

# Lessons Learned Report #1

## Renewable Energy Hub

March 2020



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*This Project received funding from ARENA as part of ARENA’s  
Advancing Renewables Program.*

## Disclaimer

*The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.*

# Executive Summary

Renewable Energy Hub has commenced an 18-month 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.

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 (the Project).

The purpose of this first ‘lessons learned’ report is to outline the key insights generated from the first stages of the Project and to provide greater context on the objectives and proposed outcomes of the Project.

Over time, we expect that lessons learned reports, to be released each quarter, will reflect insights from the digital platform such as trade volumes and pricing for the products developed, whilst also providing reflections on current energy market trends as they relate to the Project. Additionally, it is expected that updates relating to the online trading platform (e.g. usability, functionality and uptake) will be shared with the industry.

In this first lesson learned report, the following elements will be covered:

- An overview of key **NEM energy market insights** that are driving both new product development in applicable renewable energy-based hedge contracts, as well as analytics features that will be available in the ‘Hub’;
- Insights into the **current suite of products that are being traded or under-development** by Renewable Energy Hub. It will highlight the key questions driving the development of these new contract products and the role that the Market Advisory Group (MAG) has in guiding future iteration of the products;
- An overview of the **software development stage** of the ‘Hub’ and how it has progressed; and
- A view on the **external energy industry landscape** and how that might influence the development roadmap for the Renewable Energy Hub.

Renewable Energy Hub is delighted by the level of industry support exhibited for the project to date and looks forward to further progressing this ARENA-funded project.

# Market Insights

As Renewable Energy Hub has developed its new hedge contracts, one of the issues highlighted by market participants has been the challenge of valuation: without a longstanding trade history in these products, how should participants evaluate and then price these contracts?

Based on discussions with members of our Market Advisory Group (MAG), and the broader market, a number of market insights contribute to the valuation of these hedge contracts, including:

- Historical spot prices - what have spot prices been during the half hourly trading periods covered by the products?
- Cap value - what is the likelihood that those periods will coincide with prices above \$300?
- Standard contracts - what are the current market dynamics and prices in standard hedge contracts, such as baseload, peak and off-peak swaps, and \$300 caps? The relative value between standard and Renewable Energy Hub products is a key consideration for contract traders and retailers looking to hedge their exposure.
- Renewable energy prices - what are the prices being struck for solar and wind power purchase agreements (PPAs), noting that these are non-firm generation contracts?

These are explored below.

## Market Insight: Historical spot prices and trends in Solar Shape value

As noted above, a key consideration in the valuation of the new Renewable Energy Hub hedge contracts is the time and volume weighted average spot prices captured by the products. Unlike a standard baseload or “flat” contract which covers buyers and sellers for a fixed MW volume, 24 hours/day, the Solar Shape product is a sculpted volume swap, covering only those hours relevant to a generic solar generation profile.

The figure below provides the volumetric profile of the Solar Shape and Inverse Solar swap contracts. While the peak volume of the contract is constant, the shape of the contract changes on a monthly basis to account for seasonal changes in irradiance. The profile is also consistent across all NEM Regions with this consistency facilitating improved liquidity.

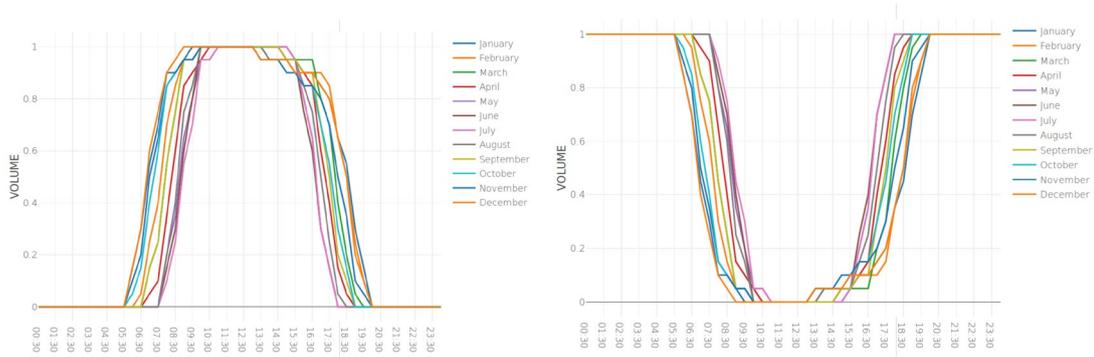


Figure 1: RENEWABLE ENERGY HUB SOLAR SHAPE & INVERSE SOLAR SWAP CONTRACT VOLUMETRIC PROFILES (1MW peak profile across 48 half hour trading periods)

The charts below illustrates the daily, volume weighted average price of the Solar Shape contract, against daily average spot price (RRP) in both NSW and Queensland over the preceding 13-month period (1/1/2019 - 31/1/2020). The chart also shows the daily average relative value captured by the Solar Shape profile compared to the average spot price for the day.

What is clear from the charts, as well as Figure 3, is that the relative value of the half hours captured by the Solar Shape shifts as the seasons change. Intuitively this makes sense as, for example, during Q4 (October - December) 2019 the market in Queensland experienced negative prices for 2% of the time, the second highest quarter on record; this was associated with relatively low demand and high solar output over this period<sup>1</sup>.

<sup>1</sup> AEMO, Quarterly Energy Dynamics Q4 2019

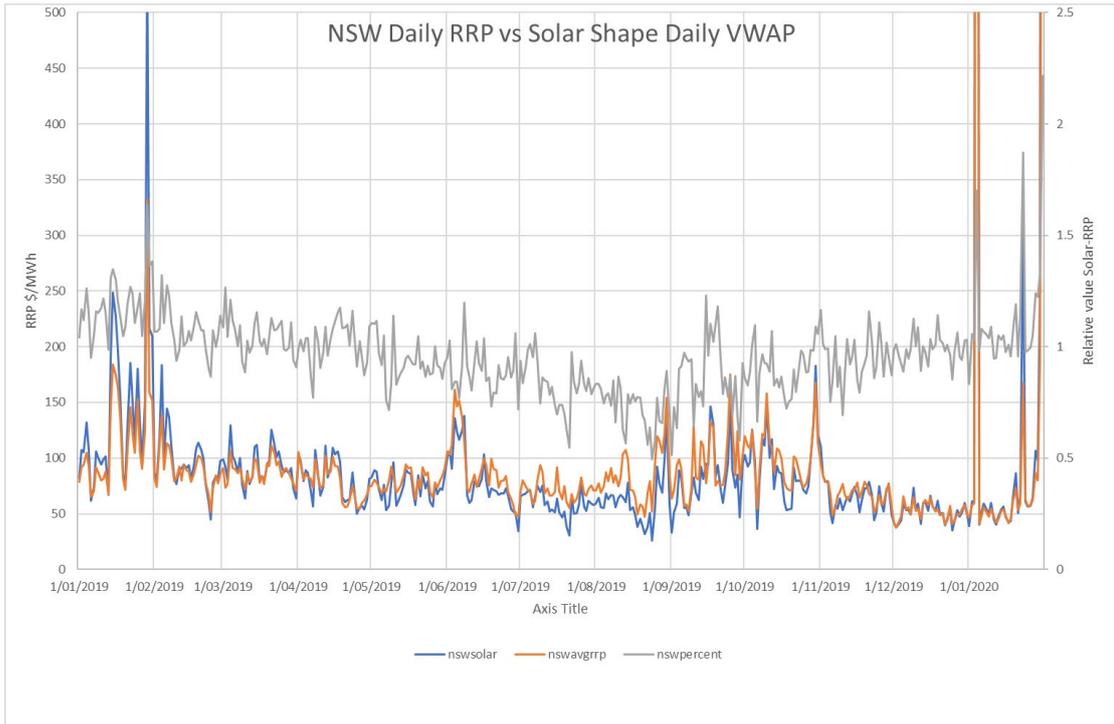


Figure 2a: DAILY VOLUME WEIGHTED AVERAGE PRICE OF SOLAR SHAPE VS SPOT PRICE (RRP) IN NSW

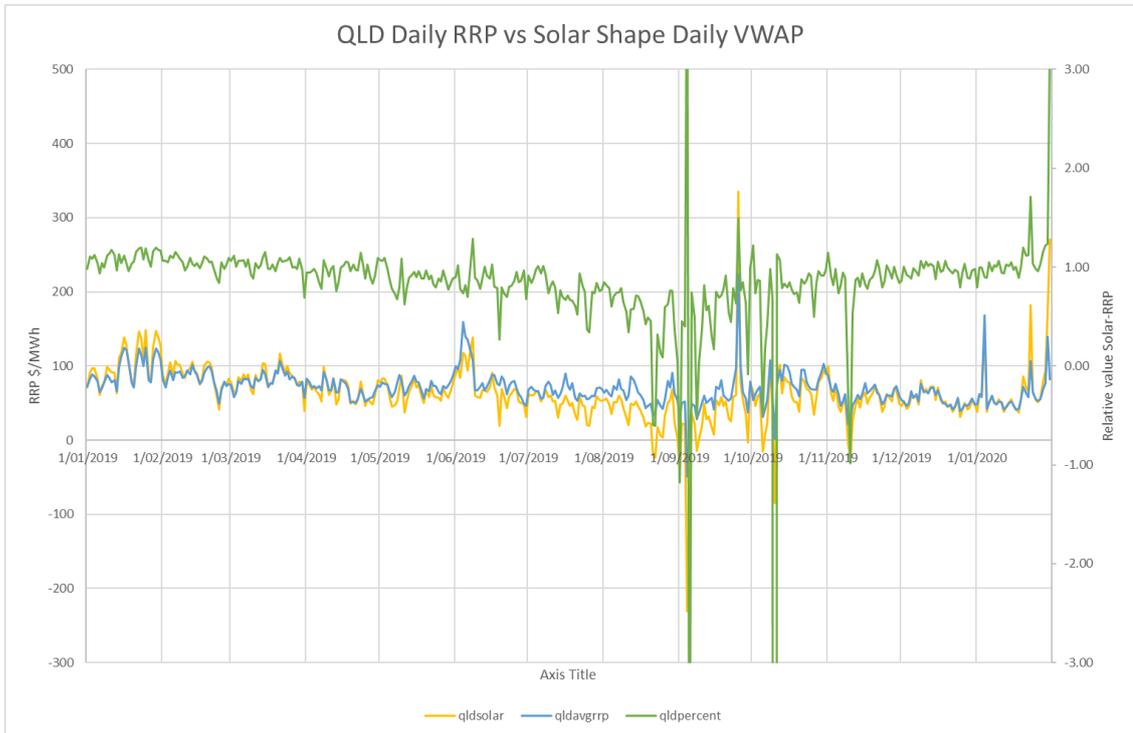


Figure 2b: DAILY VOLUME WEIGHTED AVERAGE PRICE OF SOLAR SHAPE VS SPOT PRICE (RRP) IN QLD

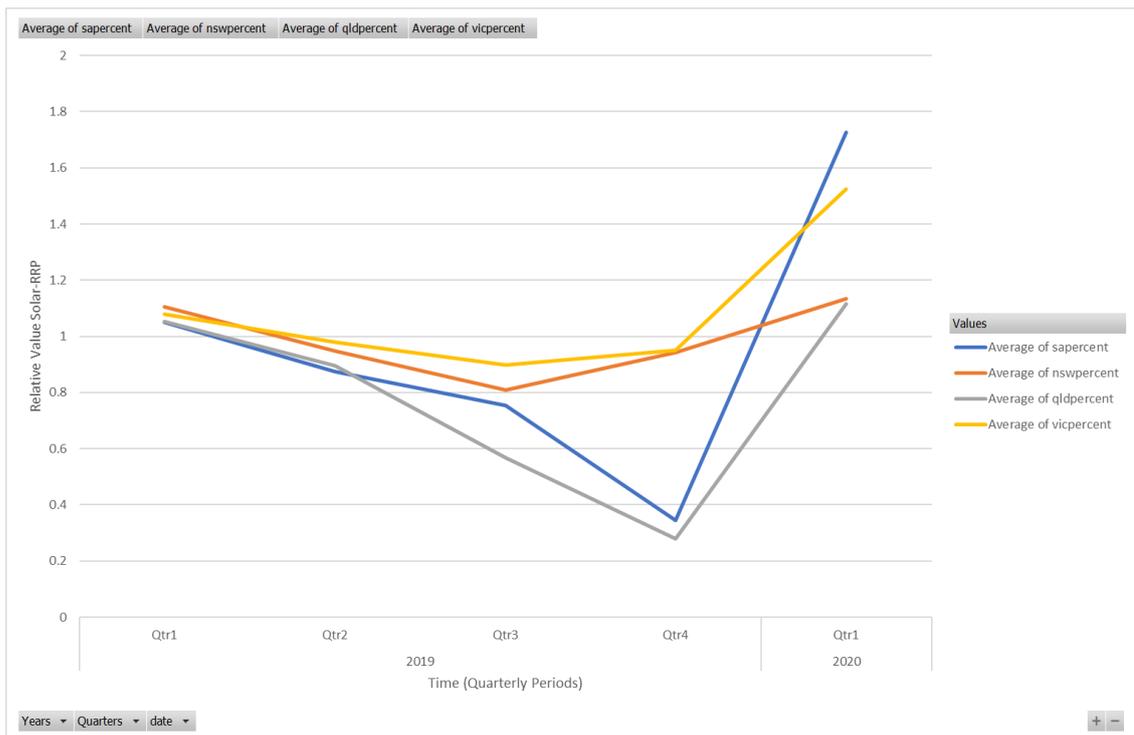


Figure 3: QUARTERLY AVERAGE RELATIVE VALUE OF THE DAILY VOLUME WEIGHTED AVERAGE PRICE OF SOLAR SHAPE VS SPOT PRICE (RRP) IN ALL NEM STATES

Note that the data for Q1 2020 relates only to January and is therefore somewhat skewed due to the high spot prices experienced during half hour periods covered by the Solar Shape in that month.

### Market Insight: Rapid decline in contract market during Q1 2020

The futures contract market in standard electricity products has experienced a significant drop in prices over the first quarter of 2020. The drivers for this downward shift in prices are beyond the scope of this report, however, importantly this has seen a drop in prices paid for the Solar Shape contract. Figure 4 (below) highlights the drop in price for the Q3 2020 NSW baseload contract over the last seven months, in particular since the start of January this year.

The chart also identifies two trades of the Q3 2020 NSW Solar Shape contract, and the price differential to the baseload contract. As expected, the traded price of the Solar Shape has decreased along with the broader market trend, however, it appears that the more recent trade has been undertaken at a significantly lower relative value to the baseload contract.

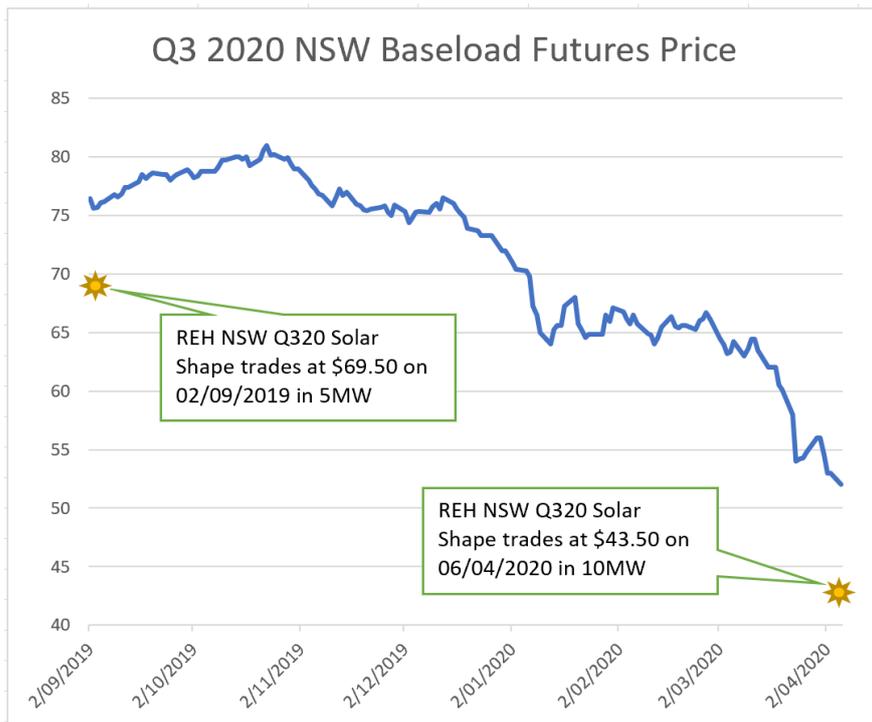


Figure 4: Q3 2020 NSW BASELOAD FUTURES CONTRACT SETTLE PRICES VS SOLAR SHAPE (Sources: ASX Energy, TFS Australia, Renewable Energy Hub)

While the trade in September 2019 was at 91% of the value of the baseload contract on the same day (\$69.50 for the Solar Shape vs \$76.40 for baseload), the more recent Solar Shape transaction was at 84% (\$43.50 for the Solar Shape vs \$52 for baseload). The data points are too limited at this stage to suggest there has been a fundamental shift in the market’s view of the relative value of the Solar Shape to baseload contract, however, Figure 3 would suggest that in 2019 the relative value of the Solar Shape profile to Spot price in NSW was just above 80%.

We will continue to track the relative values of the Renewable Energy Hub contracts to standard contracts as the Project progresses. Based on feedback from the market, the ability to calculate these relativities will be a key feature of the Hub digital platform.

# New Product Development

The initial stages of the Project have focussed on the scoping, development and testing of a select range of contract products that support renewable energy generators and buyers. The development of these products has been guided by detailed market analysis, consultation with the Market Advisory Group (MAG) and other key market stakeholders.

An update on the progress of key products and insights gathered are summarised below.

## Solar Products

At the commencement of the Project Renewable Energy Hub had launched the Solar Shape and Inverse Solar Shape contracts into the market. We have built awareness around these products and facilitated considerable trading activity. At the time of writing we have facilitated over 90 transactions in the Solar Shape and Inverse Solar products, with 14 different counterparties.

However, we have been challenged by divergent views in contract valuation by market participants. This divergence results in wide ‘spreads’ between bids (buyers) and offers (sellers). Throughout a trading day these spreads may stay as wide as \$10.

A key driver of these wide spreads is a divergence in views between buyers and sellers as to the ‘cap value’ captured by the solar products. That is, how likely is it that the periods of the day covered by the Solar Shape or Inverse Solar products will align with trading periods where prices exceed \$300.

### What is a cap contract?

A cap contract operates like insurance whereby the buyer of the cap (usually an energy retailer) pays the seller a premium to protect them against prices above an agreed level. In the Australian energy market, caps usually settle against a \$300 strike price. If the wholesale spot price goes above that strike price, the seller of the cap pays the difference between the spot price and \$300 to the buyer, thereby protecting them against extreme price events.

If sellers expect there will be many high price periods (>\$300) during the contract tenor this will be reflected in higher strike prices to ensure that they lose less of the ‘upside’ in their contract position. However, buyers have suggested that rather than paying a higher strike price for the solar swap products, it would instead be more cost effective to buy caps to protect themselves from high price events. Having done that, they do not wish to pay for any ‘cap value’ in the swap contract strike price.

In response to this feedback, Renewable Energy Hub has created Solar Shape and Inverse Solar <\$300 products. As the name suggests, these product iterations utilise the same generic solar profile as the current products but cover only prices below \$300, thus excluding any cap value. We hope that this contract design will make it

easier for market participants to close the often large bid/offer spreads in the market for the solar products.

Buyers of the Solar Shape that also require hedge cover for prices >\$300/MWh within the Solar Shape profile, as such they retain a number of options:

- Purchase the current Solar Shape product (all prices);
- Purchase flat electricity cap products (subject to shape requirements); or
- Purchase the Solar Shape (all prices) and sell the Solar Shape (prices < \$300/MWh), leaving the net Bought position as the Solar Shape (prices > \$300/MWh).

Sellers of the Solar Shape product that wish to also sell for prices >\$300/MWh within the Solar Shape profile also retain a number of options:

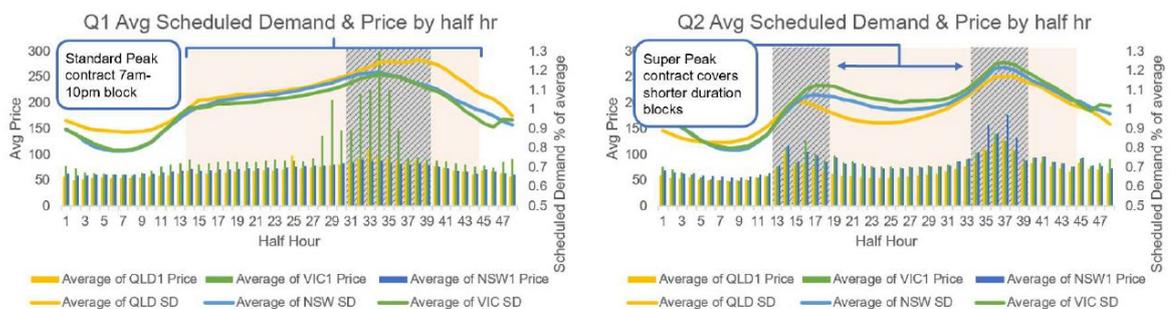
- Sell the current Solar Shape product (all prices);
- Sell flat electricity cap products (subject to shape requirements); or
- Sell the Solar Shape (all prices) and buy the Solar Shape (prices < \$300/MWh), leaving the net Sold position as Solar Shape (prices > \$300/MWh).

Renewable Energy Hub plans to trial a market for Solar/Inverse Solar <\$300 products, commencing Q2 2020. If we see a meaningful market response and take-up of these product variations, they will be maintained. If there is little response from the market, then the products will be removed from the online Hub marketplace and not actively offered by our team. The results of this trial will be discussed in subsequent knowledge sharing reports.

## Super Peak

The ‘Super Peak’ swap contract was launched by Renewable Energy Hub in March 2020 after considerable consultation with the MAG. The product is a swap contract targeting intra-day and seasonal peaks offering a new hedging option for participants with exposure during emerging ‘super peak’ shoulder periods. The product seller is likely to be suited to dispatchable, peaking generators (e.g. hydro) and energy storage operators.

Figure 5: SUPER PEAK PRODUCT Q1 and Q2 PROFILE (demand and price data is from 2018)



On March 31<sup>st</sup>, the Super Peak product completed its first trade involving Snowy Hydro selling a 25MW contract to a buyer covering calendar years 2021 and 2022. A media announcement detailing the transaction is provided as an attachment to this report.

### The Market Advisory Group (MAG)

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.

The MAG currently 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
- Stanwell
- Shell New Energy
- TFS Green
- White & Case
- Macquarie Bank
- Enel X
- ARENA
- Bold Trading
- Tesla
- Marchmont Hill Consulting

## Other Initiatives

At this stage, the Renewable Energy Hub is continuing to consult the market and is considering the development of the following new product initiatives:

- **A virtual battery swap contract** is currently under-development by the Renewable Energy Hub. The objective of this product is for participants to agree upon a set spread between the ‘charge’ and ‘discharge’ (the buy and sell legs of the trades) price for battery operators enabling merchant battery operators to de-risk their energy arbitrage revenue.
- **A wind product**, that will be a standardised product that does not duplicate existing weather products. Renewable Energy Hub has committed to additional research on potential approaches, noting there are existing weather derivative products in market that seek to address earnings volatility for wind generators. Renewable Energy Hub is currently engaging MAG members bilaterally to discuss the functionality and utility of this product.

# Software Development

Renewable Energy Hub is also progressing the development of the digital market platform. The Hub platform will facilitate price discovery, evaluation of market opportunities and ultimately liquidity in the new hedge contracts developed during the Project.

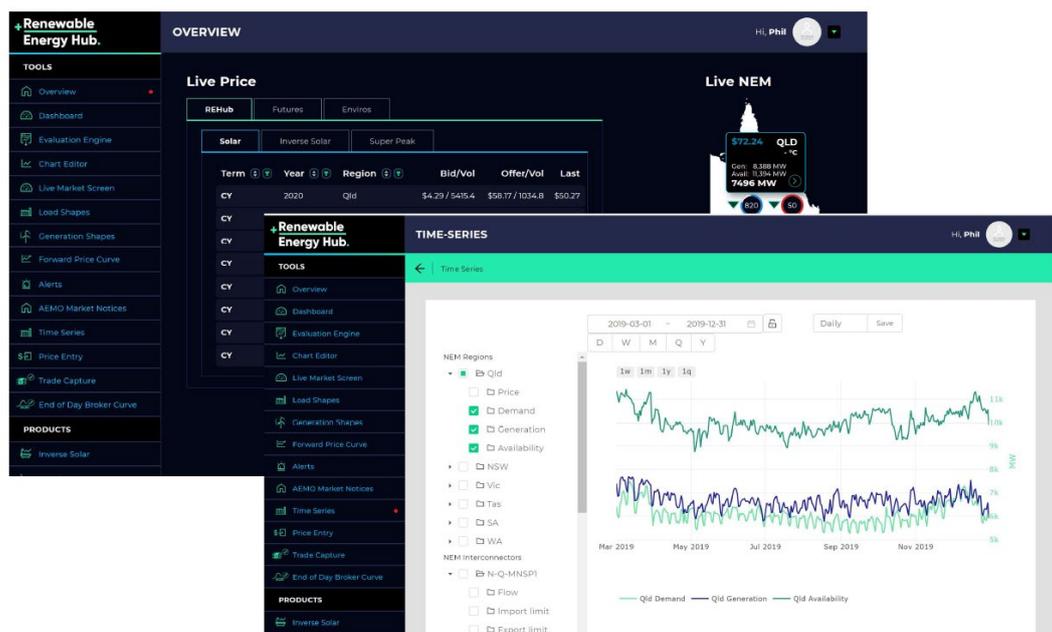
At present, the Renewable Energy Hub is continuing both front and back-end development with an iterative internal user testing program. We have undertaken over 40 briefings with potential users of the platform to gather feedback and input into the product design.

Several areas of interest have been highlighted by the market during these consultations:

1. Contract evaluation challenges: as noted in the preceding sections, a key barrier to the adoption of new hedge contracts is the uncertainty regarding pricing of the product:
  - a. Rapid calculation of relative contract values in a live market context and to assess these changes over time and under different conditions.
  - b. Evaluate contracts against historical performance as well as forecasts of spot price.
2. Assessment of the risk for renewable energy generators when selling firm, fixed profile contracts. The platform will include features that enable generators to assess their output (historical or forecast) against a range of contracting scenarios to determine contract payouts and earnings volatility.

A public launch of the platform, based on the current project plan, is expected to take place by mid-year.

Figure 6: SCREENSHOTS OF THE 'HUB' DIGITAL MARKET PLATFORM



# Broader External Market Reflections

Renewable Energy Hub has also identified the following external market trends which are being considered and may influence the outputs of this ARENA-funded project.

## **The development of large-scale Renewable Energy Zones (REZs)**

As is frequently noted, the existing transmission infrastructure in the NEM has limited remaining capacity to accommodate the development of large-scale renewable energy generation projects, and commonly those developments which are reaching financial close are now increasingly required by AEMO to include system support capabilities typically provided by synchronous condensers and battery energy storage. To address this, many reforms are being advanced including for example, COGATI (now wrapped into the ESB2025 program of work), initiatives to advance the implementation of priority aspects of AEMO's ISP, and commercial developments involving non-prescribed transmission infrastructure.

Renewable Energy Zones (REZs) will be the most efficient way to enable large scale renewable energy development in the NEM. This efficiency benefit will be delivered by a design which will seek to minimise all costs to generators, for example including:

- fit for purpose transmission infrastructure, embracing line design and sole purpose dedicated substations and access bays;
- step up and other connection assets (i.e. efficient connection infrastructure), and;
- grid stability support assets, for example including battery energy storage and synchronous condensers as required to support the generator connections, shared by all successful connecting generators.

These design outcomes and their inherent efficiencies will be necessary whether a REZ is developed through regulatory or commercial mechanisms. Further, under these models it is likely that there will be a clear separation of ownership such that the corporate entity providing the 'grid stability services' to the various competing renewable energy developers on a REZ will be a third party - possibly a TNSP, and possibly a separate entity. Contracts will underpin both the development and operation of the grid stability assets and services. Renewable Energy Hub is considering the role of its hedge contract products in supporting this change in new generation development.

## **Is there an additional role for grid connected battery energy storage?**

The nature of grid connected battery energy storage may change, driven by the markets and services provided, calling for a different form of contract.

For example, the Hornsdale 100MW/129MWh Power Reserve utilises a lithium-ion battery to provide network security services to Australian Energy Market Operator (AEMO). This battery chemistry is well suited to the highly dynamic and responsive nature of these markets, which operate in the range of seconds and less.

As variable renewable energy provides an increasing proportion of the NEM's energy, there will be a need for predictable intra-day extension of the effective energy output from these assets, for example to cover a reasonably predictable evening peak in consumer demand.

This need could be met by a range of assets including (peaking) thermal plant, pumped hydropower, or indeed a cheaper form of battery energy storage such as flow batteries whose chemistry is optimally suited to a regular deep charge - deep discharge cycle. If developed in concert with a REZ, this would call for an alternative form of contract to that which might underpin the services provided by a lithium-ion battery. These changes are likely to influence the design and specifications for our virtual battery contract in the medium to long-term.

# Attachment 1 - Super Peak Media Release

For immediate release - 08/04/2020

## **NEW ERA FOR RENEWABLES AS FIRST NEW SUPER PEAK FIRING CONTRACT SIGNED**

Renewable Energy Hub has completed a landmark 2-year energy deal with Snowy Hydro to supply energy during the high-priced morning and evening shoulder periods, when household demand is high but rooftop solar production is low.

It's the first transaction of Renewable Energy Hub's new 'super peak' electricity contract and involves Snowy Hydro selling a 25MW contract in calendar 2021 and 2022. What makes this contract different is it covers only the high-demand hours of the morning, afternoon and evening periods.

Renewable Energy Hub's Head of Markets Chris Halliwell said these 'super peak' periods are becoming more pronounced in the National Electricity Market (NEM) as solar suppresses net demand and prices during the middle of the day, only for demand and prices to ramp up rapidly as the sun sets.

"This new hedge contract enables market participants to manage the risk of very high prices during these periods," said Mr Halliwell.

"Importantly, it also gives renewable energy generators like Snowy Hydro access to new markets, and encourages new forms of supply into the grid to improve energy security"

Cameron Fisher, General Manager of Trading at Snowy Hydro said as the energy market transitions to more renewables, there is a growing need for new hedging instruments backed by on-demand energy resources such as hydro and batteries.

"The super peak products are a natural fit for Snowy Hydro and complement the existing firming products we are offering to both the wholesale and large customer markets," Mr Fisher said.

The deal comes after Renewable Energy Hub secured backing from the Australian Renewable Energy Agency (ARENA) in January to build a new digital marketplace and innovative hedging contracts for clean energy technologies, such as the super peak contract.

The firming market platform will for the first time support clean energy projects, large energy users and wholesale energy market participants to access to innovative technology specific contracts.

The super peak contract, ideal for pumped hydro, batteries and other forms of flexible peaking generation, is one of a number of new standardised contract types that will be offered through Renewable Energy Hub's online platform.

The online market platform supporting these new solutions will provide data and tools to facilitate price discovery, support the evaluation of PPAs and contracting

options, and recognises the unique requirements of contracting and procuring variable renewable energy.

The market for financial products that manage the risk in the Australian energy system is estimated to be worth \$26 billion a year, almost \$10 billion more than the actual energy market itself. Products such as swaps, caps and options are key tools in helping energy buyers and sellers manage their risk and provide a stable price to customers. Yet this market has not evolved to embrace the new requirements of clean generation and emerging technologies in Australia.

“This new marketplace will facilitate trade in contracts that reflect the ‘profile’ of renewable generation, filling a gap in risk solutions and creating price efficiency to unlock more clean energy technology,” said Mr Halliwell.

“Importantly, this new marketplace with contracts such as the super peak will ‘firm up’ Australia’s rapidly-growing fleet of renewables by enabling generators, retailers and large energy users managing their PPAs to trade fixed volumes of clean energy out into the future.”

The growth in these new kinds of financial products, including the super peak swap, will provide new incentives for market players to seek out assets - such as batteries, hydro power and other ‘balancing’ resources that can firm up the intermittency of renewables.

“This effectively turns a financial firming solution into a physical firming solution, hastening the arrival of those storage and other balancing resources required to help the energy system make the required transition to 100 per cent renewables,” said Halliwell.

“Snowy Hydro is always looking for new ways to deliver greater value to our customers and help underpin the energy transition occurring in the market. Being involved in the first trade of the super peak contract enables us to utilise our existing hydro assets, providing the on-demand renewable energy needed to firm up intermittent energy sources.” Mr Fisher said.

[renewableenergyhub.com.au](https://renewableenergyhub.com.au)

### **About Renewable Energy Hub.**

Renewable Energy Hub is a full-service, end-to-end energy marketplace. The bridge between energy buyers and energy projects.

We help big corporate buyers figure out the best way to spend their energy dollars and we help wholesale providers unlock new energy demand. Sometimes that means wrangling long-term PPA agreements with renewable energy projects, other times we’ll look at firming market options or simple retail contracts.

The end goal is simple: save clients money, drive industry growth, and help corporate buyers navigate the sometimes complex world of renewable energy.

### **A bright idea.**

We do things a little differently. Unlike traditional energy brokers or advisers, we're not just looking for quick wins and the cheapest price (although we have that knowledge on tap). There are plenty of price finders out there. It's our job to forge competitive partnerships and build structured energy contracts. Other brokers react to energy markets - we make them.

### **Experience matters.**

Renewable Energy Hub is part of Tradition, Asia Pacific's most experienced wholesale energy and renewable markets team. There's no-one with bigger reach or better contacts in the renewables sector. We know what projects are coming down the pipeline and how to leverage the best deals. Clean energy is in our DNA.

### **Background**

A swap is an agreement between a wholesale energy buyer and seller, allowing both to hedge against often huge price fluctuations in the 'spot' market. They agree to a set price for energy (called a strike price). If the wholesale spot price of energy goes above the strike price, the seller swaps the difference for the strike price (essentially giving it all to the buyer), but if it goes below the strike price, the buyer 'tops up' their payment to the level of the strike price. It means that the seller can be guaranteed a set income and the buyer can stabilise their costs.

A cap contract operates like insurance whereby the buyer of the cap (usually an energy retailer) pays the seller a premium to protect them against prices above an agreed level. In the Australian energy market, caps usually settle against a \$300 strike price. If the wholesale spot price goes above that strike price, the seller of the cap pays the difference between the spot price and \$300 to the buyer, thereby protecting them against extreme price events.

This makes sense for traditional non-variable power generation, including coal generators, that can pump out energy at any time, because the strike price is flat across the day. However, it doesn't work for renewables because they are exposed to unfavorable swaps or caps at times of the day that they aren't producing power at all.

Through the ARENA funded project, Renewable Energy Hub will work with market participants to develop specifications for a suite of innovative hedge contracts that are suited to both variable renewable energy (e.g. wind and solar) and new sources of clean dispatchable capacity (e.g. battery storage, pumped hydro storage and d