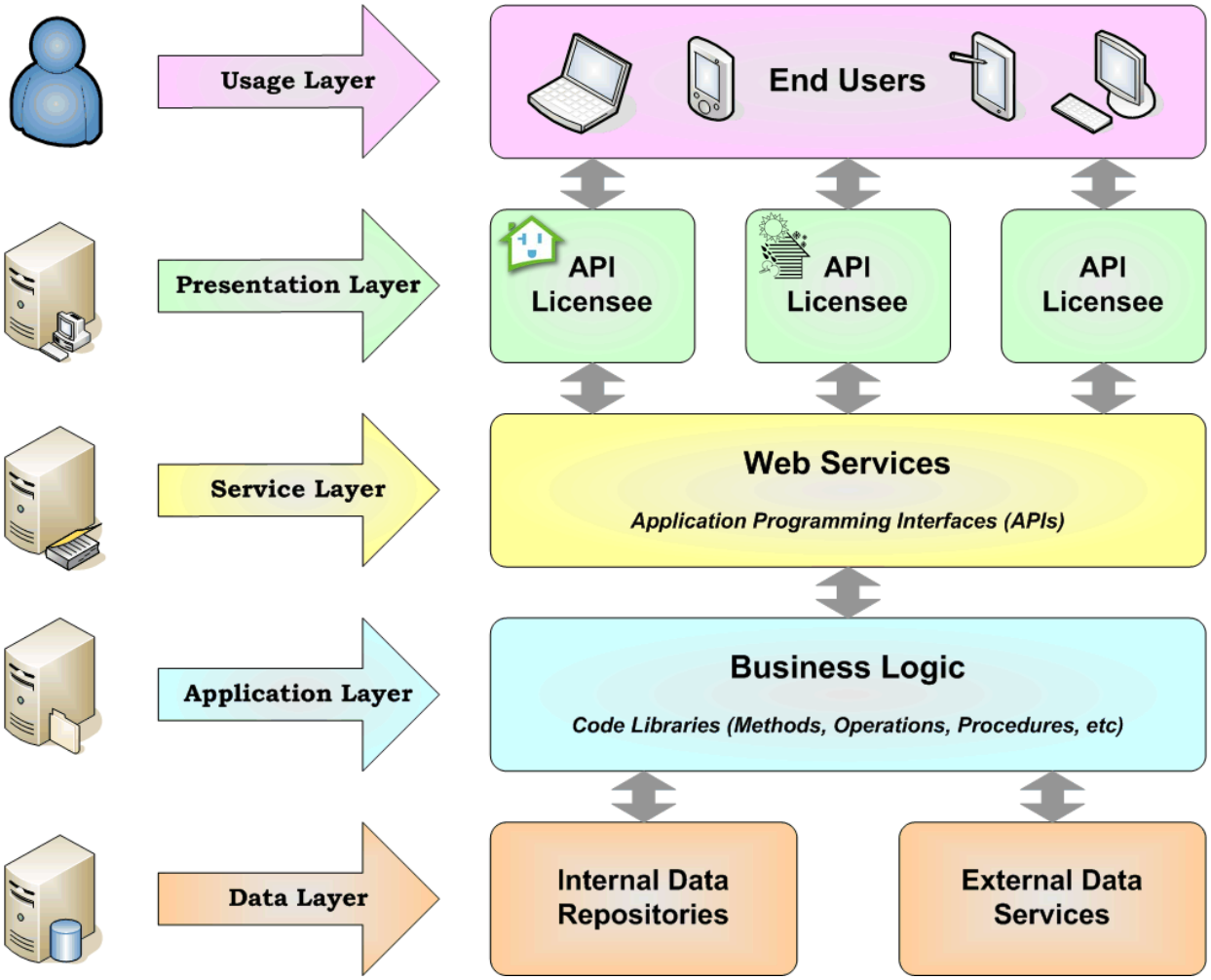


Vice President Joe Biden discusses a new federal program to make it easier for Americans to make their homes more energy efficient, Tuesday, Nov. 9, 2010, in the Eisenhower Executive Office Building on the White House complex. (AP Photo/J. Scott Applewhite) (J. Scott Applewhite - AP)

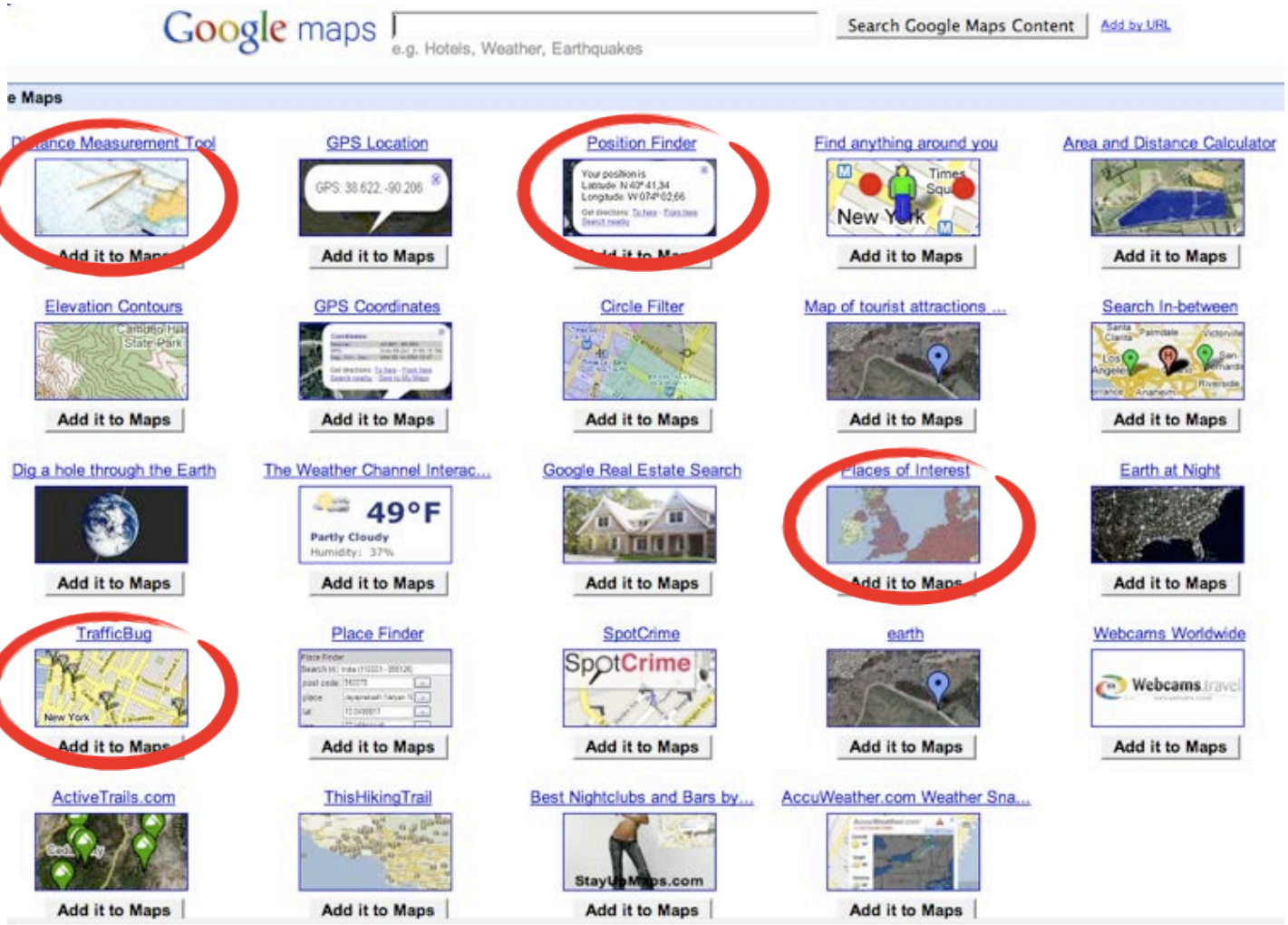


- Launched by Vice President Biden November 9, 2010 [BETA]
- Pilots Tests Spring-Summer 2011
- National Launch version 1.0 – 1st Quarter 2012

What is an API?



A Familiar API….



Existing HES API Users

Home Energy Saver:

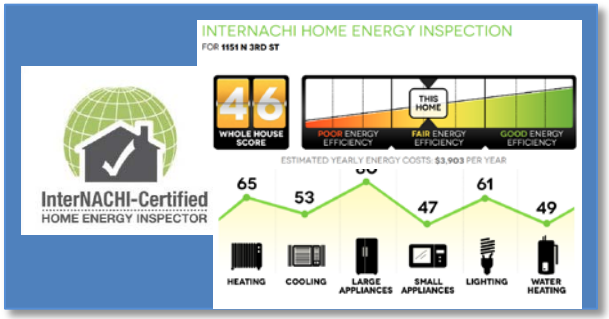
Consumer | Pro | Scoring Tool

Cool California: CARB

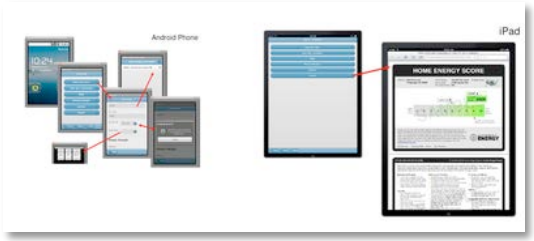
Wattzon

iViro (iPhone)

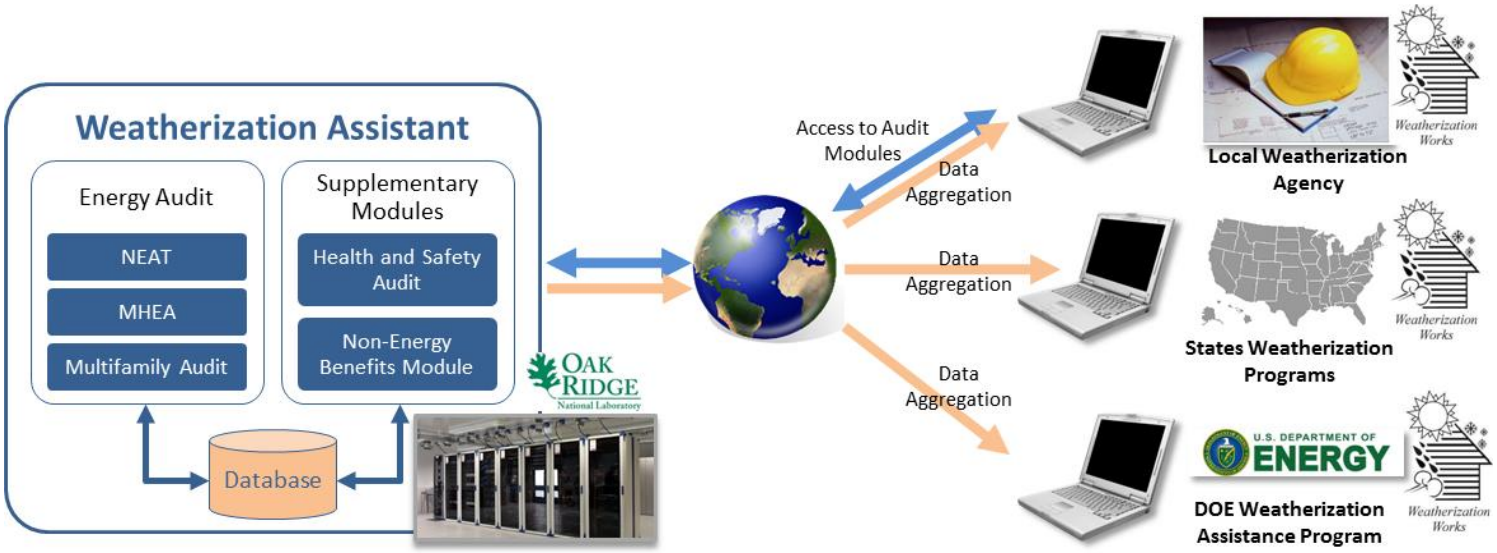
InterNACHI



MNCEE: mobile Scoring

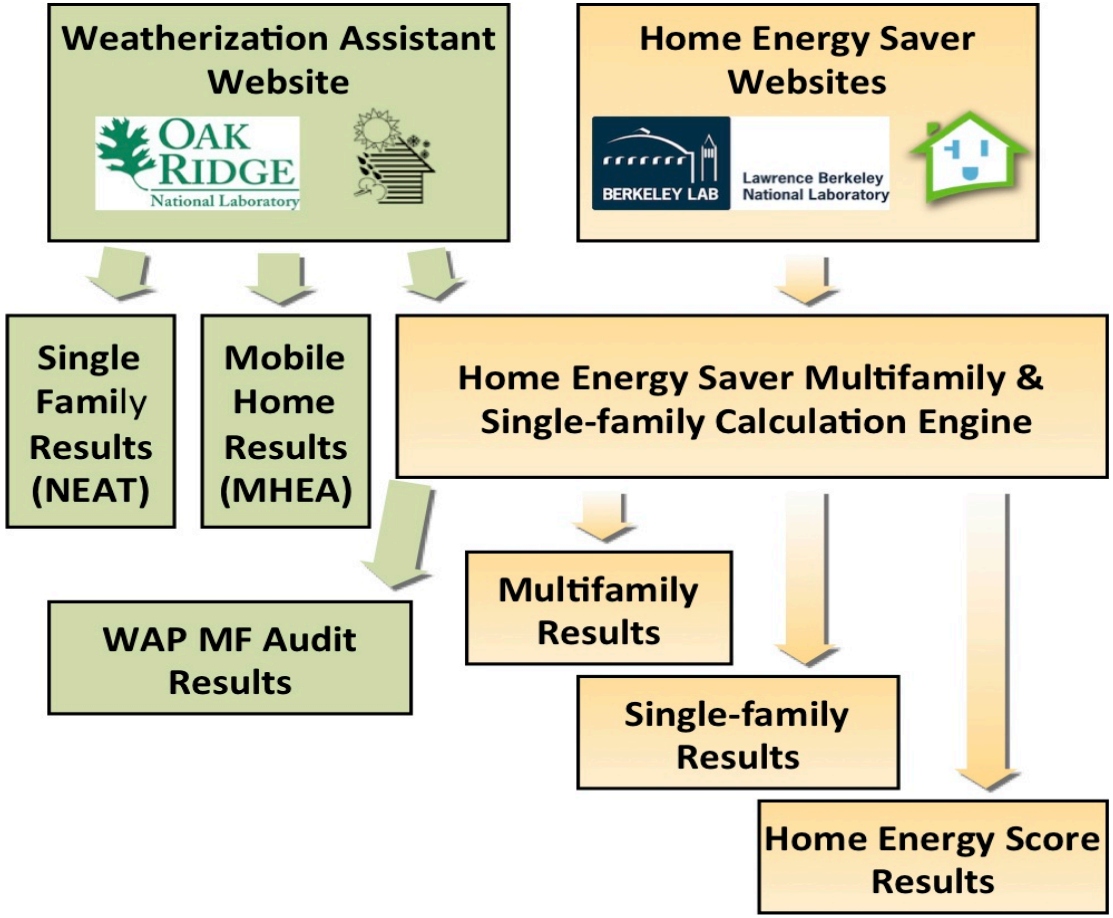


Weatherization Assistant Changing



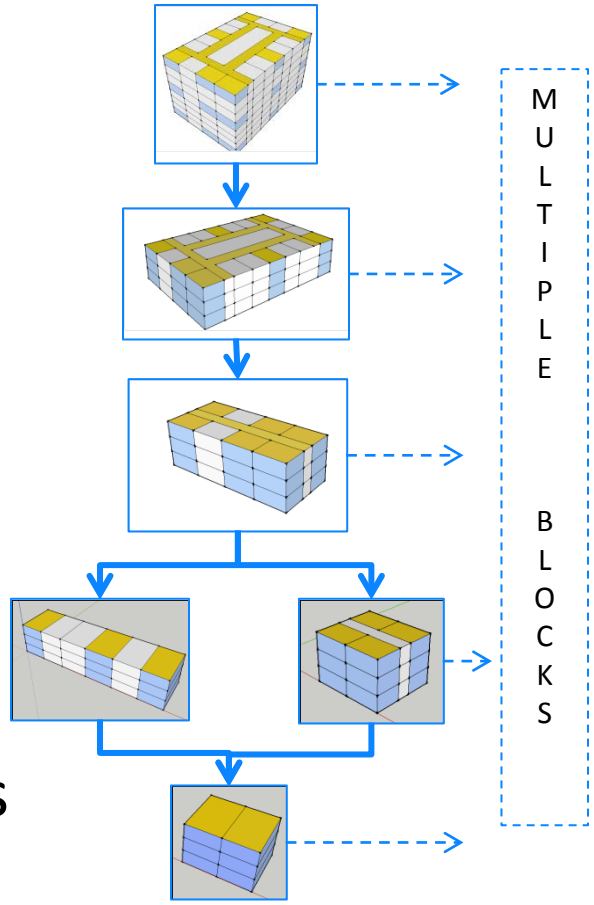
- NEAT, MHEA, H&S, NEBs, new multifamily tool
- All run as Internet web service, secure servers
- Central data base

Weatherization Assistant Changing



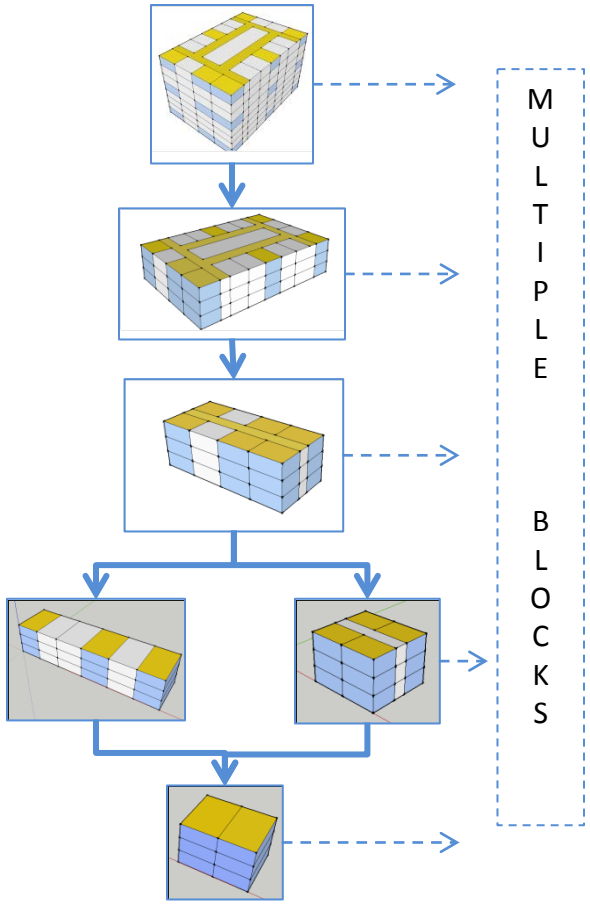
Multifamily Tools Dev Staging

- **Version 1 (1st Quarter 2012)**, will handle buildings with simpler configurations, mostly low-rise buildings, available for testing soon
- **Version 2 (Winter 2013)** will be developed in a second stage and will increase the energy calculation capabilities to handle taller building configurations, more complex energy systems, and more complex measures



New Modeling Approaches

- Multiple Thermal Zones, adaptive coding approach to generalize most/all geometries
- Simplified Building Typologies, balance simplification of input with complexity of buildings
- DOE-2.1e calculation engine, with specialized models as needed
- Macros and repetitive blocks of DOE-2 code for scaling spaces, surfaces, and systems as needed

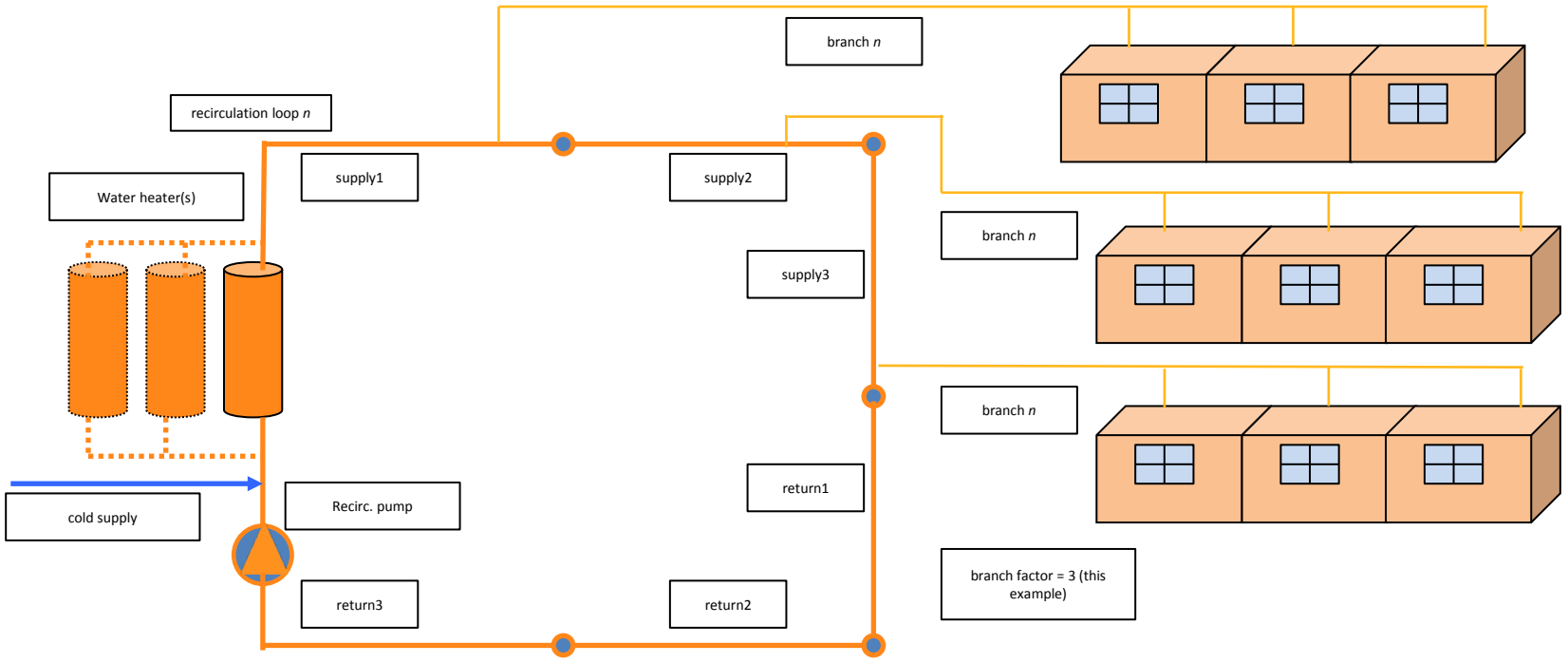


Major Components Developed for the Multifamily Tool

- New HES MF API web service to HES back end applications (layers) to handle multifamily energy calculations and interfaces to different clients
- New re-architected HES backend building class model using state-of-the-art PHP methods and MySQL database
- Domestic Hot Water models for both single unit and central system types
  - Individual unit systems: Based on the existing Home Energy Saver model
  - Central plant based systems with recirculation loops: A generic non-California specific version built from the multifamily DHW model documented in *Draft Measure Information Template – Water and Space Heating ACM Improvement,* 2013 California Codes And Standards Enhancement Initiative report, May 24, 2011 Public Workshop. ("2013 CASE Space and Water Heating 051911.pdf", PG&E, SCE, SDGE, Sempra. Download at www.energy.ca.gov)

Major Components Developed for the Multifamily Tool

Central plant DHW systems with recirculation loops



Future Directions

- Deploying at scale through web services so that third-party developers (public/private) can create user interfaces “powered” by HES
- Building engagement through Social Media communities
- Differentiating HESConsumer and HESPro offerings
  - HESConsumer Multifamily – Tenants
  - HESPro Multifamily – Owners/Property Managers
- Validating against actual home data
  - 1st round done with detailed data from Florida, Oregon and Wisconsin
- Mounting new technologies, modeling techniques, and interfaces

Features in the pipeline

- Improved/updated defaults
- Expanded list of retrofit measures
- Batch run and parametric analysis features
  - Using APIs
- New technologies and end-uses
- Multifamily modeling
- Utility bill calibration
- Behavioral variables

Team

Founder and Project Leader - Evan Mills

CORE TEAM

Chief Engineer - Rich Brown
Senior Engineer - Norm Bourassa
Senior Engineer - Leo Rainer
Usability - Kath Straub
Research and User Support - Greg Homan
User Interface Programming - Sondra Jarvis and Vinit Jain
Graphic design and art direction - Anthony Ma, Eyespeak, and Karen Lee
Project manager - Chris Havstad

CONTRIBUTORS

Modeling

Heating/cooling simulation - Jeff Warner
Miscellaneous equipment - Marla Sanchez
Water heating - Jim Lutz
Ducts - Iain Walker
Electricity tariffs - Chris Bolduc, Richard White, Katie Coughlin

Data

Weather data - Joe Huang, Steve Konopacki, Robin Mitchell
Zip-code-to-weather-tape correlation - Jesse Cohen
Market research - Mithra Moezzi, Celina Atkinson
Utility tariffs - Hongjie Qu
Carbon emissions factors - Jon Koomey
Appliances - Peter Biermayer, Judy Lai
Infiltration - Nance Matson
Product characteristics - Celina Atkinson

Outreach

Social Media - Diane Chojnowski
Education - Rolland Otto, Mai Sue Chang, Eli Marienthal

IT and Software Engineering

Web application programming - Bighead Technologies

Testing

Infosys
uTest.com

Extras

Home Energy Saver in a Nutshell

- Developed at LBNL. Sponsors: DOE, EPA, HUD/PATH, CEC, California Air Resources Board, Touchstone Energy Cooperatives, Infosys
- Web-based hourly simulation: DOE-2 (single-zone) and other models.
- Computes a home's energy consumption (all end uses), cost, and carbon footprint on-line in a matter of seconds for any location in the US. Benchmarks to typical homes, by geography.
- Hundreds of possible "asset" and "operational" inputs, with smart defaults available for each home description question.
- Generates a list of payback-ranked energy-saving recommendations.
- Provides extensive decision-support information to help users implement the recommendations. Linked social media environments.
- Transparently documented – no "black boxes"
- 600k plus web visits each year
- Third-party developers creating derivative tools via APIs for desktop & mobile applications