



**Light  
House**  
Architecture  
& Science

**Q&A**





# How do you compare value?

It's hard to know where to start when planning your new home or renovation.

Services vary greatly between builders and design professionals, and you may feel that you need to be an expert yourself to understand what you should be asking for.

We compiled this Q&A to introduce our own approach, provide some background information, and highlight some areas to consider when researching your options.

**The big picture**

**Quantifiable results**

**Tried + tested**

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**Industry leadership**

**A well informed process**





# The big picture

**Q**

**What are the most important design elements in your homes?**

**A**

While developing our modular design approach we held workshops with locals from the Canberra region. During this process, community members emphasised four key elements: light, warmth, social spaces and connection to the outdoors. These four elements have become a mantra for every home we design. In addition, as architects, we use a considered approach to resolve the function and detail of each design so that your home has no 'awkward' spaces and 'feels right'. All of these things ensure that your home is highly liveable, beautiful, and enjoyable.

**Q**

**What are the key principles you employ to achieve an energy efficient home?**

**A**

a. Orientation

Understanding the sun's position is the key to designing energy efficient houses in our climate. A Light House home is a light-filled home that harnesses the power of the sun over winter and protects you from the sun's heat in summer.

b. Insulation

Appropriate levels of properly installed insulation are critical for creating a comfortable home. Just 5% gaps in insulation can reduce its effectiveness by 50%.

c. Minimising air leakage while allowing for good ventilation

A highly insulated home is no good if inside air is constantly escaping through gaps in the building envelope. Our design approach and involvement during construction reduces the opportunities for air leakage.

For example, we put few holes in the ceiling, avoid using unsealed downlights and carefully seal junctions and penetrations. Random, uncontrolled and expensive air leakage should not be confused with ventilation.

**A** Ventilation is planned during the design phase, controlled by you and very important for a comfortable home.

... These three approaches only work effectively when used correctly, and used together. For more information, see our journal article: *10 key principles for new houses in the Canberra climate*

**Q** **What makes a home 'healthy'?**

**A** A home affects the health of its residents in so many ways.

a. Psychologically. Natural light and connection to the outdoors are proven to be critical to human psychological health.

b. Socially. A home that functions well and has excellent communal spaces, as well as places to retreat to, will encourage healthy happy families and social gatherings.

c. Physically. Good air quality, accessibility, hygiene, and quiet rooms to sleep in are all obvious factors for a healthy home.

We have designed homes for people with physical disabilities, intellectual disabilities, allergies, people recovering from traumatic/stressful periods in their life, and in preparation for end of life.

**Q** **How much will my home cost?**

**A** Asking how much a three bedroom home will cost is much like asking how much a four door car costs - depending on the size, features, and finishes, the cost can vary greatly. However - we know this answer isn't very useful, so we'll attempt to give you a rough indication from our past projects.

Based on our completed projects to date, our typical family homes (two adults, two kids), are usually completed for a total construction contract price of \$440,000-\$600,000, including GST. (Refer to the question on '*inclusions*' to clarify what this covers). The size of these homes typically varies from 145m<sup>2</sup> - 190m<sup>2</sup> (excluding garage or carport).

**A** Our smaller homes (for retirees, first home buyers and unconventional households) are typically completed for a total construction contract price of \$300,000-\$440,000, including GST. The size of these homes usually varies from 100m<sup>2</sup> - 145m<sup>2</sup> (excluding garage or carport).

**Q** **Will the house be tailored to the Canberra climate?**

**A** Yes. Just like we dress for the temperature, set up a picnic out of the wind, or pitch a tent in the afternoon shade, it is silly to ignore these same elements when it comes to building. Canberra has a continental climate, with dry air, warm to hot summers, and cold winters. We experience cool westerly winds in winter and hot summer winds from the east through to the North West. The average maximum temperature in January is 28°C, but our dry air and elevation often brings cool evenings (perfect for purging built up heat and cooling thermal mass at night). The average maximum temperature in July is just 11°C, however, our crisp winter air leads to many clear sunny winter days (wonderful for naturally heating a home).

To invest a large amount of money on a 'one size fits all' house is a poor investment. Our experience, research, and testing, is tailored to the Canberra region and maximises the performance of your home in relation to heating, cooling, water management, moisture control, ventilation, daylight and shading, and longevity. Our interdisciplinary approach means that our science team is working closely with our architects at every stages of development during your project. Available technologies take the guess work out of passive design, and allow us to optimise your home down to every window and eave location and size.



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Quantifiable results





# Quantifiable results

**Q** What EER do your homes achieve?

**A** All new Canberra house plans must achieve an EER of at least 6 stars. We aim for 8. An 8 star design requires 53% less energy per square metre for heating and cooling compared to a 6 star design. With good design, reaching 7+ stars is not difficult or expensive in our climate. As energy prices continue to rise, reducing your home's energy needs is no longer just an ethical choice, but also a smart investment decision. In the future, well designed, efficient homes will command premium prices. Light House has extensive experience in the most affordable ways to achieve high performance homes.

We believe that an EER of 8 is the 'sweet spot' because our research indicates that the added cost of pushing for a higher rating (in the Canberra climate) will likely outweigh the costs of a solar system sized to offset any energy your 8 star home uses.

For more information on how the EER software works, see our journal article: *How does EER software work?*

**Q** Do you test the building's thermal performance 'as built'?

**A** Yes. Current Australian housing legislation only requires that the house design achieves an EER of 6 stars. Unfortunately, construction quality and last minute changes can significantly affect the actual performance of the home. Our in-house scientists can test your completed home using thermal imaging and fan depressurisation to ensure the building envelope is thoroughly insulated and properly sealed so that the house will live up to its energy efficiency potential. It's just as important to us, as it is to you, that we are producing the high quality buildings that we say we are.

## **Q** What is your approach to air leakage in your homes?

**A** In North America and Europe there are legislated standards for air leakage, but it's a relatively new concept in Australia. The average Canberra home replaces its entire volume in air at least once every hour – but it doesn't take much to reduce this significantly. We employ simple approaches to achieve significant results, such as limiting holes in the building envelope such as regular downlights, using radiant heat systems instead of ducted, or including square set cornices. Working closely with our builders is also critical to ensuring all gaps are caulked, taped or filled.

At Light House, we use a blower door to test the air leakage on every house we complete. Most Canberra homes would rate at about 15-30 air changes per hour at @50 pascal testing conditions. We aim for a rating of 5-8. Below 3 Ach you need to install mechanical ventilation systems to ensure indoor air quality. The German Passivhaus standard is 0.6ACH or less! Our opinion is that great results can be achieved without going to this extreme level of airtightness, and save on the additional of expensive 'building wraps' and mechanical ventilation systems.

Addressing air leakage in homes is the single most cost effective way to reduce energy consumption, yet it is still a relatively new concept in Australia. Addressing air leakage alone can reduce a home's power bills and carbon emissions by up to 25%.

For further reading, see *this* 2012 ACT Government low income housing energy efficiency case study project that our director, Jenny Edwards, consulted on.

## **Q** What is your approach to 'resale value'?

**A** We believe firmly that the Australian market is desperate for options beyond the 'McMansion', and have observed recent trends to support this. Only two of our homes have ever been sold, and have both achieved sales of 16% above equivalent market value. Instead of being concerned about double garages and extra bathrooms, we would encourage you to consider the following:

a. Energy Efficient Houses are increasing in demand. Read more *here* about the increasing demand for clever, energy efficient housing.

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b. Vibrant and sustainable suburbs are about diverse housing stock, not a glut of 'cookie-cutter' homes. We've worked hard to map the options for diverse housing typologies in the Canberra context. See our 'pick-a-path' map *here*.

c. If you build a house for you, not only will you benefit more from your investment, but it is very likely that there is someone else out there that would also highly value the same features as you; such as designing for accessibility in old age, including a 'airbnb' room, or leaving lots of garden space for a large veggie patch.



**Contents**

**Tried + tested**





# Tried + tested

## **Q** What insulation do you use and where?

- A**
- > R5 Bradford batts to ceilings
  - > R2.5 Bradford batts to external walls (including adjoining garage if present)
  - > R2.5 Bradford batts between levels (if there is a second storey)
  - > R1.5 Bradford batts to internal walls
  - > R1 polystyrene to the underside and vertical edge of the concrete slab
  - > We also avoid 'thermal bridging' such as steel beams or adjoining slabs to the house

A thoroughly insulated home will keep you cosy in winter and cool in summer.

## **Q** What kind of windows will you install?

**A** Windows are essentially big holes in your insulated walls and can greatly compromise the thermal performance of your home. We don't include single glazed windows as we believe they are a poor choice for homes in our climate. But beyond just double glazing, we also strongly suggest that clients consider a frame type other than straight aluminium which is highly conductive and tends to trigger condensation. The Australian window industry is fast changing, and we are constantly researching the best options available in composite aluminium/PVC frame, full PVC frames, and timber frames, and will discuss the best options available to you at the time. We will help you with these decisions using thermal performance modelling of your particular design so that you can weigh the cost against the thermal benefit. We also coach you through window operations, clever fly screen solutions, and 'low-e' coatings that further improve the performance of your windows.

**Q****What considerations do you put in to window location?****A**

Poor window location can drastically reduce the quality of a home. This is why even in our modular homes, the location and size of windows is thoroughly customised for each site, orientation, and design. We consider the following:

a. Passive design. Windows must be located to maximise sunshine coming in during winter, but avoid sun strike during summer.

b. Balancing window size. Vast areas of glass (even double glazing) will greatly reduce the energy efficiency of your home. Rather than designing big walls of glass, we are very critical of placing appropriately sized windows to capture views and light, and connect you to the outdoors to create a sense of a light filled, open home that relates to your garden.

c. Cross ventilation. We aim to create two sources of light in every room, and therefore encourage cross ventilation through all spaces in the house.

d. Location and purpose. In recent years it has become a trend to use windows purely as a fashion statement at the front of the house, but those three vertical windows at the front are not cost effective, thermally effective, or view effective. We consider the use of each room and the available view to create beautiful spaces that are a pleasure to be in.

**Q****Do you consider the embodied energy of materials?****A**

We believe sustainable material selection is about more than just embodied energy. While we do consider embodied energy, we also consider a material's effectiveness, suitability, longevity, ability to be recycled/salvaged, and cost and aesthetics. Cost and aesthetics are also important aspects when it comes to building energy efficient homes; a cost effective solution is a more widely available solution, and a beautiful solution is one that will be respected, cared for and maintained for a longer lifetime.

*This link* provides more data on the impacts of embodied energy.



**Do you favour gas or electrical appliances, heating, and hot water?**



We strongly encourage clients to switch to an all electric household to avoid significant yearly gas connection fees, and increasing gas prices. By going 'all electric' you have the capability to install a solar PV system and generate your own renewable electricity. While many people feel uncomfortable saying goodbye to their gas cooktop, our clients who have bravely made the switch to induction say they would never go back.



**What kind of heating and cooling system will you install in our home?**



Light House homes require minimal heating over winter and little to no active cooling in summer. Our standard approach is to include a few electric panel heaters, and ceiling fans, to the main living area(s), as well as under-tile heating to the bathroom(s). We will simulate the thermal performance of your home's exact design, orientation and construction and discuss additions or reductions to these requirements.



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**The devil in the details**





# The devil in the details

**Q** How do you protect the house against termites?

**A** We use a physical barrier system called Termimesh. We believe that an impregnable physical barrier is a better solution than relying on chemical treatments. Its effectiveness is guaranteed for at least 10 years, while chemical solutions may start to lose effectiveness in as little as three years.

**Q** Do you use low VOC paints and finishes?

**A** Yes. VOC stands for volatile organic compounds. Studies have shown that VOCs can have compounding long-term health effects. While VOCs can be found in many places in a home, one of the most effective ways to significantly reduce them is to use low VOC paints and finishes.

**Q** Do you insulate the underside and the vertical edge of the concrete slab?

**A** Yes. The slab of the house is part of the 'building envelope' just like the walls or roof, and in Canberra's climate it is important to insulate it to maximise thermal efficiency in the during winter. A concrete slab is an excellent source of 'thermal mass'. Thermal mass refers to a material's capacity to store and radiate heat such as concrete.

Our homes are designed so that in winter, the sun floods in and hits the slab warming it during the day, and during the evening it re-radiates this heat through the house. Insulation ensures this heat is not lost to the cool ground below. In summer, we shade adequately so no sun hits the slab. At night you open all the windows, cool the slab down, and then during the following day the slab can absorb some of the

**A** heat from the air in the house and essentially help reduce this inside temperature.

••• Insulation insures heat doesn't seep in the sides from the outside air. Because Canberra is primarily a 'heating load climate' it is highly beneficial to insulate the slab – often contributing a whole star to your EER rating in a sensibly oriented home. Insulating the slab, particularly the vertical edge, is not a common practice among traditional builders. We use extruded polystyrene to insulate below the slab and along its edge. We believe every part of your home should work hard to make it comfortable and healthy.

**Q** **Do you use MDF skirtings, architraves and trimmings?**

**A** No. We never specify MDF and instead nominate pine. MDF is often bonded using formaldehyde resins, creating a dangerous dust for tradesmen, and may leach formaldehyde into the air of the home. Formaldehyde has been classified as a known human carcinogen.

**Q** **What method of moisture/condensation control do you use?**

**A** As housing energy ratings have improved and the use of insulation has increased, moisture control has become an important issue. We install vapour-permeable membranes in the roof and walls rather than foil sarking. When adequate levels of bulk insulation are installed, reflective foil sarkings offer little thermal benefit and their impermeability can create condensation problems within wall and roof spaces in cold winter climates like Canberra's. This condensation can lead to mould growth in your walls and cause serious structural degradation.

To reduce the chances of warm moist air entering the walls and roof we ensure that the internal building envelope is well sealed and that exhaust fans are installed in areas generating lots of moisture. If water vapour does get into the walls or roof it

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can escape through the vapour-permeable membrane, preventing any moisture damage to the structure.

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Check out an interview with our director, Jenny Edwards, about mould in homes *here*.



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**Industry leadership**





# Industry leadership

**Q** Do you use the services of a registered architect, or a draftsman?

**A** Our lead architect, Sarah Lebner, is a registered architect, and is supported by Jeremy Wells, who is also fully registered. All other design staff are either working towards their final stages of registration, or undertaking their Masters of Architecture at University. In addition, we maintain a network of 'mentoring architects' – a small group of local senior architects that we regularly collaborate with to further our own learning and development.

To become registered an architect must complete five years of university education followed by at least two years on-the-job experience, followed by a log book, rigorous exam, and interview. Registration is governed against a national standard and is achieved by proof of experience against specific competencies. Architects are also held to a professional code of conduct. Currently there is no governing standard for someone who describes themselves as a building designer or draftsman.

**Q** What are your firm's scientific qualifications?

**A** Director, Jenny Edwards, has a Masters degree in science and is an ACT licensed Building Energy Efficiency Assessor. She has been conducting theoretical building-envelope testing using thermal performance simulation software (FirstRate and BERSPro), and doing physical building-envelope testing, for air leakage and insulation integrity, using the fan depressurisation method (blower door) and thermal imaging, since 2009.

Jenny has used her science training in a variety of roles: from research and education to public relations and policy. She began her research career in a Cooperative Research Centre based at CSIRO and ANU in the early 90s and later worked in the innovation policy section of the federal government. In 2008 Jenny founded 'Energy Imaging' – the first Australian business to combine the use of air leakage testing and

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thermal imaging in the local construction industry (following training in NZ and the US).

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Jenny has advised and consulted to the government on several projects such as the ACT Legislative Assembly Green House Gas Reductions Enquiry and the ACT Government Outreach Energy and Water Efficiency Program. She currently sits on the Residential Technical Advisory Group for the Building Code Energy Performance Trajectory Project. This project is a partnership between the Australian Sustainable Built Environment Council (ASBEC) and ClimateWorks Australia that aims to improve the energy efficiency standards of the National Construction Code.

We encourage you to appreciate that energy efficiency, and closely-related condensation management, issues are a relatively new considerations in our slow moving industry and unique climate, and to be cautious of under-qualified 'experts', especially if you are seeking a home that performs to a high level without blowing the bank. Also be aware that we have complete financial independence from any of the products we test, use and recommend – we provide genuinely objective advice based on our experience designing, building and testing smart, sustainable homes.

We are the only company in our region that combines ten years of theoretical building science development, and project specific simulation/optimisation during all design stages, along with physical testing of the built home. In fact, we suspect we may be the only company in Australia providing this level of in house service, as standard across all our projects.

**Q**

**How do you maintain innovation in your practice?**

**A**

We work hard to balance tried and tested methods with new innovations by doing the following:

a. Continue to engage with research initiatives such as the 2012 ACT Government low income housing energy efficiency case study project listed *above* in order to quantitatively analyse the benefits of various technologies.

**A**

b. Maintain relations with past clients and conduct post-occupancy reviews to receive feedback.

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c. Work closely with our builders and trades to seek feedback and approach new items collaboratively and holistically.

d. Research new technologies and test them with clients that express a willingness to try new approaches.

Director, Jenny Edwards, and her partner are currently constructing their own modular designed Light House. It packs a four bedroom, two bathroom home into just 150m<sup>2</sup>. On a small 405m<sup>2</sup> block, with the trickiest 'north-to-the-front' orientation, it will still achieve an EER of 8.2 stars!

The home is set to have over 40 sensors to monitor the various technologies we are testing in the home, such as phase change materials, a Cupolex slab paired with a Ventis passive heating/cooling system, infrared heating, and heat exchange ventilation.

Jenny's project is a true demonstration of the lengths we go to to practice what we preach.



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**A well informed process**





# A well informed process

**Q Will you help us decide whether to knock down rebuild or renovate?**

**A** Making this decision is often the hardest choice of all. At Light House we advise that it very much depends on your block and your existing home. Some sites and houses have good bones and orientation working strongly for the renovation case. Sadly, others require significant overhaul, upgrade or compromise on the path to improving their energy efficiency, sustainability and the comfort, health and happiness of their occupants.

After meeting with you, if the decision doesn't seem obvious, we can provide a feasibility study service to conduct a site visit and analyse the site and house potential along with your own priorities and budget, and provide you with a recommended options and their associated opportunities and costs.

**Q What methods of communication/project tracking do you use during the design and construction process?**

**A** We use a user-friendly, online system that allows you to log in and see everything in one place: selections, plans, ongoing communication, useful information, fees, timeline, scheduled meetings, and more. This provides us with an open, efficient and reliable stream of communication, and provides our clients with all the information they need for each element of the project , ensuring we don't overlook anything in our discussions.

**Q Do you have 'set inclusions' or offer complete customisation? How do you present cost options to us?**

**A** This is where we vary significantly from most architecture firms and building companies. Our modular design approach was developed to simplify the design and

**A** specification process, but still allow customisation in key areas. Our modular clients start with a standard list of inclusions that we believe to be quality selections on a sensible budget. From here, clients can choose to upgrade or downgrade certain selections. Your choices are made via our interactive online client system, so that you can choose to upgrade or downgrade, item by item, in your own time. Each item is accompanied by relevant information so that you can make well-informed decisions. Many other home building companies will price their houses based on their most basic inclusions, and only offer upgrade options. We start with selections we consider to be good quality and value for money and give you the power to tighten, or expand, your budget in different areas.

Our custom clients have more free reign to go out and hand pick every element of their home, however we still offer them our 'standard' inclusions as a starting point and help them maintain budget perspective.

Our history of working with builders and cost estimators means we maintain a well developed costing database that allows us to provide clients with costing information at each stage of their project. Costing information is presented in a table format, demonstrating 'basic', 'standard' and 'upgrade' options to give clients control over their budget when making selections.

**Q** **Do your costings and inclusions cover fencing, letterbox, clothesline, light fittings, fly screens, paving, decking, driveway, demolition, slope related expenses/ retaining walls, and service connections?**

**A** Yes. When we discuss the budget for your home we endeavour to be as comprehensive and transparent as possible, and all of the options available to you will be listed in our online client communication/project tracking system. Be wary of price indications from companies that don't include these items.

The small list of items that we don't include are: security systems, microwaves, fridges, curtains/ blinds/pelmets, and soft landscaping (plants/grass/mulch).

**Q** **Will you help us choose a builder, and stay involved during construction?**

**A** Yes. Our services do not stop after design and documentation is complete. We work closely with a small group of builders who share our collaborative philosophy and

**A** approach to energy efficiency. We offer various levels of service during the tender period and construction period to suit your circumstances and budget.

••• Some important items to consider:

> ACT minimum defects warranty period is 65 days. We would encourage extending this to a minimum of 6 months, but ideally 9 months, so that the house can experience the extremes of the seasons and have time to settle and identify any areas that may need some attention.

> Working with an architect and a builder that are familiar with one another generally results in consistent outcomes, established expectations, and good communication during the build.

> Having your home tested in regards to air leakage and thermal imaging not only identifies any areas for improvement, but also helps your builder understand and improve their techniques, educate trades, and impact the broader industry.

> Keeping your architect involved during construction can often save time and money in pre-empting potential issues, identifying problems early, and coming up with effective solutions to any problems that may arise.

> Taking the time to fully design, document and specify all elements of your home prior to tendering the project means that quotes from builders can be thoroughly costed and are likely to experience very little variation during construction.

**Q** **Do you provide us with upfront information on various approvals or required consultants and their associated costs?**

**A** We understand how important it is to avoid unexpected expenses before your build has even begun.

Approval requirements vary from project to project and can be confusing at the best of times. Our initial fee proposal to you clearly outlines various approvals that may be relevant to your situation, and indicates the fees you can expect to pay for these approvals. Along with this, we clearly itemise the documentation requirements and fees for each approval.

**A** Similarly, we table the specialist consultants that may be required or desired for your project, and an indication of fees for their services. We can recommend consultants  
••• we work with regularly, but it is ultimately up to you to nominate a specialist to work for you. Coordination of information provided by consultants you engage is automatically included in our service.

**Get in touch!**





Get in touch!

