

Green Building



THE FUTURE OF GREEN BUILDING



As we are becoming more aware of the impact of development on our environment, the green building market will continue to grow around the world in the years to come. Green building is on the rise in the fast growing economies of China, India, and South East Asia, while in the UK from 2019 all new buildings will have to meet zero carbon standards. In France this is occurring in 2020. Over the next few years we may see a fundamental change in the way buildings are designed, constructed and operated where green buildings will be the required norm.

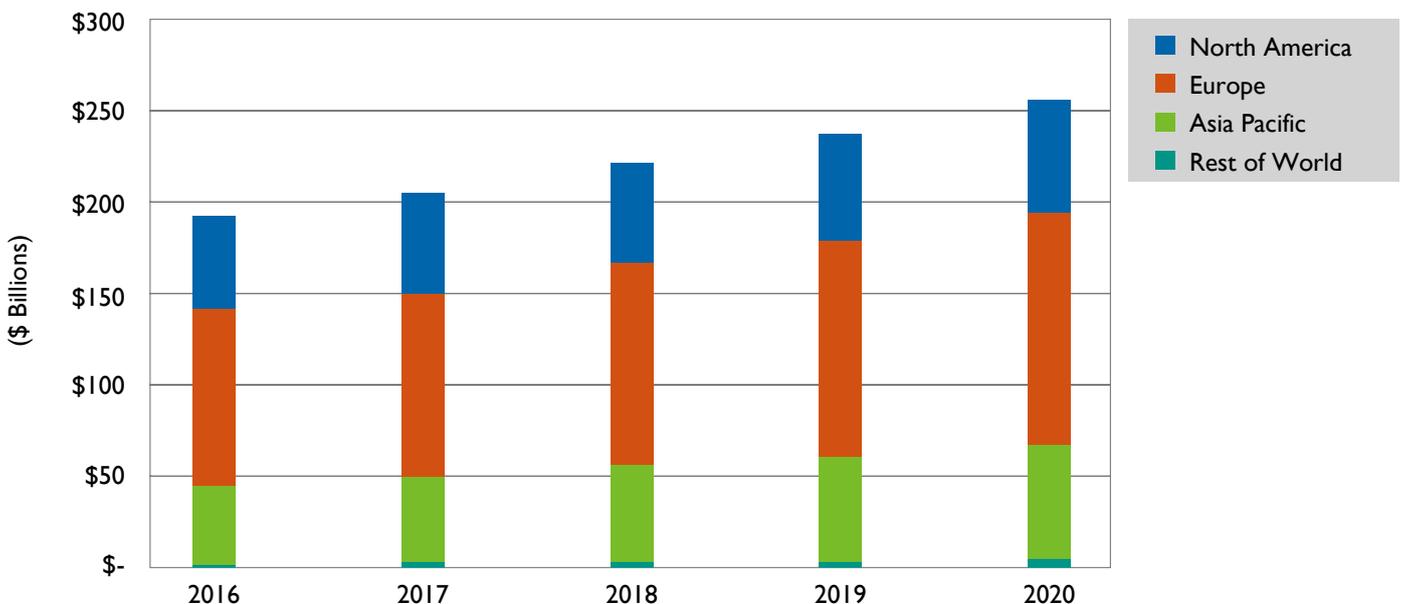
Innovation and technology will lead the way as society shifts toward a more environmentally sustainable infrastructure. Raven, in their quest to aid architects, designers and engineers, have developed high quality door and window

sealing solutions for energy efficiency, indoor environment quality improvement, and safety of commercial and residential buildings. This brochure will aid the reader on the value of door and window sealing as it applies to Green Building Programs, such as LEED, BREEAM and Green Star.

Raven premium sealing systems not only provide solutions to reduce the leakage of heating and air-conditioning energy to allow energy savings, but they also contain and protect against fire and smoke, sound, weather, draughts, dust and light.

Raven door and window sealing systems are one of the most cost effective methods for saving energy and improving climate control. In combination with double glazing and building insulation they provide very effective energy savings and climate control.

Chart 1.1 Market Value of Green Construction Materials by Region, World Market: 2016 -2020



What is a green building?

Any type of building that is designed and constructed with green building features as below:

- Buildings that strive for energy efficiency through:
 1. Appropriate orientation of the building
 2. Efficient lighting systems
 3. Use of alternative renewable energy sources such as solar or wind
 4. Effective insulation of walls and roof
 5. Use of double glazed ultra violet reflective glass to prevent heat gain
 6. Appropriate balance of opening in façade and optimized shading
 7. Good management, maintenance & monitoring to facilitate continuous performance improvement
 8. Use of reflective material on roofs such as albedo roof surfaces
- Buildings that ensure water efficiency
- Buildings that have local/recycled material for construction
- Buildings that have effective waste management
- Ensuring improved indoor environment quality
- Buildings integrated with efficient BMS
- Buildings on appropriate sustainable sites
- Buildings that use innovative and logistic design features to achieve sustainable development





Benefits of RAVEN Door and Window Sealing Systems

Raven sealing systems are an integral component to a building's HVAC system (Heating, ventilation & air-conditioning). The objective is to prevent heating/cooling loss from a building therefore saving energy and reducing maintenance costs. Raven sealing systems significantly reduce heating and cooling loss to the external environment whilst also providing acoustic protection from noise pollution as well as preventing draughts and rainwater penetration through the gaps of doors and windows.

Health	<p>Raven sealing systems prevent the intrusion or leakage of elements through gaps in doors and windows which may impact human health. Raven seals help control the movement within a building of airborne pathogens, dust and other particles.</p> <p>Raven have a range of products specifically designed for health applications which include easy wipe down designs and gaskets and cover strips that contain a Nano-tech Antimicrobial additive. These unique features together with regular cleaning practices offer the best protection against surface bacteria around sealed doors and windows.</p>
Comfort	<p>Installation of Raven sealing systems significantly contribute to the physical comfort of occupants by preventing the intrusion of noise, light draughts, dust, insects and vermin, rain and fire or smoke. Unsealed doors and windows also allows the leakage of heating and cooling impacting occupant comfortability whilst also significantly increasing energy costs.</p>
Indoor Environment Quality	<p>Raven sealing systems improve indoor environment quality but reducing the intrusion of unwanted noise, draughts, dust, insects and vermin. Climate control, energy efficiency and therefore indoor environment quality is significantly enhanced with the installation of Raven door and window sealing systems.</p>
Safety	<p>Raven's range of fire and smoke sealing systems which includes intumescent seals are designed, tested and certified to meet international building regulations and standards. Used in conjunction with fire doors, Raven's fire and smoke sealing systems prevent the passage of smoke and spread of fire improving the safety of building occupants.</p>
Atmosphere Pollution	<p>Raven door and window sealing systems prevent the leakage of heated or cooled air aiding in temperature maintenance. This has a significant effect on reducing loads on heating and cooling systems and hence, reducing energy consumption, associated GHG and other pollutant emissions.</p>
Durability	<p>Raven test their automatic door bottom seals to over one million openings to ensure durability and reliability. Products are manufactured from the highest grade components ensuring seals perform for many years to come in both residential and commercial applications.</p>
Reusability	<p>Many Raven door and window seals can be removed and reused on different doors or windows of the same size or smaller.</p>
Design for Disassembly	<p>Whilst many seals can be removed and re-used elsewhere with replacement components available, the long life expectancy of Raven products find the need to disassemble not likely before building renovations or demolition.</p>
Recyclability	<p>All Raven product packaging including cardboard and plastic are recyclable. Anodised aluminium components are fully recyclable if separated and sent to appropriate recycling facility. In most cases, majority of product components are recyclable and can be separated.</p>

Green Building Rating Systems

LEED: Developed by the U.S Green Building Council, LEED® (Leadership in Energy and Environmental Design) is an internationally recognized green building program.

LEED® is a certification system that deals with the environmental performance of buildings based on overall characteristics of the project. For commercial buildings and neighborhoods, to earn LEED® certification, a project must satisfy all LEED® prerequisites and earn a minimum 40 points on a 110-point LEED® rating system scale. Homes must earn a minimum of 45 points on a 136-point scale. Certification is categorized into four levels, Certified, Silver, Gold and Platinum.

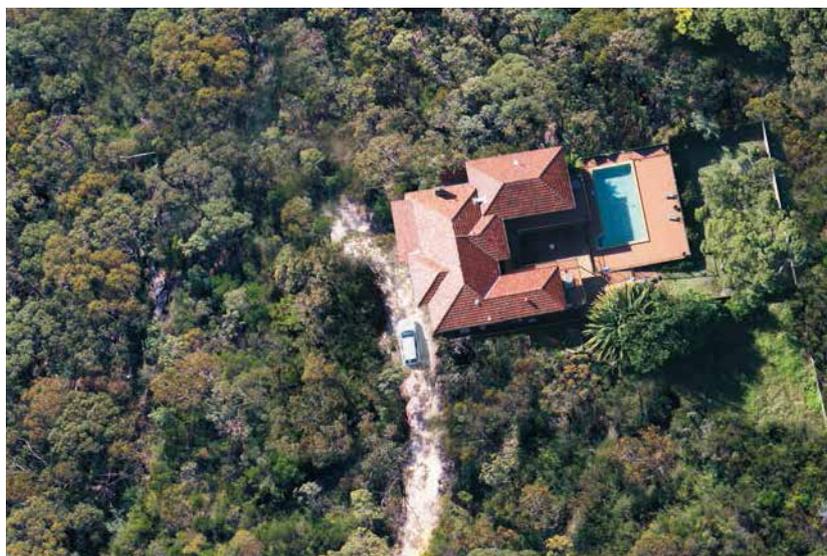
Credit Points Guidelines (LEED)

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

BREEAM: Is the Building Research Establishment Environmental Assessment Method for buildings. Its sets the standard for best practice in sustainable design and has become the defacto measure used to describe environment performance.

Credit Points Guidelines (BREEAM)

1. **Management:** Management policies, building credit points and benchmarks are developed on a case by commissioning and procedural issues.
2. **Health and Wellbeing:** Indoor and external issues affecting health and wellbeing of building occupants. The assessment criteria vary with building type.
3. **Energy:** Operational energy (and CO2 emissions) of the completed development. The energy category is heavily dependent on the expected carbon emissions (including Low Carbon and Renewable Technologies), however it also includes credit points relating to metering and sub-metering.
4. **Transport:** A series of transport and site access related credit points e.g. cyclist facilities, public transport links, deliveries etc.
5. **Water:** Credit points relating to efficient water use of base building and tenant services.
6. **Materials:** Environmental implications of building materials including responsible sourcing and lifecycle impacts prescribed standards are met, the development can pick and choose between additional credit points.
7. **Waste:** Rewards recycling and management of waste products both during construction and once in operation.
8. **Land Use and Ecology:** Credit points to encourage the use of brownfield sites, rehabilitation of contaminated land as well as conservation and enhancement of the site ecology.
9. **Pollution:** Reduction and/or elimination of air, water and light pollution.
10. **Innovation:** Additional credits available by significantly exceeding particular BREEAM requirements, using BREEAM accredited professionals, or being genuinely innovation in approach.



Indicative list of Green Buildings rating system followed in respective countries.

Rating System	Agency	Countries Following it
Asia		
Green Olympic Building Assessment System (GOBAS)	Ministry of Science and Technology (MoST), Qinghua University	China
GRIHA	The Energy Research Institute (TERI)	India
LEED India	India Green Building Council (IGBC)	India
Green Mark	Building and Construction Authority (BCA)	Singapore
Hong Kong Building Environmental Assessment Method (HK-BEAM)	HK BEAM Society, Business Environment Council (BEC)	Hong Kong
Ecology, Energy saving, Waste reduction and Health (EEWH)	Taiwan Green Building Council	Taiwan
Comprehensive Assessment System for Building Environmental Efficiency (CASEBB)	Japan Sustainable Building Consortium (JSBC), The Institute for Building Environment and Energy Conservation	Japan
Green Building Index Rating System (GBI)	GBI Organisation	Malaysia
Building for Ecologically Responsive Design Excellence (BERDE) Program	The Philippine Green Building Council (PHILGBC)	Philippines
GREENSHIP	The Green Building Council of Indonesia	Indonesia
Korea Green Building Certification (KGBC)	The Ministry of the Environment and the Ministry of Land, Transportation and Maritime Affairs (MLTMA)	South Korea
LOTUS Green Building Rating & Classification System	The Vietnam Green Building Council (VGBC)	Vietnam
Europe		
BREEAM	UKGBC	UK
Protocollo ITACA	Federal Association of the Italian Regions	Italy
ESCALE	CSTB	France
DGNB Certification System	The German Sustainable Building Council (DGNB)	Germany
Eco Quantum	IVAM Environmental Research	Netherlands
Papoose	TRIBU	Finland
Eco Effect	Royal Institute of Technology, Stockholm	Sweden
Eko Profiles	The Norwegian Building Research Institute	Norway
Eco Building Total Quality Assessment	Arge TQ	Austria
North America		
LEED	USGBC	USA, Thailand, UAE, Brazil, Sri Lanka, Chile, Israel, South Korea, Mexico, New Zealand, Republic of Panama, Puerto Rico, China, Cambodia, Myanmar
LEED Canada	Canada GBC	Canada
Australia		
Green Star	Green Building Council Australia	Australia
NABERS / ABGR	New South Wales Department of Environment and Climate Change	Australia

Raven Sealing Systems as it applies to LEED and BREEAM:

LEED	BREEAM
<p>LEED® for Commercial Interiors – Version 3</p> <p>ENERGY AND ATMOSPHERE (EA) Prerequisite 2: Minimum Energy Performance Required</p> <p>INDOOR ENVIRONMENT QUALITY IEQ Credit 7.1: Thermal Comfort: Design Points available: 1</p>	<p>BREEAM Gulf</p> <p>HEALTH & WELLBEING Hea 13 – Acoustic performance Point Available: 2</p> <p>ENERGY Ene 1 – Reduction of CO2 emissions Points Available: 15</p> <p>Ene 7 – Cold storage Points Available: 3</p>
<p>LEED® for New Construction & Major Renovations – Version 3</p> <p>ENERGY AND ATMOSPHERE (EA) Prerequisite 2: Minimum Energy Performance Required</p> <p>INDOOR ENVIRONMENT QUALITY IEQ Credit 7.1: Thermal Comfort: Design Points available: 1</p>	<p>BREEAM Issue 3</p> <p>HEALTH & WELLBEING Hea 13 – Acoustic performance Point Available: 2</p> <p>ENERGY Ene 1 – Reduction of CO2 emissions Points Available: 15</p> <p>Ene 7 – Cold storage Points Available: 3</p>

Testing Result on Energy Efficiency

A. Air Permeability Performance Test Result

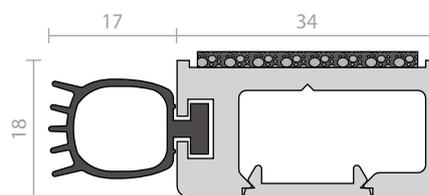
Below are the tests results of Raven RP47Si door frame / perimeter seal, including thermal and air permeability performance as well as acoustic testing after and before installation of Raven door and window sealing products.

Before installation of Raven RP47Si seals, the thermal transfer coefficient was 1.7W/ (m2.K). After installation, it improved to 0.9W/ (m2.K), close to an impressive 50% improvement. These tests were performed through thermal IR imaging, in which the temperatures were measured between the thermal bridges at the bottom of the door and surrounding the handle. The result shows the temperature difference between the measuring areas, where there was a change from over 10C to less than 5C.

$$K = \frac{Q - Q1 - Q2 - Q3}{(t_h - t_c) \times A} \quad q' = \frac{293}{101.3} \times \frac{q_t \cdot P}{T} \quad (2.2)$$

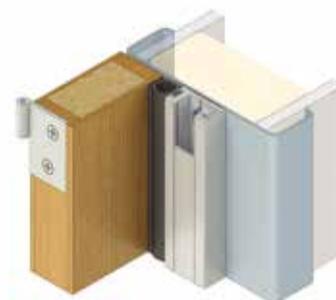
Before installation of RP47Si, the air permeability performance test is as below:

Air permeability performance	Air flow rate per unit join length q_1 (m ³ /(m·h))	Positive pressure	3.39
		Negative pressure	2.69
	Air flow rate per area (m3/(m ² ·h))	Positive pressure	9.27
		Negative pressure	7.35



After installation of RP47Si, the air permeability performance test is as below:

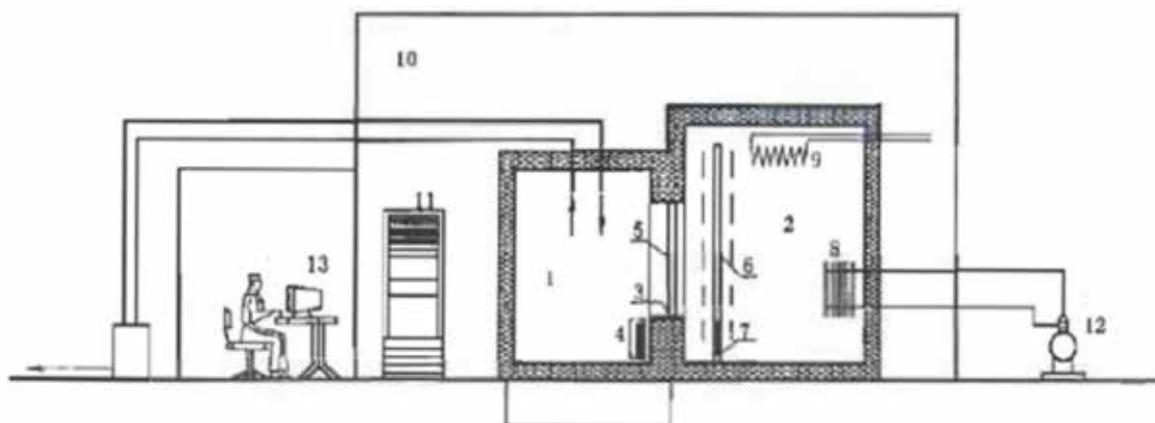
Air permeability performance	Air flow rate per unit join length q_1 (m ³ /(m·h))	Positive pressure	0.11
		Negative pressure	0.27
	Air flow rate per area (m3/(m ² ·h))	Positive pressure	0.29
		Negative pressure	0.74



Testing results of RP47Si:

According to standard GB/T 7106-2008 "Graduation and test methods of air permeability, water proof test, and wind resistance performance test on external window and door":

- Before installation of Raven RP47Si seals, the air permeability performance test reached level 2 under positive pressure and level 3 under negative pressure.
- After installation of Raven RP47Si seals, both positive and negative tests reached level 8, showing substantial improvements in effectively blocking air going through the gaps around the head and jambs of the tested door frame.

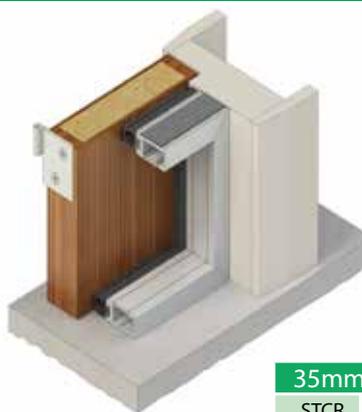


B. Acoustic Performance Test Results

- Before installation of Raven RP47Si, the weighted sound reduction index (Sound Transmission Loss – STC) of tested doors was 18db.
- After installation of Raven RP47Si, the weighted sound reduction (Sound Transmission Loss – STC) improved to 27db.

$$R = L_1 - L_2 + 10 \lg \frac{S}{A}$$

RP47 Si



	35mm Door		44mm Door	
	STCR	wS	TC	Rw
No Door Seals	17	18	15	16
Fully Caulked Door	30	30	33	33
Tested Assembly	30	30	32	32

		Frequency (Hertz) vs STL (dB)																	
		100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
35mm Door(dB)	Hz	20.6	20.9	20.4	26.7	22.2	26.6	24.3	25.2	27.7	28.4	28.8	30	31.6	33.7	35.3	36.8	37.4	37.5
44mm Door(dB)	Hz	21.5	20.5	23.2	26	25.2	27.4	29	29.4	30.5	31	31.6	32.7	34.8	36.5	36.8	37.5	38.6	38.4

C. Energy Simulation and Efficiency Test Results

Simulating Shanghai weather conditions (typical summer and winter conditions), the results were transformed from air permeability into air change rate under 3 categories including a villa, high-rise residential apartment and a hotel:

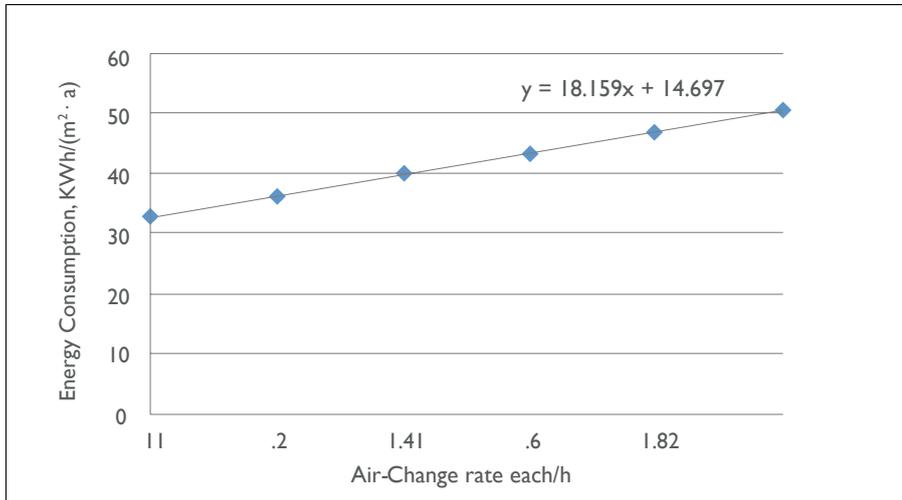
The results show that the air permeability performance for all windows and doors greatly improved under installation of Raven sealing:

- Villa: The total energy consumption of the Villa per unit area reduced by 14.3% from 39.2 kWh (m².a) to 33.62 kWh (m².a)
- High-rise residential buildings: The total energy consumption reduced by 17.2% from 41.05 kWh (m².a) to 33.97 kWh (m².a)
- Hotel: The total energy consumption reduced by 15.6% from 44.24 kWh (m².a) to 37.35 kWh (m².a)

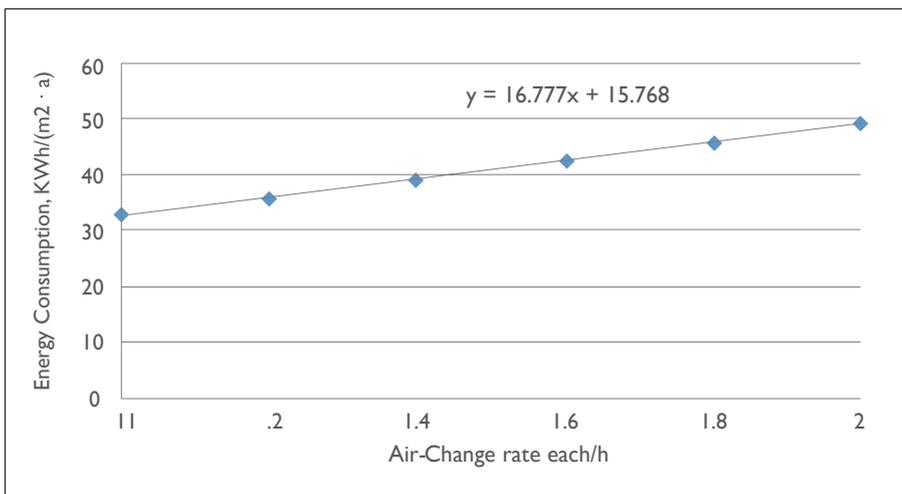
World renowned Beijing TsingHua University developed DeST to evaluate energy consumption for different building types in terms of air permeability and calculation of the air change rate. (Before installation and after installation of RP47Si). Air change rates are based on Shanghai and China national standards on energy efficiency design.

Air change rate= unit area air permeability x total area of windows and door/total room volume.

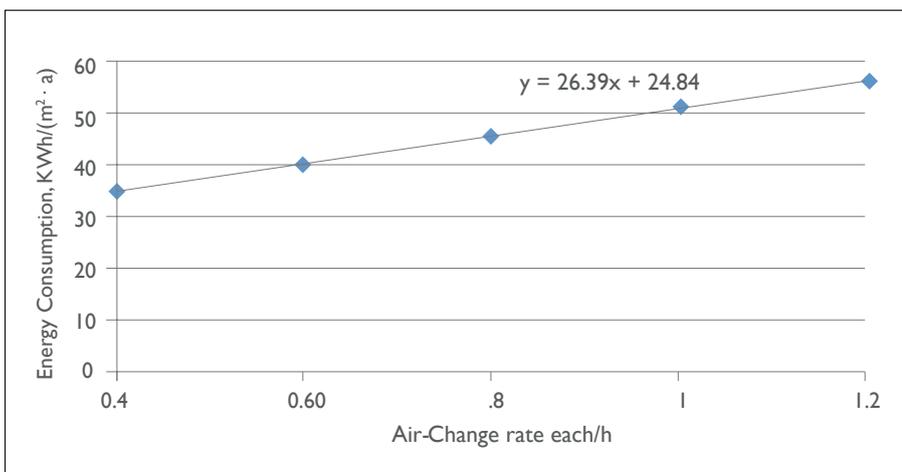




Villa: Total Energy Consumption



High Rise Residential Building



Hotel

Raven sealing systems on windows and doors provide substantial improvements and solutions for energy efficiency, including saving energy cost, acoustic barriers and weatherproofing. Economical pricing and easy installation make Raven sealing systems a great investment for any commercial and residential building today.



Raven Seals Cut Energy Use by 50% !

David Saunders, architect of S2 Design designed and built his private home in metropolitan Melbourne, providing a best-practice example of environmentally aware and sustainable living.

With a focus on reducing energy consumption, Raven door and window seals were installed throughout the home to eliminate the loss of energy through gaps in doors and windows and to provide acoustic, weather and vermin protection.

David's home energy consumption is automatically monitored allowing David to see exactly how much energy the home is using at any time or over any period.

The energy consumption used to heat and cool the home was immediately reduced by 50% with the installation of Raven Door & Window seals that equated to a cost saving of over \$1,200 per year!

Raven Door & Window seals are a low cost and effective solution to an expensive problem; David found, the fitting of Raven seals to his home will pay for themselves in less than 2 years.



Verified Product Certificate

This is to confirm that the following product has been verified as meeting the Ecospecifier Verified Product Standard and is approved for inclusion on ecospecifier.com.au.

COMPANY **Raven Products**
 PRODUCT **Door and Window Sealing Systems**
 VALID TO **19/05/2019**

Ecospecifier's role is:

- ✓ To provide a third party, independent and unbiased assessment of information provided by manufacturers and other sources.
- ✓ To assess products using Australian and International Standards, independent test data, third party research and expert opinion.
- ✓ To determine if products are eco and health preferable based on the premise that:
 - they exhibit one or more eco or health preferable characteristic compared to other products in their category, or
 - they are a member of a product category that is in itself an eco or health preferred category; and
 - they do not contain 'significant' ecological or health damaging content.

Certified by Ecospecifier Pty Ltd per

David Baggs | Technical Director
 Registered Architect, FRJA, ABSA, Green Star AP, LEEDAP

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