ZOOS VICTORIA
Fighting Extinction

Environmental Sustainability Investment Prospectus

2019–2024

Manna Gum
Coranderrk Bushland Reserve,
Healesville Sanctuary
Photograph by Kiam Yoong

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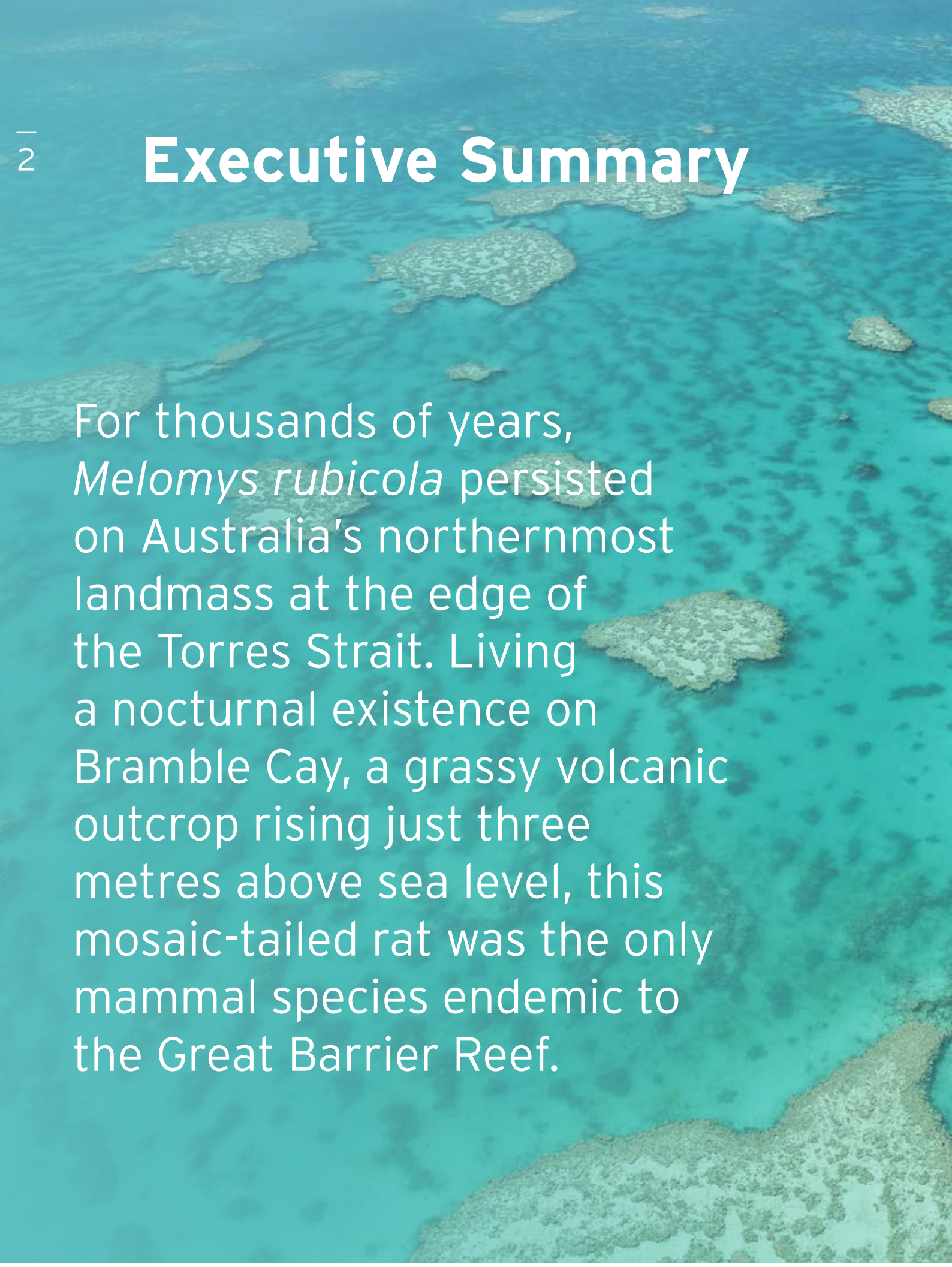
Executive Summary



For thousands of years, *Melomys rubicola* persisted on Australia's northernmost landmass at the edge of the Torres Strait. Living a nocturnal existence on Bramble Cay, a grassy volcanic outcrop rising just three metres above sea level, this mosaic-tailed rat was the only mammal species endemic to the Great Barrier Reef.

In 2019, the same year as the publication of this Environmental Sustainability Investment Prospectus, the Federal Government declared the Bramble Cay melomys, *Melomys rubicola,* the first Australian mammal species to become Extinct due to human-induced climate change.

At Zoos Victoria, our mission is Fighting Extinction. At this pivotal point in our planet's history and as a zoo-based conservation organisation, we take pause to recognise that if immediate and widespread action is not taken to limit global warming to 1.5° Celsius above pre-industrial levels, many more species of wildlife will also be pushed beyond the brink.

We heed the warnings of the United Nation's International Panel on Climate Change (IPCC), but we also choose to focus on the actions that can and must be taken to lessen the impacts of global warming.

In its 2018 special report, the IPCC projected that warming of 1.5°C will result in the loss of around 70% of the world's coral reefs and that warming of 2°C could result in the loss of up to *all* of the world's coral reefs. It also reported that limiting global warming to 1.5°C, as compared to 2°C, could reduce the number of people exposed to climate change-associated risks by several hundred million and significantly reduce biodiversity loss of terrestrial species. These are worth fighting for and we all, including Zoos Victoria, have a crucial role to play in curbing emissions to limit global warming.

In our home state of Victoria, we are witnessing the impacts of climate change on some of our very own 27 Fighting Extinction Species. The Mountain Pygmy-possum (*Burramys parvus)* - Australia's only hibernating marsupial - can spend up to seven months of the year under a blanket of snow. With 2018 Australia's third warmest year on record, the three remaining populations of this Critically Endangered marsupial are facing changes to alpine habitat, disruptions to hibernation and severely diminished food resources.

Others on our Fighting Extinction Species List, including the Mallee Emu-wren (*Stipiturus mallee*) and Guthega Skink (*Liopholis guthega*) are also contending with increased pressures from extreme environmental events such as wildfire, made more severe by anthropomorphic climate change. And as the great barometers for environmental health, amphibians are suffering in a warming climate and declining at a faster rate than any other vertebrate species. In our own backyard, Victoria's only endemic frog species, the Baw Baw Frog (*Philoria frosti*) is now represented by more genetic diversity secured in Melbourne Zoo's Baw Baw Bunker than in the wild.

As a zoo-based conservation organisation charged with the protection of wildlife, Zoos Victoria works hard to mitigate the threats facing our Fighting Extinction Species, and this compels us to do everything we can to ensure we are not contributing to those threats. This Environmental Sustainability Investment Prospectus 2019-24 represents our increased efforts to reduce our ecological footprint and to inspire our millions of visitors and other organisations to live and work more sustainably.

Testament to our commitment, we are proud to have been the first zoo in the world to be independently certified Carbon Neutral.

Having maintained this status since 2013 (for our operations during the 2011-2012 financial year), Zoos Victoria seeks to continuously improve and further invest in environmental sustainability.

The projects in this plan detail important improvements linked with our everyday operations caring for and recovering wildlife. These projects include, but are not limited to, minimising our carbon emissions, increasing water efficiency, reducing waste, procuring more responsibly, protecting the habitat provided by our three properties and better showcasing the work that we do.

In September 2015, the UN General Assembly adopted its Agenda for Sustainable Development, encompassing 17 Sustainable Development Goals (SDGs). These focus on areas that are universally important for the future of humanity and the planet. They include areas such as water, sanitation, clean energy, food security and wellbeing and are built on the core principle of "leaving no one behind". Using these as a reference point, project areas listed in this prospectus are aligned with one or multiple SDGs.

We are proud to update you on achievements made since the previous Environmental Sustainability Investment Prospectus 2014-19. We also hope that the projects outlined within these pages for this critical five year period will inspire you to join us, as fellow human beings, to tread a little lighter on our world and to protect the precious wildlife with which we share it.

Beads for Wildlife
Photograph by Brooke Squires

Environmental Sustainability at Zoos Victoria

Badger Creek,
Healesville Sanctuary
Photograph by Kiam Yoong

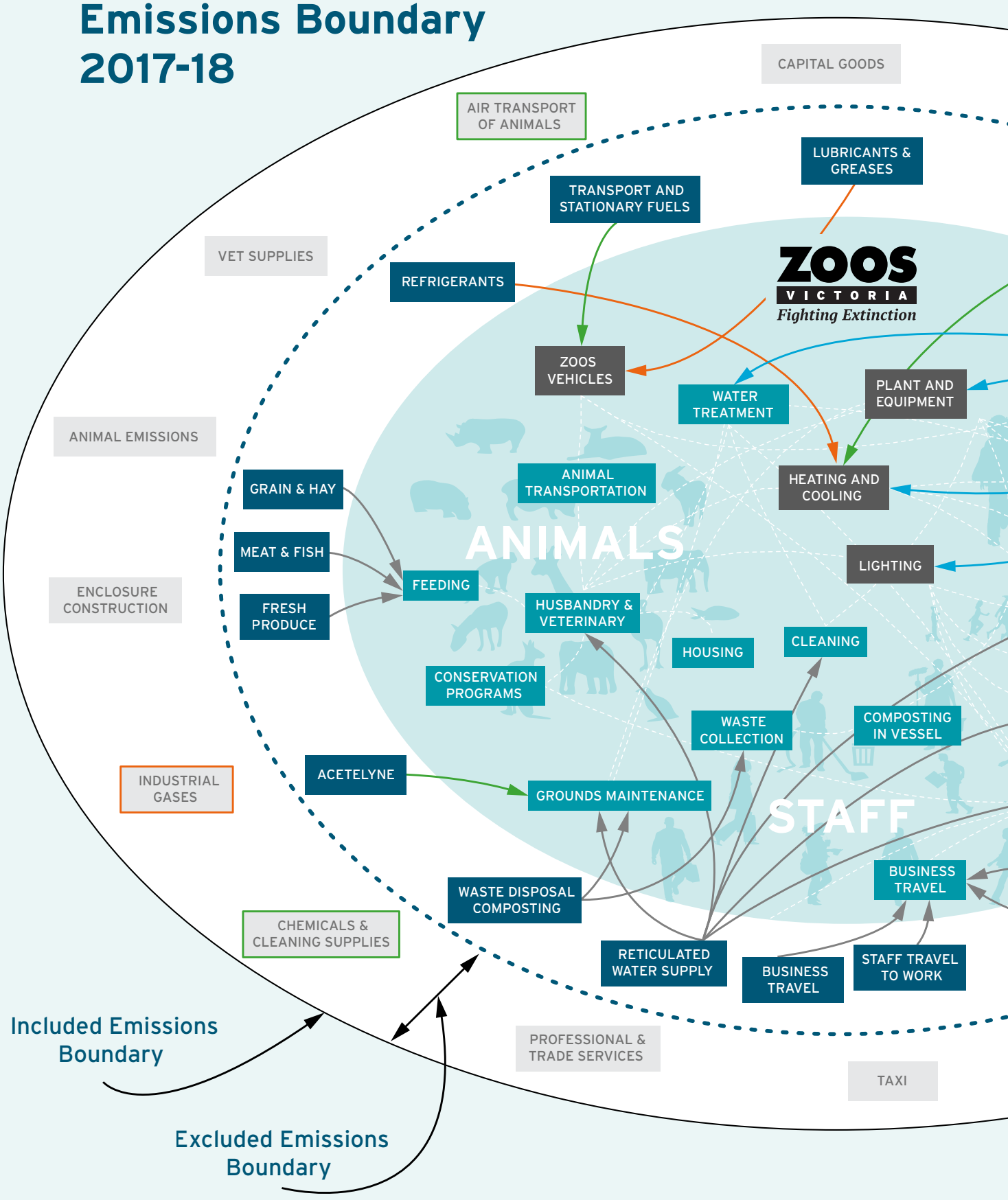
Zoos Victoria is a not for profit, zoo-based conservation organisation, delivering conservation outcomes through our three great zoos; Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo. We are committed to fighting extinction locally and abroad, prioritising our efforts to save 27 native threatened species on the brink of extinction.*

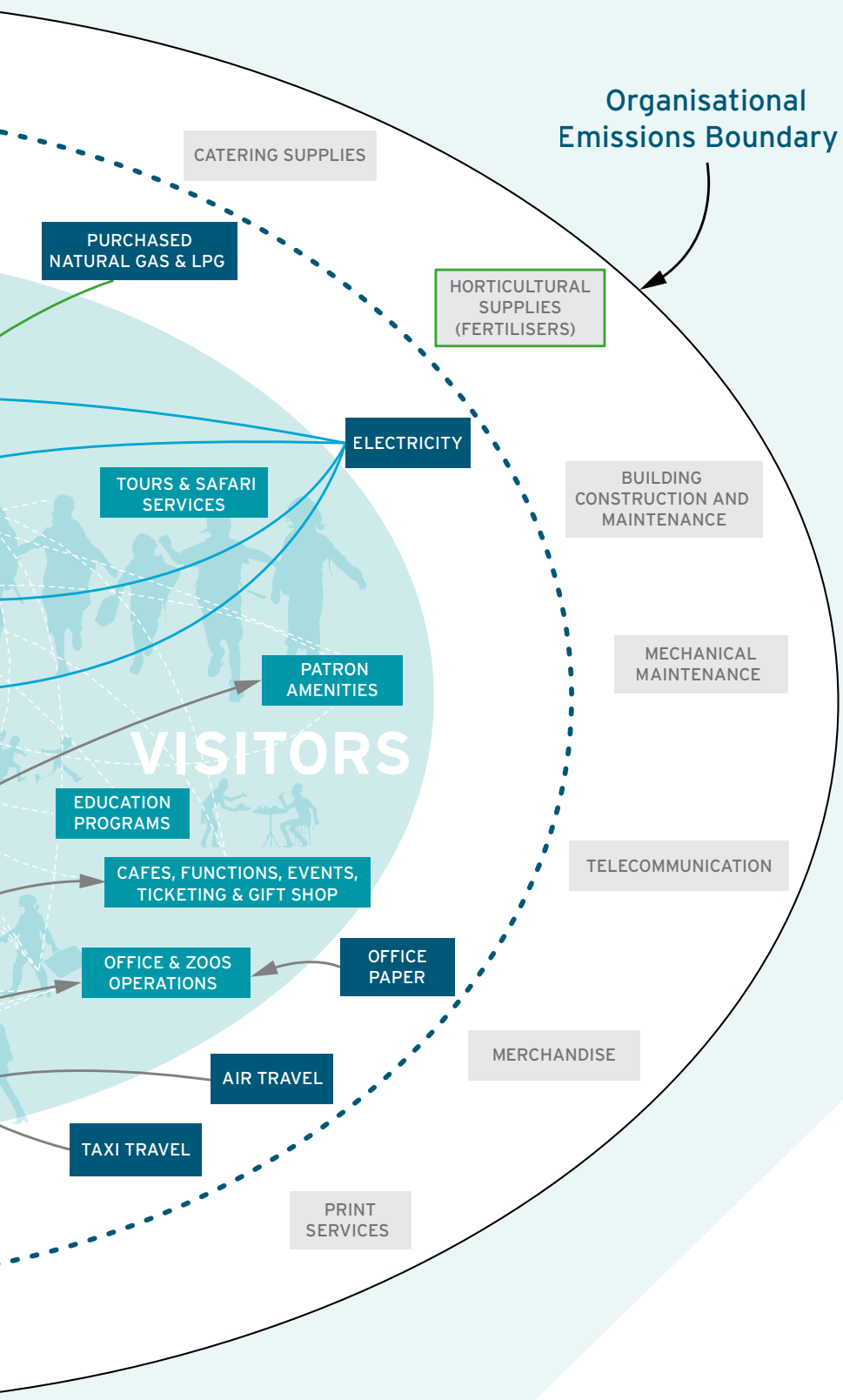
Zoos Victoria is dedicated to connecting the more than 2.5 million people that visit us each year to wildlife, inspiring them to take actions that ultimately bring about gains for species in the wild. Through our involvement in native threatened species recovery programs and international partnerships, Zoos Victoria witnesses first-hand the impact of human-induced threats on wildlife. This motivates us to take great leaps to minimise our own environmental footprint.

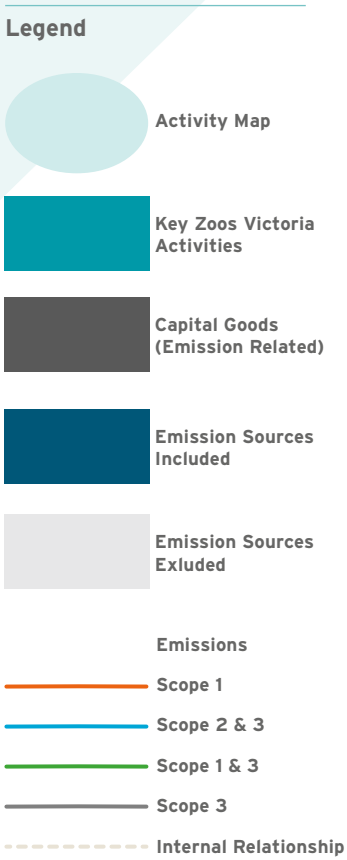
In March 2013, Zoos Victoria became the first zoo in the world to be certified Carbon Neutral. The scope of this certification covers emissions generated by activities such as business travel (air and road), staff travel to and from work, waste to landfill, composting, energy supply, paper use, reticulated water, refrigerant losses and the supply of animal foods. In the years since certification, we have continually sought to improve the reach of scope of carbon neutrality and have mapped out our emissions sources for a holistic representation of where to concentrate efforts to better our practices.

**Detailed plans for these species can be found in Zoos Victoria's Wildlife Conservation Master Plan 2019-24.*

Zoos Victoria's Carbon Emissions Boundary 2017-18




Organisational
Emissions Boundary
CATERING SUPPLIES
PURCHASED NATURAL GAS & LPG
HORTICULTURAL SUPPLIES (FERTILISERS)
ELECTRICITY
TOURS & SAFARI SERVICES
BUILDING CONSTRUCTION AND MAINTENANCE
MECHANICAL MAINTENANCE
PATRON AMENITIES
VISITORS
EDUCATION PROGRAMS
CAFES, FUNCTIONS, EVENTS, TICKETING & GIFT SHOP
TELECOMMUNICATION
OFFICE & ZOOS OPERATIONS
OFFICE PAPER
MERCHANDISE
AIR TRAVEL
TAXI TRAVEL
PRINT SERVICES


Legend
Activity Map
Key Zoos Victoria Activities
Capital Goods (Emission Related)
Emission Sources Included
Emission Sources Exluded
Emissions
Scope 1
Scope 2 & 3
Scope 1 & 3
Scope 3
Internal Relationship

Our Achievements

As we solidify our position as a leader in sustainable practices, Zoos Victoria is constantly updating and improving our environmental programs to ensure that our operations align with our values and mission.

Our Environmental Sustainability Strategy guides our practice across the following areas:

- Carbon Management and Reduction
- Energy Efficiency
- Water Efficiency
- Waste Management
- Green Procurement
- Staff Training and Support
- Environmentally Sustainable Development

601kW worth of Solar Photo Voltaic panels generate over 790,000kWh annually.

With thanks to AGL and the Lord Mayor's Charitable Foundation for their support of the Solar PV projects.

Coranderrk – With thanks to the Australian Government's National Landcare Program, Vizard Family Foundation, The John T Reid Charitable Trusts, The Ian Potter Foundation and Merrin Foundation for their support.

With thanks to Lord Mayor's Charitable Foundation and CSIRO for the Printed Organic Solar trial.

OFF-GRID Solar Trees

100% RENEWABLE ENERGY at Healesville Sanctuary through the Melbourne Renewable Energy project- power from the Crowlands Wind Farm

ZERO WASTE TO LANDFILL - Only Organics, Soft-Plastics and Comingled public waste bins on site.

DOUBLE GLAZING at Melbourne Zoo's Butterfly House to maximise heat retention.

With thanks to the Yulgilbar Foundation for their support of this project.

COMPOSTING SYSTEM at Melbourne Zoo. A state-of-the-art in-vessel system turning zoo organic waste into Zoo Gro, a rich compost sold for use as soil conditioners and organic fertilisers.

With thanks to the Yulgilbar Foundation for their support of this project.

MELBOURNE ZOO'S WATER TREATMENT PLANT has been showcased to become millions of visitors, treating all stormwater and animal wash-downs to Class A water for reuse across the zoo.

IMPROVED RESTORATION AND PROTECTION OF HABITAT along the Werribee River, with thanks to Melbourne Water for their support. Corranderk – with thanks to the Australian Government's National Landcare Program, Vizard Family Foundation, The John T Reid Charitable Trusts, The Ian Potter Foundation and Merrin Foundation for their support.

LANDSCAPE DESIGN to shift the zoos' iconic gardens towards native and drought tolerant vegetation.

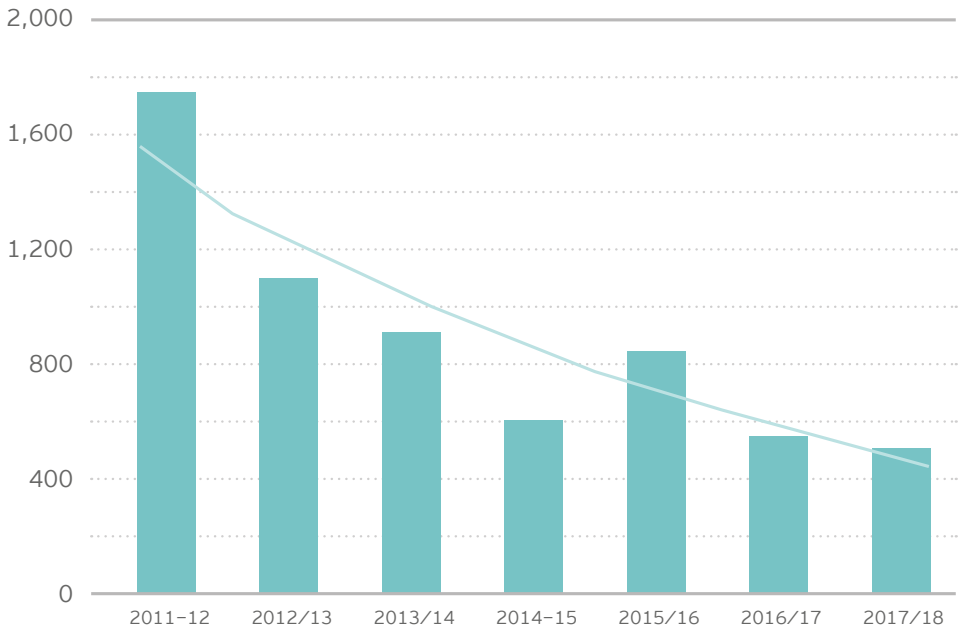
CARBON NEUTRAL certification was obtained for Zoos Victoria's properties, Melbourne Zoo, Werribee Open Range Zoo and Healesville Sanctuary via third party certification under the Australian Government's National Carbon Offset Standard (NCOS) for carbon neutrality in March 2013, covering our operations since 2011. This significant milestone has positioned Zoos Victoria as pioneers in the zoo industry, demonstrating our commitment to leading the charge in tackling our ecological footprint.

ISO 14001 Certification for our Environmental Management System from 2012.

Our Progress

Waste to landfill

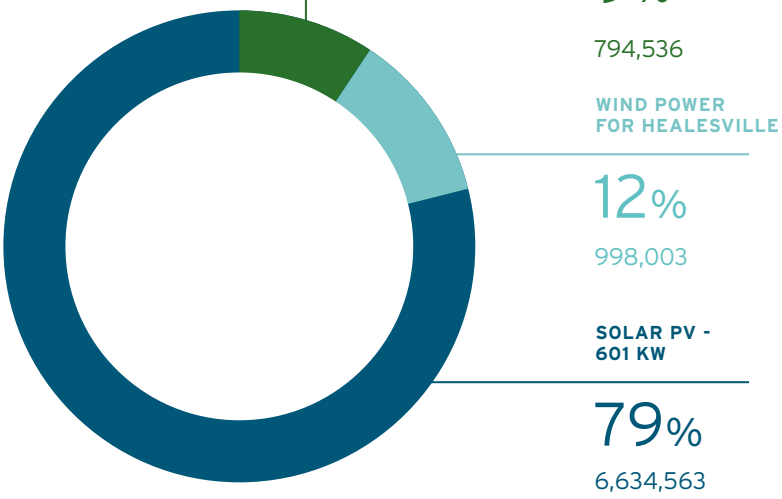
Diversion rate from landfill in Dec 2018 = 84%



Renewable Energy at Zoos Victoria

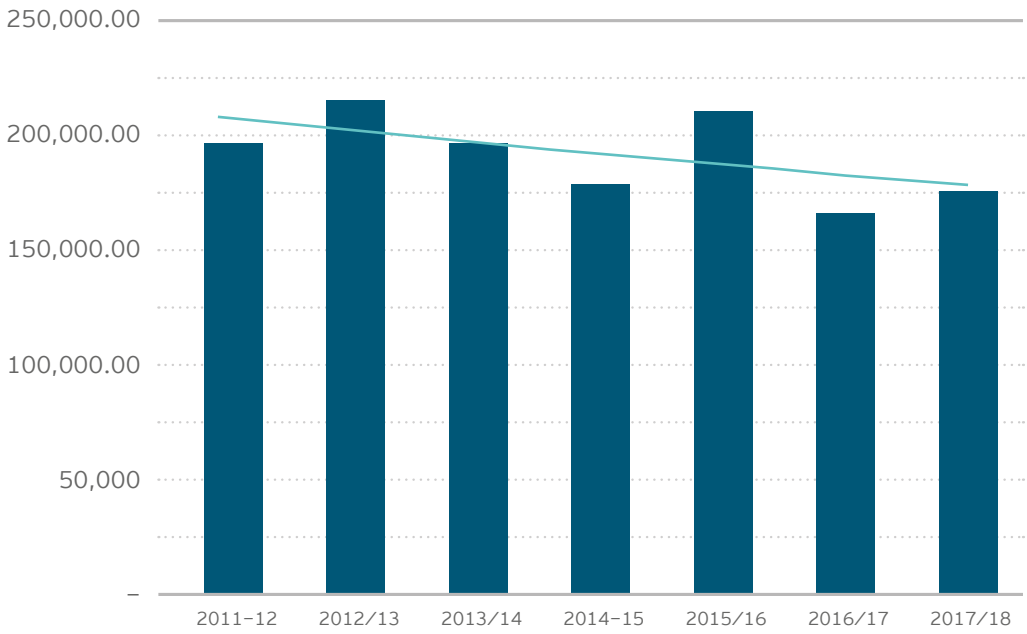
Figures based on data obtained in 2017-18 with projected renewable energy production. This amount of renewable energy is equivalent to taking 492 cars off the road or powering 308 average Australian houses.

Our grid electricity produces 7,830 tonnes of CO2e per year. The section 'Reducing Greenhouse Gas through Renewables and Efficiencies' highlights potential projects to reduce emissions from coal fired electricity generation.



Potable Water

There is a downward trend in water consumption due to efficiencies and water recycling.



Note: Melbourne Zoo recycles approximately 80,000 KL of water which is equivalent to 32 Olympic size swimming pools per year.

Zoos Victoria has obtained Fairtrade Workplaces, NCOS (Carbon NEutral Certification) and ISO 14001:2015 Environmental Management System certifications. NCOS (Carbon Neutral Certification), ISO 14001:2015 Environmental Management System.

Sustainability at work at our 3 zoos:

MELBOURNE ZOO

The Royal Melbourne Zoological Garden was established in 1862 and is firmly ingrained in the hearts and minds of the people of Melbourne. With over 150 years of history and aging infrastructure, upgrades and improvements to enhance resource efficiencies are required to minimise our oldest zoo's ecological footprint.

Progress to improve efficiencies across all areas of Melbourne Zoo's operations have already been made, with projects including the implementation of a water treatment plant, improvements in waste processing and reductions in energy usage. Although these achievements are significant, this is only the beginning.

Opening its gates to the bulk of Zoos Victoria's annual visitation, Melbourne Zoo is uniquely placed to raise the bar and showcase practical sustainability measures that inspire visitors to take their own action to conserve the natural world.

WERRIBEE OPEN RANGE ZOO

With guests venturing onto an open savanna located on the outskirts of Melbourne, Werribee Open Range Zoo delivers a safari adventure like no other. While the large open spaces offer animals huge areas to roam, the provision of heating and appropriate climate control for these megafauna species also presents challenges. Fortuitously, the abundance of grassland and open space makes Werribee Open Range Zoo well suited for its own renewable energy generation.

Under the previous Environmental Sustainability Investment Prospectus, Zoos Victoria invested in sustainability measures at Werribee Open Range Zoo by building our unique off-grid Solar Trees and installing 200kW of grid-connected rooftop solar.

Located in the fastest growing municipality in Australia, Werribee Open Range Zoo presents an opportunity to promote environmentally sustainable behaviours and showcase leading innovations and technologies to an ever-growing number of visitors.

HEALESVILLE SANCTUARY

Devoted to the care and wellbeing of Australia's native fauna, Healesville Sanctuary has become a fixture of the Yarra Valley, adored by locals and overseas visitors alike. A visit to the Australian Wildlife Health Centre not only provides people with an unforgettable opportunity to share in the stories of the 2000 plus animals that are treated there annually, but the building itself highlights the Sanctuary's commitment to sustainable development. Rainwater harvesting, solar panels and energy efficient designs are all within a glance. As of January 2019, the Sanctuary is powered by 100% renewable energy. This comes from 102 kW rooftop solar with the remaining provided by the Crowlands Wind Farm near Ararat, Victoria.

Whilst Healesville Sanctuary showcases its commitment to dealing with human-induced pressures on our wildlife, the husbandry requirements associated with caring for native threatened species from alpine regions continues to drive high energy consumption at the Sanctuary. The continued success of the captive breeding and reintroduction programs for our threatened alpine species such as Corroboree Frogs and Mountain Pygmy-possums depends on these facilities, however significant investment is required to improve energy efficiencies and reduce the ecological footprint left by our operations.

Werribee River,
Werribee Open Range Zoo

Goals and Projects: The next 5 years

Having now become the world's first zoo to achieve carbon neutral certification, our commitment to continual improvement is best captured by our environmental sustainability goals for the next 5 years.

Zoos Victoria will:

MAINTAIN Carbon Neutral Certification.

ACHIEVE a diversion rate of 100% by June 2021*.

REDUCE our carbon footprint through future developments across Zoos Victoria.

ACHIEVE 100% responsible procurement by June 2021.

REDUCE Zoos Victoria's water consumption by a further 10% by June 2021.

**excludes prescribed industrial waste or waste that cannot be recycled or reused.*

Proposed Projects:

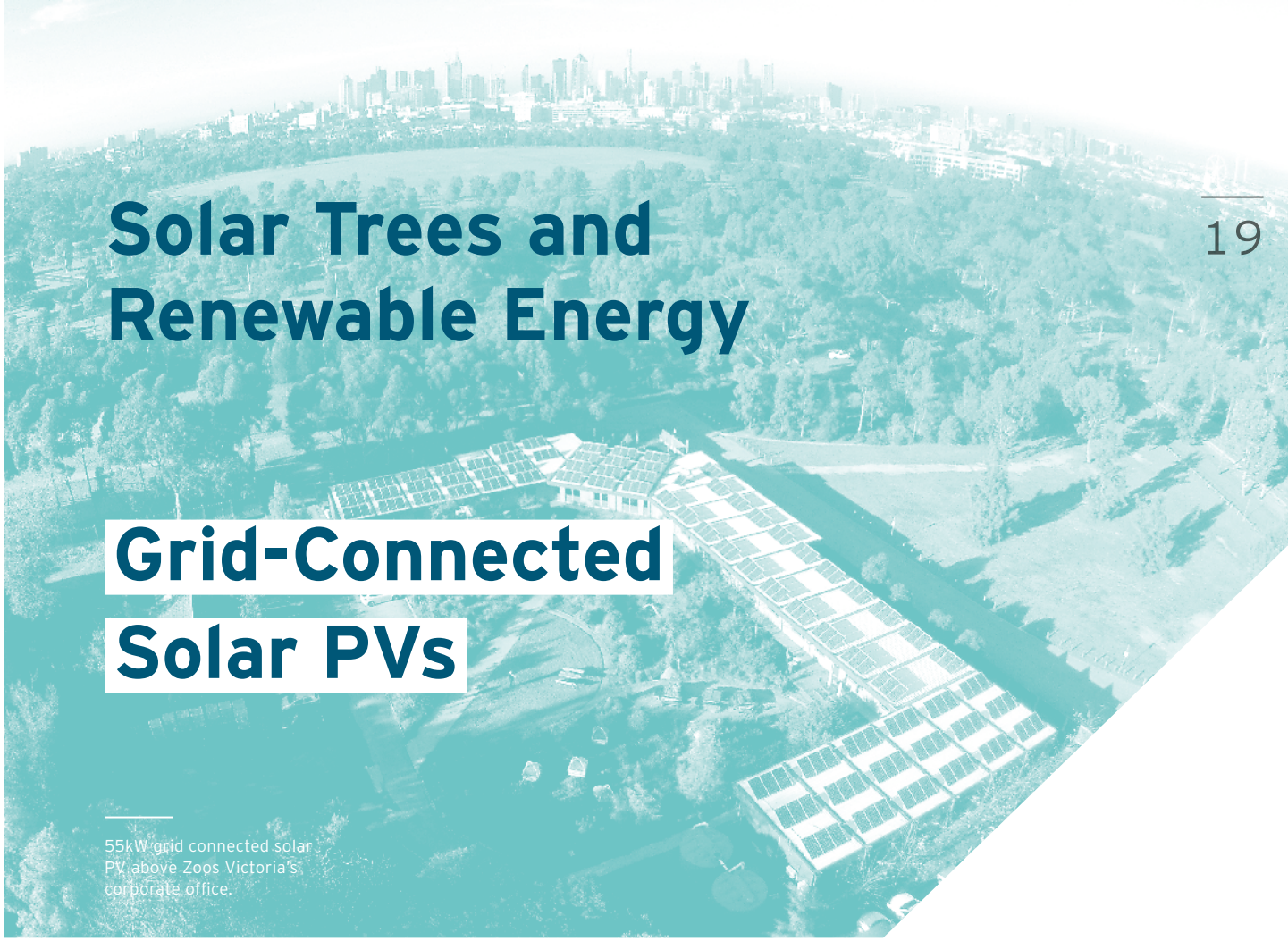
Reducing Greenhouse Gases through Renewables and Efficiencies

As part of our continual efforts to reduce carbon emissions, we will be expanding on our investments in renewable energy and energy efficiencies. The following is a breakdown of renewable energy generation at our zoos:

Renewable Energy at Zoos Victoria	Onsite generation - Solar PV - kW	Estimated Offsite generation - Crowlands Wind farm - kWh per year	Estimated power from renewables per year	% of renewables
Melbourne Zoo	299	0	392,938.56	6.6%
Werribee Open Range Zoo	200	0	262,918.26	20.0%
Healesville Sanctuary	102.18	998,003	1,132,267.74	100.0%
Total Zoos Victoria	**601**	**998,003**	**1,788,124.56**	**19.0%**

Solar Trees and Renewable Energy

Grid-Connected Solar PVs



55kW grid connected solar PV above Zoos Victoria's corporate office.

Expanding on our solar PV

Solar PVs (photovoltaic energy) has been widely adopted by Zoos Victoria as a means of minimising greenhouse gas emissions through the production of our own clean power onsite. Our projects range from small installations of about 5kW to larger single installations of about 55kW depending on available roof space. In total, we have installed about 581kW of rooftop solar and plan to increase this number (where possible) to new and existing buildings, exhibits and public places. As we have limited rooftop space, our future plan is to investigate solar shading as a viable alternative to rooftop installations. Co-benefits of this include the provision of shade for animals, staff and visitors. Installations can also provide an educational experience by physically showcasing the feasibility of the technology for the practical promotion of renewable energy. Alongside out solar PVs, a smart connected system can also be implemented for optimum renewable energy distribution and interaction with the grid.

Project examples include:

Werribee Open Range Zoo
Bus depot and animal shelters/exhibits

< $500,000

Solar Shading at Materials Recovery Facility

$500,000 to $1,000,000

Melbourne Zoo
Solar Shading at Wild Seas and Bistro

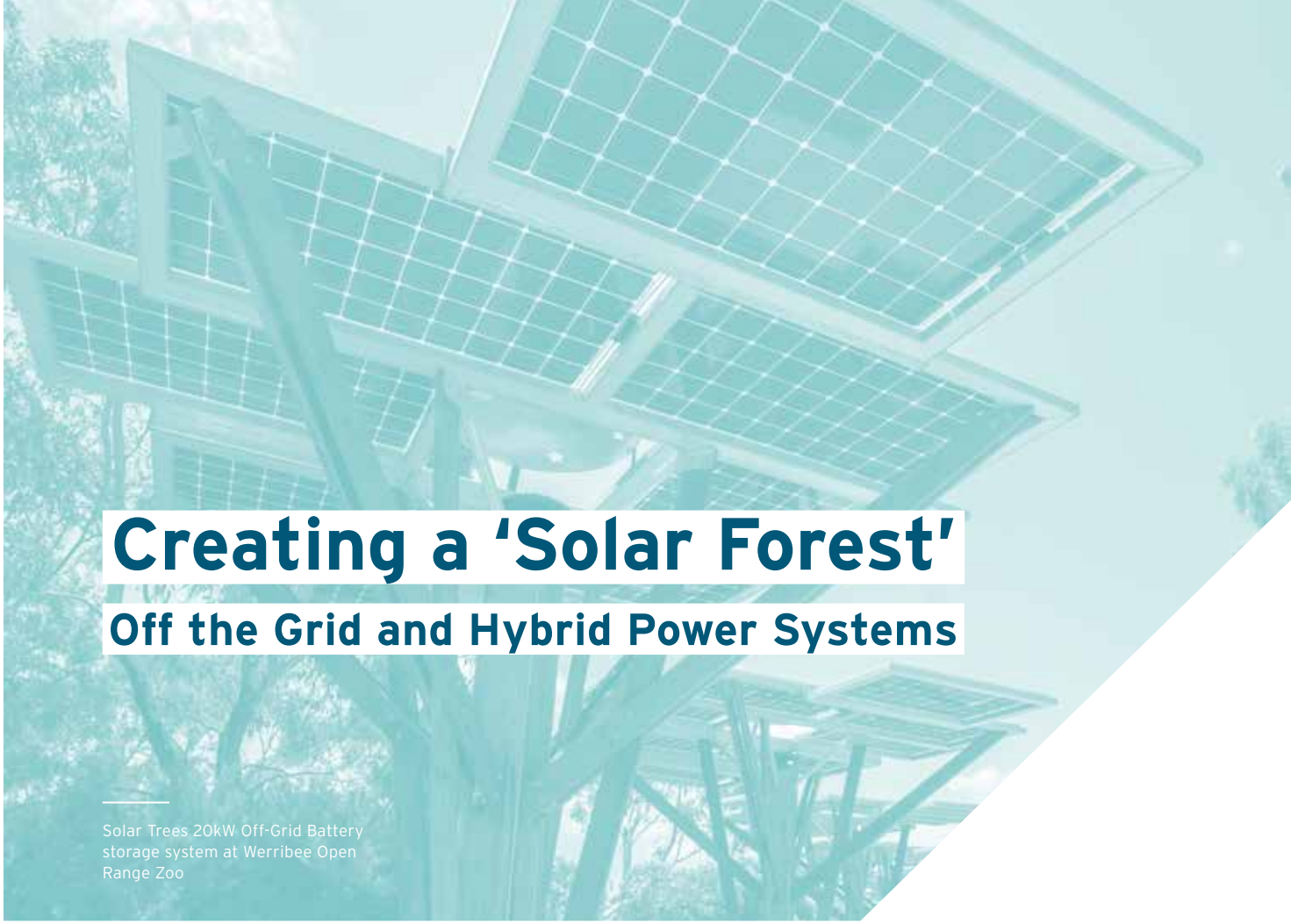
< $500,000

Healesville Sanctuary
Entrance buildings

< $500,000

Benefits of investment:

A $100,000 investment will procure approximately 50kW of rooftop solar PV, which will produce approximately 65,700 kWh and negate 78 tonnes of CO2e (carbon dioxide equivalent) per year with a simple payback period of 7.6 years.



Creating a 'Solar Forest'

Off the Grid and Hybrid Power Systems

Solar Trees 20kW Off-Grid Battery storage system at Werribee Open Range Zoo

Expanding our Solar Trees and other off-grid systems

At our three properties, Zoos Victoria has many main meters connected at various points of an extensive electricity distribution system. Using off-grid and hybrid systems, buildings and precincts can be fully or partially separated from the electricity grid ensuring ease of implementation and a possible reduction in cost associated with incoming power line expansions.

At Werribee Open Range Zoo, we have constructed an off-grid system of 8 Solar Trees as part of our *Solar Forest* project. In total, the trees have an off-grid capacity of 20kW solar PV with a battery system.

Key features of the system include:

- Battery stored power used for lighting at night in areas such as carparks.
- Natural materials that give an organic feel to the structure, with all cabling concealed and 100% recycled/reclaimed timber used.
- Bi-facial semitransparent solar panels that allow light to filter through the canopy, creating a dappled lighting effect similar to that provided by Acacia trees in nature.
- Scalability; allowing for the addition of more trees and battery storage if required.

With the success of the Solar Trees, we are looking to add to our Solar Forest in other areas for the supply of both off-grid and hybrid power. Possible areas and use include:

Project examples include:

Werribee Open Range Zoo
Off-grid exhibits e.g.
Cheetah and Giraffe

< $500,000

Solar Forest at Car Park or large areas to power large sections of the zoo

$1,000,000 - $2,000,000

Melbourne Zoo
Green Café, Main Drive and Twilights Lawn for greening our concerts

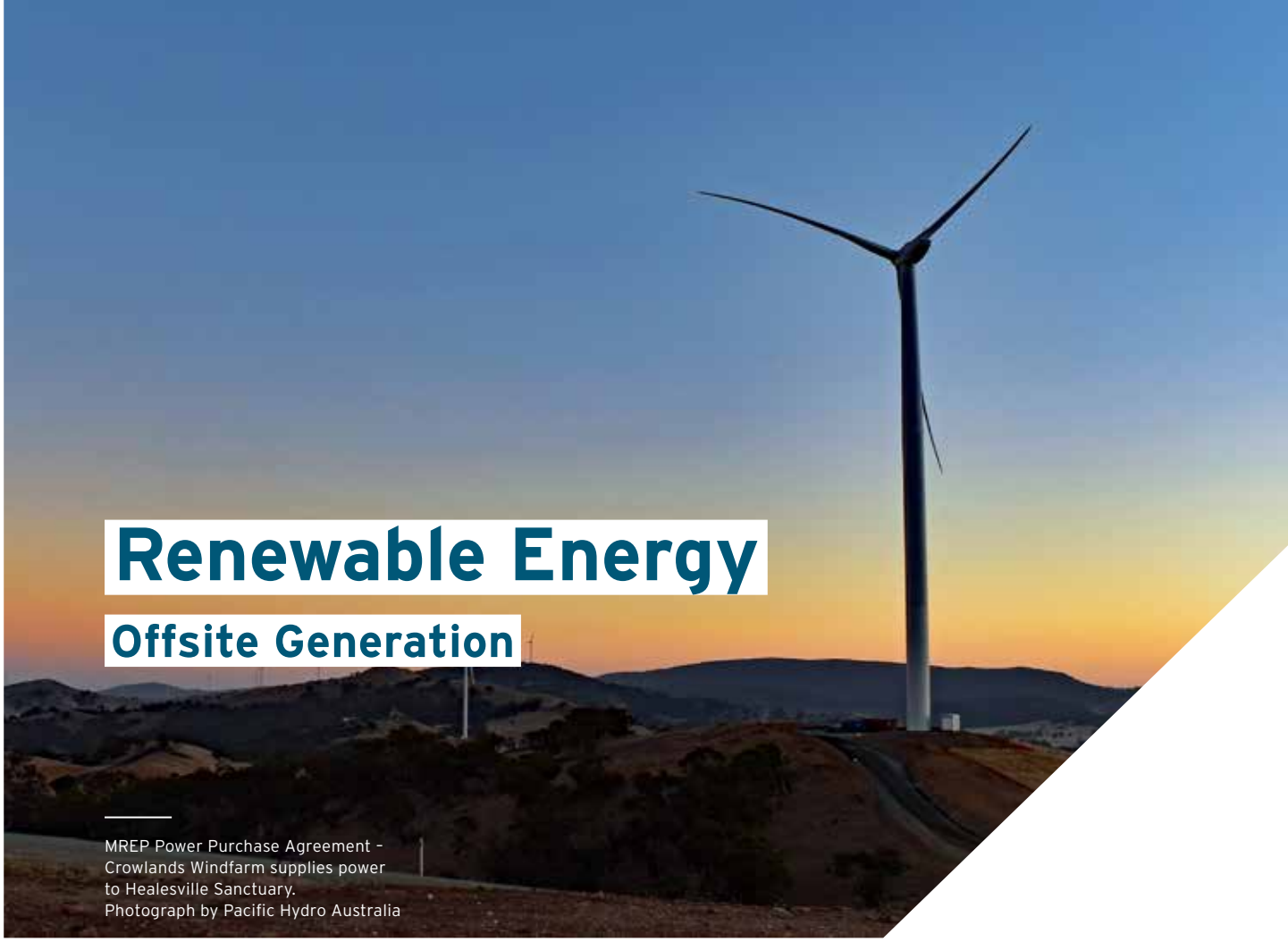
< $500,000

Healesville Sanctuary
Hybrid power at the Australian Wildlife Health Centre

< $500,000

Benefits of investment:

A $300,000 investment will procure 8 trees with 20kW of solar PV, which will produce approximately 26,280 kWh and negate 31 tonnes of CO2e per year. While the simple payback on electricity is greater than 10 years, the Solar Trees have other benefits such as the ability to showcase the advantages of renewable energy without being dependent on network approvals or electrical upgrades. The Solar Trees are also aesthetically pleasing and provide much needed shade for our visitors.



Renewable Energy

Offsite Generation

MREP Power Purchase Agreement - Crowlands Windfarm supplies power to Healesville Sanctuary.
Photograph by Pacific Hydro Australia

Increasing our renewable energy to 100% through offsite generation

For the first time in Australia, Zoos Victoria has joined together with other like-minded organisations and formed the Melbourne Renewable Energy Project (MREP). As a collective, we purchase renewable energy from a newly built 39-turbine, 80MW wind farm at Crowlands in Victoria. Owned and operated by Melbourne-based clean energy company Pacific Hydro, MREP members have entered into a long-term power purchase agreement and committed to buying 88GWh of electricity per year from the Crowlands Wind Farm.

The MREP approach enables us to take an active role in securing a renewable electricity supply and to take systematic action on climate change. It also provides long-term price certainty, enabling Zoos Victoria to mitigate the risk of increased energy costs in a volatile market.

In 2019, Zoos Victoria's overall renewable energy consumed was about 19% of total electricity. Space for renewable energy generation at Zoos Victoria's properties is limited. Hence, to achieve 100% renewable energy, we will require investments in offsite generation.

Offsite generation required includes:

Werribee Open Range Zoo

Power Required per year
1,050,000 kWh

Greenhouse Gas reduction
1,239 tonnes CO2e

< $500,000

Melbourne Zoo

Power Required per year
5,584,500 kWh

Greenhouse Gas reduction
6,590 tonnes CO2e

$1,000,000 - $1,500,000

Benefits of investment:

A $300,000 investment will procure 100% renewable energy per year through a power purchase agreement for Werribee Open Range Zoo.

Note that this is only an estimate based on energy consumption from the 2017-18 financial year, estimated cost of electricity and large-scale energy certificates (LGCs).

Energy Efficient and Greenhouse-friendly Animal Exhibits

Conserving More Than Butterflies

Orchard Swallowtail Butterfly
House at Melbourne Zoo
Photography by Jo Howell

Melbourne Zoo

Upgrading the energy efficiency of our iconic Butterfly House

The Butterfly House is a beloved attraction at Melbourne Zoo. Built in 1985 almost entirely from glass, it was the first fully enclosed butterfly glasshouse in a temperate climate in the Southern Hemisphere. It is is one of Australia's largest butterfly enclosures, housing 400-600 active butterflies at any one time. With all butterflies bred onsite and up to 30,000 released into the structure annually, this is a significant operation for Melbourne Zoo.

One of the challenges of caring for butterflies is maintaining optimal tropical climatic conditions irrespective of Melbourne's famous changeable weather. Within the Butterfly House, temperatures must only range from 22 to 28°C and humidity must remain between 65 and 75%. Consequently, this enclosure is the single highest natural gas user across Zoos Victoria, accounting for a third of the organisation's total consumption.

In 2012, the glass roof of the Butterfly House was upgraded to a double glazed (argon filled) glass. This measure proved worthwhile, having reduced the natural gas consumption of the enclosure by 35%. To build upon this work and to further improve the building's efficiency, high performance double glazing to the walls of the Butterfly House is proposed.

A total of 187 square meters of new glass is required to achieve a projected natural gas savings of 23%.

Melbourne Zoo

This project would result in:

Natural Gas reduction per year
77.3 MWh

Greenhouse Gas reduction
14 tonnes CO2e

< $500,000

Benefits of investment:

A $350,000 investment will further reduce the natural gas consumption of the Butterfly House by 77.3MWh. This will result in a reduction of greenhouse gas emissions by a further 14 tonnes annually and greatly improve the maintenance of optimal temperature and humidity required to care for the resident butterflies.

Maintaining the Delicate Balance of Wild Seas

Seal at keeper talk presentation
at Melbourne Zoo
Photograph by Sarah Summers

Constructed in 2009, the Wild Seas Precinct showcases Victoria's coastal environment and the exquisite marine life that calls it home. These species include Australian and Long-nosed Fur Seals, Little Penguins, Fiordland Penguins, Fiddler Rays, Port Jackson Sharks and other fish species. With an unmissable conservation focus, the area highlights the threats to Victoria's coastal areas and highlights what people can do to help protect them.

An extensive web of 24-hour life support systems maintains the quality of numerous bodies of water for the animals of Wild Seas. This life support system is comprised of pumps, chillers, UV generators and filters that process around 1.5 million litres of water several times a day. As a result, the energy required to maintain this system and support the species living at Wild Seas accounts for the greatest level of electricity consumption across any single precinct at Melbourne Zoo.

For the cooler Port Phillip Bay and Penguin habitats, electrical chillers are used to maintain optimum temperatures. In order to significantly enhance the energy efficiency of this precinct, Melbourne Zoo hopes to install more efficient cooling for these areas.

In the outdoor seal swimming range, shade sails are already used to reduce the heat absorbed by the water from the sun. Using the existing retractable steel structures currently placed over the outdoor pools, an innovative project is proposed to replace the shade sails with thin-film solar technology or rail mounted solar PV. This will add to the amount of renewable energy produced onsite by solar PV panels, and, if replicated in the spectators' viewing area, provide shade for animals and visitors alike.

The project scope is as follows:

Melbourne Zoo
Wild Seas
Install efficient cooling

< $500,000

Melbourne Zoo
Wild Seas
Install solar Photovoltaic shade sails

< $500,000

Benefits of investment:

A $200,000 investment in solar PV shading could provide 40kW of electricity, reducing our greenhouse gas emissions by 69 tonnes of CO2e per year. Visitors will also benefit from the provision of shade while experiencing the seals at this outdoor section of the precinct and Melbourne Zoo staff will have a high profile opportunity to integrate a sustainability-focused interpretive element within the Seal area.

Animals in our care

Keeping them warm and cool

Inland Bearded Dragon Reptile House Healesville Sanctuary
Photograph by Jo Howell

At Zoos Victoria, animal welfare is a major priority. Inherent to this is ensuring that we provide appropriate heating, cooling, humidity levels and ventilation for all individuals. As a result, significant amounts of energy are required. Projects in the Energy Efficiency category are analysed case by case to simultaneously achieve best practice animal care and maximise the efficiency of equipment installed.

Examples of Energy Efficiency project locations are:

Melbourne Zoo
The Orang-utan Sanctuary is home six individual Sumatran Orang-utans. These individuals have access to a temperature controlled habitat, two outdoor ranges and a series of temperature controlled night dens.

A combination of more efficient heating, cooling, ventilation and humidity together with smart control systems will produce better environmental and animal husbandry outcomes for this Critically Endangered and highly intelligent species.

< $500,000

Melbourne Zoo
The Reptile House is home to more than 65 reptile species and has an adjoining amphibian building where some of Australia's rarest frog species are cared for. A hydronic system provides general heating and heat lamps are used to replicate species-appropriate microclimates. However, some amphibians such as the Critically Endangered Baw Baw Frog and Corroboree Frogs require chilled waters to replicate their alpine environments.

For efficiency gains, a ground-sourced heat pump will produce hot water for the hydronic heating system. Concomitantly, reverse chilled water could be supplied to our cold climate amphibians.

< $500,000

Melbourne Zoo
Pygmy Hippopotamus and Brazilian Tapir have access to water bodies that are maintained at 22°C. These pools are heated by gas heaters producing direct CO2 emissions.

For efficiency gains and better environmental outcomes, a more efficient heater or solar heating system will reduce greenhouse gas emissions. Given the availability of space, a ground-sourced heat pump could also be installed at the Brazilian Tapir habitat.

< $500,000

All zoos
General heating for animals is provided by heat pads and space heating located at strategic locations in both indoor and outdoor areas.

For efficiency gains, on-demand heater and heat mats are proposed at animal exhibits for both indoor and outdoor areas. Insulation in these spaces will further ensure a reduction of heat loss. These initiatives will result in a reduction of greenhouse gasses and the maintenance of temperatures required for optimum animal care.

< $500,000

Benefits of investment:

A $300,000 investment will provide a ground-sourced heat pump to heat the building and exhibits of Melbourne Zoo's Reptile House and World of Frogs. For each unit of energy (kW) used, the heap pump will produce and deliver on average four times the amount of heating or cooling to the building. This will significantly reduce greenhouse gas emissions from this precinct and directly contribute to the world-class care of some of Zoos Victoria's Fighting Extinction species, the Critically Endangered Baw Baw Frog and Southern Corroboree Frog.

Fresh food and Efficient Refrigeration

Best practice animal husbandry requires fresh food and the ability to prolong its shelf life. At our properties, Zoos Victoria has an extensive range of refrigeration systems that maintain the highest quality food for a diverse range of species, each with specific dietary requirements. Refrigeration, particularly larger chillers and cool rooms, require significant amounts of energy and results in the emission of greenhouse gases. Upgrades in refrigeration and the rooms themselves will increase efficiency and reduce associated emissions.

Refrigerants contained within cooling equipment are also an important consideration as these have a high global warming potential when leaked into the environment. One kilogram of the refrigerant *R410a* has the same greenhouse impact as two tonnes of carbon dioxide, this is tantamount to running a car constantly for six months. Swapping out existing refrigerants with to more up-to-date and climate-friendly alternatives will reduce Zoos Victoria's greenhouse gas emissions.

Projects in this area include:

All zoos
Chiller and cool room refrigeration efficiency upgrades

< $500,000

All zoos
Change to more climate- friendly refrigerants

< $500,000

Net Zero Emissions Buildings and Exhibits

Solar Trees 20kW off-grid battery storage system at Werribee Open Range Zoo
Photograph by Kiam Yoong

Imagine net zero carbon buildings, or exhibits that are highly efficient and fully powered by onsite renewables. Projects in this area are a culmination of all proposed works to ensure the best possible environmental outcomes.

Project components include:

- Solar Trees producing renewable energy with battery storage
- Heat pumps for hot water, hydronic heaters and absorption chillers
- LED lighting
- Building insulation
- Variable Speed Drives (VSDs) and energy efficient pumps
- Energy monitoring and control systems
- Power Factor and Harmonic corrections

All zoos
Re-development of an existing building or exhibit to achieve net zero emissions

< $500,000

All zoos
Re-development of an existing precinct to achieve net zero emissions

$500,000 to $1,000,000

Preserving our Precious Water

Under a medium emissions scenario referenced by the Australian Government's *Climate Change in Australia*, most of country, including Zoos Victoria's three properties, is very likely to experience hotter and drier conditions in the near future. As such, we endeavour to reduce our reliance on water and better preserve that which we use in our zoos.

Rainwater Harvesting

Melbourne Zoo's Water Treatment and Recycling Plant
Photograph by Kiam Yoong

At Melbourne Zoo, our Water Treatment Plant recycles approximately 100 mega litres annually. This accounts for about half of the zoo's total annual water use. Rainwater is collected along with water used for animal and enclosure washing and recycled at this plant. The plant uses gross pollutant traps, microfiltration, ultraviolet sterilisation and chlorine dosing to treat the site's storm water, water bodies and waste water from animal husbandry to become Class A recycled water. This recycled water is used for grounds irrigation, for flushing toilets, filling water bodies and to wash down animal areas. The recycled (treated) water tank has a capacity of 620kL and the raw water tank capacity contains 780kL, limiting potential storage options during summer when water is at peak demand. By having tanks both underground and external around the zoo, extra capacity can be stored for raw water, treated water and harvested rainwater. This combination of approaches will ensure the optimum reuse of water at Melbourne Zoo.

At Healesville Sanctuary, the Australian Wildlife Health Centre is completely reliant on rainwater. This facility is equipped with the capability to harvest, filter and treat rainwater for the hospital's use. This example should be replicated at other buildings and exhibits around the Sanctuary.

At Werribee Open Range Zoo, recycled water is used from the nearby Melbourne Water Western Treatment Plant. Beyond this, Werribee Open Range Zoo has a number of buildings with the potential to harvest rainwater themselves. By installing tanks around Zoos Victoria's largest property, we can hold and maximise the use of rainwater, thereby reducing consumption of potable water onsite.

All zoos
Rainwater harvesting using above ground tanks

< $500,000

All zoos
Rainwater harvesting using below ground tanks

< $500,000
for small installations

$500,000 to $1,000,000
for large installations

Benefits of investment:

A $100,000 investment will procure below ground tank/s with an estimated capacity of 100KL. These tanks will also free up space allowing backfilled areas to be used for recreational and practical activities.

Black Water Harvesting

Melbourne Zoo's Water Treatment and Recycling Plant at Melbourne Zoo - Photograph by Kiam Yoong

The state of Victoria is experiencing low rainfall and prolonged hot weather. As a consequence, water storage levels are lower than usual and we need to find ways of procuring water from alternatives sources. At Melbourne Zoo, our Water Treatment Plant is capable of treating black water (waste and sewage water) to become Class A recycled water suitable for reuse within the zoo. In order to reduce our reliance on potable water, we will explore opportunities to further harvest black water from our trade waste system to Class A recycled water and put it to use in our zoo. The trade waste system encompasses all liquid waste generated from activities in zoo grounds that is discharged back into the sewage system.

Melbourne Zoo

Black water harvesting using the zoo's Water Treatment Plant.

Project components could include:

- Upgrades to treatment plant
- Rerouting underground sewer pipes
- Installing underground holding tanks

$500,000 to $1,500,000

Improving Water Quality

Group of four Australian Pelicans at Melbourne Zoo
Photograph by Rick Hammond

All our zoos have water bodies that are part of exhibits or natural ecosystems. With climate change and associated drier conditions, these water bodies will require more interventions to effectively manage water quality for the safety of the animals that call these spaces home. As part of our efforts to protect and enhance the quality of Zoos Victoria's water bodies for both zoo animals and wildlife, desired projects include:

Melbourne Zoo Pelican Lake

Werribee Open Range Zoo's Hippopotamus wetland

Healesville Sanctuary's wetland

- Artificial wetland systems for water purification
- Filtration systems
- Solar aeration

< $500,000

Habitat Protection and Improvement

Improving Wetlands and Waterways

Badger Creek,
Healesville Sanctuary
Photograph by Kiam Yoong

Both Werribee Open Range Zoo and Healesville Sanctuary have direct interactions with natural and human-made wetlands and waterways. These habitats are home to a diverse range of species of frogs, birds, turtles, fish and invertebrates and, as a zoo-based conservation organisation, it is imperative that we continue in the footsteps of the Wathaurung, Boonerwrung and Wurundjeri peoples to protect and enhance these places.

The Werribee River winds through the Zoo, providing staff and visitors with a unique opportunity to explore a beautiful and ancient wildlife corridor. Stormwater from within Zoo's boundary and from neighbouring market gardens also runs through the property. At Healesville, Badger Creek flows through the site and the Sanctuary encompasses and manages Coranderrk Lake. To reduce eutrophication (excessive growth of plants and algae from nutrient run-off) of these important water bodies, the following projects are proposed.

Wetlands at Werribee Open Range Zoo

Werribee Open Range Zoo has a number of wetlands including our Hippopotamus exhibit and the wildlife corridor along the edge of the Werribee River. Wetlands act as nature's water purification system and improvements to the vegetation will both promote and speed up the purification process. This can be accomplished by planting larger reed beds coupled with the use of solar aerators to promote aerobic decomposition of organic matter.

‹ $500,000

Core River activation at Werribee Open Range Zoo

Use gravity to feed into the core river dam to reactivate the dry river along the walking trail.

Benefits of the project include:

- Reduced pumping head to irrigate core area gardens.
- Increased amenity and habitat.
- Potential for use as a backup for all irrigation and therefore minimise reliance on potable water as a backup.

‹ $500,000

Red Gum trees management at Melbourne Zoo

Establish individual tree management plans and actions for Melbourne Zoo's remnant Red Gum trees.

‹ $100,000

All zoos - Create rain gardens and vegetation swales

Bioremediation vegetated swales and rain gardens act like bio-filters to extract nutrients and other pollutants. The natural processing of stormwater running through these systems occurs before the water reaches the natural creeks and rivers. Potential projects exist at both Healesville Sanctuary and Werribee Open Range Zoo with benefits that include;

- Improved habitat for local wildlife and the ecosystem as a whole
- Improved visual impact of the environment

‹ $500,000

Zero Waste to Landfill

As part of our commitment to continual improvement, Zoos Victoria has started our Zero Waste to Landfill project with Phase 1 – *achieve a diversion from landfill rate of 88%** to be achieved by June 2019. An onsite system has already been implemented with landfill bins replaced by separate bins for organics and soft plastics. Together with another for comingled recycling, this 3-bin system will be the standard at our three zoos, ensuring that all waste from visitor and staff is reused or recycled and does not end up in landfill.

Phase 2 of this project will increase our diversion rate from landfill to 100%*. This project involves changes at the back-of-house operations to ensure maximum recycling and reusing of materials.

**excludes prescribed industrial waste or waste that cannot be recycled or reused.*

Materials Recovery Facility

In-vessel Composter at Melbourne Zoo's Materials Recovery Facility
Photograph by Kiam Yoong

At Melbourne Zoo our Materials Recovery Facility (MRF) ensures that all waste is sorted for reuse, composting, recycling or sent for treatment before going to landfill. With this MRF, Melbourne Zoo has consistently achieved close to 90% diversion rate from landfill. It is proposed that all of our zoos will have an MRF in place to achieve our Zero Waste to Landfill goals. Equipment or infrastructure required includes:

All zoos - Materials Recovery Facility (MRF)

Waste Sorting Equipment:
The composition of general waste consists of a high percentage of recyclable materials such as organics, plastics, paper and metal. Using a sorting facility including conveyers, compactors and tumblers, all recyclable material can be removed and recycled.

< $500,000

Shredder:
Shredders are used to break down materials for further processing. Predominately used for organics waste, the materials that pass through the shredder will be more efficiently composted.

< $500,000

Sorting Bays:
Sorting bays are used to separate recycled or reusable material.

< $500,000

Composting bays or in-vessel composters:
Static aerated composting bays or in-vessel composters are used to hold and compost organic material for the reduction of greenhouse gas emissions.

< $500,000

Sludge Bays:
Sludge bays are used to 'de-water' sludge from water bodies and water treatment plants. Sludge not treated in this way must go to landfill.

< $500,000

New waste bin system
for collection of organics
and recyclables
Photograph by Kiam Yoong

Creating our own Circular Economy for Single-Use Plastics and Comingled Waste

Every year an estimated 8 million tonnes of plastic waste enters our oceans. Awareness of plastics pollution, especially in the marine environment, has hit an all-time high with governments and organisations throughout the world taking necessary steps to reduce plastics ending up as marine debris.

In the Federal Government's *2016-17 Australian Plastics Recycling Report*, the national plastics recycling rate is reported to be 11.8% of total waste. Of this, 43.4% is reprocessed in Australia and 56.6% overseas. With changing standards such as China's *National Sword Policy* enforcing restrictions on the importation of recycled materials and ever-increasing consumer awareness, recycling overseas will continue to become more difficult and costly. To ensure that valuable materials continue to be used and do not end up in landfill, circular economies on comingled waste and single-use plastics will have to be established locally.

In recognition of the threats posed by single-use plastics to wildlife, the World Association of Zoos and Aquariums (of which Zoos Victoria's CEO is President) signed a Memorandum of Understanding with the United Nations Environment Programme in October 2017. This saw the Zoo sector, including Zoos Victoria, commit to reducing plastic pollution and taking measures to protect marine environments. WAZA's statement highlights the scale of plastic impacts on our oceans: '*Plastic pollution, the decimation of coral reefs and animals for wildlife products are becoming increasingly critical problems. Is it estimated that if action is not taken now, there will be more plastic in the oceans than fish, by 2050.*'

At Zoos Victoria we have a number of initiatives restricting the use of single-use plastics. Examples include the banning of single-use plastics bags and straws. This has been enforced via Zoos Victoria's Single-use Plastics Policy since December 2018. To ensure success in further reducing comingled waste and eliminating single-use plastics from our zoos we will investigate the following:

All zoos

Establish a circular economy on single-use plastics and/or comingled waste. This will ensure our collected single-use plastics/comingled waste is recycled back into useful products to be used at our zoos.

< $500,000

Resource Monitoring and Controls

Our zoos are like communities with complex and varied spaces such as gardens, office buildings, infrastructure for accommodation, animal exhibits, hospitals, kitchens, restaurants and natural habitats. These spaces and buildings require vast amounts of resources to keep to different standards. Understanding resource consumption is part of Zoos Victoria's continuous improvement, and to do this we must ensure we have the right data and system controls to ensure strategic and optimal use of resources. One such project to achieve this will focus on expanding our existing electricity monitoring system to incorporate controls and monitor other resources and environmental factors.

Building Management Systems

For best animal care and human comfort, smart control systems can be implemented to ensure the efficient use of resources and minimisation of greenhouse gasses. Our animal exhibits are unique, and environmental parameters can be challenging to maintain. With a building management system, we can improve the efficiency of these parameters through automation and monitoring.

All zoos
Building Management Systems in offices and animal enclosures.

< $500,000
(depending on scale)

Monitoring of energy and water

To understand and manage our resources, Zoos Victoria needs to monitor and measure all resources including electricity (produced on site and used from the grid), water (recycled or potable), natural gas and environmental parameters such as humidity, moisture, PH and temperature. This project will upgrade areas for improvement while taking into account the capability for Building Management Systems.

All zoos

- Expansion of electricity monitoring (sub-metering).
- Natural Gas monitoring
- Water (potable and recycled) monitoring

< $500,000
depending on scale

- Environmental parameters monitoring for building management systems or controls.

< $500,000

Carbon Neutral Certification and Carbon Offsets

Zoos Victoria is committed to carbon neutrality. To achieve this target, we have first and foremost invested in reducing our carbon footprint through improvements to operations across our three zoos. To fulfil our commitment to carbon neutral certification under the National Carbon Offset Standard (NCOS), Zoos Victoria is required to purchase offsets on an annual basis.

As a zoo-based conservation organisation, it is important we choose carbon offsets that have co-benefits for habitat protection, biodiversity and people. In the past, we have chosen projects both in Australia and oversees that focus on reforestation and the protection and rehabilitation of degraded forest. We also choose projects in line with our own conservation commitment. We seek support in the following areas:

Procurement of NCOS accepted carbon offsets
Every year, Zoos Victoria procures carbon offsets to fulfil the requirements of our National Carbon Offset Standard (NCOS) certification. As a zoo-based conservation organisation, we have elected to procure offsets from bio-sequestration projects that place emphasis on avoiding deforestation and supporting the rehabilitation of degraded land. These offsets are evaluated and selected both for their co-benefits in preserving and protecting bio-diversity and for together capacity for community involvement and sustainable development.

All zoos
Procurement of NCOS accepted carbon offsets that are aligned with our values

< $500,000

Development of NCOS accepted carbon offsets
As a consequence of human-induced climate change, we are witnessing unprecedented habitat and bio-diversity loss. As an organisation dedicated to fighting extinction, we are seeking like-minded organisations to partner with us for the development of bio-sequestration projects for carbon offsets that have significant co-benefits for bio-diversity preservation and wildlife conservation.

All zoos
A partnership(s) in developing NCOS accepted offsets that complement in-situ wildlife conservation.

> $1,000,000
dependant on scale

Sustainable Procurement

At Zoos Victoria, we strive to reduce our environmental footprint through procurement. This means, we always strive to prioritise products and services that have minimal environmental, safety, social and economic impacts over their life cycle.

We have already made a number of changes to improve sustainable procurement, including:

- Implementing a target to procure 100% ethical good and services (where applicable) by 2023
- Evaluating suppliers for sustainability credentials
- Developing sustainable procurement contract clauses and selection criteria
- Purchasing products such as certified seafood, recycled paper products, sustainably harvested timber, timber substitutes, and 100% Segregated Certified Sustainable Palm Oil
- Investing in a certified Fairtrade Workplace
- Empowering the Sustainable Procurement Team to achieve positive environmental outcomes through sustainable procurement practices

Our next focus is on improving the procurement of sustainable products.

Electric Vehicles

Electric vehicles are maturing by the year, and predictions indicate a promising future for EV technology. Benefits include:

- Reduced dependency on fossil fuels
- Reduced carbon emissions
- Promotion of private sustainable transport modes

Commercial vehicles

At our zoos, we operate an extensive range of commercial vehicles ranging from buses to trucks and buggies.

Some of Zoos Victoria's buggies are electric, but we are keen to expand this to all (where possible) our commercial vehicles.

Passenger EVs

Imagine a zero emissions car. Now imagine three of them, one for each of our three world class zoos! Zoos Victoria has already trialled electronic vehicles at each of our 3 properties. Our next step is to secure these cars. Charging stations will be powered by 100% renewable energy and the electric fleet will be used to transport staff within and between our 3 zoos and throughout the surrounding metropolitan Melbourne area.

There is a unique opportunity to skin the cars with images and contribute to raising the profiles of some of our lesser known Fighting Extinction Species.

Cleaning and Disinfecting, the Environmental Way

To maintain best practice animal husbandry and staff and visitor hygiene, we rely on a range of chemicals for cleaning, sanitising and disinfecting. For better environmental outcomes, Zoos Victoria plans to reduce our dependence on chemicals by using electrolysed water. Electrolysed water, or eWater has been trialled at our zoos resulting in a reduction of chemical use and increased safety for zoo staff. Overall, the use of electrolysed water will result in:

- Occupation Health and Safety improvement
- Reduced discharges of chemicals directly into the environment or via treatment plants
- Reduced handing and processing of chemicals
- An overall reduction in expenditure on chemicals

Ethical Products

Tiger Indrah at Melbourne Zoo
Photograph by Rick Hammond

At Zoos Victoria, we consider and favour ethical products (where possible) in procurement. Since 2015, we have been certified as a Fairtrade Workplace. We also have public-facing community conservation campaigns such as *Don't Palm Us Off* that promote consumer action. We must walk the walk, and to do this, Zoos Victoria has a target to procure 100% ethical (where applicable) by 2023. This means we will be looking into procuring products and services with criteria covering the following:

- Animal cruelty
- Fairtrade
- Poverty eradication
- Employee exploitation and slavery
- Child labour
- Corruption

Projects to progress our commitment to responsible procurement include:

All zoos

EV passenger vehicles

< $500,000

EV commercial vehicles

< $500,000
for vans and small truck

$3,000,000
for bus (people movers) at Werribee Open Range Zoo

Equipment to produce electrolysed water for cleaning and disinfecting. Possible locations include animal kitchens, vet hospitals and cleaners' stations.

< $500,000

Ethical procurement of goods and services (individual items or a collection)

Assessment, tracking and reporting of sustainable and ethical procurement

< $500,000

Showcasing Sustainability

While Zoos Victoria has made enormous shifts and significant investment to improve our sustainability performance, many of our initiatives are not visible to the public. As advocates for wildlife, it is our wish to use our unique platform to showcase sustainability initiatives to our millions of visitors.

Sustainability Hub

Zoos Victoria is proposing a Sustainability Hub at each of our three zoos to showcase projects and initiatives and inspire our visitors to undertake their own actions at home.

Green Walls

At each zoo, we will plant green walls to provide an appropriate context from which to communicate compelling messages about creating a sustainable world.

All zoos

Sustainability Hub

< $500,000

Green walls

< $500,000

Summary of Projects

Project	Impact Area	Cost Range	Page #
Reducing greenhouse gas through renewables and efficiencies			
Solar Trees and Renewable Energy • Grid Connected solar PVs • Solar Trees - Off the Grid & Hybrid Power systems • Renewable Energy – Offsite generation	Greenhouse Gas	< $500,000 < $1,000,000 for Melbourne Zoo's MRF site - $1,000,000 - $2,000,000 for Werribee Open Range Zoo's solar car park < $500,000 for Werribee Open Range Zoo's renewable energy power purchase < $1,000,000 for Melbourne Zoo's renewable energy power purchase	
Energy efficient and greenhouse-friendly animal husbandry (exhibits)			
Conserving More Than Butterflies	Greenhouse Gas and Animal Husbandry	< $500,000	
Maintaining the Balance of Wild Seas • Efficient cooling • Solar PV shading	Greenhouse Gas and Animal Husbandry	< $500,000 depending on project	
Animals in our Care – Keeping them warm and cool	Greenhouse Gas and Animal Husbandry	< $500,000 depending on project	
Greenhouse-friendly Refrigeration & Efficiency • Cool room and chiller upgrades • Greenhouse Friendly refrigerants	Greenhouse Gas	< $500,000	
Net Zero Emissions Buildings and Exhibits			
Re-development of an existing: • Building or exhibit • Precinct	Greenhouse Gas	< $500,000 depending on project size $500,000 to $1,000,000 for precincts or larger buildings	

Preserving our precious water		
Rainwater Harvesting	Water	< $500,000 for small to medium installations $500,000 to $1,000,000 for large installations
Blackwater Harvesting	Water	$500,000 to $1,000,000
Improving Water Quality	Water	<$500,000 depending on project
Habitat Protection and Improvement		
Improving wetlands and waterways	Water and Habitat	< $500,000 depending on project
Zero Waste To Landfill		
Materials Recovery Facility	Waste	< $500,000 depending on project
Circular Economy & Single-Use Plastics	Waste and Market Opportunities	< $500,000
Resource Monitoring and Controls		
Building Management Systems	Greenhouse Gas and water	< $500,000 depending on scale
Monitoring of energy and water	Greenhouse Gas	< $500,000 depending on scale
Carbon Neutral Certification and Carbon Offsets		
Offset procurement	Greenhouse Gas and Habitat	< $500,000
Offset development	Greenhouse Gas and Habitat	> $1,000,000
Sustainable Procurement		
Sustainable Vehicles	Greenhouse Gas	< $500,000 for passenger and light commercial ~ $3,000,000 for customised busses.
Environmentally Friendly Cleaning and Disinfecting	Safety, Environmental protection and water	< $500,000
Ethical Products	Procurement	< $500,000
Showcasing Sustainability		
Sustainability Hub	Communications	< $500,000
Green Walls	Communications	< $500,000

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Fighting Extinction

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