SUSTAINABLE ENERGY & ENVIRONMENTAL PLAN

GLOBAL RESOURCE EFFICIENCY SERVICES WWW.GRESWORLD.COM

Sustainable Energy & Environment Plan

The objectives of creating the Sustainable Energy & Environmental Plan are:

1. To establish a strategy framework for sustainable energy and environmental activities.
2. To define the projected energy and resource needs over a 25 year time horizon.
3. To evaluate utility plant options to meet future needs including renewable energy options.
4. To develop a Sustainable Energy Environment Master Plan which describes the strategies and the roles for staff.
5. To develop possible funding strategies for plan implementation.
6. To assist in the selection of an energy measure implementation partner and to define the partnering relationship, if applicable.

Approach

The scope of work describes the tasks required to accomplish the six objectives defined above. The approach is based on the creation of a baseline of existing energy/utility use in buildings. The second aspect of work will be to conduct a Building Life-Span Analysis of all buildings. The third aspect of the work will be an estimate of the possible energy/utility savings based on our collective knowledge of building systems and their condition. After estimation of savings, we will be able to project future energy use.

The next step will be a review of energy price curves for existing energy sources (grid electricity and natural gas) and renewable energy options. The energy price curves will be projected over the 25-year time horizon. The utility plant options can now be evaluated in both economic and environmental terms. After some discussion, an optimum utility plant strategy can be selected.

Finally, an energy partner can be selected to integrate implementation measures and possibly assist with funding mechanisms. Issues such as specifications for energy audits, building documentation standards, training needs and monitoring and validation strategy must be defined before the partner starts any work.

Study Overview

Building efficiency measures must become part of building asset plan where the life cycle of building systems and components is integrated with decisions about efficiency measures for a building retrofit.

The planning sequence for efficiency measures is illustrated in the diagram.

The Capex (Capital Expenditures) Strategy drives the Capex Plan where we look at remaining useful life of building systems and components. The Capex Plan provides a 25 year forecast of building expenditures based on the various building systems. An example is shown in the spreadsheet.

SAMPLE BUILDING 55087 sq ft DESCRIPTION	YEAR BUILT	REPLACEMENT COST	LIFE YEARS	FCI % ESTIMATE
A Foundations	1968-85	$813,715	100	0%
B Superstructure	1968-85	$1,653,019	100	0%
B Exterior Envelope	1968-85	$1,345,957	60	10%
B Roofing	1968-85	$501,535	40	30%
C Interior Construction	1968-85	$1,345,957	50	10%
C Stairs	1968-85	$87,001	70	10%
C Interior Finishes	1968-85	$726,714	30	20%
D Plumbing	1968-85	$358,240	50	10%
D HVAC	1968-85	$1,734,903	40	40%
D Fire Protection	1968-85	$158,649	30	25%
D Electrical	1968-85	$1,125,896	40	15%
E Equipment and Furnishings	1968-85	$501,535	40	20%
F Special Structures	1985	$0	50	10%
G Site services and grounds	1985	$839,304	50	10%
TOTALS		$11,192,426		

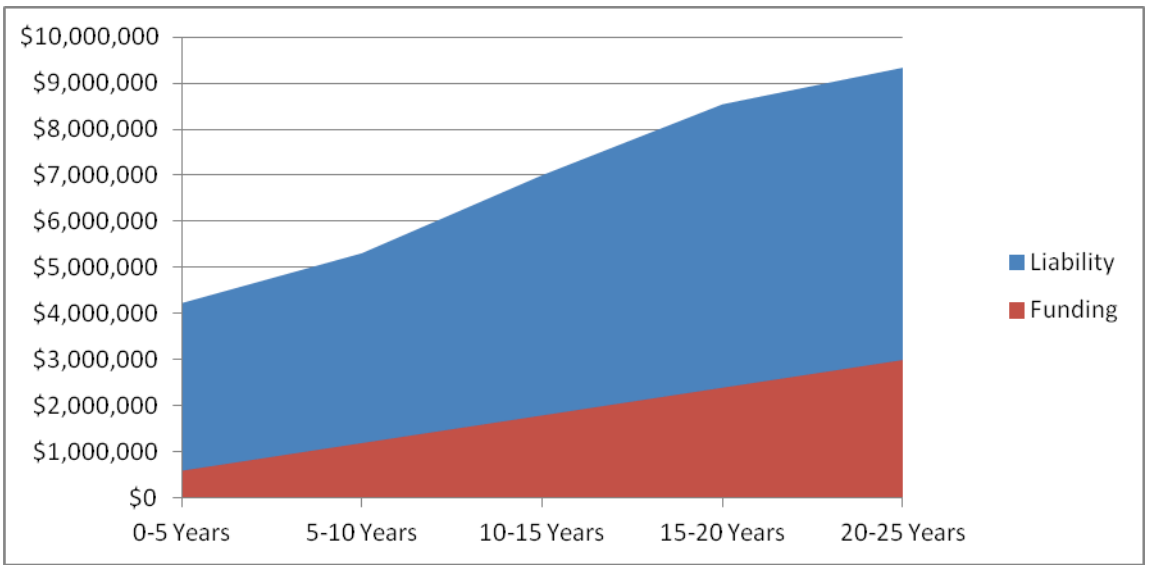
The energy audit and plan are based on the Capex Plan to ensure the right sequence of decision making and risk management. The Capex Plan and Energy Plan are just part of the building asset management framework.

Various building components will undergo replacement at different times during the life of a facility. If one assumes a building lasts 100 years, some components, such as a roof, will require numerous cyclical replacements. Each component has a unique life cycle that may be altered depending on the type and level of maintenance

adopted. The task of keeping any building in good condition is expensive and requires both capital and maintenance dollars.

An analysis will show that significant Facility Renewal funding contributions will be required over the next 25 years to maintain the facilities in their current form with unchanged functional use. A graphical projection of the cumulative renewal needs and the cumulative assumed current funding allocation of 0.5% replacement value as the red wedge shows the funding gap. The unfunded liability gap is shown as the blue wedge for WIC buildings.

Cumulative Need and Cumulative Funding at Historical Rates



Appendix A Achieving Best Practices

Best practice dictates that Capex plan will incorporate the following features:

- Complete inventory of all building assets
- Nomenclature for describing the assets
- Useful life of each building component
- Replacement cost of each building component

The Capex Plan can then forecast all capital expenditures for each building and establish funding priorities. The un-funded projects can also be tracked as a measure of building condition. The Facility Condition Index is defined as the un-funded capital project value divided by the entire building replacement cost and expressed as a percentage. The Capex Plan is important to energy projects, since many energy measures involve some form of building renewal. For example, the replacement of an old roof with a new energy efficient roof is really two things:

1. Purchase of a replacement roof (renewal capital)
2. Purchase of the additional insulation to achieve energy savings

Most comprehensive energy measures will involve some form of building renewal and component replacement. Strategically, we want to maximize the use of energy savings measures to fund building renewal in the Capex Plan. A strategy must be developed to integrate the capital plan and the energy retrofit plan. The Capex Plan and the Energy Audit/Plan need exactly the same site visits and review of building drawings. GRES uses the one set of Site visits to serve both purposes. The Energy Audit outline shows the sequence of tasks required to complete the process.

1. Review of Building Drawings and Documents
2. Site visit data collection
3. Energy Use Analysis
4. Mechanical/HVAC measures
5. Electrical/Lighting Measures
6. Selection of Measures based on the Capex Plan
7. Financial Projections and Funding of Measures

Appendix B - New Building Asset Management Framework

A typical building asset management framework is shown in the diagram below:

Asset Management Framework

	FACILITY PLAN	CAPITAL PLAN	OCCUPANTS	OPERATIONS	MAINTENANCE	ENERGY MANAGEMENT
Process	Need / Enrollment	Inventory	Inputs	Standards & Documentation	Inputs	Audit
	Functions / Technology	Assessment	Activities	Operate / Control	Repair / PM	Measure Implementation
	Space Forecast	Capital Forecast	Monitor & Outputs	Monitor & Outputs	Monitor & Outputs	Monitor & Outlets
IT need to manage asset	Building / Sape nomenclature	Building Asset register	Occupancy Plans and Scheduling	Building Documentation Building / Space nomenclature Equipement nomenclature	Asset Register Equipement Nomenclature	Building Documentation Equipement Nomenclature
Links	Links to Capital Plan new building Vs Retrofit existing occupant needs Energy plan	Links to Space forecast Energy Measures Maintenance	Links to Needs Enrollment Functions Technology	Link to Maintenance Energy Management	Link to Capital Plan Replacement	Link to Capital Plan Loads Systems Plant

Asset management involves facility planning, capital expenditure planning for building replacement and renewal, property management of occupant activities, operations of buildings, maintenance of grounds and buildings, and energy management.

Normally, energy management might be included with Operations. Energy Management has been highlighted due to the linkage with the Capex Plan.

Appendix C DRAFT PLAN OUTLINE

1 Objectives

1.1 Utility Supply Management

- Time of use electricity metering
- Demand response
- Gas purchase agreement
- Water Use

1.2 Energy & Environmental Management

- Energy retrofit program for ___% savings
- Smart metering
- Occupant participation
- O&M documentation and training

1.3 Renewable Energy

- Target of ___%

2 Asset Management Strategy

2.1 Alignment of Energy Efficiency measures with Capital forecast

- Asset Management Framework
- Loads-Systems-Plant sequencing
- Leverage energy savings for renewal capital

2.2 Economic criteria for retrofits and life cycle costing

- Life Cycle Costing (LCC)
- Discount rate for LCC
- Escalation rates for utility types
- Renewal and savings funding

3 Utility Supply Management

3.1 Electricity

- Smart metering
- Sub metering
- Building Automation metering interface

3.2 Natural Gas

- Group purchasing
- Portfolio approach

3.3 Water

- In Building
- Landscaping

4 Energy & Environment Management

4.1 Audits

- Energy Accounting for Audits
- Investment grade audits
- O&M documentation

4.2 Retrofits

- Retrofit projects
- Commissioning

4.3 Training and Technology Transfer

- Training needs
- Workshop process
- Training evaluation

4.4 Communication to Stakeholders

- Stakeholders
- Web site
- Web communication

4.5 Monitoring and Savings Verification

- Energy accounting software
- Weather correction
- Changes in use and baseline

4.6 Building Automation and Real Time Metering

- Smart metering
- Sub metering
- BAS for metering interface

4.7 O&M documentation

- CAD documentation
- Ops manual
- BAS documentation

4.8 Education

- All Occupants
- Energy Star

5 Renewable Technologies

5.1 Renewable Strategy

- Efficiency first
- Incentives
- Sponsorship

5.2 Combined Heat Cooling & Power (CHCP) Economics

- PV solar
- Wind
- Thermal solar
- Ground source heat pumps
- Cogen

5.3 Combined Heat Cooling & Power (CHCP) Projects

- PV Solar
- Wind
- Thermal Solar
- Ground source heat pump
- Cogen

6 New Buildings & Additions

6.1 Building Design Process

- Design Build
- Integrated Design Process
- Green Material policy
- Life Cycle costing guideline

6.2 Commissioning

- Process
- Commissioning agent
- Acceptance testing and documentation

7 Stakeholder communication

7.1 Cross functional issues

- Planning and operations
- Purchasing and use
- Transportation

7.2 Teaching and Learning

- Systemic thinking
- Buildings as a system

7.3 Web Site

- Communication needs
- Site design
- Site reporting

8 Implementation

8.1 Retrofit Project Implementation

8.2 Renewable Implementation

8.3 Education & Communication Implementation