

# Green Growth

From LEED-ND to Smart Environments  
for Resource Saving

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S3 Platform: 11th Peer Review Workshop, Crete, September 26-27, 2013

## Contents

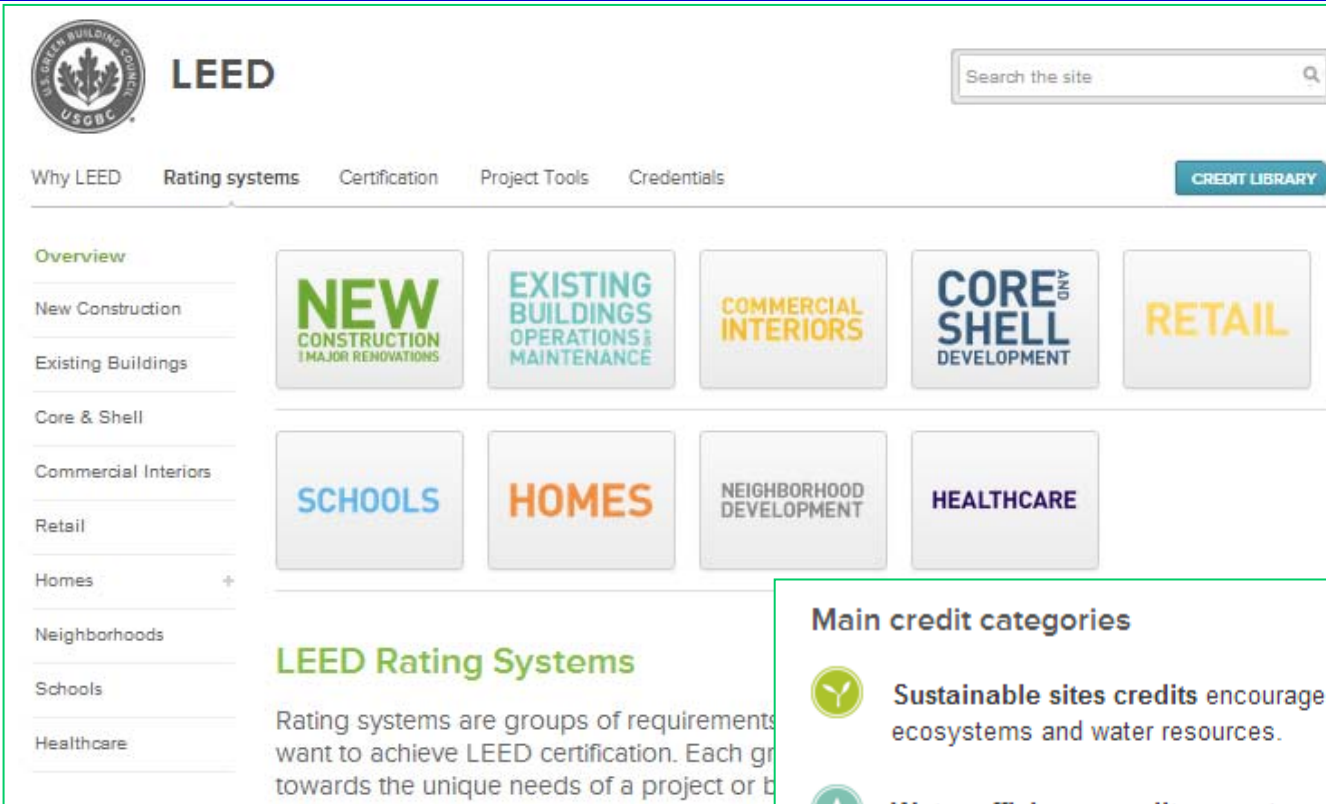
*1. Green growth: LEED-ND top-down planning*

*2. Green growth: Bottom-up smart environments*

*3. Hotel Energy Efficiency Solutions Platform*

# LEED: Leadership in Energy and Environmental Design

## A standard for the design and assessment of green growth








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

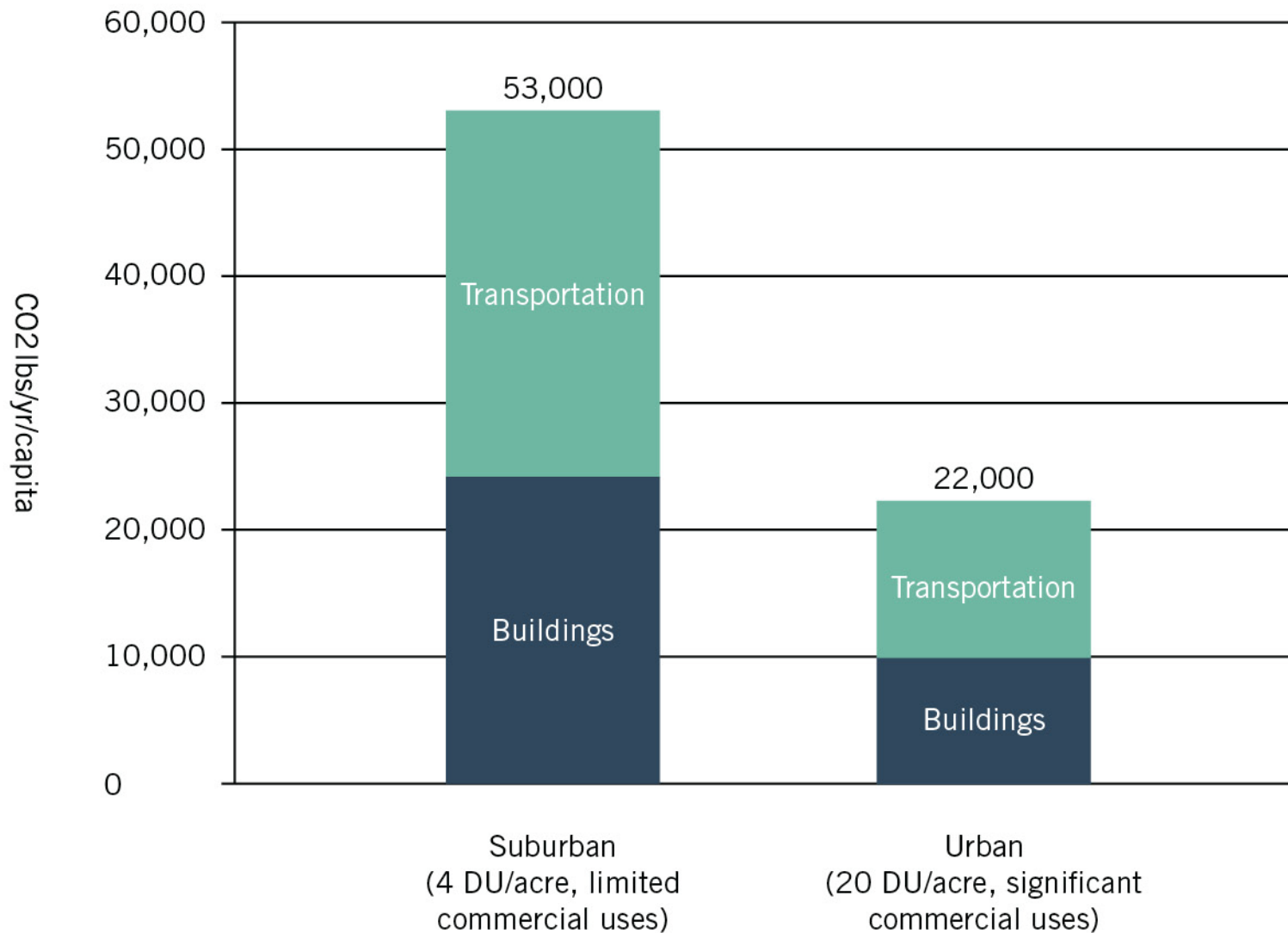


Source: LEED for Neighborhood Development - 2009 Pilot Version



# LEED ND for green growth planning

## Residential CO2 emissions with respect to density

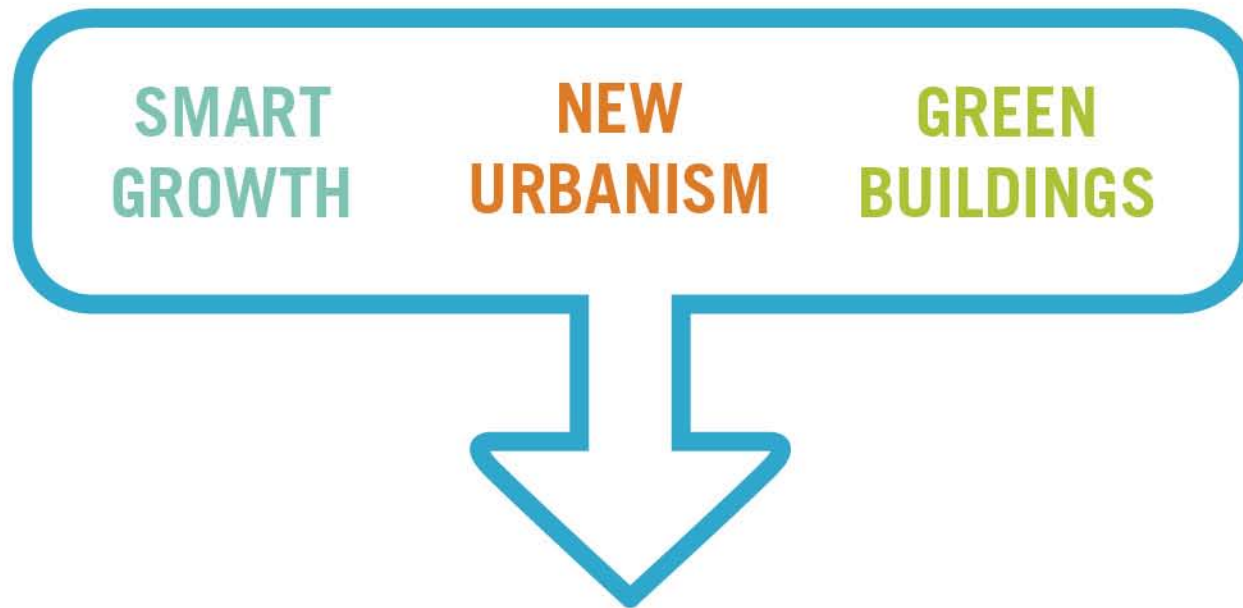


Slide information from Criterion Planners

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

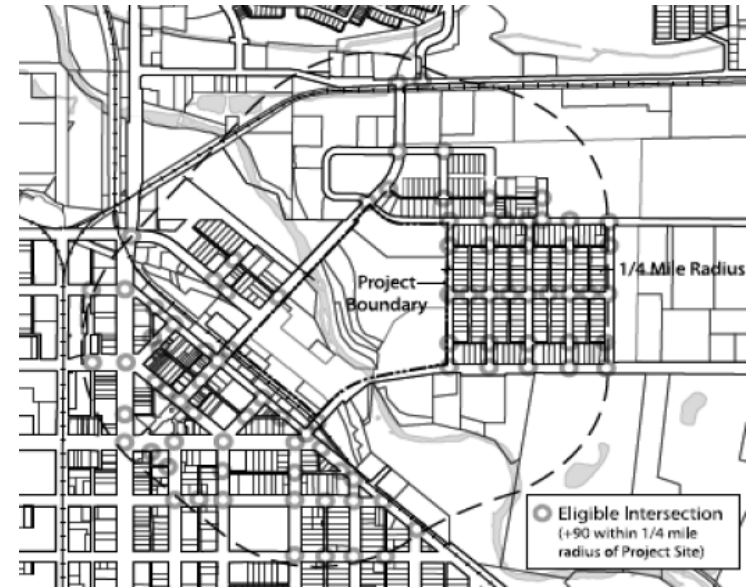
Source: LEED for Neighborhood Development - 2009 Pilot Version



# 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



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

## 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



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		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1 Certified Green Buildings	5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2 Building Energy Efficiency	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3 Building Water Efficiency	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4 Water-Efficient Landscaping	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5 Existing Building Use	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6 Historic Resource Preservation and Adaptive Reuse	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7 Minimized Site Disturbance in Design and Construction	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 8 Stormwater Management	4
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 9 Heat Island Reduction	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 10 Solar Orientation	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 11 On-Site Renewable Energy Sources	3
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 12 District Heating and Cooling	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 13 Infrastructure Energy Efficiency	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 14 Wastewater Management	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 15 Recycled Content in Infrastructure	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 16 Solid Waste Management Infrastructure	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 17 Light Pollution Reduction	1

Source: LEED for Neighborhood Development - 2009 Pilot Version

### LEED® for Neighborhood Development

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<b>Total Possible Points**</b>	<b>110*</b>
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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



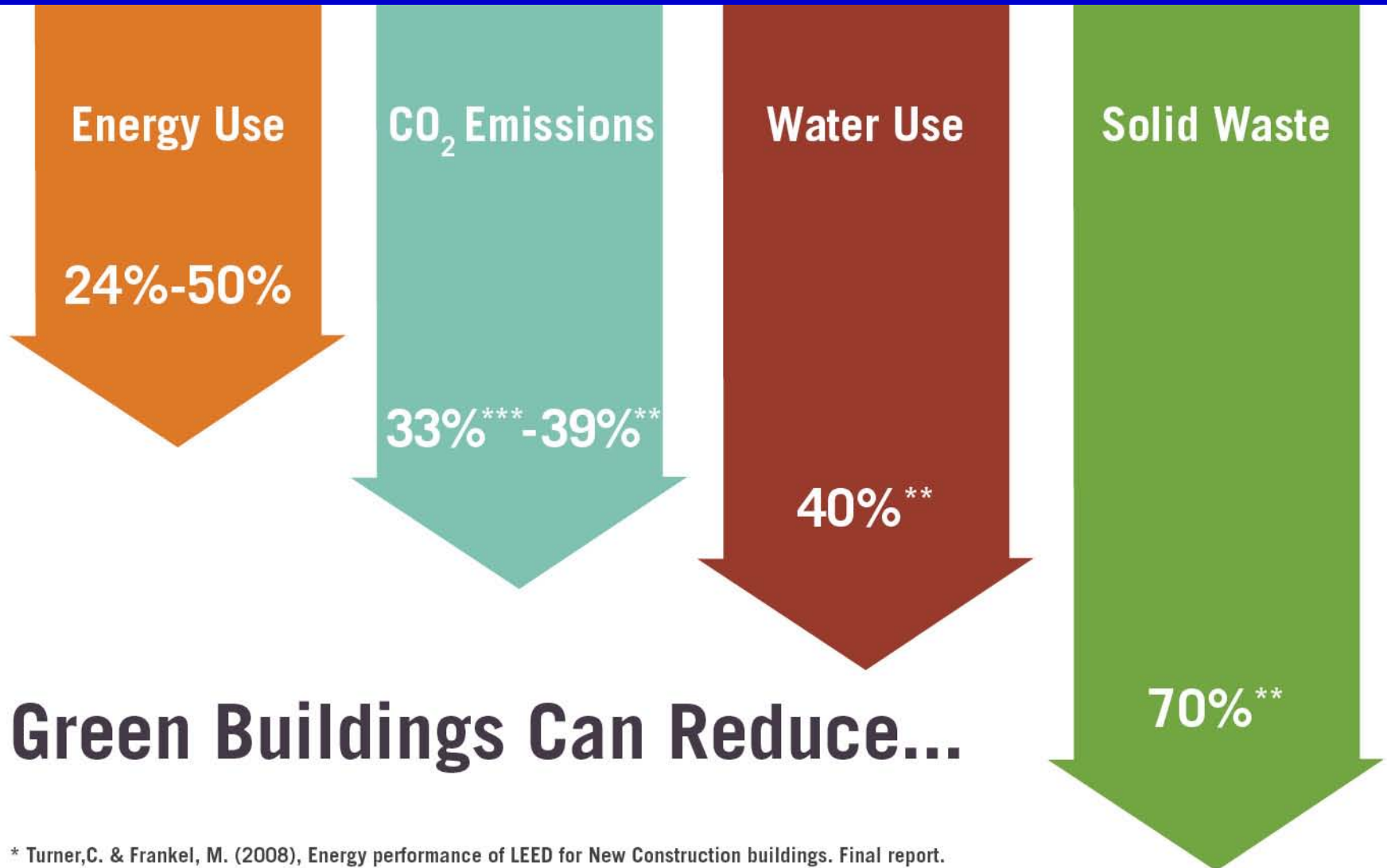
Regional Priority Credit

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.

Source: LEED for Neighborhood Development - 2009 Pilot Version

## *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

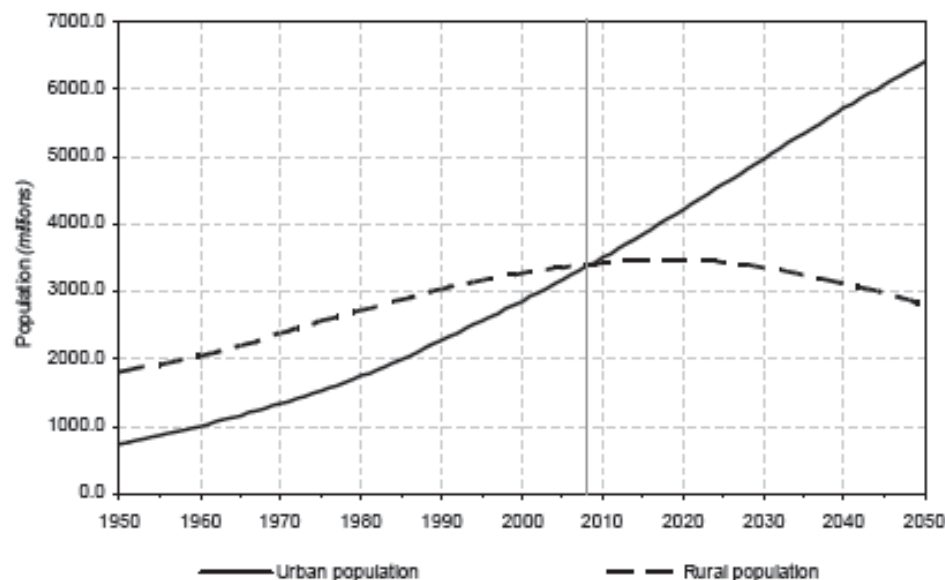
Now that the economy and housing are prompting more people to sit back on their heels, smart growth is making a comeback. But smart growth is still making a back seat. But smart growth is still making a back seat. But smart growth is still making a back seat.

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

**VALET BIKE PARKING:** Easy access to public transit.  
**COMMUTING:** Cities tackle the problem of getting people to work.  
**STREET CARS:** Transforming the way people get around.

That's not to say the principle of smart growth is new. On the contrary, he says, the widely accepted that they've been around for a long time. Urbanism, the design movement that encourages businesses in a pedestrian-friendly environment, is still making a back seat.

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.

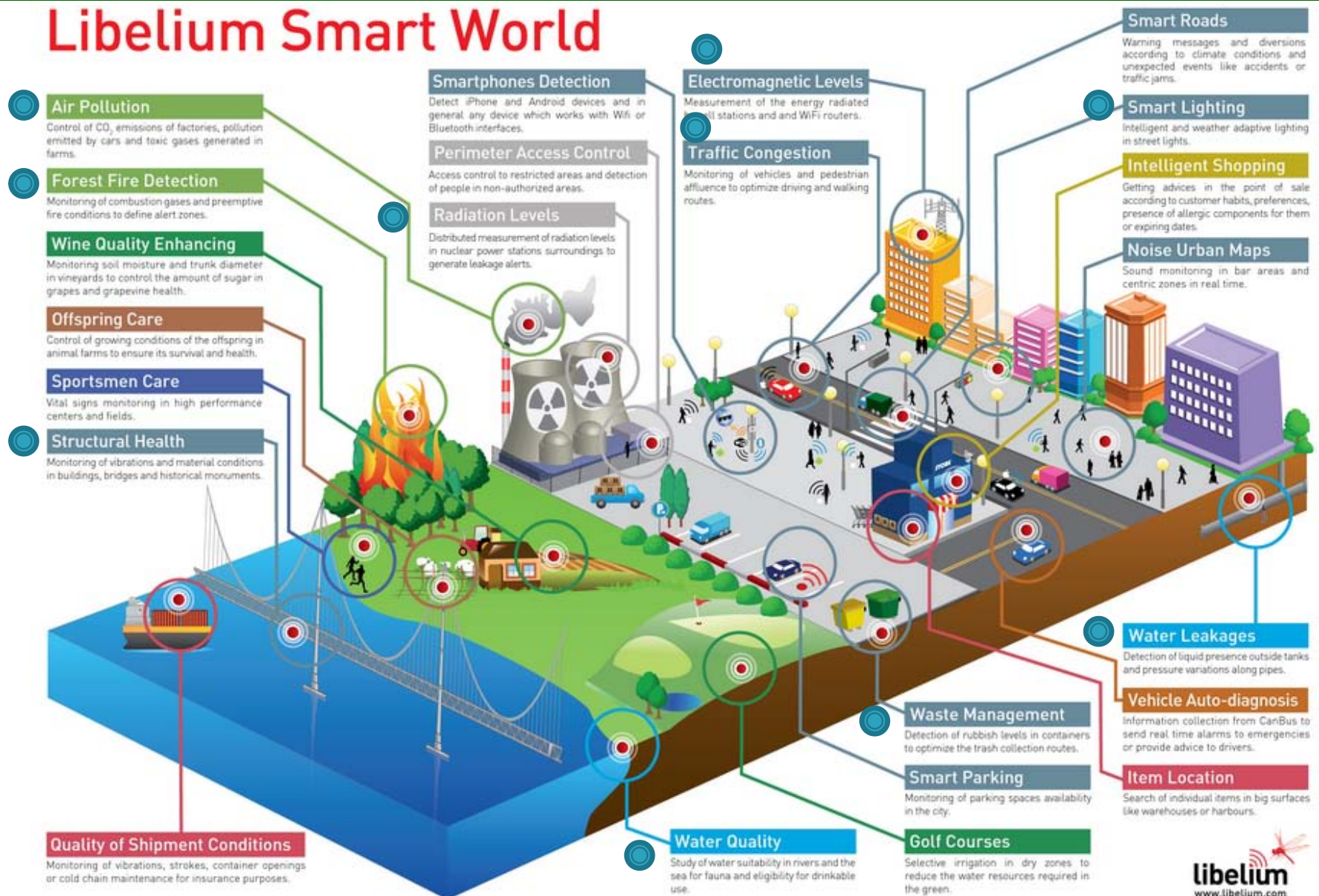




# Intelligent / Smart Environments

## Sensor networks – Open data – Web 2.0 data

### Libelium Smart World





# Intelligent / Smart Environments

## Applications for optimization

### Crowdsourcing

**CROWDSOURCING LANDSCAPE** Beta v1

**Improve My City**  
Citizens Requests, Complaints & Suggestions

Issue Category / Status Selection | Ordering | Display # | [+ Report an issue](#)

#25. One more trashcan is needed **Open**  
Germanou Karavangelis, Mitera 57001, Greece  
Issue reported 4 months ago and acknowledged 4 months ago

#23. Broken tiles **Acknowledged**  
Thessalonikis-Polygyrou, Thessaloniki 57001, Greece  
Issue reported 4 months ago and acknowledged 4 months ago

#21. On what a big pothole **Acknowledged**  
Makadonias 12-24, Thessaloniki 57001, Greece  
Issue reported 4 months ago and acknowledged 4 months ago

#13. Road full of potholes **Acknowledged**  
Chalkidiki, Thessaloniki 57001, Greece  
Issue reported 4 months ago and acknowledged 4 months ago

#12. Tree branches block the way **Closed**  
Panoramatos, Thessaloniki 57001, Greece  
Issue reported 4 months ago and closed 4 months ago

#7. Road under construction **Acknowledged**  
Megalou Alexandrou 34-44, Thessaloniki 57001, Greece

**Intelligent / Smart Cities Open Source Community**

Home Applications About Participate Feedback Blog

Search

ICOS / Applications / Infrastructure and Utilities

### Applications for Infrastructure and Utilities

**Water Storage**

See daily-updated information about Australia's water storages from your iPhone.

Development Agency: Australian Government - Bureau of Meteorology  
Civic Function: Infrastructure and Utilities  
Software Type: Open Data, Visualization of Information

[View Details](#)

**MAT Sim**

A toolkit for building multi-agent transport simulations.

Development Agency: TU Berlin, ETH Zurich, Senozon  
Civic Function: Infrastructure and Utilities  
Software Type: Simulation, Visualization of Information

[View Details](#)

**OpenTripPlanner**

Communicates transit schedule, travel, and map information in a single standards-based, affordable package that any agency can use.

Development Agency: OpenPlans  
Civic Function: Infrastructure and Utilities  
Software Type: Visualization of Information

[View Details](#)

**CITY FUNCTIONS**

View applications for:

- City Governance
- Generic Apps
- Infrastructure and Utilities
- Innovation Economy
- Quality of Life

**SOFTWARE TYPES**

View applications characterised as:

- Business – Collective Intelligence
- Collaborative Development
- Communication Tool
- Contact Relationship Management System
- Content Management System
- Crowdsourcing
- Data Mining
- Data Storage
- Geographic Information System
- Open Data
- Simulation
- Social Networking
- Statistical Analysis
- Visualization of Information
- Wiki

### Open source / Open data






# Smart Amsterdam


## 43 projects for energy, environment, mobility

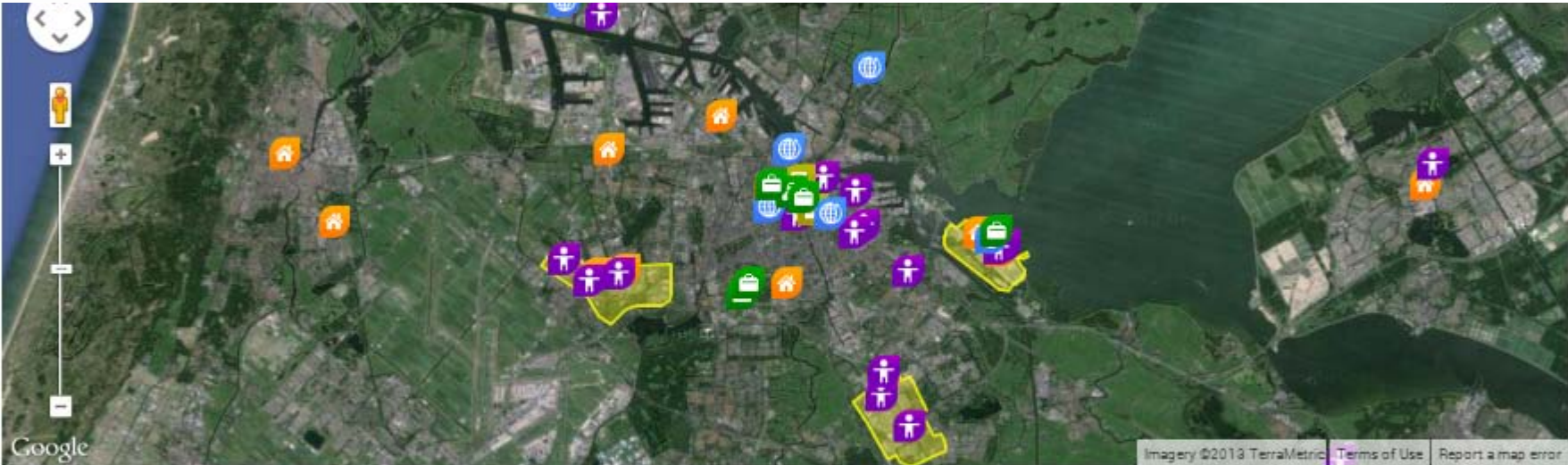
**amsterdam**  
**city**

Projects News Knowledge centre

Theme ▾ Area ▾ Project ▾ Partner ▾

☒ Show all  Living  Working  Mobility  Public Facilities  Open Data





Google Imagery ©2013 TerraMetrics 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*



HOTEL  
ENERGY  
SOLUTIONS

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

[www.hotelenergysolutions.net](http://www.hotelenergysolutions.net)



[www.hes-unwto.org](http://www.hes-unwto.org)

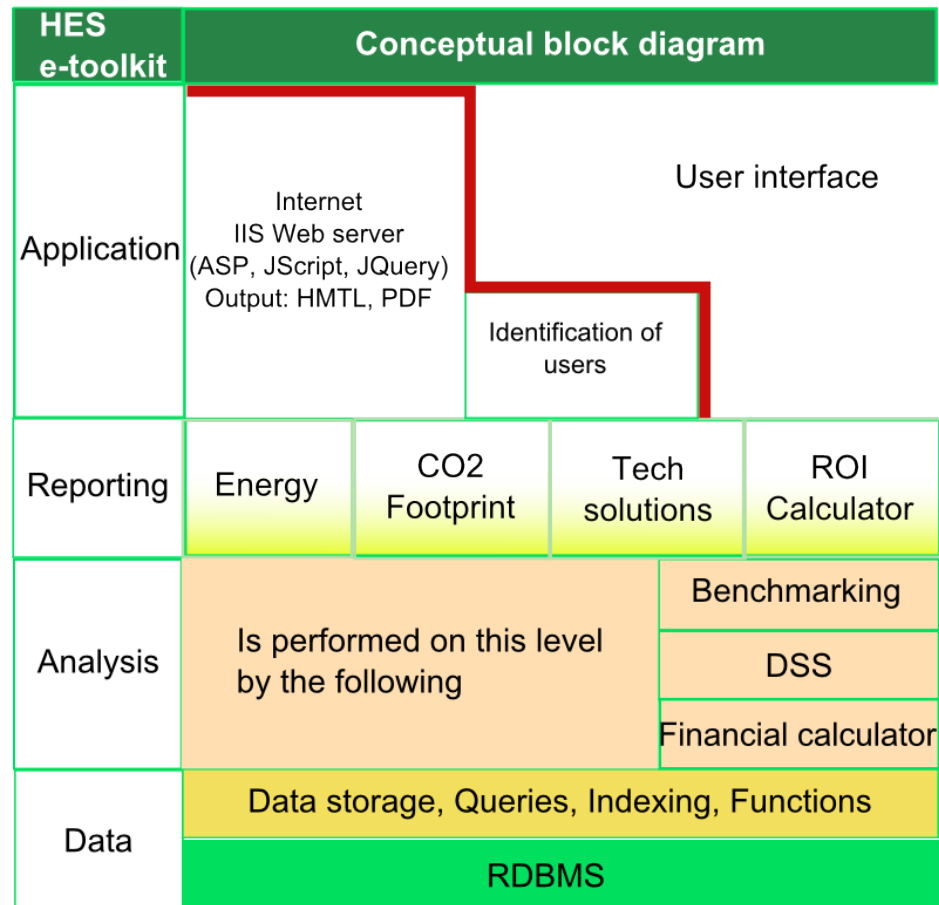
HES e-toolkit







# 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 - Home](#) [About](#) [Application components](#) [User guide](#) [English](#) [Go](#)

[+ Project](#) [My account](#) [My projects](#) User: **test\_hotel** [Log Out](#)

### Hotel energy calculator

[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 ?

Unit

☐ Coal ?

☐ District Heating ?

☒ (LPG) Liquefied petroleum gas ?

Type of use: ?

☒ Heating ☐ Air conditioning & Ventilation ☐ Domestic hot water ☐ Lighting

Amount of liquefied petroleum gas ?

Unit

☐ Natural gas ?

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





# 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:

 **Questionnaire**

 **Energy related report**

 **Energy solutions**

 **Return on investment calculator**

 **Carbon footprint**

 **Market your activities**

**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

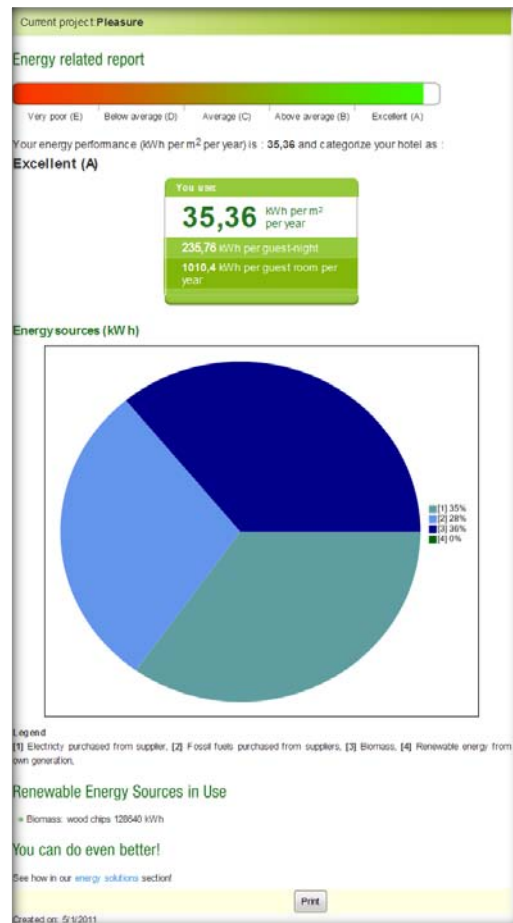


**Application message 09/04/2012:**  
In version 13.01 we have performed a major update to HES e-toolkit.  
We have tried to assure that everything is working as smooth as possible.  
In case that you identify anything that is not working as it should have been, please do not hesitate to [contact us](#)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





## (2) Energy report



Energy benchmark



Energy indicators



Percentages of energy sources to total energy use



Renewable energy sources in use

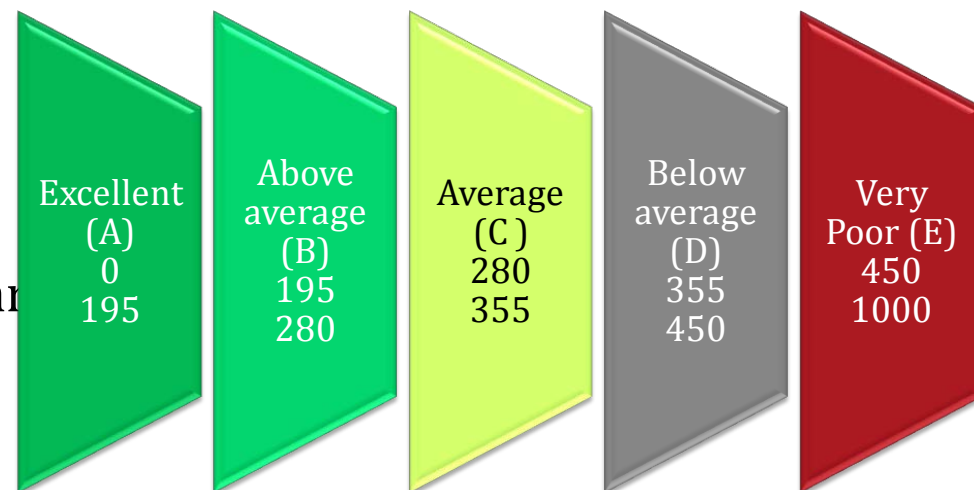


Link to energy solution report



## Energy report: Indicators and Benchmarking

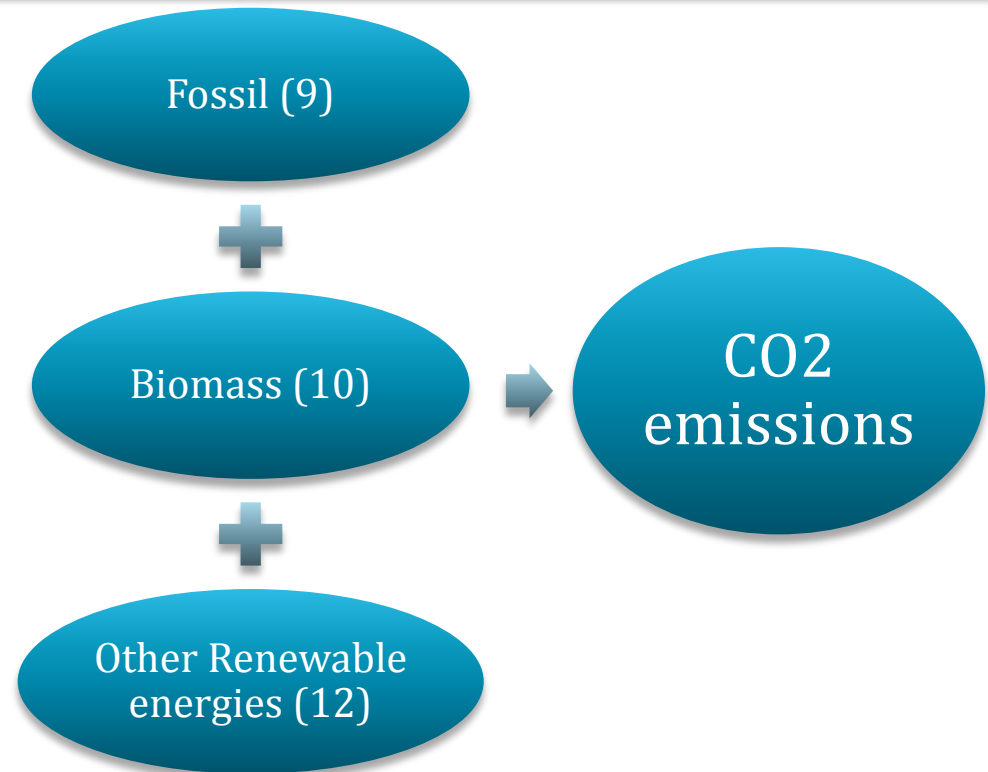
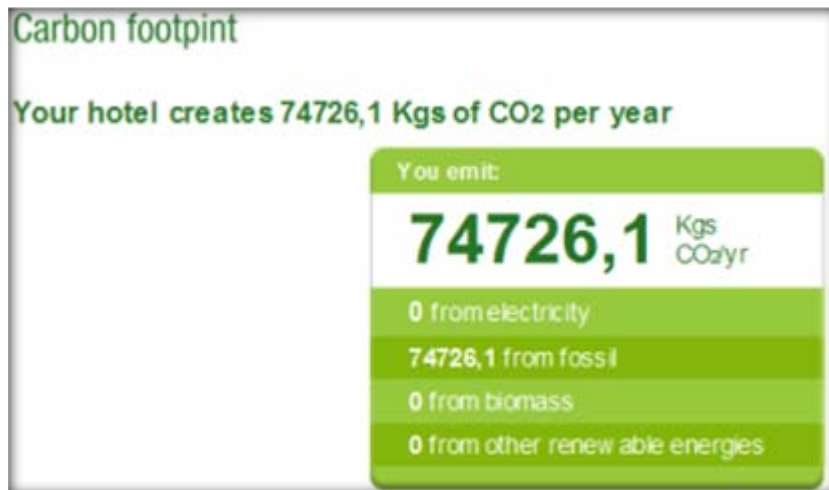
- ▶ kWh per m<sup>2</sup> per year
- ▶ kWh per guest-night
- ▶ kWh per guest room per year
- ▶ Energy sources (kWh)
  - Electricity purchased from supplier
  - Fossil fuels purchased from suppliers
  - Biomass
  - Renewable energy from own generation





## (3) Carbon footprint

31 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 <a href="#">Read more ...</a> 	Efficient solutions for active space cooling <a href="#">Read more ...</a> 	Aerothermal heat pumps <a href="#">Read more ...</a> 
General electricity	Energy saving light bulbs <a href="#">Read more ...</a> 	Key card systems to switch off electricity in guestrooms <a href="#">Read more ...</a> 	Solar Photovoltaic <a href="#">Read more ...</a> 

### 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

Twenty solutions

Energy efficiency  
Renewable energies

No / small investment  
High investment

Heating / cooling  
General electricity







## **(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
- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>▶ Lighting (Energy efficient lights, automated controls)</li><li>▶ Sun-shading devices</li><li>▶ HVAC (Energy efficient motors, insulation of water systems, automated heating and ventilation controls)</li><li>▶ Insulation (Walls, windows, roofs)</li><li>▶ Monitoring and auditing energy use</li><li>▶ Staff training</li></ul> | <ul style="list-style-type: none"><li>▶ Solar heating and cooling</li><li>▶ Solar Photovoltaic</li><li>▶ Heat pumps (ground source, air)</li><li>▶ Wind power</li><li>▶ Biomass</li><li>▶ Geothermal energy</li><li>▶ Small Hydropower</li></ul> |
|---|--|



## (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
<b>TOTAL INVESTMENT</b>	<b>6610</b>

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 &gt; discount rate

NPV &gt; 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

