

Green Growth

From LEED-ND to Smart Environments
for Resource Saving

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LEED: Leadership in Energy and Environmental Design






A standard for the design and assessment of green growth

The screenshot shows the LEED website interface. At the top left is the US Green Building Council (USGBC) logo. To its right is the word "LEED" in a large, bold font. A search bar is located in the top right corner. Below the logo and search bar is a navigation menu with links for "Why LEED", "Rating systems", "Certification", "Project Tools", and "Credentials". A "CREDIT LIBRARY" button is positioned to the right of the navigation menu. On the left side, there is a vertical sidebar with a list of categories: "Overview", "New Construction", "Existing Buildings", "Core & Shell", "Commercial Interiors", "Retail", "Homes", "Neighborhoods", "Schools", and "Healthcare". The main content area features a grid of ten colored boxes representing different LEED Rating Systems: "NEW CONSTRUCTION MAJOR RENOVATIONS" (green), "EXISTING BUILDINGS OPERATIONS & MAINTENANCE" (teal), "COMMERCIAL INTERIORS" (orange), "CORE AND SHELL DEVELOPMENT" (blue), "RETAIL" (yellow), "SCHOOLS" (light blue), "HOMES" (orange), "NEIGHBORHOOD DEVELOPMENT" (grey), and "HEALTHCARE" (dark blue). Below this grid, the heading "LEED Rating Systems" is followed by a paragraph: "Rating systems are groups of requirements that projects want to achieve LEED certification. Each group is tailored towards the unique needs of a project or building type."

- Started in 1998, LEED standards have been applied to more than 7000 projects in the United States and 30 countries worldwide.
- The pilot version, LEED NCv1.0, led to LEED NCv2.0, then LEED NCv2.2 in 2005, and v3 in 2009.

LEED 2009 has placed a relatively greater emphasis on "the reduction of **energy consumption** and **greenhouse gas** emissions associated with building systems, transportation, the embodied energy of water, materials and solid waste."

Main credit categories

-  **Sustainable sites credits** encourage strategies that minimize the impact on ecosystems and water resources.
-  **Water efficiency credits** promote smarter use of water, inside and out, to reduce potable water consumption.
-  **Energy & atmosphere credits** promote better building energy performance through innovative strategies.
-  **Materials & resources credits** encourage using sustainable building materials and reducing waste.
-  **Indoor environmental quality credits** promote better indoor air quality and access to daylight and views.

LEED-ND Neighborhood Development

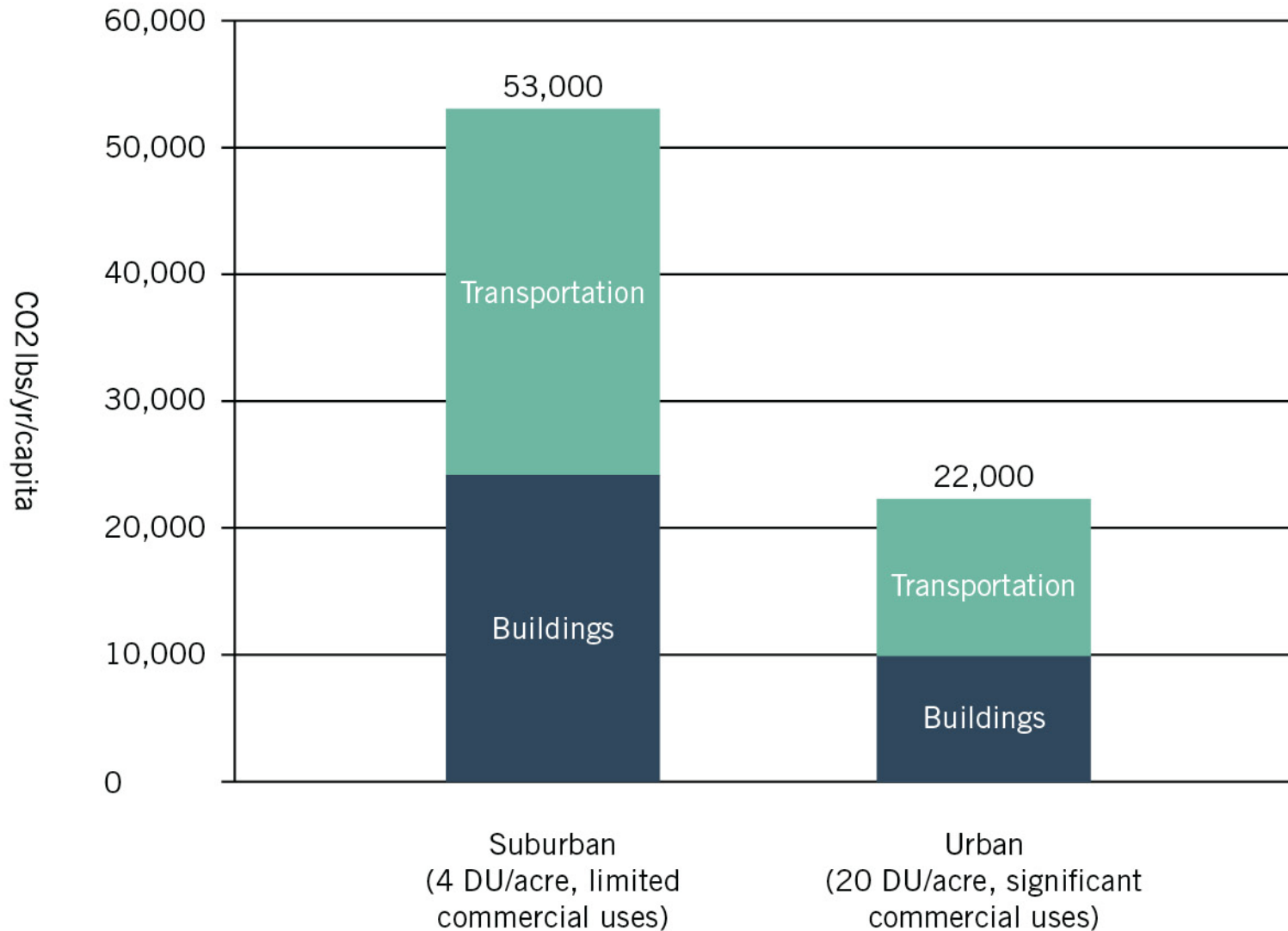
Sprawl as main cause of high energy use & CO2 emissions



Source: LEED for Neighborhood Development - 2009 Pilot Version

LEED ND for green growth planning

Residential CO2 emissions with respect to density

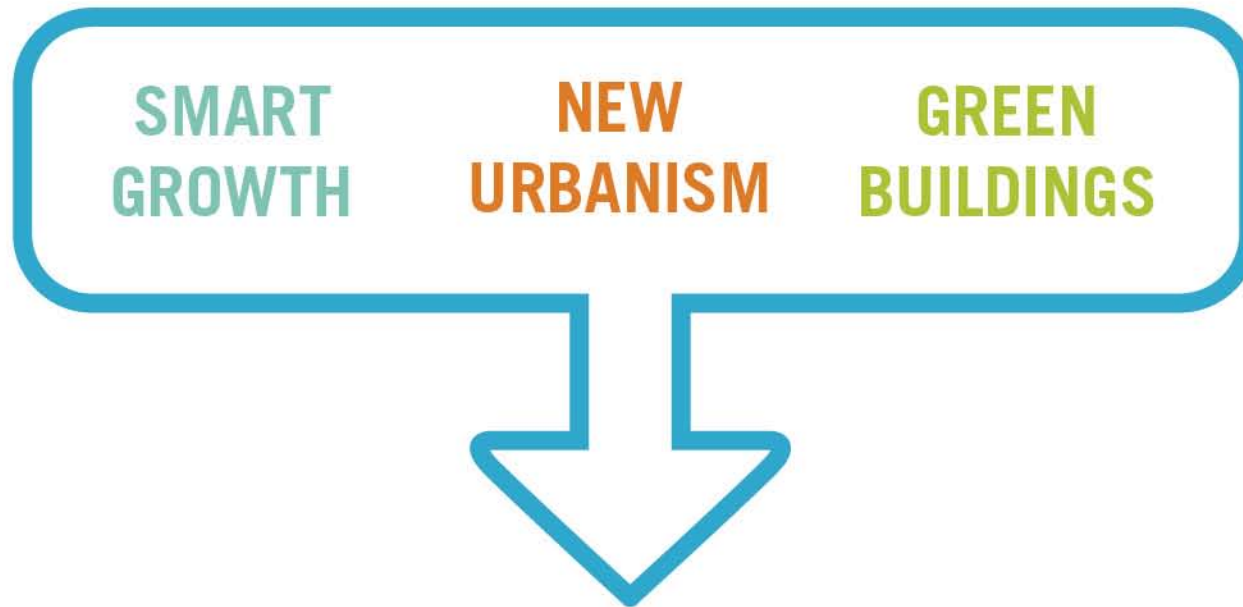


Slide information from Criterion Planners

Source: LEED for Neighborhood Development - 2009 Pilot Version

LEED ND planning

3 blocks of principles



IMPROVED QUALITY OF LIFE

Block 1: Smart growth

Smart Growth is well-planned development that protects natural ecosystems, imperiled species, and farmland, revitalizes communities, offers affordable housing, keeps jobs close to housing, and reduce automobile dependence.

Smart Growth is...

more transportation choices
and less traffic

vibrant cities, suburbs and towns

wider variety of housing choices

well-planned growth that improves
the quality of life

Smart Growth is NOT...

against cars and roads

anti-suburban

against growth

about telling people where or
how to live

Smart location credits

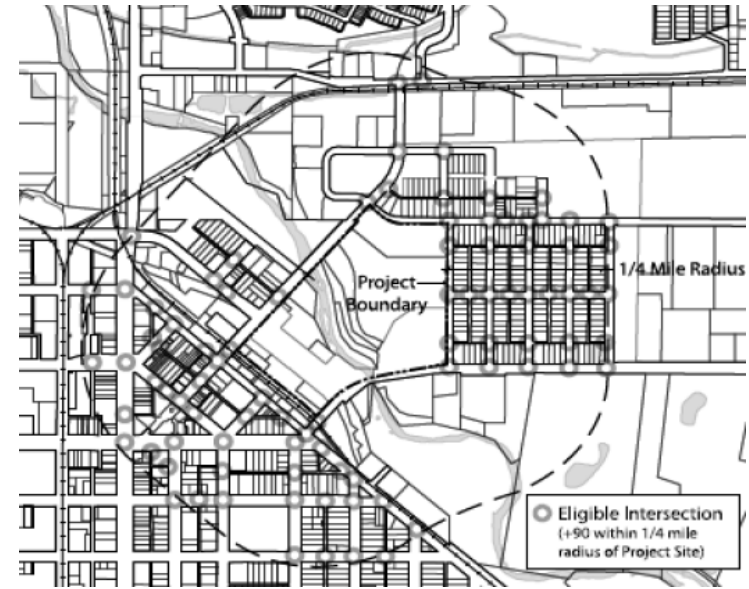
0 0 0			Smart Location and Linkage	27 Points Possible
Y			Prereq 1 Smart Location	Required
Y			Prereq 2 Imperiled Species and Ecological Communities	Required
Y			Prereq 3 Wetland and Water Body Conservation	Required
Y			Prereq 4 Agricultural Land Conservation	Required
Y			Prereq 5 Floodplain Avoidance	Required
			Credit 1 Preferred Locations	10
			Credit 2 Brownfield Redevelopment	2
			Credit 3 Locations with Reduced Automobile Dependence	7
			Credit 4 Bicycle Network and Storage	1
			Credit 5 Housing and Jobs Proximity	3
			Credit 6 Steep Slope Protection	1
			Credit 7 Site Design for Habitat or Wetland and Water Body Conservation	1
			Credit 8 Restoration of Habitat or Wetlands and Water Bodies	1
			Credit 9 Long-Term Conservation Management of Habitat or Wetlands and Water	1

Source: LEED for Neighborhood Development - 2009 Pilot Version

Block 2: New urbanism

Principles of the New Urbanism

- ➔ • Compact, walkable neighborhoods
- ➔ • Mixed-use urban form
- ➔ • Highly connected street networks
- ➔ • Sufficient density
 - Building design that emphasizes human-scale
 - Range of housing to serve diverse populations



Connected and open community

Compact development

Neighborhood pattern and design credits

0 0 0			Neighborhood Pattern and Design	44 Points Possible
Y			Prereq 1 Walkable Streets	Required
Y			Prereq 2 Compact Development	Required
Y			Prereq 3 Connected and Open Community	Required
			Credit 1 Walkable Streets	12
			Credit 2 Compact Development	6
			Credit 3 Mixed-Use Neighborhood Centers	4
			Credit 4 Mixed-Income Diverse Communities	7
			Credit 5 Reduced Parking Footprint	1
			Credit 6 Street Network	2
			Credit 7 Transit Facilities	1
			Credit 8 Transportation Demand Management	2
			Credit 9 Access to Civic and Public Spaces	1
			Credit 10 Access to Recreation Facilities	1
			Credit 11 Visitability and Universal Design	1
			Credit 12 Community Outreach and Involvement	2
			Credit 13 Local Food Production	1
			Credit 14 Tree-Lined and Shaded Streets	2
			Credit 15 Neighborhood Schools	1

Source: LEED for Neighborhood Development - 2009 Pilot Version

Block 3: Green infrastructure and buildings



GREEN BUILDINGS

“Green buildings” emphasize environmental excellence and sensitivity in their design, incorporating strategies like energy and water efficiency, high indoor air quality, and sustainably sourced (or recycled) materials. LEED-ND contains

prerequisites and credits for energy efficiency, water efficiency, and certified green buildings—underscoring their foundational role for a sustainable neighborhood.



In addition to water efficiency inside buildings, **water used outside buildings** for landscaping and street trees determines a neighborhood’s overall water use. Planting native species is preferable as they are less disruptive to natural ecosystems; in arid climates they tend to be drought-tolerant and require less irrigation. For plants that require irrigation, using efficient irrigation equipment, capturing rainwater, or recycling wastewater can reduce overall water consumption.

Green infrastructure and buildings credits

Green Infrastructure and Buildings, Continued

Yes	?	No		
			Credit 1 Certified Green Buildings	5
			Credit 2 Building Energy Efficiency	2
			Credit 3 Building Water Efficiency	1
			Credit 4 Water-Efficient Landscaping	1
			Credit 5 Existing Building Use	1
			Credit 6 Historic Resource Preservation and Adaptive Reuse	1
			Credit 7 Minimized Site Disturbance in Design and Construction	1
			Credit 8 Stormwater Management	4
			Credit 9 Heat Island Reduction	1
			Credit 10 Solar Orientation	1
			Credit 11 On-Site Renewable Energy Sources	3
			Credit 12 District Heating and Cooling	2
			Credit 13 Infrastructure Energy Efficiency	1
			Credit 14 Wastewater Management	2
			Credit 15 Recycled Content in Infrastructure	1
			Credit 16 Solid Waste Management Infrastructure	1
			Credit 17 Light Pollution Reduction	1

Source: LEED for Neighborhood Development - 2009 Pilot Version

LEED[®] for Neighborhood Development

Total Possible Points 110***

 **Smart Location & Linkage 27**

 **Neighborhood Pattern & Design 44**

 **Green Infrastructure & Buildings 29**

** Out of a possible 100 points + 10 bonus points*

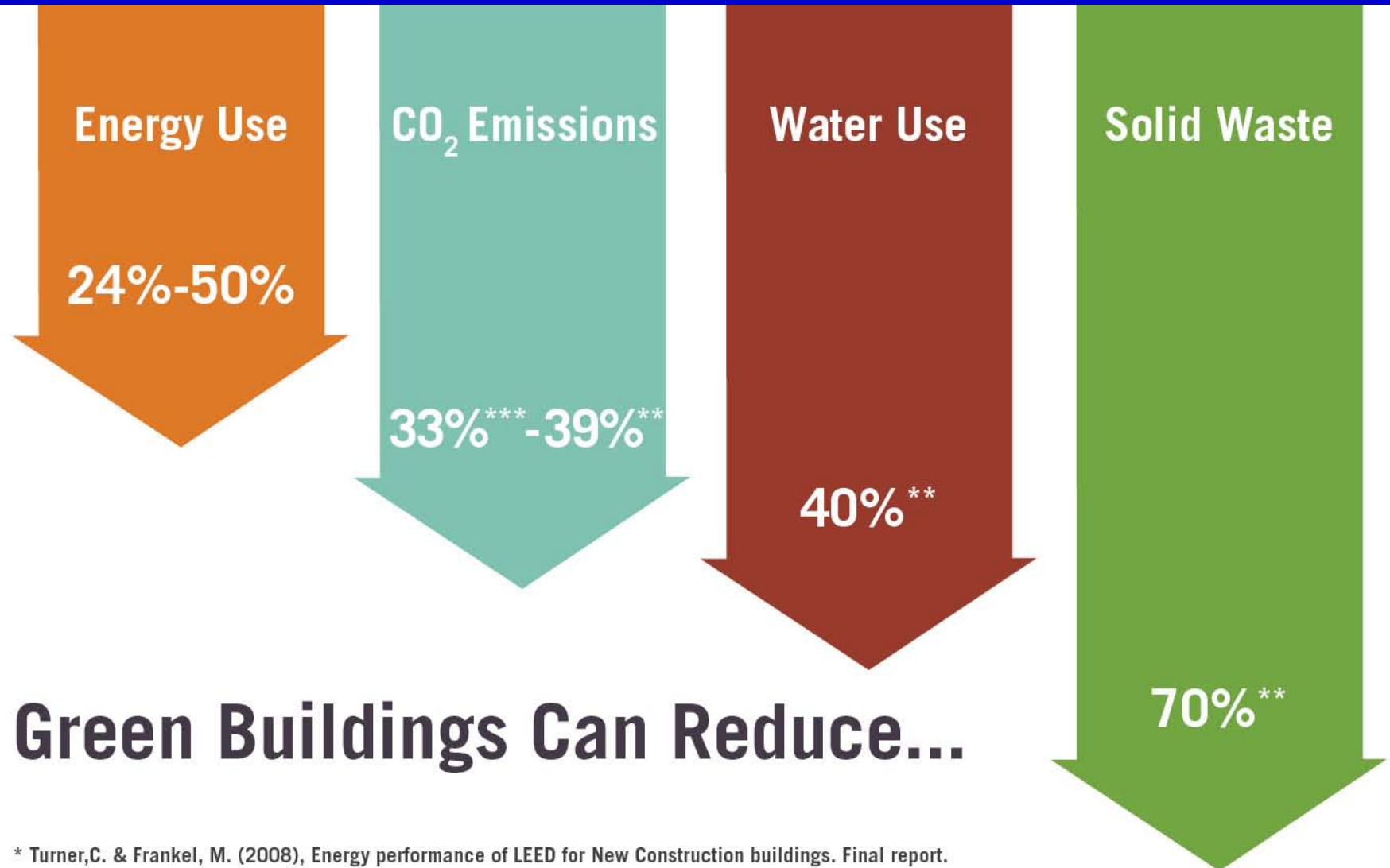
*** Certified 40+ points, Silver 50+ points,
Gold 60+ points, Platinum 80+ points*

 **Innovation & Design Process 6**

 **Regional Priority Credit 4**

LEED ND

Expected impact



Green Buildings Can Reduce...

* Turner, C. & Frankel, M. (2008). Energy performance of LEED for New Construction buildings. Final report.

** Kats, G. (2003). The Costs and Financial Benefits of Green Building. A Report to California's Sustainable Building Task Force.

*** GSA Public Buildings Service (2008). Assessing green building performance. A post occupancy evaluation of 12 GSA buildings.

2. Green growth: Bottom-up smart environments

Intelligent Environments for Green Growth

Open smart platforms + User-driven innovation

Will 'intelligent cities' put an end to suburban sprawl?

By Haya El Nasser, USA TODAY

Updated 1/28/2011 4:08:27 PM | 12 | 2 | [Share](#)

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When the economy was roaring and housing booming, reining in suburban sprawl dominated the development debate under the name of "smart growth."



By Ric Francis, AP

Suburban sprawl communities like the one here in

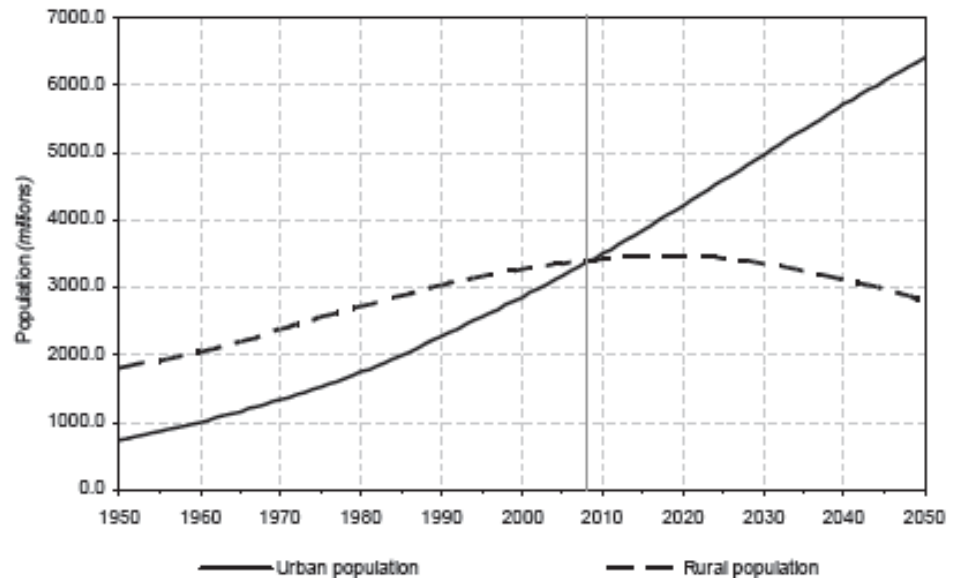
Now that the economy and housing are prompting more people to stay back seat. But smart growth still makes "intelligent cities."

"There's a 15- to 20-year cycle in terms," says Robert Lang, urban planning professor at the University of Nevada-Las Vegas. "Smart growth is not a new concept. Smart growth is not a new concept."

VALET BIKE PARKING: Easing the commute
COMMUTING: Cities tackle the problem of street cars
STREET CARS: Transforming the city

That's not to say the principle of smart growth is dead. On the contrary, he says, the widely accepted that they've embraced urbanism, the design movement of smart growth, encourages businesses in a pedestrian-friendly environment.

Figure 1.1. Urban and rural populations of the world, 1950-2050



	Population (billion)				
	1950	1975	2007	2025	2050
Urban population					
World.....	0.74	1.52	3.29	4.58	6.40
More developed regions.....	0.43	0.70	0.91	0.99	1.07
Less developed regions.....	0.31	0.82	2.38	3.59	5.33

Intelligent / Smart Environments

How it works

Smart environments

- “is a small world where all kinds of smart devices are continuously working to make inhabitants' lives more comfortable”,
- Environments “able to acquire and apply knowledge and also adapt to its inhabitants in order to improve their experience”.
- “Inhabitants may wish to ensure the safety, or reduce the costs of maintaining the environment, or automate tasks typically performed”.

(Cook, D.J. and Sajal. K.D. (2005) Smart Environments: technology, protocols and applications, Wiley)

Broad layers of SE

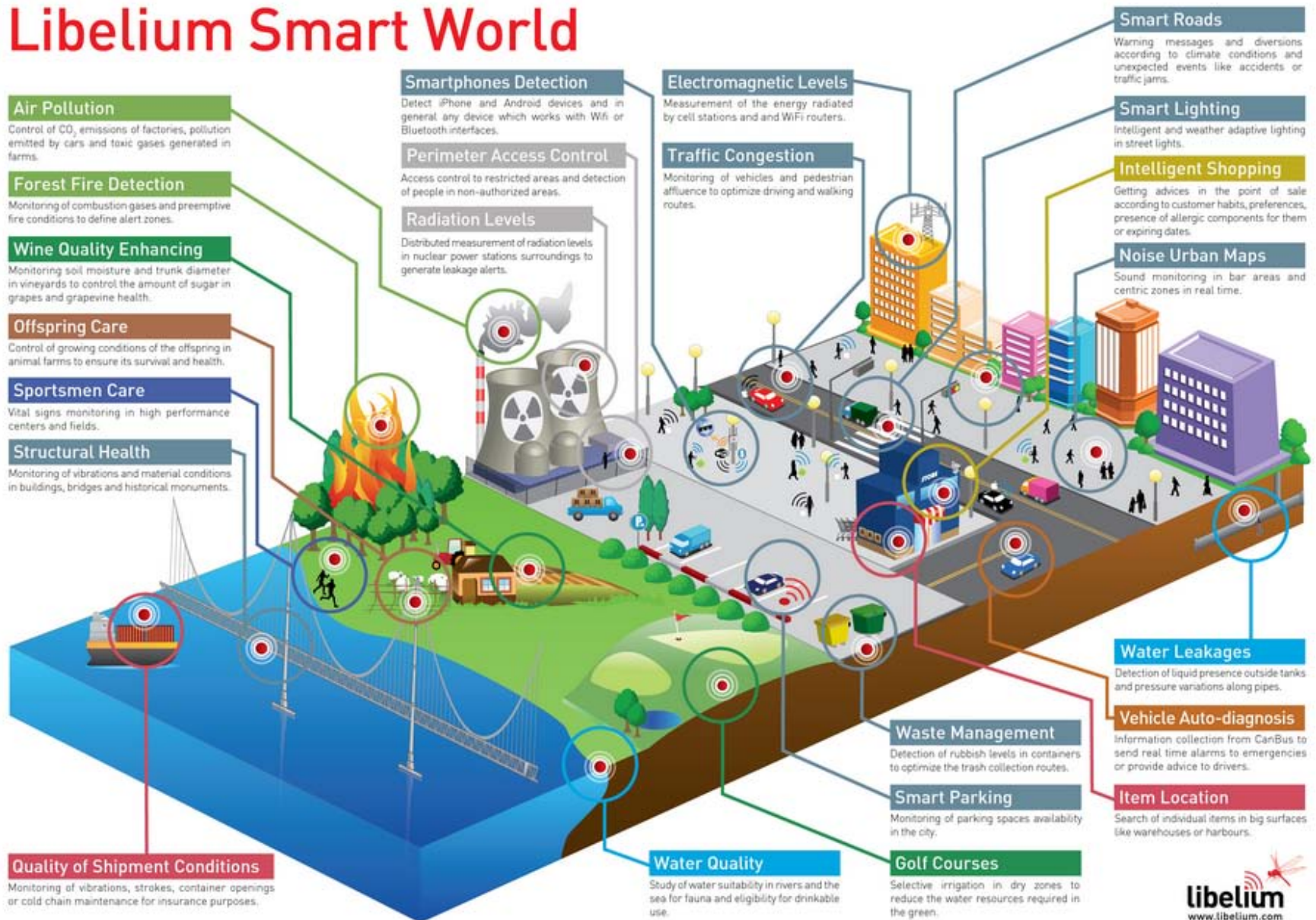
- Communication: Networks and Sensors
- Applications: Software, data bases, info processing, visualization, optimization
- User involvement / benefit: Content, decision making, crowdsourcing, societal applications, social innovation.



Intelligent / Smart Environments

Sensor networks – Open data – Web 2.0 data

Libelium Smart World



Intelligent / Smart Environments

Applications for optimization

Crowdsourcing



Improve My City

Citizens Requests, Complaints & Suggestions

Open source / Open data

Smart Amsterdam

43 projects for energy, environment, mobility

amsterdam city

Projects News Knowledge centre

Theme Area Project Partner

Show all Living Working Mobility Public Facilities Open Data

Google

Imagery ©2013 TerraMetric Terms of Use Report a map error

Amsterdam Smart City is...

5 Themes →

Amsterdam Smart City (ASC) is a unique partnership between businesses, authorities, research institutions and the people of Amsterdam. Together, our goal is to develop the Amsterdam Metropolitan Area into a smart city. We focus on the themes living, working, mobility, public facilities and open data.

3 Areas →

Amsterdam Smart City has established the Amsterdam Metropolitan Area as an urban living lab that allows businesses the potential to both test and demonstrate innovative products and services. Three areas in the Amsterdam Metropolitan region play a significant role.

43 Projects →

Partners of ASC initiate and deploy various of projects focussing on energy transition and open connectivity.



Smart Santander

A testbed for energy, mobility, environment



Figure 1: Outdoor parking and Environmental Monitoring deployed architecture

The Santander testbed is composed of around 3000 IEEE 802.15.4 devices, 200 GPRS modules and 2000 joint RFID tag/QR code labels deployed both at static locations (streetlights, facades, bus stops) as well as on-board of mobile vehicles (buses, taxis).

Open Call from the FP7 SmartSantander project for innovative applications and services, experimenting with the IoT in the context of the city

3. Hotel Energy Efficiency Solutions Platform



A web platform developed for UNWTO (World Tourism Organization) and UNEP (United Nations Environment Programme)

www.hotelenergysolutions.net



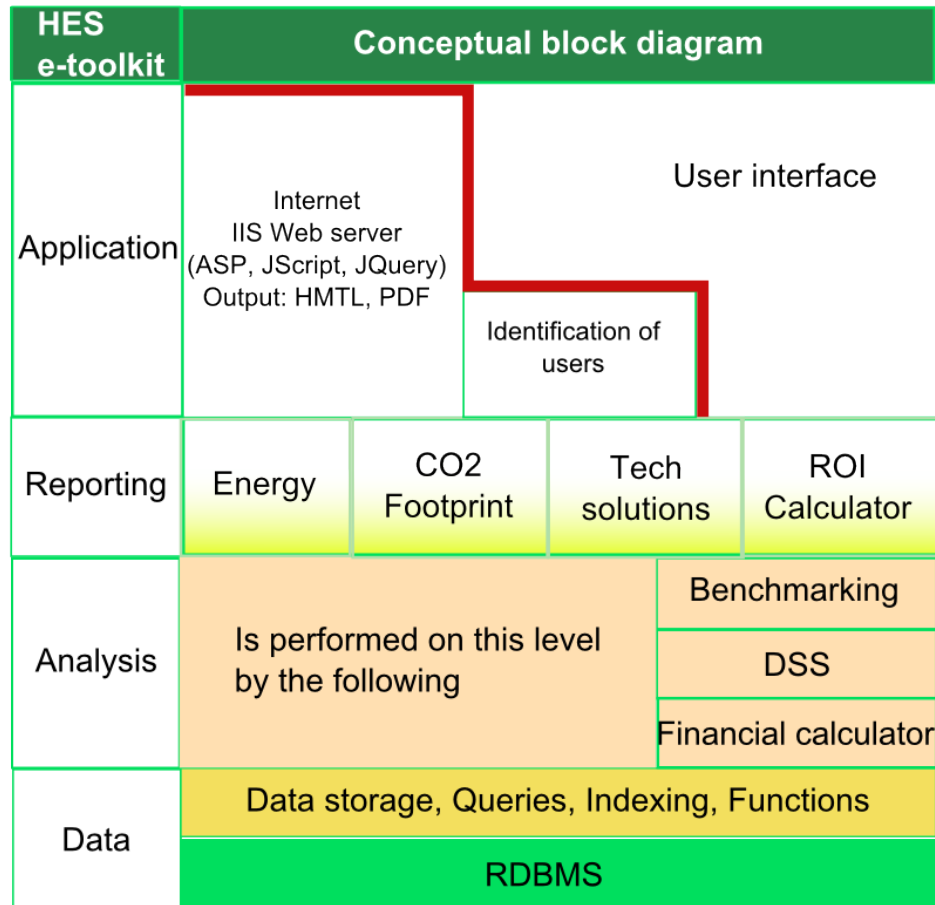
www.hes-unwto.org



HES e-toolkit



HES Platform





(1) Data - Questionnaire and / or smart meters

6 fields:

- ▶ General data
- ▶ Hotel type, occupancy and staff
- ▶ Hotel description
- ▶ Energy consumption (purchased and non-renewable sources)
- ▶ Renewable energy produced by the hotel
- ▶ Energy efficiency measures



Hotel energy calculator

+ Project

[My account](#)

[My projects](#)

User: **test_hotel**

[Log Out](#)

Questionnaire

Current project: **Pleasure**



Step 4: Energy consumption (purchased from renewable and non-renewable sources)



Show all the energy sources you use currently. ⌚ 10 min.

Energy related report

Energy solutions

Return on investment calculator

Carbon footprint

Market your activities

Step 4: Energy consumption (purchased from renewable and non-renewable sources) ?

Electricity ?

Type of use: ?

Heating Air conditioning & Ventilation Domestic hot water Lighting

Amount of total electricity consumed ?

125000

Unit

Kilowatt hour (kWh)

Coal ?

District Heating ?

(LPG) Liquefied petroleum gas ?

Type of use: ?

Heating Air conditioning & Ventilation Domestic hot water Lighting

Amount of liquefied petroleum gas ?

100000

Unit

Kilowatt hour (kWh)

Natural gas ?

Heavy oil (e.g., heavy fuel oil, residential fuel oil) ?

Data: User interface



Following data entry ->Reporting

Hotel energy calculator Project [My account](#) | [My projects](#) | User: **test_hotel** | [Log Out](#)

Current project: **carbon footprint test**

You have complete the questionnaire! The following reports are available:

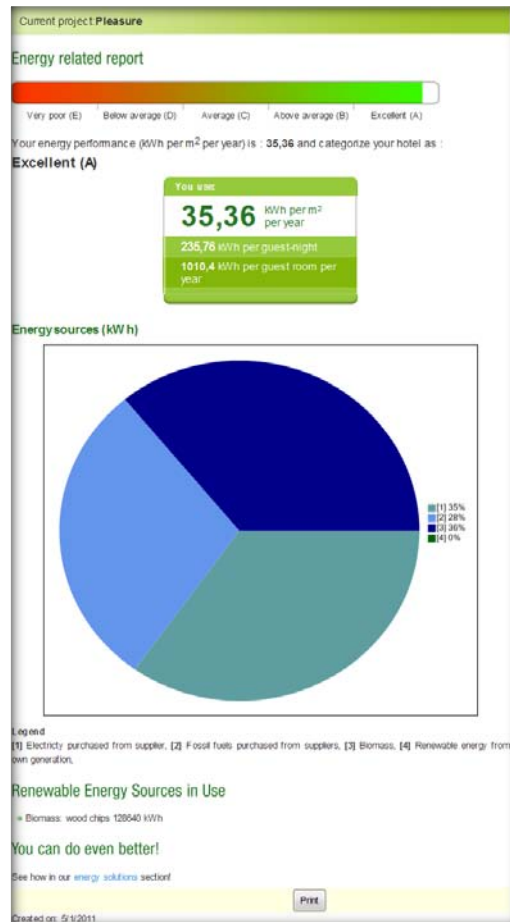
- Energy related report**
Assessing y our hotel's current energy use/efficiency and carbon footprint.
- Energy solutions**
Assessing y our hotel's current energy use/efficiency and carbon footprint.
- Carbon footprint**
Measuring y our hotel's impact on our climate by estimating the total set of greenhouse gases (GHG) emissions.
- Return on investment calculator**
Assessing which investment could achieved the best return on the investment and pay back period

Application message 09/04/2012:
In version 13.01 we have performed a major update to HES e-toolkit.
We have tried to assure that everything is working as smooth as possible.
In case that you identify anything that is not working as it should have been, please do not hesitate to [contact us](#) to resolve the issue.





(2) Energy report



Energy benchmark



Energy indicators



Percentages of energy sources to total energy use



Renewable energy sources in use

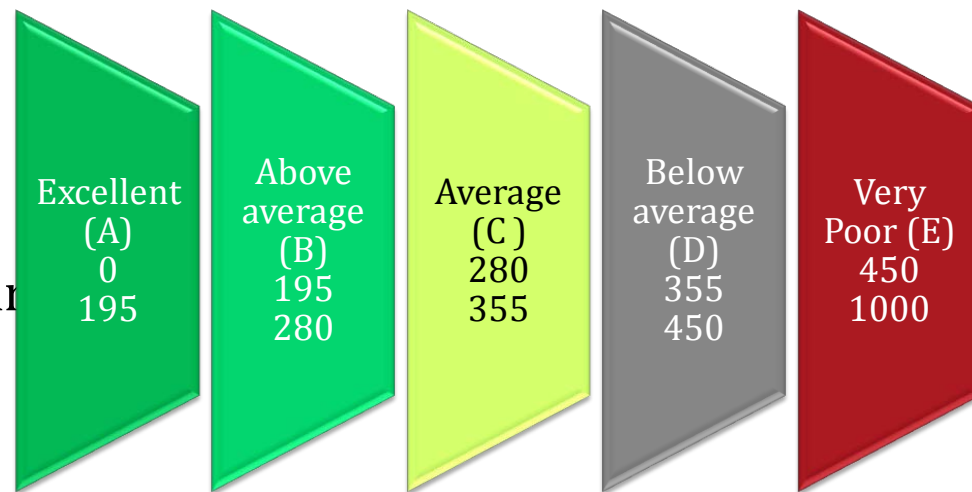


Link to energy solution report



Energy report: Indicators and Benchmarking

- ▶ kWh per m² per year
- ▶ kWh per guest-night
- ▶ kWh per guest room per year

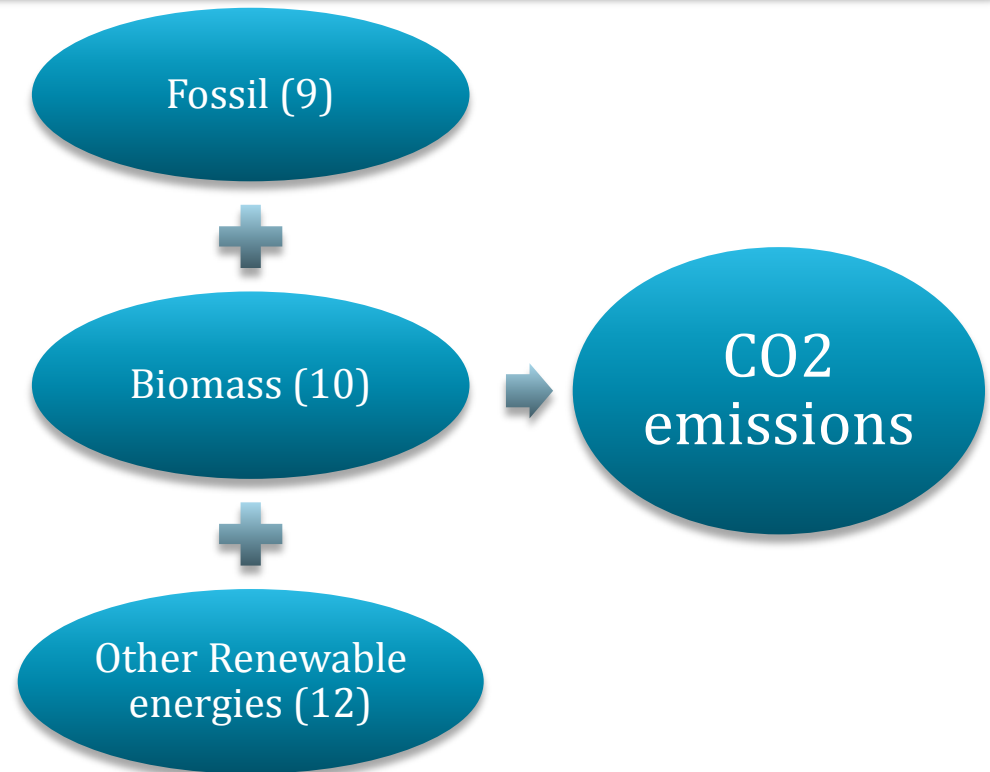
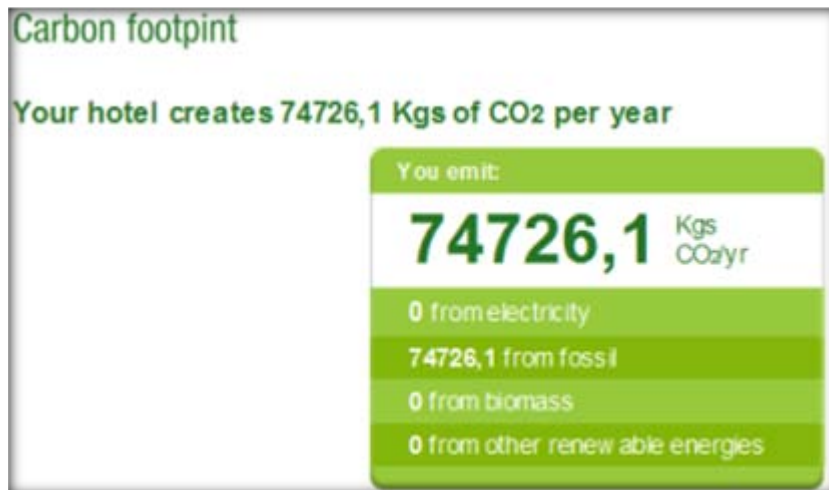


- ▶ Energy sources (kWh)
 - Electricity purchased from supplier
 - Fossil fuels purchased from suppliers
 - Biomass
 - Renewable energy from own generation



(3) Carbon footprint

21 different types of fuel emissions are taken into account








(4) Energy solutions - Decision support system

Energy Solutions

Recommendations based on the data entered in the questionnaire

According to your answers the following are the proposed solutions to be implemented at your hotel

	Reduce your energy consumption!		Use renewable energy!
	No / small investment	High investment	
Heating / Cooling	Prevention of air infiltration and of unnecessary outdoor air supply Read more ... 	Efficient solutions for active space cooling Read more ... 	Aerothermal heat pumps Read more ... 
General electricity	Energy saving light bulbs Read more ... 	Key card systems to switch off electricity in guestrooms Read more ... 	Solar Photovoltaic Read more ... 

How to go further

Obtain in-depth recommendations: ask for an [energy audit of your hotel](#)

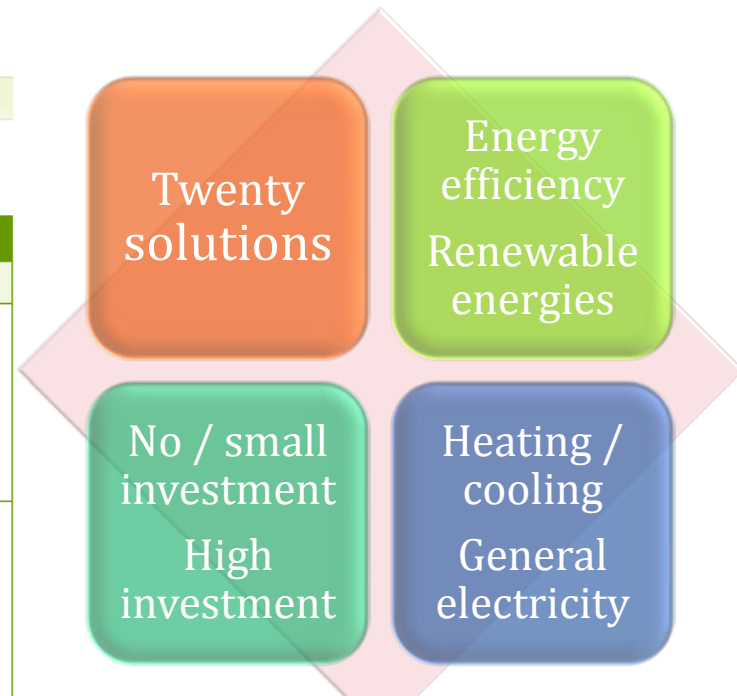
Involve your staff: see [how to train them on energy issues](#)

Information to guests: For your energy efficiency policy to be successful, it is essential to [involve your guests](#).

The [EU Eco-label for tourist accommodation](#) has been created to identify and highlight tourism companies that respect the environment. As an official certification from the European Union, it has gained European-wide recognition and can be effectively integrated into your marketing strategy.

Tell your guests about your concern for the environment: see how in our [dedicated section](#)

Created on: 20/4/2013 8:54





(4) Energy solutions - Decision support system

- ▶ Twenty (20) Energy Efficiency (EE) solutions are evaluated. Solutions a hotel has already installed or would be unsuitable for it, are excluded

- ▶ Lighting (Energy efficient lights, automated controls)
- ▶ Sun-shading devices
- ▶ HVAC (Energy efficient motors, insulation of water systems, automated heating and ventilation controls)
- ▶ Insulation (Walls, windows, roofs)
- ▶ Monitoring and auditing energy use
- ▶ Staff training

- ▶ Solar heating and cooling
- ▶ Solar Photovoltaic
- ▶ Heat pumps (ground source, air)
- ▶ Wind power
- ▶ Biomass
- ▶ Geothermal energy
- ▶ Small Hydropower



(5) ROI Calculator

Current project: **Pleasure**

Summary of investments and income

Energy efficiency

	Normal Energy tariff (EUR/KWh)	Total Investment (EUR)	Annual Maintenance and Operation cost (EUR)	Potential Annual Energy Savings (EUR)
Window insulation	0	0	0	0
Building insulation	0	0	0	0
Prevention of air infiltration and of unnecessary outdoor air supply	0	0	0	0

Summary of ROI Metrics

Total Equity (EUR)	3610
Total Debt (EUR)	3000
TOTAL INVESTMENT	6610

Total Investment	3610
IRR	-0,76
Net Present Value	-3610
Discounted Payback Period (years)	0

Cash flow from investment

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
(-) Equity Investment	-3610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal (1)	-3610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net income after taxes	-3610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Investment is beneficial when :
 IRR > discount rate
 NPV > 0

Created on: 17/5/2013 13:06

Cash flow from Operation





From top-down planning -> bottom-up platforms

For Hotels

- Simplify the adoption of green growth solutions
- Understand the current energy use and emissions
- Calculate margins of improvement
- Get ideas about solutions for improvement
- Calculate ROI and benefit of alternative solutions

For Regions

- Move from top-down planning (LEED-ND) to bottom-up **collaborative platforms** for energy and environmental improvement

