

Knowledge Sharing Report

Final Report

Renewable Energy Hub

April 2021



Project Summary	
Project	Renewable Energy Hub: A Wholesale Renewable Energy Firming Marketplace Demonstration Project
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Glossary of Terms

AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
Cap Contract	A cap contract trades a fixed volume of energy for a fixed price when the spot price exceeds a specified price. It provides electricity purchasers with insurance against high prices.
DERs	Distributed Energy Resources
FCAS	Frequency Control Ancillary Services deployed to stabilise system frequency. AEMO operates eight FCAS markets covering two types of service: <u>Regulation FCAS</u> : Immediate and automatic response to a change in locally-sensed system frequency. <u>Contingency FCAS</u> : Capacity that is online and able to serve load immediately in response to an unexpected event.
Futures Contract	A futures contract is a legal agreement to buy or sell energy at a predetermined price at a specified time in the future.
Firming	Firming up supply means guaranteeing supply from other sources in the event of intermittency issues with solar and wind generation. Typical physical firming resources include battery or pumped hydro storage. Firming may also be achieved through the use of financial instruments whereby price risk is managed or ‘hedged’ through use of futures contracts.
Hedge Contract (energy)	A hedge contract involves establishing a (contracted) position in the futures or options market that is equal and opposite to a position at risk in the physical energy market. It is intended to offset potential losses or gains that may be incurred by rising or falling energy prices.
LCOE	Levelised Cost of Energy. A measure of the average net present cost of electricity generation for a generating plant over its lifetime.
MAG	Market Advisory Group. Renewable Energy Hub has established the MAG as a key group of stakeholders to guide the Project.
NEM	National Electricity Market
Option Contract (energy)	An options contract offers the buyer the opportunity (but not the obligation) to buy or sell—depending on the type of contract they hold—the underlying energy. Unlike futures, the holder is not required to buy or sell the asset if they choose not to.

Offtake Agreement	An offtake agreement is an arrangement between a producer and a buyer to purchase or sell portions of the producer's energy from one or more generation assets.
OTC	Over the Counter - refers to trading done directly between two parties, without the supervision of an exchange. Intermediaries, such as brokers may facilitate bilateral agreements between counterparties.
PPA	Power Purchasing Agreement - an example of an offtake agreement.
Pumped Hydro	A type of hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation
REH / RE Hub	Renewable Energy Hub
Swap	A swap is a type of futures contract whereby a floating (or market) price is exchanged for a fixed price, over a specified period(s) of time. Energy consumers and retailers utilise swaps in order to fix or lock in their energy costs, while energy generators utilise swaps in order to lock in or fix their revenues and/or cash flow.
Tolling Agreement	A tolling agreement is an offtake contract that provides for rent of the energy asset from its owner. This agreement allows the renter to operate the asset, and sell its output, and also makes the renter liable for energy the asset imports.
VPP	Virtual Power Plant; is a pooled set of decentralised units (or DER) in a power network. They are operated by a common, centralised IT control system.
VRE	Variable Renewable Energy

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Executive Summary

Renewable Energy Hub (REH) has commenced an 18-month project (the “Project”) with support from the Australian Renewable Energy Agency (ARENA). The project will work with market participants to develop specifications for a suite of innovative, standardised hedge contracts that are suited to both variable renewable energy (VRE) generators and new sources of clean dispatchable capacity (e.g. battery storage, pumped hydro storage and demand response), as well as the changing needs of energy retailers and large customers.

Though the energy transition is gaining momentum with increasing volumes of VRE assets coming onto the market, there is a lack of volume and diversity in hedge contracts to support forward markets for these asset classes. This lack of products reduces choice, impacting liquidity and in the long run increases the difficulty of new participants entering the market and participating in an effective and efficient manner.

In addition to developing new hedge contracts, the Project also involves the development of a digital platform that will enable prospective counterparties to access live market pricing, assess the value of the new hedge contracts, evaluate the risks of different contract positions under a range of scenarios and provide a point of market access for new and emerging clean energy providers.

1 Project Context

1.1 Background

The rapid transformation of the Australian electricity system towards a higher penetration of variable renewable energy (VRE) requires commensurate innovation in financial markets. The Project aims to contribute to innovations in the financial markets as the system transitions towards a high renewable energy future.

The current suite of hedging products (swaps, caps and options) used in the financial market were designed several decades ago and developed around coal and gas supplies. Since then, they have not changed materially to accommodate the transforming supply, demand and price dynamics created by the rapid deployment of VRE (both utility scale and behind the meter).

Traditional hedge contracts allow energy retailers and large electricity users to manage the price risk associated with the electricity they buy. Generators also rely on hedge contracts to manage the risk of volatile wholesale electricity prices, smooth revenue flows and support financing for new projects.

The rapid and sustained growth in VRE generation is changing the hedging needs of market participants. This requires new hedge contracts for those parties to be able to cover their exposure.

Drawing on the technical expertise of both REH and a Market Advisory Group (MAG), the Project is designing a suite of new financial hedge contracts. These will be tailored to the physical characteristics of both VRE and clean dispatchable capacity assets. These new financial instruments will create a point of access to the contracts market for VRE and dispatchable capacity projects. Creating a liquid forward market in firm hedge contracts opens new sources of revenue for clean energy providers, potentially supporting finance for these assets. It enables a range of new participants to contribute to VRE growth and support the energy transition across the NEM.

Likewise, creating new hedge contracts that more efficiently manage the risk and volatility of the changing supply/demand and price dynamics in the National Electricity Market (NEM) will enable energy retailers (and by implication, their customers) to more cost effectively hedge the price of electricity in a high renewables system.

The Project will also develop a digital platform that will enable prospective counterparties to access live market pricing, assess the value of the new hedge contracts, evaluate the risks of different contract positions under a range of scenarios and provide a point of market access for new and emerging clean energy generators, energy retailers and large energy users. In doing so, this platform will improve transparency and hedge contract liquidity.

1.2 Current market challenges

The NEM is a gross pool, energy only market characterised by high volatility. Given such characteristics, contracting through forwards contracts is critical to accessing financing, hedging risk, and increasing revenue certainty. Given the novel nature of renewable or VRE assets classes, the development of OTC contracts is in their infancy.

It is critical that such products emerge to support forward markets in VRE because:

- Transparent standardised forward markets perform an important role in stabilising markets¹.
- Such contracts provide further certainty and confidence for further investment in VRE and renewables.
- Wind and solar are now a proven technology, and within Australia, the lowest cost form of new build generation capacity². For the energy transition to succeed VRE must be proven across not just technical but also commercial and market domains.

With the Renewable Energy Target (RET) largely met, and with it the primary driver for retailers signing long term PPAs, renewable energy projects need new sources of revenue certainty. The Clean Energy Regulator has noted that some of this may come from corporate demand for renewable energy supply³, however, there is also a need to facilitate participation by clean energy providers in the wholesale contract market.

1.3 Project Objectives

The objectives for the Project seek to address the limitations set out above:

- The Project will enable **greater utilisation of the contracts market by VRE generators and clean dispatchable capacity providers**. By creating a market in hedge contracts tailored to the physical characteristics of both VRE and clean dispatchable capacity assets, the Project will open new sources of revenue for clean energy providers.
- Creating new hedge contracts that efficiently manage the risk and volatility of the changing supply, demand and price dynamics of the NEM will **also enable retailers (and by implication, their customers) to more cost effectively**

¹ AEMC, Market making arrangements in the NEM, Rule determination, 19 September 2019
<https://www.aemc.gov.au/sites/default/files/2019-09/Final%20determination.pdf>

² Graham, P.W., Hayward, J, Foster, J., Story, O. and Havas, L. 2018, GenCost 2018. CSIRO, Australia
<https://www.csiro.au/en/News/News-releases/2018/Annual-update-finds-renewables-are-cheapest-new-build-power>

³ Clean Energy Regulator, The Renewable Energy Target 2019 Administrative Report - The acceleration in renewables delivered in 2019, 17 September 2020
<http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/The%20Renewable%20Energy%20Target%202019%20Administrative%20Report%20%E2%80%93%20The%20acceleration%20in%20renewables%20delivered%20in%202019.pdf>

hedge the price of electricity in a system with an increasing proportion of renewable energy.

These outcomes will be demonstrated through utilisation of the new hedge contracts, participation on the trading platform and engagement in knowledge sharing activities and outputs by market participants including generators, renewable energy developers, retailers, large customers and investors.

1.4 Project Outputs and Deliverables

The outputs and deliverables of the Project are listed below.

- The Project will produce a series of new hedge contract specifications tailored to the needs of VRE generators, clean dispatchable energy providers and energy retailers. The number, type and form of hedge contracts will be determined in consultation with the MAG as well as through broader market consultation processes.
- As part of the Project, REH will facilitate a series of pilot transactions in the new hedge contracts which will test their market value, credit, risk and legal requirements.
- REH will construct and operate an online market platform that will facilitate price discovery, enable evaluation of trading options, provide access to market data and reduce transaction costs.
- The Project will produce a series of knowledge sharing outputs (such as this document) including reports and workshops, as well as provision of market data, including pricing and availability of contracts, volumes, trends and transaction reporting.

1.5 Delivery Phases

The Project involves four workstreams implemented over an 18-month period. These workstreams will be delivered in a series of overlapping cycles and will not be sequential. This will allow rapid and ongoing iterations of new products to be developed and pilot transactions completed. In parallel to product development, market engagement and testing, REH will develop the online market platform and undertake a series of knowledge sharing activities.

The Project's four workstreams are as follows:

1. **Product development:** REH will develop specifications for a range of new hedge contracts. These product designs will be built upon through consultation with the market advisory group as well as broader market consultation processes. Several of these new products are presented in this report.
2. **Pilot transactions:** The new hedge contracts will be progressively released into the market to test that they can be used in negotiated pilot transactions between parties. Pilot transactions will be used to build familiarity with

contract specifications and requirements, prepare legal documentation to support trades, as well as enabling market participants to build an understanding of the drivers of value and pricing.

3. **Platform build:** This workstream involves the design, build and delivery of an online market platform to support the new hedge contracts. The platform will provide users with up-to-date pricing and product information, tools to enable comparison of different hedge contracts so buyers and sellers can establish fair value, tools to test the performance of hedging strategies under different scenarios and support trade execution and confirmation.
4. **Knowledge sharing:** The knowledge sharing activities and deliverables of the Project will include a series of reports (such as this), presentations and workshops on the performance of new hedge contracts as well as the market impact of the Project.

1.6 Market Advisory Group

The Market Advisory Group (MAG) has been an invaluable resource for testing, validating and ideating on existing and new products. The nature of the engagement and level of feedback provided by participants has shown that the group is functioning well due to the significant level of input provided by participants which has been a value-add to product development activities.

Specifically, the MAG has assisted with providing detailed guidance on product specifications and the likely product attractiveness across key market participants including generators, retailers, traders, and large energy consumers. In addition, the group has provided feedback on early versions of the digital platform, testing prototypes and participating in user testing sessions.

The MAG consists of the following organisations:

- Renewable Energy Hub
- Alinta Energy
- Origin Energy
- Total Eren
- Energy Australia
- ERM Power
- Snowy Hydro
- Enel Green Power
- Habitat Energy
- Neoen
- AGL
- Stanwell
- Shell New Energy
- TFS Green
- White & Case
- Macquarie Bank
- Enel X
- ARENA
- Bold Trading
- Tesla
- HydroTasmania
- Marchmont Hill Consulting

1.7 About this Report

This is the final report for the Project. The purpose of this report is to provide an overview of the Project, the findings and outcomes from the work undertaken, lessons learned, and what comes next for Renewable Energy Hub and the products we have developed to advance renewables in Australia throughout this period.

2 Project Details

2.1 Project outputs

2.1.1 Produce a series of new hedge contract specifications tailored to the needs of VRE generators, clean dispatchable energy providers and energy retailers.

Throughout the Project, Renewable Energy Hub has worked in partnership with industry to create four new hedge contracts that are specifically designed to work with renewable energy. These contracts and a brief summary of their market impact are listed below.

Solar Shape and Inverse Solar Shape

These two related products provide a level of contract flexibility to manage the intermittency of renewable generation. The shapes of the contracts are tailored to specific periods of the day and provide an alternative to flat contracts.

These contracts are best suited to support solar generators to minimise their merchant exposure by providing them coverage against prolonged periods of low prices. In particular, they're suited to developers or relatively immature generators who are not established and do not have strong credit lines, thereby supporting these solar developments to enter the market. In this way, they're supporting the growth and investment in new renewable energy projects in Australia.

Super Peak

The energy market have been extremely supportive of the Super Peak swap contract, especially buy-side businesses, as this contract offers a hedge against the most expensive periods of the day, in the morning and evening when the sun isn't shining and the wind isn't blowing. Previously it has been difficult to contract around these periods.

The Super Peak potentially reduces the need for further hedges against these 'devils horn' large peak times. Standardising around a transparent product opens the market, creates more liquidity and makes it easier to manage these periods of the day.

Virtual Storage

In early 2021 the first transactions of the Virtual Storage contract were announced, which led to a marked increase in interest and attention to the Virtual Storage contract, which was the final of the group to be transacted as part of the Project. It is expected that merchant battery operators will be the main sellers of this product, as it enables them to de-risk their energy arbitrage revenue. Energy retailers will be

the natural buyers, as they look to cover high priced periods of the day. The move to five minute settlements is also expected to increase utilisation of this product.

2.1.2 Facilitate a series of pilot transactions in the new hedge contracts which will test their market value, credit, risk and legal requirements.

Since their creation, these new hedge contracts have traded more than 1GW with more than 20 counterparties. All contracts have now been traded in the market, with the first transaction of the Virtual Storage contract gaining significant media attention, being called a ‘game changer’ across the Australian Financial Review, RenewEconomy, Energy Magazine and more.

2.1.3 Construct and operate an online market platform that will facilitate price discovery, enable evaluation of trading options, provide access to market data and reduce transaction costs.

Renewable Energy Hub’s Marketplace platform (the Hub) officially launched during milestone 2 and welcomed its first client and users. In addition, at least 18 demonstration sessions have been conducted and 10 formal proposals sent for new organisations to subscribe to the Hub.

Feedback from potential clients has been positive, with strong endorsement of the aims of the product and its ability to increase liquidity in the contract markets by providing the data, tools and transactions market participants need identify opportunities and transact with confidence.

As more users subscribe to the Hub and began using its tools, the additional trade data will further indicate the platform’s success in increasing liquidity and unlocking capital in renewable energy.

2.1.4 Produce a series of knowledge sharing outputs

Throughout the Project, Renewable Energy Hub participated in many knowledge sharing activities, including presentations, webinars and a series of reports, like this one.

The significant reports we have produced during the Project are listed below with an analysis of their effectiveness.

Knowledge sharing activity	Effectiveness
Short Market Platform Launch Report (Explanatory Memorandum)	The Platform Launch Report gave us a good basis to build our marketing collateral for the Hub, in outlining the functionality of the platform and its value proposition for each of our key segments.

<p>Contract performance report</p>	<p>This report brought together analysis of quantitative data collected during the Project, feedback collected during Market Advisory Group (MAG) meetings, as well as several in-depth interviews undertaken with market participants who have actively traded the REH hedge contracts.</p> <p>This report was extremely effective in bringing this feedback together and outlining a clear case of support and the value of these new hedge instruments.</p>
<p>Cost benefit analysis</p>	<p>The cost benefit analysis is an enormously comprehensive document, encompassing different combinations of assets, contracts and spot prices to evaluate our working hypothesis that the Renewable Energy Hub hedge contracts provide an overall benefit to renewable energy dominated portfolios and retail loads.</p> <p>This level of analysis will be important for market participants to understand that these innovations have been thoroughly evaluated and tested for their true value and their ability to improve their risk position.</p>
<p>Market impact report</p>	<p>The Market Impact Report is a comprehensive document with in-depth analysis of the new hedging approaches with our contracts. It will be extremely valuable in demonstrating to the market that these products have been developed with significant consultation with industry; are tested and proven in live trading environments; and can offer tangible benefits to market participants.</p>

2.2 Project outcomes

The following outputs were identified as the key to meeting the Project objectives. In this Final Report we provide a critical analysis of the extent to which these outcomes have been met.

2.2.1 Assess the relative performance of the new hedge contracts and where appropriate, make any recommendations for changes to product specifications.

Renewable Energy Hub has been delighted by the level of industry support we have received throughout the Project. This knowledge sharing outcome drew heavily upon the Market Advisory Group, which proved an invaluable resource for the testing, validating and ideating on our new products. Despite COVID-19 meaning that all meetings were conducted remotely via video conference, the nature of the engagement and level of feedback provided by participants has been a huge value-add to product development activities.

2.2.2 Assess the cost-effectiveness of the new hedge contracts and their value to counterparties.

The aim of the cost benefit analysis was to broadly compare the risks and rewards across different hedging scenarios by comparing MW coverage and cashflows across these hedging strategies, as well as the trade-offs between different risk/reward metrics.

The propositions that this report sought to test is whether Renewable Energy Hub hedge contracts provide more flexible coverage and revenue generation options, as compared with merchant exposure, PPAs and traditional hedge contracts traded OTC and on the ASX.

It is apparent from the cost benefit analysis outlined in this report that Renewable Energy Hub hedge contracts do indeed provide more options to service the varying risk/reward appetites of portfolio owners that are exposed to wholesale energy market prices.

2.2.3 Assess the impact of the Project on market participants and their longer-term strategic approach to managing wholesale price risk.

As outlined in detail in the Market Impact report, our analysis on the impact of the Project on market participants has been positive, across the new product suite.

The two Solar Shape products provide a level of contract flexibility to manage the intermittency of renewable generation and are best suited to support solar

generators minimise their merchant exposure by providing them coverage against prolonged periods of low prices.

The Super Peak contract has been received extremely well by the market, as it offers a hedge against the most expensive periods of the day, which has previously been difficult to contract.

The Virtual Storage contract has had a very strong early market response, influenced by the high-profile trade involving Hydro Tasmania. When the move to five minute settlements happens in later 2021, this product is expected to become more utilised.

2.3 Project highlights, breakthroughs and difficulties

This Project has brought with it many highlights, with the original four workstreams all successfully achieved: Contract development, pilot transactions, development of the Hub, and knowledge sharing. The Renewable Energy Hub team is proud to have advanced renewables and addressed some of the key challenges in the financial market as the system transitions towards a higher penetration of variable renewable energy.

A major **highlight** is the launching of our new hedge contracts into the market, and significant amount of trading and transaction activity, with more than 20 counterparties transacting over 1GW of these new contracts.

A major learning by the team over the duration of the Project has been the impact of changing NEM dynamics on the trading activities of different counterparties. As noted in our [Lessons Learned Report 2](#) the increased volatility in spot markets created by the ongoing deployment of solar PV (otherwise know as the “duck curve”) has created increased interest and trading activity in the Super Peak contract. Buyers see demand in the middle of the day falling at increasing rates (driven by a proliferation in DERs, particularly rooftop PV) with demand increasing at peak usage times in the morning and evening. The Super Peak contract is well suited to these market dynamics.

Conversely, the Solar Shape contract has had dwindling utilisation in recent months, precisely for the same reason the Super Peak has traded actively. Low and stable prices during the day thanks to the ongoing deployment of solar PV reduces the need to hedge these periods of the day. We envisage that there will be natural ebbs and flows in interest in the different products as the underlying physical system transitions.

Retailers (particularly those without generation capacity) have noted, however, that the Solar Shape contract it is a product that can bring liquidity to the market for renewable energy backed contracts. This feedback is particularly important, and points to the value of standardisation of renewable energy backed hedge contracts over traditional “run of meter” PPAs. Counterparties are able to easily trade into and

out of contract positions using the Solar Shape and Inverse Solar contracts to manage their exposures to solar generation.

Further to the above point, the standardisation and associated liquidity also drives price transparency. Market participants noted that traditional PPAs may require up to 12 months of negotiations and significant information asymmetry, while the Renewable Energy Hub contracts provide visibility of the market valuations and straight forward contracting mechanics. The project team is also developing similar markets for energy storage technologies using the Virtual Storage contract.

On top the amount of trading activity with the new contracts, our team have had ongoing positive engagement with clean energy investors about how this new contract market can underpin the financing of new clean energy project. A key challenge for project developers in unlocking finance for their new projects is access to long term revenue contracting options. While the Renewable Energy Hub contracts have tended to trade over nearer term time horizons, the Project team is currently in discussions with a number wind, solar and battery storage project developers about using the Renewable Energy Hub contracts as the basis for longer term agreements that would satisfy project finance requirements.

A significant **breakthrough** moment was achieved during Milestone 2 with the launch of the Hub marketplace, providing users with up-to-date pricing and product information, tools to enable comparison of different hedge contracts (including the new hedge contracts developed in the Project), and the ability to test the performance of hedging strategies under different scenarios. While the Hub is operational with current users, we are working towards an official public launch mid-2021 including a new name and brand.

A notable **challenge** encountered during the Project has been the time that the market has needed to understand, digest and get comfortable with our new hedge contracts. While we were eager to launch all new hedge contracts at once and stimulate trading activity, our stakeholders advised that a gradual release was necessary to build familiarity and slowly transaction volume slowly. Similarly, the importance of liquidity in these contracts meant that fewer, standardised contracts were necessary rather than too many diverse or niche products.

Further to building familiarity with new contracts, a key learning from the Project was the time required for counterparties to obtain internal new product approvals (risk and trading limits), develop accounting procedures (mark-to-market) and requisite settlements processes. In response to some of the challenges faced by counterparties in grappling with internal approvals and ongoing limits on trading, many of the tools offered on the Hub, including end of day price curves, data for settlement calculations, and contract comparison/evaluation tools seek to address these barriers to participation.

In our work with clean energy generators, we've invested a large amount on energy into encouraging a paradigm shift in the way they think about selling their energy, away from the previous model of long-term PPA and/or merchant, to one that requires more proactive trading mindset. While these contracts will ultimately

benefit them in being able to secure greater returns for their output, it does also require a change in their approach to managing revenue.

A tool in leading this change of thinking and adopting a more proactive trading mindset is the Hub, with the tools it has for comparing contracts and trading positions. With the Hub in development, this work was done by our team on a case-by-case basis but will increasingly be offered as part of a product and service offering with Hub subscriptions.

2.4 Project conclusions and recommendations

Renewable Energy Hub is confident that we have a strong foundation for ongoing growth. We're extremely happy with the way our new contracts and digital platform have been received by the market, with interest from energy generators, retailers, investors, as well as broader energy market stakeholders such as exchanges.

With a pleasing amount of transaction activity already on our hedge contracts, we expect this will significantly increase as more renewable energy enters the NEM, increased adoption of net-zero targets from governments and industry, and a greater understanding and comfort with new hedging approaches, led by our own marketing and communications efforts, as well as those of our clients.

After significant financial and human capital investment into the Hub, the platform is now ready for a large public launch, to showcase its tools and unique value proposition to energy market participants, and welcome users at scale. After doing a large number of demonstrations and showcases as part of the Project, we have a healthy pipeline of prospects and potential client we will continue to engage with, as well as expanding our reach to new markets.

3 Further Information

For additional information regarding Renewable Energy Hub's unique hedging contracts and the Hub digital marketplace, we have prepared a range of reports and supporting materials. Please visit our ARENA [project page](#) to review Knowledge Sharing materials including the Hub Platform Launch report, Legal Overview Report and Lessons Learned Reports. These documents provide detailed analysis and guidance on the legal structure and requirements of the hedge contracts, recent transaction details and further detail on the operation of the digital platform.

If you wish to access the Hub platform, including the Assets Plus tools set, please register on our website - <https://www.renewableenergyhub.com.au/marketplace>