PRESENTATION TO:
DMO STAKEHOLDER FORUM

29 OCTOBER 2020

WHOLESALE ENERGY COSTS AND ENVIRONMENTAL COSTS

METHODOLOGY REVIEW

PRESENTERS:
RICHARD LENTON

LOCATION
VIA VIDEO CONFERENCE

INTRODUCTION

1

ACIL ALLEN'S SCOPE OF WORK

- ACIL Allen engaged to support AER in estimating cost inputs required for determination of DMO 3 prices
  - Specifically - wholesale and environmental cost inputs to inform determination for 2021-22
  - Estimates are to be based on relevant cost drivers for an efficient retailer supplying electricity to residential and small business customers
- ACIL Allen's work is broadly divided into two phases
  - Phase 1: Review and assess methodology used in DMO 2 and consider changes for DMO 3
  - Phase 2: Estimating underlying costs to inform DMO 3 determination

OUTLINE OF TODAY'S PRESENTATION

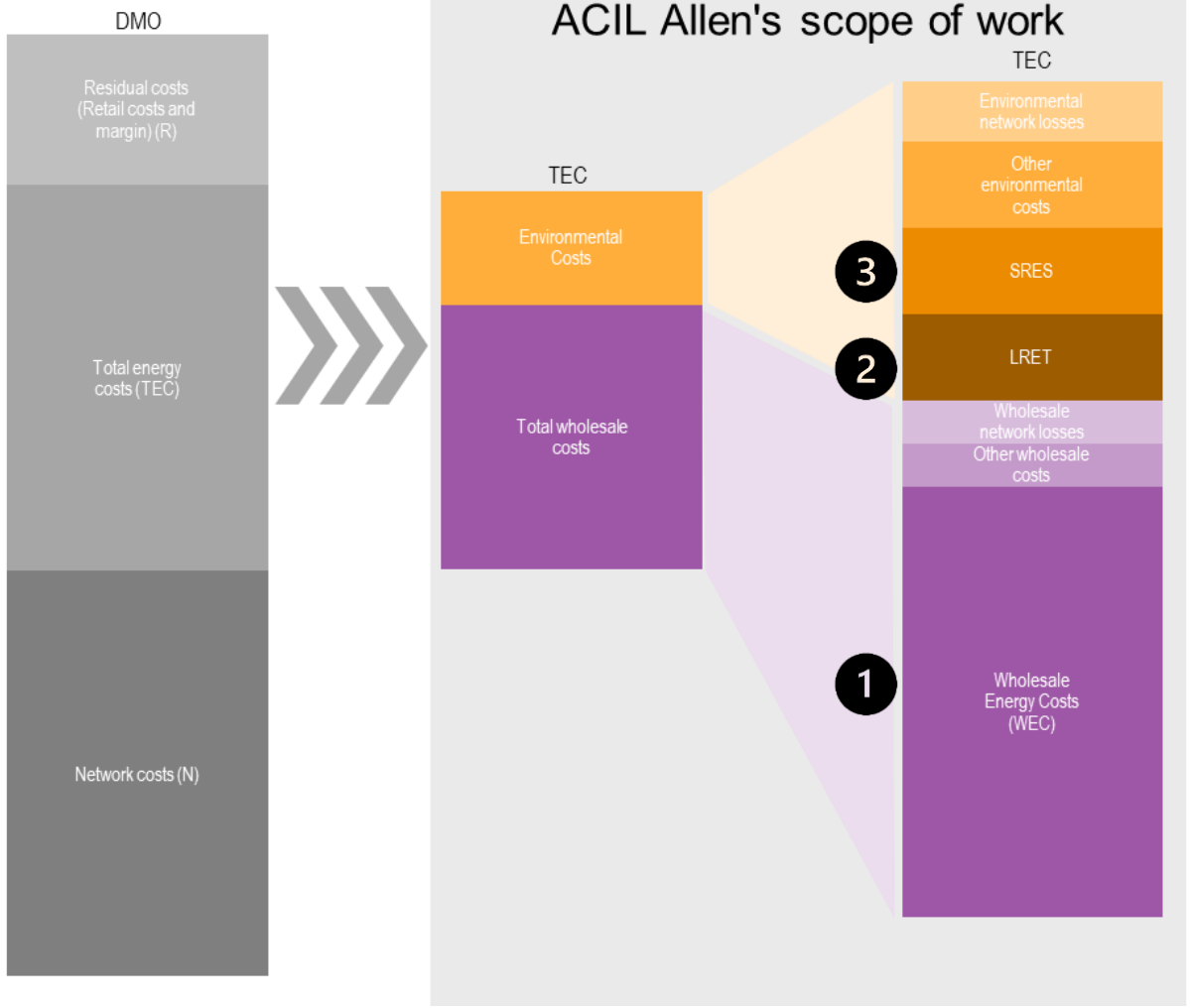
- Purpose of today's presentation is to
  - Recap the methodology for DMO 2
  - Provide a summary of our review recommendations for adjusting the methodology for DMO 3
    - ACIL Allen was engaged in 2019 to develop and implement wholesale and environmental cost estimation methodology for DMO 2
    - As such, for DMO 3, we are not required to devise and propose a methodology from first principles (or '*from scratch*'), but rather to consider the methodology used in DMO 2 and how it may be refined
  - Listen to any other matters that are of relevance to our engagement

RECAP OF METHODOLOGY

2

MARKET BASED APPROACH – FROM RETAIL PERSPECTIVE

- Current methodology, adopted for DMO 2, estimates costs from a retailing perspective
  - Estimates energy and environmental costs expected to be incurred in a given determination year
- Market based approach based on a large number of wholesale market simulations
  - To estimate expected spot market costs and volatility, and cost of hedging spot price risk by entering into electricity contracts with prices represented by the observable futures market data
- Environmental and other energy costs are added to wholesale energy costs
- Total is then adjusted for network losses to give Total Energy Cost (TEC)
- Three largest cost inputs to TEC are the WEC, LRET and SRES costs 1 2 3



WHOLESALE ENERGY COSTS (WEC)

- WEC is a function of four components:
  - load profile
  - wholesale electricity spot prices
  - forward contract prices
  - contracting strategy
- Key steps are:
  1. Forecast hourly load profile – generally is a function of the underlying demand forecast as published by AEMO, and accounting for further uptake of rooftop solar PV
  2. Forecast hourly wholesale electricity spot prices
  3. Adopt a contracting strategy – to hedge against risk in spot price uncertainty in a given year
  4. Estimate contract prices (base, peak, caps)
  5. Calculate spot and contracting cost for each hour and aggregate – for each hour calculate spot purchase cost, contract purchase costs, and different payments, and then aggregate to get an annual cost which is divided by the annual load to get a price in $/MWh terms
- Simplification of what occurs in actual market in that it is based on a specified hedging strategy using observable prices for base, peak and cap contracts only

WHOLESALE ENERGY COSTS (WEC)

- Previous steps produce a single estimate of WEC
- WEC will vary due to variations in demand, and spot prices that eventuate for given year
- Therefore, important to estimate WEC under range of plausible sensitivities, to understand range of potential outcomes
- Do this by utilising
  - A stochastic demand and renewable energy resource model to develop multiple weather influenced simulations of hourly demand and renewable energy resource traces
  - A stochastic outage model to develop multiple dispatchable power station availability simulations
  - An energy market model to run multiple simulations of hourly spot prices using stochastic demand and renewable energy resource traces and power station availabilities as inputs
  - A hedge model taking above analyses as inputs to estimate a distribution of hedged prices for the simulations to estimate a distribution of hedged prices (the WEC) for an optimal hedging strategy

Monte Carlo Spot Price Simulation Inputs

1 Regional Demand Forecast
Underlying demand forecast parameters
(annual energy, winter/summer P10, P50, P90 peak demand)

2 Regional Demand Profiles
~50 simulated hourly underlying demand profiles for each region - driven by observable variations in weather

3 Availability / resource profiles
11 simulated hourly forced outage sets for each thermal and hydro generator
~50 simulated hourly renewable resource profiles for each renewable generator

4 PowerMark

Generators
Capacity
Technology
Technical features
Costs
Availability parameters
Hedging

Portfolios
Station
Station
Unit
Unit
Unit
Unit

Regional Demand
Underlying demand
Non-scheduled generation
Rooftop PV uptake
Storage uptake
EV uptake

Transmission network
Regulated / Merchant Interconnectors
Key network constraints

Regional Profiles
Hourly underlying demand
Hourly rooftop PV and storage
Hourly EV recharging

Availability / resource (hourly)
Hourly planned outages
Hourly forced outages
Hourly renewable resource profiles

Key dynamic constraints

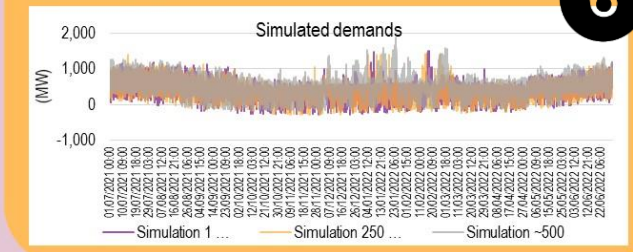
LP Dispatch Engine (representation of NEMDE)

Portfolio Optimisation
Generator bidding behaviour
Offer curve construction

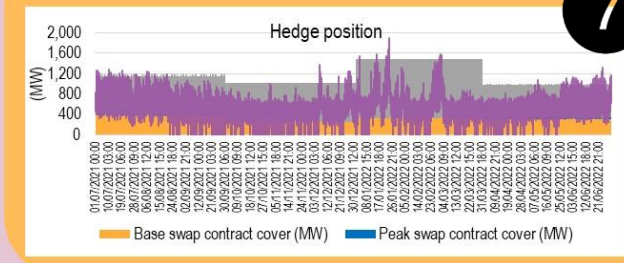
Model results
Hourly dispatch
Hourly prices
Hourly Interconnector flows

Hedge Model Simulation Inputs

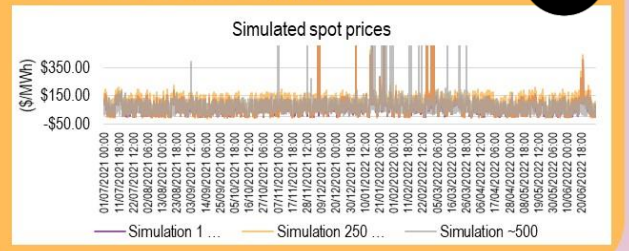
6 Distribution Zone Demand Profiles
~50 simulated hourly demand profiles for each distribution zone's NSLP and CLP - driven by observable variations in weather and linked to the assoc regional demand profile



7 Hedging Strategy
Chosen hedging strategy for each distribution zone - chosen to minimise 95th percentile simulated WEC. Held constant for each simulation



5 Regional spot prices
~500 simulated sets of 8,760 hourly spot prices

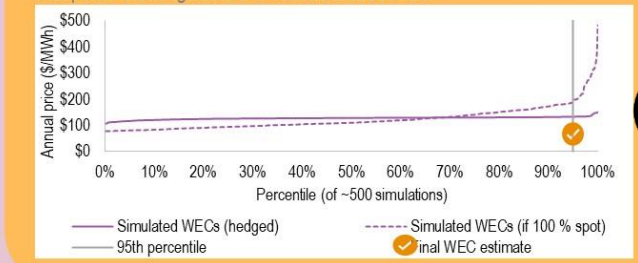


8 Contract prices
From ASX Energy and/or brokers

9

Hedge Model Simulation Outputs

Simulated WECs
~500 simulated annual WECs for each distribution zone's NSLP and CLP
95th percentile hedged WEC chosen as final estimate



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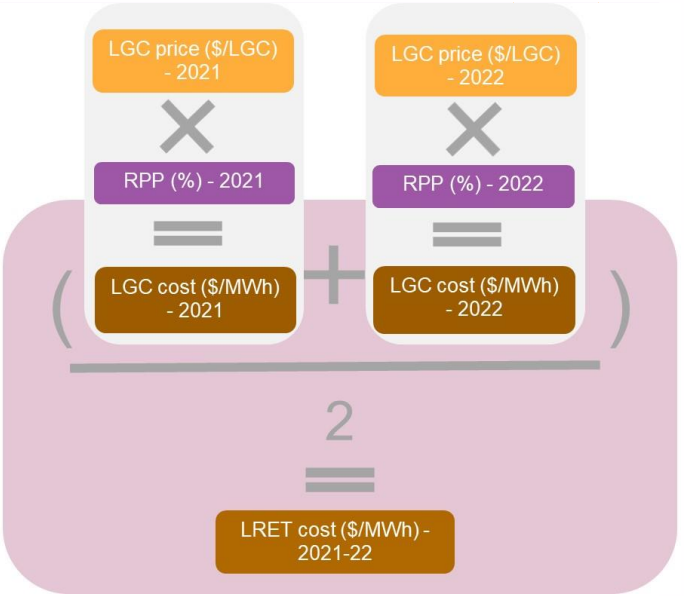
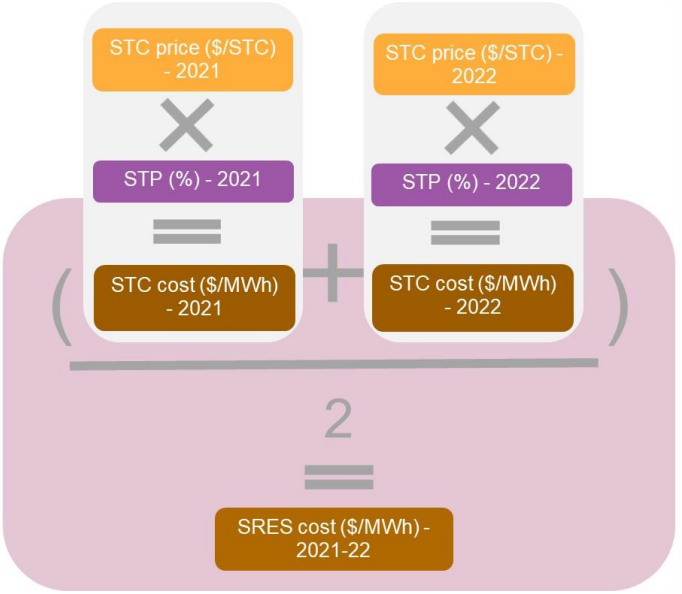
OTHER WHOLESALE COSTS

- Other wholesale costs are estimated using publicly available information from AEMO or ASX Energy:
  - NEM market fees – use AEMO's budget report, which contain forecasts of fees in 2021-22
  - Ancillary services costs – use AEMO published weekly ancillary services recovery data and average the most recent 52 weeks of costs
  - Prudential costs
    - AEMO prudential costs – use AEMO published volatility factors
    - Hedge prudential costs – use ASX Energy margin parameters
  - RERT – use AEMO published RERT costs for the 12-month period prior to the determination year and express in $/MWh by prorating the cost across all consumers in the region on a consumption basis

ENVIRONMENTAL COSTS

- LRET
  - Estimate RPP in 2021 and 2022
  - Calculate average LGC price using forward prices
    - Calculate trade-weighted average of LGC forward price since commencement of trading for compliance year
  - Multiply RPP by LGC price in 2021 and 2022
  - Average 2021 and 2022 to estimate cost of LRET for 2021-22 period
- SRES
  - Estimate STP in 2021 and 2023
  - Use CER STC clearing price
  - Multiply STP by STC price in 2021 and 2022
  - Average 2021 and 2022 to estimate cost of SRES for 2021-22 period





OTHER ENVIRONMENTAL COSTS

- New South Wales Energy Savings Scheme (ESS)
  - Use IPART published targets in 2021 and 2022
  - Calculate average ESC price using forward prices from broker
  - Multiply ESS target by ESC price in 2021 and 2022
  - Average 2021 and 2022 to estimate cost of ESS in 2021-22 period
- South Australia Retailer Energy Efficiency Scheme (REES)
  - Little publicly available data on cost of REES
  - Use estimate in AEMC price trends report
    - Is assumed to hold constant in nominal terms

AREAS OF CONSIDERATION FOR REFINEMENT OF METHODOLOGY FOR DMO 3

3

APPROACH TO REVIEW

- Consider whether any new cost components ought to be included in estimate of wholesale and environmental costs
  - Retailer Reliability Obligation (RRO) – not triggered for DMO 3
- Consider whether any aspects of methodology used in DMO 2 ought to be refined for DMO 3
  - Five-minute settlement
  - Ancillary Services
  - Separate WEC estimates for residential and small business customers
  - Whether estimate of LGC costs considers data other than broker supplied exchange data
  - Manner in which impact of COVID-19 is considered when estimating wholesale and environmental costs
  - Matters raised in AER position paper
    - Use of 95th percentile WEC
    - Hedge book build up

REVIEW OF ESTIMATION METHODOLOGY - FIVE-MINUTE SETTLEMENT

- Five-minute settlement to commence 1 October 2021
- May have two impacts:
  - Manner in which plant change their bidding strategy
    - Whether market views five-minute settlement as having potential to lower or raise wholesale electricity prices will be reflected in forward contract market price data
  - Availability of cap contracts offered to forward contract market, and evolution of other contract products
    - In August 2020, ASX Energy announced no facilitation in trade of caps after 30 September 2021. For three remaining quarters of 2021-22 determination period, there is currently no cap contract price and volume data available from ASX Energy
- This raises three immediate questions
  - From where should reliable cap price and volume data be sourced?
  - Whether any changes need to be made to the methodology to reflect the lower availability of cap contracts?
  - Are there other traded contract products recently developed or taken up in response to five-minute settlement that should be included in hedge strategy within hedge model?

REVIEW OF ESTIMATION METHODOLOGY - FIVE-MINUTE SETTLEMENT

- Will continue to use ASX Energy trade volumes and prices for base and peak swap contracts for all four quarters of DMO 3, and for the first quarter of DMO 3 for cap contracts
  - Any noticeable change in volumes offered in market will be reflected in hedging strategy
- Consulted with ASX Energy and broker, and at this stage both intend on developing a new cap product accounting for five-minute settlement which will be made available in near future
  - ACIL Allen proposes to make use of ASX Energy trade volume and price data of this new cap product in hedge model
  - ACIL Allen proposes to continue to use services of a broker to supplement estimate the trade volume weighted price of contracts from ASX Energy
- ACIL Allen's recommendation
  - On balance, ACIL Allen is of the opinion that moving to five-minute settlement does not require a change in methodology used to estimate WEC. However, limits on caps and inclusion of other contract products, where appropriate, will be taken into account

REVIEW OF ESTIMATION METHODOLOGY - ANCILLARY SERVICES COSTS

- Current approach estimates ancillary service costs across the NEM and is the same in each region
  - Although approach is reasonable when there is no islanding of regions
    - Possible in future there will be more islanding events which may well result in regional price separation of ancillary services
- ACIL Allen's recommendation
  - ACIL Allen proposes to continue to use the same data set, but provide separate estimates of ancillary services costs for each region
    - Noting that within a region, each distribution zone will have same ancillary services cost

REVIEW OF ESTIMATION METHODOLOGY - SEPARATE WEC FOR RESIDENTIAL AND SMALL BUSINESS CUSTOMERS

- Current methodology estimates WEC based on NSLP for given distribution zone
  - Results in same WEC estimate being used for residential and small business customers
- Majority of residential and small business customers subject to DMO are on accumulation (or basic) meters
  - Customers with digital (or interval) meters are in minority
  - In some ways it is technology of meters (and data) that influences the WEC estimation methodology
- Only way to estimate separate WEC for residential and small customers is to use interval meter data from AEMO
- Raises to issues
  - Load profile for customers on basic meters (the NSLP) may be different to load profile of customers on interval meters
  - Not possible to directly estimate a separate WEC for residential and small business customers on basic meters (majority of customers subject to DMO) – can only be inferred

REVIEW OF ESTIMATION METHODOLOGY - SEPARATE WEC FOR RESIDENTIAL AND SMALL BUSINESS CUSTOMERS

- Raises following questions
  - Do separate WECs estimated for residential and small-business customers, based on interval meter data, also apply to customers on basic meters?
    - Results in less accurate WEC since small proportion of customers on interval meters may not be representative of majority customers on basic meters
  - Do only customers on interval meters have separate WECs (residential/small business)?
    - This would mean differentiating between customers based on their meter type
    - All residential and small business customers on a basic meter have same WEC – which defeats the purpose of having separate WECs
  - Data transparency?
    - Relies on data not in public domain
- ACIL Allen's recommendation
  - No change to current approach of using NSLPs and CLPs to estimate the WEC for residential and small-business customers

REVIEW OF ESTIMATION METHODOLOGY - LGC COSTS

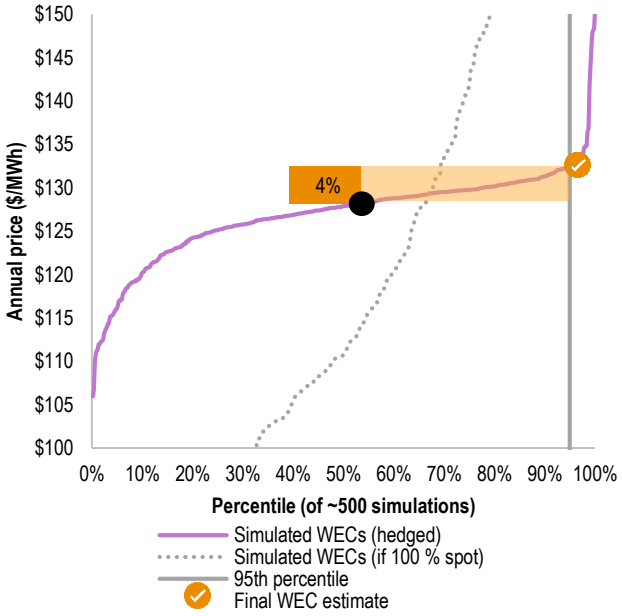
- ACIL Allen made clear in DMO 2 its view that market-based approach using contemporary forward LGC prices represents most appropriate indicator of current market consensus view of price of LGCs
  - Not restating arguments today
- We note that market-based approach for estimating LGC costs is adopted by all regulators in the NEM:
  - AER for the DMO - south east Queensland, New South Wales, and South Australia
  - ESC for the VDO - Victoria
  - QCA - regional Queensland
  - Independent Competition and Regulatory Commission (ICRC) - ACT
  - Office of the Tasmanian Economic Regulator - Tasmania.
- ACIL Allen's recommendation
  - ACIL Allen sees no valid reason to change the current approach for estimating the cost of the LRET

REVIEW OF ESTIMATION METHODOLOGY - ACCOUNTING FOR IMPACTS OF COVID-19

- Extent to which COVID-19 is impacting the market is inherently taken into account in current methodology
- Key inputs to methodology likely to be impacted by COVID-19:
  - Demand forecast parameters
    - Accounted for by AEMO in 2020 ESOO
  - Demand profiles
    - Accounted for in load data
    - Queensland, New South Wales, and South Australia have not experienced the same degree of COVID-19 cases and restrictions to date as Victoria
  - Contract prices
    - Forward contract market already reflecting the market's view of impact of COVID-19 on wholesale electricity prices in 2021-22 and will continue to evolve its view over time
  - Spot prices
    - Simulation inputs get updated routinely on a regular basis.
- ACIL Allen's recommendation
  - On this basis, ACIL Allen is satisfied current methodology appropriately captures impacts of COVID-19 on the wholesale electricity market, and its associated costs

WHOLESALE ENERGY COSTS (WEC) – 95TH PERCENTILE

- 95th percentile WEC from distribution of WECs used as final estimate
  - Distribution of WECs from simulations exhibits a narrow spread, which is to be expected since they are hedged values
    - 3-8% difference between average outcome and 95% percentile outcome (4% difference in example to right)
- Choosing 95th percentile strikes right balance given intent of DMO
  - Regulated price cap, not a regulated price
  - Acknowledges different retailers have different retail load shapes with different actual WECs
    - one retailer might have an actual WEC close to average, another might be close to 95th percentile
  - Allows retailers to compete below the WEC component of DMO price cap
    - encourages consumer engagement
  - Whilst at same time providing a reasonable sine estimate of WEC across a variety of different retailers
  - And therefore, contributes to achieving the key policy objectives of the DMO



WHOLESALE ENERGY COSTS (WEC) – HEDGE BOOK BUILD UP

- Contract prices
  - ASX Energy and broker data used to estimate contract prices
    - Base, peak and cap quarterly contracts
    - Hedge book build based on observed trade volumes
    - The contract price is equal to the trade-weighted average price
    - Using trade volumes since the contract commenced trading
    - Start date of book build not forced
  - Let the data do the talking
    - Rather than prespecifying or forcing a particular pattern or starting time in hedge book build up