Implementing Energy Efficiency Projects and Developing Climate Change Action Plans

Implementing Energy Efficiency Projects

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ASSOCIATION OF BAY AREA GOVERNMENTS
energy watch

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Project Phases

- Energy Audit
- Project Selection and Financing
- Design
- Construction
- Operations and Maintenance
- Measurement and Verification

Energy Audit Basics

- What
- Why
- When
- Where
- How
- Who?

WHAT is an Energy Audit?

- Study of a facility that describes ways to reduce energy costs
  - Quantifies $ savings and costs
  - Preliminary or investment grade
  - Targeted or comprehensive
  - Helps prioritize investments

WHAT is in an Energy Audit?

Main Elements	Preliminary Audit	Investment Grade Audit
Description of Facility	Size, type of construction, use of facility, major types of equipment, operating hours	More detailed, may include data logging
Current Energy Costs	Monthly and annual use and costs, average energy costs	Adds: Breakdown by end-use, comparison to weather data
Proposed Measures	Brief descriptions, including low cost/no cost	More detailed scope, especially with lighting
Economic Analysis	Rough calculations of savings and cost, less accurate, simple payback	More detailed, accurate engineering analysis and cost estimates. May include lifecycle costing.

Most Common Measures

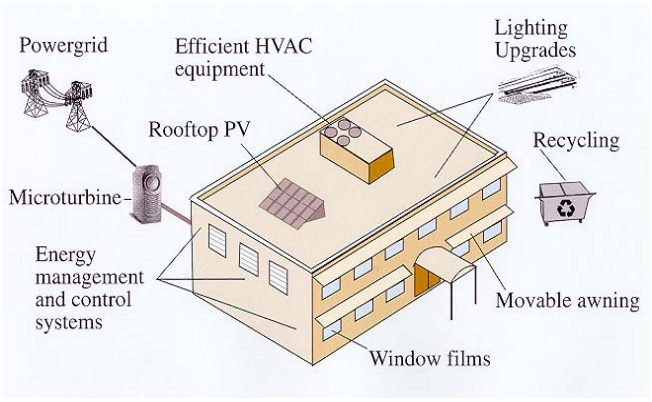
- Upgrade lighting
- Install occupancy sensors
- Add or upgrade HVAC controls
- Replace very old AC equipment
- Install variable frequency drives on pumps and fans

Audit Executive Summary

Recommended Energy Efficiency Measures

ECM #	ECM Description	Billing Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Propane Savings (Therms)	Avoided GHG (lbs)	Annual Cost Savings ($)	Installation Cost ($)	Simple Payback (years)	Measure Useful Life (yr)
Lighting System Projects									
L-1	Replace Incandescent Lamps w/ Compact Fluorescent	0.7	915	0	448	$141	$453	3.2	8
L-2	Retrofit T12 Lamps with T8s and Electronic Ballasts	12.5	19,829	0	9,716	$2,970	$26,364	8.9	16
L-3	Convert Exit Signs to LED	0.1	449	0	220	$57	$314	5.5	16
L-4	Install Occupancy Sensors Where Appropriate	0.0	11,168	0	5,472	$1,367	$6,267	4.6	8
HVAC Control Projects									
H-1	Improve HVAC controls	0	8,960	0	4,390	$1,308	$21,522	16.5	15
Other Projects									
DHW-1	Shut Down Propane Water Heater	0	0	530	6,360	$595	0	Immediate	n/a
	Total	13.2	41,321	530		$6,438	$54,920	8.5	

WHY do an Energy Audit?



WHEN to do an Energy Audit?

- After prioritizing facilities
- Before investing money in design or construction
- When developing a climate action strategy

WHEN a Preliminary Audit?

- Considering using an ESCO or direct install program (SBEA e.g.)
- Need more information to justify an investment grade audit
- Large capital investment not anticipated
- Have projects scoped and need only a rough estimate of savings and cost
- Want to focus on low cost/no cost measures
- When developing a climate action plan

WHEN an Investment Grade Audit?

- High energy-use facility
- Large capital investments anticipated
- Need accurate cost estimates
- Operational problems to solve
- Preliminary audit showed savings potential
- Multiple lighting fixture types and uses
- When required by funding source
- Not required for all types of financing

WHERE to do an Energy Audit?

- Most buildings have room for improvement
- Prioritize high-energy using facilities with known problems
- Facilities that will be around for awhile

HOW is an Audit Done?

- Collect information
  - Survey site
  - Ask questions
  - Identify problems
  - Get utility data
  - Review drawings

HOW is an Audit Done?

- Identify Potential Measures
  - Lighting
  - HVAC
  - Controls
  - Boilers
  - Motors
  - Pumps
  - On-Site Generation

HOW is an Audit Done

- Evaluate measures
  - Engineering calculations of savings
  - Cost estimates
  - Economic analysis

Table 1 Financial Analysis of Phase I Projects Laguna Honda

SUMMARY BY YEAR

Quarter	4	8	12	16	20	24	28	32	36	40	44	48
Year	1	2	3	4	5	6	7	8	9	10	11	12
	04/99	04/00	04/01	04/02	04/03	04/04	04/05	04/06	04/07	04/08	04/09	04/10
PROJECT SAVINGS												
Energy Savings (kWh)	0	0	391,983	1,567,931	1,567,931	1,567,931	1,567,931	1,567,931	1,567,931	1,567,931	1,567,931	1,567,931
Gas Savings (therms)	0	0	81,675	326,701	326,701	326,701	326,701	326,701	326,701	326,701	326,701	326,701
Gas Price Index	1.0410	1.0730	1.1050	1.1380	1.1720	1.2070	1.243	1.281	1.319	1.359	1.422	1.464
Electricity Cost ($/kWh)	0.05541	0.05694	0.05750	0.05776	0.05158	0.04834	0.04785	0.04992	0.05437	0.05536	0.05637	0.05740
Electricity Monetary Savings ($)	0	0	22,539	90,564	80,874	75,794	75,025	78,271	85,248	86,801	88,384	89,999
Gas Monetary Savings ($)	0	0	29,448	121,310	124,935	128,666	110,970	110,970	110,970	110,970	114,381	114,381
Other Savings ($)	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL PROJECT SAVINGS	0	0	51,987	211,874	205,809	204,460	185,996	189,241	196,219	197,771	202,766	204,381
PROJECT COSTS												
Audit	68,987	35,528	0	0	0	0	0	0	0	0	0	0
Design	0	133,231	0	0	0	0	0	0	0	0	0	0
CM	0	33,308	102,921	0	0	0	0	0	0	0	0	0
Construction	0	333,078	1,029,211	0	0	0	0	0	0	0	0	0
Subtotal	68,987	535,145	1,132,132	0	0	0	0	0	0	0	0	0
Contingency	2,070	16,054	33,964	0	0	0	0	0	0	0	0	0
O&M	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL PROJECT COSTS	71,057	551,200	1,166,096	0	0	0	0	0	0	0	0	0
PROGRAM MANAGEMENT COSTS												
Program Managemen Hours		335	338	0	0	0	0	0	0	0	0	0
NET SAVINGS	(71,057)	(551,200)	(1,114,109)	211,874	205,809	204,460	185,996	189,241	196,219	197,771	202,766	204,381
NET PRESENT VALUE												

- Prepare Report

WHO provides Energy Audits to Local Governments?

- California Energy Commission (up to 10K of cost)
- ABAG Energy Watch Partnership
- PG&E (free self-audits and preliminary audits for qualifying customers)
- Energy consulting/engineering firms (Fee for service)
- ESCOs (as part of performance contract)
- Specialized lighting contractors

HOW Much Does an Audit Cost?

- It depends on size, location, complexity
- Preliminary audits: ~ $0.03 to $0.06/sf
- Investment grade audits: ~ $0.15 to $0.25/sf
- “Free to you” through several programs

Project Phases

- Energy Audit
- Project Selection
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- Measurement and Verification

HOW do you Select Projects?

- Consider economic benefits
- Consider other attributes
  - Improved building comfort
  - Improved worker productivity
  - Improved lighting quality
  - Replace aging equipment
  - Ease of maintenance

How should you get started?

- Incremental Approach: One project at a time over several years

OR

- Comprehensive Whole-Building Approach: One package of measures all at once

Incremental Approach

Advantages

- Utilizes in-house staff more easily
- Requires less technical expertise
- Requires less set up time
- Allows for early success that can be used to promote further investment in energy efficiency
- Allows program benefits to be quickly distributed among a greater number of facilities
- Allows speedy implementation of simple measures

Incremental Approach

Disadvantages

- Cream-skimming makes longer payback projects more difficult to install later
- Reduces the total achieved savings
- Reduces ability to implement more sophisticated measures (such as energy management systems) that provide more savings/benefits to the facility
- Reduces “ultimate” pace of energy retrofitting (when considering total energy savings potential)

Comprehensive Whole-Building Approach

Advantages

- Achieves maximum potential
- Enables inclusion of more sophisticated measures with additional benefits
- Allows interactions between measures to be evaluated
- Economies of scale
- Faster pace of energy retrofits

Comprehensive Whole-Building Approach

Disadvantages

- Requires more lengthy approval process/set up time
- Requires higher level of energy engineering skills
- Involves more contracting for services and more administrative support

Pilot-Project Approach

- Start with smaller pilot projects to demonstrate success
- Build case for comprehensive project based on pilot projects

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"Net Positive" Cash Flow

Option A (Fast Track Financing)			
Savings	**Cost**	**Annual Cash Flow**	**Cumulative Cash Flow**
$20,000	($17,978)	$2,022	$2,022
$20,000	($17,978)	$2,022	$4,043
$20,000	($17,978)	$2,022	$6,065
$20,000	($17,978)	$2,022	$8,087
$20,000	($17,978)	$2,022	$10,108
$20,000	($17,978)	$2,022	$12,130
$20,000	($17,978)	$2,022	$14,152
$20,000	$0	$20,000	$34,152
$20,000	$0	$20,000	$54,152
$20,000	$0	$20,000	$74,152
$20,000	$0	$20,000	$94,152
$20,000	$0	$20,000	$114,152
Net Present Value of Option A			**$73,236**

Finance Options

- *Internal Capital or Operating Budget*
- *Loan programs* (California Energy Commission and ABAG)
- *Bonds* provide lowest interest rates and long-term repayment schedules, but require large projects to justify their high administrative costs
- *Municipal lease-based financings* can be simpler and less costly than bonds to implement and provide greater flexibility, but tend to carry a higher interest rate
- *Certificates of Participation (COPs)* are lease-purchase agreements that are divided and sold as securities to multiple investors: well suited for larger, longer term projects, have lower interest rates, but the transactions are complex and the costs of issuance are higher

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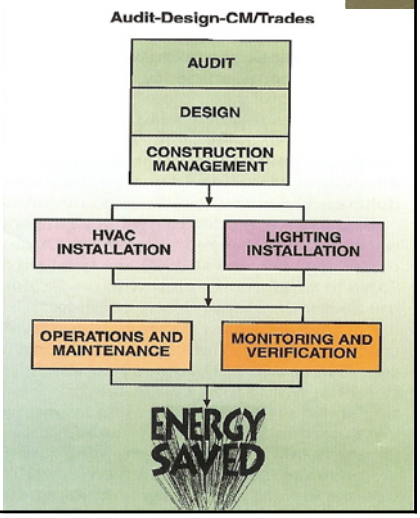
Project Contracting Options

- Options range from “unbundled” to “bundled”
  - Audit-Design-Construction Manager / Trades
  - Audit / Design-Build
  - Performance Contracting

Audit-Design-CM/Trades

How It Works

- One contract for audit, design, construction management; construction by separate trades
- Construction management activities include coordination and direct oversight of trade contractors
- In-house maintenance of installed energy efficiency measures, and monitoring and savings verification



Audit-Design-CM/Trades

Advantages

- More familiar contracting process than performance contracting
- Construction is competitively bid
- Municipality has greater control over all project stages
- Easier to use small and local contractors or in-house staff
- Lower overall project costs
- Better than design-build for complex HVAC systems

Audit-Design-CM/Trades

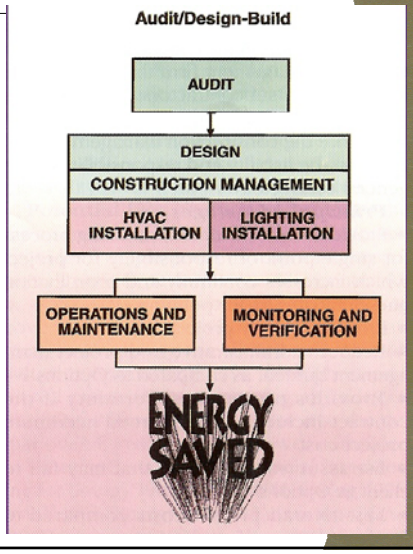
Disadvantages

- Maybe slower than more bundled approach
- Final costs known later due to bidding out construction
- Requires more in-house project management

Audit/Design-Build

How It Works

- One contract for audit, one contract for design and construction
- Design-build firm takes on the responsibilities of the construction manager and general contractor
- Design-build firm is responsible for hiring and coordinating the bids and work of the subcontractors



Audit/Design-Build

Advantages

- Single point of responsibility for design and construction
- Good for projects not requiring detailed design (lighting e.g.)
- Good for Implementing solar projects since design-build is the emerging industry standard and solar design expertise is found within installation contractors
- Reduced finger pointing and increased continuity
- Ability to “fast-track” design and construction phases
- Provides early cost commitments and more cost certainty

Audit/Design-Build

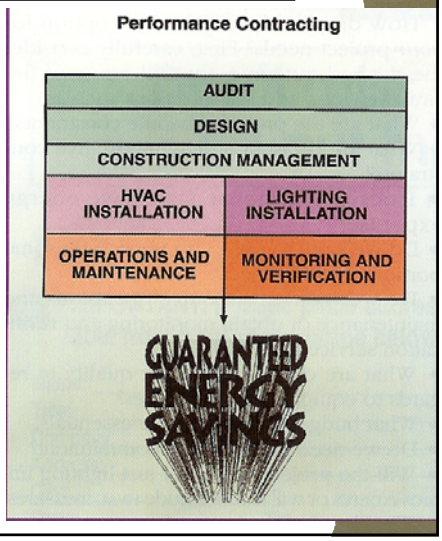
Disadvantages

- Won’t work well if scope isn’t clearly defined in audit and contract
- Energy-efficient aspects could be compromised in Contractor’s quest for cost-savings
- Less chance to use in-house staff and local small businesses and to select trades

Performance Contracting

How It Works

- One contract provides full turnkey services
- Municipality pays premium for performance warranty ("guaranteed savings")



Performance Contracting

Advantages

- Single point of responsibility for project
- Contractor provides project management
- One selection/contracting process reduces administrative burden
- Provides speedy project delivery because services are bundled
- Provides greater project cost certainty
- Improves persistence of savings
- Minimizes the municipality's risks
- No initial costs to municipality

Performance Contracting

Disadvantages

- Success depends on largely on performance of one firm and on an air tight contract
- Demonstration of project performance can be complex and costly
- Municipality has less control over design decisions
- Requires hiring third-party "owner's rep" to watch ESCO
- Potential for conflicts of interest
- Less opportunities to use small or local contractors
- May be more costly than traditional contracting
  - Construction not competitively bid
  - Warranty premium increases project costs by 5% to 10%
  - Mark-ups on the sub-consultants
  - Measurement and verification costs are high because of the need to demonstrate satisfaction of performance to protect warranty

Conclusions

- Use energy audits to identify projects– use results to help inform your climate action strategy
- Get started with smaller projects using internal resources
- No single best project delivery option – depends on your municipality's needs and circumstances
- If you are considering Performance Contracting, *Do Your Homework*
- Take advantage of the excellent resources available through ABAG, ABAG Energy Watch, CEC and Utilities