OPTIONAL FIRM ACCESS

AEMO ACCESS SETTLEMENTS IMPLEMENTATION COST ESTIMATE REPORT

Updated: **February 2015**

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about AEMO's potential implementation cost of Optional Firm Access, as at the date of publication.

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Previous Publication

This costing report was first delivered to the Australian Energy Market Commission in December 2014. It was also included as an attachment in AEMO's Draft Report into Optional Firm Access and published on AEMO's website. Following stakeholder feedback, this costing estimate has been updated. The updated version will be included in AEMO's Final Report into Optional Firm Access to be published in March 2015.

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1. Introduction

1.1 Background

On 25 February 2014 AEMO received a request from the Standing Council on Energy and Resources (SCER) to conduct a detailed design and testing of the optional firm access (OFA) framework[1], in collaboration with the Australian Energy Market Commission (AEMC). Each institution received a separate, yet linked, terms of reference (TOR).

Under the TOR, AEMO is responsible for the following work:

- Design and develop a functional specification of the access settlement system consistent with design parameters provided by the AEMC;
- Test market outcomes through access settlement simulations under different sets of assumptions about generator bidding behaviour and options for allocating access rights that will be agreed with the AEMC;
- Provide input into the implementation planning for the access settlement system; and
- Review and identify any changes to the existing settlements residue auction (SRA) units that could be made to reflect their enhanced firmness under OFA.

AEMO is also asked:

- To prepare a rule change to implement access settlement on a standalone basis, without the more complex parts of the reform that involve transmission network service providers (TNSPs), described as “stage one”;
- To contemplate the implementation of access settlement in some regions but not in others.

1.2 Objective of this paper

This report provides an “order of magnitude” cost estimate of the changes relating to access settlement that may be required at AEMO should the OFA framework implementation go ahead. It is likely that AEMO would also be responsible for performing some functions outside access settlement which are not costed here. The scope of work of the cost estimate is discussed in Chapter 0 of this report.

While AEMO is not required to perform any costing for OFA implementation, as that task is assigned to the AEMC in the TOR, a joint decision was made with the AEMC that AEMO would perform this costing exercise to assist the AEMC in understanding the cost of implementing OFA at AEMO. AEMO notes that the AEMC will conduct its own research into the implementation cost of the broader OFA, and this is expected to consider generator and transmission costs as well as AEMO’s costs as the market operator that are presented in this report.

1.3 Stakeholder Feedback

This report was included as an appendix within AEMO’s Draft Report into Optional Firm Access published in December 2014. A number of comments were received to that appendix which has caused AEMO to produce this update. This updated version will be included in the same appendix to AEMO’s Final Report into Optional Firm Access.

[1] SCER’s request is available at: http://www.aemo.com.au/Electricity/Market-Operations/~/media/Files/Other/OFA/SCER%20Transmission%20Frameworks%20letter%20250214.pdf.ash. Viewed: 15 December 2014.

2. Scope

2.1 In scope

The scope of this costing exercise is limited to the components of OFA that are directly associated with AEMO's market operator function, the cost of which would be recovered through NEM participant fees. Specifically, the following components are costed in this report:

- Maintenance of a list of firm access quantities and access settled meters as advised by TNSPs or other processes.
- Changes to the settlements processes to operate access settlement, covering both generator firm access and firm interconnector access.
- Changes to constraint formulation or tagging processes necessary to support the access settlement concept
- Testing of new systems.
- Provision of additional market information to assist participant engagement with OFA settlements.
- Retirement of the existing SRA arrangements.

AEMO approached the costing from the perspective of a full, non-staged OFA implementation. However, a similar access settlement system build would be required for a "stage one" implementation or a partial geographic implementation. In all implementation scenarios, the outcome of this cost estimate should not materially differ.

2.2 Out of scope

At the time of writing this report, the AEMC has not made governance recommendations regarding the operation of key new systems supporting OFA. For example, it is possible the AEMC may recommend that AEMO is the most appropriate agency to take on functions beyond access settlement, such as the:

- Pricing model.
- Auction and trading platforms.
- TNSP incentive calculation.
- Transitional Access Allocation work.
- Nomination of access settled meters.

These components of the OFA framework are excluded from the scope of estimation.

In addition, the following items are also out of scope:

- Non-AEMO costs (e.g. participant and TNSP costs).
- Costs associated with adapting the Victorian TNSP model to OFA.[2]
- Costs associated with the South Australian advisory function.
- Victorian generator to TNSP (AEMO) contracting costs.
- New National Transmission Planner costs (e.g. any functions associated with the pricing model).
- Costs incurred by AEMO prior to the AEMC issuing the final determination on OFA rule change.

This costing assumes the model is fully specified by the conclusion of the rule change process. It includes the cost of converting this design into business requirements, but does not include any design or redesign of the model itself.

[2] Victorian TNSP costs will be assumed by AEMC as similar to other states.

3. Assumptions

3.1 Accuracy level

All project estimates involve assumptions, uncertainty and risk. Therefore, the confidence level of estimates is directly related to the activity and task definition and available information. Project estimates should be refined as more information becomes available, making project estimation an iterative and evolving process.

The accuracy level used for this initial cost estimate is “an order of magnitude” and the cost will be represented as a range. Should OFA implementation proceed to the project initiation phase, it is highly recommended that the estimate be refined, as more detailed design and other information should be available by that time.

3.2 Estimation process

The key input for this costing exercise is the draft concept design developed by AEMO; refer to Appendix A for further details. Based on this document, assumptions of the required system changes at AEMO are made by the relevant subject matter experts; these are listed Chapter 3.4. Following this, an estimation of the amount of effort required to implement the system changes are made and these are summarised in Chapter 4.

As this costing will eventually be used in the overall cost-benefit analysis of OFA, AEMO’s policy is to capture the total cost of the project, which includes corporate overhead costs.

3.3 Project assumptions

For costing, an assumption was required regarding implementation date. It was assumed that the OFA implementation project, should it go ahead, will be delivered during the 2017-18 financial year and be completed by mid-2018 (AEMO’s deliverables only). The project would be delivered as part of AEMO’s standard electricity release program and there would be a dedicated project manager looking after the delivery and day-to-day management of the project in accordance with AEMO’s project management methodology.

In the earlier version of this report AEMO assumed that the project would wholly utilise AEMO’s internal labour, and noted that should contract labour be required to backfill any resource gaps, it is likely to have a significant impact on the cost of the project. However, following stakeholder feedback, the assumption is updated to include the use of some contract labour consistent with typical practices on similar projects at AEMO which will make up 50% of the labour requirements for IT development and system testing work. Contract labour will not be required for other aspects of the project.

AEMO’s labour rates for 2017-18 are yet to be determined, but they have been estimated for purpose of this costing exercise based on the 2014-15 rates being compounded by 3% p.a. All costs provided in this report are shown as present value.

It is not expected that any new hardware or external software are required to be procured for this project.

3.4 System change assumptions

The following system changes are assumed in determining the effort required to deliver the project.

Overall goal of OFA

- Generator settlements are adjusted by the access settlement logic, implying that during congestion:
  - At the margin, all scheduled and semi-scheduled generators are exposed to a local (nodal) price.
  - A firm access right entitles a generator to receive a priority share of the resultant congestion residue.

- Owners of Firm Interconnector Rights (FIR) will also receive payment based on congestion residue. FIRs are only available on regulated interconnectors, not MNSPs.

Settlement changes

- NEMDE is to remain unchanged.
- Access settlement applies only to scheduled and semi-scheduled generators and regulated interconnectors. There is no change to customer settlements.
- Access settlement estimates need to be calculated in pre-dispatch, p5, and dispatch timeframes.
- Real settlement happens at settlement time and re-settlement time.
- Settlement is based on an entity called Revenue Meter Identifier (RMID). A RMID will be a combination of one or more DUIDs. It is assumed that this is the same concept as the existing RMIDs used at AEMO.
- Access settlement is based on flowgate prices (FGP), which are the shadow prices of flowgate constraints. Flowgate constraints will need to be tagged as such.

OFA settlement algorithm

- The algebra is formulaic and is assumed to be resolved by the design process prior to implementation by AEMO.

Access entitlement scaling and flowgate price scaling

- These scaling functions require optimisation searches across one variable and a monotonic function.

Abnormal market pricing conditions

- The logic for handling these will be fully specified prior to implementation by AEMO.
- The general logic is described in Appendix A.

Metering versus dispatch

- Access settlement is to operate on a 30 minute basis. Thirty-minute settlement data would be used wherever possible. However, constraint information is inherently based on five minute dispatch quantities.
- This implies:
    1. An estimated auxiliary load (EAL) factor is required in all time frames other than settlement;
    2. Generation quantities in any of the settlement formulas are different depending on timeframe:
        a) SCADA meter – EAL
        b) Dispatch quantity – EAL
        c) Revenue meter
    3. Rather than using the NEMDE calculated right-hand-sides, the quantities would be scaled from the left-hand-side quantities from two.

FIR settlement algorithm

- Each dispatchable interconnector variable has two associated directional FIRs, e.g. there is one each for Heywood east, Heywood west, Murraylink east, Murraylink west.

- The relevant constrained directional interconnector in a particular flowgate constraint equation can be determined from the polarity of the interconnector's left-hand-side coefficient, the constraint's inequality sign and the polarity of the right-hand-side.
- Access settlement will consume the majority of inter-regional settlement residue. A small amount of residue can still accumulate, associated with loss factor pricing and non-firm capacity of interconnectors. These are to be identified and credited to the importing TNSP.

Settlement residue auction

- This function is to cease. Ongoing savings can be included. Note the processes that release FIRs are not in scope of this costing study.

Negative residue

- Although most negative residue is funded by access settlement, some small quantities can remain.
- AEMO's negative residue management process will be withdrawn.
- After access settlement, residual negative residues will be allocated to the importing TNSP using the same process as occurs currently.

Prudential forecaster

- To the extent prudentials are affected by generator settlements, e.g. for netted generator-market customer position, then the prudentials forecaster will need to be changed to account for access settlement adjustments.

Process flow

1. Registration data: Firm access level. Access settlement meter identifiers. Capacities. Estimated auxiliary load factors.
2. Constraints tagged as flowgate.
3. NEMDE run which gives FGPs and dispatch quantities.
4. OFA engine:
    a. Calculate local marginal prices (LMPs) for each generator.
    b. Scale LMPs to above the market price floor by scaling FGPs.
    c. For each flowgate (needs metering/EAL):
        i. Calculate effective flowgate capacity.
        ii. Calculate entitlement and usage for each generator and directional interconnector.
5. Settlements (or settlements estimate). Will need new inputs detailing entitlements, FGPs, constraint coefficients, firm, non-firm and (for FIRs) non-firm residual entitlement scaling factors, FIR amount.
6. Reporting.

4. Resource and cost estimate

4.1 Access settlement

The expected project activities and resource requirements in order to implement access settlement at AEMO are summarised in Table 1.

As the access settlement system is expected to be fully automated, it will not require significant resources to support and maintain the system; therefore, any ongoing support and maintenance costs are assumed to be absorbed into business-as-usual costs.

The estimated project cost is between $990,000 and $2,650,000.

Table 1 Project activities and resource estimates

Project activities	Description	Resources (AEMO teams)	Effort (FTE weeks)
Project Initiation & Planning	Project set up, planning workshops, business case, risk assessment	PM, CD, MOP, S&P, IMT	20 - 60
Detailed Design	Business analysis, Requirements Description (RD), Design Description (DD), IMT Impact Assessment.	BA, MOP, S&P, IMT, CD	20 - 60
Development	Develop codes, database build, release plan, etc.	IMT Dev, Contract Labour	30 - 80
System Test	Test script, test environment setup, perform system tests of the above codes, correct defects, regression tests, reporting.	IMT Test, Contract Labour	40 - 90
User Acceptance Test	User tests from Operations (incl. test scripts, user tests, defect fix, end-to-end testing, sign-offs)	MOP, RTO, S&P	20 - 60
Pre-production	Include participant tests	Test	8 - 20
Production / Deployment	(DBA 4 + Platform 4) x 2 environments, to be changed once RD/DD is made available	Test, DBA, Platform	8 - 20
Project Management	Day-to-day management, monitoring, reporting, issues & risk management, governance, admin, etc.	PM	40 - 80
Stakeholder engagement	External communications, forums, working group	MOP, S&P, IMT, CD	4 - 12
Training	Documentation, training material, training sessions	MOP, S&P, IMT, CD	4 - 12

BA = Business Analyst; CD = Corporate Development; DBA = Database Administrator; MOP = Market Operations and Performance; PM = Program Manager; S&P = Settlements & Prudentials; IMT = Information Management and Technology

4.2 Auctions

The OFA reform will change market settlements and no longer create inter-regional settlement residue, which supports the Settlement Residue Auction (SRA) mechanism. Rather, the management of this risk is intended to occur through the new firm interconnector right (FIR), the settlement of which is included in the above estimate.

Therefore, the SRA would retire. This would result in the elimination of the costs of administering SRA, which are recovered from settlements residues by way of fees. These costs are regularly forecasted by AEMO and historical cost information exists, which makes estimation more accurate.

The total savings is calculated over a 5-year period from when SRA is assumed to be retired, which is at the beginning of 2018-19.

It is estimated that the saving is between $865,000 and $1,057,000 (present value). Note that these transactional costs are recovered from auction fees, i.e. they are recovered from successful bidders and not recovered from Participant Fees.

The AEMC continued their development of two new auctions, namely the long term inter-regional access and the short term firm access auctions. AEMO understands that the AEMC intends to recommend that these be operated by AEMO. Therefore, their build cost should be included in AEMO's implementation costs.

Unfortunately AEMO is unable to estimate the build and operating cost of these two auctions at this time. This is because:

- The proposal that AEMO operate them emerged recently.
- The auctions have only been conceptually described to date and AEMO considers they need further development before they can be reasonably costed.

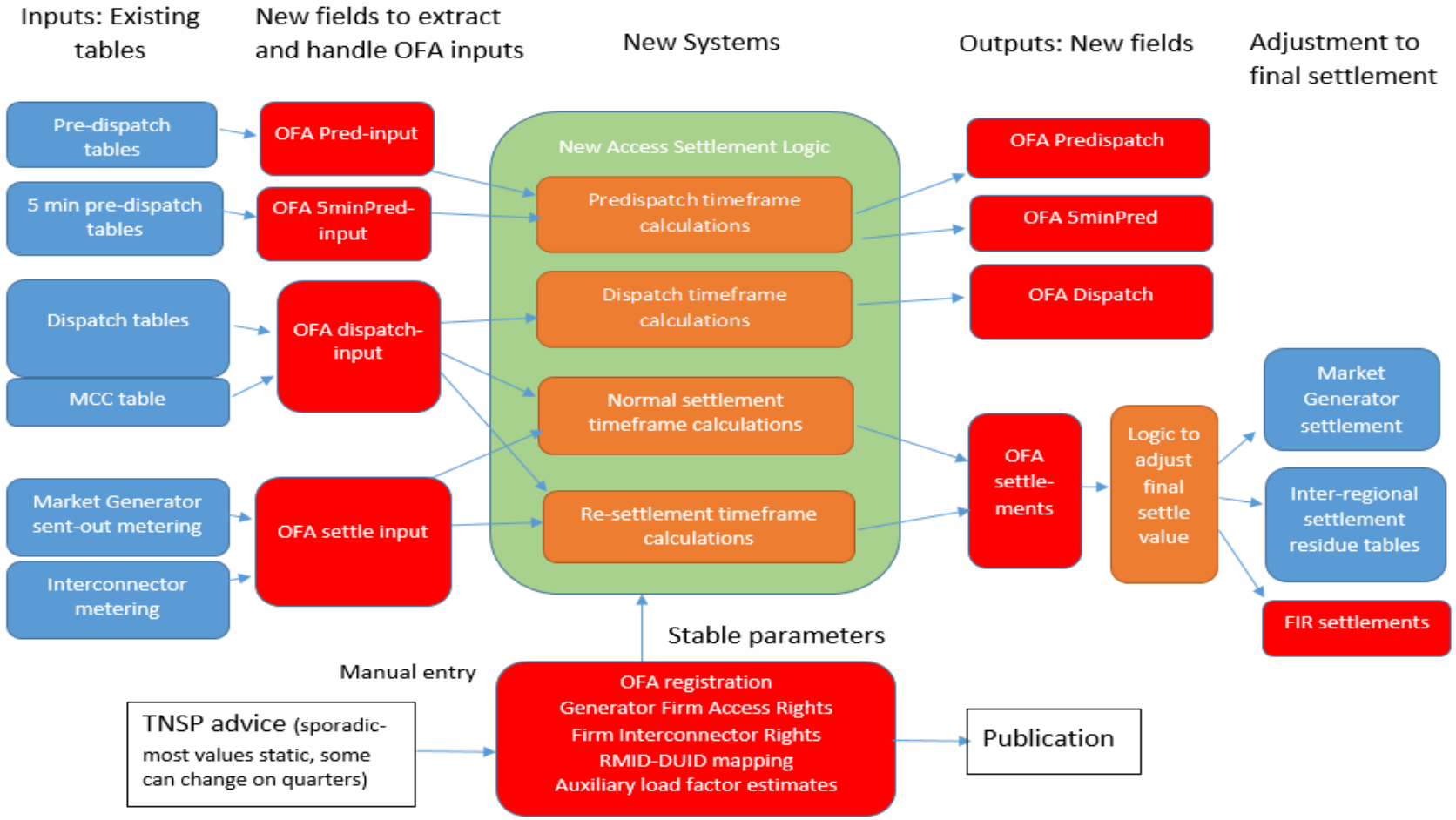
It is hoped these auctions' designs will progress during the remainder of the AEMC's project and AEMO will engage with AEMC on them and a view on their costs should emerge through that.

In the meantime, AEMO considers it reasonable to assume that the operating costs of these auctions would be no less than the operating costs of the existing SRA. For the purposes of estimating OFA transactional costs, at this time the saving of SRA retirement should not be netted off AEMO's total implementation costs.

Further, there is a yet uncosted build cost for both auctions. AEMO recommends that any preliminary OFA transactional cost estimates note this omission.

APPENDIX A. CONCEPT DESIGN FOR COSTING

This diagram identifies, at a conceptual level, those areas of AEMO's infrastructure to be affected by OFA operation. The general architecture of AEMO's Access Settlement Build is shown below (example for costing purpose only):



(Red=new fields, Blue=existing table, Brown=New process logic)

Assumed data inputs and outputs to be used

Function	Timeframe
1. Manage "fixed" OFA input quantities. (Equivalent to "registration" values for OFA). Includes access levels, RMID-DUID mapping, auxiliary load estimates.	Used in all timeframes. Values to be manually entered, changed ~ annually upon provision of external (TNSP) advice. ~10 values per DUID.
2. Forecast Access settlement in predispatch.	Pre-dispatch timeframes. Logic run immediately after half hourly pre-dispatch. (Not sensitivities)
3. Forecast Access settlement in 5 min predispatch.	5-minute pre-dispatch timeframes. Run immediately after 5-minute dispatch.
4. Estimate Access settlement in real-time	Real-time 5-minute dispatch. One calculation run immediately after NEMDE executes
5. Access Settlement Processing	Processing for preliminary statement, Processing for final statement.
6. Access Settlement Resettlement Processing	Twenty week revision, thirty week revision.

Access settlement logic (for the purpose of visualising build, test and procedural complexity)

Condition	Process logic	Notes
1. "Normal" pricing conditions	Standard access settlement formula	Uses constraint marginal prices (MCC table), RRP, fixed values, actual sent-out generation (estimated sent-out if not yet available). Will require a simple goal-seek/LP.
2. Released over-constrained dispatch	Standard access settlement using new RRP	As above
3. Rejected RRP due to manifestly incorrect inputs	Standard access settlement using new RRP	As above

Condition	Process logic	Notes
4. Intervention pricing	Standard access settlement using what-if RRP not ROP	As above, using what-if marginal prices
5. Mandatory restriction pricing	Standard access settlement using RRP not ROP	As above
6. LMP scaling: occurs when an LMP (i.e. RRP - constraint penalty$/gen coefficient) would be below -$1,000	Access settlements scaled back to bring lowest LMP to -$1,000	Requires additional “goal-seek”/LP.
7. Administered pricing	Regional Scaling factor to be applied to all access settlements in order to sum payments to zero	Scaling factor equation is linear
8. Over-constrained flowgate (constraint) price failed to release in first MCC run	MCC manual release to be performed prior to final statement	Not a new process-an acceleration of existing MCC manual relaxation timetable
9. Detect and resolve residual negative inter-regional residue	Adjust existing settlement mechanism to detect and recover negative inter-regional residue but calculation to be performed after access settlement payments	Adjustment to existing process. Access settlements intends to fund negative inter-regional residues directly, but in very exceptional circumstances, a negative inter-regional residue may remain even after access settlement.