The Development of First Performance-Based Green Building Rating System in MENA Region

Dr. Yousef Alhorr
Founder & Chairman
September 2011
Environmental Challenges and Impacts
(1) CLIMATE CHANGE

The amount of carbon dioxide in the atmosphere is a major factor related to recent climate change patterns.

The GCC Countries have high per capita values, with Qatar having the highest rate.

UAE, Kuwait & Bahrain have comparable values.

1 2006 US Greenhouse Gas Inventory Executive Summary. [URL](http://www.epa.gov/climatechange/emissions/)
2 Dr. Pieter Tans, NOAA/ESRL ([www.esrl.noaa.gov/gmd/ccgg/trends](http://www.esrl.noaa.gov/gmd/ccgg/trends))
The GCC Countries have high energy consumption rates.

Qatar has the highest energy consumption rate per capita in the world, followed by Bahrain, Kuwait and UAE.

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(4) WATER DEPLETION_ renewable resources

• Countries in GCC have an extremely limited amount of renewable water resources per person, with an average of 120 cubic meters/person/year & World Ave. is 8200 cubic meters/person/year.

- In GCC, overall per capita freshwater availability has fallen from about 680 cubic meters in 1970 to about 180 cubic meters in 2000 (75% less).

![Graph showing water depletion in different countries]
(5) WATER POLLUTION

Aquifers Salinity
• The overexploitation of groundwater resources (irrigation) has severely compromised the quality of the water by the intrusion of seawater into aquifers¹

Contamination from Oil Pollution
• 1 – 1.2 million barrels of oil and waste products enter the Arabian Gulf each year which is flushed very slowly through the narrow Strait of Hormuz²

Contamination from Desalination Processes
• Seawater and marine life is affected by rejected brines, which have elevated temperatures, increased salt concentration, and residual chemicals from the desalination processes³

1 “Coastal management in the Persian Gulf region...,” by Nadim, Bagtzoglou, and Iranmahboob. University of Connecticut, Department of Civil and Environmental Engineering
2 “Water Resource Management Challenges in the GCC Countries,” by Al-Zubari
3 “Pollution Impacts of Desalination,” by Abderrahman and Hussain
(6) MATERIALS DEPLETION

Most GCC countries rank in the top ten worldwide in terms of waste production per capita.

55% is estimated waste in GCC countries to be construction and demolition waste.¹

Estimated Waste in GCC Countries

C&D Waste in QATAR

It is estimated that around 20,000 tons/day (~7.3 million tons/year) of construction and demolition (C&D) waste are produced as a result of the extensive construction and demolition activities.

¹ Middle East Waste Summit, www.wastesummit.com
(7) AIR POLLUTION
From major pollutants – NOx, SOx, CO, CO2, VOCs

GCC Countries Total Emissions

Saudi Arabia 57%
UAE 17%
Kuwait 11%
Qatar 6%
Oman 3%
Bahrain 6%

Total Emissions of Major Countries

China 46%
USA 41%
Japan 6%
Germany 3%

1 International Energy Agency (IEA) Statistics Division. 2006
Environmental Challenges and the Built Environment

Resource Consumption
- water
- fossil fuels
- materials
- other natural resources

Environmental Degradation
- air pollution
- water pollution
- land contamination
- climate change

Social & Economic
- cultural value
- economic value
- human health & comfort

Environmental Benefits
- CONSERVE: water, energy, and other resources
- IMPROVE: water, land, and air quality
- MINIMIZE: emissions and waste production
- ENHANCE: biodiversity and ecosystems

Social & Economic Benefits
- PROVIDE: quality indoor environment
- CREATE: opportunities in green products & services
- PRESERVE: cultural identity
- REDUCE: operations & maintenance costs

SUSTAINABILITY / GREEN BUILDINGS PRACTICES
Direct Savings/Benefits On Resources

- Savings in water consumption: 30%
- Savings in energy use and reduction of greenhouse gas emissions: 30%
- Reduction of construction and demolition waste sent to landfills: 50-75%
Development of the Global Sustainability Assessment System (GSAS)
Local (GSAS) vs International Systems

Ground-up Approach Serving Regional Context
Developing from scratch allows for the seamless integration between regional specific requirements and sustainable goals.

Best Mix
Combines the best methods from six established systems resulting in a customized tool specific to the requirements and needs of the region.

Performance-based
Categories, criteria, and measurements are defined to be performance-based and quantifiable, where possible.

Flexibility & Control
Complete control over the development, customization, deployment, and future modifications of the rating system without external interferences.
GSAS Development Approach

LEVEL (I) TECHNICAL CORE TEAM

LEVEL (II) EXPERT REVIEW TEAM
USA HONG KONG
UK JAPAN
AUSTRALIA CHINA
CANADA NETHERLAND

LEVEL (III) LOCAL TEAMS

SUPPORT TEAM (IN-HOUSE)

FEEDBACK FOCUS GROUP (GOV/NON-GOV)

GORGIA TECH

UNIVERSITY OF PENNSYLVANIA
BUILT ENVIRONMENT & GSAS MICRO/MACRO LEVEL ASSESSMENT

- GSAS BUILDINGS SCHEMES – MICRO LEVEL ASSESSMENT
- GSAS NEIGHBOURHOOD SCHEME – MACRO LEVEL ASSESSMENT

Groundwork

140+ BUILDING RATING SYSTEMS TOOLS GUIDELINES

40 WHOLE BUILDING RATING SYSTEMS

6 ESTABLISHED RATING SYSTEMS

EXISTING ENERGY STANDARDS

GCC CONTEXT

UK: BREEAM

US: LEED

Canada: Green Globes

Hong Kong: CEPAS

Japan: CASBEE

International: SBTool

Expert Review

Fields

[1] Energy Experts
[2] Systems Developers
[3] Industry Specific

Regions

[1] US
[2] UK
[3] Netherlands
[4] Canada
[5] Japan
[6] China
[7] Hong Kong
[8] Australia

Rating System

GCC Sustainability Assessment System

Design Guidelines

Rating Elements

Weighting + Scoring

GCC Energy Standard
<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Energy</td>
<td>(24%)</td>
</tr>
<tr>
<td>Water</td>
<td>(16%)</td>
</tr>
<tr>
<td>Indoor Environment</td>
<td>(14%)</td>
</tr>
<tr>
<td><em>Cultural + Economic Value</em></td>
<td>(13%)</td>
</tr>
<tr>
<td>Site</td>
<td>(9%)</td>
</tr>
<tr>
<td>Urban Connectivity</td>
<td>(8%)</td>
</tr>
<tr>
<td>Materials</td>
<td>(8%)</td>
</tr>
<tr>
<td>Management + Operations</td>
<td>(8%)</td>
</tr>
</tbody>
</table>
**Urban Connectivity**
- Load on Local Traffic Conditions
- Pedestrian Pathways
- Proximity to Amenities
- Light Pollution
- Noise Pollution
- Public Transportation
- Private Transportation
- Sewer & Waterway Contamination
- Shading of Adjacent Properties

**Site**
- Ecological Value of Land
- Vegetation & Shading
- Desertification
- Rainwater Runoff
- Mixed Use
- Heat Island Effect
- Adverse Wind Conditions
- Acoustic Conditions
- Landscape Management

**Energy**
- Energy Demand Performance
- Energy Delivery Performance
- Fossil Fuel Conservation
- CO2 Emissions
- NOx, SOx, & Particulate Matter

**Water**
- Water Consumption

**Materials**
- Regional Materials
- Responsible Sourcing of Materials
- Structure Reuse: On-site
- Materials Reuse: Off-site
- Recycled Materials
- Design for Disassembly
- Life Cycle Assessment (LCA)

**Indoor Environment**
- Thermal Comfort
- Low-Emitting Materials
- Natural Ventilation
- Mechanical Ventilation
- Indoor Chemical & Pollutant Source Control
- Views
- Glare Control
- Illumination Levels
- Acoustic Quality
- Daylight

**Cultural & Economic Value**
- Heritage & Cultural Identity
- Support of National Economy

**Management & Operations**
- Commissioning Plan
- Energy Use Sub-metering
- Leak Detection
- Organic Waste Management
- Recycling Management
- Intelligent Building Control System
GSAS Neighborhoods Overview – Macro Level Scheme

Neighborhoods typically consist of many components including:
• various building typologies
• infrastructure networks
• transportation networks
• public or open spaces
NH Rating System Development

QA/GCC RESEARCH
- ecology + climate
- materials + resources
- policies + initiatives

Existing Infrastructure
- GSAS

Neighborhood Rating Systems
- LEED
- BREEAM
- CASBEE
- Green Mark
- Sustainable Sites
- Estidama

Additional Regional Initiatives
- Qatari/GCC Law

SCREENING CRITERIA
- stage 1

SCREENING MEASUREMENT
- stage 2

CRITERIA
- In Scope
  - Criteria applicable to region
- Out of Scope
  - Criteria not applicable to region

MEASURE
- level 1
  - Quantitative
  - Usable
  - Communicable + Comprehensive
- level 2
  - Partially complies with level 1 requirements
- level 3
  - Qualitative
  - Unusable
  - Incommunicable + Incomprehensible

FILTERS
- level 1
  - Performance-based
- level 2
  - Prescriptive
  - Inapplicable to Qatar

CRITERIA
- region specific
  - Ecology + Climate
  - Materials + Resources
  - Culture + Heritage

SUB-FILTERS
- level 1
  - Quantifiable
  - Applicable
  - Low level of complexity
  - Communicable

EXPERT REVIEWERS
[1] Urban Planning
- Gary Hack, PhD
[2] Landscape Architecture
- Laurie Olin, RLA, FASLA
- Muscoe Martin, AIA, LEED AP
[4] Transportation + Infrastructure
- Anthony Tomazinis, PhD

EVALUATION + INPUT
- stage 1

QATAR
- EVALUATION + INPUT
- stage 2
**Rating System Development**

*Existing Systems*

**LEED for Neighborhood Development [US]**
Pilot Launched 2009, V.2 Launched 2010

**BREEAM Communities [UK]**
Launched June 2009

**CASBEE Urban Development [Japan]**
Published July 2006, revised in 2007

**Green Mark for Districts [Singapore]**
Version 1.0, October 2009

**Sustainable Sites Initiative [US]**
Guidelines and Performance Benchmarks, 2009

**Estidama [Abu Dhabi]**
Launched May 2010
### GSAS Neighborhoods Criteria Summary

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>Criteria</th>
<th>Goals</th>
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<tr>
<td>UC</td>
<td>Urban Connectivity</td>
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<td>The neighborhood shall control its effect on the urban environment with regard to factors associated with material extraction, processing, manufacturing, distribution, use/re-use and disposal for the development of the infrastructure and the design of buildings.</td>
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<tr>
<td>UC.1</td>
<td>Transportation Load</td>
<td>Regional Materials</td>
<td>The neighborhood’s ecological impact shall be controlled with regard to factors associated with material extraction, processing, manufacturing, distribution, use/re-use and disposal for the development of the infrastructure and the design of buildings.</td>
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<tr>
<td>UC.2</td>
<td>Proximity to Existing Neighborhoods</td>
<td>Responsible Sourcing of Materials</td>
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<tr>
<td>UC.3</td>
<td>Wastewater Load</td>
<td>Materials Reuse</td>
<td></td>
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<tr>
<td>UC.4</td>
<td>Solid Waste Load</td>
<td>Recycled Materials</td>
<td></td>
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<tr>
<td>S</td>
<td>Site</td>
<td>Life Cycle Assessment (LCA)</td>
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</tr>
<tr>
<td>S.1</td>
<td>Land Preservation</td>
<td>Heat Island Effect</td>
<td>The neighborhood’s outdoor environmental quality shall be controlled with regard to factors such as thermal comfort and air quality, air movement and acoustics.</td>
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<tr>
<td>S.2</td>
<td>Water Body Preservation</td>
<td>Adverse Wind Conditions</td>
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<td>S.3</td>
<td>Habitat Preservation</td>
<td>Air Flow</td>
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<td>Landscape Amenities</td>
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<td>S.5</td>
<td>Walkability</td>
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<td>S.6</td>
<td>Bikeability</td>
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<td>S.7</td>
<td>Desertification</td>
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<td>S.8</td>
<td>Parking Footprint</td>
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<td>S.9</td>
<td>Mixed Use</td>
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<td>S.10</td>
<td>Crime Prevention</td>
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<td>S.11</td>
<td>Public Space</td>
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<td>S.12</td>
<td>Acoustic Conditions</td>
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<td>S.13</td>
<td>GSAS Rated Buildings</td>
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<td>Energy</td>
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<td>E.1</td>
<td>Energy Delivery Performance</td>
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<td>Fossil Fuel Conservation</td>
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<td>E.3</td>
<td>CO2 Emissions</td>
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<td>E.4</td>
<td>NOx, SOx, &amp; Particulate Matter</td>
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<td>W</td>
<td>Water</td>
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<td>W.1</td>
<td>Water Consumption</td>
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<td>Construction Plan</td>
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<td>MO.2</td>
<td>Management Plan</td>
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<td>MO.3</td>
<td>Wastewater Management Plan</td>
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<td>MO.4</td>
<td>Organic Waste Management Plan</td>
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<tr>
<td>MO.5</td>
<td>Solid Waste Management Plan</td>
<td></td>
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</tbody>
</table>
Building Assessment: Points Achieved vs. Points Attainable

- Illustrates points achieved and the maximum attainable points for each category
- Allows user to see which category can be improved upon to obtain desired amount of points and rating level
Scoring Levels (6 Stars)

• Displays the GSAS rating level achieved by the project

• Chart is interactive – bullet point automatically readjusts as the total points achieved by the project changes

<table>
<thead>
<tr>
<th>Score</th>
<th>Certification Level</th>
<th>GSAS Certification</th>
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<tbody>
<tr>
<td>$X &lt; 0$</td>
<td>-</td>
<td>Certification denied</td>
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<tr>
<td>$0.0 \leq X \leq 0.5$</td>
<td>★</td>
<td>Certification achieved</td>
</tr>
<tr>
<td>$0.5 &lt; X \leq 1.0$</td>
<td>★★</td>
<td></td>
</tr>
<tr>
<td>$1.0 &lt; X \leq 1.5$</td>
<td>★★★</td>
<td></td>
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<tr>
<td>$1.5 &lt; X \leq 2.0$</td>
<td>★★★★</td>
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<td>$2.0 &lt; X \leq 2.5$</td>
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<tr>
<td>$2.5 &lt; X \leq 3.0$</td>
<td>★★★★★★</td>
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</table>
Scope Of GSAS Rating System

(I) Design       (II) Construction       (III) Operation

Applications Of GSAS Rating System

- Neighborhood (New 2010)
- Commercial Buildings
- Residential Buildings
- Schools
- Core & Shell
- Construction
- Hotels
- Mosques
- Light Industries
- Sports Facilities
- Parks
- Operation
**GSAS Resources**

**Manuals Suite**
30+ volumes documenting all aspects related to GSAS categories

**Tools Suite**
Automated calculators for assessing different criteria attainment based on objective measures and metrics

**Project Management Suite**
Web-based solution developed to manage the certification process from registration through certification allowing all stakeholders to interact online

**i GSAS Suite (In Progress)**
An interface layer which provides a set of specialized tools used to obtain the input data required by QSAS tools suite
GSAS Manuals Suite
v1.0-2010
## Facilities - Water Consumption

### Legend

- **User Input**
- **Reference Information**
- **Computed Values**
- **Constants**

### Facilities Fixtures

<table>
<thead>
<tr>
<th>Metric</th>
<th>Unit Type 1</th>
<th>Unit Type 2</th>
<th>Unit Type 3</th>
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<tbody>
<tr>
<td><strong>Flush Fixtures</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Low-flow Toilet</td>
<td>4.16 liters</td>
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<td></td>
</tr>
<tr>
<td>Ultra Low-flow Toilet</td>
<td>3.03 liters</td>
<td></td>
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<tr>
<td>Composting Toilet</td>
<td>0.00 liters</td>
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<td></td>
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<tr>
<td>Dual Flush Toilet (Low Flush)</td>
<td>3.03 liters</td>
<td></td>
<td></td>
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<tr>
<td>Dual Flush Toilet (Full flush)</td>
<td>6.06 liters</td>
<td></td>
<td></td>
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<tr>
<td>Conventional Toilet</td>
<td>6.06 liters</td>
<td>6.06</td>
<td>5.00</td>
</tr>
<tr>
<td>Shower</td>
<td></td>
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<tr>
<td>Conventional Showerhead</td>
<td>9.46lit/min</td>
<td>9.46</td>
<td>2.00</td>
</tr>
<tr>
<td>Low-flow Showerhead</td>
<td>6.81lit/min</td>
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<td></td>
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<tr>
<td>Faucets</td>
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<tr>
<td>Conventional Residential Sink</td>
<td>9.46lit/min</td>
<td>9.46</td>
<td>4.00</td>
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<tr>
<td>Low-flow Residential Sink</td>
<td>6.81lit/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional Institution Sink</td>
<td>9.46lit/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-flow Institution Sink</td>
<td>6.81lit/min</td>
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<td></td>
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<tr>
<td>Dishwasher</td>
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<tr>
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<td>22.71lit/run</td>
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<td>Water Efficient Residential Dishwasher</td>
<td>15.14lit/run</td>
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<tr>
<td>Conventional Institution Dishwasher</td>
<td>9.46lit/rack</td>
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<td></td>
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<tr>
<td>Water Efficient Institution Dishwasher</td>
<td>3.03lit/rack</td>
<td></td>
<td></td>
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<tr>
<td>Clothes washer</td>
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<td></td>
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</tr>
<tr>
<td>Conventional Residential Clothes washer</td>
<td>68.13lit/load</td>
<td>68.13</td>
<td>1.00</td>
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<tr>
<td>Water Efficient Residential Clothes washer</td>
<td>34.07lit/load</td>
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<tr>
<td>Conventional Institution Clothes washer</td>
<td>83.27lit/load</td>
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</tr>
<tr>
<td>Water Efficient Institution Clothes washer</td>
<td>45.42lit/load</td>
<td></td>
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</tbody>
</table>
GSAS Online Project Management Suite

Our Philosophy

The primary objective of Qatar Sustainability Assessment System (QSAS) is to create a sustainable built environment that minimizes ecological impact while addressing the specific regional needs and environment of Qatar.

The built environment contributes to air pollution, land use and contamination, fossil fuel depletion, water depletion, materials depletion, impacts on human health, and climate change. Responsible design, construction, and building operations can mitigate the negative effects of the built environment.

News & Events

Get updates on the latest training workshops and events by checking out the "News & Events" section. In addition, you can download our latest press releases and media coverage.

Manual Updates

Latest versions of GSAS Reference manuals, including GSAS for Schools, are now available for download from the "Resources" tab.
Economic Benefits of Green Buildings

- Decrease in operating costs: 13.6%
- Increase in building values: 10.9%
- Improvement in ROI: 9.9%
- Increase in occupancy: 6.4%
- Rent Increase: 6.1%
Barriers to Green Buildings

Barrier 1: Lack of Builder Incentives
Barrier 2: Lack of Product/Systems Information and Sourcing
Barrier 3: Inadequate Client Knowledge
Barrier 4: Perceived & Actual cost increases
Barrier 6: Lack of knowledge how to build a green
Barrier 7: Certification cost/paperwork
Barrier 8: Lack of regulations / Building code
Holistic Approach for Deployment
Knowledge Dissemination

- Green Buildings Solutions Conference & Exhibition
- International Journal of Sustainable Built Environment
- Certification Based Training – QSAS CGP
- Continuing Development Programs for Practitioners (CPD)
- Seminars and Webinars
- Publications (Books, articles, etc…)

Knowledge Dissemination
Gradual Deployment Plan

**PHASE (I)**
PILOT STAGE
2010-2011

**PHASE (II)**
TRANSITION STAGE-(Compuls. GOV Buildings)
+ New Master Plan Developments
2012-2016

**PHASE (III)**
COMPULSORY – Commercial-New Buildings
2016-

**PHASE (IV)**
COMPULSORY – EXISTING (Retrofit) COMM. HIGH RISE
2018-

**PHASE (V)**
COMPULSORY RESIDENTIAL
2020-
QSAS Projects Certification Statistics

- NH: 56 million square meter of sustainable city master plan development
- Mixed Use: 3 million square meter of mixed development master plan
- Sports: 54,000 square meter of sports facility
- Residential: 49,000 square meter of residential buildings
- Commercial: 600,000 square meter of commercial buildings
- Core & Shell: 8,500 square meter of core and shell buildings
- Hotels: 75,000 square meter of hotel buildings
Deployment & Impact on GCC Countries

Process
- ASSESSMENT
- CERTIFICATION
- IMPROVEMENTS (R & D)

Policies
- Emissions Cap
- Materials Rating
- Waste Disposal
- Water Resource Management
- Urban Planning

Development Opportunities
- Immediate
  - Renewables
  - Materials Industry
  - Recycling
- Over Time
  - Transportation
  - Underground Networks & Services

Benefits
- Economic
  - Renewable Energy Industry
  - Materials Industry
  - Carbon Trading
- Ecological
  - Reduce Resource Depletion
  - Minimize Climate Change