REPOWERING
OUR REGIONS

Nature
Conservation
Council

#REPOWER
NSW

Introduction

NSW is lagging in the clean-energy revolution that is sweeping the rest of the country and the world.

Most electricity in NSW is supplied by five coal-fired power stations, all within 170 km of Sydney.

They emit millions of tonnes of toxic air pollution and greenhouse gasses every year, and their ageing technology threatens the reliability of the grid.

A different future is needed. Unprecedented heatwaves and lengthening bushfire seasons are threatening communities and nature. Only by tackling pollution can we bring our climate back into balance.

Meanwhile our coal and gas-fuelled system is becoming unaffordable. Gas exporters have driven up domestic prices, coal plants are reaching the end of their lives, and political point-scoring is holding up investment in new sources of energy.

NSW has the makings of a clean-energy superpower. The state has world-class solar and wind resources in abundance. In just two days, NSW receives enough wind and sunshine to power all our homes, businesses and industry for a year.

But it won't be the centralised system of the past. Electricity generation will occur on the rooftops of millions of homes, and on wind and solar farms spread across the state's regions.

This report synthesizes the results of dozens of comprehensive studies to describe the current state of NSW's clean-energy industry, the pathway to 100% clean-energy, and the benefits that will flow to regional NSW.

From cutting our household power bills and climate pollution, to creating jobs and investment in regional towns, to community funds and drought-proof income for farmers, the clean-energy transition has much to offer the people of NSW.

But the transition will not happen as quickly and as fairly as we need without leadership from the NSW Government. Clean energy should benefit everyone in NSW, from coal-dependent communities to pensioners and renters.

It's time for NSW to embrace clean energy to achieve the energy trifecta: cleaner, cheaper, more reliable electricity.

Key to the maps used throughout this report.

Solar Farms
- Existing
- In construction
- Planned and approved

Wind Farms
- Existing
- In construction
- Planned and approved

Pumped-Hydro
- Existing

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PHOTO (FRONT COVER): © First Solar.

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☀ 3   ❄ 2

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Tamworth

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Bega

South Pacific Ocean

KEY FINDINGS

A ROOFTOP REVOLUTION IS UNDERWAY

- Thousands of homes and businesses are taking control of their energy bills, with rooftop solar potentially supplying 25% of all energy in NSW by 2030, up from 2% in 2017.

- The rooftop solar revolution could create and sustain an average of 14,000 direct, full-time jobs a year from 2017 to 2030, almost 10 times the state's 1,550 rooftop solar workforce in 2015–16.

- Policies to make the rooftop revolution fair and affordable include giving renters, social housing tenants and apartment dwellers access to solar, and devising innovative tariffs to encourage household use of batteries to stabilise the grid and reduce peak demand.

CLEAN ENERGY IS A NEW INDUSTRY FOR REGIONAL NSW

- Regional NSW's world-class wind and solar resources could provide more energy than the state's entire coal and gas reserves, potentially generating 267 times more energy than the state needs with zero pollution.

- Drought-proofed incomes, jobs and economic activity can help regional areas through economic fluctuations.

- Community benefit funds and community ownership maximise advantages of clean-energy for regional communities.

EMBRACING CLEAN ENERGY PROMISES A JOBS AND INVESTMENT BOOM

- Moving to 100% clean energy will create 22,000 full-time jobs in NSW (14,000 in rooftop solar and 8,000 in large-scale wind and solar).

- In 2017, $2.3 billion dollars of investment was secured for large-scale clean-energy projects under construction.

- There are 52 projects in the development pipeline, representing $11 billion of potential investment.

- Making the grid run on 100% clean energy is a great nation-building project that will bring $25 billion in investment and growth to regional NSW.
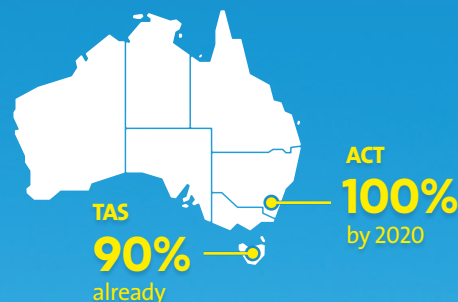
"MOVING TO 100% CLEAN ENERGY WILL CREATE 22,000 FULL-TIME JOBS IN NSW."

PHOTO: © First Solar.

IS IT POSSIBLE

TO POWER NSW WITH 100% CLEAN ENERGY?

While NSW only gets 6% of its electricity from solar and wind, other states and countries are already well on their way to powering their economies with 100% renewable energy.

TAS
90%
already

ACT
100%
by 2020

The ACT is on track to use only 100% clean-energy in the next five years, while Tasmania already gets 90% of its power from clean sources. On the other side of the globe, Denmark and Scotland both source more than half their electricity from clean sources, while the United Kingdom is on track to phase out coal by 2025 and California has reached 40% clean-energy. Universities, industry consultants and even CSIRO have studied 100% clean energy in Australia and have found it is achievable, affordable and reliable.

"SWITCHING TO **100% RENEWABLE ELECTRICITY** BY 2030 WOULD NOT ONLY BE RELIABLE AND CLEAN, BUT ALSO **CHEAPER** THAN TODAY'S WHOLESALE PRICES."

PHOTO: Taralga Wind Farm in South East NSW. © Shutterstock / Olga Kashubin.

100% CLEAN ENERGY AUSTRALIAN STUDIES

100% Renewable Energy for Australia
UTS Institute for Sustainable Futures, 2016

Key Finding: The transition to a 100% renewable electricity system by 2030 is both technically possible and economically viable in the long term.

"Because renewable technologies have no ongoing fuel costs, power sector fuel savings of $340 billion and transport fuel savings of $400 billion more than compensate for the higher investment costs, a net saving of $90 billion."

UTS:ISF
INSTITUTE FOR SUSTAINABLE FUTURES

Electricity Network Transformation Roadmap
CSIRO and Energy Networks Australia, 2017

Key Finding: Switching to a 100% renewable energy economy by 2050 would not only be reliable and clean, but also save consumers $414 per year on their energy bills, largely because networks, which constitute the bulk of household bills, can be more efficiently used with smart, distributed generation and storage.

Energy Networks Australia **CSIRO**

Least Cost 100% Renewable Electricity Scenarios in the Australian National Electricity Market
Dr Benjamin Elliston, University of NSW, 2013

Direct Quote: "The electricity sector is a prime candidate for rapid decarbonisation due to its significant greenhouse gas emissions yet wide range of zero-emission supply options."

UNSW SYDNEY

Zero Carbon Australia Stationary Energy Plan
Beyond-Zero Emissions, 2010

Direct Quote: "Detailed modelling was undertaken to ensure that the new renewable energy supply can meet all demand projected under the Zero-Carbon Australia 2020 Plan, 24 hours a day, 7 days a week, 365 days a year."

beyond ZERO emissions

100% Renewable Electricity in Australia
Prof. Andrew Blakers, Australian National University, 2017

Key Finding: Using pumped-hydro for storage, the overall cost of a balanced, 100% renewable grid is as low as 7.4c/kWh, which is cheaper than current wholesale prices.

Australian National University

100 Per Cent Renewable Study
Australian Energy Market Operator, 2013

Direct Quote: "Reliance on a broad mix of generation spread across all regions is expected to be critical to maintaining the supply/demand equilibrium necessary for system security and reliability."

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

100% Wind, Water and Sun Energy Plan
Prof. Mark Jacobson, Stanford University, 2016

Key Finding: Australia will save $22.5 billion in health costs and $418 per person in energy costs by switching to clean fuels such as wind, water and solar.

Stanford University

CLEAN ENERGY
ON DEMAND

Wind and sunshine are abundant, cheap and clean, but they need to be complemented by flexible resources to cover peaks in demand and troughs in solar and wind generation.

These balancing technologies include energy storage, on-demand generation, smarter management of the electricity grid and locating sources in different weather zones across the country. Fortunately, many studies by universities, engineers and regulators have identified technology mixes that will provide affordable, reliable ways to power our homes, businesses and heavy industry.

"THERE HAVE BEEN MASSIVE FALLS IN THE COSTS OF PRODUCING EQUIPMENT FOR GENERATION OF LOW EMISSIONS ENERGY AND FOR STORING ENERGY OF ALL KINDS."

– **Professor Ross Garnaut**
6 October 2016

PHOTO: Economist Ross Garnaut visiting Torresol Energy's Concentrating Solar-Thermal Power Station near Seville, in Spain. © Beyond Zero Emissions.

TECHNOLOGIES
THAT WILL BACK UP A
100% CLEAN-ENERGY GRID

BATTERIES

Lithium-ion batteries are rapidly becoming more efficient and less expensive as the industry ramps up to new economies of scale. These batteries already power our mobile phones and laptops. Now they are beginning to revolutionise cars, homes and even electricity grids. Batteries are already cost effective for some solar households and are expected to halve in price over the next three years, giving people even more control of their energy bills. Morgan Stanley predicts household battery installations in Australia will grow from 30,000 in 2017 to 1 million by 2020. Large-scale batteries have now been installed in South Australia and Victoria to help stabilise the grid for all power users.

PHOTO: Tesla's South Australian Powerpack array being installed in September, 2017. © Timothy Artman / Tesla.

CONCENTRATING SOLAR-THERMAL WITH STORAGE

Solar-thermal plants focus and store the sun's heat to run a steam turbine with zero pollution and zero fuel costs. Energy is stored efficiently in tanks of molten salt with less than 1% heat lost per day, enabling them to generate electricity day and night. Solar thermal plants have been generating power in California since 1984, but are relatively new in Australia. Australia's first large-scale solar thermal plant is now in construction at Port Augusta in South Australia, following a five-year community campaign. Beyond Zero Emissions and the University of Melbourne found solar thermal plants could reliably supply 60% of Australia's energy needs as part of a 100% clean-energy grid.

PHOTO: Torresol Energy's Concentrating Solar-Thermal Power Station near Seville, in Spain. © Torresol Energy Investments.

OFF-RIVER PUMPED-HYDRO

Hydro-electric dams have been used to store energy and generate pollution-free electricity for decades. Traditional hydro dams, however, harm river ecosystems and are vulnerable to drought. Off-river pumped-hydro systems offer affordable energy storage with fewer environmental impacts. Australian National University (ANU) researchers have identified thousands of potential sites in NSW outside national parks and other protected areas that have sufficient elevation to store energy efficiently. By re-using water in a closed-loop system, pumped-hydro systems require very little water after they are first filled. ANU's cost analysis suggests a 100% clean-energy system backed up by pumped hydro would power Australia for less cost than current wholesale prices.

PHOTO: Snowy Hydro Tumut 3 generating station. © Colin Henein.

1 WESTERN NSW

For communities whose fortunes are tied to cycles of drought and rain, farming the wind and sun promises to provide a drought-proof, reliable source of income.

Western NSW's scorching sun makes it one of the best places in the world for solar farms. This includes both photovoltaic (PV) and concentrated solar thermal (CST) farms that store heat and convert it to electricity as needed.

Conditions are also excellent for wind farms in the Broken Hill, Hay and Cobar areas.

So far one solar farm is in operation at Broken Hill. Fifteen projects are in development that will bring the region's clean-energy capacity to 1900 MW. The region has far greater potential beyond this, but additional transmission will be essential to unlock this potential.

KEY to the maps in this report can be found on the front inside cover.

CASE STUDY

Broken Hill Solar Farm

A boost for the tourism industry is one of the more surprising spin-offs from the Broken Hill Solar Farm that opened on the edge of the Silver City in January 2016.

"The industrial experiences people can have when they visit our region are now not just about mine sites, we also have the solar farm," said Broken Hill Mayor Darriea Turley. The 53 MW facility represents an exciting new direction for a city whose name has been synonymous with mining for more than a century.

"Broken Hill used to mine mineral resources—now we're mining renewable resources. The community is rethinking what the town represents because the town was always mining underground. Now it is mining the surface—the wind and the sun," Ms Turley said.

"If you drive between here and Adelaide, you see so much land and so much opportunity for renewable energy. It is an untapped industry that just requires space to farm the sun and wind. And if there is one thing that rural people like to do, it's farming."

TOP: Broken Hill Solar Farm. © AGL.
BOTTOM: Sturt's Desert Pea grows abundantly around the Broken Hill Solar Farm. © AGL.

WESTERN NSW'S 100% CLEAN-ENERGY ROAD MAP

In a 100% clean-energy NSW, Western NSW would provide 22% of the state's electricity needs. It has good wind resources and world-class solar resources.

ROOFTOP SOLAR

About 31,000 households or 29% of all homes have already gone solar, far ahead of the state average of 18%. By 2030, rooftop solar could generate four times more power, enough to power all the homes in the region.

Existing (and in construction)
136MW

Potential (by 2030)
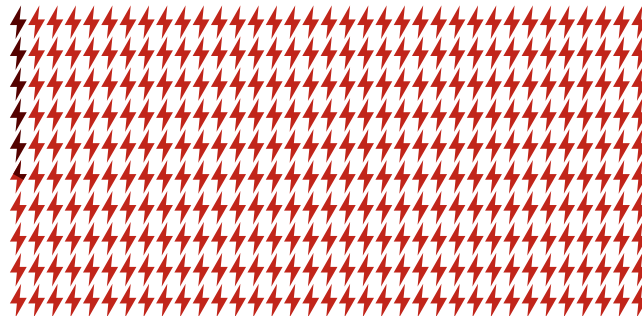**604MW**

Homes with Solar

29%
(31,000 homes)
have already installed solar

75%
(80,500 homes)
install solar by 2030

SOLAR FARMS

Under the *Repowering our Regions* road map, solar industry could grow steadily to 3,500 MW by 2030. Transgrid has identified opportunities for 5,000 MW of solar farms.

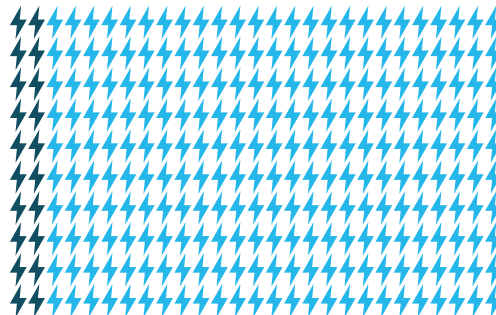**Existing** (and in construction)
53MW

Potential (by 2030)
3,500MW

WIND FARMS

When the 200 MW Silverton Wind Farm starts in 2018 it will power more than 137,000 homes. The *Repowering our Regions* road map forecasts 2,700 MW of wind farms operating by 2030, enough to power 1.6 million homes.

Existing (and in construction)
200MW

Potential (by 2030)
2,700MW

⚡ 10 MW

Benefits of 100% Clean Energy for Western NSW

$8 BILLION INVESTMENT
in Western NSW energy infrastructure.
Western NSW would export clean energy to other regions.

14.4 MILLION TONNES
of climate pollution can be avoided every year.
That's equivalent to the pollution from 5.6 million cars.

1,590 NEW JOBS
in Western NSW for the next 13 years and beyond.
These would be direct full-time jobs for Western NSW.

$410 BILL SAVINGS
on Australian energy bills every year.
These savings would be nationwide by 2050.

SEE THE TECHNICAL REPORT for calculations and detailed figures at **nature.org.au/regions-technical-report**

2 NEW ENGLAND

New England has always been an electricity importer, but by harvesting the region's wind and solar resources it could become a significant exporter of renewable energy, helping NSW transition to 100% clean energy.

The Moree Solar Farm started generating in 2016 and there are now two wind farms and one solar farm being built, while five more large-scale projects are in the development pipeline. These eight projects will attract $1.6 billion of investment, create 738 construction and 50 operations jobs, and supply enough electricity to power all the homes in the New England region six times over.

The region's household rooftops are also making a big contribution. Already 12,000 homes have solar panels, which is 21% of all households, and the change is gathering pace. In the first six months of 2017, another 800 houses made the switch. Every time another home sources its energy from the sun, NSW requires less energy from polluting coal-burning power plants.

KEY to the maps in this report can be found on the front inside cover.

CASE STUDY

The Sapphire Wind Farm seeks community ownership

The Sapphire Wind Farm just west of Glen Innes will be the largest in the state. Owners CWP Renewables are seeking interest in the community partly owning the 75-turbine facility so profits from the sale of power can remain in the local community.

With $1.2 billion of investment secured, construction is now under way, with about 100 people employed. In the longer term, eight staff will be employed to run the plant. In addition, the wind farm is establishing a community benefit fund worth $300,000 per year, about $4,000 a year for each turbine. The project will also provide drought-proof income to the landholders who host the turbines and other infrastructure on their land.

Each year the Sapphire Wind Farm will offset 600,000 tonnes of climate pollution from coal and gas plants and power 110,000 homes. By itself, this project will replace more than 12% of the output of the Liddell coal-fired power station in the Hunter Valley, which is due to retire in 2022.

TOP: Members of the Sapphire Wind Farm team with Nationals' Member for the Northern Tablelands, Adam Marshall. © CWP Renewables.
BOTTOM: The base of one of the Sapphire Wind Farm turbines during construction. © CWP Renewables.

NEW ENGLAND'S 100% CLEAN-ENERGY ROAD MAP

By implementing the *Repowering our Regions* road map, New England could provide 15% of the state's power thanks to the region's good grid transmission infrastructure and excellent wind and solar resources.

ROOFTOP SOLAR

About 12,000 homes, or 22% of all houses have already gone solar. The region's rooftops have space to generate seven-times more power than they do today.

Existing (and in construction)
50MW

Potential (by 2030)
315MW

Homes with Solar

21%
(11,964 homes)
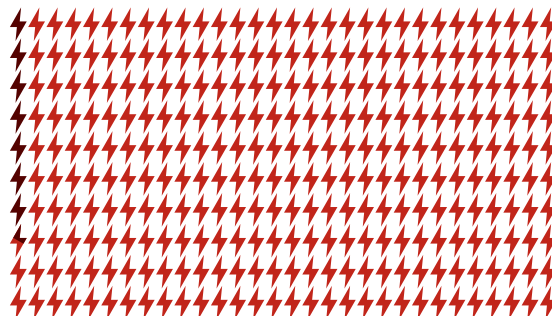have already installed solar

75%
(39,000 homes)
install solar by 2030

SOLAR FARMS

267 MW of solar farms are being planned in the region. Under the *Repowering our Regions* road map, this will grow to 3,000 MW, while TransGrid says the region could feed in up to 5,000 MW with network upgrades.
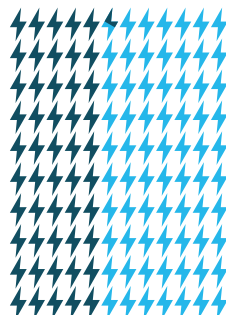
Existing (and in construction)
76MW

Potential (by 2030)
3,000MW

WIND FARMS

About 655 MW of wind farms are already proposed or under construction. The *Repowering our Regions* road map would have 1,200 MW of wind farms operating by 2030.

Existing (and in construction)
508MW

Potential (by 2030)
1,200MW

⚡ 10 MW

Benefits of 100% Clean Energy for New England

$5.2 BILLION INVESTMENT
in New England energy infrastructure.
New England would export clean energy to other regions.

9.2 MILLION TONNES
of climate pollution can be avoided every year.
That's equivalent to the pollution from 3.6 million cars.

1,160 NEW JOBS
in New England for the next 13 years and beyond.
These would be direct full-time jobs for New England.

$410 BILL SAVINGS
on Australian energy bills every year.
These savings would be nationwide by 2050.

SEE THE TECHNICAL REPORT for calculations and detailed figures at **nature.org.au/regions-technical-report**

3 CENTRAL WEST

With its excellent grid transmission infrastructure, abundant wind and solar resources and proximity to power-hungry cities, the Central West is primed to become a clean-energy powerhouse for NSW.

The region has 19 operating and proposed renewable energy projects that will generate about 1,500 MW, more than some of the state's coal-fired power plants.

The Central West also has the potential to be an energy-storage hub that could help balance supply and demand on a 100% renewable grid.

Hundreds of potential off-river pumped-hydro sites have been identified in the more mountainous parts of the region, as well as great potential for concentrating solar-thermal plants with storage.

With the right policy settings, clean-energy will become a new pillar of the local economy.

KEY to the maps in this report can be found on the front inside cover.

CASE STUDY

Manildra Solar Farm

The Cabonne Shire will become a renewable energy producer for the first time when the 120-hectare Manildra Solar Farm is completed in 2018.

The facility will generate enough electricity to power 14,000 homes and prevent the emissions of more than 91,000 tonnes of CO2 emissions a year from coal-fired power stations. That's a saving equivalent to the pollution from 35,000 cars.

The project, which is being developed by global firm First Solar, is providing significant economic benefits to the region by creating jobs, supporting small businesses and developing regional skills in a growing industry.

The project also reinvests in the community through the Manildra Solar Farm community fund, a development fund supporting community based initiatives.

When the project was announced, the then Cabonne Mayor Ian Gosper welcomed the news. "This is great news for Manildra, Cabonne and the environment," Mr Gosper said. "The solar farm will be one of the largest infrastructure projects undertaken in Cabonne and will create additional jobs and local investment in materials and services, particularly during the construction stage."

TOP: Manildra landscape. © Sacha Fernandez.
BOTTOM: An aerial view of the Manildra Solar Farm during construction. © First Solar Australia

CENTRAL WEST'S
100% CLEAN-ENERGY ROAD MAP

By implementing the *Repowering our Regions* road map, the Central West could provide 18% of the state's power, significantly more than the 11% supplied by the Mt Piper coal-fired power station at Lithgow, and with zero pollution.

ROOFTOP SOLAR

22% of all homes in the region have solar, a total of 33,810 solar homes. Under the *Repowering our Regions* plan, uptake could expand to 75% (121,000 homes) by 2030.

Existing (and in construction)
127MW

Potential (by 2030)
906MW

Homes with Solar

22%
(33,810 homes)
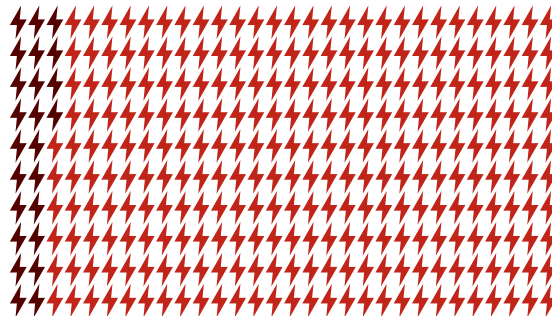have already installed solar

75%
(121,000 homes)
install solar by 2030

SOLAR FARMS

The *Repowering our Regions* road map forecasts 3,000 MW of solar farms by 2030, while TransGrid has identified 5,000 MW of potential in the region with grid upgrades.

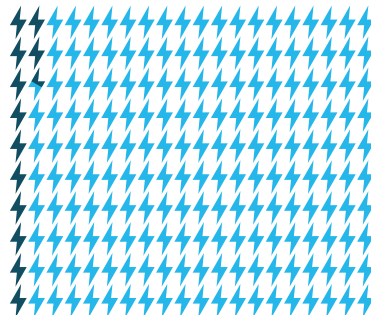**Existing** (and in construction)
240MW

Potential (by 2030)
3,000MW

WIND FARMS

The *Repowering our Regions* road map forecasts 2,000 MW of wind farms by 2030, enough to power more than a million homes. AEMO estimates the region's total wind-energy potential at 53,000 MW.

Existing (and in construction)
123MW

Potential (by 2030)
2,000MW

⚡ 10 MW

Benefits of 100% Clean Energy for the Central West

$6.4 BILLION INVESTMENT
in Central West energy infrastructure.
The Central West would export clean energy to other regions.

12 MILLION TONNES
of climate pollution can be avoided every year.
That's equivalent to the pollution from 4.7 million cars.

1,340 NEW JOBS
in Central West for the next 13 years and beyond.
These would be direct full-time jobs for the Central West.

$410 BILL SAVINGS
on Australian energy bills every year.
These savings would be nationwide by 2050.

SEE THE TECHNICAL REPORT for calculations and detailed figures at **nature.org.au/regions-technical-report**

4 SOUTH EAST

NSW

CROOKWELL 2 WIND FARM

WOOLONGONG

Hume Hwy

Kiama

Goulburn

Yass

3 3 3

Nowra

3

Canberra (A.C.T.)

2

Bundawang National Park

Ulladulla

Braidwood

Kings Hwy

Batemans Bay

Bimberi Wilderness

Dampier

Monaro Hwy

Princes Hwy

South Pacific Ocean

Cooma

Wadbilliga National Park

Narooma

Jindabyne

Kosciuszko Rd

Kosciusko National Park

Barry Way

Bega

Monaro Hwy

Bombala

The Southern Tablelands and the South Coast are leading the state in wind energy, hosting eight of the state's nine operating wind farms.

The region is also the state's "battery," with pumped-hydro plants in the Kangaroo Valley and the Snowy Hydro ready to store the state's excess wind and solar generation for when it's needed.

Wind farms have diversified the region's economy. They provide drought-proof income to farmers, employ locals in construction, operations and maintenance, and have established community benefit funds.

There are another nine wind farms in the construction and development pipeline that could provide even more benefits to the local community, including through community ownership models pioneered by Hepburn Wind in Victoria and Sapphire Wind in the New England region.

Thanks to its exceptional wind resources and good grid transmission infrastructure, the South East region has a crucial part to play in the state's clean-energy future.

KEY to the maps in this report can be found on the front inside cover.

CASE STUDY

Charlie Prell and the Crookwell 2 Wind Farm

Crookwell farmer Charlie Prell's great-grandfather chose well when he settled in the district more than a century ago. The property has some of the best granite and basalt soils in the country and reliable springs all year round.

But he could never have imagined how the winds that buffeted those hills would one day be a reliable source of income for his great-grandson. The property will soon host a handful of the 28 turbines that will make up the Crookwell 2 Wind Farm, which will power 41,600 homes with clean-energy.

"Benefits as a resident and farmer are life changing—not only for me but for the local community and my neighbours," he said. "When they complete Crookwell 2 Wind Farm the farming families underneath it will be paid up to $275,000 a year for the next 25 years. This wind farm will also contribute more than $100,000 a year to the local Community Enhancement Fund."

Charlie says most farmers don't have super, so the windfarms around Crookwell mean there will be lots of people who can retire with dignity.

TOP: Charlie Prell on his farm in Crookwell. © Lynne Strong.
BOTTOM: View of wind turbines from the Hume Highway in the South East of NSW. © Shutterstock / Taras Vyshnya.
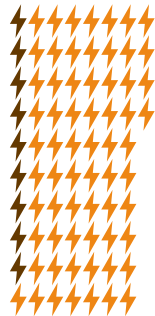
SOUTH EAST'S
100% CLEAN-ENERGY ROAD MAP

By embracing rooftop solar and continuing steady growth in its wind industry, the South East will be one of four key clean-energy producing regions in NSW, meeting 14% of the state's power needs.

ROOFTOP SOLAR

27,300 homes in the region have installed rooftop solar (22% of all houses). There's enough roof-space to increase the installed capacity by eight-times.

Existing (and in construction)
90MW

Potential (by 2030)
740MW

Homes with Solar

22%
(27,334 homes)
have already installed solar

75%
(98,800 homes)
install solar by 2030

SOLAR FARMS

While AEMO identifies significant solar potential in the South East, solar resources are more consistent elsewhere in the state. The *Repowering our Regions* road map forecasts some solar farms co-locating with wind farms to share infrastructure.
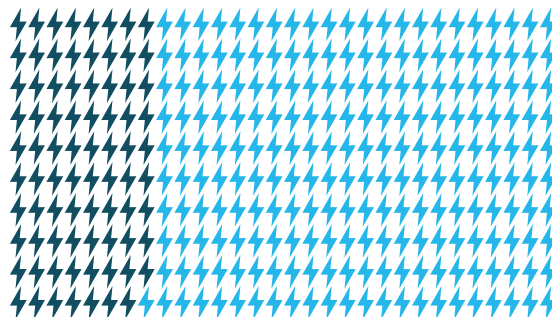
Existing (and in construction)
13MW

Potential (by 2030)
200MW

WIND FARMS

Wind farms generate 700 MW of electricity and a further 1,600 MW is in the development pipeline. The *Repowering our Regions* road map would have this rise to 3,000 MW by 2030, enough to power 1.7 million homes.

Existing (and in construction)
790MW

Potential (by 2030)
3,000MW

⚡ 10 MW

Benefits of 100% Clean Energy for the South East

$4.5 BILLION INVESTMENT
in South East energy infrastructure.
The South East would export clean energy to other regions.

9.2 MILLION TONNES
of climate pollution can be avoided every year.
That's equivalent to the pollution from 3.6 million cars.

1,000 NEW JOBS
in South East for the next 13 years and beyond.
These would be direct full-time jobs for the South East.

$410 BILL SAVINGS
on Australian energy bills every year.
These savings would be nationwide by 2050.

SEE THE TECHNICAL REPORT for calculations and detailed figures at **nature.org.au/regions-technical-report**

5 NORTH COAST

NSW

The North Coast has emerged as a role model for the rest of Australia when it comes to renewable energy projects driven by the community, for the benefit of the community.

The old model of electricity centrally generated and sold to passive consumers is being turned on its head, especially in the North Coast, the state's leader in rooftop solar.

Renewable energy presents a chance to put the power back in the hands of households and communities, but it takes innovative community energy models to make it a reality.

CASE STUDY

Lismore Community Solar

The Lismore community and council are building Australia's first community-owned and council operated solar farms.

Two 100 kW solar farms are being funded by Lismore locals, who get a return on their investment, and operated by the council, which gets a chance to cut its power bills.

"Community investors get a return, and we benefit from the renewable energy, so it's a win-win," said Lismore Council Environmental Strategies Officer Sharyn Hunnisett.

"It took us four years to get the business model right."

The first 100 kW solar farm is in operation on the roof of the local sports and aquatic centre, while the second will float on a pond at the council's sewage treatment plant.

The sewage treatment plant, council's biggest user of electricity, will become Australia's largest floating solar farm when it's completed at the end of 2017.

The project spurred a new floating pontoon design for Australian conditions. The pontoons reduce evaporation and algae growth, and the water in the pond cools the solar panels, improving panel efficiency by about 10%.

"We've had so much interest from across Australia, which is fantastic, so we've been able to share our story," Sharyn said. "The idea was to make a model that could inspire others."

The project is also a hit locally, with the share offer being over-subscribed within two weeks.

The Lismore Council is committed to being self-sufficient for energy by 2023, and Sharyn sees a bright future for the community ownership model.

"I think it'll escalate," she said. "In Europe it's very common to have community energy projects."

"We've been slow to start in Australia, but there have been huge leaps and bounds in just a few years. Now that it's happening, it's giving other communities confidence."

TOP: Sharyn Hunnisett, Lismore City Council's Environmental Strategies Officer.
BOTTOM: Lismore's Sports and Aquatic Centre is now a 100 kW solar power generator. © Rainbow Power Company.
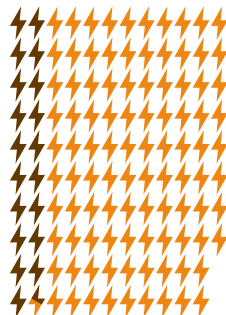
NORTH COAST'S
100% CLEAN-ENERGY ROAD MAP

The North Coast is leading the state in community energy projects and household solar. By continuing these themes the region can achieve energy independence and break through the monopoly of big energy companies.

ROOFTOP SOLAR

Already, almost a third of North Coast households are generating their own power with solar, far ahead of the state average of 18%. The average solar system size is 3 kW, although in the last six months the average installation size jumped to 5.2 kW.

Existing
(and in construction)
194MW

Potential
(by 2030)
1,180MW

Homes with Solar

31%
(62,800 homes)
have already
installed solar

75%
(157,000 homes)
install solar
by 2030

Benefits of 100% Clean Energy for North Coast

310K **HOUSES POWERED**

with clean energy generated on the North Coast.
That's enough for the entire North Coast and 50% to spare.

12 **MILLION TONNES**

of climate pollution can be avoided every year.
That's equivalent to the pollution from 4.7 million cars.

1,100 **NEW JOBS**

in North Coast for the next 13 years and beyond.
These would be direct full-time jobs for the North Coast.

$410 **BILL SAVINGS**

on Australian energy bills every year.
These savings would be nationwide by 2050.

SEE THE TECHNICAL REPORT for calculations and detailed figures at **nature.org.au/regions-technical-report**

CASE STUDY

Enova Energy

Northern Rivers locals have started their own electricity retailer, Enova Energy, to support renewables and keep profits in their community. The company has about 3,500 customers and 15 local employees and 50% of profits are reinvested into the community.

"When the Bentley campaign won, a lot of people in the community asked: if we are saying 'no' to CSG, what are we saying 'yes' to?" said Enova Community manager Sandi Middleton. "We decided we wanted to say 'yes' to renewable energy, and what was missing was a renewable energy retailer."

Six months later, $4 million was raised from 1,093 shareholders, the majority Northern Rivers locals, and Enova was born, the first community-owned renewable-energy retailer in Australia.

TOP & BOTTOM: Employees of Enova energy and community members with Ben Franklin MLC. © Enova Energy.

6 NSW HUNTER & LITHGOW

SUPPORTING COMMUNITIES IN TRANSITION

Coal-fired power stations in Lithgow and the Hunter Valley have powered NSW for decades, but a transition to clean energy is now under way in Australia and globally.

The sooner we transition the better—for the climate, for air quality, and for land and water resources. We also need to ensure this momentous structural adjustment is fair to the communities and workers who are on the front line of this transition.

Since 2012, three coal-fired power stations in NSW have closed: Munmorah and Redbank in the Hunter region and Wallerawang at Lithgow. Liddell is scheduled to close by 2022 and the remaining four plants must close by 2030 to limit climate change to less than 2° C.

Communities that have supplied our state with electricity for so long must not shoulder the burden of the transition to clean energy alone, and they must share in the benefits.

CASE STUDY

Repower Port Augusta—A smooth transition and clean energy on demand

Alinta Energy's Northern coal-fired power station employed dozens of workers in the town of Port Augusta, but as the plant came to the end of its life, the local community started a campaign to replace it with a clean, solar-thermal power plant when it retired.

A solar-thermal plant will provide not only jobs and opportunity, but also clean, dispatchable power with no fuel costs.

Unfortunately, the Allinta power station closed in May 2016 before an alternative was secured.

In mid-2017, the solar-thermal plant was finally secured when SolarReserve won a tender to supply power to the South Australian Government for 7.5c/kWh, beating gas plants in the tender. Construction of this Australian-first project will start in early 2019 and conclude in 2020.

The five-year campaign by the local community was ultimately successful, and the new power station will provide 4% of that state's energy needs and employ 50 workers.

TOP: Hundreds turned out to rally in South Australia ahead of the State Government's decision to back solar-thermal in Port Augusta.
BOTTOM: Crescent Dunes is the world's first utility-scale facility to feature advanced molten salt power tower energy storage capabilities. © SolarReserve.

ENSURING A JUST TRANSITION

Communities and industries in transition have historically been poorly supported in Australia.

The closure of the Newcastle steel works in 1999 is one exception, where programs of training and economic development meant employment in Newcastle actually rose, the economy became more diverse and resilient, and Newcastle is now a far cleaner, healthier city.

As part of the Paris climate agreement, Australia and 195 other countries are committed to a "just transition" that supports the most affected workers in obtaining secure jobs in a clean-energy economy.

To ensure a just transition takes place, we need:

- A transition fund that supports job creation in areas where electricity generation from coal is in decline, for example supporting clean-energy projects in the Hunter and Lithgow.

- A transition authority that gives key stakeholders—residents, workers, traditional owners, businesses and environment groups—a say in the future for their area.

- An orderly plan for the closure of coal-fired power stations, to give certainty to workers and the electricity grid.

PHOTO: © Lindsey Dillon.

POWER STORAGE OPPORTUNITIES

With the Liddell coal-fired power station due to close in 2022 and energy prices already spiking on hot days, NSW needs new sources of clean energy that can switch on as needed to supply peak demand.

Pumped-hydro and solar-thermal are two clean technologies that could serve this role.

Lithgow and the Hunter Valley are home to many excellent potential sites, as they have existing high-voltage transmission infrastructure, skilled energy workforces, and the steep slopes required for pumped-hydro.

Pictured is a potential pumped hydro site near Rossgole in the Upper Hunter. This single site would store 4 GWh of energy in a 6 GL water reservoir, enough to supply the peak demand of 1 million households for two hours.

For this site, net evaporation from the 35-hectare reservoir would be 900mm per year, or 0.3 GL per year. For comparison, the Bayswater and Liddell coal-fired power plants use up to 72 GL of water per year. Evaporation can be reduced by 90% with the installation of floating solar panels or shade balls, which would result in rainfall in the reservoir exceeding evaporation (see North Coast case study for more information).

PHOTO: Potential pumped hydro site near Rossgole in the upper Hunter. © Google Earth.

POLICIES
TO MAKE IT HAPPEN

The switch from burning coal to clean energy can't happen fast enough. Climate impacts are already biting hard, with record-breaking heatwaves across the state in 2017, and 50-degree days predicted for Sydney.

Coal-burning power stations are coming to the end of their lives, with three out of five facilities in NSW already with scheduled closure dates. And now that 70% of Australia's gas is shipped overseas, gas and electricity prices have surged. Clean energy can bring jobs and opportunities to many of NSW's regional areas. All that's missing is the political will to implement the following six steps.

The NSW Government should:

1. Commit to the transition our climate needs

Legislate clean-energy targets that are within our carbon budget: 100% clean-energy by 2030.

Australian and international authorities say that NSW needs to close its coal-fired power stations and transition to 100% clean energy by 2030, to do its fair share towards meeting the Paris agreement goals and avoiding dangerous climate change.

2. Bust bills by harvesting the sun and the wind

Run clean-energy auctions to guarantee that enough wind and solar is built in NSW to improve competition and bring down today's high prices. Wind and solar farms supply electricity far more cheaply than current wholesale prices, which are set by coal and gas. Reverse auctions, where the cheapest bidder wins, provide much-needed investor certainty.

We'll need 1.5 GW of wind and solar farms completed each year to reach 100% clean-energy by 2030.

3. Breakthrough technologies of tomorrow: clean energy on demand

Support dispatchable clean energy by tendering for new plants to come on line. Batteries are needed for short-term grid stabilisation and storing solar energy for use in the evening. Concentrating solar-thermal and off-river pumped-hydro are also needed for longer-term energy storage. Government support achieved breakthroughs in price for solar and wind power, and this needs to be repeated for on-demand technologies. NSW is blessed with abundant pumped-hydro sites and solar-thermal resources.

7.5 GW of additional storage will be needed in NSW to back up a 100% renewable energy grid by 2030. The Federal Government's Snowy 2.0 could supply up to 2 GW of this.

4. Create new jobs in our regions

Establish a long-term clean-energy program and set investment criteria in clean-energy auctions that reward local manufacturing. With long-term certainty, the renewable energy industry can deliver jobs not only in construction, installation and operation, but also manufacturing in NSW. For example, the Taralga wind farm is using Australian-made towers for its wind turbines, while the White Rock wind farm is using Australian-made transformers, creating jobs across the country. NSW deserves a clean-energy manufacturing industry.

5. Support coal communities to transition

Establish a funded transition plan and a transition authority for the Hunter Valley and Lithgow. The transition authority would ensure the burden of the transition doesn't fall on the communities that have been supplying our electricity for generations. For comparison, the Victorian Government put $266 million into helping communities through the Hazelwood transition.

6. Solar for tenants and low-income households

Support community-owned renewable energy projects to get started and enable tenants and low-income households to access clean energy. Everyone should have the power to generate their own electricity and enjoy the benefits of going solar.

7. Unlock clean-energy hotspots with transmission infrastructure

Conduct a cost-benefit analysis to identify the best areas to connect, and invest $1 billion to build a modern, clean grid that will give NSW a competitive advantage for decades to come.

Regional NSW has some of the world's best solar resources, and excellent wind, and new transmission infrastructure is required to allow these areas to power NSW.

Glossary

AEMO	Australian Energy Market Operator
Clean energy	In this report we refer to clean energy as sources of energy that don't create pollution or waste. For example, wind, solar, hydro, geothermal, wave and tidal. Clean energy excludes ultra-super-critical coal-fired power stations and gas-fired power stations as they emit hundreds of kilograms of CO_2 and other pollutants per MWh of electricity produced.
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
CST	Concentrated solar thermal.
Distribution	Transporting electricity through street-level power lines from substations to houses.
GWh	Gigawatt-hours. NSW consumed 67,500 GWh of grid electricity in 2016–17.
kW	Kilowatts. The average NSW rooftop solar system has a capacity of 3.6 kW. This means it has capacity to produce 3.6 kW of power at its peak.
kWh	Kilowatt hours. The average NSW household uses 14.4 kWh of energy per day. Energy is calculated as power × time.
MW	Megawatts.
Pumped-hydro	A method of storing and generating energy using water. See the section on clean-energy on demand.
PV	Photovoltaic.
Renewable energy	Energy sourced from renewable sources such as wind, solar, geothermal, hydro, wave and tidal energy. Often used interchangeably with clean energy.
TransGrid	The operator of all transmission lines in NSW. TransGrid was privatised in 2015.
Transmission	Transporting electricity over large distances through high-voltage power lines.

Notes on Calculations and Assumptions

Where this report references job creation figures, the numbers refer to full-time jobs averaged over 13 years of the study period, 2017 to 2030.

Estimates of investment, construction jobs and operations jobs for large-scale projects are based on the average of estimates made by project proponents for the 53 projects in the development pipeline.

Total clean energy required in 2030 is based on flat demand and a small increase in generation to cover curtailment and storage losses.

The forecast distribution of projects across the regions, and the types of technologies likely to be deployed, is based on estimates by CSIRO and Energy Networks Australia, opportunities identified by TransGrid and resource estimates by ROAM consulting and the NSW Department of Industry.

Calculations, further findings and detailed assumptions are available in the technical report which accompanies this report, available at **nature.org.au/regions-technical-report**

Nature Conservation Council

The Nature Conservation Council and the environment groups we represent have been winning protections for nature in NSW for more than 60 years. We have been at the centre of many of the state's iconic conservation battles, and have notched up countless wins for nature and local communities.

Today, we are focused on cleaning up the state's dirty electricity system, ending unsustainable tree clearing on farms and in our forests, bringing our rivers back to health, and giving the marine life in our coastal waters the protection it deserves.

Find out more by visiting **nature.org.au**

#REPOWER NSW

#Repower is a national campaign of Australians working to transition from dirty coal and gas to 100% renewable power by 2030. We recognise that climate change is already occurring, and we can't wait for the Federal Government and the big polluting energy companies to lead. It's up to us, right now.

Together, we can make it happen starting right here in NSW. Join us at **repowernsw.org.au**