Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA

Open Source Network Tariff Tool

Outcomes to date, what's coming next

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Energy Consumers Australia
Board Stakeholder Forum

Sydney

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CEEM Research and Impact Strategy

Collaboration between Engineering and Australian School Business, working with Science, Built Environment, Social Sciences, Law

Focus on applied research **with impact** in Australian Electricity Sector

- Sustainable Energy Transformation
  - Facilitating high future renewable energy penetrations
  - Sustainable energy services in developing countries
- Energy & Environmental Market Design, related policies
  - `Designer` renewable & energy efficiency markets
  - The interface between electricity markets and `external` policies
- Distributed energy
  - Technical integration challenges and opportunities
  - Market and regulatory frameworks to facilitate efficient distributed energy investment, participation by energy users

Energy users and retail arrangements

- From clients
  - Early tailored industrial and commercial (lighting) applications with *service oriented contracting arrangements*
- ..to citizens
  - Electricity as an essential public good 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 retail energy ‘pricing’, more cost-reflective network tariffs*
- ..to perhaps now partners, competitors, or even ‘deserters’?
  - *A potentially far reaching, genuine market and socially beneficial opportunity?*

Now, some of all of the above, arrangements need to work for all

- *Wide range of stakeholders seeking to understand highly complex context and proposed changes, but only limited public data and (until now) no public tools*

PROJECT OVERVIEW			
Grant no	**AP 814**	**Date of report**	**11 / 01 / 2018**
Grant recipient	UNSW		
Project title	Tariff Assessment Tool		

PROJECT OUTCOMES: *outline the project outcomes during the reporting period*

Describe the intended project outcome/s, and whether they were met. Where the outcomes were different from those proposed in the grant application, explain the reasons for the variation

The research project aimed to provide **tools and stakeholder engagement** in order to build **knowledge and capacity for effective evidence-based advocacy around network tariff design and regulation**.

An open source tool was developed with stakeholder input via the reference committee, at three workshops in Canberra, Sydney and Melbourne, and made available for free download via the CEEM website.

Stakeholder engagement was established via the reference committee, the workshops and direct consultations with key stakeholders. Knowledge and capacity for stakeholders to engage in advocacy was built via:

- a series of presentations of industry perspectives and discussion around the challenges and opportunities of tariff design at the project workshops
- demonstration and training around the tool at the workshops and during further focused training with key stakeholders
- dissemination of peer reviewed research papers on tariff design and regulation using the tool as the basis for the analysis.

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

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UNSW SYDNEY

Project Name: Undefined

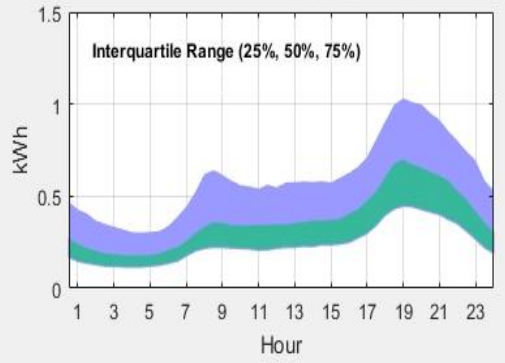
Select Load:

Select: SGSC Set

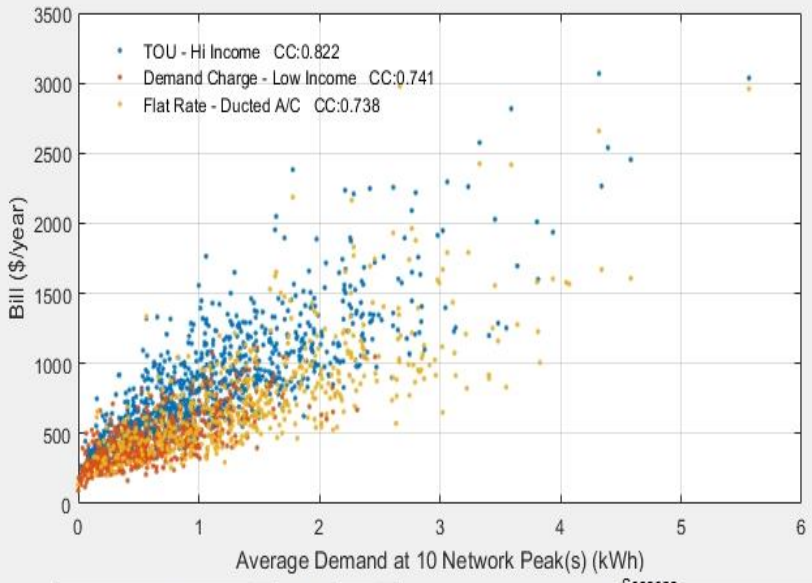
Select user group based on demographic info:

Income (ASSRTD):	All
Gas Usage (ASSRTD):	All
Electricity Usage (ASSRTD):	All
Dwelling Type:	All
Income:	All
Aircon Type:	Ducted
Num of Occupants:	All
70+ Occupants:	All
Has Gas:	All
Trial Region Name:	All

No. of users: 503 Show: Daily Profile interquartile Range



Single Variable Graphs | Dual Variable Graphs | Single Case Graphs



X axis: Average Demand at 'N' Netw... N= 10 One Peak/Day

Y axis: Bill ($/year)

Seasons: Spring Autumn Summer Winter

List of cases: X

C. 1 ? Exp X

C. 2 ? Exp X

C. 3 ? Exp X

Load Info | Tariff Info | Demog Info

Case 3 (Flat Rate - Ducted A/C)

Demographic Information:

- Income (ASSRTD): All
- Gas Usage (ASSRTD): All
- Electricity Usage (ASSRTD): All
- Dwelling Type: All
- Income: All
- **Aircon Type: Ducted**
- Num of Occupants: All
- 70+ Occupants: All
- Has Gas: All
- Trial Region Name: All

Select Tariff:

Type: All

State: All

Provider: All

Year: All

Tariff: AusNet TOU seaso... X i

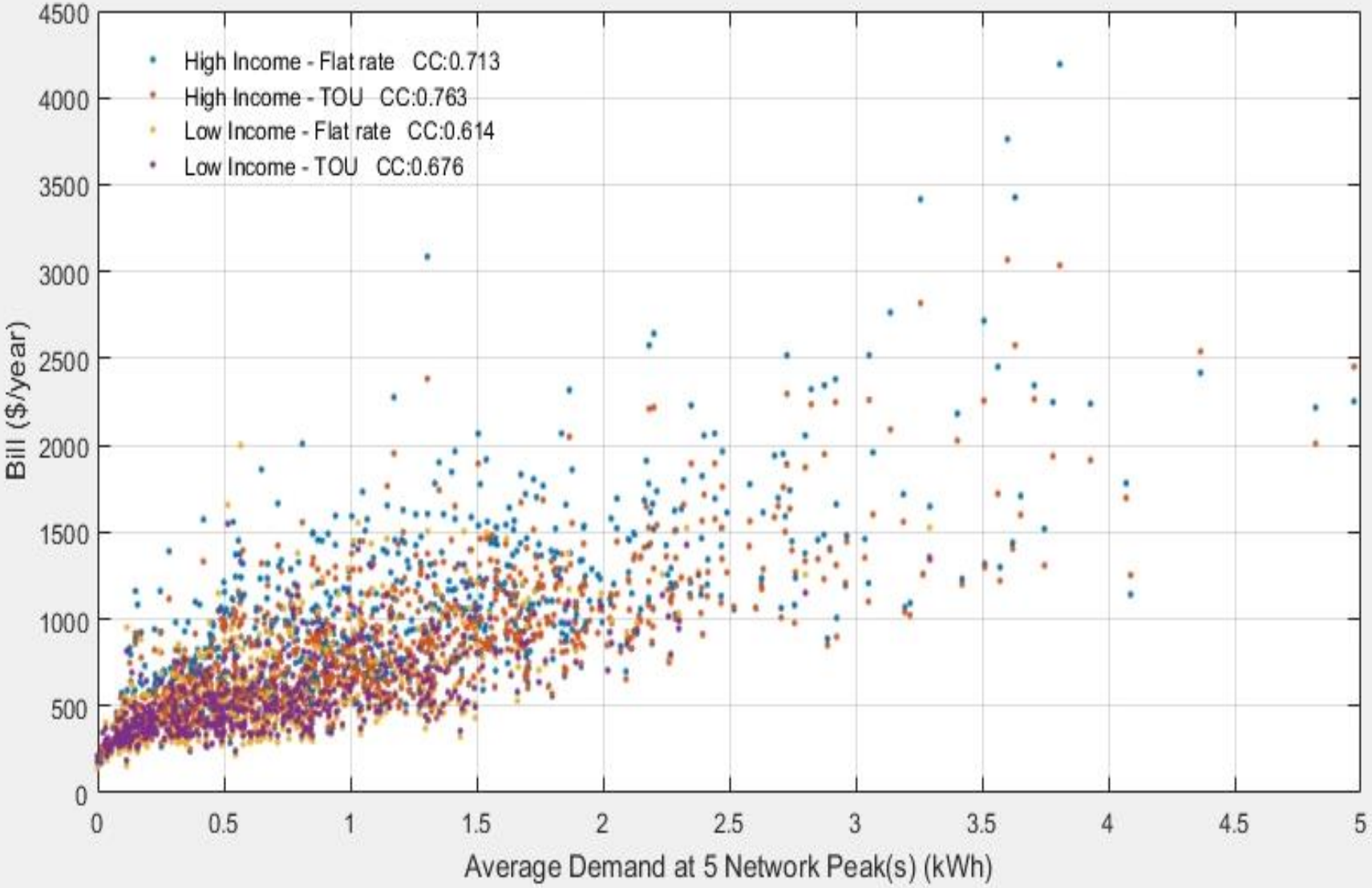
Name: **AusNet TOU seasonal 2017/18** Type: **TOU Seasonal** State: **VIC** Add

DUOS | TUOS | DUOS+TUOS | NUOS

Daily Charge ($/day): 0.32247

	Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	StartMonth
1	Sum peak	0.4512	$/kWh	14	0	18	0	1
2	Sum shoulder	0.3976	$/kWh	12	0	14	0	1
3	Sum shoulder	0.3976	$/kWh	18	0	20	0	1
4	Sum off peak	0.0358	$/kWh	0	0	12	0	1

Exclude GST



X axis: Average Demand at 'N' Netwo...

N= 5

☑ One Peak/Day

Y axis: Bill ($/year)

Seasons

☑ Spring ☑ Autumn

☑ Summer ☑ Winter

What's next for the tool

- Updating
  - Network tariff proposals and process continues
- Extensions
  - Incorporating retail tariffs for analysis of final household bills, retail tariff structures, implications of different network tariff pass-through
  - Modelling implications of small energy users seeking to reduce electricity bills through installation of PV, battery energy systems, demand response and energy efficiency
  - Ability to test impacts of particular retail tariff options, and possible responses, for individual consumers.
  - Targeted enhancement of specific features of tool (improved charts and figures, sensitivity analysis, improved statistical analysis)

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.

Nem Data Tool:

nem-data is a simple tool for creating custom data sets using publicly available information about the Australian National Electricity Market (NEM).

Links: Github

National Electricity Market Optimiser (NEMO) 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

Tariff Design and Analysis (TDA) 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

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Open data, tools ..*and processes*

openmod open energy modelling initiative

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 ical and economic s used to underpin on, and yet energy t open to scrutiny. ne economic and l NEMS) are met ergy Information onounces: "Most found out that it

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 energy-data agencies to coordinate the collection and archiving of a range of important data.

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

ge of qualitatively and for numbers neration level of a

ates to policies on n — that produce ny, and so can be driving forces that l and solar power. e not openly avail- er the security of l scrutiny; worries ontext; and a lack

nown that closed mple is the spread- Rogoff paper used y. The European model that could sm. Assumptions

The vast majority of published research is still untouched by these fledgling initiatives. Only one energy journal — *Energy Economics* — currently requires data and models alongside submissions. Other journals should follow suit.

The open sharing of code and data is also important because it permits more meaningful collaboration between academics. Sharing a DNA sequence in an established format is, of course, easier than sharing the unstructured assumptions behind a techno-economic scenario study, for which no standard format exists yet. So the energy community must decide on standards for sharing code, data and assumptions.

A change in journal policies would help to kick-start these discussions. In policy-focused research, where one 'truth' does not exist, one cannot assess whether a modelled scenario is 'correct', so the important yardstick is not truth, but trust. The arrival of the post-truth world shows that trust in experts is lower than ever — and surely this is partly the experts' fault. ■

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Openmod in a nutshell

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

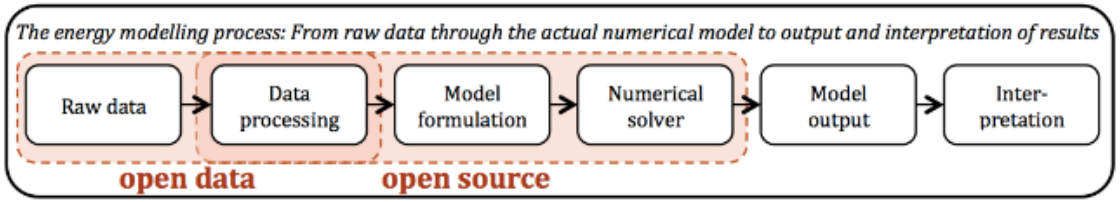
Energy models are widely used for policy advice and research. They serve to help answer questions on energy policy, decarbonization, and transitions towards renewable energy sources. Currently, most energy models are black boxes – even to fellow researchers.

"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

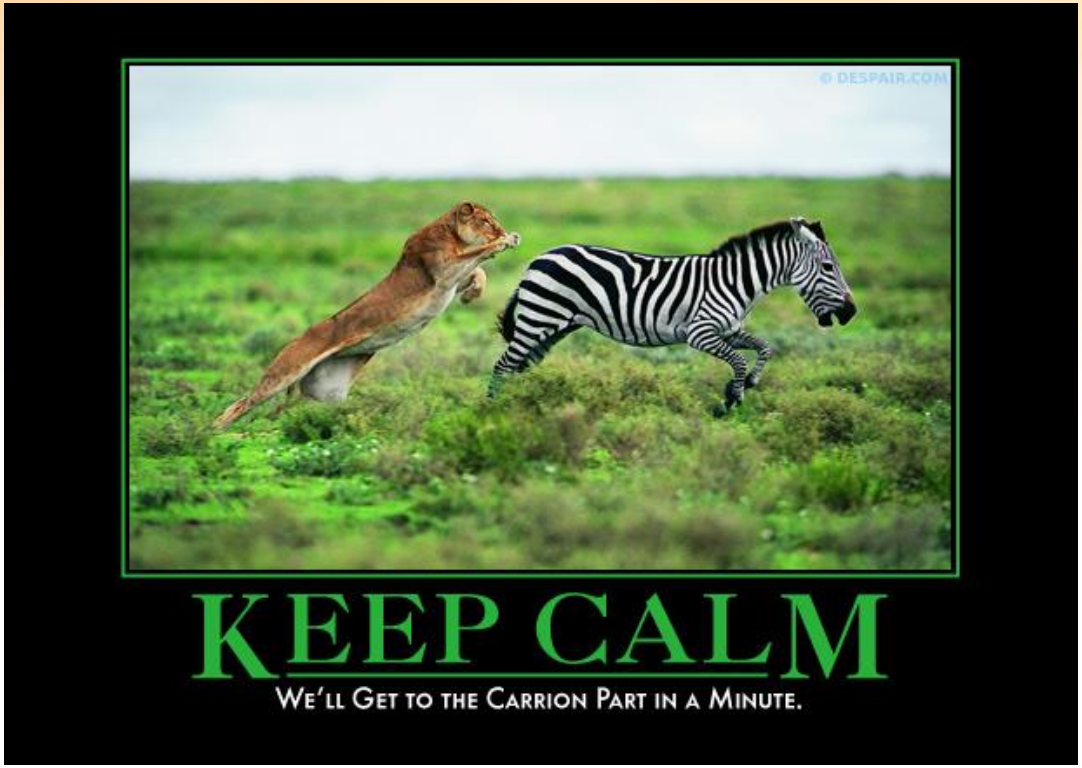


Where next?

"The best way to predict your future is to create it!"

Abraham Lincoln

"Keep calm..
& carry on"



Thoughtful, careful, coherent, comprehensive efforts

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Thank you… and *questions*

The CEEM Tariff Tool Team: *Dr Navid Haghdadi and Dr Anna Bruce, Nick Gorman, Assoc. Prof. Iain MacGill, Dr Rob Passey, Sharon Young*

Many of our publications are available at:

www.ceem.unsw.edu.au