



**INTEGRATED
ENVIRONMENTAL
SOLUTIONS**

The 'LESSONS' Project

**Understanding the Gaps Between Operational Energy
Use and Modeling**

Ruth Kerrigan: ruth.kerrigan@iesve.com



The LESSONS Project

“LESSONS is an innovative website, where case studies from previous projects will be stored in a data base. Practitioners will be able to search for ‘lessons’ from past projects to influence and improve their designs. Practitioners will also be able to upload their own ‘Lessons’ from projects they have completed”

www.buildinglessons.com

Technology Strategy Board
Driving Innovation

“Low Impact Buildings: Design and Decision Tool”

PICK EVERARD



Introduction

20 20 20 Targets

- reduce GHG emissions to 20% of 1990 levels,
- 20% of EU energy to come from renewable resources
- 20% reduction in primary energy use compared with baseline projections.

Approximately 80% of a building's total lifecycle energy usage occurs during its operational stage

'As-built' performance of new or refurbished buildings frequently does not achieve the 'as-designed' predicted performance

The EU Energy Efficiency Action Plan 2011 states that the barriers to energy efficiency in buildings need to be overcome in order to meet the targets

Introduction

Reasons for Inefficiency in Buildings

- The discontinuity between the design and as-built building envelope and systems
- The discontinuity between the design of the building and the operation of the building
- The discontinuity between design stage assumptions and how the control systems are set up and operated
- Most building management systems (BMS) are fixed scheduled and unable to adapt to changing environmental, building envelope, and usage conditions
- Most BMS are using control algorithms several generations behind state-of-the art
- Typical BMS and non-BMS controls systems do not integrate the diverse building systems and equipment well

Concept

What is it?

A website to provide dramatically better guidance of design decisions to deliver zero carbon and low impact buildings

Why do it?

The real performance of 'green' buildings often falls well below design expectations because designers cease to be involved post occupancy

Concept

How will it improve design



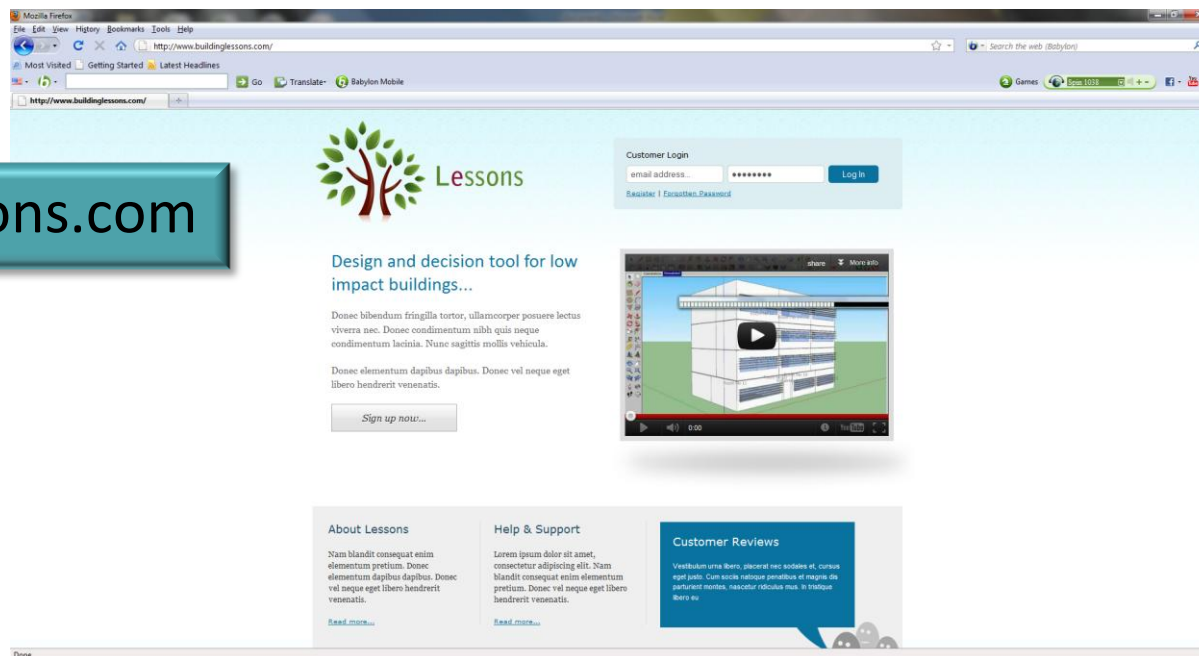
- Creates a tool that allows designers to access previous design cases and insights relevant to their current projects
- Provides comparisons between the expected design performance and the actual operational performance to allow the user to use similar systems or a similar approach
- Allows the modelling providers, such as IES, Energy+, TAS etc to examine where operational data differs from estimated data and understand how to improve their design software
- Provides greater accessibility to design and decision tools for all practising engineers
- Provides access to relevant design information
- Provides tools that help “every stage of the design process

Concept

What does it look like

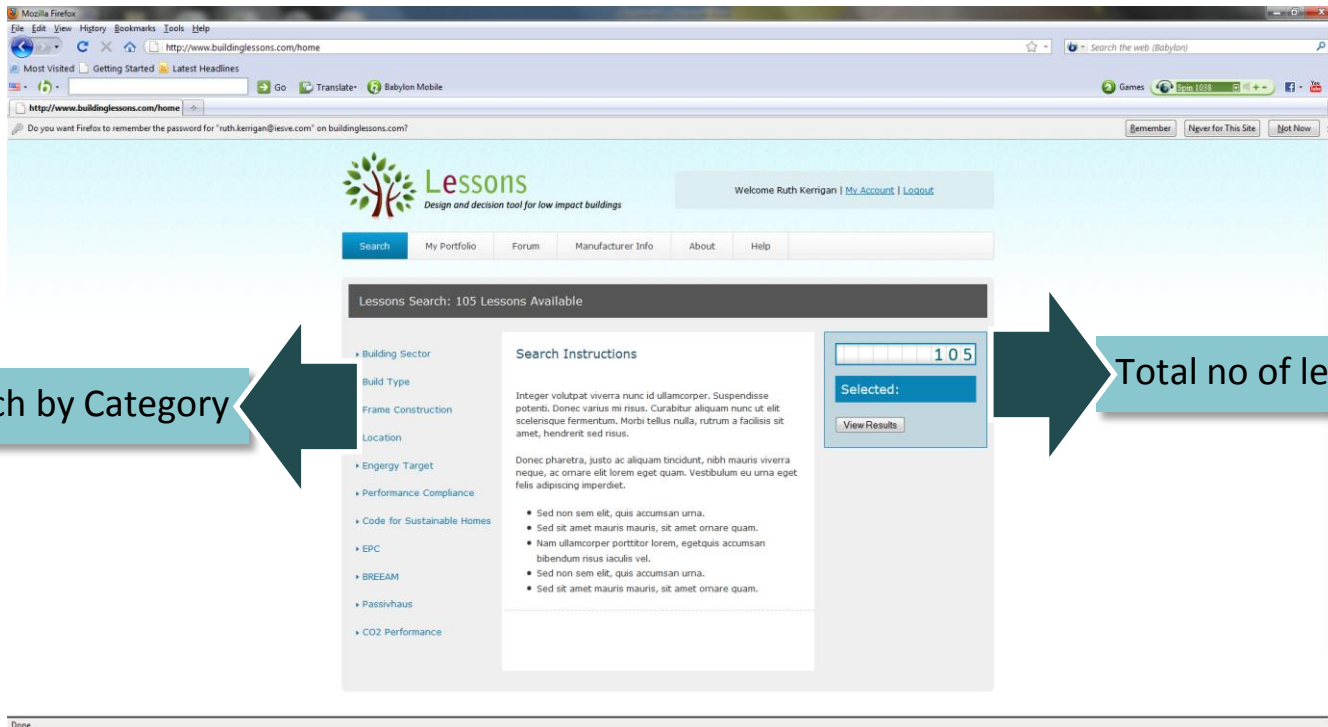


www.buildinglessons.com



Functionality

Search



Search by Category



Total no of lessons available



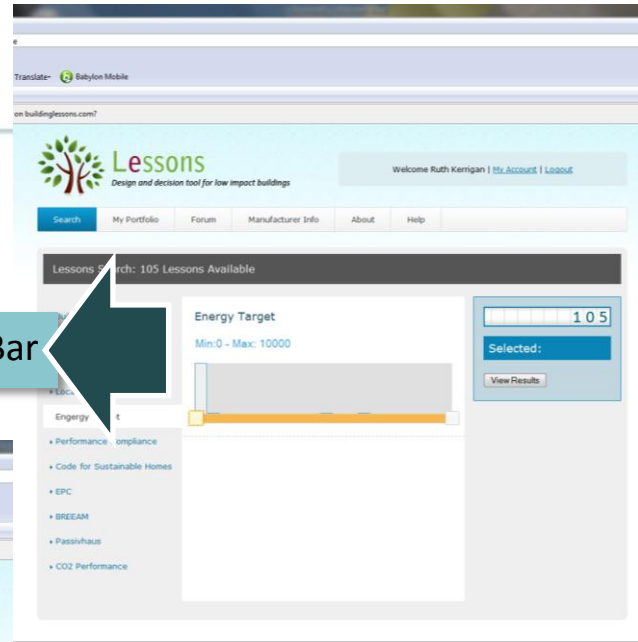
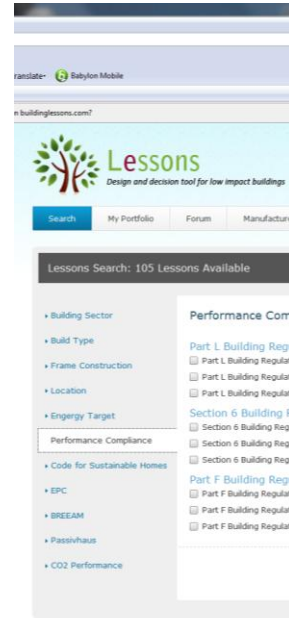
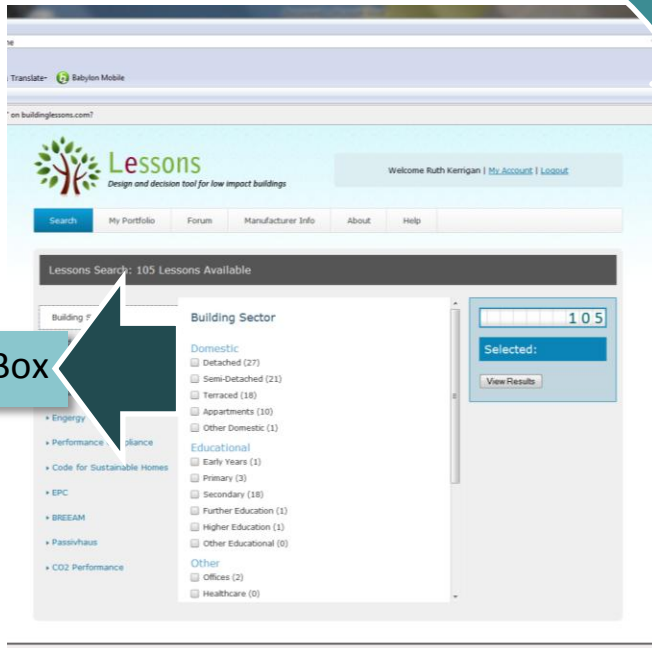
Functionality

Search

Slide Bar

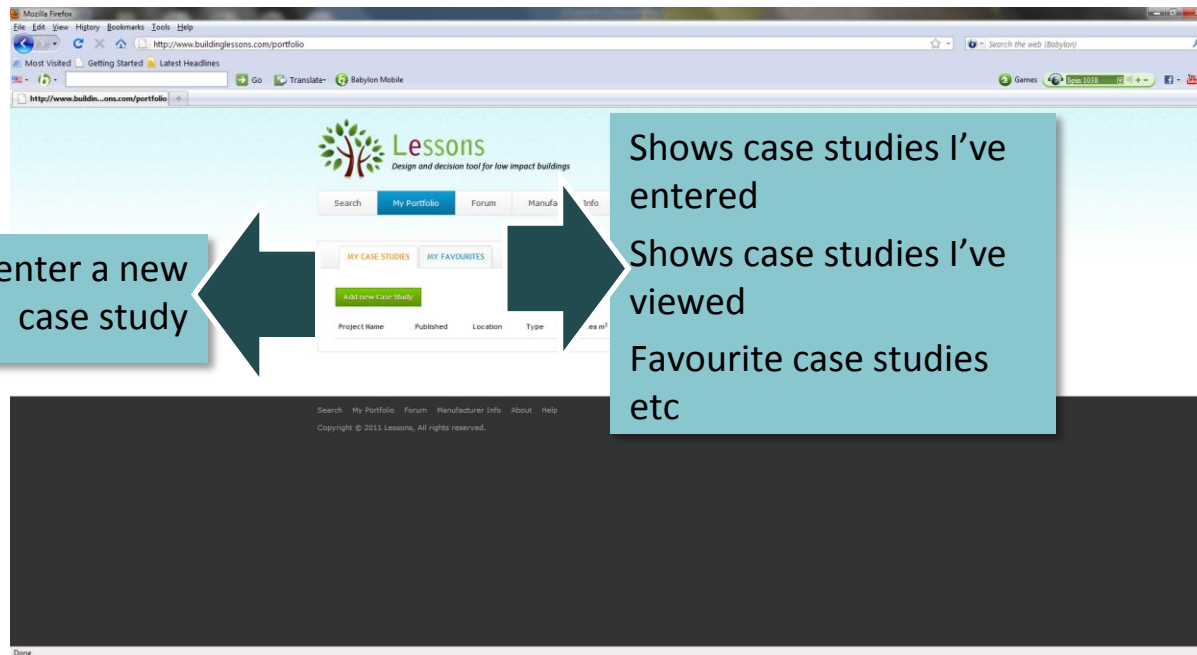
Check Box

Shows number available



Functionality

My Portfolio



Shows case studies I've entered

Shows case studies I've viewed

Favourite case studies etc

Allows you to enter a new case study

Functionality

New Case Study



Various levels of information

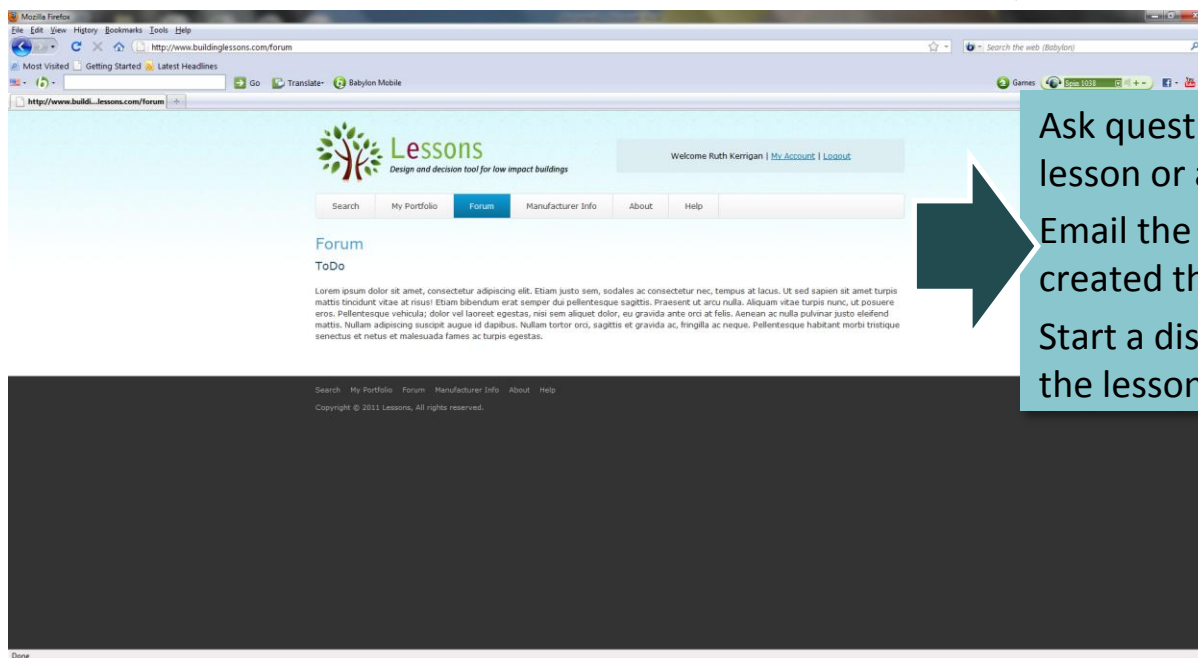
Post Occupancy Information to compare design against use

Enter anecdotal lessons

Design and Construction Information, which are effectively 'Lessons' in themselves

Functionality

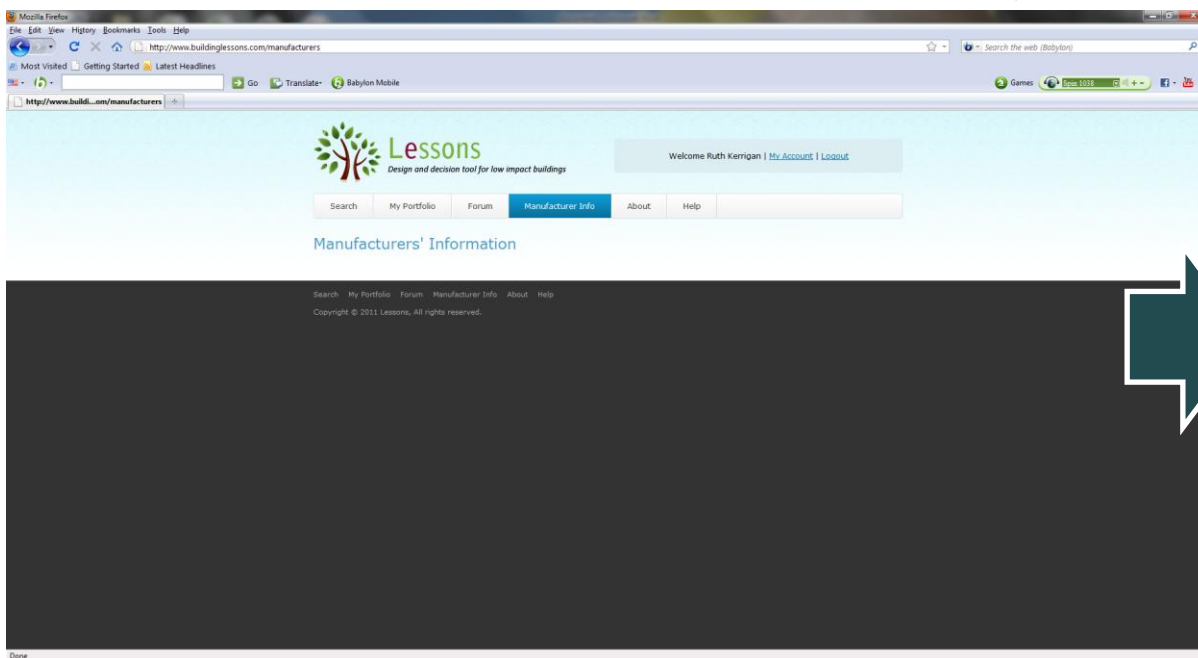
Forum



Ask questions about a lesson or a case study
Email the person who created the case study
Start a discussion about the lesson etc

Functionality

Manufacturer Info



Choose a manufacturers product to add to your case study

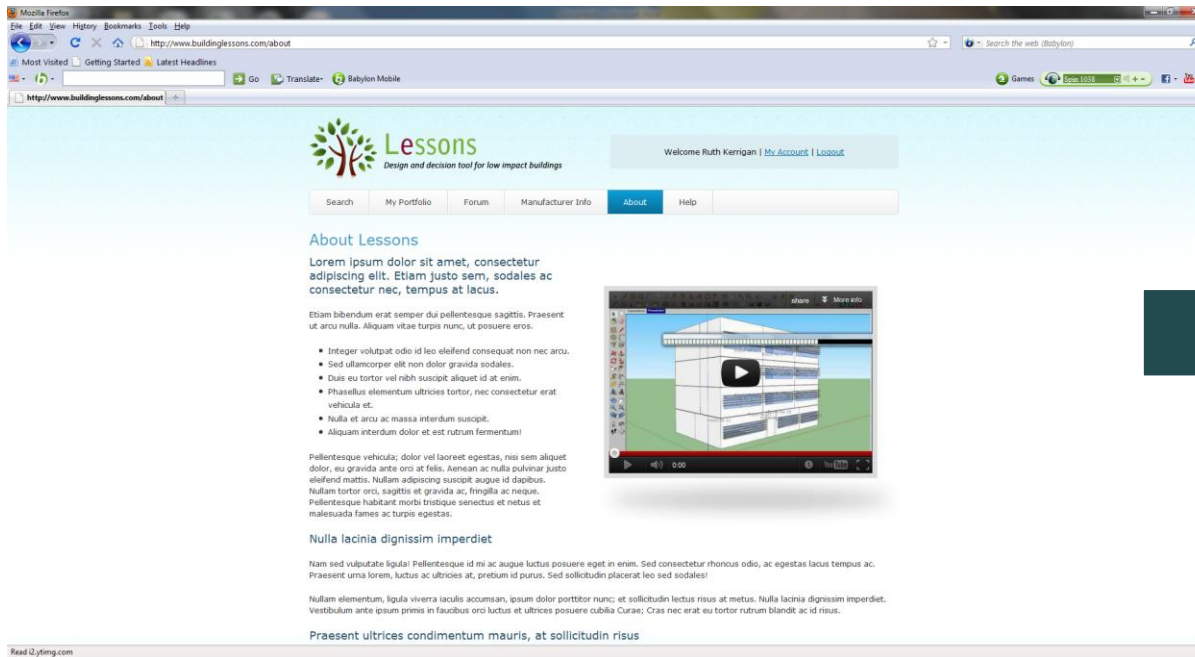
View where a manufacturers product has been used

Manufacturers can upload data for use with case studies

Manufactures can create a 'performance component' of their technology to be linked with IES software and uploaded to a case study for use with a 3D design model

Functionality

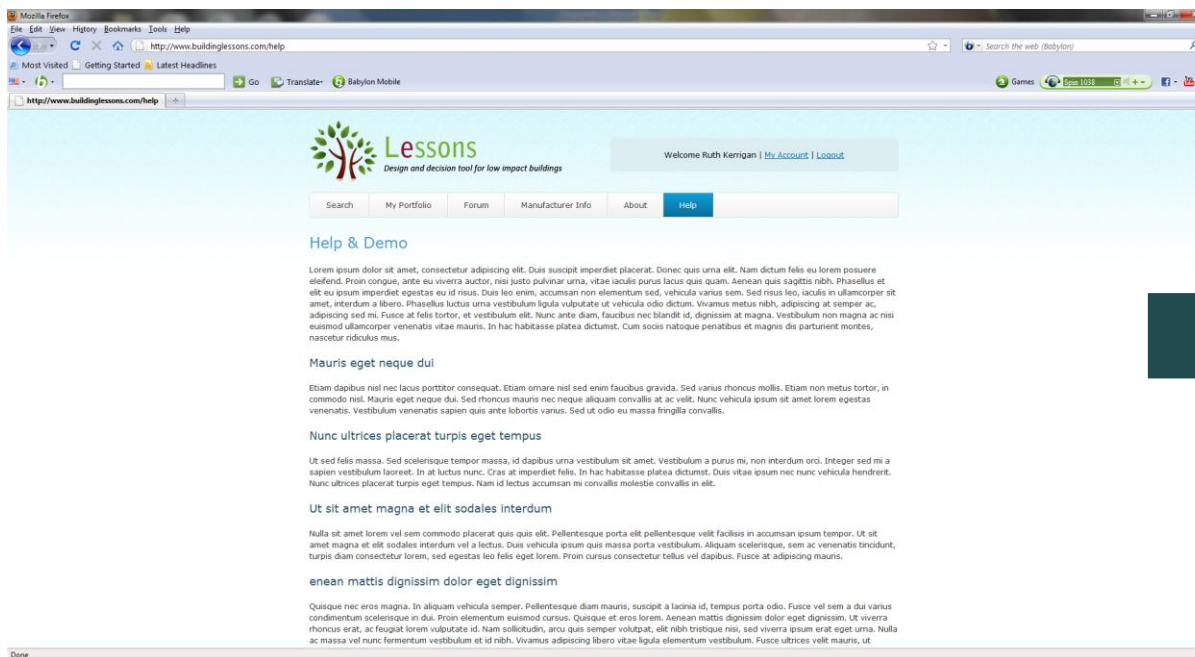
About



Information about the website

Functionality

Help



Help files, manuals and youtube demos to show the user how to enter, search and use the website

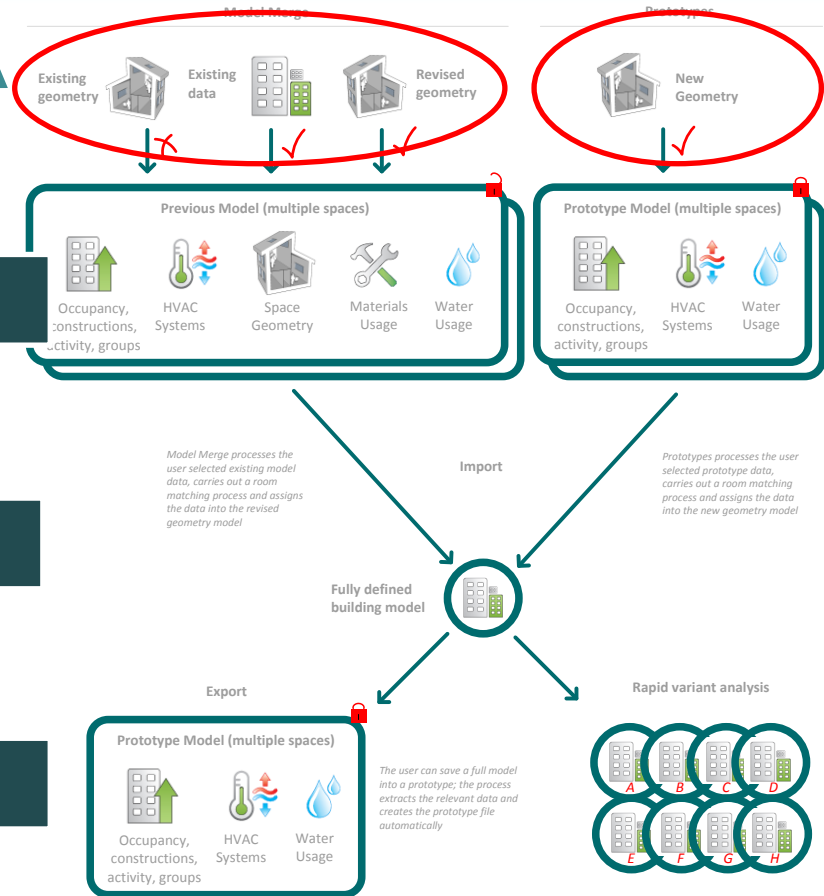
Functionality

Upload/Download

imports and exports user chosen data, namely: templates, constructions, profiles, systems, openings and room group definitions

The user can control what data is imported / exported and how the imported data is applied to a model

The function can match rooms by room name and replace existing data or just import the data to model databases for manual assignment



Example

Lessons Search: 105 Lessons Available

Building Sector

- Build Type
- Frame Construction
- Location
- Energy Target
- Performance Compliance
- Code for Sustainable Homes
- EPC
- BREEAM
- Passivhaus
- CO2 Performance

Building Sector

Domestic

- Detached (27)
- Semi-Detached (21)
- Terraced (18)
- Apartments (10)
- Other Domestic (1)

Educational

- Early Years (1)
- Primary (3)
- Secondary (18)
- Further Education (1)
- Higher Education (1)
- Other Educational (0)

Other

- Offices (2)
- Healthcare (0)

3

Selected:

- Primary

View Results

Example

buildinglessons.com/home/searchresults?activeFilters=building_sector_6

ites Tools Help

welcome Ruth Kerrigan | [MY ACCOUNT](#) | [LOGOUT](#)

Design and decision tool for low impact buildings

Search My Portfolio Forum Manufacturer Info About Help

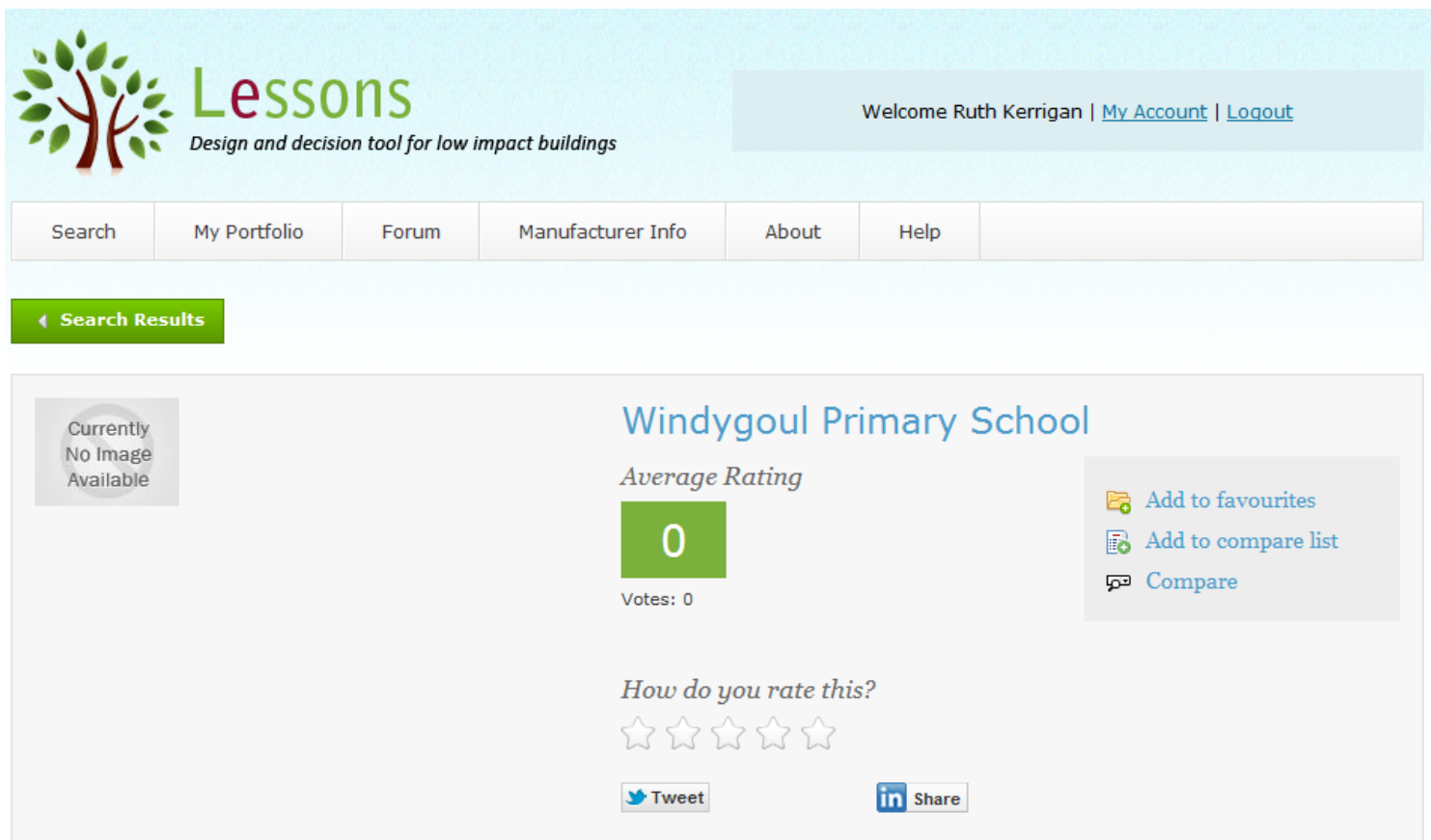
← Back to Search

SERACH RESULTS

Image	Casestudy Name	Lessons	Building Type	Region	Rating
Currently No Image Available	Brenzett	2	New Build	Kent	★★★★★ Vote Count: 1
Currently No Image Available	Bessemer Grange	1	New Build	London	No rating yet
Currently No Image Available	Windygoul Primary School	7	New Build	East Lothian	No rating yet

← Back to Search

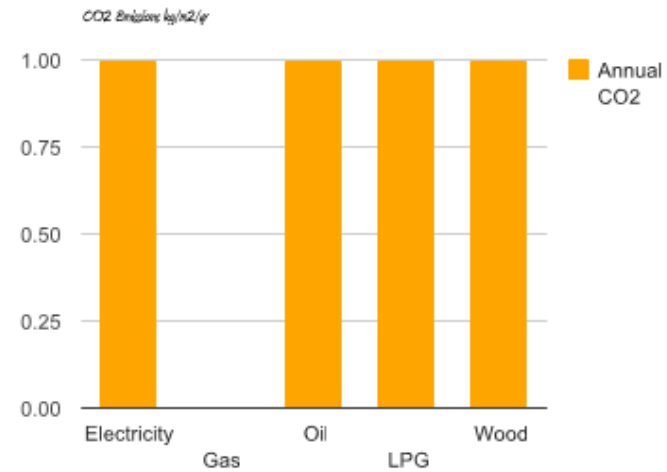
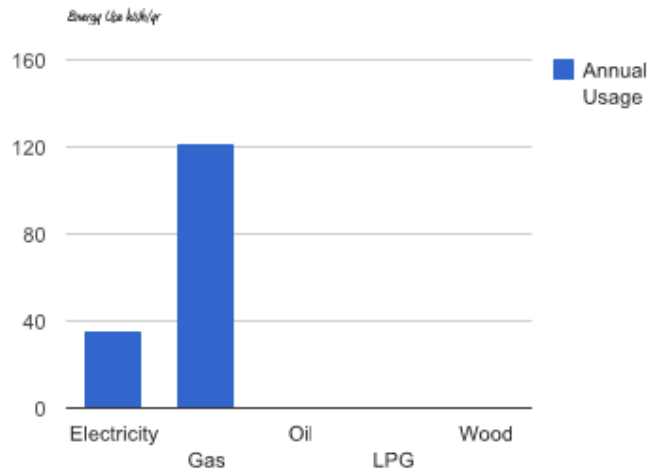
Example



The screenshot shows the 'Lessons' website interface. At the top left is the 'Lessons' logo, a stylized tree, with the tagline 'Design and decision tool for low impact buildings'. To the right, a user is logged in as 'Ruth Kerrigan' with links for 'My Account' and 'Logout'. Below this is a navigation menu with 'Search', 'My Portfolio', 'Forum', 'Manufacturer Info', 'About', and 'Help'. A green 'Search Results' button is visible. The main content area displays 'Windygoul Primary School' with an 'Average Rating' of 0 (0 votes) and a 'How do you rate this?' section with five empty stars. There are also social media share buttons for 'Tweet' and 'Share'.

Example

CHARTS



Example

GENERAL	
Property	Value
Source of Information	P19 - Carbon Trust
Building Phase	Completed
Project Type	New Build
Building Sector	Primary
Construction Type	Offset MMC
Year of Completion	2007 Quarter 2
Building Area m ²	3462
Town/City	Windygoul
County or Region	East Lothian
Postcode	
Country	
Performance Compliance	Part L Building Regulations 2006
Code for Sustainable Homes	Not Applicable
EPC	Not Applicable
BREEAM	Not Applicable
Passivhaus	Not Applicable
Energy Performance (predicted) kWh/m ² /yr	1

Example

LESSONS

Category	Sub-Category	Lesson
Construction Process	Design	The walls of the building are constructed from pre-fabricated timber frame panels which contain insulation manufactured from recycled newspaper. In addition to offering insulation in excess of the levels required under current legislation, the panels fit neatly together with air-tight joints and so reduce uncomfortable and energy wasting draughts. These prefabricated panels accelerated the build process and reduced the generation of on-site waste during construction.
Construction Process	Manufacture	
Construction Process	Construction	
Technology Types	Insulation	
Construction Process	Design	An underfloor heating system has been installed in most areas of the building. Underfloor heating is an efficient means of providing warmth evenly across a whole room and improves comfort levels by avoiding the creation of hot and cold spots. The heating system is supplied by highly efficient gas condensing boilers.
Construction Process	Design	The school was designed to maximise the availability and use of natural lighting. The classrooms have sloped ceilings and are glazed at occupant level on both outer facing walls. On the opposing walls, which face into the courtyard, windows are mounted at a higher level. The classrooms are thus provided with ample daylight. Glazing on the Northern elevation of the building is minimised to prevent heat loss. Inevitably, however, some artificial lighting was required in the school. To provide this without excessive energy consumption, the design team opted for highly efficient fluorescent lighting with automatic controls. These controls, which monitor both occupancy and level of natural light in the room, minimise energy use by ensuring that lights are only switched on when the room is occupied and by automatically dimming the lights in relation to the amount of daylight available.
Technology Types	Glazing	
Construction Process	Design	Control Lighting to Save Energy No matter how efficient the light, it will waste energy if left on whilst the room is empty. Also, using natural light will only save energy when electric lights are controlled in relation to the amount of daylight available (i.e. dimming or switching off when there is sufficient daylight to support the activity being undertaken in the room). For new buildings, or refurbishment of lighting systems in existing buildings, select automatic lighting controls which take account of room occupancy and natural light levels.
Wider Professions	Management	
Construction Process	Design	By installing opening windows on opposing walls in the classrooms, the designers created a passive ventilation system that supplies fresh air and cooling without the need for power hungry air conditioning systems. The windows are opened and closed under manual control, with the higher level windows using small motors controlled by the room's occupants. As the air in the room warms up, it rises to the higher part of the ceiling and escapes via the high level windows. In doing so, cooler fresh air is drawn into the room through the outer facade windows. The lower windows have a higher hopper so that fresh air does not blow across occupants and cause discomfort in winter. Modelling of the building carried out by consultants during the design process indicated that, by using this passive ventilation strategy, with solar shading on the outside, excessive temperatures would not be a problem. The experience of the occupants of the school is that comfort levels are good and that
Technology Types	Natural Ventilation	
Technology Types	Glazing	

Example

CONSTRUCTION

Category

External Wall

[↑ Back to top](#)

BUILDING SERVICES

Category

Other Renewables

Other Renewables

[↑ Back to top](#)

DESIGN

Strategy	Priority	Description
daylighting	High	The school was designed to maximise the availability and use of natural lighting. The classrooms have sloped ceilings and are glazed at occupant level on both outer facing walls. On the opposing walls, which face into the courtyard, windows are mounted
ventilation	High	By installing opening windows on opposing walls in the classrooms, the designers created a passive ventilation system that supplies fresh air and cooling without the need for power hungry air conditioning systems.

TEAM

Name	Role	Company
East Lothian Council	Client	East Lothian Council

[↑ Back to top](#)

ENERGY

Property

	DESIGN	ESTIMATED
Energy Use: Electric kWhr/yr		36
Energy Use: Gas kWhr/yr		122
Energy Use: Oil kWhr/yr		1
Energy Use: LPG kWhr/yr		1
Energy Use: Wood kWhr/yr		1
CO ₂ Emissions: Electric kg CO ₂ /yr		1
CO ₂ Emissions: Gas kg CO ₂ /yr		0
CO ₂ Emissions: Oil kg CO ₂ /yr		1
CO ₂ Emissions: LPG kg CO ₂ /yr		1
CO ₂ Emissions: Wood kg CO ₂ /yr		1

Impact

Benefits with respect to operation versus model



- Design is based on lessons from existing buildings, therefore comparison of how the design performed versus how the building operated can be taken into account
- Lessons with respect to design strategy, systems used, constructions used etc can be examined and learnt from
- Models of exemplar buildings with respect to 'as designed' performance against 'as built' performance can be downloaded and used with your own design model
- Technologies used can be examined with respect to their advantages and disadvantages and informed decisions with respect to whether or not to use them can be made

Impact

Wider Impacts



- Improved design, quality and productivity
- Better design at early stage
- 40-50% lower energy use and carbon emissions
- Drive towards zero carbon buildings
- Informed information for the retrofit market
- ...

Thank you
Q&A