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Open-source software for assessing utility-scale renewable performance in the Australian NEM

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The Australian National Electricity Market (NEM) is undergoing rapid change as utility-scale wind, solar and now battery storage technologies enter the market. As this change takes place a potentially wide range of stakeholders including researchers, market participants, consultants and energy NGOs, seek to analyse available data and produce new insights into the future of the NEM. This task is possible largely due to high levels of transparency around market data, with the Australian Energy Market Operator (AEMO) releasing nearly all the data used in the central dispatch process. However, a significant processing and interpretation overhead exists when analysing the large and often complex datasets made available to the public. This paper reports on a new open-source software tool called nem-data, which aims to lower this overhead and improve the accessibility of data sourced from AEMO.

While many similar proprietary tools exist and are widely used by industry stakeholders nem-data offers additional benefits. It is completely open to modification and extension with the source code available on GitHub but is also highly portable with the ability to package the tool as an executable file and operate it via a graphical user interface. The online documentation is also completely open to extension and modification. The documentation outlines how to use the tool, the processing methodology used for each type of data file, where the data is sourced from and a guide to interpreting the data. Together the open nature of the tool and the documentation provides a platform for users to share information on the publicly available AEMO datasets in a format that is accessible and useable by other researchers and analysts

While most NEM data tools are proprietary, significant overlap exists between the open source tool OpenNEM (McConnell et al., 2018) and nem-data, and they share many of the benefits described above. From the authors perspective, where they currently diverge on a functional level is nem-data's access to a wide selection of data without the need for the user to have any coding knowledge. Additionally, the parallel evolution of open-source development may be beneficial to the research community due to the cross-pollination of knowledge and ideas between projects (Pfenninger et al., 2018).

To demonstrate the use of nem-data this paper provides two examples of how it can be used to assess utility renewable performance. Firstly, with a simple example that outlines accessing 5 min dispatch data and implementation of a tool to calculate plant performance statistics. Then a second more complex example explains the creation of a dataset summarising the sub 5 min output of utility-scale solar at a regional level. These examples demonstrate how nem-data provides access to the FCAS 4 second Causer Pays database, the Market Management System database and the Registration Master List. It can be used to merge the datasets, filter the data to return records for solar generators and then aggregate the data at a regional level. Overall, nem-data is demonstrated as a framework for implementing and sharing custom data processing algorithms of an arbitrary level of complexity.

The capabilities of nem-data are generalizable and can be applied to different datasets in various combinations. With the basic functionality demonstrated, expanding the tool to offer access to a

greater number of AEMO datasets is primarily limited by the need to test and document each additional dataset rather than the process of developing new functionality.

Currently debate about the NEM and its transition to a high renewables low carbon future is a major focus of stakeholders and decision makers in Australia. Energy researchers have previously highlighted the benefits of open data and open-source software in improving transparency and reproducibility (Pfenninger et al., 2018). These attributes are seen as key to conducting to proper scientific research and may well be key to the development of a better-informed discussion on energy policy in Australia.

References

McConnell, D., Holmes à Court, S. and Tan, S, (Accessed July 2018), https://opennem.org.au, *Website*.

Pfenninger, S., *et al*. (2018) ‘Opening the black box of energy modelling: Strategies and lessons learned’, Energy Strategy Reviews, Volume 19, Pages 63-71.