Green Growth
From LEED-ND to Smart Environments for Resource Saving

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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."
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

Source: LEED for Neighborhood Development - 2009 Pilot Version
LEED ND planning
3 blocks of principles

IMPROVED QUALITY OF LIFE

Source: LEED for Neighborhood Development - 2009 Pilot Version
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.

<table>
<thead>
<tr>
<th>Smart Growth is...</th>
<th>Smart Growth is NOT...</th>
</tr>
</thead>
<tbody>
<tr>
<td>more transportation choices and less traffic</td>
<td>against cars and roads</td>
</tr>
<tr>
<td>vibrant cities, suburbs and towns</td>
<td>anti-suburban</td>
</tr>
<tr>
<td>wider variety of housing choices</td>
<td>against growth</td>
</tr>
<tr>
<td>well-planned growth that improves the quality of life</td>
<td>about telling people where or how to live</td>
</tr>
</tbody>
</table>

Source: LEED for Neighborhood Development - 2009 Pilot Version
## Smart location credits

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preferred Locations</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Brownfield Redevelopment</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Locations with Reduced Automobile Dependence</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Bicycle Network and Storage</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Housing and Jobs Proximity</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Steep Slope Protection</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Site Design for Habitat or Wetland and Water Body Conservation</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Restoration of Habitat or Wetlands and Water Bodies</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Long-Term Conservation Management of Habitat or Wetlands and Water Bodies</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Walkable Streets</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Compact Development</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Connected and Open Community</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Mixed-Use Neighborhood Centers</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Mixed-Income Diverse Communities</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Reduced Parking Footprint</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Street Network</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Transit Facilities</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Transportation Demand Management</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Access to Civic and Public Spaces</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Access to Recreation Facilities</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Visitation and Universal Design</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Community Outreach and Involvement</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>Local Food Production</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Tree-Lined and Shaded Streets</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>Neighborhood Schools</td>
<td>1</td>
</tr>
</tbody>
</table>

*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.

Source: A Citizen’s Guide to LEED for Neighborhood Development
# Green infrastructure and buildings credits

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

Source: LEED for Neighborhood Development - 2009 Pilot Version
## LEED® for Neighborhood Development

<table>
<thead>
<tr>
<th>Category</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Location &amp; Linkage</td>
<td>27</td>
</tr>
<tr>
<td>Neighborhood Pattern &amp; Design</td>
<td>44</td>
</tr>
<tr>
<td>Green Infrastructure &amp; Buildings</td>
<td>29</td>
</tr>
<tr>
<td>Innovation &amp; Design Process</td>
<td>6</td>
</tr>
<tr>
<td>Regional Priority Credit</td>
<td>4</td>
</tr>
</tbody>
</table>

*Out of a possible 100 points + 10 bonus points

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

Source: LEED for Neighborhood Development - 2009 Pilot Version
LEED ND
Expected impact

Green Buildings Can Reduce...

- Energy Use: 24%-50%
- CO₂ Emissions: 33%***-39%**
- Water Use: 40%**
- Solid Waste: 70%**

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

When the economy was roaring and housing booming, reinin suburban sprawl dominated the development debate under the name of "smart growth." Now that the economy has slowed, prompting more people to stay in their cars and prompting more people to stay in urban centers, the debate has shifted to a new name: "intelligent cities."

"There's a 15- to 20-year cyclical shift," says Robert Lang, urban planner at the University of Nevada-Las Vegas. "There's a new awareness of the need for urban renewal." Smart growth is no longer the only option.

VALET BIKE PARKING: Easy COMMUTING: Cities tackle I STREET CARS: Transforming the streetscape

That's not to say the principles of smart growth are dead. On the contrary, he says, the principles of urbanism, the design movement that advocates for walkable, mixed-use development, have gained new traction.

Suburban sprawl communities like the one here in Las Vegas, once seen as the future, may not be able to compete with the walkable, bike-friendly neighborhoods of cities.

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Urban Population</th>
<th>Rural Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>0.74</td>
<td>3.20</td>
</tr>
<tr>
<td>1970</td>
<td>1.52</td>
<td>2.94</td>
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<tr>
<td>2000</td>
<td>3.10</td>
<td>1.90</td>
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<tr>
<td>2025</td>
<td>4.58</td>
<td>1.40</td>
</tr>
<tr>
<td>2050</td>
<td>6.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>
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

- Air Pollution
  - Control of CO₂ emissions of factories, pollution emitted by cars and toxic gases generated in farms.

- Forest Fire Detection
  - Monitoring of combustion gases and preemptive fire conditions to define alert zones.

- Wine Quality Enhancing
  - Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

- Offspring Care
  - Control of growing conditions of the offspring in animal farms to ensure its survival and health.

- Sportsmen Care
  - Vital signs monitoring in high performance centers and fields.

- Structural Health
  - Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.

- Smartphones Detection
  - Detect iPhone and Android devices and in general any device which works with WiFi or Bluetooth interfaces.

- Perimeter Access Control
  - Access control to restricted areas and detection of people in non-authorized areas.

- Radiation Levels
  - Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.

- Electromagnetic Levels
  - Measurement of the energy radiated by cell stations and WiFi routers.

- Traffic Congestion
  - Monitoring of vehicles and pedestrian influence to optimize driving and walking routes.

- Smart Roads
  - Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

- Smart Lighting
  - Intelligent and weather adaptive lighting in street lights.

- Intelligent Shopping
  - Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.

- Noise Urban Maps
  - Sound monitoring in bar areas and centric zones in real time.

- Water Leaks
  - Detection of liquid presence outside tanks and pressure variations along pipes.

- Vehicle Auto-diagnosis
  - Information collection from CarBus to send real time alarms to emergencies or provide advice to drivers.

- Item Location
  - Search of individual items in big surfaces like warehouses or harbours.

- Water Quality
  - Monitoring of parking spaces availability in the city.

- Smart Parking
  - Monitoring of parking spaces availability in the city.

- Waste Management
  - Detection of rubbish levels in containers to optimize the trash collection routes.

- Golf Courses
  - Selective irrigation in dry zones to reduce the water resources required in the green.

- Quality of Shipment Conditions
  - Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.
Intelligent / Smart Environments
Applications for optimization

Crowdsourcing

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

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

OpenTripPlanner
Communicates transit schedule, travel, and map information in a single standards-based, affordable package that any agency can use.
Development Agency: OpenPlains
Civic Function: Infrastructure and Utilities
Software Type: Visualization of Information

Open source / Open data
Smart Amsterdam

43 projects for energy, environment, mobility

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 focusing on energy transition and open connectivity.
12.000 sensors

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

HES e-toolkit

www.hes-unwto.org
## HES Platform

<table>
<thead>
<tr>
<th>HES e-toolkit</th>
<th>Conceptual block diagram</th>
</tr>
</thead>
</table>
| **Application** | Internet  
IIS Web server (ASP, JScript, JQuery)  
Output: HTML, PDF  
Identification of users  
User interface |

<table>
<thead>
<tr>
<th>Reporting</th>
<th>Energy</th>
<th>CO2 Footprint</th>
<th>Tech solutions</th>
<th>ROI Calculator</th>
</tr>
</thead>
</table>
| **Analysis** | Is performed on this level by the following | | | Benchmarking  
DSS  
Financial calculator |
| **Data** | Data storage, Queries, Indexing, Functions | | | RDBMS |
(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
Step 4: Energy consumption (purchased from renewable and non-renewable sources)

- Electricity

Type of use:
- Heating
- (LPG) Liquefied petroleum gas

Amount of total electricity consumed: 125000

Unit: Kilowatt hour (kWh)

Type of use:
- Heating
- (LPG) Liquefied petroleum gas

Amount of liquefied petroleum gas: 100000

Unit: Kilowatt hour (kWh)
Following data entry -> Reporting

Hotel energy calculator
- Questionnaire
- Energy related report
- Energy solutions
- Return on investment calculator
- Carbon footprint
- Market your activities

Current project: carbon footprint test
You have complete the questionnaire! The following reports are available:

**Energy related report**
Assessing your hotel's current energy use/efficiency and carbon footprint.

**Energy solutions**
Assessing your hotel's current energy use/efficiency and carbon footprint.

**Carbon footprint**
Measuring your hotel's impact on our climate by estimating the total set of greenhouse gases (GHG) emissions.

**Return on investment calculator**
Assessing which investment could achieve the best return on the investment and payback 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

<table>
<thead>
<tr>
<th>Category</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
<th>(D)</th>
<th>(E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>0</td>
<td>195</td>
<td>280</td>
<td>355</td>
<td>450</td>
</tr>
<tr>
<td>Above average</td>
<td></td>
<td></td>
<td>280</td>
<td>355</td>
<td>450</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>355</td>
<td>450</td>
<td>1000</td>
</tr>
<tr>
<td>Below average</td>
<td></td>
<td></td>
<td></td>
<td>450</td>
<td>1000</td>
</tr>
<tr>
<td>Very Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1000</td>
</tr>
</tbody>
</table>
21 different types of fuel emissions are taken into account.
# 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.

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

### 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
- Inform your 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 (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
## ROI Calculator

### Summary of investments and income

#### Energy efficiency

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Window insulation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Building insulation</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Prevention of air infiltration and of unnecessary outdoor air supply</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

#### Summary of ROI Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Equity (EUR)</td>
<td>3610</td>
</tr>
<tr>
<td>Total Debt (EUR)</td>
<td>3000</td>
</tr>
<tr>
<td>TOTAL INVESTMENT</td>
<td>6610</td>
</tr>
</tbody>
</table>

#### Cash flow from investment

<table>
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<tr>
<th>Year</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>10</th>
<th>11</th>
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<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-) Equity Investment</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td></td>
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<tr>
<td>Subtotal (1)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td></td>
</tr>
<tr>
<td>Net income after taxes</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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#### Cash flow from Operation

- IRR: -0.76
- Net Present Value: -3610 EUR
- Discounted Payback Period (years): 0

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

Created on: 17/5/2013 13:06
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

**From top-down planning -> bottom-up platforms**

**Energy Related Report**
- Information on the hotel's current energy performance, benchmarking

**Energy Solutions Report**
- Suggestions for energy efficiency and renewable energy technologies

**Carbon Footprint Report**
- Information on hotel's carbon emissions

**Additional Information Input**
- Cost of Energy technology type
- Cost of installation
- Debt information

**Return on Investment Calculator ROI**
- Helps to decide whether it's financially worthwhile to invest in EE or RE