



Centre for Energy and  
Environmental Markets



**UNSW**  
SYDNEY

# Retail Electricity Tariff Design and Assessment Tool Workshop

**UNSW**

11 December 2019  
Sydney, Australia

# Welcome from the SPREE/CEEM Distributed Energy Modelling and Analysis Team

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[github.com/unsw-ceem](https://github.com/unsw-ceem)

# The electricity sector – start at the ‘ends’

- Consumers apparently at the centre of the National Electricity Objective  
... although they aren't so sure  
... with some reason

*“To promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to –*

- *price, quality, safety, reliability, and security of supply of electricity; and*
- *the reliability, safety and security of the national electricity system.”*

National Electricity Law (Schedule to the National Electricity (South Australia) Act 1996), s.7

*“How confident are you that the overall market is working in your long-term interests?” (% 7 out of 10 or higher)*

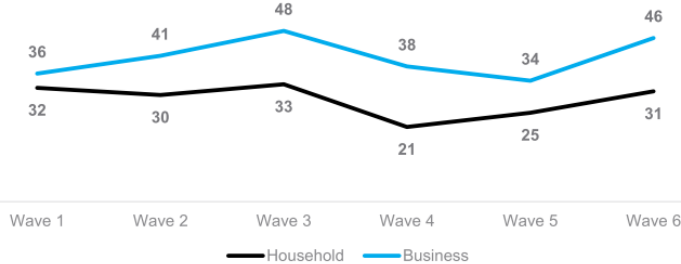
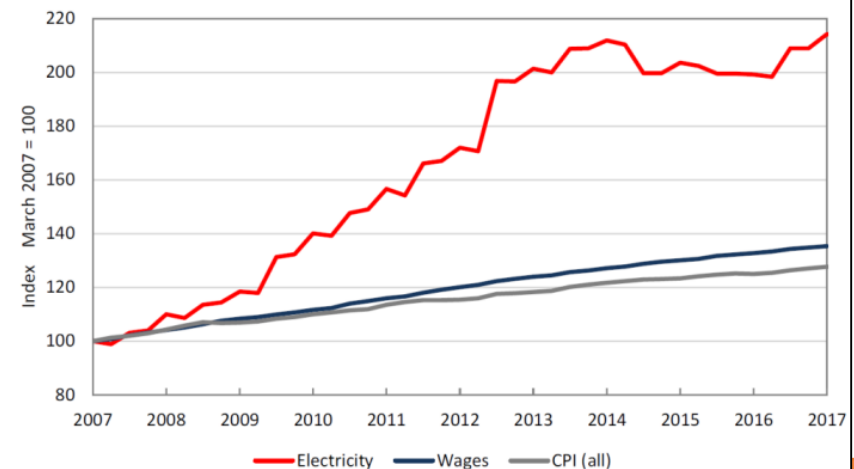
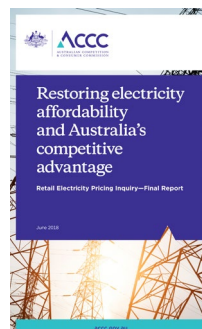


Figure 1.3: CPI for electricity compared with other sectors and wage growth

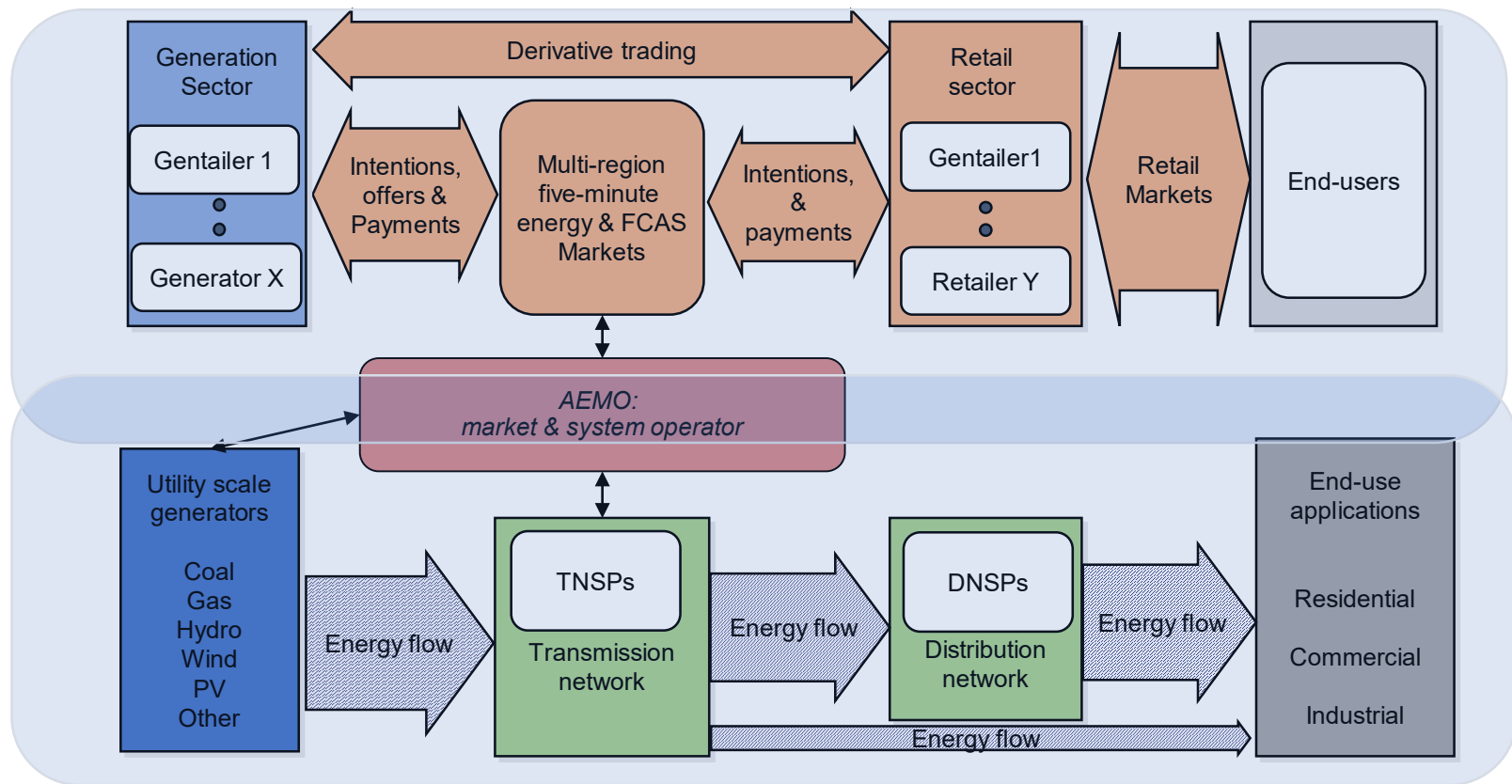


Essential.  
Energy Consumers Australia  
Energy Consumer Sentiment Survey  
December 2018



# The Australian National Electricity Market (NEM)

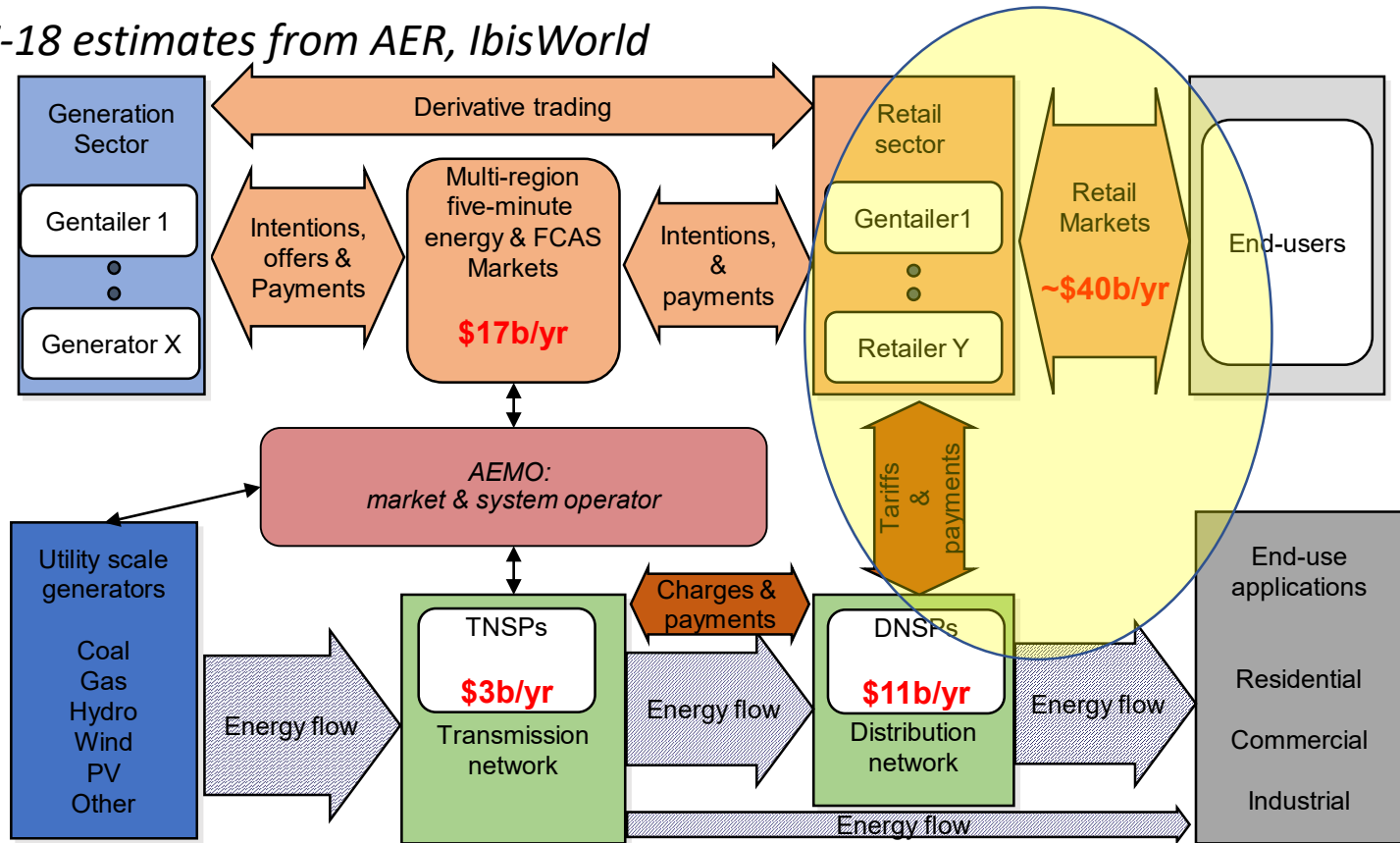
- *Not national, and mostly a power system*



(adapted from Outhred, *The Australian National Electricity Market*, 2010)

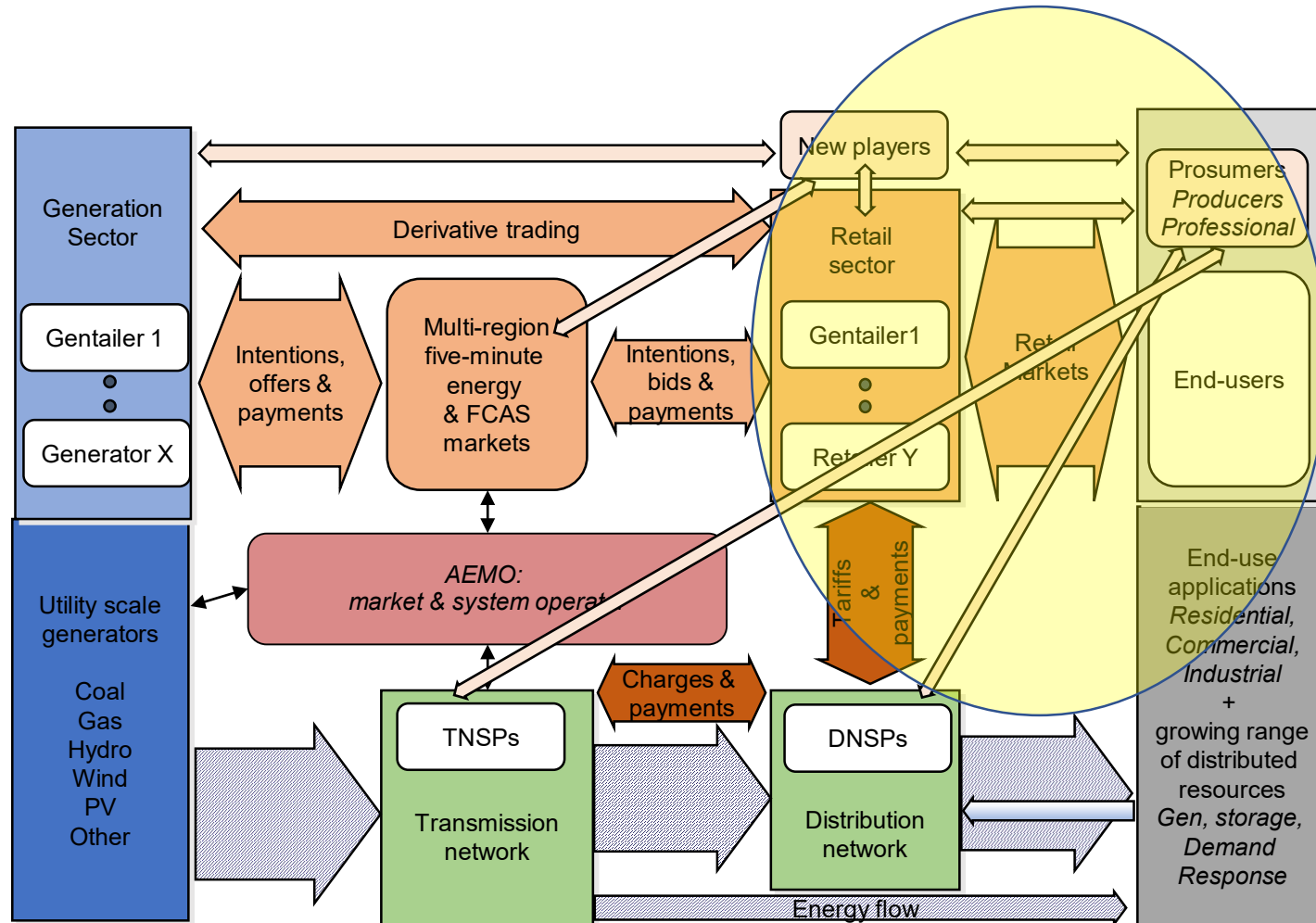
# The NEM's energy user 'interface'

- 2017-18 estimates from AER, IbisWorld



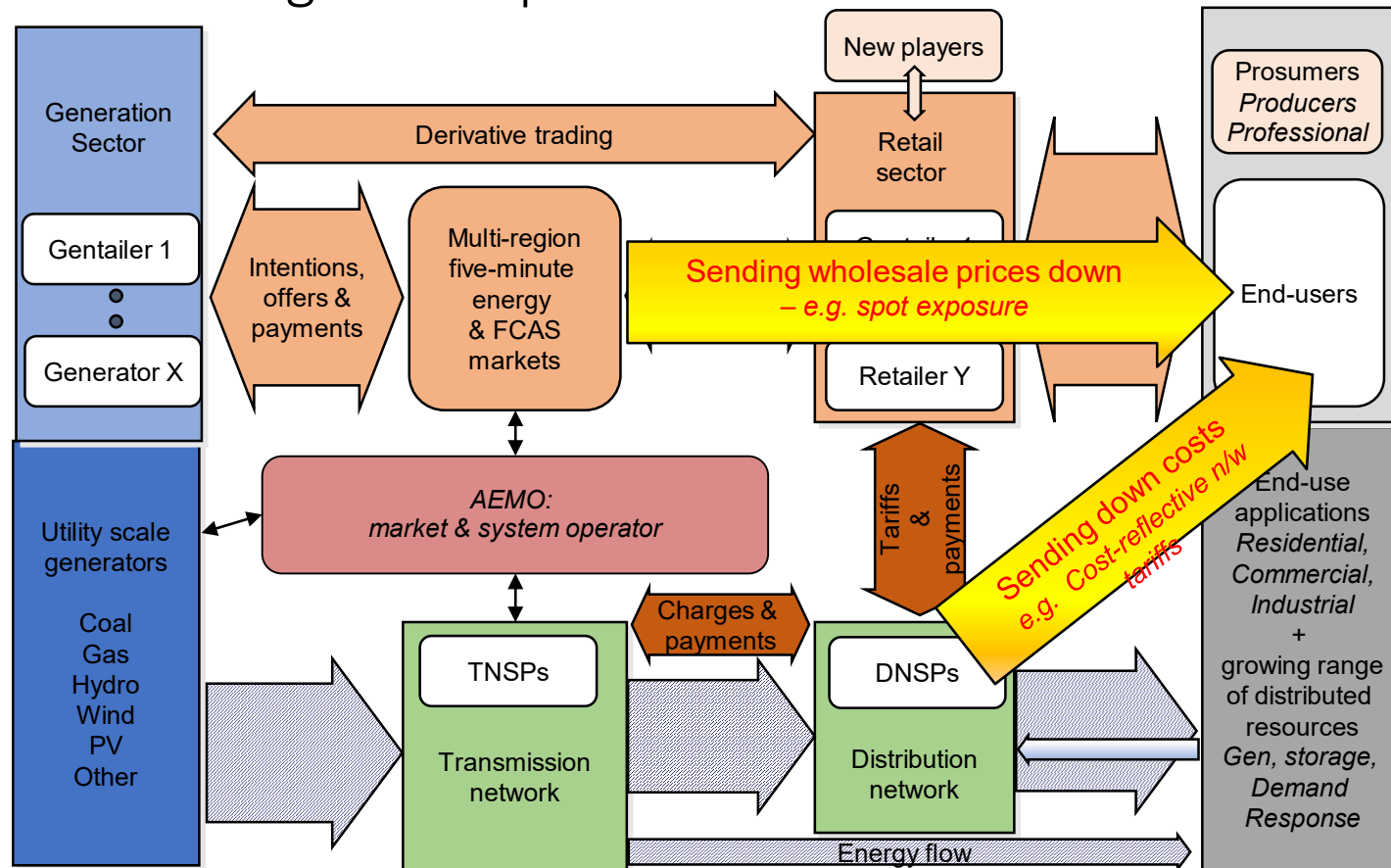
(adapted from Outhred, *The Australian National Electricity Market*, 2010)

# The evolving NEM – ‘interface’ not getting simpler



(adapted from Outhred, *The Australian National Electricity Market*, 2010)

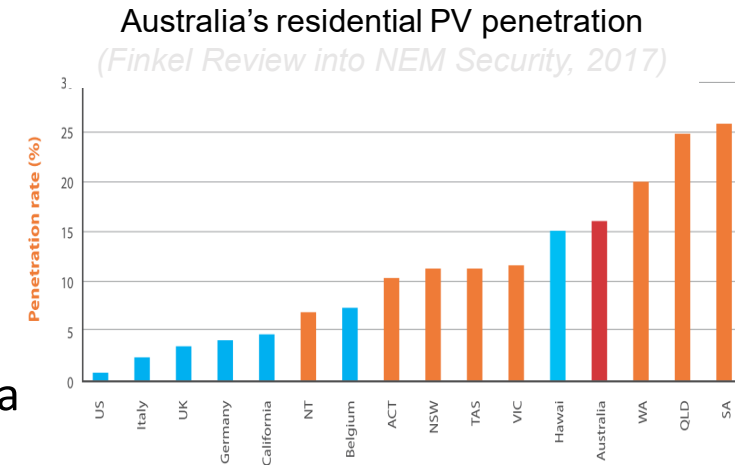
# Integrating 'utility' and 'consumer' operational and investment decision making – send prices down



(adapted from Outhred, *The Australian National Electricity Market*, 2010)

# The opportunity - a greater role for energy-users in our energy future

- A growing appreciation of our diverse energy users and contexts
  - Citizens, consumers, customers... now increasingly possible partners, competitors, communities, collectives
  - Contexts – housing types, vulnerable consumers...
- New opportunities for energy users to engage
  - PV, Storage, demand-side participation, energy efficiency
- Improving regulatory, market and policy efforts to appropriately facilitate end-user engagement
  - From assumptions of rational, utility maximising individual customers driven by prices... to a more complex appreciation of energy decision making, individual yet also collective goals and actions, and hence coordination, sharing
- *New ways to explore these challenges & opportunities; learn, disseminate and broaden the conversation*







## NEW ENERGY COMPACT: DRAFT 3.0 FOR CONSULTATION

November 2019

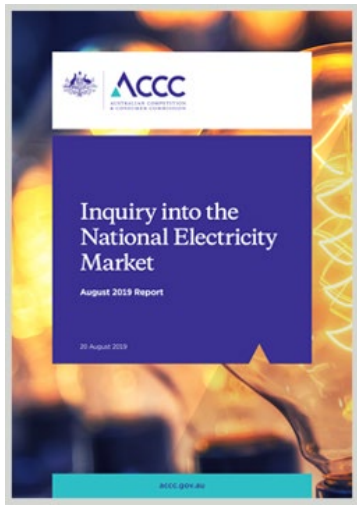
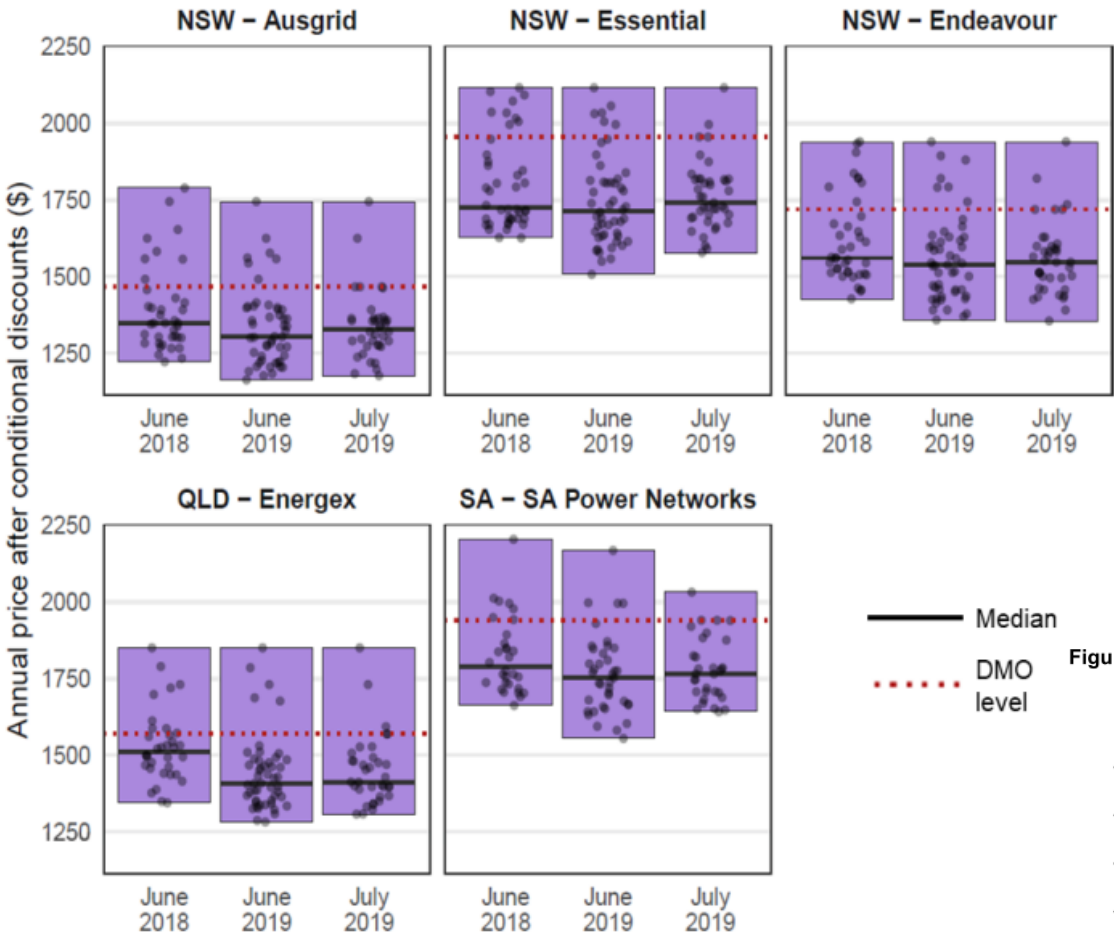
### VISION

"An inclusive, sustainable energy system that actively improves outcomes for all"

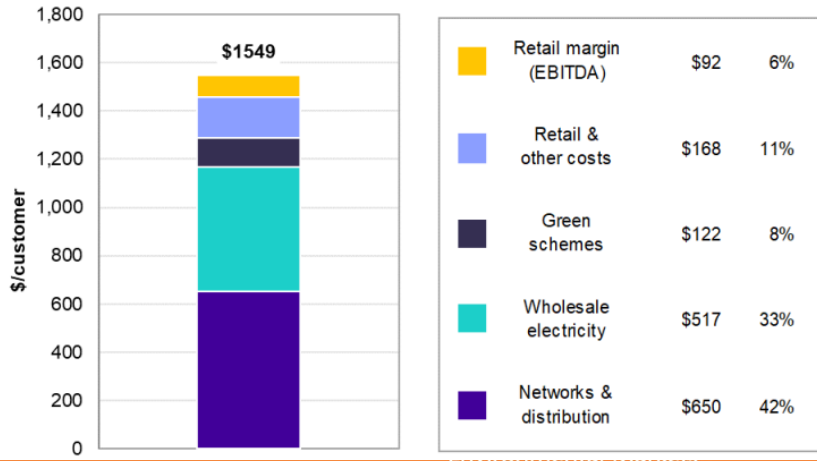
### GUIDING PRINCIPLES



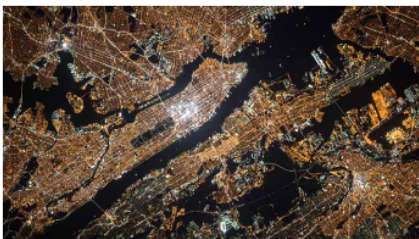
**Figure 1: All retailers' residential flat rate market offers as at 1 June 2018, 1 June 2019 and 12 July 2019 (all available discounts applied)**



**Figure 7: Components of a residential customer bill across the NEM, 2017–18, real \$2017–18, excluding GST<sup>11</sup>**



# User-Centred Energy Systems



## About Us

The User-Centred Energy Systems mission is to provide evidence from socio-technical research on the design, social acceptance and usability of clean energy technologies to inform policy making for clean, efficient and secure energy transitions

## About Us



### About Business Models and Systems

This course focuses on identifying measures and incentives that support the transition to a global low-carbon energy services and non-energy business models.

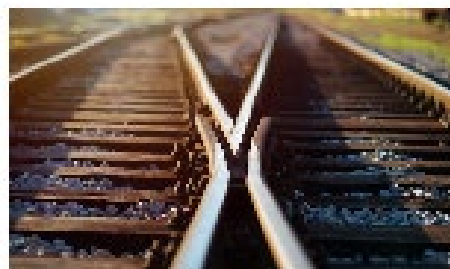
[Learn more](#)



### About Social Licenses to Operate

This course will assess a full set of leading and emerging CBM practices for wind and solar energy, including the role, assessment and regulatory obligations of all stakeholders and engagement activities.

[Learn more](#)



### About Energy Sector Behavioural Insights Platform

The Energy Sector Behavioural Insights Platform brings together government policy makers and the scientific community to design and evaluate behavioural policy.



### About Hard-to-Reach Energy Users

This course will be getting along as on the a long and a variety of applying lessons learned from a collaboration of the researchers and global agencies...

[Learn more](#)



### About Global Observatory on Power-Risk Energy Trading

This course (the Observatory) is a forum for international stakeholders to understand the policy, regulatory, and technical challenges and opportunities associated with the introduction of a global market for power.

[Learn more](#)

# 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 Pfenniger.

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 or seek to understand the technical constraints on deploying new energy technologies. It is modelling for insight (by an academic exploring a range of qualitatively different scenarios for a clean energy supply, say) and for numbers (as in a government agency deciding on the remuneration level of a technology-support scheme).

Trust in this research matters because it contributes to policies on energy research and development.

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. 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

**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.

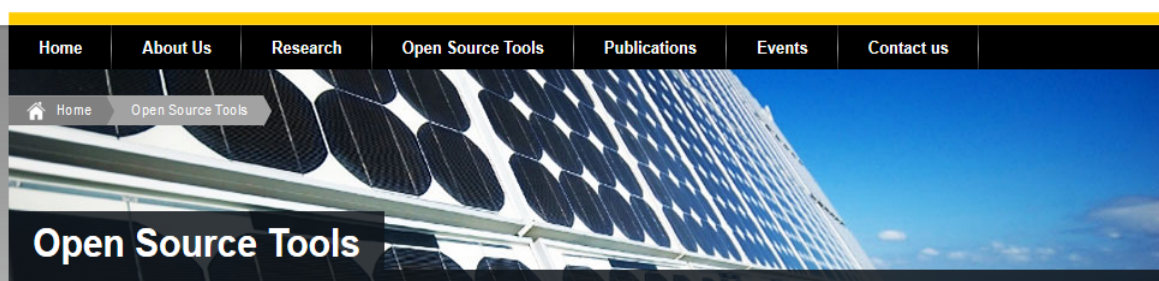
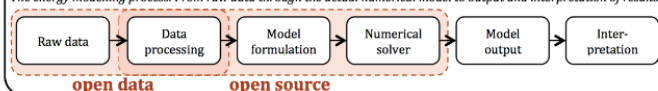
"Open" refers to model source code that can be studied, changed and improved as well as freely available energy system data.

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

The energy modelling process: From raw data through the actual numerical model to output and interpretation of results



## 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](#).

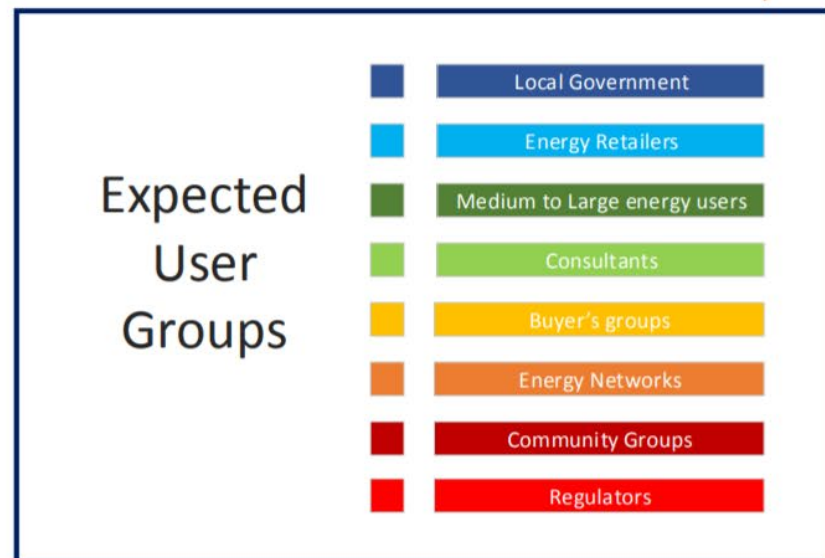
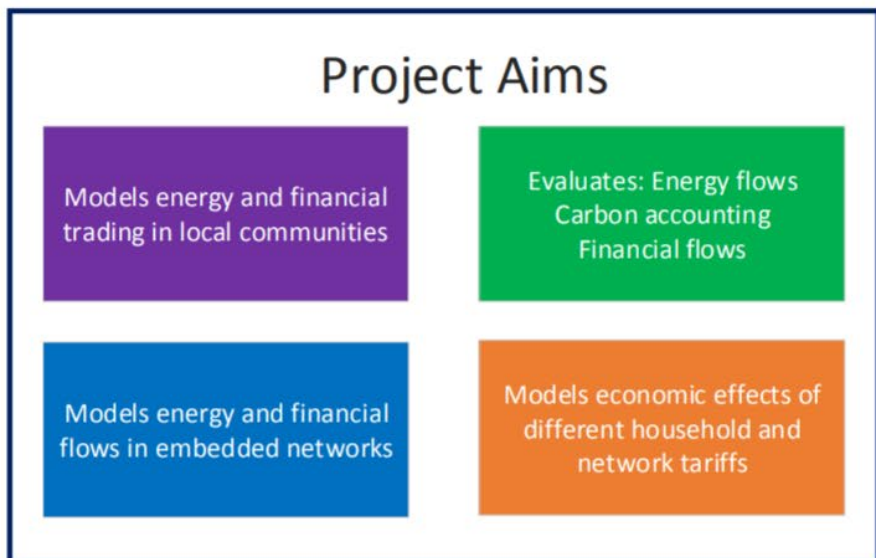
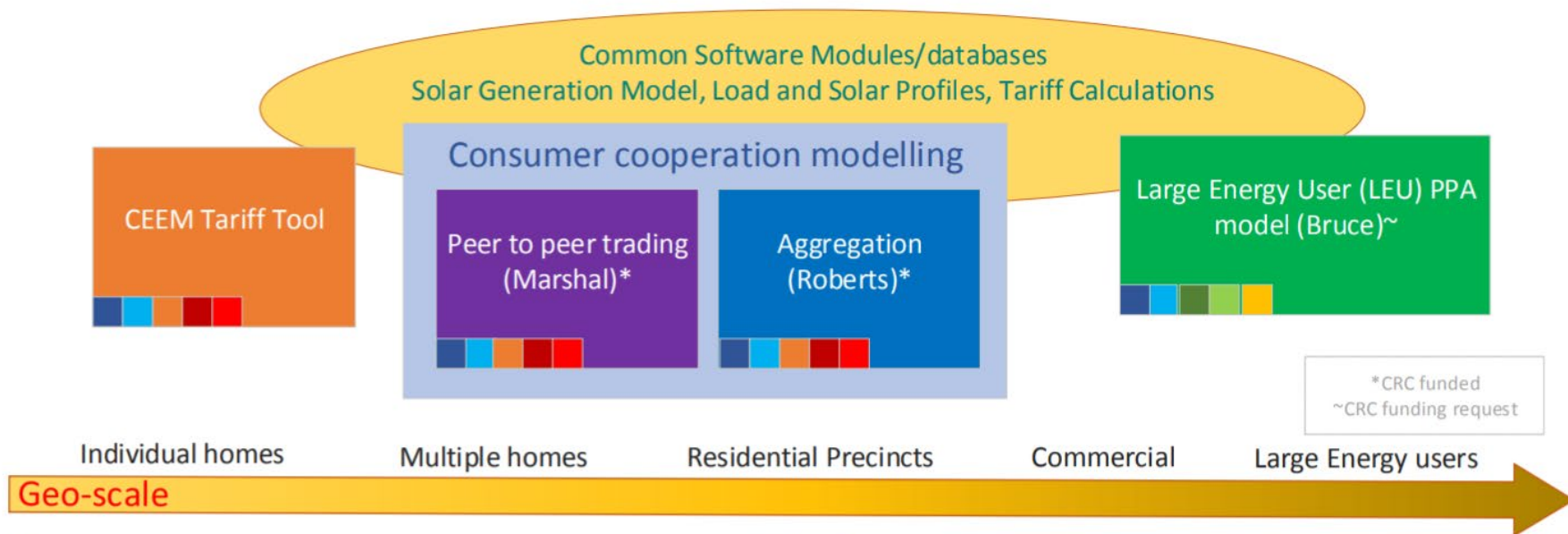
Links: [Github](#)

### NemLite - Open Source model of NEM Dispatch Engine:

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

Links: [Github](#)





# Tariff Design and Assessment Tool: Progressively greater ambition...

PROJECT OVERVIEW			
Grant no	AP 814	Date of report	11 / 01 / 20 18
Grant recipient	UNSW		
Project title	Tariff Assessment Tool		
PROJECT OUTCOMES: <i>outline the project outcomes during the reporting period</i>			
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:			
<ul style="list-style-type: none"> <li>- a series of presentations of industry perspectives and discussion around the challenges and opportunities of tariff design at the project workshops</li> <li>- demonstration and training around the tool at the workshops and during further focused training with key stakeholders</li> <li>- dissemination of peer reviewed research papers on tariff design and regulation using the tool as the basis for the analysis.</li> </ul>			

944

2017/18

**UNSW**

An expanded open source modelling tool for assessing how different network and retail tariffs, and distributed energy options, impact on small energy consumers

The proposed project would deliver on these three major extended capabilities as well as ongoing tool development in response to changing approaches to network tariff design.

The current version of the tool (publicly available for download) has been designed to assist stakeholders to investigate how different tariff structures impact on the expected bills of different types of residential consumers. The tool offers a range of different analysis and result visualisations. In summary the tool allows users to:

- Create projects and add analysis to different projects for later referral
- Choose from the existing load profiles (more than 5000 annual household load profiles)
- Filter the load profiles based on the available demographic information
- Import new load profile and demographic information
- Visualise the individual and aggregate load profiles using multiple methods including seasonal pattern, peak analysis, annual energy distribution, daily interquartile range, etc
- Apply the network tariffs available in the tool (60+ tariffs for different Australian States) to calculate the annual bill based on any subset of the load profiles
- Apply the retail tariffs available in the tool
- Modify the parameters of the tariffs to investigate the impacts on annual bills
- Investigate different components of the network bill (DUOS, TUOS, and NUOS) to calculate the revenue for different sectors (distribution, transmission, etc). This can also be done for the retail component where retail tariffs are available
- Adjusting the network peak time to see the impact on the tariffs based on the coincident peak demand
- Create different types of new tariffs including, flat rate, time of use, block usage, demand charge, etc
- Compare the results of multiple analyses in different visualisation platforms including single variable comparison, dual variable comparison, and individual cases
- Export the figures, and copy them into clipboard to incorporate in any report
- Export the results to excel file to do further analysis on the results outside the tool

1. Continued collaboration with advocacy stakeholders, networks and the regulator to continue to develop the existing Tariff Design and Analysis Tool in response to emerging tariffs and trends such as uptake of demand-side technologies and retail market developments.
2. Use of the improved version of the Tariff Design and Analysis Tool for the network tariff determinations over the coming two years.
3. Workshops to facilitate (i) stakeholder input to the tool and (ii) demonstration of the tool to improve stakeholder capacity to use the tool and build knowledge about tariff design and regulation. These events are also expected to result in increased engagement in and collaboration on consumer-focussed tariff advocacy, specifically over the next 18 months during the next round of regulatory process.
4. Ongoing IT and tool development support to assist interested stakeholders to effectively use the software. The tool is made freely available and is designed so that interested stakeholders can download and run it on their own computers. As more, and different types of, stakeholders use the Tool, it will require increased maintenance and adjustments to make it accessible to this broader audience.
5. Addition of new features to the tool, in addition to the three major features discussed above, including the following:
  - Extension of the tool to include multi-year analysis
  - The addition of sensitivity analysis for the tariff component to explore the impact of adjusting components for different user groups
  - Improved statistical analysis to explore the confidence interval of the analysis results
  - Automatic unsupervised classification (clustering) of the user profiles to generate distinct user groups based on the impact of tariffs and load pattern
  - Clustering of retail tariffs into distinctive groups to use as representative tariffs, which reduce the complexity of applying large numbers of similar tariffs
  - A new set of charts and figures for enhanced result visualisation

# Workshop Agenda

---

- 10 - 10:15  
Welcome and introduction to the project- *Iain MacGill*
- 10:15 - 10:30  
Introduction to the TDA Tool - *Navid Haghdadi*
- 10:30 - 10:50  
Demo of the new version - *Nick Gorman*
- 10:50 – 11:10  
Use case presentation - *Rob Passey*
- 11:10 – 11:25  
Tariff analysis for individual user - *Anna Bruce*
- 11:25 – 12  
Feedback and Questions
- 12pm – 1pm  
Continue the discussion over lunch



# Tariff Design and Analysis tool – the previous version

The open source TDA tool aims to assist stakeholders to investigate how different tariff structures impact on the expected bills of different types of residential consumers, while also estimating how well the tariffs align these customer bills with their impact on longer-term and wider electricity industry costs.

The screenshot displays the TDA (CEEM, UNSW) software interface. The top left shows the logo for the Centre for Energy and Environmental Markets and UNSW Sydney. The main interface is divided into several sections:

- Select Load:** A dropdown menu set to 'SGSC' with a 'Set' button.
- Select user group based on demographic info:** A series of dropdown menus for 'Income (ASSRTD)', 'Gas Usage (ASSRTD)', 'Electricity Usage (ASSRTD)', 'Dwelling Type', 'Income', 'Aircon Type', 'Num of Occupants', '70+ Occupants', 'Has Gas', and 'Trial Region Name', all set to 'All'.
- No. of users:** 3663. A 'Show:' dropdown is set to 'Daily Profile interquartile Range'.
- Daily Profile interquartile Range:** A line graph showing electricity usage (kWh) over 24 hours. The y-axis ranges from 0 to 0.8 kWh, and the x-axis shows hours from 1 to 23. The graph is divided into three colored areas representing the 25th, 50th, and 75th percentiles.
- Single Variable Graphs:** A scatter plot showing 'Bill (\$/year)' on the y-axis (0 to 12000) versus 'Electricity Usage (kWh/year) × 10<sup>4</sup>' on the x-axis (0 to 4). Three data series are plotted: 'AGL TOU CC:0.992' (blue dots), 'Ausgrid TOU CC:0.977' (yellow dots), and 'AGL energy part CC:0.992' (orange dots). The AGL TOU series shows a strong positive correlation between electricity usage and bill, while the other two series show a much weaker correlation.
- List of cases:** A list of three cases (C. 1, C. 2, C. 3) with expand and delete buttons.
- Case 3 (AGL energy part):** Details for Case 3, including 'No. of users: 3663', 'Database: SGSC', and 'Network Load: Whole Dataset'.
- Select Tariff:** Configuration options for the 'AGL TOU' tariff, including 'Type: TOU', 'State: NSW', and 'Provider: All'. A table below shows the tariff structure with columns for Name, Rate, Unit, StartHour, StartMin, EndHour, EndMin, Weekday, and Weekend.

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

# Tariff Design and Assessment (TDA) tool

## Where to find it?

[https://github.com/UNSW-CEEM/TDA\\_Matlab](https://github.com/UNSW-CEEM/TDA_Matlab)

<http://ceem.unsw.edu.au/open-source-tools>

<https://www.researchgate.net/project/Tariff-Design-and-Analysis-TDA-Tool>

[https://github.com/UNSW-CEEM/TDA\\_Python/releases](https://github.com/UNSW-CEEM/TDA_Python/releases)

The screenshot shows the GitHub repository page for 'Tariff Design and Analysis (TDA) Tool'. The repository is owned by 'UNSW-CEEM' and has 5 updates, 5 recommendations, 7 followers, and 96 reads. The project log shows an update from 'You' on Nov 20 titled 'Next TDA workshop'. The update text reads: 'Hi all, We are running a workshop to discuss recent progress and possible next steps of the tariff design and analysis tool. More information on this workshop and a number of other events organised by CEEM can be found here: <http://apvi.org.au/solar-research-conference/workshops/>. The workshop will be on Monday 3rd Dec 10am to 12pm at UNSW. It is free for everyone but requires registration. For more info check out the above link.'

The screenshot shows the GitHub profile page for 'Centre for Energy and Environmental Markets'. The profile includes a bio, location (Sydney Australia), website (http://ceem.unsw.edu.au/), and statistics: 6 repositories, 5 people, 0 teams, 0 projects, and settings. A search bar and filters for repository type and language are also visible.

The screenshot shows the 'TDA\_Matlab' repository page on GitHub. The repository is titled 'Electricity networks Tariff Design and Analysis (TDA) tool'.

The screenshot shows the 'ceem.unsw.edu.au/open-source-tools' website. The website features a navigation menu with 'Home', 'About Us', 'Research', 'Open Source Tools', 'Publications', and 'Events'. The main content area is titled 'Open Source Tools' and lists several tools: 'NEMOSIS - NEM Open Source Information Service', 'NEMO - National Electricity Market Optimiser Tool', and 'TDA - Tariff Design and Analysis Tool'. Each tool has a brief description and links to its GitHub repository or other resources.

# Tariff Design and Assessment (TDA) tool

## How to install it?

[https://github.com/UNSW-CEEM/TDA\\_Matlab/releases](https://github.com/UNSW-CEEM/TDA_Matlab/releases)

[https://github.com/UNSW-CEEM/TDA\\_Python/releases](https://github.com/UNSW-CEEM/TDA_Python/releases)

UNSW-CEEM / TDA\_Matlab

Watch 0 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Releases Tags Draft a new release

Latest release

v1.0m  
209312c

TDA

NavidHaghdadi released this on 2 Aug · 6 commits to master since this release

Assets 4

- TDA\_mac.zip 279 MB
- TDA\_win.zip 279 MB
- Source code (zip)
- Source code (tar.gz)

Please first unzip the file (TDA\_win for windows, or TDA\_mac for mac) and run the TDA.exe (windows) or TDA.app (mac).

UNSW-CEEM / TDA\_Python

Unwatch 2 Unstar

Code Issues 0 Pull requests 0 Actions Projects 0 Wiki Security Insights Settings

Releases Tags

Pre-release

v0.2

nick-gorman released this 22 hours ago

Added info button and updated chrome portable settings

Assets 4

Pre-release

v0.1

nick-gorman released this 3 days ago · 1 commit to master since this release

Testing release format.

Assets 4

# Tariff Design and Assessment (TDA) tool

## How to find more information about it?

UNSW-CEEM / TDA\_Python

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## 5. Using the tool

Navid Haghdadi edited this page 2 hours ago · 2 revisions

Edit New Page

### What does TDA do?

The Tariff Design and Assessment tool is designed to assist stakeholders to investigate how different tariff structures impact on the expected bills of different types of residential consumers. The tool offers a range of different analysis and result visualisations as described in this section. In summary the tool allows users to:

- Create projects and add analysis to different projects for later referral
- Choose from the existing load profiles (more than 5000 annual household load profiles)
- Filter the load profiles based on the available demographic information
- Import new load profile and demographic information
- Visualise the individual and aggregate load profiles using multiple methods including seasonal pattern, peak analysis, annual energy distribution, daily interquartile range, etc
- Apply end user technologies to the load including adding solar, battery and demand response strategy and create a new load profile based on these technologies.
- Apply the network and retail tariffs available in the tool (100+ tariffs for different Australian States) to calculate the annual bill based on any subset of the load profiles
- Modify the parameters of the tariffs to investigate the impacts on annual bills
- Investigate different components of the network bill (DUOS, TUOS, and NUOS) as well as other sectors (retail and wholesale market) to calculate the revenue for different sectors (distribution, transmission, etc).

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<https://github.com/UNSW-CEEM>

# Tariff Design and Assessment (TDA) tool

## What does the previous version do?

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: 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: All  
 Num of Occupants: All  
 70+ Occupants: All  
 Has Gas: All  
 Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range

Single Variable Graphs Dual Variable Graphs Single Case Graphs

List of cases:

- C. 1 [?] Exp X
- C. 2 [?] Exp X
- C. 3 [?] Exp X

Load Info Tariff Info Demog Info

**Case 3 (AGL energy part)**

No. of users: 3663  
 Database: SGSC  
 Network Load: Whole Dataset

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All  
 State: All  
 Provider: All  
 Year: All  
 Tariff: AGL TOU [X] [I]

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 [Save]

# Tariff Design and Assessment (TDA) tool

Select load from a range of existing load profiles, or upload your own set of loads!

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load:

Select user group based on demographic info:

Income (ASSRTD):

Gas Usage (ASSRTD):

Electricity Usage (ASSRTD):

Dwelling Type:

Income:

Aircon Type:

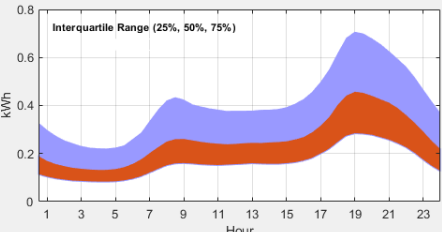
Num of Occupants:

70+ Occupants:

Has Gas:

Trial Region Name:

No. of users: 3663 Show:



Single Variable Graphs Dual Variable Graphs Single Case Graphs



X axis:

Y axis:

List of cases:

- C. 1
- C. 2
- C. 3

Load Info Tariff Info Demog Info

**Case 3 ( AGL energy part )**

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Tariff:

Name: **AGL TOU** Type: **TOU** State: **NSW**

Type:

State:

Provider:

Year:

Tariff:

Daily Charge (\$/day):

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST

Save the modified tariff as:

# Tariff Design and Assessment (TDA) tool

## Filer the load profiles by the demographic information

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: 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: All
- Num of Occupants: All
- 70+ Occupants: All
- Has Gas: All
- Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range

Single Variable Graphs Dual Variable Graphs Single Case Graphs

List of cases:

- C. 1 [?] Exp X
- C. 2 [?] Exp X
- C. 3 [?] Exp X

Load Info Tariff Info Demog Info

**Case 3 (AGL energy part)**

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU [X] [I]

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 [Save]

# Tariff Design and Assessment (TDA) tool

Get quick analysis of the set of selected loads

TDA (CEEM, UNSW) Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: 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: All  
 Num of Occupants: All  
 70+ Occupants: All  
 Has Gas: All  
 Trial Region Name: All

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year) vs Electricity Usage (kWh/year) × 10<sup>4</sup>

- AGL TOU CC:0.992
- Ausgrid TOU CC:0.977
- AGL energy part CC:0.992

X axis: Annual kWh  
 Y axis: Bill (\$/year)

List of cases:

- C. 1 [?] [Exp] [X]
- C. 2 [?] [Exp] [X]
- C. 3 [?] [Exp] [X]

Load Info Tariff Info Demog Info

**Case 3 (AGL energy part)**

No. of users: 3663  
 Database: SGSC  
 Network Load: Whole Dataset

No. of users: 3663 Show: Daily Profile interquartile Range

Interquartile Range (25%, 50%, 75%)

kWh vs Hour

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All  
 State: All  
 Provider: All  
 Year: All  
 Tariff: AGL TOU [X] [I]

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 [Save]



# Tariff Design and Assessment (TDA) tool

Add a network tariff (and some limited retail tariffs) and optionally change any parameters

TDA (CEEM, UNSW) Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: 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: All  
 Num of Occupants: All  
 70+ Occupants: All  
 Has Gas: All  
 Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range

Single Variable Graphs Dual Variable Graphs Single Case Graphs

List of cases:

- C. 1 [?] Exp X
- C. 2 [?] Exp X
- C. 3 [?] Exp X

Load Info Tariff Info Demog Info

**Case 3 ( AGL energy part )**  
 No. of users: 3663  
 Database: SGSC  
 Network Load: Whole Dataset

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All  
 State: All  
 Provider: All  
 Year: All  
 Tariff: AGL TOU [X] [I]

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 [Save]

# Tariff Design and Assessment (TDA) tool

Visualize the results of the analysis by a range of different graphing options

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

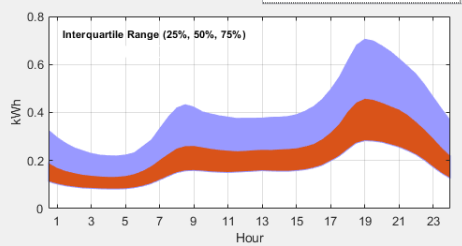
Centre for Energy and Environmental Markets UNSW SYDNEY

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: All  
 Num of Occupants: All  
 70+ Occupants: All  
 Has Gas: All  
 Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range



Project Name: Undefined

List of cases:

C. 1 ? Exp X  
 C. 2 ? Exp X  
 C. 3 ? Exp X

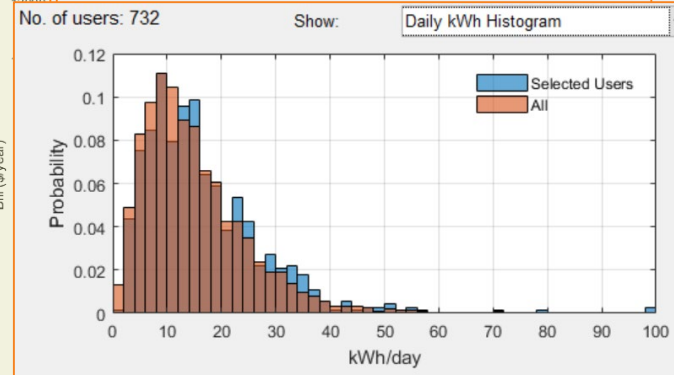
Load Info Tariff Info Demog Info

**Case 3 ( AGL energy part)**

No. of users: 3663  
 Database: SGSC  
 Network Load: Whole Dataset

Single Variable Graphs Dual Variable Graphs Single Case Graphs

No. of users: 732 Show: Daily kWh Histogram



X axis: Annual kWh  
 Y axis: Bill (\$/year)

Select Tariff:

Name: AGL TOU Type: TOU State: NSW Add

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 Save

# Tariff Design and Assessment (TDA) tool

Add up to 10 analysis case and compare the results

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help




Single Variable Graphs Dual Variable Graphs Single Case Graphs



X axis: Annual kWh  
Y axis: Bill (\$/year)

Project Name: Undefined

List of cases:

- C. 1 ? Exp X
- C. 2 ? Exp X
- C. 3 ? Exp X

Load Info Tariff Info Demog Info

**Case 3 ( AGL energy part )**

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Load: 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: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range



Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU [X] [I]

Daily Charge (\$/day): 0


Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 [Save]


# Tariff Design and Assessment (TDA) tool

Add tariffs, loads and projects; exports the results to excel, and change the preferences in the context menu

TDA (CEEM, UNSW)
Project Load Tariff Export Preferences Help



Centre for Energy and Environmental Markets



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: All

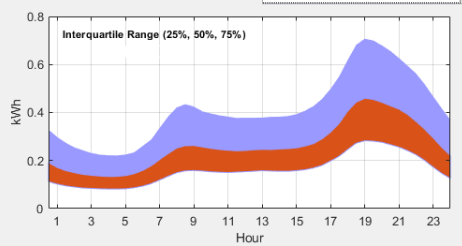
Num of Occupants: All

70+ Occupants: All

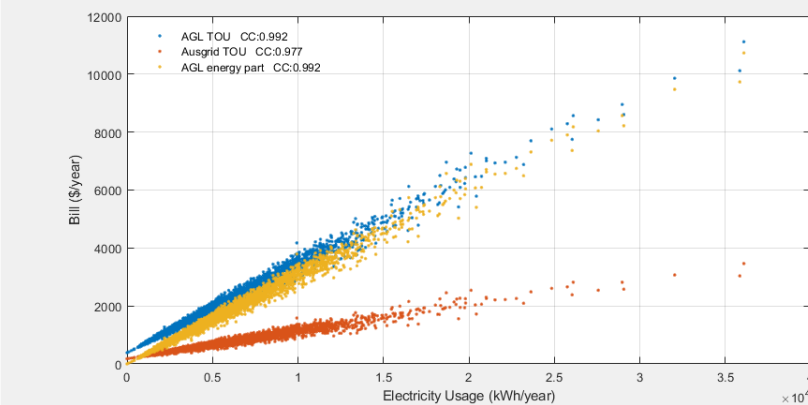
Has Gas: All

Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range



Single Variable Graphs Dual Variable Graphs Single Case Graphs



X axis: Annual kWh

Y axis: Bill (\$/year)

**List of cases:**

C. 1 ? Exp X

C. 2 ? Exp X

C. 3 ? Exp X

---

Load Info Tariff Info Demog Info

**Case 3 ( AGL energy part)**

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

**Select Tariff:**

Name: AGL TOU Type: TOU State: NSW Add

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU X |

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Exclude GST Save the modified tariff as: AGL TOU V2 Save

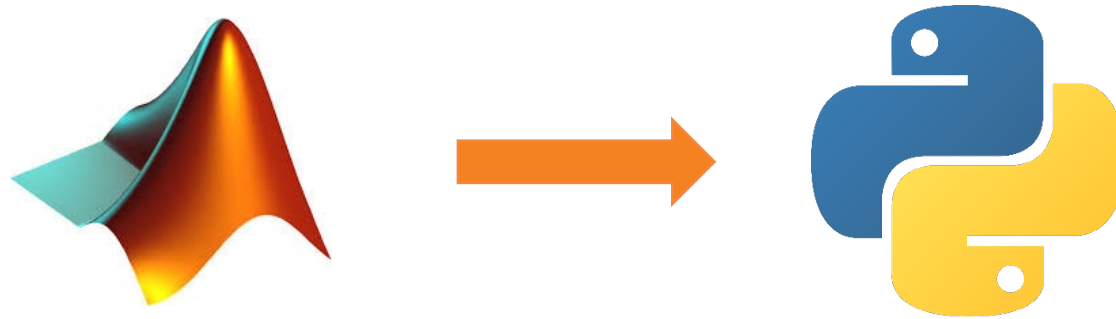
# New Developments

---

- Moving to Python
- More Analyses and Visualisation features
- Retail Tariffs and wholesale market price
- Network, Wholesale, Retail Tariff Combined Analysis
- Distributed Resources/Response:
  - PV
  - Battery
  - Demand response

## New Development: Converting to Python

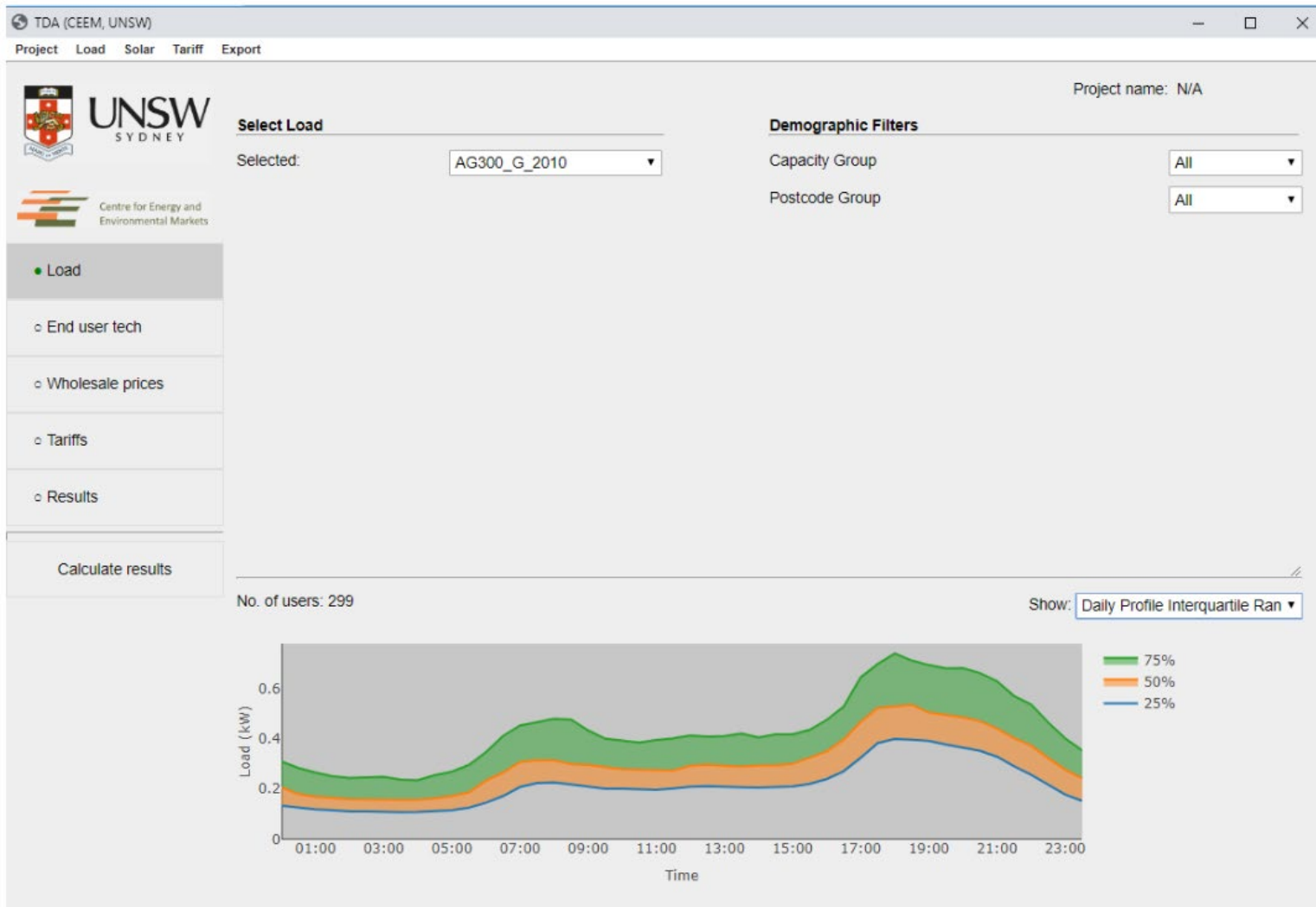
---



- Even more open source!
- Easier collaboration in non-academic environment
- Reduced size

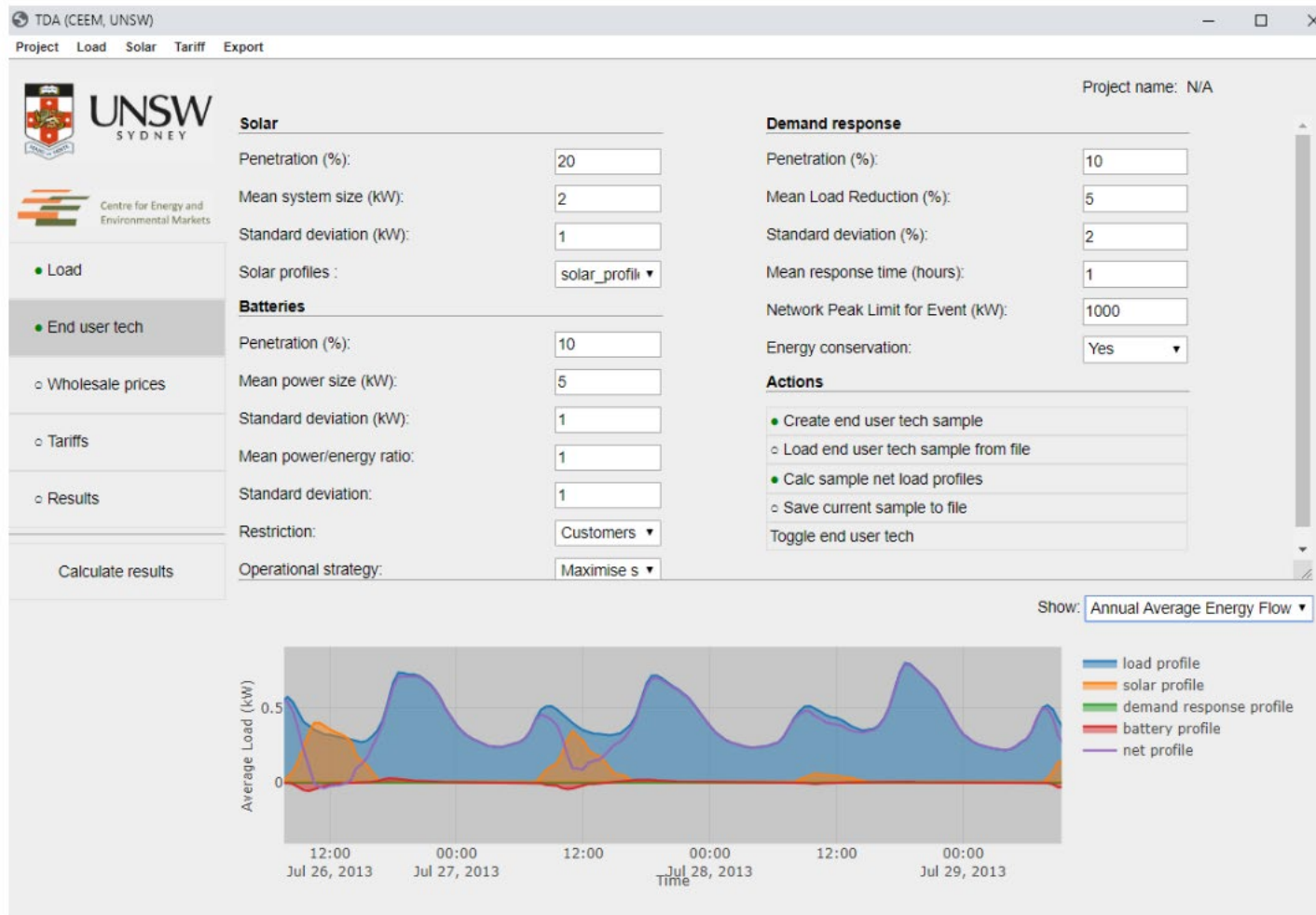


# Python version features

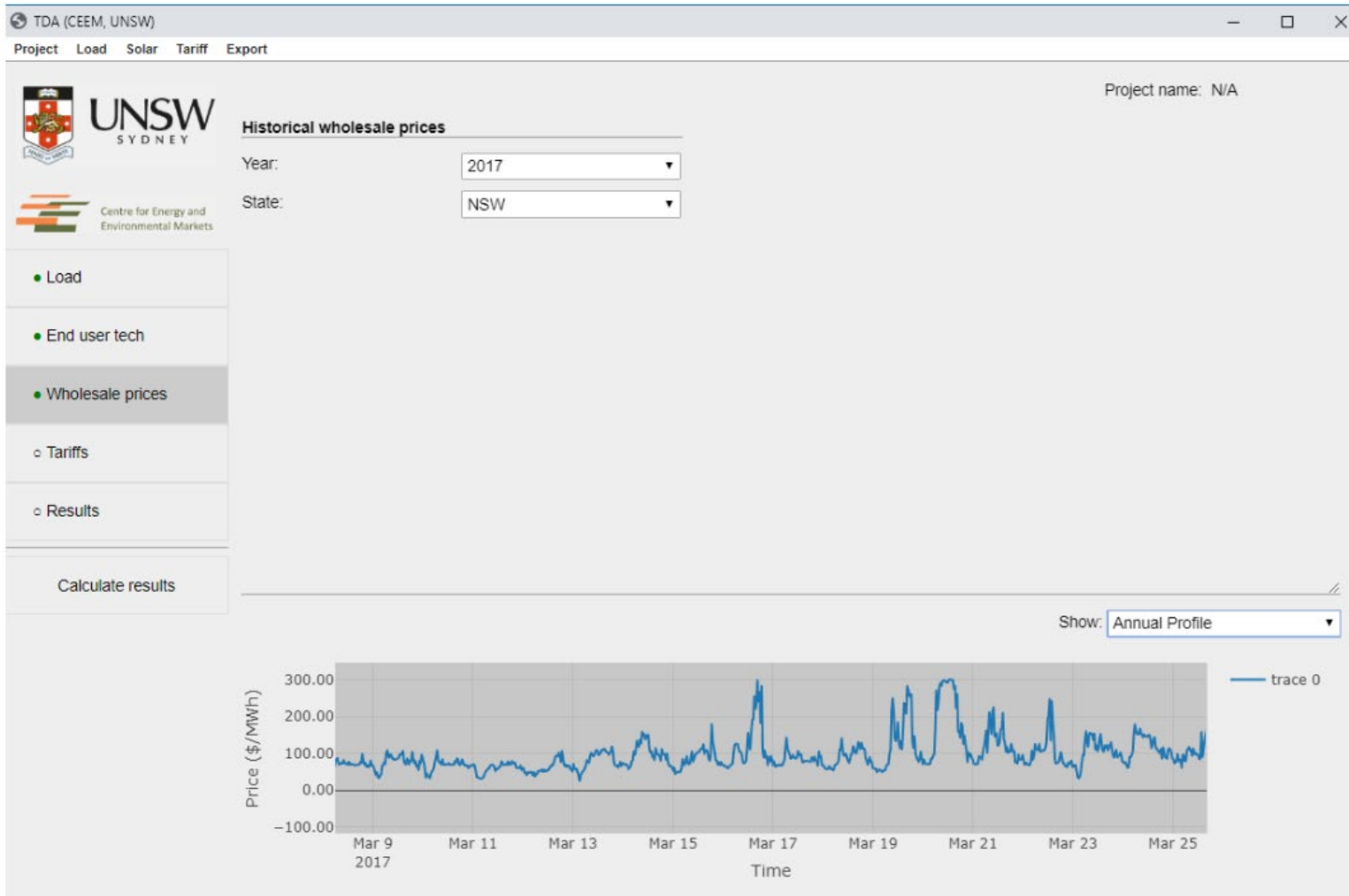




# Python version features



# Python version features



# Python version features

The screenshot shows the 'TDA (CEEM, UNSW)' application window. The interface is divided into several sections:

- Header:** 'TDA (CEEM, UNSW)' with window controls and a menu bar (Project, Load, Solar, Tariff, Export).
- Left Sidebar:** UNSW Sydney logo and 'Centre for Energy and Environmental Markets'. A navigation menu includes 'Load', 'End user tech', 'Wholesale prices', 'Tariffs' (selected), and 'Results'. A 'Calculate results' button is at the bottom.
- Main Content Area:**
  - Project name:** N/A
  - Filter tariffs:** Type: Any, State: QLD, Provider: Energex, Year: 2017/18.
  - Select tariff:** Energex TOU QLD 2017/18
  - Tariff Details:** Name: Energex TOU QLD 2017/18, Type: TOU, State: QLD.
  - Actions:** Delete from active database, Save new version of tariff.
  - DUOS/TUOS/NUOS:** Tabs for DUOS, TUOS, and NUOS.
  - Daily:** Table with Unit (\$/day) and Value (0.5181).
  - TOU:** Table with columns: Name, Month, TimeIntervals, Unit, Value, Weekday.

	Name	Month	TimeIntervals	Unit	Value	Weekday
<input checked="" type="checkbox"/>	Off Peak	[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]	{'T1': ['00:00', '07:00'], 'T2': ['22:00', '24:00']}	\$/kWh	0.0655	True
<input checked="" type="checkbox"/>	Peak-weekdays	[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]	{'T1': ['16:00', '20:00']}	\$/kWh	0.1822	True
  - Footer:** '+ Add component' button and 'NUOS = DUOS + TUOS' text.

---

Join the discussion group at:

<https://groups.google.com/forum/#!forum/ceem-tda>

## Q&A

