Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



Workshop on Community Microgrid and Solar Apartments Models

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UNSW SYDNEY

LOW CARBON LIVING CRC

Rydges Hotel, Sydney

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Our workshop task

- Introduce ourselves and our work
- Introduce two new open source tools
  - 1. Community Microgrid model
    - Can be used to model the electrical and financial flows for a microgrid with behind the meter PV and a centralised battery
  - 2. Solar Apartments model
    - Can be used to model the electrical and financial flows in apartment buildings with PV (and batteries) installed behind the meter or distributed through embedded networks
- Facilitate you to beta test these tools
- Seek your guidance on possible improvements and extensions to the tools
- Invite you to participate further in the development and use of these and other tools

Welcome from the SPREE/CEEM Energy User Centered Modelling and Analysis Team

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Energy users and retail arrangements

- From clients
  - Early tailored industrial or commercial (lighting) applications with *service oriented contracting arrangements*
- ..to citizens
  - Electricity as an essential public good – rural electrification with *socially constructed tariffs*
- ..to consumers
  - The vertically integrated utility of growing size and scope with overall *cost-recovery, socially constructed, tariffs*
- ..to customers
  - Electricity industry ‘reform’, liberalisation, restructuring with *more mkt oriented energy ‘pricing’, more cost-reflective network tariffs*
- ..to perhaps now partners, competitors, or even ‘deserters’?
  - *More of the same or a genuine market opportunity?*

Facilitating greater consumer engagement – demand-side participation *in principle*

Efficient markets are characterised by effective participation of both the supply and demand side. The supply side of the market provides a product or service at a price, and the demand side (ie consumers) responds to the price/value of the product or service being offered.

While there is some evidence of uptake of DSP in the NEM over recent years, the efficiency of the electricity market can be improved by more active participation by the demand side. This will require changes to some aspects of how the supply side of the electricity market operates and interacts with consumers.

(AEMC, Power of Choice, 2012)

The Power of choice review has identified opportunities for consumers to make more informed choices about the way they use electricity. Consumers require tools - information, education, and technology, and flexible pricing options - to make efficient consumption decisions. Recommendations presented in this report will support these conditions and enable consumers to have more control of their electricity expenditure.

Facilitating greater engagement *in practice?*

Cost reflective N/W tariff proposals to date:

- higher fixed charges
- 'non-peak demand' demand charges
- special 'solar' household tariffs

(Reneweconomy, 2015)

Continuing failure to address serious retail market deficiencies

- eg. facilitating new players and business models

And concerning developments for application of embedded networks,

All may limit consumer options to invest in new technologies and work together to reduce bills, deploy renewables, build consensus for energy transition

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Open data, tools … and processes

Energy scientists must show their workings

Public trust demands greater openness from those whose research is used to set policy, argues **Stefan Pfenninger**.

The global transition towards a clean and sustainable energy future is well under way. New figures from Europe this month show that the continent is on track to reach its goal of a 20% renewable-energy share by 2020, and renewable capacity in China and the United States is also rising. But many technical, political and economic uncertainties remain, not least in the data and models used to underpin such policies. These uncertainties need open discussion, and yet energy strategies all over the world are based on research not open to scrutiny.

Researchers who seek, for example, to study the economic and energy model used by the US government (called NEMS) are met with a forbidding warning. On its website, the Energy Information Administration, which is developing the model, pronounces: "Most people who have requested NEMS in the past have found out that it was too difficult or rigid to use."

At least NEMS (National Energy Modelling System) is publicly available. Most assumptions, systems, models and data used to set energy policy are not. These black-box simulations cannot be verified, discussed or challenged. This is bad for science, bad for the public and spreads distrust. Energy research needs to catch up with the open-software and open-data movements. We energy researchers should make our computer programs and data freely accessible, and academic publishing should shun us until we do.

Our community's models are relevant to policy because they explore alternative scenarios that remain hidden, like the costs of technologies, can largely determine what comes out of such models. In the United Kingdom, opaque and overly optimistic cost assumptions for onshore wind went into models used for policymaking, and that may well have delayed the country's decarbonization.

This closed culture is alien to younger researchers, who grew up with collaborative online tools and share code and data on platforms such as GitHub. Yet academia's love affair with metrics and the pressure to publish set the wrong incentives: every hour spent on cleaning up a data set for public release or writing open-source code is time not spent working on a peer-reviewed paper.

Nevertheless, some academic-led projects are pushing towards more openness. The Enipedia project is building a worldwide open database on power plants, with data such as their locations and emissions. The Open Power System Data project gathers data such as electricity consumption from government agencies and transmission-network operators, and pushes for clarity on the licensing under which these data are made available. The Open Energy Modelling Initiative is emerging as a platform for coordinating and strengthening such efforts.

Regulation can also help. The European Union has mandated open access to electricity-market data, resulting in the creation of the ENTSO-E Transparency Platform to hold it, and there are good arguments for the creation of national

BLACK-BOX **SIMULATIONS** CANNOT BE **VERIFIED,** DISCUSSED OR **CHALLENGED.**

openmod open energy modelling initiative

Openmod in a nutshell

The Open Energy Modelling (openmod) Initiative promotes open energy modelling in Europe.

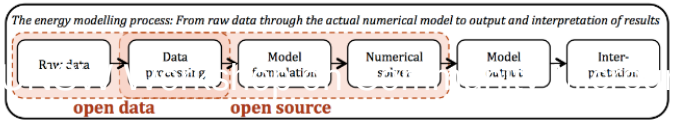
Energy models are widely used for policy advice and research. They serve to help answer questions on energy policy, decarbonization, and transitions towards renewable energy sources. Currently, most energy models are black boxes – even to fellow researchers.

"Open" refers to model source code that can be studied, changed and improved as well as freely available energy system data.

We believe that more openness in energy modelling increases transparency and credibility, reduces wasteful double-work and improves overall quality. This allows the community to advance the research frontier and gain the highest benefit from energy modelling for society.

We, energy modelers from various institutions, want to promote the idea and practice of open energy modeling among fellow modelers, research institutions, funding bodies, and recipients of our work.

The idea of openmod



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Open Source Tools

CEEM's researchers believe in the value of open source modelling in the Energy and Environmental research space. In this regard, we have developed a series of open source tools which are listed below. For a list of some of our under development tools you can refer CEEM's Github page.

NEMOSIS - NEM Open Source Information Service:

Open-source access to Australian National Electricity Market data.

Links: Github

NEMO - National Electricity Market Optimiser Tool:

NEMO, the National Electricity Market Optimiser, is a chronological dispatch model for testing and optimising different portfolios of conventional and renewable electricity generation technologies. It has been developed since 2011 and is maintained by Ben Elliston through his PhD at CEEM. NEMO is available under a free software license (GPL version 3) and requires no proprietary software to run, making it particularly accessible to the governments of developing countries, academic researchers and students. The model is available for others to inspect and to validate results.

Links: Github, OzLabs

TDA - Tariff Design and Analysis Tool:

We have developed a modelling tool to assist stakeholders wishing to contribute to network tariff design in the Australian National Electricity Market. It is an open source modelling tool to assist stakeholders in assessing the implications of different possible network tariff designs, and hence facilitate broader engagement in the relevant rule making and regulatory processes in the NEM. Our tool takes public energy consumption data from over 5000 households in NSW, and allows users test a wide range of existing, proposed and possible tariffs structures to see their impacts on network revenue and household bills. Demographic survey data of the households allows you to explore the impacts of these tariffs on particular household types – for example, families with young children. The tool can also show how well different tariffs align these household bills with a households' contribution to network peak demand. The tool and data are open source – you can check, validate and add your own data sets; test existing or even design your own tariffs, and validate and even modify the underlying algorithms.

Links: Project page, Github, Researchgate

Local Solar Sharing Scheme Model:

Intended for modelling embedded networks, local solar and peer to peer electricity networks. This software was developed by Naomi Stringer, Luke Marshall and Rob Passey at CEEM. A working build with a simple user interface for OSX can be found here.

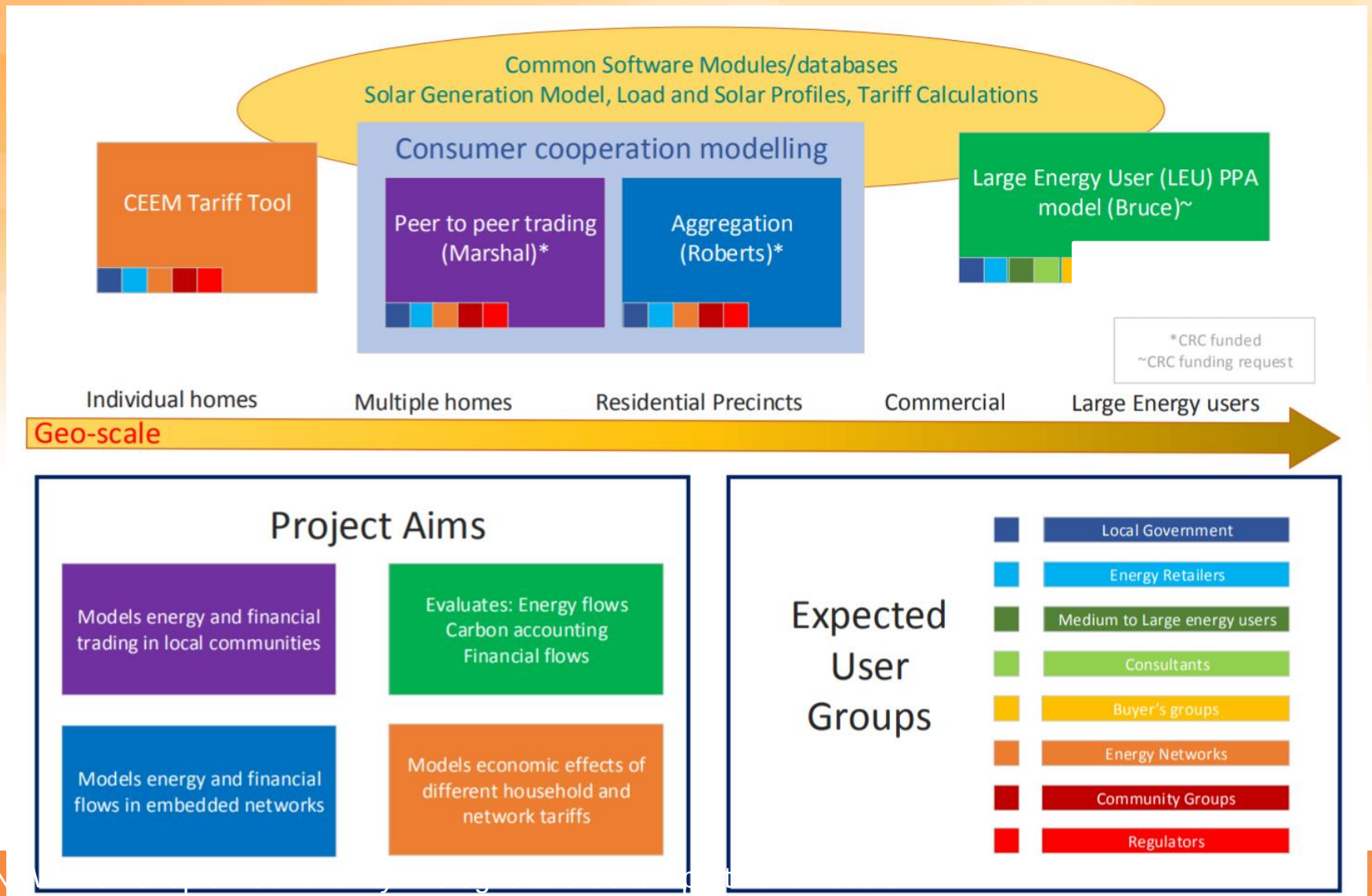
Links: Github

NemLite - Open Source model of NEM Dispatch Engine:

Intended to replicate the performance of the National Electricity Market Dispatch Engine (NEMDE).

Links: Github

SPREE/CEEM open-source DER modelling tools



The plan for the day

Program

9am to 9:30am	Arrival and registration
9:30am to 9:45am	Welcome and project background Iain MacGill
9:45am to 10:00am	Download and install models Rob Passey
10:00am to 10:30am	Community Microgrid model Rob Passey
10:30am to 11:00am	Solar Apartments model Mike Roberts
11am to 11:30am	Morning tea
11:30am to 12:30pm	Participants opportunity to use the models through the UI
12:30pm to 1pm	Lunch

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Thank you… let's begin

Many of our publications are available at:
www.ceem.unsw.edu.au