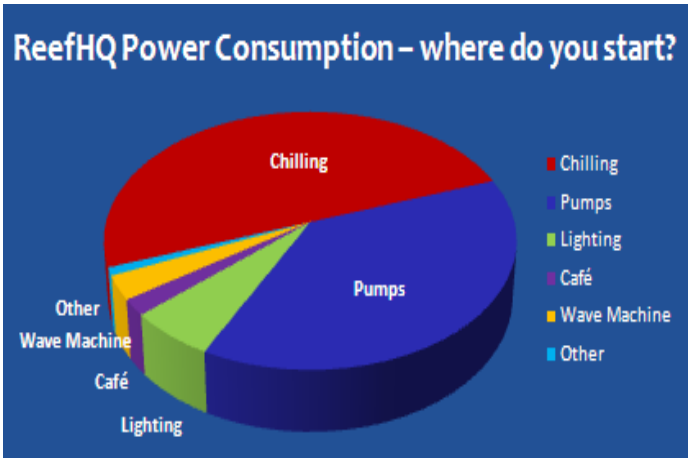
Greening Reef HQ Aquarium

After 5 years of hard work and commitment, this year Reef HQ Aquarium expects to meets its ambitious 50% energy use reduction target. Before 2006, Reef HQ Aquarium had no formal strategies for the sustainable use of its business resources. Motivated by concerns about Climate Change and rising energy costs, a small working group (including Reef HQ Aquarium's in-house electrician) convened to conduct an internal audit of infrastructure and processes. The audit showed that in the 2006/7 financial year, Reef HQ Aquarium used 2,438 Megawatts of coal-fired power, which today would cost about $400,000 and would power 305 average Queensland homes. The group settled on a reduction target of 50% from the 2006 baseline in 5 years, which they felt was very ambitious but achievable, but at that stage they had no real strategies to achieve the target.

Results from 1st Year:

Staff behaviour, procedures and maintenance were addressed in the first year with very encouraging results. Reef HQ Aquarium staff were trained to avoid wasting energy by not leaving doors open and turning off unused equipment. The building air-conditioning set-point was raised from 23C to 24.5C and air-conditioning maintenance issues were addressed. Some minor building works were undertaken including the installation of window tinting and removal of dilapidated skylights. These simple measures resulted in a 13% reduction in power consumption.

Formal Audits:



Although Reef HQ Aquarium has very good in house expertise, formal audits were required to secure the necessary funding for change. The necessary expertise to make any further efficiency gains with regards to the main building chilling system was also lacking. Formal audits were undertaken including two energy audits sponsored by Ergon Energy, Reef HQ Aquarium engaged a specialist Aquarium consultant to deliver a strategic infrastructure plan and Tropical Energy Solutions to undertake a feasibility study on the use of solar power. The audits were a valuable tool and in particular, the technical audit conducted by McClintock Engineering Group (a Townsville based engineering firm), provided a level of innovation and strategy required to make the ambitious 50% reduction target a reality.

Lighting – Symbol of Energy Efficiency:

Deciding where to start is not simple, even if the big offenders are clear. The decision is governed by the ability to implement the change (ie. there may be little budget to make changes initially). Following the initial operational changes, Reef HQ Aquarium started with lighting as the team had good in-house expertise (including an electrician) to manage the change. It was also an area that was relevant to all business and individuals, so lighting was an excellent area to support innovation and showcase initiatives that really engage people.

Looking back after three years, the results for implementation of energy efficient general lighting were excellent. The overall payback time for general lighting initiatives was two and a half years. Reef HQ Aquarium is over $10,000 ahead, and overall energy consumption reduced by 3.1%

Innovations in Exhibit Lighting – Reef HQ Aquarium imports the first Plasma light into Australia

There has been an explosion of products available for specialist lighting. Reef HQ Aquarium experimented with numerous styles including LED, engineered skylights and Plasma floodlights and was the first business to import a plasma light which uses a novel technique using microwaves to emit the light. Aside from increased efficiency which has led to reduced energy costs, these lights have excellent spectral output, have reduced hazardous waste and add less heat load to the building.

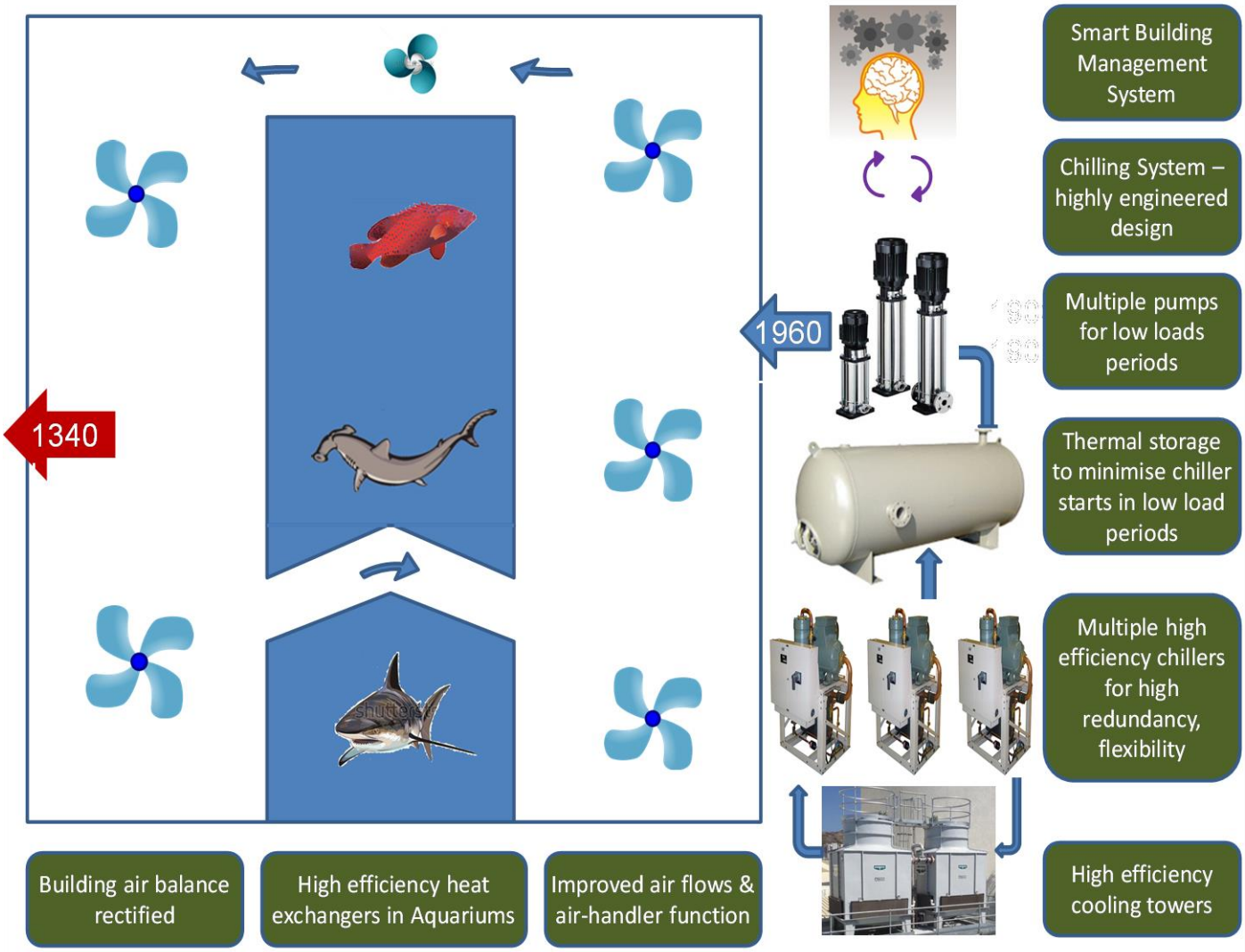
Pump Rationalisation:

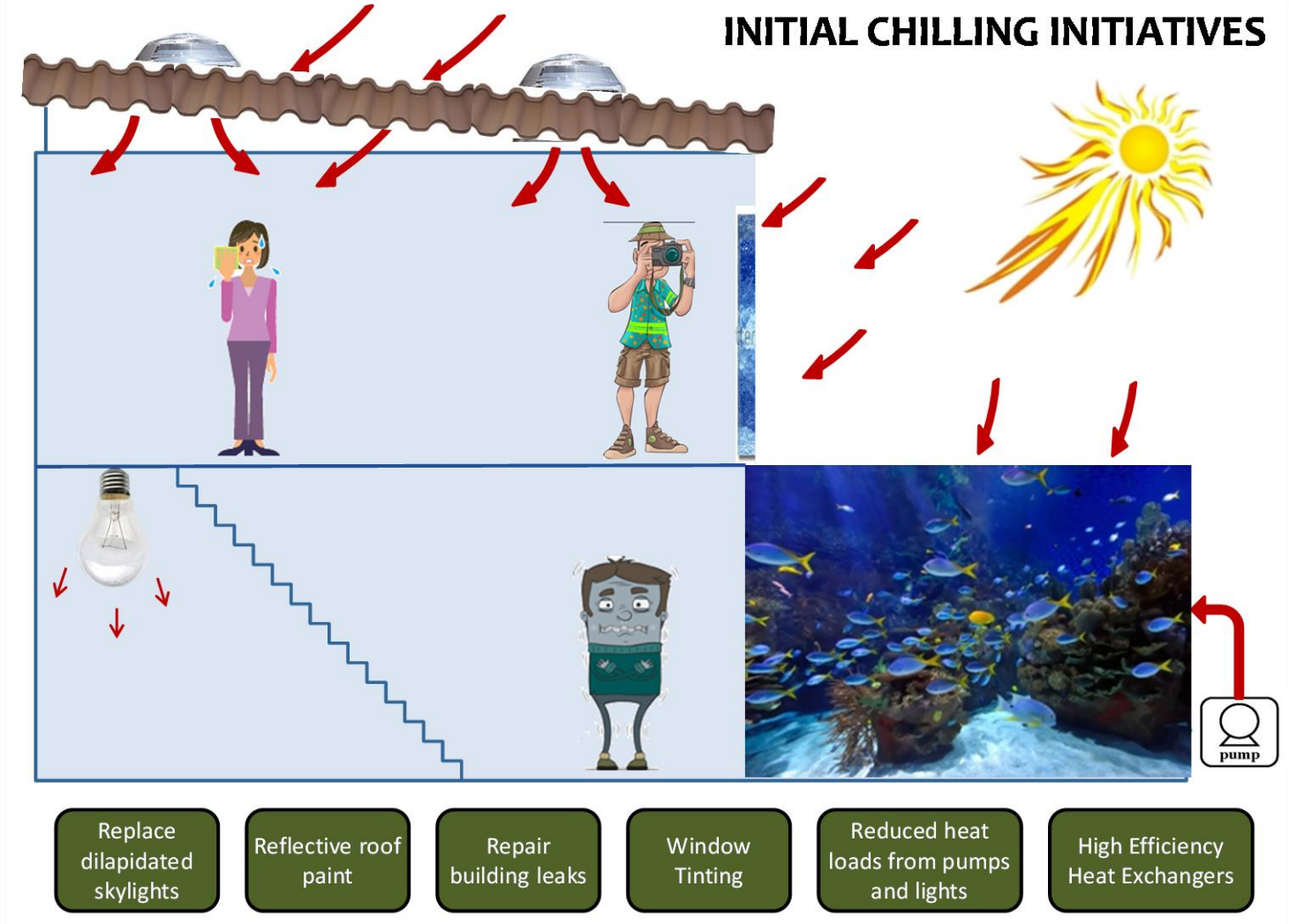
Reef HQ Aquarium completely rationalised the pumping systems including pump and piping design, pump choice. In one extreme example, with the large pumps a $1500 motor change resulted in a $10,000/yr energy cost saving. A cost benefit analysis of the smaller pumps revealed that the 'cheap' pump of choice was costing $20,000/yr more than the most expensive pump on the market. Submersible pumps in the main Reef Tank that were inefficient, unreliable and expensive to maintain were replaced with new innovative, super efficient, low voltage, carbon fibre and plastic pumps, resulting in huge cost savings. $120,000 was spent over 3 years resulting in a 55% reduction in pumping energy demand and a $270,000 return on investment

Upgrade of Chilling Systems:

One of the main outcomes of the energy audits was the significant flaws in the buildings chilling systems which were also now reaching the end of their life. Following and capital funds injection in 2010, the aquarium undertook a major upgrade to the main building air-conditioning system. The innovative design by Craig McClintock, a Townsville based mechanical engineer, the excellent quality of work by the Townsville based mechanical services contractor Peak Are Pty Ltd has resulted in benefits and energy use reductions well beyond expectations.

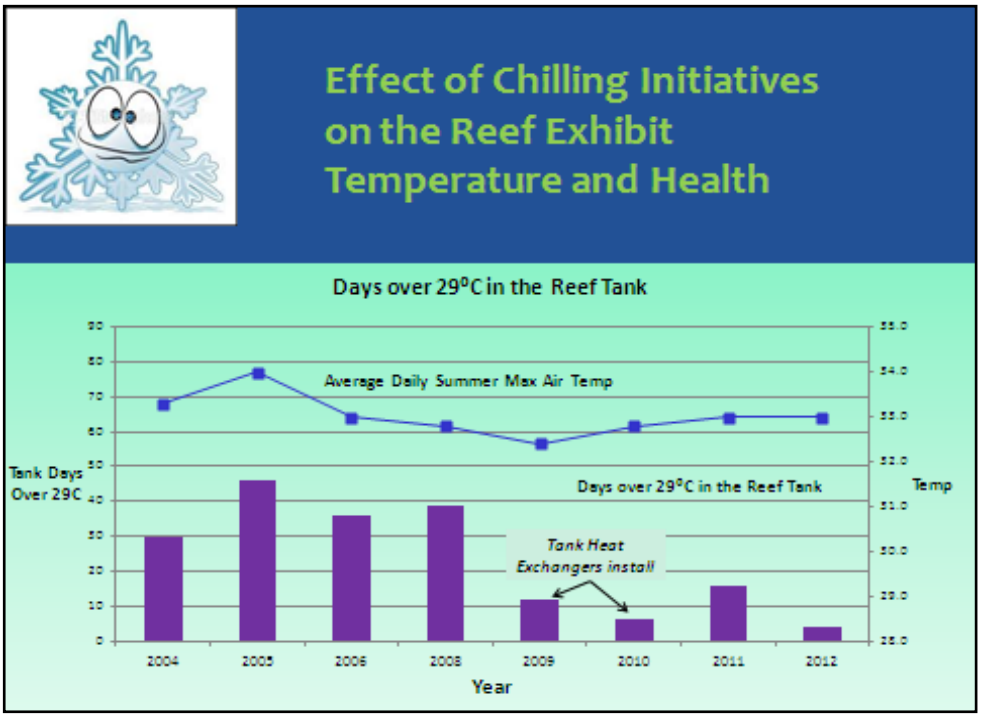
The new system was engineered to rectified issues with the building air balance and piping design. Air flows were improved and the 'building management system', the computerised brain of the system ensures that the system responds in a dynamic way to changing demand.





The system is a water-cooled system which is 1.7 times more efficient than the old air cooled system. It also utilises a thermal storage tank to maximise efficient in low load periods and minimise chiller starts. It is expected that the system will reduce Reef HQ Aquarium's overall energy demand by more than 23%.

Prior to a major upgrade of the building chilling systems in 2012, a number of initiatives were implemented to reduce heat loads into the building, reducing the demand on the building chilling systems. These included removing dilapidated skylights, reflective roof coatings, window tinting, reduced heat loads from lights and pumps, rectification of building air leaks and the installation of high efficiency heat exchangers for tank chilling.

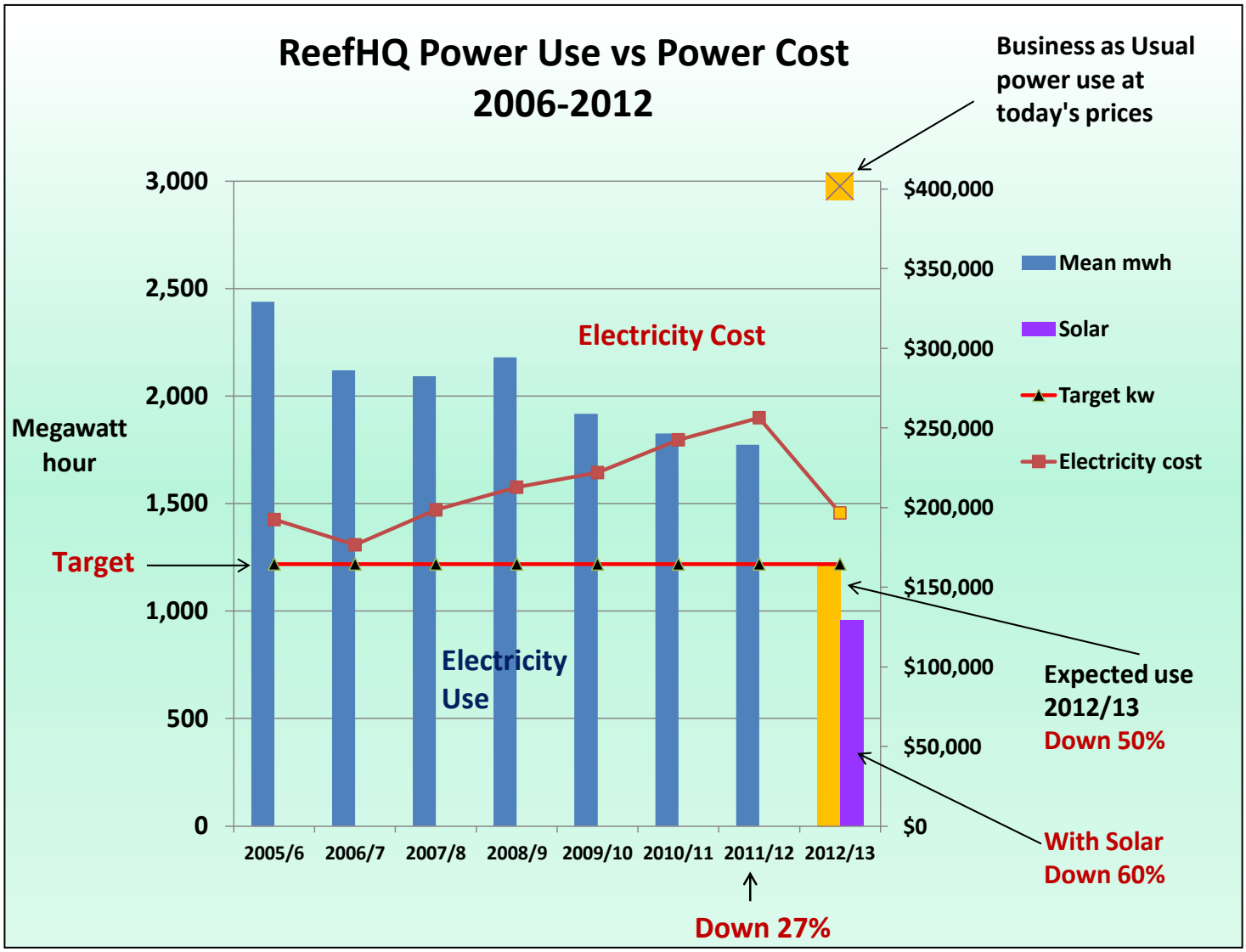


One of the best returns on investment for the energy reduction initiatives has been the effect on exhibit health of the aquarium's most prized asset: the world's largest living coral reef aquarium. The business as usual approach to tank cooling was to cool the entire building 24/7 for the small exhibits and inefficient polypipe heat exchangers on the large exhibits. The installation of high efficiency heat exchangers has delivered a dramatic reduction in days over the bleaching threshold temperature in the Coral Reef Exhibit. This will have a considerable effect on the quality and health of the Aquarium ecosystem.

Reef HQ Aquarium goes Solar:

The world's largest living coral reef aquarium is now registered as a solar power station. Like the corals in the reef aquarium, Reef HQ is now using the suns rays to make its own energy. The system is 206kw peak system, which should provide for at least 25% of the Aquarium's power needs. Already one of the largest rooftop systems in North Queensland, Reef HQ Aquarium has room to expand this system in the future.

The Bottom Line:



This graph shows Reef HQ Aquarium's power use from 2006 with the energy reduction target. As the initiatives were implemented you can see a drop off in energy use while the actual cost of the aquarium's energy bill continued to increase do to escalating energy prices. By June 2012 a 27% reduction from the baseline had been achieved and it is expected that with the new chilling system and solar power systems commissioned July 2012, the 50% reduction target will be met if not exceeded in the 2012-13 financial year. The graph also shows what Reef HQ Aquarium would be paying with business as usual energy use at today's prices.