

Performance based testing versus Energy ratings



Ecological footprint of a house



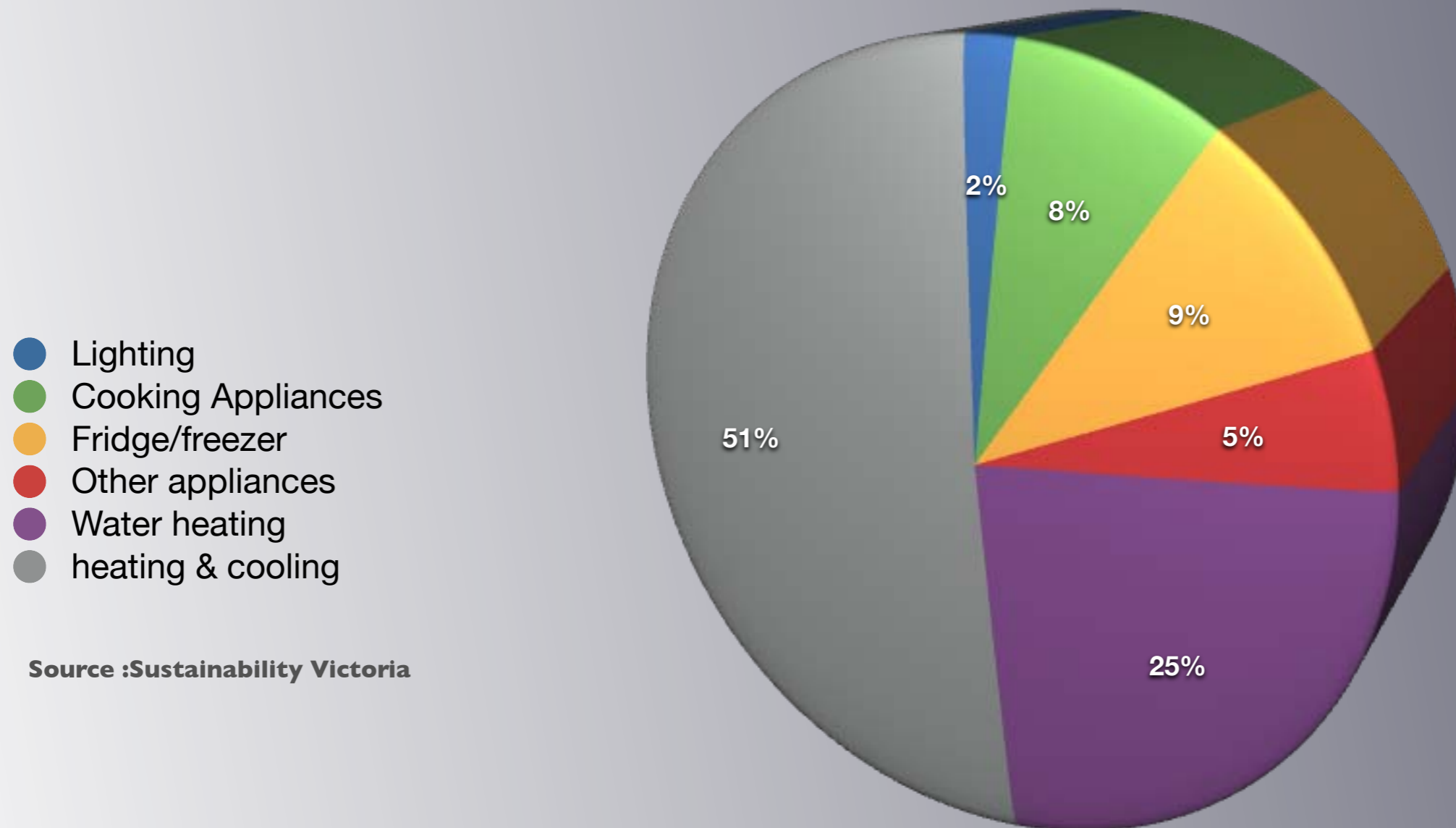
- Construction & Maintenance
- Natural Gas
- Electricity

Grant, Milne, Wackernagel 2005. "The Ecological Footprint of the Aurora Residential Development." ALCAS Fourth Australian Conference on Life Cycle Assessment.

CO2 Emissions from each Victorian Home



Energy consumption of each Victorian Home



Source :Sustainability Victoria

Note: In NSW heating & cooling accounts for 38% of energy consumption

CO₂ Emissions from each Victorian Home for heating and cooling (2010)





37,300
balloons
appliances

39,150
balloons
hot water

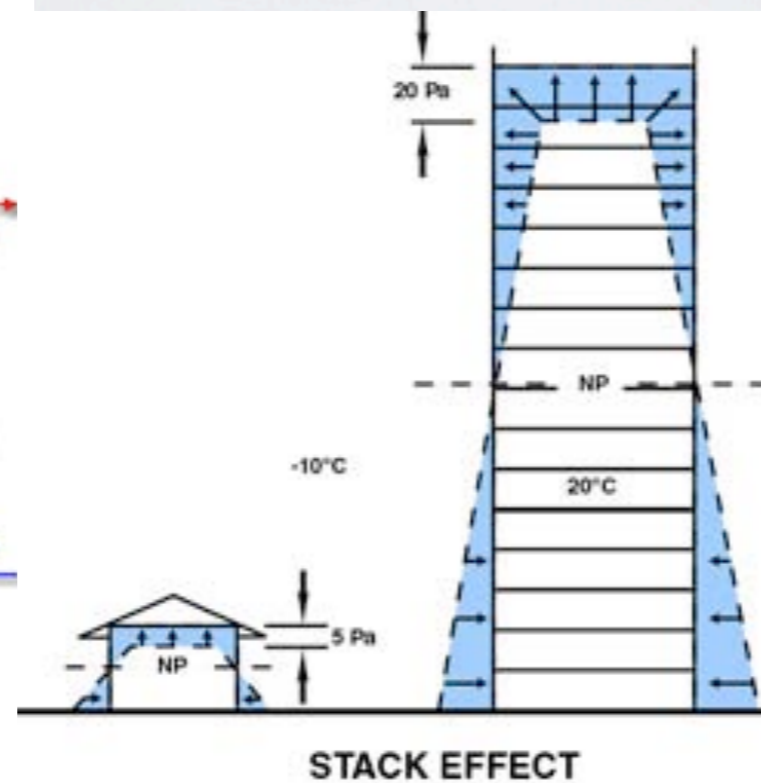
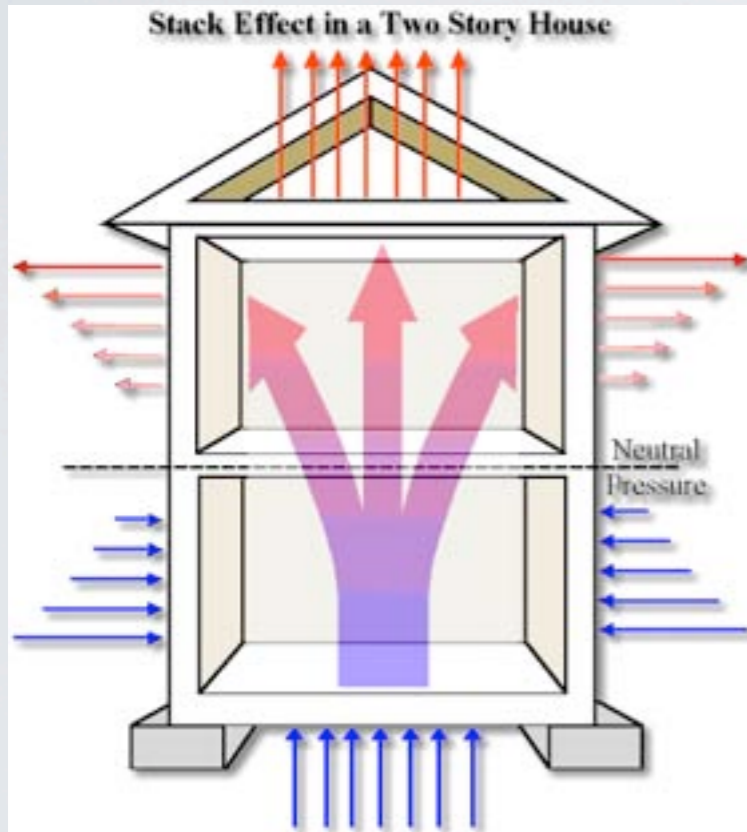
The average Victorian house produces 4.7 tonnes of CO₂ through heating & cooling

What causes a leaking building envelope?

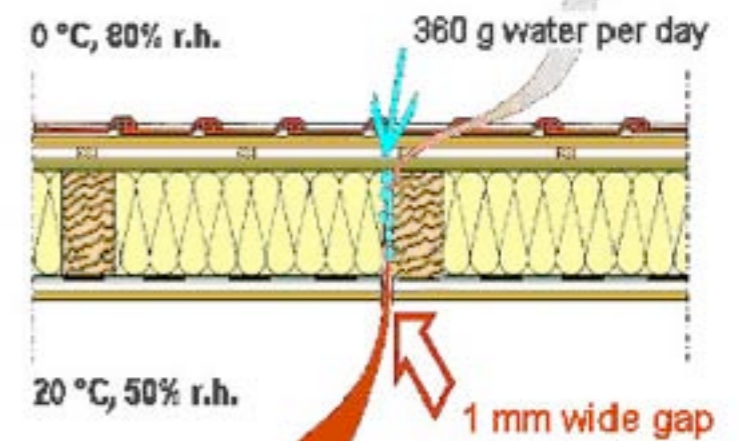
Answer:

A: holes & gaps

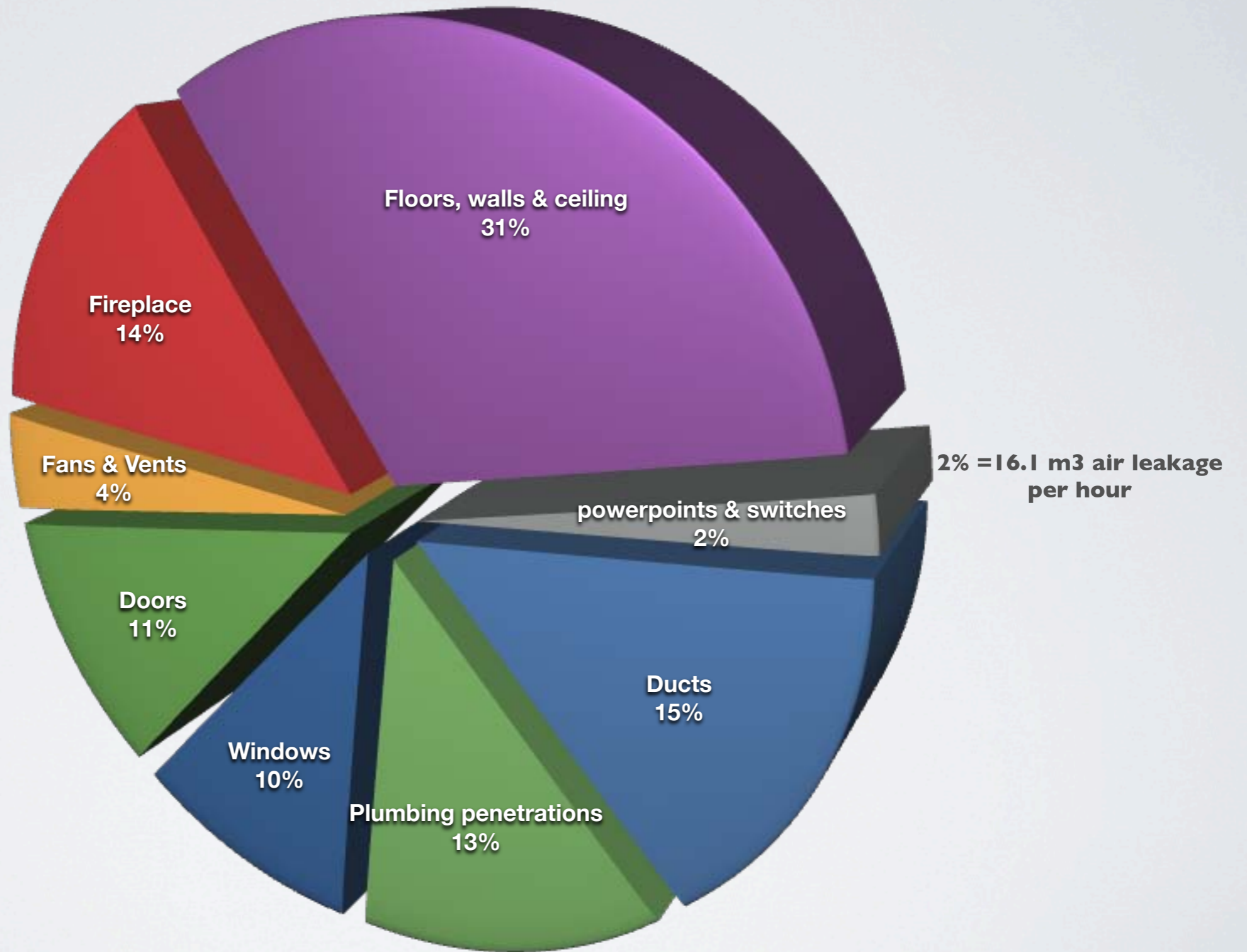
B: air pressure



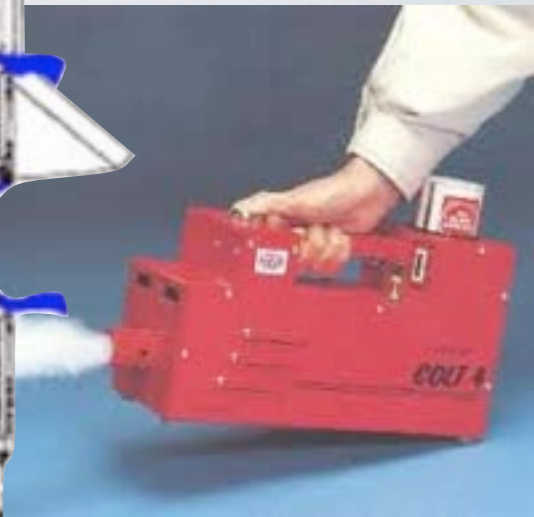
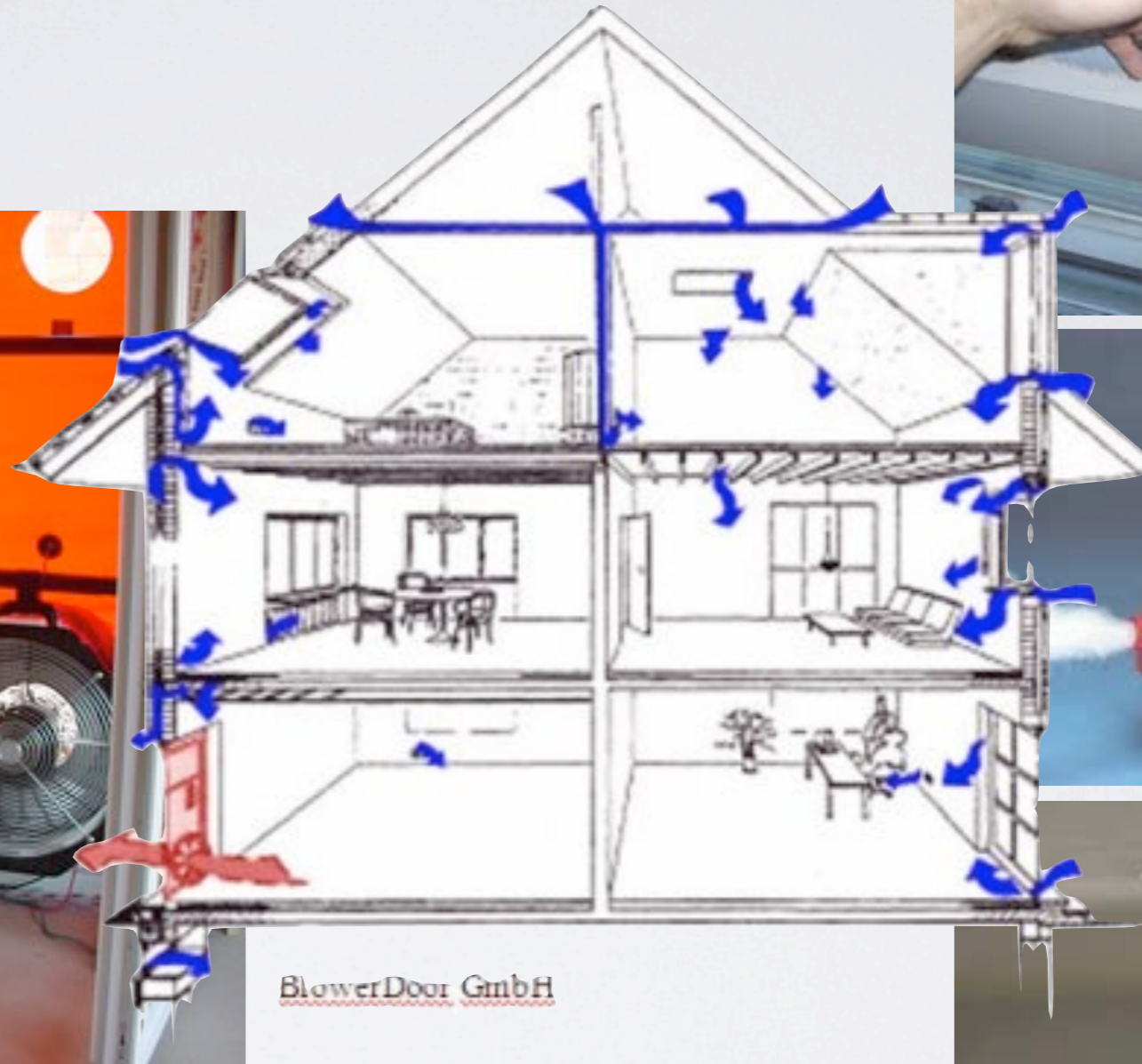
The problem is a gap with airflow from inside out



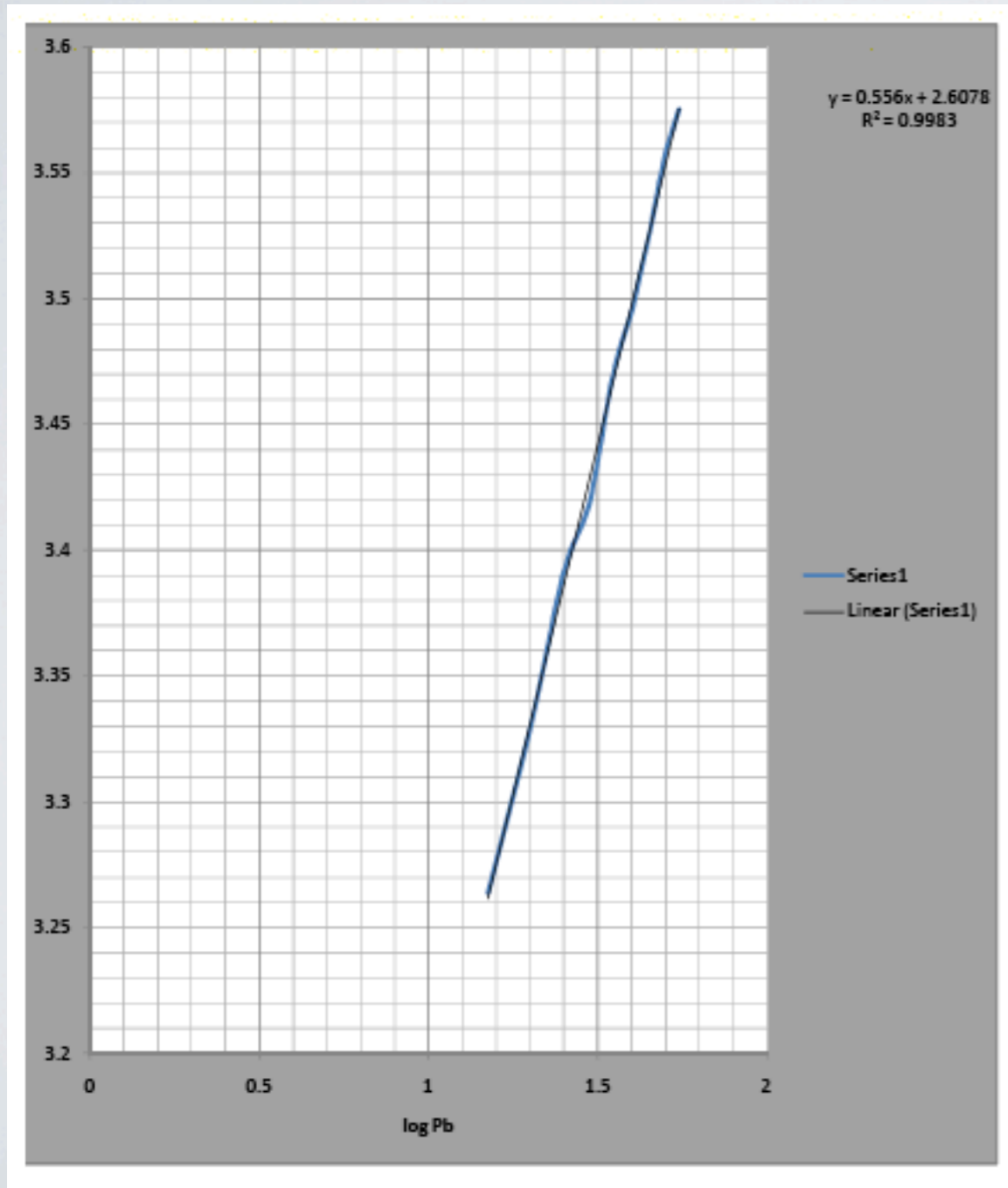
Air leakage in a home



Assessing air leakage & energy loss using the fan pressure kit as a diagnostic tool



Assessing air leakage & energy loss using the fan pressure kit as a diagnostic tool

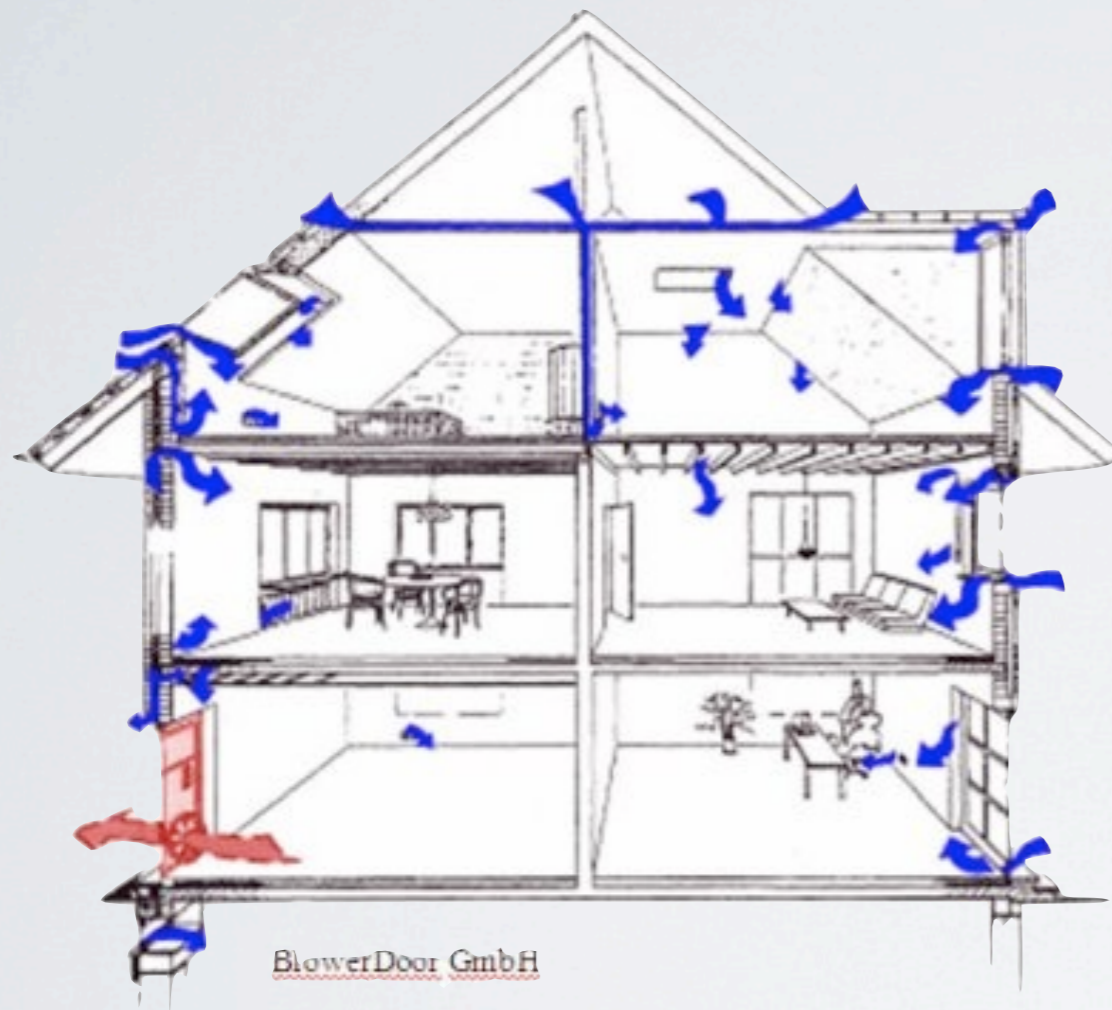


First Objective:

Determine the air leakage rate, or Air Change per Hour (ACH) rate of the building.

- The air leakage/ACH of a building is expressed in ACH50. This is the volume of air leaking from the building at a pressure difference of 50 Pascals between inside and outside.
- Internationally, airtightness testing of buildings is always measured at 50 Pascals.
- Australian developed software can calculate the ACH50 results back to ambient air pressure, while taking into account the outside windspeed, location of dwelling and climate zone.

Assessing air leakage & energy loss using the fan pressure kit as a diagnostic tool



Second Objective:

Locate all air leaks in the building envelope.

Creating a pressure difference of 50 Pascals between inside and outside exposes all air leaks in the building envelope.

- Ceiling: downlights/exhaust fans/attic access
- Walls: windows/doors/wall vents/plumbing
- Floor: timber/skirting

Assessing air leakage & energy loss using the fan pressure kit as a diagnostic tool

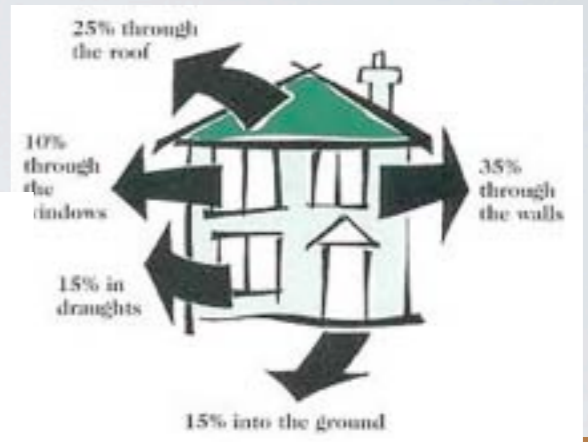
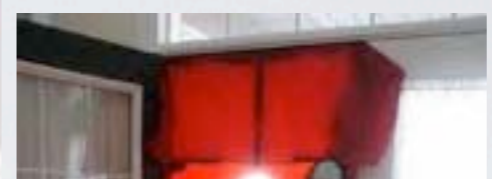
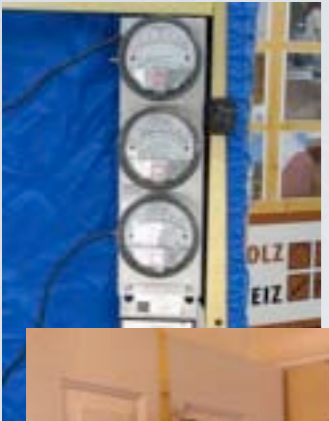


Third Objective:

Determine the final air leakage rate, or Air Change per Hour (ACH) rate of the building, after completion of any remedial work.

- Maximize energy efficiency of the building
- Ensure good indoor air quality
- Ensure adequate combustion air where needed

Performance based testing with a fan pressure kit: A well established practise of energy efficiency assessment in many countries for over 30 years



- Canada
- USA
- England*
- Scotland*
- Ireland
- Denmark
- Sweden
- Norway
- Germany
- Austria
- Switzerland
- New Zealand
- Australia

Office of the Deputy Prime Minister
Leading sustainable communities

The Building Regulations 2000

Conservation of fuel and power

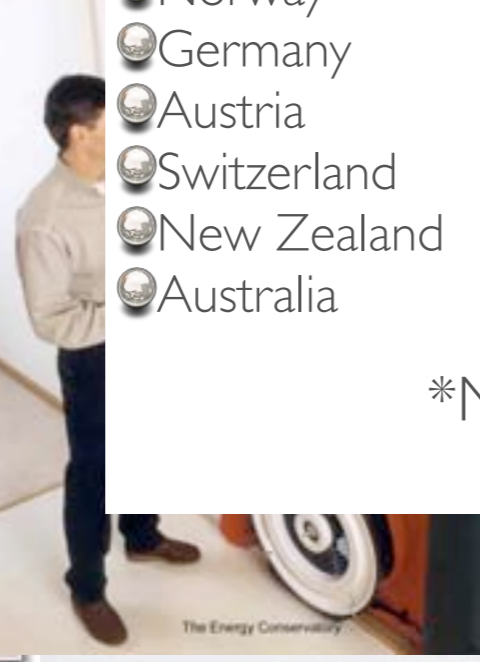
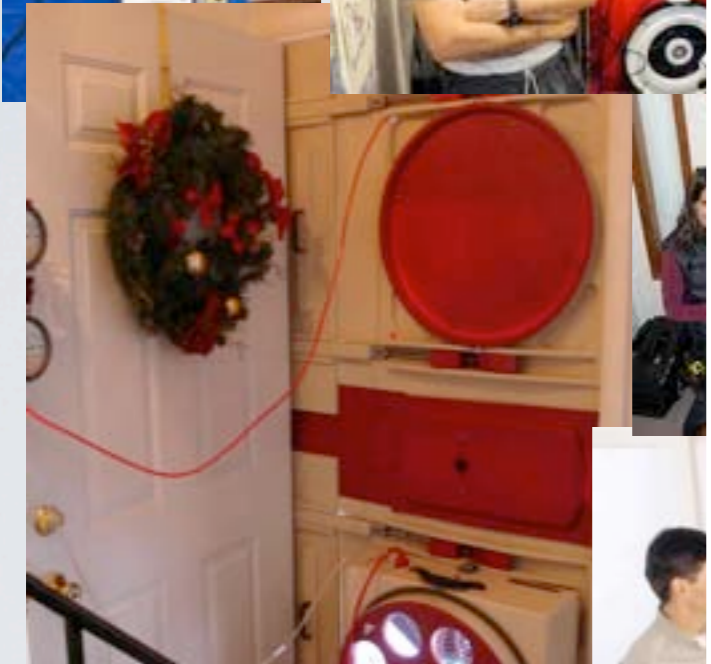
L1A

APPROVED DOCUMENT

L1A Conservation of fuel and power in new dwellings

Coming into effect 6 April 2006

2006 edition



*Mandatory since 2006

The ABC of a sustainable home:

$$a^2 + b^2 = c^2$$

a²

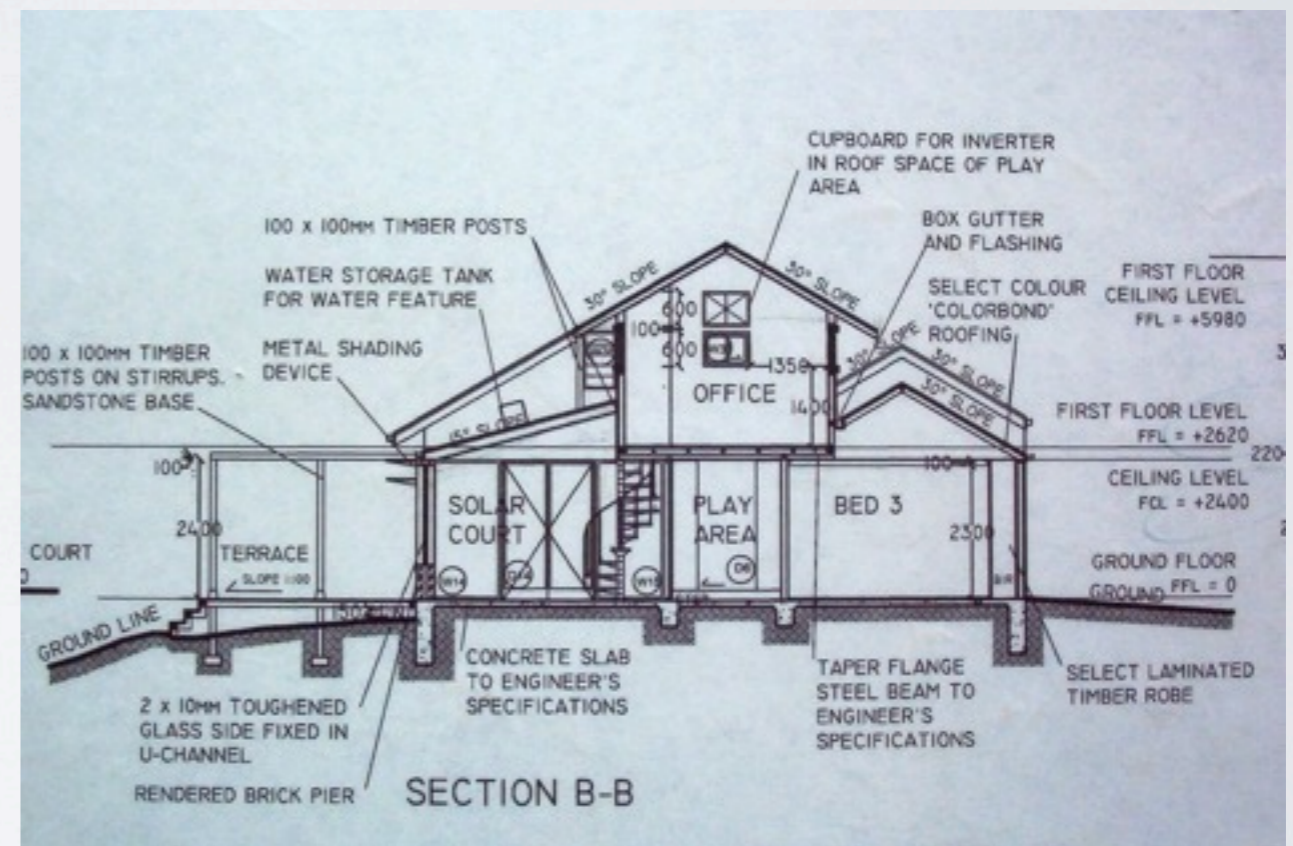
Sustainable Design

FirstRate Software:

- Orientation
- Shading
- Cross ventilation
- Insulation levels
- Glazing
- Thermal mass

Missing:

Specifications for insulating & sealing building envelope



b²

Sustainable Construction

Inspected during construction:

- Foundation works
- Structural integrity
- Safety
- Trade compliances:
- Plumbing
- Electrical

Missing:

The sustainable element:
Quality control for insulating & sealing
building envelope



$$a^2 + b^2 = c^2$$

Sustainable Design + Sustainable Construction = True Energy Efficiency Performance

a^2

Expand on sustainable design elements:

FirstRate Software:

- More refined 'Seal gaps & cracks' section.
- Possible options to improve point score

Building Regulations:

- More detailed insulation installation instructions.
- Introduce 'Sealing Building Envelope' section.

6²

Introduce sustainability in construction process:

Include insulation and sealing details on drawings

Include building envelope inspection:

- Insulation placement
- Sealing of building envelope

Subject each home to performance based test

- Same benchmark for all builders and house designs
- Guaranteed 'real life' energy savings

e²

True energy efficiency

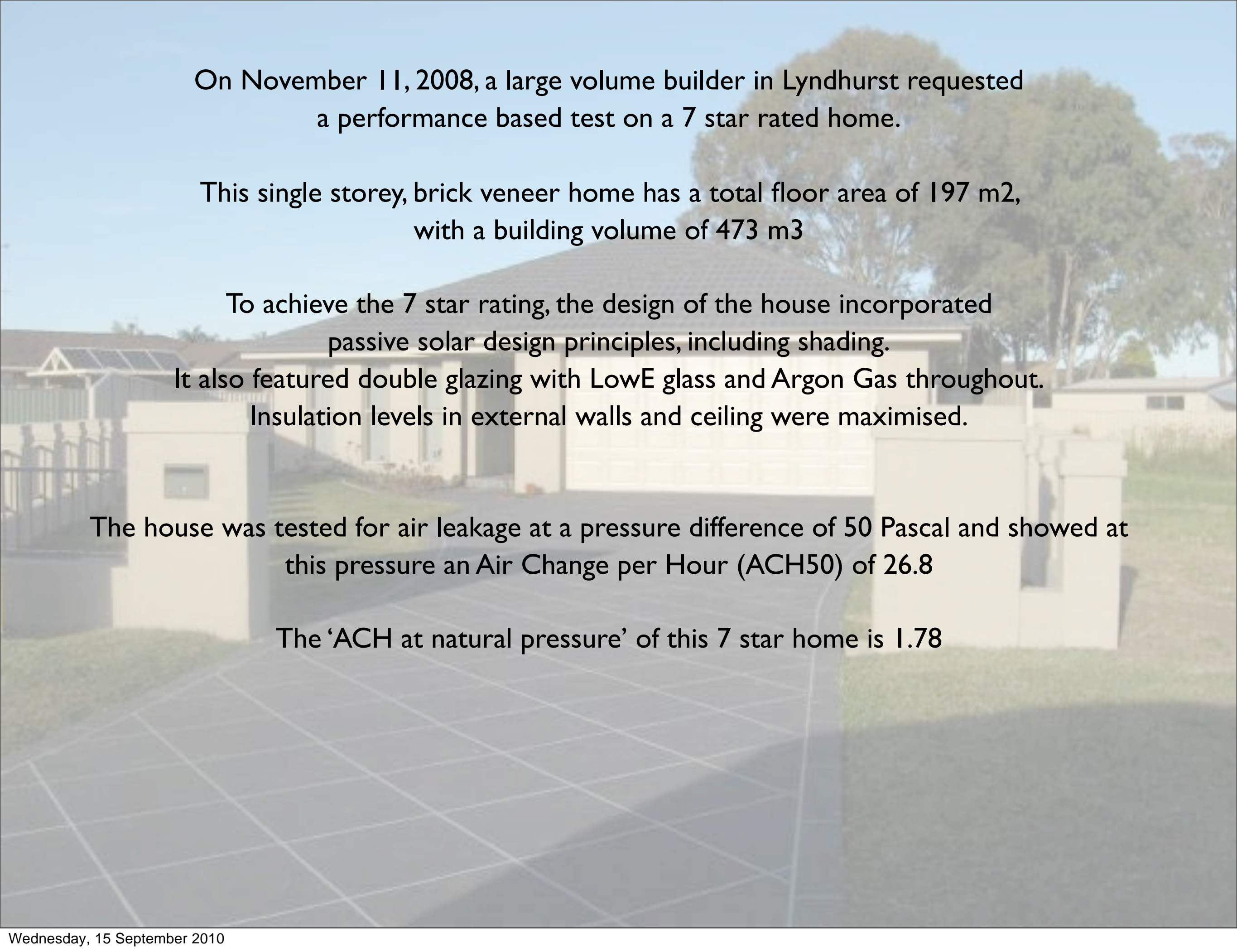
- Easily achievable for new and existing homes
- Low cost implementation
- Real CO₂ reductions
- Lower energy bills & higher comfort levels
- Quality assurance for builder & home owner
- Excellent return on investment

Case study of 7 star rated project home

Performance based test with fan pressure kit
carried out by
Air Barrier Technologies

Test location: Lyndhurst, Victoria

Test date: November 11, 2008



On November 11, 2008, a large volume builder in Lyndhurst requested a performance based test on a 7 star rated home.

This single storey, brick veneer home has a total floor area of 197 m², with a building volume of 473 m³

To achieve the 7 star rating, the design of the house incorporated passive solar design principles, including shading.

It also featured double glazing with LowE glass and Argon Gas throughout. Insulation levels in external walls and ceiling were maximised.

The house was tested for air leakage at a pressure difference of 50 Pascal and showed at this pressure an Air Change per Hour (ACH50) of 26.8

The 'ACH at natural pressure' of this 7 star home is 1.78

Ideally, the 'ACH at natural' for this house should have been 0.35.

According to the Accurate software this 7 star rated home should use no more than 83 MJ/M2/year for heating and cooling.

However, because of its ACH of 1.35, this home uses 293 MJ/M2/year and its **real** energy efficiency performance is that of a 2.5 to 3 star rated home.

Accurate star rating and MJ/m2/year of energy consumption :

Climate region	Location	Star rating																			
		0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
19	Charleville	525	434	359	298	249	209	177	151	131	114	100	87	76	66	56	45	35	26	17	9
20	Wagga	804	663	548	455	380	321	273	235	204	178	156	137	118	100	82	64	47	30	15	3
21	Melbourne	676	559	462	384	321	271	230	198	171	149	131	114	98	83	68	54	39	25	13	2
22	East Sale	791	653	541	449	376	317	269	231	201	175	153	133	115	98	80	63	46	30	15	2
23	Launceston	895	740	615	513	431	366	314	272	237	208	183	160	138	117	95	74	53	33	15	1
24	Canberra	957	792	657	547	458	387	330	284	247	216	189	165	142	120	99	77	56	35	17	2
25	Cabramurra	1666	1404	1188	1012	870	753	658	580	513	454	401	352	303	255	208	160	114	71	33	1
26	Hobart	876	723	598	498	417	354	303	262	229	202	177	155	134	113	92	71	51	31	14	0
27	Mildura	660	541	444	367	305	256	218	187	163	143	126	110	96	81	67	53	38	25	13	3
28	Richmond	555	450	365	298	245	203	171	146	127	112	99	87	77	66	55	44	34	23	14	7
29	Weipa	830	743	671	611	560	517	479	445	414	384	355	326	296	266	237	207	179	153	130	111
30	Wyndham	1229	1071	943	839	754	685	626	576	530	488	447	406	364	321	278	234	192	154	121	95

This 7 star rated home is producing 2,152 kg of CO₂e more than it should.

The leakage was caused by:

- 3 single cavity sliders
- 1 double cavity slider
- 1 exhaust fan without draft stopper
- gas fireplace flue and vents
- 49 downlights
- 1 evaporative cooler without functioning damper
- a 20 mm gap at door to garage
- ineffective brush seals at front door
- Leaking sliding doors to outside

The builder estimated the additional cost to get from 5 to 7 stars at \$5,000.00

The added cost to seal the leaks during construction was estimated at \$600.00

Potential saving for the builder: \$4,400.00

Potential saving for the homeowner: \$315 per year

Potential saving for the environment: 2,152 kg of CO₂e



Questions?

